
Appendix II Synthesis of Public Comment

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on the Advance Notice of Proposed Rulemaking for
Water Quality Challenges
in the San Francisco Bay/Sacramento-San Joaquin Delta Estuary

A Report to the
United States Environmental Protection Agency
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EXECUTIVE SUMMARY

In February 2011, the U.S. Environmental Protection Agency (EPA) released an Advance Notice of Proposed Rulemaking (ANPR) to assess whether current regulatory mechanisms (including standards for toxics, nutrients, and estuarine habitat protection) are effective in protecting water quality and aquatic life in the Bay Delta Estuary and its tributaries. The ANPR sought public input on whether the EPA should be taking new or different actions under its programs to address water quality challenges affecting fish and other estuarine resources.

EPA sought comments on specific topics and questions related to contaminants (ammonia, selenium, pesticides, contaminants of emerging concern) and aquatic habitat (estuarine habitat, fish migration corridors, wetlands). Interested parties were encouraged to read the Unabridged ANPR *Water Quality Challenges in the San Francisco Bay/Sacramento-San Joaquin Delta*, available at the EPA.gov website, and to provide additional technical information and suggestions for EPA actions.

Altogether, 55 respondents submitted comments, including individual respondents, representatives of various sectors of government, various types of membership associations, and non-governmental organizations (NGOs). Most of the key stakeholder groups are represented in the group of respondents, including state and federal agencies, water use agencies, regulated dischargers, environmental groups, commercial fishing, recreational boating, and local government. More than half the comments are substantive indicating respondents had technical expertise and familiarity with water quality regulations.

Several main themes emerge from the public comments:

- Several stakeholder groups support an EPA evaluation of aquatic life protection by Clean Water Act (CWA) programs in the Bay Delta Estuary as a timely action, but some groups identify concerns over the possibility of additional regulations.

- Respondents call for a comprehensive regional monitoring program for the Delta and urge EPA to actively support it.

- Respondents express concerns about EPA's focus on point of discharge regulation, water quality criteria, and specific permit requirements. Respondents want to see more focus on pollution prevention by means of source control.

- Many respondents identify a regulatory gap that allows legal registration and application of pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) that subsequently cause water quality problems, which are regulated by the Clean Water Act (CWA). Respondents describe concerns about aquatic

toxicity from legally applied pesticides and want EPA to address this internal program issue.

- Various interest groups see the development of wildlife and aquatic life criteria for selenium as an opportunity for addressing science and regulatory gaps, if based on new information on environmental processes in the estuary.

- Several respondents identify mercury as an important issue that the ANPR does not specifically address. They would like to see the issue more fully addressed, especially loadings, methyl mercury production, and fish tissue levels.

- Several commenters support nutrient numeric endpoints (NNEs) for the Delta, ammonia criteria focused on spring phytoplankton inhibition, and a broader analysis of nutrients beyond ammonia and its toxicity.

- Respondents want EPA to address contaminants of emerging concern (CECs) at the source. For example, during the registration of a product, or as an integral part of research, development, and product testing, before such products are publicly available.

- Commenters representing federal resource agencies, an environmental organization, and a wastewater discharger propose various success measures for salmonid migration in Central Valley streams. Commenters highlight the incomplete and dated nature of information about migration dynamics of adult San Joaquin salmon.

- Commenters disagree on the issue of estuarine habitat and the use of a salinity gradient with compliance points as the regulatory structure to protect estuarine fish species.

- Some respondents recommend protecting wetlands by focusing regulatory action on restoring ecological wetland functions.

The views expressed in the synthesis report are from the individuals and organizations that participated in the public comment process. They reflect concerns over future policy decisions affecting the Delta and its values as a resource. Since a number of respondents prepared detailed, substantive comments (respondents submitted 640 pages of comments, in total, plus numerous references and supporting materials), we strongly encourage interested parties to examine the full, unedited record of public comment at http:/ / www.epa.gov/ sfbay-delta/ actionplan.html.

INTRODUCTION

The Advance Notice of Proposed Rulemaking (ANPR) for Water Quality Issues in the San Francisco Bay/ Sacramento-San Joaquin Delta Estuary (Bay Delta Estuary) is part of a comprehensive set of commitments made by Federal agencies to address California water issues under the Interim Federal Action Plan released in December 2009. The purpose of the ANPR is to help the U.S. Environmental Protection Agency (EPA) assess whether the current regulatory mechanisms designed to protect aquatic life and water quality in the Bay Delta Estuary and its tributaries are effective, including standards for toxics, nutrients, and estuarine habitat protection.

EPA used the ANPR to seek public input on whether to take new or different actions to address water quality challenges affecting fish and other estuarine resources. The public comment will inform EPA's assessment and possible follow up actions.

The comment period opened on February 22, 2011, and ended on April 25, 2011. This document provides a synthesis of the public comment.

REQUEST FOR PUBLIC COMMENT

EPA provided options for submitting comments electronically at the Federal Rulemaking Portal, by email, or by hardcopy. Interested parties were encouraged to read the Unabridged ANPR *Water Quality Challenges in the San Francisco Bay/Sacramento-San Joaquin Delta* and provide additional technical information and suggestions for EPA actions. EPA sought comments on specific topics, and specific questions on each topic:

- Contaminants
- Ammonia: Toxic and Nutrient Effects
- Selenium
- Pesticides
- Contaminants of Emerging Concern
- Estuarine Habitat
- Fish Migration Corridors
- Wetlands

EPA released the ANPR on February 10, 2011, and simultaneously issued a press release. On the same day, EPA's Bay-Delta team posted information about the ANPR and relevant documents on EPA's San Francisco Bay Delta Estuary website and distributed email announcements to relevant mailing lists.

ABOUT THE RESPONDENTS

Respondents provided optional information about themselves by entering fields in the electronic submittal form or, more informally, in submitted cover letters and emailed comments. This information was used to characterize respondents by sector, perspective, and interest and involvement in the Delta. While this data-gathering method is not scientific, it provides a general picture of who responded and how.

Total Response

Fifty-five (55) respondents submitted comments. The majority of respondents (51) submitted comments electronically (Federal Rulemaking Portal, email, or both). All submissions were original and no form letters were used. Of the 55 respondents, 37 respondents submitted prepared letters. Twenty-one respondents submitted additional information as uploaded files, hardcopies, or on a CD. About a quarter of the total response (14) consisted of brief general comments or email messages.

See also Appendix A, Table 1.

Sector

Thirty-two respondents (60%) identified themselves as representatives of various organizations. The top sectors represented were government, various types of membership associations, and non-governmental organizations (NGOs), which together accounted for 54% of the total response.

The fifteen government responses represented various levels of government, with four respondents each affiliated with federal, state, and regional agencies, and three with local agencies. This breakdown includes one presumably mislabeled comment (organization: "Student"[1], agency: federal).

About 40% of respondents were private individuals and/ or small business owners representing the private sector.

See also Appendix A, Table 2, 3, and 4.

Perspective

Non-affiliated individuals and small businesses comprised 38% of respondents. The bulk of this group provided general comments and only 2 of the 21 comments directly answered the specific questions in the ANPR.

[1] EPA-R09-OW-2010-0019

Respondents representing an organization (62% of respondents) included policy makers, planners, and resource managers (9), environmental advocates (6), regulated dischargers (6), water agencies (4), regulatory agencies (3), consultants (2), water users (2), a commodity group (1), and a research institution (1).

See also Appendix A, Tables 5 and 6.

Interest and Involvement in the Delta

By volume, self-representation and the general public interest (grouped as public involvement) were respondents' primary cited interest (25), followed by natural resource management (7), water supply (7), environmental protection (5), wastewater (3), agriculture (2), stormwater (2), boating (1), land use (1), renewable energy (1), and science (1).

Accordingly, a large number of the responses were personal comments of individuals (12) or representing a small business or an industry (11). Other responses were from entities involved in the Delta as authorities at the regional (9), local (5), statewide (5), or national level (4), or as environmental (6) or recreational groups (1).

See also Appendix A, Tables 7, 8, 9, and 10.

MAIN THEMES THAT EMERGED FROM THE RESPONSES

The request for public comment was organized around specific questions related to some of the most significant water quality issues affecting aquatic life designated uses in the Bay Delta Estuary. These water quality topics and questions are also the framework for organizing this synthesis report. All submitted comments were systematically reviewed to summarize the main points emerging from the responses. To best capture the main points and nuances of comments, the summary draws extensively from selected direct quotes. The views expressed in the synthesis report are from the individuals and organizations that participated in the public comment process. They are not the views of EPA or Aquatic Science Center. No random sampling was performed, so the record of public comment represents the opinions of people and organizations that participated in the public comment process and not necessarily the opinions of Bay Delta stakeholders as a whole. Views from most of the key stakeholder groups, however, are represented.

Several main themes emerge from the public comment process:

- Several stakeholder groups support this new Bay Delta initiative as a timely action, but by the same token, voice concerns over the possibility of additional regulations.

- Respondents call for a comprehensive regional monitoring program for the Delta and expect EPA to actively support it.

- Respondents expressed concerns about EPA's focus on point of discharge regulation, water quality criteria, or specific permit requirements. Respondents want to see more focus on pollution prevention by means of source control.

- Many respondents are concerned about the regulatory gap that allows pesticides that are causing water quality problems and are regulated by the Clean Water Act (CWA) to be sold and used under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and want EPA to address this issue.

- Various interest groups see the development of wildlife and aquatic life criteria for selenium as an opportunity for addressing science and regulatory gaps, if based on new information describing environmental processes the estuary.

- Several respondents identify mercury as an important issue that the ANPR does not specifically address. They would like to see the issue more fully addressed, especially loadings, methylmercury production, and fish tissue levels.

- Several commenters support nutrient numeric endpoints (NNEs) for the Delta, ammonia criteria focused on spring phytoplankton inhibition, and a broader analysis of nutrients beyond ammonia and its toxicity.

- Respondents want EPA to address contaminants of emerging concern (CECs) at the source. For example, during the registration of a product, or as an integral part of research, development, and product testing, before the product is released on the market.

- Commenters representing federal resource agencies, an environmental organization, and a wastewater discharger propose various success measures for salmonid migration in Central Valley rivers and streams.

- Commenters disagree on the issue of estuarine habitat and the use of a salinity gradient with compliance points as the regulatory structure to protect estuarine fish species.

- Some respondents recommend protecting wetlands by focusing regulatory action on restoring ecological wetland functions.

GENERAL COMMENTS

Thirty of the 55 respondents answered the specific questions asked in the ANPR. While several respondents answered all questions, others chose to selectively answer one or several questions. In addition, 50 of 55 respondents provided general comments that did not address specific questions in the ANPR.

Commenters broadly support a more effective use of existing regulatory authority and a stronger role for EPA in providing technical, scientific, and management guidance. A representative statement, regarding EPA's options for ensuring water quality protection, is: "Rather than undertaking new regulatory initiatives aimed at water quality criteria for specific contaminants, we encourage EPA to assist the State and local agencies to address emerging issues through improved science, public awareness, and cooperative problem solving."[2] Another respondent, in a representative statement, "…looks to EPA as a leader by taking an independent look at the panoply of issues impacting the Bay-Delta today and providing its scientific expertise as a necessary component of comprehensive solution to these problems."[3] Various individuals and groups call on EPA to more rigorously enforce statutory and regulatory authorities, for example, one group concludes "… with a strong recommendation that EPA use its regulatory authority to ensure that regulations affecting water quality in the Delta are enforced at every level."[4]

A number of respondents are wary about possible new regulations. A local government representative captured this sentiment when stating that, "We believe the existing regulatory framework, led by the Water Boards, is well suited and has been effective to date in addressing water quality concerns."[5] Another respondent made a related point:

> Any change in EPA activities must be dependent on existing authority and the availability of existing or new resources.[6]

A number of commenters cited the development of a comprehensive regional monitoring program for the Delta as a priority, usually with an expectation for EPA to fund it. The following two comments express a common refrain:

> It is also true that "i[t] is difficult to evaluate and address contaminants in the Bay Delta Estuary in the absences of a comprehensive monitoring program" (p. 21). For this reason, the US EPA should promote efforts to

[2] CASA, BACWA, CVCWA, Tri-TAC, SCAP (EPA-R09-OW-2010-0034.1)

[3] Contra Costa County Department of Conservation and Development (EPA-R09-OW-2010-0049)

[4] Coalition for a Sustainable Delta (EPA-R09-OW-2010-0043.1)

[5] Sacramento Regional County Sanitation District (EPA-R09-OW-2010-0022.1)

[6] County of Sacramento (EPA-R09-OW-2010-0020.1)

> improve contaminant monitoring, assessment, and reporting within the estuary.[7]
>
> We cannot stress enough the importance of EPA's continued support, including funding, for our Regional Monitoring Program (RMP), for the newer Delta RMP, and for continued efforts to integrate all monitoring activities across the San Francisco Bay Estuary.[8]

A water district representative stated another widely supported view: "Multiple stressors are at work, and it is this broader set of causes that an effective regulatory response must address."[9] That said, even though comments arrive at this conclusion from different perspectives, the arguments underpinning it differ widely, especially with respect to regulating flow. One view is: "Solving the issues presented by this complex estuary therefore requires a holistic, multi-faceted solution. At the same time, solutions for the Bay Delta must be based on sound scientific analysis that look[s] beyond the tired approaches that have focused exclusively on water exports and flow."[10]

Other comments contest this view, saying that flows need to become a more explicit part of water quality regulation. An environmental organization urges EPA to "mandate that states list waterways impaired by altered flows, and ensure that states take appropriate action to address the impacts to beneficial uses associated with those altered flows."[11]

Several respondents voiced concerns over proposed actions that would focus primarily on contaminants and call for a more holistic approach:

> Considering the variety of potential stressors in the Delta, and the amount of research that has already occurred, it is unlikely that one or two contaminants are responsible for the observed decline in some pelagic species. A weight of evidence approach that considers all stressors, not just contaminants, but also flow, habitat, nutrient status and biological stressors (e.g., introduced species or pathogens) is necessary to find a solution.[12]

Local residents and commenters from local organizations uniformly share concerns over the extent of water exports and its impacts on the Delta:

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[7] San Luis Delta & Mendota Water Authority, State Water Contractors (EPA-R09-OW-2010-00 38.1)

[8] San Francisco Bay Regional Water Quality Control Board (EPA-R09-OW-2010-00 42.1)

[9] Westlands Water District (EPA-R09-OW-2010-00 37.1)

[10] Westlands Water District (EPA-R09-OW-2010-0037.1)

[11] California Coastkeeper Alliance (EPA-R09-OW-2010-0025.1)

[12] Western Plant Health Association (EPA-R09-OW-2010-0036.1)

> It is essential that the Delta continue to receive fresh waters and that they not be diverted or drained. The Delta is made up of a delicate eco-system that is grossly taxed by freshwater diversion and sales of water to other consumers.[13]

For these and other reasons, many respondents urge that EPA remain actively involved in the Bay Delta Conservation Plan (BDCP) process:

> EPA's environmental review of BDCP should ensure that the BDCP process and associated analyses adequately address water quality concerns. While EPA's involvement in BDCP may be limited in light of resource constraints, EPA's participation will ensure a more effective and efficient BDCP review process and ultimately lead to a better outcome consistent with California's co-equal goals for the Bay-Delta.[14]

CONTAMINANTS

Eight respondents answered questions on general contaminant issues, including regulated dischargers (3), environmental organizations (2), resource agencies (2), and a local business (1).

Key Points

- ⇨ Mercury emerges as an additional priority issue for continued, focused review.
- ⇨ Respondents are skeptical about the usefulness of pollutant-specific water quality criteria in addressing interactive effects between multiple contaminants and other physical, chemical, and biological stressors.
- ⇨ Respondents want EPA's follow up actions to focus on source control rather than the point of discharge.
- ⇨ One of the few suggested information sources on the possible impacts of climate change on pollution is the *2009 California Climate Change Adaptation Strategy*.

[13] Crisi Matthews Real Estate (EPA-R09-OW-2010-0003)

[14] Natural Resources Defense Council (EPA-R09-OW-2010-0027.1)

1. **Are there contaminants, other than those named above, causing adverse impacts to aquatic resource designated uses in the Bay Delta Estuary and that should receive more focused review?** (5 answers)

All five answers to the first question identify mercury as a priority issue. "Mercury is a key concern in the Bay Delta Estuary, primarily due to levels of mercury in fish tissue that can impact both human health and wildlife," comments a local government representative. "As management decisions are made, and projects implemented, that affect the estuary, EPA and other regulators should consider the potential effects of these decisions and projects on mercury entering the food chain."[15]

A federal agency representative made the following related point:

> EPA should consider mercury in its reviews. Through the TMDL process, the State of California has begun a five-year process focused on developing BMPs to control or reduce methylmercury production. We are hopeful this effort will provide tools to address methylmercury concerns and recommend EPA consider results of this process as well. We believe it would be a significant achievement to reduce methylmercury production to levels recommended in the Delta TMDL, while simultaneously implementing wetland creation and restoration recommended by the Central Valley Project Improvement Act (CVPIA), CALFED Bay-Delta Program (CALFED), Bay-Delta Conservation Plan (BDCP), and Delta Vision.[16]

Addressing the methylization of mercury in wetlands is seen as critical, as well as mercury loads emanating from upstream mines, and human exposure risks based on fish consumption. In different versions, the following remark represents a common thread through public comments: "While not directly associated with the plummeting fish populations in the region, mercury levels in the Delta, its tributaries, and San Francisco Bay have lead to numerous listings on the 303(d) list due to bioaccumulation in fish tissue. Consequently, mercury loads pose a significant health risk to both wildlife and human fishing populations."[17]

2. **How can pollutant-specific water quality criteria effectively address or incorporate interactive effects between multiple contaminants and other physical, chemical, and biological stressors?** (4 answers)

All four answers to the question are skeptical about the usefulness of pollutant-specific water quality criteria in addressing interactive effects between multiple contaminants

[15] County of Sacramento (EPA-R09-OW-2010-0020.1)

[16] US Fish and Wildlife Service (EPA-R09-OW-2010-0052.1)

[17] Clean Water Action (EPA-R09-OW-2010-0044.1)

and other physical, chemical, and biological stressors: "The potential combinations of registered pesticides and chemicals, the exposure potential and ultimate toxicities are clearly too large to effectively address"[18] states one of the respondents in a version of what is a common notion in the answers.

Respondents made the following key statements:

> Water quality criteria cannot be used effectively to address interactive effects until a robust scientific understanding of multiple stressor effects in the estuary is developed.[19]
>
> Contaminant threshold levels below the lethal level (LC50s) should be considered (e.g. EC50s, or EC25s). Studies that document synergistic effects for two compounds found in the Bay-Delta system should be used to set contaminant thresholds. … Also, adequate freshwater flows will tend to reduce concentrations of all interacting contaminant compounds and thereby reduce their individual and synergistic effects.[20]
>
> The California Office of Environmental Health and Hazard Assessment recently issued a report titled "Cumulative Impacts: Building a Scientific Foundation" that provided a road map for identifying cumulative impacts across several exposure media. In addition, EPA itself is revising its process for regulating drinking water contaminants by developing regulations based on "families" of contaminants.[21]
>
> One of the objectives of FIFRA is to ensure pesticides "will not cause unreasonable harm to the environment", thus allowing some harm to occur. During registration, the EPA evaluates each pesticide individually. While a single pesticide may not cause unreasonable harm, mixtures of multiple pesticides, on purpose or in the environment after use, can cause unreasonable harm…We believe the best way to resolve this concern is through efforts to keep pollutants from entering sensitive environments entirely. We recommend EPA evaluate its registration process, education efforts, regulatory avenues and best management practices to determine which would effectively reduce or eliminate non-target pesticide toxicity.[22]

3. What methods can be used in developing and implementing TMDLs to effectively address or incorporate interactive effects between multiple

[18] US Fish and Wildlife Service (EPA-R09-OW-2010-0052.1)

[19] County of Sacramento (EPA-R09-OW-2010-0020.1)

[20] The Bay Institute (EPA-R09-OW-2010-0040.4)

[21] Clean Water Action (EPA-R09-OW-2010-0044.1)

[22] US Fish and Wildlife Service (EPA-R09-OW-2010-0052.1)

contaminants and other physical, chemical, and biological stressors on individual water bodies or for water bodies within a watershed? (6 answers)

The answers to question 3 want the focus to be more on source control rather than the point of discharge. An environmental justice organization "recommends that source control, not just by stopping the flow of contaminants into our waters, but by stopping their use so that they have no way to enter the environment, become a stronger priority in addressing water quality."[23] Or a federal agency representative, relating concerns over the health of fish and wildlife resources: "The most effective way to reduce the effects of multiple contaminants is to minimize the overall levels of pollutants that enter the environment/ water in the first place."[24]

The pollutant-by-pollutant approach of Total Maximum Daily Loads (TMDLs) is another key concern across the answers:

> While TMDLs have the potential to drive many water quality improvements, they are limited by their focus on individual contaminants and geographical sections…Measures to address interactive effects between multiple contaminants and stressors in individual as well as multiple water bodies will require EPA and the State to employ a broader systemic approach to address water quality impairments and violations, of which TMDLs are only a part.[25]

> Using ambient water for testing is one way to address interactive effects in a TMDL. Grouping of pollutants under one TMDL based on physical/ chemical properties of the constituents is another possible way to incorporate interactive effects.[26]

4. **What information exists about how climate change impacts will effect contaminant pollution (generally or for individual contaminants)?** (3 answers)

Three respondents provide references that address implications of climate change on contaminant issues facing the Delta. A state agency representative cited the 2009 *California Climate Change Adaptation Strategy*, which "discusses cross-sector impacts, such as mosquito abatement for public health and the biological [e]ffects to fish, migratory birds, and food chain, as well as threats from contamination/ pollution expected from flooding of farms and infrastructure." The answer continues, "it is thought that higher temperatures together with flooding will likely increase algae blooms, which can lead to more wildlife diseases (e.g., avian botulism) and affect

[23] Clean Water Action (EPA-R09-OW-2010-0044.1)

[24] US Fish and Wildlife Service (EPA-R09-OW-2010-0052.1)

[25] Clean Water Action (EPA-R09-OW-2010-0044.1)

[26] Sacramento Regional County Sanitation District (EPA-R09-OW-2010-0022.1)

dissolved oxygen and fish survival."[27] The answer also suggests a greater prevalence of diseases such as West-Nile virus and avian influenza and a subsequent increase in the application of insecticides and other chemicals that could then affect fish and wildlife.

AMMONIA: TOXIC AND NUTRIENT EFFECTS

Eight respondents answered questions on ammonia, including regulated dischargers (3), resource agencies (2), water agencies (2), and an environmental organization (1).

Key Points

- ⇨ The ANPR provides a thorough and up-to-date summary of the existing information on ammonia in the Bay Delta.
- ⇨ Respondents cite three types of information in support of Delta specific ammonia standards: 1) ammonia toxicity to Delta copepods, 2) ammonia inhibition of diatoms, and 3) studies worldwide that describe the effects of changing nutrient dynamics on aquatic ecosystems.
- ⇨ The answers support the development of Numeric Nutrient Endpoints (NNE) for the Delta.
- ⇨ Runoff from irrigated agricultural lands and confined animal feeding operations are potential sources of ammonia nitrogen that have not been sufficiently assessed.

1. **What, if any, information is available on the sources or impacts of total ammonia nitrogen in the Bay Delta Estuary that is not reflected or cited above?** (5 answers)

For the most part, the respondents cite information sources that had previously been available, presented, and reviewed to evaluate the ammonia issue. Some respondents cite information that challenges existing hypotheses on the potential impacts of ammonia:

> No independent reviews of the potential impact of ammonia on the Delta have led to a consensus that ammonia, or other nutrients, are a key driver of ecological problems in the Delta, including the pelagic organism decline.[28]

[27] California Natural Resources Agency (EPA-R09-OW-2010-0054.1)

[28] Sacramento Regional County Sanitation District (EPA-R09-OW-2010-0022.1)

Other commenters cite information that supports the development of Delta specific criteria for ammonia, as discussed below (Ammonia Questions 2 and 3).

2. **Is there any information available that suggests site-specific water quality standards for total ammonia nitrogen in the Bay Delta Estuary may be more effective than current standards due to unique hydrological, chemical, biological, or physical conditions?** (2 answers)

Respondents cite local studies reporting ammonia toxicity to Delta copepods and ammonia inhibition of diatoms, and the global literature base documenting the adverse impacts of changing nutrient regimes to aquatic ecosystems, in support of site-specific ammonia standards:

> As the Bay-Delta ANPR correctly notes on page 26: "[r]ecent independent investigations in the Bay Delta Estuary raise the possibility that the 1999 EPA ammonia criteria may not be protective of pelagic species in the Bay-Delta Estuary." The recent life-cycle tests by Teh et al. (2011) with *Pseudodiaptomus forbesi* provide additional support for this conclusion.[29]
>
> There are no current standards that protect the Bay-Delta Estuary from the inhibitory effects of ammonium observed by Wilkerson *et al.* (2006) and Dugdale *et al.* (2007). EPA should develop or participate in the development of nutrient standards to protect the Bay-Delta Estuary from the inhibitory effects of ammonium.[30]
>
> There are no current standards that protect the Bay-Delta Estuary from detrimental shifts in aquatic community composition precipitated by changing nutrient forms and ratios from anthropogenic loadings of nutrients. US EPA should participate in the development of nutrient standards for the Bay-Delta Estuary that restore nutrient forms and ratios to levels that were observed prior to the changes in the community composition observed in the Bay-Delta Estuary over the last few decades.[31]

3. **What information is needed to determine effective site-specific water quality standards for total ammonia nitrogen, including narrative or numeric criteria?** (2 answers)

The two answers focus on the inhibitory effects of ammonia on phytoplankton production:

[29] San Luis Delta & Mendota Water Authority, State Water Contractors (EPA-R09-OW-2010-00 38.1)

[30] San Luis Delta & Mendota Water Authority, State Water Contractors (EPA-R09-OW-2010-00 38.1)

[31] San Luis Delta & Mendota Water Authority, State Water Contractors (EPA-R09-OW-2010-00 38.1)

> Dugdale and Marchi (2010) developed a model that can be used to calculate numeric criteria for total ammonia nitrogen to protect against the inhibitory effects of ammonium.[32]
>
> Dr. Dugdale's work (identified in response to question 1) suggests spring phytoplankton blooms are prevented at [concentrations at or below] 4 μM/ L and inhibition may begin [at concentrations] as [low] as 1 μM/ L. Laboratory and in situ experiments are needed to evaluate and establish necessary protective numeric criteria.[33]

Both answers suggest evaluating numeric nutrient criteria for the Delta[34], using EPA's *Technical Approach To Develop Nutrient Numeric Endpoints for California Estuaries* as guidance. One of the respondents suggests to use "nitrogen and phosphorus levels from times and places when or where the Delta Estuary aquatic community resembled more desirable conditions (e.g. a diatom-calanoid copepod-pelagic fish food web) … to determine numeric criteria for N:P and NO_3:NH_4. …Alternatively, N:P conditions upstream of major anthropogenic inputs of nutrients into the system could be used as a target. A third alternative would be to use nutrient conditions in the Liberty Island area where a desirable pelagic community exists as a target condition."[35]

4. What information is available on nonpoint sources of total ammonia nitrogen and how they may most effectively and efficiently be controlled? (3 answers)

Two of three answers directly address the question and both identify runoff from agricultural fertilizer application and animal waste as potential sources of ammonia to the Bay Delta. Respondents identify lack of information and regulatory gaps as constraints. One respondent, representing a federal resource agency, states that the agency is "not aware of any efforts to quantify these sources or identify ways to reduce their presence in runoff in the Central Valley."[36] According to a second answer, "ammonia nitrogen in the Delta cannot be effectively controlled until agricultural sources – both irrigated agriculture and confined animal feeding operations - are identified and monitored. Unfortunately, while the Central Valley Regional Water Quality Control Board is in its third year of regulating nonpoint source discharges from the 1500 dairies in its purview, and is developing a similar program for seven million acres of irrigated agriculture in the Delta watershed, there is still limited available data to indicate where nitrogen runoff is occurring and how its impacts can be controlled."[37]

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[32] San Luis Delta & Mendota Water Authority, State Water Contractors (EPA-R09-OW-2010-00 38.1)

[33] US Fish and Wildlife Service (EPA-R09-OW-2010-0052.1)

[34] NNEs are currently being developed for San Francisco Bay (McKee et al. 2011).

[35] San Luis Delta & Mendota Water Authority, State Water Contractors (EPA-R09-OW-2010-00 38.1)

[36] US Fish and Wildlife Service (EPA-R09-OW-2010-0052.1)

[37] Clean Water Action (EPA-R09-OW-2010-0044.1)

This respondent further suggests:

> The California Department of Food and Agriculture maintains data on fertilizer sales by county, which can be used to provide an idea of the relative quantities of fertilizer compared with nonpoint source discharges by wastewater treatment plants…While EPA has no ability to regulate discharges from agriculture, improved reporting and monitoring can help pinpoint specific problem areas.[38]

SELENIUM

Twelve respondents answered questions on selenium, including environmental organizations (4), regulated dischargers (2), resource agencies (2), water agencies (2), a regulatory agency (1), and a local resident (1).

Key Points

- ⇨ Various interest groups see the development of wildlife and aquatic life criteria for selenium as an opportunity for addressing science and regulatory gaps, if based on new information on environmental processes in the estuary.
- ⇨ The ECoS3 estuary model and the Presser-Luoma biodynamic model are new tools for better understanding the fate, transport, and biotic uptake of selenium in the estuary.
- ⇨ Additional data may help to improve the modeling framework, develop selenium criteria, and better characterize existing and future risks to fish and wildlife.
- ⇨ Retiring drainage problem lands in the Western San Joaquin Valley is a widely supported key strategy to eliminate problems caused by selenium-laden drainage water.

1. **What, if any, additional information is available to better characterize selenium sources, loadings and impacts within the watershed of the Bay Delta Estuary?** (9 answers)

Several respondents address dietary exposure and toxicity in different species in various environments. They discuss these issues in connection with EPA's development of wildlife and aquatic life guidance criteria. One respondent, referring to remaining

[38] Clean Water Action (EPA-R09-OW-2010-0044.1)

uncertainties in modeling and evaluating biotic uptake, comments: "there are still gaps in our knowledge of the key factors that affect the transfer and potential toxicity of selenium through food webs."[39] Several commenters cite the ongoing North San Francisco Bay Selenium Characterization Study as a source of new information that may help address some of these remaining uncertainties:

> Additional data are now being collected to provide better characterization of the relationship between riverine inputs of selenium and the processes in the North Bay that affect biotic uptake. This new information will be also used to fine-tune the model's calibration, which, in turn, will enhance the accuracy of the model's future predictions.[40]

> The new data collected in the Selenium Characterization Study provide the basis for a major reevaluation of selenium speciation in the bay after a gap of 10 years.[41]

Various interest groups view the development of new criteria as an opportunity to address scientific and regulatory limitations of the current water quality standards. Some consider the current standards as not sufficiently protective: "Nevertheless, a sizeable body of knowledge has been assembled in the past thirty years indicating that the current standard is insufficiently protective, but also demonstrating a way forward through the use of ecosystem scale models that link trophic levels and selenium biodynamics."[42] Others argue that the current standards overestimate the potential for adverse ecological effects. They expect this issue to be addressed by considering the new information on selenium speciation: "Selenium speciation is critical to the understanding of ecosystem impacts."[43]

Commenters also point to potential improvements to the estuary's selenium mass balance: "The Bay Delta ANPR relies on a study that drastically overstates the quantity of selenium likely to be transported into the Delta from agricultural drainage sources in the San Joaquin Basin and that also contains statements that characterize the likelihood of transport of selenium from that Basin as posing a major threat of increasing selenium contamination that would require additional intervention by US EPA. Such reliance and statements are not supported. There is an approved TMDL for selenium in the San Joaquin River and that along with current data should be used when estimating agricultural impacts from the San Joaquin River to the Delta."[44] Along the same lines, a

[39] San Francisco Bay Regional Water Quality Control Board (EPA-R09-OW-2010-00 42.1)

[40] San Francisco Bay Regional Water Quality Control Board (EPA-R09-OW-2010-00 42.1)

[41] Western States Petroleum Association (EPA-R09-OW-2010-00 23.5)

[42] The Bay Institute (EPA-R09-OW-2010-0040.4)

[43] San Luis Delta & Mendota Water Authority, State Water Contractors (EPA-R09-OW-2010-00 38.1)

[44] San Luis Delta & Mendota Water Authority, State Water Contractors (EPA-R09-OW-2010-00 38.1)

respondent suggests to undertake efforts to improve the selenium mass balance for the Sacramento/ San Joaquin Rivers to improve model inputs and assessments.

A representative of municipal dischargers suggests that based on recent data, the actual loading from Publicly Owned Treatment Works (POTWs) is likely half of that estimated in the *Preliminary Project Report* for a TMDL for San Francisco Bay:

> This report relies on effluent data from 1998 through 2007 to estimate loading from publicly owned treatment works (POTWs) at approximately 226 kilograms (kg) per year…A comparison of the calculations for most of the dischargers listed in Table 11 of the TMDL Report to those using the more recent data set is attached and shows that actual loading is likely half of that estimated.[45]

2. What data, studies, and analytical techniques (for example, models) could be used to improve our understanding of the physical processes, including surface-groundwater interactions, controlling selenium mobilization and transport to and within the Bay Delta Estuary? (3 answers)

Two respondents discuss the ECoS3 estuary model as a new tool for better understanding the fate, transport, and biotic uptake of selenium in the estuary. A regulatory agency representative describes the issue this way:

> As the ANPR notes, the Water Board has begun work on a TMDL project to address the selenium impairment listings of the northern segments of San Francisco Bay. The most current scientific evidence was used to develop the ECoS3 estuary model, which can successfully simulate selenium concentrations in the water column and sediments and track mobilization and transport of selenium through the North Bay. … Additional data are now being collected to provide better characterization of the relationship between riverine inputs of selenium and the processes in the North Bay that affect biotic uptake. This new information will be also used to fine-tune the model's calibration, which, in turn, will enhance the accuracy of the model's future predictions.[46]

The second commenter provides new ECoS3 simulation results that accurately simulate the long-term record of selenium in the clam *Corbula amurensis*: "Simple representations have been proposed for biological uptake, principally by assuming that particulate selenium is a ratio of the dissolved selenium (represented as a value of K_d…)," [47] remarks the respondent about shortcomings of previous analyses. "However, this approach does

[45] CASA, BACWA, CVCWA, Tri-TAC, SCAP (EPA-R09-OW-2010-0034.1)

[46] San Francisco Bay Regional Water Quality Control Board (EPA-R09-OW-2010-00 42.1)

[47] Western States Petroleum Association (EPA-R09-OW-2010-00 23.5)

not capture the changing selenium speciation in the Bay and does not explain the variations in clam concentrations that have been observed over the last 15 years. Given this limitation, the simple K_d-based approach may not be able to project future clam concentrations, especially when there are changes in the hydrologic drivers, such as modifications in the flows through the Delta, or changes in the mix of Sacramento and San Joaquin River inflows."[48]

The commenter suggests that ECoS3 accounts for the various transformations and uptake processes applying to the multiple dissolved and particulate species of selenium. "The goal of this effort was to develop a linkage between sources, water column concentrations, and biota concentrations that represents the best current understanding of underlying processes."[49]

As a first step, various existing data sources were used to characterize loads from all known point and non-point sources. Load estimates from the study are as follows: "Annual loadings from the Central Valley through the Delta are the largest source of selenium with high variability depending on total flow through the Delta. Loads in high flow years are estimated to be more than ten times higher than in low flow years. The average Delta load is estimated to be 3,962 kg/ yr. Local tributaries draining both urban and non- urban areas, although contributing lower flows than the Sacramento and San Joaquin Rivers, have high selenium concentrations, and are also a large source of selenium during the wet months (estimated average load of 354-834 kg/ yr). Refineries are estimated to contribute ~550 kg/ yr to North San Francisco Bay."[50]

The consistency of simulated selenium concentrations in *C. amurensis* with long-term monitoring data collected by the U.S. Geological Survey (USGS) at the Carquinez Strait for the period of 1994-2010 was presented as the most compelling evidence that ECoS3 addresses the need to better explain selenium processes controlling selenium mobilization and transport to and within the Bay-Delta Estuary:

> Overall, the model is able to describe key features in the clam concentration behavior accurately. Changes from the dry season (high concentrations) to the wet season (low concentrations) in each annual cycle are explained by the riverine input of mineral-Se with lower concentrations and lower assimilation efficiency. Changes in clam selenium concentrations from one year to the next are influenced significantly by hydrology, with wet years (such as 2005 and 2006) resulting in lower clam concentrations. The ability to explain this temporal clam behavior also provides insight into future changes in the Bay, where flow modifications in the San Joaquin River or the Delta may result in

[48] Western States Petroleum Association (EPA-R09-OW-2010-00 23.5)

[49] Western States Petroleum Association (EPA-R09-OW-2010-00 23.5)

[50] Western States Petroleum Association (EPA-R09-OW-2010-00 23.5)

> riverine inputs that differ from historical, both in volume and in the amount of particulate selenium represented by the relative proportion of Sacramento and San Joaquin River flows.[51]
>
> Although more complex than a ratio-based approach, the added benefit of explaining mechanistically an important process of selenium uptake in the system, makes this an important tool in assessing future changes over the long term.[52]

A third respondent cites the Luoma-Presser model, a biodynamic model that integrates the chemical and the physiological factors that control how various animals from different parts of the foodweb bioaccumulate selenium:

> The Luoma and Presser selenium model being used by the EPA for developing site-specific criteria for the Estuary is of high quality and is flexible enough to be used in freshwater systems inland.[53]

3. **What data are needed to track selenium impacts in the Bay Delta ecosystem as currently configured, and to evaluate potential impacts of selenium under changed flow and transport conditions into and within the Delta?** (6 answers)

Respondents identify data needs for the modeling framework, the development of selenium criteria, and better characterization of existing and future risks to fish and wildlife. A representative of a regulated discharger association comments: "There is a critical need to develop a focused data collection effort to develop information: 1) to establish existing conditions in the Bay Delta with respect to the effects of selenium, 2) to serve as a basis for measuring change to the system, and 3) to gauge the effects of ecological forcing factors such as changes in food-web structure, flow conditions, and different sources and forms of selenium to the system."[54]

Several respondents identify specific data needs for the San Joaquin River system. One strongly urges "the development of a comprehensive monitoring program in the San Joaquin River, focusing on the reach between Mud Slough (GBP[55] discharge) and the confluence with the Merced River (which dilutes the GBP-discharged selenium)," for the reason that, "special focus is needed to monitor and address potential impacts on salmonids migrating through the San Joaquin River upstream of the Merced River confluence."[56]

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[51] Western States Petroleum Association (EPA-R09-OW-2010-00 23.5)

[52] Western States Petroleum Association (EPA-R09-OW-2010-00 23.5)

[53] US Fish and Wildlife Service (EPA-R09-OW-2010-0052.1)

[54] Western States Petroleum Association (EPA-R09-OW-2010-00 23.5)

[55] GBP = Grassland Bypass Project

[56] The Bay Institute (EPA-R09-OW-2010-0040.4)

This view is echoed by another commenter, who recommends, "juvenile salmonids be sampled in areas of the San Joaquin River at greatest risk to selenium exposure to assess the level of risk posed by selenium to salmonid species. Habitat use by juvenile salmonids in the San Joaquin River should also be monitored where risks are the greatest for selenium exposure to assess the level of risk posed by selenium to salmonid species."[57]

Along these lines, a respondent identifies a broader need for more systematic monitoring of biological indicators. "Biological indicators of selenium contamination are much better than weekly or monthly water samples that can mask short-term spikes and variations in selenium loads. In the words of the U.S. Fish and Wildlife Service, "Avian and Fish Production are two of the most sensitive endpoints for selenium."[58] The respondent also makes the following recommendation:

> USEPA should develop, propose, and implement avian and fish egg selenium criteria for the Bay-Delta ecosystem… USEPA should implement biological selenium monitoring programs for avian and fish eggs, as well as other species.[59]

According to the answers, additional data could also help improve understanding of processes and mass balance calculations and result in improved modeling capabilities. The representative of a federal resource agency recommends, "the collection of particulate selenium concentrations and other data to improve mass balance calculations that will be useful for the Luoma and Presser selenium model."[60] The respondent of a trade association representing regulated dischargers suggested, "support of a modeling framework that ties together these elements and can be tested against the data should be an important component of the overall monitoring strategy for the Bay."[61] And, with regards to specific data needs:

> These data needs include 1) Delta selenium concentrations, 2) *C. amurensis* selenium concentrations and abundance, 3) particulate selenium concentrations at the ocean boundary, 4) selenium concentrations in higher trophic levels, and 5) a sustained selenium modeling framework.[62]

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[57] US Fish and Wildlife Service (EPA-R09-OW-2010-0052.1)

[58] California Water Impact Network, California Sportfishing Protection Alliance, and AquAlliance (EPA-R09-OW-2010-0024.1)

[59] California Water Impact Network, California Sportfishing Protection Alliance, and AquAlliance (EPA-R09-OW-2010-0024.1)

[60] US Fish and Wildlife Service (EPA-R09-OW-2010-0052.1)

[61] Western States Petroleum Association (EPA-R09-OW-2010-00 23.5)

[62] Western States Petroleum Association (EPA-R09-OW-2010-00 23.5)

4. **Are there additional selenium control methods or programs that should be considered for reducing selenium inputs and impacts?** (7 responses)

Based on the answers, retirement of drainage problem lands in the Western San Joaquin valley is a widely supported key strategy to eliminate problems caused by selenium-laden drainage water. One respondent advocates for the approach as follows:

> The Bureau of Reclamation, in its San Luis Feature Re-evaluation EIS[63] economic analysis concluded that retirement of drainage problem lands in the San Luis Unit is the most cost effective solution. The Environmental Working Group has identified an additional $10 million/ year in crop subsidies to those drainage problem lands in Westlands. USEPA should encourage retirement of drainage problem lands in the Western San Joaquin Valley as a means of reducing pollution, saving taxpayer funds and reducing water demand from the Delta.[64]

PESTICIDES

Eighteen respondents answered questions on pesticides, including regulated dischargers (5), resource and planning agencies (5), environmental organizations (2), regulatory agencies (2), water agencies (2), a commodity group (1), and a water user group (1).

Key Points

- ⇨ Of all pesticides, respondents consider pyrethroids the single-largest water quality concern.
- ⇨ Respondents want EPA to focus on efforts to keep pesticides from entering sensitive environments entirely rather than focusing on water quality criteria.
- ⇨ Effective solutions need to focus on the elimination of the pesticide uses and products that are likely to cause water quality problems.
- ⇨ Broad consensus exists that the most effective actions for EPA to address pesticide contamination would be a) continue to improve water quality protection through regulatory authority that exists in FIFRA, and b) implement and provide incentives for reducing pesticide use, runoff, and drift.

[63] Environmental Impact Statement

[64] California Water Impact Network, California Sportfishing Protection Alliance, and AquAlliance (EPA-R09-OW-2010-0024.1)

- ⇨ EPA's Common Effects Characterization Methodology initiative is considered the kingpin in EPA's efforts to regulate pesticide contamination in the estuary.
- ⇨ Several respondents doubt the utility of fish tissue concentrations in assessing exposure and effects of current use pesticides.

1. **What, if any, additional scientific information is available on (a) the effects of pesticides in stormwater discharges, or (b) the potential interactive effects of combinations of pesticides on aquatic resources in the Bay Delta Estuary?** (8 answers)

Pyrethroid pesticides are a main topic in the answers, whereas most if not all of the cited information had already been considered in the preparation of the ANPR. "Urban stormwater discharges and wastewater treatment plants (WWTPs) are significant sources of pyrethroid pesticides to the Bay Delta Estuary"[65], answers a commenter in response to question (a). "A recent study by Weston and Lydy[66] demonstrates this point."[67]

Some respondents cite specific monitoring results for consideration. One regulated discharger group comments on toxicity caused by organophosphate pesticides: "SRWP[68] also found there were no substantial differences in the frequency of toxicity observed in the different types of waterbodies monitored in 2006 and 2007 (mainstem river, major tributaries, agricultural drainages, and urban creeks)."[69] The results are from toxicity test with *Ceriodaphnia dubia*, a species susceptible to organophosphate pesticides, but not as susceptible to pyrethroids. That said, several other respondents cite information that supports using *Hyalella azteca* in toxicity monitoring, a resident species that is more susceptible to pyrethroids, instead of or in addition to *Ceriodaphnia dubia*.

Several respondents cite recent information to highlight what they perceive as shortcomings in the ANPR's discussion of pesticide effects. As a water user group points out, in the context of toxicity testing: "These data do not take into account an even lower threshold of toxicity to protect against sublethal effects (e.g., lower than acute toxicity values by a factor of 10) and, for pyrethroids, higher toxicity at lower temperatures (an additional factor of 3), such as those found in the Delta and its

[65] Westlands Water District (EPA-R09-OW-2010-0037.1)
[66] See ANPR note 205.
[67] Westlands Water District (EPA-R09-OW-2010-0037.1)
[68] Sacramento River Watershed Program.
[69] Sacramento Valley Water Quality Coalition (EPA-R09-OW-2010-0032.1)

tributaries during the winter storm season when pesticide runoff is greatest and sensitive life stages are most vulnerable to contaminant exposure."[70]

Finally, others cite recent studies by the National Marine Fisheries Service that should be consulted to evaluate possible impacts on salmonids. A federal resource manager puts it this way: "The recent biological opinions from NMFS on pesticides provide the most detailed, high quality, and to-date assessment of pesticide risks to salmonids."[71]

2. **What, if any, actions should EPA take under its authority to improve the effectiveness of regulating pesticide contamination of the Bay Delta Estuary watershed?** (15 answers)

There is widespread support for EPA's Common Effects Characterization Methodology initiative, which is viewed as the most important action in EPA's efforts to regulate pesticide contamination in the estuary. Says a regional resource management and planning coordinator: "The UP3 Project[72] finds that the root of pesticide-related surface water toxicity issues, and the problem that most needs a solution, is a regulatory gap: pesticides may be registered through USEPA's Office of Pesticide Programs (OPP) under the Federal Fungicide, Insecticide, and Rodenticide Act (FIFRA) that will cause water quality impairment and exceedances enforceable by USEPA's Office of Water (OW) under the Clean Water Act (CWA)."[73]

Most of the other respondents agree with this assessment, as the following comments illustrate:

> Require internal coordination efforts between FIFRA and Office of Water.[74]
>
> Regardless of any other action EPA takes to improve the water quality for aquatic species in the Estuary, long-term reduction in pesticide-related impairment cannot be achieved without improving EPA's pesticide approval process. In November 2008, EPA's Office of Pesticide Programs (OPP) and Office of Water (OW) introduced a joint project to integrate EPA's aquatic effects characterization methods and provide a common basis to achieve the water quality protection goals of the Clean Water Act (CWA) and the Federal Insecticide Fungicide and Rodenticide Act (FIFRA). This is a most welcome and important endeavor, because pesticides currently being used in accordance with approved label instructions are causing and/ or contributing to toxicity in waters of the

[70] Coalition for a Sustainable Delta (EPA-R09-OW-2010-0043.1)

[71] US Fish and Wildlife Service (EPA-R09-OW-2010-0052.1)

[72] Urban Pesticide Pollution Prevention (UP3) Project

[73] San Francisco Estuary Partnership/ Association of Bay Area Governments (EPA-R09-OW-2010-0041.1)

[74] Sacramento Regional County Sanitation District (EPA-R09-OW-2010-0022.1)

> U.S. and State…. Recent updates on the EPA OW/ OPP project have indicated that the common methodology being drafted by the two offices is likely to result in a pesticide registration process that more effectively considers aquatic impacts. We strongly encourage regional EPA staff to participate in and support this project, because we view it as the kingpin in EPA's efforts to regulate pesticide contamination of the Bay Delta Estuary.[75]

> Despite the water quality problems…that exist due to pesticide uses registered under FIFRA programs, staff believe that pesticide use regulation under FIFRA is improving its protection of water quality, and should be a key piece of the solution to the pesticide problems in the Bay-Delta. Achieving this solution will require coordination between Clean Water Act programs and FIFRA pesticide use regulatory programs.[76]

> Coordination between EPA's Offices of Pesticide Programs, Water, and Wastewater Management in reviewing pesticide data needs is essential to Clean Water Act implementation; it also provides an appropriate method of meeting FIFRA's goal of preventing unreasonable adverse impacts from pesticide use.[77]

Based on the OPP-OW "harmonization"[78] effort and other related initiatives, respondents hold expectations that the regulatory gap will be closed:

> In our experience, the greatest success in controlling pesticides discharges can be achieved when both pesticide use regulation (based on FIFRA and the California Food and Agriculture Code) and water quality-based regulations (based on the Clean Water Act and California's Porter-Cologne Water Quality Control Act) are implemented in tandem to protect water quality. An example of these programs working in tandem is the recently documented success in reducing diazinon runoff in the Sacramento and Feather Rivers, which involved Clean Water Act (Nonpoint Source and TMDL) programs, changes in the diazinon label requirements under FIFRA, and the California Department of Pesticide Regulation (DPR)'s establishment and implementation of dormant spray regulations…. Staff hopes there is now a fundamental consensus that attaining the water quality standards established under the Clean Water Act should be a goal of USEPA's OPP in regulation of pesticide use, and that non-attainment of water quality standards should be considered to be

[75] San Francisco Bay Regional Water Quality Control Board (EPA-R09-OW-2010-00 42.1)

[76] Central Valley Regional Water Quality Control Board (EPA-R09-OW-2010-00 21.1)

[77] CASA, BACWA, CVCWA, Tri-TAC, SCAP (EPA-R09-OW-2010-0034.1)

[78] San Francisco Estuary Partnership/ Association of Bay Area Governments (EPA-R09-OW-2010-0041.1)

> an unreasonable adverse effect under FIFRA. There are a number of ongoing efforts, which staff applauds, where pesticide use regulation under both FIFRA and the California Food and Agriculture Code are being closely coordinated with water quality regulation and Clean Water Act programs.[79]
>
> The UP3 Project has worked to communicate this gap to regulators. The UP3 Project has prepared comments for regulatory review periods for current pesticides of concern to water quality, through a resource-intensive pattern of reviewing work plans and communicating water quality concerns for each individual regulatory review. The UP3 Project has had successes in securing changes to label directions or allowed use patterns through these methods, and in general we believe that state and federal regulators are much more aware of water quality issues related to pesticide toxicity as a result of the decade of effort by the UPC.[80]

Several respondents, though, share the view that the practical and cost effective means of controlling pesticide discharge is for the federal government to use its authorities under FIFRA to regulate pesticide sales and use. A respondent representing regulated dischargers argues that, "POTWs have limited practical ability to keep residents and small businesses from discharging ordinary consumer products, like pyrethroids, to their indoor drains. For these reasons, attempts to address pesticide discharges through Clean Water Act-based regulation of POTWs effluent and biosolids will not lead to water quality improvement but will unfairly burden local wastewater agencies."[81]

Some point to the fact that EPA has existing authorities under FIFRA that, they argue, could be used more efficiently and effectively to protect water quality in the Bay Delta. A federal resource manager issues the following recommendations:

> Seek to amend the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) to require registrants to collect sufficient information to generate water quality criteria as part of the FIFRA registration or re-registration process in order to streamline establishment of numeric water quality criteria.... Require registrants to develop detection methodologies for all new and existing products at environmentally realistic concentrations before the products are registered or re-registered under FIFRA in order to improve the effectiveness of controlling pesticide contaminants and protect designated beneficial uses.... Require generation of toxicity data to

[79] Central Valley Regional Water Quality Control Board (EPA-R09-OW-2010-00 21.1)

[80] San Francisco Estuary Partnership/ Association of Bay Area Governments (EPA-R09-OW-2010-0041.1)

[81] CASA, BACWA, CVCWA, Tri-TAC, SCAP (EPA-R09-OW-2010-0034.1)

> determine if there are additive or synergistic interactions as part of the registration and re-registration processes under FIFRA. Put this on a fast track for the known pesticide contaminants in the Bay-Delta estuary through funding of independently conducted studies, if necessary. … Seek to amend FIFRA to add testing requirements to the registration and re-registration processes of FIFRA that match the longer exposure times to pesticides observed in the Bay Delta Estuary in order to produce accurate effects information.[82]

The representative of a regulated discharger association is equally forthright in asserting that pesticide regulation under FIFRA "can protect Delta water quality:"[83]

> Both DPR and U.S. EPA Office of Pesticide Programs (OPP) have convinced us that they have the regulatory authority necessary to protect surface waters from pesticides…. U.S. EPA Region 9 should support OPP's and DPR's actions to use their pesticide regulatory authorities to protect the Delta and all other surface waters. …Since the scope of pesticide-related water quality challenges in the Delta is not fully understood, U.S. EPA Region 9 can also provide information and resources to collaborate with other agencies (e.g., OPP, DPR, USGS) toward monitoring the highest priority pesticides, and toward providing the type and quality of information that pesticide regulators need for regulatory action.[84]

Another regulated discharger association makes equally specific recommendations for using existing FIFRA authorities to protect Bay Delta water quality:

> EPA should also update and revise data requirements for the registration and registration review of pesticides under FIFRA….EPA should also evaluate potential impacts from synergists and multiple active ingredient pesticide formulations during pesticide registration and registration review….When potential water quality impacts are identified during registration or registration review for a pesticide, EPA should implement adequate risk management strategies.... EPA has already taken important steps towards protecting water quality through its various registration processes; however, EPA can further integrate urban water quality protection more effectively into its pesticide review programs.[85]

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[82] National Oceanic and Atmospheric Administration (EPA-R09-OW-2010-0050.1)

[83] California Stormwater Quality Association (EPA-R09-OW-2010-0045.1)

[84] California Stormwater Quality Association (EPA-R09-OW-2010-0045.1)

[85] CASA, BACWA, CVCWA, Tri-TAC, SCAP (EPA-R09-OW-2010-0034.1)

Some others, however, would welcome further action by EPA under both CWA and FIFRA. "The ANPR asks whether EPA should take further action under the Clean Water Act to control the discharges of pesticides to the Bay Delta Estuary," commented a spokesperson for water agencies, "With respect to pyrethroids, the answer to these questions is unequivocally yes, consistent with and cognizant of the principles of federalism…. EPA should also take action under FIFRA to supplement its efforts to control stormwater contributions of pyrethroids."[86]

3. How can the process for establishing numeric water quality criteria be streamlined while maintaining technical integrity? (4 answers)

Regarding the process for establishing numeric water quality criteria, the answers circle back to points made regarding the harmonization of pesticide harmonization under FIFRA and CWA: "In addition to continuing its efforts to harmoniz[e] the scientific underpinnings of water quality protections under FIFRA and CWA, EPA Office of Pesticide Programs should develop data requirements to be imposed on pesticide registrants for pesticide registration, registration review, and related regulatory process under FIFRA that are consistent with the data requirements for development [of] WQCs.,"[87] comments a local government official. "This will not only streamline WQC development, but will provide better data for making pesticide registration decisions protect water quality to levels consistent with water quality standards."[88]

All four answers raise fundamental concerns over EPA's focus on water quality criteria. "It would be better not to focus on criteria but rather implement and provide incentives for reducing pesticide use, runoff and drift,"[89] suggests one participant. "The potential combinations of registered pesticides and chemicals, the exposure potential and ultimate toxicities are clearly too large to effectively address. We believe the best way to resolve this concern is through efforts to keep pollutants from entering sensitive environments entirely. We recommend EPA evaluate its registration process, education efforts, regulatory avenues and best management practices to determine which would effectively reduce or eliminate non-target pesticide toxicity."[90] All answers oppose changes to established procedures for developing water quality criteria and reiterate key points made in response to General Contaminants Question 2, regarding the need to shift focus from end-of-pipe regulation to source control:

> As detailed in the response to question 2 above, the water quality impacts of pesticides should be properly evaluated and mitigated during EPA's

[86] Westlands Water District (EPA-R09-OW-2010-0037.1)

[87] County of Sacramento (EPA-R09-OW-2010-0020.1)

[88] County of Sacramento (EPA-R09-OW-2010-0020.1)

[89] US Fish and Wildlife Service (EPA-R09-OW-2010-0052.1)

[90] US Fish and Wildlife Service (EPA-R09-OW-2010-0052.1)

> registration processes thus preventing water quality impacts and making mitigation under the Clean Water Act minimal or unnecessary.[91]
>
> EPA should be very cautious about streamlining how to establish numeric criteria as the streamlining itself could threaten the technical integrity of the criteria development process, especially where little data exists. Any process that relies on large safety factors to account for a paucity of supporting data should be avoided.[92]
>
> We are in favor of the continued use of EPA guidelines and methods for the development of aquatic life-based criteria. EPA has these well-established procedures in place to develop water quality criteria for aquatic life and drinking water standards. EPA should not circumvent these procedures in developing regulatory criteria for pesticides.[93]

Comments also reflect frustration over the existing regulatory gap and the resulting costs to dischargers, which are perceived to be the result of water quality protection that relies heavily on CWA regulatory tools to control discharges that could be prevented in the first place by more effectively using FIFRA regulatory tools:

> Over the years, various pesticides have been implicated and identified as the source of water quality impairments. With protective aquatic life water quality criteria established for only a few of these compounds, the majority of these pesticide impairments were identified through regulatory-mandated acute and chronic toxicity testing programs. The costs to POTWs associated with these impairments have exceeded millions of dollars.[94]

4. What are the benefits and constraints of using fish tissue in place of, or in addition to, water column concentrations when establishing water quality criteria for pesticides? (4 answers)

In similar fashion, respondents are skeptical about the use of fish tissue concentrations when establishing water quality criteria. Two respondents point to the paucity of fish tissue concentration data that would likely limit this tool:

> There is a wealth of information available describing effects to various aquatic organisms based on surface water concentrations, while only limited data are available describing effect concentrations in tissues, and

[91] CASA, BACWA, CVCWA, Tri-TAC, SCAP (EPA-R09-OW-2010-0034.1)

[92] Sacramento Regional County Sanitation District (EPA-R09-OW-2010-0022.1)

[93] CASA, BACWA, CVCWA, Tri-TAC, SCAP (EPA-R09-OW-2010-0034.1)

[94] CASA, BACWA, CVCWA, Tri-TAC, SCAP (EPA-R09-OW-2010-0034.1)

> such concentrations are organism and tissue specific. Therefore, it is most useful to have water quality (and sediment) data for assessing the potential for adverse effect to biota.[95]

Commenters also question the relevance of fish tissue concentrations in assessing exposure and effects of current use pesticides. A federal resource manager comments: "This question is less relevant for modern pesticides which do not tend to accumulate in fish tissues."[96] All commenters argue against a focus on criteria and reiterated the need to shift focus to the registration process. In the words of a wastewater source control planner, "To gain a broad picture of the effects of pesticides on ecosystem health, all pathways of exposure (water column, sediment and biota) should be assessed through the registration and registration review under FIFRA."[97]

5. Are there testing protocols that would effectively and efficiently identify synergistic toxic effects in the Bay Delta Estuary? (3 answers)

Commenters again point to the need to focus on source control and the registration process. "EPA should adopt policies and regulations to establish data requirements for pesticide regulatory activities under FIFRA that are coordinated with water quality monitoring activities,"[98] comments a local government spokesperson. "For instance, comparable methods should be developed for use in pesticide registration and registration reviews, environmental monitoring, and biomarkers."[99]

The same commenter points to shortcomings in existing testing protocols. "EPA should recognize that currently available testing protocols are likely to be inadequate for identifying synergistic effects in the estuary."[100]

And with regard to the best approach: "In coordination with the Office of Pesticide Program's 21st Century Toxicology initiative, EPA Region 9 and the Office of Water should support development of modern toxicological methods for pesticides that can be used to tease out synergistic effects."[101]

The respondent describes the expected outcome as: "Coordination of these methods, and establishment of appropriate data requirements, will help not only to identify the

[95] Sacramento Regional County Sanitation District (EPA-R09-OW-2010-0022.1)

[96] US Fish and Wildlife Service (EPA-R09-OW-2010-0052.1)

[97] Sacramento Regional County Sanitation District (EPA-R09-OW-2010-0022.1)

[98] County of Sacramento (EPA-R09-OW-2010-0020.1)

[99] County of Sacramento (EPA-R09-OW-2010-0020.1)

[100] County of Sacramento (EPA-R09-OW-2010-0020.1)

[101] County of Sacramento (EPA-R09-OW-2010-0020.1)

cause of environmental problems, but also to better predict, and prevent or mitigate problems before chemicals are allowed to be released to the environment."[102]

Another respondent suggests improving toxicity testing protocols by better accounting for synergistic effects:

> Performing toxicity testing with ambient waters directly tests for synergistic toxic effects in the Bay Delta Estuary for the selected test organisms. Ambient waters contain mixtures of chemicals at environmentally relevant concentrations. Therefore, the results of toxicity tests provide at least a snapshot of synergistic or additive effects in the samples taken.[103]
>
> The uncertainties related to the lack of realistic environmental exposure in laboratory-based toxicity testing could be addressed by conducting *in situ* toxicity testing in the Delta. This approach balances the controls of standard laboratory testing with environmentally realistic field exposures where the organisms are exposed to natural diurnal changes in temperature, light, and flow through water quality variations in the various site media (i.e., surface water, sediment- water interface, surficial sediment, or pore water). These *in situ* exposure approaches provide unique assessment information that is complementary to traditional laboratory-based toxicity testing and reduce the uncertainty of extrapolating from the laboratory to field. Native test organisms and standard method test organisms have been used successfully with *in situ* exposure methods to assess the potential for adverse effects to species of interest.[104]
>
> The relative toxicity from multiple stressors in ambient surface water or sediment samples can, some cases, be determined using toxicity identification evaluation methods (EPA 1992, 1993a, 1993b, 2007). Toxicity identified during standard toxicity tests can be fractionated and then reconstructed for various toxicants. Novel methods need to be employed for some contaminant classes such as pyrethroids (Wheelock et al. 2004; Amweg and Weston 2007; Weston and Amweg 2007) in addition to the general tools provided in the EPA Guidance (EPA 1992, 1993a, 1993b).[105]

6. What, if any, specific combinations of contaminants are of particular concern in the Bay Delta Estuary? (3 responses)

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[102] County of Sacramento (EPA-R09-OW-2010-0020.1)

[103] Sacramento Regional County Sanitation District (EPA-R09-OW-2010-0022.1)

[104] Sacramento Regional County Sanitation District (EPA-R09-OW-2010-0022.1)

[105] Sacramento Regional County Sanitation District (EPA-R09-OW-2010-0022.1)

Two respondents reiterate key points made in addressing other questions. For example, one of the respondents representing regulated municipal entities cited under question 3 reiterated one of the main points made there. "As mentioned above, the results of tests performed on ambient waters already provide an integrated account of any synergistic or additional effects."[106]

This suggestion comes from a water agency representative: "Given the recent research results demonstrating the effects on fish olfactory and lateral line function of short term exposures to low levels of copper and other contaminants, US EPA should conduct, or fund, additional investigations on the effect of metals and other contaminants on Delta pelagic and anadromous fish olfactory function."[107]

7. Should EPA and our state partners move away from evaluating isolated aquatic species for one or two pollutants, and towards evaluations of water conditions more representative of the actual aquatic conditions in the Bay Delta Estuary? How might this be done? (3 responses)

Respondents reiterate key points made in answers to previous questions. From this question forward, with some exceptions, answers are few and become increasingly standardized. This may be related to the fact that questions 7-11 are variations on similar themes, address regulatory details that are not relevant to all interests, and that the basic concerns and ideas of commenters apply to several or all of them. For example, with regard to questions 6 and 7, one respondent's "answer to these two questions is related."[108]

A respondent bases the following call for more integrated health assessments on the need for capturing the full effect of contaminant mixtures:

> While there is certainly value in conducting species' sensitivity analyses on individual pollutants, this needs to be supplemented with *in situ* analyses of species' health using biomarkers and other sublethal indications of contaminant exposure and effect. Aquatic organisms are exposed to contaminant mixtures, often at undetectable levels of each constituent, for their entire life and over multiple generations. Grab samples do not capture the variation of this mixture that can occur at hourly, daily, and seasonal time scales. In addition, short duration (e.g. 7-day) toxicity tests do not capture life cycle type effects on a population.[109]

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[106] Sacramento Regional County Sanitation District (EPA-R09-OW-2010-0022.1)

[107] San Luis Delta & Mendota Water Authority, State Water Contractors (EPA-R09-OW-2010-00 38.1)

[108] San Luis Delta & Mendota Water Authority, State Water Contractors (EPA-R09-OW-2010-00 38.1)

[109] San Luis Delta & Mendota Water Authority, State Water Contractors (EPA-R09-OW-2010-00 38.1)

> We encourage EPA to fund such an integrated and comprehensive investigation.[110]

Another respondent argues that current laboratory testing protocols could induce testing artifacts:

> Performing three-species chronic toxicity testing on upstream water, downstream water, and effluent accounts for any synergistic or additive toxicity resulting from combined contributions of contaminants. Such testing accounts for multiple contaminants, at environmentally relevant concentrations. The results of such testing near the SRCSD effluent discharge has helped to address concerns regarding the potential effects of Sacramento River water being discharged into the Bay Delta Estuary.[111]
>
> As commented previously, the uncertainties related to the lack of realistic environmental exposure in laboratory-based toxicity testing could be addressed by conducting *in situ* testing in the Delta. This approach balances the controls of standard laboratory testing with environmentally realistic field exposures where the organisms are exposed to natural diurnal changes in temperature, light, and flow through water quality variations in the various site media (i.e., surface water, sediment-water interface, surficial sediment, or pore water).[112]

8. **What new or revised effluent limitations, monitoring requirements or other permit requirements could be included in NPDES permits for discharges of pesticides from MS4s in the Bay Delta Estuary in order to meet the regulatory standard of reducing discharges to the maximum extent practicable? What information is necessary to determine permit requirements, such as identifying effluent limits that can effectively reduce ambient contaminant concentrations and restore designated uses? Please provide any available information on water quality benefits that may result from such requirements** (4 responses)

The respondents agree that additional requirements in MS4 permits would not be necessary or productive and provide three key arguments in support of their view: the most effective action for EPA to address pesticide contamination is to continue to improve water quality protection through regulatory authority that exists in FIFRA; pesticide regulation under FIFRA offers a practical and cost-effective approach to addressing problems associated with pesticides that flow to the Delta in urban runoff; and EPA should rather implement and provide incentives for reducing pesticide use, runoff, and drift.

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[110] San Luis Delta & Mendota Water Authority, State Water Contractors (EPA-R09-OW-2010-00 38.1)

[111] Sacramento Regional County Sanitation District (EPA-R09-OW-2010-0022.1)

[112] Sacramento Regional County Sanitation District (EPA-R09-OW-2010-0022.1)

9. **What new or revised effluent limitations, monitoring requirements or other permit requirements could be included in NPDES permits for stormwater discharges associated with construction activity and/or stormwater discharges associated with industrial activity to address pesticides? What information is necessary to determine permit requirements, such as identifying effluent limits that can effectively reduce ambient contaminant concentrations and restore designated uses? Please provide any available information on water quality benefits that may result from such requirements** (3 responses)

Similar to previous responses, commenters do not support additional requirements on NPDES construction permittees and called for improvements in FIFRA water quality protections. One respondent provides the following answer to Questions 8-11: "Pesticide regulation offers a practical and cost-effective approach to addressing problems associated with pesticides that flow to the Delta in urban runoff. The alternative contemplated in the ANPR—expansion of NPDES permitting for pesticides in urban runoff—would be ineffective, costly, and counterproductive."[113] Commenters also provide specific suggestions for improving FIFRA regulations and coordinating these with NPDES construction permit monitoring and Best Management Practices:

> EPA should continue to require that pesticides labeled for pre-construction termiticides include restrictions and requirements to reduce the likelihood of pesticide discharge in stormwater runoff. Such requirements have been established by EPA, largely in response to requests from CASQA and individual MS4 permittees (including the County) for cypermethrin, bifenthrin, permethrin and other pyrethroids that have been implicated in water quality problems in the estuary.[114]
>
> These pesticide label requirements should be supported by parallel BMP and monitoring requirements in NPDES construction permits.[115]

Commenters also agree that, "Pesticide restrictions in NDPES industrial permits does not seem an efficient or necessary means to address pesticide applications at industrial facilities."[116] The respondents expect pesticide use restrictions under FIFRA and surface water protection regulations developed by the California Department of Pesticide Regulation to fully address pesticide problems in stormwater runoff.

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[113] California Stormwater Quality Association (EPA-R09-OW-2010-0045.1)

[114] County of Sacramento (EPA-R09-OW-2010-0020.1)

[115] County of Sacramento (EPA-R09-OW-2010-0020.1)

[116] County of Sacramento (EPA-R09-OW-2010-0020.1)

10. Should EPA use its residual designation authority at 40 C.F.R. 122.35 to designate currently unregulated small MS4s to ensure that municipalities have programs in place to control the discharge of pesticides in stormwater to the maximum extent practicable? What information is necessary to determine permit requirements, such as identifying effluent limits that can effectively reduce ambient contaminant concentrations and restore designated uses? Please provide any available information on water quality benefits that may result from such requirements (4 answers)

This question receives the same resistance as previous ones: "Municipalities do not have the authorities necessary to prevent toxicity in their effluents: they cannot control pesticide labels—and in most states (including California) they cannot regulate pesticide users and cannot determine which pesticides can be sold in their cities. Since most urban dischargers do not have the ability to control pesticides, expansion of urban stormwater discharge permits would be ineffective toward addressing pesticide problems in the Delta."[117] Or: "Without improvement in FIFRA water quality protections, additional requirements on NPDES permittees to address pesticide impacts are likely to be ineffective."[118]

A federal resource manager, on the other hand, suggests to extend NPDES permitting to currently unregulated small MS4s and to include requirements for stormwater management plans and low impact development strategies:

> Require that all small, currently unregulated MS4s obtain National Pollutant Discharge Elimination System (NPDES) stormwater permit coverage and are required to utilize Standard Urban Stormwater Management Plan (SUSMP)/ low-impact development (LID) strategies, including best management practice (BMP) sizing criteria, to minimize the inputs of pesticides and other contaminants to the Bay Delta Estuary. NMFS believes that many of the development companies in the State of California are well versed in the SUSMP/ LID requirements from their projects in already regulated areas and that completing coverage across the state should not be overly burdensome…. Ensure that stormwater permits require periodic testing of discharges from existing urban developments and that toxicity detections trigger a toxicity identification evaluation (TIE) followed by an appropriate series of actions meant to prevent further toxic discharges. Ensure that stormwater permits require periodic analysis of individual contaminants and receiving waters to determine the effects of discharges on water quality standards in a waterbody.[119]

[117] California Stormwater Quality Association (EPA-R09-OW-2010-0045.1)

[118] County of Sacramento (EPA-R09-OW-2010-0020.1)

[119] National Oceanic and Atmospheric Administration (EPA-R09-OW-2010-0050.1)

One of EPA's actions would then be to ensure the implementation of stormwater regulation and management: "Audit the Regional Water Quality Control Boards and the State Water Resources Control Board to determine if strict enforcement and reporting of the stormwater best management practices (BMP) requirements for redevelopment, as defined under the current and future stormwater NPDES permits, is taking place as required."[120] And as necessary, "Take corrective action against permittees who are not implementing the provisions properly."[121]

11. Should EPA use its residual designation authority at 40 C.F.R. 122.26(a)(9)(i)(C)-(D) to designate currently unregulated stormwater discharges that contribute pesticides to surface waters? What information is necessary to determine permit requirements, such as identifying effluent limits that can effectively reduce ambient contaminant concentrations and restore designated uses? Please provide any available information on water quality benefits that may result from such requirements (3 answers)

The answers repeat points made previously and are echoed in a general comment from a regulatory agency: "Municipalities, however, do not have control of what pesticides are sold or used, nor do they have resources to regulate pesticide applications."[122]

Respondents identify as a core issue the application by residents and professionals of USEPA-registered pesticides causing toxicity in discharges for which municipalities are ultimately held responsible. "Treatment of municipal stormwater to meet the low levels of pesticides necessary to prevent toxicity and achieve compliance with water quality standards would likely not be feasible."[123]

Education, low impact development, and permits requiring the implementation management practices to reduce toxic levels of pesticides in discharges are some of the feasible control efforts that were identified. That said, there are "likely limitations to how much pesticide reduction municipalities can feasibly achieve."[124]

The general consensus emerging from these answers is that effective solutions need to focus on the elimination of the pesticide uses and products that are likely to cause water quality problems.

[120] National Oceanic and Atmospheric Administration (EPA-R09-OW-2010-0050.1)

[121] National Oceanic and Atmospheric Administration (EPA-R09-OW-2010-0050.1)

[122] Central Valley Regional Water Quality Control Board (EPA-R09-OW-2010-00 21.1)

[123] Central Valley Regional Water Quality Control Board (EPA-R09-OW-2010-00 21.1)

[124] Central Valley Regional Water Quality Control Board (EPA-R09-OW-2010-00 21.1)

CONTAMINANTS OF EMERGING CONCERN

Seven respondents answered questions on contaminants of emerging concern (CECs), including regulated dischargers (3), an environmental organization (1), a local resident (1), a resource management agency (1), and water agencies (1).

Key Points

- ⇨ The San Francisco Bay RMP currently prepares a CEC synthesis focused on San Francisco Bay.
- ⇨ CECs can enter the aquatic environment from a variety of sources, including municipal and industrial wastewater systems, urban stormwater, confined animal feeding operations, and agricultural runoff.
- ⇨ Respondents expect EPA to play a lead role in developing monitoring methods and screening processes, and coordinating regulatory monitoring requirements.
- ⇨ Respondents want EPA to provide leadership in source reduction for CECs through its authority to regulate the use of chemicals in products or processes.

1. **What, if any, additional information is available regarding the effects of CECs on aquatic resources in the Bay Delta Estuary?** (4 responses)

Respondents identify the following additional information resources: SETAC expert groups such as the Pharmaceutical Advisory Group and Nanotechnology Advisory Group; recent findings indicating exposure by Delta fish to endocrine disrupting chemicals (Brander and Cherr 2008, Connon et al 2010, Riordan and Adam 2008, Sommer 2008); the workshop report *Managing Contaminants of Emerging Concern in California*; and a CEC synthesis report being prepared by the San Francisco Bay RMP and expected to be available in the summer of 2012.

2. **What, if any, specific information exists to identify the sources and nature of discharges of CECs into the Bay Delta Estuary?** (5 responses)

Three respondents focus on CECs in discharges from municipal wastewater treatment systems. That said, one respondent replies: "We agree with the statement in the ANPR that CECs can be introduced into the aquatic environment through a variety of sources, including not only municipal wastewater systems but also industrial wastewater systems, urban stormwater, animal husbandry operations, and agricultural runoff. To be effective, efforts to address CECs must consider all of these sources, not just

POTWs."[125] The respondents cite several studies, concluding that wastewater discharges are a likely source of a number of compounds that have been detected in the Delta downstream of urban centers. These compounds include caffeine, numerous pharmaceuticals, industrial chemicals, and fire retardants.

3. **What, if any, monitoring mechanisms or methodologies are available to assist in identifying CECs?** (5 responses)

Commenters endorse EPA's role in developing monitoring methods and screening processes, and coordinating regulatory monitoring requirements: "We encourage EPA to improve CEC analytical techniques…"[126] one commenter advises. Another "recommends that EPA establish coordinated product screening and environmental monitoring requirements for producers of chemicals that are potentially CECs that are designed to identify and prevent environmental impacts caused by their products."[127]

The spokesperson of several discharger associations suggested special studies, such as those conducted by the San Francisco Bay and Southern Bight RMPs, as a useful approach for characterizing sources and impacts of CECs:

> Additionally, our associations believe that the most useful approaches to identify the sources, fate, transport and effects of CECs in the environment is through special studies, rather than by a traditional regulatory approach or via routine compliance monitoring programs typically used for conventional and priority pollutants. The state of the science is not yet sufficiently developed to set regulatory standards, and therefore it is premature to require routine monitoring for many, if not most, CECs. Instead, special studies designed to answer particular questions related to the sources, fate, transport and effects of various CECs (or classes of CECs) are part of the important foundational work necessary to determine which compounds are of greatest concern and how best to address them. Much work in this area is already being undertaken by academic experts and applied research institutions such as the Southern California Coastal Water Research Project (SCCWRP) or the San Francisco Estuary Institute (SFEI), and they are well-positioned to assist in this role.[128]

Another respondent points to a risk-based monitoring strategy, as developed for recycled waters, as a model: "A State Water Board's expert panel supports a risk-based approach for evaluating the potential for adverse effects from CECs in their "Monitoring Strategies for Chemicals of Emerging Concern (CECs) in Recycled Water."

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[125] CASA, BACWA, CVCWA, Tri-TAC, SCAP (EPA-R09-OW-2010-0034.1)

[126] CASA, BACWA, CVCWA, Tri-TAC, SCAP (EPA-R09-OW-2010-0034.1)

[127] County of Sacramento (EPA-R09-OW-2010-0020.1)

[128] CASA, BACWA, CVCWA, Tri-TAC, SCAP (EPA-R09-OW-2010-0034.1)

This approach recommends monitoring (i.e., measured environmental concentration or MEC) and interpreting these monitoring data through chemical specific comparisons of concentrations known to cause adverse effects (i.e., monitor triggering level or MTL)."[129]

4. **What, if any, methods are most effective to minimize introduction of CECs into the Bay Delta Estuary?** (6 responses)

Four commenters want EPA to assume a stronger role in addressing problems with CECs at their source. One respondent stated: "The area in which EPA can make the biggest difference in minimizing introduction of CECs into the environment is by providing leadership in source reduction for CECs."[130]

One of several identified problems is stormwater authorities' limited ability to control pollution sources. As one respondent states, "EPA must bring to bear other avenues of environmental protection, including chemical policy reforms and regulations to actively reduce the use of toxic, bioaccumulative, and persistent chemicals and promote environmentally sound alternatives."[131]

Issues brought forth are the technical challenges in removing the usually low concentrations of CECs from wastewater and stormwater and the associated cost. Respondents consider pollution control strategies for discharges technically questionable and financially unsustainable. They also point out that the Water Boards and local agencies, unlike EPA, do not have the authority to regulate the use of chemicals in products or processes. One commenter recommends "that EPA establish coordinated product screening and environmental monitoring requirements for producers of chemicals that are potentially CECs that are designed to identify and prevent environmental impacts caused by their products."[132]

According to one comment, the most effective treatment process for removing trace concentrations of pharmaceuticals and personal care products and other endocrine disrupting compounds would be a multiple barrier, treatment train approach that combines various advanced processes (e.g., reverse osmosis, advanced oxidation processes, ozonation, activated carbon). Costs to implement this treatment technology are expected to be exorbitant.

PROTECTING ESTUARINE HABITAT, FISH MIGRATION CORRIDORS AND WETLANDS

[129] Sacramento Regional County Sanitation District (EPA-R09-OW-2010-0022.1)

[130] CASA, BACWA, CVCWA, Tri-TAC, SCAP (EPA-R09-OW-2010-0034.1)

[131] Clean Water Action (EPA-R09-OW-2010-0044.1)

[132] County of Sacramento (EPA-R09-OW-2010-0020.1)

Comments were requested on three topics related to aquatic habitat:

- Estuarine habitat
- Fish migration corridors
- Wetlands

ESTUARINE HABITAT

Five respondents answered questions on estuarine habitat, including environmental organizations (2), a resource management agency (1), water agencies (1), and a water user group.

Key Points

⇨ There are two distinct views about changing the location of the low salinity zone to achieve ecosystem benefits. One view argues that there is an extensive body of scientific evidence for adopting new regulations to protect estuarine habitat and the pelagic species dependent on it and that the mechanisms behind the relationships are probably numerous and complex; the other view argues that the biological mechanisms are generally not known.

⇨ Ecosystem responses to the location of the low salinity zone in spring and fall are connected, but the connections may be indirect, variable, and dependent upon other factors. Comments also suggest that winter-spring X2 is probably reflective of very different mechanisms than fall X2.

⇨ Modeling tools such as CALSIM II can help water resource managers identify strategies for simultaneously meeting Delta salinity targets for resident fishes and upriver temperature targets for migrating chinook salmon, while minimizing impacts on agricultural and urban water supplies.

⇨ DRERIP[133] models provide a starting point for predicting how the plant community may change in response to changing salinity regimes.

⇨ Some respondents suggest that a causal relationship between the location of the low salinity zone (X2), estuarine habitat quality, and fish abundance would be required, before X2 could be used as a regulatory parameter. Others argue that X2 reflects many processes that affect the aquatic

[133] Delta Regional Ecosystem Restoration Implementation Plan

ecosystem and therefore serves as a broad regulatory tool to address ecosystem processes.

- ⇨ Tides and turbidity play a significant role by influencing spawning migrations of delta smelt; however, better information is needed to evaluate these variables as habitat characteristics for various species.

- ⇨ Delta outflows play a key role in supporting concentrations, transport, and duration of exposure effects of contaminants and nutrients in the Delta, but stakeholders are highly divided about what this implies for water quality regulation. Some suggest that EPA should recognize severe modifications to the unimpaired Delta hydrograph as the primary stressor on the Delta ecosystem and that restoration of parts of the hydrograph is an essential element in protecting the aquatic ecosystem. Others have jurisdictional concerns about using the Clean Water Act in regard to flows and that to do so would risk using dilution to solve pollution problems.

- ⇨ Some commenters suggest that performance measures for species population and/ or habitat condition would be useful components of integrated assessments of Bay Delta Estuary water quality.

1. What information is available on the effect of lower salinities in the western Delta on undesirable species such as *Microcystis*, overbite clams, or jellyfish? What, if any, information is available to determine if an increase in low salinity habitat would affect the fate, concentration and distribution of nutrients and toxics that are potentially negatively affecting the estuarine food web? (3 responses)

Two respondents point to the important role of Delta outflows in supporting dilution processes in the Delta. The representative of a federal resource agency states, "Low salinity habitat is related to Delta outflow, and higher outflows have at least a dilution effect on various pollutants."[134] Two respondents comment on possible regulatory changes for Delta outflows. One respondent suggests that EPA should recognize severe modifications to the unimpaired Delta hydrograph as the primary stressor on the Delta ecosystem:

> The long-term trend of decreased fresh water outflow relative to unimpaired outflow, and recent extremes of this trend, have served to concentrate nutrients and suspected toxins within the low salinity zone of the Delta. For example, Dugdale et al. (2007) indicate that increasing Delta

[134] US Fish and Wildlife Service (EPA-R09-OW-2010-0052.1)

> outflow in the spring may alleviate levels of ammonium that potentially impair foodweb productivity.[135]
>
> Recognizing this fact is not at all the same as arguing "dilution as the solution to pollution." Rather, it is to acknowledge that Delta outflows play a critical role in supporting natural dilution and flushing processes in the Delta, and that USEPA can restore this ecosystem process by requiring more natural volumes and temporal patterns of Delta outflow (i.e., a more natural Delta hydrograph).[136]

Water user agencies share scientific and jurisdictional concerns and see no need for EPA action regarding flow. This comment concludes:

> Considering the fact that more favorable flow conditions, which have placed X2[137] in locations considered important for healthy fish populations, have not resulted in increased abundances (Kimmerer et 2009), the predictive ability of X2 is questionable….Use of water rights to modify the location of the LSZ[138] for the purpose of anthropogenic nutrient and toxic discharges would result in an unreasonable use of water in violation of California statutory and constitutional provisions.[139]

2. Could the frequency, area, and/or duration of low salinity habitat be changed so as to achieve ecosystem benefits for the suite of species that use the low salinity zone? If so, how? Is historical data on inter- or intra- annual frequency of variability the best basis for setting goals or are there other bases that could be used? How might climate change impacts, including sea level rise, affect the size, frequency, and duration of low salinity habitat? (4 answers)

There are two distinct views about changing the location of the LSZ to achieve ecosystem benefits.

One respondent cites analyses of the historical relationship between fish abundance, fish population growth, and spatial distribution of several pelagic fish species and winter-spring Delta outflow, as presented in testimony to the State Water Resources Control Board (SWRCB) in 2010:

> In adopting new non-binding flow criteria necessary to protect public trust resources in the Delta, the State Water Resources Control Board

[135] The Bay Institute (EPA-R09-OW-2010-0040.4)

[136] The Bay Institute (EPA-R09-OW-2010-0040.4)

[137] X2 = location of the 2 parts per thousand (ppt) salinity gradient; an indicator for the location of the ecologically important low salinity zone.

[138] Low salinity zone

[139] San Luis Delta & Mendota Water Authority, State Water Contractors (EPA-R09-OW-2010-00 38.1)

> (SWRCB 2010) agreed with our findings and translated them into a set of criteria requiring that 75% of unimpaired runoff be dedicated to Delta outflow during the January [-] June period. We concur with the Board's approach as it best simulates the characteristics of a natural hydrograph and provides a clear and simple method for implementing our recommendations.[140]

Other respondents argue that relationships between Delta outflows, the location of the LSZ, and fish populations are not supported by the historical data. "The short answer is that new water quality requirements concerning the low salinity zone would be unlikely to achieve ecosystem benefits because the historical data demonstrates that natural hydrology - and, in particular, trends during wet and dry cycles - are the primary driver of low salinity habitat's characteristics,"[141] states a water user group. And further, "urges USEPA to work with scientists to better evaluate the relationship, if any, between Delta outflow and delta smelt abundance before proposing any fall X2 measure."[142] Generally, respondents agree that a fall X2 standard does not mirror historical hydrological processes, but one respondent considers it a potential tool to protect the threatened Delta smelt:

> Thus, the ecosystem response to fall X2 is different than to spring X2, is of more recent origin, and probably does not reflect processes that operated in the Delta historically…The special nature of the fall X2:abundance relationships notwithstanding, the Delta smelt is in dire jeopardy of extinction and both the Delta smelt and striped bass populations appear to receive substantial protections from supplemental flows in the fall that increase the habitat available during this period (Feyrer et al. 2010). Given this situation, USEPA should develop and promulgate new regulations for fall outflows that will allow Delta fish populations to recover.[143]

A respondent suggests the use of climate change scenarios, developed by the CASCaDE[144] Program (CALFED/ USGS funded research), as a basis for predicting possible changes: "Less water and warmer temperatures will probably result in a more lentic[145] Delta ecology rather than one with more water and cooler temperatures which would result in a more lotic[146] Delta ecology."[147]

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[140] The Bay Institute (EPA-R09-OW-2010-0040.4)

[141] Northern California Water Association (EPA-R09-OW-2010-0030.1)

[142] Northern California Water Association (EPA-R09-OW-2010-0030.1)

[143] The Bay Institute (EPA-R09-OW-2010-0040.4)

[144] Computational Assessments of Scenarios of Change for the Delta Ecosystem

[145] Lentic ("standing") waters; a lake, pond or swamp.

[146] Lotic ("flowing") waters; a river, stream, or spring.

[147] US Fish and Wildlife Service (EPA-R09-OW-2010-0052.1)

3. Are methods available for more systematically addressing ecological or biological connections between springtime X2 and subsequent fall X2 conditions? If so, what are they and what are their strengths and weaknesses? (3 answers)

One respondent doubts the validity of the question asked, for the lack of scientific evidence that X2 does indeed determine subsequent delta smelt abundance. At the same time, another respondent points to an ongoing study of the question:

> Yes, but the connections don't appear to be direct, may not be constant, and may depend upon other factors. The U.S. Bureau of Reclamation is outlining an Adaptive Management Program to look at this and other mechanisms as required by an RPA[148] (Component #3) contained within the Endangered Species Act consultation on the *Proposed Coordinated Operations of the Central Valley Project (CVP) and State Water Project (SWP)* (USFWS 2008). This program is expected to be initiated in 2011.[149]

As for addressing the most relevant connections, the respondent proposes to examine the relationships between spring X2 conditions and the success of Delta smelt population between the previous fall and the subsequent summer:

> For such an analysis, it will be important to remove the effect of the stock population size on subsequent results (i.e. determine the effect, if any, of outflow conditions on population growth after accounting for abundance of spawners in the previous generation). In addition, USEPA should investigate the effect of winter and spring X2 values on the geographical distribution of Delta smelt spawning (as measured by the spring Kodiak Trawl).[150]

4. Would changes in system operations to move X2 seaward in the fall adversely affect the reservoir storage needed to conserve salmonid fish spawning and other designated uses in the watershed? Of so, under what conditions? (3 answers)

A resource management agency and a water user group are concerned that changes in water system operations to move X2 seaward in the fall would come at the cost of other designated uses.

> Yes. Changes in water system operations to move X2 seaward in the fall would adversely affect reservoir storage needed by

[148] "Reasonable and Prudent Alternative" under the Endangered Species Act.

[149] US Fish and Wildlife Service (EPA-R09-OW-2010-0052.1)

[150] US Fish and Wildlife Service (EPA-R09-OW-2010-0052.1)

> salmonids in most years. The National Marine Fisheries Service has indicated that there should be a minimum of 2.4 million af[151] of carry-over storage at Shasta Reservoir in order to protect spawning and rearing habitat. … By contrast, most of the proposals made to the SWRCB would reduce carry-over storage substantially, so that it would only exceed 2.4 million af in approximately 25% of years. [Organization] members presented evidence concerning the very significant impacts that new X2 standards requiring more Delta outflow could have on not only storage levels in Shasta Reservoir on the Sacramento River, but also Folsom Reservoir on the American River and Oroville Reservoir on the Feather River. This evidence demonstrates that such new X2 standards could dramatically reduce reservoir storage levels, which would have the potential to decimate salmonid populations throughout the Sacramento River system. This testimony, as presented by Walter Bourez of MBK Engineers, is available on-line at http:/ / www.waterboards.ca.gov/ waterrights/ water_issues/ programs/ bay_delta/ deltaflow/ svwu.shtml, along with all exhibits to that testimony. NCWA strongly urges USEPA to reject any proposed changes in water system operations that would have such an adverse effect on the many species that are listed as either threatened or endangered under the federal Endangered Species Act.[152]
>
> There is a likely cost when stored water reserves are used elsewhere in the system. The Department of Water Resources (DWR), and USBR have the required modeling tools to answer this question fairly accurately. A range of water year types can be examined using CALSIM II, and several available water temperature models can evaluate potential temperature effects to the Sacramento River.[153]

Another respondent suggests moving X2 westward only following wet and above normal years. Rather than impacting reservoir storage in the subsequent year, water releases in fall seasons following wet and above normal years would benefit Chinook salmon, by compensating for typically low fall releases owed to the lack of demand from water users in such years. As the respondent concludes:

> We believe that if these fall X2 requirements are implemented along with the NMFS Biological Opinion RPA (NMFS 2009; RPA Actions

[151] Acre-feet

[152] Northern California Water Association (EPA-R09-OW-2010-0030.1)

[153] US Fish and Wildlife Service (EPA-R09-OW-2010-0052.1)

> I.2.1 to I.2.4), then any impacts to carryover storage and coldwater pool will be minimal.[154]

The ultimate goal, as all three answers suggest, would be to achieve consistency between ecosystem benefits for the Delta species using the LSZ and implementing the NMFS Biological Opinion on the Central Valley Project focused on salmonids, while minimizing impacts on agricultural and urban water supplies.

5. What information is available on the effects of salinity management on terrestrial plant communities and/or tidal marsh endemic species? What indirect effects does this have on the aquatic communities? (2 answers)

One respondent refers to the wealth of literature on the subject of plant species distribution versus salinity in the soil and surface water. The respondent cites a study of the role of sedimentation in marsh development in the estuary (Culberson et el 2004), to support that plant community movement and plant performance over time, while not definitive, can be reasonably predicted. The respondent notes further that effects of salinity management on aquatic communities are difficult to measure. Therefore, conceptual models such as the DRERIP models should be used and CALFED ERP documents may provide a useful source of information. The second respondent proposes that the desired natural communities depend on natural variability in salinity and that X2 should be managed accordingly.

6. Does the geographic location of low-salinity habitat have an effect on the quality of the habitat or its availability to species of concern? If so, what is the nature and extent of such effect? Is the distribution pattern of low salinity habitat important in determining its quality? (3 answers)

Respondents suggest that any proposed relationship between the location of the low salinity zone (X2), estuarine habitat quality, and fish abundance requires scientific validation. Disagreement centers on the requirement for causal relationships to be the basis of protective actions. One respondent puts it this way:

> It is often assumed that the position of the low salinity zone, with respect to shallow shoals or tidal wetlands, is responsible for the winter-spring X2:abundance relationships that are so well-documented in the literature. In fact, this is only one of several potential explanations for the winter-spring X2(outflow):abundance relationships (Kimmerer 2002b). …If the position of the 2ppt isohaline[155] relative to other habitat features was responsible for the improved performance of pelagic species when winter-spring X2

[154] The Bay Institute (EPA-R09-OW-2010-0040.4)

[155] Of equal or constant salinity. A line on a chart connecting all points of equal salinity

> moves west, then one would expect to detect a threshold value for X2 that was consistent across species. No such threshold X2 value has been detected for any population studied in the Bay-Delta.[156]

A spokesperson for water agencies states that it is problematic to assume that the X2 location is a reliable habitat indicator for Delta smelt and other species:

> First, it does not account for the fact that each species that resides in the Bay-Delta has its own unique habitat, which is defined as the geographic area that supports a suite of physical and biotic resources upon which the species depends for its survival and reproduction…. Second, the use of X2 in resource management planning as a surrogate habitat parameter is scientifically problematic, unless it has been validated that X2 correlates well in its spatially and temporal distribution with the suite of physical and biological resources required by the targeted species.[157]

A resource agency representative answers that research is currently being conducted to address the question and referred to the *Interagency Ecological Program (IEP) 2011 Work Plan*.

7. Are spring/neap differences in tidal water quality important for aquatic species? If so, how should these habitat characteristics be evaluated? (2 answers)

One respondent suggests that tides and turbidity play a significant role by influencing spawning migrations of delta smelt, and that better information is needed to evaluate these variables as habitat characteristics for various species. "Additional study is needed to determine the historical and current primary causes of turbidity in the various sub-regions of the Bay-Delta. Without an understanding of the causes of turbidity on a sub-regional basis, it will be difficult to assess on a species-by-species basis, the importance of tidal water quality as measured by turbidity."[158] Another respondent suggests that, based on recent findings (Enright et al. (in preparation), spring/ neap differences in tidal water quality may be discernable at the landscape level but that showing what the links are to aquatic species performance will be unlikely for some time.

[156] The Bay Institute (EPA-R09-OW-2010-0040.4)

[157] San Luis Delta & Mendota Water Authority, State Water Contractors (EPA-R09-OW-2010-00 38.1)

[158] San Luis Delta & Mendota Water Authority, State Water Contractors (EPA-R09-OW-2010-00 38.1)

8. How can performance measures for species population and/or habitat condition be used to evaluate restoration of Bay Delta Estuary water quality? (3 answers)

One respondent notes that such performance measures require an appropriate context to be properly evaluated, since there are many additional environmental and anthropogenic factors determining water quality. Another respondent recommends developing specific performance targets as a basis for regulatory standards. And another, "In developing and promulgating new water quality regulations, USEPA should articulate specific goals and quantifiable objectives for desired conditions in the Bay-Delta (i.e. what does a functioning," healthy" ecosystem look like, as defined using attributes of population viability and ecosystem health) and then identify which of these goals will be served by specific improvements in water quality and to what extent."[159]

FISH MIGRATION CORRIDORS

Seven respondents answered questions on migratory corridors, including resource management agencies (3), water agencies (2), an environmental organization (1), and a regulated discharger (1).

Key Points

- ⇨ Some respondents express concerns over disrupted physical-chemical gradients as a barrier to salmon migration in the San Joaquin River system, whereas others suggest that the available data are insufficient to demonstrate that such gradients affect the migratory corridor for salmon.
- ⇨ Respondents identify physical and chemical as well as biological measures for protecting fish migration designated uses.
- ⇨ Respondents confirm that temporal characteristics of a migration corridor should be considered in relation to the survival of salmon.
- ⇨ Respondents suggest that concerns over the restoration success of migratory corridors might be addressed or alleviated by ensuring adequate flows in the Lower San Joaquin River.
- ⇨ Proposed options for improving dissolved oxygen regimes in the Delta include the full implementation of an existing TMDL for the San Joaquin River Deep Water Ship Channel, using EPA's existing Clean Water Act

[159] The Bay Institute (EPA-R09-OW-2010-0040.4)

authorities to more stringently enforce the Act, and new regulations for San Joaquin River inflows.

⇨ Additional barriers to fish migration in the Bay Delta Estuary that are not covered by the ANPR are the Yolo Bypass and Suisun Marsh.

1. What role, if any, do gradients in physical and chemical constituents of water play in the suitability of the Bay Delta Estuary and San Joaquin River Basin migratory corridor for adult salmon? (5 responses)

Several respondents share concerns over disrupted physical-chemical gradients as a barrier to salmon migration in the San Joaquin River system. One commenter notes that it is uncertain whether the needed migratory corridor between the San Joaquin River and Pacific Ocean can be maintained by permitting exports from the south Delta that exceed San Joaquin inflows by a 3:1 ratio. Other respondents suggest that the available data are insufficient to demonstrate that gradients in the physical and chemical constituents of water in the Bay-Delta and San Joaquin River system affect the migratory corridor for salmon.

2. What are the best measures of success for restoration of a migratory corridor? Could these measures be incorporated into new or revised biological criteria protecting the fish migration designated use? (4 responses)

Respondents identify physical and chemical as well as biological measures for protecting fish migration designated uses: "Rather than defining water quality and flow criteria only, biological criteria that more directly measure fish migration and spawning success could be developed and used."[160]

One federal resource management agency suggests specific measures of success that could be used as a basis for biological criteria:

> Metrics for determining the success of restoration efforts to improve migratory corridors could include: increased downstream juvenile salmonid survival, increased access to and acreage of floodplain rearing habitat, improved habitat complexity, reductions in bottlenecks and predatory hotspots, reductions in water temperatures, improvements in dissolved oxygen and other water quality parameters, and increased flow/ reductions in travel time for juvenile salmonids to overcome tidal barriers. Such information could be used in developing criteria to meet fish migration objectives in the Water Quality Control Plan.[161]

[160] Sacramento Regional County Sanitation District (EPA-R09-OW-2010-0022.1)

[161] National Oceanic and Atmospheric Administration (EPA-R09-OW-2010-0050.1)

Other respondents -- including another federal resource management agency, an environmental organization, and a regulated discharger-- recommend additional metrics for measuring success, such as direct counting of adult salmonids passing specified locations in the river system, the fraction of the migration season that the corridor remains open, and the frequency (in terms of years) that the migration corridor is open for the full migration season.

3. **Should temporal characteristics be included in the definition of the physical and/or chemical properties of a migration corridor based on a reference condition? If so, how? What frequency and duration of such a corridor is required for salmonids? How might these characteristics change with the impacts of climate change?** (4 responses)

Respondents confirm that the timing of a migration corridor should be considered in relation to the survival of salmon and raised several points: "Parameters for protecting migrating fishes and maintaining migration corridors should provide a seasonal component that considers the most sensitive species that are likely to be migrating seasonally", states on respondent.[162]

Another respondent makes a related point: "The baseline for determining the migration period for different fishes in the Delta must be based on our knowledge of seasonality and variability in the life cycle of the species of interest."[163] Referring to conceptual models developed as part of the CALFED Ecosystem Restoration Program's DRERIP process (e.g. Rosenfield 2010), this respondent proposes to base timing, initiation, and duration of protections for migration corridors in relation to the expected range of timing for each species' various life history stages portrayed in the DRERIP models. "Because the life histories of native fishes are very often cued to flow patterns in the Delta and these life histories probably evolved to capitalize on these flow patterns, the knowledge assembled in the DRERIP (or other) conceptual models must be combined with estimates of unimpaired flow patterns to form a baseline for a USEPA water quality performance metric."[164]

4. **Would establishing a migratory corridor for upmigrating adult Chinook salmon succeed in improving adult migration success if temperatures in the river channels upstream of Vernalis are unchanged? If so, how? How might actions to establish a migratory corridor in the south Delta also moderate temperature and/or dissolved oxygen problems in the San Joaquin River?** (2 answers)

[162] Sacramento Regional County Sanitation District (EPA-R09-OW-2010-0022.1)

[163] The Bay Institute (EPA-R09-OW-2010-0040.4)

[164] The Bay Institute (EPA-R09-OW-2010-0040.4)

Both respondents raise various issues that would need to be considered for a salmon migratory corridor to succeed. Both suggest that adequate flows in the Lower San Joaquin River might address or alleviate these issues.

For example:

> Any change in system hydrology could affect the physical, chemical, and biotic processes, and thus can affect related temperature and DO[165] conditions in the San Joaquin River…. Based on the identified need for additional studies to resolve the *existing* DWSC[166] DO impairment, it is apparent that it is unlikely that there is sufficient data or analytical techniques or modeling available at this time to predict how improving migratory conditions in the South Delta might change the lower San Joaquin River-South Delta temperature and DO conditions. That said, moving greater volumes of water through the system has the potential to improve both temperature and DO conditions in this portion of the system where flows have been low, and thus, water exchange rates have also been low.[167]

5. What additional efforts to improve dissolved oxygen regimes in the Delta are necessary to provide an adequate migratory corridor for San Joaquin salmonids? (3 responses)

The respondents express concerns about efforts beyond the Central Valley Regional Water Board's Dissolved Oxygen TMDL for the Lower San Joaquin River Deep Water Ship Channel. "[Our organization] does not support development of additional solutions for DO impairments in the DWSC until the current studies are completed and a determination of long-term solutions can be made," says one respondent who feels that supporting the implementation of studies and actions required by the Dissolved Oxygen TMDL for the DWSC was the best approach.[168] Or another, "EPA should use its Clean Water Act authorities to enforce the Act and ensure the TMDL is being achieved."[169] The head of an environmental organization disagrees with these positions:

> Additional efforts to eliminate dissolved oxygen impairment on the lower San Joaquin River are essential to restoring salmonids and other migratory fish (anadromous and pelagic) to the San Joaquin watershed. …USEPA should develop and promulgate new regulations for San Joaquin inflows throughout the year in order to protect spatial distribution (e.g. spawning

[165] Dissolved oxygen
[166] Deep Water Ship Channel
[167] Sacramento Regional County Sanitation District (EPA-R09-OW-2010-0022.1)
[168] Sacramento Regional County Sanitation District (EPA-R09-OW-2010-0022.1)
[169] Westlands Water District (EPA-R09-OW-2010-0037.1)

in the San Joaquin River and its tributaries) of public trust resources that use the Delta as a migratory corridor.[170]

6. What other information is available on the barriers to salmon migration on the San Joaquin River system? (2 responses)

Fremont Weir in the Yolo Bypass and the operation of salinity control gates in Suisun Marsh are mentioned as additional barriers to migration in the Bay Delta Estuary that are not covered in the ANPR. Studies published and compiled by the San Joaquin River Restoration Program and studies done in the Central Valley by biologists from various resource agencies (National Marine Fisheries Service, California Department of Fish and Game, DWR) are suggested as additional information sources on the issue.

WETLANDS

Five respondents answered questions on wetlands, including resource management agencies (2), an environmental organization (1), a private individual (1), and a regulated discharger (1).

Key Points

- ⇨ Respondents propose to consider ecological functions when permitting wetland activities, and develop ecosystem viability criteria for use in the permitting process.
- ⇨ Areas with concentrations of wetlands within the estuary (Suisun Marsh, for example) have consistently shown to have relatively higher populations of native fishes associated with them.
- ⇨ Protecting the integrity of hydro-geomorphic and ecological processes, along with the protection of upland buffer areas, are critical to the continuing evolution and existence of tidal marshes within the Estuary.

1. What different approaches under the Clean Water Act Section 404 program should EPA consider, in consultation with the U.S. Army Corps of Engineers, to improve the protection of aquatic resource functions in the Bay Delta Estuary? (5 responses)

Not all answers directly address the question, but those that do comment on the need to more fully consider ecological functions. One respondent proposes to explicitly consider the landscape level values of wetlands when permitting wetland activities, and develop ecosystem viability criteria for use in the permitting process.

[170] The Bay Institute (EPA-R09-OW-2010-0040.4)

2. What information exists that describes the relationship between the quantity and quality of wetlands and Bay Delta Estuary water quality and fish populations? (3 responses)

Not surprisingly, all respondents point to the scarcity of existing information on these relationships and, consequently, suggest further research in this area or making inferences from whatever information is available for the Bay-Delta and elsewhere. "Various monitoring efforts, such as those performed in Suisun Marsh and Yolo Bypass, can provide inferences about the relationship between the quantity and quality of wetland habitat and fish abundance/ health, "[171] states one respondent, and another:

> Very little information is available on the relation between these variables. It is known from other estuaries and in concept. There is information that suggests that the floodplain function of the Yolo Bypass is beneficial to out-migrating salmonid growth (DWR/ IEP and other references). Areas with concentrations of wetlands within the Estuary (Suisun Marsh, for example) have consistently shown to have relatively higher populations of native fishes associated with them (University of California-Davis reports, Schroeter and Moyle 2002, Matern et al 2002).[172]

3. In light of projected impacts of climate change (including sea level rise and its effects on levee stability), what specific activities can EPA undertake to improve long-term protection of existing and future wetlands, especially those resources on subsided islands? (3 comments)

One answer specifically addresses the question asked, i.e. what specific activities EPA can undertake to improve long-term protection of existing and future wetlands. The respondent, representing a federal resource agency, suggests:

> Tidal wetlands with good internal integrity and adjacent upland areas should allow wetland adaptation and movement with sea level change. Protecting hydrobiogeomorphic integrity and processes are critical to the continuing evolution and existence of tidal marshes within the Estuary. Subsided lands will need restoration efforts to accumulate sediments or organic matter prior to fully return to tidal influence before they can provide tidal marsh functions.[173]

[171] National Oceanic and Atmospheric Administration (EPA-R09-OW-2010-0050.1)

[172] US Fish and Wildlife Service (EPA-R09-OW-2010-0052.1)

[173] US Fish and Wildlife Service (EPA-R09-OW-2010-0052.1)

The respondent also points out that, "Protection of buffer lands is critical to the future of tidal marsh habitat."[174] One other respondent affirms the importance for EPA to take actions, whereas another suggests that, "Better information on how much sea level is anticipated to rise is needed for [farmers] to develop a plan on how to adapt their operations to prepare for the changes."[175]

CONCLUSION

There is a great deal of concern over future policy decisions affecting the Delta's resources, and this appears to have motivated many of the responses to the ANPR. At the core of these concerns are the values the Delta provides as a natural resource: "The California Delta is one of the greatest national assets we have", states a local resident.[176] Others provide related comments:

> The Delta supports a statewide agricultural industry that generates more than $30 billion in revenue annually and provides drinking water for tens of millions of California residents. Similarly, the state's salmon fishing industries — and the thousands of jobs they sustain — depend on the health of the Delta estuary….The San Joaquin Delta is far more, however, than a simple water resource for the state. The Delta is a unique place with a distinct economic and cultural heritage.[177]

> The residents of [our jurisdiction] rely on the Delta for their municipal and industrial water supply, for fishing and other forms of recreation, for work and as a place to live. The County has a strong interest in protecting Delta water quality, restoring the Delta sustainable ecosystem, and preserving the values of the Delta place to live, work and enjoy. The County looks to EPA as a leader by taking an independent look at the panoply of issues impacting the Bay-Delta today and providing its scientific expertise as necessary components of a comprehensive solution to these problems.[178]

Due to the Delta's significance and the complexity of issues, respondents appreciate the opportunity to provide input in EPA's strategic planning process. A representative of a large statewide discharger association puts it this way:

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[174] US Fish and Wildlife Service (EPA-R09-OW-2010-0052.1)

[175] County of Sacramento (EPA-R09-OW-2010-0020.1)

[176] Jamie Carey (EPA-R09-OW-2010-008)

[177] Jerry McNerney, Congress of the United States, House of Representatives (EPA-R09-OW-2010-061.1)

[178] Contra Costa County Department of Conservation and Development (EPA-R09-OW-2010-0049)

> We commend U.S. EPA Region 9 for soliciting broad-based input to assist it with developing a strategy to collaborate with the state of California on protecting the Delta, which is a vital national resource. We understand that U.S. EPA seeks input on all types of possible actions to protect Delta water quality, including but not limited to actions that would require rulemaking.[179]

The representative of a regulatory agency makes the same point: " Staff also appreciates the chance for regulators and other stakeholders to be part of that evaluation through the ANPR."[180] A public representative summarizes the widely shared expectation to be heard, here on behalf of his constituency:

> Thank you for soliciting public input on actions the Environmental Protection Agency (EPA) could potentially take to address water quality challenges in the Sacramento-San Joaquin Delta. As EPA considers future policy decisions, I insist that you closely consider the public comments you receive from residents of the San Joaquin Delta region.[181]

The intent of the ANPR was not always clearly understood by respondents. Most respondents appeared to understand that the ANPR was designed as an information gathering process for evaluating water quality challenges affecting fish and other estuarine resources in the Bay Delta Estuary. Seeking public comment through the ANPR was the first step in evaluating whether the EPA should be taking new or different actions under its programs to more effectively address water quality problems in the Bay Delta Estuary. However, several respondents seemed to think EPA issued the ANPR as a first step in asserting expanded regulatory and enforcement authority in the region. The following comments are representative of this confusion:

> The EPA seems to be treating this ANPR as the first step in EPA's assertion of enforcement jurisdiction over violations of California's NPDES permitting program.[182]

> As noted earlier in this letter, [we] are concerned that the Bay-Delta ANPR, after it discusses the too-long ignored key water quality issues that need priority attention, strays into flow related, state water rights issues that are outside federal jurisdiction.[183]

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[179] California Stormwater Quality Association (EPA-R09-OW-2010-0045.1)

[180] Central Valley Regional Water Quality Control Board (EPA-R09-OW-2010-00 21.1)

[181] Jerry McNerney, Congress of the United States, House of Representatives (EPA-R09-OW-2010-061.1)

[182] San Joaquin River Exchange Contractors Water Authority (EPA-R09-OW-2010-031.1)

[183] San Luis Delta & Mendota Water Authority, State Water Contractors (EPA-R09-OW-2010-00 38.1)

> We provide this information in hopes that the EPA can update and amend its scientific information, and with the caution that any rulemaking or regulatory action based on the current information… would not be defensible.[184]

More commonly, though, commenters welcome EPA's renewed commitment to addressing the Delta's serious water quality issues. And by the same token, commenters express support for the ANPR as an appropriate step in the right direction. One respondent, for example, states: "The [respondent] is pleased that EPA has begun to engage in a more comprehensive strategic planning process than in the past, recognizes the complexity of the environmental issues in the Delta, and has identified many of the diverse stressors that are acting on the Delta ecosystem."[185]

Repeatedly, respondents welcome the initiative as an opportunity for addressing the Delta's issues through improved coordination. One respondent states, "Given these challenging tasks, we are encouraged by EPA's efforts to address water quality conditions affecting aquatic resources in the San Francisco Bay/ Sacramento-San Joaquin Delta Estuary. To help coordinate our efforts with those of EPA, we offer the following comments on [the ANPR]. The [organization] is concerned with Delta water quality and any potential adverse impacts it may have on human health, the ecosystem and water supply. ….In 2010, the State Water Resources Control Board (Water Board) indicated that some of the most serious water quality problems in the Delta watershed and all of California are related to nonpoint source. The Water Board has programs to address these sources, but there remains a strong need to address the management of pollutants that are discharged from both and nonpoint sources into the Delta…. although significant efforts to address water quality problems in the Delta have already been implemented or are in development, we believe that this action by EPA is timely. State and federal agency assessments of Delta water quality continue to identify impairment of beneficial uses. Should EPA choose to take action to address Delta water quality problems, the following would be most helpful."[186]

In large and general, respondents view the ANPR as an opportunity to improve the effectiveness of regulations and the investment of public funding. As one respondent states:

> I am encouraged by EPA's investigations into new approaches to address water quality in the San Francisco Bay/ Sacramento-San Joaquin Delta Estuary.[187]

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[184] San Joaquin River Group Authority (EPA-R09-OW-2010-00 29.1)

[185] Coalition for a Sustainable Delta (EPA-R09-OW-2010-0043.1)

[186] Delta Stewardship Council (EPA-R09-OW-2010-0057.1)

[187] Environmental Incentives, LLC (EPA-R09-OW-2010-0046)

Appendices

Appendix A: Tables

Table 1: Response, by submission type

	Number	Percent each submission type	Percent total
All responses			
Federal Rulemaking Portal	40	100	73
Email[1]	11	100	20
Hardcopy[2]	4	100	7
TOTAL	**55**		**100**
Prepared Letters			
Federal Rulemaking Portal	30	75	55
Email[1]	3	27	6
Hardcopy[2]	4	100	7
Total	**37**		**67**
Additional Information			
Federal Rulemaking Portal	16	40	29
Email[1]	4	36	7
Hardcopy[2]	1	25	2
Total	**21**		**38**

1. Responses submitted only by email, excluding responses that were simultaneously submitted to the Federal Rulemaking Portal.
2. Responses submitted only by hardcopy, excluding responses that were simultaneously submitted to the Federal Rulemaking Portal or by email.

Table 2: Response, by affiliation

	Number	Percent
Response		
Affiliated[1]	32	58
Not affiliated[2]	23	42
TOTAL	**55**	100

1. Responses submitted on behalf of an organization.
2. Responses submitted by private individuals or small business owners.

Table 3: Response, by sector

	Number	Percent
Sector		
Academia	1	2
Government	15	27
Join powers authorities	1	2
Membership associations	8	15
Non-governmental organizations	6	11
Private business	6	11
Private individuals	16	29
Special status public agencies	2	4
TOTAL	**55**	**100**

Table 4: Response, by government agency type

	Number	Percent
Agency type		
Federal	4	27
Local	3	20
Regional	4	27
State	4	27
TOTAL	**15**	**100**

Table 5: Response, by perspective

	Number total	Percent total
Perspective		
Commodity group	1	2
Consultant	2	4
Environmental advocacy	6	11
Private individual/business	21	38
Regulated discharger	6	11
Regulatory authority	3	6
Research	1	2
Resource policy, planning, and management	9	16
Water agency	4	7
Water user	2	4
TOTAL	**55**	**100**

Table 6: Response to each topic, by perspective[1]

	Number	Percent each perspective	Percent total	Percent, excluding generic responses[2]
Contaminants				
Perspective				
Commodity group	0	0		0
Consultant	0	0		n/a
Environmental advocacy	2	33		40
Private individual/business	1	5		25
Regulated discharger	3	50		50
Regulatory authority	0	0		0
Research	0	0		n/a
Resource policy, planning, & mgmt	2	22		33
Water agency	0	0		0
Water user	0	0		0
Total response	**8**		**15**	**27**
Ammonia: Toxic and Nutrient Effects				
Perspective				
Commodity group	0	0		0
Consultant	0	0		n/a
Environmental advocacy	1	17		20
Private individual/business	0	0		0
Regulated discharger	3	50		50
Regulatory authority	0	0		0
Research	0	0		n/a
Resource policy, planning, & mgmt	2	22		33
Water agency	2	50		50
Water user	0	0		0
Total response	**8**		**15**	**27**
Selenium				
Perspective				
Commodity group	0	0		0
Consultant	0	0		n/a
Environmental advocacy	4	67		80
Private individual/business	1	5		25
Regulated discharger	2	33		33
Regulatory authority	1	33		50
Research	0	0		n/a
Resource policy, planning, & mgmt	2	22		33
Water agency	2	50		50
Water user	0	0		0
Total response	**12**		**22**	**40**

Table 6 (continued): Response to each topic, by perspective[1]

	Number	Percent each perspective	Percent total	Percent, excluding generic responses[2]
Pesticides				
Perspective				
Commodity group	1	100		100
Consultant	0	0		n/a
Environmental advocacy	2	33		40
Private individual/business	0	0		0
Regulated discharger	5	83		50
Regulatory authority	2	67		100
Research	0	0		n/a
Resource policy, planning, & mgmt	5	56		83
Water agency	2	50		50
Water user	1	50		50
Total response	**18**		**33**	**60**
Contaminants of Emerging Concern				
Perspective				
Commodity group	0	0		0
Consultant	0	0		n/a
Environmental advocacy	1	17		20
Private individual/business	1	5		25
Regulated discharger	3	50		50
Regulatory authority	0	0		0
Research	0	0		n/a
Resource policy, planning, & mgmt	1	11		17
Water agency	1	25		25
Water user	0	0		0
Total response	**7**		**13**	**23**
Estuarine Habitat				
Perspective				
Commodity group	0	0		0
Consultant	0	0		n/a
Environmental advocacy	2	33		40
Private individual/business	0	0		0
Regulated discharger	0	0		0
Regulatory authority	0	0		0
Research	0	0		n/a
Resource policy, planning, & mgmt	1	11		17
Water agency	1	25		25
Water user	1	50		50
Total response	**5**		**9**	**17**

Table 6 (continued): Response to each topic, by perspective[1]

	Number	Percent each perspective	Percent total	Percent, excluding generic responses[2]
Fish Migration Corridors				
Perspective				
Commodity group	0	0		0
Consultant	0	0		n/a
Environmental advocacy	1	17		20
Private individual/business	0	0		0
Regulated discharger	1	17		17
Regulatory authority	0	0		0
Research	0	0		n/a
Resource policy, planning, & mgmt	3	33		50
Water agency	2	50		50
Water user	0	50		50
Total response	**7**		**13**	**23**
Wetlands				
Perspective				
Commodity group	0	0		0
Consultant	0	0		n/a
Environmental advocacy	1	17		20
Private individual/business	1	5		25
Regulated discharger	1	17		50
Regulatory authority	0	0		0
Research	0	0		n/a
Resource policy, planning, & mgmt	2	22		33
Water agency	0	0		25
Water user	0	0		0
Total response	**5**		**9**	**17**
Additional Comments[3]				
Perspective				
Commodity group	1	100		
Consultant	2	100		
Environmental advocacy	5	83		
Private individual/business	18	86		
Regulated discharger	3	67		
Regulatory authority	2	100		
Research	1	100		
Resource policy, planning, & mgmt	9	100		
Water agency	4	100		
Water user	1	50		
Total response	**46**		**84**	

1. Responses addressing one, several, or all questions to a topic.
2. Excluding responses not addressing any of the specific questions.
3. General comments not addressing any specific question.

Table 7: Response, by interest

	Number total	Percent total
Interest		
Agriculture	2	4
Boating	1	2
Environmental protection	5	9
Land use	1	2
Natural resources management	7	13
Public involvement	25	46
Renewable energy	1	2
Science	1	2
Stormwater	2	4
Wastewater	3	6
Water supply	7	13
TOTAL	**55**	**100**

Table 8: Response, by involvement

	Number total	Percent total
Involvement		
Business/industry	11	20
Environmental group	6	11
Federal agency/national authority	4	8
Local agency/authority	5	9
Personal	12	22
Recreational group	1	2
Regional agency/authority	9	16
State agency/authority	5	9
TOTAL	**55**	**100**

Table 9: Response to each topic, by interest in the Delta[1]

	Number	Percent each group	Percent total	Percent, excluding generic responses[2]
Contaminants				
Interest				
Agriculture	0	0		0
Boating	0	0		n/a
Environmental protection	0	0		0
Land use	0	0		n/a
Natural resources management	2	29		33
Public involvement	3	12		33
Renewable energy	0	0		n/a
Science	0	0		n/a
Stormwater	1	50		50
Wastewater	2	67		67
Water supply	0	0		0
Total response	**8**		**15**	**27**
Ammonia: Toxic and Nutrient Effects				
Interest				
Agriculture	0	0		0
Boating	0	0		n/a
Environmental protection	0	0		0
Land use	0	0		n/a
Natural resources management	2	29		33
Public involvement	1	4		11
Renewable energy	0	0		n/a
Science	0	0		n/a
Stormwater	1	50		50
Wastewater	2	67		67
Water supply	2	29		33
Total response	**8**		**15**	**27**

Table 9 (continued): Response to each topic, by interest in the Delta[1]

	Number	Percent each group	Percent total	Percent, excluding generic responses[2]
Selenium				
Interest				
Agriculture	0	0		0
Boating	0	0		n/a
Environmental protection	1	20		50
Land use	0	0		n/a
Natural resources management	2	29		33
Public involvement	5	20		56
Renewable energy	0	0		n/a
Science	0	0		n/a
Stormwater	0	0		0
Wastewater	2	67		67
Water supply	2	29		33
Total response	**12**		**22**	**40**
Pesticides				
Interest				
Agriculture	2	100		100
Boating	0	0		n/a
Environmental protection	2	40		100
Land use	0	0		n/a
Natural resources management	5	71		83
Public involvement	2	8		22
Renewable energy	0	0		n/a
Science	0	0		n/a
Stormwater	2	100		100
Wastewater	2	67		67
Water supply	3	43		50
Total response	**18**		**33**	**60**

Table 9: Response (continued): Response to each topic, by interest in the Delta[1]

	Number	Percent each group	Percent total	Percent, excluding generic responses[2]
Contaminant of Emerging Concern				
Interest				
Agriculture	0	0		0
Boating	0	0		n/a
Environmental protection	0	0		0
Land use	0	0		n/a
Natural resources management	1	14		17
Public involvement	2	8		22
Renewable energy	0	0		n/a
Science	0	0		n/a
Stormwater	1	50		50
Wastewater	2	67		67
Water supply	1	14		17
Total response	**7**		**13**	**23**
Estuarine Habitat				
Interest				
Agriculture	0	0		0
Boating	0	0		n/a
Environmental protection	0	0		0
Land use	0	0		n/a
Natural resources management	1	14		17
Public involvement	2	8		22
Renewable energy	0	0		n/a
Science	0	0		n/a
Stormwater	0	0		0
Wastewater	0	0		0
Water supply	2	29		33
Total response	**5**		**9**	**17**

Table 9: Response (continued): Response to each topic, by interest in the Delta[1]

	Number	Percent each group	Percent total	Percent, excluding generic responses[2]
Fish Migration Corridors				
Interest				
Agriculture	0	0		0
Boating	0	0		n/a
Environmental protection	0	0		0
Land use	0	0		n/a
Natural resources management	3	43		50
Public involvement	1	4		11
Renewable energy	0	0		n/a
Science	0	0		n/a
Stormwater	0	0		0
Wastewater	1	33		33
Water supply	2	29		33
Total response	**7**		**13**	**23**
Wetlands				
Interest				
Agriculture	0	0		0
Boating	0	0		n/a
Environmental protection	0	0		0
Land use	0	0		n/a
Natural resources management	2	29		33
Public involvement	2	8		22
Renewable energy	0	0		n/a
Science	0	0		n/a
Stormwater	1	50		50
Wastewater	0	0		0
Water supply	0	0		0
Total response	**5**		**9**	**17**

Table 9: Response (continued): Response to each topic, by interest in the Delta[1]

Additional Comments[3]	Number	Percent each group	Percent total
Interest			
Agriculture	1	50	
Boating	1	100	
Environmental protection	4	80	
Land use	1	100	
Natural resources management	7	100	
Public involvement	21	84	
Renewable energy	1	100	
Science	1	100	
Stormwater	1	50	
Wastewater	2	67	
Water supply	6	86	
Total response	**46**		**84**

1. Responses addressing one, several, or all questions to a topic.
2. Excluding responses not addressing any of the specific questions.
3. General comments not addressing any specific question.

Table 10: Response to each topic, by involvement in the Delta[1]

	Number	Percent each type of involvement	Percent total	Percent, excluding generic responses[2]
Contaminants				
Involvement				
Business/industry	1	9		17
Educational	0	0		n/a
Environmental group	2	33		40
Federal agency/national authority	1	25		33
Local agency/authority	0	0		0
Personal	0	0		0
Recreational group	0	0		n/a
Regional agency/authority	3	33		38
State agency/authority	1	20		25
Total response	**8**		**15**	**27**
Ammonia: Toxic and Nutrient Effects				
Involvement				
Business/industry	0	0		0
Educational	0	0		n/a
Environmental group	1	17		20
Federal agency/national authority	2	50		67
Local agency/authority	1	20		50
Personal	0	0		0
Recreational group	0	0		0
Regional agency/authority	4	44		50
State agency/authority	0	0		0
Total response	**8**		**15**	**27**
Selenium				
Involvement				
Business/industry	2	18		33
Educational	0	0		n/a
Environmental group	4	67		80
Federal agency/national authority	1	25		33
Local agency/authority	1	20		50
Personal	1	8		50
Recreational group	0	0		n/a
Regional agency/authority	2	22		25
State agency/authority	1	20		25
Total response	**12**		**22**	**40**

Table 10 (continued): Response to each topic, by involvement in the Delta[1]

	Number	Percent each type of involvement	Percent total	Percent, excluding generic responses[2]
Pesticides				
Involvement				
Business/industry	2	18		33
Educational	0	0		n/a
Environmental group	2	33		40
Federal agency/national authority	2	50		67
Local agency/authority	1	20		50
Personal	0	0		0
Recreational group	0	0		n/a
Regional agency/authority	7	78		88
State agency/authority	4	80		100
Total response	**18**		**33**	**60**
Contaminants of Emerging Concern				
Involvement				
Business/industry	0	0		0
Educational	0	0		n/a
Environmental group	1	17		20
Federal agency/national authority	1	25		33
Local agency/authority	1	20		50
Personal	1	20		50
Recreational group	0	0		n/a
Regional agency/authority	3	33		38
State agency/authority	0	0		0
Total response	**7**		**13**	**23**
Estuarine Habitat				
Involvement				
Business/industry	1			
Educational	0			
Environmental group	2			
Federal agency/national authority	1			
Local agency/authority	1			
Personal	0			
Recreational group	0			
Regional agency/authority	0			
State agency/authority	0			
Total response	**5**		**9**	**17**

Table 10 (continued): Response to each topic, by involvement in the Delta[1]

	Number	Percent each perspective	Percent total	Percent, excluding generic responses[2]
Fish Migration Corridors				
Involvement				
Business/industry	0	0		0
Educational	0	0		n/a
Environmental group	1	17		20
Federal agency/national authority	3	75		100
Local agency/authority	1	20		50
Personal	0	0		0
Recreational group	0	0		n/a
Regional agency/authority	2	22		25
State agency/authority	0	0		0
Total response	**7**		**13**	**23**
Wetlands				
Involvement				
Business/industry	0	0		0
Educational	0	0		n/a
Environmental group	1	17		20
Federal agency/national authority	3	75		100
Local agency/authority	0	0		0
Personal	0	0		0
Recreational group	0	0		n/a
Regional agency/authority	1	11		13
State agency/authority	0	0		0
Total response	**5**		**9**	**17**

Table 10 (continued): Response to each topic, by involvement in the Delta[1]

Total response	**5**	**9**	**17**
Additional Comments[3]			
Involvement			
Business/industry	7	64	
Educational	1	100	
Environmental group	5	83	
Federal agency/national authority	4	100	
Local agency/authority	5	100	
Personal	10	83	
Recreational group	1	100	
Regional agency/authority	9	100	
State agency/authority	4	80	
Total response	**46**	**84**	

1. Responses addressing one, several, or all questions to a topic.
2. Excluding responses not addressing any of the specific questions.
3. General comments not addressing any specific question.

Appendix B: List of Respondents

AquAlliance, Chico, CA
Marcus Balanky
Bay Area Clean Water Agencies
Gene Beley, Stockton, CA
Jim Bell
Pat Borison
David Brown, Elk Grove, CA
California Coastkeeper Alliance, Fremont, CA
California Department of Pesticide Regulation
California Natural Resources Agency, Sacramento, CA
California Sportfishing Protection Alliance, Stockton, CA
California Stormwater Quality Association, Menlo Park, CA
California Water Impact Network, Santa Barbara, CA
Jamie Carey
CASA
Central Delta Water Agency, Stockton, CA
Central Valley Clean Water Association
Central Valley Regional Water Quality Control Board, Rancho Cordova, CA
City of Antioch, CA
Clean Water Action, San Francisco, CA
Coalition for a Sustainable Delta, Bakersfield, CA
Congress of the United States, Washington, DC
Contra Costa County, Martinez, CA
Thomas J. Cordano, Sacramento, CA
County of Sacramento
Crisi Matthews Real Estate
Delta Stewardship Council, Sacramento, CA
Discovery Bay Yacht Club
David Ford, Fair Oaks, CA
Environmental Incentives, South Lake Tahoe, CA
Jon A. Hammari, Carmichael, CA
Dr. Irwin Haydock
Larry Ladd
Natural Resources Defense Council
No information provided (2)
Northern California Water Association, Sacramento, CA
Pacific Advocates
Sacramento Regional County Sanitation District, Sacramento, CA
Sacramento Valley Water Quality Coalition, Sacramento, CA
San Francisco Bay Regional Water Quality Control Board, Oakland, CA
San Francisco Estuary Partnership

San Joaquin Exchange Contractors Water Authority, Los Banos, CA
San Joaquin River Group Authority
San Louis & Delta-Mendota Water Authority, Los Banos, CA
SCAP
Seafood Suppliers Inc., San Francisco, CA
Terry Spragg
Robert Stanley, Chico, CA
State Water Contractors, Sacramento, CA
Douglas Stocks, Oroville, CA
Student
The Bay Institute
TriTAC
United States Department of Commerce, Long Beach, CA
United States Department of the Interior, Sacramento, CA
University of Nevada, Reno, NV
Valley Permit Services
Western Plan Health Association, Sacramento, CA
Western States Petroleum Association
Westlands Water District, Fresno, CA