



Water Quality Progress Report

Lower Sacramento and Feather Rivers – Diazinon and Chlorpyrifos

(Approved 2004, 2008)

WATER QUALITY STATUS

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

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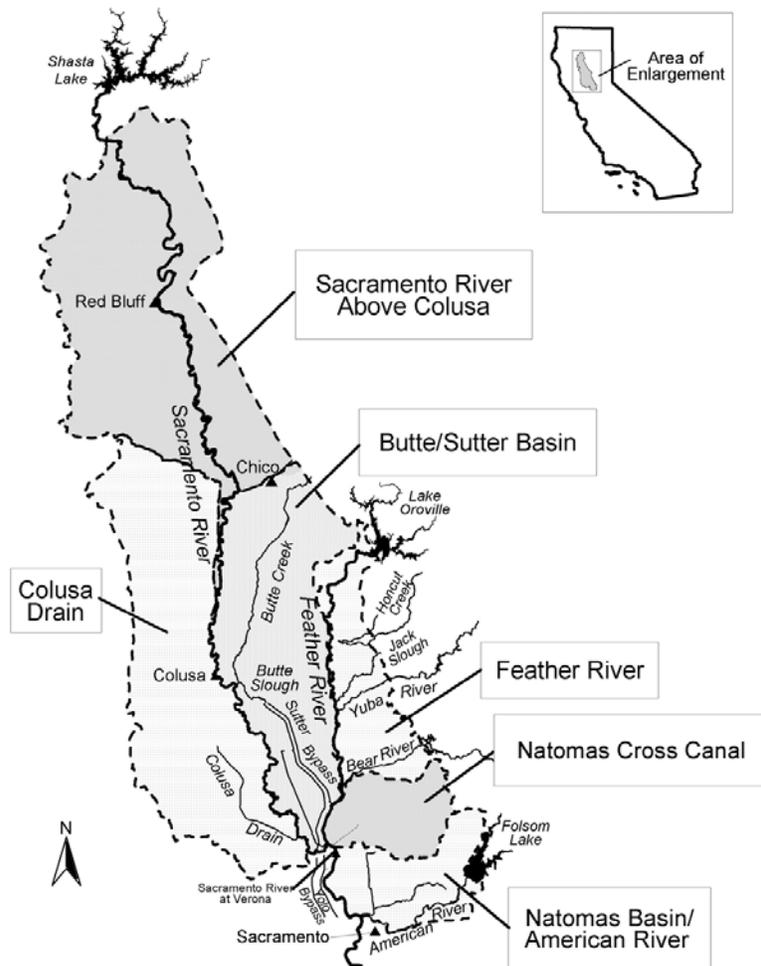
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Last Updated 6/15/2015

Total Maximum Daily Load (TMDL) Summary

Waterbody – The middle and lower segments of the Sacramento River, which flows from Lake Shasta to the Sacramento-San Joaquin Delta, and the Feather River below Lake Oroville were impaired for diazinon and chlorpyrifos; therefore a TMDL was developed. These water bodies are located in the Sacramento Valley (see map) and drain approximately 5,200 square miles, which is the northern third of the California Central Valley. The Sacramento River is the largest River in California and the main source of freshwater flow to the Sacramento-San Joaquin Delta. The Feather River is the largest tributary to the Sacramento River.



Diazinon and Chlorpyrifos TMDL Area (Sacramento Valley Floor)

Water Quality Goals

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

Chlorpyrifos	Acute	0.025 $\mu\text{g/L}$ (1 hour average)
	Chronic	0.015 $\mu\text{g/L}$ (4 day average)
Diazinon	Acute	0.16 $\mu\text{g/L}$ (1 hour average)
	Chronic	0.10 $\mu\text{g/L}$ (4 day average)

Targeted Attainment Date –Compliance with water quality objectives, waste load allocations, and load allocations in the Sacramento and Feather rivers is required by August 11, 2008, which is the United States Environmental Protection Agency (USEPA) approval date.

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 Sacramento and Feather rivers since the early 1990s. These monitoring data have confirmed the presence of diazinon and chlorpyrifos in the Sacramento and Feather rivers and their tributaries. These waterbodies were first added to the California List of Impaired Waterbodies in 1994 for aquatic toxicity caused by diazinon and chlorpyrifos, 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, which gets most of its freshwater inflows from the Sacramento River.

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 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 Sacramento and Feather rivers.

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 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 Sacramento and Feather rivers. 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:

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

Where:

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

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

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

$O_{\text{chlorpyrifos}}$ = 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 are both set equal to the equation for the loading capacity. If each source and subwatershed 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 study area 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 Sacramento Valley, California Department of Pesticide Regulation (DPR), County Agricultural Commissioners, pesticide manufacturers, the University of California, the Sacramento River Watershed Program, the Coalition for Urban and Rural Environmental Stewardship, and the Sacramento Valley Water Quality Coalition (SVWQC).

Data collected in the Sacramento and Feather rivers indicate that these waterbodies are attaining the water quality objectives for both chlorpyrifos and diazinon; therefore the TMDL loading Capacity and water quality objectives are being achieved. The reduction of diazinon in the Sacramento and Feather rivers has been documented as a [nonpoint source success story](#) by USEPA.

Overall, these results imply a positive change in water quality due to implemented management practices, especially in the main stems. Continued monitoring and additional data are necessary to ensure that the diazinon and chlorpyrifos concentrations remain below water quality objectives. 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.

Implementation Activity	Target Date	Status	Progress Details
Issue waiver of waste discharge requirement (WDR), and WDRs	8/11/2008	Complete	<ul style="list-style-type: none"> Water Quality Coalition waiver of WDR issued in 2006 (link) as part of the Central Valley Water Board's Irrigated Lands Regulatory Program (ILRP). Updated in 2006, 2008, and 2011 (link). Third Party Group WDR issued in 2014 (link) for growers in the SVWQC.
Management Plans	None specified	Complete	<ul style="list-style-type: none"> Management Plans for the SVWQC are approved annually, and include activities to comply with this TMDL. Irrigated Lands Regulatory Program (IRLP) is currently being implemented (link).
Water Board review of the allocations and implementation provisions.	6/30/2013	Complete	Resolution R5-2014-0041 (link)
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	<ul style="list-style-type: none"> 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.
Prohibition of Discharge	None specified	Complete	<ul style="list-style-type: none"> 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 Irrigated Lands Regulatory Program (ILRP).
Additional actions	None specified	In Progress	<ul style="list-style-type: none"> 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

Implementation Activity	Target Date	Status	Progress Details
			chlorpyrifos were cancelled by USEPA in 2004 and 2000, respectively.
TMDL Monitoring Program Objectives			
The SVWQC reports to the Water Board annually on monitoring required to meet the TMDL monitoring goals under the ILRP. Progress on individual goals is summarized below.			
1. Determine compliance with established water quality objectives (WQOs) and the loading capacity applicable to diazinon and chlorpyrifos in the Sacramento and Feather Rivers.	None specified	Complete	Data have been collected by the SVWQC and others. These data indicate that samples in the Sacramento and Feather rivers are attaining the TMDL for both diazinon and chlorpyrifos.
2. Determine compliance with established load allocations for diazinon and chlorpyrifos.	None specified	Complete	Data indicate that samples in the Sacramento and Feather rivers are attaining the TMDL for both diazinon and chlorpyrifos; therefore, the load allocations have been met.
3. Determine the degree of implementation of management practices to reduce off-site movement of diazinon and chlorpyrifos.	None specified	Complete/ Ongoing	Implementation of the approved management plan is the primary mechanism for addressing management of diazinon and chlorpyrifos.
4. Determine the effectiveness of management practices and strategies to reduce off-site migration of diazinon and chlorpyrifos.	None specified	Complete/ Ongoing	Implementation of the approved management plan is the primary mechanism for addressing management of diazinon and chlorpyrifos.
5. Determine whether alternatives to diazinon and chlorpyrifos are causing surface water quality impacts.	None specified	Complete/ Ongoing	Both agricultural and stormwater dischargers monitor for alternatives insecticides which have potential to cause impacts to water quality, as well as toxicity. A number of pesticides of concern, such as pyrethroids have been identified are being addressed by the dischargers, the Central Valley Water Board, DPR, and others through various regulatory processes.
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	Both agricultural and urban stormwater dischargers are implementing toxicity monitoring, which meets this goal. Coalitions are required to conduct acute toxicity monitoring in water and sediment twice per year. Some toxicity is present, however the magnitude and extent of toxicity is much less than the toxic pulses of diazinon which were observed coming down the Sacramento and Feather rivers and through

Implementation Activity	Target Date	Status	Progress Details
			the Delta in the early 1990s.
7. Demonstrate that management practices are achieving the lowest pesticide levels technically and economically achievable.	None specified	Complete/ Ongoing	To address specific water quality exceedances, the Coalition and its partners developed a Management Plan in 2008, subsequently approved by the Water Board. The Management Plan is updated annually. Implementation of the approved plan is the primary mechanism for addressing exceedances observed in the Coalition's ILRP monitoring.

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

- **TMDL Staff Report – May 2007** (report [link](#); appendices [link](#))
- **Basin Plan Amendment (May 2007)** – 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 and Feather Rivers ([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, Coalition Group Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands** ([link](#))
- **Monitoring and Reporting Program, Order No. R5-2009-0875, for Sacramento Valley Water Quality Coalition under Amended Order No. R5-2006-0053 Coalition Group Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands** ([link](#))
- **Sacramento Valley Water Quality Coalition Annual Monitoring Reports/Plans and Water Board Staff Review** (2014, 2013, 2012, 2011, 2010, 2008, 2007, 2005) ([link](#))
- **Irrigated Lands Regulatory Program Water Quality Data** available at California Environmental Data Exchange Network (CEDEN [link](#))
- **EPA Reporting Watershed Improvement (SP12) Report**, Improving California Central Valley Watersheds: Diazinon Reduction in the Feather and Sacramento Rivers ([link](#))
- **EPA's Nonpoint Source Success Story** ([link](#))