

Need for Reliable Water Quality Monitoring/Evaluation of the Impact of SWRCB Water Rights Decisions on Water Quality in the Delta and its Tributaries.¹

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

G. Fred Lee & Associates

El Macero, CA 95618

Ph 530 753-9630 Fx 530 753-9630

gfredlee@aol.com www.gfredlee.com

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The current State Water Resources Control Board (SWRCB) review of water rights (water flow management) in the San Joaquin River (SJR) and the Delta is developing an update of water management policies and its impact on water quality/beneficial uses of the Delta and its tributaries. Over the past 16 years that we have been involved in water quality issues in the Delta and its tributaries, we have had the opportunity to become familiar with the existing water quality database and the impact of how water flow management policies that are controlled by past water rights decisions of the SWRCB impact water quality. Beginning in 1999, in connection with our involvement as advisors to the SJR Deep Water Ship Channel (DWSC) DO TMDL Steering Committee and as the CALFED supported PI for a \$2 million directed action project devoted to investigating the characteristics and factors influencing the low DO problem in the DWSC, we had the opportunity to become familiar with the existing water quality database on the characteristics of the San Joaquin River and its tributaries. Similarly, we have been active on the Sacramento River Watershed Program and its water quality monitoring program since it was initiated in the mid 1990s. This activity has enabled us to become familiar with the current understanding of water quality in the Sacramento River and its tributaries.

We have been involved in Delta water quality issues since the summer 1989. During the past two years we have investigated the current database on Delta water quality with particular reference to how Delta water flow management impacts water quality. In June 2004 we developed the report, "Overview of Sacramento-San Joaquin River Delta Water Quality Issues," Lee and Jones-Lee (2004a) that specifically discussed the current water quality characteristics of the Delta and how water flow manipulations especially South Delta water exports by the State (SWP) at Banks and federal (CVP) at Tracy projects are potentially impacting water quality in the Delta. While as discussed below, there are well documented examples of where flow diversions/manipulations in the San Joaquin River watershed and in the South Delta are significantly adverse to water quality, overall it is concluded that, at this time, there is a lack of understanding of how water flow management authorized/mandated by the SWRCB as part of its water rights decisions has been and is impacting water quality.

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One of water quality issues of concern is that the past SWRCB water rights decisions focused on TDS/EC as the water quality parameter of concern. Thus far, the Board has failed to address aquatic life related water quality issues such as chemicals that are toxic to aquatic life, those that bioaccumulate to excessive levels in Delta fish that are a threat to the health of those who use Delta fish as food, nutrients etc. i.e., those chemicals that are impairing Delta water quality/beneficial uses.

Lee and Jones-Lee (2004a) have reviewed the current CVRWQCB Clean Water Act 303(d) listing of “water quality limited” Delta channels and the reasons for the listing. As they discuss, the CVRWQCB, SWRCB and the US EPA (2003) have adopted/approved the 303(d) listing of several Delta channels with the listed cause as “hydromodification” (altered flow). Since many of the Delta channels are Clean Water Act Section 303(d) water quality “limited” for one or more pollutants and are subject to TMDLs to control the water quality objective violation, export of additional Delta water by the SWP/CVP could be in violation of the Clean Water Act requirements of no additional loads of the constituents that cause the water quality limited conditions. Also, further increasing the factors such as “hydromodification” that potentially aggravates current water quality impairment could be a violation of CWA requirements for development of a TMDL. Of particular concern is the impact of the export pumping on the flow (magnitude, direction) of water in a Delta channel that alters the magnitude and location of the water quality impacts of pollutants introduced into the Delta channel. The impacts of concern include:

- Toxicity to fish, zooplankton, benthic invertebrates and algae due to currently used pesticides in agricultural and urban areas,
- Bioaccumulation in higher trophic level fish and other edible organisms of “legacy” organochlorine pesticides such as DDT, dieldrin, chlordane, toxaphene etc. and non pesticides such as PCBs, and dioxins that are a threat to human health when the fish are consumed as food,
- Potential spread the excessive bioaccumulation of mercury in Delta edible fish,
- Reduced primary production in the Central Delta arising from drawing low nutrient Sacramento River water to the South Delta by the export Projects,
- Loss of Chinook salmon home stream signal in upper San Francisco Bay and the western Delta during the fall in the SJR DWSC below Columbia Cut as a result of the export projects drawing all San Joaquin River watershed water to the export pumps. This leads to Chinook salmon straying from home stream for spawning,
- Adversely impact low DO problems in SJR DWSC and in the South Delta,
- Distribution of heavy metals (copper, lead, cadmium and selenium) in water column and sediments that impacts aquatic life,
- Influence of excessive salt/EC impacts on irrigated agriculture and domestic water supplies,
- Distribution of excessive TOC/DOC that impacts domestic water supply water quality,
- Influences the distribution of pathogens/pathogen indicators that influence contact recreation safety and the use of the water for domestic water supply,

- Excessive fertilization of Delta waters that develop aquatic plant growths that impact contact recreation, domestic water supply water quality and use of Delta water for drip irrigation.

Before any additional export of South Delta water is permitted, the water exporter should be required to fund studies that,

- Adequately define the current impacts of existing Delta water exports on aquatic life related Delta water quality. This will require funding a comprehensive water quality monitoring/evaluation program to better define existing aquatic life related water quality impacts of South Delta water exports that includes substantial funds that can be used to search for new unidentified water quality problems,
- Develop and implement a mitigation program for current water quality impacts of existing Delta water exports on Delta aquatic life,
- Estimate the potential impacts of proposed future additional Delta water exports on aquatic life related beneficial uses of the Delta,
- Develop and begin to implement a mitigation plan for the potential water quality impacts of additional South Delta water exports.

Lee and Jones-Lee (2004a) discussion of Delta water quality issues list current water quality objective violations that have led to TMDLs. As discussed by Lee and Jones-Lee (2004a) SWRCB water rights decisions that impact flow of water into the Delta and within the Delta, impact the magnitude and location of water quality objective violations in the Delta.

SWRCB (2000) Order for D-1641 states on page 148,

6. The water quality objectives condition shall be updated to read as follows:

The quantity of water diverted under this permit is subject to modification by the Board if, after notice to the permittee/licensee and an opportunity for hearing, the Board finds that such modification is necessary to meet water quality objectives in water quality control plans which have been or hereafter may be established or modified pursuant to Division 7 of the Water Code. No action will be taken pursuant to this paragraph unless the Board finds that:

(1) adequate waste discharge requirements have been prescribed and are in effect with respect to all waste discharges which have any substantial effect upon water quality in the area involved, and (2) the water quality objectives cannot be achieved solely through the control of waste discharges.

0000013

As indicated, the current D-1641 provides the SWRCB with the obligation to critically examine how the past and any proposed water diversion/manipulations have in the past and may in the future impact Delta water quality.

Delta Water Quality Monitoring Programs

The key to reliably managing water quality in the Delta is a comprehensive water quality monitoring and evaluation program. There are several water quality monitoring programs being conducted in the Delta and its nearby tributaries. In general, these programs have specific objectives related to managing Delta resources. The most

comprehensive of these programs is the Interagency Ecological Program (IEP) Environmental Monitoring Program (EMP). On March 25, 2003, Stephen Verigin of the Department of Water Resources (DWR) and Susan Ramos of the US Bureau of Reclamation (USBR) submitted a revised Delta water quality monitoring program to Celeste Cantú, Executive Director of the State Water Resources Control Board (available at http://iep.water.ca.gov/emp/EMP_Review_Final.html). This monitoring program is being conducted as part of implementing the State Water Resources Control Board's Water Rights Decision 1641 covering the export of water from the Delta by the state and federal projects. As stated in the cover letter for this submission,

“D-1641 specifies three goals for this monitoring program: (1) to ensure compliance with Bay-Delta water quality objectives; (2) to identify meaningful changes in any significant water quality parameters potentially related to operation of the State Water Project (SWP) or the Central Valley Project (CVP); and (3) to reveal trends in ecological changes potentially related to SWP/CVP operations. Condition 11 (e) requires DWR/USBR to evaluate the EMP and report their conclusions to the Executive Director of the State Water Resources Control Board every three years.”

The 2001-2002 Review of the Environmental Monitoring Program states that,

“The Environmental Monitoring Program (EMP) was initiated in 1971 and now monitors water quality and phytoplankton, zooplankton, and benthos abundance and distribution in the upper San Francisco Estuary.”

As discussed by Lee and Jones-Lee (2004a), the current D-1641 monitoring program falls far short of providing the information needed to reliably evaluate the impact of the SWP and CVP operations on Delta water quality.

SJR DWSC Low DO Problem

Lee and Jones-Lee (2004a) review of Delta water quality provides information on the low dissolved oxygen problem in the San Joaquin River Deep Water Ship Channel with particular reference to the impact of SJR watershed and the south Delta State and Federal export Projects. As discussed by Lee and Jones-Lee (2003, 2004b,c, 2005) the current DWSC watershed management of flow significantly impacts the DWSC low DO problem. While the impact of flow management in the SJR DWSC watershed has been known since the 1960s, (see DFG et al. 1964) the SWRCB D-1641 water rights decision postponed adjusting water rights and flow management until the SJR DWSC low DO TMDL was established. Now that this TMDL has been adopted by the CVRWQCB and is being reviewed SWRCB and eventually the US EPA, the SWRCB should proceed to adjust water rights/diversion of SJR watershed and South Delta water exports to minimize the adverse impacts on the DO concentrations in the DWSC.

As discussed by Lee and Jones-Lee (2005), achieving at least 1,500 cfs of SJR DWSC flow will essentially eliminate the low DO problem in the DWSC. In most situations, except severe droughts, there is sufficient flow in the SJR at Vernalis to provide the

needed SJR DWSC flow provided the State and Federal export projects do not divert most of the SJR Vernalis flow into the South Delta at the Head of Old River (HOR). As discussed by Lee and Jones-Lee (2003, 2005) operating the HOR to be developed operable barrier to allow most of the SJR Vernalis flow to pass through the DWSC to Turner Cut before export by the Projects from the South Delta will reduce the cost of oxygen demand control and aeration to control the low DO problem in the DWSC.

It will be important that the SWRCB correct the problems that have been created by the State and Federal export projects export of South Delta water through the HOR to the South Delta as part of its current deliberations on D-1641 water rights.

Other Water Quality Problems Impacted by D-1641. If the current SWRCB water rights review for Delta and its tributaries is to accomplish the needed water quality management to adequately address current water quality problems in the Delta and its tributaries, there is need for the SWRCB to address the full range of water quality problems that exist in the Delta that are impacted by flow manipulations in the SJR DWSC watershed including South Delta exports. The Lee and Jones-Lee (2004a) report on Delta Water quality issues provides detailed guidance on the approach that needs to be adopted to begin to address these problems. A section of the Lee and Jones-Lee (2004a) of Delta water quality issues devoted to water quality monitoring is presented below.

Need for Expansion of the Delta Water Quality Monitoring/Evaluation Program

There is need to significantly expand the water quality monitoring/evaluation program for the Delta. This is a significantly neglected area. While there is an Interagency Ecological Program (IEP) monitoring program that is required as part of implementation of D-1641, it is not focused on water quality and is largely conducted with limited regard to providing information pertinent to water quality assessment. The current Delta water quality monitoring program needs to be expanded so that the focus is on an assessment of beneficial use impairment, rather than the current approach of monitoring algae, zooplankton, fish and sediment organisms. There is a variety of factors, such as invasive species, that can influence phytoplankton, zooplankton and benthic organism populations, which cause the IEP EMP to fail to provide the information needed on the impacts of chemical stressors and water exports on Delta aquatic-life-related beneficial uses.

As discussed above, the Delta channels and near tributaries have been found to be impaired under the Clean Water Act section 303(d). The monitoring program that is needed should specifically focus on assessing the current status of the impairment for each of the 303(d) listings needs to be developed. Particular reference should be given to whether the impairment, which is generally based on excessive concentrations of a chemical constituent, is a “real” impairment, or represents the application of worst-case-based water quality criteria/standards to Delta waters. Further, the monitoring program should specifically address the magnitude, area and duration of the impairment. With respect to duration, is it a pulse-type duration associated with and following pesticide application, or is the impairment during a season - year-round? This information can then be used to prioritize the second phase of the monitoring.

The second phase should be devoted to defining the constituents responsible, if not already defined (such as for toxicity), and the sources of these pollutants. The monitoring results can lead to the information base needed to begin to implement the TMDL that is needed to control the exceedance of an appropriately developed water quality standard/objective.

If it is found that the impairment represents an “administrative” impairment related to using worst-case generic national water quality objectives rather than site-specific objectives that are appropriate for the Delta waters of concern, then work with the CVRWQCB should be initiated to develop the site-specific objectives that will be protective without spending large amounts of funds for constituent control that will have little or no impact on the beneficial uses of the waterbody in question.

The monitoring program should include both the water column and sediments. It should be integrated with the CVRWQCB agricultural waiver monitoring program that is being implemented. The agriculture waiver monitoring program is defining the amounts of potential pollutants in runoff/discharges from agricultural lands, as well as the amounts of pollutants entering the Delta from tributary sources. Ultimately, the agricultural waiver program should include developing an understanding of how the pesticides, fertilizers and other constituents added to agricultural lands and those that are discharged from agricultural lands in the form of tailwater or subsurface drain water impact water quality.

The D-1641 water quality monitoring should focus on measuring not only chemical constituents that are, at some times and locations, pollutants (i.e., impair beneficial uses of the waterbody), but also aquatic life toxicity in the water column and/or sediments. Further, the bioaccumulation of known hazardous chemicals, such as the organochlorine “legacy” pesticides (DDT, chlordane, dieldrin, toxaphene, etc.), PCBs, dioxins and furans, should be measured. Substantial monitoring funds should be available for toxicity identification evaluations (TIEs) to identify the cause of toxicity in the water column or sediment, wherever it is found.

An area of concern is that there is no monitoring of the amount of water hyacinth and *Egeria densa* that develop in the Delta. This is a significant deficiency in the current Delta water quality monitoring program that should be immediately corrected, since these aquatic plants cause some of the most significant water quality problems/impairment of beneficial uses of the Delta. The magnitude of this problem can be judged by the fact that the California Boating and Waterways conduct extensive water hyacinth control through herbicide addition.

Changing the DO WQO for the Lower Stanislaus River

At the recent SWRCB D-1641 hearing on the San Joaquin River water rights/water quality standards issues, the Exchange Contractors presented modeling results that included mention of changing the lower Stanislaus River DO WQO. At this time the DO WQO for the lower Stanislaus River is set at 7.0 mg/L to permit spawning of cold water migratory fish (salmonids and steel head). In order to achieve this objective, release of water from New Melones Reservoir occurs during the summer months to increase the

flow of the lower Stanislaus River. The Exchange Contractors indicated that since cold water migratory fish reproduction does not occur in the lower Stanislaus River the releases of water from New Melones reservoir is not necessary to protect cold water fish spawning in the lower Stanislaus River. If the DO WQO for the lower Stanislaus River is lowered to 5 mg/L, the water releases from New Melones Reservoir could be made at other times to help solve the CVRWQCB CWA 303(d) listing for excessive TDS (salt) concentrations in the San Joaquin River at Vernalis.

An issue that has not been addressed in this matter is the potential impacts of reducing the flow out of New Melones Reservoir on the current water quality problems in the lower Stanislaus River. At this time the US EPA (2003) has established Clean Water Act section 303(d) limited conditions in the lower Stanislaus River for several pollutants/conditions. This reach of this river is listed as impaired for diazinon, "Group A Pesticides," mercury, and "Unknown Toxicity." TMDLs have been scheduled for remediation of the violation of the WQOs caused by these conditions.

Reducing the flow of high quality water in the lower Stanislaus River that is derived from New Melones Reservoir would represent a degradation of existing water quality due to the likely increase in the concentrations of the listed pollutants. Such an increase in concentration of the listed pollutants would likely represent a violation of the Antidegradation requirements of the US EPA Clean Water Act and the State of California Porter Cologne Act. This issue needs to be considered as part of a proposal to change the lower Stanislaus River DO WQO that would result in decreased releases of New Melones Reservoir water. This may require that a comprehensive monitoring/evaluation program be implemented to develop the information needed to understand the impacts of altered New Melones Reservoirs releases on the water quality impacts in the lower Stanislaus River with particular reference to the 303(d) listed pollutants in the lower Stanislaus River.

Altered Lower San Joaquin River Flow

The San Joaquin River (Merced River to South Delta Boundary) is 303(d) listed as impaired for boron, chlorpyrifos, DDT, diazinon, electrical conductivity, Group A Pesticides, and Unknown Toxicity. Several of the current proposals for solving the CWA 303(d) listing for excessive salt concentrations at Vernalis include the potential for reduced flows of the SJR at Vernalis. Reduced flow of the San Joaquin River at Vernalis as part of solving the salt TMDL could aggravate impairments by the 303(d) listed pollutants. There is need for studies to evaluate the impact of reduced SJR flow on the existing pollutants impacts. A comprehensive water quality monitoring program needs to be developed and implemented as part of developing the salt TMDL to evaluate whether any reduction of flow of the SJR at Vernalis is in violation of the Federal and State antidegradation requirements.

The Stanislaus River and San Joaquin River flow manipulations as part of satisfying one TMDL such as for excessive salt must be based on an adequate database that is the result of comprehensive monitoring/evaluation similar to that discussed for the Delta in this report. The SWRCB water quality monitoring advisory panel recommended below

should include review of the monitoring/evaluation program for the Stanislaus River and the San Joaquin Rivers.

SF Bay Regional Monitoring Program

Over the past 10 years there has been comprehensive water quality monitoring of San Francisco Bay and its associated estuary. This effort was conducted under what is known as the Regional Monitoring Program (RMP). The San Francisco Estuary Institute (SFEI) held its annual conference on May 4, 2004, at which the results of the past year's RMP, as well as an overview review of the past five years' RMP were presented and discussed. This review and other information on this program is available from the SFEI website, www.sfei.org.

The focus of the RMP has been on those constituents that are causing the Bay to be on the 303(d) list, with emphasis on those constituents which are bioaccumulating to excessive levels in edible organisms, such as mercury, organochlorine legacy pesticides, PCBs and dioxins. Taberski (2004) of the SFBRWQCB presented a review of the value of the RMP in helping the San Francisco Bay Regional Water Quality Control Board develop the information needed to begin to manage the water quality impacts of the constituents that cause the Bay to be on the 303(d) list.

While aggressive monitoring/evaluation programs are being conducted in the San Francisco Bay area for mercury, PCBs, dioxins, PAHs, organochlorine legacy pesticides, aquatic life toxicity, etc., except for mercury, essentially no work is being done in the Delta to address these constituents which are a cause of Delta waters to be listed as 303(d) impaired. A similar type of program to the San Francisco Bay RMP needs to be developed for the Delta to address the known water quality impairments that are occurring in Delta channels. Davis (2005) (pers. comm.) has indicated that SFEI staff are developing a report, "The Regional Monitoring Program: Science in Support of Managing Water Quality in San Francisco Bay," currently in draft form that discusses the development and organization of the RMP. Davis indicated that he may be contacted for information on the availability of this report (jay@sfei.org).

Availability of Funding for Monitoring. In addition to the water quality monitoring programs' in the Delta having been deficient for many years, the current and especially the future situation is likely to be even bleaker because funding decreases are occurring associated with the current state of California budget shortfall. There is need to restore and greatly expand the funding available for Delta water quality monitoring.

While some take the position that it is the responsibility of the Central Valley Regional Water Quality Control Board to conduct monitoring of Delta water quality, this approach is not viable, since the Regional Board does not and will not likely have the funds to undertake this effort. As a result, it will be necessary for SWRCB, CA Bay Delta Authority (CBDA) and those responsible for discharges/runoff to the Delta and its tributary exports should be responsible to pay for the funding the D 1641 water quality monitoring program. This funding requirements should be part of SWRCB water rights decisions and CVRWQCB NPDES discharge permits.

CALFED/CBDA's Activities in Addressing Water Quality Problems in the Delta

When CALFED first became active, there was a major effort to develop a water quality management program in the Delta and its tributaries. The consulting firm that had the initial contract to support CALFED activities assigned the responsibility for developing these programs to an individual(s) with limited understanding and experience in water quality issues. This person(s) made significant errors in evaluating water quality in the Delta, such as claiming that there were major heavy metal problems in the Delta due to stormwater runoff from urban areas that necessitated the collection and treatment of all urban stormwater runoff to remove heavy metals. Eventually, as a result of comments made by various individuals, including the authors, on the unreliability of the proposed water quality management program, that effort was terminated and replaced by a new effort involving committees of interested experts advising CALFED on the water quality problems that exist in the Delta and its tributaries. This led to the development of a Comprehensive Monitoring, Assessment and Research Program (CMARP, 1999). While this approach had considerable technical merit, CALFED management did not follow through, and all of the effort made by many individuals was lost several years ago. Since then, CALFED/CBDA's water quality management program has been essentially restricted to a major effort devoted to mercury and the low-DO problem in the first seven miles of the Deep Water Ship Channel below the Port of Stockton. There has been no effort devoted to many of the other well-documented water quality problems that exist in the Delta, such as those associated with the previous 303(d) lists and the 2002 303(d) list of impaired Delta channels.

Delta Water Quality Research Needs

Presented in the Lee and Jones-Lee (2004a) report and for some issues discussed below is a summary of the areas of Delta water quality-related investigations needed to better define the known and potential water quality problems that are impacting the beneficial uses of Delta waters. The information gained from such investigations would be an important step in developing a technically valid, cost-effective program to manage Delta water quality as well as the impacts of the D-1641 allowed exports on South Delta water on Delta water quality. Additional information on each of the areas summarized below is provided in the Lee and Jones-Lee (2004a) report.

Organochlorine Pesticides, PCBs and Dioxins. The finding of excessive bioaccumulation of the organochlorine legacy pesticides (such as DDT, chlordane, dieldrin, toxaphene, etc.), PCBs and dioxins (OCs) in Delta and near-Delta tributary fish mandates that a substantial research effort be initiated on the current degree and extent of excessive bioaccumulation of OCs in edible Delta fish. Also the amount of these chemicals entering the Delta from tributary, agricultural, urban and wastewater sources needs to be defined. Studies need to be conducted on the role of Delta sediments as a source of OCs that are bioaccumulating to excessive levels in Delta channel fish. US EPA aquatic organism bioaccumulation testing should be conducted to determine whether the organochlorines are present in sediments at sufficient concentrations of bioavailable forms to bioaccumulate to excessive levels in Delta fish. Where this occurs studies need to be conducted to develop biota sediment accumulation factors which can

be used to relate sediment concentrations to edible and other organism tissue residues. This approach is discussed in Lee et al. (2002).

It will also be important to determine whether the organochlorines are adverse to aquatic life. Particular attention should be given to dioxins in the vicinity of the Port of Stockton. It is now well-established that very low levels of dioxins can be adverse to fish and other aquatic life, below those concentrations that are known to cause cancer in people. The research on the organochlorines should include not only water column effects, but also benthic organism effects.

Where toxic hot spots are found in Delta and near-Delta tributary sediments of the OCl_s that are significant sources for excessive bioaccumulation in edible organisms, studies need to be done to determine if the addition of activated carbon is a potential remediation approach for controlling the bioavailability of sediment-associated OCl_s.

Currently Used Pesticides/Herbicides. Work needs to be done on the occurrence and water quality significance of the various pesticides/herbicides used in the Delta and in Delta tributaries, with respect to their potential to be adverse to aquatic life and other beneficial uses of Delta waters. Through CA Department of Pesticide Regulation reporting, each of the pesticides/herbicides used in the Delta should be investigated to determine whether it is present in runoff/discharges from the areas of use in agricultural and urban areas at sufficient concentrations to be toxic or otherwise deleterious to various forms of aquatic life. Consideration should be given not only to toxicity in the water column but also to sediment toxicity and other adverse impacts caused by the currently used pesticides. Further, this should be an ongoing program, where if a new pesticide/herbicide is used in the Delta or near-Delta tributaries, studies would be conducted to determine whether its initial use is adverse to aquatic life and other beneficial uses of Delta waters. This effort should include the herbicides used for aquatic weed control, where studies independent of those conducted by those applying the herbicides are conducted to determine whether there are adverse water quality impacts caused by the use of the herbicides for aquatic weed control within the Delta and near-Delta waters.

Heavy Metals. Work needs to be done to define whether heavy metals are causing water quality problems-impairment of the beneficial uses for aquatic life, etc., in the Delta or near-Delta tributaries. Of particular concern is the potential for food web accumulation of cadmium or nickel, where concentrations of metals below the water quality objective can result in adverse effects to host organisms and higher trophic level organisms through accumulation of tissue residues of the metal. Further work needs to be done on whether selenium additions to the Delta are adverse to Delta aquatic life.

Impacts of the State and Federal Export Projects on Delta Water Quality. The state and federal export projects have the potential to cause significant adverse impacts on the water quality beneficial uses of the Delta. As discussed herein, the work that has been done under D-1641 to evaluate these impacts is deficient compared to that which is needed to define the impacts of Delta export projects on Delta water quality. A team of

independent experts should work together to properly evaluate the potential adverse impacts of Delta water exports. Where this team finds potential problems with a particular type of pollutant, such as an organochlorine pesticide, mercury, currently used pesticides, heavy metal inputs from tributaries, etc., studies should be conducted to evaluate how the movement of water in the Delta caused by the export projects impacts the effects of these constituents on Delta water quality.

Phytoplankton Primary Production within the Delta. An assessment should be made of the factors controlling phytoplankton primary production within the Delta. Particular emphasis should be given to why, based on the nutrient content of Delta waters, there is not more primary production. It has been found that Delta waters, when allowed to stand, such as in a water supply reservoir, will produce substantial crops of phytoplankton. What is the role of light limitation due to inorganic turbidity and color on primary production? Is the export of water from the Delta creating insufficient time in Delta waters during the summer and fall months for the phytoplankton to develop before the water is exported from the Delta via the export pumps? What is the role of the export projects' drawing large amounts of low-nutrient Sacramento River water through the Delta in the limitation of algal production? Another area of concern is whether invasive species are significantly controlling phytoplankton biomass through harvesting of phytoplankton.

Another research area is an evaluation of the importance of phytoplankton derived from the San Joaquin River watershed as a source of assimilable organic carbon for the Delta food web. There is need to better understand the food web in the Delta and especially what controls the lowest trophic level biomass. Of concern is whether reducing the algal loads to the Central Delta would be detrimental to the food web.

Biomarkers, PPCPs, Endocrine Disrupters, Etc. A substantial research effort should be initiated on the occurrence of sublethal effects of various types of chemicals, such as PPCPs, endocrine disrupters and low levels of pesticides (at concentrations below those that are acutely toxic to aquatic life) on Delta water quality. Particular attention should be given to waters near the cities of Stockton and Tracy and downstream of the Sacramento Regional County Sanitation District discharges to the Delta, as well as other upstream communities that discharge wastewaters to Delta tributaries. Consideration should also be given to any discharges/runoff from dairies and other animal husbandry facilities as a source of PPCPs.

Delta Sediments. A comprehensive program of investigating the toxicity of Delta sediments should be initiated, using a variety of sensitive test organisms. Where toxicity is found, sediment-based toxicity investigation evaluations should be conducted to determine the cause of the toxicity and the sources of the constituents responsible for the toxicity. This work should include the development of biological effects-based sediment quality objectives for Delta sediments. Total chemical concentrations or co-occurrence-based sediment quality objectives should not be used in the Delta or other waterbodies that are tributary to the Delta (or, for that matter, elsewhere) as a basis for evaluating

sediment quality, because of the unreliability of total concentrations in predicting bioavailable/toxic forms of potential pollutants.

Organism Assemblages. Surveys of Delta sediment benthic and epibenthic organisms should be conducted to determine where altered organism assemblages are occurring, compared to what would be expected based on an unimpacted sediment population. Where altered organism assemblages are found studies need to be conducted to determine the reason for this situation.

Total and Dissolved Organic Carbon. Studies need to be conducted on the sources of total and dissolved organic carbon for the Delta from tributaries and within the Delta from aquatic vegetation. The organic carbon should be investigated in terms of the total labile and refractory carbon that can adversely impact domestic water supply water quality. Particular attention needs to be given to urban wastewater and stormwater runoff as a source of refractory TOC that can impact domestic water supply water quality. Studies need to be conducted on the potential for controlling refractory TOC from the various sources, including agricultural runoff, urban and industrial land runoff, wastewaters, etc. An evaluation needs to be made of the cost of controlling excess TOC in water utilities' raw water at the source, compared to the cost of controlling it at the water treatment works.

Pathogens. The monitoring that the DeltaKeeper has been doing in the eastern and Central Delta needs to be expanded to all parts of the Delta, to determine where pathogen indicator organisms, such as *E. coli*, are present at concentrations which are indicative of a public health threat for contact recreation in the waters of that area. In those areas where there are consistent violations of the *E. coli* water quality standard, there is need to conduct further studies to determine the specific sources of *E. coli* that are responsible for the violations.

Nutrients. Investigations need to be conducted to determine the degree of nutrient control needed from the Delta watershed and within the Delta to achieve desired water quality from the perspective of domestic water supply and aquatic weed growth, especially hyacinth and *Egeria densa* within the Delta.

Salts. There is need to determine the appropriate salt loads to the Delta from the San Joaquin River watershed, to protect the use of Delta waters for domestic water supply and the associated recharge of groundwaters from the wastewaters based on a Delta water supply, as well as to protect irrigated agriculture in the Delta.

Dissolved Oxygen. There is need to do further work on the relationship between various oxygen demand sources for the Deep Water Ship Channel, with particular reference to the interrelationship between the oxygen demand loads from the city of Stockton's domestic wastewaters, the city of Stockton's stormwater runoff, and the planktonic algae from the San Joaquin River watershed, to the DO depletion associated with the flow of the SJR through the DWSC. There is need to understand the impact of significantly

reducing the flow of the SJR into the South Delta via Old River on water quality in the South Delta.

There is also need to understand the origin of the low DO that occurs in Old River near the Tracy Boulevard bridge, and what can be done to control it, as well as the low DO that occurs in Middle River within the South Delta.

There is need to investigate the potential occurrence of low DO in the Central Delta, especially Turner Cut and Whiskey Slough, under worst-case conditions of oxygen demand loads from the DWSC.

HR 2828

HR2828, Water Supply, Reliability, and Environmental Improvement Act states,

“(D) PROGRAM TO MEET STANDARDS-

(i) IN GENERAL- Prior to increasing export limits from the Delta for the purposes of conveying water to south-of-Delta Central Valley Project contractors or increasing deliveries through an intertie, the Secretary shall, not later than 1 year after the date of enactment of this Act, in consultation with the Governor, develop and initiate implementation of a program to meet all existing water quality standards and objectives for which the Central Valley Project has responsibility.”

In order to properly implement HR 2828 there will be need to develop and implement a comprehensive water quality monitoring/evaluation program for the Delta of the type discussed herein.

Overall Conclusion

There are significant water quality problems in the Delta and its tributaries that are being impacted by the water rights decisions made by the SWRCB. Past water rights decisions have not adequately/reliably addressed how flow diversions/manipulations in the Delta and its tributaries impact Delta water quality. At this time, except for the low DO problem in the SJR DWSC, how the past water rights decisions impact the magnitude, location and duration of aquatic life toxicity, excessive bioaccumulation of organochlorine legacy pesticides, PCBs, dioxins, in edible fish tissue, mercury methylation that leads to excessive fish tissue residues that are a threat to those who use fish as food etc is unknown. There is an urgent need to for the SWRCB to build into the future water rights decisions, the requirement those who divert water, discharge waste waters and irrigation tail waters, as well as all of those who use the waters that are diverted from the Delta and its tributaries, provide the funds needed to support/fund a comprehensive water quality monitoring program to reliably determine how the diversion/manipulation water and discharge of waste waters/tail waters impact Delta and its tributaries water quality.

Need for Independent Data Review and Report Development

There is a significant problem with agencies such as those involved in IEP EMP failing to conduct comprehensive data review and report development that addresses the key issues

associated with the impact of the South Delta Project water diversions on Delta water quality. As discussed by Lee and Jones-Lee (2004a) in their review of Delta water quality, Dr. G. F. Lee was a member of the 2002 IEP EMP D-1641 review panel. As part of this review he found that the review was conducted in such a manner to fail to begin to address the impact of the past D-1641 water rights decisions on Delta water quality. In fact it became clear that the monitoring program and its reporting was designed to not detect the impact of water diversions. When suggestions were made on issues that needed to be addressed to properly ascertain the impact of South Delta water exports on Delta water quality, those responsible for conducting the studies did not want to address this issue. This is somewhat understandable since some of the key personal in the IEP EMP are representatives of the water exporters, such as DWR and USBR. It is inappropriate to have those responsible for water diversions to influence/control the monitoring program that is suppose to discern the impact of the diversions/exports on Delta water quality.

SWRCB as part of the current D-1641 review should establish and independent SWRCB water rights water quality monitoring advisory panel that would be responsible to the SWRCB for developing a water quality monitoring program that would discern the impacts of Delta tributary and South Delta exports/manipulations on Delta and Delta tributary water quality.

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