California Rice Commission
East San Joaquin Water Quality Coalition
Kings River Water Quality Coalition
Sacramento Valley Water Quality Coalition
Tule Basin Water Quality Coalition
Western Growers Association
Western Plant Health Association
Westside San Joaquin River Watershed Coalition

May 14, 2014

Via Electronic Mail Only

Dr. Charles Burt, Chair
Agricultural Expert Panel
c/o Jeanine Townsend, Clerk to the Board
State Water Resources Control Board
1001 I Street, 24th Floor
Sacramento, CA 95814
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SUBJECT: Comments for Agricultural Expert Panel Consideration

Dear Dr. Burt and Members of the Expert Panel:

The agricultural organizations listed above have reviewed the questions presented to the Expert Panel by staff of the State Water Resources Control Board (State Board), and appreciate the opportunity to provide written comments to the Expert Panel. Accordingly, the signatory agricultural organizations have prepared the following responses to each question. The comments provided here were prepared with the assistance of John Dickey, Ph.D., who is a Certified Professional Soil Scientist and Certified Crop Advisor-Agronomist, in collaboration with the signatory agricultural organizations.

As a preliminary matter, we believe it important for the Expert Panel to understand and recognize that responses to the questions below must be considered in context with respect to the purpose of the information, and for whose purposes the information is developed. In other words, it is important to identify the intended audience and use of the information such as indicating if the information in question is to be used by growers, third party groups such as the agricultural coalitions, or regulatory agencies such as the regional water quality control boards (regional boards). Where appropriate, we have endeavored to make such distinctions in our responses. Further, we encourage the Expert Panel to consider this important factor in its deliberations. The Draft Report as issued by the Expert Panel should be clear as to its recommendations, and for whose benefit the recommendations are provided.

In general, the comments provided below can be summarized into four main themes that correspond to the four key categories in which the questions have been organized: vulnerability and risk assessment, application of management practices, verification measures, and reporting.

- **Vulnerability and Risk Assessment.** To determine vulnerability and/or risk for the purposes of focusing regulatory attention, we support the methodologies currently being used by several of the Central Valley agricultural water quality coalitions in developing their Groundwater Assessment Reports (GAR). Specifically, two GARs have been completed and submitted to the Central Valley Regional Water Quality Control Board (Central Valley Water Board) for review and/or approval. The two reports to date are the GAR as prepared by the California Rice Commission, and the GAR as prepared by the East San Joaquin Water Quality Coalition. The California Rice Commission GAR has been approved by the Central Valley Water Board, and the East San Joaquin Water Quality Coalition GAR is under review. Other GARs are in development and will be submitted soon. The approaches taken in these specific GARs, and in the approach outlined in the Central Valley Water Board waste discharge requirements, are sound for determining the level of vulnerability to groundwater from overlying agricultural sources. Similarly, the approach taken by several Central Valley water quality coalitions in assessing, monitoring, and managing agricultural sources that might influence surface waters is also sound.

  These approaches generally include characterization of irrigated agricultural activities with respect to their potential to retain or remove applied materials, and the potential for those materials to be transported into receiving waters. As part of these analyses, factors affecting pathways to surface water and groundwater resources (topography, soils, and underlying geology and aquifers), as well as the condition of those water resources (e.g., historical levels of pollutants), are thoroughly characterized. This provides foundational understanding of the environment upon which testable hypotheses and monitoring program designs can be based. As new monitoring data become available, such results are evaluated and interpreted in a manner that allows for the update of the initial characterization (if necessary), and gives agricultural coalitions the ability to focus and refine the monitoring design for future years. As is evident by the successes in the Central Valley's surface water program, these approaches have proven to be a successful means of identifying water quality challenges related to agricultural practices, and assists agricultural coalitions in focusing limited resources on addressing these challenges by applying or developing appropriate management practices.

- **Application of Management Practices.** In general, the signatory agricultural organizations do not believe it appropriate or legal for regional boards to dictate specific management practices in its orders. Water Code section 13360 states that, "[n]o waste discharge requirement or other order of a regional board or the state board or decree of a court issued under this division shall specify the design, location, type of construction, or particular manner in which compliance may be had with that requirement, order, or

decree, and the person so ordered shall be permitted to comply with the order in any lawful manner." Notwithstanding this legal bar, we do believe it is appropriate for the Expert Panel to identify and make recommendations with respect to specific management practices or planning processes that growers should consider when making decisions with respect to nitrogen (N) use in their operations. And in fact, we have provided input on this below. However, and as stated previously, Expert Panel recommendations should clearly distinguish between practices and information that is useful for growers as compared to information that would be appropriate for reporting to regional boards.

- **Verification.** Under the Verification category, the questions appear to be looking for two distinct types of verification information. First, it refers to verification of implementation of management practices, and second, verification that the practices themselves are effective in protecting groundwater and surface water. In the opinion of the signatory agricultural organizations, the Management Practices Evaluation Program (MPEP) requirements as included in the Central Valley waste discharge requirements will provide the appropriate level of verification with respect to the effectiveness of certain identified management practices for areas identified as high vulnerability. The MPEP process will consist of evaluating representative management practices at representative agricultural operations to determine if such practices are protective of groundwater quality. Then, based on the information obtained, Central Valley agricultural coalitions will need to determine if other operations within the coalition area need to adopt similar practices. This approach will take some time, but it will ensure that practices implemented are protective of groundwater quality. Moreover, the MPEP approach for verification will generate timely and useful information and will provide more benefit than either (a) widespread monitoring of first encountered groundwater, or (b) collection of N quantities (e.g., applied and consumed N) for thousands of management blocks into a central database.

  With respect to verification of practices that are being implemented, the Central Valley waste discharge requirements require all growers to prepare Farm Evaluations, using an approved template, for submittal to the third party agricultural coalition. The Farm Evaluation template that was approved for the East San Joaquin Water Quality Coalition requires growers to identify the management practices that they use for their growing operation. By receiving such information, the third party agricultural coalition can then evaluate if growers are implementing management practices that have been identified as being effective through the MPEP verification process. If the information provided shows that improvements are necessary, the third party agricultural coalition can then focus its resources to work directly with those growers needing improvement. This process provides for the appropriate level of verification with respect to seeing that appropriate practices are being implemented. Reporting of such information is discussed further below.

- **Reporting.** Reporting information to the regional boards at an appropriate level is key in that it ensures compliance with program requirements, and provides regional boards with necessary information to bring enforcement actions if such actions are necessary. Reporting of certain water quality specific information is also necessary as it allows regional boards to determine if program requirements are effective in protecting waters of the state. However, excessive reporting requirements can be expensive and can direct valuable resources away from efforts that are more effective in protecting waters of the state. Also, reporting itself does not improve water quality, and thus the need for reporting needs to be balanced against the need for the information being requested. As it evaluates various reporting recommendations, the Expert Panel should be mindful of costs associated with reporting and the need for information. Specifically, the Water Code states that the burden of reporting, including costs, "shall bear a reasonable relationship to the need for the report and the benefits to be obtained from the reports." (Wat. Code, § 13267(b)(1).)

Our comments in response to the specific questions are provided here. The questions posed to the Expert Panel are underlined, and each is followed by comments on the preceding question.

I. Vulnerability and Risk Assessment

1. How can risk to or vulnerability of groundwater best be determined in the context of a regulatory program such as the ILRP?

As discussed in our summary comments above, the methodologies employed by several Central Valley water quality coalitions in developing their GARs are sound for determining the level of vulnerability of groundwater to overlying agricultural sources. These approaches generally include characterization of irrigated agricultural activities with respect to their potential to retain or remove applied materials, and the potential for those materials to be transported into underlying groundwater. As part of these analyses, pathways to groundwater resources (underlying soils, geology, and aquifers), as well as the condition of groundwater in the region (e.g., historical levels of pollutants), are thoroughly characterized. This provides for a sound, foundational understanding of the environment upon which testable hypotheses and monitoring program designs can be based. As new monitoring data become available, these results can then be used to update the initial characterization, and to focus and refine the monitoring design for future years.

2. Evaluate and develop recommendations for the current approaches taken to assessing risk to or vulnerability of groundwater.

The approaches listed in a through e under question number 2 have generally been put forward by regional boards to assess risk on a field-by-field basis. Assessing vulnerability or risk on such a small scale for regional board use is impractical, and an inefficient use of resources. Rather, and as described above, we believe it more appropriate to assess vulnerability

for groundwater through the GAR process, and to assess vulnerability for surface water through the current surface water monitoring programs and their requirements for follow-up actions when water quality exceedances are measured. For individual growers (i.e., for their personal use), such approaches may be helpful. It is in this context with respect to individual grower use that comments below are provided.

a. Nitrate Hazard Index (as developed by the University of California Center for Water Resources, 1995).

The authors of the index describe its purpose as follows, "[t]o provide information for farmers to voluntarily target resources for management practices that will yield the greatest level of reduced nitrogen contamination potential for groundwater by identifying the fields of highest intrinsic vulnerability." Accordingly, the authors of the index indicate that it is a helpful prioritization tool for individual growers, and can assist growers in identifying intrinsic vulnerability associated with their operation. Growers can then use this information to assist them in making decisions with respect to their agricultural operations. We agree with the index authors that the index is a useful tool for growers, and we believe that the index can be a useful tool for coalitions for making prioritization and vulnerability determinations. However, the index is not designed for determining compliance at the field level.

b. Nitrate Loading Risk Factor (as developed by the Central Coast Regional Water Quality Control Board in Order R3-2012-0011).

The calculations established by Central Coast Water Board staff and adopted by the Central Coast Water Board alternatively consider crop type, irrigation method, and applied water nitrate concentration, and (in an alternative formulation), consider soil type and deep tillage. As with 2a, it is a field-by-field risk index that may provide some useful information to growers. However, the risk factor approach set forth by the Central Coast Water Board is not appropriate for regulatory purposes as it fails to consider a number of important factors such as crop need. As such, it has limited utility for regulatory purposes.

c. Nitrogen Consumption Ratio.

With respect to the "Nitrogen Consumption Ratio," we believe, as a preliminary matter, that the focus should be on **crop need**—not **crop consumption**. Specifically, crop need is the amount of N that must be applied to a crop to achieve an expected yield. To calculate the correct amount of N to apply, one must account for the following:

- N needed to harvest "x" yield (N taken up by plants and removed in harvested material and N taken up by plants but left in the field)
- N needed for ongoing plant health purposes
- N temporarily bound in the soil
- N accounted for in irrigation water

- N supplied by mineralization of soil organic matter
- N transported from root zone in percolation

In comparison, crop consumption is the amount of N in lbs/ac that must be applied to replace the following:

- the N removed annually from the harvested portions of the crop
- cullage
- hulls/stems, etc.
- N stored in trees or vines (perennial crops)

In other words, although crop consumption is a key factor in determining crop need, a ratio that focuses on crop need will be a more valuable and accurate tool as compared to a ratio based only on crop consumption.

Considering the difference between the two, we believe it appropriate for the Expert Panel to opine on the difference between the two, and to make a recommendation with respect to what approach it considers to be more valuable.

Next, we comment on the ratio approach in general. As just noted, we believe that the focus should be on crop need versus crop consumption. Thus, any ratio approach that follows should also be developed based on crop need. However, at this time, certain Central Valley agricultural water quality coalitions have determined that sufficient information does not currently exist to make the ratio approach useful.

Further, to provide explanation and context, it is relevant for the Expert Panel to understand how the ratio issue came about, which we provide here. When the Central Valley waste discharge requirements were first being negotiated, some in agriculture believed that the ratio approach would be a simple approach for obtaining grower information that could then be conveyed to the third party for aggregation on a township level. By aggregating the information, it was originally thought that this would then allow third parties to compare N usage across similar crops and soil types to identify outliers. The information was then proposed to be used for focusing education and outreach on those outliers. However, as certain agricultural water quality coalitions have begun to implement the Central Valley waste discharge requirements, the limitations of the ratio in its current form have become more apparent.

Specifically, there is currently a lack of information for many crops to make appropriate decisions regarding crop need. This includes, e.g., lack of consumption information, and amount of N temporarily bound in soil. Until such information is developed, the ratio may not be a useful for reporting to the coalition and for the basis of township-based reports.

Moreover, the ratio was not developed with the intent of it being used to identify vulnerability or risk. It was also not designed for regulatory purposes, other than to provide the third party coalition with some information with respect to N applied as compared to crop need and removal to try and evaluate grower practices on an aggregated township basis. As information is developed through the MPEP and other research efforts, a ratio approach (based on crop need) may become a useful planning tool for growers and subsequently a reporting tool for coalitions, and might then be appropriate for verification-type uses. Until then, we support efforts to develop the necessary information.

d. Size of the farming operation.

This factor has no known relationship to the risk of vulnerability posed by irrigated agriculture.

e. High Vulnerability Areas Methodology (as developed by the Central Valley Regional Water Board in a series of Waste Discharge Requirements issued to agricultural coalitions in the ILRP).

As indicated previously, we believe that the vulnerability approach in the Central Valley waste discharge requirements provides an appropriate methodology for assessing vulnerability on a broad scale. Such approach is comprehensive in that it considers soil types, groundwater quality data from a number of different sources, and other relevant information. It can also be updated as necessary as additional information is obtained. However, the vulnerability approach through the GARs is not appropriate for use on a field-by-field basis. Information in the GAR can be used by growers to assist them in making decisions for their operation, but it is not necessary nor is it an appropriate method for individual growers to conduct their own GAR in the same manner as the GARs are prepared for broader geographic areas.

3. How can risk to or vulnerability of surface water best be determined in the context of a regulatory program such as the ILRP?

Methodologies used by Central Valley water quality coalitions in assessing, monitoring, and then managing surface waters are sound for determining surface water vulnerability to irrigated agricultural sources of nonpoint source pollutants. The approaches used in the Central Valley generally include characterization of irrigated agricultural activities with respect to their potential to retain or remove applied materials, and the potential for those materials to be transported into receiving waters. As part of these analyses, factors affecting pathways to surface water (topography, soils, and proximity of agricultural operations to waterways), as well as the condition of surface waters (e.g., historical levels of pollutants), are thoroughly characterized. This provides foundational understanding of the environment upon which testable hypotheses and monitoring program designs can be based. As new monitoring data become available, such results are evaluated to update the initial characterization, and to assist agricultural coalitions in focusing their outreach and educational activities, and for refining the monitoring design for future years.

4. Evaluate and develop recommendations for the current approaches taken to assessing risk to or vulnerability of surface water.

Similar to the comments above under question number 2 for groundwater, the factors identified in a through d appear to be associated with a determination of vulnerability or risk for an individual agricultural operation. In particular, factors a through c are used by the Central Coast Water Board for prescribing certain requirements to individual agricultural operations. In general, the signatory agricultural organizations do not believe that it is necessary or productive to prescribe certain requirements based on a perception of risk associated with the factors identified in a through c below. As described in response to question number 3 above, a more efficient approach for protecting surface water can be achieved through representative receiving water monitoring and follow-up actions based on receiving water monitoring results. Such an approach ensures that water quality problems are addressed and that limited resources are used efficiently. In contrast, the Central Coast Water Board approach as identified in factors a through c below presumes that agricultural operations that fit within the defined parameters are impacting surface water quality and as a result, such operations must meet certain specified requirements. It does not account for or consider management practices that may be employed that eliminate or significantly reduce risk. Thus, we do not support use of such factors for assessing risk and prescribing requirements.

a. Proximity to impaired water bodies.

While proximity to a water body may be one factor with respect to risk or vulnerability of surface water, it is not the only factor and should not be used by itself to determine risk. This factor needs to be assessed in conjunction with a number of other factors, including the slope of the field, soil types, and implementation of management practices, to determine actual risk.

b. Usage of particular fertilizer or pesticide materials.

As with proximity to an impaired water body, usage of registered materials in a legal manner does not in itself indicate risk. In addition, properties of the material (Koc, solubility, ionic properties) and the context (weather conditions) and manner (application location, method, and rate) of use also determine the extent to which a material can or does migrate. Distance to the resource and the sensitivity (e.g., aquatic toxicity) of the resource to the material need to also be considered. Accordingly, use of a material alone should not be used for assessing risk and prescribing requirements.

c. Size of farming operation.

This factor has no known relationship to the risk of vulnerability posed by irrigated agriculture.

d. High Vulnerability Areas Methodology (as developed by the Central Valley Regional Water Board in a series of Waste Discharge Requirements issued to agricultural coalitions in the ILRP).

As indicated above, the Central Valley's program of conducting representative surface water monitoring in conjunction with development of management plans when there are surface water quality issues is an appropriate approach for identifying vulnerable areas with respect to surface water.

II. Application of Management Practices

As indicated in our summary comments above, regional boards may not dictate the manner of compliance, or in other words, prescribe specific management practices in orders. Notwithstanding this fact, we do believe it appropriate for the Expert Panel to make recommendations with respect to grower level management practices. Such recommendations, however, should clearly be noted as being appropriate for grower implementation—not prescriptive requirements for regional board adoption.

5. What management practices are expected to be implemented and under what circumstances for the control of nitrogen?

The most appropriate management practices for addressing N are those that are part of a decision-making process that leads growers to make good N decisions that account for and consider the need to protect water quality. For example, nitrogen management planning in the manner described in University of California Cooperative Extension Training (UCCE) training, which is specific to each field situation, is a management practice. Included in such planning, one may consider, e.g., practices and tools that may favor retention of applied N in soil through careful irrigation, and cover cropping. Ultimately, we believe that N management planning done correctly by growers is the most appropriate management practice because it requires many different inputs of information, and will result in decision-making processes that are protective of groundwater and surface water.

Further, nitrogen management planning is informed by field research. The current research mechanisms, along with the cooperative extensive services that have existed for decades, can assist California agriculture in meeting the challenges associated with N.

Specifically, examples of management-unit-specific factors that can influence N application decisions are crop type/variety, crop rotation, cropping history and expectation, planting date, yield history and expectation, soil conditions including texture, salinity, and residual N content, within-block variability, crop residue mass load and carbon:nitrogen ratio, irrigation method and practices, climatic and microclimatic conditions, anticipated N losses and uptake per unit production, and estimated potential for leaching of excess nitrogen.

One key management practice component is the increasing care that must be taken to retain N in the root zone until it can be used by the crop. Adoption of N management tools, and recent changes in other management practices, have a significant influence on the retention and use of N in crop root zones. For example, use of low volume irrigation systems, such as drip and microsprayers, have vastly expanded in acreage due in part to substantial production benefits for crops such as tomatoes, cool-season vegetables, almonds, grapes, and walnuts. N management planning tools from UCCE and industry are increasingly used to select fertilizer application form, rate, placement, and timing. In some cases, research on agricultural use of N needs to be expanded to provide sufficient guidance. Moreover, it is expected that, as new information becomes available, it will be relayed to growers and their advisors, and would be used in nitrogen management planning. The aggregate impact of implementing management practices of these types that are part of nitrogen management planning processes would be to improve the efficiency with which N is delivered to crops, while minimizing the mass of N lost to groundwater.

Overall, considering the complexity of issues associated with N and the number of factors that must be considered in nitrogen management planning processes by growers, we do not believe that there is one management practice, or suite of management practices, that can be prescribed by regional boards. Rather, the agricultural water quality coalitions in conjunction and coordination with commodity groups, the UCCE and industry, should continue to conduct outreach and education with respect to nitrogen management planning decisions. It is these types of efforts that will ultimately ensure that growers are implementing appropriate management practices. Meanwhile, the GAR approach, MPEP, groundwater trend monitoring, and annual reporting of coalition outreach activities will provide regional boards the information that they need to ensure that efforts are being made to first identify and then implement protective management practices.

6. What management practices are recommended for consideration by growers when they are selecting practices to put in place for the control of nitrogen?

In general, and as discussed in response to question number 5 above, the "best" management practice is planning and consideration of a variety of factors as part of a grower's decision-making process in determining the right time, right place, right material, and right amount with respect to application of N. Under such an approach, growers are more likely to use and control N in the manner that is useful for the crop but not detrimental to groundwater. Moreover, the diversity of field conditions requires that practices be defined as decision processes, not as rigid sequences of actions. Careful N management includes consideration of crop, irrigation, and fertilization practices. The outcome of this fertilization management approach should be informed decisions by growers with respect to applied form, rate, placement, and timing. However, the outcome could differ substantially among management blocks/units. Thus, we believe that while practices may have common elements across groups of management blocks, the best practice for addressing N is a decision process that leads growers to make the best decision for a particular management block that is protective of water quality. Such a

process is flexible in that if conditions change after planting or crop set in a permanent crop, growers may adapt their decisions regarding N applications as necessary during the growing season. But ultimately, all decisions will be made with protection of water quality as a key component.

In summary, use of a sound decision-making planning process for N management should be the recommended practice at the grower level. It is important to note that this comment is specific to grower information and grower planning processes for their own operation. The issue of what information is necessary for the regional boards to ensure that implemented practices are protective of groundwater is discussed below under Reporting.

7. Evaluate and make recommendations regarding the usage of the following management practices.

    a. Nitrogen mass balance calculations and tracking of nitrogen applied to fields. This should include consideration of measuring and tracking Nitrogen.

        i. Applied to crops or fields.

        ii. In soil.

        iii. In irrigation water.

        iv. Removed from field.

        v. Estimation of losses.

    b. Templates for determining nitrogen balance.

    c. The usage of nitrogen balance ratios.

    d. Nutrient management plans.

All of these factors are best considered in the context of N management planning by growers and their crop advisors at the management block/unit level. As stated previously, management practice decisions need to be site-specific, and be integrated among crop, irrigation, soil/climate setting, and fertility management, and need to be iterative to adjust for changing conditions. It is therefore most important to ensure that the proper decision processes are in place. The individual factors as identified above, or simplified subsets thereof, are not appropriate for regulatory tracking purposes (see further discussion below). Moreover, we contend that among the various types of information sought for consideration, crop need is more useful than crop consumption.

8. Evaluate and make recommendations regarding the most effective methods for ensuring growers have the knowledge required for effectively implementing recommended management practices.

The delivery of information to growers can be accomplished in a number of ways, and all delivery mechanisms can be effective. For example, for decades growers have relied on their commodity organizations and UCCE to provide information on appropriate practices associated with a number of issues. These are delivery approaches that are recognized and trusted by growers. For information specific to water quality issues, growers have come to rely on the agricultural water quality coalitions, and such coalitions are well versed in conveying the appropriate level of information to growers to ensure that they are implementing practices that are protective of water quality. Information is conveyed through grower group meetings, as well as through individual grower consultations. Considering the number of different mechanisms, all of which can be effective, we recommend that there be a number of different options available to growers for obtaining such information.

With respect to the particular categories identified below, we understand this question to be requesting input on various mechanisms for mandating and ensuring that growers either be trained specifically for issues pertaining to the application of N, or that they be required to use a hired consultant of some sort for N recommendations. Our comments below are provided with this understanding.

a. Required training.

Growers should be given the option of obtaining N management training similar to that provided to CCAs by UCCE under CDFA auspices should growers choose to take such courses. However, such training should not be required of growers. As a practical matter, it is unlikely that the resources exist to provide such training to all growers, except through the agricultural coalition outreach and education efforts that have been ongoing for years.

b. Required certifications.

Growers should not be required to obtain a "CCA" certificate unless they chose to do so. Moreover, growers should be able to rely on properly trained CCAs or equivalent (e.g., Certified Professional Soil Scientist, CCA-Agronomist) that have obtained suitable certifications. Growers should also have the option of self-certification given that (a) not all growers are in a position to hire outside professionals to advise them, (b) growers who have adequate expertise and know their operations intimately should be capable of N management planning, and (c) at present and for the foreseeable future, there is a shortage of CCAs, CCA-Agronomists, and Certified Professional Soil Scientists with training in N management planning (about 700, statewide).

c. Workshops sponsored by third parties such as: CDFA, County Agricultural Commissioners, Farm Bureau, UC Cooperative Extension.

As indicated above, there are a number of delivery mechanisms, and all can be effective.

d. Usage of paid consultants – e.g., CCAs/PCAs.

Requiring the use of paid consultants in regional board orders is not appropriate. The focus should be on ensuring that the grower, or whomever the grower is relying on for such decisions, is sufficiently qualified and informed to render appropriate decisions and guidance. It should remain the discretion of each grower to use paid consultants to assist in farm management activities.

e. UC Cooperative Extension specialists.

UCCE and its specialists tend to avoid management block- or unit-specific recommendations, and generally are not equipped to provide such specific recommendations. Rather, UCCE and its specialists prefer to provide growers and their advisors with knowledge and tools to make appropriate, management block- or unit-specific decisions.

III. Verification Measures

9. What measurements can be used to verify that the implementations of management practices for nitrogen are as effective as possible?

As noted in our summary comments above, verification can occur on two levels: verification of practices, and verification that N management practices are widely and correctly applied. Our comment here focuses on approaches that can be used to verify that certain practices are effective. Once a practice has been determined to be effective, then application of such practices can be advocated as appropriate and applicable. The primary approach for such management practice verification is contained in the MPEP requirements as set forth in the Central Valley waste discharge requirements. In general, the MPEP will result in evaluation and identification of protective management practices for various commodities under a range of conditions that are representative. Further, the MPEP concentrates on making such determinations for areas that have been identified as highly vulnerable under the GARs. This helps to assure that limited resources and efforts are focused on the areas of greatest concern. The results from the MPEP can then be used to determine if practices at other agricultural operations that have similar conditions are adequate or need to be improved. The MPEP program is appropriate because it will likely include representative field level studies that are focused on determining practice effectiveness specific to protecting groundwater. Well-documented, sound results are then conveyed to others for implementation as applicable.

10. Evaluate and make recommendations regarding the usage of the following verification measurements of nitrogen control.

    a. Sampling first encountered groundwater via shallow monitoring wells.

Before responding to this comment, it is necessary to first clearly identify and define what is meant by the terms first encountered groundwater, shallow groundwater, and deeper groundwater. For the purposes of our comments here, we define these terms to mean as follows:

- *First encountered groundwater*: Water in the pore space of the shallowest soil or aquifer material that is perennially saturated (all pores full of water). Sampling of this water generally requires installation of a monitoring well.

- *Shallow groundwater:* Water contained in the shallowest, generally unconfined aquifer. This water can be sampled from existing or new monitoring wells, or from other wells (e.g., agricultural or domestic) screened in this aquifer.

- *Deeper groundwater*: Water contained in aquifers below the shallowest, generally unconfined aquifer. This water can be sampled from existing or new monitoring wells, or from other wells (e.g., agricultural or domestic) screened in this aquifer.

With respect to sampling of first-encountered groundwater, it is not typically part of N management at the field level because it is not a relevant factor in deciding how much N to apply. Rather, soil samples are usually employed, since it is from soil that crops can actually extract N. As a diagnostic of sources, it may be difficult or impossible to relate N in first-encountered groundwater to a known source in space or time. On the other hand, root-zone soil sampling is frequently employed for research and development, or detailed performance assessments of specific, representative management blocks. Soil pore water sampling, and sampling just below the root zone, is used far less frequently, but may also be a useful tool. This is because knowing about the amount of N in the root zone is more helpful in assessing the performance of a management block, and thus by extension, the practices employed on management blocks. Note that soil sampling is not always essential for a correct N application recommendation.

Testing of first-encountered groundwater may have value in some focused studies, but even there it is likely to be inferior to analyses of soil and soil pore water. For large-scale assessment, regional representative sampling of shallow and deeper groundwater should be conducted to assess water quality trends. The use of monitoring well networks like those frequently utilized in point-source permitting processes, is neither practical nor necessary for application to irrigated cropland. Importantly, given the vast expanse of cropland in California, sampling of first-encountered groundwater under every field is not economically feasible.

b. Direct sampling of groundwater from existing wells, such as an irrigation well or domestic drinking water well, near the field(s) where management practices for nitrogen are being implemented.

To answer this question, it is important to first determine the purpose for obtaining such information. If the purpose is to determine the effectiveness of management practices, we contend that the MPEP is more effective and scientifically valid rather than requiring direct sampling of all existing wells. Using existing irrigation or domestic drinking water wells is unlikely to provide useful information because siting of such wells was done based on water supply needs, and not for the evaluation of practices. Further, such wells may be influenced by other factors because they were sited for different purposes.

If the purpose is to determine and gather information for long-term trends in groundwater quality, we contend that results from a regional network of sampled wells can be used efficiently for this characterization. Monitoring of all irrigation and domestic wells is not necessary for obtaining trends, and again, is not useful for evaluating the effectiveness of management practices.

Further, data from such wells has limited usefulness because of the following:

- At best, groundwater N concentrations reflect the results of N management that occurred many years in the past.

- Unless the groundwater in question is being applied to crops (in which case its N content figures into N management planning), knowing the N concentrations of underlying groundwater does nothing to inform N management, and nothing to improve the environmental performance of irrigated lands. This is because (a) care must be taken in managing applied N, whether or not underlying groundwater happens to have low, moderate, or high N concentrations at the moment, and (b) N in these zones is not available to crops.

- As a diagnostic of sources, it may be difficult or impossible to relate N in groundwater to a known source in space or time.

c. Sampling of the soil profile to determine the extent to which nitrogen applied to a field moved below the root zone.

The use of soil sample results may be important information for growers to use as part of their N management planning process, but such results are not appropriate for verification purposes.

d. Representative sampling of a limited area and applying the results broadly.

It is not possible to answer this question in its current form because it does not identify what would be sampled in the representative area. We are uncertain if the question is referring to sampling of groundwater, soil, or some other parameter. However, to the extent that the question is referring to groundwater sampling, we agree in general that "representative" sampling is more appropriate than requiring groundwater monitoring of all farms. Such representative sampling approaches should be employed in both the trend monitoring programs as well as in the design of the MPEP. If the question is referring to representative sampling of fields where the impact of specific management practices is documented and verified to be effective, then applying the results broadly is appropriate (the approach used for the MPEP),

e. Sampling water in surface water containment structures for their potential discharge to groundwater.

Sampling of water in a surface water containment structure as a standard requirement is not necessarily an appropriate verification measure because it fails to consider if the containment structure in question, and the water within the containment structure, actually poses a threat to groundwater quality. Sampling alone does not take into account soil type, construction of the structure, and other factors that can affect the potential discharge to groundwater.

f. Estimating discharge to groundwater based on nitrogen balance model and measured irrigation efficiency.

This sort of detailed assessment is appropriate when it is part of studies conducted under the MPEP, which is a verification program as discussed above. However, it is not necessary to apply such assessments to every field.

11. Evaluate the relative merits, and make recommendations regarding the usage of, surface water measurement systems derived from either receiving water or a discharge monitoring approach to identify problem discharges.

The surface water monitoring approaches developed in the Central Valley waste discharge requirements are generally adequate to assess the influence of surface water discharges on receiving waters. Monitoring networks that include representative sampling locations in certain specified watersheds and/or subwatersheds have been installed and sampled for a number of years. Where problems have been detected, coalitions have effectively engaged growers to perform detailed source assessments, and to identify and implement corrective actions.

IV. Reporting

12. Evaluate and make recommendation on how best to integrate the results of the Nitrogen Tracking and Reporting System Task Force with any above recommendation regarding management practices and verification measures.

The Expert Panel is not beholden to the recommendations contained in the *Nitrogen Tracking and Reporting System Task Force Report*, and accordingly should not feel obligated to take the recommendations contained within the report. Rather than relying on or looking to this report, the Expert Panel should determine independently and make its own recommendations as to appropriate reporting of information.

In conducting such an assessment and making reporting recommendations, we encourage the Expert Panel to consider the intent and purpose of reporting certain information, and the usefulness of the information to the regional board with respect to its authority for protecting water quality. For example, there has been much public debate regarding the need for reporting the amount of total N applied by all growers. Some advocate that such information is necessary because it provides regional boards with information that it can use to estimate what quantity of N is traveling to groundwater, while others argue that such information is not useful to regional boards because it is just a total number that fails to consider crop need, atmospheric losses, N retained in soil, and other relevant information. Regardless, the point is that the Expert Panel needs to carefully consider the objective to be obtained with reporting.

Specifically, we believe that the most useful information that should be reported to regional boards is a combination of the following:

- Identification of protective management practices (i.e., MPEP).
- Classify lands based on crop/irrigation systems and levels of underlying groundwater vulnerability in each general locale, as described in GARs.
- Track application of suitable, protective management practices.
- Track the extent to which suitable management practices are implemented.
- Report the extent to which suitable management practices are implemented on a township level, as a percentage of each crop/irrigation setting.

To a large extent, the MPEP and Farm Evaluation elements of the Central Valley waste discharge requirements collectively already require that this information be developed and reported for highly vulnerable lands.

With respect to tracking N applied on a field-by-field basis, the Expert Panel should consider the level of effort that might be required to implement such a tracking and reporting program statewide.

- First, it is exceptionally rare and difficult to attempt, much less to achieve, characterization of any single parameter across all of the management blocks/units over a vast (millions of acre) area. However, where this has been attempted, the results and costs are instructive. Examples include crop mapping efforts by DWR and the United States Bureau of Reclamation (USBR), pesticide use reporting, property taxation systems, and production reporting related to commodity programs. Each are exceptionally costly, suggesting that such programs cannot be developed without high levels of investment that would drain resources from practice development and implementation, likely impeding the achievement of water quality protection goals. Further, an inaccurate program, or methods of interpreting this costly information that might be misleading or distracting, can do more harm than good. Two examples of costly programs that track just a couple of land parameters follow. We encourage the Expert Panel to be mindful of the fact that a proposed N tracking program would exceed any of these existing programs in the number of parameters and frequency of collection per block/unit, and the complexity of the implied interpretation of those data.

    - DWR maps field boundaries and crops in irrigated fields. The program cost for the Northern District (roughly the Sacramento Valley) runs about $500,000/year when staff time is considered. Crop, irrigation method and source, and whether or not the field appears to have multiple crops are the main parameters noted. In many cases, not all parameters are collected, and field boundaries are probably too approximate for use in an N tracking program. Moreover, fields are checked only about once every seven years.

    - USBR maps crops only annually in the Imperial Irrigation District boundary area. This alone costs an estimated $600,000/year, or a little over a dollar per acre.

- Second, tracking N balances for intensive vegetable cropping operations with multiple crops and small management blocks could require collection and management of at least 10x the data required to track larger, single-crop, field crop settings. Program costs in these settings might reasonably be assumed to be proportionally (10x) higher. The previous two examples are more representative of the simpler, less costly case.

In summary, comprehensive N tracking and reporting, in which N balances for each management block/unit every year would be collected and managed, would be a very costly undertaking. Such an effort would only be warranted if commensurate benefits resulted, and if alternative tracking and reporting programs were not available. As shown above, we believe that there are alternative tracking and reporting requirements that provide regional boards with useful information for determining if management practices are protective of water quality, and if such

practices are being implemented. Thus, rather than recommending the tracking and reporting of N, which we contend does not provide useful information that is reasonable considering the burden of obtaining the information, we encourage the Expert Panel to carefully evaluate the approaches advocated above (e.g., MPEP and tracking of management practice implementation).

13. Evaluate and make recommendations on the reporting requirements to report budgeting and recording of nitrogen application on a management block basis versus reporting aggregated numbers on a nitrate loading risk unit level. (Definitions of "management block" and "nitrate loading risk unit" are contained in State Water Board Order WQ 2013-0101.)

Reporting should be structured to verify that practices to reasonably maximize retention and use of applied N in the root zones of management blocks are being implemented. This type of reporting does not create a need for reporting the amount of N applied. Rather than expending limited resources on reporting of N, we recommend that resources be focused on more productive actions, such as GAR development, MPEP, outreach to members on MPEP results, and regional trend monitoring networks.

To the extent, however, that such reporting is nevertheless required, the following should be considered:

- Aggregation of fields/management blocks into relatively uniform management units, whether such units are physically contiguous or not. This will substantially reduce the reporting burden without loss of useful information. The same aggregation principle is being applied to reporting of management practice implementation with the Central Valley farm evaluations.

- Any broad-scale tracking should strictly minimize the number and complexity of parameters collected, since little meaningful analysis can be performed without knowing more about blocks/units than can practically be collected at this scale.

- Among N quantities that can be used, N crop need incorporates more site-specific information (loss processes, alternative N sources, etc.) than N consumption, and is therefore more useful.

- If N mass balances are determined to be appropriate for verification purposes (to which we would disagree), then in order of preference, consider the following approaches in lieu of broad-scale monitoring and reporting of N balances:

    - Detailed monitoring of typical, archetypal plots that represent the range and diversity of conditions for which N balances are to be characterized.

    - Employ standard statistical sampling methods, so that information can be gathered on representative sites.

We thank you for your service in this important endeavor and look forward to reviewing the Draft Report this summer.

Sincerely,

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