Water Quality Progress Report

Sacramento-San Joaquin River Delta – Diazinon and Chlorpyrifos

(*Approved 2007*)

WATER QUALITY STATUS

- ○ TMDL targets achieved
- ● Conditions improving
- ○ Improvement needed
- ○ Data inconclusive

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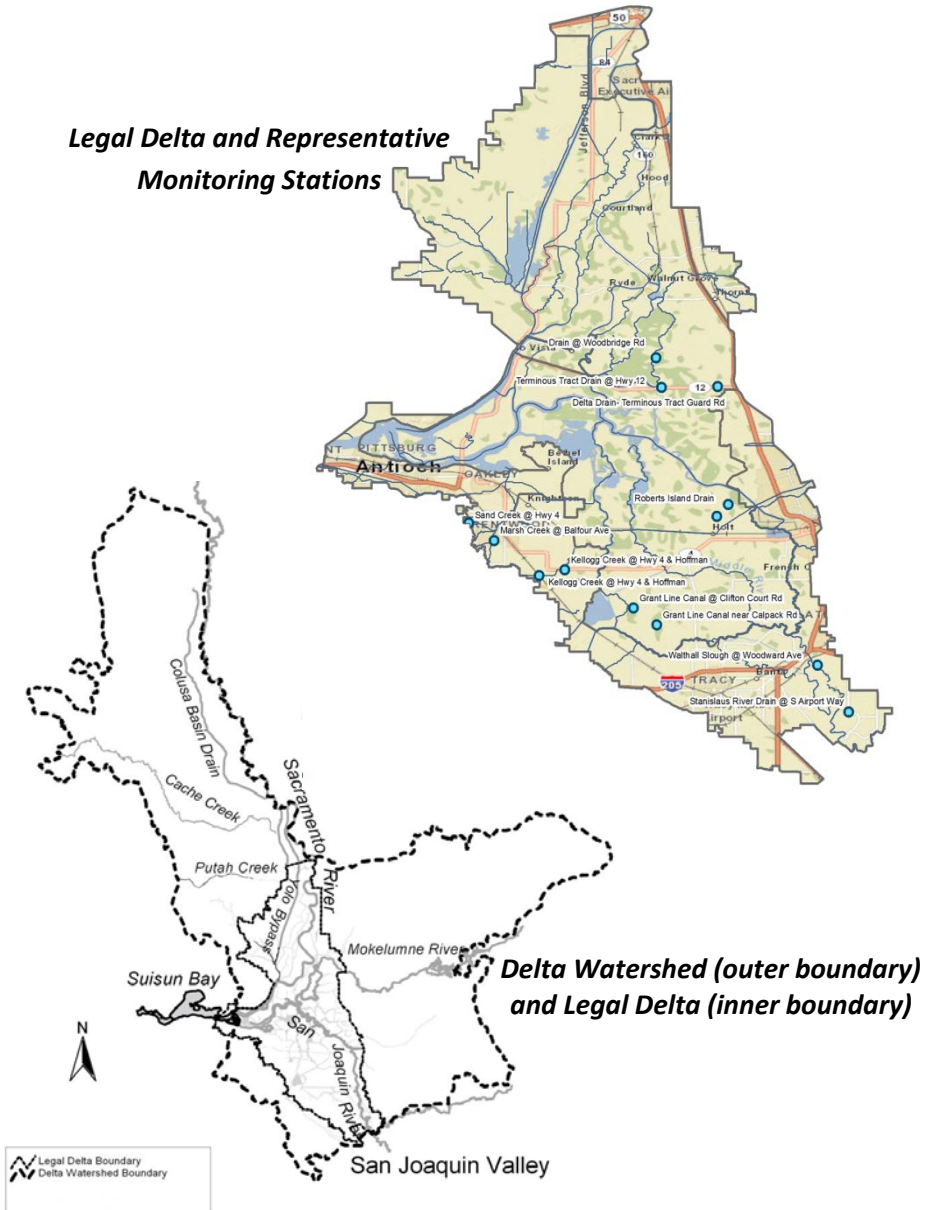
Total Maximum Daily Load (TMDL) Summary

Waterbody – The Sacramento-San Joaquin Delta is an expansive inland river delta and estuary formed at the western edge of the Central Valley by the confluence of the Sacramento and San Joaquin rivers. There are146 waterways within the legal Sacramento-San Joaquin River Delta (Delta Waterways) addressed by the TMDL (see map). This area includes river channels and diked islands hydrologically-connected through surface water flows, draining 1,153 square miles between the Sacramento and San Joaquin Rivers. Sources of pesticides come from both the legal Delta as well as the larger Delta watershed including pesticides in the Sacramento and San Joaquin Rivers.



Water Quality Goals

To protect the freshwater habitat beneficial use, the TMDL includes numeric water quality objectives (represented by concentrations in micrograms per liter [μg/L]) that are not to be exceeded more than once in a three year period:

Chlorpyrifos	Acute	0.025 μg/L (1 hour average)
	Chronic	0.015 μg/L (4 day average)
Diazinon	Acute	0.16 μg/L (1 hour average)
	Chronic	0.10 μg/L (4 day average)

Targeted Attainment Date – Compliance with the water quality objectives, load allocations, and wasteload allocations is required by December 2011 for the dormant season (December through February) and March 2012 for the irrigation season (March through November).

Water Quality Impairment –Diazinon and chlorpyrifos are two insecticides used in agricultural settings. These insecticides can be acutely toxic to aquatic life, wildlife, and humans. Aquatic invertebrates appear to be the aquatic organisms most sensitive to diazinon and chlorpyrifos exposure. These insecticides are also more toxic when they are together in solution.

State and federal agencies, along with other groups, have been collecting samples in the Delta Waterways since the early 1990s. These monitoring data have confirmed the presence of diazinon and chlorpyrifos. The Delta Waterways were first added to the California List of Impaired Waterbodies for diazinon and chlorpyrifos in 1998, associated with impairment of the freshwater habitat designated use. Toxicity Identification Evaluation (TIE) tests indicated that the toxicity in samples from the Delta Waterways was caused by diazinon and/or chlorpyrifos. The abundance of aquatic invertebrates in the Delta has been declining and the invertebrate community composition has substantially changed over the last three decades. Toxic substances, including pesticides such as chlorpyrifos and diazinon, as well as insufficient freshwater flows, loss of aquatic habitat, invasive species, and hydromodification are contributing to the decline in the invertebrate community. The deterioration of the zooplankton community results in population losses for many of the resident and migratory fish that feed exclusively on aquatic invertebrates in early life stages.

Pollutant Sources – Diazinon and chlorpyrifos have historically been used in both urban and agricultural environments. The product registrations for most urban (non-agricultural) uses of diazinon and chlorpyrifos were cancelled by the United States Environmental Protection Agency (USEPA) in 2004 and 2000, respectively. Because these pesticides are no longer sold for urban residential use their concentrations have decreased rapidly in municipal wastewater treatment plant and municipal stormwater discharges. Agricultural applications are the primary sources of diazinon and chlorpyrifos to the Delta waterways.

Pesticides applied to agricultural areas are transported to surface waters primarily by stormwater runoff and by drainage or runoff of irrigation water. Agricultural pesticide application can be separated and evaluated by season. Dormant season pesticide applications occur in the Delta watershed during the winter months, generally from December through February. During this season, pesticides are carried to surface water by stormwater runoff. Excess pesticides on trees and the soil run off with the water during rain events. On the other hand, irrigation season pesticide applications occur from March through November. During the irrigation season, chlorpyrifos and diazinon move with irrigation water from agricultural fields to the Delta Waterways. In addition, throughout the year localized drift from pesticide applications and atmospheric deposition can contribute pesticides to surface waters.

When diazinon and chlorpyrifos were first identified as causes of impairment to this watershed, most of the diazinon application was occurring during the dormant season. During this dormant period, almonds, peaches, and apricots accounted for most diazinon use. Almonds, cantaloupe, and peaches received the most diazinon during

the irrigation season. Chlorpyrifos had the opposite application trend as the majority was applied during the irrigation season, particularly on almonds, cotton, alfalfa, and walnut. During the dormant season, almonds, apples, and peaches were the primary crops sprayed with chlorpyrifos. Statewide, use of diazinon has decreased between 2002 and 2012 in both agricultural and structural pest control, while use of chlorpyrifos has not changed appreciably in that time.

Loading Capacity and Allocations – The loading capacity is the maximum amount of a contaminant or stressor that can be assimilated in a waterbody without exceeding the TMDL numeric targets (which are equal to the water quality objectives for this TMDL). The diazinon and chlorpyrifos loading capacity and source allocations in this TMDL are concentration-based limits. These limits are measured in receiving waters. Mass based limits were not established due, in part, to complex hydrology influenced by tides and diversions. Additive toxicity was incorporated into the loading capacity because diazinon and chlorpyrifos can be present at levels of concern in Delta Waterways at the same time. They are more toxic to aquatic life when they are found in combination than they are individually. The diazinon and chlorpyrifos loading capacity in is represented by an equation, where the sum of diazinon and chlorpyrifos concentrations divided by their corresponding water quality objective (i.e., the cumulative impact) must be less than one (<1). This relationship is expressed as:

$$\text{Loading Capacity} = (C_{diazinon}/O_{diazinon}) + (C_{chlorpyrifos\ s}/O_{chlorpyrifos}) < 1$$

Where:

$C_{diazinon}$ = Diazinon concentration in the receiving water.

$C_{chlorpyrifos}$ = Chlorpyrifos concentration in the receiving water.

$O_{diazinon}$ = Acute or chronic diazinon Water Quality Objective or criterion.

$O_{chlorpyrifos}$ = Acute or chronic chlorpyrifos Water Quality Objective or criterion

Waste load allocations (point sources for municipal wastewater treatment plants and stormwater discharges with National Pollutant Discharge Elimination System [NPDES] permits) and load allocations for agricultural nonpoint are both set equal to the equation for the loading capacity. If each source does not exceed one in this cumulative impact equation, then the loading capacity will be met. Since the Delta Waterways are so numerous, and the points of discharge to the Delta Waterways are even more numerous, representative monitoring in key Delta Waterways and representative tributaries is used to estimate conditions in remaining Delta Waterways and their tributaries.

Is Water Quality Improving?

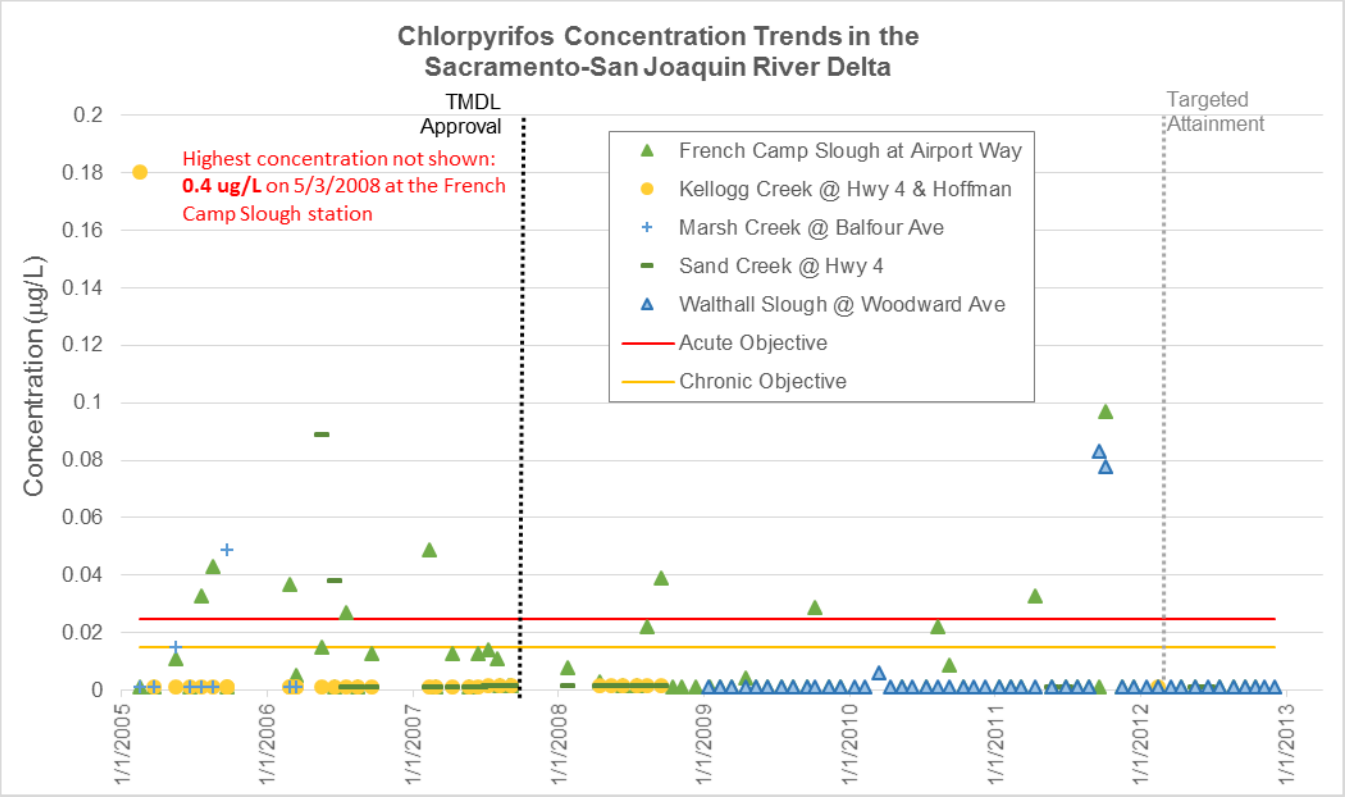
Water quality has improved in Delta Waterways through successful efforts to reduce pesticide discharges including the cancellation of non-agricultural uses and a substantial reduction in the use of diazinon and chlorpyrifos as the agricultural sector transitioned to different pesticides, such as pyrethroids. Many other activities were implemented before, during, and subsequent to the TMDL to reduce discharges of these pesticides by reducing runoff through improved application practices, reduced use, and reduced runoff volume. Many agencies and stakeholders have been involved in pesticide-control efforts including: growers, commodity groups and pesticide applicators, California Department of Pesticide Regulation (DPR), County Agricultural Commissioners, pesticide manufacturers, the University of California, the Coalition for Urban and Rural Environmental Stewardship, the San Joaquin County and Delta Water Quality Coalition, and the Sacramento Valley Water Quality Coalition. In addition, reductions of diazinon and chlorpyrifos in the two main tributaries of the Delta were required under separate TMDLs for the Sacramento and San Joaquin rivers and have resulted in decreased discharges of these pesticides in the Delta.

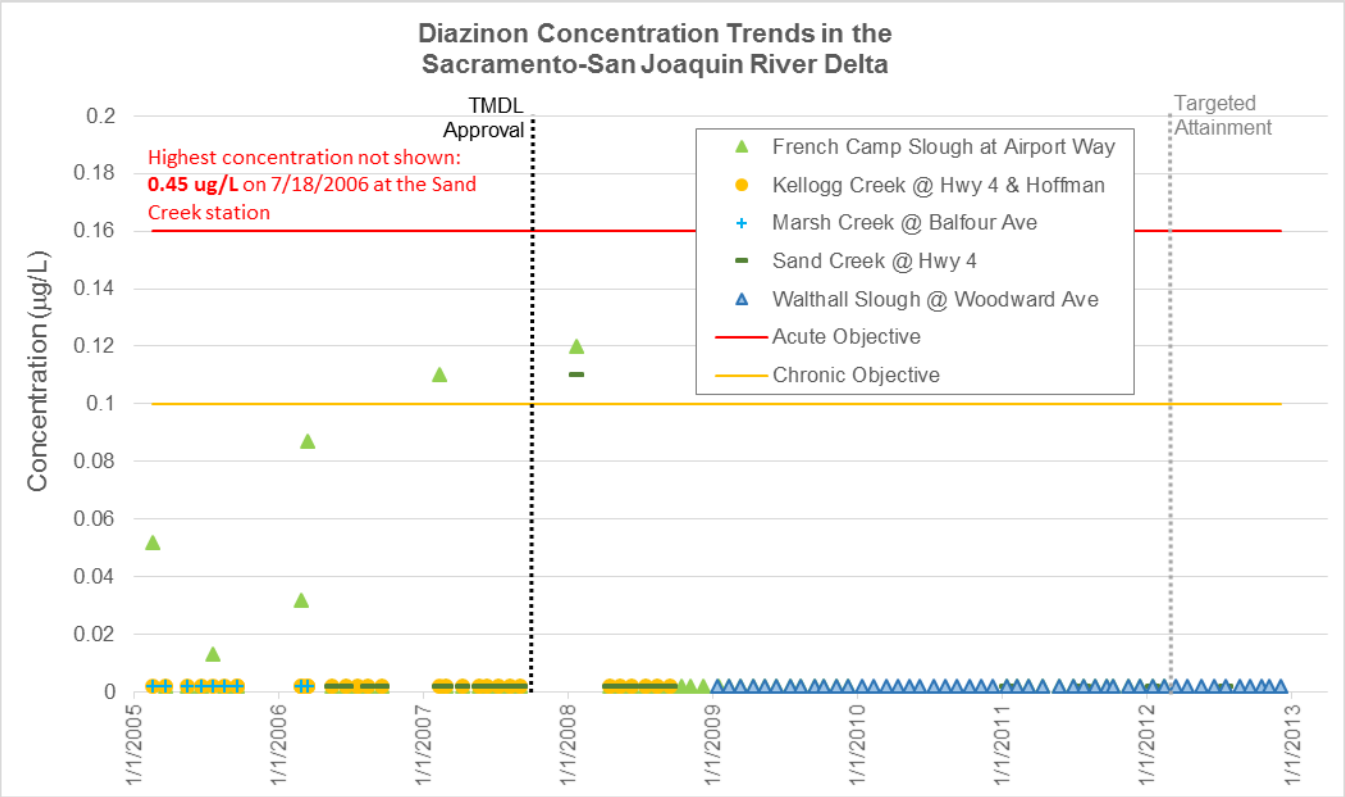
In addition to these successful activities, further effort to reduce sources of pesticide pollution may be needed to ensure consistent attainment of water quality objectives. Diazinon concentrations in the Delta Waterways were below the acute and chronic objectives for at least the past three years at 12 monitoring locations, and before the

targeted attainment date of March 2012. The most recent exceedance of the diazinon acute objective observed in the available monitoring data was in 2006 and the chronic objective was exceeded in early 2008. Diazinon is not often detected in water samples from the Delta Waterways and levels of diazinon are below objectives when it is detected.

Chlorpyrifos is detected in water samples at monitoring stations more often than diazinon. Exceedances of the chlorpyrifos objectives have been observed as recently as 2011, particularly at the French Camp Slough and Walthall Slough monitoring locations. These values were several times higher than the water quality objective. However, reductions have generally been observed over time. While additional practices need to be implemented to effectively minimize chlorpyrifos loading to the Delta Waterways, it is important to note that if the concentrations continue with the recent observed trends, then chlorpyrifos will likely meet the TMDL loading capacity in the near future.

No detections of chlorpyrifos and diazinon in the Delta Waterways during the 2012 water years shows a positive change in water quality due to implemented management practices. Continued monitoring and additional data are necessary to evaluate trends resulting from implemented management practices, and to assess if the improvement in water quality is sustained and if chlorpyrifos concentrations continue to decline. In addition, sampling for additional pesticides is being conducted, as required in the TMDL-related monitoring provisions, to determine if concentrations of alternative pesticides have are impacting the health of aquatic organisms.





TMDL Progress – Implementation activities and milestones

Implementation Activity	Target Date	Status	Progress Details
Compliance with numeric Water Quality Objectives and Loading Capacity will be required no later than December 1, 2011 during the dormant season (December through February of the following year) and no later than March 2, 2012, for the irrigation season (March through November).	12/01/2011 for dormant season; 03/02/2012 for irrigation season	In progress	• Water quality objectives for diazinon are being attained. • Progress is being made on reducing chlorpyrifos concentrations. Recent monitoring data show reductions over time, but exceedances have been observed within the last three years.
Issue waiver of waste discharge requirement (WDR) or WDR	12/31/2009	Complete	• Water Quality Coalition waiver of WDR issued in 2006 (link). • Updated in 2006, 2008, and 2011 (link). • Third Party Group WDRs issued in 2014 for the Sacramento Valley Coalition and the San Joaquin County and Delta Water Quality Coalition (link)

Implementation Activity	Target Date	Status	Progress Details
Management Plans	None stated	In progress	• Management Plans for the Sacramento Valley Coalition and Delta Coalition are approved annually, and include activities to comply with this TMDL. • Irrigated Lands Regulatory Program (IRLP) is currently being implemented (link).
Five year Review	12/31/2010	Complete	• Resolution R5-2014-0041 (link)
Annual Water Board, DPR, County Agricultural Commissioners' Meetings & Review	2008	In progress	• Coordination with County Agricultural Commissioners is done by coalitions under the Irrigated Lands Regulatory Program (ILRP). • Meetings have occurred ancillary to meetings to discuss other relevant and timely topics.
Prohibition of Discharge	Dormant season 12/1/2010 Irrigation season 3/2/2011	In Progress	• Triggered if pesticides exceed objectives after target dates for dormant season and irrigation seasons. • Only applies to dischargers causing or contributing to the exceedance of water quality objectives or loading capacity, which limits assessment of its applicability. • Consequently, a new Resolution R5-2014-0041 (link), which would apply to many Central Valley waterbodies including all Delta waterways and all seasons, has been adopted by the Central Valley Water Board and is scheduled for consideration by the State Water Board and the Office of Administrative Law. • The Central Valley Water Board is taking enforcement action on agricultural dischargers without regulatory coverage under the ILRP.
Additional actions	None specified	In Progress	• In 2005, DPR, established regulations for sprays of pesticides on dormant orchards to reduce runoff. These are enforced by DPR and the County Agricultural Commissioners. • Product registrations for most urban (non-agricultural) uses of diazinon and chlorpyrifos were cancelled by USEPA in 2004 and 2000, respectively.

Implementation Activity	Target Date	Status	Progress Details
TMDL Monitoring Program Objectives			
1. Determine compliance with established water quality objectives and loading capacity, applicable to diazinon and chlorpyrifos in the Delta Waterways.	None specified	In Progress	• Monitoring has been performed by the Agricultural coalitions and other dischargers. • Water quality objectives for diazinon are being attained. • Progress is being made on reducing chlorpyrifos concentrations. Recent monitoring data show reductions over time, but exceedances have been observed within the last three years. The last reported exceedance was in 2013 (2013 Annual Monitoring Report [AMR], Table 38; link).
2. Determine compliance with the load allocations applicable to discharges of diazinon and chlorpyrifos into the Delta Waterways.	None specified	In Progress	• Load allocations are being met for diazinon. • Progress is being made on reducing chlorpyrifos concentrations. Recent monitoring data show reductions over time, but exceedances have been observed within the last three years. The last reported exceedance was in 2013 (2013 AMR, Table 38; link).
3. Determine the degree of implementation of management practices to reduce off-site movement of diazinon and chlorpyrifos.	None specified	Complete/ Ongoing	Thus far, Coalitions have collected detailed information on management practices implemented to reduce migration of pesticides.
4. Determine the effectiveness of management practices and strategies to reduce off-site migration of diazinon and chlorpyrifos.	None specified	Complete/ Ongoing	Coalitions document the newly implemented management practices, and in combination with monitoring data, evaluate the reduction in off-site migration of chlorpyrifos and diazinon that could be attributed to implementation of new or additional management practices.
5. Determine whether alternatives to diazinon and chlorpyrifos are causing surface water quality impacts.	None specified	Complete/ Ongoing	Based on the 2013 AMR toxicity results, pyrethroids were identified as potential alternatives impairing water quality in the San Joaquin County and Delta Water Quality Coalition (SJCDWQC) region (Table 39). Management and focused plans that are in place promote implementation of management practices that minimize water quality impacts from alternatives to chlorpyrifos and diazinon.

Implementation Activity	Target Date	Status	Progress Details
6. Determine whether the discharge causes or contributes to a toxicity impairment due to additive or synergistic effects of multiple pollutants.	None specified	Complete/ Ongoing	Coalition monitoring includes toxicity monitoring that meets this goal. Coalitions are required to conduct acute toxicity monitoring in water and sediment twice per year. In the 2013 AMR for the SJCDWQC (link), toxicity was observed in seven samples. In one sample, organics and cationic metals caused the toxicity and in two other samples, pyrethroids and chlorpyrifos were detected (Table 39 in 2013 AMR). The Sacramento Valley Water Quality Coalition (SVWQC) also monitors in the Sacramento/ Amador Subwatershed which covers the northern part of the Delta. Their 2013 AMR did not report any toxicity in Delta stations (link).
7. Demonstrate that management practices are achieving the lowest pesticide levels technically and economically achievable.	None specified	Complete/ Ongoing	The management practices implemented by growers appear to be resulting in a reduction of discharges and Coalition members are in the process of achieving the lowest pesticide levels technically and economically feasible.

What Next?

Water quality is improving but has not yet achieved water quality goals. Application of both diazinon and chlorpyrifos has decreased as many growers have begun using alternative pesticides, such as pyrethroids, which also cause aquatic toxicity. Cancellation of residential uses of diazinon and chlorpyrifos has mitigated risks to aquatic life from these two pesticides in urban areas but there are still risks from agricultural uses. Continued implementation of the ILRP will be key to addressing these impairments. Likely, new pesticides will emerge in the future and continued monitoring for aquatic toxicity will be the most efficient way to assess pesticide impacts over time. During pesticide registration and registration review, aquatic life risk mitigation strategies are developed into pesticide use instructions that must appear on product labels and must be followed by pesticide applicators. Increased coordination between State and Federal water quality and pesticide use regulators will help to achieve the long term goal of improved aquatic health.

Information Source Documents

- **Final Basin Plan Amendment** – Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the Control of Diazinon and Chlorpyrifos Runoff into the Sacramento-San Joaquin Delta (2006 approval [link] and 2014 update [link])
- **CV RWQCB TMDL Resolution** – Amendment to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the Control of Diazinon and Chlorpyrifos Runoff into the Sacramento-San Joaquin Delta (link)
- **Strategic Workplan for Activities in the San Francisco Bay/Sacramento-San Joaquin Delta Estuary** (link)
- **Irrigated Lands Regulatory Program** (link) and **Water Quality Monitoring** (link)

- **Monitoring and Reporting Program for Coalition Group Conditional Waiver of Waste Discharge Requirements for Irrigated Lands Regulatory Program** (link)
- **Waste Discharge Requirements General Order for Growers within the San Joaquin County and Delta Area that are Members of a Third-Party Group** (link)
- **San Joaquin Delta and Water Quality Coalition Monitoring & Reporting Program Plan Documents** (link)
    - **Monitoring Plan Update** – August 1, 2014 (link)
    - **Annual Monitoring Reports** (link)
- **2010 San Joaquin Delta and Water Quality Coalition Monitoring & Reporting Program Plan** (link)
- **Sacramento Valley Water Quality Coalition** (link)
- **Summary of Current Water Quality Monitoring Programs in the Delta** (link)