

Attachment D: Considerations regarding the Implementation of Proposed EC Water Quality Objectives in NPDES Permits Governing Discharges to Reach 83 of the Lower San Joaquin River

If adopted in a Basin Plan amendment (BPA), the proposed EC water quality objectives (WQOs) for Reach 83 of the Lower San Joaquin River (LSJR) as described in the Task 4 Report will be used in the derivation of future NPDES effluent limitations for the Cities of Modesto and Turlock. The LSJR Committee (LSJRC) requested consideration of this issue since it is important to the determination of the economic impacts of the proposed WQOs for these municipalities.

This document provides background information regarding the NPDES-permitted discharges by the Cities of Modesto and Turlock to Reach 83 of the LSJR, the relative magnitude of the salinity loadings associated with those discharges, and recommendations regarding information that should be considered in the derivation of effluent limitations in future NPDES permits for these municipal wastewater treatment facilities.

BACKGROUND ON MUNICIPAL TREATED EFFLUENT DISCHARGES TO REACH 83

Both the Cities of Modesto and Turlock discharge treated wastewater effluent to Reach 83 of the LSJR in the reach between Crows Landing and the confluence with the Tuolumne River as shown in **Figure D-1**. Agricultural diversions (by Patterson Irrigation District and West Stanislaus Irrigation District) occur in this segment of the LSJR.

City of Modesto

The City of Modesto (Modesto) discharges to the LSJR under requirements specified in California Regional Water Quality Control Board, Central Valley Region (Central Valley Water Board) Order R5-2012-0031 (NPDES No. CA0079103). The current permit expires on June 1, 2017. Discharge of secondary effluent is currently only allowed between October 1 and May 31 when the average daily San Joaquin River to effluent flow ratio exceeds 20:1; discharge of tertiary effluent is allowed any time. Modesto's future plan is to cease all secondary effluent discharge and discharge tertiary effluent year-round at an average dry weather flow (ADWF) of 19.1 million gallons per day (mgd), or 29.6 cubic feet per second (cfs).

EC Effluent Limitations in Current Modesto NPDES Permit

The EC effluent limits in the current City of Modesto NPDES permit are as follows:

Interim average monthly EC effluent limit = 1341 μ mhos/cm.

Final EC effluent limits are average monthly of 700 μ mhos/cm (April 1 through May 31) and 1000 μ mhos/cm (October 1 through March 31). The final EC limits in all but

critically dry years will become effective July 2022. In critically dry years, the final EC limits will become effective in July 2026.

A time series plot of EC concentrations for effluent discharged to the LSJR by Modesto for the period January 2006 through January 2015 is shown in **Figure D-2**. A trend line of EC concentrations for Modesto effluent discharge is provided in **Figure D-3**. This figure shows projected EC concentrations along the trend line at 5 year intervals, for illustrative purposes. Prediction of future effluent concentrations depends on a number of variables (future water conservation, source and quality of water supply, etc.) which are beyond the scope of this analysis. It should be noted that the recent measured increasing concentrations shown in **Figure D-2** are the result of decreasing effluent flow rather than increases in salt load.

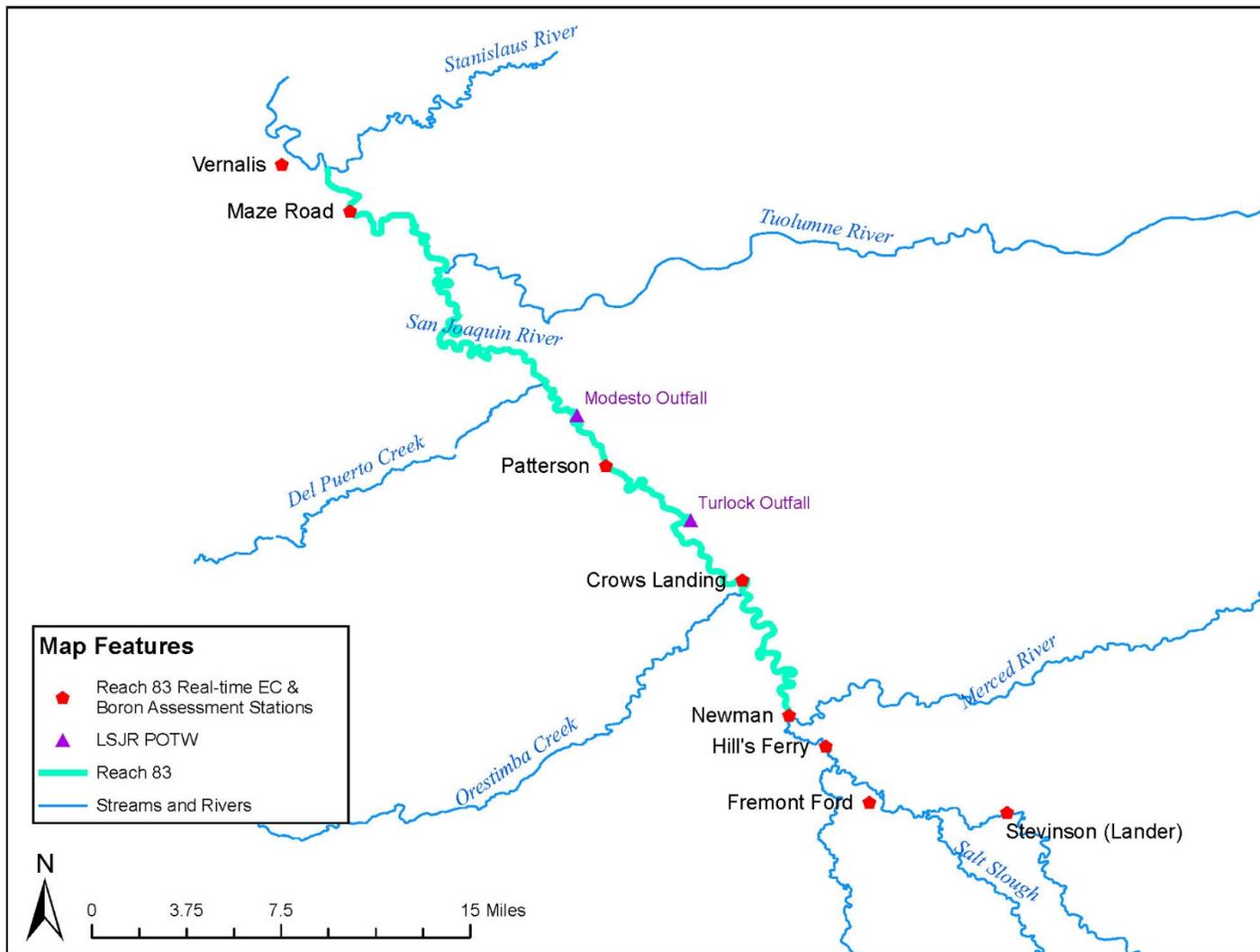


Figure D-1: Water Quality Monitoring Stations and POTW Discharges within Reach 83 of the Lower San Joaquin River.

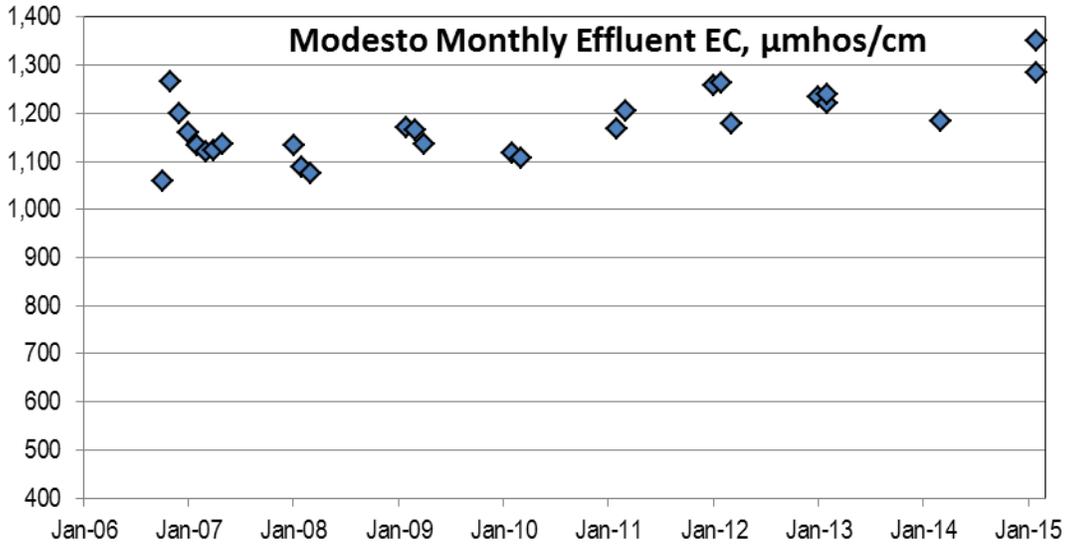


Figure D-2: City of Modesto Monthly Average EC Concentration (μmhos/cm) for Effluent Discharged to the LSJR – January 2006 through January 2015.

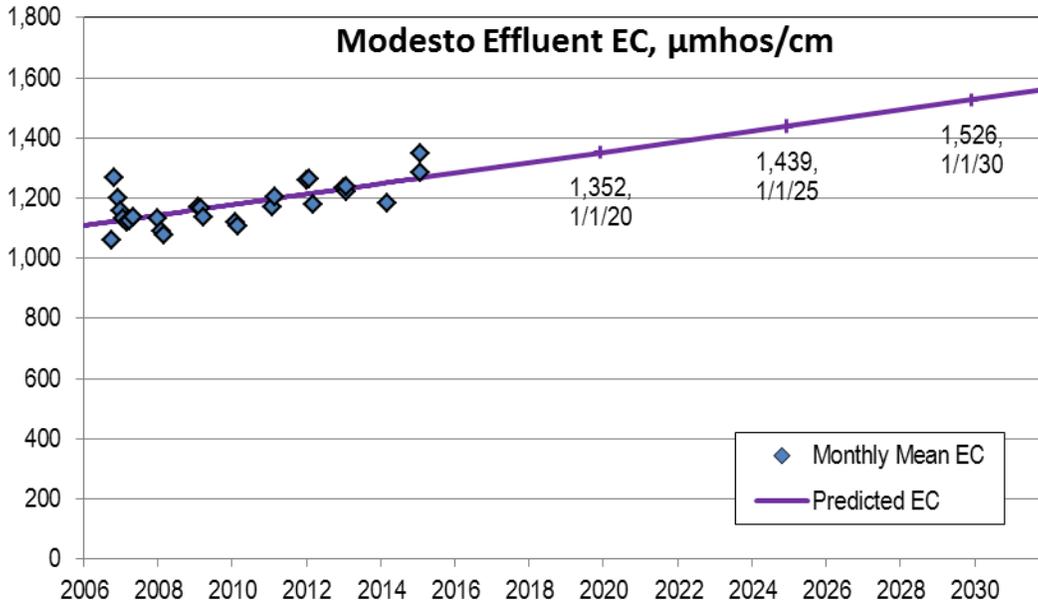


Figure D-3: Extrapolation of City of Modesto Monthly Average Effluent EC through the Year 2030

As required by its current NPDES discharge permit, the City of Modesto has an active Salinity Minimization Program in place, as documented in its annual Salinity Compliance Schedule Progress Report to the Central Valley Regional Water Board. The City has performed a source identification study and continues to monitor its major trunk lines. Modesto has participated in projects to provide access to increased volumes of surface water supplies as part of its efforts to reduce effluent EC levels through decreased reliance on higher EC groundwater supplies.

City of Turlock

The City of Turlock (Turlock) discharges to the LSJR under requirements specified in Central Valley Water Board Order R5-2015-0027 (NPDES No. CA0078948). This order expires May 31, 2020. Turlock operates a tertiary treatment facility and is allowed to discharge continuously to the San Joaquin River. The current ADWF from the City’s treatment facility is approximately 10 mgd, or 15.5 cfs. The City’s NPDES permit allows for a maximum discharge rate of 20 mgd (ADWF), or 31 cfs.

EC Effluent Limitations in Current Turlock NPDES Permit

The EC effluent limitation in the current NPDES permit for the City of Turlock is as follows:

Final = 1250 μ mhos/cm as calendar year annual average

A time series plot of effluent EC concentrations for Turlock for the period January 2005 through January 2015 is shown in **Figure D-4**. A trend line of effluent EC concentrations for Turlock is provided in **Figure D-5**. This figure shows projected EC concentrations along the trend line at 5 year intervals, for illustrative purposes. Prediction of these future concentrations depends on a number of variables (future water conservation, water supply quality, etc.) which are beyond the scope of this analysis. Similar to the City of Modesto, the recent measured increasing concentrations in salinity depicted in **Figure D-4** are the result of decreasing effluent flows rather than increased salt load.

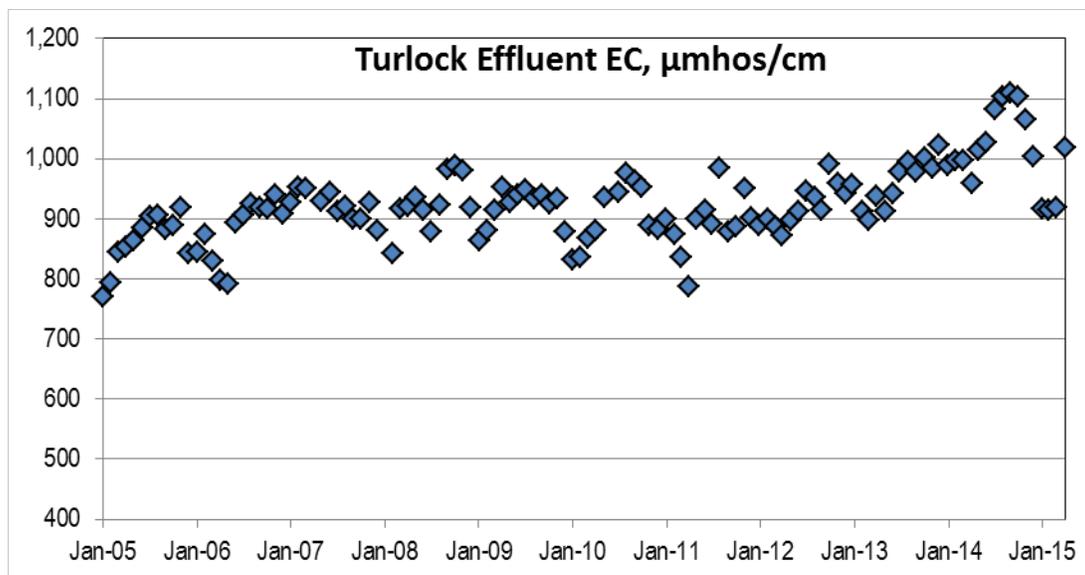


Figure D-4: City of Turlock Monthly Average Effluent EC Concentration (μ mhos/cm) – January 2005 through January 2015.

As required in its current NPDES permit, the City of Turlock has an active Salinity Minimization program. The City performed a Phase 1 Salinity study in 2011 and a Phase 2 study in 2013. Turlock has an industrial pretreatment program which addresses multiple constituents, including salinity. The City regularly inspects its Significant Industrial Users and implements an industrial source control program for salinity. The City is currently preparing a Salinity Source Control Work Plan to refine previous salinity source control measures and implement additional measures, as necessary.

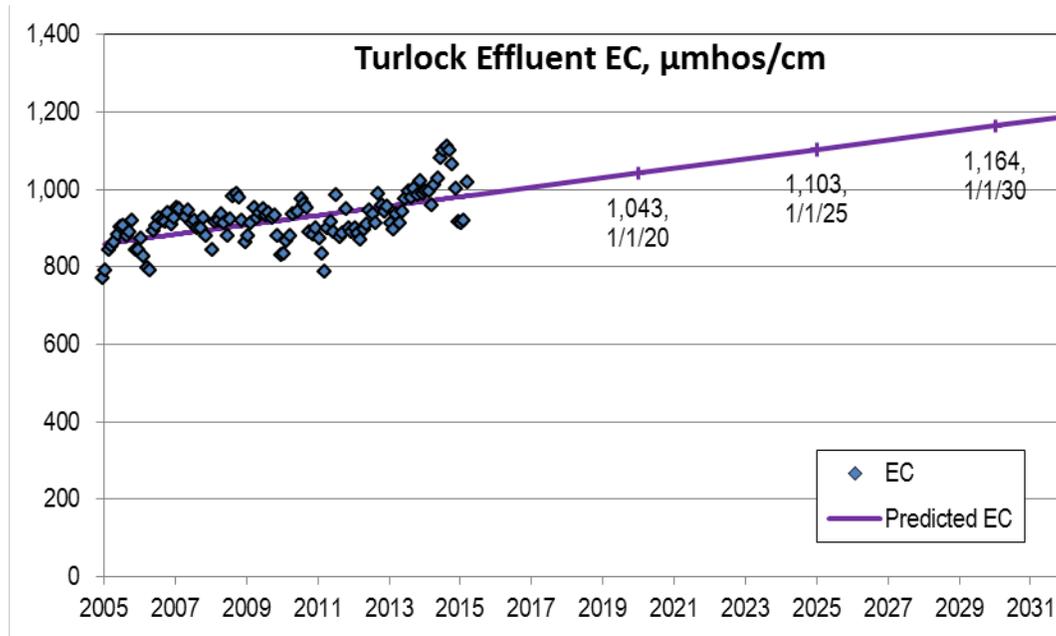


Figure D-5: Extrapolation of City of Turlock Monthly Average EC through the Year 2030 Based on Effluent EC Measured from January 2005 through January 2015.

POTW SALINITY CONTRIBUTIONS TO LSJR

As background, and to provide a perspective on the magnitude of the salinity contribution of the Cities of Modesto and Turlock to the LSJR, the salinity loading resulting from maximum permitted flow conditions and an effluent EC quality of 1550 $\mu\text{mhos/cm}$ has been compared to historic salinity loadings in the LSJR at Crows Landing. This POTW salinity loading represents a potential future discharge scenario resulting from the adoption of proposed water quality objectives for Reach 83 of the LSJR. A time series plot of the combined POTW loadings at permitted flows and an effluent EC quality of 1550 $\mu\text{mhos/cm}$ is depicted in **Figure D-6**. This plot illustrates the small contribution of the POTWs to the historical TDS loading in the LSJR at Crows Landing.

The POTW loading depicted in **Figure D-6** is derived as summarized in **Table D-1**.

For the calculations supporting the values shown in **Table D-1**, effluent EC concentrations were converted to equivalent TDS concentrations using an assumed TDS/EC ratio of 0.60 to allow for the development of the salinity loadings shown in the table and in **Figure D-6**.

Table D-1: Estimated TDS Loadings to the Lower San Joaquin River by the Cities of Modesto and Turlock with Assumed Effluent EC Quality of 1550 µmhos/cm at Permitted Flow.

| | Flow (cfs) | TDS (tons per day) |
|--------------------|-------------|-----------------------|
| Modesto 1,550 EC | 29.6 | 74.1 |
| Turlock 1,550 EC | 31.0 | 77.6 |
| POTW Totals | 60.6 | 152 |

NPDES PERMITTING DETERMINATIONS

Two key decisions will be required in future NPDES permitting determinations for Modesto and Turlock related to the establishment of effluent limitations consistent with the proposed EC WQOs in Reach 83:

1. Whether effluent limits will be required
2. If limits are required, what the magnitude and averaging period of the effluent limits will be

Under U.S. EPA regulations governing the issuance of NPDES permits, effluent limitations are required for a specific constituent if a discharge is deemed to have a “reasonable potential to cause or contribute to a violation of a water quality objective”. Because the cities of Modesto and Turlock are subject to the wasteload allocation requirements of the Salt and Boron TMDL for the Lower San Joaquin River established in 2006, reasonable potential to cause or contribute to existing EC objectives at Vernalis will likely be deemed to exist and effluent limits for EC will likely be required in the NPDES permits for these discharges.

Given that EC limits will likely be required, the determination of the magnitude and averaging period for the required EC effluent limits will be the next step.

The effluent limitations that will be developed must meet the following requirements:

- Must protect the AGR (irrigation water supply) beneficial use in the LSJR, with particular attention given to the segment between Crows Landing and the Tuolumne River
- Must not adversely impact the attainment of the EC objectives in the LSJR at Vernalis, and
- Must comply with State and federal anti-degradation policies, including consideration of best practicable treatment and control consistent with maximum benefit to the people of the State of California.

As has been discussed in the LSJR Committee meetings, NPDES permitting should consider the relative importance of salinity loadings from the Cities of Modesto and Turlock during different seasons and water years. The relative importance of the salinity loads from the two cities and the benefit of salinity load reductions on beneficial use protection should be addressed in setting future effluent limitations. NPDES permitting determinations should also account for the continued impact of water conservation, water supply constraints and extended dry period conditions on effluent quality.

As an example of the type of water quality impact analysis that should be considered during future NPDES permitting, a mass balance analysis was performed to determine the minimum concentration at which the combined discharge from the Cities of Modesto and Turlock would be expected to contribute to an exceedance of the proposed 30-day average water quality objective of 1550 $\mu\text{mhos/cm}$ in Reach 83 between Crows Landing and the Tuolumne River. The analysis was based on the following assumptions:

- Modesto and Turlock wastewater treatment plants - each discharging at current permitted ADWF (19.1 mgd and 20 mgd, respectively)
- Effluent EC converted to equivalent TDS using a factor of 0.60
- Historical flows in LSJR at Crows Landing for 1995 through 2013
- Predicted EC levels at Crows Landing based on Planned Bundle simulation
- EC levels in LSJR converted to TDS using a factor of 0.64
- A mass balance was performed and determination was made with regard to the concentrations at which POTW discharges would cause the LSJR to exceed an EC level of 1550 $\mu\text{mhos/cm}$.

The following results were obtained (6,575 cases examined):

| | |
|----------------------------------------------------------------------------------------------------|--------------------------|
| POTW caused exceedances of 30-day average 1,550 $\mu\text{mhos/cm}$ EC in LSJR below Crows Landing | 24 |
| Single exceedance | 1994 $\mu\text{mhos/cm}$ |
| 99 th percentile not to exceed level | 2672 $\mu\text{mhos/cm}$ |
| 97.5 th percentile not to exceed level | 3256 $\mu\text{mhos/cm}$ |

The calculations supporting the above results are included in an attached spreadsheet. This example is provided to demonstrate the type of mass balance analysis that should be considered in future NPDES permitting to support the consideration of future effluent limitations.

COMPLIANCE WITH DOWNSTREAM WATER QUALITY OBJECTIVES

Future effluent limitations for Modesto and Turlock must provide beneficial use protection in the LSJR and must not adversely affect compliance with downstream WQOs. To evaluate the specific impact of POTW salinity loadings resulting from a range of alternative effluent limitations on downstream compliance with the proposed EC WQOs at Maze Road Bridge and the EC WQOs at Vernalis, additional modeling would be required.

One option would be to follow the approach used in the LSJR Committee's approach to development of information supporting the proposed EC WQO for Reach 83. In that work, WARMF modeling results were developed based on specific management scenarios to provide water quality output at Maze Road Bridge. That information was then communicated to Mr. Dan Steiner, who used his modeling tools to predict effects on WQO compliance at Vernalis as described in the Task 4 report.

For effluent limitation derivation purposes, different salinity loadings from Modesto and Turlock associated with a range of different effluent limitations could be input into the WARMF model.

Output from those model runs could be provided as input to Dan Steiner's models. This would allow a specific evaluation of the water quality impact of different candidate effluent limitations and would help resolve uncertainty regarding these effects.

RECOMMENDATIONS REGARDING THE IMPLEMENTATION OF PROPOSED OBJECTIVES IN NPDES PERMITS

Based on the above considerations, the following recommendations are provided regarding the implementation of the proposed EC objectives in the NPDES permits for the cities of Modesto and Turlock. This information is intended to inform and assist Regional Water Board staff in the derivation of future EC effluent limits in these NPDES permits.

- The proposed effluent limitations must protect the AGR (irrigation water supply) beneficial use in the LSJR, must not impact attainment of the Vernalis EC objectives, and must comply with State and federal anti-degradation policies.
- A range of possible effluent limitations and averaging periods should be evaluated in the NPDES permitting process.
- Mass balance calculations and modeling should be performed to assess the impact of different POTW salinity discharges on conditions in the river. The relative importance of the salinity loads from the two cities and the benefit of load reductions on beneficial use protection should be addressed in the NPDES permitting process.
- NPDES permitting determinations should account for the continued impact of water conservation, water supply constraints and extended dry period conditions on effluent quality.
- A re-opener should be provided in the NPDES permit to allow re-evaluation of effluent limitations based on the actual conditions that are observed to occur in the LSJR after full implementation of the Grassland Bypass Project and other planned projects. Also an evaluation should be performed to determine whether water conservation, water supply changes, or other factors caused an increase in effluent EC that would preclude attainment with proposed future effluent limitations.
- In addressing compliance with State and federal anti-degradation policies, a socio-economic analysis should be performed to address the water quality impacts, treatment costs and beneficial use protection associated with the range of candidate effluent limitations.
- Modeling work should be performed using available modeling tools to assess the impact of the range of candidate effluent limitations on compliance with downstream water quality objectives at Maze Road Bridge and Vernalis. The extended dry period exception associated with the proposed EC WQOs for Reach 83 should be considered in this evaluation.
- Effluent limitations should be selected based on NPDES permitting requirements at the time of the renewal, results from the above analysis and other considerations (e.g. available dilution, actual and projected effluent quality, ambient conditions in the LSJR, etc.).

Figure D-6.

