Water Quality Progress Report

Lower San Joaquin River – Diazinon and Chlorpyrifos

(*Approved 2006*)

WATER QUALITY STATUS

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

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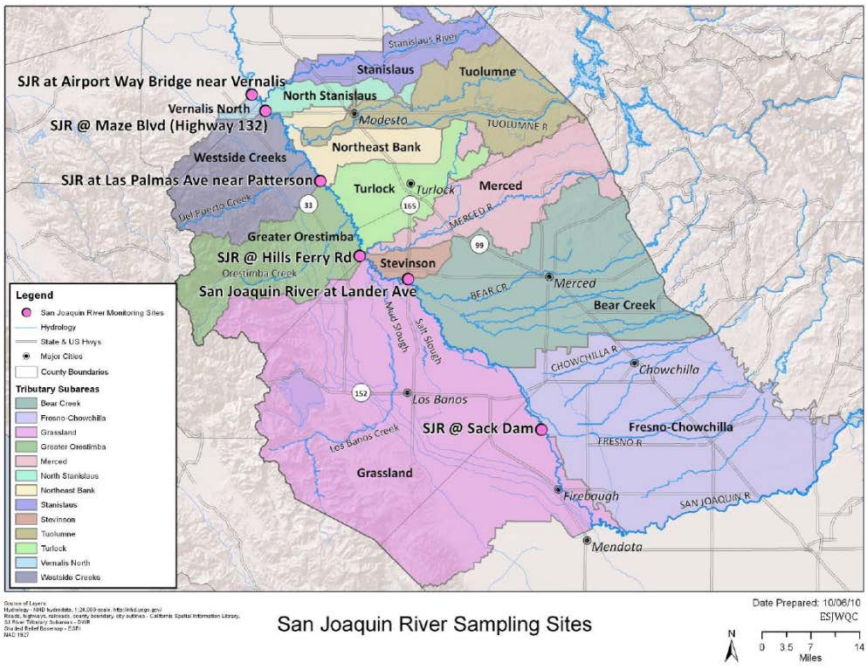
Total Maximum Daily Load (TMDL) Summary

Waterbody – This TMDL covers 130 miles of the Lower San Joaquin River (LSJR) from Mendota Dam to Vernalis at Airport Way Bridge. This area drains approximately 4,580 square miles, from the Sierra Nevada Mountains on the west, downstream to the legal boundary of the Sacramento-San Joaquin Delta at Vernalis. The map below shows the watershed covered by the TMDL as well as six sampling points used to measure compliance in the TMDL.

LSJR Watershed and Compliance Points for the Pesticide TMDL



http://www.swrcb.ca.gov/rwqcb5//water_issues/irrigated_lands/management_plans_reviews/coalitions/east_sanjoaquin_waterquality/esjwqc_2012jul25_amr_amend.pdf

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 2010 for the dormant season (December through February) and March 2011 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 LSJR since 1991. These monitoring data have confirmed the presence of diazinon, chlorpyrifos, and other pesticides in the LSJR and its tributaries. The LSJR was first added to the California List of Impaired Waterbodies for aquatic toxicity caused by diazinon and chlorpyrifos in 2002, associated with impairment of the freshwater habitat designated use. In addition, toxic substances, including pesticides, are considered one of the stressors contributing to the collapse of the aquatic ecosystem in the San Francisco Bay Delta Estuary. The LSJR is the second largest freshwater tributary to the Delta.

Pollutant Sources – Diazinon and chlorpyrifos have historically been used in both urban and agricultural environments. The product registrations for almost all 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 concentrations in wastewater treatment plant and municipal stormwater discharges have decreased drastically and now, agricultural applications are the primary sources of diazinon and chlorpyrifos to the LSJR watershed.

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 LSJR 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. 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 LSJR. 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. Additive toxicity was incorporated into the loading capacity because diazinon and chlorpyrifos can be present at levels of concern 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 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

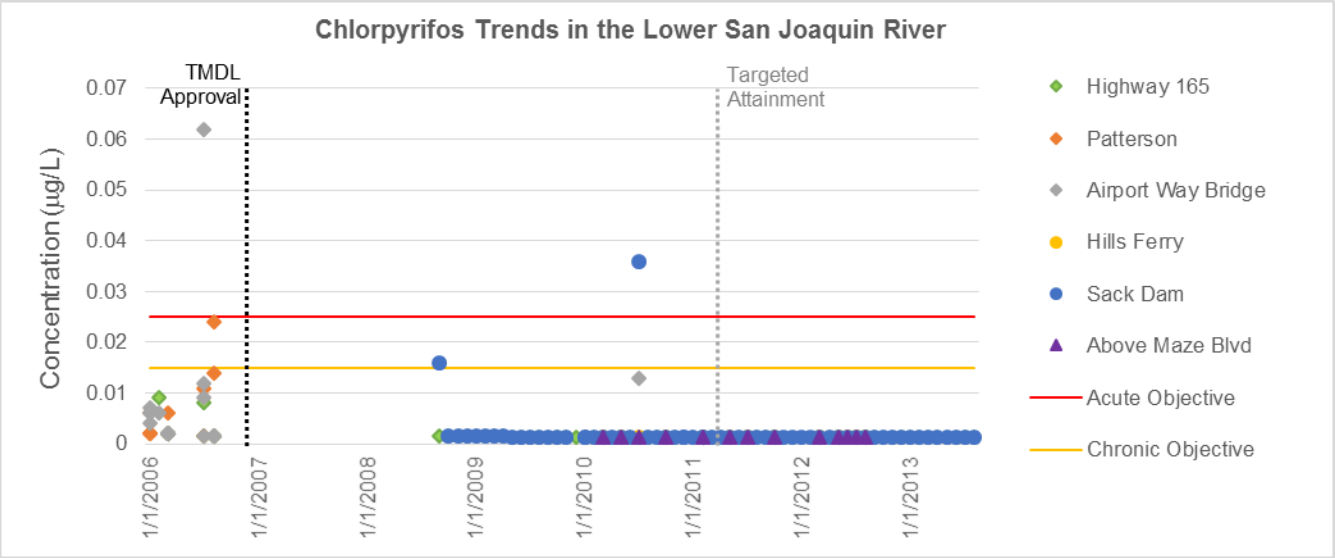
Waste load allocations (point sources for municipal wastewater treatment plants and stormwater discharges with National Pollutant Discharge Elimination System [NPDES] permits) and load allocations for agricultural nonpoint sources (established for subareas represented by compliance points) are both set equal to the equation for the loading capacity. If each source and subarea does not exceed one in this cumulative impact equation, then the loading capacity will be met.

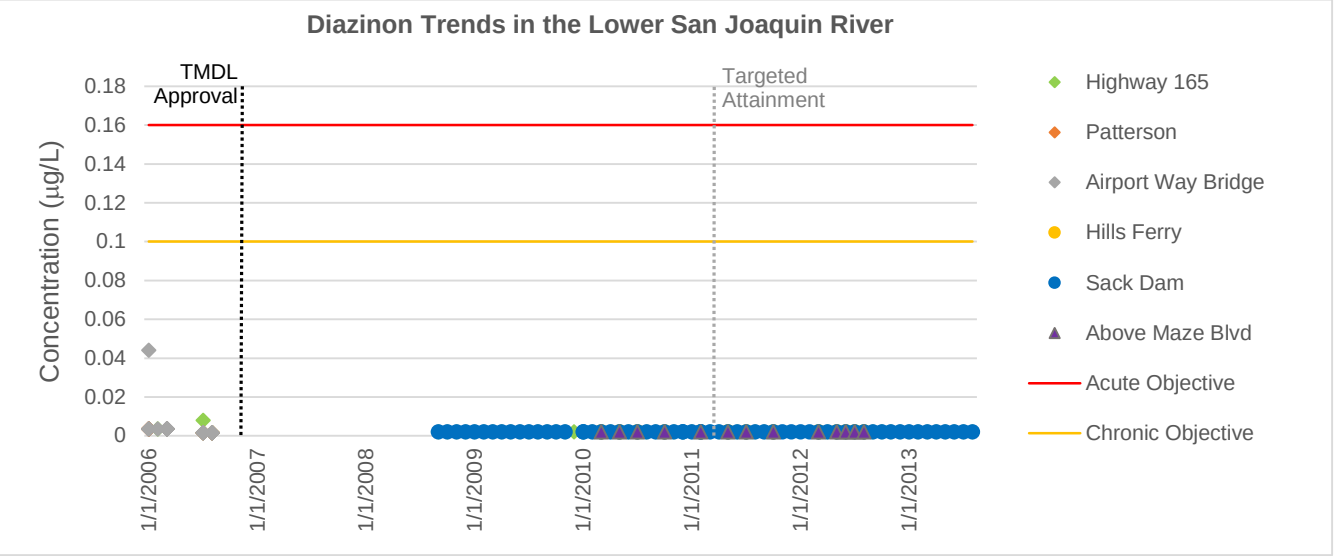
Is Water Quality Improving?

The water quality has improved in the LSJR 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 in the San Joaquin Valley, California Department of Pesticide Regulation (DPR), County Agricultural Commissioners, pesticide manufacturers, the University of California, the Coalition for Urban and Rural Environmental Stewardship, the Eastside San Joaquin Water Quality Coalition (ESJWQC), and the Westside San Joaquin Valley Water Quality Coalition (WSJVWQC).

Both diazinon and chlorpyrifos concentrations were below the acute and chronic objectives for at least the past three years at all six compliance points. Therefore, since 2011 the TMDL loading capacity and water quality objectives are being achieved. The reduction of diazinon in the San Joaquin River has been documented as a nonpoint source success story by USEPA. California Environmental Data Exchange Network (CEDEN; www.ceden.org) data for the LSJR are only available beginning in 2006 and no exceedances of diazinon were observed in this dataset. Chlorpyrifos data did show some exceedances of the water quality objective; however, concentrations decreased in 2007 after adoption of the TMDL. The most recent exceedance was in 2010 at the Sack Dam compliance point. This one exceedance is before the targeted attainment date identified in the TMDL. In addition, consistent with the water quality objectives, chlorpyrifos data have been below the water quality objectives for at least the past three years.

No detections of chlorpyrifos and diazinon in the LSJR during the 2011 to 2013 water years and a decrease in the proportion of pesticide exceedances overall implies a positive change in water quality due to implemented management practices. Continued monitoring and additional data are necessary to evaluate trends and to assess if the improvement in water quality is sustained. In addition, additional sampling for potential replacement pesticides is being conducted as required in the TMDL-related monitoring provisions. This monitoring will be used to determine whether concentrations of alternative pesticides have increased as these pesticides can also impact the health of aquatic organisms; samples collected in 2011 indicate that other pesticides may be contributing to water quality impairments in some LSJR tributaries.





TMDL Progress – Implementation activities and milestones

Implementation Activity	Target Date	Status	Progress Details
Compliance with applicable water quality objectives, load allocations, and waste load allocations for diazinon and chlorpyrifos in the San Joaquin River is required by December 1, 2010.	12/01/2010 for dormant season; 03/02/2011 for irrigation season	Complete	Thus far meeting the water quality objectives and allocations (based on 2013 monitoring data in CEDEN). • Last reported exceedance was in 2010.

Implementation Activity	Target Date	Status	Progress Details
The water quality objectives and allocations will be implemented through one or a combination of the following: the adoption of one or more waivers of waste discharge requirements (WDR), and general or individual WDRs. To the extent not already in place, the Water Board expects to adopt or revise the appropriate waiver(s) or waste discharge requirements by December 31, 2007.	12/31/2007	In Progress/ Complete	These requirements have been included in the agricultural waiver issued by the Central Valley Water Board under the Irrigated Lands Regulatory Program (ILRP) for the Westside Coalition and waste discharge requirement for the East San Joaquin Coalition and applicable NPDES permits.
The Water Board intends to review the diazinon and chlorpyrifos allocations and the implementation provisions in the Basin Plan at least once every five years, beginning no later than December 31, 2009.	12/31/2009	Complete	Resolution R5-2014-0041 (link)
Pursuant to California Water Code (CWC) Section 13267, the Executive Officer will require dischargers to submit a management plan that describes the actions that the discharger will take to reduce diazinon and chlorpyrifos discharges and meet the applicable allocations by the required compliance date.	None specified	Complete	This is being conducted under the agricultural waiver and waste discharge requirements
Water Board staff will meet at least annually with staff from the Department of Pesticide Regulation and representatives from the California Agricultural Commissioners and Sealers Association to review pesticide use and instream pesticide concentrations during the dormant spray and irrigation application seasons, and to consider the effectiveness of management measures in meeting water quality objectives and load allocations.	Annually	In Progress	• Coordination with County Agricultural Commissioners is done by coalitions under the ILRP. • Meetings have occurred ancillary to meetings to discuss other relevant and timely topics.

Implementation Activity	Target Date	Status	Progress Details
Two prohibitions: • Beginning December 1, 2010, the direct or indirect discharge of diazinon or chlorpyrifos into the San Joaquin River is prohibited during the dormant season (1 December through 1 March) if any exceedance of the chlorpyrifos or diazinon water quality objectives, or diazinon and chlorpyrifos loading capacity, occurred during the previous dormant season. • Beginning March 2, 2011, the direct or indirect discharge of diazinon or chlorpyrifos into the San Joaquin River is prohibited during the irrigation season (2 March through 30 November) if any exceedance of the chlorpyrifos or diazinon water quality objectives, or diazinon and chlorpyrifos loading capacity, occurred during the previous irrigation season. These prohibitions do not apply if the discharge of diazinon or chlorpyrifos is subject to a waiver of waste discharge requirements implementing the diazinon and chlorpyrifos water quality objectives and load allocations for diazinon and chlorpyrifos for the San Joaquin River, or governed by individual or general waste discharge requirements.	12/01/2010 03/02/2011	Complete	This has not gone into effect, since the objectives and loading capacity are being met. The Central Valley Water Board is, however, following through with enforcement for 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 (WQOs) and the loading capacity applicable to diazinon and chlorpyrifos in the San Joaquin River.	None specified	Complete	Monitoring has been performed by the Coalitions and other dischargers. All samples collected from the San Joaquin River (6 stations) during the 2011-2013 water years were below detection limits and water quality objectives for chlorpyrifos and diazinon.
2. Determine compliance with established load allocations for diazinon and chlorpyrifos.	None specified	Complete	San Joaquin River tributaries were monitored in water year 2011 and 3 of 115 samples exceeded the chlorpyrifos criteria on the Eastside and 15 out of 159 samples exceeded the criteria on the Westside. This is an improvement over 2010. Recent monitoring at the 6 mainstem compliance points all meet the water quality criteria, and thus the load allocations.
3. Determine the degree of implementation of management practices to reduce off-site movement of diazinon and chlorpyrifos.	None specified	Complete/ Ongoing	Thus far, the Coalitions have collected detailed information on management practices implemented to reduce migration of pesticides in subwatersheds from four out of five subareas defined in the Basin Plan.
4. Determine the effectiveness of management practices and strategies to reduce off-site migration of diazinon and chlorpyrifos.	None specified	Complete/ Ongoing	Both 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.

Implementation Activity	Target Date	Status	Progress Details
5. Determine whether alternatives to diazinon and chlorpyrifos are causing surface water quality impacts.	None specified	Complete/ Ongoing	The Coalitions monitor for high risk pesticides which are used in their areas, including alternatives to diazinon and chlorpyrifos. Based on the PUR data analysis, chemistry and toxicity results, carbaryl, dimethoate (Table 32 in 2011 Annual Monitoring Report [AMR]), and pyrethroids were identified as potential alternatives impairing water quality in the ESJWQC region. Several alternatives impairing water quality were detected in the WSJWQC region–pyrethroids, carbamates, current use organochlorines (endosulfan) and organophosphate pesticides. Management and focused plans that are in place promote implementation of management practices that minimize water quality impacts from alternatives to chlorpyrifos and diazinon.
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	The Coalitions monitor for toxicity as part of their routine monitoring which mostly occurs in the tributaries of the LSJR. Coalitions are required to conduct acute toxicity monitoring in water and sediment twice per year. 7 water column samples were found toxic and 12 sediment samples were found toxic in the 2011 water year. TIEs conducted at one station found that pyrethroid insecticides were the cause of toxicity and pyrethroids and chlorpyrifos were detected in other samples that showed statistically significant toxicity in LSJR tributaries.
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 (pp. 63 2011 AMR).

What Next?

Water quality goals are currently being achieved. 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

- **San Joaquin River Organophosphorous (OP) Pesticide TMDL Report** (link)
- **Final Basin Plan Amendment** – Amending the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the Control of Diazinon and Chlorpyrifos Runoff into the San Joaquin River (link)
- **EPA Approval Letter for the TMDL and Checklist** (link)
- **San Joaquin River Chlorpyrifos and Diazinon 2011 Water Year Annual Monitoring Report**, Prepared by the East San Joaquin Water Quality Coalition and the Westside San Joaquin River Watershed Coalition (link)
- **CVRWQCB Staff Review of the 2011 Water Year Annual Monitoring Report** (link)
- **East San Joaquin Annual Monitoring Report for 2012**, Prepared by the East San Joaquin Water Quality Coalition (link)
- **2003-2005 Water Quality Monitoring Reports** (link)
- **EPA's Nonpoint Source Success Story** (link)