California Regional Water Quality Control Board
San Francisco Bay Region

RESPONSE TO WRITTEN COMMENTS
on October 2011 Tentative Order for
Central Contra Costa Sanitary District Wastewater Treatment Plant
5019 Imhoff Place, Martinez, Contra Costa County

The Regional Water Board received written comments from the following parties on a tentative order distributed in October 2011 for public comment:

1. Central Contra Cost Sanitary District
2. San Luis & Delta-Mendota Water Authority and State Water Contractors
3. San Francisco Baykeeper

This response to their comments summarizes each comment in *italics* followed by the Regional Water Board staff response. For the full content and context of each comment, refer to the comment letters.

In addition, we identify below staff-initiated changes to the tentative order. These changes modify Attachment G, Regional Standard Provisions, and Monitoring and Reporting Requirements, to be consistent with current circumstances.

CENTRAL CONTRA COSTA SANITARY DISTRICT

District Comment 1: ***The District requests several revisions to the facility information for accuracy and clarity.*** *The District requests several specific revisions to the tentative order in underline/strikeout format to improve accuracy and clarity.*

Response: We agree and revised the tentative order to reflect them.

District Comment 2: ***The District requests clarification of the minimum dilution requirements.*** *The District requests revisions to Prohibition III.B and Fact Sheet sections IV.A.2, section IV.A.4, and section IV.C.4.b regarding the minimum initial dilution requirement. The District thinks the revisions are more consistent with the prohibition's derivation and written so that the provision cannot be interpreted to apply under all possible conditions.*

Response: We agree and revised the tentative order. However, we did not revise it exactly as suggested. Instead, we revised Prohibition III.B to clarify that the dilution ratio refers to the nominal dilution at the outfall and added the following sentence:

> Compliance shall be achieved by proper operation and maintenance of the discharge outfall to ensure that it (or its replacement, in whole or in part) is in good working

order and is consistent with, or can achieve better mixing than, that described in the Fact Sheet (Attachment F). The Discharger shall address measures taken to ensure this in its application for permit reissuance.

This revision is consistent with the text we are now using in other permits under development. It requires that the outfall diffuser be maintained so as to ensure that the dilution assumptions underlying the permit's requirements remain valid. Accordingly, we revised Fact Sheet section IV.A.2 to explain that we used a dilution credit of 44:1 in the calculation of one or more water quality-based effluent limitations, based on available information about the dilution at the outfall, and that this prohibition is necessary to ensure that our assumptions remain valid. We also revised Fact Sheet section II.A.4 to add a more detailed description of the diffuser.

We revised Fact Sheet sections IV.A.4 and IV.C.4.b consistent with the District's suggestions.

District Comment 3: ***The District requests that the narrative chronic toxicity effluent limitation more accurately reflect the appropriate Basin Plan language.*** *The District requests that the narrative chronic toxicity effluent limit be revised because language is more stringent than what is required in the Basin Plan. The Basin Plan states that "there shall be no chronic toxicity in ambient waters." The language included in the tentative order indicated that there was to be no chronic toxicity in the effluent, which did not allow for any dilution at the outfall.*

Response: We agree and revised the tentative order to more accurately reflect the appropriate Basin Plan language.

District Comment 4: ***The District requests removal the requirement to measure pH, temperature, and ammonia concurrently in both effluent and receiving water.*** *The District requests removing Footnote 8 from Table E-3, which had required that ammonia samples be collected concurrently with effluent and receiving water monitoring for temperature and pH. The Regional Monitoring Program (RMP) is responsible for receiving water monitoring, and it is impractical to coordinate sampling timing between organizations. Also, the footnote is unnecessary because effluent pH and temperature are reported daily and will certainly be available for the one day per month that the 24-hour composite ammonia sample is collected.*

Response: We agree and revised the tentative order.

District Comment 5: ***The District requests that detailed chronic toxicity test information be required to be retained on site, but not reported.*** *The District questions the value of providing the requested level of detail about chronic toxicity tests (in addition to the results) in PDF format with electronic self-monitoring reports and suggests that it would be sufficient to instead retain those records onsite and available for review.*

Response: We disagree. We review this background information regarding the chronic toxicity tests, including the detailed information about how the tests were performed, to ensure permit compliance. Without this information, we cannot always understand the results in their appropriate context.

District Comment 6: ***The District requests Table E-4 be revised to eliminate the requirement to collect multiple grab samples for pretreatment monitoring and a reduction in monitoring frequencies for volatile organic compounds (VOCs) and base/neutrals and acids extractable organic compounds (BNAs).***

Table E-4 contains monitoring requirements for pretreatment and biosolids. The District requests that the Regional Water Board reduce the monitoring frequencies for VOCs and BNAs from quarterly to semi-annually based on its evaluation of historical data, which were rarely measured above detection levels.

The District also requests that it be allowed to continue collecting a single grab sample for certain constituents in place of multiple grab samples equally spaced over a 24-hour period. The District thinks that multiple grab samples would not provide any additional benefit, and it is not a practical use of staff resources.

Response: We agree and revised the tentative order.

District Comment 7: ***The District requests a correction to the rationale for including copper effluent limits.*** *The District notes that the justification for establishing copper effluent limitations was in error because the maximum effluent concentration (12 µg/L does) not exceed the governing water quality objective (14 µg/L).*

Response: We agree and revised the tentative order. Our revision cites the specific Basin Plan provision that requires the copper limit.

District Comments 8 and 9: ***The District requests revisions for clarity.*** *The District requests to eliminate the word "minimum" from the BOD and TSS removal requirements in Table 6 and to refer to Appendix A for a definition of "RP" in Provision VI.C.3.c(1).*

Response: We disagree. We retained the word "minimum" to clarify that BOD and TSS removal is a minimum limit, whereas all other limits in Table 6 are maxima. We did not refer to the definition of "RP" in Attachment A because doing so is unnecessary and, as it is, the wording of Provision VI.C.3.c(1) is taken directly from the State Implementation Policy.

District Comments 10 — 16: ***The District notes typographical errors.*** *The District noted error in Attachment B, MRP section VIII.C.1, Fact Sheet section IV.A.3, Table F-7, Fact Sheet section IV.C.4.c(4)(c), Fact Sheet section IV.C.4.c(4)(c), Fact Sheet section VI.E, and Fact Sheet section VI.E.*

Response: We revised the tentative order.

SAN LUIS & DELTA-MENDOTA WATER AUTHORITY AND STATE WATER CONTRACTORS (Water Agencies)

Water Agencies Introductory Comments: ***The Water Agencies request designated party status.*** *The Water Agencies request designated party status, claiming they have a direct interest in the tentative order. They also summarize the state of knowledge regarding potential ammonia impacts on Suisun Bay and offer three remedies they hope the Water Board will consider. These remedies are discussed further in Water Agencies Comments IV.A, IV.B, and IV.C.*

Response: We are not formally designating parties for this tentative order because doing so will not limit or enhance any party's rights under these proceedings. Designating parties is normally unnecessary for NPDES hearings; it is more common for enforcement hearings. A designated party has the right to submit evidence, is allowed to cross-examine during hearings, and is subject to the same time limits during hearings as other parties, such as the discharger (in contrast, "interested" parties can only make policy comments and cannot offer evidence). However, our standard NPDES hearing practices provide all these rights anyway, even without formal designation. The Water Agencies have had the same opportunity to submit written comments and evidence as all other parties, will be offered the same amount of time for oral comments at the hearing, and will have the same ability to cross-examine (if they so choose) as everyone else.

Regarding the three remedies the Water Agencies ask the Water Board to consider, see our responses to Water Agencies Comments IV.A, IV.B, and IV.C, below.

Water Agencies Comment I: ***The tentative order does not address ammonium discharges.*** *The Water Agencies contend that the tentative order does not address ammonium discharges and object to its water quality-based ammonia effluent limits being higher than the plant's current ammonia discharge concentrations. The Water Agencies contend that, because some other wastewater treatment plants remove ammonia, requiring this plant to remove ammonia would not require a new or unproven technology.*

Response: We agree that the tentative order did not explicitly address ammonium discharges. We revised the tentative order (Fact Sheet section IV.C.7) to include findings related to ammonium. The ammonia limits proposed in the tentative order were based only on the Basin Plan's un-ionized ammonia objective. These limits were based on water quality requirements, not the actual discharge or current performance.

We agree that technology for additional ammonia removal is available. However, U.S. EPA's technology-based requirements for municipal wastewater treatment plants (i.e., the secondary treatment standards) do not require ammonia removal. We believe more information is needed before imposing an ammonium limit that requires additional treatment. We are working with the Bay Area Clean Water Agencies (BACWA) to obtain this information (see Exhibit 1 for some of our correspondence with BACWA). In the interim, we revised the tentative order (Table 7 and

Fact Sheet section IV.C.7) to incorporate a mass-based effluent limit that reflects existing ammonium treatment performance (see response to Water Agencies Comment IV.C).

Water Agencies Comment II: ***Uncontrolled ammonium discharges could adversely affect beneficial uses.*** *The Water Agencies call on the Water Board to review available scientific information and contend that available information points to the need for ammonia removal. Essentially, the Water Agencies contend that there is reasonable potential for the discharge to cause or contribute to violations of water quality standards; therefore, effluent limits are necessary to address ammonium discharges. The Water Agencies note that (1) excessive ammonium is toxic to copepods, (2) excess ammonium inhibits nitrogen uptake by diatoms and reduces diatom primary production, (3) nutrient discharges affect algal communities by changing nutrient ratios to favor harmful species, and (4) nutrient removal at wastewater treatment plants improves ecosystems and aquatic life where implemented.*

Response: We agree that available scientific information provides cause for concern. We do not agree that existing information is sufficient to require additional ammonia removal from the District's discharge at this time. Available information may not be as conclusive as the Water Agencies suggest. The copepod ammonium toxicity is not an issue for Suisun Bay because the ammonia concentrations observed in Suisun Bay are well below the low observed effect concentration derived in the studies. The potential for ammonium from the District's discharge to inhibit phytoplankton productivity in Suisun Bay exists, but needs to be evaluated in the context of other possible factors that could also affect productivity. Finally, scientists disagree about whether changing nutrient ratios are harming Suisun Bay algal communities.

More information is needed to understand the relative contributions of the various Suisun Bay ammonia sources to Suisun Bay ammonia concentrations and their impacts (for example, tidal action likely affects various ammonia sources differently). While the Suisun Bay ammonia load from the upstream Sacramento County Regional plant is similar in magnitude to the District's load, the District's discharge is located at the western end of Suisun Bay, close to where Suisun Bay flows into the Carquinez Strait and San Pablo Bay. It is likely that the District's actual contribution to Suisun Bay effects is much smaller than that of the Sacramento County Regional plant because a much larger portion of the District's ammonia flows out of Suisun Bay soon after discharge.

Efforts are underway to obtain the information we need to better evaluate ammonia's potential water quality effects throughout our region. Our approach is consistent with SIP section 1.3, step 8, which indicates that when available data are insufficient to complete a reasonable potential analysis, monitoring should be required as necessary to determine whether an effluent limit is appropriate. We are working with the Bay Area Clean Water Agencies (BACWA) and other stakeholders to complete necessary studies and engage in joint fact finding, We plan to complete this work in time for the District's next permit reissuance (see Exhibit 1).

Water Agencies Comment III.A: ***The tentative order should not provide a dilution credit for ammonium.***

The Water Agencies contend that the tentative order is flawed in providing a dilution credit for ammonium. They make six points:

1. *They assert that the tentative order says a mixing zone cannot be evaluated due to the complex hydrology of San Francisco Bay, and further assert that it is illogical to provide full dilution credit such that calculated limits are less stringent than current performance.*
2. *They point out that, when the Basin Plan states, "…ammonia will be diluted or degraded to a nontoxic state fairly rapidly," it refers to un-ionized ammonia, not ammonium.*
3. *They note that the Basin Plan cautions against providing a dilution credit for a discharge to a tidal zone. They then object to there being no finding justifying proposed effluent limits greater than those calculated from water quality objectives.*
4. *They mention that the dilution study indicates that mixing does not persist in the far field, beyond the zone of initial dilution. Therefore, the study only presents findings for initial dilution.*
5. *They say the Basin Plan cautions against relying on models because they only estimate initial dilution. None accounts for tidal currents.*
6. *They argue that the tentative order does not address ammonium concentrations found to be toxic to copepods and to inhibit diatom productivity; therefore, the tentative order is insufficiently protective.*

Response: We disagree that the ammonia dilution credit in the tentative order is unjustified. The Water Agencies' concerns regarding the ammonia dilution credit appear to be misplaced since, as the Water Agencies correctly point out, the tentative order's ammonia limits are based solely on the Basin Plan's un-ionized ammonia objective. The proposed limits do not address ammonium concerns and were not intended to do so. Dilution credit may be appropriate for un-ionized ammonia, but it may or may not be appropriate for ammonium. See our response to Water Agencies Comment IV.C regarding revisions to the tentative order that address ammonium. Our responses to the Water Agencies' six points are as follows:

1. The tentative order does *not* say a mixing zone cannot be evaluated. It describes the challenges in establishing a mixing zone and estimating dilution, and, considering these challenges, it justifies limiting dilution credits to reflect only initial dilution or even more so in some circumstances. The proposed dilution credits are based on the properties of the outfall and conservatively account for uncertainties regarding mixing within receiving waters.

2. We agree that the quoted Basin Plan text regarding ammonia dilution and degradation pertains to un-ionized ammonia. Since the tentative order only addressed un-ionized ammonia, it was consistent with this portion of the Basin Plan. Nevertheless, we note that un-ionized ammonia and ammonium always exist together in equilibrium; as one form degrades, so does the other.

3. The Basin Plan describes challenges related to estimating dilution for discharges to tidal waters; it does not prohibit doing so. Moreover, it does not prohibit limiting dilution credits

to reflect only initial dilution, as the tentative order does. By not accounting for dilution by tidal action, the proposed ammonia dilution credit is more conservative than it would otherwise be. Contrary to the Water Agencies' comment, the ammonia limits in the tentative order are based on un-ionized ammonia water quality objectives; therefore, no special findings are necessary. Providing a dilution credit does not mean a resulting limit is not based on water quality objectives. The Basin Plan allows higher limits than those based on water quality objectives if justified to encourage water recycling, but that is not the case here.

4. We agree that the dilution study only presents findings for initial dilution. It does not account for far-field mixing. Therefore, the proposed dilution credit conservatively reflects only initial dilution. It does not, as the Water Agencies imply, reflect any additional far-field dilution.

5. The Basin Plan describes challenges related to modeling discharges to tidal waters. It does not prohibit far-field dilution modeling that incorporates tidal mixing. However, since such models are not readily available, most dilution studies (including the one cited in this tentative order) are limited to initial dilution, which is more conservative.

6. We agree that Suisun Bay ammonium concentrations provide cause for concern and that the tentative order did not address these concerns. We address them in our responses to Water Agencies Comments IV.A, IV.B, and IV.C, below, and in the revised tentative order (Table 7 and Fact Sheet sections VI.C.1.c and IV.C.7).

Water Agencies Comment III.B: ***The tentative order does not comply with anti-backsliding and antidegradation policies.***

The Water Agencies object to the tentative order's conclusion that, because the previous permit did not contain ammonia limits, the proposed new limits comply with anti-backsliding requirements. The Water Agencies also object to the tentative order's conclusion that the proposed ammonia limits comply with antidegradation requirements.

The Water Agencies cite antidegradation policies that apply when allowing waste flows or concentrations to increase in high quality waters and require effluent limits based on best practicable treatment or control (BPTC). The Water Agencies claim the tentative order would increase Suisun Bay ammonia concentrations because its limits are higher than the maximum observed effluent concentration. They also claim it would allow a 30 percent increase over existing discharge flows, thus increasing ammonia loads.

The Water Agencies warn against relying on prior California Environmental Quality Act (CEQA) documentation to comply with antidegradation policies. They call for revising the antidegradation analysis and recirculating the tentative order for public comment.

Response: We disagree. The tentative order complies with anti-backsliding and antidegradation requirements. Anti-backsliding requirements relate to changing effluent limits from one permit to the next. Reissued permits may not contain less stringent effluent limits than those in the permits they replace, except under specific circumstances. Because the previous permit did not contain

ammonia effluent limits, this tentative order could not possibly contain less stringent ammonia effluent limits. Therefore, it complies with anti-backsliding requirements.

Antidegradation requirements relate to changes in receiving water quality. Water Board actions, such as issuing permits, cannot result in water quality degradation, except under specific circumstances. The baseline water quality condition for comparison purposes is the water quality that reflects all past regulatory and permitting actions approved in accordance with antidegradation policies. In this case, the ammonia baseline is the condition that reflects the previous permit, which the Water Board issued in accordance with antidegradation policies. When compared to the previous permit, the tentative order could not possibly degrade Suisun Bay water quality with respect to ammonia. Contrary to the Water Agencies' claim, the tentative order does not authorize any increase in effluent flow or ammonia concentrations beyond those the previous permit allowed. The Water Agencies incorrectly compare the permitted flow to the actual existing flow. The permitted flow in the tentative order is the same as it was in the previous permit. The Water Agencies also incorrectly compare the proposed ammonia limits to actual effluent concentrations. The previous permit contained no ammonia effluent limit. Therefore, by imposing an ammonia limit for the first time, the tentative order is more stringent than the previous permit and could only improve water quality, not degrade it. No CEQA document is necessary to support this conclusion. For these reasons, no findings justifying degradation are necessary, and there is no need to recirculate the tentative order for further comment.

Antidegradation policy set forth in State Water Board Resolution 68-16 requires that effluent limits be based on best practicable treatment or control (BPTC) to ensure that pollution or nuisance will not occur and that the highest water quality consistent with maximum benefit to the people of California will be maintained. U.S. EPA specifies technology-based limitations for municipal wastewater treatment plants. These "secondary treatment standards" do not require ammonia removal, and other municipal treatment plants in our region that discharge into deep water do not routinely treat to a higher standard. Nevertheless, the plant's existing treatment is clearly practicable; therefore, we revised the tentative order (Table 7 and Fact Sheet section IV.C.7) to include new performance-based ammonia effluent limits.

Water Agencies Comment IV.A: ***The Water Board should reduce ammonium discharges by requiring nitrification.***

The Water Agencies ask the Water Board to set final effluent limits that require nitrification (and possibly denitrification) and provide a compliance schedule for designing and building the additional treatment. They call for interim limits based on the maximum observed ammonia discharge concentration. The Water Agencies assert that, because other municipal wastewater treatment plants provide nitrification, feasible technologies are practicable and must be required as BPTC pursuant to antidegradation policies.

Response: We disagree. Although we may require some plants to provide nitrification (and possibly denitrification) in the future, requiring such treatment would be a big step and should be undertaken only after gaining a better understanding of the water quality benefits. Nitrification is also costly and consumes substantial energy, resulting in significant air emissions and other

environmental impacts. While we agree that there are good reasons to be concerned about Suisun Bay ammonium concentrations, we do not believe available information is yet sufficient to require nitrification by the District (see response to Water Agencies Comment II). We are working with BACWA to obtain sufficient information (see Exhibit 1).

As discussed in our response to Water Agencies Comment III.B, we do not believe antidegradation policies necessarily require nitrification as BPTC at all municipal wastewater treatment plants. U.S. EPA's technology-based limitations for municipal wastewater treatment plants do not require ammonia removal. Nevertheless, we revised the tentative order (Table 7 and Fact Sheet section IV.D) to include new performance-based ammonia effluent limits.

Water Agencies Comment IV.B: ***The Water Board should defer permit reissuance until pending studies are completed.***

The Water Agencies suggest, as an alternative to requiring nitrification now, delaying permit reissuance until pending studies are completed and ammonia effluent limits may be established with more certainty.

Response: We disagree. NPDES permits are to be reissued every five years. The existing permit expires on March 31, 2012. It will take several more years to complete the studies necessary to develop ammonia limits that account for ammonium impacts. We are working with BACWA to obtain this information (see Exhibit 1), but the studies will take time. Postponing adoption until they are completed serves no purpose. This is unnecessary because the five-year permit term ensures that the entire permit will be reconsidered within about five years.

Water Agencies Comment IV.C: ***The Water Board should more effectively address ammonium.***

The Water Agencies' offer a third suggestion for reducing ammonium discharges if the Water Board decides to reissue the permit on time and is not yet prepared to require nitrification. In this case, the Water Agencies urge the Water Board to adopt findings acknowledging that ammonium could be harming Suisun Bay and describing studies underway to address these concerns. They ask the Water Board to establish a schedule for completing the studies and to ensure the funding necessary to complete them. They also ask the Water Board to commit to reconsidering the ammonia issue within 12 months and provide opportunities for public participation. Finally, they ask the Water Board to impose effluent limits based on actual treatment performance.

Response: We agree, mostly. We revised the tentative order (Fact Sheet section IV.C.7) to include findings related to ammonium. We also revised the tentative order (section VI.C.1.c) to allow the Water Board to reopen the permit and reconsider ammonium issues when more information is available. Prior to any Water Board action on this matter, it would provide opportunities for public participation, as it does with any permit reissuance or amendment. We did not, however, commit the Water Board to reopen the permit within 12 months. In our view, more time will be needed to complete necessary studies (note the schedule set forth in our correspondence with BACWA, Exhibit 1).

We revised the tentative order (Table 7 and Fact Sheet section IV.C.7) to incorporate a new performance-based ammonia effluent limit because the plant's existing treatment is clearly practicable. To avoid inadvertently imposing a disincentive for water conservation and recycling, the new limit is mass-based, calculated by multiplying average ammonia concentration by the plant's designed flow capacity.

SAN FRANCISCO BAYKEEPER

Baykeeper Comment 1: ***The tentative order must include effluent limitations for residual chlorine and settleable matter.***

Baykeeper says the Basin Plan requires all NPDES permits for wastewater treatment facilities protect beneficial uses by limiting residual chlorine discharges to 0.0 mg/L and settleable matter discharges to 0.2 ml/1-hour per day and 0.1 ml/1-hour per on average over 3 days (Basin Plan Table 4-2).

Response: We disagree. Residual chlorine effluent limits are unnecessary because the District does not use chlorine to disinfect its wastewater. It uses ultra-violet radiation. Likewise, settleable matter effluent limits are unnecessary because Basin Plan Table 4-2 does not require them. In the past, Basin Plan Table 4-2 required settleable matter limits for all treatment facilities, but this requirement, found in footnote d, has since been removed for settleable matter. The settleable matter limits had become outdated for municipal wastewater treatment plants since they were historically used to evaluate primary treatment. All municipal wastewater treatment plants must now meet more stringent secondary treatment standards.

Baykeeper Comment 2: ***The tentative order must conduct a reasonable potential analysis that addresses pharmaceuticals, chemicals from personal care products, and sediment toxicity.***

Baykeeper says the tentative order's reasonable potential analysis ignores several pollutants likely in the wastewater, such as antibiotics, contraceptives, various medicines, nanoparticles from sunscreen, and chemical fragrances. It says these substances may cause ecological and human harm, noting, for example, that triclosan (the active ingredient in many antibacterial products) has been detected in San Francisco Bay, is toxic to aquatic organisms, and bioaccumulates within the food web. At a minimum, Baykeeper requests monitoring for pharmaceuticals and personal care products.

Baykeeper also says the tentative order should evaluate the potential for sediments to impair Suisun Bay. According to the State Water Board's "Water Quality Control Plan for Enclosed Bays and Estuaries—Part 1, Sediment Quality", sediments are not to have pollutants that harm benthic communities, wildlife, resident finfish, or human health. Baykeeper faults the tentative order for dismissing the sediment quality objectives because "there is no evidence directly linking compromised sediment conditions to the discharges subject to this Order." Instead,

Baykeeper says the tentative order should require sediment pollutant monitoring to evaluate the need for additional limits during the next permit cycle.

Response: We did not revise the tentative order. We are unaware of promulgated water quality standards that would allow us to perform a reasonable potential analysis for the compounds Baykeeper suggested. While we share some of Baykeeper's concern that some of the compounds have been detected in the Bay, there is insufficient information to specifically determine if the levels detected are causing actual problems, or how to translate a potential problem into a numeric limit.

Until sufficient information is available, the tentative order, like nearly all other permits in this region, would require compliance with the Basin Plan's toxicity objective through acute and chronic toxicity testing and compliance with limitations if appropriate. Toxicity tests would measure unregulated pollutants, such as personal care products and pharmaceuticals, or pollutants with synergistic effects, in the discharges. Both of these tests are conducted on the most sensitive species available and serve as indicators for protecting all other aquatic life. Including mortality, the chronic toxicity tests specifically measure sublethal impacts, such as changes in reproduction or growth, from these unregulated compounds.

That said, we are working with the San Francisco Estuary Institute (SFEI) to better understand personal care products and pharmaceuticals, and to identify any that we should target for further monitoring. For example, SFEI measured triclosan at detectable concentrations in San Francisco Bay, but found the concentrations to be less than the known toxicity threshold for this pollutant. Moving forward, SFEI has a workgroup through the Regional Monitoring Program (RMP) that is addressing emerging contaminants and is expected to produce a report on next steps in spring 2012. The RMP has and is currently funded in large part by all San Francisco Bay dischargers.

Regarding sediment monitoring, the tentative order would require the District to participate in the RMP. Through this effort, additional sediment toxicity data are being collected that will allow us to revisit whether the discharge may be impacting sediment quality. The State Water Board's *Water Quality Control Plan for Enclosed Bays and Estuaries—Part 1, Sediment Quality* requires a multiple lines of evidence approach (toxicity, chemistry, and benthos) to determine impairment. For San Francisco Bay sites identified as impacted, SFEI is working on how to conduct a stressor analysis to determine the causal factors behind toxicity. This is a necessary step before we can conduct a linkage analysis to identify sources of sediment toxicity. Given the complex nature of assessing sediment quality, we believe it is most effective to require all San Francisco Bay dischargers to support the RMP as opposed to requiring individual dischargers to attempt this complex and costly work by themselves.

STAFF INITIATED CHANGES

In addition to making minor formatting and typographical edits, Water Board staff made the following revisions to Attachment E, Monitoring and Reporting Program. These changes modify Attachment G, Regional Standard Provisions, and Monitoring and Reporting Requirements, to be

consistent with current circumstances. The revisions to Attachment G are shown in underline/~~strikeout~~ format.

We revised MRP section VIII.A as follows:

A. General Monitoring and Reporting Requirements

The Discharger shall comply with all Federal Standard Provisions (Attachment D) and Regional Standard Provisions (Attachment G) related to monitoring, reporting, and recordkeeping, with modifications shown in section VIII.D below.

We added MRP section VIII.D as follows:

D. Modifications to Attachment G

1. Attachment G sections V.C.1.f and V.C.1.g are revised as follows, and section V.C.1.h (Reporting data in electronic format) is deleted.

f. Annual self-monitoring report requirements

By the date specified in the MRP, the Discharger shall submit an annual report to the Regional Water Board covering the previous calendar year. The report shall contain the following:

1) Annual compliance summary table of treatment plant performance, including documentation of any blending events (this summary table is not required if the Discharger has submitted the year's monitoring results to CIWQS in electronic reporting format by EDF/CDF upload or manual entry);

2) [Subsection V.C.1.f.2 is unchanged from Attachment G.]

3) Both tabular and graphical summaries of the monitoring data for the previous year if parameters are monitored at a frequency of monthly or greater (this item is not required if the Discharger has submitted the year's monitoring results to CIWQS in electronic reporting format by EDF/CDF upload or manual entry);

[Subsections V.C.1.f.4 through V.C.1.f.7 are unchanged from Attachment G.]

g. Report submittal

The Discharger shall submit SMRs addressed as follows, unless the Discharger submits SMRs electronically to CIWQS:

California Regional Water Quality Control Board
San Francisco Bay Region

1515 Clay Street, Suite 1400
Oakland, CA 94612
Attn: NPDES Wastewater Division

h. Reporting data in electronic format – Deleted

2. Attachment G sections V.E.2, V.E.2.a, and V.E.2.c are revised as follows, and sections V.E.2.b (24-hour Certification) and V.E.2.d (Communication Protocol) are deleted.

2. Unauthorized Discharges from Municipal Wastewater Treatment Plants[1]

The following requirements apply to municipal wastewater treatment plants that experience an unauthorized discharge at their treatment facilities and ~~are consistent with and~~ supersede requirements imposed on the Discharger by the Executive Officer by letter of May 1, 2008~~, issued pursuant to California Water Code Section 13383~~.

a. Two (2)-Hour Notification

For any unauthorized discharges that ~~result in a discharge to~~ enter a drainage channel or a surface water, the Discharger shall, as soon as possible, but not later than two (2) hours after becoming aware of the discharge, notify the ~~State Office of~~ California Emergency ~~Services~~ Management Agency (CalEMA currently 800-852-7550), the local health officers or directors of environmental health with jurisdiction over the affected water bodies, and the Regional Water Board. ~~The~~ Timely notification by the Discharger to CalEMA also satisfies notification to the Regional Water Board~~'s online reporting system at www.wbers.net, and~~. Notification shall include the following:

[Subsections V.E.2.a.1 through V.E.2.a.6 are unchanged from Attachment G.]

b. 24-hour Certification – Deleted

c. 5-day Written Report

Within five business days, the Discharger shall submit a written report~~, via the Regional Water Board's online reporting system at www.wbers.net,~~ that includes, in addition to the information required above, the following:

[Subsections V.E.2.c.1 through V.E.2.c.7 are unchanged from Attachment G.]

d. Communication Protocol – Deleted

[1] California Code of Regulations, Title 23, Section 2250(b), defines an unauthorized discharge to be a discharge, not regulated by waste discharge requirements, of treated, partially treated, or untreated wastewater resulting from the intentional or unintentional diversion of wastewater from a collection, treatment or disposal system.

Exhibit 1

Matthew Rodriquez
Secretary for
Environmental Protection

California Regional Water Quality Control Board
San Francisco Bay Region

1515 Clay Street, Suite 1400, Oakland, California 94612
(510) 622-2300 • FAX (510) 622-2460
http://www.waterboards.ca.gov/sanfranciscobay

Edmund G. Brown Jr.
Governor

January 24, 2012
CIWQS Place IDs 213875, 219552, and 270006

Bay Area Clean Water Agencies
Attn: Amy Chastain, Executive Director
P.O. Box 24055
Oakland, California 94623

Dear Ms. Chastain:

SUBJECT: Water Board Support for Nutrient Strategy Development and Implementation

We support the proposal by the Aquatic Science Center and the San Francisco Estuary Institute, *Nutrient Strategy Development and Implementation: A proposal to BACWA and the San Francisco Bay Regional Water Quality Control Board* (revised January 18, 2012), and we appreciate the Bay Area Clean Water Agencies' (BACWA's) support as well. The potential impacts of nutrient discharges on San Francisco Bay water quality in general, and ammonium discharges on Suisun Bay water quality in particular, are of increasing concern and not well understood. We believe this proposal will allow the Water Board and BACWA to take necessary next steps to inform future decisions, and we look forward to working closely with BACWA as we move forward.

Consistent with the proposal, our goal is to collect sufficient information for sound decision-making by February 2016, prior to considering the Central Contra Costa Sanitary District's NPDES permit for reissuance. We understand that the path to reach our goal is uncertain; therefore, we look forward to approaching these studies adaptively and seeking input from scientific experts and others with a stake in San Francisco Bay water quality. We recognize that the scope of future work will depend on the outcomes of our initial efforts. Therefore, we support the overall schedule set forth in the proposal, with the understanding that it could change.

We believe the proposal, which BACWA has agreed to fund, at least initially, provides the certainty we need to ensure that this important work will proceed without delay. Naturally, we assume that BACWA will fund future efforts as roughly outlined in the proposal. If not, we reserve our right and responsibility to require appropriate dischargers to submit necessary information pursuant to California Water Code § 13267. To ensure that adequate progress on the proposal continues through the coming years, we request that routine progress reports be submitted at least annually.

Please use Naomi Feger, the Water Board's Chief of Planning, as BACWA's contact for carrying out the proposal and for the nutrient strategy in general. She is reachable at NFeger@waterboards.ca.gov or 510-622-2328.

Sincerely,

Digitally signed by Bruce Wolfe
Date: 2012.01.24 15:33:15 -08'00'

Bruce H. Wolfe
Executive Officer

Cc: James Kelly, Central Contra Costa Sanitary District
Gary Darling, Delta Diablo Sanitary District
Ronald Matheson, Vallejo Sanitation and Flood Control District
David Senn, Aquatic Science Center / San Francisco Estuary Institute

January 18, 2012

Mr. Bruce Wolfe
California Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, CA 94612

RE: BACWA Support for Development and Implementation of a Nutrient Science and Management Strategy

Dear Mr. Wolfe:

I am writing on behalf of the Bay Area Clean Water Agencies (BACWA) to inform you that, on December 19, the BACWA Executive Board approved funding for a work to help advance the understanding of potential nutrient-related impacts on San Francisco Bay water quality and to develop numeric nutrient endpoints (NNEs). The attached proposal was developed by the San Francisco Estuary Institute/Aquatic Science Center (SFEI/ACS) as requested by BACWA, and in coordination with San Francisco Bay Regional Water Quality Control Board (Regional Water Board) staff.

The proposal consists of three work elements; identified as high priority projects by SFEI/ASC, the Regional Water Board and BACWA:

- **Work Element #1. Coordination of Nutrient Strategy Development and Implementation**

This element will enable refinement of the preliminary Nutrient Strategy already developed by the Regional Water Board and based on the NNE Literature Review and Data Gaps analysis. It will also provide resources to develop more detailed work plans and funding proposals for parts of the Strategy that are currently only captured in general terms. An important component of this element will be the convention of stakeholder and technical advisory groups to assist with refining goals, developing work plans, identifying priority projects, and strategizing about funding mechanisms.

- **Work Element #2. Box Models and Budgets, Suisun Bay and South Bay: Hypothesis testing and sensitivity analysis**

This element will build upon conceptual model work funded by the Regional Monitoring Program (RMP) for completion in 2012 and the phytoplankton assessment framework funded by the Water Boards in 2012. The outcomes will be numeric box models for Suisun Bay and the South Bay, which are critical links between the conceptual models and future three dimensional dynamic simulation models. These models will assist with generating and testing hypotheses; quantifying the relative importance of processes; and performing sensitivity analysis to help identify critical data gaps. In addition, these models will be used to evaluate biological response under future scenarios in these Bay segments (e.g., decreased nutrient loads, changes in flow from the Delta, changes in nitrogen speciation due to potential addition of a nitrification step at wastewater treatment plants, continued decreases in suspended sediment loads, etc.).

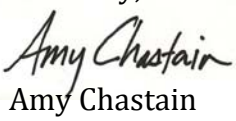
- **Work Element #3: Suisun Bay Study Plan Development**

Questions about the potential relationship between ammonia, nutrients, and other stressors in the Suisun Bay and the decline of protected pelagic fish species have been raised by this Regional Water Board, the Central Valley Regional Water Board, and stakeholders (including agencies that rely on water from the Central Valley Water Project). These issues are also identified in the NNE Literature Review and the current version of the Nutrient Strategy as requiring further investigation. This element is a logical next step towards resolving existing uncertainties. Specific deliverables include: (1) a draft study plan summarizing existing knowledge related to beneficial use impairment from ionized ammonia, describing ongoing studies, and identifying additional studies to address knowledge gaps; (2) a technical report on the life cycles of diatoms and copepods suspected of being adversely affected by ammonia, nutrients and other stressors in the system; and (3) a Suisun Bay model that builds upon work element two (described above) and that is consistent with the Bay-Delta wide modeling plan being developed within the nutrient strategy.

This work will be carried out by the San Francisco Estuary Institute and Aquatic Science Center (SFEI/ASC), in cooperation with the Regional Water Board, BACWA, other regional stakeholders, and regional scientists. It supplements and complements work previously undertaken by SFEI/ASC and funded by BACWA, including the June 2011 Nutrient RMP Workshop and South Bay nutrient load refinement. It is also consistent with work in progress related to the Surface Water Ambient Monitoring Program-funded Suisun Bay Work Plan which BACWA and the Central Contra Costa Sanitary District have supported and the Regional Monitoring Program's 2012 nutrient studies recently approved by the Steering and Technical Review Committees.

In early 2012, we anticipate working with SFEI/ASC and Regional Water Board representatives to develop the details necessary to implement this $350,000 proposal. We believe that this effort is a good start towards a cohesive plan that will provide strong scientific and technical bases for future scientific studies and models that can then be used understand nutrient-related impacts on the Bay and ultimately guide management decisions to further protect the San Francisco Bay Estuary.

Sincerely,



Amy Chastain
Executive Director

Attachment: Nutrient Strategy Development and Implementation: A proposal to BACWA and the San Francisco Bay Regional Water Quality Control Board

CC: Tom Mumley, SFBRWQCB
Naomi Feger, SFBRWQCB
Lila Tang, SFBRWQCB
Bill Johnson, SFBRWQCB
Vince Christian, SFBRWQCB
David Senn, SFEI/ASC
Gary Darling, Delta Diablo Sanitary District
Amanda Roa, Delta Diablo Sanitary District
BACWA Executive Board

Nutrient Strategy Development and Implementation: A proposal to BACWA and the San Francisco Bay Regional Water Quality Control Board

David Senn, PhD.
Aquatic Science Center and
San Francisco Estuary Institute

December 19, 2011, revised
January 18, 2012.

1. Introduction

San Francisco Bay has long been recognized as a nutrient-enriched estuary, but one that has historically proven resilient to the harmful effects of nutrient enrichment, such as excessive phytoplankton blooms and hypoxia. However, evidence is building that, since the late 1990s, the historic resilience of the Bay to the harmful effects of nutrient enrichment is weakening, as shown through significant increases in phytoplankton biomass (e.g., Cloern et al., 2007) and through hypothesized linkages between elevated ammonium and decreased diatom primary productivity rates (e.g., Dugdale et al. 2007).

Concurrently, the State Water Resources Control Board (State Board) has begun developing numeric objectives for nutrients in estuaries, and has adopted the Nutrient Numeric Endpoint (NNE) framework for this work. The NNE framework utilizes biological indicators as endpoints combined with load-response modeling to determine nutrient loads to estuaries that are protective of beneficial uses. The California Regional Water Quality Control Board, San Francisco Region, (Regional Water Board) is using the NNE approach to develop nutrient objectives for the San Francisco Bay. An early product of that effort was a literature review (McKee et al., 2011) that identifies candidate biological indicators for the Bay and important science and data gaps that need to be addressed along the path to setting nutrient objectives.

In response to the apparent changes in the Bay's resilience to nutrient loading and recognizing the need for nutrient objectives, Regional Water Board staff and various Bay stakeholders have begun the process of developing a Nutrient Strategy. An initial draft strategy was developed in 2011, with a main goal of laying out a well-reasoned and cost-effective program to generate the scientific understanding needed to fully support major management decisions related to nutrients. The draft strategy has four main work elements: i) defining the problem; ii) monitoring program development and implementation; iii) developing a nutrient assessment framework; iv) developing a modeling strategy that can be used to assess potential impacts of various management actions.

Within the framework of the Regional Water Board and BACWA's cooperative effort on nutrients in San Francisco Bay, this proposal requests funds to support on-going nutrient strategy development, and to begin work on two sets of high priority projects. The proposal consists of three work elements: Work Element #1: Coordination of Nutrient Strategy Development and Implementation; Work Element #2: Box Models and Budgets, Suisun Bay and South Bay: Hypothesis testing and sensitivity analysis; and Work Element #3: Suisun Bay Study Plan Development. This work will be carried out by the SFEI/ASC in collaboration with the Southern California Coastal Water Research Project (SCCWRP), and in cooperation with the Regional Water Board, BACWA, other regional stakeholders, and regional scientists.

2. Work Element 1: Coordination of Nutrient Strategy Development and Implementation.

Numerous organizations are either funding or actively engaged in nutrient-related work in the Bay-Delta Estuary (e.g., the Regional Water Board, Central Valley Regional Water Board, Interagency Ecological Program (IEP), United States Geographical Survey (USGS), Romberg Tiburon Center, State and Federal Contractors Water Agency (SFCWA), Delta Stewardship Council (DSC), BACWA, Bay Area Stormwater Management Agencies Association (BASMAA), and the California Department of Water Resources). However, there is limited coordination between these efforts, and no overarching set of science or management goals, or a cohesive science plan, across Bay segments and into the Delta. A nutrient science and management strategy for the Bay-Delta Estuary is urgently needed so that work is carried out in a coherent, complementary, and prioritized fashion.

This work element focuses on coordinating the on-going development of an Estuary-wide nutrient strategy that has broad-base support among the stakeholder and regulatory/management communities. For jurisdictional reasons, an initial focus will be placed on the Bay-proper (west of and including Suisun Bay), however upstream factors that strongly influence Suisun and downgradient Bay segments (e.g., nutrient loads, flow) will obviously remain major considerations.

Work Process and Deliverables

The draft nutrient strategy (September 2011) will serve as the baseline document for further strategy development. The major deliverable of Work Element #1 will be a revised draft nutrient strategy that describes management questions and goals, major work elements that address the questions/goals, sub-tasks within each work element, and detailed work plans or scopes of work. To the extent possible, a draft funding strategy will also be developed. An additional deliverable will be a Bay-Delta nutrient website that will serve as a clearinghouse for information (news, downloadable reports, links to related websites, calendar), and a related listserv.

SFEI/ASC and will work with the Regional Water Board, BACWA and other stakeholders on the process for developing the strategy documents, including the organizational structure/process for decision-making. SFEI/ASC staff will meet with scientists with expertise in this area to refine goals and develop the detailed scientific work plans. Smaller meetings, or sub-committee meetings, with program managers (e.g., IEP, DSC) and stakeholders groups are also envisioned to identify priority projects and strategize about ways to fund work. To inform the website development, an informal survey of anticipated users will be conducted in the first quarter of 2012 to identify content that will be most useful. SFEI/ASC will work with the Regional Water Board, as requested, to ensure that documents - including

agendas, meeting minutes and reports - will be made available to Regional Water Board staff in a timely fashion so they can be posted on the agency's website.

Deliverables will include the draft nutrient strategy, which will be completed by November 2012. The website and listserv will be on-line by April 2012.

3. Work Element 2: Box Models and Budgets, Suisun Bay and South Bay: Hypothesis testing and sensitivity analysis.

Nutrient dynamics and biological response to nutrient loads in San Francisco Bay are highly complex and highly variable in both space and time. The published literature suggests that the accumulation of phytoplankton biomass in the Bay is strongly limited by tidal mixing, grazing pressure by invasive clams, and light limitation from high turbidity. In addition, it is hypothesized that, in the North Bay, elevated levels of ammonium actually inhibit diatom primary productivity and contribute to relatively low levels of phytoplankton biomass there (Dugdale et al., 2007). However, the relative importance of these processes on the food web is poorly understood, and it is thus difficult to determine what are the main drivers, and in turn anticipate changes in biological response to future changes in the system. Further, to date, there has been limited quantitative assessment of nutrient budgets in Bay segments, and such budgets are needed to, for example, assess the importance of internal sources and sinks (mineralization of organic matter in the sediments and nitrogen and phosphorous flux to the water column, denitrification at the sediment water interface).

A major component of the NNE framework is the use of "load-response" models to translate numeric endpoints into sustainable load estimates. A recent report sponsored by BACWA (BACWA 2011) recommended a staged approach to nutrient and water quality model development in the Bay, beginning with conceptual model development, and followed by numeric models of increasing complexity, as needed. The San Francisco Bay Regional Monitoring Program (RMP) has funded a nutrient conceptual model project that began in January 2012. This project will develop spatially and temporally explicit conceptual models for individual Bay segments. It will also evaluate scenarios for future changes to key drivers/factors that influence biological responses to nutrient loads, prioritize scenarios that could be investigated through future modeling efforts, and additional scientific investigations to address critical knowledge gaps. A critical intermediate step between conceptual models and three-dimensional (3D) dynamic simulation models is the development of numeric box models for individual Bay segments.

This work element proposes to develop box models for Suisun Bay and South Bay for the purposes of generating and testing hypotheses; quantifying the relative importance of different processes; performing sensitivity analysis to help identify critical data gaps and will support evaluation of proposed indicators as part of the

NNE. In addition, these models will be used to evaluate biological responses under future scenarios in these Bay segments (e.g., decreased nutrient loads, changes in flow from the Delta, changes in nitrogen speciation due to potential addition of a nitrification step at wastewater treatment plants, continued decreases in suspended sediment loads, etc.). Work will begin by convening a Model Evaluation Group (MEG) to develop a modeling plan. Work Element #2 will consider models that are already under development by USGS and the San Francisco State University's Romberg Tiburon Center for Environmental Studies (SFSU-RTC), and those researchers will be integrally involved as project advisors (USGS: J. Cloern, J. Kuwabara; SFSU-RTC: R. Dugdale, A. Parker). This effort will also include consideration of research/models available nationwide. This is a two year project, beginning in the third quarter of 2012.

Work Process and Deliverables

This study will be designed around addressing questions with clear management implications and with direct linkages to beneficial uses. Although secondary producers will be included in the model (e.g., zooplankton, clams), this is not intended to be a food web model or assess changes to the food web. Instead, secondary producers have been added as top-down controls on the accumulation of phytoplankton biomass. The main endpoints of interest for this work will be phytoplankton biomass and dissolved oxygen, and using mass balance constraints to gain a better understanding of internal processes and loads. Some examples of the modeling goals and approach are described below. However, a key task of the MEG will be to identify the main questions to be addressed through the modeling work, approaches for incorporating key processes into the model, and the appropriate model platform. A draft technical report produced by the MEG will be reviewed by a stakeholder advisory group, and stakeholder comments will be addressed in a final version.

For South Bay, key questions to be addressed through modeling work may include: What conditions would generate water-quality impairment such as hypoxia or chlorophyll concentration beyond a threshold, or significant shifts in the algal community composition given today's nutrient loading? How much must nutrient inputs be reduced to prevent these impairments? How would the Bay respond to a steady increase in air temperature or reduced freshwater inflow and flushing? How would it respond to a steady increase in water transparency?

For Suisun Bay the questions would be somewhat different. Relevant and testable questions include: How relatively important are ammonium, nutrients, and other stressors; light limitation; and clam grazing as controls on annual primary production or algal community composition? How would phytoplankton biomass in Suisun Bay respond to reductions in ammonium loading and reductions in nitrogen loading? How would phytoplankton biomass respond to changes in the speciation of nitrogen loaded to the system (i.e., nitrate instead of ammonium, due to

nitrification in POTWs)? Under the above scenarios, what is the relative importance of freshwater flow (e.g. wet versus dry year and current water supply scenarios versus planned changes in flows). For both sets of models, best estimates of current and future loads will be needed. Thus, results from another RMP-funded study that will quantify loads to individual Bay segments will serve as important input. Planned changes at the Sacramento County Regional Wastewater Treatment Plant will explicitly be taken into account for future scenarios in Suisun Bay. The relative importance of loads from the Central Contra Costa Sanitary District (CCCSD), the Delta Diablo Sanitation District (DDSD), and other discharges will also be evaluated under those conditions.

The model for South Bay will be developed as a two-layer box model to allow for vertical stratification and bloom formation in the surface stratified layer. Suisun Bay will be set up as a two-compartment horizontal model to represent the shallow and deep waters. In both models, water column boxes will be coupled to sediment process boxes. Dynamic components will include: a small number of phytoplankton life forms (e.g., diatoms, flagellates, cyanobacteria), ammonium, nitrate+nitrite, zooplankton, light attenuation coefficient, and dissolved oxygen. Key processes will include: vertical mixing (wind and tides); horizontal transport across boundaries; nutrient inputs; benthic regeneration; nitrification-denitrification; pelagic regeneration; ammonium and nitrate uptake; growth rate as a function of internal nitrogen pools, light, temperature; zooplankton grazing; benthic grazing; photosynthesis; pelagic respiration; benthic respiration; and air-water oxygen exchange.

Researchers at USGS and SFSU-RTC have initial models that already include many of these parameters. The focus of this project will be on continued model development, as well as model calibration and validation, and on future scenario analysis. If time and funding permit during the two-year project, the core model features developed through the box model work will be incorporated into a coarse spatially explicit box model of the whole Bay (e.g., the Uncles-Peterson model). This would be a logical next step, building toward implementation of a full 3D model.

It is anticipated that this project will be carried out by a PhD-level scientist with a strong background in both modeling and biogeochemistry. This scientist will be hired for a two-year position and will be based at SFEI, but work closely with researchers at USGS and RTC for model development. Deliverables will include regular project updates (6 month intervals), as well as draft and final reports. This project will continue until approximately June 2014. While BACWA is only being asked to fund this work though 2012, BACWA has expressed a commitment to ensure that funding is made available for subsequent years.

4. Work Element #3: Suisun Bay Study Plan Development

Several nutrient-related issues in Suisun Bay have recently been brought to the forefront by Regional Water Board staff due to time-sensitive considerations around the reissuance of the CCCSD discharge permit. The issues are related to:

- the extent to which loads from CCCSD and DDSD, and other discharges, affect ammonia/ammonium concentrations in different parts of Suisun Bay and over different seasons;
- the impact of other ammonium sources on ammonia/ammonium concentrations (e.g., including sediment flux.);
- how temporal variations in Suisun Bay ammonium concentrations relates to diatom and copepod life cycles, driven by concerns over potential ammonium inhibition of diatom primary production and ammonium toxicity to copepods.

The potential role that elevated ammonium levels play in beneficial use impairment in Bay-Delta Estuary were explored during a 2009 CALFED Bay-Delta workshop and a subsequent Central Valley Regional Water Quality Control Board Ammonia Summit. The CALFED Bay-Delta workshop resulted in a research framework that proposed a number of research topics.[1]

Several of the issues raised by the San Francisco and Central Valley Regional Water Boards, and identified in the Ammonia Summit summary, specific to Suisun Bay, are currently being explored in studies carried out through a Regional Water Board-coordinated effort, in collaboration with the SFCWA, SFSU-RTC, BACWA, and CCCSD. Additional relevant studies are also being carried out through the IEP as part of the Bay-Delta program. Some of these studies are ongoing, and for others final syntheses have not yet been completed.

In addition, resolving scientific issues related to ammonium in Suisun Bay has been envisioned as an important component of the nutrient strategy. As such, a synthesis of the science related to ammonium, nutrients and other stressors on beneficial uses in Suisun Bay are planned within the context of Work Element #1 and an RMP-funded conceptual model and problem definition study for the Bay. However, the focus and level of detail required exclusively for Suisun Bay extends beyond the intended scopes of those projects and will require additional resources.

[1] A Framework for Research Addressing the Role of Ammonia/Ammonium in the Sacramento-San Joaquin Delta and the San Francisco Bay Estuary Ecosystem, available at http://www.swrcb.ca.gov/centralvalley/water_issues/delta_water_quality/ambient_ammonia_concentrations/ammonia_mem.pdf.

Work Process and Deliverables

Three components and deliverables are proposed to address time-sensitive questions related to ammonium studies in Suisun Bay. Work on these deliverables will commence in 2012, but will likely extend beyond 2012, as discussed further below. See Section 5 for schedule deliverable due dates. One of the goals of these studies is to enable Regional Water Board staff to make decisions related to permit reissuance by February 2016.

The first deliverable will be a study plan that summarizes existing knowledge related to beneficial use impairment from ionized ammonia in Suisun Bay, describes recently completed or on-going studies - including the Regional Water Board's ongoing Suisun Bay study - and identifies additional studies needed to address persistent knowledge gaps. As noted above, some of this work falls generally within the scope of Work Element #1 and the conceptual model studies being sponsored by the RMP, and this deliverable is meant to complement and augment those efforts. The study plan will propose a schedule for completion of additional studies identified and a schedule, dependent on identifying future funding, for completion of the deliverables identified in the work elements discussed below. It is anticipated that the study plan will be revisited annually as part of annual progress report submittal and adjustments will be recommended to Regional Water Board staff. The study plan may also be adaptively managed as an element of the overall nutrient strategy.

A second deliverable under Work Element #3 will be a technical report that: i) describes the life cycles of the diatoms and copepods shown, or suspected, to be adversely impacted by ammonia (e.g., feeding, reproduction, salinity tolerances, population dynamics, etc.); ii) summarizes available information regarding the potential impacts of ammonia on these biological resources (e.g., toxicity and other adverse effects); iii) explores the potential role of nutrients and other stressors in the system; iv) identifies remaining critical information gaps.

A third work product will be a Suisun Bay model, provided that funding is available beyond 2012. The efforts in work element #2 should identify the key questions that need to be addressed through modeling (e.g., contribution of CCCSD and DDSD, and other discharges, to ammonium concentrations at various points in space and time within Suisun Bay, nutrient dynamics, and linkages to biological endpoints), the modeling approaches/platforms needed to address these questions, and data/research needs for calibrating and validating the model. The understanding gained from box-modeling work described in Work Element #2 will contribute significantly to developing a Suisun Bay specific model for ammonium, as will the RMP-sponsored conceptual model. The model for Suisun Bay should ideally be consistent with the Bay-Delta wide modeling plan.

Due to the complex nature of these questions, the myriad researchers addressing them, and the fact that highly relevant studies are being carried out in Spring 2012

(with sample analysis and data interpretation ongoing through Fall 2012), developing these work products is expected to be an iterative process. Work will commence on Work Element #3 in 2012, and will include activities such as literature review, meetings with regional scientists and workgroups carrying out studies. In addition to the annual progress reports, other progress updates will be provided as necessary. Work on some of these deliverables will extend beyond 2012, with the focus, scope, budget, and funding to be refined through discussions with Regional Water Board, stakeholders, and technical experts as part of the development of the study plan.

5. Schedule and Budget

The budget and schedule below are estimates and will be refined as needed. This funding is anticipated to be sufficient for all 2012 deliverables, although it is expected that additional costs will arise in 2012 associated with coordinating strategy development and implementation. These include convening technical teams (travel, honarium or per diem), holding stakeholder meetings (e.g., lunch, refreshments), funding experts to contribute to the writing of technical reports, and regional travel expenses for SFEI staff to attend meetings.

Funding and schedules for work completed beyond 2012 will be agreed upon by the Regional Water Board, BACWA and other stakeholders.

	Dates[2]	**2012 Funding**
Work Element #1: Nutrient Strategy		$200,000
Revised Nutrient Strategy	Nov. 2012	
Website	Apr. 2012	
Listserv	Apr. 2012	
Coordination & Reporting[3]	NA	
Work Element #2: Suisun and South Bay Box Models		$75,000[4]
Box model study plan	Jun. 2012	
Model data compilation	Nov. 2012	
Final model technical report[4]	Jun. 2014	
Work Element #3		$75,000
Draft Suisun Bay study	Sep. 2012	
Suisun Bay study plan	Dec. 2012	

[2] Dates are estimates and are contingent on funding.
[3] Includes coordination for Elements #2 and 3 and reporting on the status to the Regional Water Board and stakeholders.
[4] $75k supports the first six months of effort for this two-year task, which is 25% of its anticipated total cost through June 2014.

Ammonium impacts technical report	Jun. 2013
Suisun Bay model	Feb. 2014
Final synthesis report	Feb. 2016
Total	**$350,000**