Comments on the Delta Stewardship Council's Third Staff Draft Delta Plan – Chapter 6 Improve Water Quality to Protect Human Health and the Environment – Released April 22, 2011

Submitted to Delta Stewardship Council
by
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Updated May 1, 2011

The Delta Stewardship Council (DSC) Third Staff Draft Delta Plan outlined the DSC mission as follows:
"*The Delta Stewardship Council was established as an independent State agency by the Sacramento-San Joaquin Delta Reform Act of 2009.*

The primary responsibility of the Delta Stewardship Council (DSC) *is to develop, adopt, and implement by January 1, 2012, a legally enforceable, comprehensive, long-term management plan for the Sacramento-San Joaquin Delta and the Suisun Marsh—the Delta Plan—that achieves the coequal goals of 'providing a more reliable water supply for California and protecting, restoring and enhancing the Delta ecosystem' and does this 'in a manner that protects and enhances the unique cultural, recreational, natural resource and agricultural values of the Delta as an evolving place' (Water Code section 85054).*

The coequal goals are the guiding principles for the Delta Plan. Additionally, the Sacramento-San Joaquin Delta Reform Act of 2009 states that the policy of the State is 'to achieve the following objectives that:
(a) Manage the Delta's water and environmental resources and the water resources of the state over the long term.
(b) Protect and enhance the unique cultural, recreational, and agricultural values of the California Delta as an evolving place.
(c) Restore the Delta ecosystem, including its fisheries and wildlife, as the heart of a healthy estuary and wetland ecosystem.
(d) Promote statewide water conservation, water use efficiency, and sustainable water use.
(e) Improve water quality to protect human health and the environment consistent with achieving water quality objectives in the Delta.
(f) Improve the water conveyance system and expand statewide water storage.
(g) Reduce risks to people, property, and state interests in the Delta by effective emergency preparedness, appropriate land uses, and investments in flood protection.

(h) Establish a new governance structure with the authority, responsibility, accountability, scientific support, and adequate and secure funding to achieve these objectives' (Water Code section 85020 et. seq.)."

These comments are submitted to the DSC pursuant to the request for the stakeholders/public to provide comments on the drafts of the DSC staff drafts Delta Plan. While these comments are devoted to a review of the draft Plan's "Chapter 6 Improve Water Quality to Protect Human Health and the Environment," they are also applicable to the Legislature's declared coequal goals for the management of the Delta resources and the other listed management goals. For several comments on specific issues, we have provided a summary of information from our experience and expertise as background foundation to the comments.

The discussion herein uses the term "water quality" as referencing the impacts of pollutants on the beneficial uses of Delta waters including impacts on aquatic life and terrestrial resources, and on public health through drinking water, contact recreation, and the consumption of aquatic life derived from the Delta.

The terms pollutant/pollution and contaminant/contamination are used in accord with the Porter-Cologne Water Quality Control Act definitions:
[http://www.swrcb.ca.gov/laws_regulations/docs/portercologne.pdf]
"(k) 'Contamination' means an impairment of the quality of the waters of the state by waste to a degree which creates a hazard to the public health through poisoning or through the spread of disease."
(l)(1) 'Pollution' means an alteration of the quality of the waters of the state by waste to a degree which unreasonably affects either of the following:
(A) The waters for beneficial uses.
(B) Facilities which serve these beneficial uses.
(2) 'Pollution' may include 'contamination.'"

Overall Findings
The DSC staff's Third Draft Plan Chapter 6 falls far-short of providing adequate and reliable information on the water quality, environmental, and public health issues that the DSC should consider and address in the development of its Delta Plan and in the implementation of "Directed Actions" intended to protect the Delta ecosystem, Delta water resources and their quality and Delta water for export to other areas of the state. While many, but not all, of the key water quality issues are mentioned in this draft, inadequate background information and reliable references to readily available literature are included to provide the DSC and others the guidance needed to understand the issues of concern and to develop and assess the Directed Actions that should be implemented to adequately control the water quality issues.

One example of such shortcomings is the inadequacy of information provided in this Chapter on the impact of aquatic plant nutrients on Delta aquatic resources and on domestic water supply water quality. The chapter does not make reference to the large amount of information provided by experts on impacts of nutrients on Delta water quality in the California Water and Environmental Modeling Forum (CWEMF) one-day Technical Workshop on "Overview of Delta Nutrient Water Quality Problems: Nutrient Load – Water Quality Impact Modeling held

Tuesday, March 25, 2008." The presenters at that workshop, recognized experts in the topic area, discussed the severe water quality/resources impairment in the Delta related to aquatic plant nutrients. While the staff draft mentions the need for development of nutrient criteria, the date that the DSC should adopt for the regulatory agencies should is inappropriate considering the technical issues that need to be addressed in developing reliable nutrient criteria that can be used to establish nutrient management goals without large amounts of expenditure of funds for source nutrient control that do not develop technically valid cost effective management approaches. A discussion of these issues is provided in these comments.

One of the most important issues that did not receive adequate attention in this draft is the potential impact on Delta water quality of DSC Directed Action that involves alterations in the flow of water into and within Delta channels. There is substantial readily available literature on Delta water quality impacts of past Delta flow management associated with water diversions/exports, including how the current federal and state export of South Delta water eliminates the San Joaquin River (SJR) home stream homing signal to Chinook Salmon spawning areas in the SJR watershed. References to this literature would provide important information that the DSC and others need in order to understand the potential impacts of alterations in Delta tributary and in-Delta channel flows and how to develop directed actions that involve flow management. Information on these issues is presented herein.

The third staff draft contains a number of one-sentence statements identifying particular water quality issues that the DSC or others need to address. The draft, however, fails to provide reference to sources of information from which the DSC and others could obtain additional technical information on the issues. We have provided more detailed discussion of the need for attention to many of the issues so-identified, including information on how to best approach the resolution of the problem from a technical perspective. The discussion presented herein can provide background foundation to the need for the DSC to address a particular issue as well as guidance on a suggested approach.

The references provided in the third staff draft do not include some of the most important, readily available literature on Delta water quality issues. For example, while mention is made in this draft of unrecognized unregulated pollutants in Delta waters, no reference is provided to a comprehensive Central Valley Regional Water Quality Control Board (CVRWQCB)/University of California Davis report that discusses these issues. As discussed further in these comments, that report provides important information on the specific issues that need to be investigated as part of evaluating the role of unregulated potential pollutants on Delta water quality.

A significant problem with the discussion of the impact of ammonia and nitrate on Delta water quality is the presentation on how altered N/P ratios have altered the Delta ecosystem. The detailed references included in the draft Chapter 6 in support of the staff's position on this issue do not include references to the work of other experts on the impact of nutrients on algal populations in the Delta who have concluded that the so-called "impact" of changes in N/P ratios on algal populations is not technically valid, and that such changes are more likely due to decreased primary production due to reduced phosphorus inputs to the Delta. The staff's discussion of this issue is misleading and likely in significant technical error.

While low dissolved oxygen (DO) is mentioned in the third staff draft Chapter 6 as needing to be addressed by the DSC as part of development of the Delta Management Plan, no reference is provided to the reports from the several-million-dollar CALFED-supported project that discuss the causes of the low-DO problem in the San Joaquin River Deep Water Ship Channel (DWSC) and the finding that the Department of Water Resources (DWR) Banks and US Bureau of Water Resources (USBR) Jones export pumping projects are a significant cause of the low-DO problem in the DWSC and several South Delta channels. The Bay Delta Conservation Plan's (BDCP) proposed peripheral canal diversion of Sacramento River water around the Delta could greatly aggravate the low-DO problem in the South Delta Channel. Recent reports submitted to the CVRWQCB discuss important issues and measures that need to be implemented to control the residual low-DO problem in the DWSC. These issues need to be considered in the DSC's development of a Delta Plan. Information on this issue is presented herein.

These and a number of other water quality issues in the Delta that should have been discussed with appropriate references are discussed in these comments. Chapter 6 needs to be redrafted to more adequately present and discuss Delta water quality issues that the DSC needs to address as part of developing a Delta Plan with particular emphasis on Directed Action formulation/review.

Background to These Comments

Dr. G. Fred Lee has spent five decades applying his professional expertise in environmental engineering, aquatic chemistry, and water quality/public health with considerable expertise in domestic water supply water quality to the investigation and solution of water quality problems across the US and in many other countries. Drs. Lee and Anne Jones-Lee (Lee and Jones-Lee) began their work on Delta water quality issues in 1989, when they served as private consultants to review the anticipated water quality that would occur in the Delta Wetlands, Inc. proposed Delta island water supply reservoirs. At that time they both held graduate faculty positions at the New Jersey Institute of Technology (NJIT) where they taught and conducted research on various aspects of the impacts of chemicals on water quality. At NJIT Dr. Lee held the position of Distinguished Professor of Civil and Environmental Engineering and director of the Site Assessment and Remediation Division of a multi-university Hazardous Waste Research Center. Dr. Jones-Lee, whose expertise is in aquatic biology/toxicology, held the tenured position of Associate Professor of Civil and Environmental Engineering. Their selection as consultants on the water quality expected in the proposed Delta Wetlands water supply reservoirs was based on their extensive experience in investigating the impacts of nutrients in lakes and reservoirs throughout the US and in many other countries.

In 1999, Drs. Lee and Jones-Lee became advisors to William Jennings, DeltaKeeper, on the low-DO conditions that occur in the San Joaquin River Deep Water Ship Channel near the Port of Stockton. By 2000 their roles on that issue expanded to advising the SJR DWSC Low-DO TMDL Steering Committee on the low-DO problems in the DWSC TMDL. They were selected by that Steering Committee to rewrite the originally rejected proposal for CALFED support for the investigation and assessment of the causes, implications, and potential remedies for the SJR DWSC low-DO issues. Lee and Jones-Lee worked with Dr. C. Foe of the CVRWQCB staff and other proposed project investigators to revise the proposal, and were subsequently selected by the Steering Committee and CALFED to be the principal investigators for the approximately $2-million project. In addition to serving as project coordinators, they developed the reports cited

below that synthesized the findings of the 12 project investigators as well as insights derived from the technical literature and their experience and expertise in working on similar issues at other locations.

Following the completion of SJR DWSC low-DO synthesis report, Lee and Jones-Lee developed the first comprehensive overview report on Delta water quality issues,

> 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 (2004). http://www.gfredlee.com/SJR-Delta/Delta-WQ-IssuesRpt.pdf

Since developing that Delta water quality report they have developed about 90 additional papers and reports on Delta water quality issues, which are available on their website (www.gfredlee.com) in the Watershed Studies section San Joaquin River Watershed Delta subsection at http://www.gfredlee.com/psjriv2.htm. In addition to presentations in journals and conference proceedings, their writings include comments submitted to CALFED, SWRCB, CVRWQCB, and Delta Vision on Delta water quality issues that were under review by the agencies.

Their 2004 Delta water quality overview report as well as all of the work that they have conducted – including these comments – to review and discuss Delta water quality has been done without financial support as part of their now eight-year effort to improve the quality of science and engineering that goes into evaluating and managing Delta water quality.

As part of developing these comments, they developed the following summary that includes an annotated biography of their Delta water quality experience and specific references to the literature with Internet links to papers and reports.

> Lee, G. F., and Jones-Lee, A., "Experience in Reviewing Delta Water Quality Issues," G. Fred Lee & Associates, El Macero, CA, April 3 (2011). http://www.gfredlee.com/SJR-Delta/GFLAJL-Delta-EXP-REV.pdf

Excerpts from that bibliography are included in these comments. In order to facilitate review, the references to the literature are presented in the text so that the reader can readily examine the title of the reference and its publication location. Additional information on several of the topic areas discussed herein is provided in this annotated bibliography.

Information on Drs. G. Fred Lee and Anne Jones-Lee's academic background, university graduate-level teaching and research and private consulting experience is available on their website (www.gfredlee.com) at http://www.gfredlee.com/gflinfo.htm.

Comments on the Introduction to the DSC Staff Draft Chapter 6

The DSC staff third draft of Chapter 6 states,

"*Improving water quality is key to achieving the coequal goals. A host of agencies regulate water quality, as described in this chapter. The Delta Plan includes recommendations to improve water quality, and the Council urges that regulatory agencies apply the highest and best available standards to improving water quality."*

There is considerable confusion/controversy about the role of pollutants in adversely impacting the aquatic life resources of the Delta. Water exporters claim that it is pollutants that are the

cause of the recent major declines in certain fish species in the Delta and that the South Delta water export projects' pumping at Banks and Jones are not significantly adverse to the aquatic life resources in the Delta. Others who are experts on Delta resource management claim that the primary cause of the pelagic organism decline (POD) is the manipulation of Delta tributary flows into and within the Delta and the export of water from the Delta by the federal and state export projects. Under CALFED leadership the issue of pollutants as a cause of aquatic life toxicity and its impact on aquatic life as it may be impacting aquatic life was a grossly neglected area of attention. However, with the development of the POD investigations there has been sufficient study of aquatic life toxicity in Delta waters and sediments to conclude that pollutants in the Delta and their potential impact on aquatic life are not the primary cause of the major changes in the fisheries resources of the Delta. While there is a potential for chronic toxicity in the Delta due to contaminants, that issue has not been investigated sufficiently to define the magnitude of pollutant-caused **chronic** toxicity, or most importantly, its significance to the recent changes in the aquatic life resources of the Delta. From the information available it appears that the SWRCB-allowed diversion of flow of tributaries into and through the Delta is one of the major factors in impacting aquatic resources of the Delta.

This Council staff draft has urged the regulatory agencies (SWRCB, CVRWQCB) to apply "*the highest and best available standards to improving water quality*." Over the past 22 years we have closely followed the SWRCB and CVRWQCB approaches to addressing water quality management issues. While there have been some technical quality issues and political issues that have influenced the regulatory decisions on some water quality issues, the most important cause of inadequate regulation of Delta water quality is a lack of financial support to hire and adequately support the staff needed to investigate and implement water quality management programs in areas known to experience water quality problems. Unless the Legislature provides adequate funding to the SWRCB/CVRWQCB there will continue to be major deficiencies in the control of water quality problems in the Delta and its tributaries. The most important assistance DSC can provide to improve pollutant-related water quality in the Delta is in the securing of adequate funding to the regulatory agencies to carry out their regulatory responsibilities.

Achieving Compliance with Water Quality Objectives

The second paragraph of the DSC third staff draft Chapter 6 states,

"*The State Water Resources Control Board has listed Delta Waterways, various streams, rivers and sloughs within the Delta, the Carquinez Strait, and San Francisco Bay as having impaired water quality pursuant to section 303(d) of the federal Clean Water Act (State Water Resources Control Board 2010).*"

Item "(e)" of the DSC draft mission statement quoted above, *"Improve water quality to protect human health and the environment consistent with achieving water quality objectives in the Delta"* places considerable emphasis on the DSC's working to cause regulatory agencies to achieve water quality objectives in the Delta. To those with limited understanding of how water quality objectives are developed and implemented, the DSC third staff draft's recommendations to achieve water quality objectives seems to be a praiseworthy and achievable goal. However, given how water quality criteria/standards/objectives are, in fact, developed and implemented for non-point-source-derived pollutants, it is found that achieving the elimination of water quality

objectives in Delta waters for some of the most important causes of WQO violations in Delta waters in a technically valid cost effective manner will be difficult to achieve.

The development and implementation of technically valid water quality criteria, standards, and (CA) objectives have been a focal point of Dr. Lee's more than five-decade-long professional career. His experience includes being an invited reviewer of the National Academy of Science/National Academy of Engineering (NAS/NAE) "Blue Book" of national water quality criteria developed in 1972, serving as an invited contributor to the American Fisheries Society's review of the US EPA "Red Book" of water quality criteria of 1976, and serving as a US EPA invited peer reviewer of the US EPA "Yellow Book" of water quality criteria of 1986.
A summary of this experience is presented at:

> G. Fred Lee and Anne Jones-Lee Expertise and Experience in Water Quality Standards and NPDES Permits Development and Implementation into NPDES Permitted Discharges. http://www.gfredlee.com/exp/wqexp.htm

Drs. Lee and Jones-Lee published the following invited paper in the first issue of a new journal, *Health and Ecological Risk Assessment*; the paper discusses the appropriate use of water quality criteria in regulating potential water pollutants.

> Lee, G. F. and Jones-Lee, A., "Appropriate Use of Numeric Chemical Water Quality Criteria," Health and Ecological Risk Assessment, 1:5-11 (1995).
> http://www.gfredlee.com/SurfaceWQ/chemcri.htm

Their expertise in this topic was also recognized when they were requested to develop the following treatise:

> Lee, G. F., and Jones-Lee, A., "Clean Water Act, Water Quality Criteria/Standards, TMDLs, and Weight-of-Evidence Approach for Regulating Water Quality," Water Encyclopedia: Water Law and Economics, Wiley, Hoboken, NJ, pp 598-604 (2005).
> http://www.gfredlee.com/SurfaceWQ/WileyCleanWaterAct.pdf

In addition they developed the following report for the CVRWQCB's review of developing water pollution control programs for non-point-source pollutants in the Central Valley:

> 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/SurfaceWQ/Agwaivemonitoring-dec.pdf

That report included information on many issues that need to be considered in regulating non-point-source discharges, such as agricultural discharges/stormwater runoff, in order to protect the beneficial uses of the waters receiving the runoff/discharge without significant over-regulation of discharge/runoff or unnecessary/ineffective expenditures by agricultural interests.

As discussed in that report and has been well-established in the literature, in accord with the 1972 congressional requirements the US EPA is required to develop national water quality criteria that will be protective in all navigable US waters. That requirement has led to the

development of “worst-case”-based criteria. Implementation of such criteria as numeric standards applied to the total concentrations of contaminants will cause the over-regulation of many potential pollutants in many waters because many/most waters contain chemicals and other materials that react/interact with many potential pollutants to render them non-toxic/unavailable, or less toxic/available to affect aquatic life.

For 30 years Dr. Lee taught university graduate-level courses in aquatic chemistry and conducted about $5 million in research on aquatic chemistry issues. Fundamental aspects of aquatic chemistry are summarized in the “aquatic chemistry wheel”, which shows the types of reactions that control the chemical forms and availability of potential pollutants in aquatic systems. These issues are discussed in,

> Jones-Lee, A., and Lee, G. F., "Modelling Water Quality Impacts of Stormwater Runoff: Why Hydrologic Models Are Insufficient," Chapter 4 IN: Modelling of Pollutants in Complex Environmental Systems, Volume I, ILM Publications, St. Albans, Hertfordshire, UK, pp.83-95 (2009).
> http://www.gfredlee.com/Runoff/HydrologicModelsInadeq.pdf

They received a request to develop a summary paper on this issue as,

> Jones-Lee, A. and Lee, G. F., “Modeling Water Quality Impacts of Stormwater Runoff – Why Hydrologic Models Aren’t Sufficient,” CENews.com Feature Article, January 29 (2008). http://www.cenews.com/article.asp?id=2631
> http://www.gfredlee.com/Runoff/CENewsStmWaterModeling.pdf

As discussed in the Lee and Jones-Lee writings referenced above, the US EPA has developed guidance on how to develop site-specific water quality criteria that adjust the national worst-case criteria to the conditions of the receiving waters for a particular discharge. The site-specific criteria adjustment procedures have been used in a number of situations including for copper in San Francisco Bay. There, the municipal wastewater dischargers and municipal stormwater dischargers were facing the expenditure of large amounts of money to remove copper from the domestic wastewaters and stormwaters in order to meet the worst-case-based copper criteria. Through the site-specific assessment of the criteria for San Francisco Bay waters it was found that the copper in the domestic wastewaters and stormwater runoff to the Bay did not lead to conditions that were toxic to aquatic life in the Bay.

The characteristics of the waters in the Delta tributaries and within the Delta are such that they will tend to detoxify many potentially toxic chemicals that enter these waters. The Delta channels and tributaries have been judged to be “impaired” because of exceedance of national water quality criteria and water quality objectives based on these criteria; that, in turn, led to the CVRWQCB/SWRCB/USEPA’s placing those waterbodies on the 303 (d) list that require the development of TMDLs to eliminate the exceedances of the objectives. However, because of the characteristics of the Delta, it is likely that application of site-specific adjustments to the worst-case water quality criteria would be appropriate and provide a more reliable assessment of the need for TMDLs. As discussed by Lee and Jones-Lee in their guidance on regulating pollutants from non-point-sources – runoff/discharges, the first step in implementing a TMDL should be to determine if the exceedance of the worst-case-based water quality objective(s) represents a real, significant impairment of the beneficial uses of the waterbody that is listed as “impaired.”

The future and final DSC Delta Plan should note the need to address the 303 (d)-listed tributaries and Delta channels and also request that the legislature provide the financial resources necessary to the CVRWQCB/SWRCB to conduct studies needed to evaluate whether the worst-case national water quality criteria-based objectives need to be adjusted for site-specific conditions that exist in Delta tributaries and in Delta channel. Failure to provide the needed funded will mean that addressing the WQO violation will be extremely difficult and may not be achieved without disrupting irrigated agriculture in the Central Valley.

Drs. Lee and Jones-Lee pioneered in developing what they termed "Evaluation Monitoring" for the technically valid, cost-effective monitoring of waterbodies to evaluate real, significant water quality impairments due to pollutant discharges. Conventional water quality monitoring is frequently accomplished by collecting limited water samples on an arbitrary time schedule and then trying to analyze the data collected after a year or so of data collection. This approach frequently fails to adequately define the real, significant water quality problems in the waterbodies under study. The Lee and Jones-Lee Evaluation Monitoring approach described in the following papers was recommended for monitoring of the water quality impacts of agricultural and urban stormwater runoff in the Central Valley:

> Jones-Lee, A. and Lee, G.F., "Evaluation Monitoring as an Alternative to Conventional Water Quality Monitoring for Water Quality Characterization/Management," Proc. NWQMC National Conference Monitoring: Critical Foundations to Protect Our Waters, US Environmental Protection Agency, Washington, D.C., pp. 499-512 (1998). http://www.gfredlee.com/Runoff/wqchar_man.html
>
> 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/SurfaceWQ/concentrationvsimpact.pdf

As discussed, rather than measuring copper or some other potentially toxic chemical in runoff/discharges and receiving waters and then trying to determine if it is toxic to aquatic life, evaluation monitoring directs the measurement of toxicity in the receiving waters; if toxicity is found, its cause and source of the toxicity would then be investigated. This is a much more effective approach to water quality monitoring and development of water quality management programs.

The DSC third staff draft of Chapter 6 states,
"*WQ R6 The State Water Resources Control Board and Regional Water Quality Control Boards should work collaboratively with the Department of Water Resources, Department of Fish and Game and other agencies and entities that monitor water quality in the Delta to develop and implement a Delta Regional Monitoring Program that will be responsible for coordinating monitoring efforts so Delta conditions can be efficiently assessed and reported on a regular basis.*"

That statement needs to provide a discussion of why the past efforts to develop a regional water quality monitoring program for the Delta have failed and why the current efforts in this regard will also likely fail. The regional monitoring program in the San Francisco Bay area is often pointed to as a model of the type of regional monitoring program that should be developed in the Delta. However, there is a large difference in the potential funding basis for the two locations. In the San Francisco Bay area, several large cities with domestic wastewater discharges to the Bay were required to contribute funds to support the monitoring program; such a funding base does not exist in the Delta. The primary dischargers of potential pollutants to the Delta are agricultural sources. The CVRWQCB is having great difficulty getting agricultural concerns in the Central Valley to fund even modest a monitoring program for the limited number of the waterbodies receiving agricultural runoff. As discussed in these comments the current irrigated agricultural lands ag waiver water quality monitoring is grossly deficient compared to that needed to adequately define the impact of runoff from agricultural lands on receiving water quality. A significantly different funding mechanism will be needed in the Central Valley than that used in the San Francisco Bay area to support an adequate Delta regional water quality monitoring program. The Legislature and/or the water diverters/users will need to fund such a program.

Compliance with SWRCB D-1641

The DSC staff third draft Chapter 6 states,

"*The Bay-Delta Plan establishes water quality objectives for which implementation is best achieved through assigning responsibilities to water right holders and water users, because the parameters to be controlled are primarily significantly affected by flows and diversions; these responsibilities were established in Water Rights Decision 1641. By establishing these largely flow-based objectives, the Bay-Delta Plan is intended to provide reasonable protection for beneficial uses that require control of salinity and water project operations (State Water Resources Control Board 2006).*"

The impacts of water diversion and management of flow into and through the Delta channels are of concern. This concern evolved from our finding that the one of primary causes of the low-DO conditions in the SJR DWSC is the diversion of SJR at the Head of Old River to the export pumps at USBR Jones and DWR Banks. These issues are discussed in the following section.

Impact of Delta Water Diversions on Delta Water Quality and Low DO

In addition to serving as project coordinators for the CALFED-supported, approximately $2-million SJR DWSC low-DO project, Lee and Jones-Lee developed the reports cited below that synthesized the findings of the 12 project investigators and provided insights into the issues from the technical literature and their experience and expertise in working on similar issues at other locations.

> 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/Technical Advisory Committee and CALFED Bay-Delta Program, G. Fred Lee & Associates, El Macero, CA, March (2003).
> http://www.gfredlee.com/SJR-Delta/SynthesisRpt3-21-03.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.gfredlee.com/SJR-Delta/SynthRptSupp.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.gfredlee.com/SJR-Delta/LowDOSummaryDec2004.pdf

During the course of those investigations Drs. Lee and Jones-Lee reported that the USBR Jones, and DWR Banks south Delta water export projects were a major cause of the low DO in the SJR DWSC. The projects draw SJR water from the Head of Old River to the pumps; that water would normally have flowed through the DWSC. By reducing the flow of the SJR water through the DWSC, the projects have caused a significant increase in the hydraulic residence time of the oxygen demanding materials that enter the DWSC which allows more of the oxygen demand to be exerted in the DWSC, lowering the dissolved oxygen levels.

Impacts of Delta USBR and DWR water diversions have also been discussed in,

Monsen, Nancy E.; James E. Cloern; and Jon R. Burau. Effects of Flow Diversions on Water and Habitat Quality: Examples from California's Highly Manipulated Sacramento-San Joaquin Delta. San Francisco Estuary and Watershed Science. Vol. 5, Issue 3 (July), Article 2. (2007). http://repositories.cdlib.org/jmie/sfews/vol5/iss3/art2

Lee and Jones-Lee recently provided guidance to the CVRWQCB on how to address the residual oxygen demand in the DWSC that is caused by algae that develop in the SJR upstream of Vernalis. These issues are discussed in,

Lee, G. F., and Jones-Lee, A., "Issues in Controlling Residual Oxygen Demand in SJR DWSC That Leads to Violations of DO WQO," PowerPoint Slides, G. Fred Lee & Associates, El Macero, CA, February (2011). http://www.gfredlee.com/SJR-Delta/Issues-Ox-Demand-DWSC-Ppt.pdf

Lee, G. F., and Jones-Lee, A., "Issues in Controlling the Residual Oxygen Demand in the SJR DWSC That Leads to DO WQO Violations," Report of G. Fred Lee & Associates, El Macero, CA, November 3, 2010; updated February 6 (2011). http://www.gfredlee.com/SJR-Delta/Residual-Ox-Demand-DWSC.pdf

Lee, G. F., "Comments on Developing Nutrient Criteria for SJR Delta," email to Christine Joab, Central Valley Regional Water Quality Control Board, Rancho Cordova, CA, March 29 (2011). http://www.gfredlee.com/SJR-Delta/Delta-Nutr-Criteria-Com.pdf

Lee and Jones-Lee reported that with adequate flow of the SJR through the DWSC, and by allowing an appropriate averaging of DO water quality objective compliance it is possible to eliminate the current residual low-DO problem in the DWSC. The DSC should consider these issues in developing a Directed Action that impacts the amount of SJR flow through the DWSC. From the information available it appears that by maintaining about 1,000 cfs of SJR flow through the DWSC it would be possible to achieve acceptable DO levels in the DWSC while

eliminating the need to try to control upstream algal nutrient discharges in the Grasslands Bypass area by that area's farmers.

Following the completion of the SJR DWSC study synthesis report, Lee and Jones-Lee developed the first comprehensive overview report on Delta water quality issues:

> 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 (2004). http://www.gfredlee.com/SJR-Delta/Delta-WQ-IssuesRpt.pdf

That review was developed over the course of about one year through a series of drafts that were sent to about 100 individuals who are active in Delta water quality issues for review and comment; comments received were addressed/incorporated in the final version.

This synthesis report on water quality issues in the Delta is a discussion of the water quality objectives/standards (WQO) in Delta waters based on the CVRWQCB/SWRCB/US EPA listing of Clean Water Act (CWA) section 303(d) violations. These violations require that TMDLs be developed to control the CWA WQO violations.

Lee and Jones-Lee have also expanded and updated their discussions of Delta water quality issues including:

> Lee, G. F., and Jones-Lee, A., "Overview—Sacramento/San Joaquin Delta Water Quality," Presented at CA/NV AWWA Fall Conference, Sacramento, CA, PowerPoint Slides, G. Fred Lee & Associates, El Macero, CA, October (2007). http://www.gfredlee.com/SJR-Delta/DeltaWQCANVAWWAOct07.pdf
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> Lee, G. F., and Jones-Lee, A., "Comments on 'Draft Environmental Impact Statement Environmental Impact Report, South Delta Improvement Program' Prepared by Bureau of Reclamation for the U .S. Department of the Interior and the Department of Water Resources for the State of California Resources Agency," Report of G. Fred Lee & Associates, El Macero, CA, Submitted to CA Department of Water Resources, Sacramento, CA February 5 (2006). http://www.gfredlee.com/SJR-Delta/SDIP-ComFeb06.pdf
>
> Lee, G. F., and Jones-Lee, A., "Discussion of Water Quality Issues That Should Be Considered in Evaluating the Potential Impact of Delta Water Diversions/Manipulations on Chemical Pollutants on Aquatic Life Resources of the Delta," Report of G. Fred Lee & Associates, El Macero, CA, February 11 (2010). http://www.gfredlee.com/SJR-Delta/Impact_Diversions.pdf

Drs. Lee and Jones-Lee have continued to follow the deliberations of various agencies and committees devoted to Delta resource management issues; they have submitted comments and other writings to the SWRCB as part its review of Delta Trust tributary and Delta flow and pollutant criteria including the following:

> Lee, G. F., and Jones-Lee, A., "Comments on Water Quality Issues Associated with SWRCB's Developing Flow Criteria for Protection of the Public Trust Aquatic Life Resources of the Delta," Submitted to CA State Water Resources Control Board as part of Public Trust Delta Flow Criteria Development, by G. Fred Lee & Associates, El

Macero, CA, February 11 (2010).
http://www.gfredlee.com/SJR-Delta/Public_Trust_WQ.pdf

Lee, G. F., and Jones-Lee, A., "Impact of SJR & South Delta Flow Diversions on Water Quality," PowerPoint Slides, Presentation to CA Water Resources Control Board, D1641 Water Rights Review, January 24 (2005).
http://www.gfredlee.com/SJR-Delta/D1641SlidesSWRCBJan2005.pdf

Lee, G. F., and Jones-Lee, A, "Review of Impacts of Delta Water Quality and Delta Water Exports on the Decline of Chinook Salmon in the SJR Watershed," Comments submitted to NMFS Southwest Fisheries Science Center, NOAA, Santa Cruz, CA, by G. Fred Lee & Associates, El Macero, CA, August (2008).
http://www.gfredlee.com/SJR-Delta/Salmon-NOAAcom.pdf

Lee, G., F., and Jones-Lee, A., "Need for Reliable Water Quality Monitoring/Evaluation of the Impact of SWRCB Water Rights Decisions on Water Quality in the Delta and Its Tributaries," Submitted to CA Water Resources Control Board Workshop on D-1641 Water Rights, Sacramento, CA, March 22 (2005).
http://www.gfredlee.com/SJR-Delta/DeltaWaterExportImpactsPaper.pdf

Lee, G., F., and Jones-Lee, A., "Need for Reliable Water Quality Monitoring/Evaluation of the Impact of SWRCB Water Rights Decisions on Water Quality in the Delta & Its Tributaries," PowerPoint Slides Submitted to CA Water Resources Control Board Workshop on D-1641 Water Rights, Sacramento, CA, March 22 (2005).
http://www.gfredlee.com/SJR-Delta/DeltaWaterExportImpactsPowerPoint.pdf

Lee, G. F., "Comments on the CA State Water Resources Control Board Cease and Desist Order to Cause the US Bureau of Reclamation and CA Department of Water Resources to Control Salinity Violations in the South Delta Compliance Points," Testimony presented at CA SWRCB evidentiary hearing, Sacramento, CA, November 7 (2005). http://www.gfredlee.com/SJR-Delta/CeaseDesistSalinity.pdf

Lee, G. F., and Jones-Lee, A., "Water Quality Issues That Could Influence Aquatic Life Resources of the Delta," Comments submitted to CALFED Science Program, Sacramento, CA, by G. Fred Lee & Associates, El Macero, CA, November 28 (2005).
http://www.gfredlee.com/SJR-Delta/POD-Com.pdf

Based on the SWRCB D 1641 water rights decision, the California Interagency Ecological Program (IEP) and CALFED were supposed to address the impacts of diverting Delta water on quality/resource management issues. The synthesis report referenced above, as well as the Lee (2008) comments cited below discussed the CVRWQCB's listing of known water quality criteria violations as well as technical inadequacies in the approach that the IEP monitoring/CALFED followed to evaluate water quality problems associated with exceedances of water quality objectives. These issues are summarized in,

Lee, G. F., "Comments on CALFED Independent Science Board Review of IEP," Comments submitted to Interagency Ecological Program, February 4 (2008).

http://www.gfredlee.com/SJR-Delta/Comments-ISB-Review-IEP.pdf

It is critical that DSC establish a program that requires that the SWRCB management of the IEP Delta monitoring of the Delta channels be focused on evaluating the impact of permitted water diversions on Delta water quality and Delta resources as required in D-1641.
Dr. Lee followed the Delta Vision Blue Ribbon Panel discussions on Delta Water Quality Issues, and has discussed technical inadequacies of the staff draft discussions in,

Lee, G. F., and Jones-Lee, A., "Comments on 'Delta Vision Strategic Plan Fourth Staff Draft Volume 2: Strategy Descriptions,'" Comments submitted to P. Isenberg, Chair, Delta Vision Blue Ribbon Task Force, Sacramento, CA. Report of G. Fred Lee & Associates, El Macero, CA, September 30 (2008). http://www.gfredlee.com/SJR-Delta/DeltaVisionStaffDraft4.pdf

Lee, G. F., and Jones-Lee, A., "Delta Water Quality Standards Violations" and "Comments on Water Quality Sections of the Delta Vision Strategic Plan, Third Staff Draft – dated August 14, 2008," Submitted to Delta Vision Blue Ribbon Task Force, Sacramento, CA. Report of G. Fred Lee & Associates, El Macero, CA, September 1 (2008). http://www.gfredlee.com/SJR-Delta/DeltaVisionWQViolations.pdf

Lee, G. F., and Jones-Lee, A., "Comments on September 19, 2008 Delta Vision Task Force Meeting Discussion of Nutrient-Related Water Quality Problems in the Delta," Comments submitted to P. Isenberg, Chair, Delta Vision Blue Ribbon Task Force, Sacramento, CA. Report of G. Fred Lee & Associates, El Macero, CA, October 14 (2008). http://www.gfredlee.com/SJR-Delta/DeltaVisionCom9-19-08.pdf

Dr. Lee served as an invited peer reviewer of the Department of Fish and Game (DFG) biological objectives and flow criteria review that developed the following report:

Gross, E.S., Lee, G. F., Simenstad, C. A., Stacey, M., Williams, J.G., (Expert Panel Members), "Panel Review of the CA Department of Fish and Game's Quantifiable Biological Objectives and Flow Criteria for Aquatic and Terrestrial Species of Concern Dependent on the Delta," DFG Water Rights Program Documents Senate Bill X7 1 DFG Implementation, Submitted to California Department of Fish and Game, October (2010). http://www.dfg.ca.gov/water/water_rights_docs.html

That report discusses the need for DFG to include an evaluation of the Delta tributary and in-Delta flows in establishing the needed flows criteria, as well as guidance on the need to more adequately manage the Delta aquatic life resources through maintaining adequate flows in Delta tributaries and in-Delta channels.

Issues of Salinity Impact on Groundwater Recharge

The DSC third staff draft Chapter 6 Policies and Recommendations Salinity section states, "*Seawater contamination of municipal water supplies makes water unpalatable, contributes to the formation of harmful disinfection byproducts, and increases corrosion of pipes and equipment.*" That section failed to mention that increased Delta salinity adversely impacts the recharge of domestic wastewaters for enhancement of groundwater resources in southern California due to restrictions on the amount of salinity allowed in waters that are subject to

recharge. Keeping the salinity of the Delta waters low enhances the ability of water utilities to use treated domestic wastewaters as a source of water supply for groundwater recharge.

Groundwater Quality Protection

The DSC third staff draft Chapter 6 Drinking Water section contains the passage,
"*In addition, the drinking water supply (groundwater) of many communities within the area served by water exported from the Delta is contaminated by nitrates and other pollutants, particularly in the San Joaquin Valley. Survey findings show that a financial burden is borne by low-income households with nitrate-contaminated water (Pacific Institute 2011). The high cost of accessing water from alternative sources, coupled with the low earnings of households, makes safe drinking water in these communities unaffordable (Pacific Institute 2011).*"

While this is an important example of groundwater pollution that impacts domestic water supplies, it is a very limited significance compared to the total magnitude of the pollution of groundwater in the state. It is of concern that the SWRCB and CVRWQCB have permitted activities on the land surface that have led, and continue to lead, to groundwater pollution that impairs the use of those waters for domestic and many other purposes. A review of these issues is presented in,

> Lee, G. F., "Comments on the Draft Groundwater Quality Protection Strategy," Submitted to the Central Valley Regional Water Quality Board, July 16 (2010). http://www.gfredlee.com/Groundwater/Buford_Comm_GWStrategy.pdf
>
> Lee, G. F., and Jones-Lee, A., "Comments on Developing a Strategy for Protection of Beneficial Uses of Groundwater in the Central Valley, CA," Prepared for CVRWQCB Public Workshop, "Development of a Strategy to Protect the Beneficial Uses of Groundwater in the Central Valley," CVRWQCB, Rancho Cordova, CA, August 24 (2009). http://www.gfredlee.com/Groundwater/GroundwaterProtectionStrategy-sli.pdf
>
> Lee, G. F., and Jones-Lee, A., "Focus on Irrigated Agriculture Pollution of Groundwater," Excerpt from "Groundwater Quality Protection Issues," Report of G. Fred Lee & Associates, El Macero, CA, February 2007; Presented in part at CA/NV AWWA Fall Conference, Sacramento, CA, October (2007). http://www.gfredlee.com/Groundwater/GWProtectionIssuesAg.pdf
>
> Lee, G. F. and Jones-Lee, A., "Groundwater Quality Protection Issues," Report of G. Fred Lee & Associates, El Macero, CA, February 2007; Presented in part at CA/NV AWWA Fall Conference, Sacramento, CA, October (2007). http://www.gfredlee.com/Groundwater/GWProtectionIssues.pdf

As discussed therein, irrigated agriculture, domestic wastewater land disposal practices, dairies, feed lots, municipal landfills are all causing groundwater pollution in the Delta watershed. Irrigated agricultural practices, including drip irrigation, and areas with deep aquifers cause pollution of groundwater with salts, nitrate, and some other chemicals including some pesticides.

Following the recommendation the DSC third staff draft Chapter 6 on managing urban stormwater pollution loads quoted in another section of these comments it should be noted that

this recommendation could lead to groundwater pollution through infiltration of urban stormwater into aquifer systems. The discharge of urban stormwater to shallow wells in Modesto, CA has been found to be polluting groundwaters. The CVRWQCB issued the following statement on this issue
[http://www.ci.modesto.ca.us/pwd/docs/stormwater_permit.pdf]:
"*STORM WATER DISCHARGE TO SHALLOW GROUNDWATER*
22. The Discharger uses approximately 11,000 wells, which drain approximately thirty percent of the city, to dispose of storm water. These disposal wells are lined with rock for structural safety and additional treatment. The wells are known as 'rock wells.'

23. The rock wells pose a potential threat to the shallow groundwater."

For about 10 years Dr. Lee was a member of the American Society of Civil Engineers' Artificial Recharge of Groundwaters standards committee. He was also a contributor to "Standard Guidelines for Artificial Recharge of Groundwater," ASCE Standard EWRI/ASCE 34-01, Reston, VA (2001) and had the responsibility for developing the groundwater quality section of that report. One of the issues of concern is the potential for pollutants in recharge waters to pollute the groundwaters. Lee and Jones-Lee have developed several papers on this issue, including:

> Lee, G. F. and Jones-Lee, A., "Water Quality Aspects of Incidental and Enhanced Groundwater Recharge of Domestic and Industrial Wastewaters," Proc. Symposium on Effluent Use Management, TPS-93-3, pp. 111-120, American Water Resources Association, Bethesda, MD (1993). http://www.gfredlee.com/Groundwater/rechg.htm
>
> Lee, G. F. and Jones-Lee, A., "Water Quality Aspects of Groundwater Recharge: Chemical Characteristics of Recharge Waters and Long-Term Liabilities of Recharge Projects," IN: Artificial Recharge of Ground Water, II, Proc. Second International Symposium on Artificial Recharge of Ground Water, American Society of Civil Engineers, NY, pp. 502-511 (1995).
> http://www.gfredlee.com/Groundwater/ascegwr.htm

A special case of enhance groundwater recharge is aquifer storage and recovery (ASR) in which surface waters are injected into groundwaters for the purpose of storing the surface water in the aquifer. The injected groundwaters are subsequently pumped from the aquifer for domestic use. While that practice can be effective in enhancing domestic water supply, caution should be exercised in practicing ASR to ensure that the injected surface water does not contain pollutants that can contaminate the aquifer or lead to pollution of the injected water. The city of Tracy proposed to inject Delta Mendota Canal water into a shallow aquifer in the city using ASR with only chlorination of the water before injection. In the following report, Lee discussed concerns about that practice since the Delta Mendota canal water is derived from the polluted South Delta water and the chlorination of that water would result in the presence of chlorination byproducts that would persist in the aquifer.

> Lee, G. F. and Jones-Lee, A., "Comments on City of Tracy's Proposed Demonstration Phase Aquifer Storage and Recovery Project (ASR Demonstration Project)," Submitted to California Regional Water Quality Control Board, Central Valley Region, by G. Fred Lee & Associates, El Macero, CA, September (2004).

http://www.gfredlee.com/Groundwater/TracyASR-comments.pdf

Owing to those concerns he recommended that the city of Tracy not be allowed to proceed with that approach without extensive treatment of the canal water before injection. The city of Tracy was instead able to obtain high quality surface water for injection in its ASR system by constructing a pipeline to a high-quality eastside river.

Dr. Lee was an invited reviewer of the US EPA's proposed revised Class V injection well policy. Class V wells are those that are used to infiltrate surface waters and wastes into shallow aquifers. He, with Dr. Jones-Lee and S. Taylor developed findings on that issue in:

Lee, G.F., Jones-Lee, A., and Taylor, S., "Development of Appropriate Stormwater Infiltration BMPs: Part I Potential Water Quality Impacts, Monitoring and Efficacy Evaluation," Proc. of Ground Water Protection Council's 98 Annual Forum, Sacramento, CA, pp. 55-72, Sept (1998).
http://www.gfredlee.com/Runoff/stmwt_infil.pdf

Taylor, S. and Lee, G.F., "Developing of Appropriate Stormwater Infiltration BMPs: Part II Design of Infiltration BMPs," Proc. of Ground Water Protection Council's 98 Annual Forum, Sacramento, CA, pp. 73-80, Sept (1998).
http://www.gfredlee.com/Runoff/stmwt_infil2.html

Taylor, S., and Lee, G.F., "Design of Infiltration BMPs," slides presented at GWPC 98 Annual Forum Conference, Sacramento, CA, September 20-23 (1998).
http://www.gfredlee.com/Runoff/Infil-BMP-sli.pdf

They discussed the potential for infiltration of urban stormwater into groundwaters to pollute groundwater. They also discussed the monitoring programs that need to be conducted to ensure that surface water infiltration BMPs do not cause groundwater pollution.

DSC should work toward developing urban stormwater management programs to reduce pollutant loads to prevent groundwater pollution by stormwater. DSC should also work toward ensuring that the recharge water used for any groundwater recharge project does not pollute the aquifer or damage aquifer quality for water storage/retrieval.

Discussions at DSC meetings have mentioned concern about how the loss of groundwater supplies such as by pollution can increase pressure to use surface waters as alternate sources. Such situations have recently occurred in Davis and Woodland, CA. The SWRCB has granted a water right to those cities to take Sacramento River water for domestic supply because the groundwaters in the areas of those cities have been polluted and/or contain pollutants of natural origin that impair the use of the groundwater as a domestic source without treatment to remove the pollutants.

Dr. Lee is familiar with the groundwater quality situation in the Davis, CA area through his work as the US EPA-supported Technical Assistance Grant (TAG) advisor to the Davis South Campus Superfund Oversight Committee (DSCSOC). The University of California Davis developed shallow, unlined landfill and pits in which to dispose campus wastes, including laboratory wastes

and radioactive wastes. Even at the time that it was being practiced, it was well-known that such waste disposal measures would lead to groundwater pollution. However the UCD administration found that it was cheaper to dispose of campus wastes on its land. The pollution resulting from that practice came to be of sufficient magnitude to cause the campus area on which that waste disposal practice occurred (LEHR) to be named a national Superfund site. It is estimated that about $50 million of state of California money is being spent in "remediation" of the LEHR Superfund site to control the groundwater polluted with chlorinated solvents (chloroform and others), chromium, and other pollutants derived from the UCD waste disposal practices.

Over the period 1995-2010 Drs. Lee and Jones-Lee issued a series of reports on technical aspects of the LEHR Superfund site investigation and remediation; their reports are available on the DSCSOC website [http://www.gfredlee.com/DSCSOC/DSCSOC.htm]. One of the issues they discussed is the pollution of groundwaters in the Davis area. The aquifers of that area contain naturally occurring selenium and chromium that can be present in some well waters from the aquifer. The groundwaters of the area have also been polluted by nitrate from the agricultural use of nitrogen fertilizers. That type of pollution is still occurring in that and many other areas of California. The use of Sacramento River water for domestic water supply in Davis and Woodland will put additional pressure on Delta water resources and Delta water quality.

With respect to the SWRCB/Regional Water Boards' permitting of municipal solid wastes landfills (MSW) that have caused groundwater pollution, in the mid-1980s while holding the position of Professor of Civil and Environmental Engineering in the University of Texas system, Dr. Lee was a consultant to the SWRCB on developing updated MSW landfilling regulations. He worked with the SWRCB staff to update landfilling regulations (Chapter 15) to require that MSW landfills be sited and constructed so as to protect groundwater quality for as long as wastes in the landfill would be a threat to pollute groundwater by landfill leachate. However, as discussed in his "flawed technology" review, the SWRCB and the Regional Boards have not, in practice, effectively enforced compliance with the requirement to ensure long-term protection of groundwater quality from pollution by landfills.

> Lee, G. F., and Jones-Lee, A., "Flawed Technology of Subtitle D Landfilling of Municipal Solid Waste," Report of G. Fred Lee & Associates, El Macero, CA, December (2004). Updated June (2010).
> http://www.gfredlee.com/Landfills/SubtitleDFlawedTechnPap.pdf

The DSC third staff draft Chapter 6 Drinking Water section includes the Recommendation,
"*WQ R2 The State Water Resources Control Board and/or Central Valley Regional Water Quality Control Board should develop regulations to protect the quality of groundwater used for drinking water."*
That recommendation fails to recognize that the State Water Resources Control Board (through the Porter-Cologne Water Quality Control Act), as well as the Regional Water Quality Control Boards' Basin Plans, contain explicit requirements that the quality of groundwaters in California be fully protected from pollution/impairment. As discussed in the above-referenced report, "Groundwater Quality Protection Issues," the Porter-Cologne Water Quality Control Act (SWRCB 2006), Division 7, Chapter 1, section 13000, states,
"*The Legislature finds and declares that the people of the state have a primary interest in the conservation, control, and utilization of the water resources of the state, and that the quality of*

all the waters of the state shall be protected for use and enjoyment by the people of the state." Chapter 2, section 13050, paragraph (e) defines *"waters of the state"* as *"any water, surface or underground, including saline waters, within the boundaries of the state."*

Therefore there is no need to develop regulations as called for in WQ R2 to protect groundwater from pollution. This WQ should be revised to state that the SWRCB and the CVRWQCB should implement the existing regulations to protect groundwaters from pollution.

The DSC should facilitate the development of regulatory programs that prevent groundwater pollution. Adoption of this approach should be an important component of the Delta Plan to protect the use of Delta waters.

Delta Nutrient Water Quality Issues

The DSC third staff draft Chapter 6 Environmental Water Quality section contains the Recommendation,

"*WQ R5 The State Water Resources Control Board and the San Francisco Bay and Central Valley Regional Water Quality Control Boards are currently engaged in regulatory processes that would improve water quality in the Delta. In order to achieve the coequal goals, it is essential that these ongoing efforts be completed and if possible accelerated, and that the Legislature and Governor devote sufficient funding to make this possible. The Council specifically recommends that:*

The State Water Resources Control Board and the San Francisco Bay and Central Valley Regional Water Quality Control Boards should develop and adopt numeric objectives for nutrients in the Delta and Delta watershed by January 1, 2014."

Dr. Lee has been active in investigating the impacts of aquatic plant nutrients on water quality issues in various areas of the world since the early 1960s and in the Delta since 1989. He has been involved in more than $1-million of detailed studies on nutrient impacts on water quality and served on the steering committees that guided more than $50-million in OECD eutrophication studies in Europe, North America, Japan and Australia. Additional information on Drs. Lee and Jones-Lee's experience in investigating and managing excessive fertilization of waterbodies and many of their publications are available on their website at www.gfredlee.com in the Excessive Fertilization section at http://www.gfredlee.com/exfert.htm.

The California Water Environmental Modeling Forum (CWEMF) develops peer reviews of modeling approaches and develops workshops on water modeling issues; Dr. Lee was asked to serve as a member of the CWEMF steering committee. With Dr. Jones-Lee he developed for the CWEMF a workshop entitled, "Overview of Delta Nutrient Water Quality Problems: Nutrient Load - Water Quality Impact Modeling," which was presented to an audience of about 100 in March 2008. Information on that workshop is available on the CWEMF website [http://www.cwemf.org] at:
http://www.cwemf.org/workshops/NutrientLoadWrkshp.pdf. Additional information on the workshop is available at:

> Lee, G. F., and Jones-Lee, A., "Delta Nutrient-Related Water Quality Problems," PowerPoint Slides Presented at CALFED Science Conference, Sacramento, CA, October 24 (2008). http://www.gfredlee.com/SJR-Delta/CALFED_SciConf10-08.pdf

Lee, G. F., and Jones-Lee, A., "Synopsis of CWEMF Delta Nutrient Water Quality Modeling Workshop – March 25, 2008, Sacramento, CA," Report of G. Fred Lee & Associates, El Macero, CA, May 15 (2008). http://www.gfredlee.com/SJR-Delta/CWEMF_WS_synopsis.pdf

"Overview of Delta Nutrient Water Quality Problems: Nutrient Load – Water Quality Impact Modeling," Agenda for Technical Workshop sponsored by California Water and Environmental Modeling Forum (CWEMF), Scheduled for March 25, 2008 in Sacramento, CA (2008).
http://www.gfredlee.com/SJR-Delta/CWEMF_Workshop_Agenda.pdf

Lee, G. F., and Jones-Lee, A., "Delta Nutrient-Related Water Quality Problems," PowerPoint Slides Presented at CALFED Science Conference, Sacramento, CA, October 24 (2008). http://www.gfredlee.com/SJR-Delta/CALFED_SciConf10-08.pdf

The presentations made at the CWEMF Delta Nutrient Workshop contain important information on developing nutrient criteria that are called for in the third staff draft. As discussed in the materials cited above, there are several different types of nutrient-related water quality problems in the Delta. One is the growth of planktonic algae in the SJR that lead to oxygen demand problems in the DWSC. It may be possible to develop nutrient criteria to address this issue by the Staff-suggested date of January 1, 2014 provided that sufficient financial and staff resources are made available to the CVRWQCB/SWRCB.

It will be important for California to avoid the significant problems that are arising in the current US EPA efforts to develop nutrient criteria for Florida based on statistical correlations without proper regard to cause-and-effect relationships between nutrients and their impacts in developing nutrient criteria for the SJR to control planktonic algae. Those issues are discussed in several issues of the Lee and Jones-Lee Stormwater Runoff Water Quality Newsletters, NL 1-3, 5-1, 9-1/2, 9-8, 10- 4, 10-5, 10-6, 10-7, 10-13, 11-2, 11-5, 11-9, 12-3, 12-5, 12-6, 12-7/8, 13-3, and 14-1 available at http://www.gfredlee.com/newsindex.htm.

Another type of nutrient-caused water quality problem in the Delta is the growth of water hyacinth. Water hyacinth are floating macrophytes that obtain their nutrients from the water column. Massive growths of water hyacinth seriously impair the beneficial uses of some Delta channels. As discussed in the above-listed discussions, based on studies in Brazil it may be possible to control the excessive growths of water hyacinths in the Delta through the control of nutrient loads to those areas that experience excessive growths. However, developing appropriate nutrient criteria for controlling water hyacinth will require many years of well-funded, intensive studies well-beyond the time window the DSC staff has suggested for nutrient criteria development.

A third type of nutrient-related water quality problem in the Delta is the growth of Egeria. Egeria are rooted macrophytes that obtain their nutrients from the water column as well as the sediment; their growth in the Delta is significantly adversely impacting fisheries habitat. Because they derive nutrients from the sediment, it will not be possible to develop nutrient criteria for the control of Egeria in the Delta.

A fourth type of nutrient-related water quality problem occurs in southern California water supply reservoirs that are filled with Delta waters. As discussed by Metropolitan Water District technical staff at the Delta nutrient workshop, benthic bluegreen algae that develop in the reservoirs excrete chemicals that cause severe tastes and odors in water supplies. It will not likely be possible to develop nutrient criteria to control that nutrient-related water quality problem.

Impact of N/P Ratios on Delta Aquatic Life Resources

The DSC third staff draft Chapter 6 devotes considerable attention to the writings that discuss N/P ratios in the Delta as a cause of ecosystem changes, the pelagic organism decline (POD), and of other resource problems in the Delta. The third staff draft Chapter 6 fails to mention a number of technical issues related to that concern that are discussed in the literature. For example, in his presentation cited below, Cloern discussed the lack of technical validity in the claim that changes in N/P ratio are a cause of changes in the Delta ecosystem that has occurred in recent years.

> Cloern, James "Historical Perspective on Human Disturbance in the Sacramento-San Joaquin Delta Ecosystem", Senior Research Scientist, U.S. Geological Survey Menlo Park, CA presented at National Academies of Science (NAS) National Research Council (NRC) meeting, "**Sustainable Water and Environmental Management in the California Bay-Delta"** held on July 13-15, 2010 in Sacramento, Ca, PowerPoint slides obtained from the NRC Public Access Records Office at www.nrc.gov/reading-rm/foia/foia-privacy.html.

In his CWEMF nutrient workshop presentation entitled, "Impact of Sacramento River Input of Phosphorus to the Delta on Algal Growth in the Delta," Dr. Erwin Van Nieuwenhuyse summarized his recent paper describing the response of average summer chlorophyll concentration in the Delta to an abrupt and sustained reduction in phosphorus discharge from the Sacramento County Regional Sanitation District wastewater treatment facility. His presentation provides important information on the impact of Sac Regional phosphorus discharge on Delta planktonic algae in the Delta, and is available at, http://www.cwemf.org/workshops/DeltaNutrientsWrkshp/VanNieuwenhuyse.pdf.

As discussed in the Van Nieuwenhuyse workshop presentation and published paper, and the Lee and Jones-Lee workshop presentation, backup information, and papers referenced in their presentations, it is well-established that reducing the phosphorus loads and in-waterbody concentrations effects reductions in the phytoplankton biomass in Delta waters. This occurs even in situations in which the available phosphorus concentrations in the waterbody remain surplus compared to growth-rate-limiting concentrations. The decrease in planktonic algae in the Delta associated with decreased phosphorus loads to the Delta is important information that must be discussed in a creditable discussion of the impact of nutrients on Delta water quality. The changes in the Delta ecosystem that occurred associated with Sac Regional decreased phosphorus discharges rather than the change in N/P ratios as discussed in the DSC staff third draft are a more likely cause of changes in the fish production than the change in the N/P ratios discussed by the staff in the third draft.

Drs. Lee and Jones-Lee have found that some deterministic modeling efforts, such as some of those used for "relating" nutrient loads to eutrophication-related water quality, are not reliable

for predicting impacts of altering nutrient loads on water quality. This is due, in large part, to the fact that they do not have firm foundations in quantifiable and theoretical cause-and-effect couplings, but rather presume cause-and-effect is demonstrated by the appearance of mathematical relationships of computation of "correlation" indices. Further, while some models can be "tuned" so to cause their output to "match" an existing data set, such "tuning" does not render the models reliable for predicting water quality impacts effected by altered nutrient or pollutant loads. These issues are discussed in,

> Lee, G. F., and Jones-Lee, A., "Reliability of Deterministic Models for Predicting Water Quality Impacts of Alterations in Pollutant Loads," Report of G. Fred Lee & Associates, El Macero, CA, March (2009).
> http://www.gfredlee.com/SurfaceWQ/DeterministicModels.pdf

The DSC should adopt an approach to promote the funding of research to better define the science and engineering needed to develop technically valid nutrient management programs for discharges to Delta tributaries and within the Delta.

Comments on SJR Water Quality Issues That Impact Delta Water Quality

The DSC third staff draft Chapter 6 introductory paragraph states, *"Water quality is generally better in the north Delta than in the central and southern Delta because Sacramento River inflows are greater than inflows from the San Joaquin River, and because the proportion of agricultural drainage discharges into the San Joaquin River is greater than discharges into the Sacramento River.*" Drs. Lee and Jones-Lee have been active in evaluating the impact of agricultural discharges in the SJR watershed on SJR and Delta water quality, and discussed their findings in several papers and reports including,

> Lee, G. F., and Jones-Lee, A., "Potential Water Quality Impacts of Agriculture Runoff/Discharges in the Central Valley of California," Presented at Central Coast Agricultural Water Quality Coalition's 2007 National Conference on Agriculture & the Environment, Monterey, CA, PowerPoint Slides, G. Fred Lee & Associates, El Macero, CA, November (2007).
> http://www.gfredlee.com/SJR-Delta/SJRAgImpactsMontereyNov2007.pdf
>
> Lee, G. F. and Jones-Lee, A., "Agriculture-Related Water Quality Problems in the San Joaquin River," Proceedings of 2006 International Conference on The Future of Agriculture: Science, Stewardship, and Sustainability, Center for Hazardous Substance Research, Kansas State University, Manhattan, KS (2006).
> http://www.gfredlee.com/SJR-Delta/SJRAgAug06Paper.pdf
>
> Lee, G. F. and Jones-Lee, A., "Agriculture-Related Water Quality Problems in the San Joaquin River," PowerPoint slides presented at 2006 International Conference on "The Future of Agriculture: Science, Stewardship, and Sustainability," Sacramento, CA, August 7 (2006). http://www.gfredlee.com/SJR-Delta/SJRAgAug06Sli.pdf
>
> 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/SurfaceWQ/BMP_Rpt.pdf

Those reports contain considerable information on the regulation of the water quality impacts of chemicals in agricultural runoff/discharges that impact Delta water quality.

Drs. Lee and Jones-Lee have developed several reports for the CVRWQCB on managing the water quality impacts of chemicals in agricultural runoff including,

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/SurfaceWQ/Agwaivemonitoring-dec.pdf

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/SurfaceWQ/BMP_Rpt.pdf

Those reports contain considerable information on the regulation of the water quality impacts of chemicals in agricultural runoff/discharges.

The CVRWQCB has been developing a regulatory program to attempt to control the surface water discharges of contaminants from irrigated agriculture in stormwater runoff and tailwater discharges that cause violations of water quality objectives. Drs. Lee and Jones-Lee have been involved in reviewing the development of that program and have published a series of reports on technical concerns with that program, including,

Lee, G. F., and Jones-Lee, A., “Comments on the Tentative California Regional Water Quality Control Board Central Valley Region Monitoring and Reporting Program Order No. R5-2008-__for Coalition Groups under Amended Order No. R5-2006-0053 Coalition Group Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands, Revision 26 November 2007,” Submitted to Central Valley Regional Water Quality Control Board, Sacramento, CA, by G. Fred Lee & Associates, El Macero, CA, December 28 (2007). http://www.gfredlee.com/SurfaceWQ/AgWaiverMRPNov07.pdf

Lee, G. F., and Jones-Lee, A., “Comments on ‘Working Draft - Draft Monitoring and Reporting Program -Order No. R5-2007-__for Coalition Groups under Amended Order No. R5-2006-0053 Coalition Group Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands’ dated March 29, 2007,” Report submitted to CVRQCB, Sacramento, CA by G. Fred Lee & Associates, El Macero, CA, April 13 (2007).

http://www.gfredlee.com/SurfaceWQ/CommentsWorkingDraftMRP.pdf

Lee, G. F., and Jones-Lee, A., "Comments on 'Draft Program Environmental Impact Report for a Waste Discharge Regulatory Program for Irrigated Lands within the Central Valley Region,'" Submitted to CVRWQCB ILRP, Sacramento, CA, September 25 (2010). http://www.gfredlee.com/SurfaceWQ/ILRPcomments.pdf

Lee, G. F., and Jones-Lee, A., "Issues in Regulating Water Quality Impacts from Irrigated Agricultural Runoff and Discharges in the Central Valley of California," Report of G. Fred Lee & Associates, El Macero, CA, February 4 (2009).
http://www.gfredlee.com/SurfaceWQ/Impacts-Ag-Runoff.pdf
Other reports are available on their website, www.gfredlee.com in the Surface Water Quality in the Agriculture Impacts on Water Quality subsection at,
http://www.gfredlee.com/pwwqual2.htm#agwaiver.

As discussed in those reports, the CVRWQCB has not, thus far, required that irrigated agriculture in the Central Valley adequately monitor its stormwater runoff and tailwater discharges to evaluate the occurrence of violations of water quality objective in surface waters of the state. The DSC should adopt a program to support the CVRWQCB in adopting a comprehensive water quality monitoring program for runoff from irrigated agriculture to define the water quality impacts of runoff/discharges from those lands.

Pesticide-Caused Aquatic Life Toxicity

The DSC third staff draft of Chapter 6 Environmental Quality section contains the Recommendation,

"The State Water Resources Control Board, the San Francisco Bay and Central Valley Regional Water Quality Control Boards, and the Department of Pesticide Regulation should complete the Central Valley Pesticide Total Maximum Daily Load and Basin Plan Amendment for diazinon and chlorpyrifos by January 1, 2013."

That statement fails to provide reference to the large amount of work that the CVRWQCB has done on developing approaches for regulating the aquatic life toxicity caused by the organophosphorus (OP)-based pesticides (diazinon and chlorpyrifos). The next draft should provide reference to the CVRWQCB's discussion of this issue that appears on its webpage, http://www.swrcb.ca.gov/rwqcb5/ and http://www.swrcb.ca.gov/centralvalley/water_issues/index.shtml. Also, the CVRWQCB should be consulted to determine whether the January 1, 2013 date set forth in the recommendation is realistic for developing a Basin Plan amendment to cover the developing of a TMDL to control toxicity due to those pesticides in all the waters of the Central Valley considering the issues that need to be addressed to complete these TMDLs for the different waterbodies in the Central Valley that have aquatic life toxicity due to these pesticides that potentially impact the aquatic resources of the Delta.

The Department of Pesticide Regulation (DPR) is not responsible for developing Basin Plan amendments for the control of pesticide aquatic life toxicity. DPR should not be listed in the DSC Plan as being responsible for that activity.

An issue of concern in the CVRWQCB development of a TMDL for the OP pesticides in the Sacramento and San Joaquin Rivers is the adequacy of the monitoring program that has been developed for evaluating compliance with the TMDL. This issue has been discussed in,

> Lee, G. F., "Inadequate Approach for Implementation of the SJR OP Pesticide TMDL Compliance Monitoring," Comments submitted to William Jennings, California Sportfishing Protection Alliance by G. Fred Lee & Associates, El Macero, CA, November 8 (2005).
> http://www.gfredlee.com/Runoff/OPPestSJRBasinPlanAmend.pdf

As discussed in those comments, the CVRWQCB has not, thus far, required adequate monitoring of San Joaquin and Sacramento Rivers and their tributaries to evaluate compliance with the TMDL goals for control of aquatic life toxicity due to OP pesticides.

In 1960 Dr. Lee was appoint to the position of Professor of Water Chemistry at the University of Wisconsin Madison. In that position he develop a graduate degree program in water chemistry that was specifically designed to provide education to chemists/chemical engineers in water quality investigation/and management. Over the 30-year period that Dr. Lee held university graduate-level teaching and research positions his graduate studies conducted more than 90 MS theses and PhD dissertations on water chemistry projects. One of the types of chemicals of greatest concern was pesticides. Beginning in the 1960s Dr. Lee and his graduate students conducted studies on the occurrence, fate, transport, bioaccumulation, and impacts of several organochlorine pesticides in use at the time including DDT, dieldrin, endrin and toxaphene.

While a Professor of Water Chemistry Dr. Lee served as secretary of the technical committee of the state of Wisconsin Pesticide Review Board. That committee recommended that the state adopt a ban on the use of DDT in the state because of its potential to be adverse to some fish-eating and other bird populations.

Since then Dr. Lee has repeatedly observed the inadequate regulation (registration) of new and expanded-use pesticides; when one type of pesticide is banned, a new pesticide is manufactured to replace it but typically without adequate evaluation of the potential public health and environmental impacts.

While the organochlorine pesticides were banned based on human health and environmental impacts associated with adverse impact on bird population, the organophospate (OP) pesticides changed the environmental problem to water column aquatic life toxicity. While such toxicity was well-documented in Central Valley rivers by the CVRWQCB/USGS studies in the 1980s, DPR is still allowing the use of those pesticide on some agricultural and urban areas and the CVRWQCB is still adopting regulations to try to control that toxicity.

With the phasing out of OP pesticides for urban residential use due to potential adverse impacts on children's health, the development of pyrethroid-based pesticides has created a new problem of toxicity in aquatic sediments. It is clear that there is inadequate regulation of pesticides with respect to public health and environmental protections.

The same section of the third staff draft also states,
"*The State Water Resources Control Board, the San Francisco Bay and Central Valley Regional*

Water Quality Control Boards, and the Department of Pesticide Regulation prioritize and accelerate the completion of the Central Valley Pesticide Total Maximum Daily Load and Basin Plan Amendment for pyrethroids by January 1, 2016."
Again, there are significant problems with this recommendation that reflect a lack of familiarity with issues that need to be addressed in order to develop a CVRWQCB Basin Plan amendment to establish a TMDL for controlling the aquatic life toxicity of pyrethroid-based pesticides.

In the 1980s Drs. Lee and Jones-Lee, with the assistance of S. Taylor of RBF of Irvine, CA, conducted an approximately $0.5-million study of aquatic life toxicity in stormwater runoff in the Upper Newport Bay watershed in Orange County, CA for the Santa Ana Regional Water Quality Control Board and the Orange County "stormwater runoff water quality management agency." Summary reports from that study are available on their website (www.gfredlee.com) as,

> 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," IN: 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/Watersheds/oppesticide_unb.pdf
>
> Lee, G. F., "Results of Aquatic Life Toxicity Studies Conducted During 1997-99 in the Upper Newport Bay Watershed," Report 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 205(j) Project, G. Fred Lee & Associates, El Macero, CA and Robert Bean William Frost Associates, Irvine, CA, October (1999). http://www.gfredlee.com/Watersheds/205j_final.pdf

The initial purpose of those studies was to determine if heavy metals in highway stormwater runoff caused aquatic life toxicity in receiving waters for the runoff. It was found that the heavy metals in the highway and street runoff, which in some cases exceeded worst-case-based WQOs, were in non-toxic forms. However it was also found that urban and agricultural stormwater runoff in the study area exhibited high levels of aquatic life toxicity. About half of the measured toxicity was found to be due to OP pesticides and the other half was of unknown cause. Subsequently, with the assistance of Dr. Jeff Miller of AquaScience of Davis, CA, it was determined that much of the "unknown-caused" toxicity was likely caused by pyrethroid-based pesticides. At the time of that study the pyrethroid pesticide manufacturing companies and the regulatory agencies were claiming that the pyrethroid-based pesticides were not mobile from their place of application. This was the first study conducted anywhere that showed that the pyrethroid-based pesticides did run off from areas of application and did cause aquatic life toxicity in the receiving waters.

At the request of the DPR staff Dr. Lee presented a seminar that summarized their work on pesticide caused aquatic life toxicity.

> Lee, G. F., and Jones-Lee, A., "OP & Pyrethroid Pesticide-Caused Aquatic Life Toxicity: Inadequate Regulation of Urban Use," Abstract of presentation at DPR informal pesticide seminar, organized by Dr. Kean Goh, DPR Surface Water Program Manager, Sacramento, CA, March 9 (2010).

http://www.gfredlee.com/SurfaceWQ/DPR_WS_PestToxicityAbs.pdf

Dr. Lee has been involved in investigating the occurrence of pesticides and their impact on aquatic life since the early 1960s. This work has included investigating the organochlorine, organophosphate, and pyrethroid-based pesticides in several locations in California including the Delta. At the request of the CVRWQCB Dr. Lee conducted a review of pesticide caused aquatic life caused toxicity in several of the city of Stockton sloughs and developed the report,

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/Runoff/StockDiaTMDL12-14-02.pdf

That report discusses that the finding that the use of organophosphate-based pesticides on urban lands by residential users leads to aquatic life toxicity in the city of Stockton sloughs. The Stockton sloughs are part of the Delta waters; pesticide-caused toxicity is carried from the sloughs into the Delta.

The DSC third staff draft also states in this section,
"*Delta and tributary waters are impaired by pesticide contamination from urban and agricultural pollutants. Pesticides in current use cause measurable toxicity in the Delta and its tributaries, and new types of pesticides continue to be approved. New pesticides are sometimes approved for use without a full understanding of the potential impacts on aquatic species and ecosystems.*"
A key issue that Drs. Lee and Jones-Lee have addressed in their work on impacts of pesticide on water quality is the inadequacy of the current regulatory approaches that the US EPA Office of Pesticide Programs (OPP) and the California Department of Regulation (DPR) for permitting the use of pesticides. In the early 1980s Lee published the paper,

Lee, G. F., "The Urban Pesticide Problem: How Do We Know the Substitutes Aren't Worse Than the Ones They're Replacing?" Feature Article, Journal Stormwater 2(1):68-71, Forrester Press, January/February (2001).
http://www.gfredlee.com/Runoff/UrbanPestStormwater1.pdf

That and other papers/reports available on Drs. Lee and Jones-Lee website in the Surface Water Quality section Pesticide Toxicity subsection at http://gfredlee.com/pswqual2.htm#pesticide discuss the fact that the US EPA OPP registers pesticides for use that are likely cause aquatic life toxicity in receiving waters that receive runoff/discharges from areas of use. Such use is allowed as long as OPP considers that the aquatic life toxicity is not of "significance." As part of an effort to address this problem Lee developed the following report that discusses how the CVRWQCB could develop programs to screen new or expanded use pesticides for the potential of causing aquatic life toxicity in runoff/discharge waters.

Lee, G.F., "Pro-Active Approach for Managing Pesticide-Caused Aquatic Life Toxicity," Submitted to the CVRWQCB, Report of G. Fred Lee & Associates, El Macero, CA (2001). http://www.gfredlee.com/Runoff/ProActivePest.pdf

In an effort to try to encourage the US EPA OPP to address inadequacies in the registration of pesticides that lead to aquatic life toxicity in runoff water, Lee sent several letters to US EPA

including,

Lee, G.F., "Reregistration of Diazinon and Chlorpyrifos," Letter to B. Chambliss, US EPA, Washington, D.C., December (1997).
http://www.gfredlee.com/Runoff/reg_diaz.html

More recently several urban stormwater management agencies and the Urban Pesticide Committee (UPC) sent similar letters to the US EPA OPP to try to get this agency to change how it registers pesticides to eliminate toxicity in receiving waters from areas of pesticide use. Information on these efforts is at the UPC website, http://www.up3project.org/up3_upc.shtml.

Drs. Lee and Jones-Lee Stormwater Runoff Water Quality newsletter NL 12-4, imidacloprid pesticides are discussed as a new/expanded-use pesticide that has the potential to cause environmental impact. Information on this type of pesticide is available on the Internet under "imidacloprid. According to Wikipedia, "*Imidacloprid is a nicotine-based, systemic insecticide, which acts as a neurotoxin and belongs to a class of chemicals called the neonicotinoids. Although it is now off patent, the primary manufacturer of this chemical is Bayer CropScience, (part of Bayer AG). Imidacloprid is one of the most widely used insecticides and can be applied by soil injection, tree injection, application to the skin, or broadcast foliar or ground application as a granular or liquid formulation or as a pesticide-coated seed treatment*." Recently there has been effort Bayer has greatly expanded its use of this type of pesticide in urban areas.

As part of Drs. Lee and Jones-Lee's efforts to discuss pesticide regulation issues in the Newsletter that are potentially important to stormwater runoff water quality, last year Dr. Lee contacted a senior DPR staff member involved in the Department's review of the potential environmental impact of imidacloprid pesticides to obtain information that could be summarized in the Stormwater Runoff Water Quality Newsletter. Thus far no response has been received from DPR on this issue. Because of the expanded sales/use of the imidaclorprid pesticides the CVRWQCB/SWRCB should request/require that DPR conduct a review of the potential impact of this type of pesticide. DSC should support having the regulatory agencies conduct a comprehensive review of environmental impacts of the use of this pesticide.

Control of Excessive Bioaccumulation of Hazardous Chemicals in Edible Organisms

The DSC third staff draft Chapter 6 Environmental Quality section states,
"*Methylmercury also bioaccumulates in the food web to concentrations in some Delta fish that currently exceed public health criteria and require consumption warnings."*
and
"Problem Statement
Pollutants contained in municipal, industrial, agricultural and other non-point source discharges to the Delta and its tributary waterways, including pollutants that bioaccumulate and biomagnify in the food web, contribute to the impairment of the Delta ecosystem."
and
" *The San Francisco Bay and Central Valley Regional Water Quality Control Boards should develop and implement Total Maximum Daily Load and Basin Plan Amendment for organochlorine pesticides, selenium, and methyl-mercury, to address water quality impairment in the Delta, in accordance with the time schedule provided in the 2010 Integrated Report."*

That discussion of the excessive bioaccumulation water quality problems in the Delta and its tributaries does not provide the DSC and others with the background necessary to understand the magnitude and impact of this type of water quality problem in the Delta. Referencing is not provided to much of the readily available literature on this problem.

At the request of the CVRWQCB staff Drs. Lee and Jones-Lee developed,

> 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/SurfaceWQ/OClTMDLRpt12-11-02.pdf
>
> 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.gfredlee.com/Runoff/OCl-slides-SanDiego.pdf

Those reports discuss the more than 20 years of data that the SWRCB had collected on organochlorine legacy pesticides (such as DDT) in Central Valley waters, including Delta fish tissue, as part of the SWRCB Toxic Substances Monitoring Program. The Lee and Jones-Lee report and its supplement, for the first time, provided an analysis of the very large data base on excessive bioaccumulation of organochlorine compounds in edible fish. They found that in the 1960s-70s many of the Central Valley fish contained hazardous levels of toxic chemicals that are a threat to cause cancer in those who eat the fish. Their work also showed that while the concentrations in the fish had been decreasing, by the late 1980s there were still excessive concentrations of organochlorine legacy hazardous chemicals in some edible fish taken from the Delta and its tributaries.

In the mid 2000s the CVRWQCB obtained sufficient funding to conduct a limited sampling of Delta fish for organochlorine legacy pesticides and PCBs. Based on that updated base Lee and Jones-Lee developed,

> Lee, G. F., and Jones-Lee, A., “Update of Organochlorine (OCl) ‘Legacy’ Pesticide and PCB Concentrations in Delta and Central Valley Fish,” Report of G. Fred Lee & Associates, El Macero, CA, September 10 (2007). http://gfredlee.com/SurfaceWQ/UpdateLegacyPestCVFish.pdf

As discussed at that time, California Office of Environmental Hazard Assessment (OEHHA) had updated its approach for assessing the public health concerns about consuming fish with residues of organochlorine legacy pesticides. The combination of OEHHA “balancing” of the benefits of consuming fish against the cancer risk associated with consuming low levels of organochlorine pesticides resulted in very few exceedances of OHEHHA fish consumption screening values in Delta fish; the result was that the excessive bioaccumulation of these chemicals was no longer considered to be a major threat to those who consume fish taken from the Delta.

In an effort to obtain support to better define the existence and the sources of the bioaccumulation of hazardous chemicals in edible fish taken from the Delta, Lee and several associates submitted a proposal to CALFED for funding for the needed studies. CALFED did

not support the proposed studies; one of reasons given for not funding the work was that the excessive bioaccumulation of hazardous chemicals in edible fish taken from the Delta was a public health problem that was outside the scope of CALFED responsibility. It will be important for DSC to include public health issues associated with consumption of hazardous chemicals in Delta fish as an important component of the Delta Plan.

The DSC third staff draft of Chapter 6 discussion of the water quality problems of excessive bioaccumulation of organochlorine chemicals is deficient in its failure to mention that Delta and tributary fish contained excessive concentrations of PCBs. PCBs are industrial chemicals (non pesticides). PCB concentrations in Delta fish tissue are one of the most important public health problems of the Delta. As discussed in the Lee and Jones-Lee reports and update, the concentrations of PCBs in Delta fish has not decreased and OEHHA has reaffirmed it concern about the cancer threat of consuming fish with PCBs concentrations above OEHHA fish consumption guidelines. Lee and Jones-Lee discussed that there is need for ongoing monitoring of Delta fish for PCBs and to determine the source of the PCBs that are bioaccumulating in edible fish.

Dr. Lee became involved in investigating the occurrence, sources, and bioaccumulation of PCBs in waterbodies in the late 1960s. A summary of his experience in work on PCBs is available at,

> Lee, G. F., "Experience in Working with PCB Pollution Issues," Report of G. Fred Lee & Associates, El Macero, CA (2006).
> http://www.gfredlee.com/HazChemSites/PCBExperience.pdf

He and his graduate students were among the first in the US to find widespread pollution of water and fish by PCBs. Dr. Lee's pioneering work on PCBs as environmental pollutants in this US was featured in his interview on Walter Cronkite's CBS Evening News. Also the US Public Health Service requested that Dr. Lee conduct a review of the need for, and approach to develop, a drinking water MCL for PCBs.

Dr. Lee and his graduate student G. Veith published several papers/reports on PCB pollution issues including,

> Veith, G., and Lee, G. F., "Chlorobiphenyls (PCBs) in the Milwaukee River," Water Research 5:1107-1115 (1971).
> http://www.gfredlee.com/HazChemSites/Veith-Lee-PCB-MKERiver.pdf

He continues to be active in investigating PCB pollution issues; his most recent publications on the topic include,

> Lee, G. F., and Jones-Lee, A., "Report on the Adequacy of the Investigation/Remediation of the Brisbane Baylands UPC Property Contamination Relative to Development of That Property," Prepared for Brisbane Baylands Community Advisory Group (BBCAG), Brisbane, CA, Report of G. Fred Lee & Associates, El Macero, CA, October 19 (2010).
> http://www.gfredlee.com/Landfills/BrisbaneBaylands.pdf

In that study Drs. Lee and Jones-Lee conducted a review for a citizens' group concerned about the adequacy of a hazardous chemical site investigation and proposed remediation relative to redeveloping the area for residential housing and commercial activities. One of the issues of concern at that site was the potential for PCBs in construction and demolition wastes at the site to be present in the stormwater runoff from the area. PCBs are present in caulking compounds

used in older buildings and in concrete expansion joints. This issue are reviewed in their Stormwater Runoff Water Quality Newsletter NL 9-4 available at http://www.gfredlee.com/Newsletter/swnewsV9N4.pdf.

As discussed in the above-referenced Brisbane Baylands report, studies conducted by the San Francisco Regional Water Quality Control Board have determined that the demolition of housing and other buildings can lead to PCBs in stormwater runoff from these areas. These studies conclude that this could be a source of the elevated PCBs in San Francisco Bay fish. Lee and Jones-Lee have recently developed the report,

> Lee, G. F., and Jones-Lee, A., "PCBs as Contaminants in Construction and Demolition (C&D) Wastes," Report of G. Fred Lee & Associates, El Macero, CA, December 5 (2010). http://www.gfredlee.com/Landfills/CD-LandfillsPCB.pdf

The DSC should recommend that studies of construction and demolition areas should be investigated in the Central Valley to determine if these areas are part of the unknown sources of PCBs that are present in Central Valley/Delta fish.

One of the reasons there is inadequate information on the excessive bioaccumulation of hazardous chemicals in edible Delta fish is that CALFED and the state Legislature have not provided the CVRWQCB with adequate funding to conduct the monitoring needed to determine where excessive bioaccumulation is occurring and the sources of the chemicals responsible. In an effort to stimulate additional funding Lee and Jones-Lee developed the following report,

> Lee, G. F., and Jones-Lee, A., "Need for Funding to Support Studies to Define the Magnitude of the Excessive Bioaccumulation of Organochlorine 'Legacy' Pesticides and PCBs in Edible Fish That Can Cause Cancer in Those Who Use Delta/Central Valley Fish as Food," Report of G. Fred Lee & Associates, El Macero, CA, April 4 (2005) http://www.gfredlee.com/Runoff/OClProblemProject.pdf

They also develop several papers/reports on developing programs to control excessive bioaccumulation of organochlorine pesticides and PCBs including,

> Lee, G.F, and Jones-Lee, A., "Developing TMDLs for Organochlorine Pesticides and PCBs," Presented at the American Chemical Society Environmental Chemistry Division national meeting in San Diego, California, April (2001). http://www.gfredlee.com/Runoff/sandiego_030801.pdf

In an effort to demonstrate an approach that can be followed to evaluate the role of aquatic sediments as a source of PCBs, DDT, and other bioaccumulatable chemicals, Lee and Jones-Lee and S.Ogle developed the report,

> 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/HazChemSites/SmithCanalReport.pdf

That study showed that the PCBs in a city of Stockton slough, Smith Canal, were in part bioavailable to be transferred through the aquatic food web to bioaccumulate to excessive levels in edible fish.

Regulating Contaminants in Aquatic Sediments

Dr. Lee has been active in investigating the water quality significance of potential pollutants in aquatic sediments since the early 1960s. His work has included more than $1-million in laboratory and field studies upon which he has authored more than 90 papers and reports. Many of those papers and reports on these issues are available on his website, www.gfredlee.com in the Contaminated Sediments section at http://www.gfredlee.com/psedqual2.htm. Those publications include,

> Lee, G. F., Lopez, J., and Mariani, G., "Leaching and Bioassay Studies on the Significance of Heavy Metals in Dredged Sediments," Proc. Internat. Conf. on Heavy Metals in the Environment, Toronto, Ontario, Canada, Oct 27-31, pp. 731-764 (1975). http://www.gfredlee.com/Sediment/Lee-Lopez-Mariani-HMDredge.pdf
>
> Lee, G. F., and Mariani, G., "Evaluation of the Significance of Waterway Sediment-Associated Contaminants on Water Quality at the Dredged Material Disposal Site," IN: Aquatic Toxicology and Hazard Evaluation, ASTM STP 634, American Society for Testing and Materials, pp. 196-213 (1977). http://www.gfredlee.com/Sediment/Lee-Mariani-ASTM.pdf
>
> Jones, R. A., Mariani, G. M., and Lee, G. F., "Evaluation of the Significance of Sediment-Associated Contaminants to Water Quality," Proc. Am. Water Resources Assoc. Symposium, Utilizing Scientific Information in Environmental Quality Planning, AWRA, Minneapolis, MN, pp. 34-45 (1981). www.gfredlee.com/Sediment/DMRP-Bioassay-AWRA.pdf

One of primary areas of emphasis of Drs. Lee and Jones-Lee's sediment quality management work has been the development of technically valid sediment quality criteria/objectives. Their publications on that issue include,

> 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/Sediment/BPJWOEpaper.pdf

The DSC third staff draft of Chapter 6 Environmental Quality contains the recommendation, "*WQ R8 The State Water Resources Control Board and Regional Water Quality Control Boards should conduct or require special studies to identify sources of toxicity in Delta waters and sediments.*"

With respect to the DSC third draft of Chapter 6 calling for studies to determine the sources of toxicity in Delta waters and sediments, Lee and his associates submitted proposals to CALFED to conduct studies on these issues with particular reference to the potential impact of urban

stormwater runoff toxicity impacts in Stockton sloughs on Delta aquatic life. Since CALFED did not have a program to address the impacts of toxic chemicals on aquatic life, the proposed research was not supported. With the development of the POD, funds were finally made available to conduct some UCD studies of this issue. However the level of funding made available thus far is much less than that needed to adequately investigate this issue. It will be important for the DSC to establish a program to insure that adequate funding by the Legislature is made available to conduct the needed research on this issue.

One of the areas of focus of Lee and Jones-Lee's work on Delta water quality has been sediment toxicity and the development of sediment quality objectives (SQO). This effort has focused on the SWRCB's efforts to develop SQOs for enclosed Bays and Estuaries of the state. They provided detailed comments to the SWRCB on technical problems with the approach being followed in developing SQOs including,

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

and their most recent submission,

> Lee, G. F., and Jones-Lee, A., "Comments on 'Draft Staff Report Substitute Environmental Document Proposed Amendments to the Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality for the Protection of Fish and Wildlife' Report of State Water Resources Control Board Division of Water Quality, January 28, 2011," Submitted to State Water Resources Control Board, Report of G. Fred Lee & Associates, El Macero, CA, March 14 (2011). [216 kb]
> http://www.gfredlee.com/Sediment/SedQualDraftSubCom.pdf

They have found over the past 22 years that the SWRCB staff has been working on this issue, it still has not developed technically valid, implementable SQOs that will reliably determine which sediments contain chemicals that are significantly adverse to associated waterbodies' designated beneficial uses and will provide technically valid guidance on determining the cause toxicity that can be used to guide to controlling the sources of pollutants responsible for the toxicity. . It will be important that the current SWRCB SQOs not be adopted as SQOs for Delta sediments because of their technically invalid components.

As part of the SWRCB current efforts to develop SQOs for Delta sediment samples have been tested for toxicity where it has been there is very limited sediment toxicity. A major report on these studies will be published by the SWRCB staff in the near future; that report should be referenced in future DSC plan drafts.

Regulating Urban Stormwater Runoff Potential Pollutants

The DSC third staff draft of Chapter 6 contains the recommendation,

"*WQ R7 The Central Valley Regional Water Quality Control Board, consistent with existing Water Quality Control Plan policies and water rights law, should require responsible entities that discharge wastewater treatment plant effluent or urban runoff to Delta waters to evaluate*

whether all or a portion of the discharges can be recycled or otherwise used in order to reduce contaminant loads to the Delta."

Given the nature of moderate to large stormwater runoff events and the magnitude of runoff flows, it will be very difficult, if not impossible, to significantly control "pollutant" loads from urban stormwater runoff by recycling the stormwater without making changes in land use to divert the stormwater runoff out of the normal drainage to storage of some other conveyance. Alameda County in the San Francisco Bay area determined that in order to collect the stormwater runoff from a one-day 1-in storm, 50 storage areas the size of the Oakland coliseum would be needed. While it may be possible to recycle small amounts of urban stormwater runoff, such efforts will not likely be effective in significantly reducing the "pollutant" load to the Delta.

Past BDCP deliberations have contained recommendations that urban stormwater discharges to the Delta and its tributaries pollutant loads be reduced by some arbitrary percentage. Dr. Lee has been involved in investigating water quality characteristics of urban stormwater runoff and water quality impacts of urban stormwater runoff-associated chemicals since the mid 1960s. His early studies were among the first to be conducted on this topic. Over the years he and his associates have published extensively on this issue; many of their papers and reports are on their website, www.gfredlee.com in the Surface Water Quality section Urban Stormwater Runoff subsection at, http://gfredlee.com/pswqual2.htm#runoff. Some of his papers and reports on this issue include,

Lee, G. F. and Jones, R. A., "Suggested Approach for Assessing Water Quality Impacts of Urban Stormwater Drainage," IN: Symposium Proceedings on Urban Hydrology, American Water Resources Association Symposium, November 1990, AWRA Technical Publication Series TPS-91-4, AWRA, Bethesda, MD, pp. 139-151 (1991). http://www.gfredlee.com/Runoff/storm_wa.html

Lee, G. F., and Jones-Lee, A., "Stormwater Runoff Management: Are Real Water Quality Problems Being Addressed by Current Structural Best Management Practices?" Part 1 Public Works, 125:53-57,70-72 (1994). Part Two, 126:54-56 (1995). http://www.gfredlee.com/Runoff/pubw_sw2.htm

Lee, G. F. and Jones-Lee, A., "Assessing Water Quality Impacts of Stormwater Runoff," North American Water & Environment Congress, Published on CD-ROM, Amer. Soc. Civil Engr., New York, 6pp. (1996). http://www.gfredlee.com/Runoff/asceeval.htm
Lee, G.F., "Stormwater Monitoring: Appropriate Approach," Stormwater 3:8, May/June (2002). http://www.gfredlee.com/Runoff/stmwatmon083102.pdf

Lee, G. F., and Jones-Lee, A., "Urban Stormwater Runoff Water Quality Issues," IN: Water Encyclopedia: Surface and Agricultural Water, Wiley, Hoboken, NJ pp 432-437 (2005). http://www.gfredlee.com/Runoff/WileyStormwater.pdf

Lee, and Jones-Lee also developed the following report that discusses some of the inappropriate approaches that the BDCP has been suggesting for controlling the impact of pollutants from urban stormwater runoff on Delta water quality.

"Review of Need for Modeling of the Impact of Altered Flow through and around the Sacramento San Joaquin Delta on Delta Water Quality Issues," and "Summary: Water

Quality Modeling Associated with Altered Sacramento River Flows in & around the Delta," Report to CWEMF Steering Committee, by G. Fred Lee & Associates, El Macero, CA, March (2009). http://www.gfredlee.com/SJR-Delta/Model-Impact-Flow-Delta.pdf

For the past 14 years Drs. Lee and Jones-Lee have been publishing their Stormwater Runoff Water Quality Newsletter. This email-based newsletter, sent at no cost via email at about monthly/quarterly its more than 8,000 subscribers, discusses issues pertinent to managing water quality including Delta water quality. Past issues of this newsletter devoted to Delta issues include NL-10-10/11, 10-12, 11-5, 11-7/8, 12-4, and 12-5 which are available at, http://www.gfredlee.com/newsindex.htm. One of the primary issues of concern is the appropriate regulation of potential pollutants in urban and agricultural stormwater runoff. NL 1-2, 1-3, 1-5, 1-6/7, 2-2, 5-4, 6-8, 6-9, 7-2, 7-3, 7-5, 7-6/7, 8-4, 8-5, 9-1/2, 9-5, 9-6, 9-8, 10-3, 10-8, 11-6, 11-7/8, 11-9, 12-6, 12-7/8, 13-3, and 13-4 discuss issues critical to the appropriate regulation of stormwater runoff including evaluating the water quality impairment caused by an exceedance of a water quality objective. As discussed, the state and federal water quality criteria/standards are not applicable to regulating stormwater runoff-associated chemicals at the time and near the runoff point.

Based on Lee and Jones-Lee's extensive experience in investigating the water quality impacts of urban stormwater runoff-associated potential pollutants, the BDCP's proposed approach for limiting the "pollution" load to the Delta from urban stormwater runoff is technically invalid and could cost the urban public very large amounts of money in the name of pollution control but with little or no impact on receiving water quality/beneficial uses. As discussed in the above-cited references on water quality modeling there is need to develop water quality models to evaluate the impact of urban stormwater runoff associated chemicals on the Delta water quality. Such models will need to be based on the use of the evaluation monitoring approach discussed above with the identification of real, significant water quality impairments.

Putah Creek Mercury Water Quality Issues

Putah Creek is a tributary of the Yolo Bypass and is a source of mercury for the Delta. Lee and Jones-Lee discussed the origins and present water quality concerns associated with mercury in Putah Creek in:

Lee, G. F., and Jones-Lee, A, "LEHR Superfund Stormwater Runoff and Putah Creek Mercury Issues," Journal Remediation, 19(2):123-134, Spring (2009). http://www.gfredlee.com/SJR-Delta/LEHRrunoffHgRemediation.pdf

Lee, G. F., and Jones-Lee, A., "Summary of Slides – Putah Creek Mercury Water Quality Issues," Report of G. Fred Lee & Associates, El Macero, CA, Presented to Delta Tributaries Mercury Council, December 2 (2008). http://www.gfredlee.com/SJR-Delta/PutahHgMineSummary.pdf

They have also discussed the unreliability of stormwater runoff monitoring from the LEHR Superfund site in,

Lee, G. F., and Jones-Lee, A., "Issues in Monitoring Hazardous Chemicals in Stormwater Runoff/Discharges from Superfund and Other Hazardous Chemical Sites," Journ. Remediation 20(2):115-127 Spring (2010).

http://www.gfredlee.com/HazChemSites/MonitoringHazChemSW.pdf

Unrecognized, Unregulated Potential Pollutants

There is concern about the potential for unregulated, unrecognized potential pollutants that are discharged to Delta waters by domestic wastewaters and agricultural sources including dairies to adversely affect beneficial uses of the Delta. Drs. Lee and Jones-Lee have published several reviews on these issues including,

Lee, G. F., and Jones-Lee, A., "Unrecognized Environmental Pollutants," Water Encyclopedia: Surface and Agricultural Water, Wiley, Hoboken, NJ pp 371-373 (2005). http://www.gfredlee.com/SurfaceWQ/WileyUnrecognizedPollutants.pdf

Their Stormwater Runoff Water Quality Newsletter has discussion of these issues in Newsletter NL 7-3, 8-5, 9-3, 10-7, 11-7/8, 11-11, 12-6, 13-1, and 13-4 available at, http://www.gfredlee.com/newsindex.htm.

The CVRWQCB lists on its website several reports on unrecognized, unregulated potential pollutants in Central Valley waters at, http://www.swrcb.ca.gov/centralvalley/water_issues/water_quality_studies.

The CVRWQCB supported a comprehensive study that discussed the potential role that unregulated potential pollutants could have in the POD:

Johnson, M., Werner, I., Teh, S., and Loge, F., "Evaluation of Chemical, Toxicological, and Histopathologic Data to Determine Their Role in the Pelagic Organism Decline," Report of University of California, Davis, Davis, CA to Central Valley Regional Water Quality Control Board, Rancho Cordova, CA, April 20 (2010). http://www.swrcb.ca.gov/centralvalley/water_issues/delta_water_quality/comprehensive_monitoring_program/contaminant_synthesis_report.pdf

It is possible that the unregulated chemicals that are discharged to Delta tributaries and directly to the Delta could be causing adverse impact on the aquatic resources of the Delta.

The DSC should promote funding to enable the CVRWQCB/SWRCB to conduct comprehensive studies of the unregulated unrecognized chemicals that are discharged to the Delta and its tributaries.

Drinking Water Policy

The DSC third staff draft of Chapter 6 Drinking Water contains the Recommendation,
"*WQ R1 The Central Valley Regional Water Quality Control Board should complete the Central Valley Drinking Water Policy by July, 2013, with implementation to follow.*"

Dr. Lee has been active in developing water quality management programs for domestic water supplies since the mid-1950s; his masters degree studies at the University of North Carolina School of Public Health were devoted the reactions of chlorine compounds used in drinking water treatment. Dr. Lee's PhD dissertation at Harvard University was devoted to the kinetics of chlorination of phenol as they relate to drinking water treatment. Throughout his 30-year university teaching and research career, he taught graduate-level courses on domestic water supply treatment and watershed management, and conducted numerous research projects on

domestic water supply water quality issues. For several years he was a member of the American Water Works Association's Quality Control in Reservoirs Committee and served as chair of that committee. Under his guidance that committee developed reports devoted to approaches that water utilities can follow to improve the raw water supply water quality by managing activities in the water supply watershed. In the mid-1970s Dr. Jones (Jones-Lee) began work with Dr. Lee on domestic water supply and other areas of activity. A number of their papers/reports on domestic water supply water quality issues are on their website in the Domestic Water Supply section at http://www.gfredlee.com/pdwswq2.htm and in the Watershed Studies San Joaquin River Watershed Program – Delta subsection.

One of the areas of their domestic water supply water quality specialization is relating land use activities in a water supply watershed to raw water quality. They have developed several papers on predicting how the water quality in a water supply watershed changes with changes in land use in the watershed including,

> Lee, G. F. and Jones, R. A., "Predicting Domestic Water Supply Raw Water Quality in Proposed Impoundments," IN: Proc. American Water Works Association 1984 Annual Conference Proceedings, pp 1611-1630 (1984).
> http://www.gfredlee.com/WSWQ/RawWQProposedImp84.pdf

They have published several papers/reports on domestic water supply water quality issues in Delta waters including the following invited contributions,

> Lee, G. F. and Jones, R. A., "Regulating Drinking Water Quality at the Source," Proc. University of California Water Resources Center Conference: Protecting Water Supply Water Quality at the Source, Sacramento, CA, 39pp, April (1991).
> http://www.gfredlee.com/WSWQ/wswqsour.htm
>
> Lee, G. F., and Jones-Lee, A., "Overview—Sacramento/San Joaquin Delta Water Quality," Presented at CA/NV AWWA Fall Conference, Sacramento, CA, PowerPoint Slides, G. Fred Lee & Associates, El Macero, CA, October (2007).
> http://www.gfredlee.com/SJR-Delta/DeltaWQCANVAWWAOct07.pdf

They have provided comments on several CVRWQCB drafts of the proposed drinking water policy including,

> Lee, G. F., and Jones-Lee, A., "Comments on Development of an EIR for the CVRWQCB Drinking Water Policy," Submitted to Central Valley Regional Water Quality Control Board, Rancho Cordova, CA, Report of G. Fred Lee & Associates, El Macero, CA, September 17 (2008).
> http://www.gfredlee.com/WSWQ/DWpolicyCVRWQCB.pdf
>
> Lee, G. F., "Comments on California Regional Water Quality Control Board, Central Valley Region Resolution No. R5-2004-X in Support of Developing a Drinking Water Policy for the Sacramento-San Joaquin Delta and Upstream Tributaries," Comments Submitted to CVRWQCB by G. Fred Lee & Associates, El Macero, CA, June (2004).
> http://www.gfredlee.com/WSWQ/DrinkingWaterPolicy.pdf
> 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 (2003). http://www.gfredlee.com/SJR-Delta/TOC_update.pdf

As discussed in their writings there are a number of important issues that need to be addressed in developing a technically valid drinking water policy for the Delta.

Questions or comments as well as additional information on a topic discussed herein is available by contacting G. Fred Lee at gfredlee@aol.com. Suggestions for other topics that should be considered are welcome.