

Background Information on Evaluating the Water Quality Impacts of Irrigated Agricultural Discharges/Runoff

G. Fred Lee, PhD, PE, DEE and Anne Jones-Lee, PhD.

G. Fred Lee & Associates

Ph 530 753-9630 Fx 530 753-9956

gfredlee@aol.com www.gfredlee.com

January 2005

updated

May 2005

Dr. G. Fred Lee has been involved in evaluating water quality impacts and development of management approaches for agricultural runoff/discharges since 1960. He and Dr. Anne Jones (Jones-Lee) have worked together on these issues beginning in the late 1970s. They have published several papers and reports that discuss these issues many of which are available on their website, www.gfredlee.com in the Surface Water Quality section.

Since the late 1980s, they have been active in Central Valley water quality issues in the Sacramento River and San Joaquin River watersheds and Delta. This activity has included the development of several papers and reports on water quality management issues in these areas. These reports are on their website in the "Watershed Studies" for the Sacramento River Watershed, and San Joaquin River Watershed and Delta subsections. These reports/papers include an invited paper,

Lee, G. F. and Jones-Lee, A., "An Integrated Approach for TMDL Development for Agricultural Stormwater Runoff, Tailwater Releases and Subsurface Drain Water," Proc. 2002 Water Management Conference, "Helping Irrigated Agriculture Adjust to TMDLs," pp. 161-172, US Committee on Irrigation and Drainage, Denver, CO, October (2002)
http://www.gfredlee.com/tmdl_07.2002.pdf

that discusses the TMDLs that irrigated agriculture could have to address in the San Joaquin River watershed and Delta.

Presented below is information on their reports that address issues that are pertinent to conducting the CVRWQCB Agricultural Waiver (Ag Waiver) water quality monitoring and management program.

Upper Newport Bay Watershed Water Quality Studies

Beginning in the mid 1990s Drs. G. F. Lee and A. Jones-Lee initiated a water quality monitoring program in the Orange County, CA Upper Newport Bay watershed. This program ultimately amounted to about \$500,000 of studies over 5 years. The monitoring program focused on assessing aquatic life toxicity and supporting information to identify the cause of the toxicity. These studies have addressed many of the issues that are beginning to be addressed in the CVRWQCB Ag Waiver monitoring program. The Upper Newport Bay and its tributary aquatic life toxicity studies were among the most

comprehensive studies on the aquatic life toxicity that has been conducted in a watershed in CA. Ten different urban, agriculture and other watersheds were monitored over a several year period. This program was supported the US EPA Region 9, Santa Ana Regional Water Quality Control Board and the County of Orange Public Facilities and Resources Department (Orange County stormwater management agency) through 205(j) and 319(h) grants and public and private funds. The results of these studies have become the major database for TMDLs to control water quality objective violations for heavy metals, aquatic life toxicity and organochlorine legacy pesticides and PCBs. Two major reports were developed from these studies,

Lee, G. F., Taylor, S., and County of Orange Public Facilities and Resources Department, "Upper Newport Bay/San Diego Creek Watershed 205(j) Water Quality Planning Grant, Final Report," Agreement No. 7-037-250-0, US EPA 205(j) Project, May (2001).

Lee, G. F., Taylor, S., and County of Orange Public Facilities and Resources Department, "Upper Newport Bay Water Quality Enhancement Project, Final Report," Agreement Nos. 8-023-258-0 and 8-174-250-0, submitted to State Water Resources Control Board, Santa Ana Regional Water Quality Control Board and Orange County Public Facilities and Resources Department to meet the requirements of the US EPA 319(h) Project, G. Fred Lee & Associates, El Macero, CA and RBF Consulting, Irvine, CA, May (2001).

These are very large reports that are not available electronically. However, summaries of key sections of these reports are available in,

Lee, G. F. and Taylor, S., "Results of Heavy Metal Analysis Conducted During 2000 in the Upper Newport Bay Orange County, CA Watershed," Report of G. Fred Lee & Associates, El Macero, CA (2001).
<http://www.members.aol.com/apple27298/Heavy-metals-319h.pdf>

Lee, G. F. and Taylor, S., "Results of Aquatic Toxicity Testing Conducted During 1997-2000 within the Upper Newport Bay Orange County, CA Watershed," Report of G. Fred Lee & Associates, El Macero, CA (2001).
<http://www.members.aol.com/apple27298/295-319-tox-paper.pdf>

Several issues have been raised at Ag Waiver Public Advisory Committee meetings concerning toxicity testing results. These issues have been addressed in the reports by Lee and Taylor cited above. An issue of concern was whether negative toxicity testing results means that the sample is non toxic. As discussed in our writings, laboratory toxicity tests are not sufficiently sensitive to detect low levels of aquatic life toxicity. Water samples can be toxic to aquatic life over extended periods of time that is not detected in laboratory toxicity tests of the type being conducted today.

There were questions about the use of TIEs to identify the cause of laboratory based toxicity. As discussed in the Lee and Taylor reports, TIEs will not likely be able to

identify the cause of aquatic life toxicity if the total toxicity is less than about 3 TUa. As discussed a positive toxicity test result should be followed by chemical testing to see if any pesticides and other chemicals used in the waterbodies watershed are present at concentrations that are potentially toxic to aquatic life. It should be understood that there still can be toxicity to aquatic life even if all measured chemicals are below toxic levels due to unmeasured chemicals and as a result of additive and synergistic toxicity from several chemicals. This issue has been recently discussed in,

*Lee, G. F. and Jones-Lee, A, "Regulating Water Quality Impacts of Port and Harbor Stormwater Runoff," Proc. International Symposium on Prevention of Pollution from Ships, Shipyards, Drydocks, Ports, and Harbors, New Orleans, LA, November (2003).
<http://www.members.aol.com/duklee2307/PHStormwater-papfinal.pdf>.*

Another issue of concern is the proper interpretation of toxicity test results relative to impairment of the beneficial uses of a waterbody. While positive toxicity test results are often a reliable indicator of a waterbody beneficial use impairment, there are situations where such results should not be interpreted to mean that the measured toxicity represents an impairment of the beneficial uses of the waterbody by the toxicity. Since measured toxicity is a violation of the CVRWQCB Basin Plan objective, the finding of toxicity in a toxicity test must be addressed to either control it or demonstrate that the toxicity test results are not representative of the conditions in the waterbody. An example of this type of situation occurred in the Upper Newport Bay studies as reported by,

*Lee, G. F., Jones-Lee, A. and Taylor, S., "Evaluation of the Water Quality Significance of OP Pesticide Toxicity in Tributaries of Upper Newport Bay, Orange County, CA," Ninth Symposium on Environmental Toxicology and Risk Assessment: Recent Achievements in Environmental Fate and Transport, ASTM STP 1381, pp 35-51 (2000).
http://www.gfredlee.com/oppesticide_unb.pdf.*

In this situation the duration of the time in the toxicity test for toxicity to be manifested was longer than the period of exposure that a planktonic aquatic organism could experience in the waterbody. If toxicity is found in a toxicity test it is important to examine the physical setting of the sampling location relative to toxicity testing procedures and results to determine if the toxicity test is conducted to properly represent the exposure conditions that an aquatic organism can experience in the waterbody.

Non Point Source Water Quality Monitoring and Management Reports

In 2000 under contract through CSU Fresno Water Institute, Drs. G. F. Lee and Anne Jones-Lee developed several reports for the CVRWQCB that are specifically directed to developing information that can be used to begin to monitor/manage water quality impacts of Central Valley irrigated agriculture discharges/runoff. Information on these reports and related reports and papers is presented below.

Non Point Source Water Quality Monitoring. One of the reports was devoted to providing guidance on developing a technically valid water quality monitoring program for non point sources of potential pollutants. This report is,

*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>*

This report is based on Dr. G. F. Lee's over 40 years of experience in developing water quality monitoring programs for non point sources of potential water pollutants. It provides information on the problems with a three year water quality monitoring program conducted by a contract laboratory for the Yolo County Public Works Department on Cache Creek. Yolo County Public Works asked Drs. G. F. Lee and A. Jones-Lee to develop a report on the data that had been collected in this monitoring report. They developed the report,

Lee, G. F. and Jones-Lee, A., "Review of Yolo County Lower Cache Creek Water Quality," Report of G. Fred Lee & Associates, El Macero, CA (2002) available as WQ 003 from gfredlee@aol.com

that discusses the problems with how the water quality monitoring program was conducted and how such programs should be conducted in the future to develop reliable data that can be used to define the water quality conditions in a Central Valley stream/river.

The Lee and Jones-Lee non point source water quality monitoring guidance report provides guidance on how to establish technically valid water quality monitoring programs as well as how to proceed to evaluate whether a violation of a CVRWQCB Basin Plan objective represents a significant water quality beneficial use impairment of a waterbody. As discussed in this report, in most cases, a water quality objective (WQO) violation should be followed up with site specific studies to determine if the violation represents a situation where the application of the worst case WQO over estimates the water quality impairment of the waterbody which is best addressed by site specific adjustment of the WQO. This approach is recommended by the US EPA to address the overregulation that often occurs when national worst case water quality criteria are used as a state water quality objective.

The development and appropriate use of water quality criteria/standards has been a topic of Dr. G. F. Lee's activity since the mid 1960s when the "Greenbook" of water quality criteria was first developed. He served as an invited peer reviewer of the National Academies of Science and Engineering "Bluebook" of water quality criteria published in 1973. He was also a member of the American Fisheries Society Water Quality Committee that reviewed US EPA "Redbook" of water quality criteria of 1976 and a US EPA peer reviewer of the water quality criteria development approach and several of the criteria document for the US EPA "Goldbook" of water quality criteria of 1986. This

criteria development approach adopted in the mid 1980s is the same as is being used today. It is based on the development of national water quality criteria that will be protective in all waterbodies. This means that for most waterbodies these national criteria are overprotective and need to be adjusted for site specific physical, chemical and biological conditions. Drs. G. F. Lee and Anne Jones-Lee have published an invited paper,

Lee, G. F. and Jones-Lee, A., "Appropriate Use of Numeric Chemical Water Quality Criteria," Health and Ecological Risk Assessment, 1:5-11 (1995). Letter to the Editor, Supplemental Discussion, 2:233-234 (1996). <http://www.gfredlee.com/chemcri.htm>

that discusses many of these issues. Additional information on the inadequacy of conventional water quality monitoring in providing the information needed to develop technically valid water quality management programs is provided in,

Lee, G.F., and Jones-Lee, A., "Evaluation Monitoring vs Chemical-Constituent Monitoring: Chemical Concentrations vs Chemical Impacts," Keynote presentation at CA Water Environment Association Training Seminar, "Recent Advances in Receiving Water Monitoring," Anaheim, CA, February (1999). <http://www.gfredlee.com/concentrationvsimpact.pdf>

Also of potential interest may be,

Lee, G.F. and Jones-Lee, A., "Developing Central Valley, California, Agricultural Runoff/Discharges Water Quality Monitoring Programs," Proceedings of 2003 AWRA Spring Specialty Conference, "Agricultural Hydrology and Water Quality," American Water Resources Association, Kansas City, MO, May (2003). http://www.gfredlee.com/AWRA_KC_Pap-Lee-web.pdf

Lee, G. F. and Jones-Lee, A., "Developing a Water Quality Monitoring Program for Agricultural Runoff/Discharges in the Central Valley of California," PowerPoint slides presented at American Water Resources Association Specialty Conference on Agricultural Hydrology and Water Quality," Kansas City, MO, May (2003).

Organochlorine Excessive Bioaccumulation. Another of the reports that was developed for the CVRWQCB by Lee and Jones-Lee was devoted to the excessive bioaccumulation of organochlorine pesticides, PCBs and dioxins (OCIs) in Central Valley fish. This 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/OCITMDLRpt12-11-02.pdf>
and

Lee, G. F. and Jones-Lee, A., "Excessive Bioaccumulation of Organochlorine Legacy Pesticides & PCBs in CA Central Valley Fish," PowerPoint Slides Made Available at US EPA National Fish Contaminant Forum, San Diego, CA, January (2004).
<http://www.members.aol.com/duklee2307/OCI-slides-SanDiego.pdf>

provides guidance on addressing the excessive bioaccumulation of legacy (no longer used) pesticides such as DDT, dieldrin, chlordane, and toxaphene, etc. This problem is one of the most significant water quality problems in Central Valley waterbodies due to the accumulation of these carcinogens in edible fish. Past agricultural use of these pesticides has led and continues to lead to runoff that contain OCIs that accumulates in Central Valley waterbody sediments and that bioaccumulates to excessive levels in Central Valley fish.

Also of interest is,

Lee, G. F., "Need for Funding to Support Studies to Control Excessive Bioaccumulation of Organochlorine 'Legacy' Pesticides, PCBs and Dioxins in Edible Fish in the Central Valley of California," Report of G. Fred Lee & Associates, El Macero, CA, July (2003).
http://www.gfredlee.com/OCI_Support.pdf

One of the major problem areas in California water quality regulations is the SWRCB and CVRWQCB use of so-called NAS criteria for regulating organochlorine pesticides. As discussed in,

Lee, G. F., "Unreliability of SWRCB's Use of "NAS Criteria" to Evaluate Pesticides Impacts on Aquatic Life" excerpt and adapted from, 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/Unreliability.of.NAS.Criteria.pdf>

these criteria are unreliable for evaluating the water quality significance of organochlorine pesticides. Lee and Jones-Lee discuss that it is not possible to relate concentrations of these organochlorine compounds in water or sediments to the tendency to bioaccumulate to excessive levels in edible fish. Studies of the type reported by,

Lee, G. F., Jones-Lee, A., and Ogle, R. S., "Preliminary Assessment of the Bioaccumulation of PCBs and Organochlorine Pesticides in Lumbriculus variegatus from City of Stockton Smith Canal Sediments, and Toxicity of City of Stockton Smith Canal Sediments to Hyalella azteca," Report to the DeltaKeeper and the Central Valley Regional Water Quality Control Board, G. Fred Lee & Associates, El Macero, CA, July (2002). <http://www.gfredlee.com/SmithCanalReport.pdf>

must be conducted to evaluate the bioavailable forms of OCIs in the water column and sediments.

Contaminated Sediments. Sediments in many waterbodies in the Central Valley contain elevated concentrations of potential pollutants. As part of developing the OCI report, Drs. Lee and Jones-Lee discussed the approaches that should not and should be used to evaluate the water quality significance of potential pollutants in aquatic sediments. Of particular concern are the co-occurrence based sediment quality guidelines that are proposed by some including SWRCB staff as a basis for defining excessive concentrations of some chemicals in sediments. This section of this report is available as,

Lee, G. F., and Jones-Lee, A. "Unreliability of Sediment Co-Occurrence-Based Approaches for Evaluating Aquatic Sediment Quality," Excerpts from 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, updated August (2003). <http://www.gfredlee.com/UnrelSedCooccur.pdf>.

additional information on the unreliability of chemically based so-called sediment quality guidelines is available in,

Lee, G. F. and Jones-Lee, A., "Unreliability of Co-Occurrence-Based Sediment Quality 'Guidelines' for Evaluating the Water Quality Impacts of Sediment-Associated Chemicals," Report of G. Fred Lee & Associates, El Macero, CA, September (2004). <http://www.members.aol.com/apple27298/swnews78.pdf>.

Lee and Jones-Lee have published several papers on reliably evaluating the water quality significance of chemicals in aquatic sediments including,

Lee, G. F. and Jones-Lee, A., "Appropriate Incorporation of Chemical Information in a Best Professional Judgment 'Triad' Weight of Evidence Evaluation of Sediment Quality," Presented at the 2002 Fifth International Symposium on Sediment Quality Assessment (SQA5), In: Munawar, M. (Ed.), Aquatic Ecosystem Health and Management 7(3):351-356 (2004). <http://www.gfredlee.com/BPJWOEpaper-pdf>

Lee, G. F., Jones-Lee, A., "Appropriate Incorporation of Chemical Information in a Best Professional Judgment " Triad " Weight of Evidence Evaluation of Sediment Quality" poster at the 5th International Symposium on Sediment Quality Assessment, Aquatic Ecosystem Health and Management Society Chicago, IL, October (2002). http://www.gfredlee.com/BPJ_Poster.pdf available from gfredlee@aol.com.

This paper reviews why chemical concentrations of potential pollutants in sediments cannot be used to evaluate the water quality impacts of contaminants on the waterbodies water quality. Instead a best professional judgment weight of evidence approach should be used for this purpose.

An issue that those concerned with Ag Waiver water quality issues need to keep track of is the current attempts by the SWRCB to develop sediment quality criteria. While at this time this effort is directed to marine and estuarine sediments, it could be expanded to freshwater sediments at some time in the future. Lee and Jones-Lee presented,

Lee, G. F. and Jones-Lee, A., "Development of Sediment Quality Objectives for California," Presented at the American Water Resources Association national conference, San Diego, CA, November (2003). <http://www.gfredlee.com/sediment-SQO-paperSD.pdf>

which discusses some of the technically invalid approaches that the SWRCB is taking in attempting to develop sediment quality criteria.

Drs. Lee and Jones-Lee have recently developed a paper,

Jones-Lee, A. and Lee, G. F., "Unreliability of Co-Occurrence-Based Sediment Quality Guidelines for Contaminated Sediment Quality Evaluation at Superfund/Hazardous Chemical Sites," J. Remediation, 15(2):19-33, Spring (2005). <http://www.members.aol.com/annejlee/SQGSuperfund2.pdf>

that provides a comprehensive updated review of the unreliability of cooccurrence based sediment quality guidelines.

BMPs for Ag Runoff/Discharges. The third report developed by Lee and Jones-Lee for the CVRWQCB that has direct relevance to the Ag Waiver monitoring/management requirements is,

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

This report provides information on what's known about BMPs (management approaches) for irrigated agriculture runoff/discharges for controlling water quality impacts of runoff/discharges associated constituents. This report provides information that can be of assistance to those who have to develop/review BMPs that are required as part of the Ag Waiver monitoring/management program.

TOC/DOC Management. A water quality parameters that is of concern in the use of Delta waters by water utilities that export Delta waters for domestic water supply purpose is the total organic carbon (TOC) and dissolved organic carbon (DOC). Agricultural and urban wastewater discharges and stormwater runoff are sources of TOC/DOC that contribute to the Delta excessive TOC/DOC problem. Lee and Jones-Lee have published a review of issues that need to be considered in monitoring and managing TOC/DOC in

the Delta watershed and in the Delta. These issues are covered in several of the above mentioned reports. In addition Lee and Jones-Lee have developed,

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). http://www.gfredlee.com/TOC_update.pdf

that discusses the importance of evaluating the refractory vs labile TOC/DOC in their sources for the Delta and its tributaries.

Managing Excessive Fertilization. One of topics of particular concern to the CVRWQCB in developing non point source reports was the approach that needs to be followed to develop monitoring and management programs for aquatic plant nutrients (nitrogen and phosphorus) that lead to excessive fertilization of Central Valley waterbodies. Detailed guidance on the issues that need to be considered in monitoring/evaluating and managing N and P compounds in agricultural runoff/discharges to achieve the desired level of fertility in Central Valley waterbodies. Lee and Jones-Lee have recently published several papers on managing waterbody excessive fertilization problems. These include,

Lee, G. F. and Jones-Lee, A., "Developing Nutrient Criteria/TMDLs to Manage Excessive Fertilization of Waterbodies," Proceedings Water Environment Federation TMDL 2002 Conference, Phoenix, AZ, November (2002). <http://www.gfredlee.com/WEFN.Criteria.pdf>

Lee, G. F. and Jones-Lee, A., "Assessing the Water Quality Impacts of Phosphorus in Runoff from Agricultural Lands," In: Hall, W. L. and Robarge, W. P., ed., Environmental Impact of Fertilizer on Soil and Water, American Chemical Society Symposium Series 872, Oxford University Press, Cary, NC, pp. 207-219 (2004). http://www.gfredlee.com/ag_p-1_012002.pdf

In response to a request by UC Ag Extension Drs. Lee and Jones-Lee have developed a set of PowerPoint slides covering Nutrient TMDLs and BMPs. These slides,

Lee, G. F. and Jones-Lee, A., "Nutrient TMDLs and BMPs" PowerPoint slide presentation to the UC Agricultural Extension farm advisors and researchers, Woodland, CA (2005). <http://www.gfredlee.com/pexfert2.htm>

provide a overview the issues that need to considered in managing excessive fertilization of waterbodies.

The 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 (2002). http://www.gfredlee.com/BMP_Rpt.pdf

contains an extensive discussion of excessive fertilization (nutrient) management issues.

Aquatic Life Toxicity. In addition to the aquatic life toxicity studies that Drs. Lee and Jones-Lee conducted in the Upper Newport Bay watershed studies discussed above, they have been involved in several aquatic life toxicity studies in the Central Valley. The CVRWQCB and the DeltaKeeper monitored aquatic life toxicity in stormwater runoff in Stockton during 1994-99. Drs. Lee and Jones-Lee were asked to develop a report on this database. Their report is published as,

Lee, G. F. and Jones-Lee, A., "Review of the City of Stockton Urban Stormwater Runoff Aquatic Life Toxicity Studies Conducted by the CVRWQCB, DeltaKeeper and the University of California, Davis, Aquatic Toxicology Laboratory between 1994 and 2000," report to the Central Valley Regional Water Quality Control Board and the DeltaKeeper, submitted by G. Fred Lee & Associates El Macero, CA November (2001). http://www.gfredlee.com/stockton-txt_0401.pdf

This report was developed into TMDL like technical report as,

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>

These reports provide information on the potential for urban stormwater runoff to cause aquatic life toxicity in waterbodies receiving stormwater runoff.

Delta Water Quality Issues

Drs. Lee and Jones-Lee have been involved evaluating Sacramento River and San Joaquin River Delta since 1989. They have developed several reports on these studies. These reports include,

Lee, G. F. and Jones-Lee, A., "Overview of Sacramento-San Joaquin River Delta Water Quality Issues," Report of G. Fred Lee & Associates, El Macero, CA, June (2004). <http://www.members.aol.com/apple27298/Delta-WQ-IssuesRpt.pdf>

This report presents a comprehensive review of current Delta water quality problems and the actions that need to be followed to address these problems.

They have been involved in the San Joaquin River Deep Water Ship Channel low DO problem. This involvement has included developing several reports including,

Lee, G. F. and Jones-Lee, A., "Synthesis and Discussion of Findings on the Causes and Factors Influencing Low DO in the San Joaquin River Deep Water Ship Channel Near Stockton, CA: Including 2002 Data," Report Submitted to SJR DO TMDL Steering Committee and CALFED Bay-Delta Program, G. Fred Lee & Associates, El Macero, CA, March (2003). <http://www.gfredlee.com/SynthesisRpt3-21-03.pdf>

Lee, G. F. and Jones-Lee, A., "San Joaquin River Deep Water Ship Channel Low DO Problem and Its Control," PowerPoint slides presented at SETAC World Congress Portland, OR, November 2004. Updated December (2004). <http://www.members.aol.com/annejlee/LowDOSummaryDec2004.pdf>

Lee, G. F. and Jones-Lee, A., "Supplement to Synthesis Report on the Low-DO Problem in the SJR DWSC," Report of G. Fred Lee & Associates, El Macero, CA, June (2004). <http://www.members.aol.com/duklee2307/SynthRptSupp.pdf>

Recently Drs. Lee and Jones-Lee have developed new report

Lee, G. F., and Jones-Lee, A., "SJR DWSC Flow and RRI DO for 2004," Report of G. Fred Lee & Associates, El Macero, CA, January (2005). <http://www.members.aol.com/annejlee/SJRDWSC-DO-Flow2004.pdf>

that extends the series of reports that demonstrate the impact of the State and federal South Delta export projects on the SJR DWSC low DO problem. They have developed several other Delta water quality reports that are on www.gfredlee.com in the Watershed Studies in the San Joaquin River and Delta subsection.

Ag Waiver Monitoring Program

There has been considerable discussion among the Ag Waiver coalition members and the CVRWQCB members about the requirements for the Ag Waiver monitoring programs and Ag Waiver requirements as defined by the CVRWQCB in adopting the Ag Waiver. Lee and Jones-Lee have provided several sets of comments on these issues,

Lee, G. F. and Jones-Lee, A., "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," Submitted to the Central Valley Regional Water Quality Control Board, Sacramento, CA, July (2003). <http://www.gfredlee.com/AgWaiverComments.pdf>.

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 California Regional Water Quality Control Board, Central Valley Region, Sacramento, CA, by G. Fred Lee & Associates, El Macero, CA, September 11 (2003).

<http://gfredlee.com/Jennings.Ag.Waiver.Comments-comb.pdf>

Lee, G. F., "Comments on SWRCB January 9, 2004 Review of Irrigated Agriculture Waiver Water Quality Monitoring Requirements," Comments submitted to the California State Water Resources Control Board by G. Fred Lee & Associates, El Macero, CA, January 19 (2004). <http://www.gfredlee.com/AgWaiverComments1-19-04.pdf>.

These reports discuss many of the issues that need to be resolved between the current ag waiver monitoring program compared to the Ag Waiver requirements adopted by the CVRWQCB. It also provides a discussion of the issues that need to be addressed by the CVRWQCB and the Ag Waiver participants and others in order to be able to interpret the Ag Waiver monitoring program data relative to Basin Plan objective. According to S. Azimi (personal communication) many of the issues raised by Lee and Jones-Lee in their comments on the draft and final current Ag Waiver monitoring plan are being addressed by the CVRWQCB in the development of the Phase II monitoring program.

Comment

While several of the above listed reports were developed for the CVRWQCB, the information contained in these reports does not represent CVRWQCB requirements or policy. They represent over 40 years of experience of the authors devoted to work on these issues. Questions or comments on these reports should be directed to G. Fred Lee at gfredlee@aol.com.

G. Fred Lee