

Central Valley Regional Water Quality Control Board

RESPONSE TO COMMENTS ON PYRETHROID RESEARCH PLAN

During the development of the Pyrethroid Control Program (Resolution R5-2017-0057), Central Valley Regional Water Quality Control Board (Central Valley Water Board or Board) staff recognized that the data used to evaluate the potential for registered pyrethroid products to cause or contribute to water quality concerns contained considerable knowledge gaps. Therefore, the Pyrethroid Control Program included a provision that the Central Valley Water Board would work with stakeholders to develop a Pyrethroid Research Plan (Plan) that describes research and other special studies to inform future iterations of the control program.

Board staff released the draft Plan on 17 July 2023, providing interested parties the opportunity to submit written comments on the draft Plan through 18 September 2023. On 1 August 2023, Board staff held a staff workshop to receive oral comments from interested parties. Board staff held a second staff workshop on 12 March 2024 to discuss the written comments received during the comment period and proposed revisions to address these comments. Board staff hosted additional meetings with stakeholders as requested to discuss the draft Plan. This document contains responses to written comments submitted to Central Valley Water Board staff during the public comment period and describes the revisions made to the Plan to address written comments received from stakeholders.

Many comments were comprised of multiple paragraphs, so Board staff opted to separate these comments into multiple parts to address all components of the comment. To access the full comment letters, please email R5pesticides@waterboards.ca.gov.

Please note that to reflect the research scope of the Plan more appropriately, Board staff reframed the “Management Questions” presented in the draft Plan to “Research Questions” that may inform future management decisions. This revision was presented during the staff workshop on 12 March 2024.

Comments are listed in the order received and are referred to by letter as indicated in the table below.

Written comments were received by:

	Name, Title	Organization	Submittal Date
A	Sonia Delgado, Deputy Director of Administrative Services & Regulatory Compliance	City of Patterson	September 6, 2023
B	Cameron Irvine, Sr. Environmental Scientist/ Ecotoxicologist	Robertson-Bryan Inc. on behalf of City of Stockton City of Roseville	September 18, 2023
C	Jeff Marasovich, Deputy Director of Collections & Stormwater (City of Stockton); Alex Chetley, Deputy Director of Development (County of San Joaquin)	City of Stockton and San Joaquin County	September 18, 2023
D	Theresa A. Dunham	Kahn Soares and Conway LLP on behalf of Pyrethroid Working Group	September 18, 2023
E	Debbie Mackey, Executive Officer	Central Valley Clean Water Association	September 18, 2023
F	Tim Johnson, President and CEO	California Rice	September 18, 2023
G	Edmund Yu, Staff Support	Delta Independent Science Board	September 18, 2023
H	Kelly Trunnelle, Program Manager	MLJ Environmental, on behalf of San Joaquin County and Delta Water Quality Coalition, East San Joaquin Water Quality Coalition, Westside San Joaquin River Watershed Coalition and Grassland Drainage Authority Coalition	September 18, 2023

A. Sonia Delgado, City of Patterson

Comment A1: "In reviewing the Draft Research Plan, we support the comments and recommendations outlined in the City of Stockton and the County of San Joaquin's comment letter. The City of Patterson finds the comments to be comprehensive and representative of the concerns we, as a municipal stormwater Permittee, have about the proposed Research Plan. We encourage your consideration of the concerns and recommendations presented in the City and County comment letter."

Response to Comment A1: Thank you for the comment. The Central Valley Water Board will consider all comments submitted and we confirm receipt of the comments submitted by the City of Stockton and County of San Joaquin.

B. Cameron Irvine, City of Stockton, and City of Roseville

Comment B0: From the main body of the comment letter, "The document provides a good summary of the state of pyrethroid science. However, it does not present a specific "plan" describing what will be done to fill knowledge gaps, sources of funding for this research, or a schedule for completion. Nor are the data needs ranked or ordered by Central Valley Water Board's priorities for informing future iterations of pyrethroid pesticide discharge regulations. At a minimum, identifying research priorities would improve the utility of the Pyrethroid Research Plan."

Response to Comment B0: Board staff appreciate the feedback. As outlined in Section 4.5.5.1(8) of the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (Basin Plan), the purpose of the Plan is to identify Knowledge Gaps where research and studies are needed to inform future iterations of the Pyrethroid Control Program. Board staff interpret this brief section to mean that the Plan is solely required to identify existing Knowledge Gaps that will enhance the understanding of pyrethroid environmental impacts and behavior, and any resulting research findings will be included in the re-evaluation of the Pyrethroid Control Program. Therefore, the scope of the Plan is appropriate to meet the requirements of the Pyrethroid Control Program. Board staff have revised the Plan to include a section describing and clarifying the purpose of the Plan and the intended use and application of the associated findings (see Section 1.C of the revised Plan).

Board staff are often contacted by funding agencies requesting relevant management questions that would be appropriate for funding. The Plan is intended to identify the Research Questions relevant to the Board's Pyrethroid Control Program for funding agencies, the science community, and other types of programs that fund research and monitoring. It can also be used for researchers to cite in proposals, justifying the management need for the study, similar to the Board-adopted Delta Nutrient Research Plan and the Delta Stewardship Council's Science Action Agenda. Funding and implementation of the Delta Nutrient Research Plan has been provided by many different agencies and funding organizations. As established in Basin Plan section 4.5.5.2(4), re-

evaluation of the Pyrethroid Control Program will occur using the data available, including that generated pursuant to the Plan, by the 19 February 2034 deadline.

To that end, the Plan focuses on identifying relevant Research Questions and Knowledge Gaps, including those identified since the adoption of the Pyrethroid Control Program. In addition to being beyond the Basin Plan requirements, articulating the practical and logistical steps for meeting the data and research needs is outside Board staff expertise and may limit researchers in developing proposals for funding. Rather, Board staff aimed to identify broader needs such that the Plan has greater longevity and provides researchers flexibility to innovate. The research and scientific community would be the most appropriate group to determine the detailed study designs, data, samples, etc., needed to address the identified Research Questions and fill the Knowledge Gaps.

Board staff received several written and verbal comments requesting prioritization of the Knowledge Gaps. Board staff discussed this at both staff workshops and organized a third meeting for any stakeholders that wanted to offer an approach for prioritization. Board staff also offered to append prioritization schemes for individual stakeholder groups, if submitted, in the revised Plan.

Please see Response to Comment B3 for more details.

Summary of Comment B1, From Attachment 1, Number 1: The Plan should describe the need for studies assessing the variability of pyrethroid partition coefficients in treated wastewater and/or developing site-specific pyrethroid partition coefficients.

Response to Comment B1: Board staff agree with the Commenter's recommendation, which was also raised in the 1 August 2023 staff workshop, and have revised this Knowledge Gap to reflect the need for additional study on partition coefficients in the wastewater effluent matrix.

Summary of Comment B2, From Attachment 1, Number 2: Commenter proposed that the Plan include reference to increased salinity and higher temperature effects on pyrethroid bioavailability that may offset the potential for increased effects associated with climate change in its discussion of [Research] Question #8, "How will climate change impact use, occurrence, and management of pyrethroids?"

Response to Comment B2: Board staff appreciate the comment. The Central Valley Water Board received many comments regarding the scope of the Plan. After reviewing the Basin Plan language, Board staff refined the scope of the Plan and removed Research Question #8. Board staff anticipate that climate change impacts will be addressed by research regarding salinity and temperature effects on pyrethroid toxicity.

Board staff have revised the Plan to include a section describing and clarifying the purpose of the Plan and the intended use and application of the associated findings (see Section 1.C of the revised Plan).

Summary of Comment B3, From Attachment 1, Number 3: There is no clear plan of what will be done to fill the Knowledge Gaps. Additionally, the Plan will be improved by prioritizing the listed Knowledge Gaps according to Central Valley Water Board needs for addressing Research Questions.

Response to Comment B3: Board staff considered prioritizing the Knowledge Gaps when writing the initial version of the Plan but were unable to identify appropriate criteria. Board staff held several meetings and discussions regarding the need to for prioritization of the Knowledge Gaps and potential prioritization processes. At this time, Board staff and stakeholders have not identified a clear plan for prioritization; therefore, the Plan will not include a prioritization schema. As resources become available, Board staff will, to the extent possible, consider stakeholder input in allocation of said resources in fulfillment of the Plan.

Summary of Comment B4, from Attachment 1, Number 4: The definition of the concentration addition (CA) model would be improved by indicating that CA model effects are equivalent to those from the sum of concentrations of chemicals with the same mode of toxic action. Commenter provided recommended text.

Response to Comment B4: Board staff have revised the glossary to include the recommended text.

Summary of Comment B5, Attachment 1, Number 5: Commenter recommended edits to clarify definition for EC_x.

Response to Comment B5: Board staff have revised the glossary to include these changes.

Summary of Comment B6, Attachment 1, Number 6: Commenter recommended edits to clarify definition for K_{OC}.

Response to Comment B6: Board staff have revised the glossary to include these changes.

Summary of Comment B7, Attachment 1, Number 7: Citing the most recent Central Valley Water Board (2018) Basin Plan would provide helpful context.

Response to Comment B7: Board staff have added the citation for the most recent version of the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins to Section 1.A. Pyrethroid Control Program Overview.

C. Jeff Marasovich and Alex Chetley, City of Stockton, and San Joaquin County

Comment C1: "The Draft Research Plan lacks a clear Statement of Purpose on the intended use of and application for the Research Plan study findings."

Response to Comment C1: Please see response to Comment B0.

Comment C2: This comment raised several general concerns related to the linkage between the Research Questions and Knowledge Gaps. Board staff have broken this comment into three parts to address individual aspects of the comment.

Comment C2i: "It is unclear what the current linkage is between the Draft Research Plan [Research] Questions and Knowledge Gaps, and to what extent, the [K]nowledge [G]aps will assist in answering the [Research] Questions".

Response to Comment C2i: Board staff understand the concern and appreciate the feedback. Board staff have revised the Plan in multiple ways to address this comment. First, Board staff have added Section 2.A to the Plan which includes a table summarizing the linkage between the Research Questions and the Knowledge Gaps. Second, Board staff revised text in both the Research Questions and Knowledge Gaps sections to provide clarity on the linkage.

Comment C2ii and Recommendation 2: "...there seems to be a disconnect between the types of data and information that would be needed to answer the [Research] [Q]uestions compared to the types of data and information that would be obtained through the studies identified in the [K]nowledge [G]ap section." The Commenter recommended that the Plan specify what data and information are needed to answer each Research Question and develop a crosswalk that relates the Knowledge Gaps to the Research Question(s).

Response to Comment C2ii: Please see responses to Comments B0 and C2i.

Summary of Comment C2iii, Recommendation 1: The Commenter recommended that Board staff create two separate documents, (1) a pyrethroid research plan and (2) a pyrethroid control implementation plan or similar adaptive management plan. "To this end, the Regional Water Board should identify how the actions identified for other agencies with the legal authority to regulate pesticide use including the California Department of Pesticide Regulation, U.S. Environmental Protection Agency, as well as the actions identified for the Central Valley Regional Water Board will assist in answering the [Research] [Q]uestions and in preventing water quality impairments by pesticides."

Response to Comment C2iii: The Pyrethroid Control Program already contains an adaptive management component. Evaluation of the Pyrethroid Control Program's effectiveness will be addressed through an evaluation of the data collected through implementation of the Control Program.

Per the Basin Plan section 4.5.5.2(4), Board staff are required to review the Pyrethroid Control Program, including the pyrethroid pesticides prohibition, the pyrethroid pesticides TMDL allocations, the numeric pyrethroid triggers, and the implementation provisions for pyrethroid pesticide discharges in the Basin Plan no later than 2034. This

reconsideration provides a mechanism to adapt the Pyrethroid Control Program based on the effectiveness determination and/or other data, information, and studies, including those pursuant to the Plan, that provide insight for any relevant aspects of the Control Program.

The recommendation to identify regulatory actions that may inform the Research Questions is outside of the scope of the Plan. The Plan is focused on addressing knowledge gaps and information that cannot be obtained through the Board's or other agencies' regulatory authorities. However, Board staff regularly meet with both the Department of Pesticide Regulation and U.S. EPA to discuss regulation of pyrethroids, and they have been provided the Plan for review and feedback.

Comment C3: "The Draft Research Plan does not identify how it will be implemented... absent direction from the Regional Water Board, there is concern that the implementation of the Draft Research Plan could inadvertently become a municipal stormwater permit requirement." The Commenter recommended that Board staff "include a new 'implementation' section either as a stand-alone section or as part of Section 4."

Response to Comment C3: Board staff have revised Section 1.C of the Plan to include the following statement: "The Central Valley Water Board will, as resources allow, seek to fund some studies pursuant to the Plan; however, most of the remaining needs will need to be fulfilled by research and funding agencies."

If the Central Valley Water Board refines the Pyrethroid Control Program based on the findings of the research outlined in the Plan, any modifications to the Control Program's implementation activities may be enacted through the Basin Plan amendment process. However, this process includes public input and several levels of regulatory review and approval, including the Central Valley Water Board, State Water Resource Control Board, Office of Administrative Law, and U.S. EPA. If approved, only then would the revised Control Program be implemented through permit requirements.

For more on implementation, please also see responses to comments B0 and C2iii.

Comment C4: This comment raised several general concerns related to the Pyrethroid Chemistry Methodology (formerly Pyrethroid Water Column Chemistry Analytical Method Development) Knowledge Gap. Board staff have broken this comment into three parts to address individual aspects of the comment.

Comment C4i: "The Knowledge Gaps section noted the lack of an inter-laboratory study to evaluate the laboratories accredited for pyrethroid analyses, which raises concern over the reproducibility of the results across laboratories."

Response to Comment C4i: Board staff acknowledge the concern and appreciate the feedback. Board staff have revised the Research Questions and Knowledge Gaps to elaborate on the need for inter-laboratory comparison studies.

*Comment C4ii: “There is also a limited number of laboratories accredited for the 96-hr *Hyalella* toxicity test. The EPA acute manual (EPA-821-R-02-012) cited for accreditation of this test provides very limited guidance for the test design, and differences allowed for in the method (e.g., plastic versus glass test chambers, food in the test chambers throughout the test or only for limited time preceding test solution renewal) can have a significant effect on pyrethroid availability, and therefore the presence/absence of toxicity...there is concern that variability can occur due the limited test method requirements listed in the EPA manual.”*

Response to Comment C4ii: To fulfill the requirements of the Pyrethroid Control Program, the Central Valley Water Board instructed dischargers to perform water column toxicity testing using EPA method EPA-821-R-02-012 and sediment toxicity testing using EPA method EPA-600-R-99-064. Both methods list test conditions and test acceptability criteria for *Hyalella azteca*. While EPA-600-R-99-064 method defines the test chamber shape, and both methods define the test chamber size, the material of test chamber is not defined by the methods. Per the method, it is permissible for laboratories to use both glass and plastic test chambers for pyrethroid toxicity testing.

Due to lipophilic properties of pyrethroids, loss of pyrethroids onto test chamber surfaces during testing can influence the toxicity test results. Studies have shown that pyrethroids adsorb to plastic surfaces with a greater percentage than glass surfaces, and that adsorption increases with both duration and temperature (Hladik et al, 2009; Sharom and Solomon, 1981). As the interactions between pyrethroids and both glass and plastic are known, Board staff feel this is not a knowledge gap. This issue would be more appropriately addressed through regulatory specifications for the Pyrethroid Control Program.

Comment C4iii: The Commentor recommends that “[t]he Regional Water Board should consider prioritizing the actions noted in the Knowledge Gaps section into two tiers.”

Response to Comment C4iii: Board staff appreciate the prioritization proposal. Board staff presented a modified version of this recommendation in the 12 March 2024 staff workshop but did not receive stakeholder support. Please see Response to Comment B3 for more details and current prioritization direction.

Comment C5: “It is unclear how broadly applicable the partition coefficient research described in the Knowledge Gaps section will be for the Pyrethroid Control Program.” The Commenter recommended Board staff revise the Draft Plan to describe how the

partition coefficients study outcomes will be applied, limitations of that study, and identify if there are other knowledge gaps.

Response to Comment C5: Board staff appreciate this feedback and have revised Section 3.A of the Plan to elaborate on the need for additional studies to inform any revisions to the default partition coefficients or use of site-specific partition coefficients for the Pyrethroid Control Program. Specifically, Board staff have included language addressing the Commenter's concern regarding the relevance of the sediments analyzed by UCD to the variety of sediment types in the Central Valley. However, the interpretation and application of the findings of the Final Report constitutes a regulatory determination, which is outside the scope of a research plan. Therefore, Board staff are not able to revise the Plan to describe how the study outcomes will be applied or the limitations of the study as the Commenter requested.

Comment C6: "The Knowledge Gaps section of the Draft Research Plan omitted challenges with microplastics analytical methods." The Commenter recommended Board staff revise this section of the Plan.

Response to Comment C6: Board staff appreciate this feedback and have revised Section 3.D.3 to clearly identify this need.

Comment C7: The Knowledge Gaps section of the Draft Research Plan indicates that the addition of sublethal endpoints could improve pesticide regulation and provide broader protection of aquatic ecosystems but fails to address the environmental relevance. The Commenter recommended Board staff "address how the addition of sublethal effects, especially in water, would reconcile with pyrethroid partitioning and the transient nature of stormwater events".

Response to Comment C7: Board staff acknowledge the concern and appreciate the feedback. Board staff have revised Section 3.F of the Plan to include the need for approved methods for evaluating sublethal effects resulting from acute exposure scenarios that are more representative of the transient or episodic nature of stormwater events.

D. Theresa Dunham, Pyrethroid Working Group (PWG)

Comment D0 (from the body of the letter): PWG "recommends that the overview section in the Draft Plan be revised to better characterize the limited role that the Draft Plan is intended to play with respect to future revisions to the Pyrethroid Control Program and potential consideration of adoption of numeric water quality objectives." The Commenter also recommended that the Board identify Knowledge Gaps that would provide "information they would need to comply with Water Code section 13241".

Response to Comment D0: Thank you for this feedback. Board staff have revised Section 1 of the Plan to include information on how it will be used for future considerations of the Pyrethroid Control Program.

Water Code 13241 discusses factors to be considered by a regional board in establishing water quality objectives (WQOs). As discussed in the Final Staff Report (Water Board, 2017), a goal of the phased approach of the Pyrethroid Control Program was to gather information to complete a full analysis of the Water Code 13241 factors when the Central Valley Water Board revisits the Pyrethroids Control Program so that the Board could then determine if, and at what level, pyrethroids WQOs are reasonable and necessary to protect beneficial uses.

At the time of adoption of the Pyrethroid Control Program, more information was needed on effectiveness of management practices, attainability of concentration goals, and the costs of implementation. The surveillance and monitoring requirements of the Pyrethroid Control Program were designed to collect this information. Board staff will continue to collate this information as implementation of the Pyrethroid Control Program progresses.

Board staff would like to clarify that the development of WQOs is not an express goal of the Pyrethroid Research Plan. The Water Code 13241 factors required for the development of WQOs are a regulatory requirement and are therefore outside the scope of a research plan directed toward the scientific community.

Comment D1: This comment raised several general concerns related to the Research Questions and their relation to the identified Knowledge Gaps. Board staff have broken this comment into eight parts to address individual aspects of the comment.

Comment D1i: "...during development of the 2017 Pyrethroid Control Program, Central Valley Water Board staff identified seven topics that required further study. These topics are listed in the Draft Plan. (Draft Plan, p. 5.) It was our understanding that the Draft Plan would focus on these topics and the studies needed to address these issues. The [Research] [Q]uestions are outside the list of topics and should be removed from the Draft Plan. For example, [Research] [Q]uestion #1 looks to determine if the Pyrethroid Control Program has caused there to be an increased use of replacement insecticides. Regardless of the potential answer to this question, it is unrelated to the pyrethroids in the environment and the seven study topics."

Response to Comment D1i: Board staff included the Research Questions to demonstrate the basis and scope of the Board's interest in the Knowledge Gaps identified in the Basin Plan as well as those identified following the adoption of the Pyrethroid Control Program. These Research Questions are intended to assist researchers and the scientific community with proposals. Please see Response to Comment B0 for more details.

The Commenter indicated that Research Question #1 should be removed because it is unrelated to the topics originally identified in the Pyrethroid Control Program. The Pyrethroid Control Program states that the Plan "could include" the list of identified topics. Board staff interpret this to

mean that any of the originally identified topics could be excluded from the Plan and/or that new topics could be added. Board staff have refined Research Question #1 such that it can be addressed by the scientific community and added an associated Knowledge Gap for urban insecticide use.

Board staff have further revised the Plan such that the Research Questions are more clearly related to Knowledge Gaps. Additionally, Board staff have included a table illustrating the connection between the Research Questions and Knowledge Gaps.

Comment D1ii: “[Research] [Q]uestion #2 asks if the Pyrethroid Control Program should be expanded to include the Tulare Lake Basin. That is a policy question – not a study question. Thus, it should not be included here as part of the Draft Plan.”

Response to Comment D1ii: Upon reflection, Board staff agree with this comment and have removed this Research Question from the Plan.

Comment D1iii: “With respect to [Research] [Q]uestion #3, (i.e., are current pyrethroid management practices effective), we agree that this is indeed a valuable question. However, it is outside the list of study topics originally identified and thus should be addressed in a different venue rather than this Draft Plan.”

Response to Comment D1iii: As mentioned above in Response to Comment D1i, Board staff interpret the language in the Basin Plan to mean that new topics could be added as relevant. Board staff have revised Research Question #3 such that it can be addressed by the scientific community and refined the associated Knowledge Gap accordingly.

Comment D1iv: “[T]he beneficial use in question is ‘aquatic life’, which is fairly universally applied to waterbodies throughout the region. We are uncertain as to the statement in the Draft Plan that suggests that there are different beneficial uses in Black, Indigenous, and People of Color (BIPOC) and economically disadvantaged communities besides aquatic life to which pyrethroids would impact.”

Response to Comment D1iv: Subsistence fishing and tribal cultural practices rely on the presence of sufficient aquatic organisms in surface water. Exposure to pyrethroids could have detrimental effects on the population of aquatic organisms which would impact their availability for subsistence and cultural practices of tribal and disadvantaged communities. Therefore, Board staff disagree with the comment that Research Question #4 (Question #3 in the revised Plan) “appears to be misplaced” in the draft Plan. Board staff agree with the Commenter’s statement, “When the Central Valley Water Board looks to refine the

Pyrethroid Control Program in the future, it will be appropriate and necessary for the Central Valley Water Board to consider the impact of such refinements as related to racial equity at that juncture.” To make informed decisions on impacts of program refinement as related to racial equity, the Central Valley Water Board is committed to collecting data related to tribal and disadvantaged communities.

Comment D1v: “Of the nine management questions, [Research] [Q]uestions 5, and 7, seem to be most closely affiliated with the study topics and the original intent and purposes of the Draft Plan. However, with that said, since these are identified [K]nowledge [G]aps, it is probably unnecessary to include them as a [Research] [Q]uestion as well.”

Response to Comment D1v: Given the formatting of the Plan, the Research Questions play a distinct role from the Knowledge Gaps, and both are necessary. Board staff revised the Plan to provide clarity, and these revisions are described in Responses to Comments B0 and D1i.

Comment D1vi: “With respect to [Research] [Q]uestion #6, the PWG disagrees with this question for technical reasons, which is discussed below in section II.”

Response to Comment D1vi: Board staff will respond accordingly in Response to Comment D2v.

Comment D1vii: “[Research] [Q]uestions 8 and 9 regarding impacts on pyrethroid use due to climate change and food production needs appear to be asking how such outside factors may put pressure on the need for increased pyrethroid use to control pests and maintain or increase food production in the Central Valley. While these are valuable questions... they too are misplaced here in this Draft Plan.”

Response to Comment D1vii: Board staff agree with the comment and have removed Research Questions 8 and 9. Board staff anticipate that climate change impacts will be addressed by research regarding co-stressor effects on pyrethroid toxicity. Board staff agree that the question regarding food production needs is outside the scope of Water Board authority and is therefore not appropriate for the Plan.

Comment D1viii: The Commenter recommended to remove [Research] Questions in their entirety and “actively include and engage stakeholders to identify appropriate [Research] [Q]uestions” in the future.

Response to Comment D1viii: Board staff have added an Appendix to describe the outreach and engagement conducted to prepare the draft Plan, including identification of appropriate Research Questions. Board staff provided multiple opportunities for stakeholder input including multiple staff workshops, individual stakeholder meetings, and a 63-day public comment period. Additionally, Board staff provided the PWG an

opportunity to review the draft Plan and provide feedback prior to public release and offered an individual meeting to PWG to discuss their specific feedback. Board staff believe that they provided sufficient opportunity for all stakeholders to propose additional or alternative Research Questions. As mentioned in Response to Comment B0 and D1i, the Research Questions are important for effective implementation of the Plan.

Comment D2: This comment raised several general concerns related to the “varying levels of usefulness” of “the data and information to be obtained from the identified knowledge gaps”. Board staff have broken this comment into five parts to address individual aspects of the comment.

Comment D2i: “[T]he Draft Plan does not explain or identify any criteria that were used by Central Valley Water Board staff in selecting the cited papers. Further, it appears that the Draft Plan did not consider or take into account available risk assessments and EPA submissions prepared by the PWG. If it is a matter of availability, the PWG is more than willing to work with Central Valley Water Board staff to make them available.”

Response to Comment D2i: Board staff have revised the Plan to clarify the criteria used to select the cited papers, namely that the papers were scientifically peer reviewed and published in journals and/or websites. Board staff appreciate the Commenter's offer of their toxicity database and will accept the data provided it conforms to the citation criteria.

Comment D2ii: “[W]hile some cited stressors (e.g. salinity and microplastics) are probably important in their own right in terms of general water quality, the PWG does not expect them to be highly relevant to pyrethroid risk as compared to other identified factors. The PWG provides brief commentary on each of the nine [K]nowledge [G]aps identified in the Draft Plan.”

Response to Comment D2ii: Board staff have addressed the Commenter's specific commentary on each of the Knowledge Gaps in Response to Comment D3. Please see Responses to Comments D3d(2) and D3d(3) for Board staff's responses on salinity and microplastics, respectively.

Comment D2iii: “...the PWG first finds it necessary to emphasize our concern with the Draft Plan's conclusion that additional research on fate and transport would not further inform the Pyrethroid Control Program...The PWG disagrees with this conclusion. Although the PWG agrees that the dominant pathways for transport have been addressed, the Draft Plan does not address that the manner in which residues found in sediments become less bioavailable with aging; this will be a critical factor in understanding the significance of sediment residue detections and any persistence of sediment residues. The papers published by the University of California Riverside (UCR) research team led by Dr. Jay Gan demonstrate that fractions of sediment-associated residues are “bioaccessible” whereas the remainder is not. Moreover, the papers demonstrate the real-world significance of this phenomenon (see, e.g. summaries in Lu. Z. et al., 2019.).

Without more research to fully characterize this critical aspect of pyrethroid fate and transport in aquatic systems, it will not be possible to place the significance of measured sediment residues into meaningful context.”

Response to Comment D2iii: Board staff appreciate this feedback and have reviewed the citation provided. Board staff have revised Section 3.C of the Plan to address the Commenter’s specific suggestions.

Comment D2iv: “...the recent report from the University of California Davis (UCD) scientists who have measured KOC and KDOC coefficients in 19 California stream segments derived from the SPoT sampling program, the PWG strongly recommends that before this data is used for regulatory purposes, the report needs to be revised to provide estimates of uncertainty in the study’s findings. Additionally, new work needs to be conducted to understand the relevance of the 19 tested sediments to the universe of Californian stream sediments. The latter is an important omission that should be added to the Draft Plan.”

Response to Comment D2iv: Feedback and suggestions on the recent UCD partition coefficients report (Agreement 18-027-150, Draft Report) were solicited through a separate public comment process. The comment to revise the report is outside scope of the Plan and this public comment process.

Board staff have revised Section 3.A of the Plan to elaborate on the need for additional study to inform any revisions to the default partition coefficients or use of site-specific partition coefficients for the Pyrethroid Control Program. Specifically, Board staff have included language addressing the Commenter’s concern regarding the relevance of the sediments analyzed by UCD to the universe of Californian stream sediments.

*Comment D2v: “PWG disagrees with the significance of [Research] [Q]uestion #6 regarding which other taxa may be affected by pyrethroids. The most sensitive aquatic species to all pyrethroids tested to date are two related groups of invertebrates that include the freshwater amphipod *Hyaella* spp. and the saltwater mysid shrimp *Americamysis bahia*. Water quality management objectives for pyrethroids are largely driven by the desire to protect these most sensitive groups. Nearly all other aquatic invertebrate species and fish (typically 95% or more of species tested) are less sensitive to pyrethroids than the amphipods and mysids that are already used to drive water quality criteria related decisions. As such, there is little useful additional information to be gained from investigating potential effects on other taxa.”*

Response to Comment D2v: Board staff appreciate concerns raised about Research Question #6. Board staff do not disagree with the Commenter that *Hyaella* spp. are the most sensitive species when lethality is defined as the endpoint. However, Chronic Toxicity in Other Taxa was proposed as

a Knowledge Gap during the adoption of the Pyrethroid Control Program and based on literature review, Board staff are unable to demonstrate that the Knowledge Gap has been filled. Therefore, Board staff did not remove this Knowledge Gap.

Comment D3: The Commenter provided detailed comments on each of the identified knowledge gaps in D3a-i.

Comment D3a Partition Coefficients (K_{OC} and K_{DOC}): The Commenter provided an overview of comments submitted on UCD's Agreement 18-027-150 Draft Report and emphasized their recommendation that the Plan be revised to contextualize the sediments used in the study.

Response to Comment D3a: Board staff appreciate this feedback. The Commenter's concerns related to UCD's Draft Report, the overview of which was provided in the comment, were communicated to the Contractor for consideration in the development of the Final Report through a separate public comment process. The Commenter's recommendation of additional characterization of the sediment samples analyzed by UCD is the purview of the Contractor, and is, therefore, inappropriate for inclusion in the Plan. As stated in Response to Comment D2iv, Board staff have revised Section 3.A of the Plan to elaborate on the Commenter's specific concerns regarding the relevance of the sediments analyzed by UCD. Additionally, the interpretation of the findings of the Final Report constitutes a regulatory determination, which is outside of the scope of a research plan, and therefore, will not be included in the revised Plan.

Comment D3b Pyrethroid Water Column Chemistry Analytical Method Development [Pyrethroid Chemistry Methodology]: The Commenter advocated for focusing on interlaboratory calibration rather than statewide method development due to concerns over access to necessary equipment.

Response to Comment D3b: Board staff acknowledge the concern and appreciate the feedback.

Comment D3c Fate and Transport of Particulate-Bound Pyrethroids: The Commenter disagreed with the Draft Plan's assertion that no further research was needed for this Knowledge Gap. The Commenter identified the impacts of aging on the bioaccessibility of sediment-bound pyrethroids as an outstanding need for this Knowledge Gap.

Response to D3c: Board staff appreciate this feedback and have reviewed the citation provided. Board staff have revised Section 3.C of the Plan to address the Commenter's specific suggestions.

Comment D3d: Pyrethroid Co-Stressors

Comment D3d(1): Temperature: The Commenter raised concerns over the utility of further research into temperature effects on pyrethroid toxicity. The Commenter “suggests that further analysis be aimed at determining whether the observed or predicted magnitude of temperature-induced toxicity changes is enough to substantially affect risk management decisions except in special cases...”

Response to Comment D3d(1): The incorporation of temperature effects in toxicity relationships was an identified Knowledge Gap during the adoption of the Pyrethroid Control Program, and Board staff are unable to demonstrate that the Knowledge Gap has been filled. The Commenter’s suggested research angle falls within the scope of the Knowledge Gap as written in the draft Plan. However, Board staff have revised Section 3.D.1 to clarify the outstanding needs for this Knowledge Gap.

Comment D3d(2) Salinity: The Commenter “does not believe that this is a major source of uncertainty in the risk management of pyrethroids although it may be of general scientific interest to investigate the potentially complex impacts of salinity changes on the general ecology of California waters.” The Commenter provided a citation for Central Valley Water Board staff consideration.

Response to Comment D3d(2): Board staff have reviewed the recommended citation and revised Section 3.D.2 of the Plan.

Comment D3d(3) Microplastics: The Commenter “suggests that it may be more valuable for the Central Valley Water Board to support studies that investigate any impact of micro-plastics IN THE PRESENCE of typical naturally-occurring concentrations of suspended sediments, dissolved and particulate organic matter, algal cells, etc. Then, perhaps the relevant question would be, before investing resources and research efforts on this issue, whether microplastics impact pyrethroid behavior substantially differently from other particles of similar size occurring naturally in California water bodies?”

Response to Comment D3d(3): Board staff acknowledge the comment and recommendation. Board staff revised Section 3.D.3 to elaborate on the Commenter’s specific suggestions.

Board staff want to clarify that the Central Valley Water Board will not dictate studies or research directions to provide flexibility for researchers. The studies proposed pursuant to the Plan will be the purview of the funding agencies and science community.

Comment D3e Synergistic and Additive Toxicity: The Commenter refuted the Draft Plan’s summary of the findings of Giddings et al. (2016).

Response to Comment D3e: Board staff acknowledge this comment but maintain their interpretation of the data as presented in Table 2 of Giddings et al. (2016). Based on Table 2, piperonyl butoxide and pyrethrins synergism occurs between 1.7 and 3.5 µg PBO/L. Board staff have revised Section 3.E to include these numeric values to provide clarity to the Plan's summary of the citation results.

Comment D3f Evaluation of Sublethal Effects: The Commenter questioned assertions made in this Knowledge Gap and alluded to articles supporting their position.

Response to Comment D3f: Board staff acknowledge this comment. The statement that sublethal effects occur “at exposure levels far below the concentrations that cause lethality”, was accurately paraphrased from Werner and Moran (2008), as cited in the draft Plan. As indicated in the response to Comment D2i, Board staff welcome any publicly available peer-reviewed articles that the Commenter recommends for consideration in the revised Plan.

Comment D3g Chronic Toxicity in Other Taxa: “Understanding both chronic and acute impacts of chemicals including pyrethroids is essential for effective aquatic risk assessment. PWG again refers to the very extensive database of aquatic toxicity studies maintained by PWG (current to October 2021 and available upon request from PWG).”

Response to Comment D3g: Board staff appreciate and accept the Commenter's offer of reference material, provided it conforms to the criteria described in response to Comment D2i; namely, that the reference is peer-reviewed.

Comment D3h Pyrethroid Bioaccumulation: The Commenter asserted that pyrethroids do not bioaccumulate, bioconcentrate, or biomagnify, and provided supporting evidence as an attachment. The Commenter recommended that research focus on toxicokinetics rather than bioaccumulation. Further, the Commenter expressed surprise that the Knowledge Gap did not include a discussion of recent work from the Lydy Group.

Response to Comment D3h: Board staff acknowledge this comment and understand the concern. Board staff have reviewed the citation provided by the Commenter but cannot include it in the Plan as Board staff cannot verify that it meets the criterion of being scientifically peer-reviewed. Board staff maintain that bioaccumulation of pyrethroids is a Knowledge Gap as Board staff found limited studies on the topic that matched the citation criteria.

Board staff have reviewed recent research performed by Lydy's group and have included it in the revised Plan where appropriate. Additionally, Board staff feel that toxicokinetics were addressed in various Knowledge Gaps of

the draft Plan as written. Furthermore, Board staff have expanded on the previous discussion through the inclusion of additional citations.

Comment D3i Agricultural [Alternative] Pyrethroid Management Practices: “For research in this area to be meaningful, the Central Valley Water Board should consider providing for an exception to potential exceedances arising from such experimental studies in order to reward growers for offering their land to research long-term improvement to agricultural practices.”

Response to Comment D3i: Board staff appreciate this insight. While Board staff acknowledge the potential concerns from growers, the Plan is not the appropriate medium to provide incentives or exemptions from regulatory program requirements. At the discretion of the Board, such exemptions may be considered on a case-by-case basis as research proposals are solidified.

Comment D4: The Commenter “recommends additional edits to the Draft Plan for clarity and accuracy.”

Response to Comment D4: Board staff appreciate this comment and have revised the draft Plan accordingly.

E. Debbie Mackey, Central Valley Clean Water Association (CVCWA)

Comment E1: This comment raised two concerns related to the purpose of the Plan. Board staff have broken this comment into two parts to address individual aspects of the comment.

Comment E1i: “Thus, the origin of the Research Plan requirement was to resolve scientific uncertainties to support the future needs of the control program. This purpose is not apparent in the Draft Research Plan. CVCWA recommends that additional attention be given to the statement of purpose of the Pyrethroid Research Plan. Specifically, the Draft Research Plan should identify the specific needs for the Pyrethroid Control Program, how each of the research topics will assist in fulfilling the identified needs, and whether any other policy analysis or technical information will be necessary in order to fully meet the identified needs.”

Response to Comment E1i: Please see Responses to Comments B0 and C2i.

Comment E1ii: “...during the development of the Basin Plan Amendment, it was the stakeholders’ understanding that future iterations of the Pyrethroid Control Program could result in potential numeric water quality objectives for pyrethroids... Yet, the Draft Research Plan does not include a strategy to develop the specific information that is required to support a Section 13241 analysis and adopt numeric objectives in future iterations of the Pyrethroid Control Program. This is an example of the needs that should be identified in the Draft Research Plan, along with corresponding research topics and necessary technical information.”

Response to Comment E1ii: Please see Responses to Comments B0 and D0.

Comment E2: This comment raised general concerns related to the Research Questions. The submitted comment was organized into parts a and b. Board staff have broken this comment into eight parts to address individual aspects of the comment.

Comment E2(0): “CVCWA is generally supportive of the concept of including management questions in the Draft Research Plan. However, a number of the questions should be limited in scope or re-characterized as “research questions” needed to address knowledge gaps, and some additional management questions should be added, as described below.”

Response to Comment E2(0): Board staff appreciate the support for the inclusion of management questions in the Plan. Board staff agree with the recommendation and as mentioned in the introduction of this Response to Comments, Board staff have refined and re-characterized the Management Questions to Research Questions.

Comment E2(a)i: “some of the management questions should be eliminated as too broad in scope. For example, Question 9 raises issues of worldwide food security. This type of question is beyond the scope of a water quality issue that the Regional Board can effectively tackle. Similarly, other management questions are really research questions looking to provide information to fill knowledge gaps, such as Question 7 concerning the relationship between salinity and pyrethroid toxicity. And although Question 4 asks an important question on whether there are disproportionate impacts of pyrethroids or replacement insecticides on disadvantaged and Tribal communities, this question is not limited to water quality impacts.”

Response to Comment E2(a)i: Board staff have removed Question #9 (How will increased food production needs affect reliance on pyrethroids?). Board staff agree that the question is outside the scope of Water Board authority and is therefore not appropriate for the Plan.

Board staff have revised Question #7 to “How will co-stressors affect pyrethroid toxicity?” Board staff anticipate that salinity impacts will be addressed by research regarding co-stressor effects on pyrethroid toxicity.

For information addressing the concern about Question #4 (now Question #3), please see Response to Comment D1iv.

Comment E2(a)ii: “Of the nine proposed management questions listed in the Draft Research Plan, Questions 2, 3, and 8 should be retained as valid and appropriate management questions.”

Response to Comment E2(a)ii: Board staff appreciate the comment. However, based on feedback in the 12 March 2024 staff workshop, Board

staff have removed Question #2 (What is the extent of pyrethroid contamination in the Tulare Lake Basin? Should the Pyrethroid Control Program be expanded to include this Basin?) as it is outside the research scope of the Plan. Board staff have removed Question #8 (How will climate change impact use, occurrence, and management of pyrethroids?) as Board staff anticipate that climate change impacts will be addressed by research regarding co-stressor effects on pyrethroid toxicity. Question #3 (now Question #2) has been refined to “Are alternative pyrethroid management practices needed to protect beneficial uses now and in the future?” to better fit the scope of the Plan.

Comment E2(a)iii: “Question 1 should be revised so that the inquiry on replacement pesticides is more targeted to the management practices adopted as part of dischargers’ pyrethroid management plans, rather than impacts of replacement pesticides generally.”

Response to Comment E2(a)iii: Board staff agree that Question #1 warranted revision. However, Board staff feel that the Commenter’s recommendation is more regulatory and therefore doesn’t align with the revised scope of the Plan. Board staff have refined Research Question #1 such that it can be addressed by the scientific community and added an associated Knowledge Gap for urban insecticide use.

Comment E2(a)iv: “Question 4 should be limited to impacts related to water quality.”

Response to Comment E2(a)iv: Please see Response to Comment D1iv.

Comment E2(a)v: “Questions 5, 6, and 7 should be re-characterized as research questions needed to provide information to fill knowledge gaps.”

Response to Comment E2(a)v: Board staff appreciate the comment and have re-characterized all Management Questions to Research Questions. Please see Section 2 for the revised Research Questions.

Comment E2(b)i: The Commenter recommended four additional Research Questions for inclusion in the Plan.

Response to Comment E2(b)i: Board staff appreciate the Commenter’s recommendations. However, the proposed questions were regulatory in nature, and therefore do not fit the refined scope of the Plan. Board staff will consider these questions as they continue to review data collected through the implementation of the Pyrethroid Control Program.

Comment E2(b)ii: “Moreover, CVCWA agrees with the comments made at the public meeting that there is a need to link the types of data and information needed to address the [Research] [Q]uestions with the types of data and information that would be obtained through the studies identified in the [K]nowledge [G]ap section. Data and information that would be necessary to fully

answer the [Research] [Q]uestions are not currently identified in the [K]nowledge [G]ap section. These two sections of the Draft Research Plan should be harmonized, consistent with a clear statement of purpose. As suggested above, revising and recharacterizing the list of [Research] [Q]uestions will provide a better structure for establishing these linkages.”

Response to Comment E2(b)ii: Please see Response to Comments B0 and C2i.

Comment E3: This comment raised general concerns related to select Knowledge Gaps. The submitted comment was organized into parts a - c. Board staff have broken this comment into eight parts to address individual aspects of the comment.

Comment E3(a)i: “With respect to the knowledge gaps identified in the Draft Research Plan, CVCWA appreciates Regional Board staff’s work to date to improve the analytical methods for pyrethroid monitoring...The only approved method now is for ambient monitoring. This is a knowledge gap that needs to be addressed and is not adequately captured in the discussion on page 12 of the document.”

Response to Comment E3(a)i: Board staff appreciate the acknowledgement. Board staff would like to clarify that the analytical methods approved for use in the Pyrethroid Control Program are not strictly for ambient water. Board staff have revised the Plan to reflect that in their validation packages, participating laboratories were required to demonstrate the attainment of method quality objectives in a synthetic wastewater matrix. Board staff will provide the validation package requirements to the Commenter upon request.

Comment E3(a)ii: “With respect to the three laboratories that have been accredited for pyrethroid analysis at the lower reporting limits, there has not been an inter-laboratory comparison study to evaluate the reliability or consistency of the analysis across laboratories. Each of these laboratories developed their own internal methods and are presumably using different instrumentation to meet the required minimum reporting limits. Again, to ensure confidence in the monitoring data that will be used for future iterations of the Pyrethroid Control Program, more attention must be given to the laboratory methods, accreditation, and consistency of laboratories performing the analyses.”

Response to Comment E3(a)ii: Board staff appreciate the feedback. Please see Response to Comment C4i.

Comment E3(a)iii: “Additionally, the statement on page 12 that the “Regional Board has authority to validate methods for five of the six pyrethroid analytes included in the Pyrethroid Control Program” is not accurate. Under current authorities, the Regional Board requests validation of methods by the Environmental Laboratory Accreditation Program (ELAP). ELAP validates and approves the method, consistent with the USEPA method update rule. CVCWA

requests that the method validation process be correctly explained and identified in the Draft Research Plan.”

Response to Comment E3(a)iii: Board staff have revised the Plan to clarify the steps taken to validate vs. accredit the analytical methods.

Comment E3(b)i: “The results in the Draft Report prepared by Dr. Young show that partition coefficients vary widely and do not reflect site-specific conditions. CVCWA requests that the Research Plan acknowledge this variability and provide guidance on how the Regional Board expects that the Young study coefficients will be used by dischargers to reflect their local receiving water conditions.”

Response to Comment E3(b)i: The interpretation and application of the findings of Agreement 18-027-150 constitutes a regulatory determination, which is outside the scope of a research plan. Board staff will work with the Permitting section to address any discharger questions regarding the use of partition coefficients in permits. Please see Responses to Comments C5, D2iv, and D3a.

Comment E3(b)ii: “CVCWA requests that the Pyrethroid Research Plan provide greater clarity and detail for the process and information that is needed to obtain Executive Officer approval of a site-specific or alternative partition coefficient.”

Response to Comment E3(b)ii: Given the research scope of the Plan, it is not an appropriate medium for outlining the regulatory process and information needed to obtain Executive Officer approval of a site-specific or alternative partition coefficient. Interested parties may use the study design outlined in the Final Report for Agreement 18-027-150 as an example of how they may approach determining site-specific partition coefficients. Guidance for requesting use of site-specific coefficients should be coordinated through Board staff by the requesting permittee.

Comment E3(b)iii: “...the wastewater partition coefficients in Table IV-Z are based on a single study from [SacSewer] published in 2013 using data from the former treatment plant. This study is now outdated in characterizing [Sac Sewer]’s dissolved pyrethroid concentrations given the change in [Sac Sewer]’s treatment plant technology and is not representative of many treatment systems in operation in the Central Valley. We have also learned from Dr. Young’s Draft Report that there is extreme variability across sites; relying on one coefficient from one study is clearly not appropriate to capture the variability across the wastewater sector. The lack of a robust study for a wastewater partition coefficient should be added as an issue to be addressed as a knowledge gap.”

Response to Comment E3(b)iii: Board staff appreciate this comment and agree with all points raised. Board staff have revised Section 3.A to address all concerns.

Comment E3(c)i: "...CVCWA questions whether a focus on microplastics in the Pyrethroid Research Plan is reasonable given the other topics where there is considerable uncertainty and limited understanding... Given the other knowledge gaps, as noted below, CVCWA requests that the discussion of microplastics be revised to state the relative priority of the issue..."

Response to Comment E3(c)i: Board staff appreciate this concern. Board staff would like to clarify that pyrethroid interactions with microplastics is a knowledge gap in the literature, and Board staff believe that its inclusion in the Plan is necessary to comprehensively present existing scientific uncertainties about pyrethroid behavior in surface waters and sediments. Please see Responses to Comment B0 and B3 for more information on the prioritization of Knowledge Gaps.

Comment E3(c)ii: "Further, our limited understanding of microplastics in the environment is compounded by research needs including analytical methods to support monitoring, chemistry, and toxicity studies. Although standardized methods are now available for monitoring microplastics in drinking water, standardized methods for microplastics identification and quantification have yet to be developed for the matrix of ambient waters and sediment...CVCWA requests that the discussion of microplastics...at least be revised to include a description of the challenges in applying current microplastics analytical methods to surface waters and sediments."

Response to Comment E3(c)ii: Board staff appreciate the feedback and have revised Section 3.D.3 to clearly identify the need for analytical methods in ambient water and sediments.

Comment E4: This comment raised general concerns related to prioritization and implementation. Board staff have broken this comment into two parts to address individual aspects of the comment.

Comment E4i: "Respectfully, without a plan to prioritize and implement the research needs, CVCWA is concerned that there will be little progress made on addressing important knowledge gaps and scientific uncertainties in working toward a more scientifically defensible Pyrethroid Control Program... The stakeholder process for the Regional Board's Delta Nutrient Research Plan can serve as an example to follow... Similar criteria could be used to develop priorities for pyrethroid research, monitoring, and analytical method development."

Response to Comment E4i: Board staff appreciate this comment and the recommendation to use the prioritization criteria from the Delta Nutrient Research Plan (DNRP). The DNRP prioritization criteria was developed to evaluate specific research proposals and monitoring recommendations. Therefore, as discussed in the 12 March 2024 staff workshop, these criteria are not appropriate to apply to the Plan, which describes broad Knowledge Gaps. Please see Response to Comment B3 for more information on the prioritization of Knowledge Gaps.

Comment E4ii: “Absent any direction or explanation from the Regional Board, there is concern that there will be a lack of coordination among those entities funding and conducting the studies. The Regional Board should include an implementation section in the Draft Research Plan that indicates how the Draft Research Plan will be coordinated, prioritized, and implemented in the future, keeping in mind the terms of the Basin Plan Amendment.”

Response to Comment E4ii: Board staff have revised the Plan to explain that, similar to the implementation of the Delta Nutrient Research Plan, the Central Valley Water Board will, as resources allow, seek to fund some studies pursuant to the Plan. Board staff expect that the remaining needs will need to be fulfilled by research and funding agencies who will include the Knowledge Gaps in their requests for proposals once the Plan is approved by the Central Valley Water Board. Please see Response to Comment B0 for more information.

F. Tim Johnson, California Rice

Comment F1: This comment raised concerns about the need for the Plan to “include a mechanism to engage stakeholders in the crop protection and production agriculture communities”, which the Commenter feels “is absent from the [D]raft [P]lan and its absence significantly disadvantages the Central Valley Water Board.” Board staff have broken this comment into two parts to address individual aspects of the comment.

Comment F1i: “Industry Input – the plan lacks input from pesticide registrants and the agricultural community. Absent are the resources of scientists from companies who have for decades studied these compounds and understand their interaction with the environment. Also absent is the expertise of growers who understand use patterns of crop protection materials. Both stakeholder groups could positively inform the proposed workplan.”

Response to Comment F1i: Board staff have added an Appendix to describe the outreach and engagement conducted to prepare the draft Plan. Board staff provided all interested parties the opportunity to engage on the draft Plan by disseminating information through the Central Valley Water Board’s public noticing protocol and through the Pyrethroid Control Program subscription list. Additionally, Board staff updated the Pyrethroid Control Program webpage with information about opportunities to provide feedback and/or participate in workshops regarding the Plan. Board staff coordinated internally with the Irrigated Lands Regulatory Program (ILRP) and presented at the July 2023 Quarterly ILRP Stakeholder Meeting to describe the draft Plan and announce the public comment period and August 2023 staff workshop.

Furthermore, pesticide registrants and the agricultural community were provided the opportunity to engage on the draft Plan. Representatives from the PWG and consultants representing agricultural coalitions

attended the staff workshops and provided detailed public comments that Board staff have addressed in the revised Plan. Please see responses to Comment Letters D and H.

Comment F1ii: “Research – The highly specified endpoints proposed for research must include active input from the scientists within the registrant community and grower community. Those who conduct the research and how it is performed will have a significant impact on acceptance within the user community.”

Response to Comment F1ii: As explained in Response to Comment B0, Board staff were careful not to dictate or propose endpoints for research as that is beyond the scope of the Plan as well as Board staff expertise. The studies proposed pursuant to the Plan will be the purview of the funding agencies.

Comment F2: “Finally, we agree with the comment in the [D]raft work plan that concludes that the use of these materials is likely to significantly decrease by the time the contemplated work plan is completed. Pest resistance and transition to other crop protection tools are constant factors in determining which materials are used within production agriculture. As an older class of pesticide, these factors have already been in play for many years.”

Response to Comment F2: Board staff appreciate the concern. The Central Valley Water Board will seek to develop more adaptive control programs in the future to account for dynamic pesticide use patterns.

G. Edmund Yu, Delta Independent Science Board

Comment G0: The “Summary” and “Background” sections of the comment letter raised general concerns. Board staff have broken this comment into three parts to address individual aspects of the comment.

Comment G0i: “Nevertheless, the Delta ISB feels that there should be a stronger linkage between management needs and the proposed research and a stronger focus on monitoring and adaptive management. It is not clear how new research or monitoring would directly inform the management questions laid out in the [D]raft Plan.

Response to Comment G0i: Please see Responses to Comments B0, C2i, and C2iii.

Comment G0ii: “Additionally, evaluating the effectiveness of mitigation measures, including costs, should be considered as an overarching theme.”

Response to Comment G0ii: This recommendation is outside the scope of the Plan. Please see Responses to Comments B0 and D0.

Comment G0iii: From the “Background” section, “However, the Regional Board found that ‘adequate information was not available at the time to establish numeric water quality objectives for pyrethroids.’ Therefore, the Pyrethroid Control Program included a commitment by the Regional Board to consider the adoption of numeric pyrethroid water quality objectives no later than ‘15 years from the Pyrethroid Control Program effective date’ (i.e., in 2034).”

Response to Comment G0iii: Board staff appreciate the attempt to provide an overview of the Pyrethroid Control Program and its development. However, Board staff would like to clarify that the review of the Pyrethroid Control Program in 2034 is not based on, nor is it exclusively focused on, the adoption of numeric pyrethroid WQOs. Board staff have revised Section 1 of the Plan to elaborate on the background of the Pyrethroid Control Program.

Please see Responses to Comments C2iii and D0 for more detailed information.

Comment G1: This comment raised concerns that the Plan does not optimally address management needs and the Commenter provided recommendations. Board staff have broken this into ten parts to address individual aspects of the comment.

Comment G1i: “It is not clear how the proposed research would directly inform the [Research] [Q]uestions articulated in the [D]raft Plan. For example, the Plan fails to describe monitoring approaches and evaluation criteria to inform Management Questions 1 to 4.”

Response to Comment G1i: Board staff appreciate the comment. However, Research Questions #1 – 4 from the draft Plan have been modified to fit the revised scope of the Plan. For example, Research Question #2 (What is the extent of pyrethroid contamination in the Tulare Lake Basin? Should the Pyrethroid Control Program be expanded to include this Basin?) was regulatory in nature and therefore removed as it did not fit the refined scope of the Plan. For more information on how Board staff revised the Plan to address the linkage between the Knowledge Gaps and Research Questions and Board staff’s position on the prescription of approaches to address Research Questions, please see Responses to Comments B0 and C2i.

Comment G1ii: “[I]t is important to gain reliable information on the cost effectiveness of mitigation measures.”

Response to Comment G1ii: Board staff infer that this comment is based on a consideration of Water Code 13241 factors for the development of WQOs. Therefore, please see Responses to Comments B0 and D0.

Comment G1iii: “So, a key research question is, will available substitutes for pyrethroids improve ecosystem conditions and if so, do they carry similar or other risks?... However, no research questions on [this] topic [was] presented.”

Response to Comment G1iii: The draft Plan included a Research Question (#1) regarding replacement insecticides and the associated ecological impacts. Board staff have refined this Research Question to better fit the scope of the Plan and added an associated Knowledge Gap for urban insecticide use. More information can be found in Sections 2 and 3.I of the Plan.

Comment G1iv: “Further, the [D]raft Plan identified a data gap of “costs to dischargers” of meeting water quality objectives. However, no research questions on [this] topic [was] presented. Information about costs and the effectiveness of mitigation measures is needed to make informed decisions about discharge and runoff management in point and non-point source emission.”

Response to Comment G1iv: “Cost to dischargers” is not a Knowledge Gap identified in the draft Plan. The draft Plan mentions “cost to dischargers” in Section 1.A. of the Plan:

“The Regional Board considered the factors set forth in Water Code section 13241, including achievability and economic considerations, and found that adequate information was not available at the time to establish numeric water quality objectives for pyrethroids. In particular, quantitative data on the effectiveness of available pyrethroid controls and the ultimate cost to dischargers of attaining potential pyrethroid water quality objectives were limited.”

This language was included to provide context to the phased approach of the Pyrethroid Control Program. Considerations of factors set forth in Water Code section 13241 are outside the scope of the Plan. Board staff have revised Section 1 of the Plan to clarify this point. Please see Response to Comment D0 for further information.

Comment G1v: “Finally, the Plan could more clearly indicate how research will assist in establishing numeric targets, which was identified as an impediment to TMDL implementation.”

Response to Comment G1v: The Pyrethroid Control Program has already established numeric targets, called numeric triggers. The Pyrethroid Control Program established TMDLs for nine urban waterbodies as well as a prohibition of discharge above the numeric triggers for all waterbodies in the Sacramento and San Joaquin River basins with WARM/COLD beneficial uses. Under the Pyrethroid Control Program, the TMDL wasteload allocations and load allocations are calculated according to the same equation and interpreted the same as the numeric triggers.

Comment G1vi: “Overall, the Delta ISB questions the usefulness of the [D]raft Plan for resolving management questions in a timely manner. We suspect that adequate information is currently available to establish numeric water quality objectives for pyrethroids, as other countries are rapidly moving forward to regulate these chemicals. It is difficult to understand why the Regional Board requires another 15 years of research to establish such numeric water quality objectives while the European Union (EU) finalized the scientific process and review of a number pyrethroids (cypermethrin, bifenthrin, deltamethrin, esfenvalerate, and permethrin) in 2022...The EU is expected to adopt Environmental Quality Standards (chronic and acute) in 2024.”

Response to Comment G1vi: Board staff would like to clarify that the development of WQOs is not an express goal of the Pyrethroid Research Plan. The Central Valley Water Board’s legal requirements for establishing WQOs differ from those of the EU. Furthermore, the satisfaction of these legal requirements represents a regulatory effort and is therefore outside the scope of the Plan. Please see Responses to Comments B0 and D0.

Comment G1vii, Recommendation A: “The Plan would benefit from articulating the practical and logistical steps for meeting the data and research needs, as well as the timeline to inform management questions.”

Response to Comment G1vii: Please see Response to Comment B0.

Comment G1viii, Recommendation B: “An effective adaptive management strategy should be developed that includes stronger linkages between management needs, proposed research, and monitoring. Given the known harms of pyrethroids, an adaptive management framework, such as the one described in the Delta ISB’s monitoring enterprise review, should be used to help set priorities and provide linkages between research and management decisions. Management decisions that can be addressed with key research in the short term, i.e., before the 15-year time frame, should be identified. A simple diagram or decision-tree linking information gaps to process drivers and management would be very useful for shaping the actual research and decisions.”

Response to Comment G1viii: The Plan can be used to fulfill the adaptive management framework steps described in the Delta ISB’s monitoring enterprise review. The Plan would inform steps one and two, which is to identify the purpose of monitoring and frame the problem. Additionally, based on the review findings, the Plan also identifies the problems through the Knowledge Gaps and highlights specific questions to be addressed by special studies and monitoring. Please see Responses to Comments B0, B3, C2i, and C2iii.

Comment G1ix, Recommendation C: “Given the many unknowns for pyrethroid management, it is also worth considering a dynamic adaptive planning approach rather than waiting for perfect information. This type of decision making under deep uncertainty can be used to create cost-effective interim management

approaches and strategies for future adaptation, while additional data are collected that evaluate potential system tipping points and the long-term outlook. For example, the cost-effectiveness and potential implementation scale of alternative pyrethroid reduction options could be systematically compared. If relatively low-cost management options showed promise for reducing concentrations of pyrethroids, they could be strategically implemented and monitored for effectiveness, while research is ongoing to establish the full management requirements for the TMDL. The process of developing such a system also can reveal which research needs are critical to specific decisions, including monitoring needs.”

Response to Comment G1ix: Board staff have revised Section 1.A of the Plan to explain how the design of the Pyrethroid Control Program is consistent with the Commenter’s recommendation. As explained previously, the Pyrethroid Control Program contains an adaptive management component. Moreover, Board staff regularly review data collected pursuant to the Pyrethroid Control Program to identify potential areas for improvement. Please see Response to Comment C2iii.

Comment G1x, Recommendation D: “A review of the EU Environmental Quality Standards, combined with an update of the water quality criteria already derived by the Regional Board and UC Davis, could provide numeric water quality objectives in a timely manner, thereby allowing for immediate management actions to control pyrethroids. Regular review and update of these objectives, as well as a well-designed monitoring program, should be part of the adaptive management framework.”

Response to Comment G1x: The recommendations in this comment focus on WQOs and adaptive management due to concern for timely regulation of pyrethroid discharges. Board staff would like to clarify that the development of WQOs is not an express goal of the Plan. The Pyrethroid Control Program established numeric triggers and management actions to control pyrethroids which have been in effect since 2019. Furthermore, adaptive management is built into the framework of the Pyrethroid Control Program. In addition to the adaptive management of the Pyrethroid Control Program, the Central Valley Water Board achieves the proposed regular review of water quality control programs through its Triennial Review. Board staff have revised the Plan to clarify that while fulfillment of the Knowledge Gaps is highly desired and will better inform the Control Program as a whole, it is not required, and re-evaluation of the Control Program will occur as specified by the deadlines established in the Basin Plan.

Comment G2: This comment raised concerns regarding whether the Plan will adequately address ecosystem effects of pyrethroids, and recommendations were provided. Board staff have broken this into four parts to address individual aspects of the comment.

Comment G2i: “The [D]raft Plan addresses broad, fundamental research questions in ecotoxicology and environmental chemistry focused on this group of insecticides...Addressing any one of these (e.g., sublethal effects, mixture and multiple stressor effects, bioaccumulation/biomagnification) could take many years of coordinated efforts to identify the KEY factors. Potential funding sources and cost estimates are not provided. As a result, the Delta ISB wonders how the research will be prioritized, and how the data will be used to determine management actions.”

Response to Comment G2i: Board staff acknowledge the concern regarding the complexity of the Knowledge Gaps. For more information about the Plan purpose and funding, please see Response to Comment B0.

For more information about prioritization, please see Response to Comment B3.

For more information about data use and review of the Pyrethroid Control Program, please see Response to Comment C2iii.

Comment G2ii: “A reasonable assessment of the environmental consequences of pyrethroids in the Delta requires a credible comparison of baseline and future conditions. The [D]raft Plan does not seem to provide a strategy for collecting such monitoring data.”

Response to Comment G2ii: As stated previously, articulation of how research will be conducted is outside of the scope of the Plan and Board staff expertise. For more details, please see Response to Comment B0.

Furthermore, dischargers in the Delta are currently collecting pyrethroid chemistry and toxicity data pursuant to their requirements under the Pyrethroid Control Program. Please refer to the revised Section 1.A of the Plan.

Comment G2iii, Recommendation A: “The Plan would benefit from a clear articulation of what type of data on pyrethroid concentrations, including their spatial and temporal distributions, are currently available. Further, the authors need to explain how these data can be used to assess the impact of different management practices currently employed to control the release of pyrethroids into surface waters.”

Response to Comment G2iii: Previous data on the spatial and temporal distribution of pyrethroids are discussed in the Final Staff Report (Water Board, 2017) and are therefore not summarized in the Plan. Board staff will provide the Commenter with a copy of the Final Staff Report (Water Board, 2017) upon request.

Comment G2iii, Recommendation B: “In its 2018 water quality review, the Delta ISB recommended holistic monitoring studies (e.g., ones that combine toxicity

testing and chemical analyses with fish and food-web monitoring) and increased temporal and spatial coverage of monitoring activities (see Delta ISB 2018). We recommend inclusion of a monitoring component in the [D]raft Plan to inform management and to provide adequate baseline data for future management actions. This should include all pyrethroids registered for use in California as well as the potential replacement pesticides. Agricultural as well as urban sources should be considered.”

Response to Comment G2iii: The Pyrethroid Control Program includes baseline monitoring requirements for both agricultural and urban dischargers to determine attainment of the numeric triggers. The baseline monitoring includes requirements for both toxicity testing and chemical analysis. Under the conditional prohibition, dischargers are required to develop management plans with an adaptive management component if their discharges exceed the numeric triggers. Trend monitoring, once implemented, will evaluate the effectiveness of these management plans. The Pyrethroid Control Program contains provisions for monitoring and managing alternative insecticides to the six priority pyrethroids.

Information pertaining to the Pyrethroid Control Program can be found in [Basin Plan 4.5.5.2](https://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/sacsjr_201902.pdf).
(https://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/sacsjr_201902.pdf)

Board staff have linked the Basin Plan in the revised Plan for the reader’s convenience.

Comment G2iv, Recommendation C: “In Management Question 3 of the Plan, the authors ask if current pyrethroid management practices are effective. A better question is to ask how effective they are.”

Response to Comment G2iv: Board staff have revised the Research Questions, including Research Question #3 (now Question #2), such that they are limited to questions that can be answered by the science community and/or scientific studies. Research Question #2 is now “Are alternative pyrethroid management practices needed to protect beneficial uses now and in the future?”.

Comment G3: This comment raised concerns regarding how research efforts will be coordinated with other agencies and recommendations were provided. Board staff have broken this into three parts to address individual aspects of the comment.

Comment G3i: “The program includes a provision that the Regional Board will work with stakeholders to develop the Plan. The document, however, does not identify the stakeholders clearly nor does it show clear evidence of engagement with other agencies and stakeholders for the preparation of this [D]raft Plan.”

Response to Comment G3i: Board staff appreciate this comment and the associated recommendations. Board staff have added an Appendix to describe the outreach and engagement conducted to prepare the draft Plan.

Basin Plan Section 4.5.5.1(8) identifies key stakeholders, including the Delta Independent Science Board (DISB), with whom the Central Valley Water Board should coordinate and consult on the development of the Plan, as appropriate. To this end, Board staff provided the DISB an opportunity to review the draft Plan and provide feedback prior to public release and offered an individual meeting to DISB to discuss their specific feedback.

Given the scope of the Pyrethroid Control Program, Board staff are committed to working with both independent governments, such as Tribes, and stakeholders. Stakeholders for this particular program include members of the regulated community and their representatives (agricultural dischargers and municipal stormwater and wastewater dischargers), environmental justice organizations, regulatory agencies, industry representatives, researchers, and concerned citizens. Board staff developed the draft Plan to foster efficient and productive conversations with this varied group of stakeholders. Board staff provided multiple opportunities for stakeholder input including multiple staff workshops, individual stakeholder meetings, and a 63-day public comment period. Board staff believe that they provided sufficient opportunity for stakeholders and DISB to submit feedback.

Comment G3ii, Recommendation A: “The Plan would benefit from a description of how potential research partners will be incentivized to support the Plan, as well as who those partners likely will be. The proposed process by which the research efforts will be coordinated with other agencies, institutions, and private companies needs to be well-articulated.”

Response to Comment G3ii: Board staff would like to clarify that the Plan was intended to be used by the scientific community as a justification for grant applications or other funding opportunities. Similarly, as highlighted by this commenter in comment G1vii, the Plan can be used to fulfill the adaptive management framework steps described in the Delta ISB’s monitoring enterprise review. The Plan will inform the purpose of monitoring, frame the problem, and highlight specific questions to be addressed by special studies and monitoring to address the Knowledge Gaps.

Board staff have revised the Plan to explain that the Central Valley Water Board will, as resources allow, seek to fund some studies pursuant to the Plan. Board staff expect that the remaining needs will need to be fulfilled by research and funding agencies who can include the Knowledge Gaps

in their funding efforts, grants, requests for proposals, etc., once the Plan is approved by the Central Valley Water Board. Please see Response to Comment B0 for more details.

Comment G3iii, Recommendation B: “The Plan would benefit from a discussion of other research plans for contaminants in the Delta or elsewhere and, should they exist and be shown to be effective, how they might be used as a model.”

Response to Comment G3iii: This recommendation is outside the scope of Plan. Please see Response to Comment B0.

Comment G4: This comment inquired if “data management (including quality assurance), monitoring, and adaptive management [were] part of the Plan” and a recommendation was provided. Board staff have broken this into two parts to address individual aspects of the comment.

Comment G4i: “The [D]raft Plan includes neither data management measures, which are an essential component of monitoring programs, nor an adaptive management strategy (see recommendations above). The plan does outline ongoing quality assurance measures (inter laboratory comparison) regarding establishing analytical methods for pyrethroids.”

Response to Comment G4i: As mentioned in Responses to Comments G1 and G2, the monitoring and adaptive management concerns raised by the Commenter are already being addressed through implementation activities of the Pyrethroid Control Program. Furthermore, these aspects are beyond the scope of the Plan. Please see Response to Comment B0 for details on the inclusion of data management measures.

Comment G4ii, Recommendation A: “The Delta ISB believes that a comprehensive focus on management, monitoring, data collection, and analysis as part of an adaptive management strategy is essential for an effective Plan to answer management questions (see Delta ISB 2022). These should be included as key components of the Plan.”

Response to Comment G4ii: Board staff appreciate the recommendation. Please see Response to Comment G4i.

Comment G5, under Additional Specific Comments: This section raised several concerns about regulatory actions and specific Knowledge Gaps. These comments were numbered 1-6. Board staff have broken this into ten parts to address individual aspects of the section.

Comment G5(1): “It is unclear to the Delta ISB what regulatory actions are associated with the current Pyrethroid Control Program. For instance:

- *Does the existing TMDL cover only the 6 pyrethroids named in the Plan, or all pyrethroids registered in California?*

- *Are there existing regulations limiting the use and discharge of pyrethroids from agricultural land and human communities? If so, are the polluting entities discharging concentrations exceeding the amounts allowed?*
- *What management strategies and actions are in place to bring the discharging entities into compliance?*
- *Would sanitation district facilities be actively involved in tracking human-based contributions?”*

Response to Comment G5(1): The information requested in this comment is specific to implementation of the Pyrethroid Control Program and therefore outside the scope of the Plan. Some of the information requested can be found in Section 1.A of the Plan. For regulatory actions associated with the current Pyrethroid Control Program, Board staff recommend that the Commenter review Resolution R5-2017-0057, which is available on the [Pyrethroid Control Program website](https://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/pyrethroid_control_program/) (https://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/pyrethroid_control_program/).

Information pertaining to the Pyrethroid Control Program can also be found in [Basin Plan 4.5.5.2](https://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/sacsjr_201902.pdf). (https://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/sacsjr_201902.pdf)

As it is not available online, Board staff will provide the Commenter with a copy of the Final Staff Report (Water Board, 2017) upon request.

Comment G5(2): “The [D]raft Plan refers to TMDL numeric targets (including applicable water quality standards), water quality criteria, pyrethroid concentration goals and pyrethroid triggers, all of which are (more or less) defined as numeric concentration thresholds protective of beneficial uses. Please provide an explanation for why it was possible to establish these thresholds, while much more research appears to be needed to establish water quality objectives.”

Response to Comment G5(2): To establish WQOs, the Central Valley Water Board is required to consider the factors set forth in Water Code section 13241, including achievability and economic considerations. During the development of the Pyrethroid Control Program, the Central Valley Water Board found that adequate information was not available at that time to conduct a robust review of 13241 factors to establish numeric WQOs for pyrethroids. In particular, there was limited quantitative data on the effectiveness of available pyrethroids controls and the ultimate cost to dischargers of attaining potential pyrethroid pesticide WQOs.

To address this and other uncertainties, the Pyrethroid Control Program includes a commitment by the Central Valley Water Board to review the Control Program no later than 19 February 2034. Please see Section 1 of

the revised Plan for more information. Additional details on the regulatory approaches considered and the rationale for the selected approach is available in Chapter 3 of the Final Staff Report (Water Board, 2017), which, as mentioned previously, is available upon request.

Comment G5(3): “It is unclear how research on partition coefficients proposed in the Plan will be used to achieve management goals. While researchers have shown that bioavailability of pyrethroids can decrease in the presence of particles, it is highly dependent on environmental conditions and strongly species specific. For a review on this topic, see Knauer et al. (2017).”

Response to Comment G5(3): Board staff have reviewed the provided citation and find it consistent with the use of partition coefficients in the Pyrethroid Control Program and the Knowledge Gap (Section 3.A) described in the Plan. Partition coefficients are an integral part of the Pyrethroid Control Program as they are used to calculate the freely dissolved concentrations of each of the six priority pyrethroids to assess attainment of the numeric triggers. Please see the Final Staff Report (Water Board, 2017, available upon request) and Basin Plan Table 4-2 (linked in Responses to Comments G2iii and G5(1)) for more information. Research on partition coefficients could potentially inform revisions to the Pyrethroid Control Program’s default partition coefficients or provide options for dischargers to request site-specific partition coefficients.

Comment G5(4): “Monitoring of pyrethroids in the environment requires special analytical methods. Limits of detection in the parts per trillion (nanogram to picogram/L) range are required to cover proposed or existing water quality criteria for the protection of aquatic life. While the [D]raft Plan describes the inter-laboratory comparison of analytical methods, it does not address the sensitivity of methods (i.e., detection and reporting limits) used. Sensitive water column analytical methods have been published (see Rösch et al. 2019).”

Response to Comment G5(4): Board staff appreciate the citation provided. Board staff refer the Commenter to Section 3.B of the Plan which describes the Central Valley Water Board’s analytical method validation effort. Additional information, including the laboratories accredited for pyrethroid water column analysis, is available on the [Pyrethroid Control Program website](https://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/pyrethroid_control_program/) (https://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/pyrethroid_control_program/).

Board staff have revised the Plan to reflect that, in their validation packages, participating laboratories were required to demonstrate attainment of prescribed method quality objectives. For specifics on the required performance criteria for the ongoing method validation, Board staff will happily provide the Commenter with the validation package request if desired.

Comment G5(5): “The fate and transport of pyrethroids in the environment are not addressed in the Plan, with the exception of the proposed research on partition coefficients. It is not clear to the Delta ISB if this information is already so well known that it does not need to be of concern. If so, then it should be acknowledged.”

Response to Comment G5(5): Board staff refer the Commenter to Section 3.C of the draft Plan for the Fate and Transport of Particulate-Bound Pyrethroids Knowledge Gap.

Comment G5(6): “The topic of co-stressors is addressed in the Plan, but the questions (including research on “other” species) are extremely broad. While these are important research topics, the proposed research on co-stressors (e.g., sublethal effects, additive/synergistic effects) requires a complex and extensive effort. Making the establishment of water quality objectives contingent upon the outcome of this co-stressor research appears unrealistic.” Comments on the following Knowledge Gaps are included: Temperature, Salinity, Microplastics, Synergistic/Additive Toxicity, Chronic Toxicity, and Bioaccumulation.

Response to Comment G5(6): Board staff acknowledge the concern. Board staff have revised the Plan to clarify that the establishment of WQOs is not certain nor is it contingent upon the outcome of co-stressor research pursuant to the Plan. As explained in Response to Comment B0, re-evaluation of the Pyrethroid Control Program will occur using available data, including that generated pursuant to the Plan, by the 19 February 2034 deadline.

Comment G5(6)i: *“Temperature: There is considerable information already available for pyrethroids; more than on many other chemicals. The question of how climate change/seasonal changes affect pyrethroid toxicity is important and could be used to address management questions in the future.”*

Response to Comment G5(6)i: Board staff acknowledge the comment. Please see Response to Comment D3d(1) for more information.

Comment G5(6)ii: *“Salinity: Compared to other factors affecting bioavailability of pyrethroids (e.g., species-specific differences, temperature), the impact of salinity on pyrethroid bioavailability appears to be of minor importance. Unlike metals, these organic chemicals do not change their chemical properties (i.e., chelation) depending on salinity. Species-specific differences in uptake and sensitivity are likely much more significant. Further, the authors state that “However, the Pyrethroid Control Program does not consider the impacts of salinity in its numeric trigger derivation or application.” If so, then why is this part of the Plan?”*

Response to Comment G5(6)ii: Please see Section 3.D.2 of the Plan for research demonstrating impacts of salinity on pyrethroid toxicity. Salinity is included as a Knowledge Gap expressly because it is not currently considered in the Pyrethroid Control Program.

Comment G5(6)iii: "Microplastics: The Delta ISB agrees that additional research on this topic is important but wonders if it is needed for the derivation of water quality objectives for pyrethroids. A rationale needs to be provided for prioritizing this emerging form of pollution."

Response to Comment G5(6)iii: Board staff appreciate the support for the inclusion of microplastics in the Plan. Board staff would like to clarify that the development of WQOs is not the express purpose of the Plan. For more information on the purpose of the Plan, please see Response to Comment B0 and Section 1.C of the revised Plan. For information regarding prioritization, please see Response to Comment B3.

Comment G5(6)iv: "Synergistic and additive toxicity, chronic toxicity, bioaccumulation: While these are important topics, the research to fill management needs should be much more focused. It should be based on high quality monitoring data in order to focus on real-world contaminant mixtures and their effects on key biological species. Existing modeling approaches could be used to address mixture effects and establish safety factors to account for uncertainties. Such methods are well established for risk assessment and TMDL design."

Response to Comment G5(6)iv: Board staff agree that research on these Knowledge Gaps would ideally focus on environmentally relevant co-contaminants and concentrations. This recommendation was highlighted in the relevant Knowledge Gap sections. Please see Response to Comment B0 for more information on the omission of prescribed research in the Plan.

H. Kelly Trunnelle, San Joaquin County and Delta Water Quality Coalition,
East San Joaquin Water Quality Coalition, Westside San Joaquin River
Watershed Coalition and Grassland Drainage Authority Coalition

Comment H1: This comment raised concerns regarding the linkage between Research Questions and Knowledge Gaps and the rationale for the research needs described in the Plan. A recommendation was also provided. Board staff have broken this into three parts to address individual aspects of the comment.

Comment H1i: "As discussed in the initial meeting with stakeholders on August 1, 2023, a stronger connection between the management questions and the research areas will help provide the context for why the highlighted research is needed."

Response to Comment H1i: Board staff have revised the Plan to clarify the linkage between the Research Questions and Knowledge Gaps. Please see Response to Comment C2i.

Comment H1ii: "...it's not clear why the research will improve or assist in developing regulation." The Comment included four questions that the Commenter believed would contextualize the importance of the research areas described in the Plan.

Response to Comment H1ii: Board staff appreciate the comment. Basin Plan 4.5.5.1(8) identifies topics for inclusion in the Plan. At the onset of Plan development, Board staff performed a literature review and determined that the topics identified in the Basin Plan had not been resolved. Therefore, these topics were all retained as Knowledge Gaps in the Plan.

Comment H1iii: "Ultimately, it is recommended that the [Research] Questions section of the PRP be removed to allow for a stakeholder process to better explore the answers to the [Research] Questions and how they relate to data gaps identified. Under the specific comments section of this letter (4. Conclusion (Page 21)), there is a suggestion to prioritize the data gaps. The prioritization could be based on initial management questions that would be developed and assessed further through a stakeholder process."

Response to Comment H1iii: Board staff have refined the scope of the Plan such that the Research Questions are more clearly related to Knowledge Gaps that can be addressed by the scientific community. Please see Section 2 of the revised Plan. Additionally, Board staff have added an Appendix to describe the stakeholder engagement process conducted to develop the draft Plan, including identification of appropriate Research Questions.

In addition to a written public comment period, Board staff conducted two staff workshops and held additional meetings as requested by stakeholders. This process provided multiple opportunities for stakeholders to provide suggestions and input on all aspects of the Plan, including the Research Questions. For information regarding the inclusion of Research Questions in the Plan and engagement with stakeholders, please see Responses to Comments D1viii and F1i.

For information regarding prioritization, please see Response to Comment B3.

Comment H2: The Commenter provided additional data gaps for Board staff consideration:

- *“Given Tom Young’s results and the extreme variation in the partition coefficients across the 19 SPoT locations, it seems appropriate to determine what factors are driving that variation.*
- *Pyrethroid flux in and out of freshwater sediments across the Central Valley.*
- *Understand the type, distribution, and abundance of microplastics in freshwater and freshwater sediments across the Central Valley.”*

Response to Comment H2: Board staff appreciate the recommendations. These suggestions are within the scope of the existing Knowledge Gaps, specifically Section 3.A Partition Coefficients (K_{OC} and K_{DOC}), Section 3.C Fate and Transport of Particulate-Bound Pyrethroids, and Section 3.D.3 Microplastics. Board staff have revised these Knowledge Gaps to elaborate on the Commenter’s specific suggestions.

Comment H3: The Commenter provided specific comments related to different sections of the Plan. Board staff have broken this into 15 parts to address individual aspects of the comment.

Comment H3i: The Commenter provided suggestions to improve definitions in the Plan’s Glossary, namely the definitions of bioaccumulation, biotransformation, enhancement, and K_{OC} .

Response to Comment H3i: Board staff appreciate this comment and have revised the Glossary to include the suggested changes.

Comment H3ii: In reference to Section 1.B Uses, Sources, and Fate of Pyrethroids, “The last sentence of the section is misleading. Fong et al. 2016 summarized research that had been done in labs, mesocosms, and, in some instances, based on organisms collected in the field (e.g., histopathology)... Table 1 is a compendium of effects on the various species that are found in the Delta, but because exposure in the Delta is not possible to reconstruct, there is no definitive way to state that a general stress response (for example) of chinook salmon juveniles in the Delta came from any of the pesticide groups, including pyrethroids. Rewording the last sentence of this section would help to indicate that these effects are seen in studies in the lab or mesocosms and not results from the field in which an exposure pathway is identified.”

Response to Comment H3ii: Board staff appreciate the comment and have added the recommended context. Please see Section 1.D of the revised Plan.

Comment H3iii: In reference to Section 2, Research Question #1, “The statement that neonicotinoids are ubiquitous is a conclusion that is not well supported by the three papers referenced... If a statement about widespread use and finding evidence of discharges is required, it would be best to omit a term like ‘ubiquitous’.”

Response to Comment H3iii: Board staff acknowledge the comment. Board staff have revised Research Question #1 and the associated description to fit the refined scope of the Plan. This section of the Plan no longer contains the term “ubiquitous”.

Comment H3iv: In reference to Section 2, Research Question #6, “Hyaella azteca is not depleted in surface waters where pyrethroids have been found... It might be better to replace the phrase, ‘depletion of H. azteca’ with something similar to, ‘effects on H. azteca populations.’”

Response to Comment H3iv: Board staff have removed the word “depletion” in the description of Research Question #6.

Comment H3v: In reference to Section 2, Research Question #7, “The Tanner et al. paper is focused on South Africa, not the Central Valley... There should be more supportive evidence of why salinity variation might be a concern in the Central Valley that does not rely on research from South Africa. Additionally, in this paragraph the terms “salinity variation” and “abstracted water” should both be defined.”

Response to Comment H3v: Board staff acknowledge the comment. Board staff have refined Research Question #7 to “How will co-stressors affect pyrethroid toxicity?”. Additionally, Board staff have revised the associated description to reflect citations detailing the salinity concerns in the Central Valley. Furthermore, Board staff have removed “salinity variation” and “abstracted water” from the revised description.

Comment H3vi: In reference to Section 2, Research Question #8, “Same comment about Tanner et al. as above, a South African study should not be used to support claims about the Central Valley. There is no dispute that climate change is going to impact temperatures, precipitation, etc. It would be more appropriate to site a Central Valley-based paper here.”

Response to Comment H3vi: Board staff have removed Research Question #8 as it was beyond the refined scope of the Plan.

Comment H3vii: In reference to Section 3.A, Partition Coefficients, “Given the extreme variation in the K_{OC} values generated by Young, an additional research area should be examining the causes of the variation and whether these causes should be incorporated into the Pyrethroid BPA.”

Response to Comment H3vii: Please see Response to Comment H2.

Comment H3viii: In reference to Section 3.C Fate and Transport of Particulate-Bound Pyrethroids, “The sentence about the study conducted in Southern California is confusing. It’s not clear what “spatial and temporal patterns of current-use insecticides” is, or what it has to do with finding that dust is a significant source of pesticides. It’s also not clear what the antecedent is for the

term “their” at the end of the sentence. Is it the insecticides, the dust, or the spatial and temporal patterns? Please elaborate.”

Response to Comment H3viii: Board staff appreciate the comment and have revised the relevant sentence in section 3.C of the Plan to clarify the concerns raised in this comment.

Comment H3ix: In reference to Section 3.D.2 Salinity, “The rationale for this research topic seems to be focused on understanding the direct and indirect impacts of salinity impairments rather than pyrethroids. The statement is made that, ‘the Pyrethroid Control Program does not consider impacts of salinity,’ and from the remaining part of the paragraph, it appears that there is no plan to do so. This research area seems out of place in the [Plan].”

Response to Comment H3ix: Please see Response to Comment G5(6)ii.

Comment H3x: In reference to Section 3.D.3 Microplastics, “The research need is stated as further examination of the sorption/desorption kinetics of organic compounds (presumably organic compounds is referencing pyrethroids) to and from different microplastics under environmentally relevant conditions. A recommended first step would be to do a study of the type and distribution of microplastics in surface waters in the Central Valley. This would allow the sorption/desorption studies to focus on relevant microplastics and perhaps understand that some of this research has already been conducted.”

Response to Comment H3x: Board staff appreciate the recommendation and feel that the recommendation falls within the scope of Section 3.D.3 as written. As discussed in Response to Comment B0, the articulation of how and/or which research should be conducted is outside of the scope of the Plan and Board staff expertise.

Comment H3xi: In reference to Section 3.F Evaluation of Sublethal Effects, “The traditional school of thought is that fitness involves the ability of organisms to reproduce and survive. Using the terms fitness, reproduction, and survival here is redundant. It is recommended that fitness be defined in the [Plan].”

Response to Comment H3xi: Board staff have revised Section 3.F per this comment.

Comment H3xii: In reference to Section 3.G Chronic Toxicity in Other Taxa, “There is a statement that chronic studies have higher statistical power. This is not necessarily correct and should be amended or explained further, as appropriate...Statistical power is about sample size and the variance among replicate groups. The formula for variance has the sample size in the denominator. Therefore, all things being equal, a larger sample size leads to a lower variance.”

Response to Comment H3xii: Board staff appreciate the comment and the provided citation. Board staff have reviewed the provided citation and revised the relevant sentence in Section 3.G. of the Plan.

Comment H3xiii: In reference to Section 3.H Pyrethroid Bioaccumulation, “In the second sentence, there is mention of ‘organic properties’. It’s not clear what this means. Are the properties organic? Or is this referring to the fact that pyrethroids are organic compounds and therefore have specific properties that make them tend to bioaccumulate rather than be detoxified and excreted? It is recommended that the terms ‘organic properties,’ as used here, be defined.”

Response to Comment H3xiii: Board staff have revised Section 3.H of the Plan to provide clarity.

Comment H3xiv: In reference to Section 4. Conclusion, “It would be helpful for the knowledge gaps to be ranked based on study priority. The criteria for ranking would also need to be explained but could be used to help connect the data gaps to a stakeholder process to determine and answer management questions.”

Response to Comment H3xiv: Please see Responses to Comments B3 and D1viii.

Comment H3xv: In reference to Section 4. Conclusion, “There is a gap called “chronic toxicity in other taxa”. Are there specific taxa, or is this a generic term for any taxon for which data do not currently exist? If it is the former, specific clarity needs to be added. If it is the latter, clarity to generalize the description of the gap needs to be added.”

Response to Comment H3xv: Board staff have revised Section 3.G of the Plan to clarify what is meant by “other taxa”.

References

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Water Board (2017). Proposed Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the Control of Pyrethroid Pesticides Discharges *Final Staff Report June 2017*. Available upon request.