

# MEMORANDUM



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TO: Jim Marshall, CVRWQCB

CC: Dan Madden, City of Turlock  
Michael Cooke, City of Turlock  
John Steven Wilson, City of Turlock  
Nicole Granquist, Downey Brand

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**Brian M. Laurenson, P.E.**  
707 4th Street  
Suite 200  
Davis, CA 95616  
530.753.6400 ext.230  
530.753.7030 fax  
[BrianL@lwa.com](mailto:BrianL@lwa.com)

via e-mail only

**SUBJECT: CALCULATION OF CITY OF TURLOCK WQCF NITRATE EFFLUENT LIMITATION BASED ON AVAILABLE SAN JOAQUIN RIVER ASSIMILATIVE CAPACITY (NPDES NO. CA0078948)**

The City of Turlock Water Quality Control Facility (WQCF) includes a nitrification process, which oxidizes ammonia into nitrate. The San Joaquin River concentration downstream of the WQCF discharge is always below the drinking water quality objective for nitrate (10 mg/L NO<sub>3</sub> as N) that is intended to protect infants and children from methemoglobinemia. Infants under three months old are particularly susceptible to this condition because they can lack certain stomach acids that control populations of gastrointestinal bacteria that readily convert nitrate to nitrite. The primary exposure pathway is thusly through infant formula solutions prepared with high nitrate water.

This nitrate dilution calculation methodology is intended to develop a protective water quality based effluent limitation (WQBEL) for the WQCF discharge. The approach conservatively estimates assimilative capacity of the river under critical flow conditions that can be used to calculate an effluent limitation that will not cause or contribute to an exceedance of the drinking water MCL for nitrate.

## **Assimilative Capacity**

No nitrate data are available in the San Joaquin River immediately upstream of the City of Turlock WQCF, however data from the City of Modesto's upstream monitoring location (San Joaquin River at West Main Bridge), used in the April 2008 NPDES permit renewal (October 2000 through September 2005, n=90), can provide a conservative estimate of receiving water nitrate levels. This location already includes the City of Turlock contribution (*i.e.*, the sampling location is between the Turlock and Modesto

discharges). These data were collected prior to operation of the City of Turlock nitrification facilities, and are characterized in terms of average, maximum, and standard deviation in **Table 1**.

**Table 1. Nitrate-N Concentrations in the San Joaquin River at West Main Bridge – 2000-2005.**

Month	Count	Average (mg/L NO <sub>3</sub> as N)	Std. Dev. (mg/l NO <sub>3</sub> as N)	Max Value (mg/l NO <sub>3</sub> as N)
JAN	11	2.15	0.87	4.60
FEB	9	3.24	1.33	5.40
MAR	7	3.57	0.68	4.38
APR	8	3.38	1.18	4.70
MAY	9	1.72	0.50	2.46
JUN	5	3.16	0.17	3.36
JUL	4	3.36	0.68	3.93
AUG	5	3.64	0.48	4.03
SEP	6	3.56	0.65	4.36
OCT	6	2.77	0.77	3.42
NOV	11	2.00	0.43	2.86
DEC	9	2.16	0.64	3.11
Total	90	2.75	1.02	5.40

The San Joaquin River data have a slightly higher average value between February and September. The maximum value was reported in February, a higher flow month when additional upstream dilution is available.

Critical flow conditions were calculated for the San Joaquin River at Newman for the years 1980 through 2008 (29 years). EPA's DFLOW program was used to calculate the critical "7Q10" flow of 157 cfs (101 mgd).

### **City of Turlock Nitrate Discharge**

Currently, the City of Turlock effluent nitrate concentration averages 15.5 mg/L NO<sub>3</sub> as N with a standard deviation of 3.24 mg/L NO<sub>3</sub> as N. During the period, prior to plant nitrification (November 2001 to December 2004, n=62), the plant averaged 8.96 mg/L NO<sub>3</sub> as N with a standard deviation of 7.42 mg/L NO<sub>3</sub> as N. Although the average concentration has increased because of the new WQCF nitrification process, ammonia concentrations have been significantly reduced, and the nitrate variability is much lower. The City of Turlock is permitted to discharge up to 20 mgd (31 cfs).

### **Calculation of Protective Assimilative Capacity and Proposed Effluent Limit**

Based on the 7Q10 flow critical flow period and maximum permitted effluent discharge, the ratio of river flow to effluent flow is 5:1. There are no municipal or known private drinking water supply intakes downstream of the WQCF discharge until the Delta water

intakes located downstream of Vernalis. Use of San Joaquin River water near the WQCF discharge for infant feeding is highly unlikely.

Based on the highly conservative assumptions of 5:1 dilution as a lower limit of dilution available under critical flow conditions and an average river nitrate concentration, the calculated allowable average monthly effluent limitation (AMEL) is 46.6 mg/L NO<sub>3</sub> as N. This WQBEL is calculated as a mass balance that ensures downstream compliance with water quality objective for nitrate.

However, an AMEL based on historical performance that is also achievable and more protective would be 26.2 mg/L NO<sub>3</sub> as N, which is based on the observed effluent average (15.5 mg/L) plus 3.3 times the standard deviation (3.3 x 3.24 mg/L). As the City intends to maintain the performance of the existing nitrification treatment facilities, the AMEL of 26.2 mg/L NO<sub>3</sub> as N is proposed for use as the final effluent limitation for nitrate. This proposed performance based AMEL is approximately the equivalent of a 2.2:1 dilution ratio.