Draft Summary Recommendations of the San Joaquin River Water Quality Management Group for Meeting the Water Quality Objectives for Salinity Measured at Vernalis and Dissolved Oxygen in the Stockton Deep Water Ship Channel

1. Introduction

The purpose of this paper is to summarize the work of the San Joaquin River Water Quality Management Group (Group) during the period from May, 2004 to January, 2005. The ideas, information and concepts contained in this paper will be used to assist policy makers in deciding what actions will be implemented to meet water quality objectives in the San Joaquin River, specifically salinity at Vernalis and dissolved oxygen in the Stockton Deep Water Ship Channel (see Figure 1). Once agreement among policymakers has been reached regarding what action(s) will be then taken to meet the objectives it is anticipated that an agreement and appropriate environmental review will occur. Relative to the recommendations herein, a final report of the Group will be prepared detailing its investigations supporting these recommendations.

2. Objectives of the San Joaquin River Water Quality Management Group

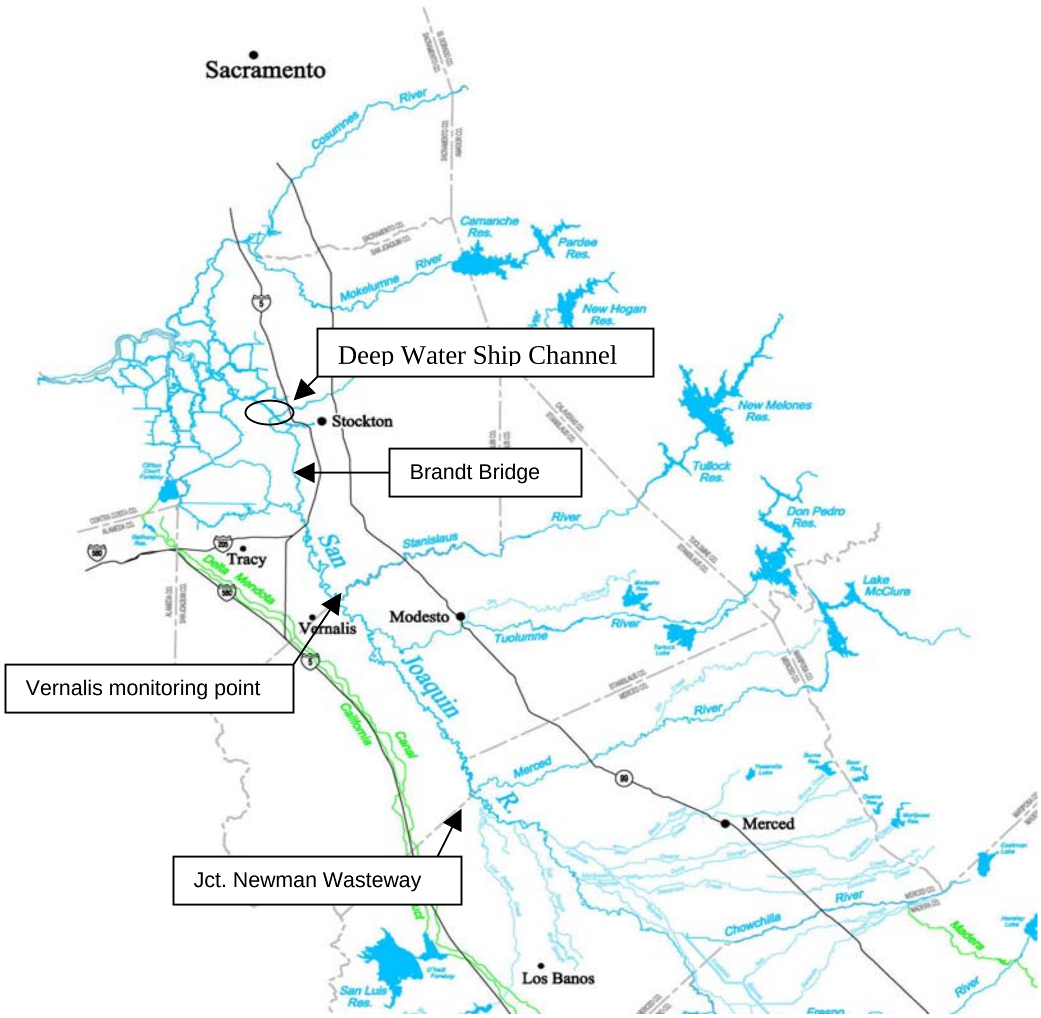
The Lower San Joaquin River (LSJR) is listed on the Federal Clean Water Act's 303(d) list of impaired water bodies for salinity and boron. The Stockton Deep Water Ship Channel portion of the LSJR is on the list for depressed dissolved oxygen (DO). The 303(d) listings require the development of Total Maximum Daily Load targets (TMDLs) to provide a basis to regulate discharges of salinity, boron and oxygen-demanding substances. The Regional Water Quality Control Board, Central Valley Region (RWQCB) has developed TMDLs for both salinity and boron and for dissolved oxygen depleting substances.[1] The RWQCB has adopted a TMDL and amendments to Water Quality Control Plan implementing the TMDL for Salinity and Boron. A TMDL has been adopted for Dissolved Oxygen and Basin Plan amendments are scheduled for a January 2005 hearing.

As discussed in the TMDLs and adopted and proposed amendments to the Water Quality Control Plan, the water quality problems of the LSJR are complex. Due to the highly modified nature of the San Joaquin River, solutions to both salinity/boron and DO are not readily available by approaching the problem through a load reduction strategy alone. Additionally, the RWQCB does not have the authority to regulate flow and thus its ability to effect solutions is limited to load-based solutions. Flow regulation is the domain of the State Water Resources Control Board.

[1] See the RWQCB's website at http://www.swrcb.ca.gov/~RWQCB, Central Valley Region5/programs/tmdl for TMDL documents.

The San Joaquin River Water Quality Management group is an informal group of stakeholders coming together to develop cooperative solutions to achieve the water quality objectives targeted by the TMDLs.[2] Participants within the Group can affect

Figure 1 Lower San Joaquin River



[2] Participants in the Group include: •U.S. Bureau of Reclamation Department of Water Resources•Central California Irrigation District•Friant WaterUsers Authority•Grassland Water District•James Irrigation District•Merced Irrigation District•Modesto Irrigation District•Oakdale Irrigation District•San Luis Canal Company, Exchange Contractor•San Joaquin County and Delta Water Quality Coalition•San Joaquin County RCD•San Joaquin River Exchange Contractors Water Authority•San Joaquin Valley Drainage Authority•San Joaquin River Group•San Luis and Delta Mendota Water Authority•South San Joaquin Irrigation District• South Delta Water Agency •State Water Contractors• Stockton East Water District•Tranquility Irrigation District•Turlock Irrigation District•Venice Island RD 2023•California Farm Bureau•Western Growers

water quality in the River with tools and strategies beyond the RWQCB's authorities in a TMDL.

The water quality objectives this Plan intends to address are shown in Table 1.

Table 1 Water Quality Objectives Addressed by the San Joaquin River Water Quality Management Plan	
Salinity and Boron : San Joaquin River at Airport Way Bridge, Vernalis, CA	Maximum 30 day running average of Electical Conductivity (EC) (*mmhos/cm*), All water year types: April-August 0.7 EC Sept.-March 1.0 EC
Dissolved Oxygen: San Joaquin River between Turner Cut and Stockton	Minimum DO (mg/l), all water years types, September-November – 6.0 mg/l, December- August 5.0 mg/l

Simply stated, the primary objective of the Group is to:

> ***Prepare and implement a plan to meet the water quality objectives for Salt and Boron at Vernalis and Dissolved Oxygen at the Stockton Deep Water Ship Channel in coordination with CALFED Stage I objectives***[3]

3. Secondary Objectives of the San Joaquin River Water Quality Management Group:

Recognizing the interconnected nature of water quality, water supply and wildlife and wildlife habitat protection issues, members of the Group also want to see the primary objective accomplished in ways compatible with the following secondary objectives. Each member of the Group does not necessarily share these secondary objectives, nor do they accept responsibility for their respective implementation. They are listed here to provide information relative to expectations in the community of stakeholders relative to improving water quality in the lower San Joaquin River. Several of these objectives focus on meeting water quality needs of the south Delta and/or providing supplemental flows for agricultural and fisheries purposes on the lower San Joaquin River.

[3] This plan incorporates real-time management elements and other strategies contemplated in but not able to ordered under the RWQCB's TMDLs. It is consistent with the real time management strategy discussed in the Salinity TMDL.

The following list of secondary objectives is not in any priority nor is it necessarily all-inclusive. Certain of these objectives may be aided by the incidental flow benefits afforded by recirculation or through use of New Melones water savings resulting from reduced dilution flow requirements associated with Westside salt load reductions.

a. Implement the Delta Improvements Package (DIP).
b. Minimize Delta water losses that impact CVP-SWP exports.
c. Maintain adequate flows and water levels in the San Joaquin River between Vernalis and the head of Old River to support diverters.
d. Maintain adequate water levels in the south Delta.
e. Improve Delta water quality for ecosystem and drinking water uses through DIP actions such as Franks Tract levee restoration
f. Maintain viability of wildlife refuges and irrigated agriculture
g. Reduce demands on New Melones Reservoir to achieve water quality and flow objectives, including but not limited to Vernalis salinity and flow, and dissolved oxygen on the Stanislaus River.
h. Minimize re-directed impacts

The Group recognizes that there are established water quality objectives that have not been explicitly identified as being targeted by the Group to be addressed but are related to the Group's primary objectives. Resolving salinity issues at Vernalis, in conjunction with SDIP barrier operations, should in most instances resolve salinity issues at the Brandt Bridge and other south Delta compliance locations. Flow objectives have only been addressed relative to resolution of Stockton DO issues.

4. Summary Nature of the Salinity Problem

The spatial and temporal nature of the salinity problems in the LSJR at Vernalis and downstream are described in the RWQCB's TMDL reports. However, this description did not include recent flow information as a result of physical changes in drainage areas and changes in water flows brought about through implementation of the Central Valley Project Improvement Act, an in particular, newly available refuge supplies.[4] In brief, the salinity problem for the LSJR is a lack of river flow combined with relatively high loadings of agricultural and urban sources of dissolved solids. High salinity levels threaten beneficial use of water in the LSJR for agricultural uses during the growing season. Additionally, the secondary maximum contaminant level for drinking water beneficial uses is 900µS/cm EC. Achieving the agricultural based standards will also protect drinking water beneficial uses.

[4] See also discussion under 6. a. Baseline of Violations, Salinity.

Table 2.
Additional Water Quality Control Plan Flow and Salinity Objectives

Flow Standards: San Joaquin River at Airport Way Bridge, Vernalis, CA – Minimum Monthly Average[5]	Feb-Apr 14 And May 16-Jun	Wet and AN 2,130 or 3,420 cfs
		BN, Dry – 1,420 or 2,280 cfs
		Critical – 710 or 1,140 cfs
	Apr 15-May 15	Wet 7,330 or 8,620 cfs
		AN 5,730 or 7,020 cfs
		BN 4,620 or 5,480 cfs
		Dry 4,020 or 4,880 cfs
		Critical 3,110 or 3,540 cfs
	October	All
Delta Salinity Standard: San Joaquin River at Brandt Bridge and other South Delta locations	All Years: April-August 0.7 EC Sept-March 1.0 EC (1.0 EC at all times after installation of in-delta barriers)[6]	
Delta Municipal & Industrial Chloride Objective: Pumping Plant #1 or SJR at Antioch Water Works Intake	Number of Days less than 150 mg/L Chloride (within intervals lasting at least 2 weeks)	Wet, 240 days
		AN, 190 days
		BN, 175 days
		Dry, 165 days
		Critical, 155 days
Delta Municipal & Industrial Chloride Objective: All Delta drinking water intakes	250 mg/L Chloride	Maximum mean Daily

[5] Partial months are averaged for that period. For example, the flow rate for April 1-14 would be averaged over 14 days. The 7-day running average shall not be less than 20% below the flow rate objective, with the exception of the April 15-May 15 pulse flow period when this restriction does not apply. The water year classification will be established using the best available estimate of the 60-20-20 San Joaquin Valley Water Year Hydrologic Classification at the 75% exceedence level . The higher flow objective applies when the 2-ppt ishohaline (measured as 2.64 mmhos/cm surface salinity) is required to be at or west of Chipps Island.

[6] Under Revised Water Right Decision 1641 (D-1641), DWR and Reclamation permits are conditioned on implementing a 0.7 EC objective at three locations: San Joaquin River at Brandt Bridge (C-6), Old River near Middle River (C-8), and Old River at Tracy Road Bridge (P-12) during April through August, beginning April 1, 2005, unless permanent barriers are constructed, or equivalent measures are implemented, in the southern Delta, and an operations plan that reasonably protects southern Delta agriculture is prepared. If these measures are taken, the salinity objective may remain at 1.0 EC year-round.

5. Summary Nature of the Dissolved Oxygen Problem.

The dissolved oxygen problem is described in detail in the RWQCB's TMDL reports on dissolved oxygen issues in Stockton Deep Water Ship Channel. The dissolved oxygen problem is described as a three-way interaction of low river flows, the presence of an unnaturally deep channel structure (Stockton Deep Water Ship Channel) and loadings of oxygen demand substances from upstream urban and agricultural sources. These factors together create a slack-water zone with low light penetration and resulting anoxic conditions. Low dissolved oxygen is thought to be a problem for resident and anadromous fish migration.

6. Baseline of Violations

a. Salinity

San Joaquin River watershed hydrology and operations are derived from a preliminary baseline study that was developed as part of Reclamation's on-going CALSIM refinement effort. This on-going effort is updating a 1980s-vintage depiction of numerous San Joaquin watershed attributes, including:

- Land-use based diversion requirements for East-side tributary systems
- East-side tributary system and Friant Division operations
- West-side return flows, inclusive of current wildlife area water supplies and operations
- Current regulatory and institutional operational objectives
- Linked Node approach to water quality modeling (disaggregation of water quality elements)

The refined baseline is substantially different from the earlier baseline. In particular, the refined baseline shows higher Vernalis flows and a dramatic change in San Joaquin River water quality in the summer months. New Melones dilution requirements now occur during winter, spring and summer months, in contrast to the earlier baseline depiction that suggested that dilution requirements were generally limited to summer months. This paradigm shift results from tracking known flow sources and their associated water quality (based on recent records) as opposed to using flow-salinity relationships (based on older records). The summer dilution requirement is much lower in the refined baseline, apparently a reflection of changed conditions within the watershed.

The earlier baseline depicted a Vernalis salinity objective that was exceeded in approximately one-third of all years. The refined baseline characterizes Vernalis salinity violations as follows:

- 13 monthly violations occur over the 73-year period of analysis. These violations occur during 7 different water years.
- 11 of these monthly violations occur during 5 years of the 1987-92 drought.
- 5 of these monthly violations occur during summer months (July-September).

b. Dissolved Oxygen

Low dissolved oxygen generally occurs in the Stockton Deep Water Ship Channel up to about Turner Cut. The point of greatest DO depletion tends to shift downstream with increased flow rates. Low dissolved oxygen is rarely a problem when flows exceed about 1,500 cfs. Worst months for DO tend to be June through October of dryer years with excursions about a third of the time during this period. Exceedences can also occur, however, in winter months of dryer years when flow is low.

7. Solution Tools Evaluated

A variety of flow augmentation and pollution reduction tactics or tools were evaluated in the development of the San Joaquin River Water Quality Management Plan. The following table briefly describes the results of individual analysis of each tool. Promising tools were combined and their effects modeled as described in the following section.

Table 3. Solution Tools Evaluated

Tools	Evaluation Findings
Flow Tools	
Recirculation	Highly effective when capacity is available to effect salinity reduction and improve river flows. Available July- Sept., with potential availability Oct.-Dec.
Transfers	Up to 12,000AF of water upstream in San Joaquin River Watershed may be available on an interim basis for strategic transfer and targeted salinity improvements needs.
HORB Operations	Planned HORB operations in conjunction with an SDIP will improve lower San Joaquin River flows. Expanded operation ability for the Barrier should be sought (e.g. June-Sept).
Load Reduction/Management	
West Side Regional Drainage Plan Actions	Ongoing and planned programs will create large salt reductions and associated dissolved oxygen load reductions.
Interception of saline groundwater at river	Expensive relative to other load reduction techniques available.
Storage for agricultural discharges	Expensive relative to other load reduction techniques available. Attractive nuisance issues for waterfowl. Potential strategic application.
Re-management of wildlife area discharges	Potential to assist in critical spring periods in conjunction with upstream releases; more study needed
Franks Track reconstruction	Promising Long-term action to improve load generation

Urban recycling/exchanges for High quality river flows	Minimal potential
Increased wastewater treatment	Adopted ammonia load reductions for Stockton WWTP will lower dissolved oxygen loading
Other: Dissolved Oxygen Aerator	Demonstration Project Aerator should proceed and be studied in conjunction with other tools implemented.

8. SANMAN Model and Modeling

The SANMAN Model Detailed Assumptions Paper, January 7, 2005, summarizes the logic used in SANMAN to estimate water quality effects of the various San Joaquin River Salinity Management actions measured at Vernalis. The SANMAN model represents salinity actions only. It is not a dynamic dissolved oxygen model capable of initially calculating effects of salinity management actions and then applying dissolved oxygen solution actions. It can, however, calculate resultant flow from salinity control actions which can be useful in addressing flow-related aspects of dissolved oxygen impairment.

a. Baseline CALSIM Studies

Because a CALSIM study with an updated San Joaquin River basin hydrology and operations fully integrated into a system-wide hydrology and operations is not currently available, two CALSIM studies are therefore employed to characterize Delta and San Joaquin River baselines in SANMAN.

Hydrology and operations for the Delta and Sacramento River watershed are based on the final (Environmental Water Account) step of Reclamation's OCAP CALSIM Study #5 dated January 21, 2004. Assumptions include, among other things, a 2020 level of development, Banks Pumping Plant at a permitted capacity of 8500 cfs, a 400 cfs DMC-California Aqueduct intertie, SWP and CVP water transfers, EWA and JPOD actions, and Cross Valley Canal wheeling. The SANMAN period of analysis approximates the CALSIM 73-year hydrologic sequence, including the period March 1922 thru September 1994. The analysis uses a monthly time step except during the April-May period, when a split-month time step is used.

Hydrology and operations for the San Joaquin River watershed are derived from a preliminary baseline study developed as part of Reclamation's on-going CALSIM refinement effort. Refinement or revision of watershed attributes include East-side land-use and tributary operations, Friant Division operations, West-side return flows, current wildlife area supplies and operations, disaggregation of various water quality elements and current regulatory and institutional objectives.

b. Vernalis Salinity Objective

The baseline Vernalis salinity objective is in accordance with D-1641: 0.7 mS/cm during April thru August and 1.0 mS/cm during September thru March. To allow post-analysis of changing San Joaquin River conditions, SANMAN removes the baseline New Melones operation provided by CALSIM to determine the New Melones baseline releases that could be modified and re-operated in reaction to changed water quality conditions in the San Joaquin River, and to provide a "without New Melones water quality release" depiction of flow and quality at Vernalis. SANMAN then re-operates New Melones to meet Vernalis water quality objectives in accordance with SANMAN computations of water quality mass balance.

c. Delta Conditions

Delta export water quality at Banks and Tracy is assumed to correlate with CALSIM-derived water quality at Rock Slough. The Delta is assumed to be in balance under base and action conditions. This assumption is used in the computation of water cost associated with salinity management actions. Stockton flow, a surrogate measure of dissolved oxygen conditions, is estimated as a function of Vernalis flow, barrier operations at the Head of Old River, and San Joaquin River consumptive use between Vernalis and Stockton.

Interim Operations Plan

New Melones baseline water quality and dissolved oxygen releases were removed and re-introduced in accordance with the Interim Operations Plan. Annual accounting of New Melones water quality releases follows a March thru February water year and is linked to five water supply classifications.

d. Delta Pumping Capacity Availability for DMC Re-circulation

The following pumping capacity priorities have been established to arrive at the net capacity available for recirculation operations, based on a physical capacity at Banks of 8,500 cfs:
:

- The priority for Tracy pumping capacity is as follows: (1) CVP contract deliveries, (2) export of additional CVP stored water, (3) CVP water transfers, (4) SWP exports through JPOD, and (5) DMC re-circulation.

- The priority for Banks capacity is as follows: (1) SWP contract deliveries, including a July through September EWA reservation up to 500 cfs, (2) SWP water transfers, (3) additional EWA reservation, (4) CVP exports and refuge supplies through JPOD, and (5) DMC re-circulation.

- Availability of Delta pumping capacity at Banks and Tracy is constrained by the maximum export-to-inflow (E/I) ratio as specified in D-1641. SANMAN allows the user to define DMC re-circulation alternatives that "purchase" additional pumping capacity by releasing additional Delta inflow, thereby "paying" the E/I cost.

Other assumptions related to exports for contract deliveries, additional export of CVP stored water, water transfers, the Environmental Water Account, JPOD and "lumped" summer capacity are contained in the SANMAN Model Detailed Assumptions Paper, January 7, 2005. Table 4 depicts the model runs that have been made and analyzed in the course of the Group's studies.

Table 4
Model Runs Executed
In Development of SJRWQMP Recommendations

Scenario	Description
	ISOLATED ACTION STUDIES
IA1	No Action
IA2	SJR Improvement Project
IA3a	20% Drain Reduction: Exchanger Region
IA3b	50% Drain Reduction: Exchanger Region
IA3c	20% Drain Reduction: Upper DMC Regions
IA3d	50% Drain Reduction: Upper DMC Regions
IA5a	Refuge Return Flow Storage Retention: 5 TAF
IA5b	Refuge Return Flow Storage Retention: 10 TAF
IA6	Mid-Priority DMC Re-circulation: Jul-Sep
IA7	High-Priority DMC Re-circulation: Jul-Sep
	COMPOSITE ACTION STUDIES
CA1	IA2 + Targeted Re-circulation & New Melones
CA2	Refuge Retention + High-Priority Recirc: Jul-Sep
	SENSITIVITY STUDIES
S1	High-Priority DMC Re-circulation: Year Round
S2	High-Priority Recirc: Year Round w/ Flow Targets
S3	High-Priority Recirc: Jul-Sep w/o DO Releases
	DRAFT PREFERRED ALTERNATIVE: ▪ Phased implementation of SJRIP (10-100%) ▪ Strategic water transfers

	▪ DMC re-circulation
MP-10 thru MP-100	Mid priority re-circulation with modified Stanislaus DO compliance
HP-10 thru HP-100	High priority re-circulation with modified Stanislaus DO compliance
MP-10DO thru MP-100DO	Mid priority re-circulation with existing Stanislaus DO compliance
HP-10DO thru HP-100DO	High priority re-circulation with existing Stanislaus DO compliance

9. Modeling Results and Recommendations

a. Short Term Actions

Modeling of the various tools evaluated by the Group has shown the proposed actions have a robust ability to improve salinity conditions on the LSJR. Foremost among these tools are elements of the West Side Regional Drainage Plan[7]. One element of this Plan, the San Joaquin River Improvements Project (SJRIP) had sufficient detail to allow quantification of its effects. Full implementation of the SJRIP alone can eliminate salinity violations. However, implementation of the SJRIP and the West Side Regional Drainage Plan will take nearly a decade and use of recirculation and transfer tools can supplement efforts to eliminate exceedences of water quality objectives in the interim while the Drainage Plan is implemented over time.

The elements of an interim strategy to comply with Salinity objectives at Vernalis are as follows:

1. Permitted Banks Pumping Plant capacity at 8,500 cfs (allows for recirculation capacity).

2. Recirculation of water via the Delta Mendota Canal and released into the Newman wasteway leading to the LSJR during July-September.[8]
3. Phased implementation of the West Side Regional Drainage Plan and the SJRIP.
4. Strategic water transfers during dry and critically dry years from the San Joaquin River Group members not to exceed 12,000 af/yr when water is otherwise unavailable at New Melones Reservoir.
5.Modified Stanislaus River dissolved oxygen compliance location to preserve New Melones Storage.[9]

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[7] Elements of the West Side Regional Drainage Plan are:
[8] Analysis below assumes high-priority recirculation, meaning recirculation capacity is used prior to New Melones releases. Each have policy implications as discussed in Section 10

Additional measures to assist in meeting Dissolved Oxygen objectives include:

6. Operable barriers in the south Delta and expanded use of a Head of Old River Barrier to be available April-November.
7. Phased implementation of the City of Stockton's ammonia removal project.
8. Installation of the demonstration aeration project in the Stockton Deep Water Ship Channel.

As soon as the recirculation capacity is available and Head of Old River barrier is in place, compliance can be assured for salinity at Vernalis by primarily relying on recirculation flows, reduced New Melones releases and some water transfers in the driest years. As the West Side Regional Plan elements are phased in, there is a diminishing need for water transfers and use of recirculation in order to achieve the water quality objectives as shown in Table 5. It should be noted that measures 1, 3, 5, 7 and 8 are activities that are all being pursued independently at this time. Item 6, operable Delta barriers and the HORB are also being pursued independently but expanded use of the HORB is considered here. Stockton's ammonia removal project is part of a compliance program under their NPDES permit. This plan ties together these activities currently underway with other actions to effect the desired outcome of improving water quality in the LSJR.

Table 5
Use of Recirculation and Transfers Relative to Increased Implementation of West Side Drainage Plans[10]

Percent of Implementation of SJRIP portion of West Side Regional Drainage Plan	Critical Year Costs & Benefits (TAF)		Water Transfers	
	Recirc	New Melones Savings	Frequency (Years)	Max Annual (TAF/yr)
0	0	0	7	23
10	84	45	2	22
20	72	49	2	16
30	60	53	1	10
40	48	57	1	5
50	38	61	0	0
60	27	65	0	0
70	16	68	0	0
80	9	71	0	0
90	4	74	0	0
100	1	75	0	0

[9] This objective is for protection of steelhead salmon and should be moved from Ripon to Orange Blossom Bridge, where the habitat for steelhead is on the Stanislaus to better represent the protection sought. This change is not considered controversial.
[10] Incorporates modification of Stanislaus River DO monitoring location

While elimination of episodes of low dissolved oxygen remains a primary objective of the plan, the efficacy of the tools to address this problem can not be accurately predicted at this time due to the more dynamic nature of that problem and lack of reliable models which account for all the variables in play. However, an operable Head of Old River barrier coupled with recirculation in summer months could increase flows in the lower San Joaquin River, to the point where dissolved oxygen rarely seems to be a problem. Such operations would need to be balanced and coordinated with operation of the barrier to meet operational objectives within the South Delta in order not to cause unintended problems while attempting to improve DO conditions. At this writing, further studies of these interactions are underway. Additional flexibility in use of the barrier in winter months of dryer years would be necessary to augment flows in conjunction with transfers to reduce or eliminate those more rare excursions in those months. Coupled with the City of Stockton's ammonia removal project and provided the demonstration project aerator which can artificially supplement channel oxygen levels proves effective[11], it is believe that dissolved oxygen excursions can be significantly reduced and likely eliminated. Operation of these tools on a real time basis will allow experience to be developed in refining how the tools can be applied over time given various circumstances in order to find the precise combination of actions that can achieve the objective. Further, as additional studies progress on upstream loads and flows, the collective understanding of this problem and the ability to solve it should improve with time.

b. Longer Term Actions

Over the longer term, 5-10 years, continued implementation of the West Side Regional Drainage Plan will diminish the need for recirculation and transfer demands. Additional improvements could be made through modified management of wildlife refuge water releases, delaying storage releases and timing releases in combination with assimilative capacity. Additional water quality improvements could be achieved through modification of Frank's tract levees, which has been shown to be able to reduce salts exported into West side drainage areas by about 20% in late summer and fall months of dryer years. This would have an unknown yet beneficial impact on the amount of salt eventually returning to the LSJR.

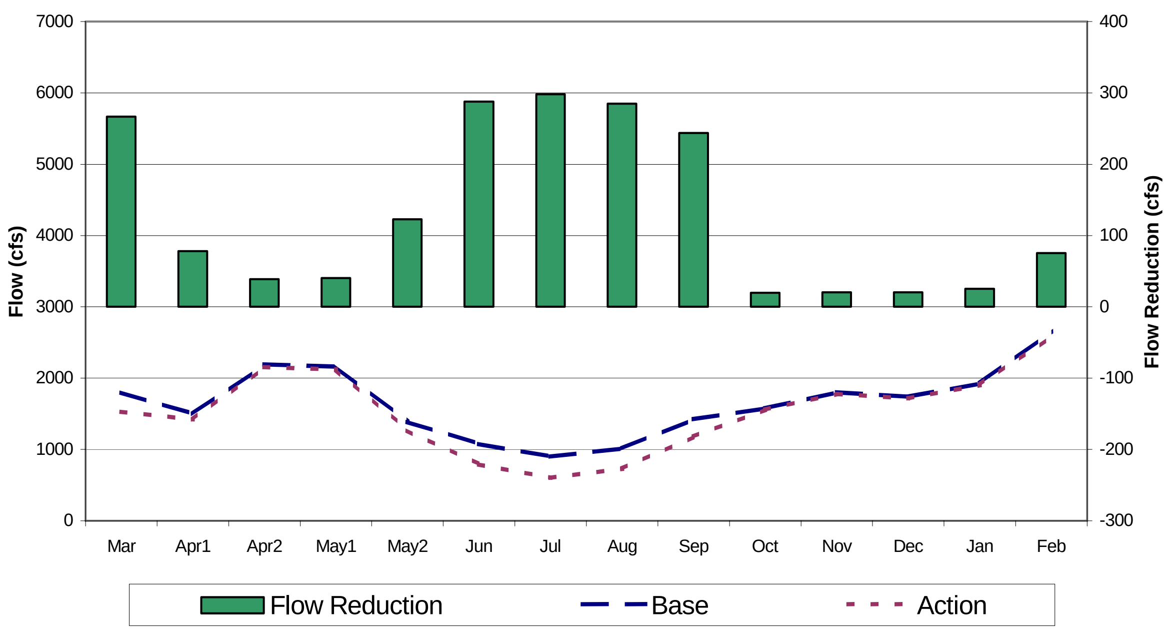
As operational experience is gained combining recirculation, HORB operations, reductions of salt and dissolved oxygen load and operation of a demonstration aerator, adjustments can be made to increase the availability of the HORB and recirculation provided other impacts can be successfully addressed. Experience will also improve the ability to utilize the aerator and evaluate trade-offs between use of the aerator and other tools.

10. Implementation Issues

There are a number of physical and institutional issues that arise in pursuing the recommended strategy for resolving salinity and dissolved oxygen problems as discussed herein. The following summarizes these issues and offers approaches to address them.

a. **Lowered flows/flow maintenance on LSJR**. As shown in Figure 1, the recommended alternative at the point where full implementation of the SJRIP portion of the West Side Drainage Plan has the effect of reducing flow during critical periods along the LSJR. Flows below 1,000 cfs are a potential problem for diverters on the LSJR, with water levels being potentially insufficient to allow pumping to occur. As this would occur in summer months of these year types, recirculation could be increased to provide for additional flow. This additional flow would also have the added benefit of reducing potential dissolved oxygen problems during these periods, provided flow could be maintained in the main stem of the river by operating the HORB. Such operations would need to be balanced and coordinated with operation of the barrier for other needs. Studies of how this might be accomplished are underway.

Figure 1. Vernalis Flow Under Fully Implemented Recommended Alternative During Critical Years with High Priority Recirculation



b. **Brant Bridge salinity objective**. Analyses under this paper and runs of the SANMAN model have been targeted to meeting the Vernalis salinity objective. A similar objective exists further downstream at Brandt Bridge. To account for depletions between Vernalis and Brandt Bridge, when necessary small additional amounts of recirculation capacity and/or transfers could be utilized to achieve salinity objectives at Brandt Bridge, provided flows could be maintained in the main stem of the river as noted in (a.) above.

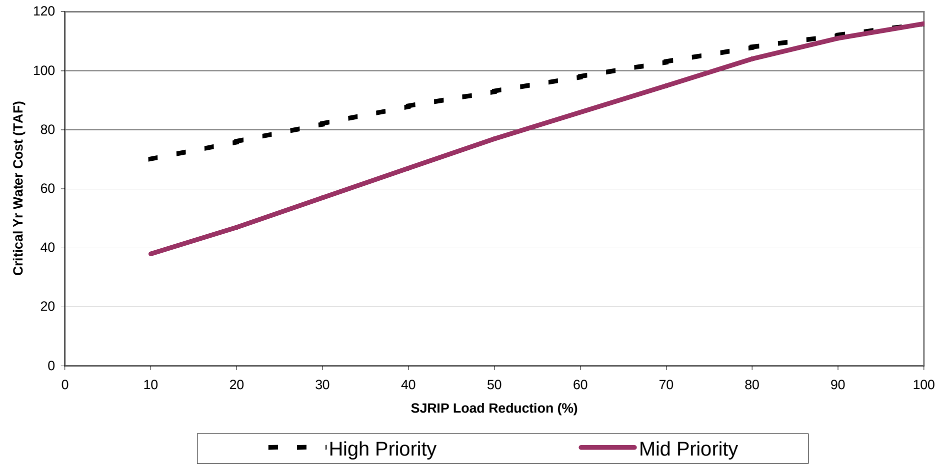
c. **Water Costs**

The SANMAN model computes two water cost values: (1) “net” water cost that includes all Delta components and (2) “re-circulation” water cost, a subset of “net” water cost that is limited to re-circulation components. The reason for this distinction is that water costs other than those associated with “re-circulation” are operational actions of the SWP/CVP operating systems in response to the effects of implementing the San Joaquin River Salinity Management actions. This distinction and the responsibility for both types of water costs need to be addressed as the study proceeds.

d. **Anti-degradation**. Due to continued urbanization of the San Joaquin Valley and implementation of conservation measures, salt loading is likely to increase from urban discharges, point and non-point and dilution flows will diminish somewhat over time. The Regional Board can address increased salt loadings through its NPDES permit process and non-point programs can at least partially address other sources. Adjustments to recirculation use and continued use of upstream transfers would be other potential tools to address changing circumstances, which are not expected to be dramatic in any event.

e. Delta Water “Costs” and High Priority vs. Mid Priority Recirculation –A solution utilizing high-priority recirculation (recirculation is utilized before New Melones releases to meet salinity objectives)will reduce the amount of water available to CVP and SWP export contractors as shown in Figure 2. Mid-priority for recirculation would utilize New Melones releases before recirculation, thus lowering, but not eliminating, this impact. Such losses can be viewed as an artifact of the operations and is not an interference with respect to SWP water rights. For the CVP, the USBR would have the responsibility to make any adjustments to its various contractors in distributing water supply impacts between increased New Melones storage and export contractor losses.

Figure 2
Delta Water Costs for Phased Implementation of Recommendation



A policy choice exists between making use of recirculation as a high or mid-priority. The Vernalis objective can be met regardless. A mid-priority choice would lower water costs to export users but limit benefits at New Melones and require more use of transfers in dryer years. In the end, as the load reduction brought on by full implementation of salt load reduction actions on the west side of the Valley occurs, recirculation is no longer needed to meet the salinity objective at Vernalis.

f. **Real time management**. Implementation of the recommendation would require a mechanism for real-time management of the tools outlined in the recommendation. Incorporating this responsibility into the existing CALFED operations group responsibilities, along with increased representation for San Joaquin River stakeholders and asset operators could address this need.

11. Next Steps

a. **Costs and Cost Analysis**. The recommendation has not yet had a cost estimate in great detail. However, it is known that about $100 million is necessary to implement the West Side Drainage Plan in total. Other components of the Plan are already in progress and have funding, except for long-term operation of a dissolved oxygen aerator and payment of costs for recirculation. No additional capital projects appear necessary. A group of stakeholders has made a preliminary commitment to fund aeration costs.[12] Inasmuch as “new” water is created within New Melones reservoir, the opportunity appears for the USBR to fund recirculation costs within the

[12] San Joaquin River Group, State Water Project Contractors, Export CVP Contractors, Port of Stockton

operations of the CVP. Further analysis of costs, potential funding sources and funding responsibilities is needed.

b. **CEQA/NEPA needs analysis**. Many of the components of the recommendation are proceeding under separate planning functions, complete with appropriate environmental review. An analysis of the appropriate type of CEQA and NEPA documentation that would be necessary to implement the recommendation needs to be undertaken to develop and approach to complying with environmental analysis needs.