GARY M. CARLTON, P.E.
EXPERT REPORT

Natural Resources Defense Council, Inc., et al.
v. Kirk Rodgers, et al
Case No. S-88-1658-LKK/GGH

Prepared for:

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1.0 ASSIGNMENT AND METHODOLOGY

I have been retained by Best Best & Krieger LLP, attorneys for the Friant Water Users Authority in the action titled "Natural Resources Defense Council, Inc., et al., v. Kirk Rodgers, et al., Case No. S-88-1658-LKK/GGH", to provide expert testimony concerning past, present and future water quality conditions in the San Joaquin River (SJR) at Vernalis and at various points in the Delta.

Specifically, I have been asked to provide opinions in response to two questions:

1. Would additional releases from Friant Dam for purposes of restoring salmon runs in the SJR as proposed by Hanson and by Kondolf result in avoidance of future exceedances of water quality objectives at Vernalis, the three South Delta EC compliance points and in the Stockton Deep Water Ship Channel (DWSC) which might otherwise occur, absent the fish restoration releases?

2. In light of current ongoing and planned water quality control and flow management programs, what is the outlook for improving water quality conditions in the SJR at Vernalis, the three South Delta EC compliance points and in the Stockton DWSC insofar as future compliance with water quality objectives, absent any additional flow associated with proposed fish restoration releases?

I have based my evaluations, opinions and conclusions relative to these two questions upon various public documents which I determined to be relevant when reviewing Central Valley Regional Water Quality Control Board (CVRWQCB) and State Water Resources Control Board (SWRCB) websites which describe data, reports, presentations, public testimony and other documents presented to the Boards relative to the subject matter entailed in the two questions posed to me. A complete listing of documents contained on those websites is provided in the attachments to this report. In addition to these regulatory agency documents, I have reviewed and relied upon various Expert Report documents which are part of the record of these proceedings. All documents cited in this report are listed in Section 5. The documents I have relied upon are the type usually relied upon by experts in my field on forming opinions on similar matters.

In formulating the opinions presented in this report, I have relied upon my education in the field of environmental engineering and in particular, my professional experience in the areas of hydrology, water quality management studies and as a regulatory manager and policy maker while at the CVRWQCB serving as Executive Officer for five years (1997-2002) and the SWRCB (2002-2005) appointed by Governor Gray Davis serving as the member with expertise in water supply and irrigated agriculture. My resume is provided in **Section 6** of this report. I have no publications in the past ten years although I did author or co-author several publications in the areas of water quality investigation in the period from 1977 to 1994. I have not testified as an expert at trial or by deposition in the past four years but did so on several occasions during the period of 1977 to 1994.

My compensation is $225 per hour for time spent preparing this report.

2.0 FACTUAL BACKGROUND

2.1 HYDROLOGY (CVRWQB 2004 a)

The hydrology of the SJR is complex and highly managed through the operation of dams, diversions, and supply conveyances. Water development has fragmented the watershed and greatly altered the natural hydrology of the river. Runoff from the Sierra Nevada and foothills is regulated and stored in a series of reservoirs on the east side of the SJR. Most of the natural flows from the Upper SJR and its headwaters are diverted at the Friant Dam via the Friant-Kern Canal to irrigate crops outside the SJR Basin. Water is imported to the basin from the southern Delta via the Delta Mendota Canal (DMC) to replace the flows that are diverted out of the basin to the south. Some water in the DMC is delivered to the Mendota Pool and distributed from there via irrigation canals to the west side. Water is also released to the SJR from Mendota pool to meet the needs of various agricultural users between the Mendota Pool and the Sack Dam. Most or all of the remaining flow in the river is diverted at Sack Dam. As a result, the SJR downstream of Sack Dam and upstream of Bear Creek frequently has little or no flow except during flood flows. During non flood-flow periods, this reach of the SJR flows intermittently and is generally composed of possibly some groundwater accretions and agricultural return flows.

The SJR downstream of Bear Creek once again becomes a permanent stream that flows all year. Except during high rainfall and flood flows during wet years, the flow in the reach of the SJR downstream of Bear Creek and upstream of the Merced River confluence is dominated by agricultural and wetland return flows, groundwater accretions, and inflow from Mud Slough and Salt Slough. Mud Slough and Salt Slough drain the 370,000-acre Grassland Watershed. These sloughs contain a mix of agricultural return flows, runoff from managed wetlands, rainfall runoff, and flood flows. Mud Slough discharges to the SJR approximately two miles upstream of the confluence of the SJR and the Merced River. Salt Slough flows into the SJR approximately six miles upstream of the Mud Slough confluence.

The major tributaries to the SJR upstream of the Airport Way Bridge near Vernalis (the legal boundary of the Delta) are on the east side of the San Joaquin Valley, with drainage basins in the Sierra Nevada Mountains. The Cosumnes, Mokelumne, and Calaveras Rivers and French Camp Slough flow into the SJR downstream of the Airport Way Bridge near Vernalis. Several smaller, ephemeral streams flow into the SJR from the west side of the valley. These streams include Hospital, Ingram, Del Puerto, Orestimba, Panoche, and Los Banos Creeks. All have drainage basins in the Coast Range, flow intermittently, and contribute sparsely to water supply. During the irrigation season, surface and subsurface agricultural return flows contribute to these creeks and sloughs.

Once the SJR reaches Vernalis, tidal stages in the Delta begin to affect its flow. The SJR flow through the Stockton DWSC is strongly affected by tidal stage, which can range from about 0.25 feet below mean sea level to about 4.25 feet above mean sea level. The ebb flows are relatively steady for several hours at about 2,500 cfs plus the flow from SJR. As the flood tide raises water levels, the ebb flow gradually decreases, and after a short period of stagnation, flow reverses. This flood tide flow averages about 2,500 cfs minus SJR river flows. This tidal cycle repeats itself every 24.8 hours and varies in intensity throughout the 29-day lunar cycle (Brown and Renehan, 2001).

2.2 WATER QUALITY OBJECTIVES, EC (CVRWQCB 2004 a)

The existing salinity water quality objectives (WQOs) for protecting agricultural beneficial uses in the SJR at Vernalis and in the Southern Delta were originally established by the SWRCB pursuant to the Water Quality Control Plan (WQCP) for Salinity for the San Francisco Bay/Delta Estuary WQCP in 1995. Compliance with the WQOs is measured based on a 30-day running average as Electrical Conductivity (EC, µS/cm). The objective is 1.0 EC from September through March and 0.7 EC from April through August during all year types and is measured at four locations:

Compliance Location	Irrigation Season April 1 – Aug. 31 (30-day running avg.)	Non-Irrigation Season Sept. 1 - Mar. 31
SJR @ Airport Way Bridge, Vernalis	700 µS/cm	1,000 µS/cm
SJR @Brandt Bridge	700 µS/cm	1,000 µS/cm
Old River near Middle River	700 µS/cm	1,000 µS/cm
Old River at Tracy Road Bridge	700 µS/cm	1,000 µS/cm

The salinity level in water can also be measured as total dissolved solids (TDS). TDS is a measure of the quantity of dissolved solids in a given volume of water and is determined by filtering and then evaporating a known volume of water and weighing the remaining solids. It is reported in terms of weight of solids per volume of water, such as milligrams per liter (mg/L). EC can be measured and used as surrogate for TDS. EC (which is also referred to as specific conductance) measures the transmission of electricity through water and is reported in units of µS/cm . There is a close correlation between TDS and EC; EC readings increase as salt levels increase. TDS (in mg/L) to EC (in µS/cm) ratios for the Lower SJR from Lander Avenue to the Airport Way Bridge near Vernalis range from 0.590 to 0.686 (SWRCB, 1987) and 0.65 is typically used as the multiplier to convert from EC to TDS.

2.3 WATER QUALITY OJBECTIVES, D.O. (CVRWQCB 2005 a)

The SJR experiences periods of low dissolved oxygen (DO) concentrations in the first few miles of the Stockton DWSC downstream from the City of Stockton. These conditions often violate the water quality objectives for DO in the Stockton DWSC as contained in the WQCP for the Sacramento River Basin and the San Joaquin River Basin (Basin Plan).

There are two parts to the Basin Plan DO water quality objectives that apply to the lower SJR for the purpose of protecting beneficial uses:

- 5.0 mg/L at all times on the SJR within the Delta (excluding SJR west of Antioch bridge). This objective first appeared for all waters of the Delta in the Interim Water Quality Control Plans for the Sacramento-San Joaquin Delta adopted in 1967 (CVRWQCB, 1967). It was adopted again into the first edition of the Basin Plan in 1975 (CVRWQCB, 1975) and remains in the current edition. The SJR west of Antioch is governed by the Basin Plan for the San Francisco Bay Regional Water Quality Control Board and is downstream of the impairment addressed by this TMDL.

- 6.0 mg/L between Turner Cut and Stockton from September 1 through November 30 This objective was first adopted by the SWRCB in the 1991 Water Quality Control Plan for Salinity, San Francisco Bay/Sacramento-San Joaquin Delta Estuary (SWRCB, 1991). This objective was adopted into the third edition of the Basin Plan in 1994 (CVRWQCB, 1994) and remains in the current edition. The objective was adopted by the SWRCB again in their 1995 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (SWRCB, 1995). The 5.0 mg/L objective applies at all other times and locations not covered by the 6.0 mg/L objective.

The 1967 Interim Basin Plan stated, "migratory salmonids require at least 5.0 mg/L DO, as do the resident game fishes. Striped bass and other fishes also require at least 5.0 mg/L DO to successfully propagate" (CVRWQCB, 1967). Prior to the latest version, the USEPA Water Quality Criteria suggested a 5.0 mg/L criterion (USEPA, 1976). This criterion was typically interpreted as being applicable at all times and places except for low flow conditions worse than the lowest seven-day flow with a ten-year return frequency (7Q10). Likewise, a study in the SJR found that the adult salmon migration run upstream past Stockton did not become steady until DO concentrations were above 5 ppm (mg/L) (Hallock, *et. al.*, 1970). This study did not discuss any time averaging or considerations of spatial variability. In 1986 the USEPA revised its suggested criterion to include a range of values and averaging periods based on life stages present (USEPA, 1986).

The 6.0 mg/L objective included in the 1991 and 1995 SWRCB water quality control plans was intended to protect fall-run Chinook salmon spawning migration. The technical basis for the objective was an agreement reached in 1969 between the California Department of Water Resources (DWR), California Department of Fish and Game, U.S. Bureau of Reclamation (USBR), and the predecessor to U.S. Fish and Wildlife Service to take specific actions to maintain the DO content in the DWSC above 6 ppm (mg/L). This agreement called for the installation of a temporary rock barrier at the head of Old River to increase SJR flows past Stockton, thus improving DO levels (SWRCB, 1991, 1995).

A number of studies performed in recent years have identified three main factors contributing to this DO impairment:

- Loads of oxygen demanding substances from upstream sources that react by numerous chemical, biological, and physical mechanisms to remove dissolved oxygen from the water column in the Stockton DWSC.
- Stockton DWSC geometry impacts various mechanisms that add or remove DO from the water column, such that net oxygen demand exerted in the Stockton DWSC is increased.

- Reduced flow through the Stockton DWSC impacts mechanisms that add or remove DO from the water column, such that net oxygen demand in the Stockton DWSC is increased.

3.0 OPINION I

Opinion I.

> Future releases of flows from Friant Dam sufficient to support restoration of salmon runs in the SJR as proposed by Hanson and by Kondolf would not significantly contribute to future avoidance of water quality objectives exceedances at Vernalis, in the South Delta or in the Stockton DWSC.

3.1 DISCUSSION, HANSON HYDROGRAPH

The hydrograph for proposed releases from Friant for fish restoration proposed by Hanson (Steiner, 2005d) would provide additional flow in the SJR beginning in February, peaking at the end of April and returning to base levels in mid-May. The time periods of incremental increases in flow occurring in the SJR as a result of the proposed Friant releases do not coincide with the time periods when significant water quality compliance issues have occurred historically and would be expected to occur in the future at Vernalis and in the Delta.

3.1 a EC WATER QUALITY OBJECTIVE AT VERNALIS

The critical water quality compliance period for EC in the SJR at Vernalis occurs from June through August in dry and critically dry years. There would be very minor or no contribution of Friant fish restoration water in the SJR at Vernalis during these critical water quality compliance periods under the fish restoration release scenario proposed by Hanson. Thus, the fish release flows would have very little or no impact on water quality conditions Vernalis.

A secondary period of historical compliance concern for EC at Vernalis has occurred in the months of February and March. EC levels approaching or exceeding the water quality objective of 1,000 µS/cm during this period are associated with releases of high salinity waters from managed wetlands in the Grasslands area (SJRWQG, 2005). This winter-period occurrence of elevated EC levels at the Vernalis compliance point has become particularly acute since the implementation of the Central Valley Project Improvement Act (CVPIA) which brought about newly available and highly reliable water supplies to the managed

Wetlands (CVRWQCB 2004b.). Prior to the implementation of the CVPIA, available water supplies for flooding of managed wetlands were variable and the resultant eventual releases in February and March were also variable in magnitude and duration. More specifically, in dry years when water flows in the SJR Basin were low due to low runoff/release conditions, the supply of water available for flooding wetlands was limited and, accordingly, the subsequent releases in February and March were also limited. Hence, with the increased volume and reliability of water supplies for flooding of managed wetlands, there is an increased predictability of problematic releases of high EC waters from the wetlands which appear as return flows to the SJR in February and March.

The fish restoration releases from Friant proposed by Hanson would appear in the SJR at Vernalis in significant quantities coincident with the occurrence of the return flows from the managed wetlands and thereby provide a benefit in terms of dilution flow to reduce the EC levels and decrease the likelihood of non-compliance with the EC water quality objective at Vernalis. However, as will be discussed in greater detail later in this report (see 4.3), alternative approaches for controlling adverse water quality impacts from these managed wetlands releases either currently exist in the form of real time management of dilution flow releases or are under consideration in the form of source control management options. These existing and prospective water quality management approaches offer a more practicable and efficient course of action than the option of relying upon fish restoration releases from Friant for managing in-stream water quality impacts associated with return flow releases from managed wetlands.

3.1 b DISSOLVED OXYGEN WATER QUALITY OBJECIVES IN THE DEEP WATER SHIP CHANNEL (DWSC)

The frequency of violations of the 5.0 mg/l objective for dissolved oxygen (DO) in the Stockton DWSC are highest, on the average, during the months of June through October (CVRWQCB 2005a). As is the case described above for EC at Vernalis, there would be very minor or no contribution of Friant fish restoration flow to the Stockton DWSC during this period and thus, very little or no impact on DO conditions in the Stockton DWSC.

Exceedances of the dissolved oxygen water quality objective in the SJR at the Stockton DWSC occasionally have also occurred historically in winter months. The supplemental flows reaching the SJR at Vernalis resulting from fish restoration releases proposed by Hanson from Friant Dam in February through May could potentially result in increased flows in the Stockton DWSC which would, in turn, reduce the potential for dissolved oxygen exceedances at that location. However, the complexities of SJR flow routing below Vernalis associated with operation of the export pumps and the Head of Old River Barrier (HORB) make it problematic to predict what portion, if any of the supplemental fish restoration flow would actually make its way past Old River and arrive at the Stockton DWSC (CVRWQCB 2005a, DWR 2005b). As was the case discussed above for alternative management options for potential water quality exceedances of EC at Vernalis, there are more practicable and reasonable water quality management approaches to prevent the occurrence of exceedances of the DO WQO in the Stockton DWSC than to rely upon releases from Friant Dam for this purpose. As will be discussed in more detail later in this report (see 4.3), extensive regulatory-driven efforts including point source and non-point source load reductions in the vicinity and upstream of the Stockton DWSC, artificial aeration of the Stockton DWSC and flow enhancement in the Stockton DWSC through operation of a new HORB in conjunction with various recirculation schemes associated with the South Delta Improvement Project (SDIP) are now underway to address the dissolved oxygen exceedance issues in the Stockton DWSC. As described in various reports related to activities to control these exceedances (CVRWQCB 2005 a), the complex hydrodynamic and biochemical oxygen demand, load-related relationships which control the dissolved oxygen conditions in the Stockton DWSC are not presently fully understood and studies are currently underway to define them adequately to allow selection of the optimal water quality management strategy.

3.1 c EC WATER QUALITY OBJECTIVES AT THREE INTERIOR DELTA COMPLIANCE POINTS

The water quality objective for EC at three locations in the Delta (SJR at Brandt Bridge, Old River near Middle River and Old River at Tracy Bridge) are at times exceeded during the agricultural irrigation season in dry years. As noted above in the discussion of management options for improving dissolved oxygen levels in the Stockton DWSC, the complex hydrodynamic conditions resulting from export pumping and operation of the HORB make it problematic to conclude that any benefit to reduce or overcome the observed exceedances would accrue from the presence of supplemental flows in the SJR at Vernalis resulting from fish restoration releases at Friant Dam. The Department of Water Resources, United States Bureau of Reclamation, South Delta Water Agency (SDWA) and the CBDA (Cal Fed) have undertaken and are continuing with extensive studies and flow modeling efforts related to installation and operation of permanent barriers at the Head of Old River and at various locations in the internal Delta channels to improve circulation, raise water levels and improve water quality (DWR 2005a,b). These efforts are the most reasonable and promising water quality management approach to improving water quality conditions at internal Delta compliance points for EC.

3.2 DISCUSSION, KONDOLF HYDROGRAPH

Kondolf presented a set of six different hydrographs that vary in shape and volume according to wetness in the Basin (Steiner, 2005 e). These six hydrographs can be generalized for purposes of analyzing downstream water quality impacts as a segment which calls for ramping up and then decreasing releases in the February through April period with a relatively steady base flow requirement throughout the remaining months of the year, with the exception of a modest flow spike in November. In all months, the supplemental flows for fish restoration called for by Kondolf are equal to or less than those called for by Hanson and, accordingly, would result in less of an incremental increase in flows at Vernalis and in the interior Delta than would result from the Hanson hydrograph (Steiner, 2005 f). Therefore, all of my conclusions regarding the impacts, if any, on exceedances of water quality standards at Vernalis and in the Delta associated with the proposed Hanson hydrograph apply equally, or more so, to the proposed Kondolf hydrographs.

4.0 OPINION II.

Opinion II. With or without any future supplemental flow releases from Friant Dam for purposes of fish restoration, as proposed by Hanson and by Kondolf, it is likely that water quality objectives will be met in the future at Vernalis for EC and in the Delta for EC and DO as a result of current on-going and planned water quality control programs and with implementation of feasible modification to the Interim Plan Operations for the New Melones Project.

4.1 DISCUSSION

Water quality conditions in the SJR at Vernalis and the four compliance points in the Delta (Brandt Bridge, Old River near Middle River and Old River at Tracy Bridge for EC and the Stockton DWSC for dissolved oxygen) are a function to varying degrees of two upstream factors: flow and quality in the SJR at the Maze Blvd. monitoring location and flow and quality of the Stanislaus River as it enters and mixes with the SJR flows downstream of Maze Blvd. Future operation of New Melones Reservoir on the Stanislaus River to meet downstream water quality and flow requirements in the Stanislaus River, the SJR at Vernalis and the Delta in combination with water quality improvements in the SJR at Maze Blvd. that have already occurred as a result of implementation of the West Side Drainage Improvement Project are likely to improve water quality conditions in the SJR at Vernalis to the point where exceedances of the EC standard no longer occur and to contribute to improved water quality conditions at the four internal delta compliance points.

Ongoing and future planned activities in the Delta and upstream on the Lower SJR involving implementation of the South Delta Improvement Plan and the Dissolved Oxygen and Salt and Boron TMDL Implementation Plans will contribute further to water quality improvement at the internal delta monitoring points such that it is reasonable to expect compliance with water quality objectives at these locations. Flow simulation models linked with water quality elements can be used to evaluate future water quality conditions which will occur from changing water quality inputs over a range of flow conditions.

My conclusions regarding the likelihood that future water quality conditions will improve at all compliance points is based upon my evaluation of current ongoing and planned improvement in water quality inputs to the SJR and the Delta (Central Valley Regional Water Quality Control Board TMDL Implementation Plans), the potential for operational changes at New Melones involving revisions to the Interim Plan of Operation (Steiner 2005 c) and implementation of the South Delta Improvement Plan (DWR 2005 a,b). My conclusions in the area of potential for future water quality improvements are also supported by my review of flow/water quality simulations conducted to predict future water quality conditions that will occur as a result of these changes (Steiner, 2005 b). Each of these considerations are discussed below in greater detail.

4.2 SJR BASIN MODEL

CALSIM is a computerized model that simulates a significant portion of the water resources infrastructure of the Central Valley and Delta regions including the SJR Basin. As a result of ongoing efforts by the United States Bureau of Reclamation to update and refine CALSIM, it was revised to reflect the current hydrologic setting of the SJR Basin and water management operations (Steiner, 2005 a). The details of the refinement activities and resultant simulations of flows and water quality are described in detail in a presentation by Daniel B. Steiner to the State Water Resources Control Board as part of the State Board Proceedings for Periodic Review of the 1995 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary Workshop, March 2005 (Steiner, 2005 b). The work conducted by Mr. Steiner shows that when hydrologic setting, water management operations and water quality input refinements are incorporated into CALSIM II and with re-operation of releases from the New Melones Project, a simulation of resultant water quality conditions in the SJR at Vernalis over the full range of recorded historic runoff conditions in the SJR Basin, shows no EC exceedances were found to occur (Steiner, 2005c).

4.3 CVRWQCB PROGRAMS FOR IMPROVING WATER QUALITY INPUTS.

Two regulatory programs initiated by the CVRWQCB have resulted in current day improvements and are expected to result in further future improvements to the SJR water quality by reducing salt loading from irrigated agriculture return flows. The first program involves control and eventual elimination of return flows from the 100,000-acre Grassland Drainage Area. Estimated salt loads to the SJR from the Grasslands Drainage area are presented in a 1998 CVRWQCB report (CVRWQCB 1998). A staff report to the CVRWQCB by the staff of the Board in April 2005 (CVRWQCB 2005 b) describes the features and status of this project. A related report entitled "Summary Recommendations of the San Joaquin River Water Quality Management Group for Meeting the Water Quality Objectives for Salinity Measurement at Vernalis and Dissolved Oxygen in the Stockton Deep Water Ship Channel" (SJRWQMG 2005) in August 2005 further describes the role of the Grasslands Bypass Project as part of the larger West Side Regional Drainage Plan in reducing salt loads to the Lower SJR. This report concludes that due to the salinity reduction effect of the West Side Drainage Plan, little or no water needs to be released from New Melones and no recirculation flows are required to meet the EC objective at Vernalis.

The second regulatory program adopted by the CVRWQCB which provides additional assurances that water quality objectives at Vernalis and in the Delta will be met in the future is embodied in the Total Maximum Daily Load (TMDL) programs for Salt/Boron and for Dissolved Oxygen (D.O.) (CVRWQCB 2004a., 2005 a). The Salt/Boron Plan calls for numerous activities involving load reductions and review of water management operations procedures through the water rights permit review process that are expected to ensure that EC water quality objectives at Vernalis and in the Delta are met. The D.O. Plan calls for load reductions, in-stream aeration of flows in the Stockton DWSC and review of water management operations procedures to ensure that D.O. water quality objectives are met in the Stockton DWSC.

4. 4 DWR/USBR PROGRAM FOR IMPROVING CIRCULATION IN THE SOUTH DELTA

Water quality at the three interior Southern Delta compliance points is influenced by water quality at Vernalis and by areas of poor circulation in the Southern Delta Channels. As discussed above, the results of flow and quality simulations for the SJR at Vernalis which incorporate an updated hydrologic setting, improved water quality inputs and re-operation of New Melones show that the water quality objectives for EC at Vernalis can be consistently met in the future. Historically, EC levels at Vernalis have degraded between Vernalis and Brandt Bridge due to additional salt loading in that reach of the SJR and, as a result, the EC standard at Brandt Bridge is sometimes exceeded. It is expected that increased reductions in salt loads above Vernalis beyond the reductions currently realized and reflected in the simulations will occur as a result of full implementation of the West Side Drainage Plan and implementation of the Salt/Boron TMDL Plan. Further reductions in salt loading between Vernalis and Brandt Bridge and throughout the Delta are expected to occur as a result of implementation of the Salt/Boron TMDL. Theses reductions will contribute to a reduced likelihood of EC exceedances at Brandt Bridge.

Modelling results described by the Department of Water Resources in their March 14, 2005, presentation to the State Water Resources Control Board as part of the Periodic Review of the 1995 Bay/Delta Plan show that operation of the proposed permanent operable barriers as called for in the South Delta Improvement Plan can achieve the water quality control objectives at the three interior Southern Delta compliance points under most conditions except at Brandt Bridge (DWR 2005a, 2005b). The permanent operable barriers may provide more flexibility for managing flows and salinity at Brandt Bridge which in conjunction with expected future reductions in loading above Vernalis and between Vernalis and Brandt Bridge as discussed above will further increase the likelihood that standards will be routinely met at Brandt Bridge.

4.5 RECENT TRENDS IN MEASURED EC CONDITIONS AT VERNALIS

Full implementation of the West Side Drainage Plan which is estimated to take up to five years will fully eliminate these discharges (SJRWQG). Discharges of agricultural return flows from the Grasslands Drainage Areas are a significant source of salt loads to the SJR (CVRWQCB 2004b, CVRWQCB 1998). However, discharge to the SJR via Mud Sough of a significant portion of the agricultural subsurface irrigation drainage (highly saline tile drainage water) from the 100,000 acre Grasslands Drainage has already been eliminated. The effects of removal of this highly saline discharge to the SJR are reflected in recent data for EC levels measured at Vernalis (Steiner, 2005 f). Review of these data show no EC violations at Vernalis over the past 10 years.

It is expected that the remaining volume of drainage water from the Grasslands Drainage Area (approximately 27,000 acre-feet / year) will be removed from the SJR within the next 5 years (SJRWQG). Removal of this remaining increment of tile drainage as a source of future salt-laden discharge to the SJR will further contribute to assurances that EC standards at Vernalis will be routinely met.

September 15, 2005
Date

Gary M. Carlton

5.0 DATA AND INFORMATION CITED IN THE REPORT

5.1 Documents Cited In The Report

Central Valley Regional Water Quality Control Board 2004a. Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basin for the Control of Salt and Boron Discharges into the Lower San Joaquin River, Final Staff Report, 10 September 2004.

Central Valley Regional Water Quality Control Board 2004b. Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basin for the Control of Salt and Boron Discharges into the Lower San Joaquin River, Draft Final Staff Report, Appendix 1: Technical TMDL Report, July 2004.

Central Valley Regional Water Quality Control Board 2004c. Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basin for the Control of Salt and Boron Discharges into the Lower San Joaquin River, Draft Final Staff Report, Appendix 5: Technical Evaluation of Alternatives, July 2004.

Central Valley Regional Water Quality Control Board 2005a. Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basin for the Control Program for Factors Contributing to the Dissolved Oxygen Impairment in the Stockton Deep Water Ship Channel, Final Staff Report, 28 February 2005.

Central Valley Regional Water Quality Control Board 2005b. Staff Report, The Grasslands Bypass Project, Status Report, April 2005.

Central Valley Regional Water Quality Control Board 1998. Loads of Salt, Boron and Selenium in the Grassland Watershed and Lower San Joaquin River, October 1985 to September 1995, Volume I: Load Calculations, February 1998.

Department of Water Resources, 2005a. Comments Regarding Southern Delta Salinity Objectives (Topic 10), State Water Resources Control Board Workshop on Amending the 1995 Bay Delta Water Quality Control Plan, March 14, 2005.

Department of Water Resources, 2005b. Presentation by John M. Ford and Stephen S. Roberts, Testimony of the Department of Water Resources on South Delta Salinity Objectives and Dissolved Oxygen Salinity Objectives in the San Joaquin River, State Water Resources Control Board Workshop on Amending the 1995 Bay Delta Water Quality Control Plan, March, 2005.

San Joaquin River Water Quality Management Group 2005. Summary Recommendations of the San Joaquin River Water Quality Management Group for Meeting the Water Quality Objectives for Salinity Measure at Vernalis and Dissolved Oxygen in the Stockton Deep Water Ship Channel, August 2005.

Steiner, Daniel B. 2005a. CALSIM II – San Joaquin River Basin Refinements and Results Presented by Daniel Steiner on Behalf of the San Joaquin River Group Authority, March 14, 2005.

Steiner, Daniel B. 2005b. Presentation of Daniel B. Steiner Concerning San Joaquin River Hydrology and Alternative Flow and Quality Objectives at Vernalis Prepared by Daniel B. Steiner, Consultant to San Joaquin River Group Authority, for the California State Water Resources Control Board Periodic Review of the 1995 Water Quality Control Plan for the San Francisco Bay / Sacramento – San Joaquin Delta Estuary Workshop, March 2005.

Steiner, Daniel B. 2005c. Memorandum to Tim O'Laughlin, San Joaquin River Basin Operations – "No Caps" Simulation, May 3, 2005.

Steiner, Daniel B. 2005 d. Expert Report of Daniel B. Steiner, Effects to Water Supply and Friant Operations Due To Changes in Releases to the San Joaquin River, August 19, 2005.

Steiner, Daniel B. 2005 e. Supplemental Expert Report of Daniel B. Steiner, Effects to Water Supply and Friant Operations Resulting From Plantiffs' Friant Release Requirements, September 2005.

Steiner, Daniel B. 2005 f. Supplemental Expert Report of Daniel B. Steiner, Effect to Hydrology Downstream of Friant Due To Alternative Release Requirements, September 2005.

5.2 Documents Reviewed and Considered In The Report

San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta) Program. Review of The 1995 Water Quality Control Plan for the San Francisco Bay/Sacramento –San Joaquin Delta Estuary Master List of Exhibits (Updated 8/31/05 – can be found at SWRCB website http://www.waterrights.ca.gov/baydelta/exhibits_list.htm).

San Joaquin River at Vernalis Salinity and Boron TMDL Document Index (can be found at http://www.waterboards.ca.gov/centralvalley/programs/tmdl/vernalis-salt-boron/index.hmtl).

San Joaquin River Dissolved Oxygen TMDL, Document Index (can be found at http://waterboards.ca.gov/centralvalley/programs/tmdl/sjr_do/index.html).

6.0 QUALIFICATIONS

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CAREER HISTORY

California State Water Resources Control Board **2002-2005**
Sacramento, CA

Appointed by Governor Gray Davis in May 2002, to serve on the SWRCB as Registered Civil Engineer Member with expertise in Irrigated Agriculture and Water Supply.

California Regional Water Quality Control Board **1997-2002**
Central Valley Region
Sacramento, CA

Executive Officer responsible for directing technical and management activities of 260 person staff at three Central Valley offices located in Fresno, Sacramento and Redding

McLaren/Hart Environmental Engineering Co. **1977-1996**
Rancho Cordova, CA

President & CEO **1992-1996**
CEO U.S. Operations **1991-1992**
Executive Vice President **1986-1991**
Vice President **1977-1986**

- Joined founders Fred and Cathy McLaren as a Vice President and first employee of McLaren Environmental Engineering in 1977. Acted as project / staff manager through the formative years as the firm grew to 50 employees by 1985. Beginning in 1986, utilized client relationships with Lockheed Missiles & Space in the San Francisco Bay Area and Northrop Corporation in Southern California to launch major new offices for the firm. Oversaw expansion of firm to mid – west and east coast in 1986-90.

- Participated in presentation of the Company to perspective buyers in 1988 with eventual sale to Sandoz Ltd. Of Basle, Switzerland, an international industrial conglomerate with $13 Billion in annual sales. As Executive Vice President in 1990, oversaw and directed integration of technical operations after acquisition by Sandoz of Fred C. Hart & Associates and merger of McLaren and Hart.

- Named CEO for U.S. operations of McLaren/Hart Environmental Engineering Corporation in July 1991.

- Named President and CEO of McLaren/Hart Environmental Engineering Corporation and MBT Environmental Laboratories (a McLaren/Hart Company) in July 1992.

- Served on Boards of Directors for McLaren/Hart Environmental Engineering Corporation, MBT Environmental Laboratories, Puris Corporation, and ALTA Laboratories.

- Served as a member of the Advisory Board for Kellogg Environmental Research Center at the Kellogg Graduate School of Management, Northwestern University, the Engineering Advisory Board for the Civil Engineering Department at University of California, Davis, the Environmental/Water Resources Engineering Advisory Committee at the California State University, Sacramento and Guest Lecturer for the U.C. Davis Environmental Studies Extension Program.

J.B. Gilbert & Associates, Planning & Engineering Consultants **1972-1977**
Sacramento, CA

Served as Senior Project Engineer for various environmental studies and wastewater management projects throughout Northern California, including major projects, as follows:

- Sacramento Regional Wastewater Management Program and City and County of San Francisco Wastewater Master Plan – environmental planning and feasibility and design studies for Regional wastewater management conveyance and treatment systems including development and feasibility analyses of combined sewer overflow control strategies.
- Tahoe Regional Planning Agency – A 2-year Basin-wide study funded by EPA under section 208 of the Clean Water Grants Program to evaluate the role of surface water runoff and erosion on the nutrient load to and associated impact on eutrophication of Lake Tahoe and to recommend appropriate land use controls.
- Dart Resorts, a subsidiary of Dart Industries – Conducted detailed studies of water quality and biota of the Truckee River from Lake Tahoe to Pyramid Lake to determine existing and future potential impacts of treated wastewater effluent discharges on the beneficial uses of the River. Included detailed review of existing wastewater treatment systems in North Lake Tahoe, Squaw Valley, Alpine Meadows, Truckee and Reno and the then proposed Tahoe Truckee Sanitation Agency tertiary wastewater treatment system. Also included extensive investigation and assessment of groundwater quality impacts from land disposal of secondary treated municipal wastewater.

Los Angeles County Flood Control District **1970-1972**
Los Angeles, CA

Staff engineer responsible for conducting various erosion control, groundwater recharge and stormwater design projects.

EDUCATION / REGISTRATIONS

- Kellogg Graduate School of Management, Northwestern University Advanced Executive Program (AEP), 1993
- M.S. Civil Engineering, California State University, Sacramento, 1974
- B.S. Civil Engineering, University of California, Davis 1970
- Professional Engineer, Civil Engineering, State of California, #C023768
- Professional Engineer, Civil Engineering, State of Nevada, #04243

Registered Environmental Assessor, State of California, #00600

EXPERIENCE SUMMARY

Over 35 years of professional technical and management experience in the field of environmental engineering.

Technical Experience

- Surface water and groundwater hydrologic studies
- Water quality assessments to determine chemical, biological and bacteriological impacts on beneficial uses of surface and groundwater from discharge of secondary and tertiary treated wastewater
- Planning, design, construction and operation of innovative, individual on-site wastewater treatment and disposal systems
- Municipal and industrial wastewater conveyance and treatment system planning, design and construction
- Hazardous waste site investigation and clean-up system design, construction and operation
- Environmental Impact Reports / Feasibility Studies for major wastewater management and land development projects
- Expert witness services and technical assistance to legal teams involving toxic tort and insurance recovery litigation

7.0 ATTACHMENTS