

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.

312ORC Orcutt Solomon Creek upstream from Santa Maria River

The Cooperative Monitoring Program sampled Orcutt Solomon Creek upstream from Santa Maria River 36 times (one sample per month) between January 2005 and December 2007.

Summary of Water Quality Data

Notable Measured Analytes for Water Quality Monitoring

Analyte/Parameter	Average	Range	Water Quality Criteria (WQC) or Guideline ¹	Percent Outside WQC or Guideline
Ammonia as N, Unionized	0.014 mg/L	0.001–0.058 mg/L	<0.025 mg/L ⁺	3%
Nitrate/Nitrite as N	34.6 mg/L	12.9–58.1 mg/L	<10.0 mg/L*	100%
Orthophosphate as P	0.35 mg/L	0.00–1.14 mg/L	<0.12 mg/L*	92%
Turbidity (NTU)	534 NTU	14–3000 NTU	<25 NTU*	97%
Conductivity	2.44 mmho/cm	0.00–3.36 mmho/cm	Ranges: ⁺ <0.75 No Problem 0.75–3.0 Increasing >3.0 Severe	% in Range: 3% 83% 14%
pH	7.8	7.2–8.2	7.0–8.3 ⁺	0%
Annual Median Dissolved Oxygen (% Saturation)	2005: 93% 2006: 82% 2007: 86%	60–156%	>85% annual median ⁺	Std met Std not met Std met
Dissolved Oxygen	8.6 mg/L	5.6–14.0 mg/L	>5.0 mg/L (GEN/WARM) * >7.0 mg/L (COLD/SPWN) ⁺	0% 9%
Chlorophyll a	3.9 µg/L	0.6–44.4 µg/L	<40 µg/L*	3%
Water Temperature	17.4°C	11.8–24.7°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 as defined in the Basin Plan for **Orcutt Solomon Creek** include Municipal and Domestic Supply (MUN), Agricultural Supply (AGR), Ground Water Recharge (GWR), Water Contact Recreation (REC-1), Non-Contact Water Recreation (REC-2), Wildlife Habitat (WILD), Cold Fresh Water Habitat (COLD), Rare, Threatened, or Endangered Species (RARE), Estuarine Habitat (EST), Freshwater Habitat (FRESH) and Commercial and Sport Fishing (COMM).

¹ 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. **One of 36 samples (3%) exceeded the standard (October 2006 – 0.058 mg/L). The average unionized ammonia concentration was 0.014 mg/L.**

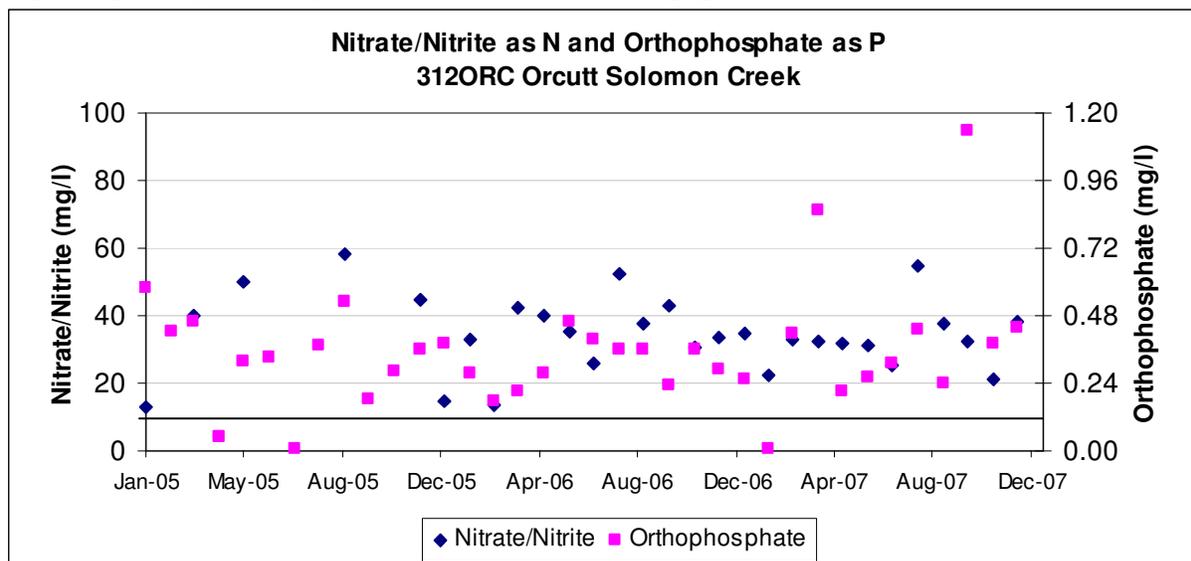
Nitrate/Nitrite as N

The Municipal and Domestic Supply (MUN) objective states in Table 3-2 of the Basin Plan that nitrate as 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. **All 29 nitrate/nitrite samples exceeded this guideline. The three highest concentrations occurred in August and September. The three lowest concentrations occurred between January and March. The average concentration was 34.6 mg/L.**

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 33 of 36 samples (92%). The average concentration was 0.35 mg/L**

The chart below shows the nitrate/nitrite and orthophosphate concentrations throughout the sampling period. The guidelines for nitrate/nitrite as N and orthophosphate as P state that their concentrations shall not exceed 10 mg/L and 0.12 mg/L, respectively, 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.² 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. **Thirty-four of 35 turbidity readings (97%) exceeded the guideline. Turbidity levels in Orcutt Solomon Creek averaged 534 NTU (over 21 times the guideline).**

² 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.

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. **One of 35 conductivity samples (3%) indicated no problems to irrigation water; 29 samples (83%) indicated increasing problems; five samples (14%) 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. **All 35 samples remained within the standard for pH, ranging from 7.2 to 8.2.**

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 35 samples met the general and WARM concentration standard, but three samples did not meet the COLD and SPWN concentration standard. Dissolved oxygen did not meet the saturation standard during 2006, with a median annual value of 82% saturation. The median annual values for 2005 (93%) and 2007 (86%) met the standard for dissolved oxygen saturation.**

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 fish³. Dissolved gas saturation levels were not collected at this site; however, oxygen levels reached 156% 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 3.9 µg/L.**

Temperature

Sullivan et al.⁴ states 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 17.4°C and ranged from 11.8 to 24.7°C. Though weekly averaged were not taken, the temperatures taken at this site indicated averages that may exceed the maximum temperatures for fish protection.**

³ 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.

⁴ 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.

Summary of Toxicity Data

Species with Significant Mortality

	Feb-05	Mar-05	Apr-05	Jul-05	Sep-05	Feb-06	May-06	Aug-06	Sep-06	Feb-07	Mar-07	Apr-07	Oct-07
Invertebrate (Water Column)	No*	Yes ⁺		No*		Yes		Yes ⁺	Yes	No*	Yes		Yes
Invertebrate (Sediment)			Yes		Yes		Yes					Yes	
Fish (Water Column)	Yes	No				No		No	No	No	No		No
Algae (Water Column)	No	No				No		No	No	No	No		No

⁺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.

Photos of Site



July 2006



February 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 (805) 549-3869 or **Amanda Bern** at abern@waterboards.ca.gov (805) 594-6197.

Attachment: Monitoring Data

Site Tag	Orcutt Solomon Creek														
312 ORC	Beneficial Uses: MUN, AGR, GWR REC1, REC2, WILD, COLD, RARE, EST, COMM, FRESH														
		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	T / STD	Water Temp
Units		mg/L	µg/L	mmho/cm	CFS	mg/L	none	mg/L	none	mg/L	%		NTU	none	°C
1/27/2005	Jan-05	0.0125	44.4	1.392	26.6	12.9	1.3	0.580	4.83	10.12	95	7.56	113	5	12.5
2/21/2005	Feb-05	0.0047	14.8	1.226	49.6			0.421	3.51	8.74	87	7.76	13.6	1	15.1
3/22/2005	Mar-05	0.0132	7.21	1.399		40	4.0	0.460	3.83	8.68	85	7.71	3000	120	14.4
4/19/2005	Apr-05	0.0067	2.42	3.056	20.2			0.049	0.41	8.97	103	7.45	425	17	21.9
5/24/2005	May-05	0.0065	1.22	2.86	12.8	50	5.0	0.320	2.67	8.78	95	7.79	327	13	18.7
6/21/2005	Jun-05	0.0056	1.35	2.481	14.5			0.330	2.75	8.23	90	7.72	632	25	18.9
7/26/2005	Jul-05	0.0125	2.18	2.78	13.3			0.004	0.03	8.41	96	7.95	435	17	21.5
8/31/2005	Aug-05	0.0129	1.41	2.605	13.0			0.373	3.11	7.12	83	7.68	457	18	22.2
9/27/2005	Sep-05	0.0352	0.62	3.332	9.3	58.1	5.8	0.527	4.39	13.99	156	7.90	49	2	20.3
10/25/2005	Oct-05	0.0027	3.08	3.362	4.7			0.185	1.54	9	92	7.59	119	5	15.8
11/29/2005	Nov-05	0.0241	1.63	2.553	9.2			0.283	2.36	8.78	88	7.80	636	25	15.2
12/15/2005	Dec-05	0.0049	0.98	2.746	5.9	44.8	4.5	0.359	2.99	10.91	101	7.61	25.3	1	11.8
1/26/2006	Jan-06	0.0052	13.7	1.515	26.3	14.9	1.5	0.378	3.15	11.27	109	8.18	134	5	14.1
2/23/2006	Feb-06	0.0018	1.1	2.505	10.0	32.8	3.3	0.275	2.29	9.89	99	7.62	108	4	14.7
3/30/2006	Mar-06	0.0008		2.334	16.2	13.4	1.3	0.177	1.48	9.48	96	7.61	126	5	15.0
4/27/2006	Apr-06	0.0125			11.0	42.1	4.2	0.212	1.76					0	
5/15/2006	May-06	0.0322	1.04	2.725	10.5	40	4.0	0.275	2.29	7.24	82	7.78	2859	114	21.1
6/28/2006	Jun-06	0.0034	2.59	2.916	9.2	35.5	3.6	0.462	3.85	5.67	60	7.33	36	1	17.3
7/26/2006	Jul-06	0.0046	1.76	2.714	17.1	25.6	2.6	0.394	3.28	5.55	65	7.70	909	36	22.5
8/23/2006	Aug-06	0.0383	2.16	2.9	11.6	52.5	5.3	0.363	3.03	7.48	82	7.88	418	17	19.0
9/27/2006	Sep-06	0.0036	1.81	2.586	8.2	37.7	3.8	0.360	3.00	8.21	85	7.89	196	8	16.7
10/25/2006	Oct-06	0.0581	2.08	3.337	8.5	42.7	4.3	0.235	1.96	7.8	89	8.15	842	34	21.2
11/15/2006	Nov-06	0.0073	1.4	2.407	7.9	30.5	3.1	0.361	3.01	7.64	79	7.73	735	29	16.9
12/14/2006	Dec-06	0.0125	2.2	2.776		33.5	3.4	0.291	2.43	7.74	77	7.73	110	4	15.0
1/30/2007	Jan-07	0.0125	1.73	3.021	6.1	34.7	3.5	0.252	2.10	8.73	86	7.70	36.9	1	14.0
2/14/2007	Feb-07	0.0006	1.46	2.383	11.2	22.1	2.2	0.004	0.03	7.76	77	7.22	31.4	1	15.0
3/21/2007	Mar-07	0.0367	1.27	2.414	5.7	33.1	3.3	0.415	3.46	9.9	100	7.64	113	5	15.1
4/11/2007	Apr-07	0.0044	1.73	2.371	9.9	32.5	3.3	0.851	7.10	9.68	97	7.85	272	11	14.9
5/29/2007	May-07	0.0019	1.36	2.373	6.7	31.9	3.2	0.211	1.76	7.69	85	7.76	894	36	20.1
6/26/2007	Jun-07	0.0038	1.92	0.001	4.3	31	3.1	0.260	2.16	9.59	104	8.04	1447	58	18.9
7/26/2007	Jul-07	0.0005	1.75	2.713	5.1	25.4	2.5	0.313	2.61	7.13	81	7.77	52.2	2	20.9
8/29/2007	Aug-07	0.0236	4.16	2.931	6.4	55	5.5	0.432	3.60	6.94	85	7.80	143	6	24.7
9/26/2007	Sep-07	0.0023	0.99	2.139	11.1	37.8	3.8	0.239	1.99	7.96	81	7.82	106	4	15.7
10/24/2007	Oct-07	0.056	1.54	2.659	8.3	32.5	3.3	1.139	9.49	9.3	104	7.92	819	33	20.3
11/29/2007	Nov-07	0.0131	1.81	2.545	5.3	21.4	2.1	0.381	3.17	8.79	86	8.06	972	39	14.1
12/18/2007	Dec-07	0.009	1.9	1.203	10.6	38	3.8	0.441	3.67	9.13	87	7.98	1112		12.9
Average		0.014	3.9	2.44	11.9	34.6		0.35		8.6	Below	7.8	534		17.4
Standard Deviation		0.015	7.8	0.70	8.6	11.5		0.21		1.6		0.2	705		3.4
Minimum		0.001	0.6	0.00	4.3	12.9		0.00		5.6	60	7.2	14		11.8
Maximum		0.058	44.4	3.36	49.6	58.1		1.14		14.0	156	8.2	3000		24.7
Standard		<0.025	<40	<0.75		<10		<0.12		>7		7-8.3	<25		
%Outside		3%	3%	3%		100%		92%		9%		0%	97%		
Standard 2				>3.0		Median Annual DO %				>5					
%Outside				14%	Year	Median	Meet Criteria			0%					
					2005	93%	Yes								
Concern Areas: Turbidity, Orthophosphates, nitrate					2006	82%	No								
					2007	86%	Yes								
indicates times exceeding standard															

