



Receiving Water Ammonia Study 2012 Annual Progress Report

Prepared by:



In Association with Applied Marine Sciences

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Introduction

The Novato Sanitary District owns and operates a secondary wastewater treatment facility (Facility). Discharge from the Facility to the receiving water, San Pablo Bay, is regulated under NPDES Permit No. CA0037958, which was most recently renewed on May 12, 2010 as Order No. R2-2010-00675 (Permit). Provision C.2.c of the Permit requires that a receiving water ammonia study be completed to characterize diurnal and seasonal variations of total and un-ionized ammonia in San Pablo Bay near the District's outfall.

The District submitted the Receiving Water Ammonia Study Work Plan to the San Francisco Bay Regional Water Quality Board on September 26, 2010, as required by Table 9, Task (a) of the Permit. Implementation of the work plan began as scheduled, with the first samples collected in January 2012. This report summarizes sampling results from calendar year 2012.

Summary of Activities

Receiving Water Monitoring

A total of 16 receiving water samples were collected during ten sampling events in January, April, July, and October 2012, representing a range of diurnal and seasonal conditions. Sampling location, procedures, and results are discussed in the sections below.

Sampling Location

All receiving water samples were collected within 300 feet of Station A ($38^{\circ} 0.970' N$, $122^{\circ} 27.730' W$), a background location beyond the influence of the discharge that is shown below in **Figure 1**. For reference, RMP station BD20 is also shown on **Figure 1**, as is the District's modeled mixing zone.



Figure 1: Location of Sampling Station, RMP Station BD20, and the District's Mixing Zone

Sampling Procedure

Sampling was conducted by staff from Applied Marine Sciences using a chartered vessel such as that shown in **Figure 2** (right). Applied Marine Sciences staff measured pH and temperature in the field. Samples for total ammonia, salinity, and hardness were collected as grab samples from 1 m below the surface. The exception was the sample collected on July 2, 2012, which was collected at 0.75 m below the surface since the total water depth was only 1 m.

One field blank and one field duplicate were collected for each parameter for each day of sampling.



Figure 2: R/V Questuary, used for collecting samples in San Pablo Bay

Grab samples were transmitted to Caltest Analytical Laboratory in Napa, California, for analysis of salinity by Standard Method (20th edition) 2520 B; hardness by Standard Method (20th edition) 2340 C; and total ammonia by Standard Method (20th edition) 4500-NH₃ C. This method for total ammonia had a method detection limit of 0.04 mg/L and a reporting limit of 0.1 mg/L.

Sample Results

Receiving water sample results were compiled and reviewed after each sampling event. All duplicate results showed less than 25% relative difference from their respective pairs and all field blanks were below the applicable method detection limits, indicating that the data set meets quality control standards for the project.

Un-ionized ammonia in the receiving water was calculated according to the equations below, which are appropriate when salinity is greater than 10 ppt (USEPA Publication 440/5-88-004, USEPA 1989, as given on page F-26 of the Permit):

$$[\text{Un-ionized NH}_3, \text{ mg/L as N}] = [\text{Total Ammonia, mg/L as N}] / (1 + 10^{(\text{pK} - \text{pH})})$$

Where:

$$\text{pK} = 9.245 + 0.116 \cdot (\text{I}) + 0.0324 \cdot (298 - \text{T}) + 0.0415 \cdot (\text{P}) / \text{T}$$

$$\text{I} = \text{the molal ionic strength of saltwater} = 19.9273 \cdot (\text{S}) / (1000 - 1.005109 \cdot \text{S})$$

S = salinity (parts per thousand)

T = temperature in Kelvin ($^{\circ}\text{C} + 273.15$)

P = pressure in atmospheres (1.0 atm)

For field duplicates, the temperature and pH associated with the duplicate pair were used to calculate the concentration of un-ionized ammonia. Results of these calculations are included with the sample results below in **Table 1**.

Table 1. Results of 2012 Receiving Water Monitoring

Sample Event ID	Sample Date	Sample Time	Salinity (ppt)	Temp. (°C)	pH	Hardness (mg/L)	Total Ammonia (mg/L as N)	Un-Ionized Ammonia (Calculated, mg/L as N)
1A	Jan. 12, 2012	8:00 AM	24	8.5	7.8	4,300	J 0.088	0.0008
1A - Dup.	Jan. 12, 2012	8:00 AM	24			4,300	J 0.077	0.0007
2A	Apr. 2, 2012	9:42 AM	15	13.6	7.84	2,800	0.12	0.0019
2A - Dup.	Apr. 2, 2012	9:42 AM	16			2,900	0.15	0.0023
2B	Apr. 2, 2012	5:36 PM	16	16.2	7.95	3,100	0.22	0.0052
3A	Apr. 3, 2012	7:00 AM	16	12.1	7.9	2,800	0.15	0.0024
3A - Dup.	Apr. 3, 2012	7:00 AM	16			2,800	0.13	0.0020
3B	Apr. 3, 2012	5:13 PM	15	15.5	7.97	2,800	0.14	0.0033
4A	Jul. 2, 2012	9:15 AM	24	19.8	7.79	3,900	< 0.04	0.0008
4A - Dup.	Jul. 2, 2012	9:15 AM	24			4,200	< 0.04	0.0008
5A	Oct. 1, 2012	7:45 AM	26	18.1	8.06	4,700	< 0.04	0.0013
5A - Dup.	Oct. 1, 2012	7:45 AM	25			4,500	< 0.04	0.0013
5B	Oct. 1, 2012	5:00 PM	25	21.5	7.88	4,400	< 0.04	0.0011
6A	Oct. 2, 2012	8:00 AM	25	17.9	7.99	4,700	< 0.04	0.0011
6A - Dup.	Oct. 2, 2012	8:00 AM	25			4,800	< 0.04	0.0011
6B	Oct. 2, 2012	4:48 PM	26	20.7	7.89	4,700	< 0.04	0.0011

Notes:

"<" indicates that ammonia was not detected. The method detection limit of 0.04 mg/L is shown.

"J" indicates the value is below the reporting limit of 0.1 mg/L and above the Method Detection Limit of 0.04 mg/L.

Effluent Monitoring

Effluent samples for ammonia, temperature, and pH were collected and reported to the Regional Water Board according to the District's Monitoring and Reporting Plan (MRP), which is Attachment E in the Permit. All effluent samples for ammonia were collected as 24-hour composites at monitoring location E-002, as defined in the MRP, during months with discharge to San Pablo Bay. Samples for ammonia were analyzed by Novato Sanitary District laboratory staff using Standard Method (19th edition) 4500-NH₃ D, with a method detection limit of 0.04 mg/L and a reporting limit of 0.1 mg/L. Temperature and pH were also monitored and reported according to the MRP. Ammonia, temperature, and pH data were previously submitted in the District's monthly self-monitoring reports for 2012, and were in full compliance with NPDES Permit requirements.

Future Work

Novato Sanitary District will continue to implement the Receiving Water Ammonia Study Plan in 2013. No updates to the Study Plan have been identified. Currently, sample collection is scheduled for 8:00 AM on January 3, April 1, July 1, and October 1, 2013, although exact sampling dates and times may vary to accommodate the safety and scheduling constraints of the sampling crew. The District will submit an annual progress report for 2013 by February 1, 2014, and a final report with the Report of Waste Discharge for permit reissuance, which is due on January 1, 2015.