Comments on the SWRCB Draft Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program Dated December 8, 2003

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On December 8, 2003, the State Water Resources Control Board (SWRCB) released for public comment a draft Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program. A public hearing on this draft policy is scheduled for February 3, 2004. Presented below are comments on this draft Policy.

The issue of properly regulating nonpoint-source-derived pollutants is a topic that I have worked on for about 43 years. In support of the Central Valley Regional Water Quality Control Board (CVRWQCB), Dr. Anne Jones-Lee and I developed reports pursuant to a contract through the California Water Institute at CSU Fresno that provided information on NPS pollution water quality monitoring program development (Lee and Jones-Lee, 2002a) and on the existing information on management practices (MPs) for irrigated agriculture stormwater runoff and tailwater/subsurface drain water discharges (Lee and Jones-Lee, 2002b).

We also developed reports on the occurrence of excessive bioaccumulation of organochlorine legacy pesticides (DDT, dieldrin, chlordane, toxaphene) and PCBs in edible fish in Central Valley waterbodies, as well as a recommended approach for controlling the excessive bioaccumulation problem in Central Valley fish (Lee and Jones-Lee, 2002c).

On behalf of the DeltaKeeper and the CVRWQCB, Dr. Jones-Lee and I, with the assistance of Dr. Scott Ogle of Pacific EcoRisk, conducted a study on the bioavailability of PCBs in city of Stockton Smith Canal sediments as a potential source of PCBs that had been found in Smith Canal fish (Lee, et al., 2002). This study represented the first application in California of the US EPA sediment bioavailability methodology using benthic organism biouptake of sediment-bound organochlorine hazardous chemicals. This methodology will need to be used to evaluate the bioavailability of organochlorine legacy pesticides and PCBs in Central Valley waterbody sediments, which will be an important part of a technically valid NPS program to control excessive bioaccumulation.

We developed a report (Lee and Jones-Lee, 2002d) for the CVRWQCB covering the approach that is needed to manage the aquatic life toxicity in city of Stockton stormwater runoff that is due to the organophosphorus pesticides (diazinon and chlorpyrifos) as part of implementing a TMDL to control the stormwater runoff toxicity. This report was based on another report (Lee and Jones-Lee, 2001), in which we assisted the CVRWQCB

and the DeltaKeeper in writing up a comprehensive report covering the city of Stockton stormwater runoff aquatic life toxicity monitoring data that the CVRWQCB and the DeltaKeeper had developed over the period 1994-2000. While urban stormwater runoff is regulated, for administrative purposes, as a point source discharge, from a management perspective, it needs to be addressed as an NPS problem.

In addition, we conducted about $500,000 of studies over a five-year period on behalf of the Santa Ana Regional Water Quality Control Board and the Orange County, California, Public Facilities and Resources Department on the occurrence, magnitude, sources and water quality significance of aquatic life toxicity in the Upper Newport Bay watershed and the Bay. These studies were supported by US EPA 205(j) and 319(h) funds. Two major reports were developed (Lee, et al., 2001a,b). The studies included monitoring aquatic life toxicity, pesticides and heavy metals in stormwater runoff from 10 different watersheds that had land use ranging from 100% agricultural to 100% urban.

During the past year I have been active in reviewing the CVRWQCB agricultural waiver monitoring program. I have provided detailed comments on the deficiencies in the CVRWQCB water quality monitoring guidance. Comments on this issue have been submitted to the CVRWQCB (Lee, 2003a) and the SWRCB (2003b).

The work on the projects that led to the various reports mentioned above has provided me the opportunity to become familiar with NPS pollution control program implementation. It is with this recent background which is directly pertinent to NPS pollution control that I wish to make the following comments on the draft Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program.

Specific Comments

Page A-14 of the draft, section D. The Key Elements of an NPS Pollution Control Implementation Program, states in the first paragraph,

> *"Before approving or endorsing a specific Third-Party Program, the RWQCB must determine that there is a reasonable likelihood that the Third-Party Program will attain the RWQCB's stated objectives."*

This is an appropriate requirement, but it has been my experience, in connection with the CVRWQCB agricultural waiver monitoring program, that this may not be properly carried out at the Regional Board level. With respect to the agricultural waiver monitoring requirements, the CVRWQCB specified certain minimum monitoring requirements; however, as I pointed out to the Board staff and to the Board (Lee, 2003a), the minimum monitoring requirements set forth cannot satisfy the objectives of the proposed agricultural waiver management program.

The Regional Board chose to ignore the obvious significant technical deficiencies in the required monitoring program in producing the data that would be useful in achieving the desired objectives of developing a database that could be used to determine the potential water quality impacts and water quality objective violations of irrigated agriculture

stormwater runoff and tailwater and subsurface drain water discharges. When several groups filed petitions to the State Board on the Regional Board's agricultural waiver program, I provided a detailed set of comments to the State Board (Lee, 2003b), pointing out the inadequacies of the proposed agricultural waiver water quality monitoring program. The State Board attorneys concluded that there were no problems with this program and that it was appropriate. This was obviously a political decision that had nothing to do with science or a scientific review.

Attached to these comments are the comments that I recently submitted to State Board Chairman Baggett (Lee, 2004) on the unreliability of the State Board attorneys/staff's review of this matter. As pointed out, it is blatantly obvious that the CVRWQCB agricultural waiver monitoring program specified in Order No. R5-2003-0826 cannot achieve the RWQCB's stated objectives for a number of the key parameters. The reasons for this are discussed in the attachment. The State Board members all chose to ignore my technical comments on these deficiencies and supported the Regional Board. This is an example of the inability of both the Regional and State Boards to use elementary technical information in adopting a nonpoint source management program. It is obvious that politics – not science or engineering – plays a dominant role in the NPS program. Further, it is clear by this example which occurred in the past month that neither the Regional Board nor the State Board can fulfill the requirement of determining that there is "reasonable likelihood that a Third-Party Program will attain the RWQCB's stated objectives."

While there are many who understand the deficiencies in the monitoring program, there are members of the agricultural community who will likely follow the Regional Board's inadequate minimum monitoring requirements, knowing that they will not generate the data that the Regional Board can use in a meaningful way to discern violations of water quality objectives for key constituents in stormwater runoff and tailwater discharges. This will lead to significant delays in achieving the objectives within the timeframe adopted by the Regional Board, since the first step in implementing the NPS policy under the agricultural waiver approach is a credible monitoring program that reliably defines the water quality objective violations, which in turn triggers the implementation of management practices to control the violations.

In the draft NPS pollution control Policy, there are a series of Key Elements delineated beginning on page A-15. Several of these require that the Regional Board carry out certain activities. It has been my experience in working closely with Regional Board staff for over 10 years with both the Central Valley and Santa Ana Regional Boards, that often the staff do not have the technical background, time and resources to carry out the Key Element requirements in the timeframe allowed. This situation will become extremely significant in preventing the NPS water pollution control program from achieving its objectives. If this NPS water pollution control program is to be a valid program, there will need to be a drastic increase in the level of support for the Regional Boards with regard to increased staff and expertise, increased funding for special studies and for hiring consultants who can work with the staff to assist them in review of issues,

and to find a way to isolate the staff and the Boards from the political pressures that often dominate water pollution control efforts in the state.

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Comments on SWRCB January 9, 2004 Review of Irrigated Agriculture Waiver Water Quality Monitoring Requirements

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As a followup to the State Water Resources Control Board (SWRCB) workshop devoted to review of the petitions that were filed on the CVRWQCB Monitoring and Reporting Program Order No. R5-2003-0826 for the agricultural water quality (WQ) waiver, Craig M. Wilson, Chief Counsel of the SWRCB stated on page 11 of the January 9, 2004, draft,

> *"We have reviewed the monitoring requirements for Coalition Groups and have determined that they reflect a comprehensive and reasonable approach for a watershed-based monitoring program."*

In connection with the request for comments on the SWRCB December 5, 2003, draft of the State Board's initial findings on the irrigated agriculture waiver (ag waiver) petitions, I provided detailed comments to the State Board on the significant technical problems with the Central Valley Regional Water Quality Control Board's (CVRWQCB's) ag waiver water quality monitoring program. I discussed that many of the monitoring parameters and the analytical methods used for them will not develop data that can be used in a regulatory program to determine if discharges/runoff from irrigated agricultural lands are causing violations of water quality objectives (WQO) in the receiving waters for this runoff/discharge.

Importance of Developing Reliable Water Quality Monitoring Guidance

My previous comments, as well as these comments are unsponsored. They are made as part of my career-long effort to improve the quality of science and engineering used in water quality investigation and management. Throughout my career I have repeatedly found that regulatory agencies and their administrative boards do not necessarily use the currently available science and engineering in developing management programs. This leads to ineffective or unreliable programs. This is what will occur with the ag waiver monitoring/management program if the current deficiencies in providing adequate guidance on the ag waiver WQ monitoring are not properly addressed. This will lead to delays in implementing the ag waiver management program such as developing management practices to control WQO violations since there will not be defined violations of a Basin Plan WQO that need to be controlled even though the water quality – beneficial uses are adversely impacted by the constituents of concern.

In the comments to the Central Valley Regional Board, as well as the State Board, I pointed out that if this issue is not adequately addressed, large amounts of funds will be spent by agricultural interests and the public in agriculture waiver water quality monitoring that would generate inadequate, unreliable and significantly deficient data on the characteristics of the runoff and its impact on the beneficial uses of the monitored and receiving waters for agricultural discharge/runoff. My comments were based on my over 43 years of work on water quality monitoring program development, development of water quality analytical methods, and using

water quality data in water pollution control programs, and 38 years of work on water quality criteria/standards development and their implementation.

Background to Ag Waiver Comments

Several years ago Dr. Val Connor then of the Central Valley Regional Water Quality Control Board asked if I would be of assistance to the CVRWQCB in developing guidance on nonpoint source water quality monitoring for the Central Valley. The focus of this effort was to be on determining the potential water quality-beneficial use impacts of Central Valley irrigated agricultural runoff/discharges. Eventually, a contract was issued to the California Water Institute at CSU Fresno to support Dr. Jones-Lee and me in this effort. This resulted in a comprehensive report,

> 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

on the issues that need to be considered in developing a credible water quality monitoring program for irrigated agricultural runoff/discharges that could be used in a CVRWQCB water quality management program. In that report, Dr. Jones-Lee and I reviewed the guidance that had been provided by others, with particular reference to the publication by the National Research Council entitled, "Managing Troubled Waters." I also provided references to the earlier work that Dr. Jones-Lee and I had done for the US EPA on developing credible water quality monitoring programs for hazardous chemicals in the US-Canadian Great Lakes. This guidance has been updated and expanded as,

> Lee, G. F. and Jones-Lee, A., "Guidance for Conducting Water Quality Studies for Developing Control Programs for Toxic Contaminants in Wastewaters and Stormwater Runoff," Report of G. Fred Lee & Associates, El Macero, CA, 30pp, July (1992).
> www.gfredlee.com/pwwqual2.htm

The NRC and our guidance both stressed the importance of adequate definition of the objectives of a water quality monitoring program.

Objectives of the Ag Waiver Water Quality Monitoring

Those familiar with water quality monitoring program development know that the first step in developing a credible program is a clear statement of the objectives of the monitoring program. Most water quality monitoring programs do not develop credible objectives, with the result that the money spent in water quality monitoring can largely wasted. In Dr. Jones-Lee and my report to the Central Valley Regional Water Quality Control Board, we provided detailed guidance on the kinds of information that is needed to achieve meaningful water quality monitoring. In reviewing the CVRWQCB agriculture waiver water quality monitoring program, I found, as I discussed in my comments on it, that this program will be significantly deficient in developing the information needed to use the monitoring results in the ag waiver water quality management

program. **One of the fundamental tenets of a credible water quality monitoring program is that it is specifically designed to achieve the objectives of the management program.**

The CVRWQCB ag waiver monitoring program "minimum requirements" set forth in Table 1, in the CVRWQCB, in its Monitoring and Reporting Program Order No. R5-2003-0826 for Coalition Groups under Resolution No. R5-2003-0105, states on page 2,

> *"The Coalition Group shall submit to the Regional Board a detailed MRP* [Monitoring and Reporting Program] *Plan that supports the development and implementation and demonstrates the effectiveness of the Watershed program to comply with conditions of the Waiver.*
>
> *The MRP Plan shall be designed to achieve the following objectives as a condition of the Waiver:*
>
> *a. Assess the impacts of waste discharges from irrigated lands to surface water;*
> *b. Determine the degree of implementation of management practices to reduce discharge of specific wastes that impact water quality;*
> *c. Determine the effectiveness of management practices and strategies to reduce discharges of wastes that impact water quality;*
> *d. Determine concentration and load of waste in these discharges to surface waters; and*
> *e. Evaluate compliance with existing narrative and numeric water quality objectives to determine if additional implementation of management practices are necessary to improve and/or protect water quality."*

This statement delineates the objectives of the water quality monitoring program that is to be conducted as part of the ag waiver water quality management program. It is these objectives that become the basis for the development of the ag waiver monitoring program that the Coalition Groups are to propose to the Regional Water Quality Control Board by April 1, 2004. However, as discussed in my comments to the Regional Board and State Board, the guidance provided in R5-2003-0826 for developing the monitoring and reporting program will not generate the data needed to accomplish the objectives set forth by the Regional Board for this program.

Someone who is not familiar with the CVRWQCB Basin Plan characteristics with respect to listing specific concentrations that would represent a violation of the Basin Plan objectives might assume that measuring the suite of parameters such as in Table 1 in the CVRWQCB Monitoring and Reporting Plan and comparing those measured values to the WQO listed in the Basin Plan would reveal potential situations where the measured parameters could be in violation of the critical concentrations listed in the Basin Plan. However, many of the potentially most important parameters in agricultural stormwater runoff, tailwater, and subsurface drain water discharges do not have specific numeric objectives against which the monitoring data can be compared. This will lead to an inability to use the data generated in the ag waiver WQ monitoring program to determine whether irrigated agricultural runoff/discharges are potentially causing water quality objective violations.

Table 1 Constituents to be Monitored[1]

Constituents	Quantitation Limit	Reporting Unit
General Parameters		
Flow	N/A	cfs (ft^3/sec)
pH	N/A	pH units
Electrical Conductivity	N/A	µmhos/cm
Dissolved Oxygen	N/A	mg O_2/L
Temperature	N/A	Degrees Celsius
Color	N/A	ADMI
Turbidity	N/A	NTUs
Total Dissolved Solids	N/A	mg/L
Total Organic Carbon	N/A	mg/L
Drinking Water		
E. coli	(b)	MPN
Total Organic Carbon	(b)	mg/L
Chloroform	(b)	µg/L
Bromoform*	(b)	µg/L
Dibromochloromethane*	(b)	µg/L
Bromodichlormethane*	(b)	µg/L
Toxicity Tests		
Water Column Toxicity	-	-
Sediment Toxicity	-	-
Pesticides (a)		
Carbamates	(b)	µg/L
Organochlorines	(b)	µg/L
Organophosphorus	(b)	µg/L
Pyrethroids	(b)	µg/L
Herbicides	(b)	µg/L
Metals (a)		
Cadmium	(b)	µg/L
Copper	(b)	µg/L
Lead	(b)	µg/L
Nickel	(b)	µg/L
Zinc	(b)	µg/L
Selenium	(b)	µg/L
Arsenic	(b)	µg/L
Boron	(b)	µg/L
Nutrients (a)		
Total Kjeldahl Nitrogen	(b)	mg/L
Phosphorus	(b)	µg/L
Potassium	(b)	µg/L

a. In addition to Toxicity Investigation Evaluations (TIEs), sites identified as toxic in the initial screen shall be re-sampled to estimate the duration of the toxicant in the waterbody. Additional samples upstream of the original site should also be collected to determine the potential source(s) of the toxicant in the watershed.

b. Quantitation limits must be lower than LC50 or other applicable federal or state toxic or risk limits.

* deleted by the State Water Resources Control Board

[1] Adapted from CVRWQCB (2003)

The deficiencies in the ag waiver WQ monitoring program discussed in my previous comments, as well as in these comments, are typical of deficiencies that occur in many water quality monitoring programs, since those who develop the water quality monitoring programs are not the individuals who will have to use the data in a management program. The approach that should be followed is not to separate the development of the monitoring program from the use of the data, but to closely integrate the two. In this way, the data generated from such programs can be used. Otherwise, substantial funds will be spent in monitoring that will be of little or no value in management.

Experience with Using CVRWQCB Basin Plan WQ Objective in Evaluating Water Quality

I can speak from experience on the deficiencies in conventional water quality monitoring programs of the type adopted by the CVRWQCB last July for ag waiver water quality monitoring, as a result of my work on behalf of the Yolo County Department of Public Works. I was a subcontractor on a Supplemental EIR for Cache Creek bank stabilization and sandbar and vegetation removal projects. As part of this effort, Dr. Jones-Lee and I conducted a critical review of the water quality monitoring data that Yolo County Department of Public Works had been collecting on Cache Creek over a period of several years. The County conducted a "conventional" water quality monitoring program, in which a wide variety of parameters were monitored periodically at several locations on Cache Creek. Our report,

> Lee, G. F., "Water Quality," Chapter 4.6 of Yolo County's Supplemental Environmental Impact Report for the Cache Creek Resources Management Plan and Cache Creek Improvement Program County of Yolo Planning and Public Works Department, Woodland, CA (2002).

was a chapter in the SEIR, which was peer reviewed by a UCD faculty member and a senior member of the Central Valley Regional Water Quality Control Board staff who both understand water quality issues and appropriate monitoring.

A key aspect of conducting the Yolo County Cache Creek projects is the 401 Certification of these projects by the CVRWQCB. This Certification requires that the project not cause violations of the CVRWQCB Basin Plan objectives. As a result of this requirement, Dr. Jones-Lee and my review of the Yolo County Department of Public Works monitoring data, which in many respects will be similar to the data generated in the ag waiver monitoring program, involved comparing the results of the monitoring to the requirements set forth in the CVRWQCB Basin Plan. It was through this effort that we discovered that it is difficult to judge violations of several Basin Plan water quality objectives based on conventional WQ monitoring program data. A detailed discussion of these issues is presented in our Yolo County report. A copy of our report is available from our website at www.gfredlee.com.

As part of developing the nonpoint source monitoring program guidance for the CVRWQCB, we incorporated our experience from trying to interpret conventional water quality monitoring data obtained in our review of the Cache Creek data into this report, indicating that there is need to address the issues that we have raised, such as being certain that the monitoring that is done provides data that can be used to implement the narrative water quality objectives set forth in the CVRWQCB Basin Plan, as well as the other objectives which set forth an approach that does not

involve a single specific numeric value or concentration in a water sample to evaluate water quality objective violations.

I have recommended in my comments to the CVRWQCB on the draft ag waiver monitoring guidance that the staff develop a set of data from the existing ag drain database then conduct a review of the use of this data to evaluate the water quality objective violations based on the CVRWQCB Basin Plan. Adopting this approach will demonstrate the problems that I have been discussing in my comments.

For example, there is not a single numeric water quality objective for turbidity, but an objective that is based on the magnitude of increase over background. Unless the monitoring program incorporates a collection of data to establish pre-rainfall runoff background turbidity, the monitoring data on turbidity collected on a particular day at a particular sampling station cannot be interpreted in terms of a WQO violation. It is, therefore, of no value in judging whether excessive suspended solids (which lead to turbidity) are being discharged from an agricultural or other source. As discussed in our reports on Cache Creek and nonpoint source monitoring guidance, there is need for a considerably different monitoring program than that set forth in the CVRWQCB ag waiver water quality Monitoring and Reporting Plan. It should not be assumed that the agricultural dischargers and their consultants will have the expertise and motivation to conduct the monitoring/evaluation programs needed to properly evaluate whether a measured concentration in an ag discharge/drain is a violation of a narrative water quality objective.

As I discussed in my comments on this proposed monitoring program, an appreciable amount of work needs to be done by the CVRWQCB to provide specific guidance on how to determine, for a variety of parameters of concern in agricultural runoff/discharges, what constitutes an impairment of the beneficial use of the receiving waters for these discharges. Since amendment of the CVRWQCB Basin Plan often requires a number of years, it could readily be that the ten-year timetable that the Central Valley Board has established for achieving the water quality objectives in the runoff/discharges from agricultural areas will not be met, since the violations of the water quality objectives for runoff/discharges from irrigated agriculture are not adequately defined. Since violations are the key to information needed by agricultural interests to implement management practice evaluation, the ag waiver WQ management program may falter on the lack of appropriate monitoring and evaluation information. Without the violations of water quality objectives being well-defined, the dischargers will not proceed to implement the management practices needed to control violations of the Basin Plan objectives.

A critical review of the requirements/guidance provided by CVRWQCB ag waiver WQ monitoring requirements shows that for some areas of water quality concern expressed in the Order, additional parameters beyond those listed in Table 1 will have to be monitored to properly assess WQO violations. Also the conventional monitoring program of periodically collecting a grab sample at a particular location will not provide the information needed to determine if a violation of a narrative WQO has occurred. A significantly expanded monitoring/evaluation program will need to be implemented to determine if a water quality objective violation has occurred for several of the Table 1 minimum required parameters. For other required monitoring parameters, the CVRWQCB will need to develop a WQO in order to determine if agricultural discharges/runoff are causing an impairment of the state's waters that requires implementation of

management practices to control particular constituents in the discharge/runoff. Examples of these types of problems are presented below.

Upstream Water Quality Problems Will Be Detected at Downstream Monitoring Stations
Repeatedly at the Central Valley Board meetings and at the State Board workshop mention was made that violations of water quality objectives at the mouth or downstream of an ag drain can lead to the need to go upstream in the ag drain to define the sources of the constituents that are causing the measured downstream WQO violations. As I have discussed in each set of comments, the approach of monitoring at the drain discharge is not necessarily protective of the State's waters, since there can readily be upstream releases from agricultural sources which lead to an impairment of the beneficial uses of the waterbody, such as for fish reproduction, but are not translated to violations at the mouth of the ag drain or in the receiving waters for an ag drain discharge.

Ammonia
The CVRWQCB does not propose to require monitoring for ammonia, even though ammonia can be present in significant concentrations in ag drains as a result of its use as a fertilizer on agricultural fields. Also, it is a constituent that is present in some wastewater discharges and runoff, such as from dairies and areas where manure is present or has been applied. I have pointed out in each of my comments that not measuring ammonia as a distinct chemical species is a significant deficiency in the Regional Board's ag waiver monitoring program. The Regional Board staff and the Board, and now the State Board staff, have not addressed this highly significant deficiency in the minimum required WQ monitoring program. Ammonia is an important WQ parameter because of its potential to cause aquatic life toxicity and to serve as a nutrient (biostimulatory substance) for causing excessive growths of aquatic plants. Ammonia is also an important constituent in causing sediment toxicity. It is one of the most important constituents in sediments causing aquatic life toxicity and should be measured in all sediment quality evaluations.

While the CVRWQCB has not adopted a WQO for ammonia, the US EPA has established an updated water quality criterion for ammonia as set forth in the November 2000 *Federal Register* that can be used to judge excessive concentrations of ammonia. It is possible that ag drains can contain sufficient ammonia to be toxic to aquatic life, violating the water quality criteria that can serve as the basis for a water quality objective. However, since the CVRWQCB does not require that ammonia be monitored as a distinct chemical species, it will not be possible to evaluate whether the objective is violated for aquatic life toxicity.

While the Regional Board's required ag waiver WQ monitoring program includes Kjeldahl nitrogen, there are no critical concentrations (WQOs) for Kjeldahl nitrogen. Kjeldahl nitrogen is the sum of the organic nitrogen and ammonia concentrations. The organic nitrogen part of it can be the dominant species of nitrogen in a Kjeldahl N measurement. There is no reliable way to interpret Kjeldahl N measurements with respect to aquatic life toxicity. While organic nitrogen can be part of the nitrogen that stimulates excessive growths of aquatic plants, parts of the organic nitrogen are refractory and do not mineralize to ammonia, which is the nutrient of concern. The ammonia can be converted to nitrate, through nitrification reactions. Both

ammonia and nitrate are of concern as aquatic plant nutrients (biostimulatory substances). A discussion of biostimulatory substances is presented in a subsequent section.

Nitrate

Another significant problem in measuring nitrogen compounds with the current ag waiver WQ monitoring program is the failure to require measurements of nitrate. Nitrate is of concern because of its potential to be adverse to drinking water quality and as a biostimulatory substance. Nitrate concentrations above about 10 mg/L N in drinking water can be toxic to young children. Concentrations of nitrate above the nitrate drinking water MCL have been found in discharges from irrigated agriculture subsurface drains in the San Joaquin River watershed. It is a WQ parameter that should be measured, since the waters in which these concentrations have Domestic Water Supply as a beneficial use listing.

Another aspect of the significant deficiency of not requiring that nitrate be monitored is that normally nitrate is the most important nitrogen biostimulatory substance leading to excessive growth of algae and water weeds. While the CVRWQCB only included Kjeldahl nitrogen as a form of nitrogen that can be a "nutrient," of greater importance as a source of nitrogen that is a biostimulatory substance is nitrate. It should be a required monitoring parameter because it is an algal/water weed nutrient and also because it occurs in concentrations above its drinking water MCL.

Nitrite is another nitrogen species that is a potential cause of aquatic life toxicity. It needs to be considered in any TIE conducted for determining the cause of aquatic life toxicity. Nitrite is also a constituent that can add to the aquatic plant nutrients (biostimulatory substances) that are of concern in ag drains and in waters receiving drainage from agricultural areas. Ag runoff/discharge waters can have excessive concentrations of nitrite. The typical analytical method for nitrate includes nitrite as a measured parameter. However without separate measurement of nitrite it is not possible to evaluate the adverse impacts of nitrite.

Phosphorus Compounds

The CVRWCB ag waiver WQ minimum monitoring requirements list the measurement of "phosphorus." I have commented in my previous comments that the minimum monitoring requirements should specify that total phosphorus, and soluble orthophosphate should be measured as part of the ag waiver WQ monitoring program. My graduate students and I (and, subsequently, several others) have shown that substantial parts of the phosphorus in agricultural and urban stormwater runoff are do not become available to support algal growth, i.e., are unavailable. Unless the current problems with the measurement of phosphorus in the ag waiver WQ monitoring are adequately addressed, the phosphorus data developed will be of little value in evaluating the potential water quality impacts of phosphorus in runoff/discharges from irrigated agriculture.

Potassium

The CVRWQCB staff and State Board staff have approved the listing of potassium as a parameter that must be measured in agricultural runoff/discharges, because it is a "nutrient." While potassium is a well known nutrient in terrestrial soil systems, it is not an element that is of concern in aquatic systems as a nutrient. As I have pointed out previously, all funds spent in

measuring potassium in ag runoff/discharges will be a waste of money. There is nothing that can be done with that data, except file it in a filing cabinet.

Biostimulatory Substances

According to the CVRWQCB Basin Plan,

> *"**Biostimulatory Substances***
> *Water shall not contain biostimulatory substances which promote aquatic growths in concentrations that cause nuisance or adversely affect beneficial uses."*

As discussed by Lee and Jones-Lee in

> 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

in order to evaluate whether excessive biostimulatory substances occur in a water, it is necessary to conduct detailed monitoring/evaluation at the sampling site and downstream. There are no numeric WQOs for biostimulatory substances. The Basin Plan requires that whatever stimulates excessive growths of aquatic plants be controlled. This means that it is not possible to use the nutrient (nitrogen and phosphorus) data generated in the ag waiver WQ monitoring program to define what an excessive discharge of a biostimulatory substance is. As discussed in our nonpoint source monitoring report, as well as in the management practices report, cited above, the approach that must be used to properly interpret excessive nutrients (biostimulatory substances) involves a detailed investigation of the water quality use impairments associated with excessive growths of aquatic plants in the waterbody where the measurements are made, as well as downstream in all waterbodies that are potentially impacted by the discharge. As we have discussed this requires a substantially different monitoring program than that set forth in the guidance/requirements provided by the CVRWQCB and that has been approved by the SWRCB staff.

As discussed in my writings on nutrient criteria development, several years ago the US EPA initiated an effort to develop chemical specific numeric nutrient criteria. The original schedule was that by 2004 the state regulatory agencies, including the Regional Board, should have in place (or be well on their way to developing) numeric chemical-specific nutrient criteria. For political and other reasons, the US EPA has backed off on this effort, and while representatives of the Agency still state that nutrient criteria development will be required, progress toward developing criteria and deadlines to achieve these criteria is proceeding slowly and has been postponed for a considerable period of time, possibly forever.

The problem with the US EPA's approach for developing numeric nutrient criteria was that the Agency was trying to develop national default criteria, which would be used if the state regulatory agencies did not develop site-specific criteria. Because of the unreliability of the US EPA national default nutrient criteria, California Regional Boards have opted to develop site-specific nutrient criteria. However, the CVRWQCB has not had funds/staff to develop these

criteria. This leads to the situation that the nutrient data developed in the ag waiver monitoring will be of limited value in defining the excessive discharge of biostimulatory substances.

California, and especially the Central Valley is far behind the rest of the country and many parts of the world in addressing excessive fertilization water quality problems. This does not mean that there are not significant problems due to excessive fertilization; in fact, the Delta receives excessive nutrients from both the Sacramento and San Joaquin River watersheds, which stimulate the growth of algae and other aquatic plants that lead to severe DO depletion problems in the Deep Water Ship Channel near Stockton, excessive growths of water hyacinth and Egeria, and tastes and odors caused by algae in domestic water supply reservoirs, as well as at the Banks pumping station. All measurements of nutrients, as part of the ag waiver monitoring program, will be of no value in defining excessive discharge of nutrients from agricultural sources, without a comprehensive downstream monitoring and evaluation program. As I have discussed there is need to fund studies to define the allowed nutrient discharges from agricultural and other sources that will control to the extent needed the excessive fertilization of waterbodies receiving agriculturally derived nutrients. This is one of the most significant problems associated with ag runoff/discharges, yet the monitoring program developed by the CVRWQCB does not even begin to effectively address this issue in a meaningful manner.

Total Organic Carbon and Dissolved Organic Carbon

The CVRWQCB WQ monitoring program requires that total organic carbon (TOC) be monitored as a drinking water parameter. Data that have been available for some time have shown that there are elevated concentrations of total organic carbon and dissolved organic carbon (DOC) in agricultural drains, in tributaries to the Delta and in the Delta, compared to those that are known to cause excessive trihalomethane formation under conventional domestic water supply treatment involving chlorination that is used for disinfection. However the CVRWQCB does not have a Basin Plan objective for TOC. Further the US EPA does not have a fixed numeric value for what constitutes excessive TOC in a domestic water supply intake. This value depends on a variety of factors, including methods of treatment, etc. Without a Basin Plan objective for TOC or DOC, it is not possible to determine the critical concentrations of these constituents in ag runoff/discharges for regulatory purposes. The net result is that another of the key parameters of concern with respect to ag runoff/discharges, for which data will be generated by the ag waiver WQ monitoring, will be uninterpretable with respect to a WQO violation because of a lack of regulatory standards.

In addition to measuring TOC, DOC should be measured since this is the parameter of greatest concern with respect to water supply impacts that lead to excessive trihalomethane formation. Further, since in some cases (especially in some ag drains) an appreciable part of the TOC is in a labile form – i.e., will decompose by the time it reaches the water supply intake – there is need to measure BOD and planktonic algal chlorophyll associated with any TOC measurements. I have provided detailed discussions of these issues; however, the CVRWQCB and the SWRCB have failed to address this matter, with the result that the TOC measurements will not provide the kind of information that is needed to begin to properly regulate excessive TOC discharges, should a TOC Basin Plan objective be developed.

Organochlorine Pesticides, PCBs and Dioxins

One of the most significant problems associated with past and, likely to some extent, current irrigated agriculture in the Central Valley is the discharge of substances that lead to excessive bioaccumulation of the legacy organochlorine pesticides, such as DDT, chlordane, toxaphene and dieldrin, in edible fish tissue. Many of the major Central Valley waterbodies, including the Delta, Sacramento River, San Joaquin River and their tributaries, are listed as Clean Water Act 303(d) "impaired" because of excessive bioaccumulation of organochlorine pesticides and PCBs. One of the issues that the CVRWQCB and SWRCB staff did not address that was raised in my previous comments was the inability to monitor, using chemical methods as prescribed by the CVRWQCB staff in their Table 1 of required minimum monitoring parameters, the organochlorine pesticides and PCBs at critical levels – i.e., US EPA recommended Water Quality Criteria of December 2002 and CTR criteria. As I pointed out, concentrations of the organochlorine legacy pesticides in water can be "non-detect," yet bioaccumulate to excessive levels in fish tissue, causing the fish to be a hazard to those who use them as food. It is for this reason that I have been recommending, and now the US EPA is beginning to work toward regulating based on fish tissue concentrations, not water concentrations. Excessive bioaccumulation of the organochlorine pesticides and PCBs in a waterbody can reliably be evaluated based on exceedance of the OEHHA fish tissue guidelines. This approach is a direct measure of a real significant water quality/public health problem.

Another aspect of trying to use the water concentration approach as an indicator of excessive legacy pesticides and PCBs, which makes it unreliable, is that in many situations, most of the organochlorine pesticides and PCBs are associated with suspended solids, which renders them unavailable in the water column. Therefore, with respect to a water column concentration in excess of a US EPA criterion, there can be exceedances without adverse impacts. It is for this reason that measurement of tissue concentrations is the reliable approach for addressing one of the most important water quality problems in the Central Valley that is associated with past – and, likely, current – agricultural activities. Dr. Jones-Lee and I, in our excessive bioaccumulation report,

> 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

have discussed the approach that should be used to define the current sources of legacy pesticides and PCBs, with particular reference to distinguishing between current agricultural runoff from areas where these materials have been applied and residues that are derived from aquatic sediments. Since many ag drains and other waterbodies in the Central Valley have fish with excessive concentrations of the legacy pesticides, it will be necessary to follow an approach similar to that outlined in our report on how to address the excessive accumulation of these chemicals in edible fish tissue. Rather than trying to evaluate the discharge of the organochlorine legacy pesticides through measuring water column concentrations, the measurement of fish tissue residues is a much more reliable and direct approach of defining whether irrigated agriculture is a significant current source of these pesticides and PCBs.

Aquatic Life Toxicity

Considerable emphasis is given in the CVRWQCB ag waiver WQ monitoring program to detecting aquatic life toxicity in ag drains and waters receiving ag drain discharges. The finding of aquatic life toxicity in waterbodies with aquatic life propagation as a designated beneficial use is a violation of the Basin Plan objective that must be corrected. Over the past 15 years there has been considerable work done in the Central Valley by the CVRWQCB staff on determining the occurrence, causes and sources of aquatic life toxicity in the Sacramento and San Joaquin River watersheds and, to a lesser extent, in the Delta and some near-Delta tributaries. In addition to toxicity due to the organophosphorus pesticides diazinon and chlorpyrifos, there is also toxicity due to other pesticides. Toxicity has recently been found to be due to the pyrethroid-based pesticides.

While the CVRWQCB specifies making pyrethroid pesticide measurements, there are no analytical methods to measure the toxic/available forms of pyrethroid pesticides. Measurement of total pyrethroids, as it is now done, significantly overestimates the potential toxicity. This means that a measured concentration of a pyrethroid pesticide cannot be reliably translated into a toxic concentration. Further there are no water quality criteria/objectives for the pyrethroid pesticides. Until water quality criteria are available, the measured concentrations of pyrethroid pesticides will not produce meaningful/useful data that can be used to evaluate excessive discharges/runoff of these types of pesticides.

One of the situations that will be encountered in the ag waiver monitoring is that there will be toxicity measured during one sampling event that will not be measured at the next event. The Regional Board needs to decide how it is going to address this type of situation. It is important that the Regional Board not adopt State Board proposed 303(d) listing policy of establishing a frequency of allowed water quality objective violations to judge excessive aquatic life toxicity. This is not a valid approach for regulating water quality impacts of chemicals.

Another issue for which there is need for guidance is that there is aquatic life toxicity in the Central Valley water that is due to unknown causes. This is stimulating an effort by the CVRWQCB to gain funding from CALFED/CBDA to investigate the occurrence, cause and sources of unknown-caused toxicity. A group of individuals has been advising the CVRWQCB in developing an unknown-caused toxicity management strategy. This updated strategy, currently in draft form, is available from K. Larsen of the CVRWQCB..

As discussed in my previous comments, guidance needs to be provided on how the CVRWQCB will address sediment toxicity that is due to low DO, and hydrogen sulfide and ammonia that are not directly discharged by an identified source. These constituents are the most common causes of sediment toxicity. Will this toxicity be ignored as is typically done by regulatory agencies or will there be control of the nutrient discharges in the watershed that lead to algae and other aquatic plants that settle, die and become a source of the oxygen demand that leads to low DO and the development hydrogen sulfide and ammonia in the sediments?

Turbidity, Suspended Solids and Sediment

The discharge of sediment from irrigated agriculture causes significant adverse impacts on water quality and other beneficial uses of Central Valley waterbodies. The Regional Board requires

that turbidity be monitored as part of the ag waiver WQ monitoring program. While turbidity approximates suspended solids concentration, it is not a reliable approach for assessing the water quality impacts of suspended solids. The CVRWQCB Basin Plan lists as the WQO for turbidity,

> *"**Turbidity***
> *Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits:*
> - *Where natural turbidity is between 0 and 5 Nephelometric Turbidity Units (NTUs), increases shall not exceed 1 NTU.*
> - *Where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20 percent.*
> - *Where natural turbidity is between 50 and 100 NTUs, increases shall not exceed 10 NTUs.*
> - *Where natural turbidity is greater than 100 NTUs, increases shall not exceed 10 percent.*
>
> *In determining compliance with the above limits, appropriate averaging periods may be applied provided that beneficial uses will be fully protected."*

Unless measurements are made before the discharge/runoff occurs to establish the background turbidity just before the runoff event, there is no way to implement the Basin Plan limits to judge a violation of the water quality objective.

While the CVRWQCB ag waiver required WQ monitoring program does not require monitoring for total sediment discharge from irrigated agriculture, it should be monitored since erosion from some of the irrigated agriculture lands especially on the west side of the San Joaquin River is the cause of significant problems in the Delta. The CVRWQCB Basin Plan defines the water quality objective for sediment as,

> *"**Sediment***
> *The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses."*

Implementation of this approach requires a comprehensive monitoring/evaluation program at the sampling site and downstream to determine if a violation of the narrative "Sediment" WQO has occurred. Without this information the measurement of suspended sediment cannot be judged based on a numeric value, but requires a special-purpose study program at and downstream of the monitoring point.

pH

While the CVRWQCB requires that pH be measured, no guidance is provided as to the time of day and location in the water column that the measurements are to be made. As I discuss in my comments on this monitoring program, samples taken near the surface in the early morning hours may show no violations of the pH WQO, yet violations of the pH objective can occur in early

afternoon as a result of photosynthetic activity with the associated CO_2 removal and increases in pH.

Dissolved Oxygen
Dissolved oxygen (DO) measurements are required; however, as I discussed in my comments on the proposed, and now adopted, ag waiver WQ monitoring program, the time of day when measurements are to be made is not specified. Measurements made in late afternoon could show that there is no DO problem, yet in the early morning, there could be a severe DO problem, which could cause fish kills through overnight low DO.

Color
The CVRWQCB has specified that color should be measured. However, the CVRWQCB used inappropriate units for presenting color measurements, compared to the approach that is used to regulate color as it may impact drinking water beneficial uses. The units for color should be the chloroplatinate units set forth in Standard Methods for the Examination of Water and Waste Water (APHA, et al. latest edition.). Further, as I have discussed, there is need to specify whether the color measurements are for true (dissolved) or apparent (total) color. Without changing the color measurement approach and specifying the type of color measurements, the data generated from measuring color in the ag waiver WQ monitoring program can be largely unreliable and uninterpretable.

E. coli
The CVRWQCB has specified that *E. coli* be monitored as part of the ag waiver WQ monitoring. While the CVRWQCB adopted *E. coli* as a proposed water quality objective for contact recreation, the SWRCB has yet to support this approach. Therefore the *E. coli* data cannot be evaluated with respect to violations of the water quality objective until the State Board approves the *E. coli* objective, and it is approved by the Office of Administrative Law. Until this occurs, fecal coliform is the water quality objective applicable to REC-1 waters.

EC
The CVRWQCB lists electrical conductivity (EC) as a measured parameter for ag waiver WQ monitoring. Since EC has a high temperature coefficient it is necessary that the EC values be measured at or converted to 25 C in order to obtain comparable, and reliable data.

Heavy Metals -Hg
The CVRWQCB has specified a set of metals (see Table 1) for water quality monitoring. The measured concentrations of dissolved forms can be compared to CTR criteria. An important metal that is not listed is mercury. This is a significant omission since excessive bioaccumulation of mercury in edible fish is a common problem in Central Valley waterbodies. Since mercury is present in irrigation waters that are diverted from Valley rivers, total and methyl mercury should be monitored in discharges/runoff from irrigated agriculture. Also, fish taken from the waterbodies impacted by ag runoff should be analyzed for mercury in edible tissue.

Flow

The CVRWQCB ag waiver WQ monitoring guidance states that flow measurements should be made at the time of sampling. This approach could lead to unreliable estimates of loads of constituents if the data collected on concentrations are applied to an assumed flow, which is the average of the flows between samplings. As I discussed, it is well established that continuous flow measurements should be made if reliable load estimates are to be obtained. This is especially important for runoff samples where the flow can change rapidly during a runoff event.

Overall

It is clear that the monitoring program guidance provided by the CVRWQCB for the ag waiver monitoring violates one of the fundamental rules of water quality monitoring program development – namely, to specifically relate the monitoring approach to the objectives of the monitoring. This issue needs to be immediately corrected, or the various Coalition Groups and individual discharges will be generating substantial amounts of inadequate and unreliable data that cannot be used to implement the agricultural runoff/discharge management program. This situation can also lead to inappropriate assessment of the water quality significance of constituents in ag runoff/discharges for which large amount of money would have to be spent implementing management practices that are not appropriate or necessary for the situation.

If members of the State Board or Regional Board question the inadequacy of the current CVRWQCB minimum required monitoring guidance, they should have their staff try to use the existing representative data for ag drains to evaluate exceedances of CVRWQCB Basin Plan objectives for the parameters listed in Table 1. This effort will lead to the conclusions drawn in this discussion.

As part of my effort to improve the quality of science used in water quality management in CA, I will provide assistance to anyone interested in developing the guidance needed to properly evaluate and manage the significant water quality problems caused by runoff/discharges from irrigated agriculture.

References

CVRWQCB, "Monitoring and Reporting Program Order No. R5-2003-0826 for Coalition Groups Under Resolution No R5-2003-0105 Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands," California Central Valley Regional Water Quality Control Board Sacramento, CA (2003).

Lee, G. F., "Comments on the Monitoring and Reporting Program for CVRWQCB Order No. R5-2003-0826 Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands, Dated July 11, 2003," Submitted to State Water Resources Control Board, Sacramento, CA, by G. Fred Lee & Associates, El Macero, CA, September 11 (2003).