UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

# TMDL Checklist

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|---|---|
| **State:** | **California, Central Valley Region** |
| **Waterbodies:** | **Nine Urban Waterbodies in the Sacramento/Roseville Area** |
| **Pollutants:** | **Pyrethroids (Bifenthrin, Cyfluthrin, Cypermethrin, Esfenvalerate, Lambda-Cyhalothrin, Permethrin)** |
| **Date of Letter Requesting: EPA Approval** | **February 22, 2019** |
| **Date EPA Received: Complete Submission** | **March 4, 2019** |
| **EPA Reviewer:** | **Matthew Mitchell** |

## 1. Submittal Letter

The submittal letter from Patrick Pulupa to Tomás Torres, dated February 22, 2019 was received by EPA on March 4, 2019. The submittal includes TMDLs for pyrethroid pesticides in the following urban waterbodies in the Sacramento/Roseville areas: Arcade Creek, Chicken Ranch Slough, Curry Creek (Placer and Sutter Counties), Elder Creek, Kaseberg Creek (tributary to Pleasant Grove Creek, Placer County), Morrison Creek, Pleasant Grove Creek (upstream of Fiddyment Road), Pleasant Grove Creek (South Branch), Strong Ranch Slough.

These TMDLs were established by the Central Valley Regional Water Quality Control Board (Regional Board) and submitted for EPA approval under Clean Water Act (CWA) Section 303(d) on February 22, 2019.

The State's submittal package includes:

(1) Staff Report: Proposed Amendments to the Water Quality Control Plan for the Sacramento and San Joaquin River Basins for the Control of Pyrethroid Pesticides Discharges, dated June 2017;
(2) Basin Plan Amendment and Regional Board Resolution No. R5-2017-0057, dated June 8, 2017, adopting the Basin Plan Amendment;
(3) State Board Resolution No. 2018-0031, dated July 10, 2018, approving the Basin Plan Amendment;
(4) Office of Administrative Law (OAL) approval document, File No. 2019-0107-03S, dated February 19, 2019;

(5) Response to comments documents from both Regional Board and State Board.

EPA considers the submittal complete as of the date of receipt of the full submittal, March 4, 2019.

## 2. TMDLs Included

| Waterbody (ID) | Listed Pollutant | Allocated Pollutant (if different than listing) | Listing Status |
|---|---|---|---|
| Arcade Creek (5192100) | Pyrethroids | - | Listed |
| Chicken Ranch Slough (51921000) | Pyrethroids | - | Listed |
| Curry Creek (Placer and Sutter Counties) (51922000) | Pyrethroids | - | Listed |
| Elder Creek (51911000) | Pyrethroids | - | Listed |
| Kaseberg Creek (tributary to Pleasant Grove Creek) (51922000) | Pyrethroids | - | Listed |
| Morrison Creek (51911000) | Pyrethroids | - | Listed |
| Pleasant Grove Creek (upstream of Fiddyment Road) (51922000) | Pyrethroids | - | Listed |
| Pleasant Grove Creek (South Branch) (51922000) | Pyrethroids | - | Listed |
| Strong Ranch Slough (51921000) | Pyrethroids | - | Listed |

EPA concludes it is appropriate for the State to include TMDLs for pyrethroids within the waterbodies listed above.

## 3. Water Quality Standards

The TMDLs address pyrethroid pesticide impairments that result in the following aquatic life-related beneficial uses not being protected in the nine urban waterbodies in the Sacramento/Roseville area including cold fresh water habitat (COLD) and warm fresh water habitat (WARM). The Regional Board determined that the WARM and COLD beneficial uses are the most sensitive to pyrethroids. The TMDLs are also intended to protect the other existing beneficial uses for the nine waterbodies including municipal and domestic supply (MUN); agricultural supply (AGR); industrial process supply (PRO); industry service supply (IND); hydropower generation (POW); contact recreation (REC-1); non-contact

recreation (REC-2); warm and cold migration of aquatic organisms (MIGR); spawning, reproduction, and/or early development (SPWN); wildlife habitat (WILD); and navigation (NAV) (Staff Report, pp. 48-49 and Basin Plan, Section 2.1, Table 2-1).

The Basin Plan currently does not include specific numeric water quality objectives for pyrethroids, but contains the following narrative water quality objectives that are applicable to pyrethroid pesticides (Basin Plan, Section 3.1.12):

"*No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses.*

*Discharges shall not result in pesticide concentrations in bottom sediments or aquatic life that adversely affect beneficial uses.*

*Pesticide concentrations shall not exceed those allowable by applicable antidegradation policies.*

*Pesticide concentrations shall not exceed the lowest levels technically and economically achievable.*"

The Basin Plan also contains a narrative water quality objective for toxicity that applies to toxicity caused by pesticides, specifying the following (Basin Plan, Section 3.1.20):

The narrative water quality objective for toxicity states: "*All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life. This objective applies regardless of whether the toxicity is caused by a single substance or the interactive effect of multiple substances. Compliance with this objective will be determined by analyses of indicator organisms, species diversity, population density, growth anomalies, and biotoxicity tests of appropriate duration or other methods as specified by the Regional Water Board.*"

EPA concurs with the State's analysis, and concludes that the numeric targets, TMDLs and associated allocations are set at levels necessary to attain applicable water quality standards.

**4. Numeric Targets** *List and describe numeric water quality targets for each TMDL; include an explanation of the basis of each target as an interpretation of water quality standards.*

Pyrethroid-Caused Sediment Toxicity Numeric Target

A pyrethroid-caused sediment toxicity numeric target is established using a chronic toxicity test, 10-day sediment exposure with *Hyalella azteca* as described further in Table 1. If other stressors are identified as the cause of toxicity, this will not be considered an exceedance of the target (Basin Plan Amendment, p. 11).

**Table 1: Sediment Toxicity Test**

| Parameter | Test | Biological Endpoint Assessed |
|---|---|---|
| Sediment Toxicity | *Hyalella azteca* (10-day chronic) | Survival |

Water Column Additivity Numeric Targets

Pyrethroid pesticides have additive toxicity in the aquatic environment. The numeric targets are set equal to the acute pyrethroid pesticides trigger and the chronic pyrethroid pesticides trigger. The equations for the triggers and for calculating concentrations of pyrethroid pesticides to be compared to the triggers are described below (Basin Plan Amendment, pp. 4-5).

Pyrethroid Pesticides Concentration Calculation

Concentrations of pyrethroid pesticides must be above reporting limits (limits of quantitation) to be included; concentrations reported as not-detected or as below the limit of quantitation will be considered as zero (0) in the below formulas. Guidance on acceptable analytical methods is given in the Surveillance and Monitoring chapter under the header Pyrethroid Pesticides Discharges.

Freely dissolved pyrethroid concentrations may be used in the below formulas to determine the sum of acute and chronic additive concentration goal units (CGUs). The freely dissolved concentration of each quantified pyrethroid pesticide in a sample may be directly measured or estimated using partition coefficients. Methods for direct measurement must be approved by the Executive Officer before they are used to determine the freely dissolved pyrethroid concentrations that are used for determining exceedances of the pyrethroid pesticides numeric triggers. To estimate the freely dissolved concentration of a pyrethroid pesticide with partition coefficients, the following equation shall be used:

**Equation 1**

$$C_{dissolved} = \frac{C_{total}}{1 + (K_{OC} \times [POC]) + (K_{DOC} \times [DOC])}$$

Where:

$C_{dissolved}$ = concentration of a an individual pyrethroid pesticide that is in the freely dissolved phase (ng/L),
$C_{total}$ = total concentration of an individual pyrethroid pesticide in water (ng/L),
$K_{OC}$ = organic carbon-water partition coefficient for the individual pyrethroid pesticide (L/kg),
$[POC]$ = concentration of particulate organic carbon in the water sample (kg/L), which can be calculated as [POC]=[TOC]-[DOC],
$K_{DOC}$ = dissolved organic carbon-water partition coefficient (L/kg),
$[DOC]$ = concentration of dissolved organic carbon in the sample (kg/L).

Site-specific or alternative study-based partition coefficients approved by the Executive Officer may be used in the above equation. If site-specific or alternative study-based partition coefficients are not available or have not been approved, the following partition coefficients shall be used in the above equation:

| | *Ambient Waters* | | *Wastewater Effluents* | |
|---|---|---|---|---|
| Pyrethroid Pesticide | $K_{OC}$ (L/kg) | $K_{DOC}$ (L/kg) | $K_{OC}$ (L/kg) | $K_{DOC}$ (L/kg) |
| Bifenthrin | 4,228,000 | 1,737,127 | 15,848,932 | 800,000 |
| Cyfluthrin | 3,870,000 | 2,432,071 | 3,870,000 | 2,432,071 |
| Cypermethrin | 3,105,000 | 762,765 | 6,309,573 | 200,000 |
| Esfenvalerate | 7,220,000 | 1,733,158 | 7,220,000 | 1,733,158 |
| Lambda-cyhalothrin | 2,056,000 | 952,809 | 7,126,428 | 200,000 |
| Permethrin | 6,075,000 | 957,703 | 10,000,000 | 200,000 |

Acute Pyrethroid Pesticides Trigger

The acute additive pyrethroid pesticides numeric trigger is equal to one (1) acute additive concentration goal unit ($CGU_{acute}$) not to be exceeded more than once in a three-year period. The $CGUs_{acute}$ are calculated as the sum of individual measured pyrethroid concentration-to-acute concentration goal ratios, as defined in the following formula. For calculation of $CGUs_{acute}$, available samples collected within the applicable averaging period for the numeric trigger will be used to determine exceedances of the trigger. Freely dissolved pyrethroid concentrations may be used in the numerator of each ratio if appropriate data are available, as described in the equation to calculate freely dissolved concentrations given above (see Equation 1).

**Equation 2**

$$CGU_{acute} = \frac{C_{bif}}{ACG_{bif}} + \frac{C_{cyf}}{ACG_{cyf}} + \frac{C_{cyp}}{ACG_{cyp}} + \frac{C_{esf}}{ACG_{esf}} + \frac{C_{lcy}}{ACG_{lcy}} + \frac{C_{per}}{ACG_{per}}$$

Where:

$C_{bif}$ = Average concentration of bifenthrin in ng/L from a 1-hour averaging period,

$C_{cyf}$ = Average concentration of cyfluthrin in ng/L from a 1-hour averaging period,

$C_{cyp}$ = Average concentration of cypermethrin in ng/L from a 1-hour averaging period,

$C_{esf}$ = Average concentration of esfenvalerate in ng/L from a 1-hour averaging period,

$C_{lcy}$ = Average concentration of lambda-cyhalothrin in ng/L from a 1-hour averaging period,

$C_{per}$ = Average concentration of permethrin in ng/L from a 1-hour averaging period,

$ACG_{bif}$ = Bifenthrin acute concentration goal of 0.8 ng/L,

$ACG_{cyf}$ = Cyfluthrin acute concentration goal of 0.8 ng/L,

$ACG_{cyp}$ = Cypermethrin acute concentration goal of 1 ng/L,

$ACG_{esf}$ = Esfenvalerate acute concentration goal of 2 ng/L,

$ACG_{lcy}$ = Lambda-cyhalothrin acute concentration goal of 0.7 ng/L,

$ACG_{per}$ = Permethrin acute concentration goal of 6 ng/L,

$CGU_{acute}$ = The sum of measured pyrethroid concentration-to-acute concentration goal ratios, rounded to one significant figure. A sum exceeding one (1) indicates an exceedance of the acute additive pyrethroid pesticides numeric trigger.

Chronic Pyrethroid Pesticides Trigger

The chronic additive pyrethroid pesticides numeric trigger is equal to one (1) chronic additive concentration goal unit not to be exceeded more than once in a three-year period. The chronic $CGUs_{chronic}$ are calculated as the sum of individual measured pyrethroid concentration-to-chronic concentration goal ratios, as defined in the following formula. For calculation of $CGUs_{chronic}$, available samples collected within the applicable averaging period for the numeric trigger will be used to determine exceedances of the trigger. Freely dissolved pyrethroid concentrations may be used in the numerator of each ratio if appropriate data are available, as described in the equation to calculate freely dissolved concentrations given above (see Equation 1).

**Equation 3**

$$CGU_{chronic} = \frac{C_{bif}}{CCG_{bif}} + \frac{C_{cyf}}{CCG_{cyf}} + \frac{C_{cyp}}{CCG_{cyp}} + \frac{C_{esf}}{CCG_{esf}} + \frac{C_{lcy}}{CCG_{lcy}} + \frac{C_{per}}{CCG_{per}}$$

Where:

$C_{bif}$ = Average concentration of bifenthrin in ng/L from a 4-day averaging period,

$C_{cyf}$ = Average concentration of cyfluthrin in ng/L from a 4-day averaging period,

$C_{cyp}$ = Average concentration of cypermethrin in ng/L from a 4-day averaging period,

$C_{esf}$ = Average concentration of esfenvalerate in ng/L from a 4-day averaging period,

$C_{lcy}$ = Average concentration of lambda-cyhalothrin in ng/L from a 4-day averaging period,

$C_{per}$ = Average concentration of permethrin in ng/L from a 4-day averaging period,

$CCG_{bif}$ = Bifenthrin chronic concentration goal of 0.1 ng/L,

$CCG_{cyf}$ = Cyfluthrin chronic concentration goal of 0.2 ng/L,

$CCG_{cyp}$ = Cypermethrin chronic concentration goal of 0.3 ng/L,

$CCG_{esf}$ = Esfenvalerate chronic concentration goal of 0.3 ng/L,

$CCG_{lcy}$ = Lambda-cyhalothrin chronic concentration goal of 0.3 ng/L,

$CCG_{per}$ = Permethrin chronic concentration goal of 1 ng/L,

$CGU_{chronic}$ = The sum of measured pyrethroid concentration-to-chronic concentration goal ratios, rounded to one significant figure. A sum exceeding one (1) indicates an exceedance of the chronic additive pyrethroid pesticides numeric trigger.

EPA concludes the State's use of these numeric targets in the TMDL analyses to be reasonable and appropriate and finds adequate basis for the targets. The targets in this TMDL submittal are established at a level necessary to attain and maintain water quality standards.

## 5. Source Analysis

Toxicity in the water column and the sediment are associated with currently applied pyrethroid pesticides. Impairments from pyrethroid pesticides result from agricultural and urban pesticide applications. Within urban sources, pyrethroids have been detected in storm water sewers in residential neighborhoods. A 2008 report prepared by the San Francisco Estuary Project found that statewide, more than 90% of the estimated urban pyrethroid use was by professional applicators for structural pest control (Staff Report, p. 8). The Regional Board determined sources through use of watershed land use and county pesticide use reporting analysis, urban pesticide studies, sub watershed water quality data along with pesticide use analysis, and special studies.

The following point sources are present: City and County of Sacramento Municipal Separate Storm Sewer Systems – NPDES No. CAS085324 and City of Roseville Municipal Separate Storm Sewer Systems – NPDES No. CAS000004.

Since pyrethroid impairments in agricultural waters are addressed by existing regulatory programs for agricultural discharges, the Regional Board is using Category 4b of the 303(d)/305(b) Integrated Report rather than establishing TMDLs to address pyrethroid impairments in agricultural waters (Staff Report, p.115).

EPA finds the State's source analysis to be complete, reasonable, and appropriate.

## 6. Linkage Analysis

The loading capacity is equal to the numeric targets, which are set to attain the narrative water quality standards for toxicity and pesticides. The loading capacities are concentration based and set equal to the acute and chronic additive pyrethroid pesticides triggers (Staff Report, p. 118).

The Regional Board asserts that attainment of the pyrethroid additivity numeric targets is also likely to result in attainment of the sediment toxicity target because similar levels of reduction would be needed to attain either target. The loading capacity is defined based on the water column targets since these can be used more directly in defining TMDL allocations and water column concentrations respond more quickly to reductions in inputs than sediment concentrations. It may take longer to attain the sediment target because sediment concentrations do not decrease as rapidly as water concentrations in response to reduced loading (Staff Report, p. 119).

EPA finds the State's analysis to be reasonable and appropriate.

## 7. TMDLs and Allocations

### TMDLs

The TMDLs are set equal to the loading capacity. The loading capacity is concentration based and equal to the acute and chronic additive pyrethroid pesticide triggers. The Staff Report explains that a concentration based loading capacity is preferable because it is an immediate measurement of whether the numeric target is attained, minimizes the sampling needed to assess compliance since no flow data is required, and is consistent with other pesticide control programs in the Central Valley.

### Waste Load and Load Allocations

The TMDLs are allocated to point sources in the Sacramento/Roseville area. Point sources are given waste load allocations.

Waste load allocations are assigned to municipal stormwater programs. Both the City and County of Sacramento and the City of Roseville have municipal stormwater permits in the watershed. Municipal stormwater programs have waste load allocations for pyrethroid pesticides that are equivalent to the concentration based loading capacity. Pyrethroids are commonly applied in urban areas.

The allocations and parties responsible for the allocations are listed in Table 2.

**Table 2: Waste Load and Load Allocations**

| Waste Load Allocations | | |
|---|---|---|
| **Responsible Party** | **Source** | **Allocation** |
| City and County of Sacramento Municipal Separate Storm Sewer Systems – NPDES No. CAS085324 | Municipal Stormwater | Equal to concentration based loading capacity |
| City of Roseville Municipal Separate Storm Sewer Systems – NPDES No. CAS000004 | Municipal Stormwater | Equal to concentration based loading capacity |

EPA concurs with the State's analysis and concludes the TMDLs are set at levels necessary to attain applicable water quality standards. EPA concludes the State's submittal includes waste load allocations and load allocations that are consistent with the provisions of the CWA and federal regulations.

**8. Margin of Safety (MOS)** *Identify and describe the submittal's explicit and/or implicit margin/s of safety for each pollutant, and why they are reasonable and appropriate.*

The TMDL has an implicit margin of safety in that allocations are assigned equal to the loading capacity concentrations, and does not account for the dilution in the TMDL waterbodies receiving storm water discharges. Since it is unlikely that all the tributaries of the TMDL waterbodies are discharging at concentrations approaching the concentration triggers, there will likely be dilution available in the TMDL waterbodies. The available dilution provides a margin of safety for the TMDL waterbodies. The TMDL also does not assume any reductions in pyrethroid loading due to degradation although degradation processes are likely to take place. This assumption also contributes to the implicit margin of safety (Staff Report, pp. 121-122).

EPA finds the State's analysis to be reasonable.

**9. Seasonal Variations and Critical Conditions**

The TMDLs and allocations expressed in terms of concentrations will address attainment of water quality standards regardless of season. Since TMDLs are expressed in terms of concentrations of pyrethroids rather than loads, seasonal variations and critical conditions are taken into account because the loading capacity is not dependent on flow or other environmental conditions (Staff Report, p. 119).

EPA finds the State's analysis to be reasonable.

**10. Public Participation**

The submittal demonstrates that the Regional Board and State Board provided opportunity for public comment, held public workshops and hearings, and responded to written and oral public comments, as well as scientific peer review comments.

- On January 11, 2017, the Regional Board publicly noticed the proposed Basin Plan Amendment and distributed the Amendment and the supporting Staff Report for public review and comment. The comment period closed on March 24, 2017. The Regional Board addressed comments and approved the package on June 8, 2017.

- On October 3, 2017, the State Board publicly noticed the TMDL and Basin Plan Amendment. The comment period ended on November 2, 2017. The State Board addressed all comments and approved the TMDLs in the BPA on July 10, 2018.

EPA finds the State provided sufficient opportunities for public comment and adequately responded to public comments.

**11. Technical Analysis**

EPA finds the State's TMDL submittal provides an appropriate level of technical analysis supporting all TMDL elements.

**12. Reasonable Assurances**

N/A