Comments on Revised Monitoring and Reporting Program for Watershed Groups under Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands Released by the CVRWQCB Staff on June 24, 2003

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In connection with the Central Valley Regional Water Quality Control Board's development of a water quality management program for pollutants in discharges from irrigated agriculture and managed wetlands in the Central Valley, there is considerable discussion about the nature of the water quality monitoring program that needs to be conducted. In connection with addressing this matter, there have been a number of reviews that provide guidance on how water quality monitoring programs should be developed/evaluated. These include the National Research Council (NRC, 1990) Managing Troubled Waters, and the Lee and Jones-Lee (1992) "Guidance for Conducting Water Quality Studies." As discussed in these reviews, the development of a comprehensive water quality monitoring program involves establishing the objectives of the monitoring program. In connection with developing a nonpoint source water quality monitoring program for the Central Valley, these issues have been reviewed by Lee and Jones-Lee (2002a).

The primary objective of the agricultural waiver water quality monitoring program must be to explicitly define the chemicals and pathogen-indicator organisms present in irrigated agricultural tailwater and subsurface drain water and stormwater runoff that have the potential to cause impairment of the designated beneficial uses of the receiving waters for these discharges.

Achieving this objective will provide the information base needed to reliably manage the water quality impacts of irrigated agricultural discharges/runoff. This objective was defined by the CVRWQCB (2001) in its September 7, 2001, Resolution No. 5-01-236, "Control of Discharges from Irrigated Lands." This Resolution specifically addresses the conditional waiving of waste discharge requirements (WDRs) for irrigation return water and stormwater runoff from agricultural lands. The WDRs were originally waived based on the condition that the runoff/discharges from irrigated lands "… *minimize sediment to meet Basin Plan turbidity objectives and to prevent concentrations of materials toxic to fish and wildlife*" and for stormwater runoff "*where no water quality problems are contemplated and no federal NPDES permit is required*."

Further the CVRWQCB Resolution No. 5-01-236, "Control of Discharges from Irrigated Lands," adopted on September 7, 2001, defines that the agricultural waiver monitoring program is to

cover the *basin*, *drain* and *field* level runoff/discharge monitoring. This level of detail is required if the monitoring program is to accomplish the defined as well as the required objective of managing the water quality impacts of agricultural runoff/discharges.

Baggett (2002), Chair of the State Water Resources Control Board (SWRCB) has discussed the State Water Board's approach for implementing Senate Bill 390 which provides for sunset of the agricultural waiver of WDRs. Baggett indicated that it is the policy of the SWRCB *"… to reduce the escape of pesticides, fertilizers and other agricultural* [chemicals] *to nearby rivers, streams and groundwater sources."* Baggett stated, *"After sufficient monitoring data have been received and analyzed, new strategies involving waivers and permits can be designed,"* and, *"A well designed monitoring program is clearly the first step."*

The CVRWQCB September 7, 2001, Resolution states that the irrigation return waters and stormwater runoff from irrigated lands have been found to contain pesticides, nutrients, sediments and other constituents that adversely impact receiving water beneficial uses. A review of the currently proposed 303(d) list of impaired waterbodies in the Central Valley shows that there are over 35 waterbodies in the Central Valley that are on the 2003 list of impaired waterbodies due to agricultural discharges/runoff. The CVRWQCB Resolution indicates that the available monitoring data do not allow the Board to identify the source of several pollutants being found in Central Valley mainstem waters. The Resolution states that site-specific information should be used to evaluate compliance with waiver conditions that must be available before a renewed waiver policy can be considered, and that the staff is directed to request agencies and organizations that work with drainage from irrigated lands to establish local water quality monitoring to identify sources of pollutants.

During 2002, at the request of the Central Valley Regional Water Quality Control Board staff, Drs. G. Fred Lee and Anne Jones-Lee developed a report (Lee and Jones-Lee, 2002a) presenting a comprehensive monitoring program that needs to be conducted to reliably assess the Basin Plan water quality objective violations caused by stormwater runoff and tailwater/subsurface drain water discharges from irrigated agriculture. This report was published as

> Lee, G. F. and Jones-Lee, A., "Issues in Developing a Water Quality Monitoring Program for Evaluation of the Water Quality - Beneficial Use Impacts of Stormwater Runoff and Irrigation Water Discharges from Irrigated Agriculture in the Central Valley, CA," California Water Institute Report TP 02-07 to the California Water Resources Control Board/ Central Valley Regional Water Quality Control Board, 157 pp, California State University Fresno, Fresno, CA, December (2002).
> http://www.gfredlee.com/Agwaivermonitoring-dec.pdf

In connection with the December 5, 2002, CVRWQCB adoption of a Conditional Agricultural Waiver, as well as the April 24/25, 2003, hearing presenting more detailed guidance on water quality monitoring associated with the agricultural waiver, the CVRWQCB staff prepared a list of parameters that should be monitored. Based on Dr. G. Fred Lee's over 40 years of experience in water quality monitoring of point and nonpoint sources and last year's experience in developing the comprehensive report, G. F. Lee provided comments on a number of deficiencies

in the staff's proposed monitoring program. A summary of Drs. Lee and Jones-Lee's qualifications to provide these comments is appended.

In reviewing the June 24, 2003, revised agricultural waiver water quality monitoring program, we find that a number of the same problems that we discussed previously occur in this updated monitoring program. As discussed previously, a number of the monitoring parameters and proposed approaches will lead to inadequate, unreliable, and in some cases, uninterpretable data on the characteristics of stormwater runoff and tailwater/drain water discharges from irrigated agricultural areas in the Central Valley. It is essential that revisions be made in this monitoring program to work toward achieving reliable, meaningful data that would be developed from the monitoring program mandated by the agricultural waiver program.

Page 7 of the Monitoring and Reporting Program, Order No. R5-2003- Watershed Groups Under Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands, section 4 Minimum Requirements, contains Table 1 Constituents to be Monitored. The following changes or points of clarification should be included in this table or as an adjunct to it.

Physical Parameters

Under Physical Parameters, the staff have listed a number of chemical parameters as physical parameters. pH, electrical conductivity, dissolved oxygen, color, turbidity, TDS and TOC are chemical parameters.

Flow. In order to reliably estimate loads, flow measurements must be made continuously, not intermittently at the time of sampling, as proposed. The intermittent time-of-sampling flow measurements can readily lead to significant errors in estimating the loads of a potential pollutant. The flow reporting units are traditionally "cfs," in lower case. Lower case is used in the text for abbreviation of "cubic feet per second," and it should be used in the table.

pH, DO and Temperature. As discussed previously, specifying that pH, DO and temperature be measured, without providing guidance as to the time of day when the measurements are to be made, is an inappropriate approach. For many waterbodies, especially agricultural drains, it would be expected that the time of day and the depth within the agricultural drain at which measurements are made will influence the pH, temperature, and dissolved oxygen values. The CVRWQCB Basin Plan water quality objectives for these parameters specify a concentration that should not be exceeded at any time or location in the waterbody.

Since pH can change by several units from early morning to late afternoon, and DO can change by several mg/L from early morning to late afternoon, it is essential that, if compliance with the water quality objective for pH is to be evaluated, measurements at about 4:00 PM should be specified. If the water quality objective for DO is to be assessed, then measurements between 6:00 and 8:00 AM should be specified. These are typical times when these parameters will be at their maximum for pH, and minimum for DO. Allowing a discharger to measure pH and DO when it is convenient to them, or when the values are at their least or greatest, for pH and DO, respectively, leads to unreliable assessments of compliance with water quality objectives.

The time of day when temperature measurements are made is important and must be specified. Since often temperature change is a critical factor, the minimum temperature in early morning and maximum temperature in late afternoon should be measured.

EC and TDS. As discussed in previous correspondence, electrical conductivity is highly dependent on temperature. Some instruments attempt to automatically correct for temperature. Others do not. This leads to the development of data where the electrical conductivity is dependent on the time of day, because the temperature can change with the time of day. Electrical conductivity should be corrected to 20°C, either automatically through temperature compensation in the conductivity instrument, or through determining, through special laboratory studies, how EC changes with temperature.

With respect to requiring measurements of TDS and EC, a note should be added that indicates that after measuring TDS and EC on a particular water over a year or so, it will be possible to develop a factor that relates EC at 20°C to TDS. This then eliminates the need for further more expensive measurements of TDS in future monitoring.

Color. As discussed in previous comments on the Regional Board's monitoring parameters, there are two forms of color: true color and apparent color. True color is obtained by filtering the sample, thereby removing turbidity. A list of recommended monitoring parameters must specify whether true or apparent color is to be monitored. If it is true color, then the filter pore-size should be specified. Otherwise, essentially meaningless data will be generated.

Drinking Water Parameters

In Table 1, under Drinking Water, *E. coli* and Total Organic Carbon are listed. These are appropriate parameters. Also, dissolved organic carbon should be added to this list. The listing of chloroform, bromoform, dibromochloromethane and bromodichloromethane in this table will cause those doing the monitoring to waste funds making measurements of these parameters. These parameters are trihalomethanes (THMs) formed from the addition of chlorine as part of disinfecting water supplies. They would not be expected to be present in agricultural runoff, and even if they were present, they would not be an important parameter in the Central Valley that would justify spending funds for obtaining data on them since THMs are rapidly lost from surface waters through volatilization and do not persist for long distances in surface waters. ("Chloroform," "dibromochloromethane" and "bromodichloromethane" are misspelled in the table.)

TOC. While the US EPA has developed drinking water TOC concentration limits to control excessive THM formation, in order to regulate TOC discharges it is necessary to have these TOC limits adopted into the Basin Plan. It is known from past monitoring that both the mainstem and many of the tributaries of the Sacramento and San Joaquin Rivers have excessive TOC compared to the US EPA guideline values. As discussed by Lee and Jones-Lee (2003) in their report,

> Lee, G. F. and Jones-Lee, A., "Issues that Need to Be Considered in Evaluating the Sources and Potential Control of TOC that Leads to THMs for Water Utilities that Use Delta Water as a Water Supply Source," Report of G. Fred Lee & Associates, El Macero, CA, May 27 (2003),

TOC measurements must be accompanied by planktonic algal chlorophyll and BOD measurements in order to determine the refractory versus labile TOC present in the samples. Agricultural interests and other dischargers of TOC should only be required to control TOC that is refractory – i.e., can reach a domestic water supply water treatment plant and thereby influence THM formation in the treated water supply. Some of the TOC discharged by agricultural and other sources in the Central Valley will, at times, not reach a domestic water supply intake, as a result of its degradation in transport from the source to the intake. These issues are reviewed by Lee and Jones-Lee (2003).

Pesticides

Under Pesticides, the organophosphorus and carbamate pesticides should be monitored, using low-level detection limit analytical procedures. Conventional procedures do not measure several of these parameters with sufficient reliability to determine if they are present at concentrations that are potentially adverse to aquatic life.

The June 24, 2003, revised monitoring program persists with requirements for measuring the organochlorine "legacy" pesticides, such as DDT, toxaphene, chlordane, dieldrin, etc., in water. As discussed in our report (Lee and Jones-Lee, 2002a) and in our previous comments, the approach that should be followed is to collect fish once during the year from the waterbody being sampled, and measure whether the fish tissue has excessive concentrations of these pesticides. As part of these measurements, PCBs should also be analyzed for, since previous work on fish tissue residues from agricultural drain fish have shown that some of them have excessive PCBs. For example, Natomas East Main Drain is listed on the 303(d) list as impaired due to excessive PCBs in edible fish. Based on a review that Drs. Lee and Jones-Lee conducted last fall (Lee and Jones-Lee, 2002b) of the existing PCB fish tissue data, there are other agricultural areas where PCBs have bioaccumulated in fish to excessive levels. Therefore, PCBs should be part of the chemicals that are examined as part of the agricultural waiver monitoring program.

Trying to measure organochlorine legacy pesticides and PCBs using chemical methods is a waste of time and money, since the analytical methods do not have the sensitivity to measure them at critical levels that can bioaccumulate to excessive levels in fish tissue, which represents a health threat to those who use the fish as food.

Another parameter that needs to be measured in fish, for at least some samples, is dioxins and furans. There are a variety of sources, including agricultural sources of dioxins, which need to be evaluated.

With respect to monitoring for pyrethroid pesticides and herbicides, large amounts of money could be spent attempting to monitor for these parameters, which would generate little or no useful data. The monitoring for these types of pesticides and herbicides should be based on their use in the watershed.

The proposed prioritization that was given to requiring that pesticide monitoring be delayed until the second phase is inappropriate. Appropriate pesticide monitoring should be part of the first phase of the monitoring program, where pesticides that have been used or are currently being

used in a watershed are monitored as part of the Phase I efforts. This is based on the fact that toxicity measurements are not an effective screen for pesticide-caused aquatic life toxicity, except at high levels of pesticides. Pesticides, such as diazinon and chlorpyrifos, can be present in water at toxic levels and not cause toxicity to aquatic life in the standard tests specified in the monitoring requirements. The US EPA's approach for developing water quality criteria for potentially toxic substances involves estimating the "safe" concentration of the substance which should not cause toxicity to about 95 percent of aquatic life forms. This "safe" concentration (water quality criterion) is considerably less than the concentration that causes toxicity in a standard toxicity test.

The data that are needed would show whether diazinon, chlorpyrifos and a number of the carbamate pesticides are present at toxic levels. The measurement of these pesticides should be done with analytical methods that have a reliable quantitation limit (detection limit) of less than 0.1 times the LC_{50} for the test organism in the US EPA OPP Ecotoxicity Database that was used to register the pesticide. The issues of properly measuring pesticides and interpretation of the data from the water column, sediments and fish tissue are discussed in detail by Lee and Jones-Lee (2002b):

> Lee, G. F. and Jones-Lee, A., "Organochlorine Pesticide, PCB and Dioxin/Furan Excessive Bioaccumulation Management Guidance," California Water Institute Report TP 02-06 to the California Water Resources Control Board/Central Valley Regional Water Quality Control Board, 170 pp, California State University Fresno, Fresno, CA, December (2002). http://www.gfredlee.com/OClTMDLRpt12-11-02.pdf

Metals

Both total and dissolved metals should be monitored. While only the dissolved metals are regulated in the water column, the total metals are of importance because they can contribute to excessive metal concentrations in sediments.

Mercury should be analyzed in fish tissue from the waterbody being monitored to determine if there is a mercury source in the watershed that is leading to excessive mercury bioaccumulation in fish tissue.

Nutrients

With respect to nutrients (on page 8 of Table 1), ammonia must be added to this list so that it is possible to calculate organic nitrogen concentration from the ammonia and the TKN concentrations. Ammonia is a toxicant that could be important in both the water column and sediments, and should be measured. Ammonia is also a source of oxygen demand that needs to be measured.

Phosphorus measurements should include both total phosphorus and soluble orthophosphate measurements. This information is essential to properly determining whether the phosphorus data are related to algal available P.

As discussed previously, there is no reason to measure potassium. Any funds spent on measuring potassium would be a waste of money. Potassium is not a nutrient in aquatic systems. There is always adequate potassium to meet algal and other aquatic plant needs.

We question the appropriateness of prioritization to Phase II or III for certain water quality parameters, such as nutrients. The additional cost to include nutrients in Phase I or II is small compared to the overall cost of the monitoring. Except for a few parameters, the cost of analysis is largely associated with sample collection. Nutrients from agricultural sources are causing major water quality problems in the Central Valley; however, since there are only narrative guidelines for "Biostimulatory Substances," there is need for the CVRWQCB to define what constitutes excessive biostimulation and the relationship to nutrients. These issues are discussed in detail in our report,

> Lee, G. F. and Jones-Lee, A., "Review of Management Practices for Controlling the Water Quality Impacts of Potential Pollutants in Irrigated Agriculture Stormwater Runoff and Tailwater Discharges," California Water Institute Report TP 02-05 to California Water Resources Control Board/Central Valley Regional Water Quality Control Board, 128 pp, California State University Fresno, Fresno, CA, December (2002c).
> http://www.gfredlee.com/BMP_Rpt.pdf

As part of monitoring nutrients, planktonic algal chlorophyll, pheophytin and Secchi depth should be included as monitoring parameters. These parameters are needed to begin to evaluate the nutrient data.

Oxygen Demand Parameters

There is need to monitor oxygen demand parameters such as $BOD_{10,}$ ammonia, chlorophyll and pheophytin in any situation where there is a DO concentration below the water quality objective at the sampling location and downstream. BOD_{10} should be added to the list of monitoring parameters.

Monitoring Locations

As discussed above, the CVRWQCB has determined that in order to reliably regulate the water quality impacts of irrigated agriculture on the water quality of the receiving waters, it will be necessary to monitor at the "*basin*, *drain* and *field"* level. *Basin* level monitoring is needed to define large-scale water quality impacts from upstream watershed sources. The *drain* level monitoring can give an indication that irrigated agricultural discharges are having an adverse impact on the drain watershed waters. The *field* level monitoring is necessary to identify specific sources of pollutants derived from agricultural activities. Failure to monitor all three levels will cause the CVRWQCB agricultural waiver monitoring program to fail to accomplish its goals of controlling the significant adverse impacts of Central Valley irrigated agricultural discharges.

The **Watershed Specific Requirements** section provides information on the characteristics of the water quality monitoring program. This section has several significant technical problems, which are discussed below.

Section 6, **Monitoring Seasons**, specifies monitoring of two major storm events during one storm season and monthly sampling during one irrigation season followed by collection and evaluation of data. Based on Dr. G. F. Lee's over 40 years of experience devoted to water quality monitoring, monitoring only two storms per season can fail to detect significant water quality problems. The agricultural waiver monitoring should require monitoring of three storms over the season focusing on the first major storm, mid winter and a late March - April storm. There are sufficient differences in the characteristics in early and late winter season agricultural runoff to require this monitoring program. The non-stormwater runoff monitoring should, in addition to monthly sampling, be designed to sample tailwater discharges shortly after application of chemicals to the agricultural lands.

Monitoring Duration. Because of the year-to-year variation in agricultural chemical use and climate it will be necessary to continue a comprehensive agricultural runoff/discharge monitoring program indefinitely (forever). It is important to understand that the currently proposed monitoring program could readily lead to a worsening of the water quality conditions in Central Valley waterbodies, as a result of new or expanded discharges of pesticides and other hazardous chemicals from agricultural activities. The recommended approach of only monitoring 20 percent of the tributaries in a year is a technically invalid approach. As discussed by Lee and Jones-Lee (2002a), the fact that the US EPA Office of Pesticide Programs allows the registration of a pesticide that is highly toxic to aquatic life that can be present in agricultural stormwater runoff or tailwater discharges and that agricultural interests are changing the use and types of pesticides used, can readily lead to greater aquatic life toxicity in the receiving waters for agricultural runoff/discharges in the Central Valley than is occurring today. Since the failure to detect a water quality problem in one year does not mean that water quality problems will not occur in discharges from an agricultural area in other years, a comprehensive agricultural discharge monitoring program will need to be a continuing requirement of practicing agriculture in the Central Valley. While it may be appropriate to adjust the frequency and locations of monitoring and the parameters monitored as information is gained on a particular watershed, the overall characteristics of the monitoring program will need to be continued indefinitely.

The **Monitoring Sites** section provides guidance on selecting monitoring sites. This section specifies that,

> "*…monitoring sites must be established initially on the water bodies that are carrying agricultural drainage into natural waterbodies. If results indicate that water quality objectives are exceeded at any site, monitoring for the constituents of concern (constituents exceeded water quality objectives) shall continue and the monitoring must be expanded upstream in a systematic search for sources.*"

This approach is not technically valid in reliably detecting water quality impacts of irrigated agriculture stormwater runoff and tailwater and drain water discharges. These issues have been reviewed by Lee and Jones-Lee (2002a), where we discuss that failure to find water quality objective violations at the mouth of an agricultural drain does not mean that the drain watershed does not have water with deteriorated water quality caused by irrigated agricultural discharges.

Some of the agricultural drains have "aquatic life" and "municipal water supply" designated beneficial uses. These designated beneficial uses include the drain watershed waterbodies. Upstream tributaries to an agricultural drain mouth monitoring point can have water quality problems that will not be observed at the downstream monitoring location. The monitoring locations should be determined based on the characteristics of land use in the watersheds and chemicals used on agricultural lands. The monitoring locations and times should be designed to detect when runoff/discharges from agricultural activities occur.

Another significant problem with the guidance provided is that there can be agricultural discharges to mainstem rivers that have localized water quality impacts that will likely not be detected by the mainstem monitoring that will apparently be accomplished by the CVRWQCB or some other agency unless major additional funding is made available for this monitoring. The mainstem monitoring must include specifically sampling areas where there are agricultural discharges directly to the mainstem.

Evaluation of Efficacy of Management Practices

The proposed monitoring program requires that the watershed groups evaluate the potential efficacy of management practices for controlling excessive concentrations of pollutants present in agricultural discharges/runoff. As part of the report on management practices for irrigated agriculture that we completed in December 2002 (Lee and Jones-Lee, 2002c), we presented a discussion of the problems with trying to evaluate the efficacy of management practices to control pollutants in irrigated agricultural runoff/discharges. The June 24, 2003, draft revised monitoring program fails to present the complexity of trying to properly evaluate the range of management practices under the variety of conditions that these practices will have to operate under in the various agricultural settings in the Central Valley. It will take at least three to five years of intensive, highly reliable studies to develop reliable conclusions on the efficacy of various management practices in controlling various discharges of pollutants from irrigated agriculture. This means it will likely be at least five to ten years before any significant amount of useful information will be generated in this topic area, provided that large-scale funding becomes immediately available for such studies. Without this funding, the evaluation of the efficacy of various management practices will at best be superficial and could be unreliable.

Importance of Providing Adequate Funding to Implement the Agricultural Waiver Monitoring Program

In addition to the substantial funds needed for monitoring and evaluation of the water quality significance of exceedances of numeric and narrative water quality objectives, there is need for substantial funding to be made available to the CVRWQCB to hire mid- and high-level staff to work with the agricultural dischargers in data/report review. It is estimated that between 30 and 40 additional staff will be needed to properly implement the proposed program. If the CVRWQCB does not receive substantial additional funding, the agricultural waiver monitoring program as proposed will not accomplish the stated goals and will represent a superficial approach toward reliably defining and managing the significant water quality impacts of irrigated agriculture stormwater runoff and tailwater discharges.

The situation that exists now with respect to regulating urban stormwater runoff, where data are gathered but there are no staff to critically evaluate the stormwater runoff data and take action

where problems exist, will become prevalent in the agricultural waiver monitoring program. Because of the sophisticated nature of reliable data interpretation, it will not be possible to hire staff members to assume this responsibility who are recent bachelors/masters degree graduates from college. There are few individuals even at the PhD level, after having worked for several years in the water quality field, who have sufficient understanding of water analysis, water chemistry, water quality, aquatic toxicology, etc., to reliably review data of this type and recommend how to proceed to determine real, significant water quality problems and address how to manage them. Failure to provide adequate funding to the CVRWQCB will result in another mandated program at the Regional Board level that is not adequately implemented.

Evaluation of the Water Quality Significance of Exceedance of a Water Quality Objective

As discussed by Lee and Jones-Lee (2002a), agricultural interests should have funds that can be used to evaluate the water quality significance of an exceedance of a numeric water quality objective. Numeric water quality objectives are, in general, based on US EPA water quality criteria, which are designed to be applicable to worst-case situations – i.e., most toxic, most available, for extended duration. The US EPA water quality criteria and state standards based on these criteria, including the Central Valley Regional Water Quality Control Board Basin Plan objectives, are designed to be adjusted for site-specific situations. In accordance with the US EPA implementation policy, as well as under Porter-Cologne, this adjustment requires a site-specific evaluation, in which the discharger funds a study that is conducted in cooperation with the Regional Board, of an appropriate adjustment of the numeric water quality objective for the conditions that exist at the point of discharge and downstream in the receiving waters.

It will be important that the funding for the agricultural waiver monitoring program include funds that can be used for site-specific studies for adjustment of numeric objectives. These issues have been discussed in detail in Lee and Jones-Lee (2002a). This adjustment should be explored as the first step in addressing the violations of a numeric water quality objective to determine if the violation is an "administrative" exceedance of the objective, related to how the objective was developed, or represents a real, significant beneficial use impairment of the receiving waters for the agricultural stormwater runoff and tailwater/subsurface drain water discharges.

Approach for Addressing Violations of Narrative Water Quality Objectives

One of the problems that the CVRWQCB staff and agricultural interests will face in implementing the agricultural waiver monitoring program is an evaluation of what constitutes an exceedance of a narrative objective by constituents derived from agricultural runoff/discharges. Without implementation guidance on evaluating exceedances of narrative objectives for various types of site-specific situations, the monitoring for the parameters for which there are narrative objectives will result in data being generated that are of little or no value in addressing whether agricultural runoff/discharges are having an adverse impact. It is important, however, for the CVRWQCB not to opt for a single Central-Valley-wide numeric value to implement the narrative objective. Instead, guidance on how to determine, for various types of agricultural settings, what constitutes a significant violation of a narrative objective should be provided. Information on these issues is provided in Lee and Jones-Lee (2002a).

Review of the Adequacy of the Agricultural Waiver Monitoring Program

As proposed in the June 24, 2003, agricultural waiver water quality monitoring program, the program that is developed by agricultural interests is to be reviewed and approved by the CVRWQCB Executive Officer. As currently formulated, the public who are concerned about the adverse impacts of agricultural discharges on Central Valley water quality would not be provided an opportunity to review the monitoring programs proposed by agricultural interests and the proposed approval of such programs by the Executive Officer. In order for this program to be effective and meet the public's needs, the public must be able to review the submissions of the agricultural interests and comment on the adequacy of the Executive Officer's proposed approval of such programs.

Monitoring Data Availability and Agricultural Waiver Needs

It appears that the proposed water quality monitoring program generation of water quality data and the need for these data in the implementation of the CVRWQCB agricultural waiver program are not properly linked. The monitoring program needs to be mated to information needs of the agricultural waiver to make future decisions on issuance of regulatory requirements and the EIR that will need to be developed by the CVRWQCB to properly regulate agricultural drainage/discharges. As proposed, some of the key data that are to be developed in the monitoring program that are needed to properly evaluate and then regulate will not be available until years after a new regulatory program will have to be formulated. The phased implementation of the water quality monitoring parameters and the 20 percent per year monitoring of a watershed lead to a situation where the information that the Regional Board will need to extend the agricultural waivers in two years will not be available for at least six to possibly as many as ten years from when the monitoring program is implemented. In order for the CVRWQCB to implement a technically valid, cost-effective program of managing the water quality impacts from irrigated agricultural discharges/runoff, funds must be made available to implement a comprehensive monitoring program throughout the Central Valley that can serve as a valid basis for regulating stormwater runoff and tailwater/drain water discharges.

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Summary of Drs. G. Fred Lee and Anne Jones-Lee's Expertise and Experience in Developing Water Quality Monitoring Programs

Dr. G. Fred Lee is President of G. Fred Lee and Associates, which consists of Drs. G. Fred Lee and Dr. Anne Jones-Lee (Vice President) as the principals in the firm. They specialize in addressing advanced technical aspects of water supply water quality, water and wastewater treatment, water pollution control, and solid and hazardous waste impact evaluation and management.

After obtaining a bachelor's degree at San Jose State University in 1955, a Master of Science Degree in Public Health from the University of North Carolina in 1957 and a PhD from Harvard University in 1960 in Environmental Engineering and Environmental Sciences, Dr. Lee taught graduate-level university environmental engineering and environmental science courses for 30 years at several major U.S. universities. During this time, he conducted over $5 million of research and published over 500 papers and reports.

Dr. Lee was active as a part-time consultant during his 30-year university teaching and research career. Drs. G. F. Lee and A. Jones-Lee have been full-time consultants since 1989. Dr. Lee has extensive experience in developing approaches that work toward protection of water quality without significant unnecessary expenditures for chemical constituent control. He has been active in developing technically valid, cost-effective approaches for the evaluation and management of chemical constituents in domestic and industrial wastewater discharges and urban and rural stormwater runoff since 1960.

Dr. Anne Jones-Lee was a university professor for a period of 11 years in environmental engineering and environmental sciences. She has a BS degree from Southern Methodist University and obtained a PhD in Environmental Sciences in 1978 focusing on water quality evaluation and management from the University of Texas at Dallas. At the New Jersey Institute of Technology she held the position of Associate Professor of Civil and Environmental Engineering with tenure. She and Dr. G. F. Lee have worked together as a team since the mid-1970s.

Dr. G. F. Lee has been an active participant in helping to organize and review the adequacy of the water quality monitoring programs conducted in the Sacramento River Watershed Program since the mid-1990s. Further, he is familiar with the San Joaquin River watershed and Delta water quality monitoring through active participation in the San Joaquin River DO TMDL program, where he was PI coordinator for an approximately $2 million/year CALFED-sponsored Directed Action water quality evaluation and management program in the San Joaquin River watershed, as it relates to impacts of constituents derived from the watershed on water quality in the San Joaquin River and the Deep Water Ship Channel near Stockton. In March 2003 Drs. G. F. Lee and A. Jones-Lee prepared a 280-page Synthesis Report covering the four years and approximately $3.5-million of studies on the San Joaquin River watershed, as they relate to low dissolved oxygen in the San Joaquin River Deep Water Ship Channel. During 2001 Dr. G. F. Lee was part of the review team for the IEP monitoring program for water quality in the Delta.

Dr. G. F. Lee has been a member of the APHA, *et al*., (1998) Standard Methods committee for development of Standard Methods for the Examination of Water and Wastewater since the early 1960s. Also during this time, he has been a member of the ASTM Committee D-19 on Water. This committee work involves his periodically reviewing new or revised analytical methods for water and wastewater components. It enables him to stay current with analytical method development and their appropriate utilization.

The authors have recently completed an approximately half-million-dollar, five-year water quality monitoring and evaluation study in Orange County, CA, on behalf of the Santa Ana Regional Water Quality Control Board. Their work included studies on organophosphate (OP) and organochlorine pesticides and PCBs (OCls) and heavy metals. The results of this program are being used by the Santa Ana Regional Board as a basis for developing several TMDLs in the Upper Newport Bay watershed.

Dr. G. F. Lee has over 40 years of experience working on helping to develop, implement and evaluate water quality criteria and state standards based on US EPA criteria. This experience includes advising a number of states (such as Wisconsin, Texas and Colorado) on the development of appropriate water quality criteria. Further, Dr. G. F. Lee was part of the National Academies of Science and Engineering's "Blue Book" of water quality criteria peer review panel that developed the Blue Book of water quality criteria in 1972. In the late 1970s he was a member of the American Fisheries Society Water Quality Section panel that reviewed the US EPA "Red Book" of water quality criteria released in 1976. Further, in the early 1980s Dr. G. F. Lee was a US EPA invited peer reviewer for the then proposed water quality criteria development approach. This is the approach that is still being used today to develop new water quality criteria. In addition, Dr. G. F. Lee served as an invited peer reviewer for several sections of the US EPA "Gold Book" of water quality criteria (ammonia and copper) as part of promulgating the Gold Book criteria in 1986.

During the 1990s, he provided detailed comments on the California State Water Resources Control Board's proposed water quality objectives that were adopted by the State Board in the early 1990s, and then rescinded by the court because the State Board did not comply with Porter-Cologne requirements for conducting an economic evaluation of the impact of adopting these criteria. Further, Dr. G. F. Lee has been an active participant in review of the California Toxics Rule criteria that were adopted in July 2000. At this time he is an active participant in the US EPA RTAG nutrient criteria development program for California and the Central Valley.

Overall, Dr. G. F. Lee is highly familiar with how water quality criteria have been developed, their strengths and weaknesses, and, most importantly, their proper application in water quality management programs. He and Dr. Jones-Lee published an invited paper, "Appropriate Use of Numeric Chemical Water Quality Criteria," discussing how the US EPA criteria and state water quality standards based on these criteria should be implemented, considering the approach for their development and their appropriate use to regulate constituents in ambient waters from various sources.

Dr. G. F. Lee has extensive experience in conducting water quality monitoring/water quality impact evaluation studies from agricultural and urban stormwater runoff. These studies were initiated in the early 1960s while he held the position of Professor of Water Chemistry and Director of the Water Chemistry Program at the University of Wisconsin, Madison. As Vice Chair of the Lake Mendota Problems Committee, he worked with the committee members representing various university departments to develop nutrient export coefficients from various types of agricultural lands in the Lake Mendota watershed. These coefficients have subsequently, through additional studies, been found to have national application in assessing the amounts of nitrogen and phosphorus derived from agricultural lands, as well as urban areas.

In the 1970s, the US EPA Great Lakes program selected Dr. G. Fred Lee to develop a water quality monitoring program for the Great Lakes focusing on toxic constituents. Upon moving back to California in 1989, Dr. G. Fred Lee and Dr. Anne Jones-Lee brought that report up-to-date with respect to broadening its scope where it now focuses on stormwater runoff water quality impacts. That report emphasizes the importance of properly developing a monitoring program to ensure that meaningful results are developed that can be used to appropriately manage water quality without unnecessary expenditures for constituent control from various sources.

During 2002 Drs. G. F. Lee and A. Jones-Lee completed three major reports for the State Water Resources Control Board (SWRCB) and Central Valley Regional Water Quality Control Board (CVRWQCB) on monitoring, evaluation of impacts and management of nonpoint source pollutants, focusing on Central Valley irrigated agriculture. These reports include

> Lee, G. F. and Jones-Lee, A., "Review of Management Practices for Controlling the Water Quality Impacts of Potential Pollutants in Irrigated Agriculture Stormwater Runoff and Tailwater Discharges," California Water Institute Report TP 02-05 to California Water Resources Control Board/Central Valley Regional Water Quality Control Board, 128 pp, California State University Fresno, Fresno, CA, December (2002) (http://www.gfredlee.com/BMP_Rpt.pdf)
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> Lee, G. F. and Jones-Lee, A., "Organochlorine Pesticide, PCB and Dioxin/Furan Excessive Bioaccumulation Management Guidance," California Water Institute Report TP 02-06 to the California Water Resources Control Board/Central Valley Regional Water Quality Control Board, 170 pp, California State University Fresno, Fresno, CA, December (2002) (http://www.gfredlee.com/OClTMDLRpt12-11-02.pdf)
>
> Lee, G. F. and Jones-Lee, A., "Issues in Developing a Water Quality Monitoring Program for Evaluation of the Water Quality - Beneficial Use Impacts of Stormwater Runoff and Irrigation Water Discharges from Irrigated Agriculture in the Central Valley, CA," California Water Institute Report TP 02-07 to the California Water Resources Control Board/ Central Valley Regional Water Quality Control Board, 157 pp, California State University Fresno, Fresno, CA, December (2002) (http://www.gfredlee.com/Agwaivermonitoring-dec.pdf).

Drs. Lee and Jones-Lee also completed a major report for the SWRCB/CVRWQCB,

> Lee, G. F. and Jones-Lee, A., "City of Stockton Mosher Slough and Five Mile Slough Diazinon and Chlorpyrifos Aquatic Life Toxicity Management Report," California Water Institute Report TP 02-08 to the California State Water Resources Control Board/Central Valley Regional Water Quality Control Board, 44 pp, California State University Fresno, Fresno, CA, December (2002) (http://www.gfredlee.com/StockDiaTMDL12-14-02.pdf),

that discusses the water quality problems caused by OP pesticides in stormwater runoff from the city of Stockton, and their management.

Further information on Drs. Lee and Jones-Lee's expertise and experience is available from their website, www.gfredlee.com.