Appendix C

APPENDICES

APPENDIX A

Proposed Basin Plan Amendment

Amend the following language in Chapter 3 of the Basin Plan as follows:

Table 3-3: Marine[a] Water Quality Objectives for Toxic Pollutants for Surface Waters (all values in μg/l)

Compound	4-day Average	1-hr Average	24-hr Average
Arsenic[b, c, d]	36	69	
Cadmium[b, c, d]	9.3	42	
Chromium VI[b, c, d, e]	50	1100	
Copper[c, d, f]			
Cyanide[g]			
Lead[b, c, d]	8.1	210	
Mercury[h]	0.025	2.1	
Nickel[b, c, d]	8.2	74	
Selenium[i]			
Silver[b, c, d]		1.9	
Tributyltin[j]			
Zinc[b, c, d]	81	90	
PAHs[k]			15

Notes:

a. Marine waters are those in which the salinity is equal to or greater than 10 parts per thousand 95% of the time, as set forth in Chapter 4 of the Basin Plan. Unless a site-specific objective has been adopted, these objectives shall apply to all marine waters, except for the South Bay south of Dumbarton Bridge, (where the California Toxics Rule (CTR) applies). For waters in which the salinity is between 1 and 10 parts per thousand, the applicable objectives are the more stringent of the freshwater (Table 3-4) or marine objectives.

b. Source: 40 CFR Part 131.38 (California Toxics Rule or CTR), May 18, 2000.

c. These objectives for metals are expressed in terms of the dissolved fraction of the metal in the water column.

d. According to the CTR, these objectives are expressed as a function of the water-effect ratio (WER), which is a measure of the toxicity of a pollutant in site water divided by the same measure of the toxicity of the same pollutant in laboratory dilution water. The 1-hr. and 4-day objectives = table value X WER. The table values assume a WER equal to one.

e. This objective may be met as total chromium.

f. Water quality objectives for copper were promulgated by the CTR and may be updated by U.S. EPA without amending the Basin Plan. Note: at the time of writing, the values are 3.1 ug/l (4-day average) and 4.8 ug/l (1-hr. average). The most recent version of the CTR should be consulted before applying these values.

g. Cyanide criteria were promulgated in the National Toxics Rule (NTR)~~. The NTR criteria specifically apply to San Francisco Bay upstream to and including Suisun Bay and Sacramento-San Joaquin Delta.~~ (Note: at the time of writing, the values are 1.0 µg/l (4-day average) and 1.0 µg/l (1-hr. average)) and apply, except when site-specific marine water quality objectives for cyanide have been adopted for San Francisco Bay as set forth in Table 3-3C.

h. Source: U.S. EPA Ambient Water Quality Criteria for Mercury (1984).

i. Selenium criteria were promulgated for all San Francisco Bay/Delta waters in the National Toxics Rule (NTR). The NTR criteria specifically apply to San Francisco Bay upstream to and including Suisun Bay and Sacramento-San Joaquin Delta. Note: at the time of writing, the values are 5.0 ug/l (4-day average) and 20 ug/l (1-hr. average).

j. Tributyltin is a compound used as an antifouling ingredient in marine paints and toxic to aquatic life in low concentrations. U.S. EPA has published draft criteria for protection of aquatic life (Federal Register: December 27, 2002, Vol. 67, No. 249, Page 79090-79091). These criteria are cited for advisory purposes. The draft criteria may be revised.

k. The 24-hour average aquatic life protection objective for total PAHs is retained from the 1995 Basin Plan. Source: U.S. EPA 1980.

Table 3-3C: Marine [a] Water Quality Objectives for Cyanide in San Francisco Bay [b] (values in µg/l)		
Cyanide	Chronic Objective (4-day Average)	2.9
Cyanide	Acute Objective (1-hour Average)	9.4

Notes:

a. Marine waters are those in which the salinity is equal to or greater than 10 parts per thousand 95% of the time, as set forth in Chapter 4 of the Basin Plan. For waters in which the salinity is between 1 and 10 parts per thousand, the applicable objectives are the more stringent of the freshwater or marine objectives.

b. Objectives apply to all segments of San Francisco Bay, including Sacramento/San Joaquin River Delta (within San Francisco Bay region), Suisun Bay, Carquinez Strait, San Pablo Bay, Central San Francisco Bay, Lower San Francisco Bay, and South San Francisco Bay.

Amend the following language in Chapter 4 of the Basin Plan as follows:

SITE-SPECIFIC OBJECTIVES

In some cases, the Water Board may elect to develop and adopt site-specific water quality objectives. These objectives will ~~be based on~~ reflect site-specific conditions and comply with the Antidegradation Policy. This situation may arise when:

It is determined that promulgated water quality standards or objectives are not protective of beneficial uses; or

Site-specific conditions warrant less stringent effluent limits than those based on promulgated water quality standards or objectives, without compromising the beneficial uses of the receiving water.

In the above cases, the Water Board may consider developing and adopting site-specific water quality objectives for the constituent(s) of concern. These site-specific objectives will be developed to provide the same level of environmental protection as intended by national criteria, but will more accurately reflect local conditions. Such objectives are subject to approval by the State Board, Office of Administrative Law, and U.S. EPA.

There may be cases where the promulgated water quality standard or adopted objectives are practically not attainable in the receiving water due to existing high concentrations. In such circumstances, discharges shall not cause impairment of beneficial uses.

<u>Site-specific objectives have been adopted by the Water Board for copper and nickel in Lower South San Francisco Bay, (Table 3-3A) and for cyanide in San Francisco Bay (Table 3-3C).</u>

IMPLEMENTATION OF EFFLUENT LIMITATIONS

In incorporating and implementing effluent limitations in NPDES permits, the following general guidance shall apply:

(A) PERFORMANCE-BASED LIMITS

Where water quality objectives in the receiving water are being met, and an existing effluent limitation for a substance in a discharge is significantly lower than appropriate water quality-based limits, performance-based effluent limitations for that substance may be specified or the effluent limit revised. Any changes are subject to compliance with the state Antidegradation Policy. The performance-based effluent limitation may be either concentration- or mass-based, as appropriate.

(B) SITE-SPECIFIC OBJECTIVE INCORPORATION

Once the Water Board has adopted a site-specific objective for any substance, effluent limitations shall be calculated from that objective in accordance with the ~~methods described above.~~ methodology in the "Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California" (SIP).

COPPER AND NICKEL IN LOWER SOUTH SAN FRANCISCO BAY

As part of the implementation plan for copper and nickel site-specific objectives, the municipal wastewater dischargers in Lower South San Francisco Bay shall have effluent limits for copper and nickel, derived from the site-specific objectives in Table 3-3A using SIP methodology. The Water Quality Attainment Strategy for copper and nickel in Lower South San Francisco Bay that implements these site-specific objectives is included in Chapter 7.

CYANIDE

Cyanide is present in low levels in all municipal wastewater effluents and most industrial wastewater effluents. Disinfection processes contribute to in-plant formation of cyanide. Therefore, cyanide in the effluent from municipal treatment plants is a combination of cyanide in the influent and cyanide produced during disinfection. Cyanide concentration spikes in the effluent, although rare, are generally caused by accidental high concentration discharges in the collection system.

As part of the implementation plan for marine site-specific objectives for cyanide, all municipal wastewater dischargers that discharge to any segment of San Francisco Bay including Sacramento/San Joaquin River Delta (within San Francisco Bay region), Suisun Bay, Carquinez Strait, San Pablo Bay, Central San Francisco Bay, Lower San Francisco Bay, and South San Francisco Bay shall have effluent limits for cyanide derived from the marine site-specific objectives in Table 3-3C, using the methodology in the SIP. Specifically, under Step 7 of the SIP methodology, effluent limits are necessary considering the nature of cyanide, its use in the disinfection process, and to promote achievement and ensure maintenance of the marine cyanide site-specific objectives.

Industrial wastewater dischargers to San Francisco Bay shall have effluent limits for cyanide derived from the marine site-specific objectives in Table 3-3C, using the methodology in the SIP. However, effluent limits shall not be required, under Step 7 of the SIP alone, where the industrial discharger demonstrates one of the following:

- Cyanide is not detected in its effluent, using a method with a detection limit of 1.0 μg/l
- It does not disinfect any portion of its effluent
- It otherwise demonstrates that cyanide is not used in its industrial process.

Effluent limits for shallow water dischargers that have been granted an exception to Basin Plan Prohibition 1 shall be based on the dilution credits set forth in Table 4-7. Setting forth dilution credits in Table 4-7 does not authorize discharges into shallow waters. Each discharger must continue to satisfy all requirements for an exception to Basin Plan Prohibition 1.

Table 4-7: Dilution Credits for Calculation of Cyanide Water Quality-Based Effluent Limits for Shallow Water Dischargers

Discharger	**Discharge Location**	**Dilution Credit**
American Canyon	North Slough	3.25:1
Fairfield-Suisun	Boynton Slough/Suisun Slough	4.0:1
Hayward Marsh	Hayward Shoreline Regional Park Marsh Basin	3.25:1
Las Gallinas	Miller Creek	3.25:1
Mt. View SD	Pacheco Slough	3.25:1
Napa SD	Napa River	3.25:1
Novato SD	San Pablo Bay	3.25:1
City of Palo Alto	Unnamed channel/South Bay	3.25:1
City of Petaluma	Petaluma River	3.25:1
City of San Jose	Artesian Slough/Coyote Creek	3.25:1
Sonoma County Water Agency	Shell Slough	3.25:1
City of Sunnyvale	Guadalupe Slough	4.0:1

Discharger	**Discharge Location**	**Dilution Credit**
USS Posco	New York Slough	3.25:1

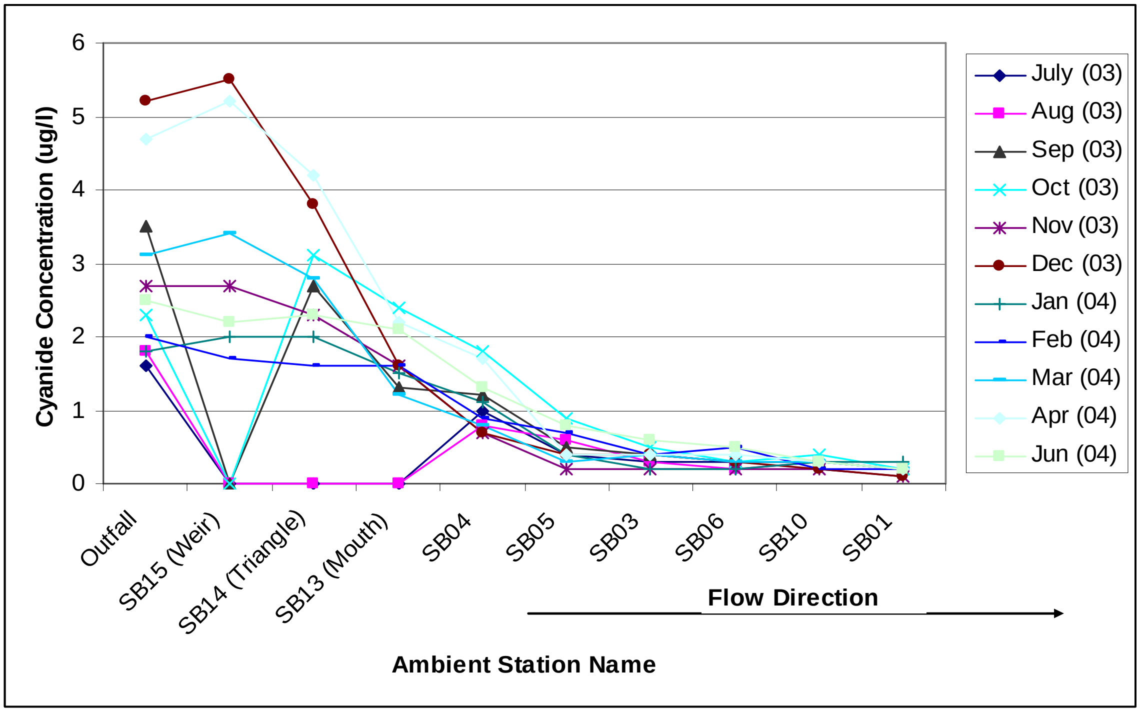
Where cyanide effluent limits are included in an NPDES permit, the discharger shall be required to implement a monitoring and surveillance program. This program shall include influent and effluent monitoring and ambient monitoring in San Francisco Bay. Each discharger shall review sources of cyanide to their influent at least once every five years. Where potential cyanide contributors exist within a discharger's service area, the discharger shall implement a local program to prevent illicit discharges to the sewer system which, at a minimum, shall include inspecting potential contributor sites, developing and distributing educational materials and preparing emergency monitoring and response plans to be implemented if a significant cyanide discharge occurs. Additionally, if ambient monitoring shows cyanide concentrations of 1.0 µg/L or higher, the discharger shall undertake actions to determine and abate identified sources of cyanide in San Francisco Bay.

APPENDIX B

Ambient Cyanide Data

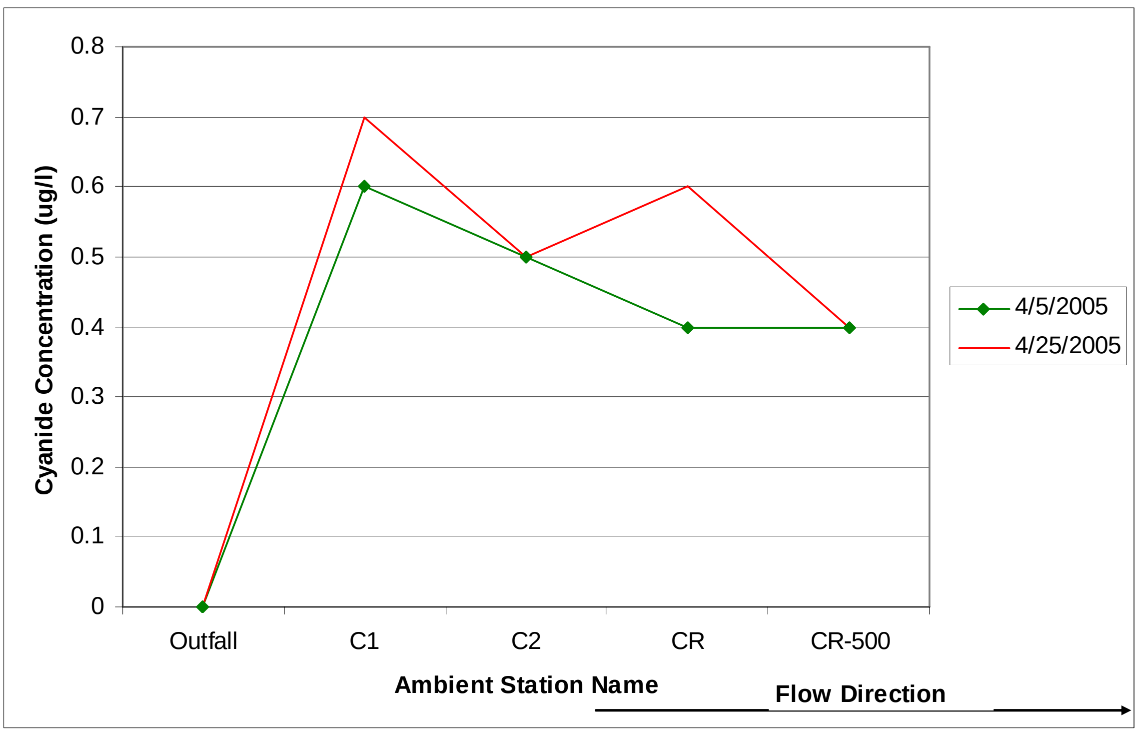
SAN JOSE-SANTA CLARA AMBIENT CYANIDE DATA (μG/L) FROM JULY 2003 TO JUNE 2004

Station	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Jun
Outfall	1.6	1.8	3.5	2.3	2.7	5.2	1.8	2	3.1	4.7	2.5
SB15 (Weir)	NS	NS	NS	NS	2.7	5.5	2	1.7	3.4	5.2	2.2
SB14 (Triangle)	NS	NS	2.7	3.1	2.3	3.8	2	1.6	2.8	4.2	2.3
SB13 (Mouth)	NS	NS	1.3	2.4	1.6	1.6	1.5	1.6	1.2	2.2	2.1
SB04	1	0.8	1.2	1.8	0.7	0.7	1.1	0.9	0.8	1.7	1.3
SB05	0.4	0.6	0.5	0.9	0.2	0.4	0.4	0.7	0.3	0.4	0.8
SB03	0.3	0.3	0.4	0.5	0.2	0.4	0.2	0.4	0.4	0.4	0.6
SB06	0.3	0.2	0.3	0.3	0.2	0.3	0.2	0.5	0.3	0.4	0.5
SB07	0.5	0.4	0.3	0.4	0.3	0.4	0.3	0.3	0.4	0.4	0.3
SB02	0.2	0.2	0.3	0.2	0.1	0.2	0.3	0.4	0.2	0.2	0.3
SB08	0.3	0.2	0.3	0.3	0.1	0.1	0.4	0.4	0.2	0.2	0.3
SB10	0.3	0.3	0.3	0.4	0.2	0.2	0.3	0.2	0.3	0.3	0.3
SB09	0.2	0.2	0.3	0.2	0.1	0.3	0.3	0.2	0.2	0.2	0.4
SB01	0.2	0.2	0.2	0.2	0.1	0.1	0.3	0.2	0.2	0.2	0.2
SB11	0.5	0.4	0.6	0.4	0.6	0.9	0.8	0.8	1.1	0.7	0.4
SB12	0.3	0.3	0.3	0.3	0.4	0.5	0.4	0.5	NS	0.5	0.3



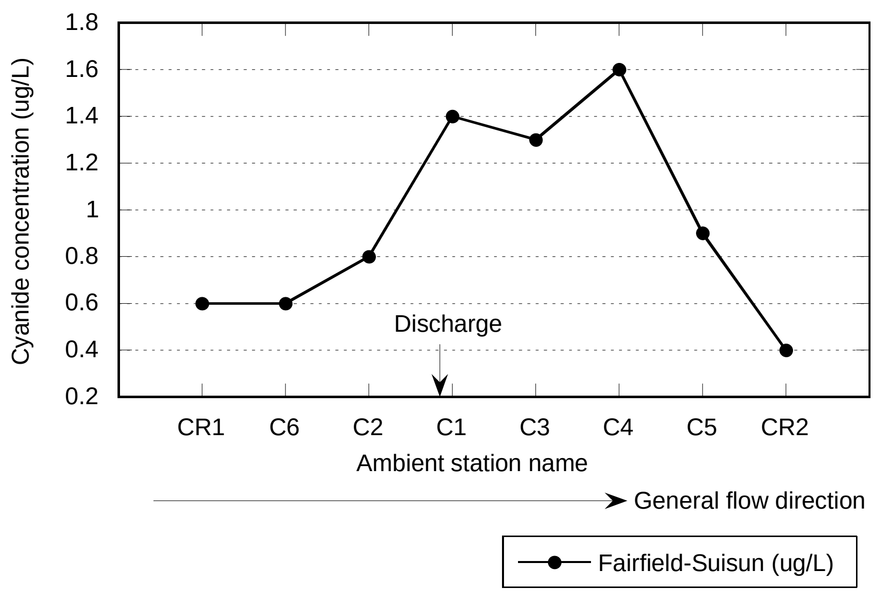
CITY OF AMERICAN CANYON AMBIENT CYANIDE DATA (μg/L)

Site	4/5/2005	4/25/2005
Outfall	<1	<1
C1	0.6	0.7
C2	0.5	0.5
CR	0.4	0.6
CR-500	0.4	0.4



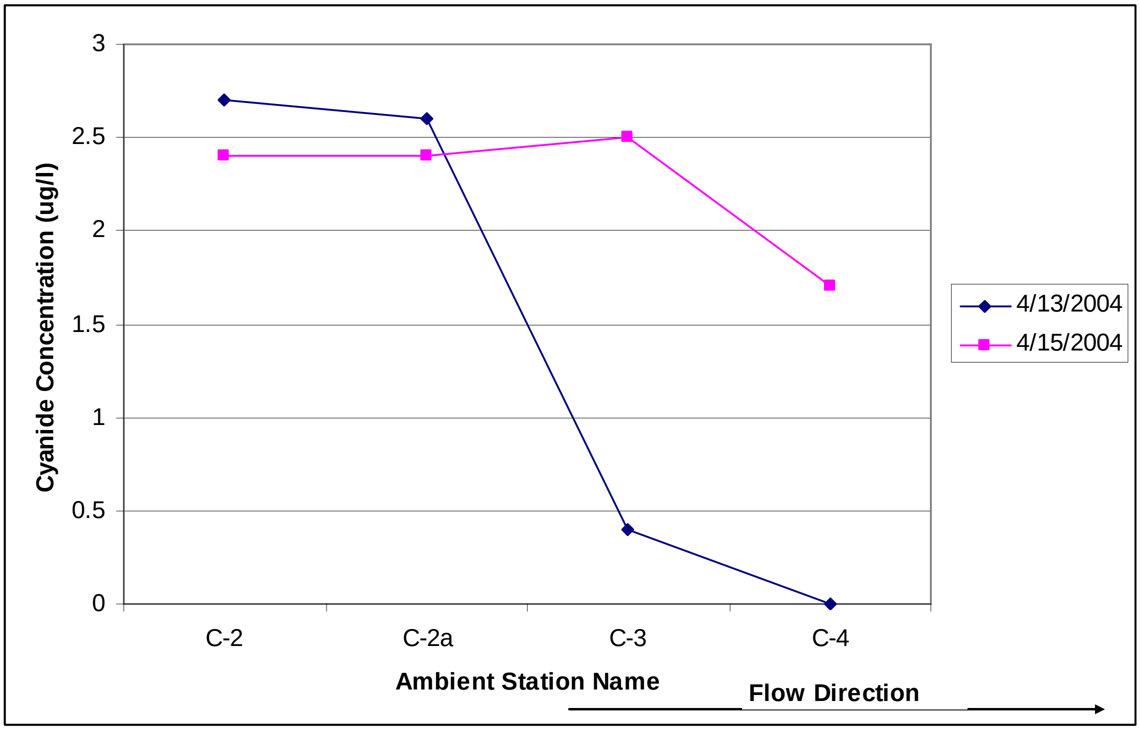
FAIRFIELD-SUISUN SEWER DISTRICT AMBIENT CYANIDE DATA (μg/L)

Station	2/26/04
CR1	0.6
C6	0.6
C2	0.8
C1	1.4
C3	1.3
C4	1.6
C5	0.9
CR2	0.4



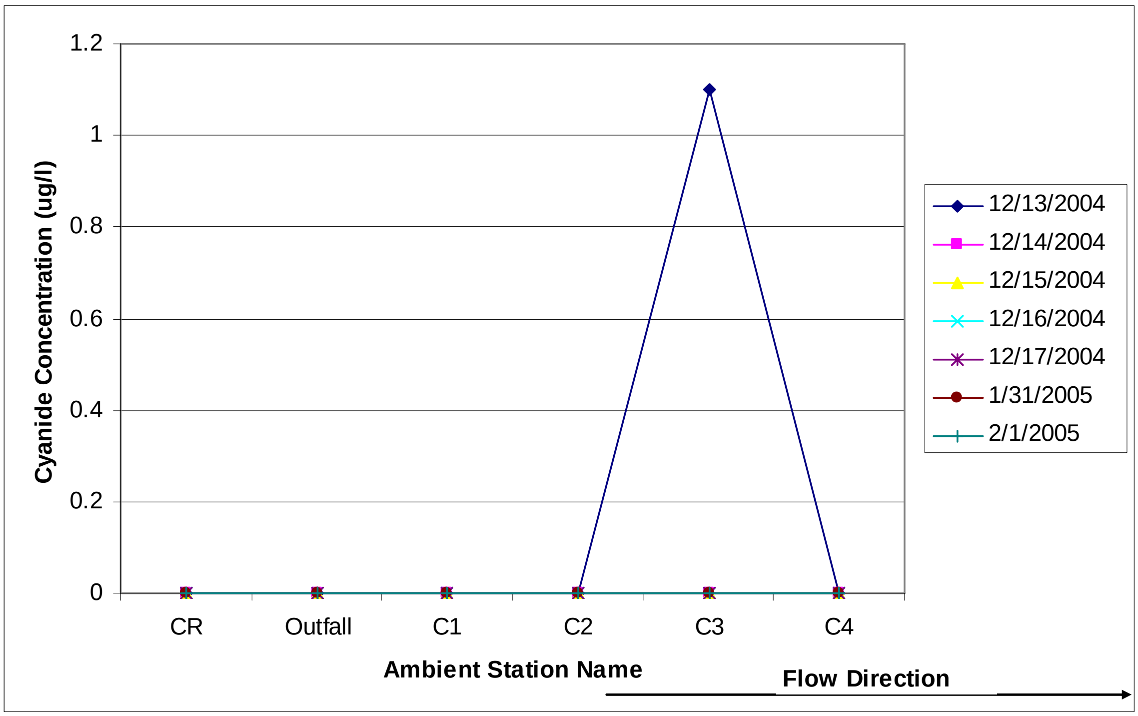
LAS GALLINAS SANITATRY DISTRICT AMBIENT CYANIDE DATA (µg/L)

Station	4/13/2004	4/15/2004	Minimum	Maximum	Average
C-2	2.7	2.4	2.4	2.7	2.55
C-2a	2.6	2.4	2.4	2.6	2.5
C-3	0.4	2.5	0.4	2.5	1.45
C-4	<0.3	1.7	0.3	1.7	1.7



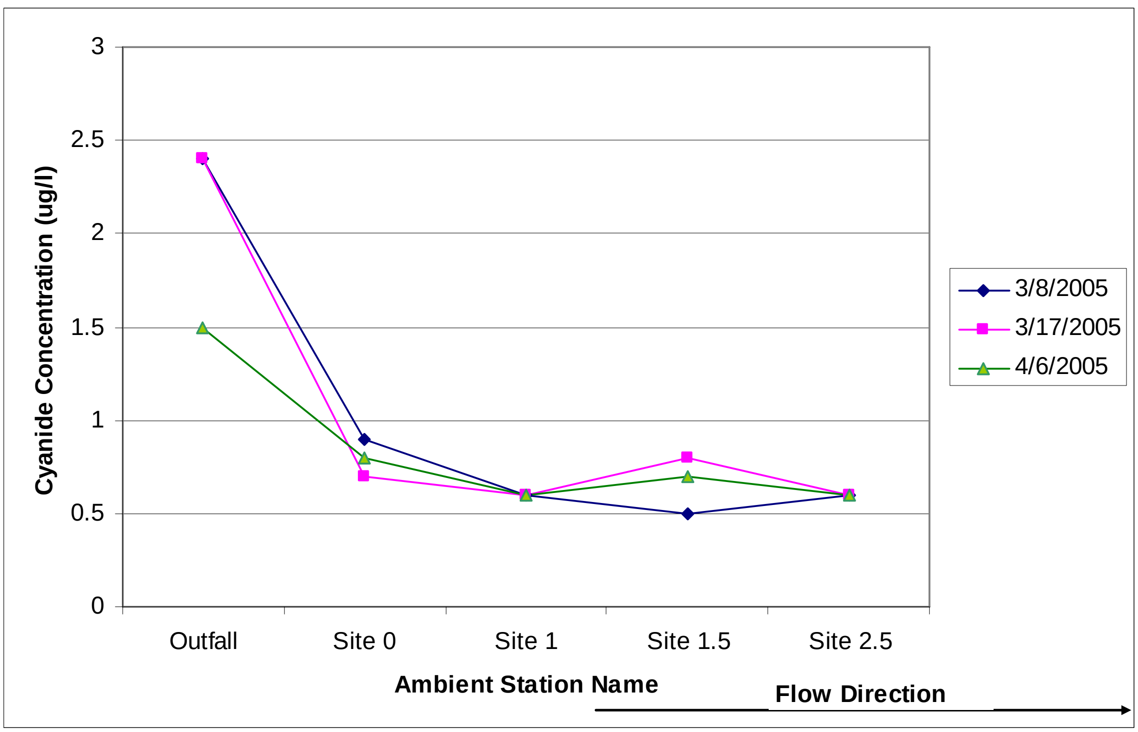
MOUNTAIN VIEW SANITARY DISTRICT AMBIENT CYANIDE DATA (μg/L)

Site	12/13/2004	12/14/2004	12/15/2004	12/16/2004	12/17/2004	1/31/2005	2/1/2005
Outfall	<1	<1	<1	<1	<1		
C1	<1						
C2	<1						
C3	1.1					<1	<1
C4	<1						
CR	<1						



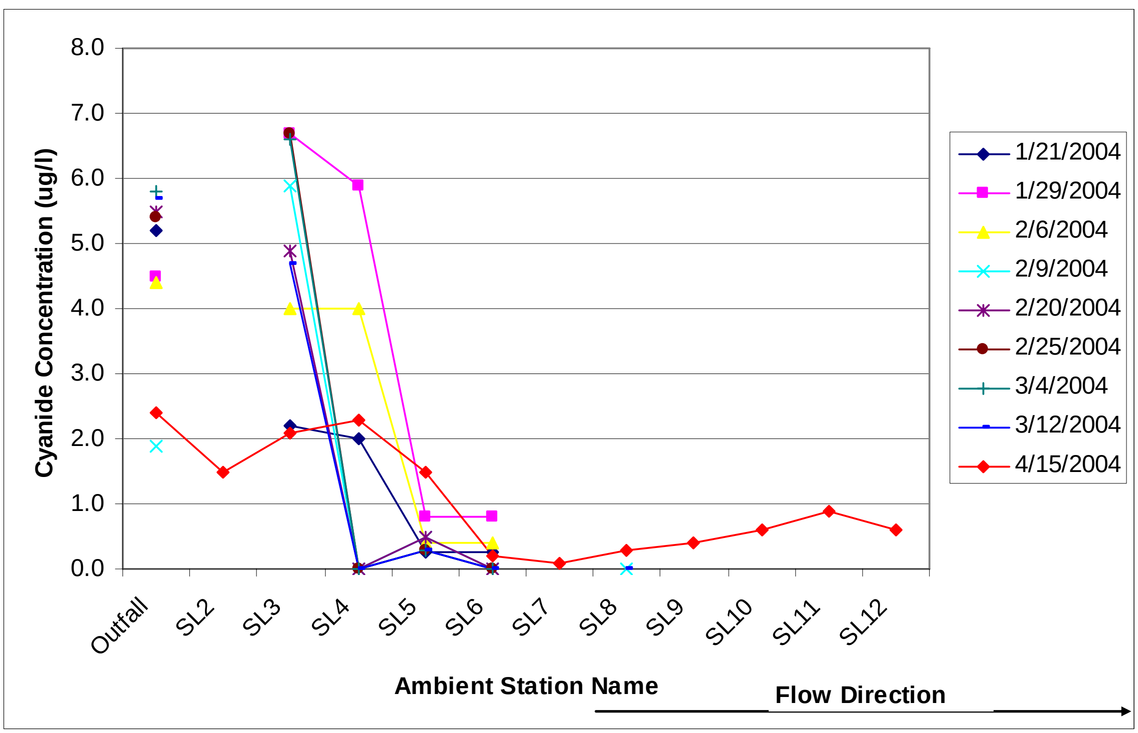
NAPA SANITATION DISTRICT AMBIENT CYANIDE DATA (µg/L)

Site	3/8/2005	3/17/2005	4/6/2005
Outfall	2.4	2.4	1.5
Site 0	0.9	0.7	0.8
Site 1	0.6	0.6	0.6
Site 1.5	0.5	0.8	0.7
Site 2.5	0.6	0.6	0.6



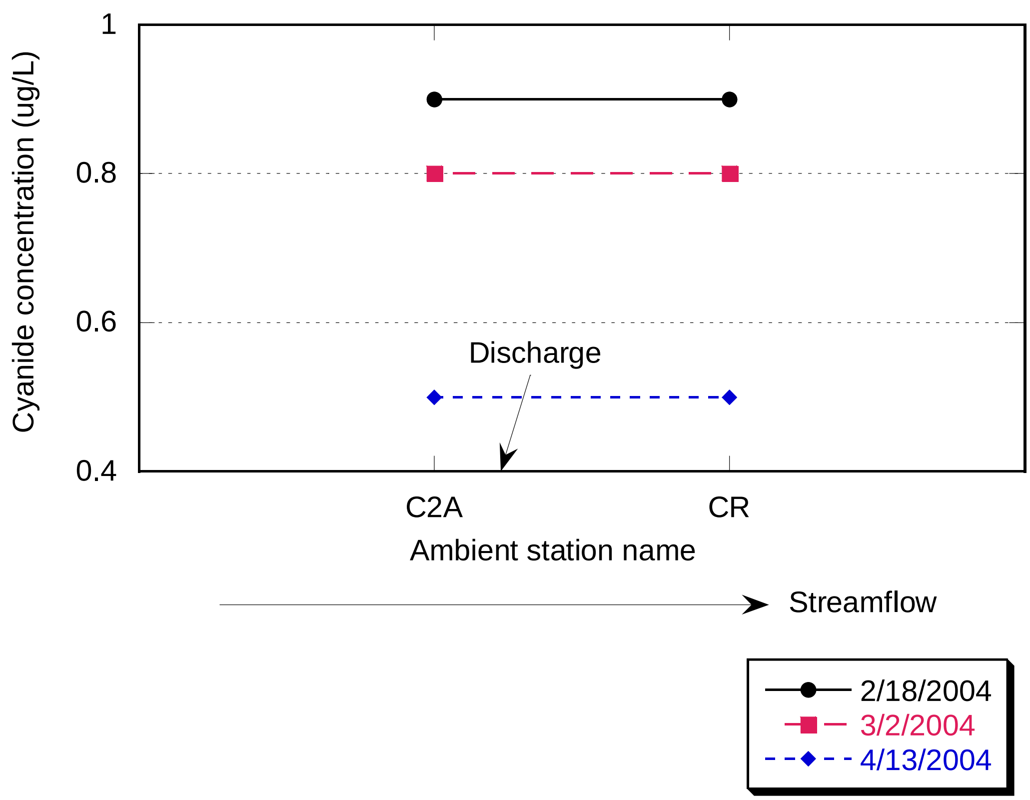
CITY OF PALO ALTO AMBIENT CYANIDE DATA (µg/L)

Site	1/21/2004	1/29/2004	2/6/2004	2/9/2004	2/20/2004	2/25/2004	3/4/2004	3/12/2004	4/15/2004
Outfall	5.2	4.5	4.4	1.9	5.5	5.4	5.8	5.7	2.4
SL2									1.5
SL3	2.2	6.7	4	5.9	4.9	6.7	6.6	4.7	2.1
SL4	2	5.9	4						2.3
SL5	0.26	0.8	0.4	0.5	0.5	0.3	0.3	0.3	1.5
SL6	0.26	0.8	0.4						0.2
SL7									0.1
SL8									0.3
SL9									0.4
SL10									0.6
SL11									0.9
SL12									0.6



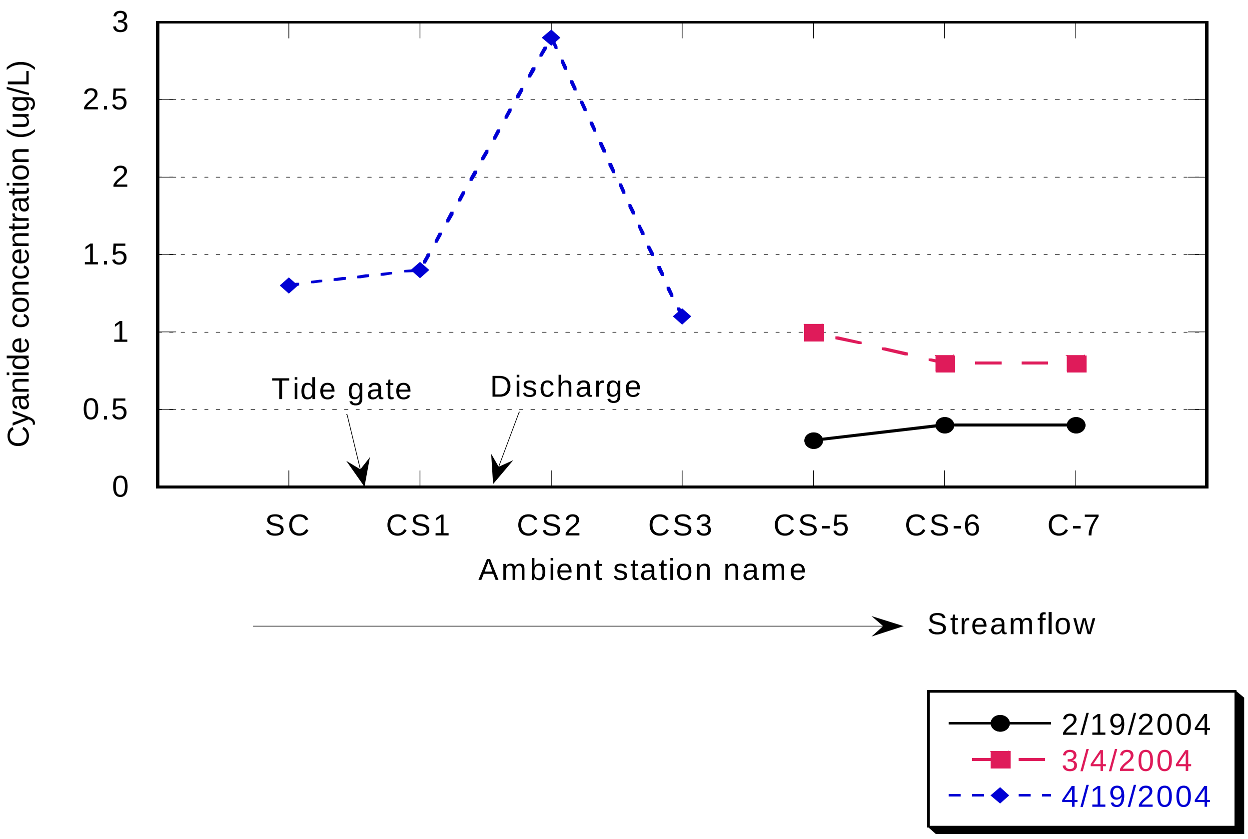
CITY OF PETALUMA AMBIENT CYANIDE DATA (µg/L)

Station	2/18/04	3/2/04	4/13/04	Minimum	Maximum	Average
C2A	0.9	0.8	0.5	0.5	0.9	0.73
CR	0.9	0.8	0.5	0.5	0.9	0.73



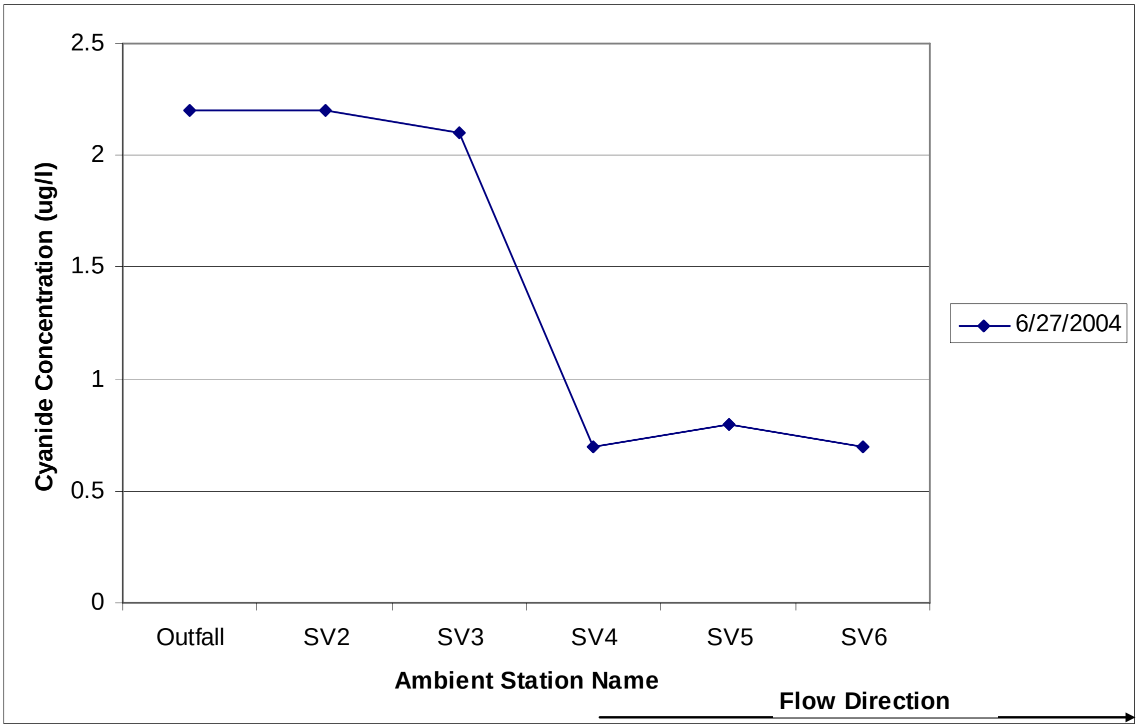
SONOMA COUNTY WATER AGENCY AMBIENT CYANIDE DATA (µg/L)

Station	2/19/04	3/4/04	4/19/04	Minimum	Maximum	Average
SC			1.3	1.3	1.3	1.30
CS1			1.4	1.4	1.4	1.40
CS2			2.9	2.9	2.9	2.90
CS3			1.1	1.1	1.1	1.10
CS-5	0.3	1		0.3	1	0.65
CS-6	0.4	0.8		0.4	0.8	0.60
C-7	0.4	0.8		0.4	0.8	0.60



CITY OF SUNNYVALE AMBIENT CYANIDE DATA (μg/L)

Site	6/27/2004
Outfall	2.2
SV2	2.2
SV3	2.1
SV4	0.7
SV5	0.8
SV6	0.7



APPENDIX C

Discharger Performance Summary

A summary of cyanide effluent concentration data for individual NPDES dischargers is provided below in Table 1 and 2. In Table 3, data are summarized by treatment category: (1) municipal secondary treatment facilities, (2) municipal advanced secondary facilities, and (3) industrial facilities. These tables are based on data from the period 2000 to 2004. Effluent data for deep water dischargers was accessed from the Electronic Reporting System (ERS) database, while shallow water discharger data was obtained directly form the dischargers as well as the ERS.

Table 1: Effluent Cyanide Concentrations in Deep Water NPDES Discharges (2000- 2004)[1]

Deep Water Dischargers	n	%ND[a]	min (μg/L)	max (μg/L)	median (μg/L)	mean[b] (μg/L)	stdev
Benicia, City of	48	14.6%	0.9	26.0	4.0	5.6	5.1
Burlingame, City of	58	31.0%	0.9	13.0	3.0	3.3	2.0
Central Contra Costa Sanitary District	45	44.4%	2.0	9.9	3.1	3.8	1.7
Central Marin Sanitation Agency	47	29.8%	0.6	16.0	3.0	4.3	2.9
Chevron Richmond Refinery	32	46.9%	3.0	14.9	10.0	7.3	3.7
ConocoPhillips (at Rodeo)	52	53.8%	3.0	14.0	5.0	6.1	2.4
Delta Diablo Sanitation District	45	82.2%	1.0	13.0	6.0	7.1	3.1
Dow Chemical Company	26	80.8%	0.9	5.7	3.0	3.3	1.4
Dublin San Ramon Services District	51	98.0%	7.0	8.8	7.0	7.0	0.3
EBDA	186	58.6%	3.0	68.0	3.0	5.1	8.1
EBMUD	101	18.8%	0.0	25.0	4.0	5.7	4.3
GWF E 3rd St (Site I)	17	88.2%	5.0	10.0	7.0	7.5	2.5
GWF Nichols Rd (Site V)	16	100.0%	3.0	10.0	7.5	7.4	2.8
Livermore, City of	7	100.0%	3.0	25.0	18.0	14.9	9.1
Martinez Refining Company	129	0.0%	4.0	29.0	13.0	13.2	5.7
Millbrae, City of	47	48.9%	0.6	18.0	3.0	3.7	2.6
Morton	6	100.0%	2.0	10.0	10.0	7.5	3.9
North San Mateo	15	93.3%	5.0	50.0	10.0	17.3	17.0
Pacifica Calera Creek	33	48.5%	1.0	60.0	3.0	4.8	10.0
Pinole-Hercules	28	64.3%	0.9	10.0	3.0	3.5	1.6
Rhodia Basic Chemicals	14	100.0%	10.0	10.0	10.0	10.0	0.0
Rodeo Sanitary District	20	65.0%	1.9	7.0	3.0	3.7	1.2
S.F. Airport, Water Quality Control Plant	48	89.6%	3.0	16.5	10.0	9.8	1.9
S.F.Airport, Industrial	145	98.6%	3.0	10.0	10.0	9.8	1.1
S.F.City & County Southeast, North Point & Bayside	113	75.2%	0.2	10.0	10.0	7.8	3.6
Sewer Authority Mid-Coastside	4	100.0%	5.0	10.0	10.0	8.8	2.5
San Francisco Oceanside	33	100.0%	10.0	10.0	10.0	10.0	0.0
San Mateo, City of	42	66.7%	3.0	15.0	3.0	4.3	2.2
Sausalito-Marin Sanitary District	41	4.9%	1.6	20.0	9.0	9.6	4.7
South Bayside System Authority	101	48.5%	1.1	14.7	10.0	7.8	3.0
South San Francisco & San Bruno	105	32.4%	3.0	430.0	8.0	18.3	45.1
Tiburon Treatment Plant	9	88.9%	5.0	5.0	5.0	5.0	0.0
Tesoro Golden Eagle Refinery	173	54.9%	3.0	28.0	10.0	8.8	4.1
US Navy Treasure Island	11	100.0%	10.0	10.0	10.0	10.0	0.0
Valero Benicia Refinery	166	97.6%	10.0	15.0	10.0	10.0	0.4
Vallejo San & Flood Control District	36	72.2%	3.0	22.8	3.0	4.8	5.0
West County/Richmond	12	8.3%	0.9	8.0	3.5	3.6	2.0

[1]Data used to compile this summary were taken from discharger-recorded data between the time period of January 2000 – April 2004. The summary represents available data from this time period rather than a continuous summary of that time period.

[a] When sample was reported as "not detected", summary statistics were performed assuming the concentration = detection limit.

[b]Averages were calculated using the probability regression method

Table 2: Effluent Cyanide Concentrations in Shallow Water NPDES Discharges (2000-2004)

Shallow Water Dischargers[a]	n	%ND[a]	min (µg/L)	max (µg/L)	median (µg/L)	mean[b] (µg/L)	stdev
American Canyon	15	53.3%	<3	2.9	<3	1.4	0.5
Fairfield-Suisun Sewer District	101	37.6%	<0.9	28	3.0	3.9	0.8
Hayward Marsh	33	54.5%	<3	11.3	<3	2.9	0.7
USD discharge into Hayward Marsh	48	66.7%	<3	24	<3	2.4	1.1
Las Gallinas Valley SD	20	55.0%	<3	10	<3	3.0	0.7
Mt. View Sanitary District	22	81.8%	<3	1.6	<3	0.5	0.6
Napa Sanitation District	54	72.2%	<0.3	20	<3	2.6	1.0
Novato Sanitation District	24	50.0%	<0.9	4.4	1.6	1.8	0.6
Palo Alto, City of	50	58.0%	<1.6	5	<3	3.3	1.0
Petaluma, City of	27	44.4%	<3	10	1.6	2.9	0.8
San Jose Santa Clara WPCP[1]	11	0%	1.6	5.2	2.5	5.1	0.4
Sonoma Valley County Water Agency	44	77.3%	<3	13	<5	3.2	0.7
Sunnyvale, City of	80	70.0%	<5	29	<5	4.4	0.8
USS-Posco	36	100.0%	5.0	10.0	10.0	8.8	2.2

[1] 2003 – 2004 data values were used for this summary. All other discharger summaries use data from 2000-2003.
[a]Non-detects (NDs) are considered smaller than those detected values when determining the minimum and median
[b]Averages were calculated using the probability regression method

Table 3: Effluent Cyanide Concentrations by Facility Category

	Advanced Secondary	Secondary	Industrial
n	440	1182	869
min (µg/L)	0.3	0.003	0.9
max (µg/L)	29	430	29
median (µg/L)	5	4.75	10
mean (µg/L)	5.6	7.1	9.3
stdev	3.4	14.8	3.9

Cyanide effluent data are shown graphically in Figures 1 through 5. Figures 1 through 3 portray effluent data for individual facilities in "box and whisker" plots. These plots show the full data set for each facility (10th percentile, 25th percentile, 50th percentile, 75th percentile and 90th percentile) and are grouped by facility category. Figure 4 shows the pooled results for all facilities in the three treatment categories. Figure 5 depicts the pooled probability plots for each of the three treatment categories. Frequency distribution of cyanide concentrations in effluent discharged to shallow waters is presented in Figure 6 indicating that only a small proportion of cyanide samples currently exceeds low toxicity threshold of 5 µg/L.

Figure 1: Maximum Daily Effluent Cyanide: Secondary Dischargers (2000 - 2004)

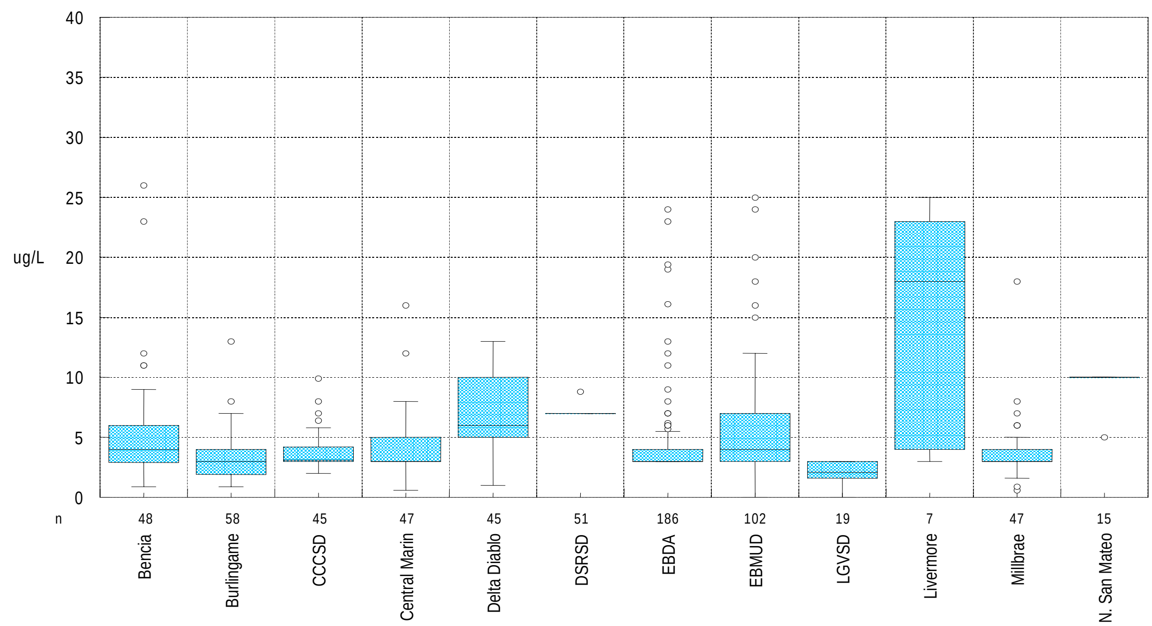


Figure 1, continued: Maximum Daily Effluent Cyanide: Secondary Dischargers (2000 - 2004)

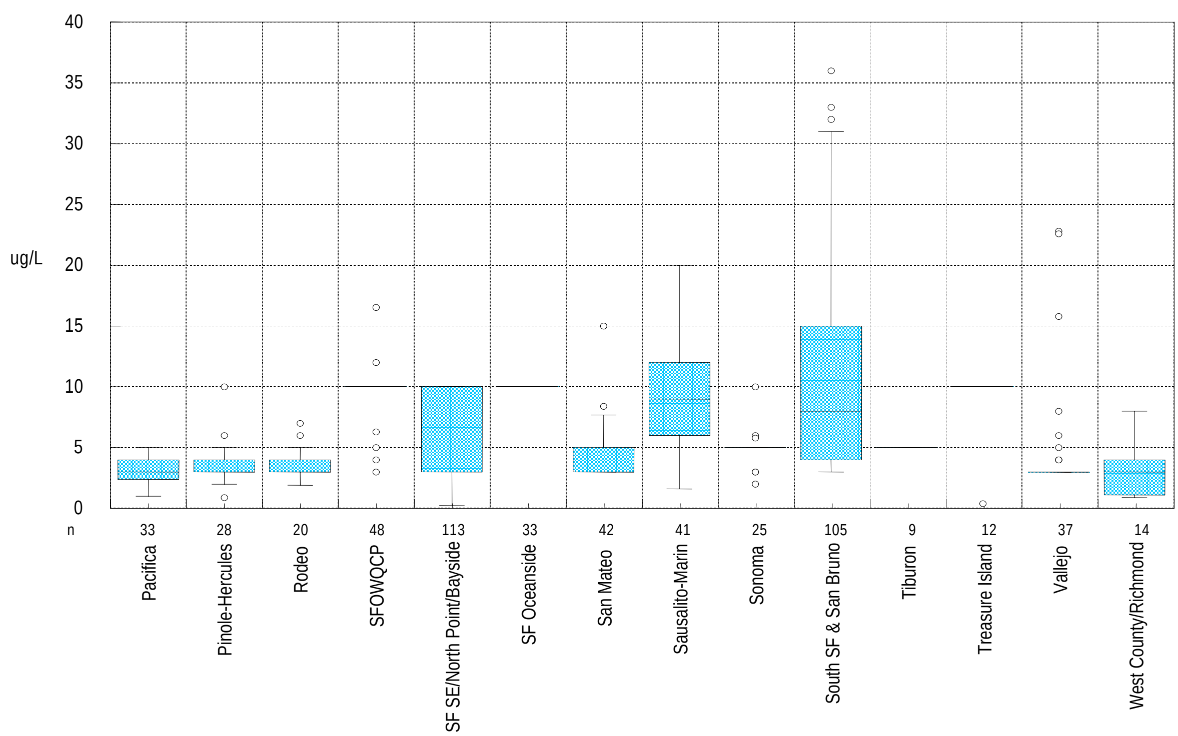


Figure 2: Maximum Daily Effluent Cyanide: Advanced Secondary Dischargers (2000 - 2004)

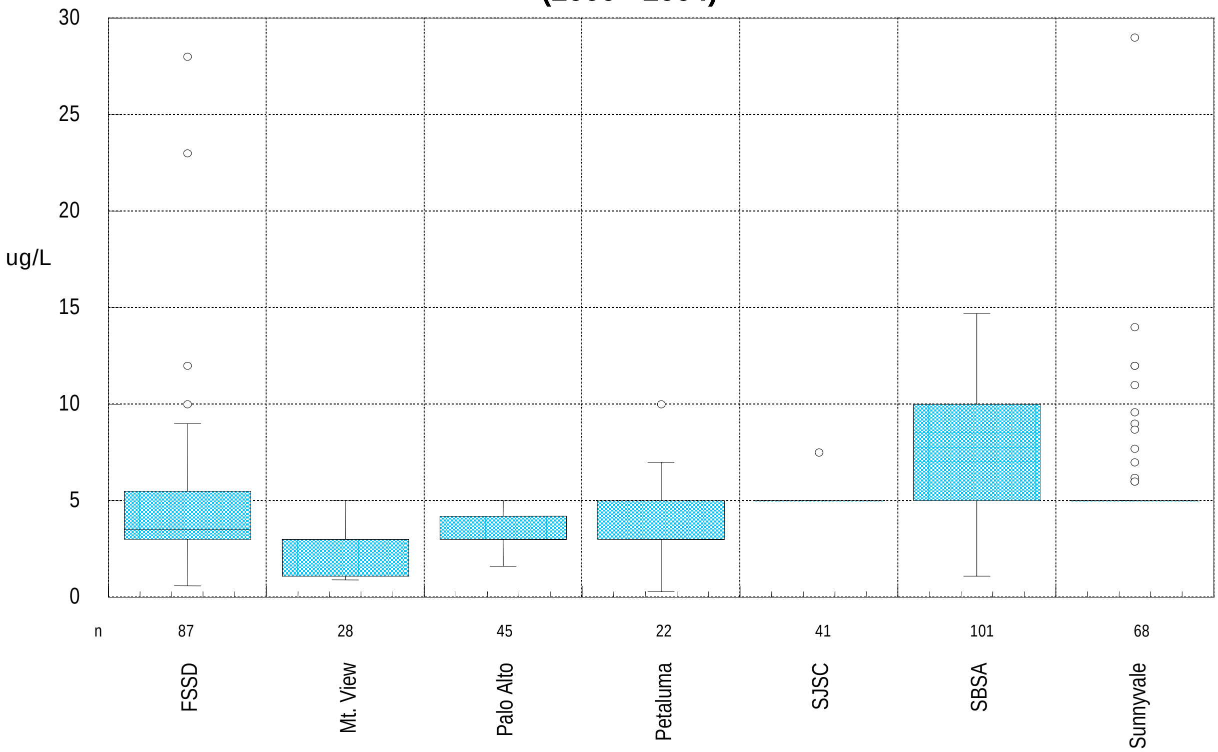


Figure 3: Maximum Daily Effluent Cyanide; Industrial Dischargers (2000 - 2004)

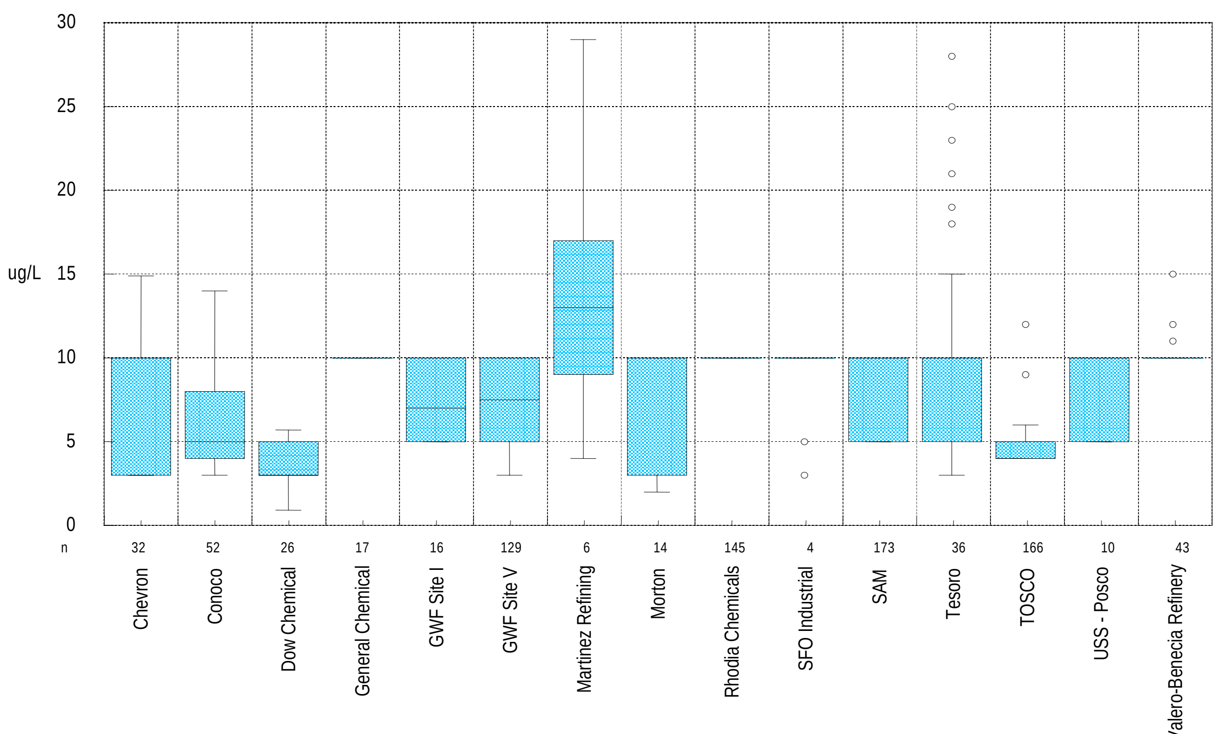
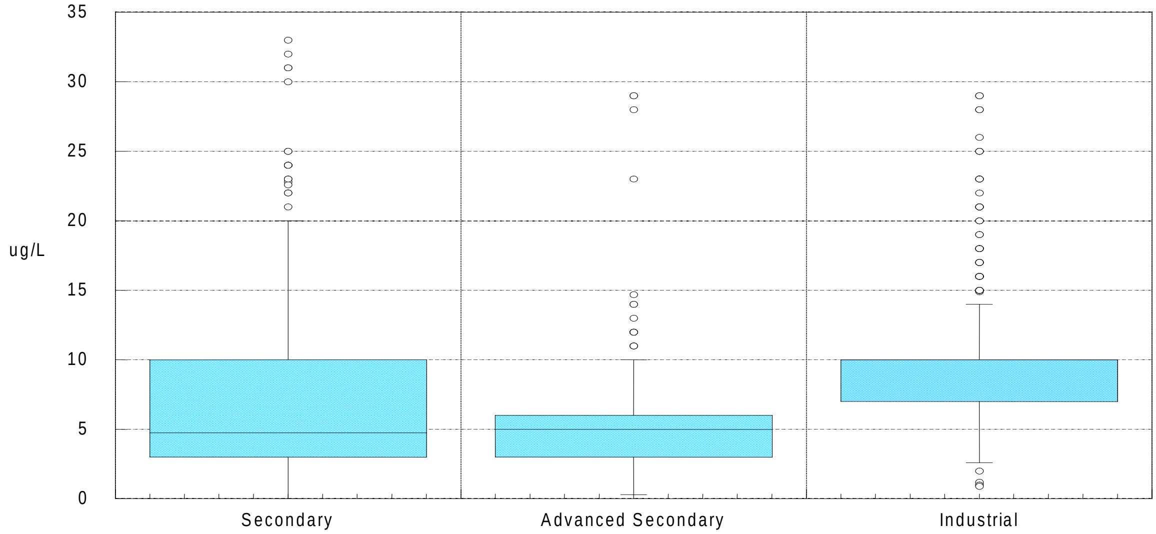


Figure 4: Effluent Cyanide Concentrations by Facility Category (2000 – 2004)



	Secondary	Advanced Secondary	Industrial
n	1182	440	869
min	0.003	0.3	0.9
max	430	29	29
median	4.75	5	10
mean	7.1	5.6	9.3
stdev	14.8	3.4	3.9

Figure 5: Maximum Daily Effluent Cyanide (2000 - 2004)

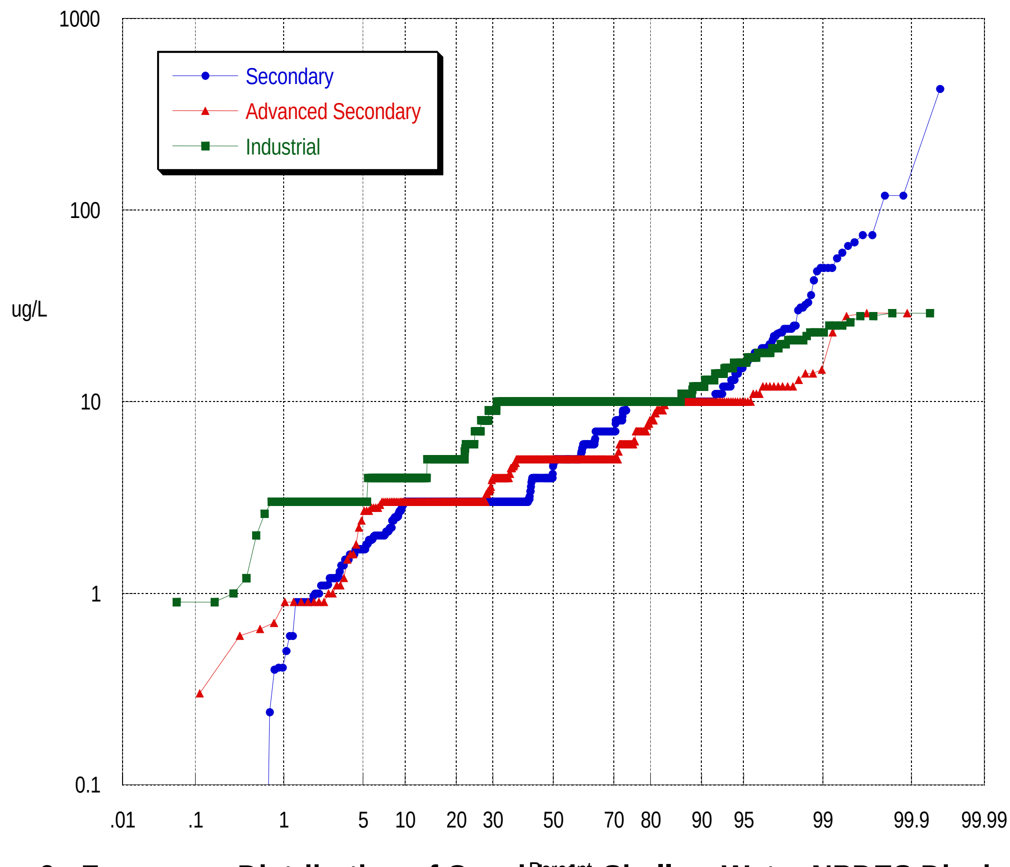
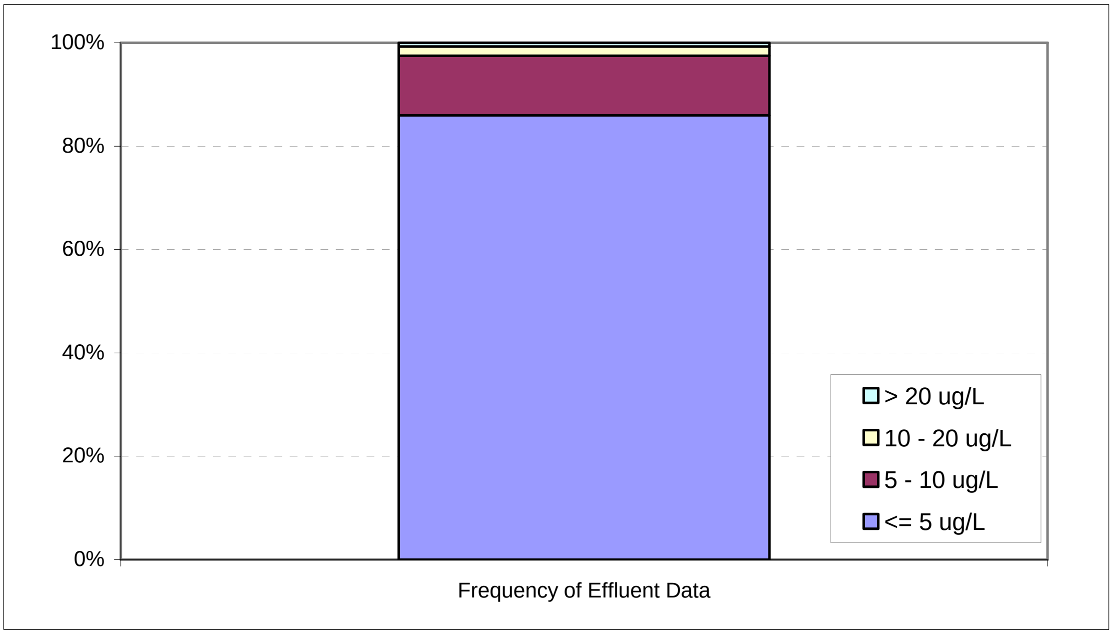


Figure 6: Frequency Distribution of Cyanide in Shallow Water NPDES Discharges (2000 - 2004)

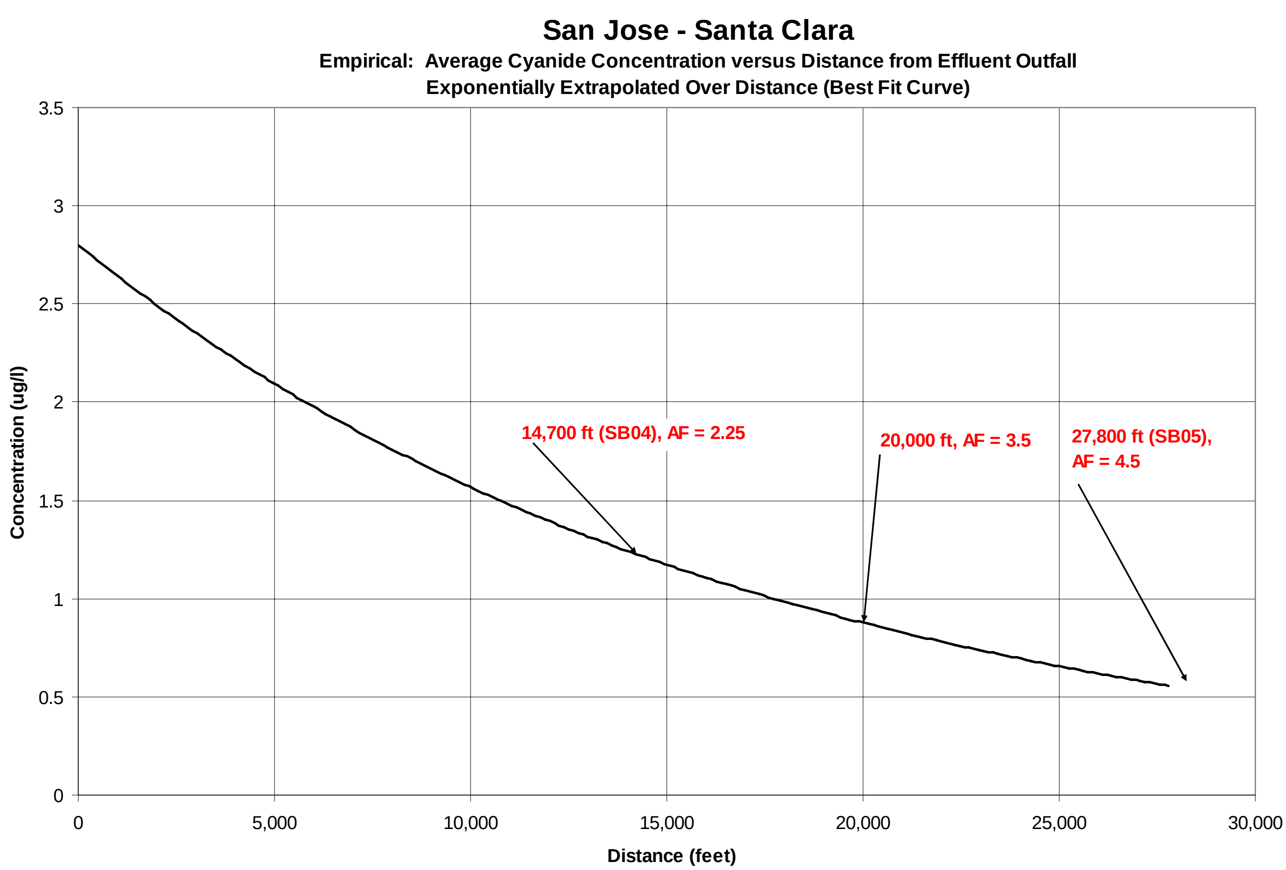

100%
80%
60%
40%
20%
0%
> 20 ug/L
10 - 20 ug/L
5 - 10 ug/L
<= 5 ug/L
Frequency of Effluent Data

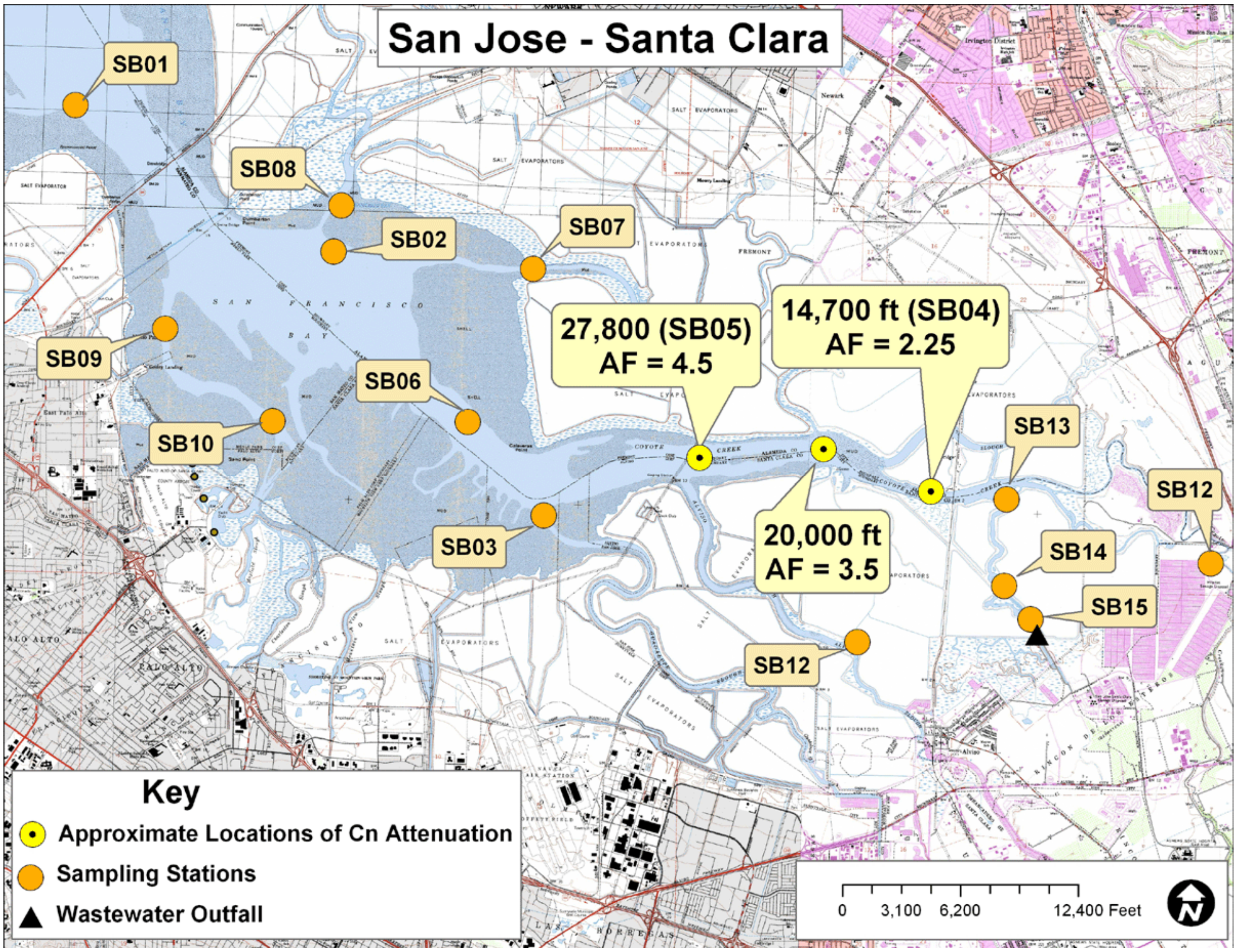
APPENDIX D

Spatial Descriptions of Effluent Attenuation

San Jose – Santa Clara

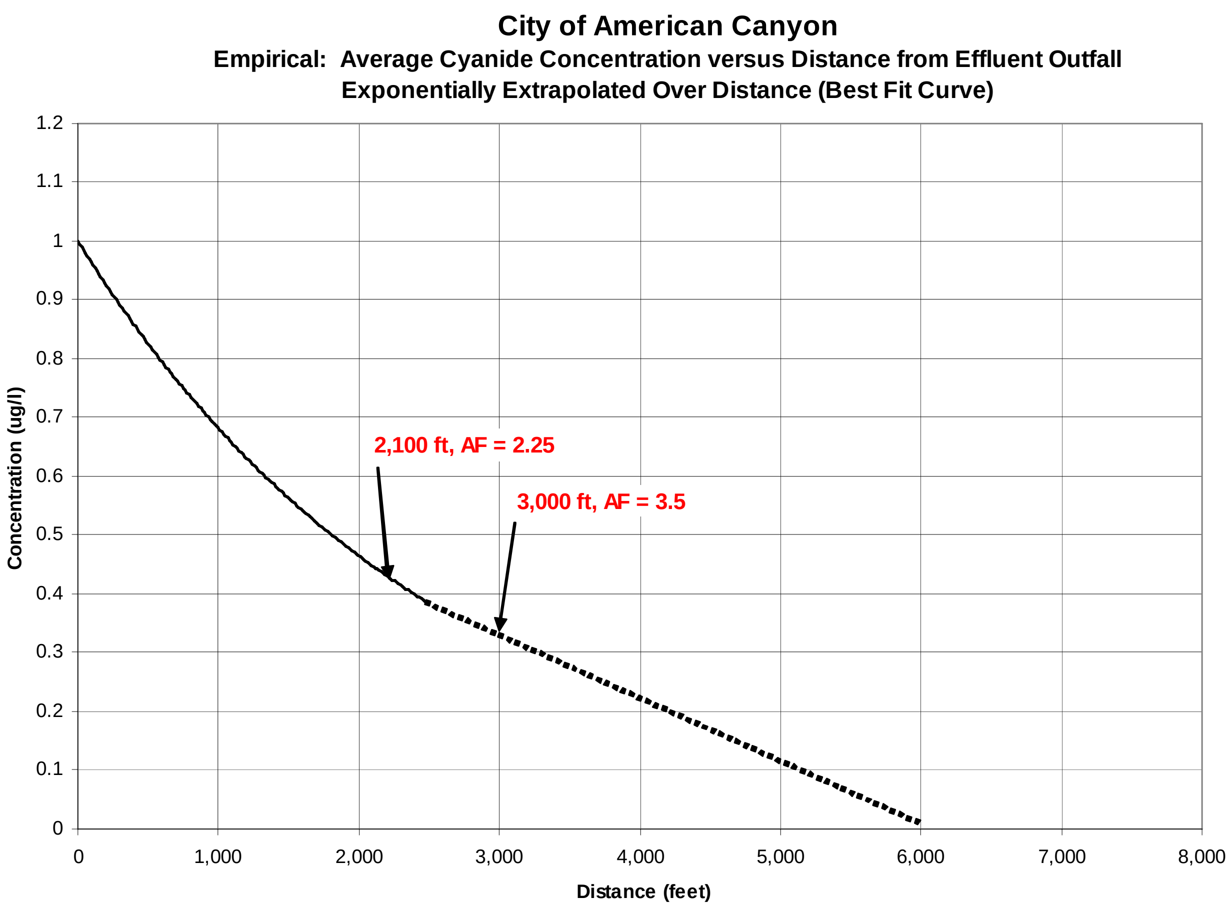
Site	Average Cyanide µg/l	No. data points	Distance from Outfall		Surface Water Area Between Sites		Median AF
			feet	kilometers	acres	sq. kilometer	
San Jose - Santa Clara							
Outfall	2.80	11	0	0	0		1
SB15 (Weir)	3.24	11	1,300	0.4	5	0.0	0.9
SB14 (Triangle)	2.76	11	7,200	2.2	26	0.10	1.1
SB13 (Mouth)	1.72	11	13,000	4.0	35	0.14	1.7
SB04	1.09	11	13,450	4.1	40	0.20	**2.25**
Attenuation	-	-	20,000	6.1	200	0.8	**3.5**
SB05	0.51	11	27,800	8.5	500	2.0	**4.5**
SB12	0.38	11	28,100	8.6	288	1.1	7.2
SB03	0.37	11	36,900	11.2	1,350	5.3	7.8
SB06	0.32	11	40,100	12.2	2,750	10.9	9.0
SB07	0.36	11	48,100	14.7	6,650	26.3	7.8
SB10	0.28	11	50,100	15.3	4,500	17.8	10.0
SB02	0.24	11	52,100	15.9	8,450	33.4	11.5
SB08	0.25	11	53,600	16.3	9,400	37.2	9.0
SB09	0.24	11	57,100	17.4	6,000	23.7	11.5
SB01	0.19	11	67,100	20.5	10,100	39.9	12.5

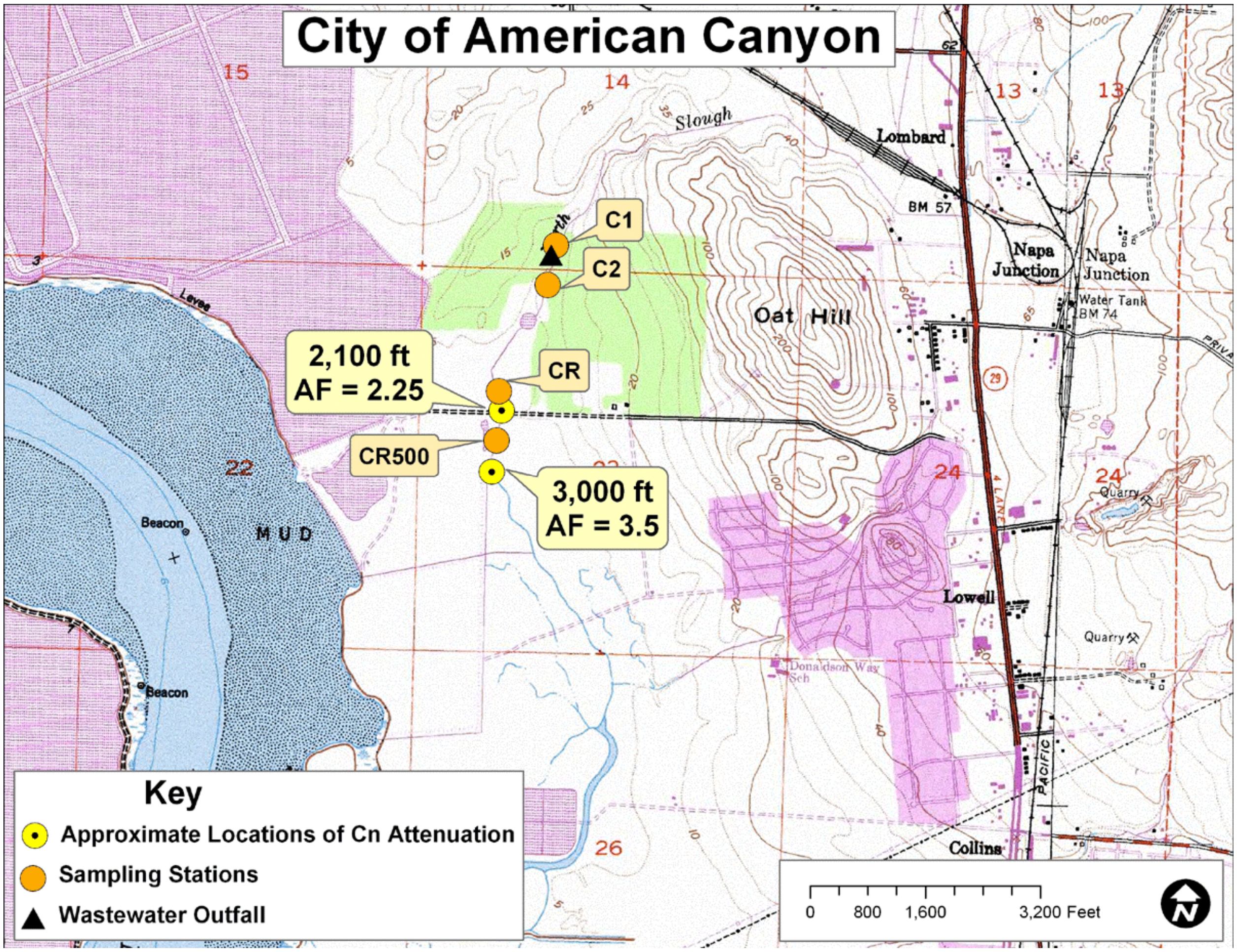



San Jose - Santa Clara
SB01
SB08
SB02
SB07
SB09
SB06
SB10
SB03
27,800 (SB05)
AF = 4.5
14,700 ft (SB04)
AF = 2.25
20,000 ft
AF = 3.5
SB13
SB12
SB14
SB15
SB12
Key
Approximate Locations of Cn Attenuation
Sampling Stations
Wastewater Outfall
0
3,100
6,200
12,400 Feet

City of American Canyon

Site	Average Cyanide µg/l	No. data points	Distance from Outfall		Surface Water Area Between Sites		Median AF
			feet	kilometers	acres	sq. kilometer	
American Canyon							
C1	0.65	2	-20	0.0	0	0	-
Outfall	1	2	0	0.0	0	0.000	1
C2	0.5	2	500	0.2	0.34	0.001	2
CR	0.5	2	2,000	0.6	1.38	0.005	2.10
Attenuation	-	-	2,100	0.6	1.45	0.006	**2.25**
CR500	0.4	2	2,500	0.8	2.87	0.011	2.5
Attenuation	-	-	3,000	0.91	3.44	0.014	**3.5**

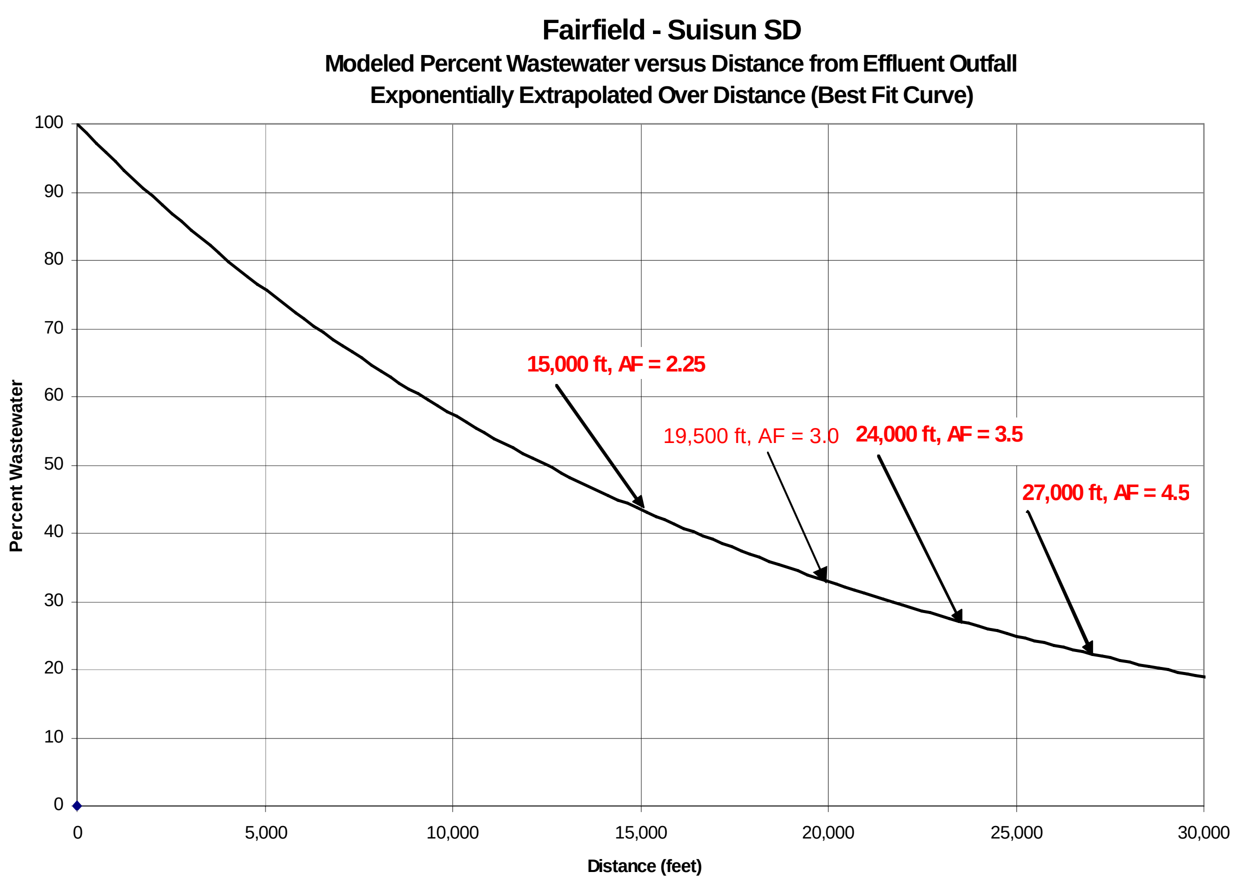


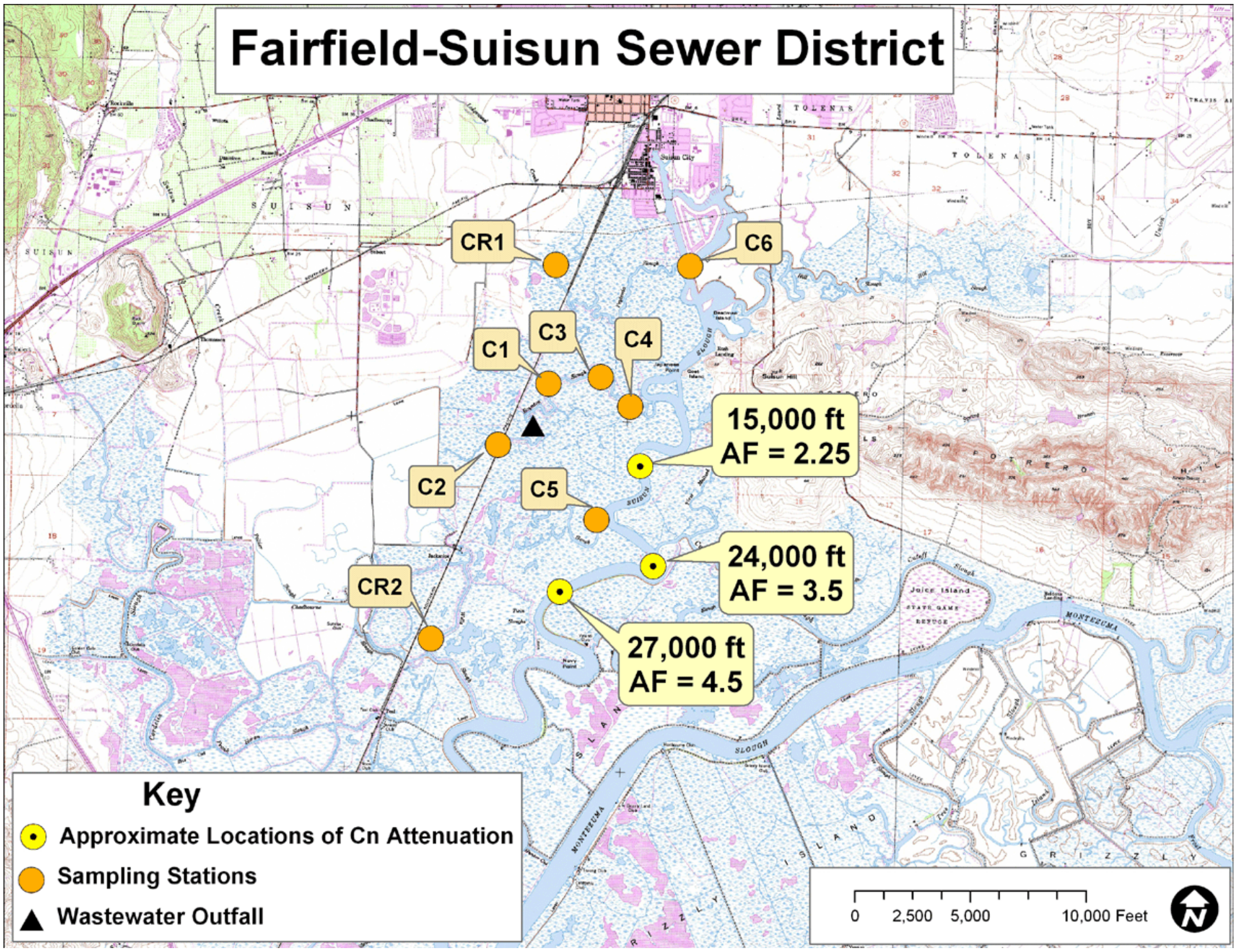

City of American Canyon
C1
C2
CR
CR500
2,100 ft
AF = 2.25
3,000 ft
AF = 3.5
Key
Approximate Locations of Cn Attenuation
Sampling Stations
Wastewater Outfall
0
800
1,600
3,200 Feet
Oat Hill
Napa Junction
Lombard
Lowell
Collins
MUD

Fairfield-Suisun Sewer District

Site	Cyanide µg/l	No. data points	Distance from Outfall		Surface Water Area Between Sites		AF†
			feet	kilometers	acres	sq. kilometer	
Faiefield - Suisun							
C2	0.8	1	-100	0	0.2	0.000	-
Outfall	1.4	1	0	0	0	0.000	1
C1	1.4	1	100	0.0	0.20	0.001	1
C3	1.3	1	1,800	0.5	3.5	0.01	1.1
C4	1.6	1	10,000	3.0	4.3	0.02	0.9
Attenuation	-	-	15,000	4.6	5.8	0.02	**2.25**
C5	0.9	1	21,000	6.4	24.5	0.10	1.6
C6	0.6	1	29,500	9.0	32.0	0.13	2.3
CR1	0.6	1	32,200	9.8	34.4	0.14	2.3
Attenuation			19,500	5.91	22.8	0.09	**3.0**
Attenuation	-	-	24,000	7.32	28.0	0.11	**3.5**
Attenuation	-	-	27,000	8.23	32.1	0.13	**4.5**
CR2	0.4	1	45,000	13.72	48.0	0.19	3.5

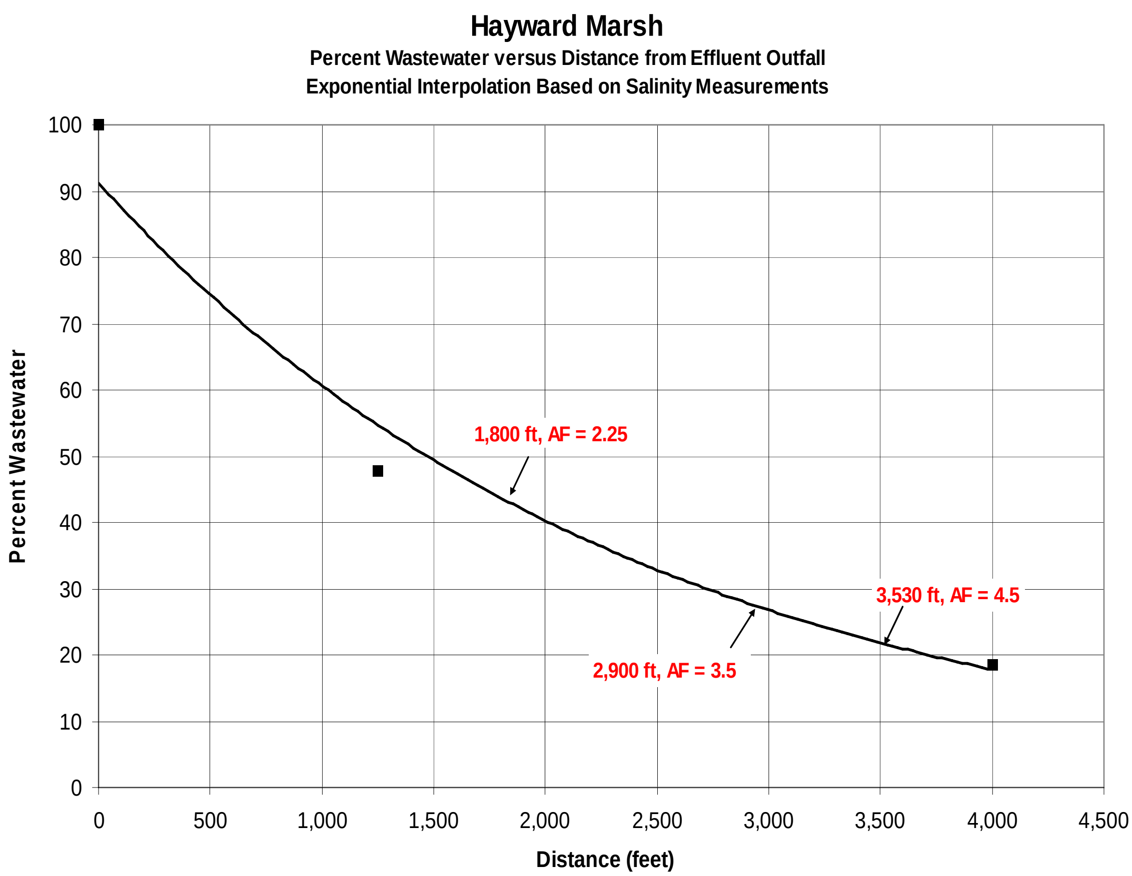
† Attenuation Factors in bold were derived from modeled percent wastewater, AF numbers not in bold are the median AF derived using empirical data.

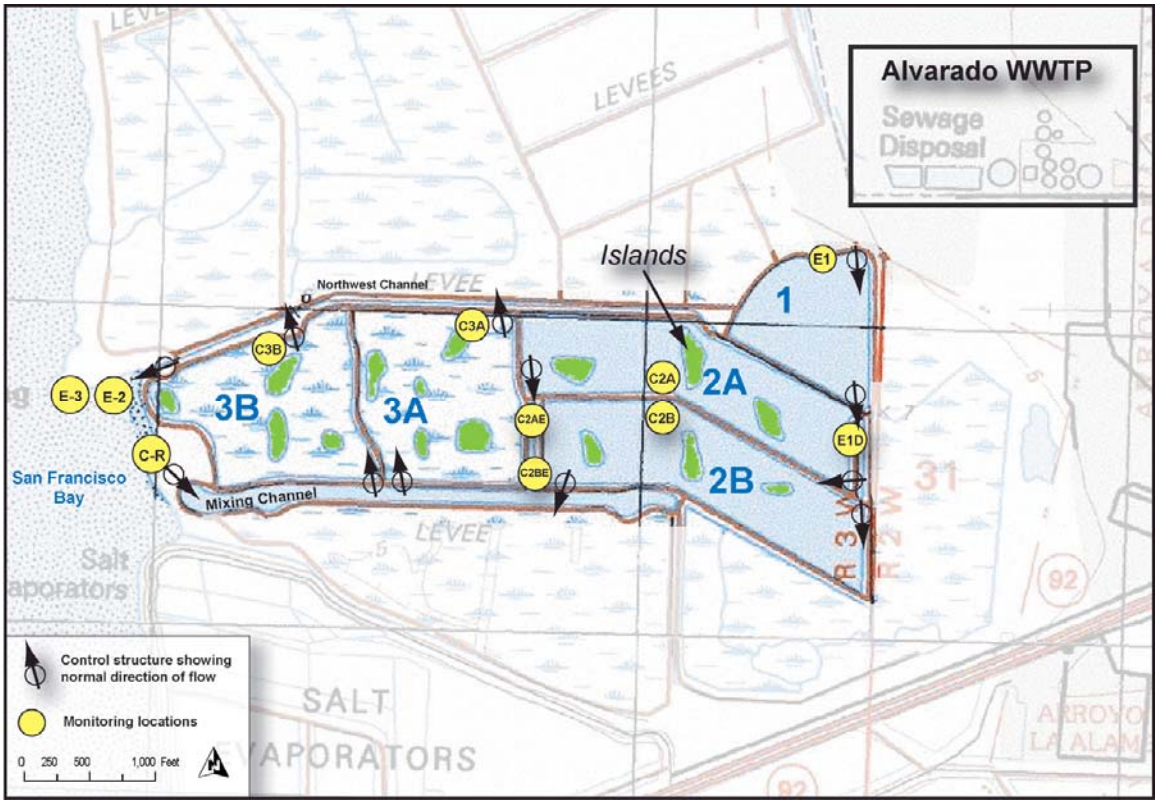



Fairfield-Suisun Sewer District
CR1
C6
C3
C1
C4
15,000 ft
AF = 2.25
C2
C5
24,000 ft
AF = 3.5
CR2
27,000 ft
AF = 4.5
Key
Approximate Locations of Cn Attenuation
Sampling Stations
Wastewater Outfall
0
2,500
5,000
10,000 Feet

Hayward Marsh

Site	Average Cyanide ug/l	No. data points	Distance from Outfall		Surface Water Area Between Sites		Median Dilution/Attenuation
			feet	kilometers	acres	sq. kilometer	
Hayward Marsh							
Basin 2	3.6	23	0	0	0	0.000	
Dilution	-	-	1,800	0.5	41.3	0.167	**2.25**
Dilution	-	-	2,900	0.9	66.6	0.269	**3.5**
Dilution	-	-	3,530	1.1	81.0	0.328	**4.5**





Monitoring Station Locations in Hayward Marsh

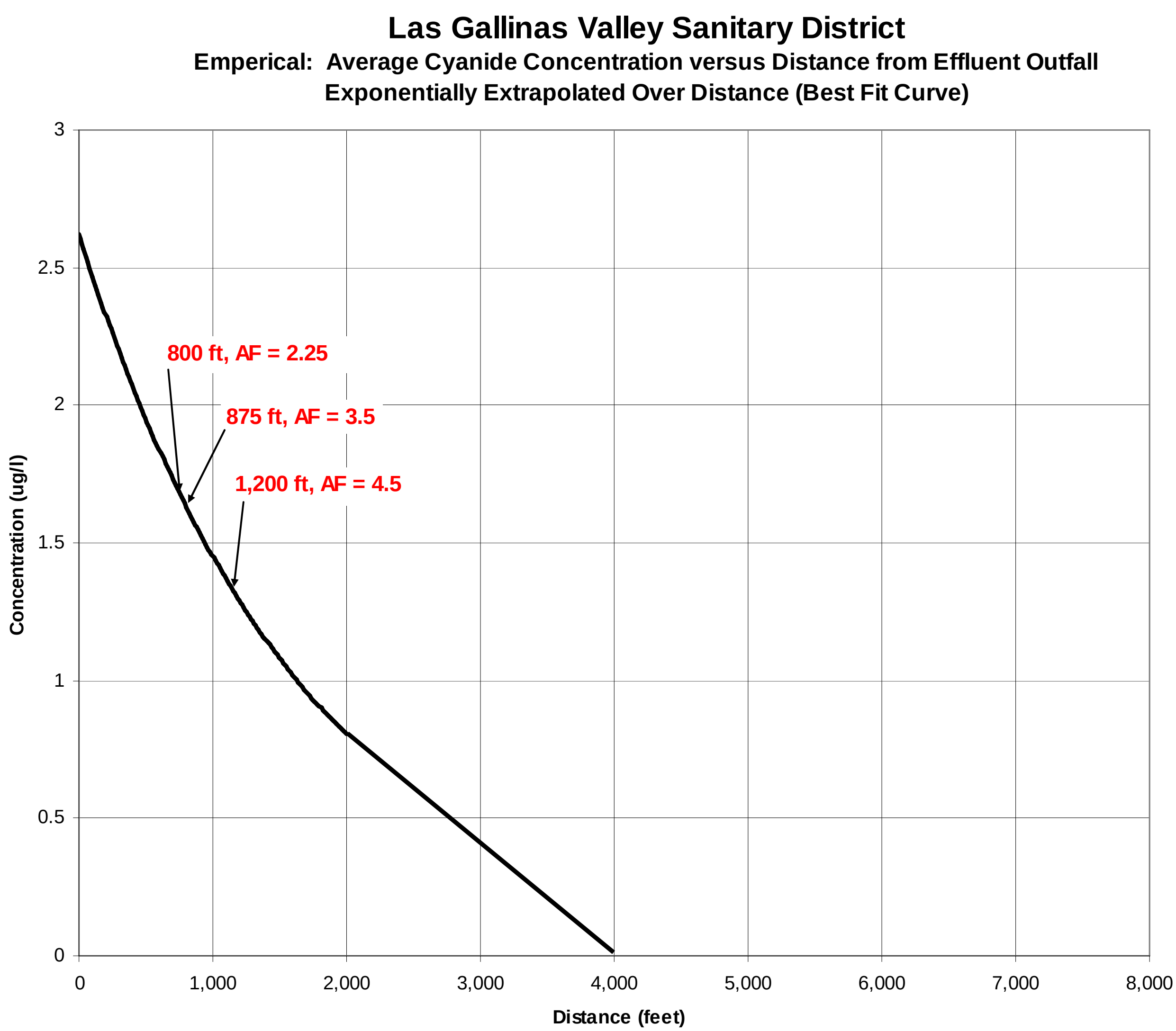
The following stations are used in calculations:

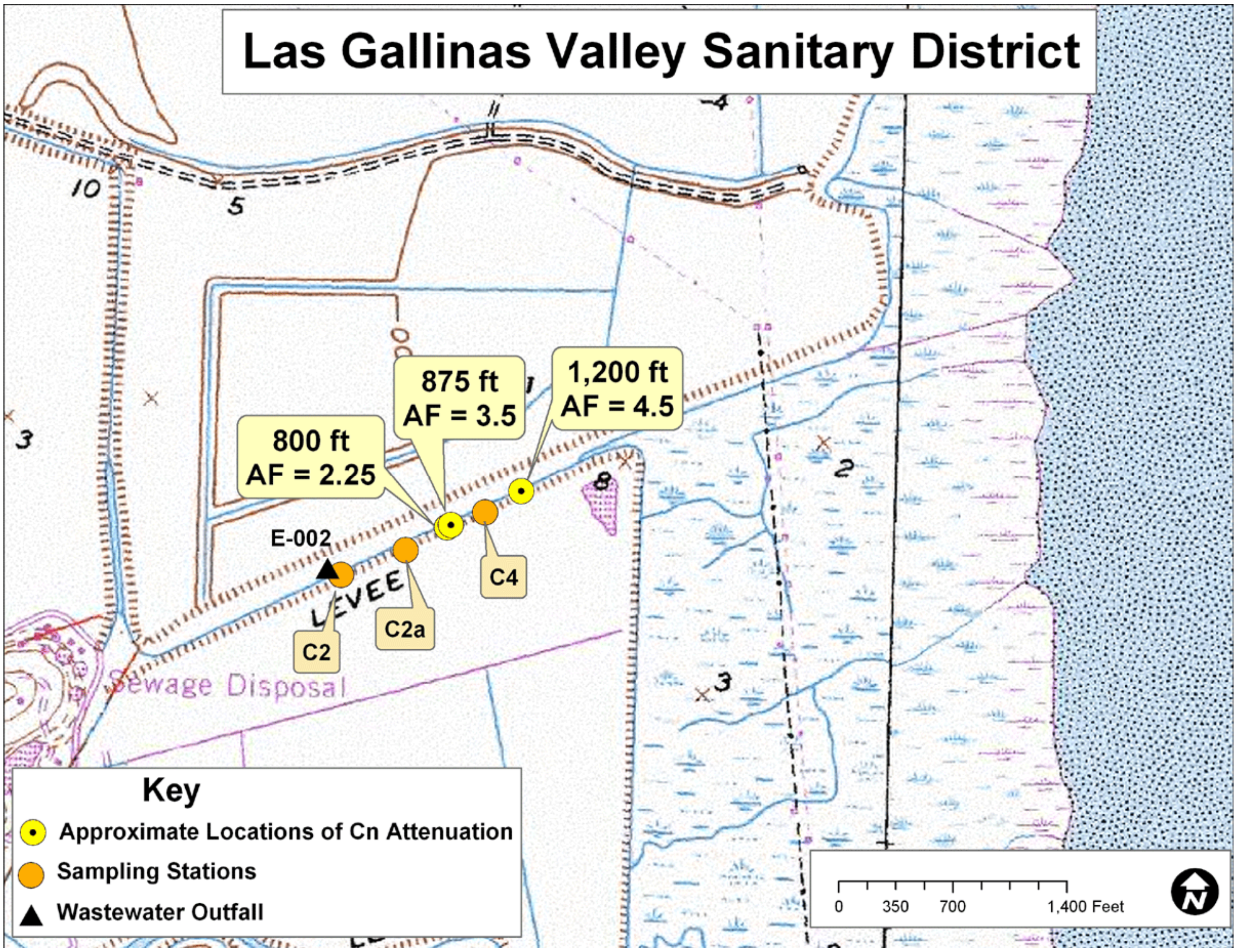
- C-2AE, C-2BE: Parallel discharge points from basins 2A and 2B, representing the permit compliance point for cyanide (averaged for each sample date)
- C-3A, C-3B: Parallel discharge points from basins 3A and 3B, 1,250 feet from basin 2A (averaged for each sample date)
- E-3: Lower San Francisco Bay, 4,000 feet from basin 2A

Las Gallinas Valley Sanitary District

Site	Average Cyanide µg/l	No. data points	Distance from Outfall		Surface Water Area Between Sites		Median AF†
			feet	kilometers	acres	sq. kilometer	
Las Gallinas							
Outfall	0.6	2	0	0	0	0.000	1
C2	2.625	2	20	0.0	0.0	0.000	0
C2a	2.1	2	50	0.0	0.0	0.000	1.3
Attenuation	-	-	800	0.2	1.0	0.004	**2.25**
Attenuation	-	-	875	0.27	1.1	0.004	**3.5**
Attenuation	-	-	1,200	0.37	2.8	0.004	**4.5**
C4	1.025	2	2000	0.61	4.4	0.011	5.2

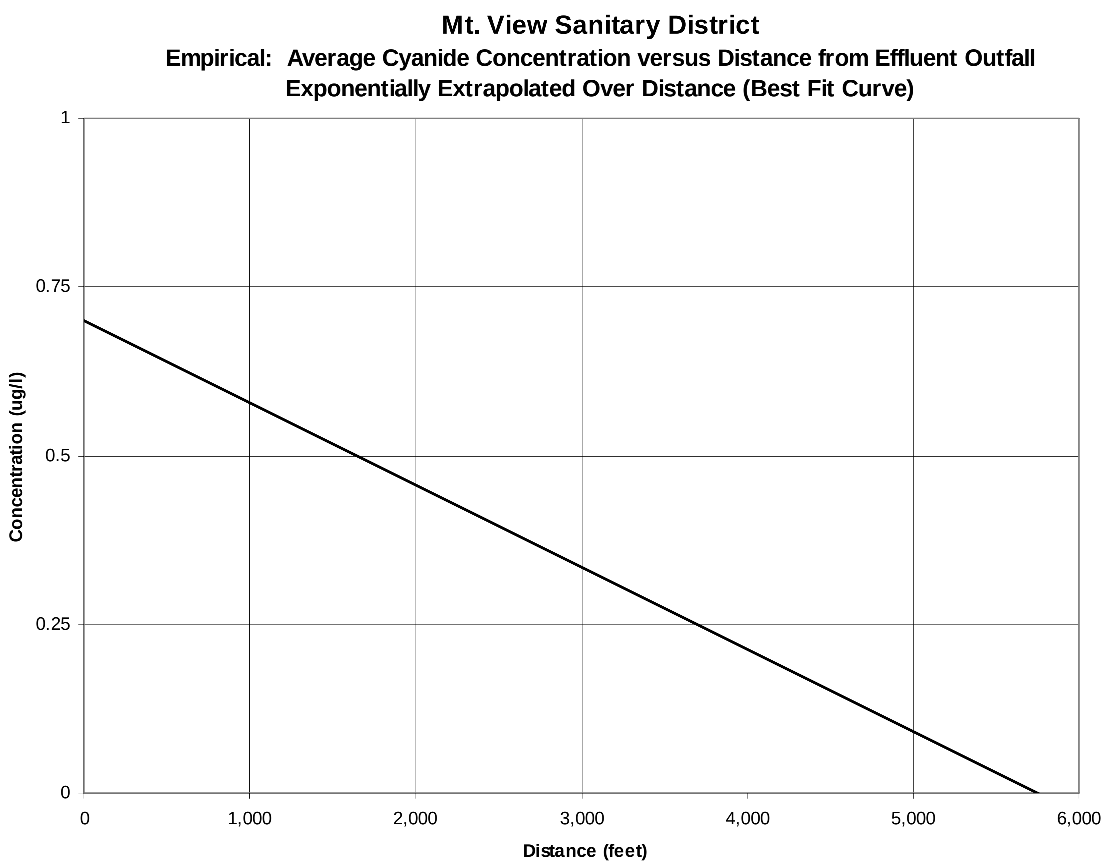
†Average Cyanide concentration at station C2 was used as outfall to calculate Attenuation Factors




Las Gallinas Valley Sanitary District
800 ft
AF = 2.25
875 ft
AF = 3.5
1,200 ft
AF = 4.5
E-002
C2
C2a
C4
LEVEE
Sewage Disposal
Key
Approximate Locations of Cn Attenuation
Sampling Stations
Wastewater Outfall
0
350
700
1,400 Feet
N

Mt. View Sanitary District

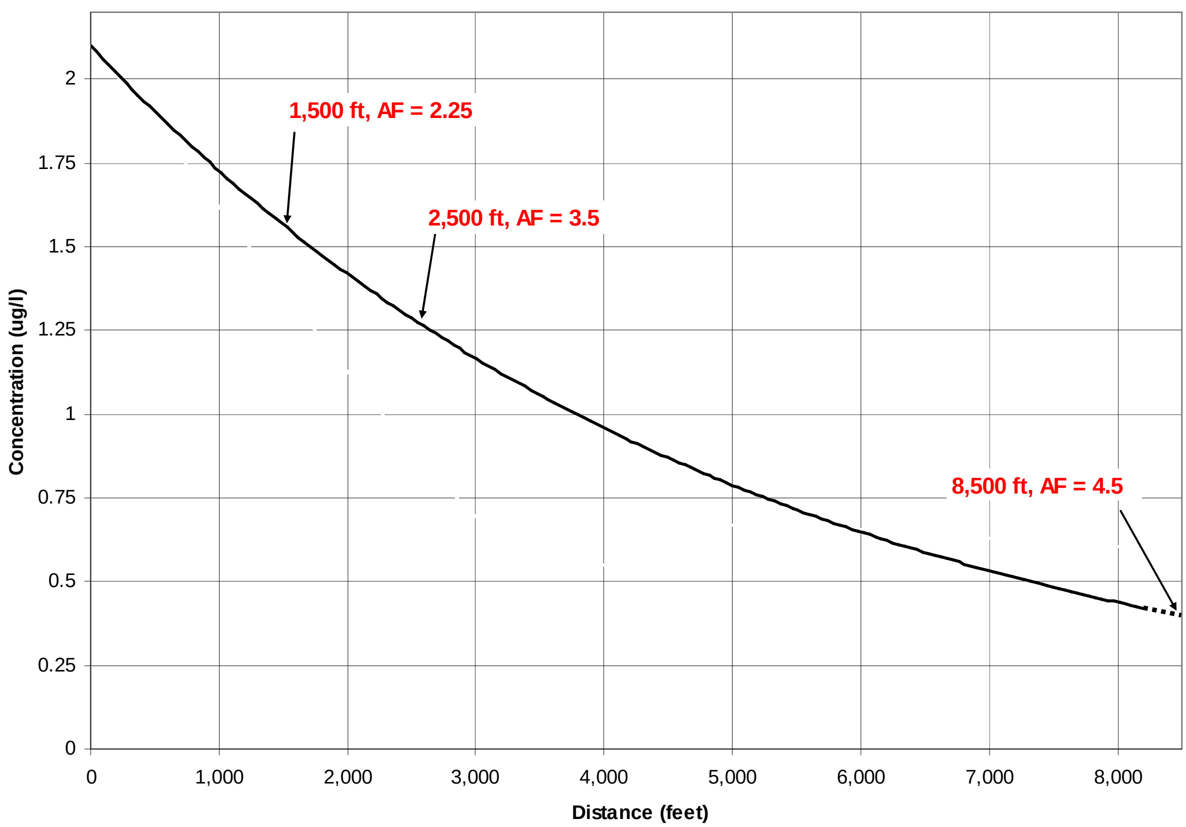
Site	Average Cyanide µg/l	No. data points	Distance from Outfall		Surface Water Area Between Sites		Median AF
			feet	kilometers	acres	sq. kilometer	
Mt. View Sanitary District							
CR	<1	1	-800	0	0.1	0.00	0
Outfall	<1	5	0	0	0	0.00	0
C1	<1	1	10	0.0	0	0.00	0
C2	<1	1	600	0.2	0.1	0.00	0
C3	0.7	3	1,800	0.5	0.8	0.00	0
C4	<1	1	6,000	1.8	2	0.01	0

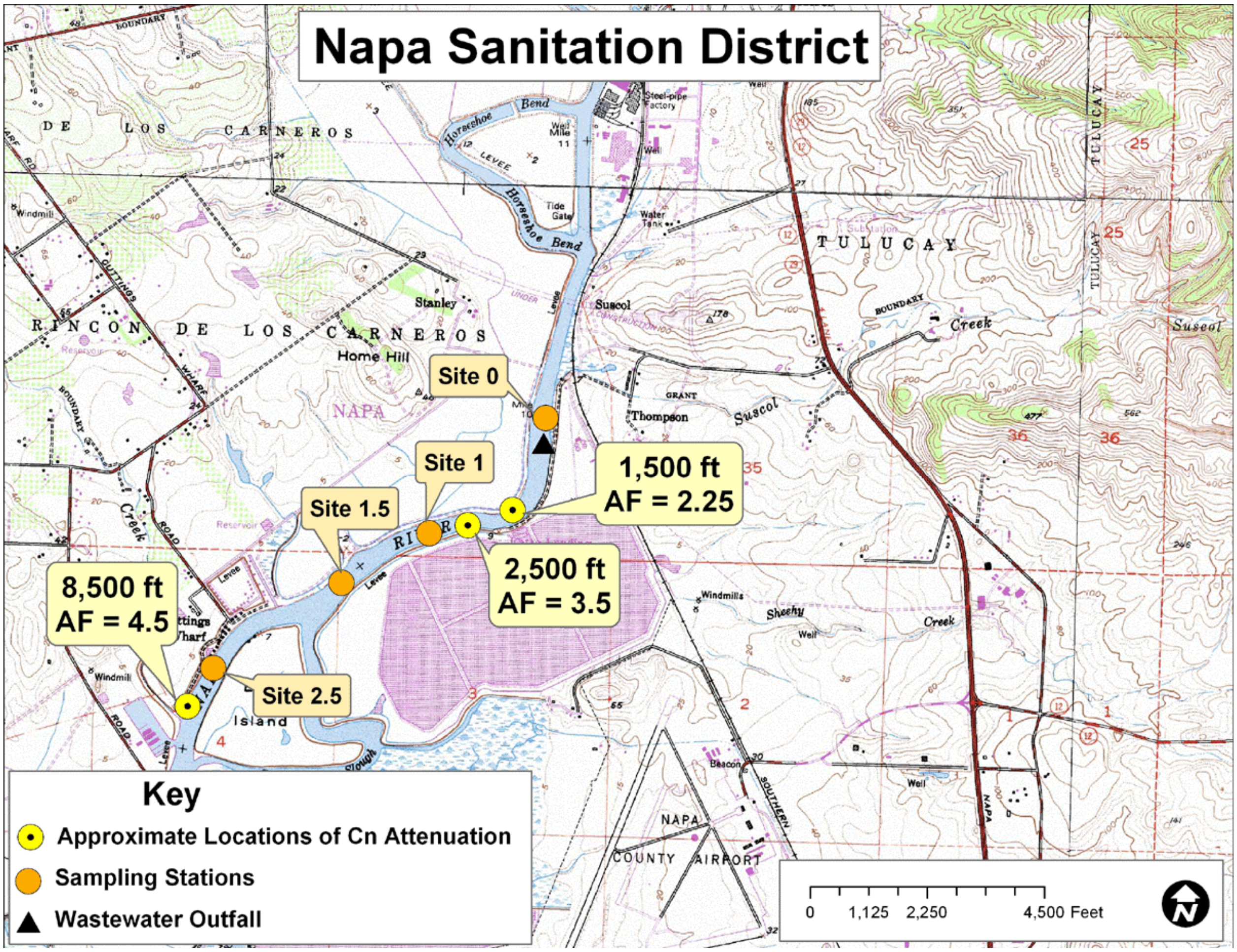


Napa Sanitation District

Site	Average Cyanide µg/l	No. data points	Distance from Outfall		Surface Water Area Between Sites		Median AF
			feet	kilometers	acres	sq. kilometer	
Napa Sanitation District							
Site 0	0.8	3	-20	0	0	0.00	-
Outfall	2.1	3	0	0	0	0.00	1
Attenuation	-	-	1,500	0.5	17	0.07	**2.25**
Attenuation	-	-	2,500	0.8	29	0.11	**3.5**
Site 1	0.6	3	3,279	1.0	37	0.15	4.0
Site 1.5	0.66	3	4,918	1.5	56	0.22	3.0
Site 2.5	0.6	3	8,197	2.5	94	0.37	4.0
Attenuation	-	-	8,500	2.6	95	0.38	**4.5**

Napa Sanitation District
Empirical: Average Cyanide Concentration versus Distance from Effluent Outfall
Exponentially Extrapolated Over Distance (Best Fit Curve)

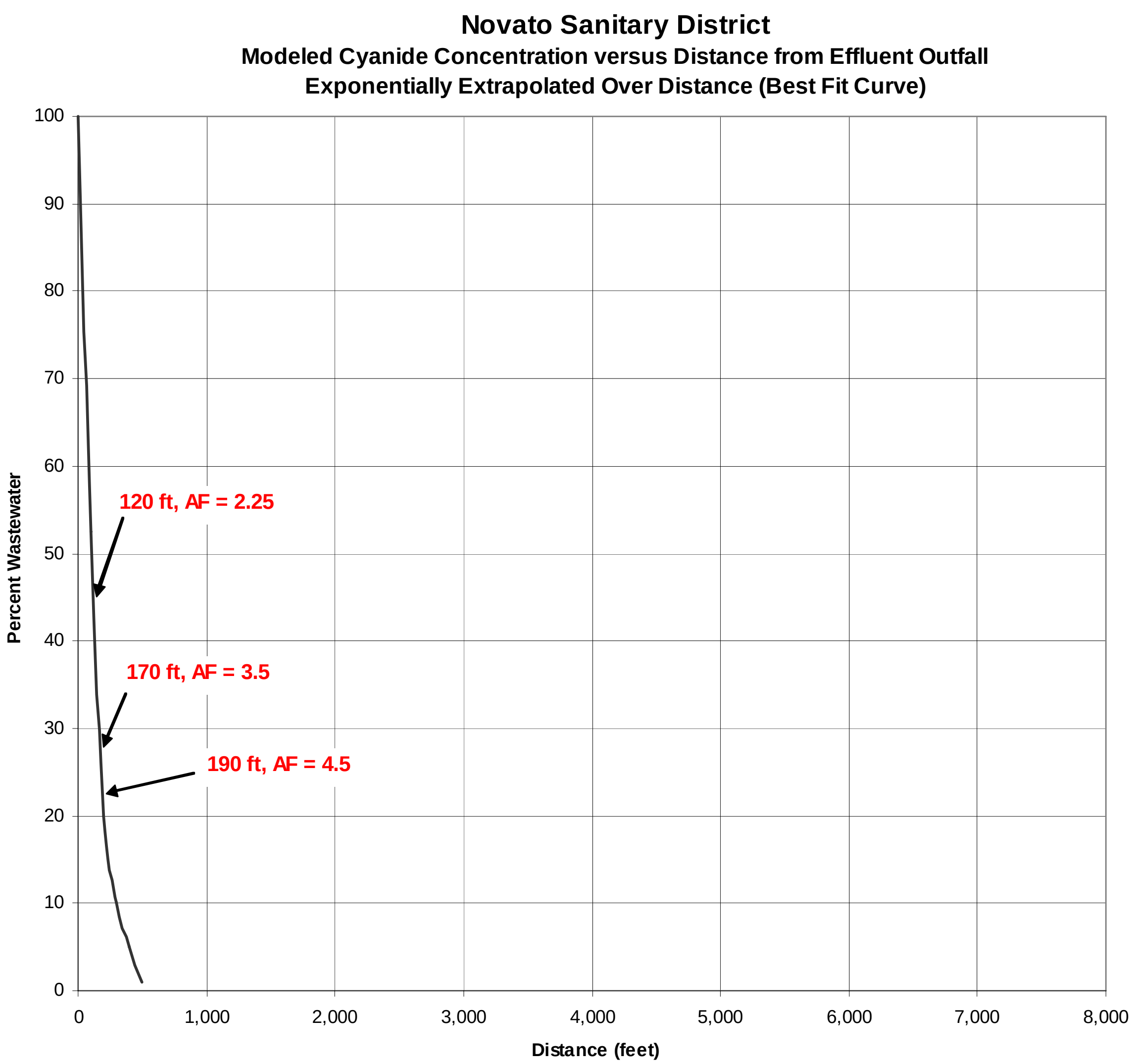


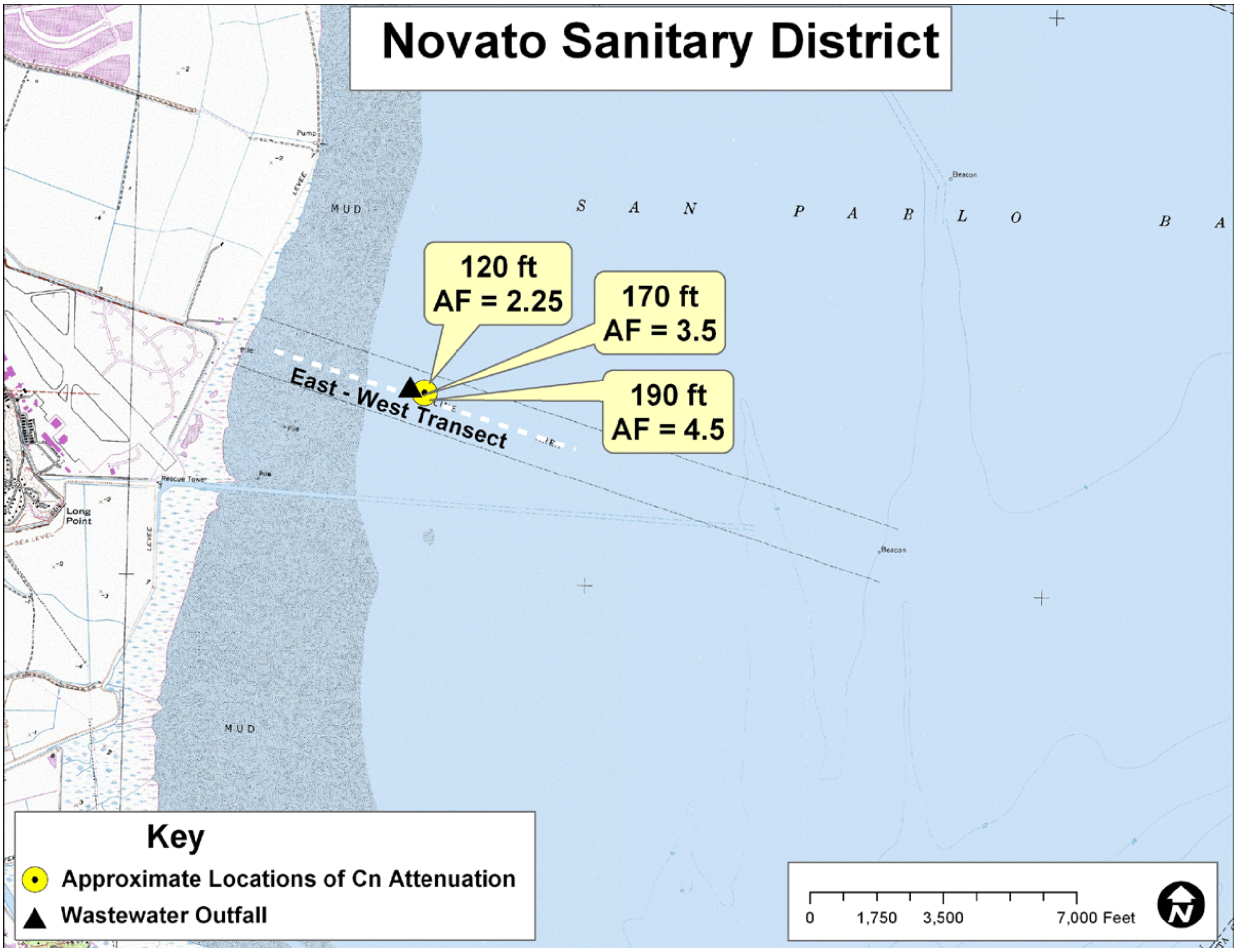

Napa Sanitation District
Site 0
Site 1
Site 1.5
Site 2.5
1,500 ft
AF = 2.25
2,500 ft
AF = 3.5
8,500 ft
AF = 4.5
Key
Approximate Locations of Cn Attenuation
Sampling Stations
Wastewater Outfall
0
1,125
2,250
4,500 Feet
N

Novato Sanitary District

Site	Cyanide µg/l	No. data points	Distance from Outfall		Surface Water Area Between Sites		AF†
			feet	kilometers	acres	sq. kilometer	
Novato Sanitary District							
Outfall	NA	-	0	0	0.00	0.0000	-
Attenuation	-	-	120	0.0	0.14	0.0006	**2.25**
Attenuation	-	-	170	0.1	0.19	0.0008	**3.5**
Attenuation	-	-	190	0.1	0.25	0.0010	**4.5**

† Attenuation Factors in bold were derived from modeled percent wastewater.



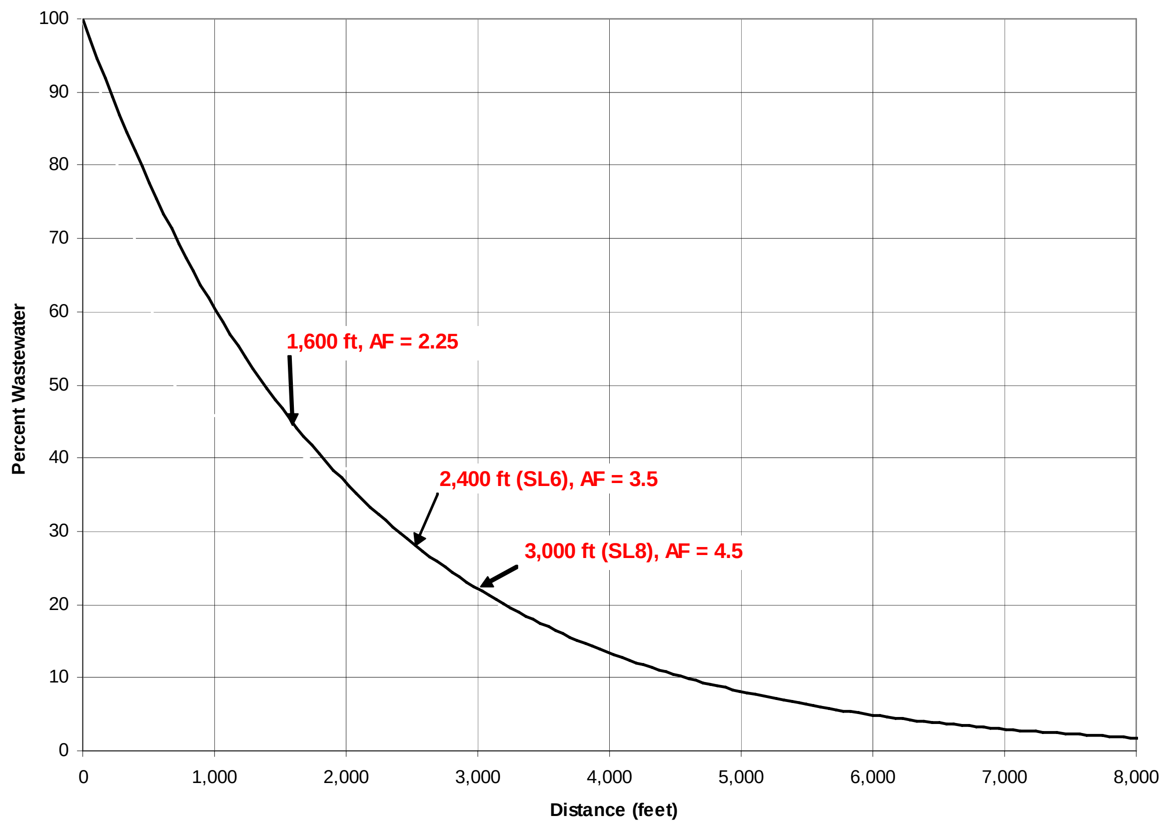

Novato Sanitary District
SAN PABLO BA
MUD
120 ft
AF = 2.25
170 ft
AF = 3.5
190 ft
AF = 4.5
East - West Transect
Key
Approximate Locations of Cn Attenuation
Wastewater Outfall
0
1,750
3,500
7,000 Feet
N

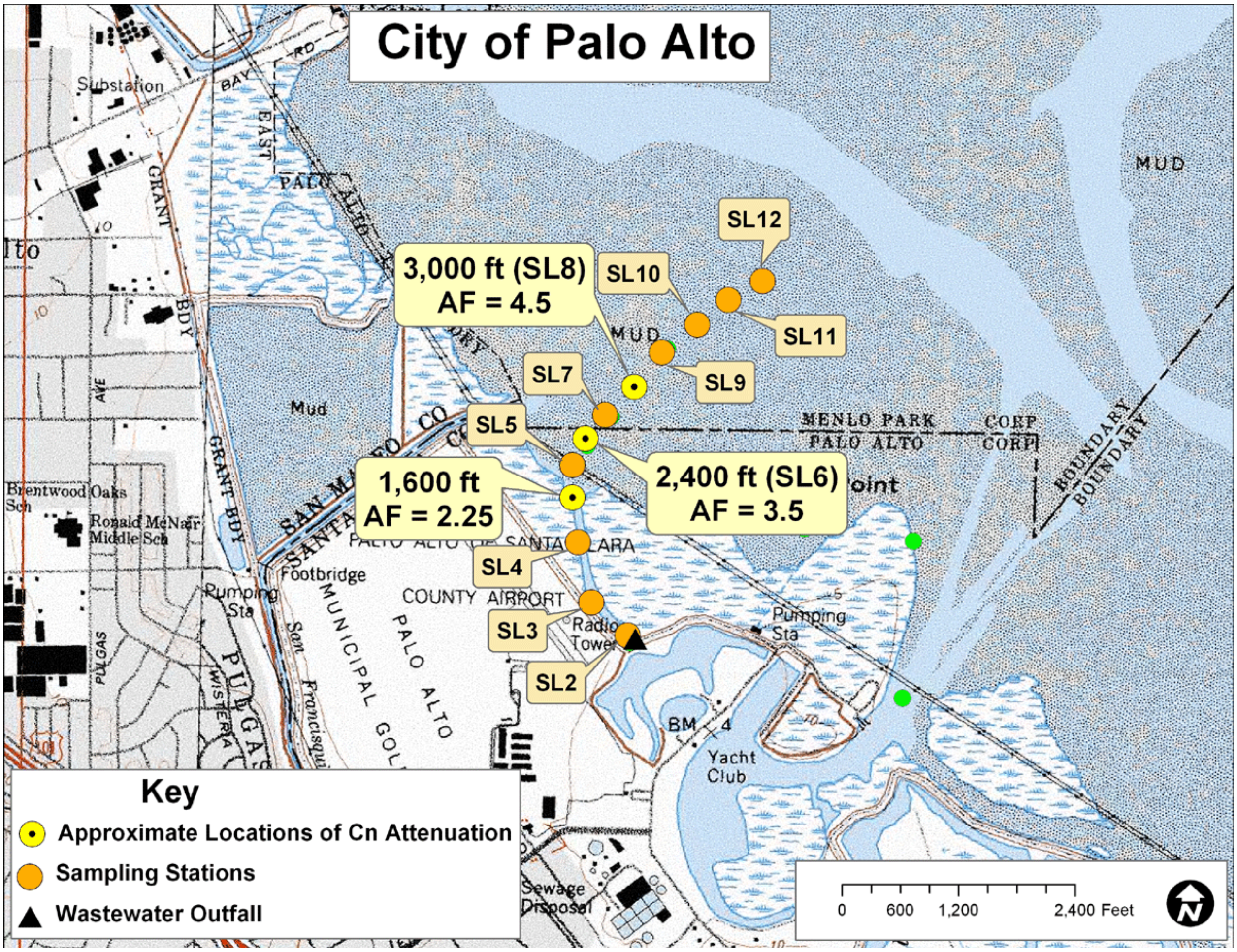
City of Palo Alto

Site	Cyanide µg/l	No. data points	Distance from Outfall		Surface Water Area Between Sites		AF†
			feet	kilometers	acres	sq. kilometer	
Palo Alto							
Outfall	4.5	9	0	0	0	0.000	1
SL2	1.5	1	20	0.0	0	0.000	1.6
SL3	4.87	9	500	0.2	1	0.004	1.1
SL4	3.55	4	1,200	0.4	2	0.009	1.1
Attenuation	-	-	1,600	0.5	4.2	0.017	**2.25**
SL5	0.54	9	2,000	0.6	5.0	0.020	11
Attenuation (SL6)	0.42	4	2,400	0.7	7	0.028	**3.5** (11.5)
SL7	0.1	1	2,650	0.8	14	0.055	24
Attenuation (SL8)	0.3	1	3,000	0.9	32	0.017	**4.5** (8)
SL9	0.4	1	3,520	1.1	80	0.020	6.0
SL10	0.6	1	4,000	1.2	400	0.028	4.0
SL11	0.9	1	4,500	1.4	900	0.055	2.7
SL12	0.6	1	5,000	1.5	2,500	0.126	4.0

† Attenuation Factors in bold were derived from modeled percent wastewater, AF numbers not in bold are the median AF derived using empirical data.

Palo Alto
Modeled Percent Wastewater versus Distance from Effluent Outfall
Exponentially Extrapolated Over Distance (Best Fit Curve)

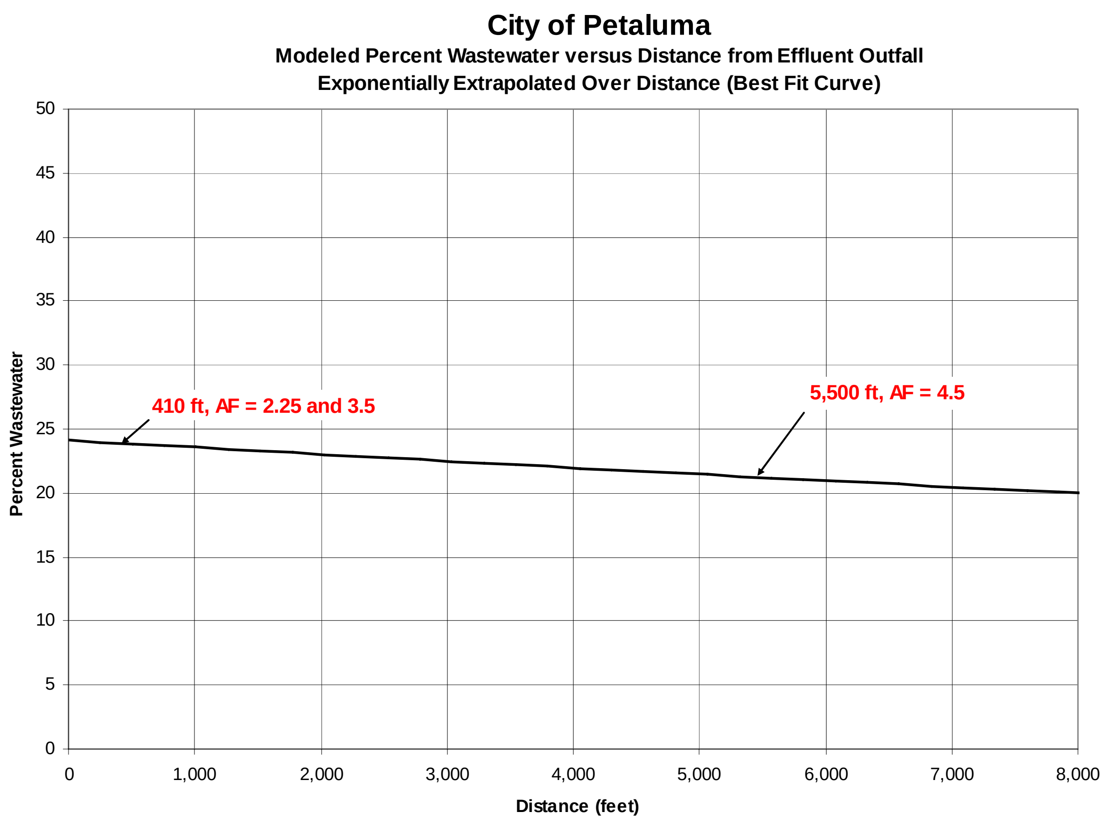


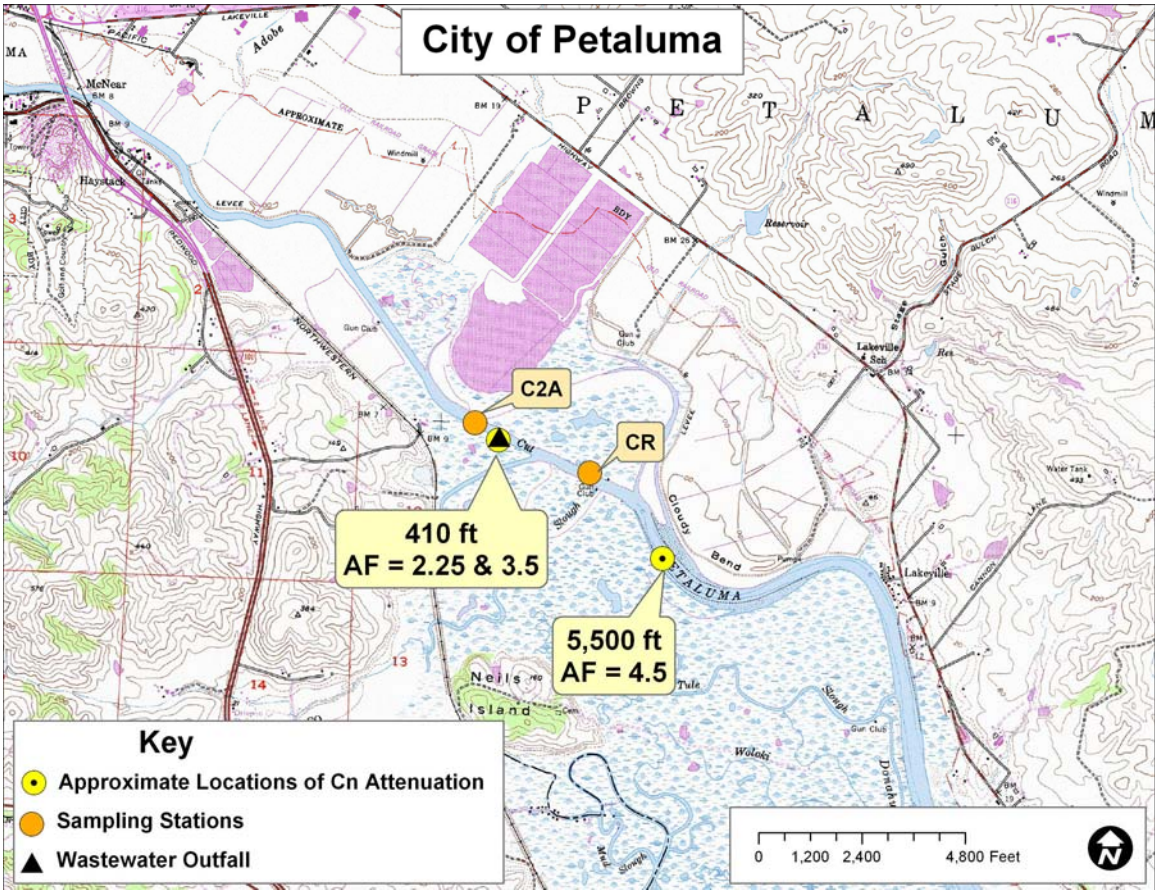

City of Palo Alto
3,000 ft (SL8)
AF = 4.5
2,400 ft (SL6)
AF = 3.5
1,600 ft
AF = 2.25
SL2
SL3
SL4
SL5
SL7
SL9
SL10
SL11
SL12
Key
Approximate Locations of Cn Attenuation
Sampling Stations
Wastewater Outfall
0 600 1,200 2,400 Feet

City of Petaluma

Site	Average Cyanide µg/l	No. data points	Distance from Outfall		Surface Water Area Between Sites		AF†
			feet	kilometers	acres	sq. kilometer	
City of Petaluma							
Outfall	1.067	3	0	0	0	0.000	-
Attenuation	-	-	410	0.1	1.5	0.006	**2.25**
Attenuation	-	-	410	0.1	1.5	0.006	**3.5**
C2A	0.73	3	500	0.2	1.8	0.007	-
CR	0.73	3	2,000	0.6	7.3	0.030	-
Attenuation	-	-	5,500	1.7	20.2	0.082	**4.5**

† Attenuation Factors in bold were derived from modeled percent wastewater, AF numbers not in bold are the median AF derived using empirical data.

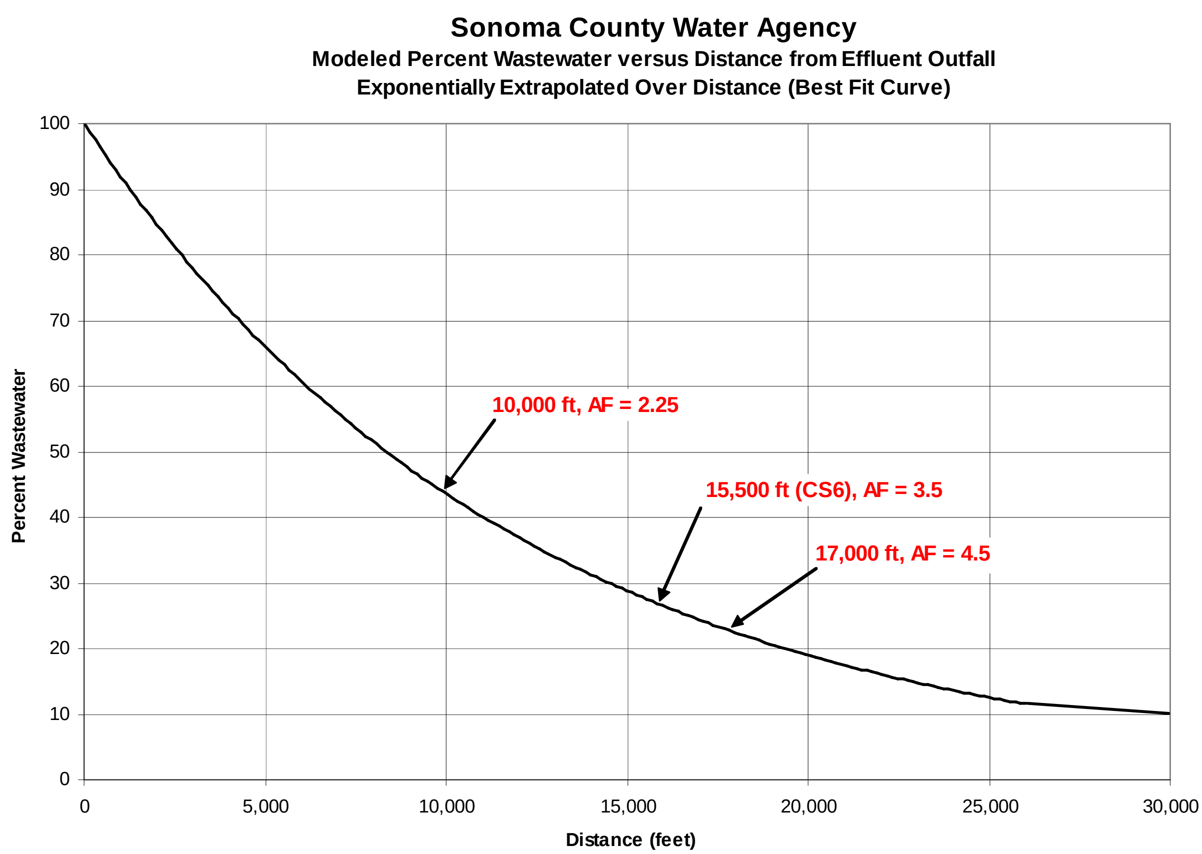


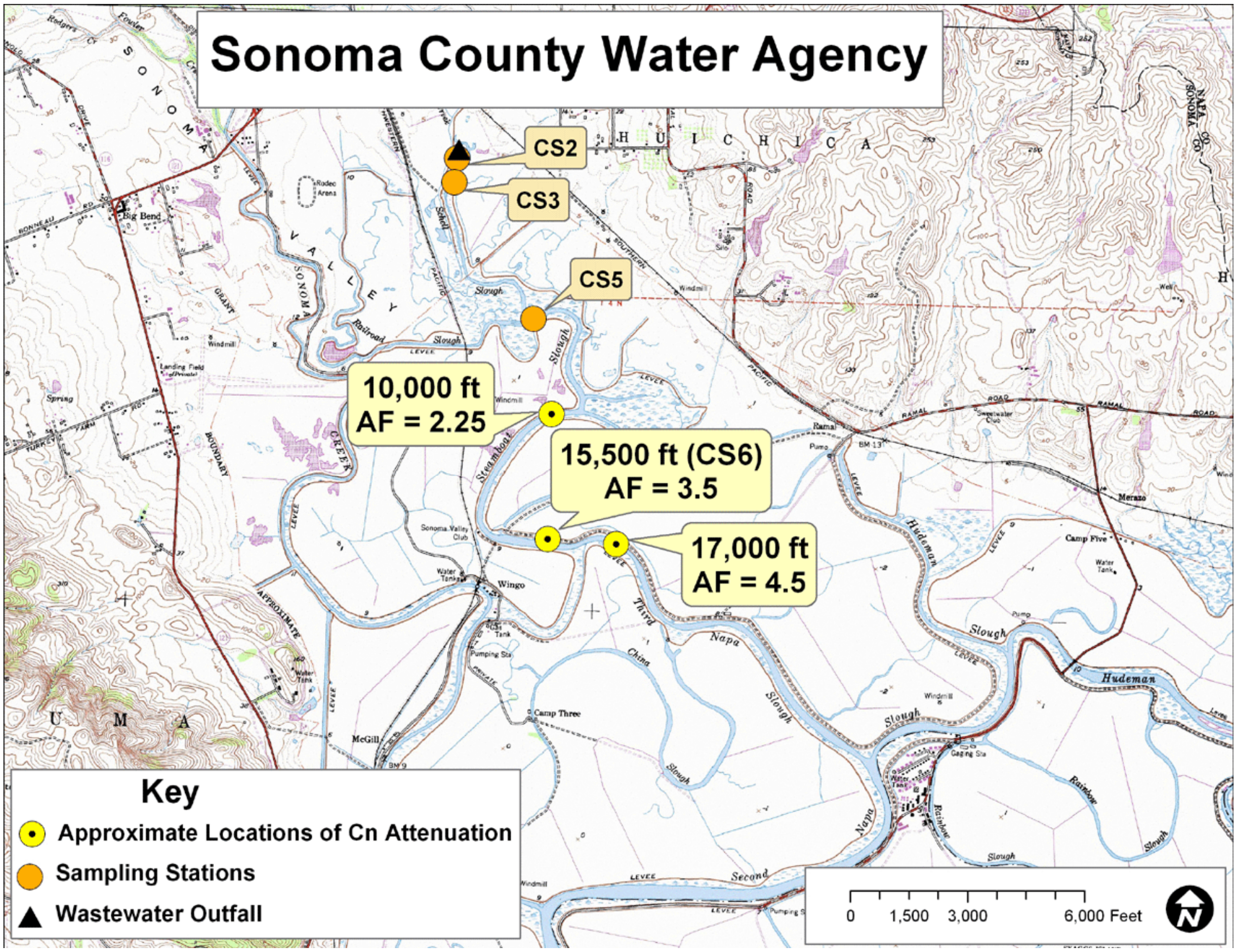

City of Petaluma
C2A
CR
410 ft
AF = 2.25 & 3.5
5,500 ft
AF = 4.5
Key
Approximate Locations of Cn Attenuation
Sampling Stations
Wastewater Outfall
0 1,200 2,400 4,800 Feet

Sonoma County Water Agency

Site	Average Cyanide µg/l	No. data points	Distance from Outfall		Surface Water Area Between Sites		AF†
			feet	kilometers	acres	sq. kilometer	
Sonoma County Water Agency							
Outfall	2.9	1	0	0	0	0.000	1
CS2	2.9	1	20	0.0	0	0.000	1
CS3	1.1	1	500	0.2	0.2	0.001	2.5
CS5	0.65	2	5,600	1.7	7.7	0.030	4.3
Attenuation	-	-	10,000	3.0	29	0.115	**2.25**
CS6	0.6	2	15,500	4.7	55	0.217	**3.5**
Attenuation	-	-	17,000	5.2	62	0.245	**4.5** (4.7)

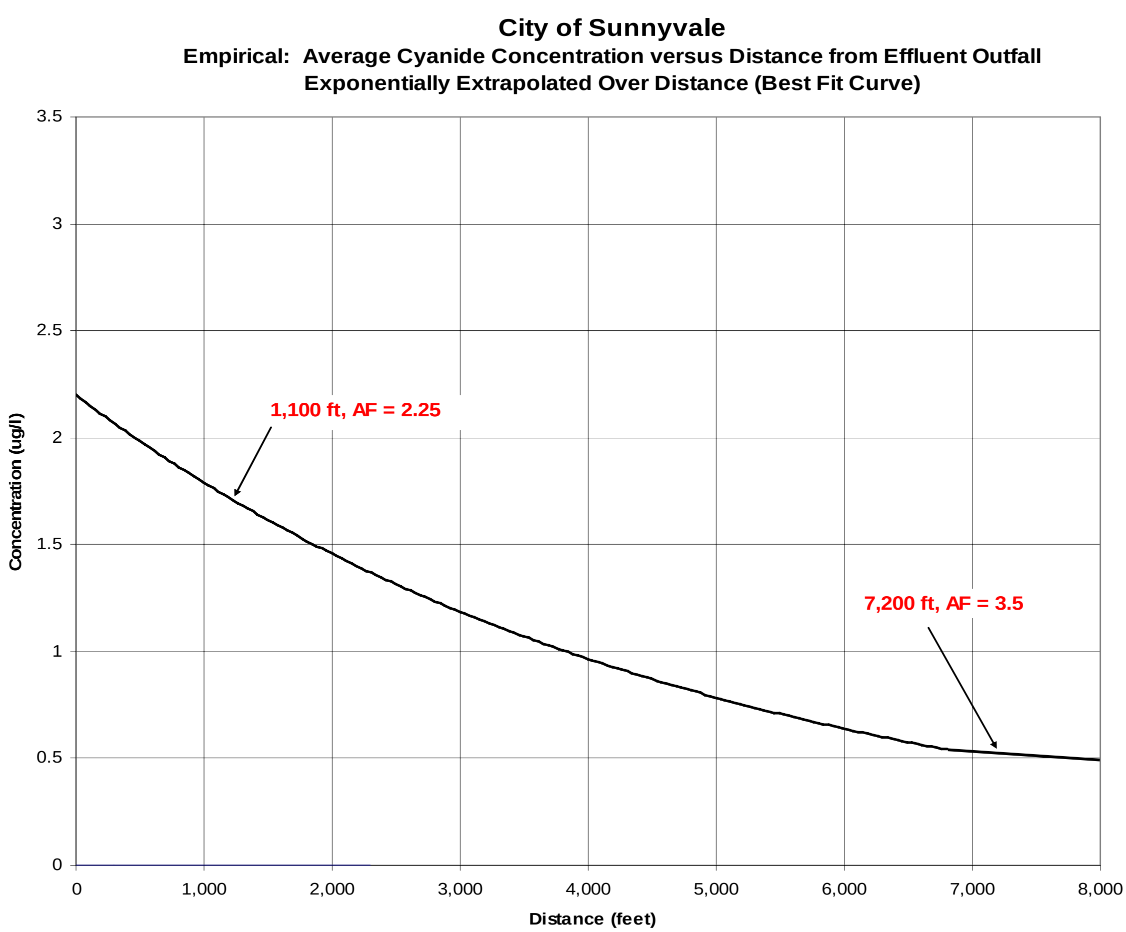
† Attenuation Factors in bold were derived from modeled percent wastewater, AF numbers not in bold are the median AF derived using empirical data.

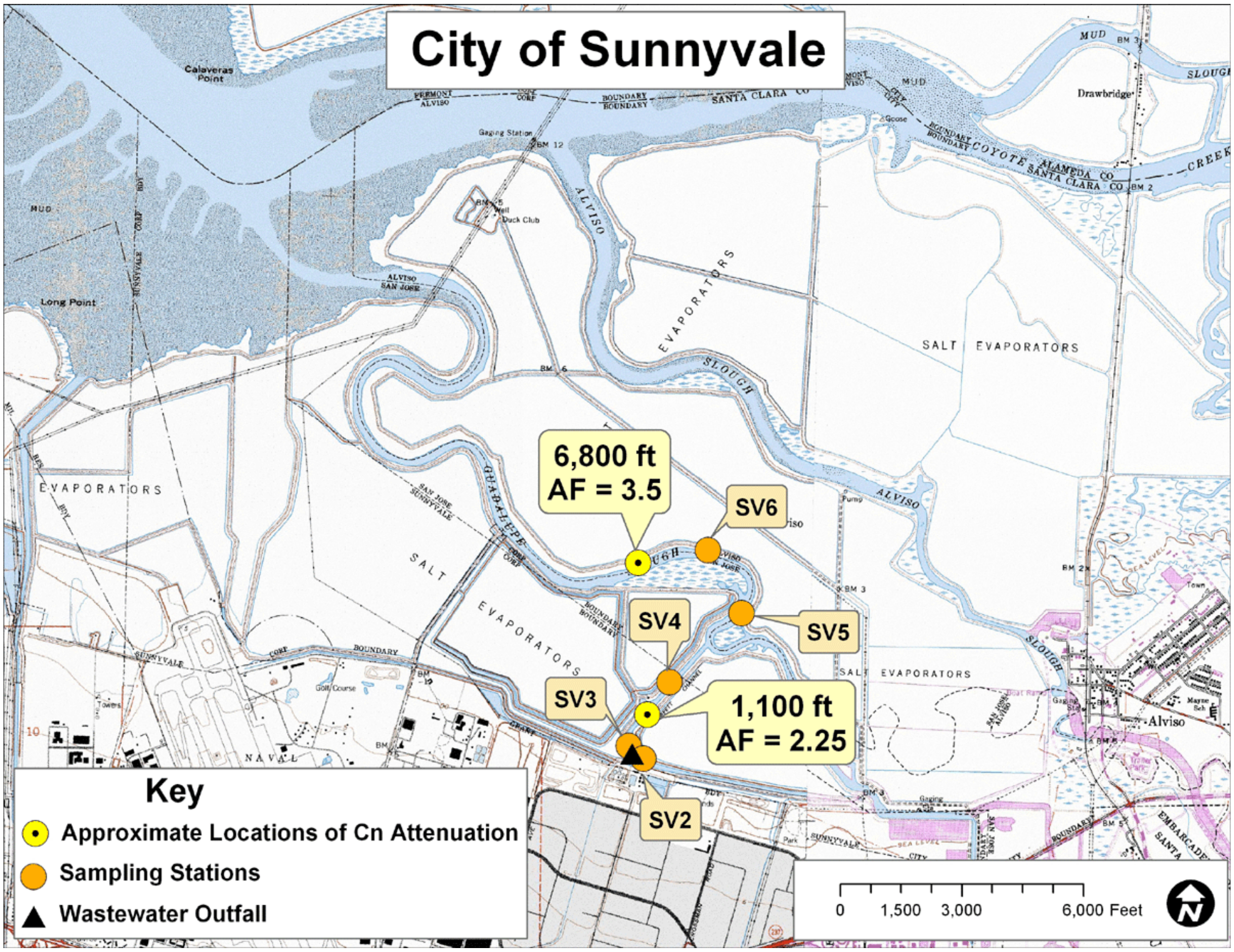



Sonoma County Water Agency
CS2
CS3
CS5
10,000 ft
AF = 2.25
15,500 ft (CS6)
AF = 3.5
17,000 ft
AF = 4.5
Key
Approximate Locations of Cn Attenuation
Sampling Stations
Wastewater Outfall
0 1,500 3,000 6,000 Feet

City of Sunnyvale

Site	Average Cyanide µg/l	No. data points	Distance from Outfall		Surface Water Area Between Sites		AF
			feet	kilometers	acres	sq. kilometer	
City of Sunnyvale							
SV2	2.2	1	-20	0	0	0.000	-
Outfall	2.2	1	0	0	0	0.000	1
SV-3	2.1	1	300	0.1	3	0.012	1
Attenuation	-	-	1,100	0.3	2	0.009	**2.25**
SV-4	0.7	1	2,300	0.7	5.8	0.023	3.1
SV-5	0.8	1	4,700	1.4	10.0	0.040	2.8
SV-6	0.7	1	6,800	2.1	11.5	0.045	3.1
Attenuation	-	-	7,200	2.2	13	0.049	**3.5**

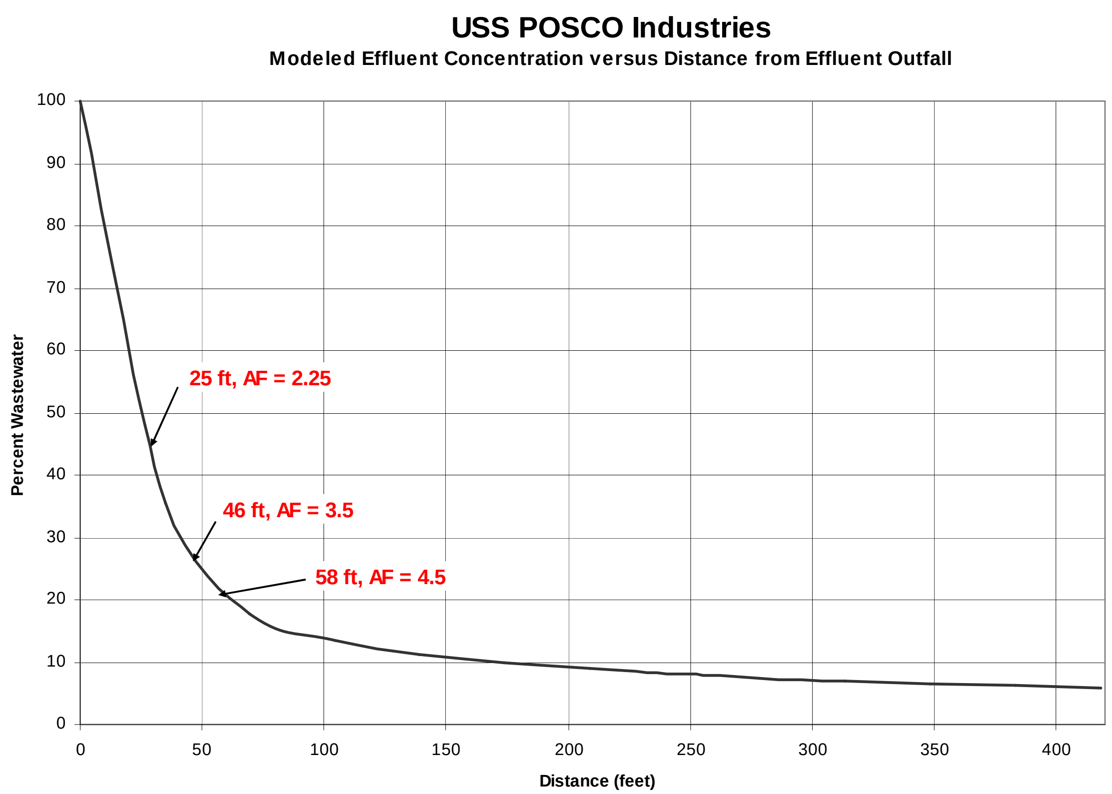


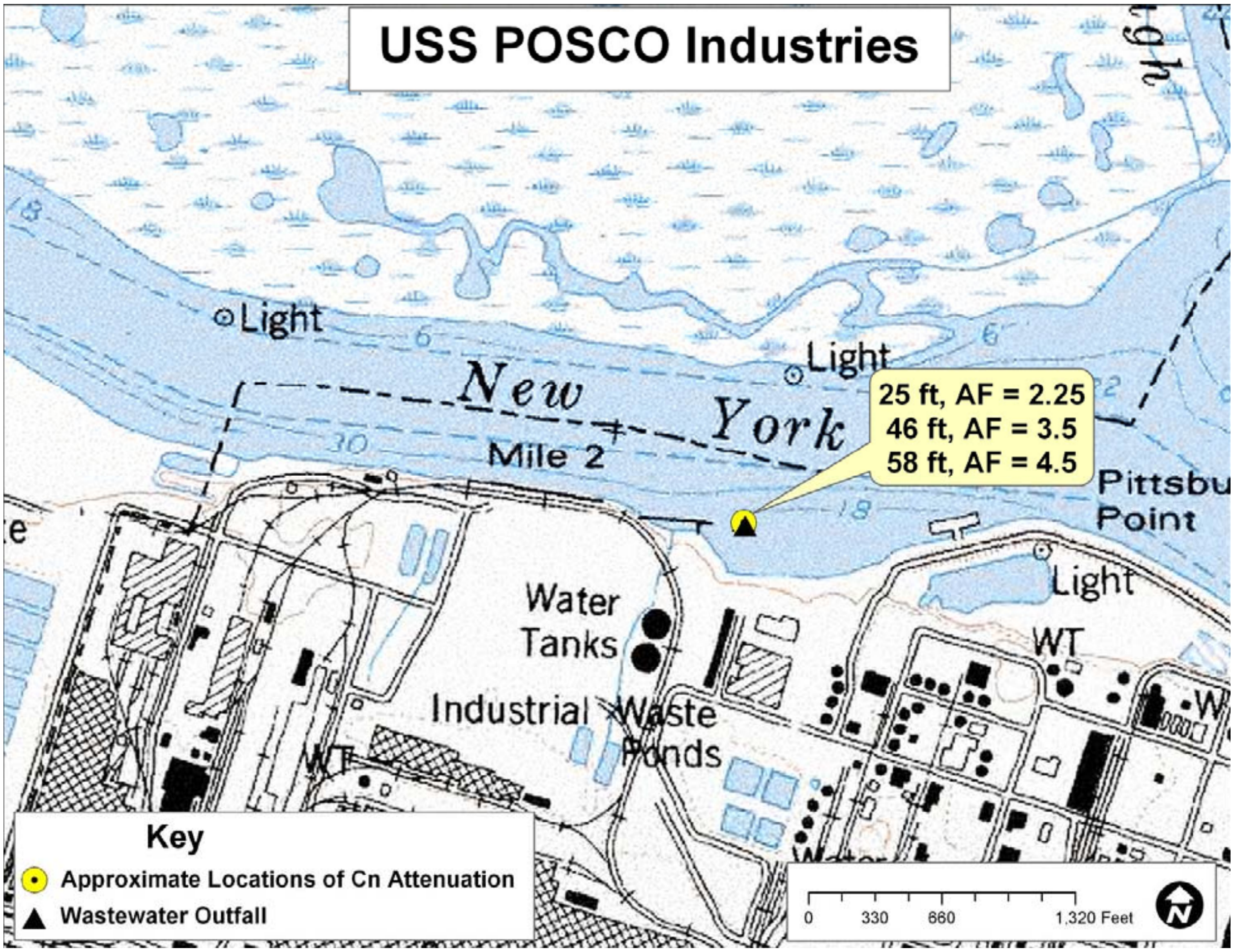

City of Sunnyvale
6,800 ft
AF = 3.5
SV6
SV5
SV4
SV3
1,100 ft
AF = 2.25
SV2
Key
Approximate Locations of Cn Attenuation
Sampling Stations
Wastewater Outfall
0 1,500 3,000 6,000 Feet

U.S. Steel POSCO Industries (UPI) Plant

Site	Average Cyanide µg/l	No. data points	Distance from Outfall		Surface Water Area Between Sites		Median AF
			feet	kilometers	acres	sq. kilometer	
USS POSCO Industries							
Outfall	NA	-	0	0	0.00	0.0000	
Attenuation	-	-	25	0.01	0.14	0.0006	**2.25**
Attenuation	-	-	46	0.01	0.19	0.0008	**3.5**
Attenuation	-	-	58	0.02	0.25	0.0010	**4.5**

† Attenuation Factors in bold were derived from modeled percent wastewater.




USS POSCO Industries
Light
New York
Mile 2
Light
25 ft, AF = 2.25
46 ft, AF = 3.5
58 ft, AF = 4.5
Pittsbu
Point
Light
Water Tanks
Industrial Waste Ponds
WT
WT
Key
Approximate Locations of Cn Attenuation
Wastewater Outfall
0
330
660
1,320 Feet

Area Measurement Methodology and Notes

Method for Surface Water Area Calculations

Surface water areas were calculated in GIS using ESRI ArcMap 8 software and USGS hydrologic GIS data (National Hydrologic Dataset, 1999). The NHD provides line map features (rivers and stream) and polygon map features (bays, lakes, estuaries, ponds). The extent of waterbodies (including estuarine) provided by the NHD are based on the USGS 7.5 minute topographic maps. According to the USGS Topographic Mapping Standards for mapping the extent of waterbodies, strict rules apply. In the case of estuarine creeks, the shoreline is defined where 'the water is at the stage that prevails when the feature is at or near capacity'. Using the NHD data, surface water areas were mapped for selected Shallow Water Dischargers along with their respective monitoring location. The respective slough or creek polygon feature was divided into sub-sections. The dividing lines for splitting the polygon feature were the monitoring locations. Once the slough or creek polygon feature was successfully sub-divided, area was calculated for each sub-section using the ‘calculate acres' script in ArcMap.

USGS Topographic Mapping Standards for Hydrography: *http://rockyweb.cr.usgs.gov*

Stream:

The limit of a STREAM/RIVER is the position of the shoreline when the water is at the stage that prevails when the feature is at or near capacity.

APPENDIX E

Summary of Water Quality Modeling Studies

Background

A number of shallow water dischargers have performed mathematical modeling studies of their discharges to waters of San Francisco Bay. The purpose of these studies has been to evaluate the water quality impact of individual discharges near the point of discharge and at locations in the Bay proper. Most of these modeling studies have used results from dye studies to check the results produced by the models. Dye studies provide empirical measures of plume movement over short time periods during and after the release of dye from a given outfall.

The dischargers that have performed mathematical water quality modeling studies are as follows:

- Novato SD (2004) (RMA, 2004)
- Fairfield Suisun SD (2004) (Flow Science, 2004)
- City of Petaluma (2001) (RMA, 2001)
- Sonoma County Water Agency (1997) (RMA, 1997)
- City of Palo Alto (1997) (RMA, 1997)
- City of San Jose (1989) (CH2M Hill, 1989)

Many of these studies have been prepared as part of a request to the San Francisco Regional Water Quality Control Board (Water Board) to grant a dilution credit in accordance with provisions in the San Francisco Bay Basin Plan (Basin Plan). Dating to the 1986 Basin Plan, provisions have existed for individual shallow water dischargers to request dilution credit (SFBRWQCB, 1995). These requests have included the need to demonstrate compliance with water quality objectives in near-field receiving waters.

For cyanide, the results of modeling studies performed to date are useful in the prediction of cyanide levels in the vicinity of shallow water discharges. Predictions can be made based on presumed percentages of effluent at different distances from the point of discharge.

Mathematical Modeling Methodology

The mathematical modeling that has been performed is in all cases based on the results from two linked models: (1) a hydrodynamic model that predicts the mixing of effluent in the estuarine waters of the Bay or its tributaries and (2) a water quality model that predicts the water quality conditions that will occur at various locations in the Bay due to the tidal mixing, advection and turbulent diffusion of treated wastewater effluent in the Bay. Typically, the flow, current, and stage information derived through the hydrodynamic model is used as input to the water quality model.

Descriptions of the modeling methodologies used to date are provided in the modeling reports described below.

Modeling Results

Modeling results from three dischargers are used to demonstrate the dilution characteristics in the vicinity of three different types of shallow water discharges. Those types are (1) discharge to the shallow mudflats along the periphery of the Bay (Novato Sanitary District); (2) discharge to a small dead-end channel along the periphery of the Bay (City of Palo Alto); and (3) discharge to a channelized slough remote from the Bay (Fairfield-Suisun Sewer District).

Novato Sanitary District

The Novato discharge has been modeled on two occasions by RMA, Inc. of Suisun, California. The first occasion was in 1997 as part of an application for dilution credit to the Water Board. A more recent (2004) modeling effort was performed as part of the anti-degradation analysis that the District is conducting as part of a request to increase the permitted discharge from 6.55 mgd to 7.0 mgd ADWF (RMA, 2004). Results from the modeling work will also be used in the assessment of water quality impacts of the proposed expansion project as part of an environmental impact report under CEQA.

The Novato discharge is located in the mudflat area along the western periphery of San Pablo Bay. The outfall is a pipeline that terminates approximately 300 feet from the shore. Most of the time, the discharge is submerged in the shallows of the mudflat. At low tides, for short time intervals, the outfall is exposed and effluent runs along a rivulet in the mudflat toward the deeper channel of the Bay. Flood tides over the mudflat results in significant mixing of the effluent with Bay waters.

The RMA models used to assess the water quality impacts of the Novato discharge are described in a March 2004 report for the District. In brief, the models used are finite element hydrodynamic and water quality models.

The models used in the analysis are RMA-2 and RMA-11. RMA-2 is a generalized free surface hydrodynamic model that is used to compute a continuous temporal and spatial description of fluid velocities and water depth throughout the San Francisco Bay and estuary. RMA-11 is a generalized two-dimensional water quality model that computes temporal and spatial descriptions of water quality parameters (both conservative and non-conservative) parameters. RMA-11 uses the results from RMA-2 for its description of the flow field.

The models have been calibrated against observed data in the Bay. The hydrodynamic model was calibrated against observed current velocities and stage data for San Pablo Bay generated in 1979 and 1980. The water quality model was calibrated for the same period using USGS salinity data. The water quality model was also calibrated against dye study results performed in March 1978 by E.H. Smith and Associates. Finally, predicted dissolved copper and dissolved nickel results were checked against actual RMP data at various RMP stations to further refine the modeling results.

The models are constructed in sufficient detail to represent the bathymetry of the Bay near the Novato discharge point and in the body of the Bay based on NOAA charts and data. The finite element network includes the entire Bay and Sacramento-San Joaquin Delta so that tidal currents are computed based on the tide at the Golden Gate, bay inputs and tributary stream inflows. The models are capable of simulating sheet flow over mud flats and movement of water over the deeper sections of the Bay in response to tidal activity. The models compute current velocities, water depth and the concentration of water quality parameters at 7.5-minute time steps throughout the tidal cycle. The model output can then be used to calculate hourly, 24-hour and 4-day average values of dilution and water quality concentrations at any desired point in the Bay.

The modeling performed by RMA allows for the development of effluent concentration profiles along directions parallel and perpendicular to the Novato outfall. This provides a picture of the dilution field around the Novato discharge, which approximates, in two dimensions, the three dimensional plumes that exist around deep water discharges. This distinguishes the Novato discharge from most of the other shallow water discharged to the Bay; other shallow water discharges exhibit more linear (one dimensional) dilution gradients due to their location in sloughs and channels.

Results from the Novato modeling effort are shown graphically in the March 2004 RMA report. Those results, derived for critical dry Delta outflow conditions, indicate maximum hourly average percent effluent levels of 70 percent at the point of discharge, with maximum hourly effluent percentages dropping to 10 percent at distances of 250 feet in either direction from the discharge. For maximum daily average effluent levels, the model results show a maximum of 12 percent effluent above the point of discharge dropping to less than 3 percent within 250 feet of the discharge point. The curves generated for the Novato report can be used to develop predicted cyanide concentrations in the Bay at given effluent concentrations.

City of Palo Alto

The City of Palo Alto discharges advanced secondary effluent into a short, unnamed channel along the western side of South Bay. The Palo Alto discharge was modeled by RMA, Inc, as part of a request to the Water Board for consideration of providing a dilution credit to the City for NPDES permit purposes (RMA, 1997). The models used in the Palo Alto work (RMA-2 and RMA-11) are the same models used by RMA in the above-described work for Novato Sanitary District. The inputs to the model were adjusted to reflect near-field conditions and bathymetry existing near the City of Palo Alto's discharge point.

The model was calibrated against the field observations derived from a dye study performed for the City in 1990 by Woodward Clyde Consultants. Additionally, modeling results for dissolved copper were checked against observed ambient copper concentrations in South Bay to finalize proper adjustments to the model.

Instantaneous, 24-hour average and 4-day dilution contours during critical dry season conditions were developed by RMA for the City of Palo Alto using the above-described models. These contour plots are provided as color figures in the December 1997 modeling report to the City. The information in these contour plots can be used to directly estimate ambient cyanide concentrations along the Palo Alto discharge gradient based on given effluent cyanide concentrations.

Fairfield-Suisun Sewer District

Flow Science Inc. from Pasadena, CA modeled the Fairfield-Suisun Sewer District (FSSD) discharge in 2004. Flow Science employed the Fischer Delta Model to assess the affect of the FSSD discharge of advanced secondary effluent from the point of discharge in Boynton Slough into Suisun Slough and thence to Grizzly Bay (Flow Science, 2004). The Fischer Delta Model employs a hydrodynamic model (DELFLO) and a water quality model (DELSAL) in its analytical approach.

Dilution characteristics were modeled for two water year conditions: 1991 (representative of a critical [dry] year condition with low Delta outflows in the winter and spring) and 1998 (representative of a wet year condition with elevated Delta outflows for a portion of the winter/spring period. Given the location of the FSSD discharge point in the northern region of the FSSD discharge point in the northern region of the Bay in Suisun Marsh, it was hypothesized that dilution characteristics of the FSSD discharge may vary with Delta outflow condition. In fact, the water quality modeling showed that dilution characteristics of the FSSD discharge are insensitive to water year conditions and that the effects are highly localized in Boynton Slough and the connecting reach of Suisun Slough.

The following is the typical percentage of effluent located at various points along the discharge gradient from Boynton Slough and Suisun Slough toward Grizzly Bay:

Station C1:	100 percent effluent
Station C2:	95 percent effluent
Station C4:	79 percent effluent
Station C6:	77 percent effluent
Station C5:	47 percent effluent
Station SU42:	4 percent effluent

The model was used to generate probability plots of percentage occurrence at different locations. The above percentages are 95^{th} percentile occurrence values. A map of these stations is provided in the Flow Science modeling report.

The information derived from the modeling of effluent percentages at given locations allows the calculation of ambient concentrations of cyanide along the discharge gradient at a given value of effluent cyanide and background cyanide levels in Grizzly Bay.

Summary

The above information provides an indication of the usefulness of available dilution modeling results on the prediction of cyanide levels in ambient waters near other shallow water discharges. Available modeling information could be used to determine dilution (i.e. percentage effluent values) in the vicinity of shallow water discharges. This information could then be compared with observed cyanide levels along discharge gradients to validate the change in ambient cyanide concentrations due to dilution.

References

RMA 1997. *Dilution Analysis and Water Quality Impacts of the Palo Alto Regional Water Quality Control Plant on South San Francisco Bay.* Prepared for the City of Palo Alto. December 1997.

RMA 2001. *Water Quality Impacts of City of Petaluma Wastewater Treatment Plant Discharge in Petaluma River and San Pablo Bay.* Draft report prepared for City of Petaluma under subcontract to Larry Walker Associates. June 2001.

RMA 2004. *Water Quality Modeling for Novato Sanitary District Anti-Degradation and EIR Water Quality Analysis*. Draft report prepared for Larry Walker Associates. March 2004.

RMA 1997. Water Quality Modeling for Sonoma County Water Agency.

Flow Science, Inc. 2004. Results of Fischer Delta Model simulations, Fairfield-Suisun Sewer District. Draft Technical Memorandum to ESA and LWA. April 2004.

CH2M Hill 1989. San Jose-Santa Clara WPCP Dilution Study. Prepared for City of San Jose.

APPENDIX F

Cyanide Attainability Analysis for Shallow Water Dischargers

CYANIDE ATTAINABILITY ANALYSIS FOR
SHALLOW WATER DISCHARGERS
(Attenuation Factors = 2.25, 3.0, 3.5, and 4.5)

PURPOSE OF ANALYSIS

This document presents the statistical analysis results in the determination of compliance attainability with the water quality-based effluent limitats (WQBELs), specifically, the daily maximum effluent limitation (MDEL) and the monthly average effluent limitation (AMEL), calculated using four cyanide attenuation factors (AF), 2.25, 3.0, 3.5, and 4.5, for thirteen shallow water dischargers.

When calculating WQBELs using SIP procedures, an attenuation factor (AF) is applied the same way as a dilution factor (D), i.e., to replace the D in the equation with the AF.

The thirteen shallow water dischargers used in this attainability analysis include:

1. City of American Canyon
2. Fairfield Suisun Sewer District
3. Hayward Shore Marsh Effluent
4. Las Gallinas Valley Sanitary District
5. Mountain View Sanitary District
6. Napa Sanitation District
7. Novato Sanitary District
8. City of Palo Alto
9. City of Petaluma
10. San Jose/Santa Clara Valley Water Pollution Control Plant
11. Sonoma Valley County Sanitation District
12. City of Sunnyvale
13. USS Posco

STATISTICAL ANALYSIS PROCEDURES AND RESULTS

The statistical analyses performed include the following:

1. Estimate statistics from the cyanide effluent data collected during 2000-2003: Since many of the data sets are censored data sets, i.e., many measurements are below detection limits (non-detect), a probability regression method was used to estimate the mean, standard deviation, coefficient of variation, as well as the 95th and the 99th percentiles. For this analysis, lognormal distribution was used assuming that individual cyanide effluent data sets follow this distribution.

   Attachment F-1 includes the probability plots of cyanide data (most of them are censored probability plots) from the 13 dischargers. These probability plots show how well a theoretical distribution fits the effluent data, therefore, help predict how good the statistical estimates are. For bad distribution fits, large deviations of statistical estimates from the true population parameters could be expected.

2. Calculate AMELs and MDELs using different attenuation factors. **Attachments F-2 through to F-5** show the detailed calculation results.

3. To determine compliance attainability statistically, we compare the mean, the 95th, and the 99th percentiles with the LTA (long term average), AMEL, and MDEL from the WQBEL calculation, respectively. If any of the statistical estimates (the mean, the 95th, and 99th percentiles) is greater than its corresponding criteria (the LTA, AMEL, and MDEL), then statistically it indicates that a compliance problem may occur. If a meaningful statistical analysis cannot be performed due to high censoring of data, the maximum effluent concentration (MEC) will be compared with the AMEL. If the MEC is less than or equal to the AMEL, compliance is attainable. The summary of this analysis for all four attenuation factors is shown in Table 16 (section 7.3.1).

4. To visualize the actual compliance or exceedance of the effluent data with the MDEL or AMEL, time series plots of all available cyanide effluent data during 2000-2005 were generated, with the MDEL or AMEL plotted as horizontal lines on the same plot. If the effluent data points fall above any of the two lines, it indicates an exceedance. **Attachment F-6** shows the time series plots with the MDEL and AMEL lines, for all four attenuation factors.

RESULTS

The following gives a brief summary of the statistical determination of compliance attainability and the comparison results of actual effluent measurements with AMELs and MDELs.

1. City of American Canyon:

AF=2.25: Attainability = Yes.
AF=3.0: Attainability = Yes.
AF=3.5: Attainability = Yes.
AF=4.5: Attainability = Yes.

There is one effluent measurement exceeding the AMEL at AF=2.25. There is no other exceedance of either the AMELs or MDELs.

2. Fairfield Suisun:

AF=2.25: Attainability = No (Mean>LTA, 95th>AMEL, 99th>MDEL).
AF=3.0: Attainability = No (95th>AMEL, 99th>MDEL).
AF=3.5: Attainability = No (95th>AMEL).
AF=4.5: Attainability = No (95th>AMEL).

At AF=4.5, there is one cyanide effluent measurement exceeding the MDEL, and three exceeding the AMEL. There are two exceedances of the MDELs and many exceedances of the AMELs at other three attenuation factors, indicating potential compliance problem. However, since the Discharger sampled twice per month most of the time during 2000-2004, by comparing the monthly averages with the AMELs, the number of exceedances drops significantly for attenuation factors 2.25, 3.0, and 3.5: There are only two exceedances of the AMELs at AF=3.0, 3.5, and 4.5, both exceedances are caused by two high measurements, 23 and 28 μg/L.

3. Hayward Marsh Effluent

AF=2.25: Attainability = No (Mean>LTA).
AF=3.0: Attainability = Yes.
AF=3.5: Attainability = Yes.
AF=4.5: Attainability = Yes.

There is/are one or two measurement(s) exceeding the AMELs for all four attenuation factors. There is no exceedance of the MDELs. However, the distribution fit is not good enough, and the percentile estimates of the mean and percentiles are most likely inflated (overestimate).

4. Las Gallinas (LGVSD)

AF=2.25: Attainability = No (95^{th}>AMEL).
AF=3.0: Attainability = Yes.
AF=3.5: Attainability = Yes.
AF=4.5: Attainability = Yes.

There is only one measurement exceeding the AMELs at AF=2.25, 3.0, and 3.5.

5. Mountain View SD

AF=2.25: Attainability = Yes.
AF=3.0: Attainability = Yes.
AF=3.5: Attainability = Yes.
AF=4.5: Attainability = Yes.

The cyanide data set is too limited, therefore, it is not recommended to estimate statistics using the parametric method. Time series plots show no exceedance of the AMELs or MDELs for any of the four attenuation factors, indicating no compliance issue.

6. Napa SD

AF=2.25: Attainability = No (95^{th}>AMEL).
AF=3.0: Attainability = No (95^{th}>AMEL).
AF=3.5: Attainability = Yes.

AF=4.5: Attainability = Yes.

These is one exceedance of the AMEL at AF=2.25. There is no exceedance of the AMELs at the any of the other three attenuation factors. There are two to six exceedances of the MDELs calculated using the four attenuation factors.

7. Novato

AF=2.25: Attainability = Yes.
AF=3.0: Attainability = Yes.
AF=3.5: Attainability = Yes.
AF=4.5: Attainability = Yes.

There is no exceedance of any of the AMELs or MDELs.

8. City of Palo Alto

AF=2.25: Attainability = Yes.
AF=3.0: Attainability = Yes.
AF=3.5: Attainability = Yes.
AF=4.5: Attainability = Yes.

There is no exceedance of any of the AMELs or MDELs.

9. Petaluma

AF=2.25: Attainability = No (95^{th}>AMEL, 99^{th}>MDEL).
AF=3.0: Attainability = No (95^{th}>AMEL).
AF=3.5: Attainability = No (95^{th}>AMEL).
AF=4.5: Attainability = Yes.

There are/is 4, 1, 1 exceedance(s) of the AMELs at AF=2.25, 3.0, and 3.5, respectively. There is no exceedance of the AMEL at AF=4.5 or any of the MDELs.

10. San Jose/Santa Clara

AF=2.25: Attainability = Yes.
AF=3.0: Attainability = Yes.
AF=3.5: Attainability = Yes.
AF=4.5: Attainability = Yes.

There is no exceedance of any of the AMELs or MDELs.

11. Sonoma Valley County SD

AF=2.25: Attainability = No (95^{th}>AMEL).

AF=3.0: Attainability = No (95^{th}>AMEL).
AF=3.5: Attainability = Yes.
AF=4.5: Attainability = Yes.

There are/is 5, 3, 2, and 1 exceedance(s) of the AMELs at AF=2.25, 3.0, 3.5, and 4.5, respectively. There is no exceedance of any of the MDELs.

12. City of Sunnyvale

AF=2.25: Attainability = No (Mean>LTA, 95^{th}>AMEL, 99^{th}>MDEL).
AF=3.0: Attainability = No (Mean>LTA, 95^{th}>AMEL, 99^{th}>MDEL).
AF=3.5: Attainability = No (95^{th}>AMEL).
AF=4.5: Attainability = No (95^{th}>AMEL).

There is only one exceedance of the MDEL at all attenuation factors, however, there are significant numbers of exceedances of the AMELs at all attenuation factors. For example, there are five measurements above the AMEL at AF=4.5. This indicates that Discharger will have compliance issues.

13. USS Posco

AF=2.25: Attainability = Yes (MEC<AMEL).
AF=3.0: Attainability = Yes (MEC<AMEL).
AF=3.5: Attainability = Yes (MEC<AMEL).
AF=4.5: Attainability = Yes (MEC<AMEL).

There are only a few detected values with the highest detected concentration of 4.6 μg/L, which is less than the AMELs calculated using all proposed attenuation factors. Detection limits are 5 and 10 μg/L respectively. Therefore, it is expected that the Discharger will be able to attain compliance with the WQBELs, even with an attenuation factor of 2.25.

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Compliance Attainability Summary

For an attenuation factor of **2.25**, only **six** dischargers will be able to achieve compliance: City of American Canyon, Mountain View, Novato, Palo Alto, and San Jose/Santa Clara, and USS Posco.

For an attenuation factor of **3.0**, in addition to the above six dischargers, two more dischargers (a total of **eight**) will be able to achieve compliance: Hayward Marsh Effluent and Las Gallinas Valley Sanitation District.

For an attenuation factor of **3.5**, only three dischargers will have compliance issues (the other **ten** will be able to achieve compliance), which are Fairfield Suisun, City of Petaluma, and City of

Sunnyvale. However, the time series plots for Petaluma cyanide effluent concentrations do not seem to indicate a compliance problem.

For an attenuation factor of **4.5**, Fairfield Suisun and Sunnyvale are the only two dischargers that will have some compliance issues, the other **eleven** will be able to achieve compliance.

More Frequent Sampling than Once Per Month Recommended

When determining compliance attainability using the statistical three-point comparison, i.e., mean versus LTA, 95^{th} percentile versus AMEL, and 99^{th} percentile versus MDEL, it seems that the 95^{th}/AMEL is the trigger indicating compliance infeasibility for most cases. Since most dischargers sample only once every month, it is practically comparing a daily sample with a monthly average limit. The time series plots also show that most exceedances are against the AMELs, unless for a few very high effluent concentrations. If the dischargers will sample more than once per month, the chance of exceeding an AMEL drops significantly: This has been illustrated by the Fairfield case. Therefore, the dischargers are encouraged to sample more than once per month to level off any high daily concentrations when comparing with the AMEL.

Recommended Attenuation Factor

It is quite clear that at AF=2.25, some dischargers will have compliance issues, even with more frequent sampling.

At AF=3.0, Sunnyvale may have bigger compliance issues than the others. If Sunnyvale samples more frequently, it might be able to describe the effluent concentrations better, but may still have difficulty in achieving compliance. Fairfield may be able to achieve compliance.

If we choose AF=3.5, with more frequent sampling, Sunnyvale might be able to achieve compliance. Fairfield should be able to achieve compliance, except for the two spiked concentrations, which might be caused by dumping events.

Use of Lower Detection Limit

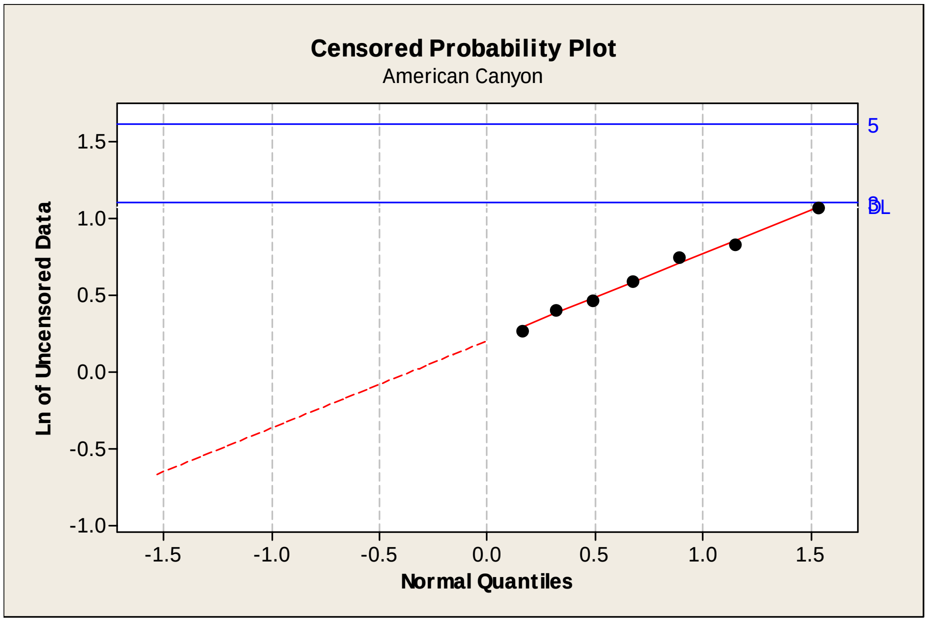
When calculating monthly average, we recommend using the method detection limit if the measurement is below the detection limit. Therefore, in addition to sampling frequency, we also encourage dischargers to use lower detection limits and report the method detection limits (instead of the reporting limits only). This will help with lowering the monthly averages when determining compliance.

Attachment F-1

Lognormal Probability Plots of Cyanide Effluent Concentrations

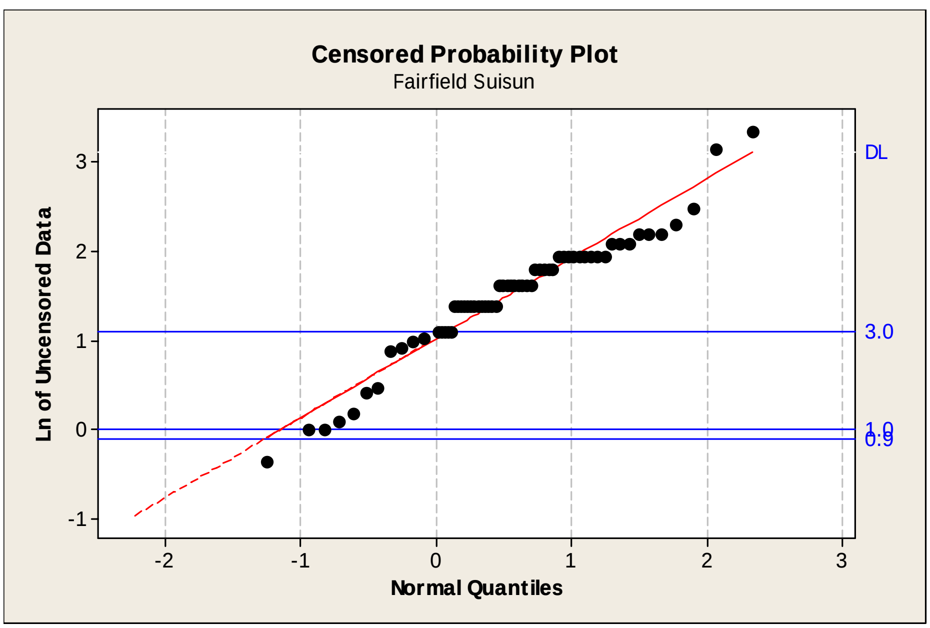
(Most Plots are Censored Probability Plots)

1. City of American Canyon



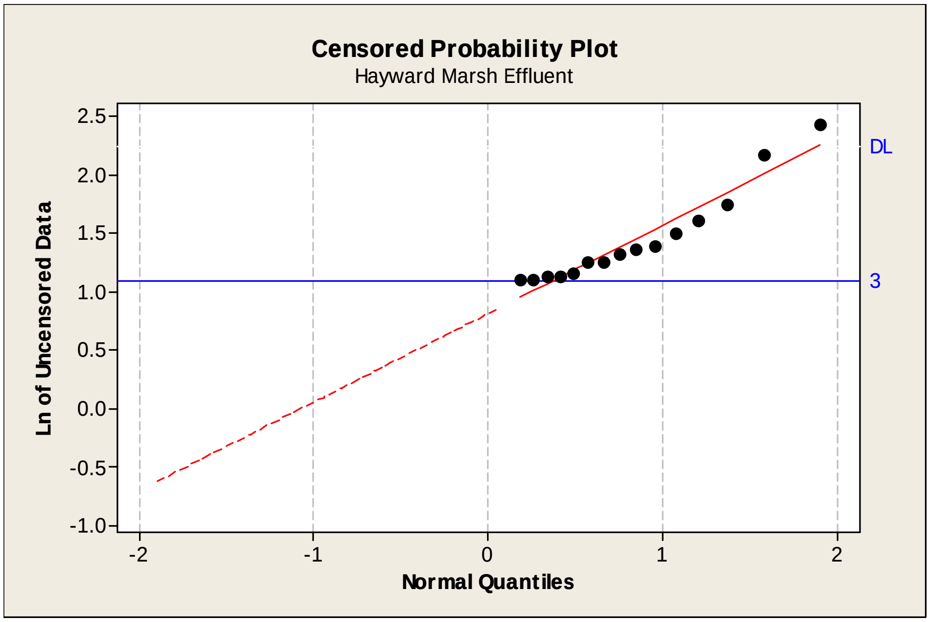
Lognormal distribution fits the data well, however, the data are too limited. There may be big deviations between the estimates and true population values.

2. Fairfield Suisun FCSD



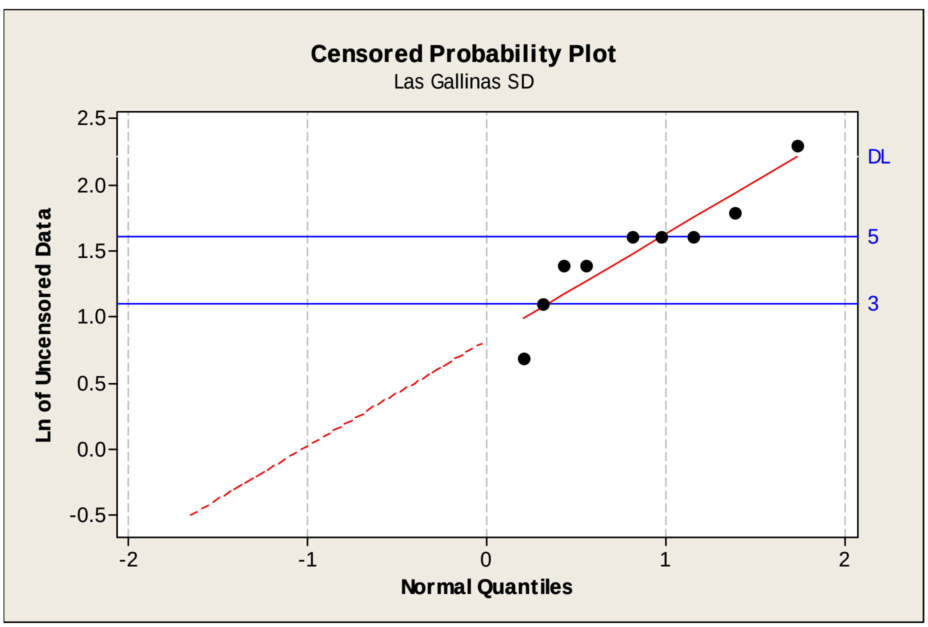
Lognormal distribution fits the data reasonably well, with small deviations. The data set is also large. Therefore, statistical estimates from this distribution fit are generally considered satisfactory.

3. Hayward Marsh Effluent



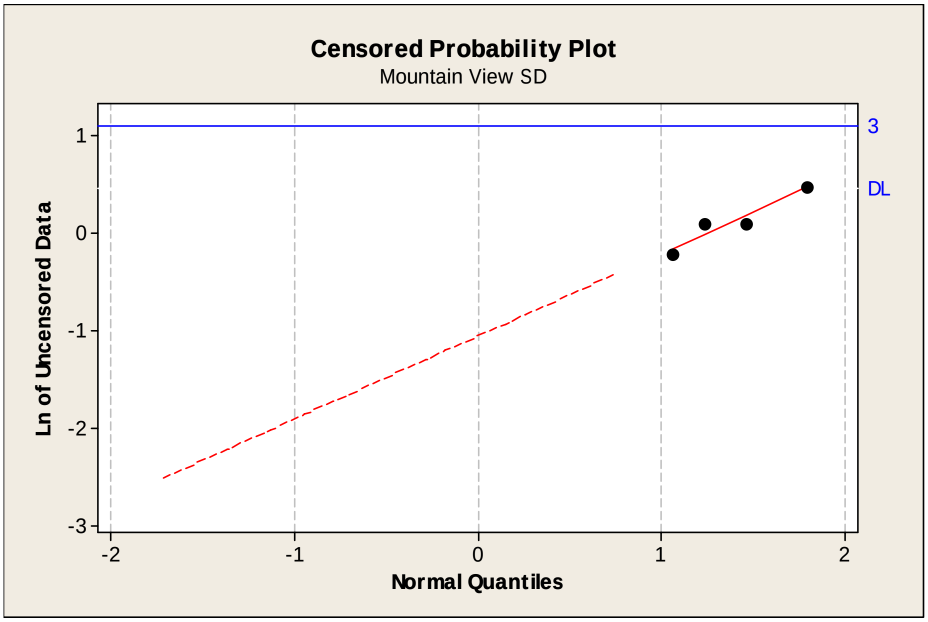
Lognormal distribution does not fit the data well. The data set is relatively small. Therefore, there will be some degrees of deviations between the statistical estimates and true population values (most likely overestimate with this method).

4. Las Gallinas Valley SD



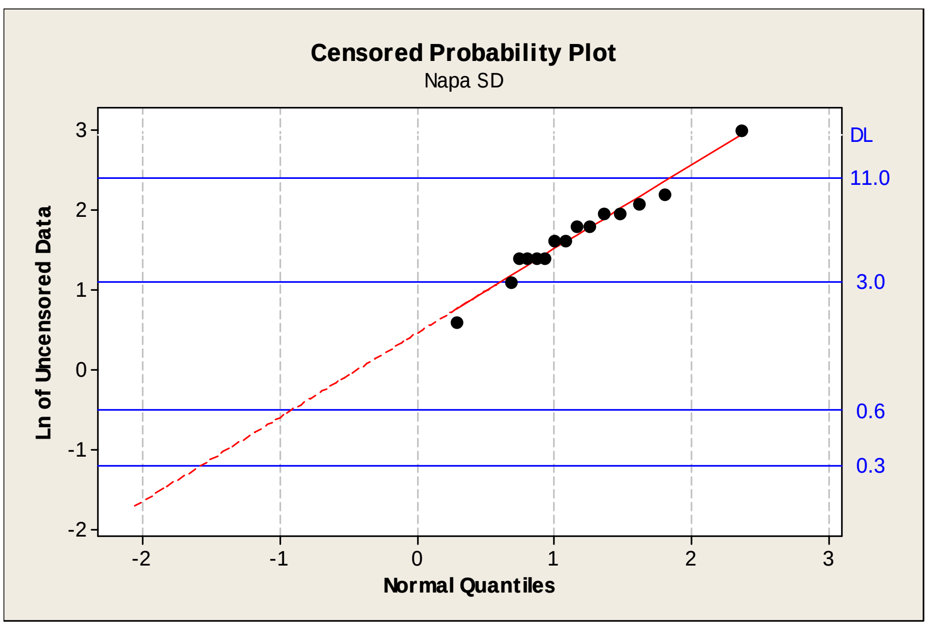
Lognormal distribution does not fit the data well. The data set is relatively small. Therefore, there will be some degrees of deviations between the statistical estimates and true population values.

5. Mountain View SD



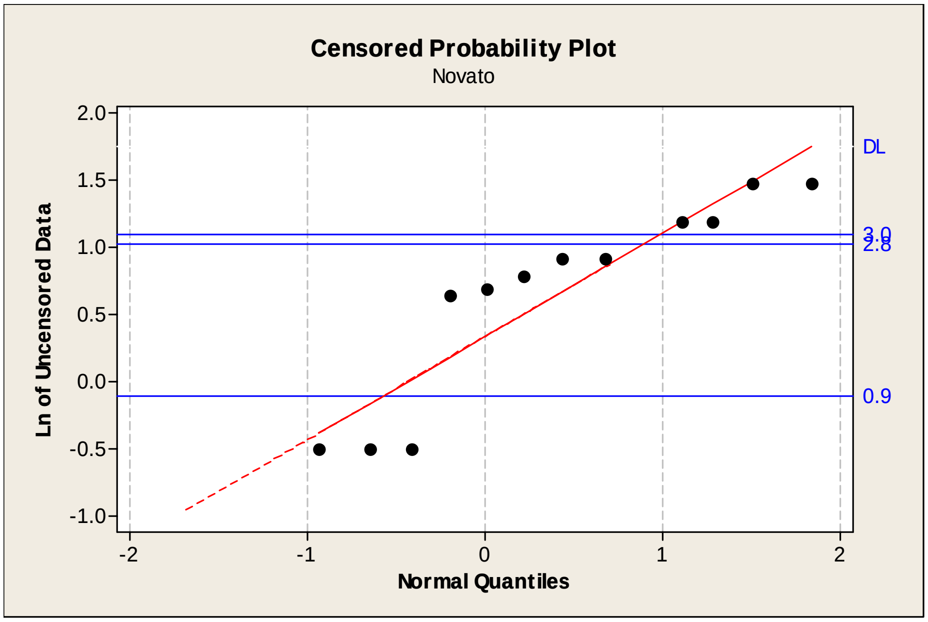
Lognormal distribution seems to fit the data well, however, the data set is too small. Therefore, it is not recommended to use this parametric method to estimate statistics.

6. Napa SD



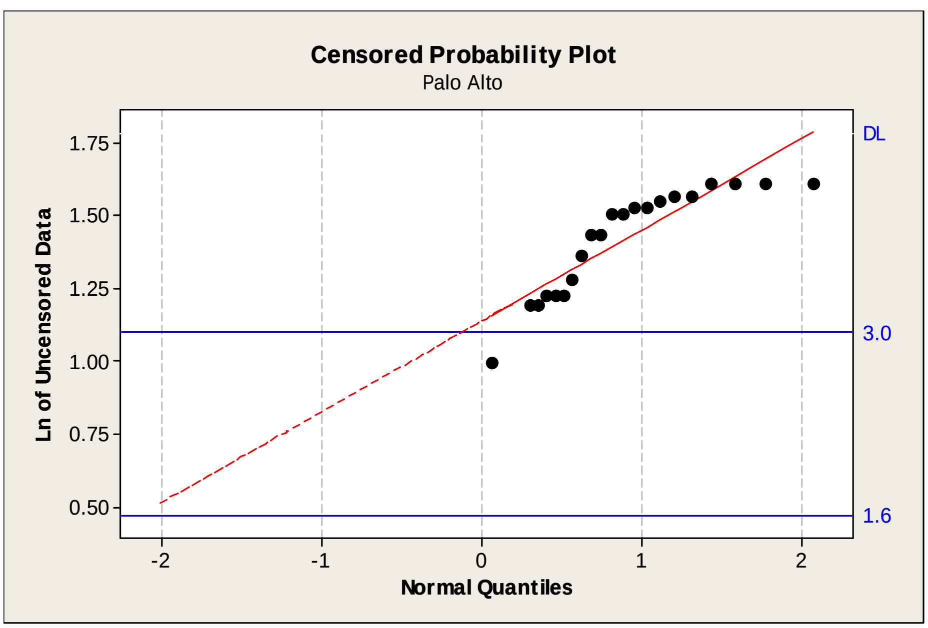
Lognormal distribution fits the data reasonably well. The data set is of medium size. Therefore, statistical estimates from this distribution fit are generally considered satisfactory.

7. Novato SD



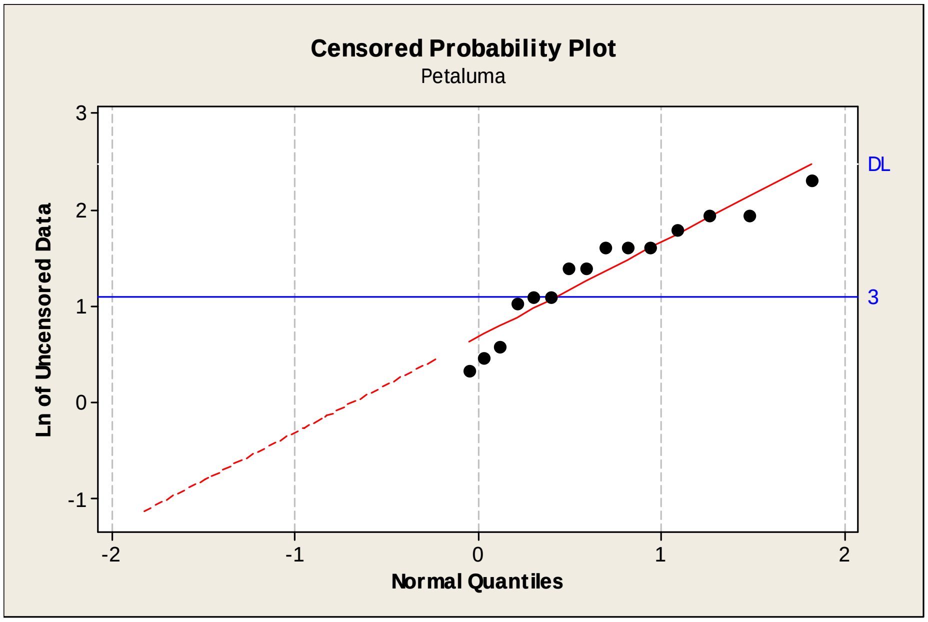
Lognormal distribution does not fit the data well. The data set is relatively small. Therefore, there will be substantial degrees of deviations between the statistical estimates and true population values.

8. Palo Alto



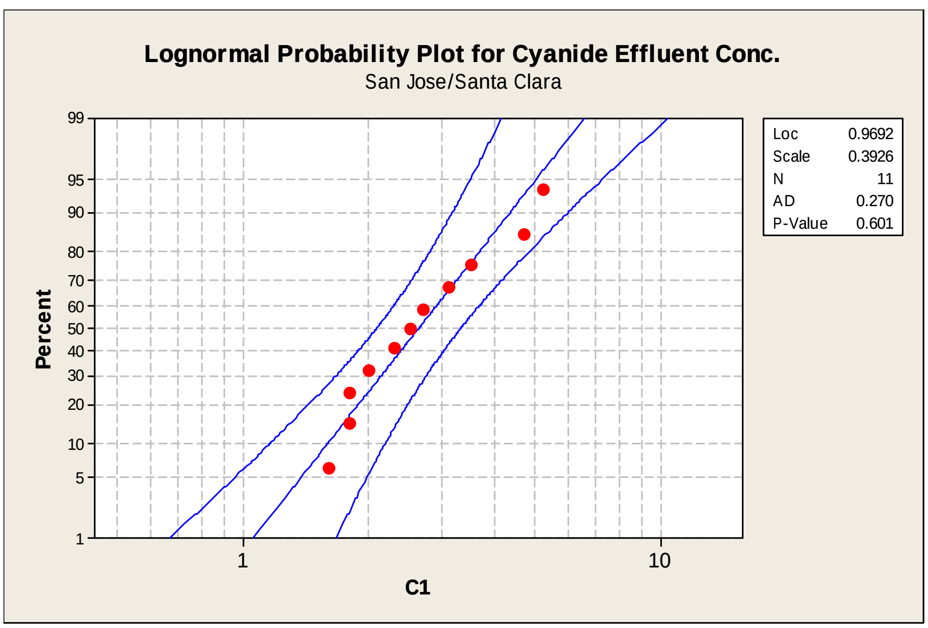
Lognormal distribution does not fit the data well. Therefore, there will be some degrees of deviations between the statistical estimates and true population values.

9. City of Petaluma



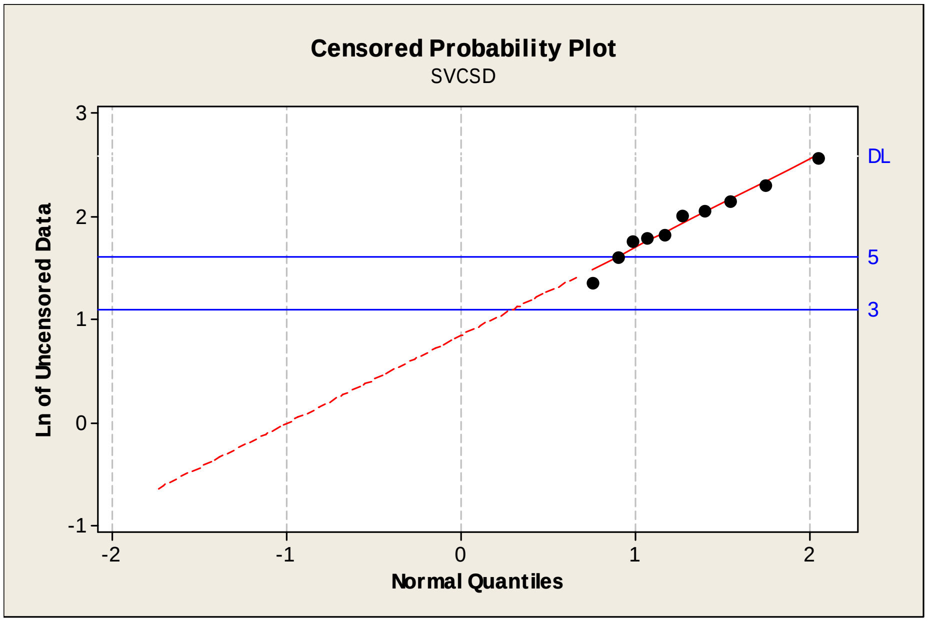
Lognormal distribution does not fit the data perfectly well, with some minor deviations. The data set is relatively small. Therefore, there will be some degrees of deviations between the statistical estimates and true population values.

10. City of San Jose/Santa Clara



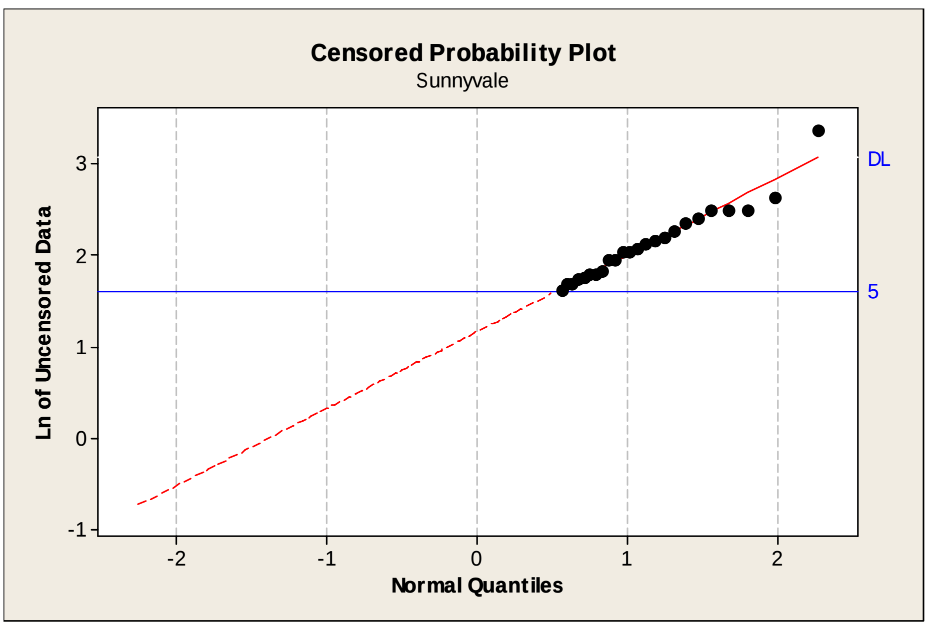
Lognormal distribution seems to fit the data well with some deviations. The data set is relatively small though. The statistical estimates are generally considered satisfactory.

11. Sonoma Valley County SD



Lognormal distribution seems to fit the data well. The data set is small though. The statistical estimates are generally considered satisfactory.

12. City of Sunnyvale



Lognormal distribution seems to fit the data well, except one extreme outlier. Therefore, there will be some degrees of deviations between the statistical estimates and true population values (the outlier will inflate the statistical estimates).

Attachment F-2

Discharger	American Canyon	Fairfield-Suisun	Hayward Marsh (Effluent)	Las Gallinas	Mt. View	Napa	Novato	Palo Alto	Petaluma	San Jose/Santa Clara	Sonoma	Sunnyvale	USS Posco
Acute Criteria	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
Chronic Criteria	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
Background	0.2	0.4	0.4	0.4	0.4	0.2	0.4	0.3	0.4	0.3	0.4	0.3	0.5
Attentuation (SB04)	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
ECA_{ac}	30.1	29.7	29.7	29.7	29.7	30.1	29.7	29.9	29.7	29.9	29.7	29.9	29.4
ECA_{ch}	9.0	8.5	8.5	8.5	8.5	9.0	8.5	8.8	8.5	8.8	8.5	8.8	8.3
CV	0.493	1.002	0.794	0.776	0.600	1.227	0.665	0.300	0.868	0.423	0.858	0.944	0.600
s	0.47	0.83	0.70	0.69	0.55	0.96	0.61	0.29	0.75	0.41	0.74	0.80	0.55
s^2	0.22	0.70	0.49	0.47	0.31	0.92	0.37	0.09	0.56	0.16	0.55	0.64	0.31
s_4	0.24	0.47	0.38	0.37	0.29	0.57	0.32	0.15	0.42	0.21	0.41	0.45	0.29
s_4^2	0.06	0.22	0.15	0.14	0.09	0.32	0.10	0.02	0.17	0.04	0.17	0.20	0.09
z	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326
$ECA_{ac,m}$	0.38	0.20	0.25	0.26	0.32	0.17	0.29	0.53	0.23	0.42	0.23	0.21	0.32
$ECA_{ch,m}$	0.59	0.37	0.44	0.45	0.53	0.32	0.50	0.71	0.41	0.63	0.42	0.39	0.53
LTA_{ac}	11.33	6.04	7.45	7.60	9.52	5.12	8.71	15.76	6.87	12.62	6.94	6.42	9.45
LTA_{ch}	5.24	3.17	3.77	3.83	4.50	2.82	4.23	6.25	3.54	5.50	3.57	3.41	4.38
LTA	5.24	3.17	3.77	3.83	4.50	2.82	4.23	6.25	3.54	5.50	3.57	3.41	4.38
s_n	0.24	0.47	0.38	0.37	0.29	0.57	0.32	0.15	0.42	0.21	0.41	0.45	0.29
s_n^2	0.06	0.22	0.15	0.14	0.09	0.32	0.10	0.02	0.17	0.04	0.17	0.20	0.09
z	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
$AMEL_m$	1.4	1.9	1.7	1.7	1.6	2.2	1.6	1.3	1.8	1.4	1.8	1.9	1.6
s	0.47	0.83	0.70	0.69	0.55	0.96	0.61	0.29	0.75	0.41	0.74	0.80	0.55
s^2	0.22	0.70	0.49	0.47	0.31	0.92	0.37	0.09	0.56	0.16	0.55	0.64	0.31
z	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326
$MDEL_m$	2.7	4.9	4.0	3.9	3.1	5.9	3.4	1.9	4.3	2.4	4.3	4.7	3.1
AMEL	7.6	6.2	6.6	6.6	7.0	6.1	6.8	7.9	6.4	7.6	6.4	6.4	6.8
MDEL	13.9	15.6	15.0	14.9	14.0	16.6	14.4	11.9	15.3	13.0	15.2	15.9	13.6

MEC	2.9	28	11.3	10	1.6	20	4.43	5	10	8	13	29	4.6
Mean	1.4	3.9	2.9	3.0	0.5	2.6	1.8	3.3	2.9	2.8	3.2	4.4	4.4
Logmean	0.20	1.02	0.81	0.84	-1.06	0.47	0.35	1.14	0.67		0.85	1.16	MEC is 4.6, NDs with MDL of 5 and 10
LnSD	0.44	0.87	0.71	0.74	0.785	1.00	0.72	0.30	0.93		0.79	0.82	
Mean	1.4	3.9	2.9	3.0	0.5	2.6	1.8	3.3	2.9	2.8	3.2	4.4	
95th	2.5	11.7	7.3	7.8	1.3	8.3	4.6	5.1	9.1	4.9	8.7	12.3	
99th	3.4	21.1	11.8	12.9	2.2	16.4	7.6	6.3	17.1	6.3	14.9	21.4	
99.87th	4.6	38.0	19.1	21.3	3.7	32.3	12.3	7.6	32.1	8.1	25.4	37.1	

Attachment F-3

Discharger	American Canyon	Fairfield-Suisun	Hayward Marsh (Effluent)	Las Gallinas	Mt. View	Napa	Novato	Palo Alto	Petaluma	San Jose/San ta Clara	Sonoma	Sunnyval e	USS Posco
Acute Criteria	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
Chronic Criteria	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
Background	0.2	0.4	0.4	0.4	0.4	0.2	0.4	0.3	0.4	0.3	0.4	0.3	0.5
Attentuation (SB05)	3	3	3	3	3	3	3	3	3	3	3	3	3
ECA_{ac}	37.0	36.4	36.4	36.4	36.4	37.0	36.4	36.7	36.4	36.7	36.4	36.7	36.1
ECA_{ch}	11.0	10.4	10.4	10.4	10.4	11.0	10.4	10.7	10.4	10.7	10.4	10.7	10.1
CV	0.493	1.002	0.794	0.776	0.600	1.227	0.665	0.300	0.868	0.423	0.858	0.944	0.600
s	0.47	0.83	0.70	0.69	0.55	0.96	0.61	0.29	0.75	0.41	0.74	0.80	0.55
s^2	0.22	0.70	0.49	0.47	0.31	0.92	0.37	0.09	0.56	0.16	0.55	0.64	0.31
s_4	0.24	0.47	0.38	0.37	0.29	0.57	0.32	0.15	0.42	0.21	0.41	0.45	0.29
s_4^2	0.06	0.22	0.15	0.14	0.09	0.32	0.10	0.02	0.17	0.04	0.17	0.20	0.09
z	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326
$ECA_{ac,m}$	0.38	0.20	0.25	0.26	0.32	0.17	0.29	0.53	0.23	0.42	0.23	0.21	0.32
$ECA_{ch,m}$	0.59	0.37	0.44	0.45	0.53	0.32	0.50	0.71	0.41	0.63	0.42	0.39	0.53
LTA_{ac}	13.93	7.41	9.14	9.33	11.69	6.30	10.70	19.36	8.43	15.51	8.52	7.88	11.59
LTA_{ch}	6.42	3.87	4.60	4.67	5.49	3.46	5.16	7.65	4.31	6.72	4.35	4.17	5.33
LTA	6.42	3.87	4.60	4.67	5.49	3.46	5.16	7.65	4.31	6.72	4.35	4.17	5.33
s_n	0.24	0.47	0.38	0.37	0.29	0.57	0.32	0.15	0.42	0.21	0.41	0.45	0.29
s_n^2	0.06	0.22	0.15	0.14	0.09	0.32	0.10	0.02	0.17	0.04	0.17	0.20	0.09
z	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
$AMEL_m$	1.4	1.9	1.7	1.7	1.6	2.2	1.6	1.3	1.8	1.4	1.8	1.9	1.6
s	0.47	0.83	0.70	0.69	0.55	0.96	0.61	0.29	0.75	0.41	0.74	0.80	0.55
s^2	0.22	0.70	0.49	0.47	0.31	0.92	0.37	0.09	0.56	0.16	0.55	0.64	0.31
z	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326
$MDEL_m$	2.7	4.9	4.0	3.9	3.1	5.9	3.4	1.9	4.3	2.4	4.3	4.7	3.1
AMEL	9.3	7.5	8.0	8.1	8.5	7.5	8.3	9.7	7.8	9.3	7.9	7.9	8.3
MDEL	17.0	19.0	18.3	18.2	17.1	20.3	17.6	14.5	18.6	15.9	18.6	19.4	16.6

MEC	2.9	28	11.3	10	1.6	20	4.43	5	10	8	13	29	4.6
Mean	1.4	3.9	2.9	3.0	0.5	2.6	1.8	3.3	2.9	2.8	3.2	4.4	4.4
Logmean	0.20	1.02	0.81	0.84	-1.06	0.47	0.35	1.14	0.67		0.85	1.16	MEC is 4.6, NDs with MDL of 5 and 10
LnSD	0.44	0.87	0.71	0.74	0.785	1.00	0.72	0.30	0.93		0.79	0.82	
Mean	1.4	3.9	2.9	3.0	0.5	2.6	1.8	3.3	2.9	2.8	3.2	4.4	
95th	2.5	11.7	7.3	7.8	1.3	8.3	4.6	5.1	9.1	4.9	8.7	12.3	
99th	3.4	21.1	11.8	12.9	2.2	16.4	7.6	6.3	17.1	6.3	14.9	21.4	
99.87th	4.6	38.0	19.1	21.3	3.7	32.3	12.3	7.6	32.1	8.1	25.4	37.1	

Attachment F-4

Discharger	American Canyon	Fairfield-Suisun	Hayward Marsh (Effluent)	Las Gallinas	Mt. View	Napa	Novato	Palo Alto	Petaluma	San Jose/San ta Clara	Sonoma	Sunnyval e	USS Posco
Acute Criteria	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
Chronic Criteria	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
Background	0.2	0.4	0.4	0.4	0.4	0.2	0.4	0.3	0.4	0.3	0.4	0.3	0.5
Attentuation (SB05)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
ECA_{ac}	41.6	40.9	40.9	40.9	40.9	41.6	40.9	41.3	40.9	41.3	40.9	41.3	40.6
ECA_{ch}	12.3	11.7	11.7	11.7	11.7	12.3	11.7	12.0	11.7	12.0	11.7	12.0	11.3
CV	0.493	1.002	0.794	0.776	0.600	1.227	0.665	0.300	0.868	0.423	0.858	0.944	0.600
s	0.47	0.83	0.70	0.69	0.55	0.96	0.61	0.29	0.75	0.41	0.74	0.80	0.55
s^2	0.22	0.70	0.49	0.47	0.31	0.92	0.37	0.09	0.56	0.16	0.55	0.64	0.31
s_4	0.24	0.47	0.38	0.37	0.29	0.57	0.32	0.15	0.42	0.21	0.41	0.45	0.29
s_4^2	0.06	0.22	0.15	0.14	0.09	0.32	0.10	0.02	0.17	0.04	0.17	0.20	0.09
z	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326
$ECA_{ac,m}$	0.38	0.20	0.25	0.26	0.32	0.17	0.29	0.53	0.23	0.42	0.23	0.21	0.32
$ECA_{ch,m}$	0.59	0.37	0.44	0.45	0.53	0.32	0.50	0.71	0.41	0.63	0.42	0.39	0.53
LTA_{ac}	15.66	8.33	10.27	10.48	13.13	7.08	12.02	21.76	9.48	17.43	9.58	8.86	13.02
LTA_{ch}	7.21	4.33	5.15	5.23	6.14	3.88	5.78	8.58	4.83	7.54	4.87	4.68	5.96
LTA	7.21	4.33	5.15	5.23	6.14	3.88	5.78	8.58	4.83	7.54	4.87	4.68	5.96
s_n	0.24	0.47	0.38	0.37	0.29	0.57	0.32	0.15	0.42	0.21	0.41	0.45	0.29
s_n^2	0.06	0.22	0.15	0.14	0.09	0.32	0.10	0.02	0.17	0.04	0.17	0.20	0.09
z	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
$AMEL_m$	1.4	1.9	1.7	1.7	1.6	2.2	1.6	1.3	1.8	1.4	1.8	1.9	1.6
s	0.47	0.83	0.70	0.69	0.55	0.96	0.61	0.29	0.75	0.41	0.74	0.80	0.55
s^2	0.22	0.70	0.49	0.47	0.31	0.92	0.37	0.09	0.56	0.16	0.55	0.64	0.31
z	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326
$MDEL_m$	2.7	4.9	4.0	3.9	3.1	5.9	3.4	1.9	4.3	2.4	4.3	4.7	3.1
AMEL	10.4	8.4	9.0	9.0	9.5	8.4	9.3	10.8	8.8	10.4	8.8	8.8	9.3
MDEL	19.1	21.3	20.5	20.4	19.1	22.8	19.7	16.3	20.9	17.8	20.8	21.8	18.6

MEC	2.9	28	11.3	10	1.6	20	4.43	5	10	8	13	29	4.6
Mean	1.4	3.9	2.9	3.0	0.5	2.6	1.8	3.3	2.9	2.8	3.2	4.4	4.4
Logmean	0.20	1.02	0.81	0.84	-1.06	0.47	0.35	1.14	0.67		0.85	1.16	MEC is 4.6, NDs with MDL of 5 and 10
LnSD	0.44	0.87	0.71	0.74	0.785	1.00	0.72	0.30	0.93		0.79	0.82	
Mean	1.4	3.9	2.9	3.0	0.5	2.6	1.8	3.3	2.9	2.8	3.2	4.4	
95th	2.5	11.7	7.3	7.8	1.3	8.3	4.6	5.1	9.1	4.9	8.7	12.3	
99th	3.4	21.1	11.8	12.9	2.2	16.4	7.6	6.3	17.1	6.3	14.9	21.4	
99.87th	4.6	38.0	19.1	21.3	3.7	32.3	12.3	7.6	32.1	8.1	25.4	37.1	

Attachment F-5

Discharger	American Canyon	Fairfield-Suisun	Hayward Marsh (Effluent)	Las Gallinas	Mt. View	Napa	Novato	Palo Alto	Petaluma	San Jose/Santa Clara	Sonoma	Sunnyvale	USS Posco
Acute Criteria	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4
Chronic Criteria	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
Background	0.2	0.4	0.4	0.4	0.4	0.2	0.4	0.3	0.4	0.3	0.4	0.3	0.5
Attentuation (SB05)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
ECA_{ac}	50.8	49.9	49.9	49.9	49.9	50.8	49.9	50.4	49.9	50.4	49.9	50.4	49.5
ECA_{ch}	15.0	14.2	14.2	14.2	14.2	15.0	14.2	14.6	14.2	14.6	14.2	14.6	13.7
CV	0.493	1.002	0.794	0.776	0.600	1.227	0.665	0.300	0.868	0.423	0.858	0.944	0.600
s	0.47	0.83	0.70	0.69	0.55	0.96	0.61	0.29	0.75	0.41	0.74	0.80	0.55
s^2	0.22	0.70	0.49	0.47	0.31	0.92	0.37	0.09	0.56	0.16	0.55	0.64	0.31
s_4	0.24	0.47	0.38	0.37	0.29	0.57	0.32	0.15	0.42	0.21	0.41	0.45	0.29
s_4^2	0.06	0.22	0.15	0.14	0.09	0.32	0.10	0.02	0.17	0.04	0.17	0.20	0.09
z	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326
$ECA_{ac,m}$	0.38	0.20	0.25	0.26	0.32	0.17	0.29	0.53	0.23	0.42	0.23	0.21	0.32
$ECA_{ch,m}$	0.59	0.37	0.44	0.45	0.53	0.32	0.50	0.71	0.41	0.63	0.42	0.39	0.53
LTA_{ac}	19.12	10.16	12.53	12.79	16.02	8.65	14.67	26.56	11.56	21.28	11.68	10.81	15.88
LTA_{ch}	8.78	5.26	6.25	6.35	7.46	4.73	7.02	10.44	5.87	9.17	5.92	5.69	7.23
LTA	8.78	5.26	6.25	6.35	7.46	4.73	7.02	10.44	5.87	9.17	5.92	5.69	7.23
s_n	0.24	0.47	0.38	0.37	0.29	0.57	0.32	0.15	0.42	0.21	0.41	0.45	0.29
s_n^2	0.06	0.22	0.15	0.14	0.09	0.32	0.10	0.02	0.17	0.04	0.17	0.20	0.09
z	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
$AMEL_m$	1.4	1.9	1.7	1.7	1.6	2.2	1.6	1.3	1.8	1.4	1.8	1.9	1.6
s	0.47	0.83	0.70	0.69	0.55	0.96	0.61	0.29	0.75	0.41	0.74	0.80	0.55
s^2	0.22	0.70	0.49	0.47	0.31	0.92	0.37	0.09	0.56	0.16	0.55	0.64	0.31
z	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326	2.326
$MDEL_m$	2.7	4.9	4.0	3.9	3.1	5.9	3.4	1.9	4.3	2.4	4.3	4.7	3.1
AMEL	12.7	10.3	10.9	11.0	11.6	10.2	11.3	13.2	10.7	12.7	10.7	10.8	11.2
MDEL	23.3	25.9	24.9	24.8	23.2	27.8	23.9	19.8	25.3	21.7	25.3	26.5	22.5

MEC	2.9	28	11.3	10	1.6	20	4.43	5	10	8	13	29	4.6
Mean	1.4	3.9	2.9	3.0	0.5	2.6	1.8	3.3	2.9	2.8	3.2	4.4	4.4
Logmean	0.20	1.02	0.81	0.84	-1.06	0.47	0.35	1.14	0.67		0.85	1.16	MEC is 4.6, NDs with MDL of 5 and 10
LnSD	0.44	0.87	0.71	0.74	0.785	1.00	0.72	0.30	0.93		0.79	0.82	
Mean	1.4	3.9	2.9	3.0	0.5	2.6	1.8	3.3	2.9	2.8	3.2	4.4	
95th	2.5	11.7	7.3	7.8	1.3	8.3	4.6	5.1	9.1	4.9	8.7	12.3	
99th	3.4	21.1	11.8	12.9	2.2	16.4	7.6	6.3	17.1	6.3	14.9	21.4	
99.87th	4.6	38.0	19.1	21.3	3.7	32.3	12.3	7.6	32.1	8.1	25.4	37.1	

Attachment F-6

Time Series Plots of Cyanide Effluent Concentrations

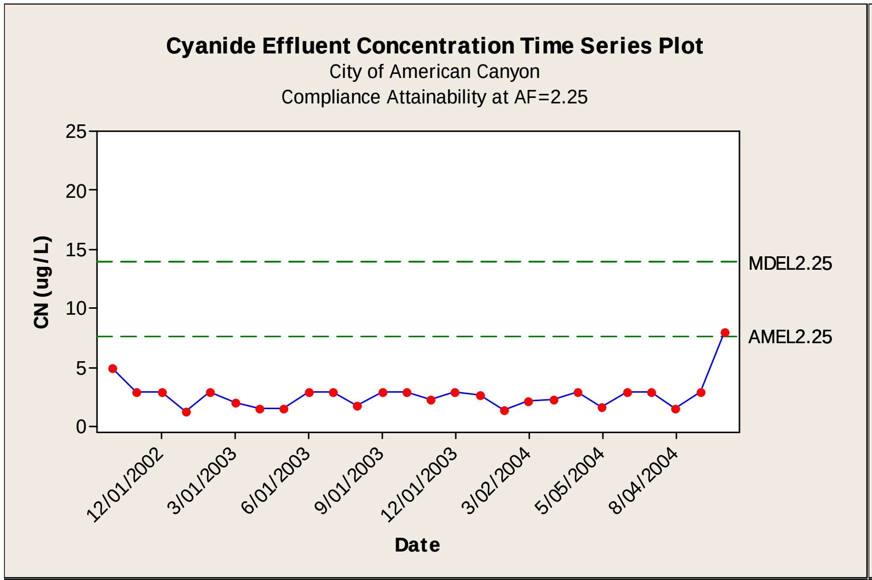
and

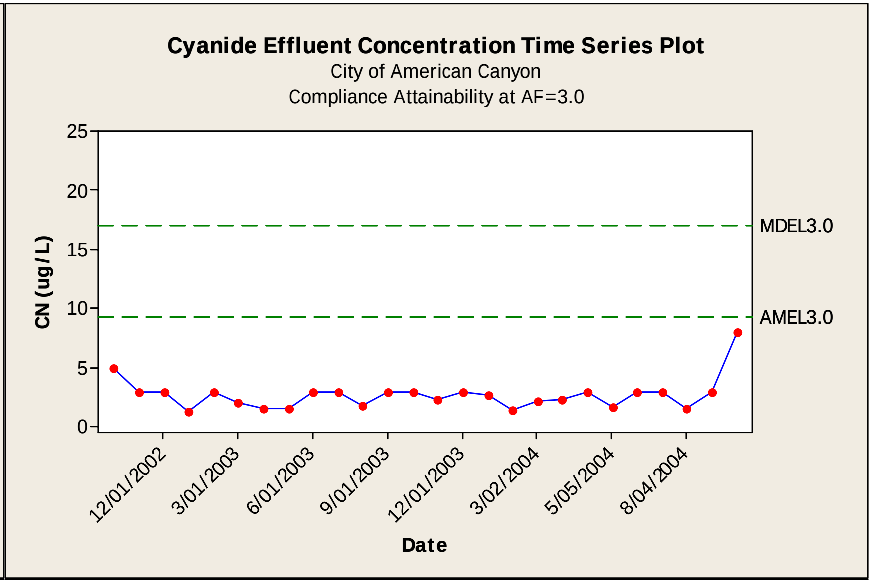
Average Monthly Effluent Limitation (AMEL)/

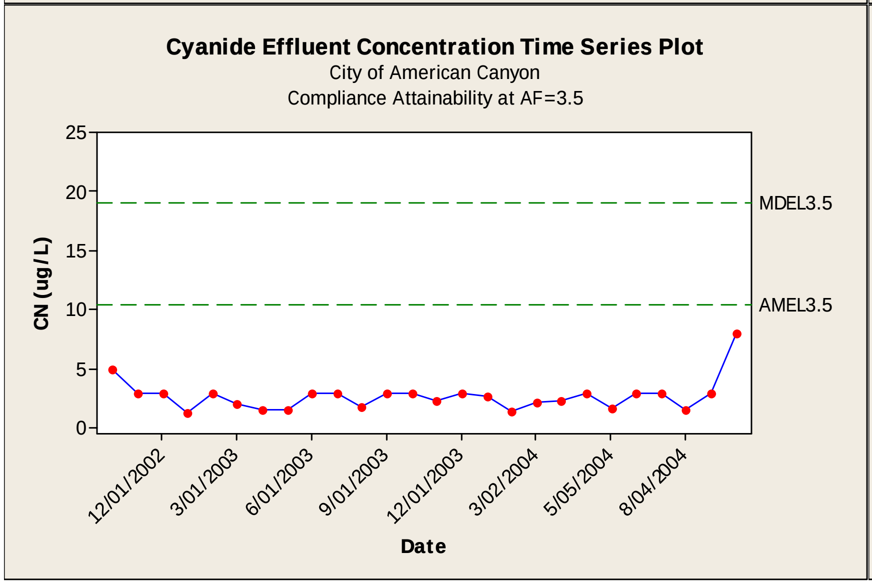
Maximum Daily Effluent Limitation (MDEL)

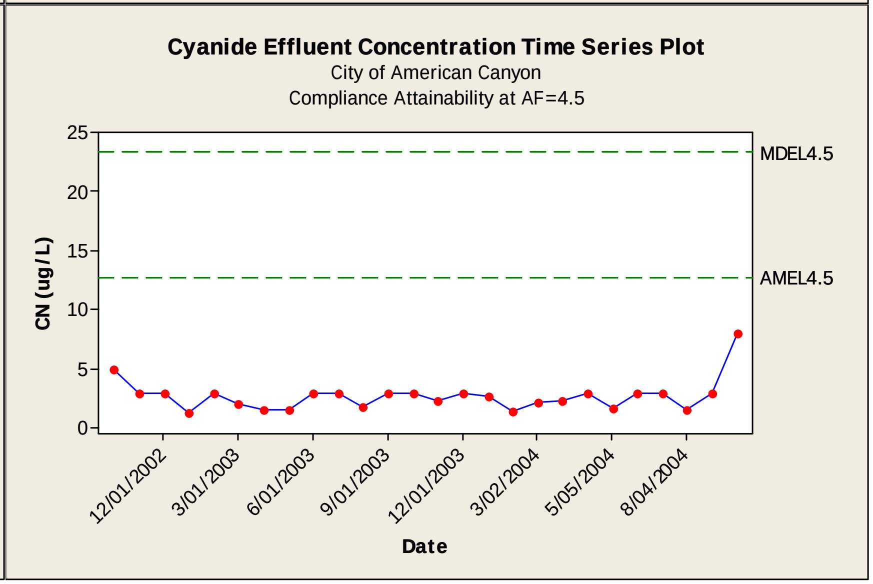
for Attenuation Factor (AF) = 2.25, 3.0, 3.5, and 4.5

1. City of American Canyon

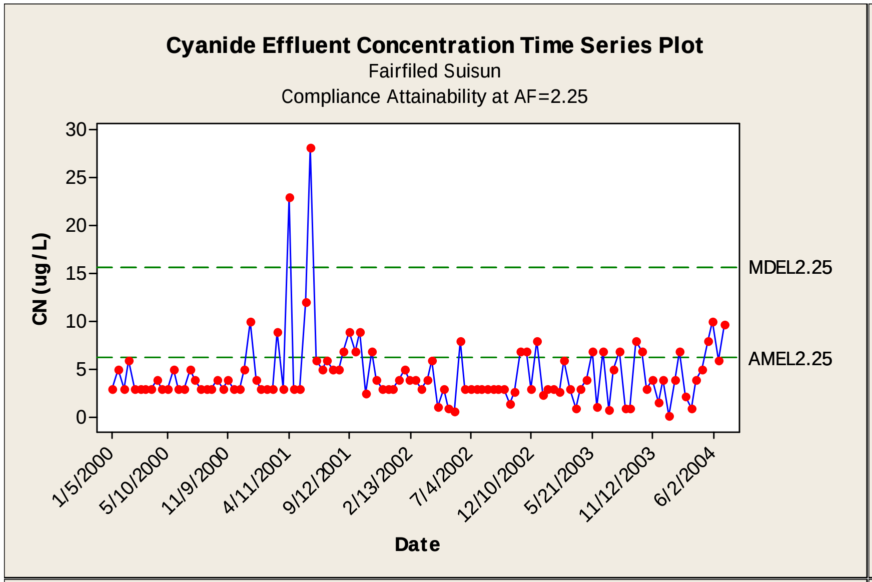


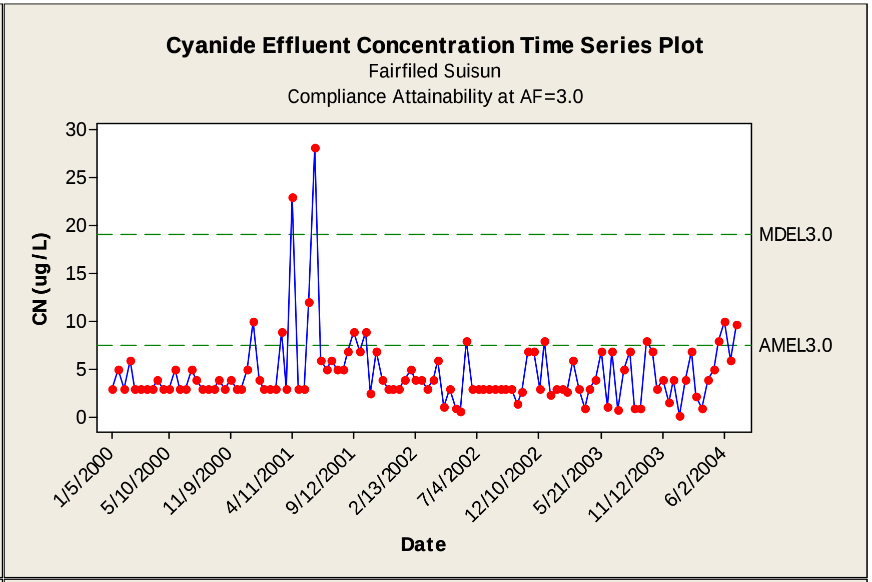


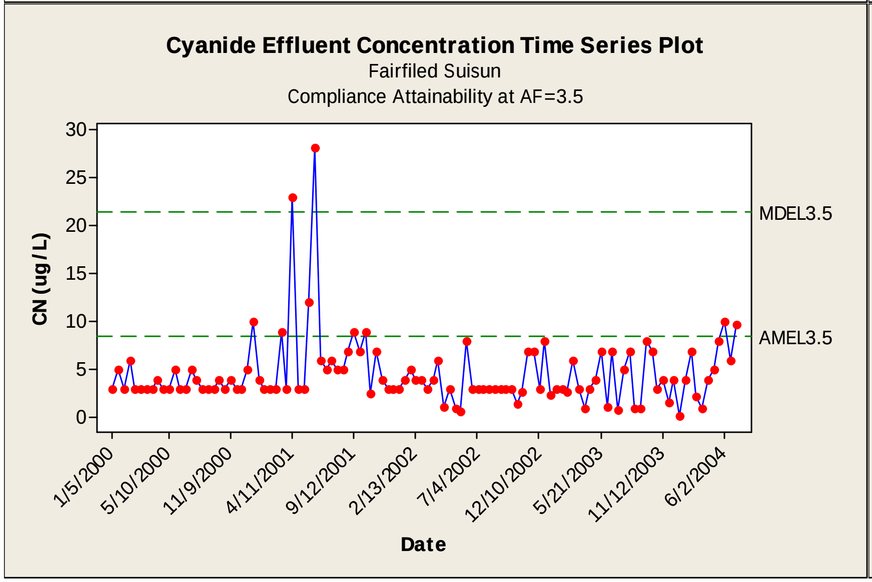


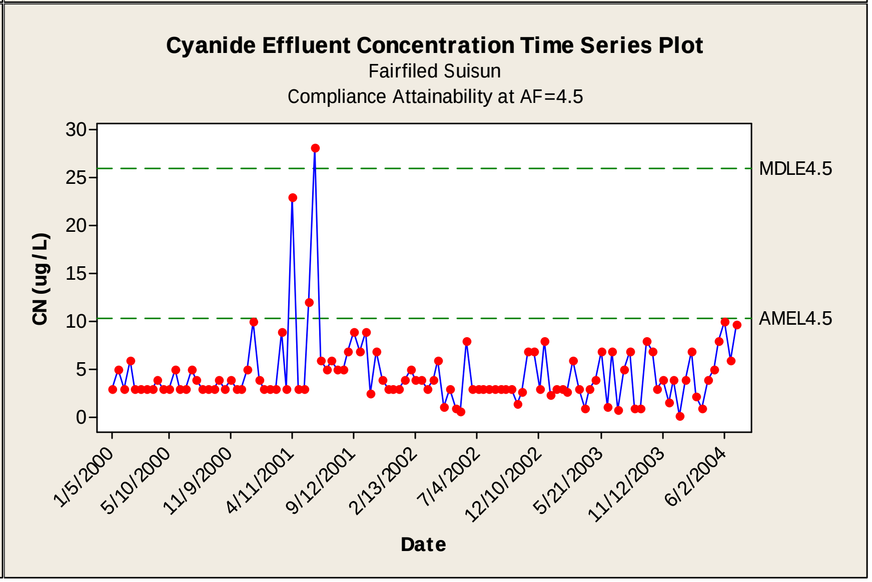


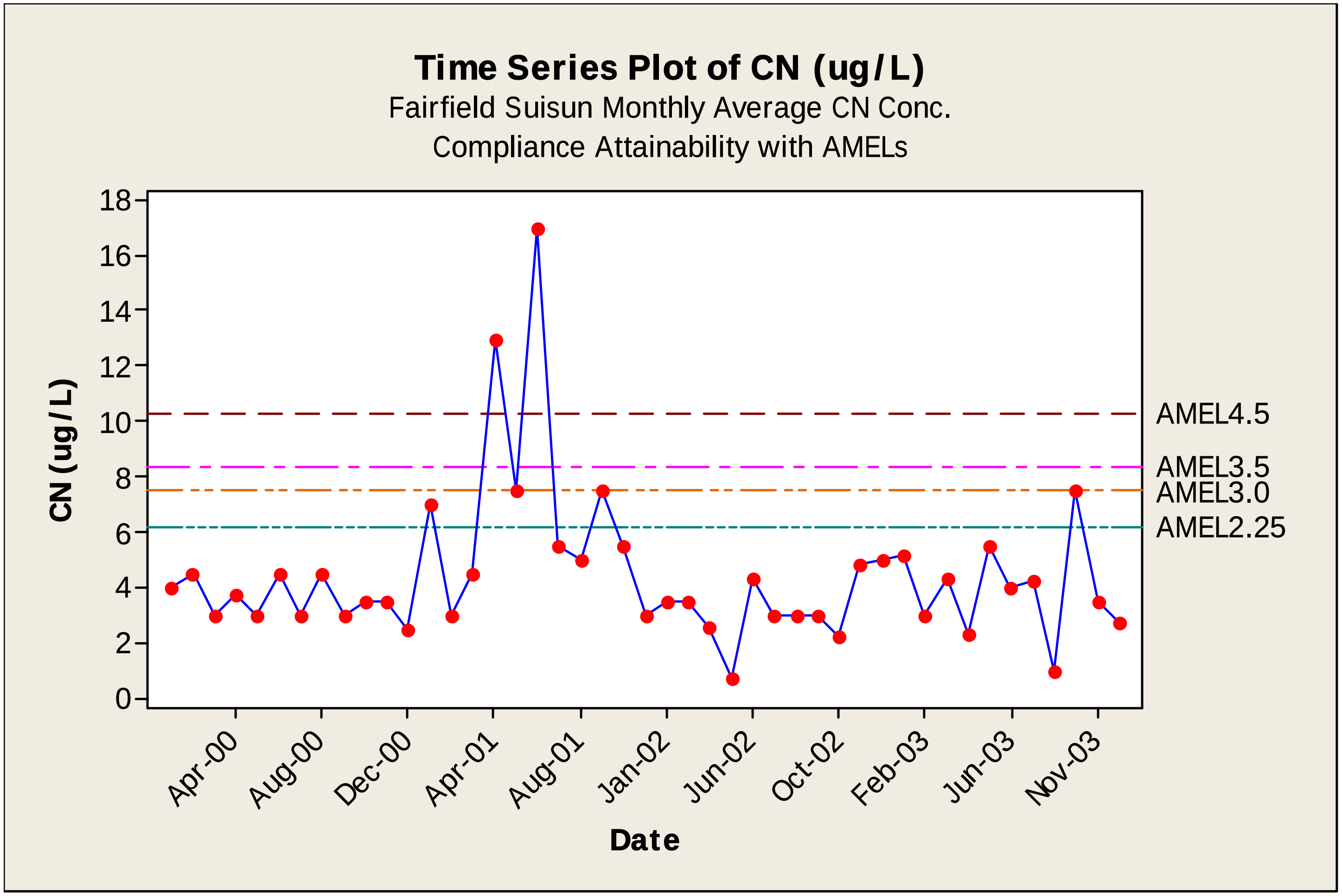
2. Fairfield Suisun



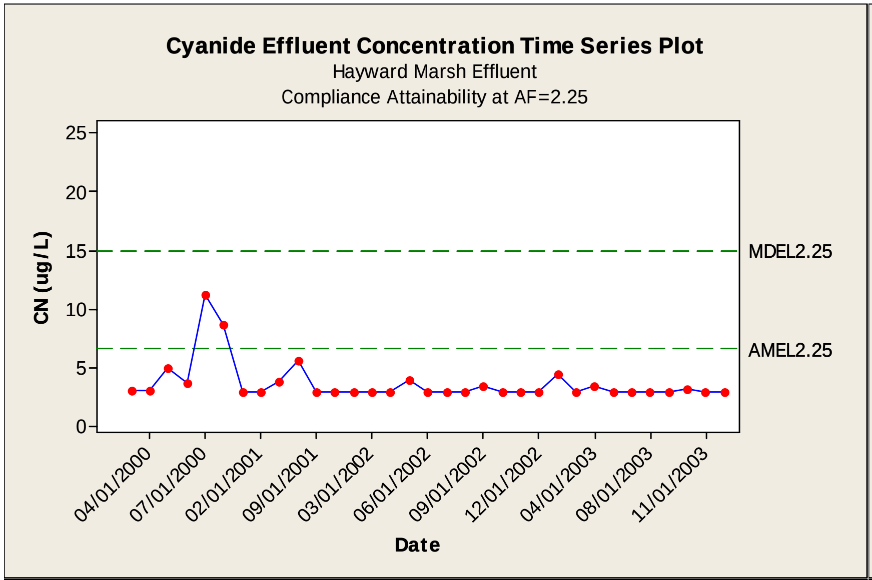


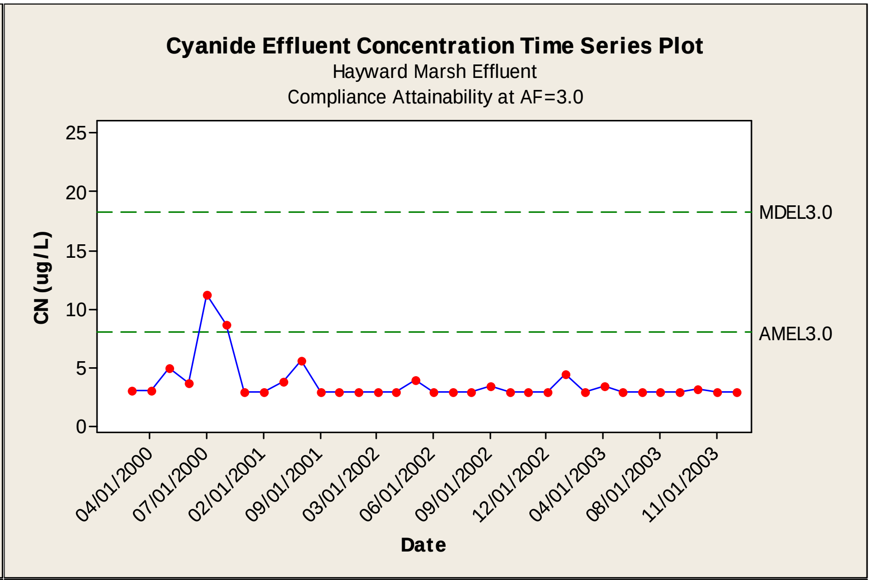


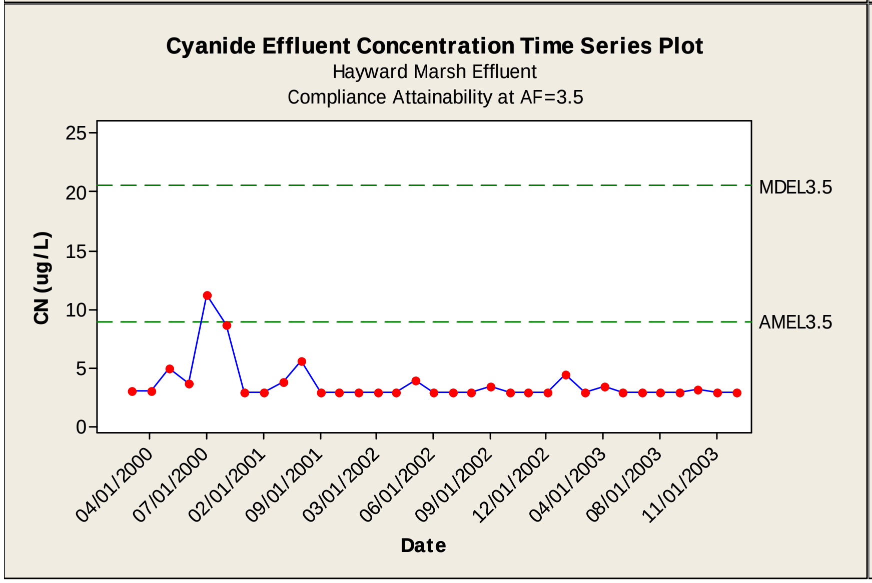


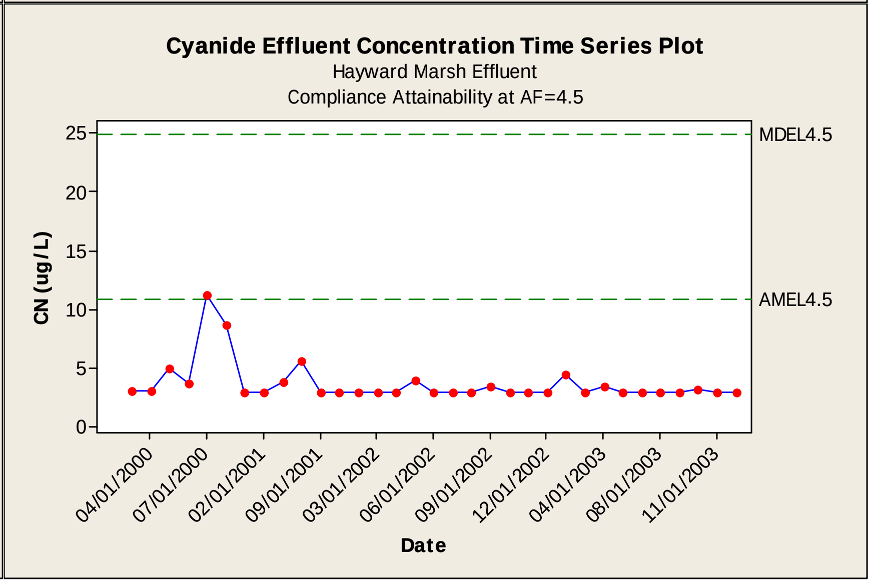

Time Series Plot of CN (ug/L)
Fairfield Suisun Monthly Average CN Conc.
Compliance Attainability with AMELs
CN (ug/L)
0
2
4
6
8
10
12
14
16
18
AMEL4.5
AMEL3.5
AMEL3.0
AMEL2.25
Apr-00
Aug-00
Dec-00
Apr-01
Aug-01
Jan-02
Jun-02
Oct-02
Feb-03
Jun-03
Nov-03
Date

3. Hayward Marsh Effluent

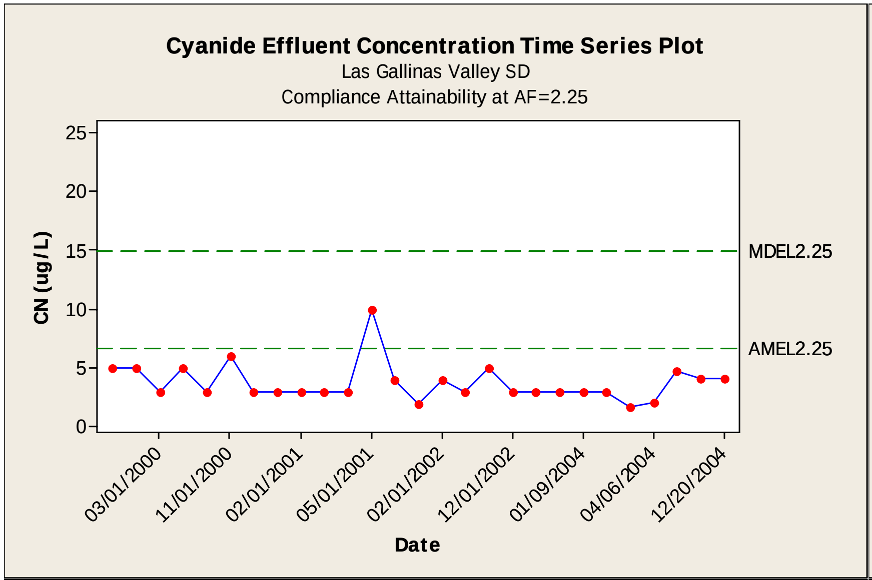


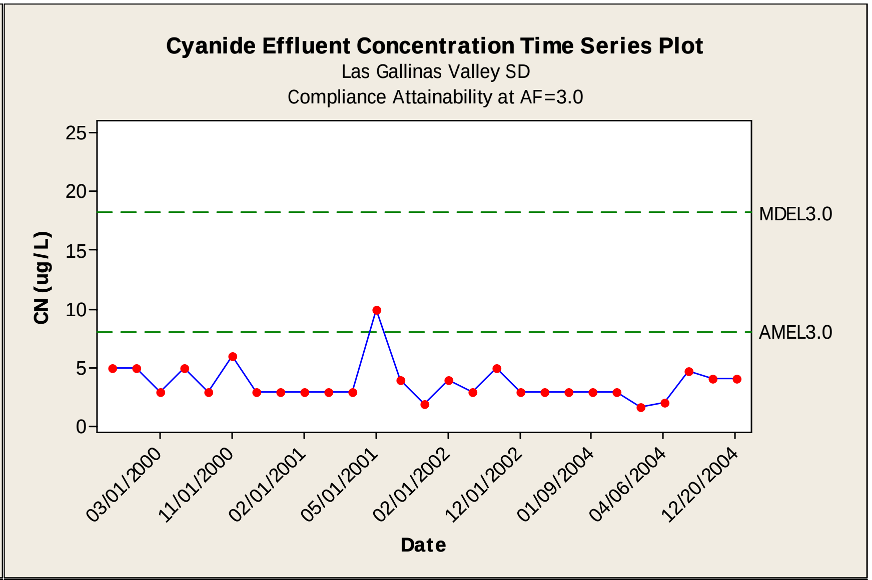


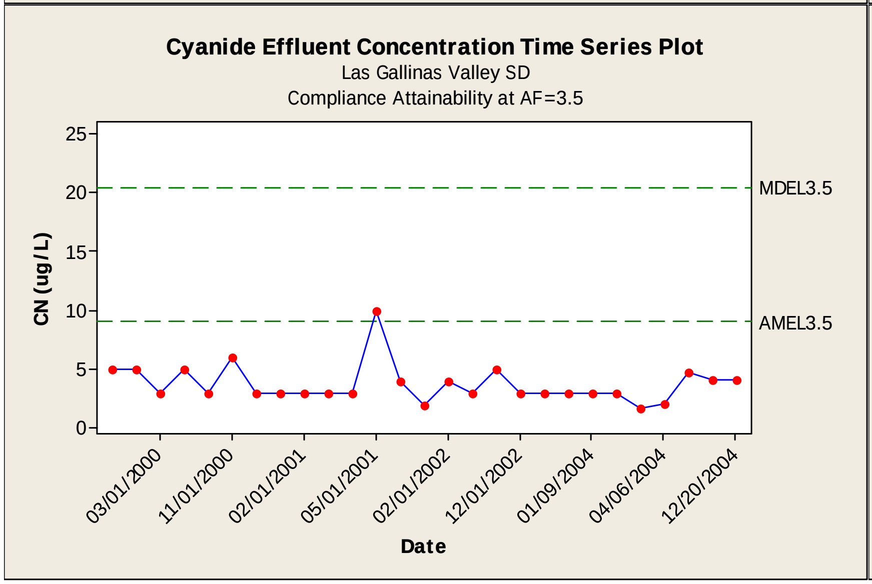


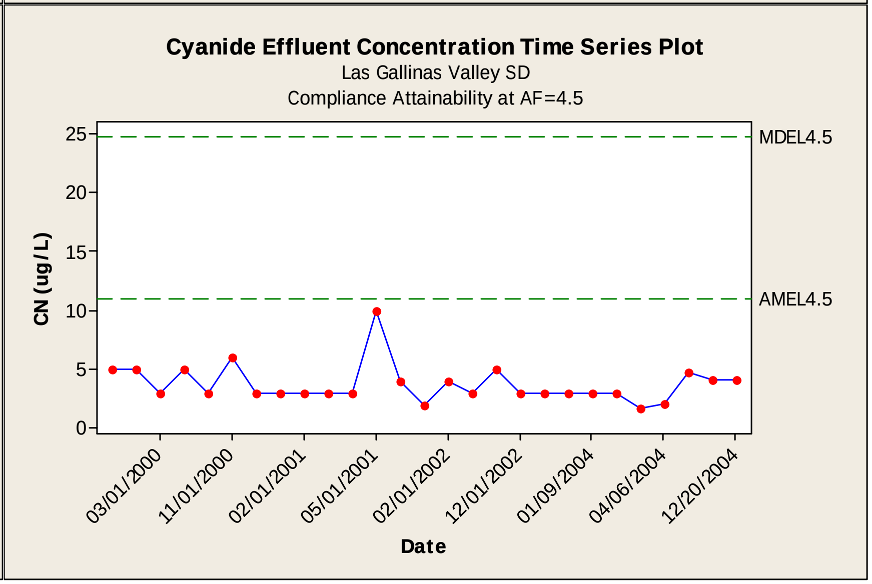


4. Las Gallinas Valley Sanitary District

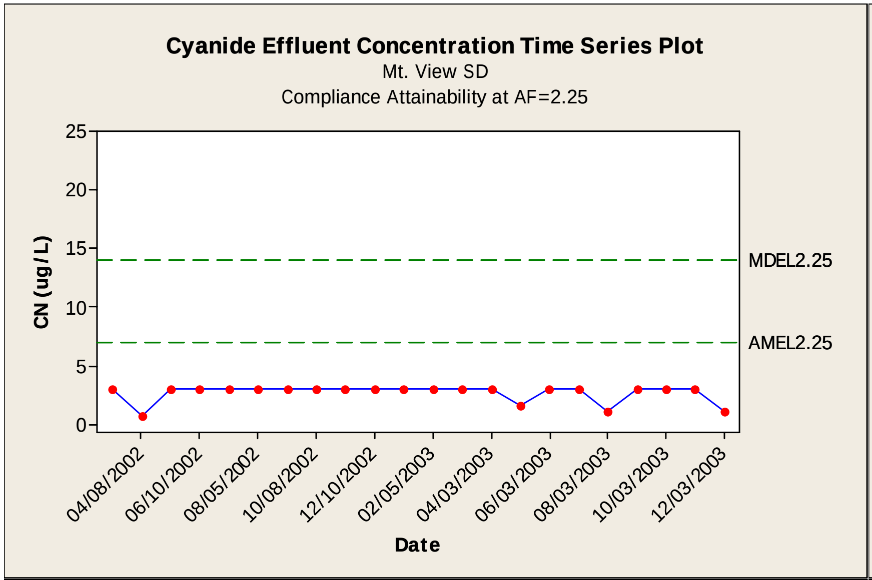


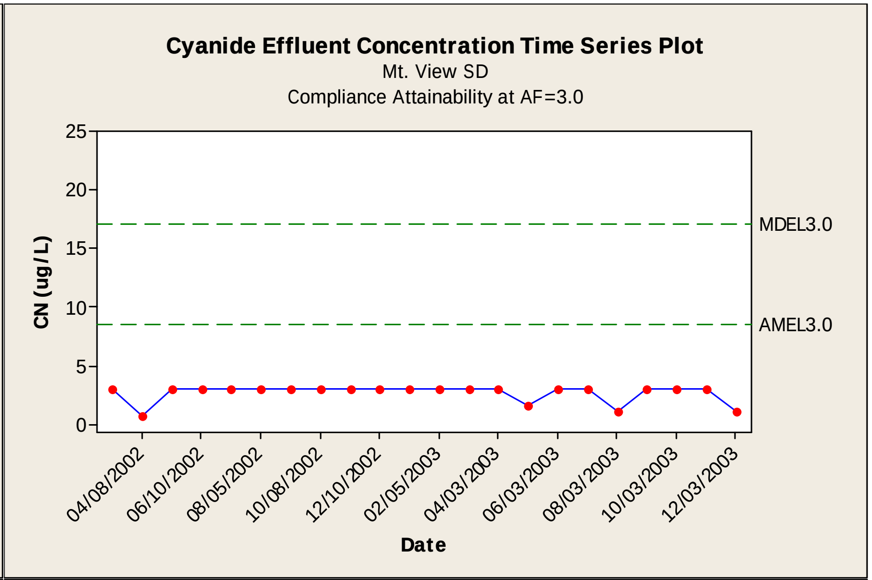


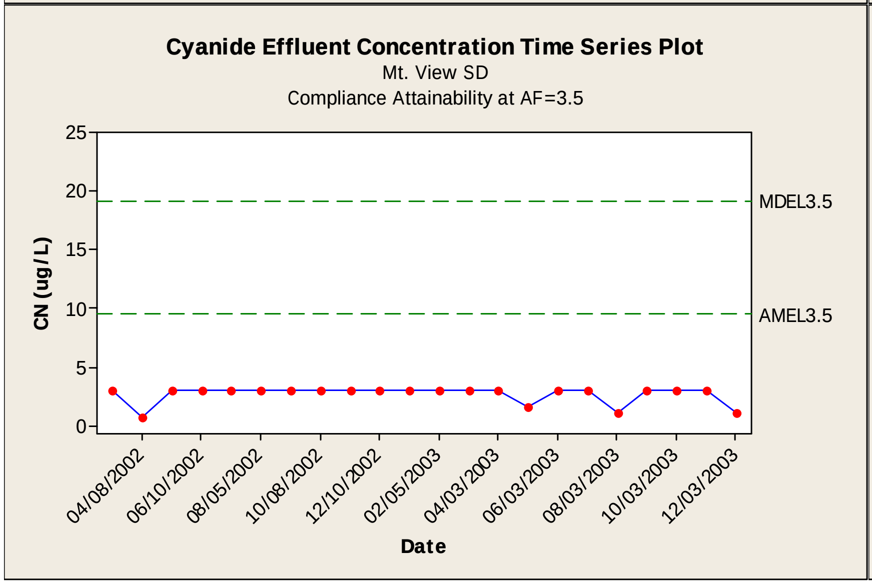


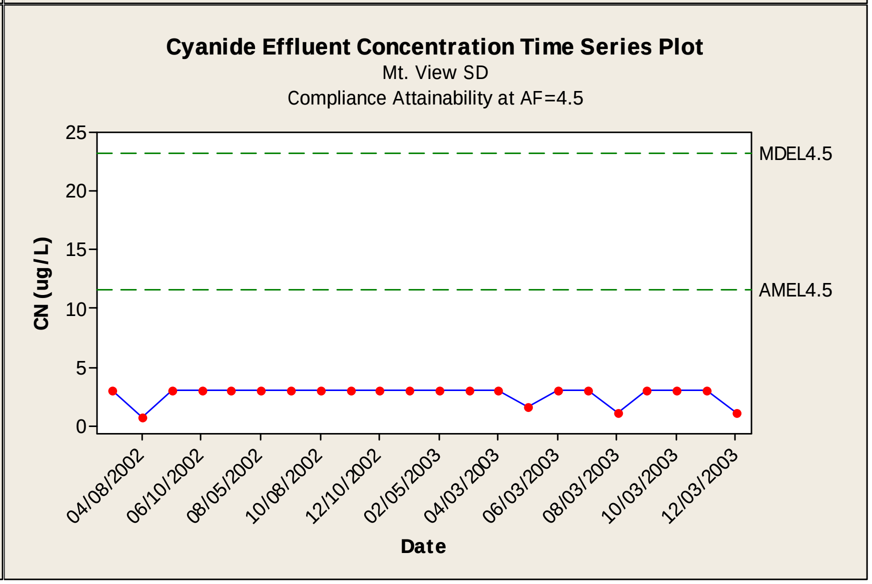


5. Mountain View

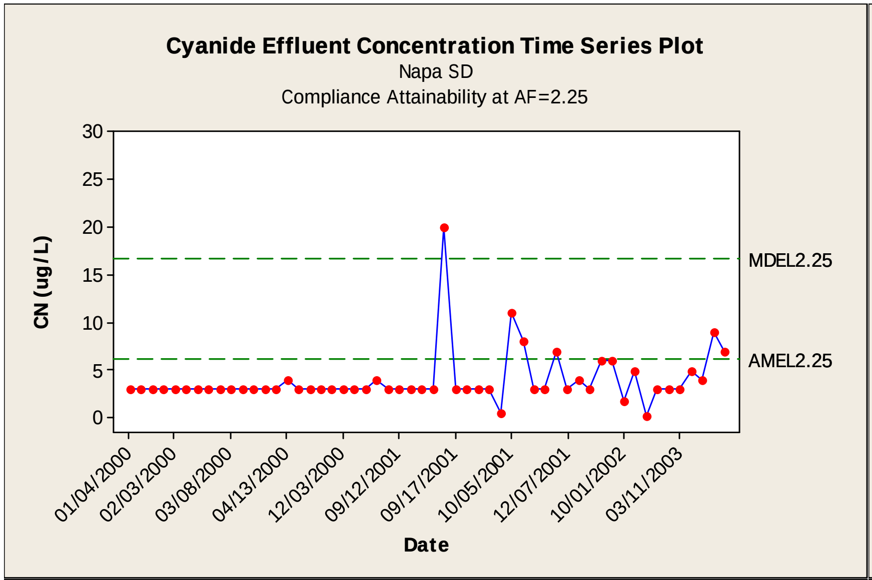


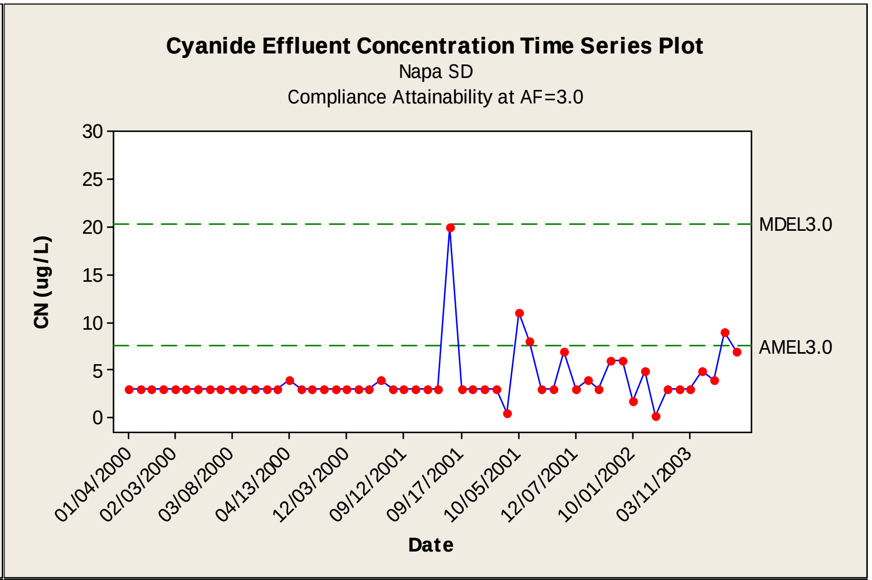


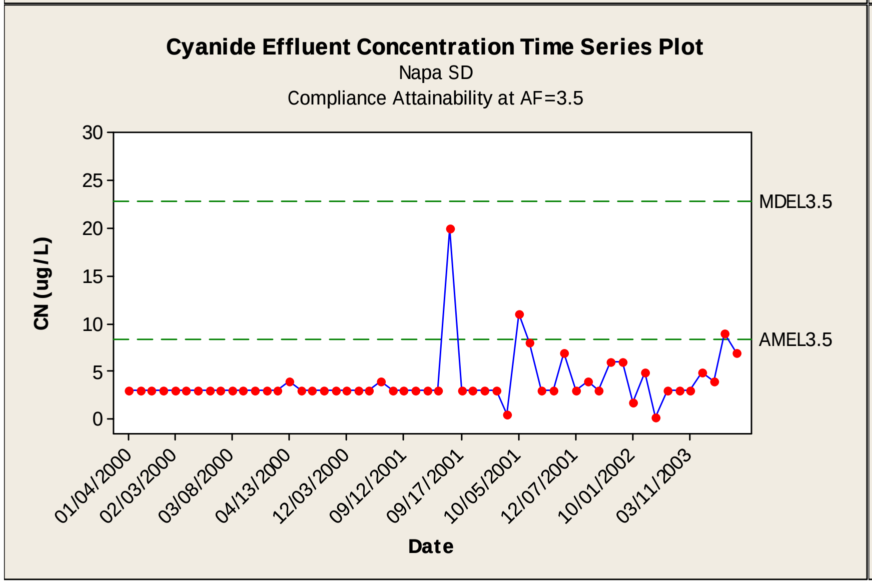


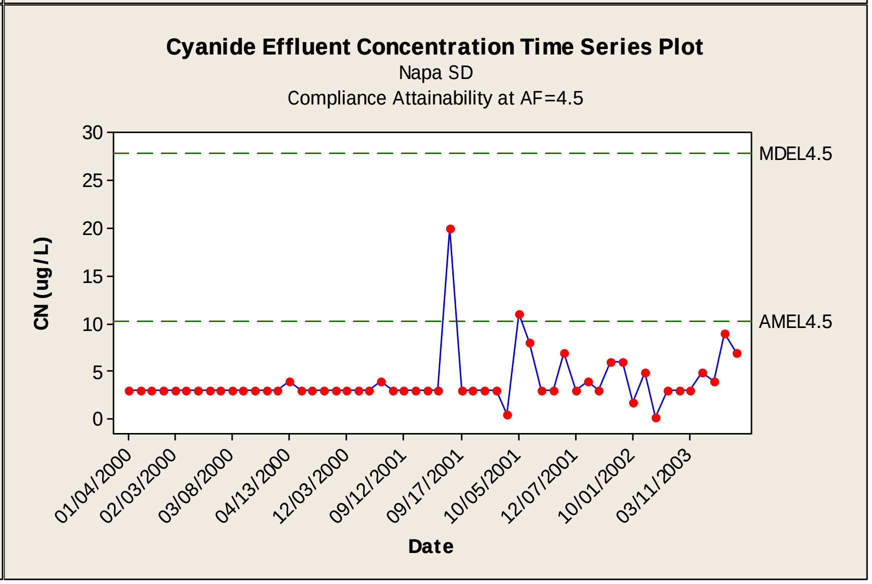


6. Napa Sanitation District

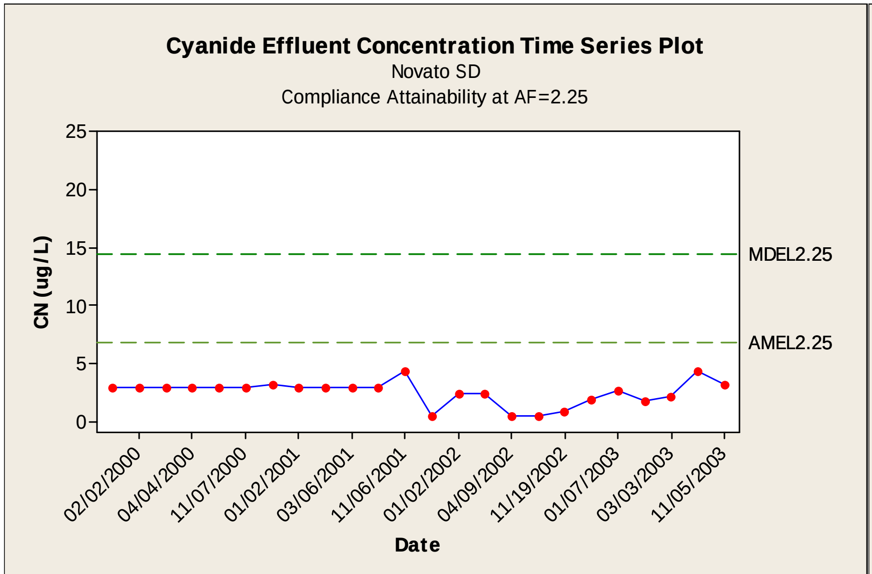


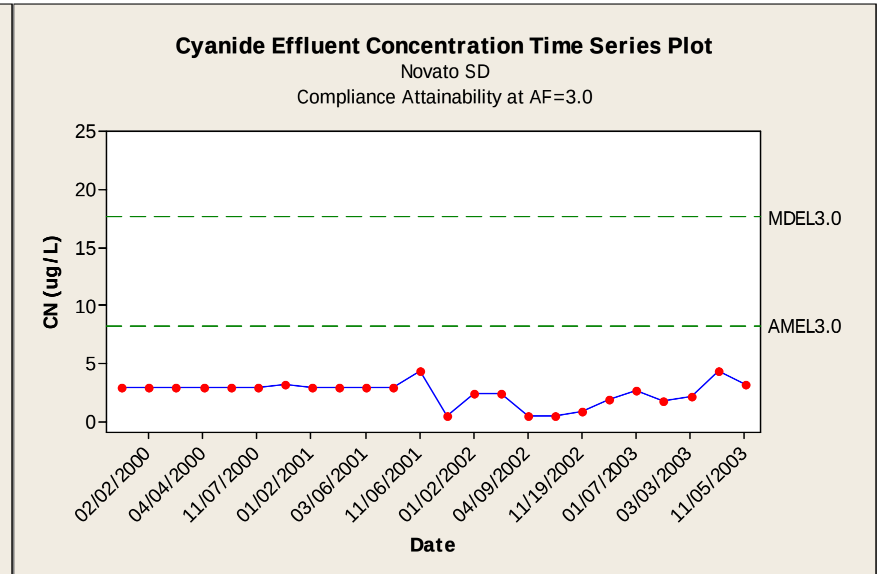


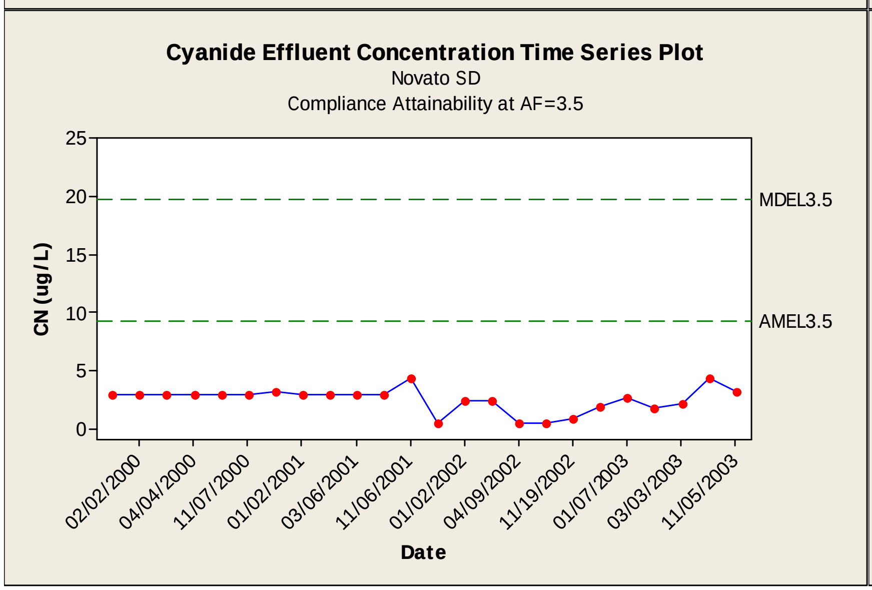


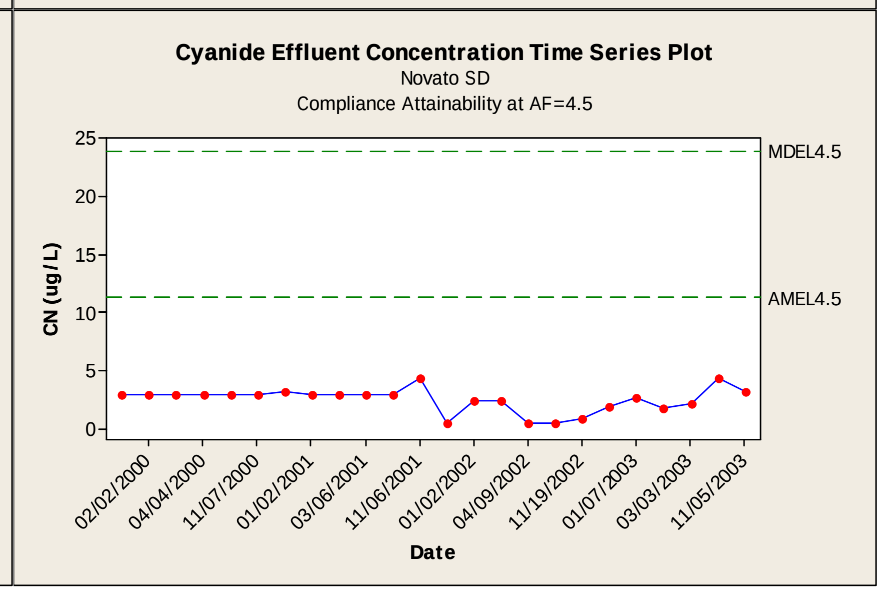


7. Novato SD

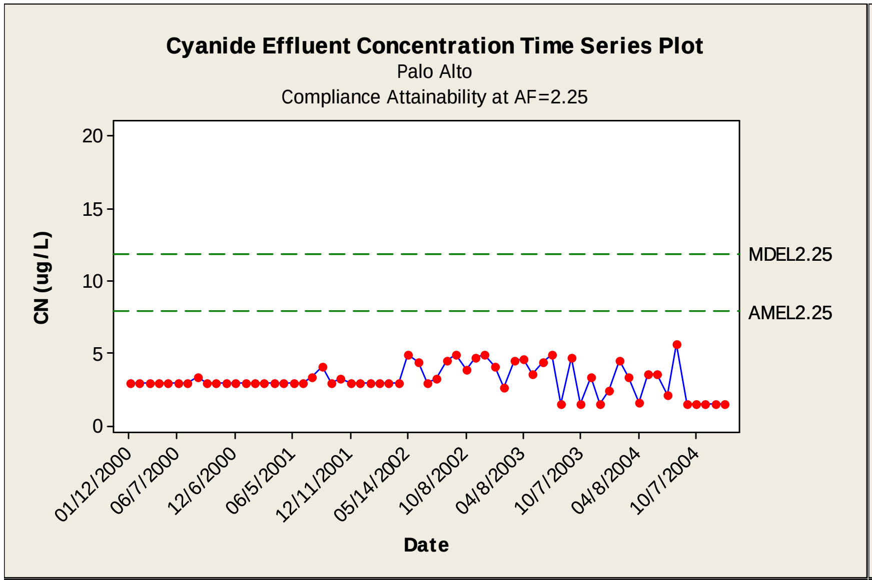

Cyanide Effluent Concentration Time Series Plot
Novato SD
Compliance Attainability at AF=2.25
CN (ug/L)
0
5
10
15
20
25
MDEL2.25
AMEL2.25
02/02/2000
04/04/2000
11/07/2000
01/02/2001
03/06/2001
11/06/2001
01/02/2002
04/09/2002
11/19/2002
01/07/2003
03/03/2003
11/05/2003
Date

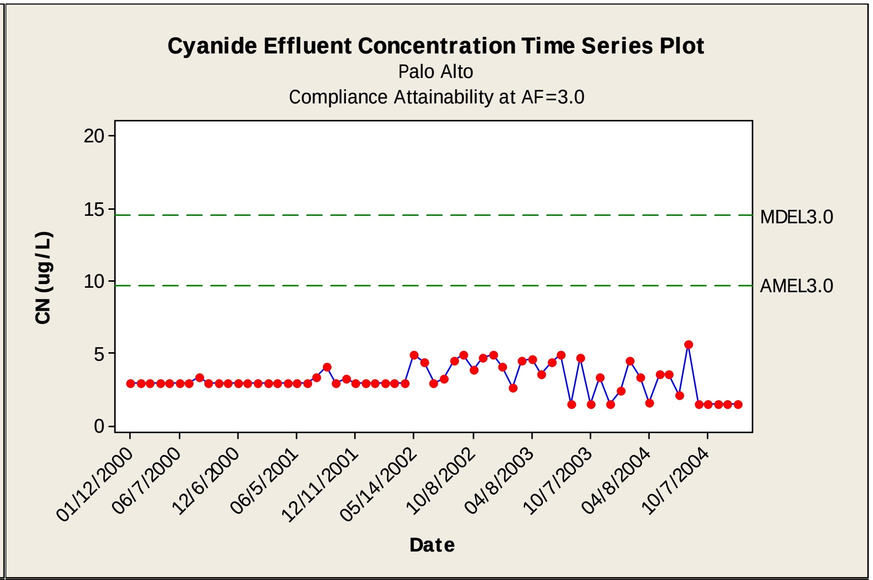

Cyanide Effluent Concentration Time Series Plot
Novato SD
Compliance Attainability at AF=3.0
CN (ug/L)
0
5
10
15
20
25
MDEL3.0
AMEL3.0
02/02/2000
04/04/2000
11/07/2000
01/02/2001
03/06/2001
11/06/2001
01/02/2002
04/09/2002
11/19/2002
01/07/2003
03/03/2003
11/05/2003
Date

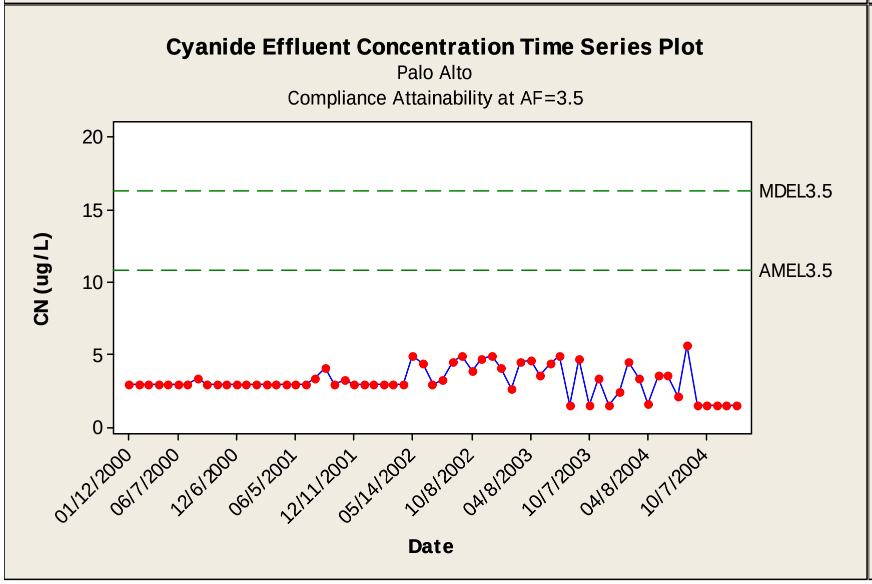

Cyanide Effluent Concentration Time Series Plot
Novato SD
Compliance Attainability at AF=3.5
CN (ug/L)
0
5
10
15
20
25
MDEL3.5
AMEL3.5
02/02/2000
04/04/2000
11/07/2000
01/02/2001
03/06/2001
11/06/2001
01/02/2002
04/09/2002
11/19/2002
01/07/2003
03/03/2003
11/05/2003
Date

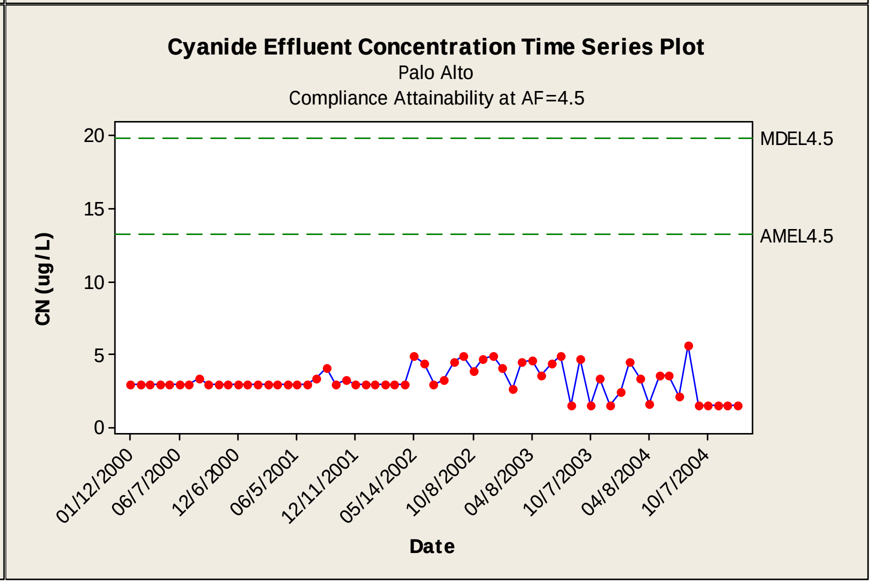

Cyanide Effluent Concentration Time Series Plot
Novato SD
Compliance Attainability at AF=4.5
CN (ug/L)
0
5
10
15
20
25
MDEL4.5
AMEL4.5
02/02/2000
04/04/2000
11/07/2000
01/02/2001
03/06/2001
11/06/2001
01/02/2002
04/09/2002
11/19/2002
01/07/2003
03/03/2003
11/05/2003
Date

8. City of Palo Alto

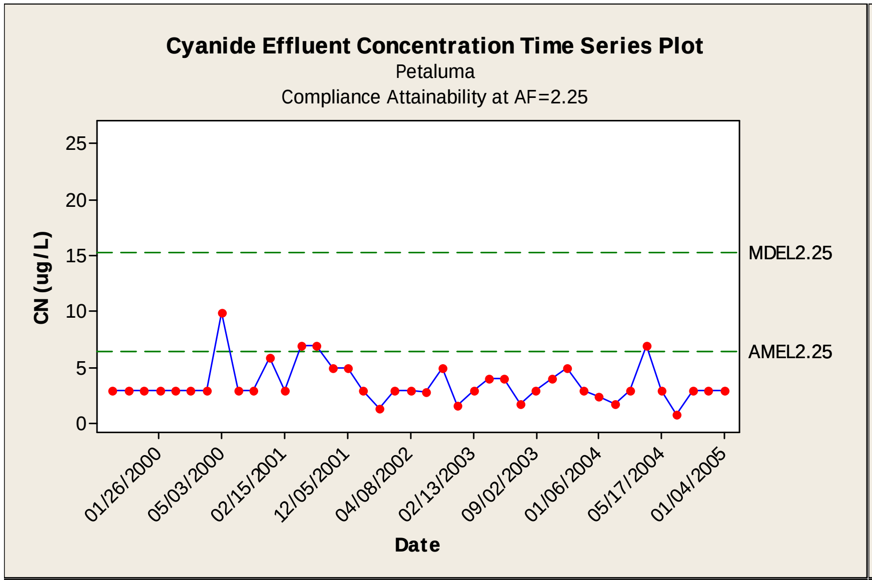


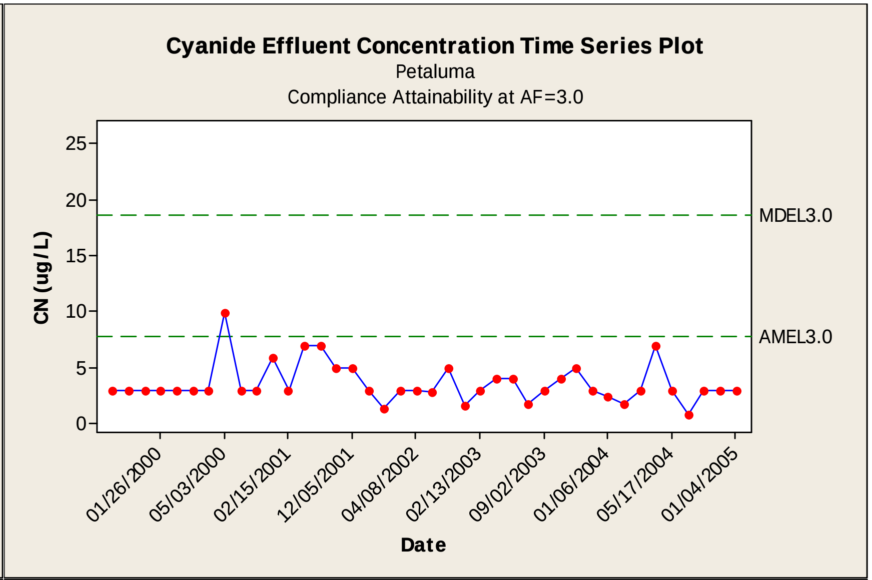


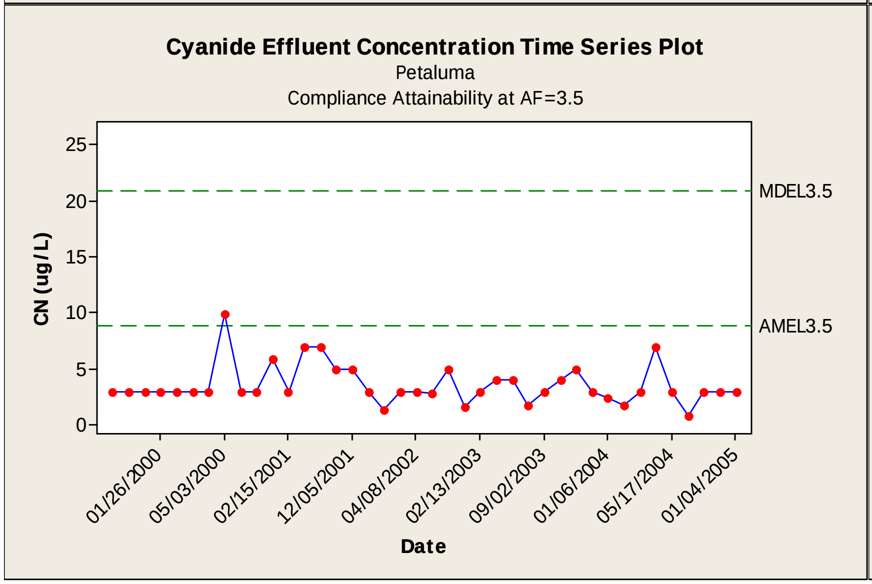


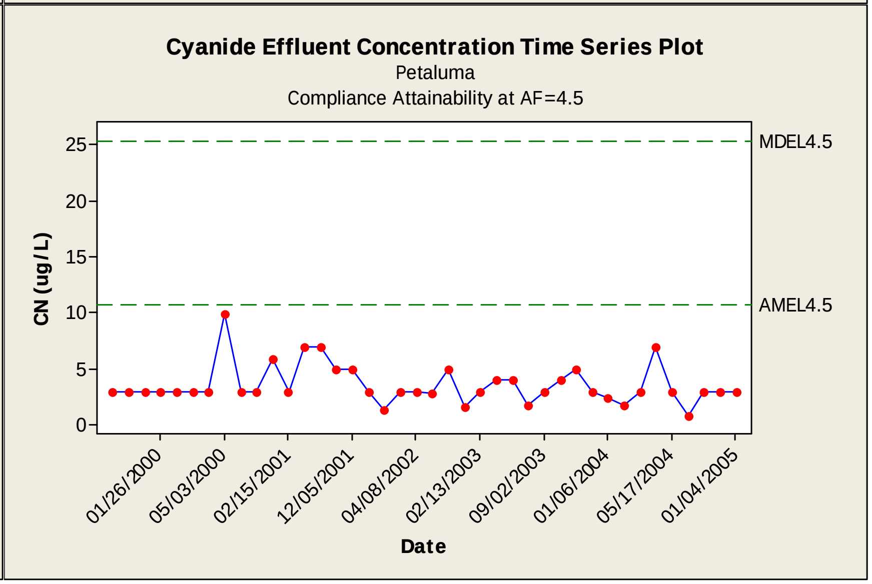


9. City of Petaluma

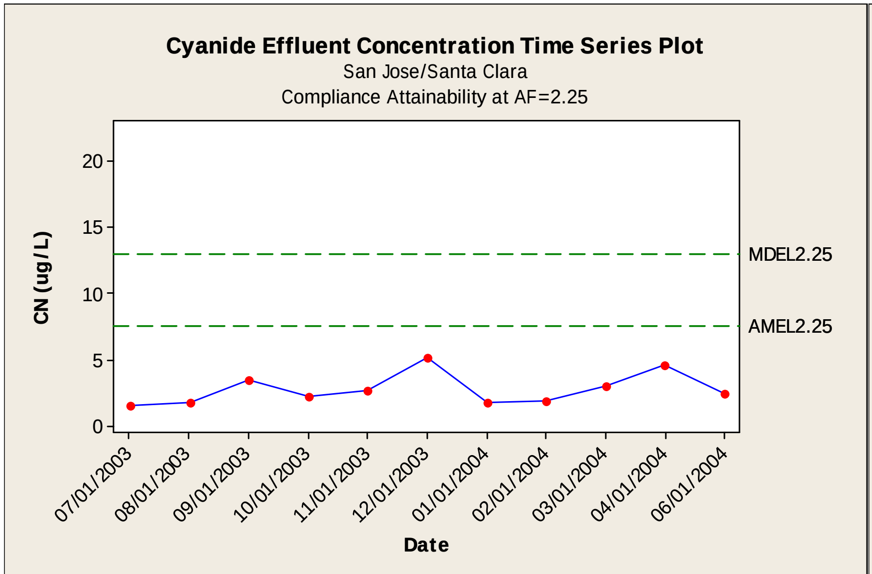


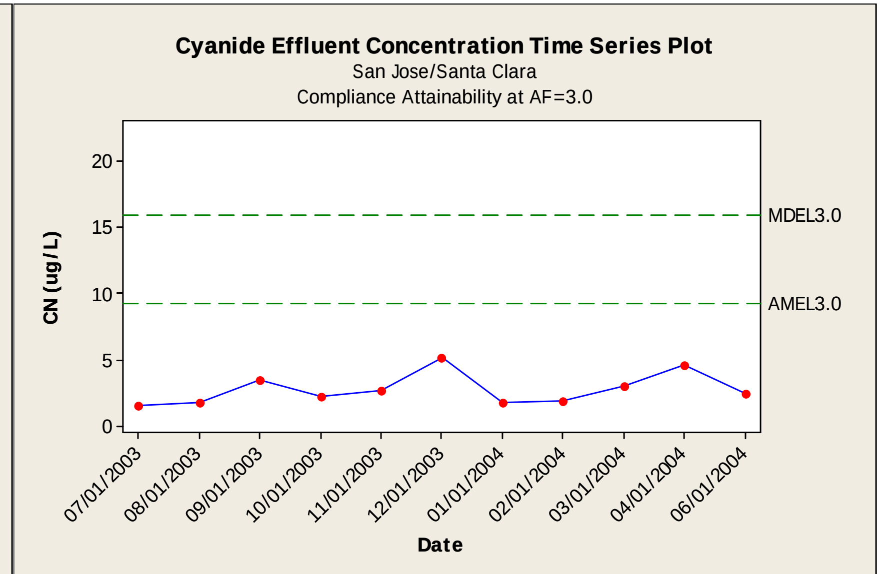


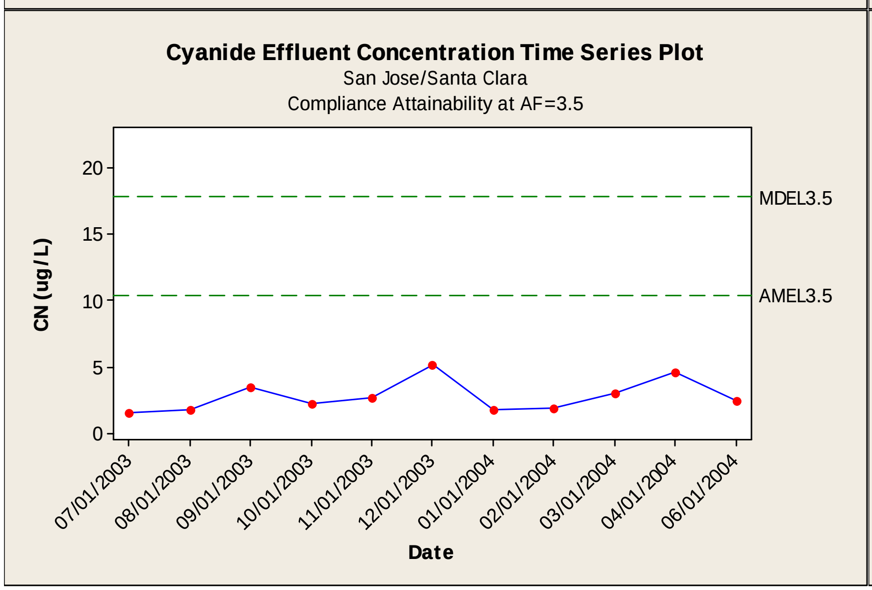


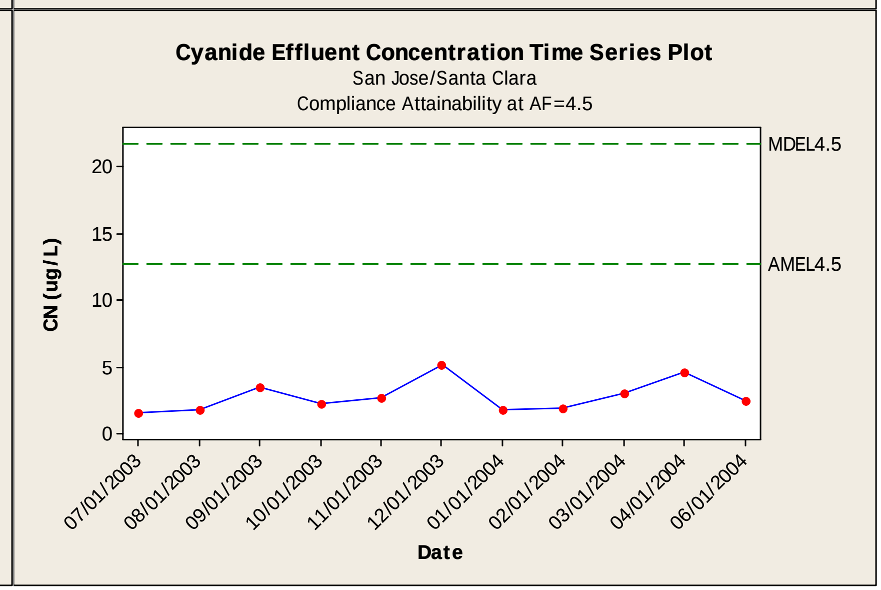


10. San Jose/Santa Clara

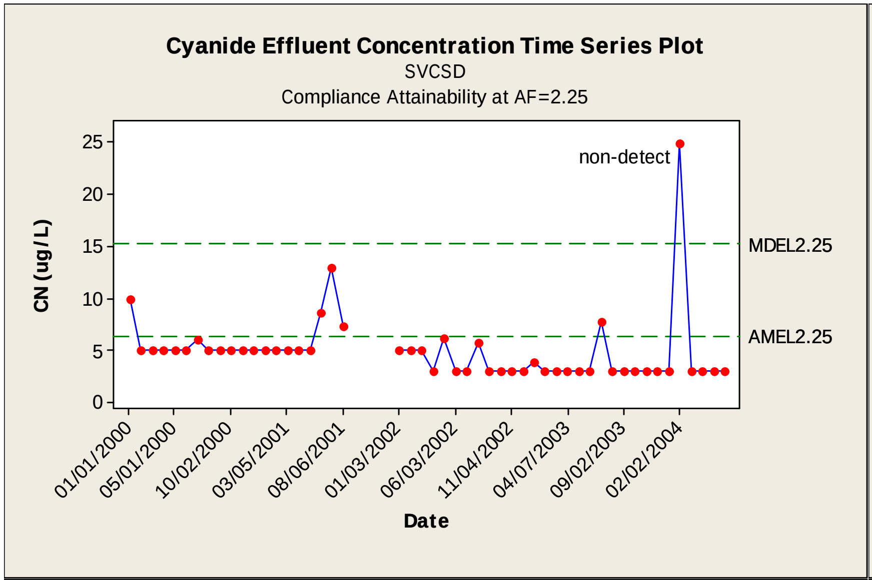


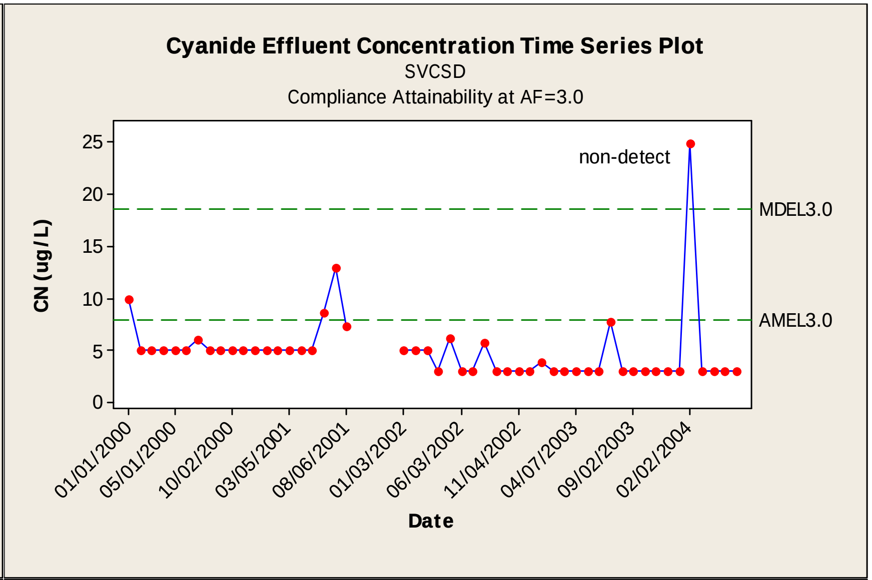


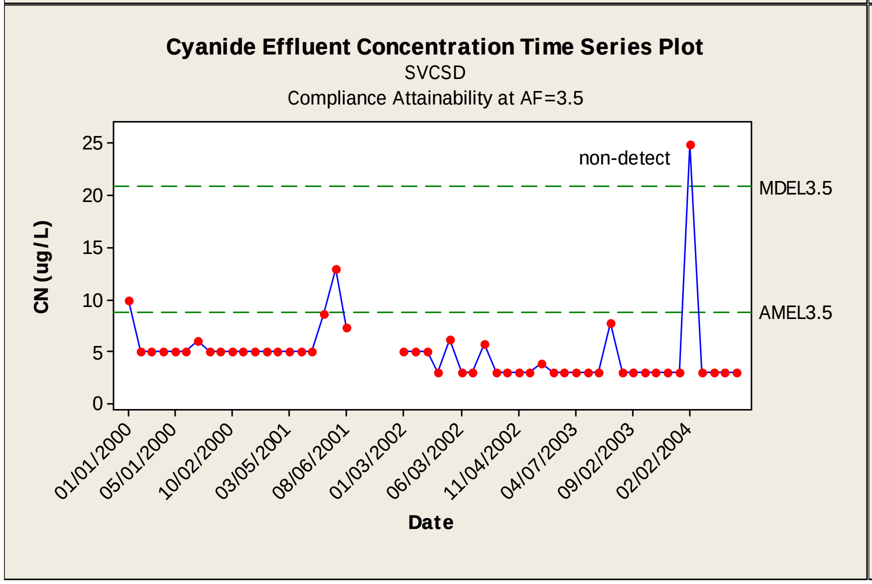


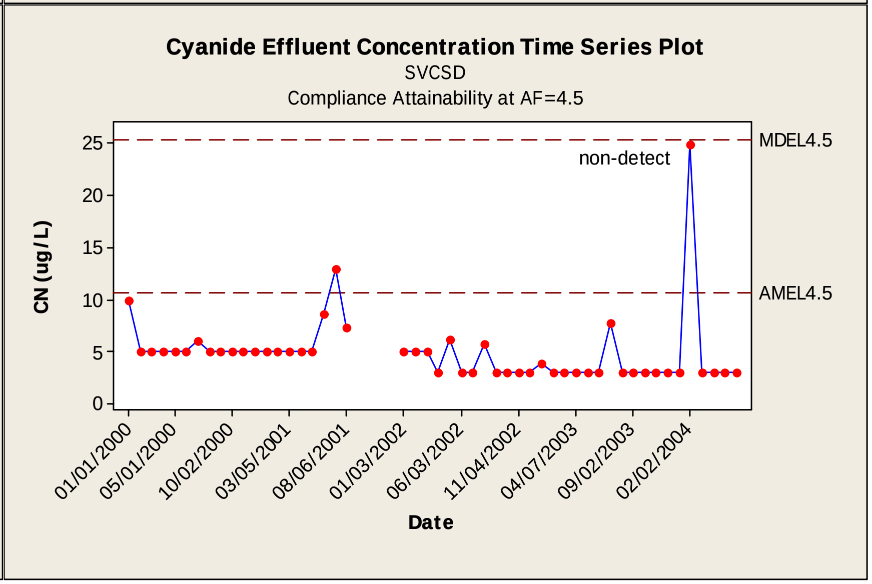


11. Sonoma Valley County Sanitation District

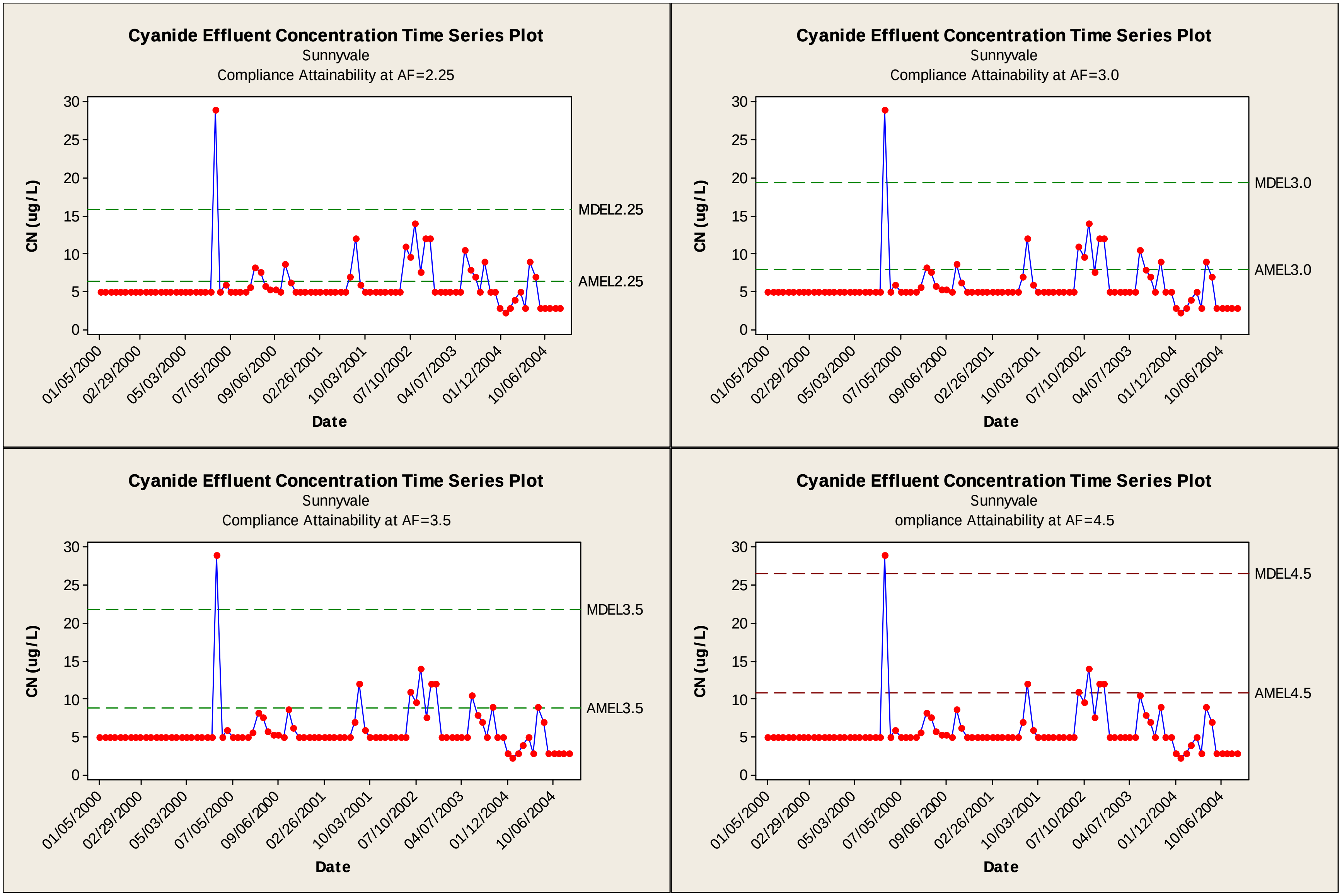




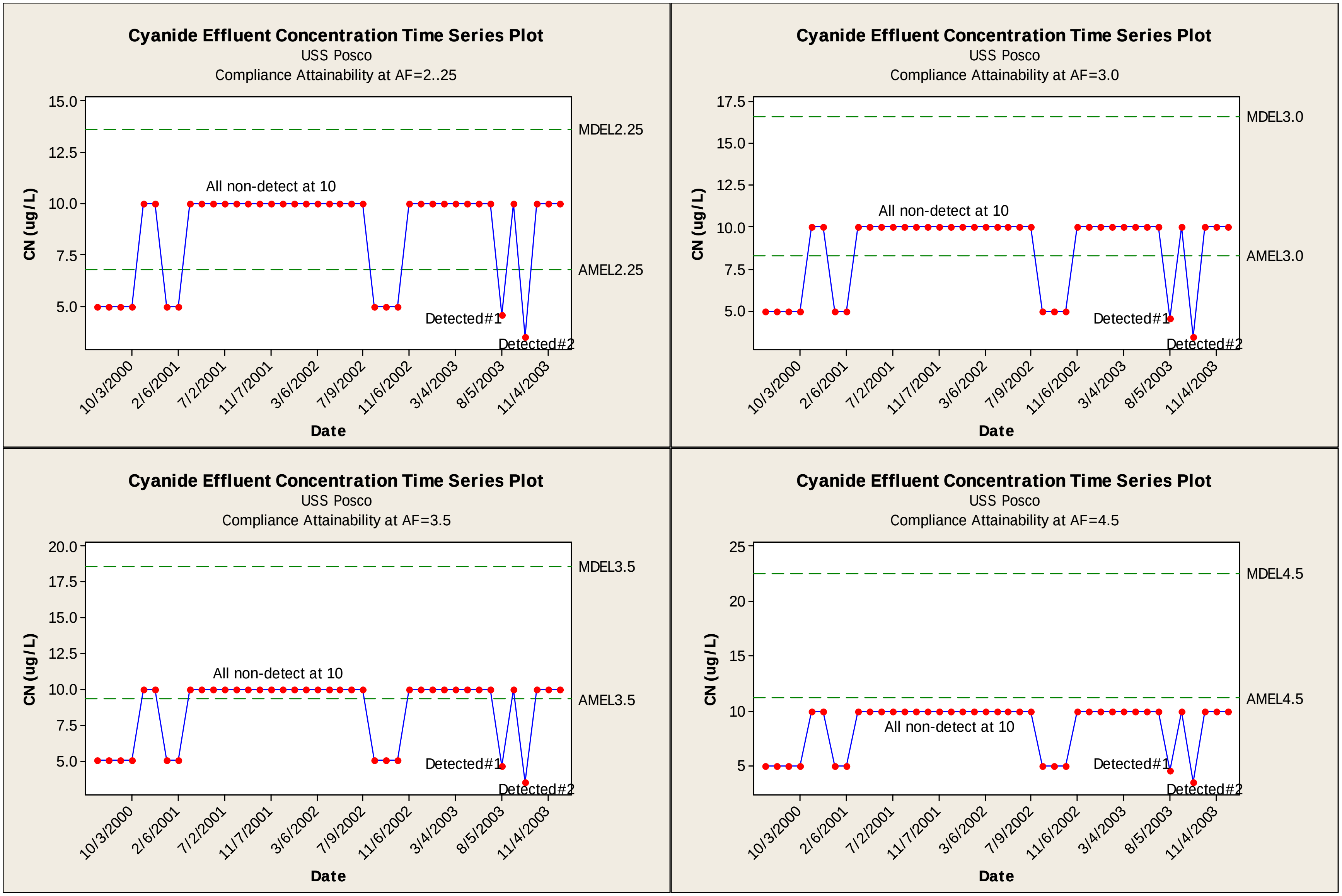




12. City of Sunnyvale



13. USS Posco


Cyanide Effluent Concentration Time Series Plot
USS Posco
Compliance Attainability at AF=2..25
MDEL2.25
AMEL2.25
All non-detect at 10
Detected#1
Detected#2
CN (ug/L)
Date
Cyanide Effluent Concentration Time Series Plot
USS Posco
Compliance Attainability at AF=3.0
MDEL3.0
AMEL3.0
All non-detect at 10
Detected#1
Detected#2
CN (ug/L)
Date
Cyanide Effluent Concentration Time Series Plot
USS Posco
Compliance Attainability at AF=3.5
MDEL3.5
AMEL3.5
All non-detect at 10
Detected#1
Detected#2
CN (ug/L)
Date
Cyanide Effluent Concentration Time Series Plot
USS Posco
Compliance Attainability at AF=4.5
MDEL4.5
AMEL4.5
All non-detect at 10
Detected#1
Detected#2
CN (ug/L)
Date

APPENDIX G

Notice of Filing and Public Hearing

California Regional Water Quality Control Board
San Francisco Bay Region

1.1 **Linda S. Adams**

Secretary for

1515 Clay Street, Suite 1400, Oakland, California 94612
(510) 622-2300 • Fax (510) 622-2460
http://www.waterboards.ca.gov/sanfranciscobay

1 **Arnold Schwarzenegger**

Governor

August 16, 2006

NOTICE OF PUBLIC HEARINGS
NOTICE OF FILING A DRAFT ENVIRONMENTAL DOCUMENT
To Amend the
Water Quality Control Plan for the San Francisco Bay Basin

NOTICE IS HEREBY GIVEN that the San Francisco Bay Regional Water Quality Control Board (Water Board) will consider an amendment to the Water Quality Control Plan for San Francisco Bay Basin ("the Basin Plan"). The proposed amendment would:

Establish new marine site-specific water quality objectives for cyanide in San Francisco Bay, and include an implementation plan to accomplish those objectives

Action on the proposed amendment will be taken in accordance with a regulatory program certified under Section 21080.5 of the Public Resources Code as exempt from the requirement to prepare an environmental impact report under the California Environmental Quality Act (Public Resources Code Section 2100 et seq.) and with other applicable laws and regulations.

There will be two public hearings on the proposed Basin Plan amendment:

DATES: October 11, 2006
December 13, 2006

TIME: 9:00 a.m. (approximate)

LOCATION: Elihu M. Harris State Building
First Floor Auditorium
1515 Clay Street
Oakland, CA 94612

STAFF CONTACTS:

Naomi Feger
San Francisco Bay Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612
510.622.2328 (ph.)
510.622.2460 (fax)
nfeger@waterboards.ca.gov

Barbara Baginska
San Francisco Bay Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612
510.622.2474 (ph.)
510.622.2460 (fax)
bbaginska@waterboards.ca.gov

1515 Clay Street, Suite 1400, Oakland, California 94612
(510) 622-2300 • Fax (510) 622-2460
http://www.waterboards.ca.gov/sanfranciscobay

MATERIALS: The proposed Basin Plan amendment, supporting staff report, and other documentation will be available online on August 18, 2006 at www.waterboards.ca.gov/sanfranciscobay/basinplan.htm . Paper copies will also be available from:

Terry Adams
San Francisco Bay Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612
510.622.2306 (ph.)
510.622.2460 (fax)
tadams@waterboards.ca.gov

The 45 day public comment period for the proposed amendment expires at 5:00 p.m. on **October 2, 2006**. All written comments, evidence, proposed testimony and exhibits on or concerning the proposed amendment shall be submitted no later than this date and time to either of the staff contacts identified above. Non-evidentiary policy statements to be made at the October hearing need not be submitted in advance.

The Water Board will receive oral public testimony on the proposed amendment at the October hearing. At the conclusion of the October hearing, in response to written comments and testimony received, the Water Board may recommend that staff make changes to the proposed amendment to be presented for its consideration at the subsequent hearing.

The Water Board will not take action until the December hearing. Water Board staff will release any proposed changes to the proposed Basin Plan amendment and/or accompanying staff report prior to the December hearing. Oral public testimony at the December hearing will be limited to comments on changes to the Basin Plan amendment the Water Board or its staff may propose subsequent to the August 18 version. At the conclusion of the December hearing, the Water Board will consider adoption of the proposed Basin Plan amendment, including changes to the proposed amendment that are consistent with the general purpose of the proposed amendment and are a logical outgrowth of the evidence and testimony received.

The public hearings will be conducted in accordance with 23 Cal. Code of Regs. § 649.3. Time limits may be imposed on oral testimony at the public hearings; groups are encouraged to designate a spokesperson.

A map and directions to the hearing are available online at www.waterboards.ca.gov/sanfranciscobay/direction.htm . The location of the hearings is accessible to persons with disabilities. Individuals who require special accommodations are requested to contact Executive Assistant Mary Tryon, (510) 622 2399, mtryon@waterboards.ca.gov, at least five (5) working days before a meeting. TTY users may contact the California Relay Service at 1-800-735-2929 or voice line at 1-800-735-2922.

Bruce H. Wolfe
Executive Officer

APPENDIX H

Environmental Checklist

1. Project Title:	Adoption of site-specific water quality objectives for cyanide for San Francisco Bay.
2. Lead Agency Name and Address:	California Regional Water Quality Control Board, San Francisco Bay Region 1515 Clay Street, Suite 1400 Oakland, California 94612
3. Contact Person and Phone Number:	Naomi Feger (510) 622-2328 Barbara Baginska (510) 622-2474
4. Project Location:	San Francisco Bay
5. Project Sponsor's Name and Address:	California Regional Water Quality Control Board, San Francisco Bay Region 1515 Clay Street, Suite 1400 Oakland, California 94612
6. General Plan Designation:	Not Applicable
7. Zoning:	Not Applicable

8. Description of Project:

The project is a proposed Basin Plan amendment adopting new cyanide water quality objectives for San Francisco Bay. Additional details are provided in the attached explanation.

9. Surrounding Land Uses and Setting:

San Francisco Bay is surrounded by urban areas.

10. Other public agencies whose approval is required (e.g., permits, financing approval, or participation agreement.)

The California State Water Resources Control Board, the California Office of Administrative Law, and the U.S. Environmental Protection Agency must approve the proposed Basin Plan amendment.

ENVIRONMENTAL IMPACTS:

Issues:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
I. AESTHETICS -- Would the project:				
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☐	☒
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☒
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☐	☒
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☐	☐	☒
II. AGRICULTURE RESOURCES -- In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Department of Conservation as an optional model to use in assessing impacts on agriculture and farmland. **Would the project:**				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒
c) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use?	☐	☐	☐	☒

ENVIRONMENTAL IMPACTS:

Issues:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
III. AIR QUALITY -- Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. **Would the project:**				
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☐	☒
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☐	☐	☒
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☐	☐	☐	☒
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☐	☒
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☐	☒
IV. BIOLOGICAL RESOURCES -- Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☐	☒	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☐	☐	☒

ENVIRONMENTAL IMPACTS:

Issues:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
IV. BIOLOGICAL RESOURCES -- (cont.):				
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☐	☐	☒
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☐	☐	☒
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☐	☒
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☒
V. CULTURAL RESOURCES -- Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?	☐	☐	☐	☒
b) Cause a substantial adverse change in the significance of a unique archaeological resource pursuant to §15064.5?	☐	☐	☐	☒
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☐	☒
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☐	☐	☒

ENVIRONMENTAL IMPACTS:

Issues:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
VI. GEOLOGY AND SOILS -- Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☐	☒
ii) Strong seismic ground shaking?	☐	☐	☐	☒
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☐	☒
iv) Landslides?	☐	☐	☐	☒
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☐	☒
c) Be located on geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?	☐	☐	☐	☒
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☐	☒
e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?	☐	☐	☐	☒
VII. HAZARDS AND HAZARDOUS MATERIALS -- Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☐	☒

ENVIRONMENTAL IMPACTS:

Issues:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
VII. HAZARDS AND HAZARDOUS MATERIALS -- (cont.):				
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☐	☒
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☒
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☒
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☐	☒

ENVIRONMENTAL IMPACTS:

Issues:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
VIII. HYDROLOGY AND WATER QUALITY -- Would the project:				
a) Violate any water quality standards or waste discharge requirements?	☐	☐	☐	☒
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☐	☒
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion of siltation on- or off-site?	☐	☐	☐	☒
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	☐	☐	☐	☒
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☐	☒
f) Otherwise substantially degrade water quality?	☐	☐	☐	☒
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☒
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	☐	☐	☐	☒

ENVIRONMENTAL IMPACTS:

Issues:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
VIII. HYDROLOGY AND WATER QUALITY – (cont.):				
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☐	☒
j) Inundation of seiche, tsunami, or mudflow?	☐	☐	☐	☒
IX. LAND USE AND PLANNING -- Would the project:				
a) Physically divide an established community?	☐	☐	☐	☒
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☒
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☒
X. MINERAL RESOURCES -- Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☒
XI. NOISE -- Would the project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☐	☒

ENVIRONMENTAL IMPACTS:

Issues:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
XI. NOISE – (cont.) in:				
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☐	☒
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☒
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☒
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒
XII. POPULATION AND HOUSING -- Would the project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	☒
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒
c) Displace substantial numbers of people necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

ENVIRONMENTAL IMPACTS:

Issues:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
XIII. PUBLIC SERVICES --				
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:				
Fire protection?	☐	☐	☐	☒
Police protection?	☐	☐	☐	☒
Schools?	☐	☐	☐	☒
Parks?	☐	☐	☐	☒
Other public facilities?	☐	☐	☐	☒
XIV. RECREATION --				
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☐	☒
XV. TRANSPORTATION / TRAFFIC -- Would the project:				
a) Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume-to-capacity ratio on roads, or congestion at intersections)?	☐	☐	☐	☒
b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?	☐	☐	☐	☒
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	☒

ENVIRONMENTAL IMPACTS:

Issues:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
XV. TRANSPORTATION / TRAFFIC – (cont.):				
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☐	☒
e) Result in inadequate emergency access?	☐	☐	☐	☒
f) Result in inadequate parking capacity?	☐	☐	☐	☒
g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	☐	☐	☐	☒
XVI. UTILITIES AND SERVICE SYSTEMS -- Would the project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☒
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☐	☒
e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project’s projected demand in addition to the provider’s existing commitments?	☐	☐	☐	☒
f) Be served by a landfill with sufficient permitted capacity to accommodate the project’s solid waste disposal needs?	☐	☐	☐	☒

ENVIRONMENTAL IMPACTS:

Issues:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
XVI. UTILITIES AND SERVICE SYSTEMS – (cont.):				
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☐	☒

Issues:	*Potentially Significant Impact*	*Less Than Significant With Mitigation Incorporation*	*Less Than Significant Impact*	*No Impact*
XVII. MANDATORY FINDINGS OF SIGNIFICANCE				
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☐	☐	☐	☒
b) Does the project have impacts that are individually limited, but cumulative considerable? (“Cumulative considerable” means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	☐	☐	☐	☒
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☐	☒

EXPLANATION

Project Description

The proposed Project is an amendment to the Basin Plan that establishes site-specific marine water quality objectives for cyanide in San Francisco Bay and an implementation plan to ensure that existing water quality is maintained, beneficial uses are protected, and current good discharger performance sustained. It also requires the imposition of effluent limits under the "Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California" (SIP) in wastewater NPDES permits and sets forth calculated dilution credits for specific dischargers, currently authorized to discharge into shallow waters, which will be used to calculate effluent limits. In addition to site-specific objectives for cyanide, the amendment also includes clarifying language for existing copper and nickel site-specific objectives, imposing effluent limits in Lower South San Francisco Bay NPDES permits.

The proposed objectives are based on the U.S. EPA promulgated National Toxics Rule (NTR) marine cyanide criteria, which have been modified for San Francisco Bay. The same criteria were adopted by the State of Washington for Puget Sound in 1997. The amendment proposes to adopt an acute water quality objective of 9.4 μg/L and a chronic water quality objective of 2.9 μg/L which are less stringent than the NTR criteria of 1.0 μg/L for both acute and chronic water quality objectives. The new objectives better reflect the most recent toxicity data for four *Cancer* species that are common to San Francisco Bay.

Environmental Analysis

The proposed project will not have a significant impact on the environment. The proposed site-specific objectives are fully protective of the most sensitive beneficial uses, as fully explained throughout the Staff Report. Additionally, the implementation plan ensures that dischargers continue to maintain or improve their current good performance. As explained in the Staff Report, less stringent effluent limits derived from the relaxed site-specific objectives and the application of dilution credits for shallow water dischargers, are not likely to increase loadings into the San Francisco Bay (see Staff Report Section 9.4 (Anti-degradation)). In the unlikely event that effluent concentrations increase in response to less stringent effluent limits, the cyanide loadings would increase by less than 15 kilograms per day over current loadings. Under this worst-case scenario, this additional loading is minor considering the assimilative capacity of the Bay for cyanide and considering that cyanide attenuates quickly. In any case, even under unlikely worst-case scenario, even the most sensitive beneficial uses would continue to be protected and there would be no significant adverse impacts.

An explanation for each box checked on the environmental checklist is provided below:

I. Aesthetics

Any physical changes to the aesthetic environment as a result of the Basin Plan amendment would be small in scale. The Basin Plan amendment would not substantially affect any scenic resource or vista, or degrade the existing visual character or quality of any site or its surroundings. It would not create any new source of light or glare.

II. Agriculture Resources

The proposed Basin Plan amendment and implementation would not result in any changes to agricultural resources and would not contribute to the conversion of farmland to non-agricultural use. It would not affect agricultural zoning or any Williamson Act contract.

III. Air Quality

The proposed Basin Plan amendment will not have adverse impacts on air quality. As it would not cause any change in population or employment, it would not generate ongoing traffic-related emissions. It would also not involve the construction of any permanent emissions sources. For these reasons, no permanent change in air emissions would occur, and the Basin Plan amendment would not conflict with applicable air quality plans. It would not expose sensitive receptors to ongoing pollutant emissions and therefore would not pose health risks or create objectionable odors.

IV. Biological Resources

The Basin Plan amendment is designed to protect biological resources, including wildlife and rare and endangered species. Two key issues were considered while assessing whether the proposed amendment was protective of biological resources: (1) the measured and potential sensitivity of species relative to the proposed objective and (2) potential frequency and duration of exposure to cyanide concentrations approaching the proposed objective. The existing cyanide toxicity studies document that the proposed site-specific objectives for cyanide are protective of sensitive saltwater and freshwater aquatic organisms. Available data show that, rainbow trout is the most sensitive fish tested among marine and freshwater species. The proposed acute objective of 9.4 μg/L is more than four times lower than the Species Mean Acute Value (44.73 μg/L) for rainbow trout (*Oncorhynchus mykiss*) ensuring a level of protectiveness. Similarly, the proposed chronic site-specific objective of 2.9 μg/L is much smaller than the cyanide concentration of 8 μg/L, the concentration at which the brook trout (*Salvelinus fontinalis*) starts exhibiting adverse effects.

Under the proposed Basin Plan amendment, existing shallow water dischargers will have water quality-based effluent limits to implement the site-specific objectives. The NPDES permit process will ensure that the sources of cyanide in the treatment plant influent are tracked and regulated by the dischargers and that the occurrences of elevated cyanide concentrations in the effluent are short-term only. Increased cyanide levels will be limited to any assigned mixing zone and will not exceed the acute toxic conditions as described above.

V. Cultural Resources

The Basin Plan amendment and the implementation plan for cyanide would not directly affect cultural resources.

VI. Geology and Soils

The implementation activities resulting from the Basin Plan amendment do not involve construction, earthmoving or soil disturbing activities and therefore would not adversely impact local geology and soils.

VII. Hazards and Hazardous Materials

The proposed Basin Plan amendment and the implementation plan for cyanide address water quality issues and would not directly involve the handling or transport of hazards and hazardous materials. Hazardous waste management activities resulting from the Basin Plan amendment would not interfere with any emergency response plans or emergency evacuation plans and would not affect the potential for wildland fires.

VIII. Hydrology and Water Quality

The proposed project amends the Basin Plan to establish site-specific marine water quality objectives for cyanide that relax the current National Toxics Rule objectives of 1 µg/L.

The results of the Regional Monitoring Program confirm that ambient cyanide concentrations in the water column of San Francisco Bay are consistently low and currently do not exceed 0.4 µg/L despite industrial and municipal wastewater discharges to the Bay containing cyanide. This suggests that the controls on wastewater dischargers have been adequate to prevent degradation or water quality impairment with respect to cyanide and that source control programs that are in place are sufficient. The proposed amendment will not affect these controls and the ambient water quality conditions should not change despite relaxing water quality objectives. In addition, this project contains an implementation plan that describes a monitoring strategy to ensure that ambient cyanide concentrations in San Francisco Bay are maintained. It is proposed that dischargers will monitor ambient levels of cyanide. An ambient trigger concentration of 1 µg/L will be established as the basis for initiation of localized review of effluent limit compliance where the trigger is exceeded.

Increased loadings due to less stringent water quality objectives are unlikely to occur as current performance by wastewater dischargers is expected at a minimum to be maintained after the Basin Plan amendment is adopted.

IX. Land Use and Planning

The Basin Plan amendment regulates water quality and would not conflict with any land use plan, policy, or regulation, and would not affect any habitat conservation plan or natural community conservation plan.

X. Mineral Resources

The proposed project addresses water quality and will not have any impact on mineral resources.

XI. Noise

The proposed project addresses water quality and will not directly cause an increase in noise levels.

XII. Population and Housing

The Basin Plan amendment would not affect the population of the Bay Area, Central Valley, or California. It would not induce growth through such means as constructing new housing or businesses, or by extending roads or infrastructure. The Basin Plan amendment would also not displace any existing housing or any people that would need replacement housing.

XIII. Public Services

The Basin Plan amendment would not affect populations or involve construction of substantial new government facilities. The Basin Plan amendment would not affect service ratios, response times, or other performance objectives for any public services, including fire protection, police protection, schools, or parks.

XIV. Recreation

The proposed project addresses water quality and will not directly affect recreational activities. No recreational facilities would need to be constructed or expanded.

XV. Transportation / Traffic

Because the Basin Plan amendment would not increase population or provide employment, it would not affect transportation facilities or generate any additional traffic.

XVI. Utilities and Service Systems

The project would amend the Basin Plan, which is the basis for wastewater treatment requirements in the Bay Area; therefore, the Basin Plan amendment would be consistent with such requirements.

Because the Basin Plan amendment would not affect water demands or supplies, it would not require the construction of new or expanded water or wastewater treatment facilities and storm water management facilities.

XVII. Mandatory Findings of Significance

The proposed Basin Plan amendment is intended to maintain all beneficial uses in San Francisco Bay. The proposed amendment does not have the potential to degrade the quality of the environment, substantially reduce fish or wildlife habitat, cause fish or wildlife population to drop below self-sustaining levels or threaten to eliminate a plant or animal community. The proposed amendment is based on the latest science pertaining to the toxicity of cyanide to aquatic organisms. Therefore, the proposed water quality objectives will fully protect beneficial uses of the Bay.

There are no potential adverse impacts that would interact in such a way as to further degrade the environment and no cumulative effects would occur. Therefore, the incremental effects of the Basin Plan amendment would be negligible when viewed in the context of the overall environmental changes foreseeable in the Bay Area as California's population grows and urban development occurs. For this reason, the Basin Plan amendment's cumulative effects would be less-than-significant, and adopting the Basin Plan amendment would require no mandatory findings of significance.

There are no direct significant impacts from the proposed project that would cause adverse effects to human beings. There are also no indirect, significant adverse impacts resulting from the proposed Basin Plan amendment and implementation plan.

APPENDIX I

Draft Model Permit Language for Municipal Dischargers

DRAFT MODEL NPDES PERMIT PROVISION FOR MUNICIPAL WASTEWATER DISCHARGERS - SAN FRANCISCO BAY

Cyanide Action Plan

As part of the implementation of the marine cyanide site-specific objective, the discharger shall implement appropriate pretreatment, source control and pollution prevention for cyanide. The discharger shall consider reductions in effluent concentration achieved through source control and economically feasible optimization of treatment plant processes if new information on cyanide minimization in disinfection processes becomes available. Identifying contributors of cyanide from the discharger's service area shall be in accordance with the following tasks and time schedule.

Task	Compliance Date
(1) Review and Update of Potential Cyanide Contributors	no later than 3 months after permit adoption

Submit an inventory of all potential contributors of cyanide to the treatment plant, acceptable to the Executive Officer, and proceed with Task 2, below. If no contributors of cyanide from the discharger's service area are identified, no further action is required during the life of this permit, unless the discharger receives a request to discharge detectable levels of cyanide to the sanitary sewer. In such an event the discharger will notify the Executive Officer and proceed with Task 2, below.

(2) Implement Cyanide Pollution Prevention Program

Submittal of Final Report — 1 year after completion of Task 1

The discharger shall implement a local program aimed at the prevention of illicit discharges of cyanide to the sewer system. The local program shall consist, at a minimum, of the following elements:

a) Maintain list of potential contributors (e.g., metal plating operations, hazardous waste recycling, etc.).

b) Monitor total cyanide monthly in influents and effluents using low detection level cyanide analytical methods.

c) Within a year of permit adoption, perform a site inspection of each potential contributor to assess the need to include the facility in an ongoing program.

d) For facilities in the ongoing program or those covered by the pretreatment program, follow EPA Guidance, such as Industrial User Inspection and Sampling Manual for POTWs (EPA 831-B-94-01), that provides inspection and wastewater sampling procedures such as:

- Perform routine inspections of facilities.

- Develop and distribute educational materials regarding the need to prevent illicit discharges to the sewer system.

e) Prepare an emergency monitoring and response plan to be implemented in the event that a significant cyanide discharge occurs that causes an exceedance of effluent limits. The Plan should include procedures to verify the delivery, use and shipment of cyanide from a facility suspected of illicit discharges (i.e., verify that State Hazardous Waste Manifests are consistent with the facility's permit application and self-monitoring report information and comparable to other disposal practices of similar local facilities).

f) Submit Final Report acceptable to the Executive Officer, documenting the above, within one year after completion of Task (1).

APPENDIX J

Basin Plan and SIP Requirements for Approval of Dilution Credit for Shallow Water Dischargers

There are provisions imposed by the *San Francisco Bay Region Water Quality Control Plan (Basin Plan)* and the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays and Estuaries of California (SIP)* that must be addressed as a condition of the award of a dilution credit to shallow water discharges. These provisions are discussed below.

Basin Plan:

The Basin Plan allows that a dilution credit may be granted for shallow water dischargers on a discharger-by-discharger and pollutant-by-pollutant basis.

For the proposed Basin Plan amendment and dilution credit consideration, each shallow water discharger has been specifically evaluated. Additionally, the dilution credit in the proposed Basin Plan applies only to cyanide, satisfying the pollutant-by-pollutant requirement.

The Basin Plan also stipulates that the Regional Board may "grant a dilution credit…if the discharger demonstrates that a pretreatment and source control program is in place, including the following:

- *Completion of a source identification study,*
- *Development and implementation of a source reduction plan, and*
- *Commitment of resources to fully implement the source control and reduction plan."*

As stated previously in this Staff Report, the cyanide measured in effluent is often a product of wastewater disinfection and is therefore not amenable to source control by municipal agencies. This is evident through inspection of influent and effluent cyanide data for Bay area treatment facilities (see Section 3.5) and is well supported in the literature (Zheng et al, 2004; WERF 2003).

A number of the shallow water dischargers (Palo Alto, San Jose, Novato Sanitary District, Sonoma County Water Agency) have performed source identification studies. Industrial sources of cyanide (metal finishers and electroplaters) were identified in the Palo Alto and San Jose service areas and were controlled through the industrial pretreatment programs at these respective municipalities. No significant cyanide sources were identified in the studies performed by Novato and Sonoma County Water Agency.

It has been demonstrated that in many treatment plants disinfection process and chlorination in particular, form a significant cyanide source which obviates the need for individual cyanide source identification studies at each facility. In lieu of such advance studies, the proposed Basin Plan amendment requires that each shallow water discharger perform an assessment of potential cyanide sources within its service area as an initial NPDES permit requirement. This will ensure that potentially significant cyanide sources are identified and will allow agencies to initiate illicit discharge prevention procedures for these sources. The NPDES permit will require the commitment of resources to fully implement the source control and illicit discharge plans in those agencies.

In addition to source identification and control, the Basin Plan requires that a demonstration be made that water quality objectives will be achieved, by ensuring the following:

A demonstration that the proposed effluent limitations will result in compliance with water quality objectives, including the narrative chronic toxicity objective, in the receiving water

The water quality-based effluent limits are derived to ensure that compliance with both acute and chronic chemical-specific water quality objectives will occur at the edge of the mixing zone for each shallow water discharger. Therefore, both numeric and narrative objectives will be attained in the receiving waters of the Bay outside of these zones. As described in Section 9.4.1, the expectation is that the concentration of cyanide in effluents is not expected to increase above existing levels. Ambient data indicate that existing concentrations of cyanide in the discharge gradients from shallow water dischargers are, in all cases, below the proposed acute cyanide saltwater objective of 9.4 µg/l and are typically below the proposed chronic objective of 2.9 µg/l. In addition, the proposed Cyanide Action Plan that will include cyanide as a pollutant of concern for all dischargers in their Pollutant Minimization Plans will reinforce the identification and control of potentially significant illicit discharges in service areas where such sources exist, adding to the existing capability to control such discharges.

An evaluation of worst-case conditions (in terms of tidal cycle, currents, or instream flows, as appropriate) through monitoring and/or modeling to demonstrate that water quality objectives will continue to be met, taking into account the averaging period associated with each objective…

The monitoring and modeling performed for shallow water dischargers provides empirical evidence (n=225) and/or predicted values to address steady state conditions along the discharge gradients. The modeling allows consideration of worst case conditions and consideration of appropriate averaging periods to ensure that water quality conditions will be met.

An evaluation of the effects of mass loading resulting from allowing higher concentrations of pollutants in the discharge, in particular, the potential for accumulation of pollutants in aquatic life or sediments to levels that would impair aquatic life or threaten human health.

As stated previously, cyanide degrades in the receiving water and does not accumulate in sediment or biota. Levels of cyanide in shallow water discharger effluent do not approach levels of concern to human health (e.g., the OEHHA drinking water public health goal of 150 µg/l).

The Basin Plan also requires that the effluent limits resulting from a dilution credit must be consistent with anti-backsliding provisions of the Clean Water Act (CWA).

Anti-backsliding provisions apply in cases where final effluent limits have been adopted in permits. For wastewater dischargers of cyanide to the San Francisco Bay, no final cyanide limits exist in their current NPDES permits. Therefore, the anti-backsliding provisions of the CWA do not apply in the case of cyanide. Additionally, none of the plants in question could comply with final limits derived from the proposed saltwater site-specific objectives for cyanide without consideration of attenuation. Therefore, anti-backsliding is not a constraint to the adoption of the proposed dilution credits for shallow water dischargers.

State Implementation Policy (SIP):

The "RWQCB shall consider the presence of pollutants in the discharge that are carcinogenic, teratogenic, persistent, bioaccumulative, or attractive to aquatic organisms."

As stated in Section 3.3, cyanide is neither carcinogenic, teratogenic, persistent, nor bioaccumulative.

The "*RWQCB also shall consider…the level of flushing in water bodies such as…enclosed bays, estuaries…where pollutants may not be readily flushed through the system.*"

The monitoring and modeling studies used in the consideration of dilution credits and mixing zones along the discharge gradients reflect consideration of the hydrodynamics and tidal flushing that occurs near shallow water discharges. Because cyanide degrades, does not accumulate in the Bay, and does not pose an ambient concentration problem in the Bay, concern regarding flushing of cyanide from the Bay system is not warranted.

Mixing zone study and mixing zone conditions

An independent attenuation study or a combination of attenuation and modeling study was performed by each shallow water discharger to evaluate dilution and degradation of cyanide in the receiving waters following the procedures set in the SIP for incompletely mixed discharges. The methodology employed to determine dilution credits from attenuation studies is summarized in Section 6 and is detailed in Appendix K.

Compliance with cyanide water quality objectives occurs at the edge of the cyanide mixing zone. In this Project the extent of the mixing zone is defined as the location in the receiving water where the ratio of effluent concentrations to receiving water concentrations of cyanide equals the attenuation value. The extent of the mixing zone for each discharger is defined in Appendix D.

"*A mixing zone shall be as small as practicable."*

The proposed dilution credits were selected to ensure that the extent of the mixing zone associated with each effluent outfall is minimized and that the computed compliance thresholds such as Maximum Daily Effluent Limit and Average Monthly Effluent Limit are protective of most sensitive aquatic life.

Also, "…a mixing zone shall not:

(1) Compromise the integrity of the entire water body…

Cyanide is not currently compromising the integrity of the Bay or its uses. Ambient monitoring indicates that cyanide levels throughout the Bay proper are less than the detection limit of 0.4 µg/l, which is significantly less than the proposed cyanide site-specific chronic objective of 2.9 µg/l. These ambient levels integrate the existing shallow water discharges of cyanide. As detailed in Section 9.4.1, the proposed consideration of dilution credits in setting effluent limits for shallow water dischargers will not cause or contribute to increased cyanide concentrations in the Bay.

(2) cause acutely toxic conditions to aquatic life passing through the mixing zone…

The copepod *Acartia clausi*, the most acutely sensitive saltwater species, has an acute LC50 value of 30 µg/l in exposures to free cyanide; Rainbow trout, the most acutely sensitive freshwater species, has an acute LC50 value of 44 µg/l free cyanide. U.S. EPA presumes that the "no acute effect" level for acute toxicity is typically one half of the LC50 value. Therefore, the approximate "no acute effect" levels for acute toxicity for *Acartia* and Rainbow trout are 15 µg/l and 22 µg/l free cyanide, respectively. Measured levels of total cyanide along the discharge gradients of shallow water dischargers are less than 7 µg/L, typically less than 3 µg/L, and do not currently approach these concentration thresholds for acute toxicity. Total cyanide levels along the discharge gradients are not anticipated to increase under the proposed effluent limits. Therefore, it is concluded that proposed effluent limits will not result in acutely toxic conditions in shallow water discharger attenuation zones.

(3) restrict the passage of aquatic life…

Cyanide concentrations in the vicinity of shallow water dischargers will not interfere with the movement of aquatic species. The discharge locations are either dead-end sloughs or otherwise sited to avoid creation of migration barriers.

(4) adversely impact biologically sensitive or critical habitats…

Available toxicological information for cyanide indicates that sensitive aquatic species will not be impacted in the aquatic habitats in question.

(5) produce undesirable or nuisance aquatic life
(6) result in floating debris, oil or scum;
(7) produce objectionable color, odor, taste, or turbidity;
(8) cause objectionable bottom deposits;
(9) cause nuisance;

At the concentrations in question, cyanide is not known to produce undesirable aquatic life, floating debris, oil, scum, objectionable color, odor, taste turbidity, objectionable bottom deposits or nuisance conditions.

(10) dominate the receiving water body or overlap a mixing zone from different outfalls;

The mixing zones described in Appendix D do not overlap.

(11) be allowed at or near any drinking water intake…"

No drinking water intakes are located in San Francisco Bay in the vicinity of the proposed Shallow Water Discharger attenuation zones.

APPENDIX K

Cyanide Attenuation and Dilution Studies

The purpose of this Appendix is to describe the methodology referenced in the Staff Report in the determination of attenuation and dilution for Shallow Water Dischargers to San Francisco Bay. As stated in the Staff Report, a special study performed by the City of San Jose in 2003 and 2004 serves as the foundation for evaluation of the attenuation factor concept in the Bay. This study included the development of a data set of effluent and receiving water cyanide concentrations over a 12 month period (n=149) in Lower South San Francisco Bay. Sampling was performed along the discharge gradient from the San Jose/Santa Clara Water Pollution Control Plant in Artesian Slough and Coyote Creek. This Appendix describes the methodology and results of that study. It also includes a comparison of the attenuation results with dilution results estimated from a dye experiment conducted in 1989. In addition, a summary of attenuation factors derived from measurements and modeling studies by other shallow water dischargers is also provided. Table 6, at the end of the Appendix, contains summary statistics on the shallow water discharger receiving water data collected for this proposed Basin Plan amendment.

This Appendix contains the following sections:

- Definition of Attenuation
- San Jose Study Description
- San Jose Study Results
- Comparison of Attenuation and Dilution Results
- Other Shallow Water Discharger Methods
- Other Shallow Water Discharger Results

Definition of Attenuation

Attenuation is defined to be the combination of dilution and degradation, where dilution is the mixing of treated effluent with Bay waters and degradation is the sum of all factors affecting the loss of cyanide in the environment, including volatilization, precipitation, sedimentation and microbial breakdown. The concept of an attenuation factor is considered to be a valid permitting approach for cyanide because cyanide is degradable and does not persist or accumulate in the aquatic environment. The City of San Jose study provides empirical and characteristic evidence of cyanide attenuation.

The formula for the determination of a cyanide “attenuation factor” (AF) value is as follows:

AF = Effluent cyanide concentration / cyanide concentration at a selected location along a discharge gradient

Synoptic (or quasi-synoptic) sampling data for effluent and receiving waters serve as the basis for attenuation factor calculations. For some Shallow Water Dischargers, where sufficient ambient data is not available, dilution estimates from mathematical modeling studies were used to provide a conservative estimate (i.e. an underestimate) of cyanide attenuation.

San Jose Study Description

The City of San Jose performed a special Cyanide Attenuation Study in 2003 and 2004 to examine changes in cyanide concentrations that occur with distance downstream from the WPCP discharge point in Artesian Slough. The information below is taken from the final report for this study titled *Cyanide Attenuation Study, Watershed Protection Group, Environmental Services Department, City of San Jose, September 1, 2004.*

The purpose of the San Jose special study was two-fold: (1) to examine cyanide formation in the WPCP and (2) to determine empirical attenuation factors for cyanide along the WPCP discharge gradient in Artesian Slough and Coyote Creek in the southernmost area of Lower South Bay. The second purpose for the study (determination of empirical attenuation factors) is the focus of the following discussion.

For the special study, the City of San Jose developed and utilized low detection limit analytical methods for total cyanide determinations in effluent and in the receiving waters. The City performed various method enhancement studies to ensure the generation of high quality information in the special study. These included a Method Detection Limit study and studies of the effect of sample preservation and holding time on cyanide results.

The cyanide analytical methods used in this study were a modified version of methods 4500-CN B, C and E from Standard Methods, 20^{th} Edition (APHA/AWWA/WEF 1998) (see description in Appendix L). Modifications of the methods were employed to lower the detection limits for measuring total cyanide. The modified procedure provided a Method Detection Limit of 0.06 µg/l and a Practical Quantitation Limit (PQL)(Reporting Limit) of 0.30 µg/l for Bay water. The Method Detection Limit for effluent samples was 0.2 µg/l, and the PQL (Reporting Limit) for effluent was 1.0 µg/l.

Discharge gradient sampling locations included plant effluent and 13 ambient downstream locations. The sampling locations are shown in Figure 1.

The cyanide concentration values for effluent and ambient sampling locations used in the City of San Jose report were based on grab samples. Samples were obtained using a sample pumping system and apparatus as recommended in USEPA 1996 guidance for clean sampling techniques. The City studied the variability of effluent cyanide concentrations over a 72-hour period and found little variation in the daily means, maximums, minimums or standard deviations of the observed concentrations. The study involved 8 samples per day at three-hour time intervals (see Figure 2). Based on these results, the use of grab samples was deemed to be a representative sampling approach in effluent and in downstream waters affected by the effluent.

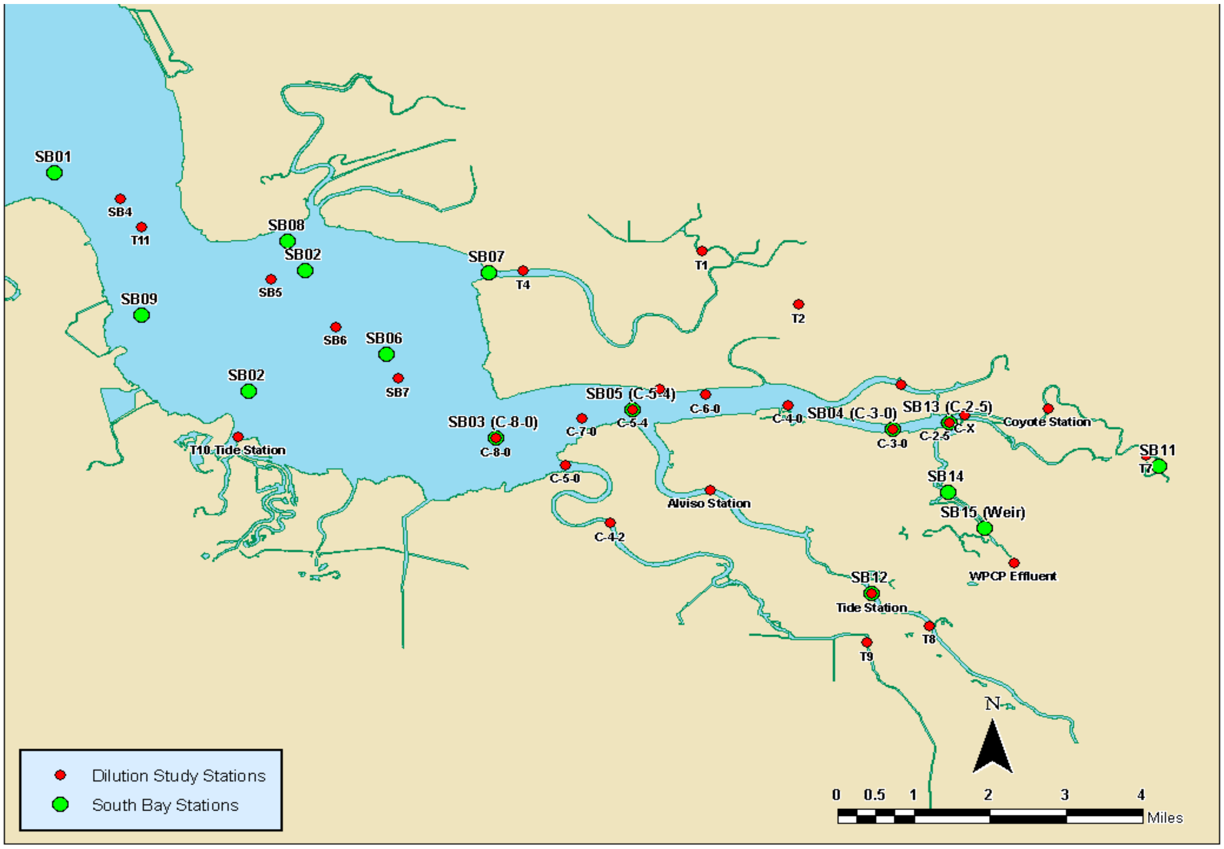


Figure 1. Sampling Locations for Empirical Cyanide Attenuation Study and Dye Experiment by San Jose/Santa Clara WPCP

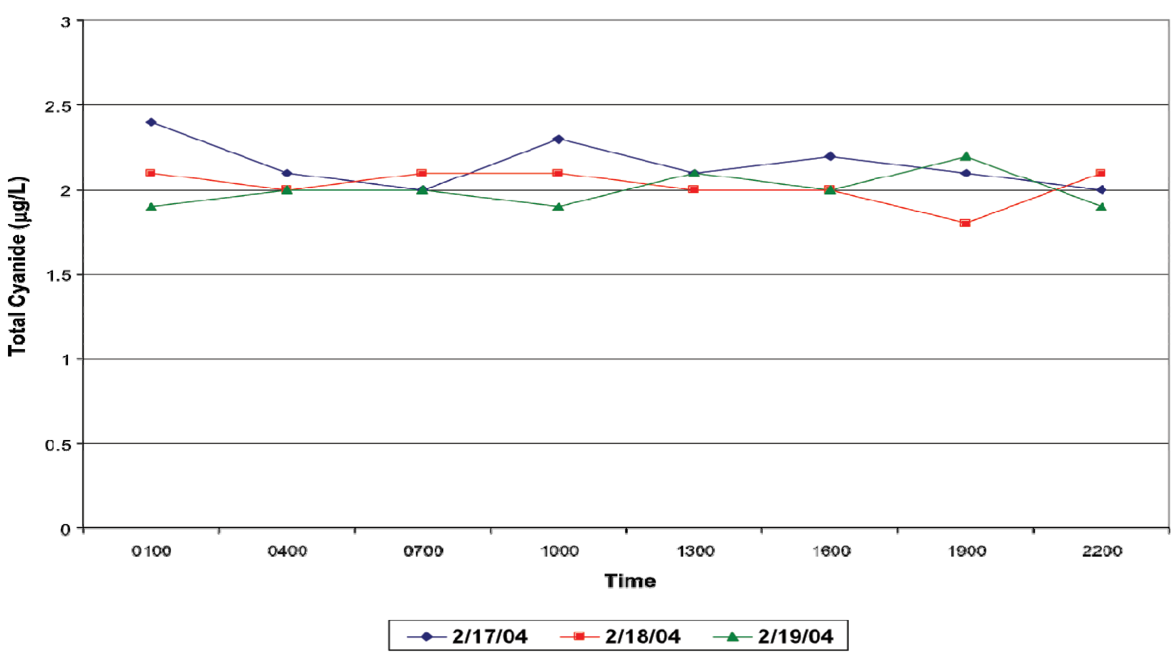


Figure 2. Variability of Effluent Cyanide Concentrations, San Jose/Santa Clara WPCP

The field sampling for each event was performed over a period of two days. Samples of effluent were typically taken during the field sampling period or the day before. Near-field ambient locations (SB15, SB14 and SB13) were typically collected over a one to 2 hour time period in each sampling event. Samples at other ambient locations were typically collected during the same 4 to 5 hour period (8AM to 1PM) each sampling day.

San Jose Study Results

The observed cyanide concentrations during the 12 month study (July 2003 to June 2004) are summarized in Table 1. It should be noted that cyanide concentrations in individual samples taken at the first two stations downstream from the effluent discharge point in Artesian Slough (SB15 and SB14) were at times slightly higher than the final effluent cyanide concentrations. The explanation for these differences is as follows: The final effluent sample is taken at the head of the effluent discharge channel; SB15 is located 790 meters downstream at the overflow weir from the discharge channel. In most instances, these samples were taken on the same day in the same 40 minute time period. Therefore, differences in concentration between these two whole effluent samples (which are essentially field duplicates) are attributable to analytical variability and short-term minor variability in effluent quality. In instances where samples were taken one day apart, apparent increases in cyanide concentration at downstream locations were likely the result of day-to-day variations in effluent cyanide concentrations in addition to analytical and short-term variability.

For the period November 2003 to June 2004 when samples were collected at all three locations, the median cyanide concentrations were 2.9 µg/l in final effluent, 3.0 µg/l at SB15 and 2.5 µg/l at SB14. In the calculation of attenuation factor values, final effluent concentrations (rather than the slightly higher SB15 concentrations) were used.

Attenuation factors were calculated for each monitoring event, using the above cyanide concentration data and the AF formula described above. The median attenuation factor values for stations SB04 and SB05 were 2.25 and 4.5, respectively. These values derived as follows:

- An attenuation factor value was calculated for each sampling event.
- The May 2004 event was excluded as an atypical event (excluding this event resulted in a more conservative, i.e. lower attenuation factor for each location)
- The median AF value at each location was determined from the data set of the individual AF values for each event.

Stations SB04 and SB05 were chosen as sites for the attenuation factor calculation based on the significant declines in cyanide concentrations observed at these locations. Under typical discharge conditions along the discharge gradient, dilution appears to be an important factor affecting the observed cyanide attenuation values. This is seen through examination of the calculated attenuation factors at stations SB04 and SB05 in comparison to calculated dilutions derived from salinity measurements taken at the same time as the cyanide samples. The salinity data used in the calculation of dilution is shown in Table 2. The comparison of these dilution values with the median attenuation factor values is shown in Table 3.

Table 1. Cyanide Attenuation Calculations in South San Francisco Bay (*City of San Jose Cyanide Attenuation Study, 2004*)

	2003						2004					
Station	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
Final effluent	1.6	1.8	3.5	2.3	2.7	5.2	1.8	2	3.1	4.7	63	2.5
SB15 (Weir)	NS	NS	NS	NS	2.7	5.5	2	1.7	3.4	5.2	59	2.2
SB14 (Triangle)	NS	NS	2.7	3.1	2.3	3.8	2	1.6	2.8	4.2	27	2.3
SB13 (Mouth)	NS	NS	1.3	2.4	1.6	1.6	1.5	1.6	1.2	2.2	7.2	2.1
SB04	1	0.8	1.2	1.8	0.7	0.7	1.1	0.9	0.8	1.7	3.3	1.3
SB05	0.4	0.6	0.5	0.9	0.2	0.4	0.4	0.7	0.3	0.4	1.1	0.8
SB03	0.3	0.3	0.4	0.5	0.2	0.4	0.2	0.4	0.4	0.4	0.8	0.6
SB06	0.3	0.2	0.3	0.3	0.2	0.3	0.2	0.5	0.3	0.4	0.4	0.5
SB02	0.2	0.2	0.3	0.2	0.1	0.2	0.3	0.4	0.2	0.2	0.3	0.3
SB08	0.3	0.2	0.3	0.3	0.1	0.1	0.4	0.4	0.2	0.2	0.4	0.3
SB10	0.3	0.3	0.3	0.4	0.2	0.2	0.3	0.2	0.3	0.3	0.4	0.3
SB07	0.5	0.4	0.3	0.4	0.3	0.4	0.3	0.3	0.4	0.4	0.4	0.3
SB09	0.2	0.2	0.3	0.2	0.1	0.3	0.3	0.2	0.2	0.2	0.4	0.4
SB01	0.2	0.2	0.2	0.2	0.1	0.1	0.3	0.2	0.2	0.2	0.2	0.2
SB11	0.5	0.4	0.6	0.4	0.6	0.9	0.8	0.8	1.1	0.7	0.3	0.4
SB12	0.3	0.3	0.3	0.3	0.4	0.5	0.4	0.5	NS	0.5	0.4	0.3

Station *2003* *2004* ***Median***

	July	Aug	AF Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	AF Value
With May 04													
Final effluent	1.6	1.8	3.5	2.3	2.7	5.2	1.8	2	3.1	4.7	63	2.5	
SB04	1	0.8	1.2	1.8	0.7	0.7	1.1	0.9	0.8	1.7	3.3	1.3	
AF	1.60	2.25	2.92	1.28	3.86	7.43	1.64	2.22	3.88	2.76	19.09	1.92	2.51
Without May 04													
Final effluent	1.6	1.8	3.5	2.3	2.7	5.2	1.8	2	3.1	4.7		2.5	
SB04	1	0.8	1.2	1.8	0.7	0.7	1.1	0.9	0.8	1.7		1.3	
AF	1.60	2.25	2.92	1.28	3.86	7.43	1.64	2.22	3.88	2.76		1.92	**2.25**
With May 04													
Final effluent	1.6	1.8	3.5	2.3	2.7	5.2	1.8	2	3.1	4.7	63	2.5	
SB05	0.4	0.6	0.5	0.9	0.2	0.4	0.4	0.7	0.3	0.4	1.1	0.8	
AF	4.00	3.00	7.00	2.56	13.50	13.00	4.50	2.86	10.33	11.75	57.27	3.13	5.75
Without May 04													
Final effluent	1.6	1.8	3.5	2.3	2.7	5.2	1.8	2	3.1	4.7		2.5	
SB05	0.4	0.6	0.5	0.9	0.2	0.4	0.4	0.7	0.3	0.4		0.8	
AF	4.00	3.00	7.00	2.56	13.50	13.00	4.50	2.86	10.33	11.75		3.13	**4.5**
With May 04													
Final effluent	1.6	1.8	3.5	2.3	2.7	5.2	1.8	2	3.1	4.7	63	2.5	
SB13 (Mouth)	NS	NS	1.3	2.4	1.6	1.6	1.5	1.6	1.2	2.2	7.2	2.1	
AF			2.69	0.96	1.69	3.25	1.20	1.25	2.58	2.14	8.75	1.19	1.91

Table 2. Dilution Calculations from San Jose Salinity Data (*City of San Jose 2004*)

Dilution at SB04 using Bay Salinity data at SB01

													Median Dilution Value
Final effluent	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	
SB04	6.2	12.8	5.1	5.3	17.6	16.5	7.6	1.9	6.7	1.3	4	3.5	
SB01	25.1	27.2	27.2	28.9	28.2	28.2	23	17.6	16.7	19.1	24.4	26.7	
Percent effluent	0.77	0.54	0.83	0.83	0.38	0.42	0.69	0.92	0.62	0.96	0.86	0.89	
Dilution	1.30	1.85	1.20	1.20	2.60	2.37	1.45	1.08	1.61	1.04	1.17	1.13	**1.25**

Dilution at SB04 using Bay Salinity data at SB02

Final effluent	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	
SB04	6.2	12.8	5.1	5.3	17.6	16.5	7.6	1.9	6.7	1.3	4	3.5	
SB02	24.7	26.7	27.7	26.6	26.2	27.7	22	12.2	16.5	18.5	22.8	24.9	
Percent effluent	0.77	0.53	0.83	0.82	0.34	0.41	0.67	0.89	0.62	0.96	0.85	0.88	
Dilution	1.30	1.88	1.20	1.22	2.98	2.43	1.49	1.13	1.62	1.04	1.18	1.14	**1.26**

Dilution at SB05 using Bay Salinity data at SB01

Final effluent	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	
SB05	19.7	19.4	18.9	12.2	24	24.5	19.7	4.7	13.5	10.6	8.2	10	
SB01	25.1	27.2	27.2	28.9	28.2	28.2	23	17.6	16.7	19.1	24.4	26.7	
Percent effluent	0.22	0.29	0.31	0.59	0.15	0.13	0.15	0.76	0.20	0.46	0.68	0.64	
Dilution	4.54	3.41	3.20	1.69	6.57	7.49	6.79	1.32	5.03	2.18	1.47	1.56	**3.31**

Dilution at SB05 using Bay Salinity data at SB02

Final effluent	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	
SB05	19.7	19.4	18.9	12.2	24	24.5	19.7	4.7	13.5	10.6	8.2	10	
SB02	24.7	26.7	27.7	26.6	26.2	27.7	22	12.2	16.5	18.5	22.8	24.9	
Percent effluent	0.21	0.28	0.32	0.55	0.09	0.12	0.11	0.65	0.19	0.44	0.66	0.61	
Dilution	4.82	3.58	3.08	1.81	11.64	8.50	9.30	1.55	5.30	2.27	1.52	1.63	**3.33**

Table 3. Effect of dilution on Attenuation Factors at Stations SB04 and SB05

Station	*Attenuation Factor (median)*	*Calculated Dilution (median)*
SB04	2.25	1.25
SB05	4.5	3.3

As shown in Table 3, the median attenuation factor at SB04 is 2.25, while the median dilution at SB04 based on salinity measurements and subsequent calculations of effluent percentages is 1.25. At SB05, the median attenuation factor is 4.5, while the calculated dilution ratio is 3.3. This finding is also supported qualitatively by historical dilution study results. Calculated AF values were 2.25 and 4.5 at SB04 and SB05, respectively. In a dilution study performed in 1990, the predicted dilutions at SB04 and SB05 were determined to be 2.1 and 4.5.

A period of rapid degradation of cyanide was observed during the extraordinary May 26, 2004 sampling event by the City of San Jose (see Figure 3). In the May 2004 event, an illicit cyanide discharge to the WPCP produced an extremely elevated effluent concentration of 63 µg/l. Measurements along the discharge gradient at SB13, SB04 and SB05 indicated cyanide concentrations of 27 µg/l, 7.2 µg/l, 3.3 µg/l and 1.1 µg/l. The associated attenuation factors at these sites were 8.8, 19.1 and 57, respectively. These values demonstrate significant, rapid degradation of the elevated cyanide concentrations that far outweighed the effect of dilution. This May observation demonstrates that degradation would be anticipated to exert a greater influence along the discharge gradient at higher effluent cyanide concentrations.

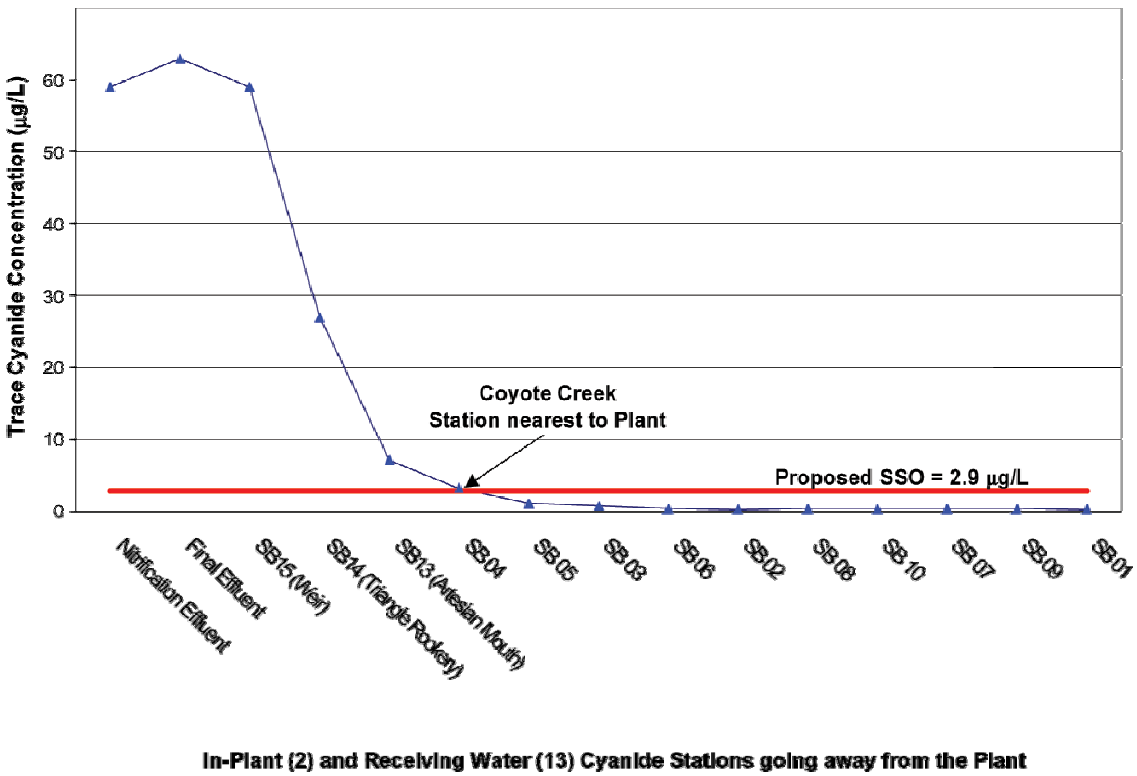


Figure 3 – High Cyanide Effluent Discharge and Receiving Water Gradient, San Jose/Santa Clara WPCP, May 26, 2004

The degradation of cyanide is also evident in the examination of ambient data in Table 1 for the far field Bay stations (SB02, SB06, SB07, SB08, SB09 and SB10) where concentrations were typically less than or equal to 0.4 µg/l and SB01, near the Dumbarton Bridge, where cyanide concentrations were always less than 0.3 µg/l. These observations are supported by RMP data that indicate cyanide levels below detection (at a detection limit of 0.4 µg/l) at other open Bay stations. Clearly, cyanide continues to degrade over time and does not accumulate in the water column of the Bay.

Comparison of Attenuation and Dilution Results

In 1989, the City conducted a study to evaluate the dilution of the San Jose/Santa Clara Water Pollution Control Plant's effluent in South San Francisco Bay (CH2M HILL 1990)[1]. This study was conducted between September 26 and 30, 1989, using Rhodamine WT, a fluorescent dye. Dye injection was continuous for three days. Continuous dye injection allowed the dilution measurements to include the cumulative effects of Plant effluent re-entrainment from tidal cycles in the study area. The study period was selected because it represented a critical period of neap tide conditions, minimum Delta outflow, and minimum freshwater flow from the creeks that would minimize dilution. Thus, the results are conservative. This study is still applicable today since average Plant flows were 111 MGD in 1989, as compared to 119 in 2005.

Measurements were made at 26 locations throughout the South Bay (Figure 1). A total of 110 measurements were made over a 3-day sampling period. Dilution at each station tended to decrease over time as a steady state condition was achieved in the receiving water. The observed minimum depth-averaged water column dilution (MAD) [2] increased with distance from the Plant. The MAD for station C-3-0 (SB04 at Drawbridge in Coyote Creek) was 3.2 (Table 4; Figure 1). The MAD for station C-5-4 (SB-05 at the mouth of Alviso Slough) was 19. The MADs at C-8-0 (at Calaveras Point, near station SB03) and further out into the Bay were found to be greater than 50. The MAD represents a very conservative measurement since it corresponds to the lowest value obtained for a particular station in the study. For example, the MAD for station SB04 was 3.2 but the maximum depth-averaged dilution for this site was greater than 50.

These dilution study results are similar to the Attenuation factors (AF) derived from the City's Cyanide Attenuation Study (Table 4). Attenuation factors for stations C-3-0, C-5-4, and the mouth of Coyote Creek were 2.25, 4.5, and 7.75, respectively. Cyanide Attenuation Study results indicated that attenuation appeared to be at least partially limited by the magnitude of cyanide concentration in the effluent that is higher cyanide concentration in the discharge produced higher attenuation factors. For example, in May 2004 an incident occurred at the Plant where approximately 60 µg/L of total cyanide was discharged from the Plant. However, the total cyanide measured at station SB04 in Coyote Creek during this incident was 3.3 µg/L. This corresponds to a station attenuation of 19, compared to the study mean station AF of 2.9 (median station AF = 2.25). WERF[3] investigators also found that "…influent with a high concentration of cyanide experienced a relatively rapid cyanide loss whereas low influent cyanide

[1] CH2MHILL. 1990. South Bay Dilution Study (Provision E5D). Prepared for the City of San Jose Department of Water Pollution Control. Permit Assistance Program. September 1990.

[2] Lowest average of all points collected at a given location at one time when measurements were made at various depths.

[3] WERF. 2003. *Cyanide Formation and Fate in Complex Effluents and its Relation to Water Quality Criteria.* WERF publication No. 98-HHE-5. Water Environment Research Foundation, Alexandria, Va. Co-published by IWA Publishing, London, United Kingdom.

concentrations exhibited a lower loss rate" in a constructed wetland. Therefore, dilution and attenuation results from these studies are conservative (minimum) values. Ambient cyanide concentrations in Lower South Bay averaged 0.29 µg/L during the study, indicating that cyanide does not persist or accumulate in the receiving water.

Table 4. San Jose/Santa Clara Water Pollution Control Plant Cyanide Dilution/Attenuation Results

Site	Distance from Outfall (km)	Surface Water Area (Acres)	Median Attenuation Factor[1]	MAD[2]
SB15 (Weir)	0.0	0.0	0.9	
SB14	1.0	6.2	1.1	
SB13 (C-2-5)	3.2	19.8	1.7	1.3
SB04 (C-3-0)	4.1	40	2.25	3.2
C-4-0	6.0	87		3.5
C-6-0	7.5	140		10.6
SB05 (C-5-4)	8.7	193	4.5	19
C-7-0	9.6	238		46
SB03 (C-8-0)	11.2	331	7.75	>50

[1]From City's 2004 Cyanide Attenuation Study

[2]From City's 1990 Dilution Study; MAD - Minimum Depth-Averaged Water Column Dilution

Other Shallow Water Discharger Methods

The purpose of effluent and ambient monitoring by other Shallow Water Dischargers was to confirm that the results obtained by the City of San Jose were observed along other discharge gradients. Monitoring results and mathematical modeling study results were used to estimate the distances from individual discharge points where specific attenuation factor values are attained (see Appendices B and D). Grab samples of effluent and receiving water were taken at the following nine other Shallow Water Discharge locations.

- American Canyon
- Fairfield Suisun SD
- Las Gallinas Valley SD
- Mt. View SD
- Napa SD
- Palo Alto
- Petaluma
- Sonoma County Water Agency
- Sunnyvale

All samples were analyzed by the City of San Jose WPCP laboratory using the same analytical methods and detection limits employed in the San Jose special study (see Appendix L for a description of the analytical method). Therefore, the data obtained from the above sampling effort is deemed to be high quality and comparable with the City of San Jose and other shallow water discharger data.

Other Shallow Water Discharger Results

The characteristic cyanide attenuation curve observed along the San Jose discharge gradient were observed at each of the other Shallow Water Discharger locations either through modeling or empirical measurements (see Appendix D). Where empirical data were used, attenuation factors were calculated as described above for the City of San Jose results. Where modeling predictions of percent effluent were used, attenuation factors were calculated as follows:

AF = Dilution factor = 1 / [Percent effluent at a given location on the discharge gradient]

The effluent percentages corresponding to attenuation factors (AF) of 2.25, 3.5 and 4.5 were as follows:

For AF = 2.25, effluent percentage = 44.4
For AF = 3.5, effluent percentage = 28.6
For AF = 4.5, effluent percentage = 22.2

Table 5 provides a summary of distances along individual discharge gradients where specific attenuation factors exist for each of the shallow water dischargers. These distances define the approximate dimensions of attenuation zones for each discharger, depending on the selected AF value.

Table 5. Attenuation Zones for Shallow Water Dischargers

Discharger	***Study Used to Develop AF versus distance curve***	***Date of study***	***Estimated Distance in feet to AF = 2.25***	***Estimated Distance in feet to AF = 3.5***	***Estimated Distance in feet to AF = 4.5***
American Canyon	Empirical data	2005	2,100	3,000	NA
Fairfield-Suisun SD	Model/ Empirical data	2004	15,000	24,000	27,000
Las Gallinas Valley SD	Empirical data	2004	800	875	1,200
Mt. View SD	Empirical data	NA	NA	NA	NA
Napa SD	Empirical data	2005	1,500	2,500	8,500
Novato SD	Model Study	2004	120	170	190
Palo Alto	Model Study	1997	1,600	2,400	3,000
Petaluma	Model/ Empirical data	2001	410	410	5,500
San Jose Santa Clara	Empirical data	2003-2004	13,450	20,000	27,800
Sonoma County Water Agency	Model Study	1997	10,000	15,500	17,000
Sunnyvale	Empirical data	2004	1,100	7,200	NA
Union SD - Hayward Marsh	Model/Empirical data	2006	1,800	2,900	3,530
USS Posco	Model Study	2003	25	46	58

NA = Data or Estimation Not Available

Notes:

Attenuation factors are calculated as follows:

Where ambient measurements are available:

AF = [Cyanide concentration in ambient water] / [Cyanide concentration in effluent]

Where percent effluent predictions are available from modeling study:

AF = 1 / [Percent effluent at an ambient location]

AF = 2.25 at 44.4% effluent
AF = 3.5 at 28.6% effluent
AF = 4.5 at 22.2% effluent

Note: In this case, the AF = dilution ratio

Table 6: CYANIDE IN SHALLOW WATER DISCHARGER RECEIVING WATERS (µg/L)

	San Jose	Other SWD Data	ALL DATA
average	0.63	1.43	0.90
std dev	0.71	1.65	1.18
CV	1.14	1.16	1.31
n	149	76	225
90th percentile	1.60	4.00	2.20
99th percentile	3.46	6.70	6.43
max	4.20	6.70	6.70

APPENDIX L

City of San Jose Modified Analytical Methods for Total Cyanide

The City of San Jose Environmental Services Department used a modified version of Standard Methods 4500-CN B, C and E (Standard Methods, 20th Edition (APHA/AWWA/WEF 1998) Method B – Preliminary Treatment of Samples, Method C – Distillation, and Method E – Colorimetric determination) for the determination of cyanide in effluent and ambient water samples. Modifications to the methods were employed to optimize (lower) the detection limits for measuring total cyanide. Deviations from Standard Methods are shown below in bold.

Samples were preserved by the addition of NaOH to a pH of at least 12 and then stored at 4 degrees Centigrade. At the time of the analysis, **700 ml** of sample was placed in a 1-liter distillation flask. **40 ml of concentrated** sulfuric acid, **35 ml** of a concentrated MgCl2 solution, and 2 grams of sulfamic acid were added to each sample. The distillation equipment consisted of the distillation flask, a cold finger condenser, a sparger and the sparger vessel. An absorber solution of 0.04 N NaOH was added to the sparger vessel. The distillation flask was heated to boiling with a heating mantle and a stream of **nitrogen gas** was bubbled through each sample for **two hours**. The stream of **nitrogen gas** carries the hydrogen cyanide over to the absorbing solution into which the cyanide dissolves. An **8.75-fold concentration** of analyte occurred during the distillation step (**700 ml sample reduced to 80 ml** absorber solution). A 35-ml aliquot of the absorber solution was used for colorimetric analysis. A **35-ml sample** was pipetted into a 50-ml flask, color development reagents were added, and the final volume was brought up to **50 ml**. Therefore, the overall concentration effect was approximately **six-fold**. The color was allowed to develop for seven to fifteen minutes. Sample determination was done using a UV/VIS spectrophotometer set at 578 nm with a **10-cm** sample cell.

This modified procedure provided a Method Detection Limit (MDL) of 0.06 ppb for Bay water and distilled water. The procedure provided a MDL of 0.2 ppb in effluent. This resulted in Practical Quantitation Limits (PQLs) of 0.3 ppb in Bay water and 1.0 ppb in effluent using the protocol described in Standard Methods, 20th edition. In short, seven replicates of reagaent (matrix) water of known analyte concentration were analyzed. The standard deviation of the replicate analysis was multiplied by the appropriate student's t value to obtain the MDL. The PQL was set at five times the MDL.

Reference

City of San Jose. 2004. *Cyanide Attenuation Study*, Watershed Protection Group, Environmental Services Department, September 1.

APPENDIX M

Evaluation of Biological Community of Shallow Water Discharger Receiving Waters

There is a question whether existing concentrations of cyanide in the immediate vicinity of shallow water dischargers are having an adverse impact on aquatic organisms. A study performed in 1997 in the Palo Alto discharge channel has been reviewed to address this question. The results of this study provide a qualitative understanding of conditions in shallow sloughs near shallow water discharges in the San Francisco Bay.

Palo Alto Study Description

A comparative study of the Palo Alto discharge channel and a nearby tidal slough was conducted in 1997 to determine if the biological community in the discharge channel was stressed relative to channels not dominated by effluent. The Palo Alto discharge channel is a man-made channel created in the 1950's to convey treated effluent from the City of Palo Alto Water Quality Control Plant to San Francisco Bay. The channel is approximately 2000 feet long and ranges in width from 20 feet at low tide to 40 feet at high tide.

San Francisquito Creek is a tidally influenced natural stream that enters San Francisco Bay approximately 1000 feet northwest of the Palo Alto discharge channel. Water quality in San Francisquito Creek is marginally affected by the Palo Alto effluent discharge. Water quality modeling results performed for the City of Palo Alto in 1997 by RMA, Inc. indicate that the percentage of Palo Alto effluent at the mouth of San Francisquito Creek is approximately 20-30 percent.

The 1997 biological assessment included sampling for benthic organisms and fish at three locations in the discharge channel and three locations in San Francisquito Creek. Benthic samples were collected at low or incoming tide using an Eckman dredge. Three grab samples were taken at each location. Fish were collected at high tide using a bag seine with 0.5 inch mesh. Sediment samples were collected at each location from the center of the flow channel using an Eckman dredge and were analyzed for grain size and organic carbon concentrations.

Palo Alto Study Results

The results of the August 1997 biological assessment of benthic community and fish in the Palo Alto effluent channel indicated that it supported a diverse assemblage of aquatic fauna. The benthic community in the discharge channel was dominated by Arthropods (crustaceans *Corophium alienese* (amphipod), *Grandidierella japonica* (amphipod), and *Nippoleucon oregonensis*). Significant numbers of Mollusks (the clam *Macoma balthica*) and Annelids (oligochaete worms of the species *Tubificidae* and polychaete worms of the species *Eteone* and *Neanthes*) were also present. The types and abundances of organisms present in the channel were deemed to be representative of typical South Bay slough species and not indicative of highly stressed benthic communities. Results from the fish sampling effort indicated that topsmelt (*Atherinops affinis*) and northern anchovy (*Engraulis mordax*) were present in large numbers. These fish species are common to the sloughs of South San Francisco Bay.

As noted previously, a parallel sampling program was performed in San Francisquito Creek in the 1997 study to provide a reference for the sampling results for the discharge channel. Comparisons between the results from the discharge channel and the creek indicated the following:

- Benthic composition and density was similar in the two waters. Both waters support a diverse benthos community with strong numbers of marine/estuarine organisms.

- Mean diversity (as measured by the Shannon-Weaver diversity index) and equitability values for the benthic community were higher in the discharge channel. These values were not indicative of a highly stressed system; instead the values were typical of a tidal slough that experiences significant seasonal salinity variation.

- Numbers of taxa and numerical abundance of benthic organisms and fish (an indicator of productivity) was slightly higher in the creek than in the discharge channel; the hypothesis offered for this difference was a reduced opportunity for primary productivity in the dead-end effluent channel as opposed to the natural creek system tributary to San Francisquito Creek.

- Sediment grain size and organic carbon content were similar in the creek and discharge channel.

In the Conclusions for the 1997 study, it is stated that the discharge channel "supports a diverse and healthy aquatic fauna". In the Executive Summary, it is stated that the "diversity and equitability indices indicate a healthy environment in both waterways".

Discussion

Palo Alto provides a reasonable case study to evaluate local effects of cyanide. This plant is a type of worst-case scenario with respect to cyanide because of three factors: (1) shallow discharge into a dead-end slough, (2) known industrial sources of cyanide to the influent, and (3) the plant processes includes chlorination and biosolids incineration, both documented in-plant sources of cyanide. In addition, of the 225 samples near shallow water discharges, the seven highest receiving water concentrations were documented in the Palo Alto effluent channel. If biological effects of current operations would be detected anywhere in San Francisco Bay, it would be in the Palo Alto receiving waters.

During 1995-1996, the Palo Alto tertiary effluent discharge rate ranged from 20.4 to 43.9 mgd. In the month of August in 1995-1996, the average flow rate was 23.6 mgd. The effluent concentration of cyanide for 1995-1996 ranged from less than 3 to 40 µg/l. Palo Alto's WQCP processes include advanced secondary processes, with activated sludge, nitrification, filtration and chlorine disinfection. Palo Alto is one of two facilities in the Bay area that incinerates its biosolids; return flows air scrubbing system for the incineration process contains cyanide. In the period from 2000 to 2003, effluent cyanide levels for Palo Alto averaged 3.3 µg/l, with maximum levels of 5.0 µg/l. From inspection of the effluent summary statistics presented in Table 16, it is observed that cyanide levels in the Palo Alto effluent are similar to a number of other Shallow Water Dischargers.

The most sensitive saltwater species to free cyanide is the copepod, *Acartia clausi*. The LC50 value for *Acartia* is 30 µg/l; the estimated concentration for no acute effects to *Acartia* is 15 µg/l. *Acartia clausi* is an estuarine copepod that exists globally and is the most abundant zooplankton species in San Francisco Bay (Davis, 1982). It is a prey organism for small fish such as anchovy. Sampling in the Palo Alto discharge channel did not include zooplankton collections, so direct information on the presence or abundance of *Acartia* in the channel is not available from the 1997 study. However, the presence of significant numbers of Northern Anchovy in the discharge channel at levels comparable to those in San Francisquito Creek suggests that prey items in the discharge channel were supportive of upper trophic level organisms.

The most acutely sensitive freshwater species to cyanide is Rainbow trout. This freshwater species would not be expected to be found in the Palo Alto discharge channel, which is a dead-end slough with very limited freshwater habitat. The estimated no acute effect concentration for Rainbow trout is 22 µg/l. In the event Rainbow trout were able to inhabit the discharge channel, acutely toxic conditions would not occur for this sensitive species. The most sensitive freshwater species to chronic effects are brook trout, bluegill and fathead minnow (see Section 4.5.2, Table 13). As for rainbow trout, these obligate freshwater species would not be able to tolerate the salinity conditions in the Palo Alto discharge channel.

Conclusions

Despite levels of cyanide in the Palo Alto effluent channel that exceed the NTR cyanide objective of 1.0 µg/l and the site specific chronic objective of 2.9 µg/l, the biological community in the Palo Alto discharge channel supports a diverse and healthy assemblage of aquatic organisms. This provides qualitative evidence to suggest that the proposed effluent limits and Cyanide Action Plan for Palo Alto and other shallow water dischargers, which will maintain existing effluent concentrations of cyanide, will be protective of aquatic life uses in the vicinity of those discharges.

Reference

Cressey, S. 1997. *Benthos and Fisheries Assessment, Palo Alto Wastewater Treatment Plant Discharge Channel.* Prepared for the City of Palo Alto under subcontract to Larry Walker Associates. November 1997.