Sea level has risen by an estimated eight inches on average over the past one hundred years and is projected to rise by at least another one to three feet over the next 100 years (Twiss et al, 2006). This rise in sea level will have two important effects relative to salinity: 1) It will increase the risk of levee failures that could draw seawater into the Delta; and, 2) It will increase the tidal mixing of seawater into the western Delta (both scenarios will increase salinity at Delta diversions). The position of the salinity gradient in the Delta is determined largely by sea level and is likely to encroach further into the Delta as sea level rises.

After rainfall (captured in "inflow") the aspects of **meteorology** that have the biggest effect on hydrodynamics in the Delta are wind and barometric pressure. Strong westerly winds can push water upstream causing abnormally high tide stages and affecting the timing of the tides. Such winds are common in the western Delta during much of the year. During winter storms, wind effects can be exacerbated by low barometric pressure. The additive effects of reduced atmospheric pressure and strong upstream winds can produce storm surges that raise water levels by two feet or more.

## *The DRERIP Hydrodynamics Conceptual Model*

The conceptual model illustrated in Figure 24 is under development as part of the CALFED Delta Regional Ecosystem Restoration Implementation Plan (DRERIP). This diagram is the simplified version of the basic model diagram but still shows the complexity of the factors that drive salinity in the system. At the time of this report, the DRERIP hydrodynamics conceptual model is planned for web based deployment. Each
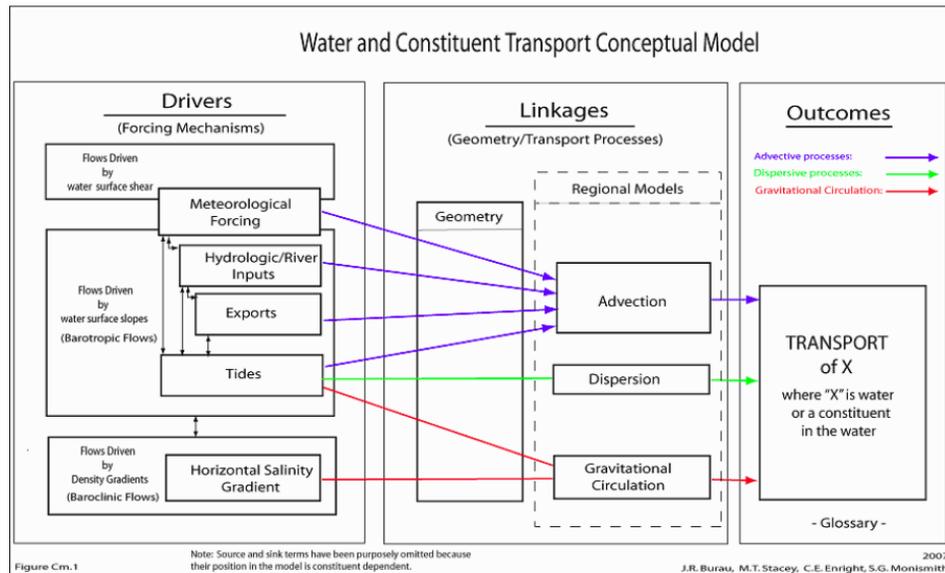


Figure 24: Conceptual model of the major hydrodynamic drivers and linkages in San Francisco Bay and the Delta (Burau et al, 2007).

of the primary drivers and linkages in the model will be expanded to include additional diagrams, text, and graphics to further explain the concept and provide supporting information. This web based conceptual model will be a more scientifically rigorous treatment of Delta hydrodynamics and will be easily modified as new information becomes available.

At its most basic level, water movement in the Delta is the result of fresh water flowing into the Delta, export pumping, tides, and flow driven by salinity gradients all acting through the complex geometry of the Delta. Tidal movement and density driven flow are the engines that move seawater into the Delta. Delta outflow (dependent on Delta inflow and diversions) pushes salinity out of the Delta. These two forces working against one another determine how much and how far salinity from seawater intrudes into the Delta. This is one way to look at what is better described as a dynamic salinity field acted on by the downstream flow of water, tidal mixing, and density driven movement of seawater in the upstream direction (baroclinic flow). This salinity field moves upstream and downstream, and expands and contracts, in response to the amount of freshwater entering the Delta, operation of Delta gates, the presence of barriers, and the amount of water pumped out of the Delta, tidal cycles, and other forces. The times of the year (usually late fall) when the Delta outflows are lowest and the field is furthest upstream are the most critical for drinking water quality.

It is important to note that the importance of the drivers shown in Figure 24 depends on the local area of interest within the Delta. Please refer to the conceptual model on the web for much more complete treatment of all aspects of Delta hydrodynamics including the geographic variation in drivers. The DRERIP conceptual models will be posted on the web at http://www.delta.dfg.ca.gov/erpdeltaplan/.

## *Tributary Conceptual Models*

Figures 25-27 capture the significant factors driving salinity in Delta tributaries. Dissolved solids (salinity) in most freshwater systems comes from a few major sources 1) natural dissolution of minerals in soils and rocks 2) agricultural chemicals 3) human or animal wastes and 4) waste from industrial chemical use. These salts are further concentrated through evapotranspiration, the evaporation of water from soil or water surfaces plus the transpiration of water by plants. Evapotranspiration is a dominant factor resulting in highly saline groundwater and drainage from irrigated lands in arid regions.

Separate conceptual model diagrams were developed for the west side of the San Joaquin Valley and the remainder of the Delta tributaries because of one unique source of salts. An estimated 513,000 tons of salt per year are transported into the west side of the San Joaquin Valley with the Delta water supplied through the Delta Mendota Canal (RWQCB, 2002). This is equivalent to about half of the San Joaquin River salt load. This salinity is a mixture of salt from seawater and salt from the tributaries and exacerbates the typical arid region irrigated agriculture problem of concentration through

evapotranspiration. Salinization of soils and groundwater is most pronounced on the west side of the San Joaquin Valley and in the Tulare Basin where land is irrigated with Delta water. In the San Joaquin River watershed, salinity is highest in the sloughs draining the Grassland area on the west side and is diluted by the flows of the east side streams. Approximately 67% of Lower San Joaquin salt load comes from the west side (RWQCB, 2002). Finally, just upstream of the point where the San Joaquin River meets the Delta, Stanislaus River releases from New Melones Reservoir are used to reduce salinity to meet the EC standard at Vernalis.
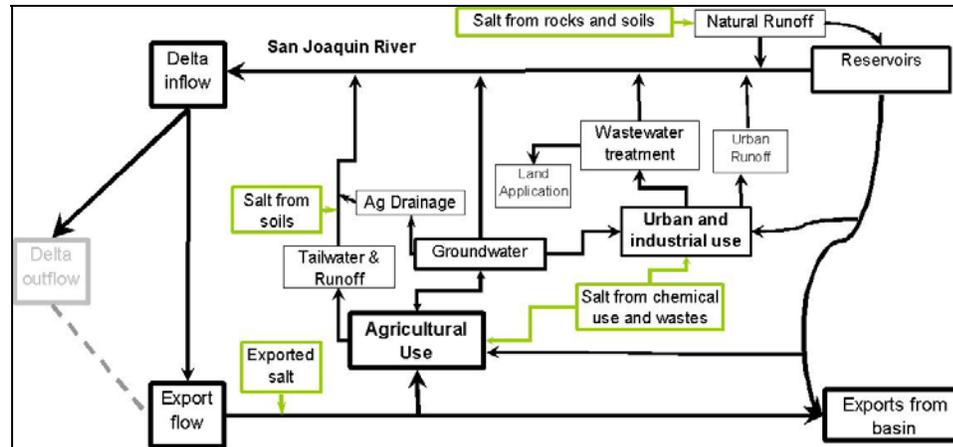


Figure 25: Conceptual model of the sources and transport of salinity in the west side of the San Joaquin basin.

In the San Joaquin Valley, the dominant sources of salinity are seawater from the Delta and natural minerals (mostly gypsum) in soils and rocks. The small amount of gypsum added to increase soil arability is thought to be insignificant compared to the amounts naturally present. Irrigation dissolves and mobilizes this store of salts. Other agricultural chemicals, animal wastes, and domestic wastewater also contribute but sulfate from gypsum dominates the salt load from the west side of the San Joaquin Valley. These sources along with the effects of evapotranspiration result in the very high salinity observed in some of the tributaries (Mud Slough for example, Figure 12). Figure 26 further illustrates the dominant sources and movement of salt in the west San Joaquin Valley. Irrigation practices, plant water utilization, and groundwater processes are central to understanding salt accumulation, mobilization, and movement associated with agriculture.

Figure 26 also illustrates the important role of consumptive use of water through evapotranspiration in western San Joaquin Valley groundwater and drainage salinity. Not shown in this figure is the significant fraction of this salt coming from naturally occurring minerals (mostly gypsum) in these soils.

Further evidence of the sources of salts in the San Joaquin River can be seen in the composition of the major ions. The ratio of chloride to sulfate in seawater is approximately 7:1. In the San Joaquin River the chloride/sulfate ratio is approximately

1:1 (DWR, 2004). The situation is complicated by the fact that a constantly varying fraction of the San Joaquin River salt load is re-circulated through the CVP and SWP diversions.
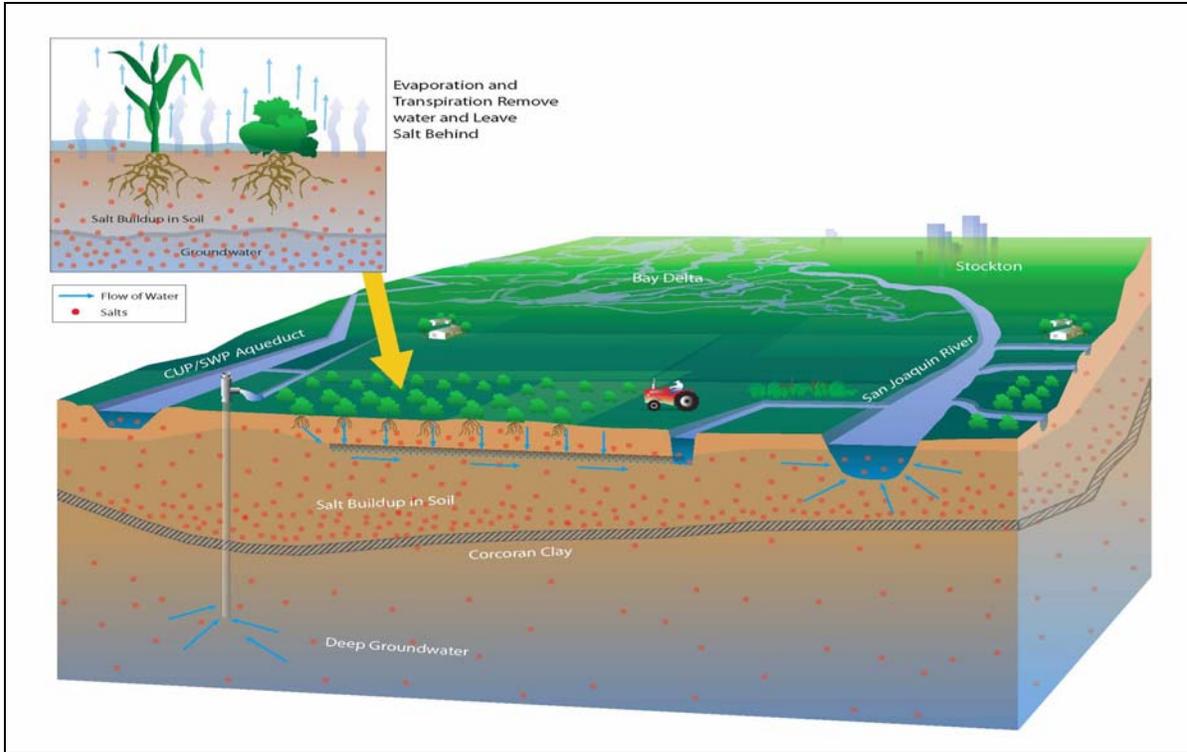


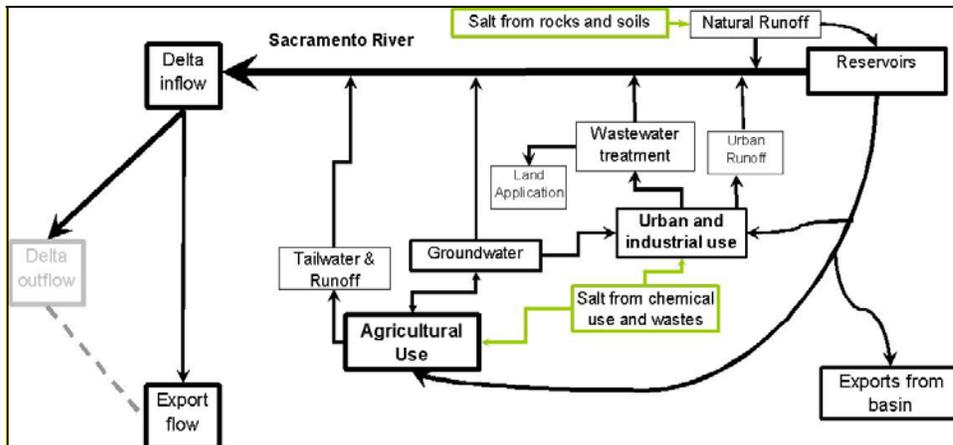Figure 26: Salt Sources and Transport in the San Joaquin Valley



Figure 27: Conceptual model of the sources of salinity in the Sacramento Valley and most other Delta watersheds.

The Sacramento River and other tributaries section of the conceptual model differs from that for the San Joaquin River only in the absence of the Delta diversion loop and the contribution

from soil gypsum. The natural watershed, agricultural, domestic wastewater sources, and other factors are similar. However, in the Sacramento River and most other major Delta tributaries, salinities are much lower than in the San Joaquin. This is primarily because of the much higher dilution flows, a result of the greater water supply in the northern half of the State. In an average year, approximately 85% of the Delta inflow comes from the Sacramento River yet the amount of acreage under cultivation in the Sacramento Valley is much less than in the San Joaquin Valley. The anion composition of the Sacramento River also indicates that gypsum is not a significant source of salt in the watershed.

# COMPUTATIONAL MODELS

In 1958, the U.S. Army Corps of Engineers constructed a physical model of San Francisco Bay and the Delta to address a number of management issues. This model, located in Sausalito, was used for scientific and engineering studies until 2000 and is still used as an educational tool. Now, computer models are the tools used by engineers and scientists to study and manage water in the Bay-Delta and its watersheds. These models have been designed for specific uses and vary considerably in complexity and performance. Models currently in regular use by the State and Federal water management agencies include DWR's Delta Simulation Model 2 (DSM2), CALSIM-II, and the Resource Management Associates (RMA) Bay-Delta Model. A number of other models are in-use by researchers and water management agencies varying in complexity from simple spreadsheet models to cutting-edge high resolution three dimensional models. Brief descriptions of the most commonly used models and their uses are provided here with examples of some of the model output tools of particular value for salinity management.

## DSM2

DSM2 is a river, estuary, and land modeling system based on a one dimensional link-node type of hydrodynamic and water quality model. It can simulate stages, flows, velocities, many mass transport processes (including salts), multiple non-conservative constituents, temperature, and movement of individual particles.

An example of the application of DSM2 is "fingerprinting." While we can (and do) monitor the flow and salinity of the major Delta tributaries we cannot predict what the resulting water quality will be at the water diversions without using a set of sophisticated computer models. This is because of the complex flow patterns and mixing that occur in the Delta's seven hundred miles of interconnected channels. The total Delta outflow is important in determining salinity at the pumps but so is the flow of the San Joaquin River itself, the ratio of San Joaquin River flow to export flow, and the configuration and operation of the Delta barriers (DWR, 2004).

Figure 28 shows a computer generated "fingerprint" of the sources of salinity at Clifton Court Forebay (feeds Banks pumping plant). It shows that the source of salinity can vary from more than 90% San Joaquin River to less than 20% over the course of a few months. Figure 29 is a volumetric fingerprint for the same period showing that even when the Sacramento River water makes up 80% of the flow at Clifton Court, it stills accounts for less than half of the salinity. The salinity graph also shows that the model does not account for all of the salinity that is monitored at Clifton Court. The DWR modelers
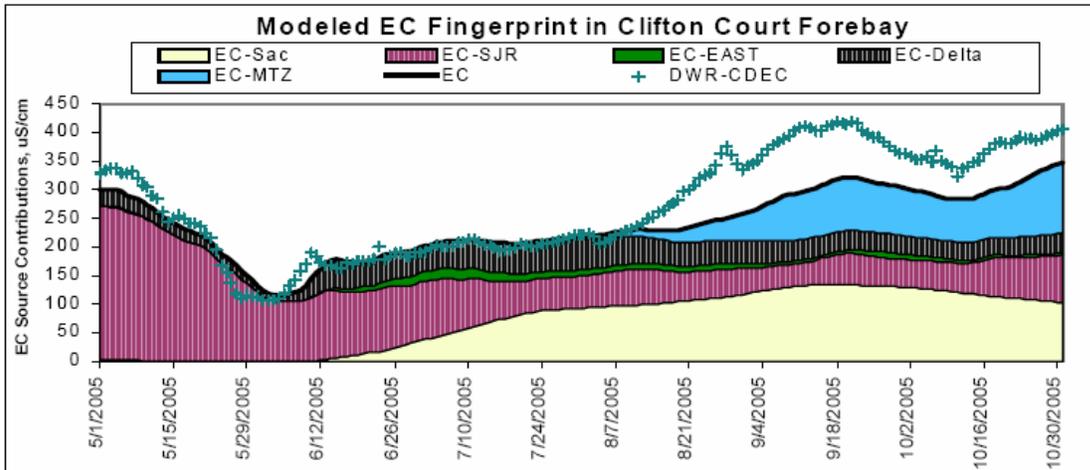
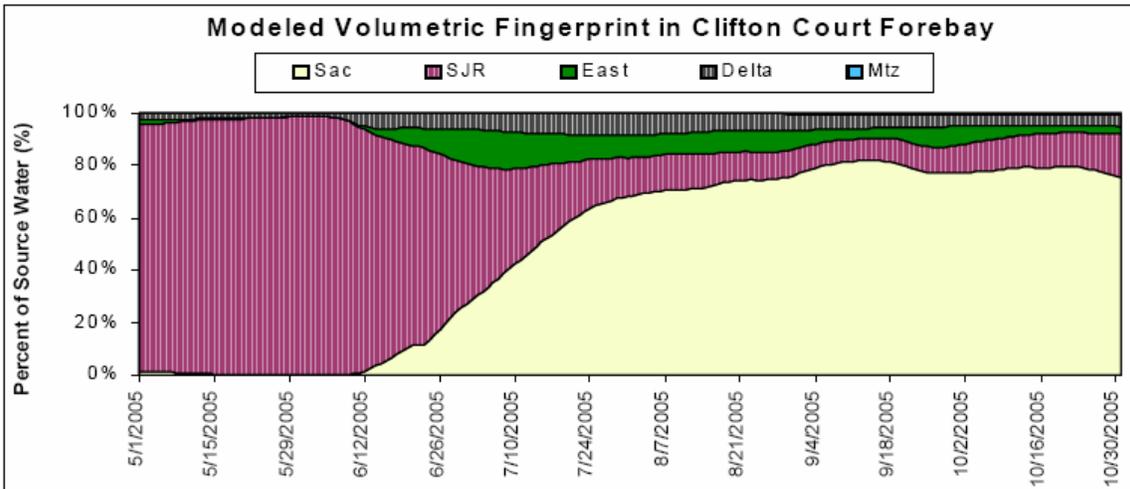Figure 28: Modeled Conductivity Fingerprint for Clifton Court Forebay
(DWR 2005)

Figure 28: Modeled Volumetric Fingerprint for Clifton Court Forebay
(DWR 2005)

think that the model is underestimating the amount of seawater salinity. Seawater salinity is represented by EC at the Martinez boundary of the model (EC –MTZ). Water quality at the export pumps can best be understood and predicted by monitoring flow and water

quality conditions at the major Delta inflows and modeling the movement of water in the Delta with an adjustment for Delta island consumptive use and discharge.

Further evidence for the validity of "fingerprinting" using the Delta models can be seen in analysis of the anion species composition of Delta waters. As discussed previously, San Joaquin River salinity has a much higher sulfate fraction than seawater. Thus the relative concentration of sulfate to total salts or sulfate to chloride can be used as a sort of tracer for San Joaquin water (DWR, 2004). Analysis of this kind of anion concentration data confirms the kinds of variation and the range that the modeling indicates.

## *CALSIM-II*

CALSIM is a generalized water resources simulation model for evaluating operational alternatives of large, complex river basins. It is used in planning studies and for development of operating rules for California's major water management systems.

## *RMA*

The Resource Management Associates (RMA) model is an advanced two dimensional model that more accurately simulates the movement of water and solutes in the large channels and flooded islands of the Bay and west Delta. It is being used extensively in planning studies in this part of the system. This kind of model is particularly useful for predicting the effects of major changes to Delta geometry such as the breaching of levees.

## *3-D Models*

Although not routinely used, advanced three dimensional (3-D) models have been developed and applied in limited areas for specific purposes. The intensive data and computational resource demands of these models generally limit their use to high priority problems. For example, three dimensional modeling has been essential to understanding the movement of water and fish at the intersection of the Sacramento River and the Delta Cross Channel.

# SALINITY MANAGEMENT

Here are some of the key findings from the salinity conceptual modeling exercise:

- Salinity at the Delta diversions comes primarily from seawater and naturally occurring minerals present in the San Joaquin River watershed.
- Discharges from urban and industrial sources are currently relatively minor sources of salt but should be monitored. New or increased industrial discharges in particular have the potential to contribute significant salt loads.
- Seawater intrusion into the Delta is highly dependent on the amount of Delta inflow.
- Water movement driven by the tides is the primary force moving seawater into the western Delta.
- When salinity and bromide are highest at the delta diversions, seawater is a significant contributing source.
- The ionic composition of San Joaquin River water is different from that of seawater and indicates that gypsum in soils is a significant source.
- The sources of the water and salts exported from the Delta at the SWP and CVP pumps vary seasonally and from year to year.
- Because regulatory standards for salinity in the San Joaquin River at Vernalis are met through release of additional water from storage in New Melones Reservoir, reducing salt loads upstream of Vernalis does not always improve water quality downstream. When salinity at Vernalis is controlled through dilution with New Melones Reservoir releases, upstream salinity reduction only serves to increase water supply by reducing the amount of New Melones water needed to meet the standard. That is, under current operations rules, salinity source reduction will only improve water quality downstream of Vernalis when the river is below the standard. A similar (although more complicated) effect may take place in the Delta when salinity standards are driving operations (reservoir releases and/or export pumping). Salinity source reduction may result in increased water supply (increased exports and/or reduced reservoir releases) rather than lower salinity in exported water.
- When San Joaquin River inflow exceeds approximately 3500 cfs, it is the dominant source of exported water at the SWP and CVP south Delta intakes.
- Bromide comes primarily from seawater in the Bay-Delta system. Median concentrations at the export pumps are about 16 times higher than in the Sacramento River at Hood and other Delta tributaries upstream of any seawater influence. (The CVP, SWP, west side San Joaquin Valley and the lower San Joaquin River are influenced by seawater and have elevated bromide concentrations.)
- Disinfection byproducts formed from bromide tend to have more serious health effects than those that do not contain bromine. These brominated chemicals are more likely to be the subject of future regulation.

Implications for Salinity Management

- Actions that reduce tidal pumping of seawater into the western Delta will reduce drinking water salinity when it is most critical (when it is highest).
- Reducing the seawater contribution to exported salinity will also do the most to reduce bromide concentrations in exported water.

- Reducing the amount of irrigation water applied on the west side of the San Joaquin Valley will reduce the amounts of naturally occurring salts leached into groundwater and into the San Joaquin River.
- Regulatory actions that reduce agricultural drainage discharges into the San Joaquin River will reduce river salinity but may not protect groundwater in the San Joaquin Valley in the long term.
- Standards specifically designed to improve salinity at the Delta diversions may be needed for source improvements to achieve the desired results. Under the current rules governing operations, upstream water quality improvement could be neutralized through reduced reservoir releases, increased pumping, or other changes to operations.
- Delta conveyance alternatives that separate high quality water from seawater will be highly effective.

## *Standards and Regulatory Programs*

Salinity in the Delta and its watersheds is largely managed through regulatory actions of the SWRCB and the Central Valley Regional Water Quality Control Board. Salinity intrusion into the Delta is controlled through standards established by the SWRCB in its Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Appendix 1). These standards are implemented through SWRCB Decision 1641 that governs operation of the CVP and SWP to protect aquatic life, agricultural, and other beneficial uses. The Water Quality Control Plan for the Sacramento River and San Joaquin River Basins contains standards (Appendix 2) and control programs for salinity in specific areas and water bodies especially in the San Joaquin Valley.

Since historical data and modeled water quality in the San Joaquin River showed that the San Joaquin River standards at Vernalis would be violated in dry years, the CVRWQCB developed and adopted a Total Maximum Daily Load (TMDL) for this river segment. This TMDL includes a system of load allocations and alternative compliance methods and has now been incorporated into the Basin Plan. On the heels of the Vernalis TMDL, the CVRWCB is developing standards and an associated TMDL for the San Joaquin River upstream to about the confluence with the Merced River. Implementation of this TMDL could have the effect of further reducing salinity in the San Joaquin River.

A related program to control selenium discharges from the Grassland area has compelled agricultural drainage dischargers using the existing section of the San Luis Drain to move towards zero discharge. The most current calculations and modeling indicate that reducing Grasslands agricultural drainage to zero will also remove enough salt from the system to achieve compliance with the Vernalis salinity standards under most hydrologic conditions.

The United States Bureau of Reclamation is required by federal law (bolstered by a court order) to address salinity in its San Luis unit area. This includes the Westlands Water

District and most of the Grasslands area. Although the USBR is compelled to provide agricultural drainage service for this area the method for complying with this requirement is not specified. The current preferred alternative is to divert drainage into reuse areas and concentrate it further through sequential reuse and an evaporation system. The accumulated concentrated brine or solid salts would be sequestered in ponds or recycled. This is the so called "in-valley" approach rather than the original San Luis Drain or a brine line to the coast to carry salts out of the Central Valley.

Voluntary programs such as the Department of Water Resources and University of California agricultural drainage management programs help to reduce the impacts of salinity by helping farmers to better manage water and salt.

Although these regulations and programs are capable of achieving compliance with the San Joaquin River salinity standards, they will not completely address the salt problems of the San Joaquin Valley. Calculated salt loads into and out of the San Joaquin Valley show that there is a salt imbalance. That is, there is more salt entering the valley than leaving it. Monitoring and studies of salt sources and transport show that the salt is accumulating in groundwater. This will eventually render this water unusable and could again increase the salinity of the San Joaquin River. To address these issues, the SWRCB and the CVRWQCB have initiated a project to develop a long-term salinity management strategy for the Central Valley.

The overall effect of these regulations and mandates is to force a complex system of water and salt management methods that allow agencies to stay in compliance while continuing to provide water and drainage services. Water quality and regulatory trends will likely require additional actions to address salinity problems in the Central Valley and Delta.

## *Current Management Tools*

The current Delta salinity control methods have evolved along with the development of the CVP and SWP and the regulations that control their operations. The major operational control methods, discussed in the "Water Operations" section of the conceptual model, include reservoir releases, barrier or gate operations, and export pumping rates. As was seen during the Jones Tract levee failure of 2004, these can be highly effective tools. When the Jones Tract levee failed on June 3, 2004, the Department of Water Resources acted quickly to counteract the sudden influx of water onto the island and the expected pulling of seawater into the system. The pumping rate at the SWP and CVP south Delta facilities was reduced drastically and reservoir releases were increased. These two operational changes kept the salinity increase to a minimum.

The Delta Cross Channel (DCC) is also an important control for salinity at the export pumps under certain hydrologic conditions. This was never more apparent than in December of 1999 when the DCC gates were closed to protect out-migrating juvenile

Chinook salmon. The gate closure was followed several days later by a rapid increase in salinity at Tracy and Banks forcing them to curtail pumping. A short time later, after the gates were reopened, water quality and operations returned to more seasonally normal conditions. Recent studies of Delta Cross Channel operations confirm its importance to export water quality when Delta inflows are low. Operation of the Delta Cross Channel, reservoir releases, and export pumping rates are the primary means of controlling salinity intrusion into the western Delta.

The other major source of salinity in the Delta - infiltration, runoff, and drainage from agriculture - is more diffuse and difficult to control. In the San Joaquin Valley, reduced salinity of imported Delta water could help to reduce the salinity of surface water and groundwater finding its way to the San Joaquin River. More efficient use of irrigation water could reduce the salt load to the river and to groundwater by reducing dissolution and mobilization of soil salts. Likewise, retirement of land from agricultural production in the most heavily salt impacted areas could also reduce salt loads. Drainage management actions, like reuse and evaporation of drainage water can provide an immediate reduction in surface water salt loads to the San Joaquin River. Real-time drainage management, the holding of drainage water and release when the river has assimilative capacity can also help to reduce peak salinities in the river and prevent violations of the salinity standards. However, these drainage mitigation measures might not be enough to prevent the gradual long term increase in groundwater salinity.

## *Future Management Options*

DWR and USBR are planning to replace the current temporary flow barriers in the south Delta with permanent operable South Delta barriers by the end of 2009. These barriers will be capable of opening and closing tidally as needed to control flows and water levels in the Delta channels between the head of Old River and the CVP and SWP south Delta pumps. These barriers will primarily be used to reduce salinity and improve water levels for agricultural water supply in these channels but may also be capable of more wide reaching flow and salinity management in the Delta. These barriers are currently undergoing environmental review with construction originally scheduled to begin in 2006.

Another tool that has been proposed to reduce salinity in the San Joaquin River is the recirculation of Delta water by way of the Delta Mendota Canal and the Newman Wasteway. This would release higher quality Delta water directly to the San Joaquin River near the confluence with the Merced River and would reduce downstream salinities. Initial experiments and studies have shown that this would be an effective salinity control tool under some flow and water quality conditions.

The Franks Tract pilot project stemmed from early hydrodynamic and water quality modeling studies suggesting that water quality at the SWP and CVP pumps could be improved significantly by restricting the tidal movement of water into Franks Tract from

the west. It has evolved into a more specific proposal for a project to restrict flow into Franks Tract by installing a barrier in False River. The CALFED agencies are also investigating how the operating scheme of the Delta Cross Channel could be modified to improve water quality while still protecting fish. The ROD action to investigate the proposed installation and operation of a screened diversion between the Sacramento River near Hood and the east Delta Mokelumne River channels is also under way. These three actions are being investigated together and are collectively called "through-Delta conveyance."

Alternatives to through-Delta conveyance are also being reconsidered in light of recent assessments of the risks to Delta water quality posed by earthquakes and climate change. One of these alternatives is to convey water completely around the Delta from the Sacramento River to the export pumps, some variation of the so-called "Peripheral Canal". This alternative would certainly reduce the salinity of exported water and salinity problems in those areas receiving this water. This alternative; however, will change the flow of fresh water through the Delta and may result in local increases in salinity.

Water rights and water quality regulations, including drinking water protection policies, will play a key role in the long term solution for salinity problems in the Delta, its watersheds, and its service area. All of the above management options will need to be considered individually and in combination to find an equitable and sustainable Central Valley and Delta salt management strategy.

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# Appendices

***Standards tables from the 1995 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary***

| Table 1 | WATER QUALITY OBJECTIVES FOR MUNICIPAL AND INDUSTRIAL BENEFICIAL USES | | | | | | |
|---|---|---|---|---|---|---|---|

| COMPLIANCE LOCATION | INTERAGENCY STATION NUMBER (RKI [1]) | PARAMETER | DESCRIPTION (UNIT) | WATER YEAR TYPE [2] | TIME PERIOD | VALUE |
|---|---|---|---|---|---|---|
| Contra Cosfa Canal at Pumping Plant #1 -or- San Joaquin River at Antioch Water Works Intake | C-5 (CHCCC06)  D-12 (near) (RSAN007) | Chloride (Cl⁻) | Maximum mean daily 150 mg/l Cl⁻ for at least the number of days shown during the Calendar Year. Must be provided in intervals of not less than two weeks duration. (Percentage of Calendar Year shown in parenthesis) | W AN BN D C | | No. of days each Calendar Year ≤ 150 mg/l Cl⁻ 240 (66%) 190 (52%) 175 (48%) 165 (45%) 155 (42%) |
| Contra Costa Canal at Pumping Plant #1 -and- West Canal at mouth of Clifton Court Forebay -and- Delta-Mendota Canal at Tracy Pumping Plant -and- Barker Sbugh at North Bay Aqueduct Intake -and- Cache Slough at City of Vallejo Intake [3] | C-5 (CHCCC06)  C-9 (CHWST0)  DMC-1 (CHDMC004)  ----- (SLSAR3)  C-19 (SLCCH16) | Chloride (Cl⁻) | Maximum mean daily (mg/l) | All | Oct-Sep | 250 |

[1] River Kilometer Index station number.
[2] The Sacramento Valley 40-30-30 water year hydrologic classification index (see page 23) applies for determinations of water year type.
[3] The Cache Slough objective to be effective only when water is being diverted from this location.

| Table 2 | WATER QUALITY OBJECTIVES FOR AGRICULTURAL BENEFICIAL USES |
|---|---|

| COMPLIANCE LOCATION | INTERAGENCY STATION NUMBER (RKI [1]) | PARAMETER | DESCRIPTION (UNIT) [2] | WATER YEAR TYPE [3] | TIME PERIOD | & VALUE |
|---|---|---|---|---|---|---|
| **WESTERN DELTA** | | | | | | |
| Sacramento River at Emmaton | D-22 (RSAC092) | Electrical Conductivity (EC) | Maximum 14-day running average of mean daily EC (mmhos/cm) | | 0.45 EC April 1 to date shown | EC from date shown to Aug 15 [4] |
| | | | | W | Aug 15 | ---- |
| | | | | AN | Jul 1 | 0.63 |
| | | | | BN | Jun 20 | 1.14 |
| | | | | D | Jun 15 | 1.67 |
| | | | | C | ---- | 2.78 |
| San Joaquin River at Jersey Point | D-15\ (RSAN018) | Electrical Conductivity (EC) | Maximum 14-day running average of mean daily EC (mmhos/cm) | | 0.45 EC April 1 to date shown | EC from date shown to Aug 15 [4] |
| | | | | W | Aug 15 | ---- |
| | | | | AN | Aug 15 | ---- |
| | | | | BN | Jun 20 | 0.74 |
| | | | | D | Jun 15 | 1.35 |
| | | | | C | ---- | 2.20 |
| **INTERIOR DELTA** | | | | | | |
| South Fork Mokelumne River at Terminous | C-13 (RSMKL08) | Electrical Conductivity (EC) | Maximum 14-day running average of mean daily EC (mmhos/cm) | | 0.45 EC April 1 to date shown | EC from date shown to Aug 15 [4] |
| | | | | W | Aug 15 | ---- |
| | | | | AN | Aug 15 | ---- |
| | | | | BN | Aug 15 | ---- |
| | | | | D | Aug 15 | ---- |
| | | | | C | ---- | 0.54 |
| San Joaquin River at San Andreas Landing | C-4 (RSAN032) | Electrical Conductivity (EC) | Maximum 14-day running average of mean daily EC (mmhos/cm) | | 0.45 EC April 1 to date shown | EC from date shown to Aug 15 [4] |
| | | | | W | Aug 15 | ---- |
| | | | | AN | Aug 15 | ---- |
| | | | | BN | Aug 15 | ---- |
| | | | | D | Jun 25 | 0.58 |
| | | | | C | ---- | 0.87 |
| **SOUTHERN DELTA** | | | | | | |
| San Joaquin River at Airport Way Bridge, Vernalis | C-10 (RSAN112) | Electrical Conductivity (EC) | Maximum 30-day running average of mean daily EC (mmhos/cm) | All | Apr-Aug Sep-Mar | 0.7 1.0 |
| -and- San Joaquin River at Brandt Bridge site | C-6 (RSAN073) | | | | -or- | |
| -and- Old River near Middle River [5] | C-8 (ROLD69) | | *If a three-party contract has been implemented among the DWR, USBR, and SDWA, that contract will be reviewed prior to implementation of the above and, after also considering the needs of other beneficial uses, revisions will be made to the objectives and compliance/monitoring locations noted, as appropriate.* | | | |
| -and- Old River at Tracy Road Bridge [5] | P-12 (ROLD59) | | | | | |
| **EXPORT AREA** | | | | | | |
| West Canal at mouth of Clifton Court Forebay | C-9 (CHWST0) | Electrical Conductivity (EC) | Maximum monthly average of mean daily EC (mmhos/cm) | All | Oct-Sep | 1.0 |
| -and- Delta-Mendota Canal at Tracy Pumping Plant | DMC-1 (CHDMC004) | | | | | |

[1] River Kilometer Index station number.

[2] Determination of compliance with an objective expressed as a running average begins on the last day of the averaging period. If the objective is not met on the last day of the averaging period, all days in the averaging period are considered out of compliance.

[3] The Sacramento Valley 40-30-30 water year hydrologic classification index (see page 23) applies for determinations of water year type.

[4] When no date is shown, EC limit continues from April 1.

[5] The EC objectives shall be implemented at this location by December 31, 1997.