Development of a Basin Plan Amendment and TMDL for the Control of Pyrethroid Pesticide Discharges

INFORMATION DOCUMENT

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Central Valley Regional Water Quality Control Board (Central Valley Water Board) staff have been working collaboratively with multiple stakeholder groups to develop a pyrethroid pesticide control program. This document provides a brief background on the concern, lists project goals and objectives, and summarizes key issues as well as regulatory alternatives being considered.

Background

Pyrethroids are commonly used pesticides, and have been found at toxic concentrations in water and sediment in both urban and agricultural areas within the Central Valley region. Six pyrethroids are the focus of this project: bifenthrin, cyfluthrin, cypermethrin, esfenvalerate, lambda-cyhalothrin, and permethrin. The main sources of pyrethroids are municipal stormwater and agriculture, but municipal wastewater also contains pyrethroids (Markle et al. 2012). Of the 14 water bodies within our region that are currently listed as impaired for pyrethroids pursuant to Clean Water Act section 303(d), nine have municipal stormwater sources and five have agricultural sources. Based on data collected since the 2010 listing cycle, several more water bodies are anticipated to be identified as impaired.

Aquatic life is the beneficial use that has been identified as impaired. Since pyrethroid pesticides are toxic at very low concentrations, criteria derived for protection of aquatic life are very low – some in the tenths and hundredths of nanograms per liter (part per trillion) as identified in Table 1. Pyrethroid toxicity is most frequently observed in benthic sediments, although water column toxicity has also been observed. To address the current and anticipated future impairments, staff began developing a proposed basin plan amendment for the control of pyrethroid pesticide discharges in 2012.

Goals and Objectives

The overall goal for the Pyrethroids BPA is to establish clear requirements for the control of pyrethroid pesticide discharges that provide reasonable protection of beneficial uses in the Sacramento and San Joaquin River Watersheds, including the Delta. Project objectives include:

Primary Objectives:

1. Establishing measurable objectives or targets for pyrethroid concentrations in waters of the State that provide reasonable protection of beneficial uses.
2. Addressing existing impairments from pyrethroid pesticides through total maximum daily loads (TMDLs) or other means.

3. Developing reasonable and attainable implementation provisions to achieve the target pyrethroid concentrations.

Additional Objectives:

4. Efficient process to address future impairments
5. Provisions for addressing alternative/replacement pesticides

The 2014 Delta Strategic Plan highlighted the need for a control program to address both sediment and water column pyrethroid concentrations. Since there is currently not adequate sediment species toxicity data or an established method for deriving sediment criteria, the proposed Basin Plan Amendment has focused on setting and achieving water column targets, however, proposed targets for TMDLs do identify no statistically significant toxicity to *Hyalella azteca* in benthic sediments.

Progress and Issues

Since 2012, staff has held six stakeholder meetings to discuss the development of the proposed Basin Plan Amendment (BPA). Topics discussed have included scope of the effort, potential water quality objectives/targets, scientific peer review results, implementation alternatives, and potential draft amendment language. Materials circulated to stakeholders during this process as well as stakeholder and technical peer review comments received by staff are available at:

http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/central_valley_pesticides/pyrethroid_tmdl_bpa/index.shtml

Staff has received comments on several aspects of the proposed amendment, most notably regarding: (1) the very low concentrations of the potential objectives/targets under consideration; (2) the uncertainty that all dischargers would be able to achieve reductions needed to achieve the proposed targets; and (3) the corresponding potential for mandatory minimum penalties for NPDES permit holders. All issues revolve around the basic concept of "reasonable protection" of beneficial uses. Based on the discussions and the results of scientific peer review, staff has been re-examining potential alternatives for the overall pyrethroid pesticide control program. Some of the key issues under consideration include the following.

Water Quality Criteria – All of the numeric values considered by staff are provided in Table 1. The table identifies the limits proposed by staff, current Basin Plan guidelines for interpreting the narrative toxicity objective when evaluating pesticides, and key potential limits evaluated during the process. Previous listings of impairment were based on either water concentrations compared to one-tenth of the lowest acute toxicity values available at the time (Basin Plan guideline) or sediment toxicity linked to pyrethroids. Staff has proposed using water quality criteria derived by the University of California – Davis (UCD) as the numeric water concentrations that would provide reasonable protection of beneficial uses. Water quality criteria based on the 5th percentile of the species sensitivity distribution are typically recommended, but the UCD method recommends adjusting criteria downward (to the 1st percentile) when the criteria based on the 5th percentile are not protective of the most sensitive

species in the data set, which was the case for five pyrethroids. In each of these cases the most sensitive species was the aquatic invertebrate *Hyalella azteca.* Most stakeholders preferred the 5th percentile numbers to the 1st percentile numbers for the derivation of aquatic life criteria and agreed with two of the scientific peer reviewers who noted that the use of the 5th percentile would be more consistent with other methods (ie. USEPA) and represents a more robust statistic. Nevertheless some stakeholders are concerned with the attainability of the very low criteria, including those based on the 5th percentile, while others are concerned that using criteria based on the 5th percentile may not be appropriately protective of aquatic life beneficial uses.

Ecological Relevance of Water Quality Criteria – The most sensitive aquatic species used to develop pyrethroid toxicity thresholds is *Hyalella azteca*. Laboratory cultures of *H. azteca* have demonstrated higher sensitivity to pyrethroid pesticides than some native populations. Native populations demonstrate varying levels of sensitivity that have correlated with pesticide use areas; sensitivity consistent with laboratory cultures in areas without documented pyrethroid concentrations and lower sensitivity (more tolerance) in areas with repeated high pesticide inputs (Weston et al. 2013; Clark et al. 2015)[1]. Utilizing the laboratory cultures may not be representative of some areas of the Central Valley; but conversely, utilizing resistant *H. azteca* may not be representative of other areas. The criteria under consideration and submitted for scientific peer reviewed utilized results from laboratory cultures of *H. azteca*.

In part due to the variability in sensitivity, some stakeholders suggested that methods such as rapid bioassessment should be considered for determining acceptable levels of pyrethroids that would maintain a native population of *Hyalella azteca* and other aquatic species and result in the attainment of beneficial uses. However it is uncertain how bioassessment would be applied given the relative insensitivity and specificity of this endpoint, the multiple stressors present, and the lack of reference conditions for most streams in the Central Valley.

Bioavailability – Pyrethroids are hydrophobic compounds, which means they have a strong tendency to bind to particulates and dissolved organic carbon (DOC). Many studies have indicated that it is mainly the fraction of pyrethroids that are freely dissolved in water that are bioavailable to organisms and have the potential to cause toxicity. The fraction of pyrethroids that is bound to particulates or DOC is much less bioavailable and has a much lower potential to cause toxicity. In many cases, the freely dissolved pyrethroid is 1-5% of what is measured in whole water, which also includes pyrethroids bound to particulates and DOC. In order to account for bioavailability in determining attainment of a numeric concentration of pyrethroids, staff has proposed that freely dissolved concentrations of pyrethroids are used, rather than the whole water concentration. Analytical methods to directly measure the freely dissolved concentration are not currently commercially available, but they are in development. The freely dissolved concentration can also be estimated with an equation if particulate and dissolved

[1] Clark SL, Ogle RS, Gantner A, Hall LW Jr, Mitchell G, Giddings J, McCoole M, Dobbs M, Henry K, Valenti T. 2015. Comparative sensitivity of field and laboratory populations of Hyalella azteca to the pyrethroid insecticides bifenthrin and cypermethrin. Environ Toxicol Chem. DOI: 10.1002/etc.2907.

Weston DP, Poynton HC, Wellborn GA, Lydy MJ, Blalock BJ, Sepulveda MS, Colbourne JK. 2013. Multiple origins of pyrethroid insecticide resistance across the species complex of a nontarget aquatic crustacean, *Hyalella azteca.* Proceedings of the National Academy of Science of the United States of America 110(41):16532-16537.

organic carbon are also measured in a sample. Staff has proposed a default calculation to account for bioavailability with options for dischargers to directly analyze the freely dissolved concentrations or develop site specific partitioning coefficients. Most stakeholders were supportive of using the bioavailable portion of pyrethroids to determine compliance.

Detection Limits - Most of the water quality criteria being considered for pyrethroids are near or below current commercially available detection limits. The current commercial analytical limitations would make it difficult to determine whether the criteria concentrations are truly being attained and in some cases, any detection would exceed the criteria.

Additivity – Pyrethroids all have very similar toxic modes of action and the scientific literature indicates that their toxicity is approximately additive. Staff have proposed that if multiple pyrethroids are detected in a sample, they should be considered additively using an equation (analogous to what was used with chlorpyrifos and diazinon pesticides). There are stakeholder concerns that because the potential water quality criteria are so low and are conservative values, that it will be very difficult to attain the criteria concentrations when they are added together.

Scientific Peer Review

A scientific peer review of the Draft Pyrethroid Pesticides Staff Report was completed in July 2015. The following five assumptions, findings, and conclusions were reviewed by the three scientific peer reviewers:

1. The proposed water quality objectives (1st percentile) are protective of the beneficial use(s) that are most sensitive to pyrethroid pesticides.
2. The underlying method for deriving the proposed pyrethroid pesticides water quality criteria, which are proposed as water quality objectives and TMDLs, is scientifically sound and includes an appropriate level of conservatism.
3. For determining attainment of water quality objectives, it is scientifically sound to consider the six pyrethroid pesticides additively if more than one is detected in a water sample. Based on current information available, it is not scientifically sound to assume additive toxicity of other constituents with pyrethroid pesticides.
4. For determining attainment of water quality objectives, it is scientifically sound to use the measured or estimated freely dissolved aqueous concentrations of pyrethroid pesticides. The proposed equation to estimate freely dissolved concentrations and the default partition coefficients are scientifically sound and protective of beneficial uses.
5. The proposed TMDL loading capacity, allocations, margin of safety, and numeric targets are clearly described and consistent with attaining water quality objectives that are protective of the beneficial use(s) most sensitive to pyrethroid pesticides.

The peer review comments received generally supported the conclusions listed above. Two of the scientific peer reviewers noted that using the 5th percentile for the proposed water quality objective was consistent with other methods (ie. USEPA), represents a more robust statistic than the 1st percentile and better balances the conservatism already built into the process.

The following table (Table 1) identifies the pyrethroid objectives proposed during the scientific peer review process as well as the additional objectives considered and discussed.

Table 1 Aquatic Life Fresh Surface Water Quality Criteria and Guidelines for Pyrethroids.

	Bifenthrin (ng/L)	Cyfluthrin (ng/L)	Cypermethrin (ng/L)	Esfenvalerate (ng/L)	Lambda-cyhalothrin (ng/L)	Permethrin (ng/L)
Proposed						
1st percentile 2015 acute via UCD method	0.06[c]	0.07[d]	0.04[e]	0.2[f]	0.03[g]	6[h]
1st percentile 2015 chronic via UCD method	0.01[c]	0.01[d]	0.01[e]	0.03[f]	0.01[g]	1[h]
Current Basin Plan Guideline for Interpreting Narrative Toxicity Objective						
1/10th lowest LC_{50}	0.05[n]	0.055[o]	0.056[p]	0.085[q]	0.03[r]	0.7[s]
Additional Criteria Considered						
5th percentile 2015 acute via UCD method	0.8[c]	0.8[d]	1[e]	2[f]	0.7[g]	6[h]
5th percentile 2015 chronic via UCD method	0.1[c]	0.2[d]	0.3[e]	0.3[f]	0.3[g]	1[h]
Pyrethroid Working Group SSD acute[i]	1.3	1.5	3.0	2.3	0.8	19
CDFW interim acute[a]	NA	NA	2	NA	NA	30
2010/11 UCD acute[b]	4	0.3	1	NA	1	10
2010/11 UCD chronic[b]	0.6	0.05	0.2	NA	0.5	2
2015 acute via USEPA method	0.059[c]	NA	0.25[e]	NA	0.21[g]	4[h]
2015 chronic via USEPA method	NA	NA	NA	NA	0.087[g]	NA
USEPA OPP aquatic life benchmark – invertebrates[m] (acute; chronic)	800; 1.3	12.5; 7	210; 69	25; 17	3.5; 2	10; 1.4
USEPA OPP aquatic life benchmark – fish[m] (acute; chronic)	75; 40	34; 10	195; 140	35; 35	105; 31	395; 51.5
Human health guidelines for drinking water						
USEPA human health benchmark – acute (1d-children)[t]	3,300,000	200,000	1,000,000	18,000	50,000	2,500,000
USEPA human health benchmark – chronic (lifetime)[t]	91,000	168,000	420,000	13,000	7,000	1,750,000

[a]Siepmann and Holm 2000; [b]Fojut et al. 2012; [c]Fojut 2015a; [d]Fojut 2015b; [e]Fojut 2015c; [f]Fojut 2015d; [g]Fojut 2015e; [h]Fojut 2015f; [i]Giddings et al. 2014; [j]ANZECC/ARMCANZ 2000; [k]CCME 2006; [l]Crommentuijn et al. 2000; [m]USEPA 2012b; [n]Bradley 2013a; [o]Bradley 2013b; [p]Bradley 2013c; [q]Bradley 2013d; [r]Bradley 2013e; [s]Bradley 2013f; [t]USEPA 2013.

Developing Reasonable and Attainable Implementation Provisions

Due to the very low pyrethroid concentrations being considered, concern as to the feasibility of being able reduce loading sufficiently to meet the proposed numbers, and the corresponding potential for mandatory minimum penalties for NPDES permit holders, staff and stakeholders have spent significant time identifying and evaluating potential regulatory alternatives.

One primary concern is the feasibility of meeting proposed numbers, especially in urban environments since storm water and municipal wastewater dischargers do not have control over the use of pesticides by individuals in their service areas. In these areas, the primary means of source control is through the implementation of the authorities of agencies which regulate pesticide use: the California Department of Pesticide Regulation (DPR); County Agricultural Commissioners; and USEPA's Office of Pesticide Programs (OPP). The approach most likely to succeed in attaining adequate pyrethroid reductions would include a combination of dischargers implementation of reasonable best management practices and the Board and/or dischargers coordinating with DPR and USEPA OPP to address pesticide uses/products with high potential to impact surface water.

Considerable pro-active engagement by the Boards and discharger community with DPR and USEPA OPP has occurred and is ongoing to address pyrethroid water quality concerns. There are multiple ongoing DPR and USEPA OPP pesticide use regulatory activities that are expected to reduce pyrethroid discharges. Most notably, in 2012 DPR adopted surface water protection regulations on non-agricultural professional pyrethroid applications. USEPA OPP currently has all the pyrethroids of concern in registration review, during which USEPA will determine whether these pyrethroid pesticides are expected to have unreasonable adverse effects, and if so take steps to mitigate those effects. DPR is following up on wastewater concerns, including conducting a study to characterize pesticide sources contributing to wastewater treatment plant influent.

Another major consideration is potential unintended consequences to NDPES permittees. The irrigated lands and stormwater programs each allow the flexibility of utilizing a best management practices or BMP based approach to progressively meet objectives. In contrast, federal regulations governing the NPDES program generally require that permits for municipal and domestic wastewater contain numeric effluent limits for any pollutant for which the discharge has "reasonable potential" to cause or contribute to an exceedance of water quality objectives with a maximum compliance time period of 10-years. These dischargers may be faced with mandatory minimum penalties without direct ability to economically treat the discharge or control the source.

Given these considerations, nine overarching alternatives have been considered to date with an additional four options specific to waste water discharges. The alternatives considered have been summarized in Table 2 in terms of meeting project goals and objectives as well as their overall advantages and disadvantages. A brief narrative summary is provided below.

1. Water Quality Objectives & TMDLs for listed urban streams & 4b for listed for ag streams

Under this alternative, water quality objectives would be adopted for all water with aquatic life uses within the Sacramento and San Joaquin River Basins. TMDLs would be adopted for urban streams currently 303-d listed as impaired. Agricultural streams with impairments would be listed as being addressed by existing regulatory requirements (Integrated Report category 4b[2]) based on implementation through the Irrigated Lands Regulatory Program.

Preliminary draft Basin Plan Amendment language based on this approach has been circulated and discussed with stakeholders in recent meetings. This approach is similar to previous diazinon and chlorpyrifos Basin Plan Amendments; however the need for more significant reductions and presence of significant urban stormwater and WWTP sources raises compliance concerns. Once water quality objectives for pyrethroids are in place, federal regulations governing the NPDES program would likely require that permits for municipal and domestic wastewater contain numeric effluent limits for pyrethroids, and WWTP dischargers could be subject to mandatory minimum penalties for exceeding these effluent limits under State requirements.

2. Numeric triggers & TMDLs for listed urban streams & 4b listed for ag streams

This alternative is the same as alternative 1 except that "numeric triggers" interpreting existing narrative water quality objectives would be proposed in lieu of new quality objectives. This distinction may offer increased flexibility to the Board, if it helps support the successful implementation of one of the alternative WWTP approaches (such as performance based effluent limits for NPDES dischargers with triggers for additional action). This approach would still trigger effective actions to reduce pyrethroids.

However there is uncertainty in the amount of flexibility utilizing a numeric trigger would provide if any numeric interpretation of a narrative objective must be included as an effluent limit for NPDES permits.

3. Water quality objectives – adjusted for economic feasibility

Under this alternative, objectives may be adjusted based on economic concerns. Current performance data, management practices feasibility and effectiveness, and costs of practices would be considered in determination of objectives that are reasonably protective of beneficial uses. One concern is that limited data exists on current performance and management practice effectiveness at this time.

[2] USEPA regulations recognize that alternative pollution control requirements may obviate the need for a TMDL. Specifically, segments are not required to be included on the Section 303(d) list if "[o]ther pollution control requirements (e.g., best management practices) required by local, State, or Federal authority" are stringent enough to implement applicable water quality standards (WQS) (see 40 CFR 130.7(b)(1)) within a reasonable period of time. These alternatives to TMDLs are commonly referred to as "Category" 4b determinations in reference to the one of the classifications used in 303(d)/305(b) Integrated Reports.

4. Basin-wide TMDL

This approach would set clear allocations for all discharges, including those to non-impaired waters, and allow compliance schedules of greater that ten years under the compliance schedule policy. This alternative would result in all agricultural, stormwater and municipal and domestic wastewater dischargers in the basin being subject to TMDL allocations. This requirement could have significant regulatory implications in terms of the monitoring and permitting requirements for all the dischargers subject to TMDL allocations.

5. Reduced geographic scope – TMDLs and 4b determinations for listed water bodies only. No basin-wide control program

This alternative would scale back the geographic scope for the establishment of water quality goals in this amendment. The geographic scope for which targets are being established could be scaled back to just the 303(d) listed impaired waters, which are nine urban segments in the Sacramento/Roseville area and five Agricultural streams in the San Joaquin Valley. The amendment still could contain some implementation and monitoring for non-impaired water bodies to meet some other project goals and fill data gaps but future impairments would continue to be addressed individually.

6. **Conditional Prohibition**

The Basin Plan Amendment could include a conditional discharge prohibition, either as an alternative or as a complement to a water quality objective-focused approach. A conditional prohibition would likely (but not necessarily) be framed in terms of management actions known or anticipated to reduce pyrethroid loads rather than on specific water quality targets to be met. Thus, this approach could require certain management practices/measures to be implemented but avoid compliance issues associated with toxicity-based effluent limits. Prohibitions are not a "water quality standard" under the Clean Water Act, and therefore would not trigger the requirement to include a numeric effluent limit in NPDES permits. If the board included monitoring requirements with a conditional prohibition, it could gather data regarding the performance and feasibility of BMPs, which may or may not inform a future basin plan amendment. The Board's rice program provides an example of a successful conditional prohibition-based program.

While a conditional prohibition would result in management practice implementation, a conditional prohibition by itself might not meet requirements for addressing TMDL development requirements for impaired waters on the 303(d) list which require a specific numeric target. However, a conditional prohibition could be combined with other regulatory approaches to meet these goals.

7. Phased Adoption of Targets or Objectives

The Board could consider the feasibility of adopting numeric targets or water quality objectives in a phased manner in combination with performance goals and triggers. This option would allow management based controls to be implemented while additional studies were conducted

on economic feasibility. The option would include a reopener clause with a potential to adjust the numeric limits based on study results.

8. **(Combination of 5 and 6) – TMDLs and 4b determinations for impaired water bodies and a conditional prohibition**

The board could adopt TMDLs and other specific regulatory requirements for the water bodies on currently listed as impaired in combination with a conditional prohibition which could be applicable basin-wide. This alternative could contain implementation requirements via a conditional prohibition and monitoring for non-impaired water bodies to meet other project goals and fill data gaps to help the development and implementation of future control programs. This alternative shares the advantages and disadvantages of alternative 5, however the inclusion of a conditional prohibition provides a tool require broad implementation of BMPs to control pyrethroids throughout the basin.

9. **(Combination of 5,6 & 7)**
   TMDLs and 4b determinations for impaired water bodies with a conditional prohibition and phased adoption of numeric limits

The board could adopt TMDLs and other specific regulatory requirements for the water bodies currently listed as impaired in combination with a conditional prohibition which could be applicable basin-wide and phased adoption of numeric targets or objectives. This alternative may attain the goal of establishing clear concentration objectives or targets, while supporting implementation of management practices to control pyrethroids and further investigations on economic feasibility of required load reductions.

Municipal Wastewater Specific Alternatives

The following are brief summaries of the alternatives specific to municipal wastewater. These can be used in combination with alternatives 1-9 above, as appropriate.

WWTP 1-Variances

The Board adopted a variance policy as a Basin Plan Amendment in 2014 that would allow the Board the authority to grant short-term exceptions from meeting water quality based effluent limitations to dischargers subject to National Pollutant Discharge Elimination System (NPDES) permits. That Basin Plan Amendment has not yet been approved by USEPA. This option would only be viable when a variance policy is fully approved. In that case, NDPES dischargers could be granted short term exceptions to meeting pyrethroid effluent limitations. Variances would need to be justified individually as part of permitting actions.

WWTP 2- BMP- Based w/ Infeasibility finding

A BMP-based approach for WWTPs could be proposed as opposed to adopting the numeric objectives as effluent limits, based on the presumption that complying with the numeric objectives is infeasible due to lack of economically feasible direct treatment alternatives. There is considerable regulatory uncertainty associated with this permitting approach.

WWTP 3- Performance-based effluent limit & BMP-requirements based on numeric triggers

Performance-based numeric limits for pyrethroids in NPDES permits would be established based on current performance. These limits would be used in combination with "numeric triggers" based on water quality criteria to trigger BMP implementation requirements (as identified in alternative 2). The Board would need to support the conclusion that a performance-based numeric limit, together with the target/trigger, would be reasonable protection of beneficial uses. There is also regulatory uncertainty associated with this permitting approach.

WWTP 4- Compliance schedules

Compliance schedules could be used for WWTPs with potential that they will not be able to immediately comply with the objectives. The option delays Permittees being found in non-compliance with permits and resulting penalties. However, compliance schedules would have to be justified and approved in each permitting action, and the Board would need to provide a specific basis for concluding compliance with the effluent limit would be possible within the time frame of the compliance schedule. Compliance schedules would have a maximum of 10 years, unless a TMDL is eventually developed with an allocation for that facility. This option does not address the attainability issues associated with objectives/targets.

Control Program Elements Under Consideration

While the overall regulatory approach may vary, the following elements could be considered under any approach:

- Numeric water quality targets that account for bioavailability
- TMDLs or equivalent for impaired waterbodies – to fulfill 303(d) requirements
  - Address impairments specified in current listings
- Implementation provisions:
  - Reasonable time for attainment
  - Management practices to reduce pyrethroids
    - Stormwater
    - Irrigated Lands
    - Wastewater
  - Recommendations for DPR and USEPA Office of Pesticide Programs
  - Follow-up actions for Central Valley Water Board to conduct with DPR & USEPA Office of Pesticide Programs to coordinate on use regulations and registration changes to protect water quality
  - Measures to fill data gaps
  - Monitoring
  - A commitment for the Board to re-visit the targets/objectives, implementation and monitoring requirements and TMDLs in a timely fashion, before the final compliance date for meeting the objectives/targets/allocations.

Table 2: Summary of Potential Regulatory Approaches

Regulatory Approach[3]	Project Objectives Met[4]	Advantages[5]	Disadvantages
1. Water Quality Objectives & TMDLS for listed urban streams & 4b for listed for ag streams	☒1 ☒2 ☒3 (possibly not reasonable for WWTPs) ☒4 ☒5	Meets all objectives. Consistent with recent other pesticide Basin Plan Amendments.	Wastewater treatment plants may be subject to mandatory minimum penalties due to the need to adopt water quality objectives as effluent limits. Compliance for ag and stormwater will be through management practice implementation but data on effectiveness of management practices is limited.
2. Numeric Triggers & TMDLS for listed urban streams & 4b listed for ag streams	☒1 ☒2 ☒3 (possibly not reasonable for WWTPs) ☒4 ☒5	Meets all objectives – reduced potential for compliance issues relative to #1	Numeric interpretation of narrative objective may require incorporation as effluent limit potentially resulting in mandatory minimum penalties. Limited data on effectiveness of management practices for ag and stormwater.

[3] These are not necessarily mutually exclusive

[4] Project objectives:

1. Establishing measurable limits on pyrethroid concentrations in waters of the State that provide reasonable protection of beneficial uses.
2. Addressing existing impairments from pyrethroid pesticides through TMDLs or other means.
3. Reasonable and attainable implementation provisions to achieve the target pyrethroid concentrations.
4. Efficient process to address future impairments
5. Provisions for addressing alternative pesticides

[5] Relative advantages and disadvantages to other options

Regulatory Approach[3]	Project Objectives Met[4]	Advantages[5]	Disadvantages
3. Water quality objectives – adjusted for economic feasibility of attainment	☒1 ☒2 ☒3 ☒4 ☒5	Avoids compliance issues and potentially detection limit issues. Should eliminate the need for a nonstandard WWTP approach	Data lacking to make robust feasibility calculations at this time.
4. Basin-Wide TMDL	☒1 ☒2 ☒3 ☒4 ☒5	Establishes allocations for all dischargers. Allows compliance schedules beyond 10 years.	All dischargers (including those to un-impaired waters) would have TMDL allocations & related monitoring requirements. Potential complexities with establishing agricultural allocations.
5. Reduced geographic scope – TMDLs and 4b determinations for listed waterbodies only. No basin-wide WQOs	☐1 ☒2 ☒3 (partially) ☐4 ☒5	Avoids WWTP compliance issues since no WWTP receiving waters would have water quality objectives or triggers set. Allows for more informed decision in the future with regard to water bodies with WWTP discharges. Addresses requirements for currently listed water bodies.	Lack of certainty of targets or implementation requirements for waters not addressed. Would not address future listings. Would not address attainability issues of achieving the targets objectives.
6. Conditional Prohibition	☐1 ☒2 ☒3 ☐4 ☒5	Avoids feasibility issues, provides more flexibility. Allows the Board to craft discharge requirements and treat dischargers differently in terms of prohibition conditions. Allows a BMP-based approach to controlling pyrethroid pesticides for all dischargers.	May be difficult to coordinate with needs of a TMDL (which requires a specific numeric target) unless tied to specific discharge concentration(s),.

Regulatory Approach[3]	**Project Objectives Met**[4]	**Advantages**[5]	**Disadvantages**
7. Phased adoption of numeric targets or objectives	☒1 delayed ☒2 ☒3 ☒4 ☒5	Establishes a clear end goal and focuses on management practice implementation while studies conducted on economic feasibility. Numeric limits may be adjusted based on new data prior to effective date. Could be used in conjunction with TMDLs and/or a conditional prohibition.	Numeric limit would rely on current assumptions/analysis. Phased numeric limit has potential conflict with 10-year limit in compliance time schedule. May require future Board actions.
8. (Combination of 5 and 6) – TMDLs and 4b determinations for impaired waterbodies and a conditional prohibition	☐1 ☒2 ☒3 ☐4 ☒5	Avoids feasibility issues, provides more flexibility since no WWTP receiving waters would have water quality objectives or triggers set. Allows a BMP-based approach to controlling pyrethroid pesticides for all dischargers. Associated monitoring of BMP performance and cost may help close current data gaps and better inform future WQO.	If the prohibition is not tied to specific numeric limits, future listings may require separate TMDLs or other control methods.
9. (Combination of 5,6 & 7) TMDLs and 4b determinations for impaired water bodies with a conditional prohibition and phased adoption of numeric limits	☒1 delayed ☒2 ☒3 ☐4 partially ☒5	Satisfies requirements for current listings. Establishes clear numeric limits and focuses on management practice implementation while studies conducted on economic feasibility for all water bodies including potential future listings. Numeric limits may be adjusted based on new data prior to effective date.	Numeric limit would rely on current assumptions/analysis. Phased numeric limit has potential conflict with 10-year limit in compliance time schedule. May require future Board actions.

Regulatory Approach[3]	Project Objectives Met[4]	Advantages[5]	Disadvantages
WWTP – Specific Alternatives			
WWTP 1- Variances	Potentially all- depending on approach to other dischargers	Can temporarily set an easier target for one group of dischargers. Temporarily avoids permit non-compliance and penalties during the variance.	Would need to be justified in each permitting action where it is needed. Limited duration. Dependent on EPA approval of the Board's Variance Policy.
WWTP 2- BMP-Based w/ Infeasibility finding	Potentially all- depending on approach to other dischargers	Avoids attainability issues while promoting effective action Allows all dischargers – irrigated agriculture, municipal storm water, and domestic waste water – to adopt a feasible, BMP-based approach.	Potential disagreement in permitting approach and uncertain resolution.
WWTP 3- Performance-Based Effluent Limit & BMP-requirements based on triggers	Potentially all- depending on approach to other dischargers	Avoids setting an unattainable numeric effluent limit while still promoting effective action.	Somewhat novel permitting approach, so permitting approval, compliance and enforcement issues are uncertain.
WWTP 4- Compliance schedules	Potentially all- depending on approach to other dischargers	Temporarily avoids permit non-compliance and penalties during the compliance schedule time-frame.	Maximum of 10 years (without a TMDL) per SWRCB compliance schedule policy. Without a concrete evidentiary basis for concluding that compliance is possible within 10 years, State Board may reject. Does not address attainability of the objectives.