

## Introduction

This water quality monitoring fact sheet was prepared by the Irrigated Agriculture Program of the Central Coast Regional Water Quality Control Board (Water Board) and made available on November 30, 2008. The data were delivered by Central Coast Water Quality Preservation, Inc. (CCWQP) to the Water Board as part of the monitoring and reporting requirements for all dischargers enrolled under *Conditional Waiver of Waste Discharge Requirements for Discharge from Irrigated Lands, Order No. R3-2004-0117*. Monitoring stations were selected to represent water quality in predominantly agricultural areas, but in some cases reflect mixed land uses upstream of the sites.

## 312MSD Main Street Canal upstream from Ray Rd at HWY 166

The Cooperative Monitoring Program sampled Main Street Canal upstream from Ray Road at Highway 166 24 times (approximately one sample per month) between December 2005 and December 2007 (one sample date was missed in July 2006).

## Summary of Water Quality Data

### Notable Measured Analytes for Water Quality Monitoring

Analyte/Parameter	Average	Range	Water Quality Criteria (WQC) or Guideline <sup>1</sup>	Percent Outside WQC or Guideline
Ammonia as N, Unionized	0.212 mg/L	0.002–2.244 mg/L	<0.025 mg/L <sup>+</sup>	63%
Nitrate/Nitrite as N	22.3 mg/L	2.0–72.6 mg/L	<10.0 mg/L*	75%
Orthophosphate as P	4.85 mg/L	0.11–36.02 mg/L	<0.12 mg/L*	96%
Turbidity (NTU)	309 NTU	9–1762 NTU	<25 NTU*	83%
Conductivity	1.46 mmho/cm	0.00–4.45 mmho/cm	Ranges: * <0.75 No Problem 0.75–3.0 Increasing >3.0 Severe	21% 75% 4%
pH	8.0	7.4–8.5	7.0–8.5 <sup>+</sup>	0%
Annual Median Dissolved Oxygen (% Saturation)	2006: 102% 2007: 86%	70–157%	>85% annual median <sup>+</sup>	Std met Std met
Dissolved Oxygen	9.3 mg/L	6.2–14.3 mg/L	>5.0 mg/L ( <b>GEN/WARM</b> ) <sup>+</sup> >7.0 mg/L ( <b>COLD/SPWN</b> ) *	0% 8%
Chlorophyll a	2.2 µg/L	0–11.1 µg/L	<40 µg/L*	0%
Water Temperature	17.6°C	8.4–24.3°C	Water Basin Specific	--

+ Indicates standard defined in the Water Quality Control Plan, Central Coast Basin (Basin Plan)

\* Indicates guideline not described in the Basin Plan or not specifically stated as applicable to the beneficial uses of the site. Origin of the guideline is described in the individual discussion of the analyte/parameter.

The present and potential beneficial uses for **Main Street Canal upstream from Ray Road at Highway 166** are not specified in the Basin Plan. General Basin Plan water quality objectives will apply. Any analytes not specified under the general objectives in the Basin Plan are compared to a different water quality guideline to create a better understanding of the site's condition.

<sup>1</sup> Water Quality Criteria (WQC) are defined in the Water Quality Control Plan, Central Coast Basin (also referred to as the "Basin Plan") to protect beneficial uses such as drinking water, fish habitat, irrigation water, etc. WQC include general water quality standards for some analytes as well as specific criteria based on the defined beneficial uses. Other water quality guidelines were compiled to provide a standard in order to compare sites. Bold indicates beneficial uses that apply to this watershed.

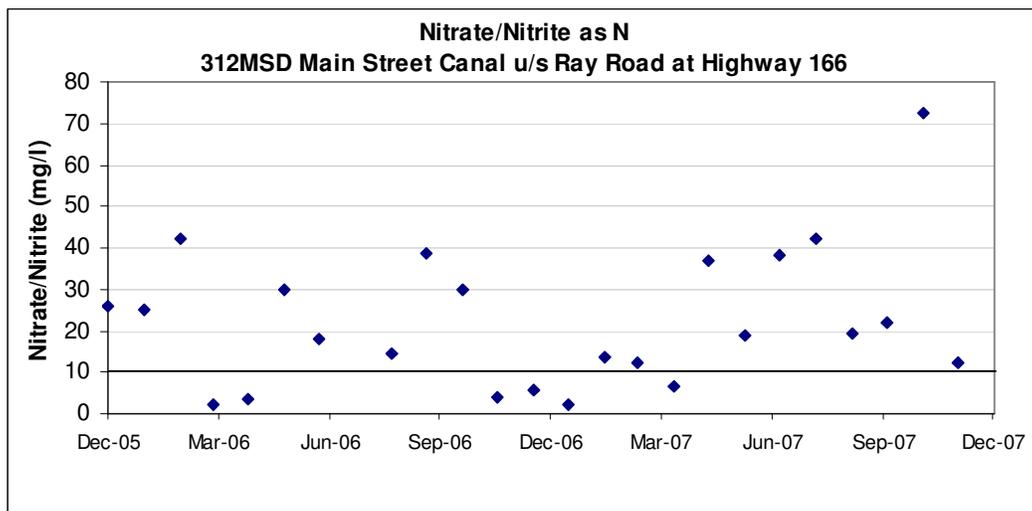
## Unionized Ammonia (as N)

Unionized ammonia (as N) is a calculated value based on water temperature, pH, and total ammonium concentration. Ammonia can be toxic in water. With high water temperature and/or high pH, ammonia becomes unionized and is toxic at much lower levels. The Basin Plan general water quality objectives state that unionized ammonia should not exceed 0.025 mg/L. Over time, ammonia should reduce to nitrate, so long-lasting levels of ammonia may indicate continuous discharges of waste. **Fifteen of 24 samples (63%) exceeded the standard, reaching almost 90 times the standard (October 2006 – 2.244 mg/L). Five samples had concentrations over ten times the standard. The average unionized ammonia concentration was 0.212 mg/L. However, the standard deviation was 0.478, indicating extreme (high and low) samples.**

## Nitrate/Nitrite as N

The Municipal and Domestic Supply (MUN) objective states in Table 3-2 of the Basin Plan that nitrate as  $\text{NO}_3$  shall not exceed 45 mg/L. This value is equivalent to 10 mg/L of nitrate as N. Nitrite accounts for a small percent of total nitrate/nitrite, and therefore, nitrate as N criterion was used as a guideline for nitrate/nitrite. **Eighteen of 24 samples (75%) exceeded the guideline, reaching as high as 72.6 mg/L (November 2007). The average concentration was 22.3 mg/L.**

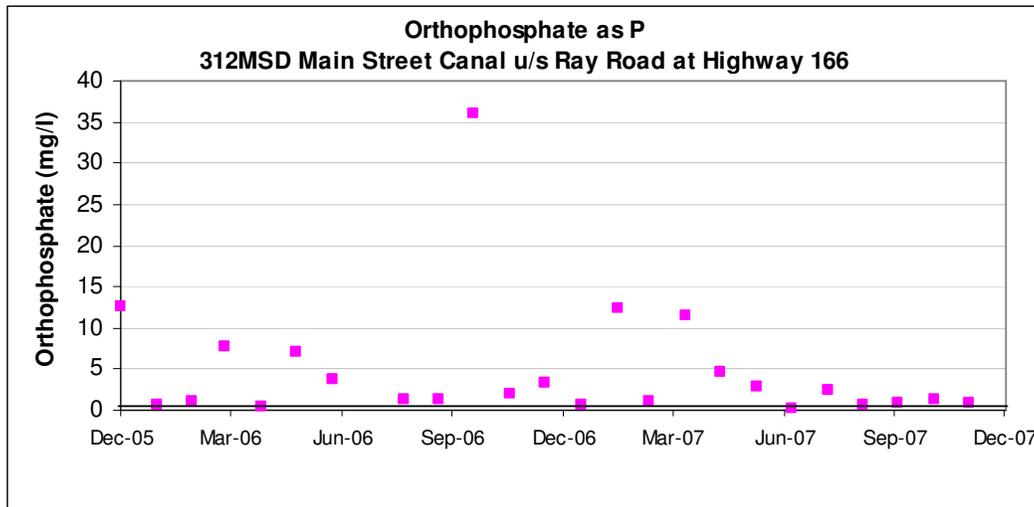
The chart below shows the nitrate/nitrite concentrations throughout the sampling period. The guideline for nitrate/nitrite states that its concentration as N shall not exceed 10 mg/L, shown by the black horizontal line on the graph.



## Orthophosphate as P

The Basin Plan does not contain orthophosphate standards. The Central Coast Ambient Monitoring program (CCAMP) non-regulatory guideline for general water quality objectives states that orthophosphate concentrations shall not exceed 0.12 mg/L. **Orthophosphate concentrations exceeded the guideline in 23 of 24 samples (96%), reaching as high as 36.02 mg/L (300 times the guideline) in October 2006. Three samples exceeded the guideline by more than 100 times, and an additional three samples exceeded by more than 50 times. The average concentration was 4.85 mg/L. However, the standard deviation was 7.68 mg/L, indicating extreme (high and low) readings.**

The chart below shows the orthophosphate concentrations throughout the sampling period. The guideline for orthophosphate states that its concentration as P shall not exceed 0.12 mg/L, shown by the black horizontal line on the graph.



### Turbidity

The Basin Plan states: “Water shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses.” Sigler et al.<sup>2</sup> shows that turbidity levels of 25 NTU or greater caused reduction in juvenile salmonid growth due to interference with their ability to find food. Turbidity is often affected by suspended material in runoff. **Twenty of 24 turbidity readings (83%) exceeded the guideline. The values appear to rise and fall in cycles; however, the cycles are not annual. Turbidity levels in the Main Street Canal averaged 309 NTU.**

### Conductivity

Conductivity is measured from a water sample. Based on Table 3-3 of the Basin Plan showing Guidelines for Interpretation of Quality of Water for Irrigation, conductivity below 0.75 mmho/cm causes no problems to irrigation, between 0.75 and 3 mmho/cm causes increasing problems, and conductivity above 3 mmho/cm causes severe problems. The conductivity level can be greatly affected by geologic and biological influences and is not necessarily related to agricultural activities. **Five of 24 conductivity samples (21%) indicated no problems to irrigation water; 18 samples (75%) indicated increasing problems; one sample (4%) indicated severe problems.**

### pH

Multiple beneficial uses have objectives for pH. The Basin Plan general water quality objective for pH is between 7.0 and 8.5; MUN, AGR, REC-1, and REC-2 pH objectives are between 6.5 and 8.3. The standard, therefore, is 7.0-8.3 if one or more of MUN, AGR, REC-1, and REC-2 is defined as a beneficial use. pH above 9 can cause skin irritant to humans and makes water inhospitable to many species. **Four of 24 pH samples (17%) exceeded the MUN, AGR, REC-1, REC-2 standard for pH, and no pH samples exceeded the GEN standard for pH. The pH levels ranged from 7.4 to 8.5.**

### Dissolved Oxygen Concentration and Dissolved Oxygen Saturation

The Basin Plan general water quality objectives state annual median dissolved oxygen shall remain above 85% saturation. General and WARM objectives state that the dissolved oxygen concentration must remain above 5.0 mg/L at all times, and SPWN and COLD objectives state that the dissolved oxygen concentration must remain above 7.0 mg/L at all times. **All 24 samples met the general and WARM concentration standard, but two samples (8%) did not meet the COLD and SPWN concentration standard. Dissolved oxygen met the saturation standard during 2006 and 2007, with median annual values of 102 and 86% saturation, respectively.**

**Though no standards have been set in the Basin Plan regarding dissolved oxygen supersaturation (>100%), studies have shown that supersaturation of gases may cause gas bubble trauma in fish<sup>3</sup>. Dissolved gas saturation levels**

<sup>2</sup> Sigler, J.W., T.C. Bjornn, & F.H. Everst. (1984). *Effects of chronic turbidity on density and growth of steelhead and coho salmon*. Transactions of the American Fisheries Society. 113:142-150.

<sup>3</sup> Mesa, M.G., L.K. Weiland, & A.G. Maule. (2000). *Progression and severity of gas bubble trauma in juvenile salmonids*. Transactions of the American Fisheries Society. 129:174-185.

were not collected at this site; however, oxygen levels reached 157% saturation, which may indicate dissolved gas supersaturation.

### Chlorophyll a

Healthy and appropriate Chlorophyll a levels are not defined in the Basin Plan. Chlorophyll a indicates phytoplankton growth, a necessary component of healthy water bodies. Because turbidity causes interference for the Chlorophyll a probe, measurements of Chlorophyll a may not be accurate when turbidity is above 1000 NTU. Chlorophyll a levels over 40 µg/L are considered problematic by North Carolina Administrative Code (NCAC). **No readings exceeded the guideline. The Chlorophyll a readings averaged 2.2 µg/L.**

### Temperature

Sullivan et al.<sup>4</sup> state that the maximum weekly average temperatures for protection of steelhead or rainbow trout, and coho salmon are 19.6 and 19.7°C respectively. **The temperature averaged 17.6°C and ranged from 8.4 to 24.3°C. Though weekly averages were not taken, the temperatures taken at this site indicate averages that may regularly exceed the maximum temperatures for fish protection.**

## Summary of Toxicity Data

### Species with Significant Mortality

	Feb-06	May-06	Aug-06	Sep-06	Feb-07	Mar-07	Apr-07	Oct-07
Invertebrate (Water Column)			Yes <sup>+</sup>	No	No*	Yes		Yes
Invertebrate (Sediment)	No	Yes					Yes	
Fish (Water Column)	No		No	No	No*	No		No
Algae (Water Column)	Yes		No	No	Yes	Yes		No

<sup>+</sup>Indicates complete mortality within 24 hours of test initiation

\*Indicates significant effect on growth or reproduction (even though mortality did not have a significant effect)

Significant effect is determined by statistically significant rates of mortality, growth, or reproduction compared to a control sample and provides an indication that something is affecting plant or animal life in the stream. Invertebrates show significant sensitivity to organophosphates and pesticides. Significant effect to algae often indicates the presence of herbicides and metals such as copper. Fish are less sensitive to organophosphates but can be impacted by other pollutants such as ammonia and pyrethroid pesticides.

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<sup>4</sup> Sullivan, K., D.J. Martin, R.D. Cardwell, T.E. Toll, & S. Duke. (2000). *An analysis of the effects of temperature on salmonids of the Pacific Northwest with implications for selecting temperature criteria*. Portland, OR: Sustainable Ecosystems Institute.

## Photos of Site



February 2006



July 2006

## QAQC

The data in this water quality monitoring fact sheets meet the quality assurance and quality control requirements of the Water Board's Surface Water Ambient Monitoring Program (SWAMP). Additional surface water monitoring data are available at the Water Board's Central Coast Ambient Monitoring Program website <http://www.ccamp.org>. Any questions regarding the data or analysis should be directed to either **Peter Meertens** at [pmeertens@waterboards.ca.gov](mailto:pmeertens@waterboards.ca.gov) (805) 549-3869 or **Amanda Bern** at [abern@waterboards.ca.gov](mailto:abern@waterboards.ca.gov) (805) 594-6197.

## Attachment: Monitoring Data

Site Tag	Main Street Canal u/s Ray Road at Highway 166													
312 MSD	Beneficial Uses: Not Specified													
		Ammonia as N, Unionized	Chlorophyll a	Conductivity	Instantaneous Flow	Nitrate/Nitrite as N	N / STD	Orthophosphate as P	OP / STD	Oxygen, Dissolved	Oxygen, Saturation	pH	Turbidity	Water Temp
Units		mg/L	µg/L	mmho/cm	CFS	mg/L	none	mg/L	none	mg/L	%		NTU	°C
12/15/2005	Dec-05	0.0608	0.86	1.758	0.02	25.9	2.6	12.6	105	10.33	102	8.09	27.3	14.6
1/26/2006	Jan-06	0.3613	1.95	1.369	1.16	25	2.5	0.614	5	12.67	118	8.33	47.9	12.2
2/23/2006	Feb-06	0.2011	0.68	4.452	0.41	42	4.2	0.998	8	11.00	96	7.74	56.8	8.4
3/29/2006	Mar-06	0.0018	3.49	0.27	0.41	1.98	0.2	7.64	64	10.47	102	7.43	191.3	14.0
4/27/2006	Apr-06	0.0100	2.03	0.2532	0.51	3.67	0.4	0.429	4	8.71	86	7.93	280.3	14.9
5/16/2006	May-06	0.0826	11.1	1.84	0.51	30	3.0	6.97	58	9.85	116	7.77	974.0	23.2
6/27/2006	Jun-06	0.0185	3.29	1.561	0.39	18.1	1.8	3.65	30	7.43	84	8.21	274.8	20.3
8/22/2006	Aug-06	0.1193	2.38	1.441	1.13	14.4	1.4	1.4	12	7.85	95	8.12	34.3	24.3
9/26/2006	Sep-06	0.0356	0.01	1.754	0.59	38.7	3.9	1.29	11	9.95	111	8.20	8.9	20.3
10/25/2006	Oct-06	2.2435	0.01	1.898	0.31	29.7	3.0	36.02	300	10.26	118	8.46	179.5	21.8
11/15/2006	Nov-06	0.0148	0.88	1.016	0.22	3.76	0.4	1.89	16	11.02	118	8.07	9.7	18.7
12/13/2006	Dec-06	0.0024	1.71	0.9929	0.08	5.7	0.6	3.305	28	7.46	74	7.47	80.4	15.0
1/30/2007	Jan-07	0.0051	3.87	0.3023	0.12	2.2	0.2	0.682	6	8.74	85	7.71	307.7	14.0
2/14/2007	Feb-07	0.3068	0.55	1.414	0.36	13.8	1.4	12.38	103	8.20	81	8.23	40.1	15.1
3/20/2007	Mar-07	0.0125	4.41	1.392	1.83	12.3	1.2	1.109	9	9.90	101	8.34	106.1	16.0
4/10/2007	Apr-07	0.0071	1.15	1.511	0.12	6.61	0.7	11.42	95	9.78	94	7.87	57.3	13.1
5/29/2007	May-07	0.0280	1.78	1.654	0.94	37.1	3.7	4.647	39	7.85	83	7.96	1043.2	18.1
6/26/2007	Jun-07	0.2774	0	0.001	-0.88	18.7	1.9	2.916	24	9.18	107	7.93	1762.0	22.8
7/25/2007	Jul-07	0.1390	3.36	2.553	0.15	38.3	3.8	0.112	1	6.86	83	7.51	22.9	23.8
8/29/2007	Aug-07	0.9417	1.69	1.849	0.68	42	4.2	2.465	21	7.39	88	7.91	15.9	23.9
9/25/2007	Sep-07	0.0041	1.63	1.559	0.40	19.5	2.0	0.648	5	6.17	70	7.95	33.0	21.1
10/24/2007	Oct-07	0.0771	2.12	1.552	0.97	21.8	2.2	0.865	7	14.28	157	8.46	183.1	19.7
11/28/2007	Nov-07	0.1113	1.98	2.338	0.70	72.6	7.3	1.359	11	8.72	88	8.20	483.7	14.9
12/18/2007	Dec-07	0.0381	2.46	0.3579	42.90	12.5	1.3	0.91	8	8.70	83	8.06	1206.0	13.2
Average		0.212	2.2	1.46	2.3	22.3		4.85		9.3	Below	8.0	309	17.6
Standard Deviation		0.478	2.3	0.92	8.7	16.9		7.68		1.9		0.3	462	4.4
Minimum		0.002	0.0	0.00	-0.9	2.0		0.11		6.2	70	7.4	9	8.4
Maximum		2.244	11.1	4.45	42.9	72.6		36.02		14.3	157	8.5	1762	24.3
Standard		<0.025	<40	<0.75		<10		<0.12		>7.0		7-8.5	<25	
%Outside		63%	0%	21%		75%		96%		8%		0%	83%	
Standard 2				>3.0						>5.0		7-8.3		
%Outside				4%						0%		17%		
										Median Annual DO %				
										Year	Median	Meet Criteria		
										2006	102%	Yes		
										2007	86%	Yes		

indicates times exceeding standard