DATE: 12/21/2018

SUBJECT: **SUMMARY OF TOTAL MAXIMUM DAILY LOADS FOR SEDIMENT TOXICITY AND PYRETHROID PESTICIDES IN SEDIMENT IN THE LOWER SALINAS RIVER WATERSHED**

This document provides a condensed summary table of the Total Maximum Daily Loads (TMDLs) and implementation plan for sediment toxicity and pyrethroid pesticides in sediment in the lower Salinas River watershed as well as a brief technical description of the numeric targets.

TMDL Summary Table:

Water Quality Goals	To restore and enhance freshwater habitat for aquatic life such as fish, wildlife, and invertebrates by reducing toxicity and pyrethroid pesticide pollution in stream sediments. To protect high quality streams and rivers and prevent any further water quality and aquatic habitat degradation.
Water Quality Objectives	The Central Coast Basin Plan (CCRWQCB, 2017) establishes water quality objectives necessary for the reasonable protection of the beneficial uses designated to each waterbody. This TMDL project interprets the following narrative water quality objectives: General Objective for 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. Compliance with the objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, toxicity bioassays of appropriate duration, or other appropriate methods.* General Objective for Pesticides*: No individual pesticide or combination of pesticides shall reach concentrations that adversely affect beneficial uses. There shall be no increase in pesticide concentrations found in bottom sediments or aquatic life.*
Impaired Waterbodies	Waterbodies that do not meet water quality objectives are considered impaired. The following waterbodies are impaired for sediment toxicity and/or concentrations of pyrethroid pesticides: Tembladero Slough/Reclamation Canal and its tributaries: - Alisal Creek - Alisal Slough - Espinosa Slough - Gabilan Creek - Merrit Ditch - Natividad Creek - Old Salinas River Lower Salinas River and its tributaries: - Blanco Drain - Chualar Creek - Quail Creek

Sources	Runoff from agricultural and municipal land uses are the sources of pyrethroid pesticides and sediment toxicity in the watershed.
Numeric Targets	Numeric targets are necessary to interpret the narrative water quality objectives. The following numeric targets are the water quality thresholds for pyrethroids and sediment toxicity that define when aquatic life is protected (i.e., water quality standards are achieved). a) Sediment Toxicity Numeric Target (also a TMDL) b) Pyrethroid Sediment Concentration Toxicity Unit Numeric Target (also a TMDL) c) Numeric Target for Pyrethroid Concentrations in Water (target only and not a TMDL) *(each described in detail on pages 3-4)*
TMDLs	TMDL stands for a Total Maximum Daily Load. This is the amount of toxicity and pyrethroid pesticides in sediment that the waterbodies can assimilate and achieve water quality standards for the protection of aquatic life. • The TMDLs for sediment toxicity are equal to the sediment toxicity numeric targets. • The TMDLs for pyrethroid pesticides are equal to the pyrethroid sediment concentration toxicity unit numeric targets. *(each described in detail on pages 3-4)*
Allocations and Responsible Parties	TMDLs are allocated to parties responsible for the pollutant loads. These TMDLs are allocated to municipalities (City of Salinas and County of Monterey) and owners/operators of irrigated agricultural lands (agriculture) in the watershed. As point source dischargers, municipalities have wasteload allocations and as nonpoint sources dischargers, agriculture have load allocations. • The City of Salinas and the County of Monterey have wasteload allocations for both sediment toxicity and pyrethroid toxicity units. • Owners/operators of irrigated agricultural lands have load allocations for both sediment toxicity and pyrethroid toxicity units.
Key TMDL Milestones	The estimated timeframe for municipalities to achieve their TMDL allocations is 2023 (five years). The estimated timeframe for agriculture to achieve their TMDL allocations is 2028 (ten years).

Implementation Strategy	TMDLs are not self-implementing but rely on existing regulatory tools such as permits and orders to correct the water quality impairment. <u>Municipalities</u> implement these TMDLs through their stormwater permits and by taking the following actions to attain the water quality goals: • Implementing management measures to reduce pesticide and sediment discharges from municipal facilities (e.g., Integrated Pest Management, street sweeping, storm drain system cleaning). • Reducing storm water discharges to receiving waters through volume-based structural control measures. • Requiring construction sites and commercial and industrial facilities to implement practices to reduce the discharge of sediment. • Participating in statewide efforts that coordinate with the Department of Pesticide Regulation (DPR) and other organizations and taking actions to protect water quality from pesticides in the urban environment. • Conducting surface water monitoring and developing annual monitoring reports. • Modeling the load(s) of total suspended solids from urban catchments to prioritize future efforts and load reduction measures. <u>Owners/operators of irrigated agricultural lands</u> implement these TMDLs by complying with the Central Coast Water Board's Agricultural Order (currently Order No. R3-2017-0002). This can be achieved by: • Implementing and reporting on management practices to reduce erosion and prevent discharge of sediment and pesticides into waterways. • Conducting monitoring, either individually or as part of a cooperative monitoring program and reporting annually on water quality conditions. • Assessing effectiveness of management practices to reduce sediment erosion and discharge to waterbodies and adapt as necessary. • Maintaining Annual Compliance Forms, documenting effectiveness of management practices and improvements, when applicable.

Technical Description of Numeric Targets and TMDLs

a) <u>Sediment Toxicity Numeric Target and TMDL</u>

The test organism and toxicity parameters identified in Table 1 shall be used to assess whether the sediment toxicity numeric target is achieved. Assessments will be conducted at receiving water(s) sites, as defined in appropriate sampling plans that have quality assurance and quality controls that are consistent with the Surface Water Ambient Monitoring Program (SWAMP).

Table 1. Standard aquatic toxicity tests (sediment toxicity numeric target)

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

Toxicity to invertebrates shall be tested using chronic toxicity test, 10-day sediment exposure with *Hyalella azteca* (USEPA, 2000).

b) Pyrethroid Sediment Concentration Toxicity Unit Numeric Target and TMDL

The combined mix of pyrethroids in a sample can have an additive effect on toxicity. Toxicity unit (TU) analysis is a common method for assessing the potential additive toxicity of pesticide compounds when one or more pesticides is present. Toxicity units are the ratio of the sample concentrations in sediment to known or published median lethal concentrations (LC50s). Sample concentrations and LC50 criteria used in this calculation are organic carbon normalized concentrations (oc). LC50 values used for the pyrethroids TU calculations are listed in Table 2.

The numeric target for the sum pyrethroid TUs is where:

Sum Pyrethroid TUs < 1.0

This is calculated by first determining the TU for each pyrethroid using the TU formula as follows:

$$\text{Pyrethroid TU} = \frac{\text{sample concentration (oc)}}{\text{known LC50 concentrations values (oc)}}$$

Then calculate the sum of pyrethroid TUs using the following formula.

Sum Pyrethroid TUs = Pyrethroid TU (1) + Pyrethroid TU (2)

Table 2. Pyrethroid sediment criteria used for toxicity unit calculations.

Chemical	LC50[1] ng/g[2] (ppb[3])	LC50 ug/g[4] oc[5] (ppm[6])	Reference
Bifenthrin	12.9	0.52	(Amweg et al., 2005)
Cyfluthrin	13.7	1.08	(Amweg et al., 2005)
Cypermethrin	14.87	0.38	(Maund et al., 2002) mean value
Esfenvalerate	41.8	1.54	(Amweg et al., 2005)
Lambda-Cyhalothrin	5.6	0.45	(Amweg et al., 2005)
Permethrin	200.7	10.83	(Amweg et al., 2005)

[1]Median lethal concentration (LC50) for amphipods (*Hyalella azteca*), [2] nano grams per gram (ng/g), [3] parts per billion, [4] microgram per gram (ug/g), [5] organic carbon normalized concentrations (oc), [6] parts per million (ppm)

c) Numeric Targets for Pyrethroid Concentrations in Water (target only and not a TMDL)

These targets represent concentrations of pyrethroids in water that protect aquatic life in the lower Salinas River watershed.

Table 3. Pyrethroid water numeric targets

Chemical	**Acute Target – CMC[1] ug/L[3] (ppb[4])**	**Chronic Target – CCC[2] ug/L (ppb)**	**Reference**
Bifenthrin	0.004	0.0006	(Palumbo et al., 2010)
Cyfluthrin	0.0003	0.00005	(Fojut et al., 2010)
Lambda-cyhalothrin	0.001	0.0005	(Fojut et al., 2010)

[1] CMC – Criterion Maximum Concentration (Acute: 1- hour average). Not to be exceeded more than once in a three-year period.
[2] CCC – Criterion Continuous Concentration (Chronic: 4-day [96-hour] average). Not to be exceeded more than once in a three-year period.
[3] microgram per liter (ug/L), [4] parts per billion

References

Amweg, E.L., Weston, D.P., Ureda, N.M., 2005. Use and toxicity of pyrethroid pesticides in the Central Valley, California, USA. Environ Toxicol Chem 24:966–972; Correction: 24:1300–1301.

Central Coast Regional Water Quality Control Board. 2017. *Water Quality Control Plan for the Central Coastal Basin, September 2017 Edition*. California Environmental Protection Agency. http://www.waterboards.ca.gov/centralcoast/publications_forms/publications/basin_plan/index.shtml

Fojut, T.L., Tjeerdema, R.S., 2010. Lambda-cyhalothrin Water Quality Criteria Report. Report prepared for the Central Valley Regional Water Quality Control Board, Rancho Cordova, CA. http://www.swrcb.ca.gov/rwqcb5/water_issues/tmdl/central_valley_projects/central_valley_pesticides/criteria

Fojut, T.L., Chang, S., Tjeerdema, R.S., 2010. Cyfluthrin Water Quality Criteria Report. Report prepared for the Central Valley Regional Water Quality Control Board, Rancho Cordova, CA. http://www.swrcb.ca.gov/rwqcb5/water_issues/tmdl/central_valley_projects/central_valley_pesticides/criteria

Maund, S.J., Hamer, M.J., Lane, M.C.G., Farrelly, E., Rapley, J.H., Goggin, U.M., Gentle, W.E., 2002. Partitioning, bioavailability, and toxicity of the pyrethroid insecticide cypermethrin in sediments. Environ Toxicol Chem 21, 9-15.

Palumbo, A.J., Fojut, T.L., Tjeerdema, R.S., 2010. Bifenthrin Water Quality Criteria Report. Report prepared for the Central Valley Regional Water Quality Control Board, Rancho Cordova, CA. http://www.swrcb.ca.gov/rwqcb5/water_issues/tmdl/central_valley_projects/central_valley_pesticides/