City of San José

San José/Santa Clara Water Pollution Control Plant Master Plan

TASK NO. 3
PROJECT MEMORANDUM NO. 2
HISTORICAL WASTEWATER AND RECEIVING WATER CHARACTERISTICS

FINAL DRAFT
July 2009

in association with

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CITY OF SAN JOSÉ

SAN JOSÉ/SANTA CLARA WATER POLLUTION CONTROL PLANT MASTER PLAN

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TABLE OF CONTENTS

Page No.

LIST OF TABLES

LIST OF FIGURES

HISTORICAL WASTEWATER AND RECEIVING WATER CHARACTERISTICS

1.0 INTRODUCTION

The purpose of this project memorandum (PM) is to examine historically recorded wastewater quality for the San José/Santa Clara Water Pollution Control Plant (WPCP), as well as the quality of onsite stormwater, groundwater, and receiving water.

Water quality data from 1998 to 2007 were used for the analysis. The various load definitions used throughout this PM are listed and defined in Table 1, along with the purpose each will serve in master planning future facilities. Table 1 also includes flow definitions that are used in PM 3.1.

The evaluation of historical wastewater water quality will be used to develop projections of future influent water quality in PM 3.8. This information will then be used in part to determine future treatment process capacity needs, based on the projected influent loads and concentrations and the existing WPCP capacity, and future level of treatment needs, by comparing projected effluent quality to future regulatory requirements.

This evaluation includes the examination of influent concentrations and loads for the conventional pollutants total suspended solids (TSS) and biochemical oxygen demand (BOD). In addition, influent loads and concentrations of ammonia-nitrogen were evaluated. For these three parameters, the loads were evaluated based on the averaging periods shown in Table 1.

Concentrations of non-conventional pollutants in influent and effluent wastewater were also examined. The non-conventional pollutants examined in the PM include selected metals, cyanide, selected organics, microbials, total dissolved solids (TDS), conductivity, and hardness.

In addition to evaluating the WPCP influent and effluent wastewater characteristics, onsite stormwater, groundwater, and receiving water characteristics were examined. This evaluation provides information on the water resources that may potentially be affected by the WPCP and focused on concentrations of metals, organics, and TDS.

2.0 CONVENTIONAL POLLUTANTS

The conventional wastewater pollutants examined include BOD, TSS, and nutrients, including ammonia-nitrogen, nitrate, and phosphate. Influent samples are collected from the main raw sewage wet well. This location includes contributions from recycle streams. The sampling locations are shown in the process train schematics in the Appendix. The impact of the recycle streams on influent pollutant loads is addressed in Section 2.2.

Table 1 Wastewater Flow and Loading Definitions
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Term	Definition	Purpose
Wastewater Flow Definitions		
ADWIF	Average Dry Weather Influent Flow The average daily flow over any five weekday period between the months of June and October. The maximum of the weekday averages is reported for permit compliance.	To assess future permit compliance.
ADWF[1]	Average Dry Weather Flow The average daily influent flow occurring over the three consecutive lowest flow months in the dry weather season (May through October).	To develop base wastewater flow projections and to evaluate taking various process units out of service. Often used when describing nameplate capacity of treatment plants.
ADWEF	Average Dry Weather Effluent Flow The average daily effluent flow occurring over the three consecutive lowest flow months in the dry weather season (May through October).	To assess future permit compliance.
ADAF	Average Daily Annual Flow The average daily flow or loading for an annual period.	To evaluate annual power use.
ADMMF	Average Daily Maximum Month Flow The average daily flow occurring during the peak flow month of the year. Peak flow and peak loadings do not necessarily have to occur in the same month. ADMMF typically occurs in the wet season (November through April).	To size wastewater treatment facilities to meet 30-day National Pollutant Discharge Elimination System (NPDES) permit requirements.
PHWWF	Peak Hour Wet Weather Flow The peak hour flow resulting from a rainfall event.	To set plant hydraulic capacity.
MDWWF	Maximum Day Wet Weather Flow The maximum daily flow occurring in the wet season (November through April).	Used to evaluate ability to meet daily max permit limits.
Wastewater Load Definitions		
ADWL	Average Dry Weather Load The average daily loading occurring over the three consecutive lowest flow months in the dry weather season (May through October).	To develop base wastewater load projections and to provide the basis for sizing certain treatment facilities.

Table 1 Wastewater Flow and Loading Definitions (Continued)
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Term	Definition	Purpose
ADAL	Average Daily Annual Load The average daily loading for an annual period.	To size certain solids facilities (such as lagoons and drying beds) and evaluate annual power use.
ADMML	Average Daily Maximum Month Load The average daily organic or suspended solids loading occurring during the peak loading month of the year. Peak flow and peak loadings do not necessarily have to occur in the same month.	To size wastewater treatment facilities to meet 30-day NPDES permit requirements and sizing for various solids handling facilities including digesters and thickening equipment.
AWL	Average Week Load The average daily loading occurring during the average week flow.	To size certain liquids facilities for operational considerations.
MDDWL	Maximum Day Dry Weather Load The maximum day loading occurring during the dry weather season (May through October).	Together with consideration of diurnal variation, often used to determine aeration demands as well as to check max day requirements.
MDWWL	Maximum Day Wet Weather Load The maximum daily loading occurring in the wet season (November through April).	Together with consideration of diurnal variation, often used to determine aeration demands as well as to check max day requirements.
MWWWL	Maximum Week Wet Weather Load The maximum week loading occurring in the wet season (November through April).	Used in a biological nutrient removal plant to determine the solids retention time for nitrification and denitrification.
MPWL	Mean Peak Week Load The average daily loading occurring during the maximum average week.	Used in solids process calculations to determine process sizing.

Note:

(1) This definition for ADWF is equivalent to the Average Dry Weather Effluent Flow (ADWEF) in the WPCP NPDES Permit (No. CA0037842). In this PM, the ADWF averaging period is used to calculate the ADWL.

2.1 Influent Concentrations

Figures 1 and 2 present the influent TSS and BOD concentration data, respectively, from 1998 to 2007. Both of these figures include the 24-hour composite samples collected approximately three times per week, as well as the annual average concentrations. BOD and TSS concentrations have varied over the study period. Average annual influent BOD and TSS concentrations range from approximately 283 to 336 milligrams per liter (mg/L), and from approximately 279 to 322 mg/L, respectively. There are no apparent long term trends with time in the BOD and TSS data.

The influent nutrient data for the WPCP is limited to ammonia-nitrogen. Figure 3 presents the influent ammonia-nitrogen concentration data. The 24-hour composite samples from 1998 to 2007, collected on a daily basis, and the annual average concentrations are included in Figure 3. The influent ammonia-nitrogen concentrations have varied over the study period, but show a generally increasing trend that is likely due to water conservation. Average annual influent ammonia-nitrogen concentrations range from 21 mg/L as N in 1998 to 28 mg/L as N in 2007.

2.2 Monthly, Seasonal and Annual Loadings

BOD, TSS, and ammonia-nitrogen loads were calculated using the daily averaged flow multiplied by the 24-hour composite concentrations. These loads were then used to determine loads on various averaging periods including monthly, seasonally, and annually. The seasonal loads for each year include loads calculated for the wet and dry seasons.

To quantify the impact of the plant recycle streams on the influent load the load contributions from the recycle streams were estimated. The contribution of the recycle streams to the influent loads was evaluated using available flow and water quality data. The recycle streams include the lagoon supernatant, the dissolved air floatation (DAF) thickener bottom sludge, and WPCP process water. Available flow and water quality data for the recycle streams was limited to the period between November 8, 2005 and December 31, 2007. The lagoon supernatant data included flow data metered prior to entry to the lagoons. This flow value is a conservative number because there are evaporative losses in the lagoon that likely lead to a lower flow volume that is returned to the headworks for treatment. Water quality data for the supernatant included BOD, TSS, and ammonia-nitrogen. The DAF bottom sludge flow is metered, but no water quality data were available. The assumed concentrations for BOD, TSS, and ammonia-nitrogen were 100, 1,000, and 20 mg/L, respectively. These concentrations are conservative estimates of the water quality in this return flow based on knowledge of the DAF process performance.

The WPCP process water is metered but no data were available. It was assumed that the WPCP process water has similar water quality as the WPCP effluent, and therefore the final effluent concentrations were assumed. In addition to the recycled flows, stormwater is routed to the headworks for treatment. There are no available flow or water quality data for

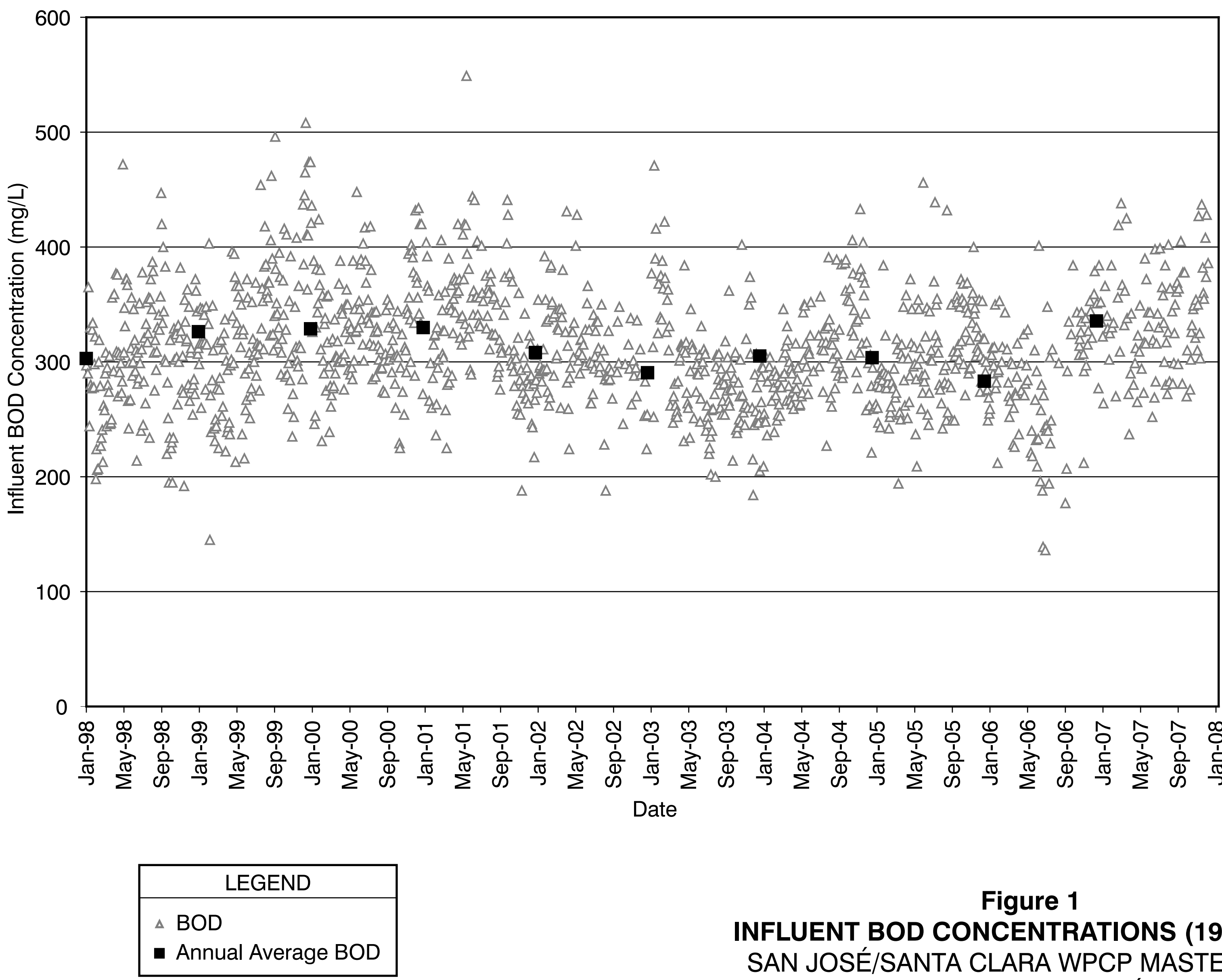

Figure 1
INFLUENT BOD CONCENTRATIONS (1998-2007)
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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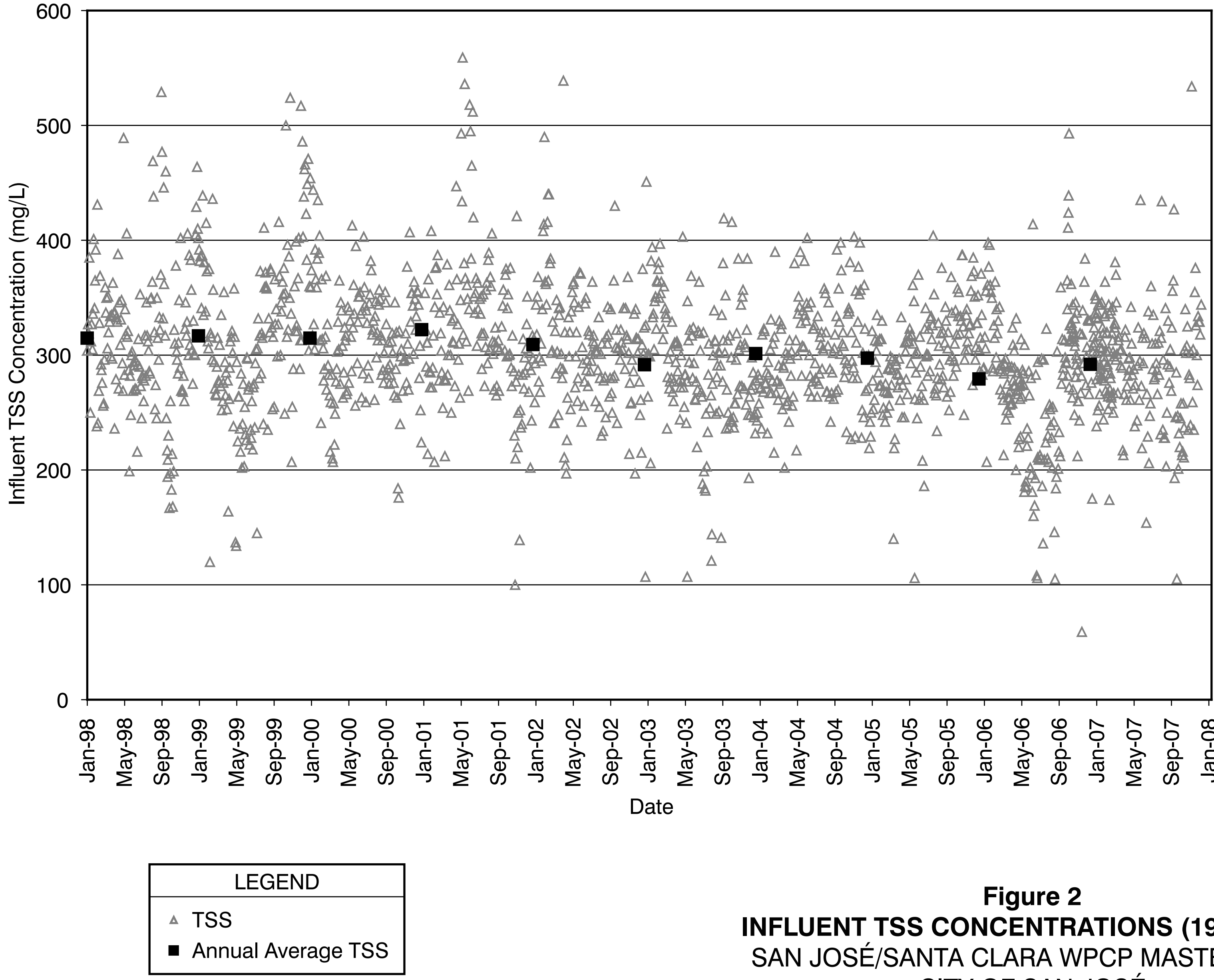

Figure 2
INFLUENT TSS CONCENTRATIONS (1998-2007)
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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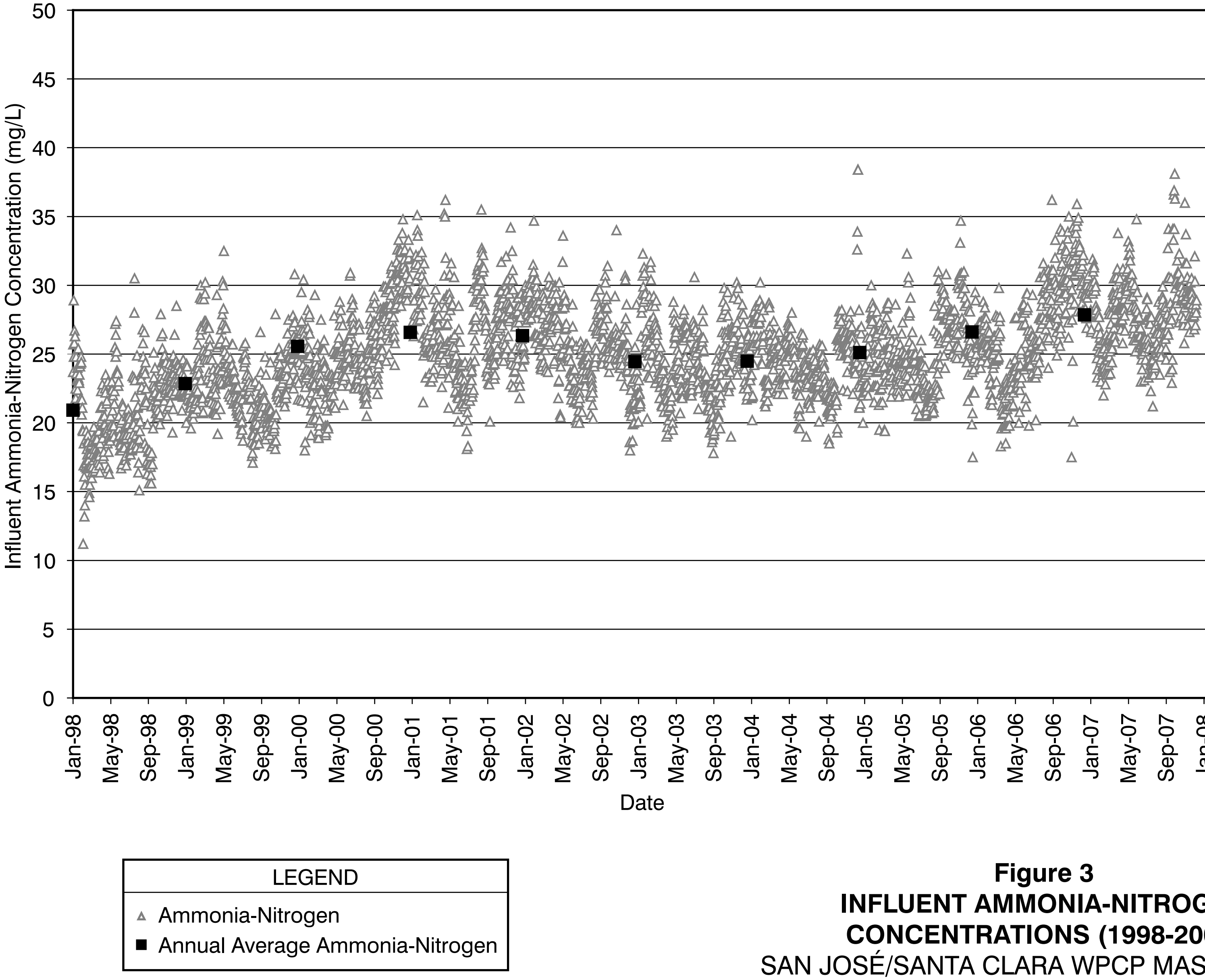

Figure 3
INFLUENT AMMONIA-NITROGEN CONCENTRATIONS (1998-2007)
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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stormwater. However, it is assumed that the stormwater contributions are intermittent and have relatively low BOD, TSS, and ammonia-nitrogen loads relative to the influent wastewater.

Results of the analysis indicated that average BOD and TSS contributions from the recycle streams are small, contributing less than 4 percent of the average day annual load (ADAL). The average ammonia-nitrogen load from the lagoon supernatant is approximately 3,740 pounds per day (lbs/day), which is approximately 14 percent of the ammonia-nitrogen ADAL.

The monthly average BOD, TSS and ammonia-nitrogen loads from 1998 to 2007 include recycle flow contributions and are presented in Figures 4 through 6, respectively. The loads have varied over the study period, with the greatest loads typically occurring in the winter or early spring. The BOD and TSS loads have generally decreased slightly while the ammonia-nitrogen loads have increased slightly.

The BOD, TSS, and ammonia-nitrogen loads were calculated for several different averaging periods. Tables 2 through 4 include the ADALs as well as dry weather and wet weather loads, including ADWL, MDDWL, MDWWL, MWWWL, and ADMML. Through initial load calculations for the various averaging periods and per discussion with City staff, it was determined that a 2 standard deviation outlier test should be conducted on the BOD and TSS loads. The outlier test was conducted on the BOD and TSS loads for each year. Within each year the dry weather season loads (May 1 through October 31) were analyzed for outliers, and each of the wet months within the year were analyzed separately for BOD and TSS outliers.

These annual and seasonal loads are presented graphically for BOD, TSS, and ammonia-nitrogen in Figures 7 through 9, respectively. The annual and seasonal BOD, TSS, and ammonia-nitrogen loads have varied over the study period. In general, the BOD and TSS loads have decreased slightly over the study period. There is a slight increase in the ammonia-nitrogen ADAL and ADWL. For BOD, TSS, and ammonia-nitrogen, the ADWLs are generally less than the ADALs. As expected, the ADMMLs are greater than the ADALs, but less than the maximum week and maximum day loads. The MDDWLs for ammonia-nitrogen are greater than the MDWWLs in 1998 and 2005 through 2007. In these years, relatively high ammonia-nitrogen concentrations occurring in the dry weather seasons led to greater MDDWLs than MDWWLs.

Peaking factors or loading ratios for the various loads relative to the ADWLs are presented for BOD, TSS and ammonia-nitrogen in Table 5. The 10-year and 5-year average ratios are also included in Table 5. While the peaking factors have varied, there are no apparent long term trends. The 10-year and 5-year averages are similar for BOD, TSS and ammonia-nitrogen.

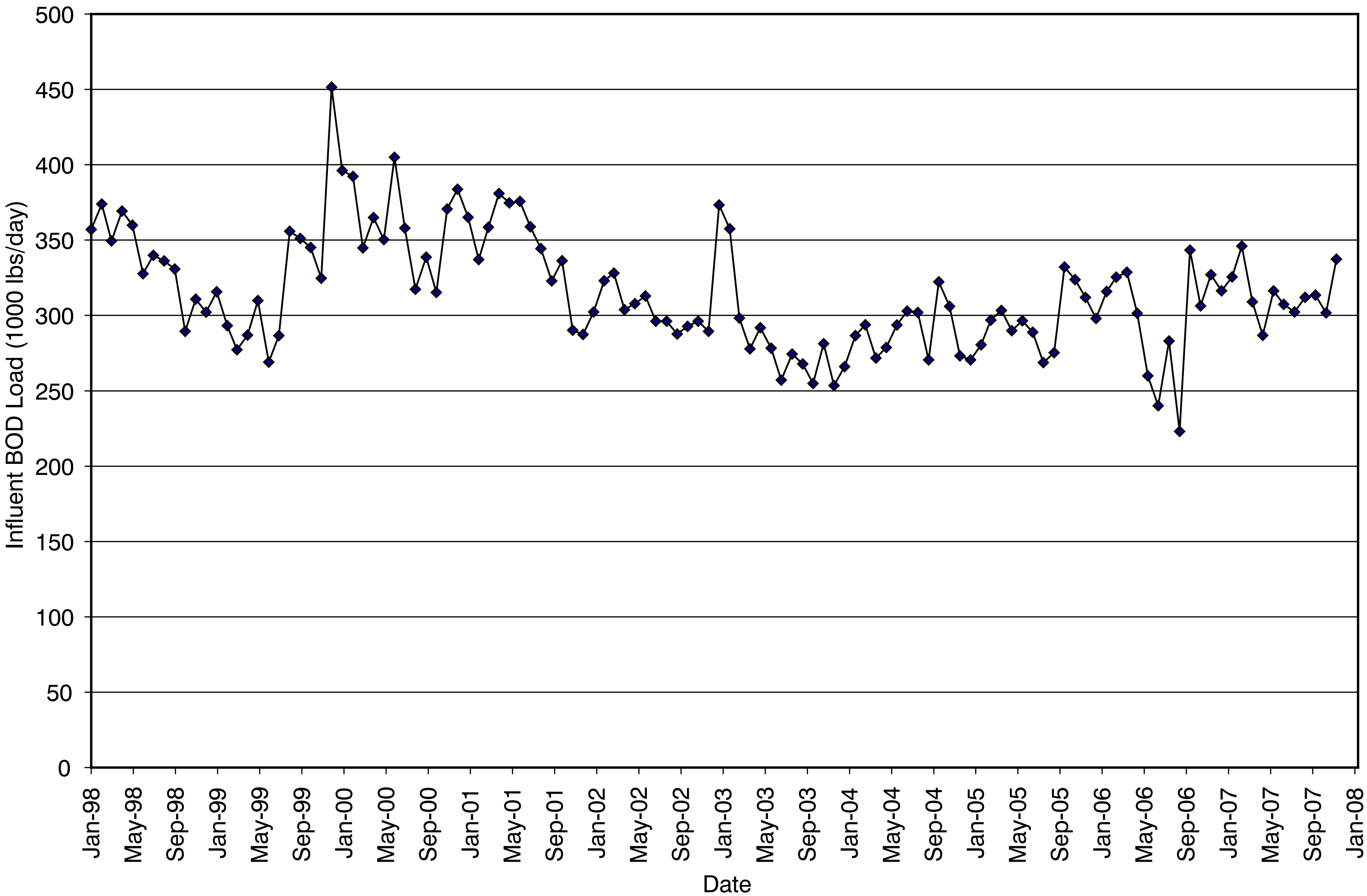

Figure 4
MONTHLY AVERAGED INFLUENT BOD LOADS (1998-2007)
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CITY OF SAN JOSÉ

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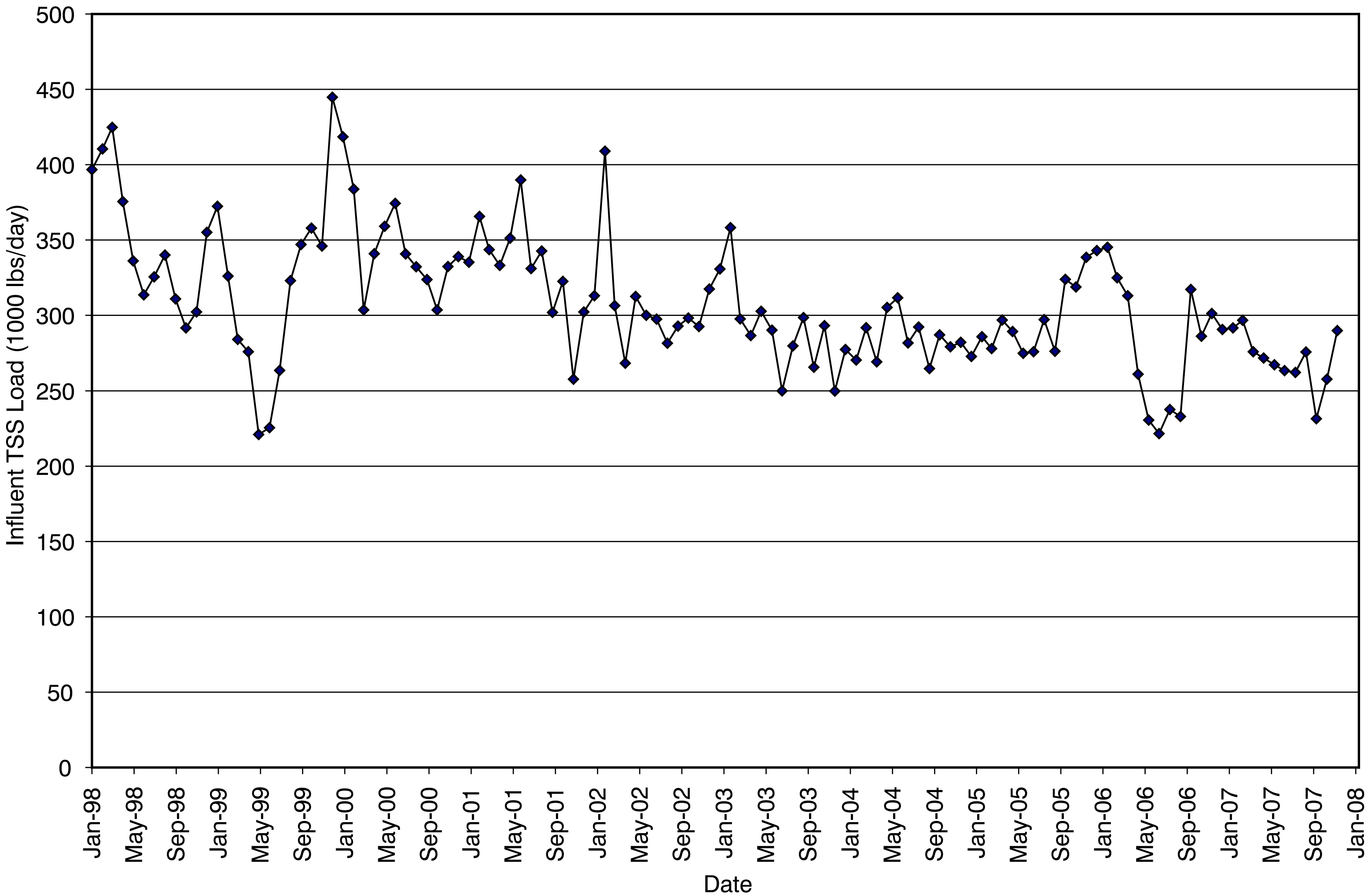

Figure 5
MONTHLY AVERAGED INFLUENT
TSS LOADS (1998-2007)
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CITY OF SAN JOSÉ

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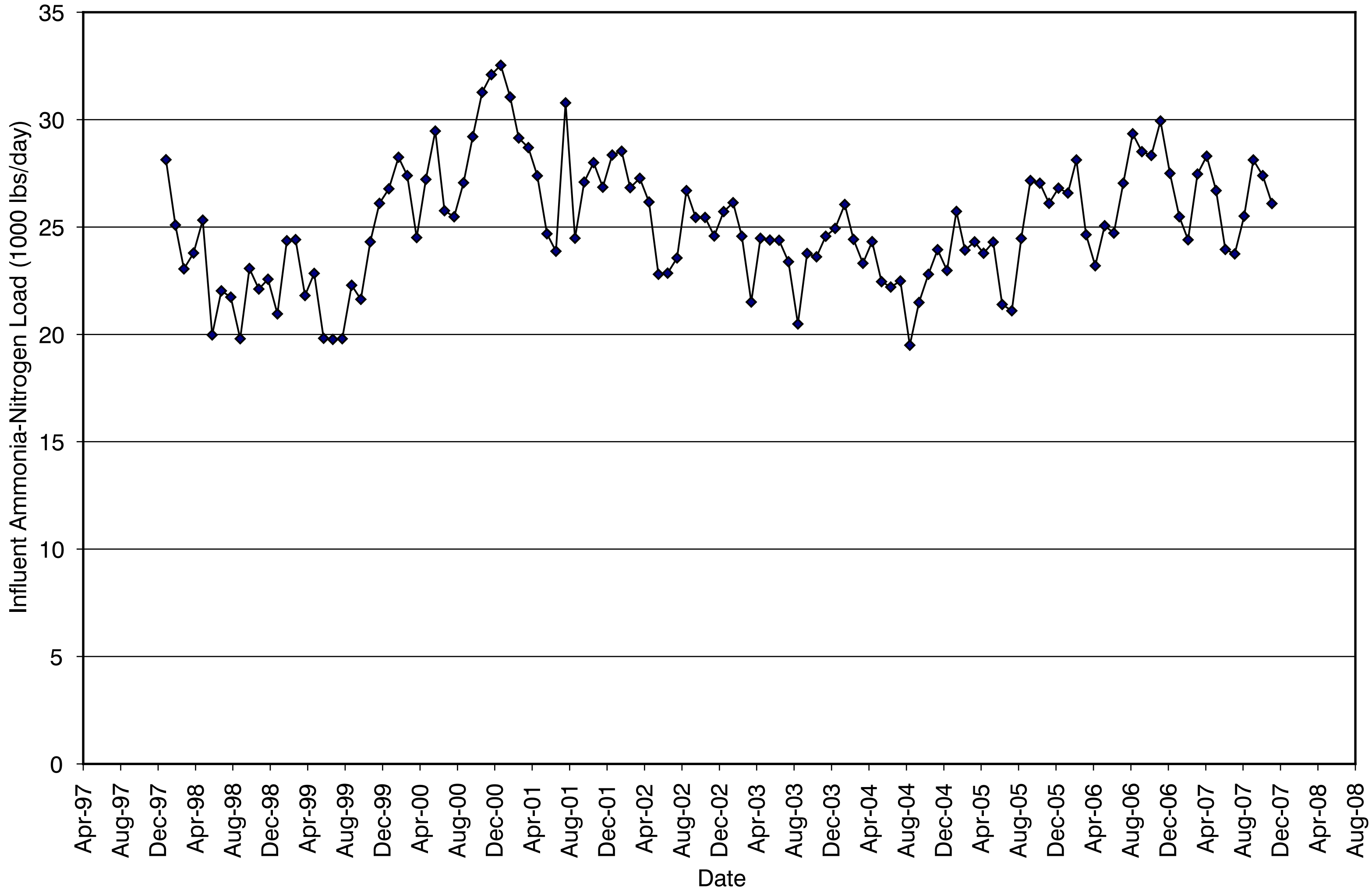

Figure 6
MONTHLY AVERAGED INFLUENT
AMMONIA-NITROGEN LOADS (1998-2007)
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CITY OF SAN JOSÉ

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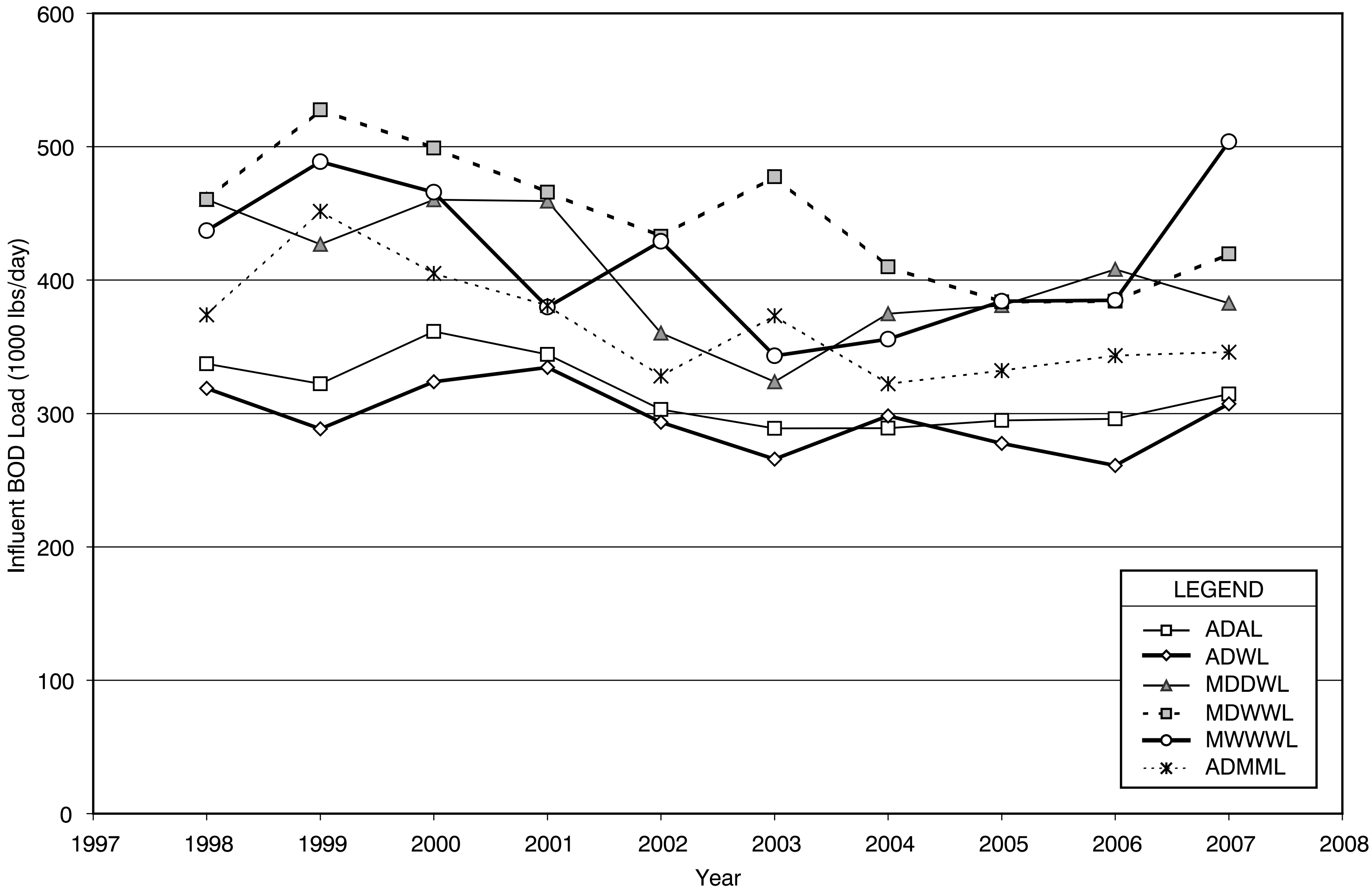

Figure 7
ANNUAL AND SEASONAL BOD LOADS
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CITY OF SAN JOSÉ

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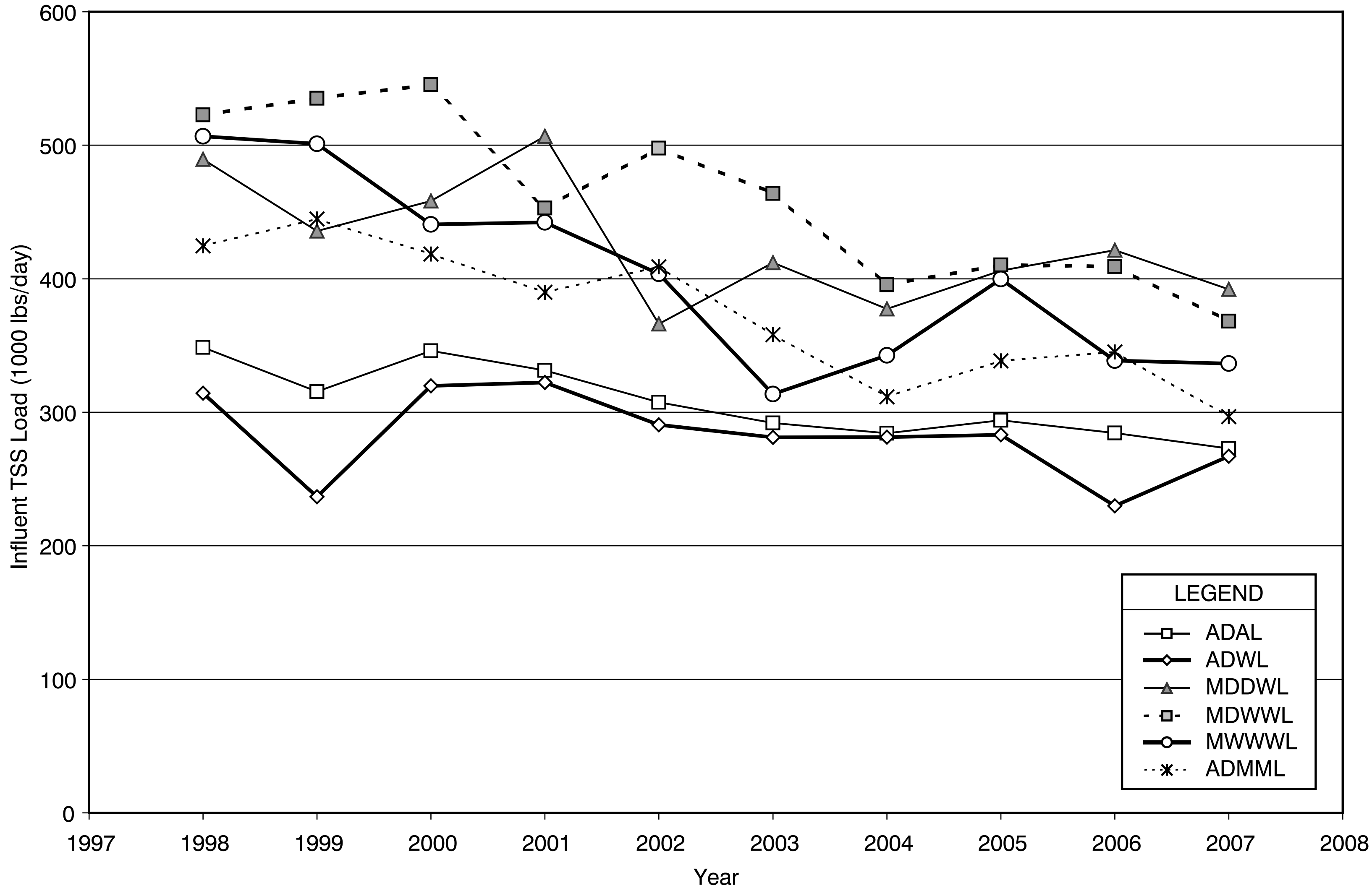

Figure 8
ANNUAL AND SEASONAL TSS LOADS
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

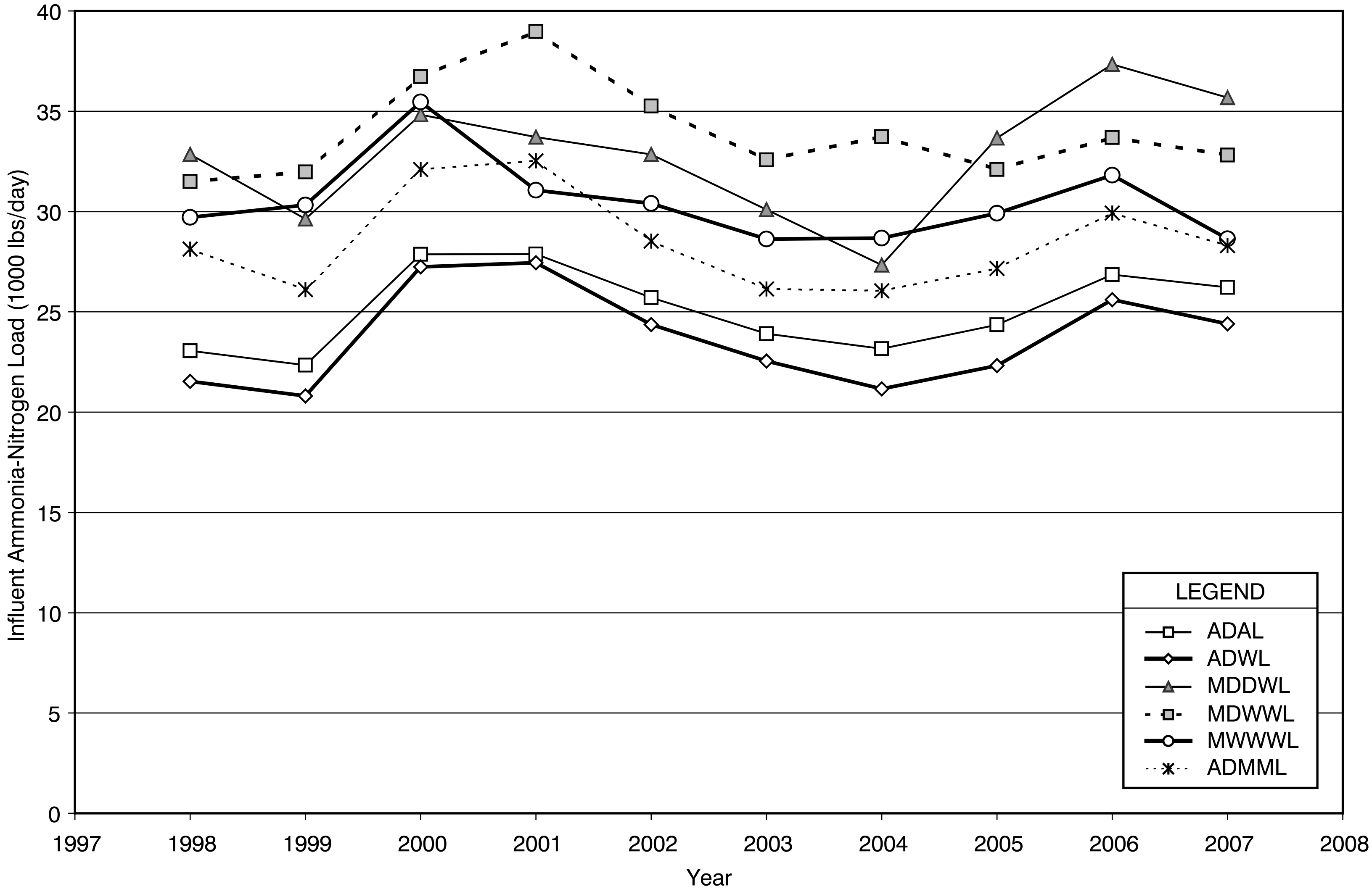

Figure 9
ANNUAL AND SEASONAL AMMONIA-NITROGEN LOADS
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CITY OF SAN JOSÉ

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Table 2 Annual, Seasonal, and Peak Influent BOD Loadings
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

	Average Day Annual Loading (1000 lbs/day)	Year		Wet Weather		
		Average Daily (1000 lbs/day)	Maximum Day (1000 lbs/day)	Maximum Day (1000 lbs/day)	Maximum Week (1000 lbs/day)	Maximum Month(1) (1000 lbs/day)
1998	337	319	460	460	437	374
1999	322	289	427	528	489	452
2000	361	324	460	499	466	405
2001	344	335	459	466	380	381
2002	303	293	360	433	429	328
2003	289	266	324	477	343	373
2004	289	298	375	410	356	322
2005	295	278	381	384	384	332
2006	296	261	408	384	385	343
2007	315	307	383	420	504	346
Avg.(2)	315	297	404	446	417	366

Notes:

(1) Maximum month loads typically occur during the wet weather season. However, the ADMML was determined by taking the maximum of the monthly average loads over the entire year.

(2) Avg. = 10-year average.

Table 3 Annual, Seasonal, and Peak Influent TSS Loadings
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Year	Average Day Annual Loading (1000 lbs/day)	Dry Weather		Wet Weather		
		Average Daily (1000 lbs/day)	Maximum Day (1000 lbs/day)	Maximum Day (1000 lbs/day)	Maximum Week (1000 lbs/day)	Maximum Month(1) (1000 lbs/day)
1998	349	314	490	523	507	425
1999	316	237	436	535	501	445
2000	346	320	458	545	441	419
2001	331	322	507	453	442	390
2002	307	291	366	498	404	409
2003	292	281	412	464	314	358
2004	284	281	377	395	343	312
2005	294	283	406	410	400	338
2006	285	230	421	409	339	345
2007	273	267	392	368	337	297
Avg.(2)	308	283	427	460	403	374

Notes:

(1) Maximum month loads typically occur during the wet weather season. However, the ADMML was determined by taking the maximum of the monthly average loads over the entire year.

(2) Avg. = 10-year average

Table 4	Annual, Seasonal, and Peak Influent Ammonia-Nitrogen Loadings San José/Santa Clara Water Pollution Control Plant Master Plan City of San José					
		Dry Weather		Wet Weather		
Year	Average Day Annual Loading (1000 lbs/day)	Average Daily (1000 lbs/day)	Maximum Day (1000 lbs/day)	Maximum Day (1000 lbs/day)	Maximum Week (1000 lbs/day)	Maximum Month[1] (1000 lbs/day)
1998	23.1	21.5	32.9	31.5	29.7	28.1
1999	22.3	20.8	29.6	32.0	30.3	26.1
2000	27.9	27.2	34.8	36.7	35.5	32.1
2001	27.9	27.4	33.7	39.0	31.1	32.5
2002	25.7	24.4	32.9	35.3	30.4	28.5
2003	23.9	22.5	30.1	32.6	28.6	26.1
2004	23.2	21.2	27.3	33.7	28.7	26.1
2005	24.4	22.3	33.7	32.1	29.9	27.2
2006	26.9	25.6	37.3	33.7	31.8	29.9
2007	26.2	24.4	35.7	32.8	28.6	28.3
Avg.[2]	25.1	23.7	32.8	33.9	30.5	28.5

Notes:

(1) Maximum month loads typically occur during the wet weather season. However, the ADMML was determined by taking the maximum of the monthly average loads over the entire year.

(2) Avg. = 10-year average.

2.3 Day of the Week TSS, BOD, and Ammonia-Nitrogen Loading Variations

A comparison between day of the week dry weather loadings for 2002 and 2007 was made to determine if the proportion of wastewater loads received during the week has changed significantly. The average daily BOD, TSS, and ammonia-nitrogen loads for each day of the week are presented in Tables 6 through 8, respectively. Average daily loads were not calculated if there were less than 6 sampling events occurring on that day within the six month dry weather season.

For BOD and TSS, most of the data in 2002 and 2007 were collected on Mondays, Wednesdays, and Fridays, therefore a weekday versus weekend comparison is not feasible. Ammonia-nitrogen loads were available each day of the week in 2002 and 2007. There is not a distinct weekday versus weekend difference in 2002 or in 2007.

2.4 Influent and Effluent Nutrient Concentrations

In addition to ammonia-nitrogen, nitrate and phosphate data were compiled. The nitrate and phosphate data is limited to effluent concentrations. A summary of the averages and ranges of concentrations is presented in Table 9. Influent ammonia-nitrogen concentrations were discussed in Section 2.1. The influent ammonia-nitrogen concentrations include the contribution from the recycle streams. Average effluent ammonia-nitrogen concentrations range from 0.3 to 1.2 mg/L and show a generally decreasing trend from 1998 to 2007.

Table 5	Loading Ratios for BOD, TSS, and Ammonia-Nitrogen San José/Santa Clara Water Pollution Control Plant Master Plan City of San José				
Year	**ADAL/ ADWL**	**MDDWL/ ADWL**	**MDWWL/ ADWL**	**MWWWL/ ADWL**	**ADMML/ ADWL**
			BOD		
1998	1.1	1.4	1.4	1.4	1.2
1999	1.1	1.5	1.8	1.7	1.6
2000	1.1	1.4	1.5	1.4	1.3
2001	1.0	1.4	1.4	1.1	1.1
2002	1.0	1.2	1.5	1.5	1.1
2003	1.1	1.2	1.8	1.3	1.4
2004	1.0	1.3	1.4	1.2	1.1
2005	1.1	1.4	1.4	1.4	1.2
2006	1.1	1.6	1.5	1.5	1.3
2007	1.0	1.2	1.4	1.6	1.1
5 yr Average	1.1	1.3	1.5	1.4	1.2
10 yr Average	1.1	1.4	1.5	1.4	1.2
			TSS		
1998	1.1	1.6	1.7	1.6	1.4
1999	1.3	1.8	2.3	2.1	1.9
2000	1.1	1.4	1.7	1.4	1.3
2001	1.0	1.6	1.4	1.4	1.2
2002	1.1	1.3	1.7	1.4	1.4
2003	1.0	1.5	1.6	1.1	1.3
2004	1.0	1.3	1.4	1.2	1.1
2005	1.0	1.4	1.4	1.4	1.2
2006	1.2	1.8	1.8	1.5	1.5
2007	1.0	1.5	1.4	1.3	1.1
5 yr Average	1.1	1.5	1.5	1.3	1.2
10 yr Average	1.1	1.5	1.6	1.4	1.3
			Ammonia-Nitrogen		
1998	1.1	1.5	1.5	1.4	1.3
1999	1.1	1.4	1.5	1.5	1.3
2000	1.0	1.3	1.3	1.3	1.2
2001	1.0	1.2	1.4	1.1	1.2
2002	1.1	1.3	1.4	1.2	1.2
2003	1.1	1.3	1.4	1.3	1.2
2004	1.1	1.3	1.6	1.4	1.2
2005	1.1	1.5	1.4	1.3	1.2
2006	1.0	1.5	1.3	1.2	1.2
2007	1.1	1.5	1.3	1.2	1.2
5 yr Average	1.1	1.4	1.4	1.3	1.2
10 yr Average	1.1	1.4	1.4	1.3	1.2

Table 6 Daily BOD Loading Averages (2002, 2007)
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Day of the Week	2002 Load (1000 lbs/day)	2007 Load (1000 lbs/day)
Monday	280	286
Tuesday	NA	NA
Wednesday	312	320
Thursday	NA	NA
Friday	308	317
Saturday	NA	NA
Sunday	NA	NA

Note:
NA = Not Available.

Table 7 Daily TSS Loading Averages (2002, 2007)
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Day of the Week	2002 Load (1000 lbs/day)	2007 Load (1000 lbs/day)
Monday	293	259
Tuesday	NA	NA
Wednesday	291	274
Thursday	NA	NA
Friday	308	275
Saturday	NA	NA
Sunday	NA	NA

Note:
NA = Not Available.

Table 8 Daily Ammonia-Nitrogen Loading Averages (2002, 2007)
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Day of the Week	2002 Load (1000 lbs/day)	2007 Load (1000 lbs/day)
Monday	23.9	25.5
Tuesday	24.8	27.1
Wednesday	24.6	26.5
Thursday	24.7	26.3
Friday	25.4	26.6
Saturday	24.9	25.5
Sunday	23.8	24.7

Table 9 Influent and Effluent Nutrient Concentrations San José/Santa Clara Water Pollution Control Plant Master Plan City of San José

Nutrient	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Ammonia-Nitrogen										
Influent (mg/L)	20.9	22.9	25.5	26.6	26.3	24.5	24.5	25.1	26.6	28.0
Effluent (mg/L)	–(1)	–(1)	0.90	0.27	0.42	0.32	0.26	0.31	0.35	0.45
Nitrate (NO_3-N)										
Effluent (mg/L)	–(1)	–(1)	9.8	8.1	8.5	7.2	7.4	8.4	NA	NA
Phosphate										
Effluent (mg/L)	–(1)	–(1)	4.9	4.1	3.7	NA	NA	NA	NA	NA

Notes:
NA = Not Available.
(1) Data from 1998 and 1999 not used due to unusual operation of the treatment plant during that period.

Average effluent nitrate (NO_3-N) concentrations range from 8.4 to 9.8 mg/L. Average effluent phosphate concentrations range from 3.7 to 4.9 mg/L. Additional discussion of treatment performance is included in PM 3.3.

3.0 NON-CONVENTIONAL POLLUTANTS

The analysis of non-conventional pollutants is based on water quality data collected from the main raw sewage wet well and includes contributions from the recycle streams. Data for the non-conventional pollutants in the recycle streams were not provided in the dataset. The effect of the recycle streams on concentrations of non-conventional pollutants was not quantified.

The non-conventional pollutants examined in the PM include the following:

- Metals: Copper, mercury, nickel and selenium.
- Cyanide.
- Organics: 4,4'-DDE, dieldrin, heptachlor, heptachlor epoxide, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, dioxin, tributyltin, polychlorinated biphenyls (PCBs), and diazinon.
- Microbial constituents: Total coliform, fecal coliform, and enterococci.
- Other constituents: TDS, conductivity, and hardness.

As discussed in PM 4.1, several constituents of the WPCP discharge might have the potential to violate Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) objectives. The San Francisco Bay Regional Water Quality Control Board (RWQCB) conducted a reasonable potential analysis (RPA) to determine the constituents of the WPCP discharge may have the potential to exceed Basin Plan objectives. Water Quality Based Effluent Limits (WQBELs) are included in the WPCP's current NPDES permit for these constituents. The RWQCB has also completed an RPA for the purpose of drafting the next permit, and the results of this analysis form the basis for the WQBELs included in the preliminary Draft Permit. In addition, the City prepared a RPA for the purpose of this master planning process to identify constituents that would have WQBELs in the next permit cycle. The results of this informal RPA are for planning purposes only.

For the master planning process, the constituents with WQBELs in the current permit and the preliminary Draft Permit were considered "pollutants of concern" (POCs) and include the metals, cyanide and the organic compounds based on discussions with City staff. Proposed final permit limits were included in the Draft NPDES Permit issued in August 2008. The POCs are evaluated in Section 3.1 with the exception of ammonia-nitrogen, which was discussed in Section 2.4.

3.1 Pollutants of Concern

3.1.1 Metals and Cyanide

Influent and effluent metals and cyanide data were compiled for years 2003 through 2007. Table 10 presents a summary of the data. For values less than the reporting limit, the reporting limit value was assumed for the purpose of calculating the average concentrations. Figures 10 through 14 show the influent and effluent concentrations for the metals and cyanide from 2003 to 2007. All metals concentrations are expressed as the total concentration. Data for dissolved metals were not available.

Table 10 Summary of Influent and Effluent Metals Concentrations
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

	Influent			Effluent		
Pollutant	**N**	**No. less than RL**	**Average Concentration (μg/L)**	**N**	**No. less than RL**	**Average Concentration (μg/L)**
Copper	463	0	104	244	5	2.90
Mercury	418	0	0.260	100	6	0.00368
Nickel	446	0	13.3	247	1	6.29
Selenium	59	0	2.05	66	0	0.45
Cyanide	357	325	5.0	332	312	5.1

Notes:
N = Number of Samples.
RL = Reporting Limit.

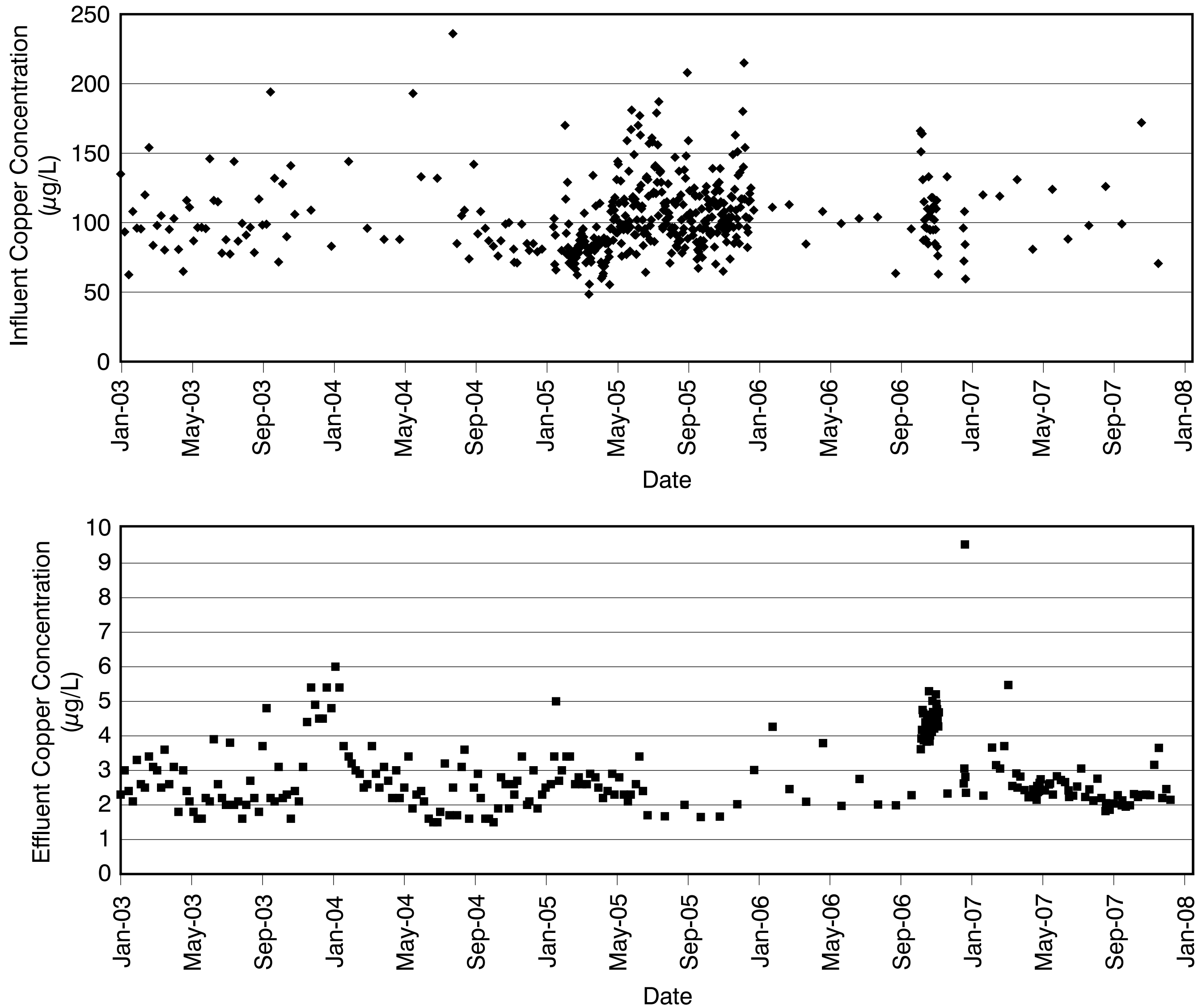

Figure 10
INFLUENT AND EFFLUENT COPPER CONCENTRATIONS
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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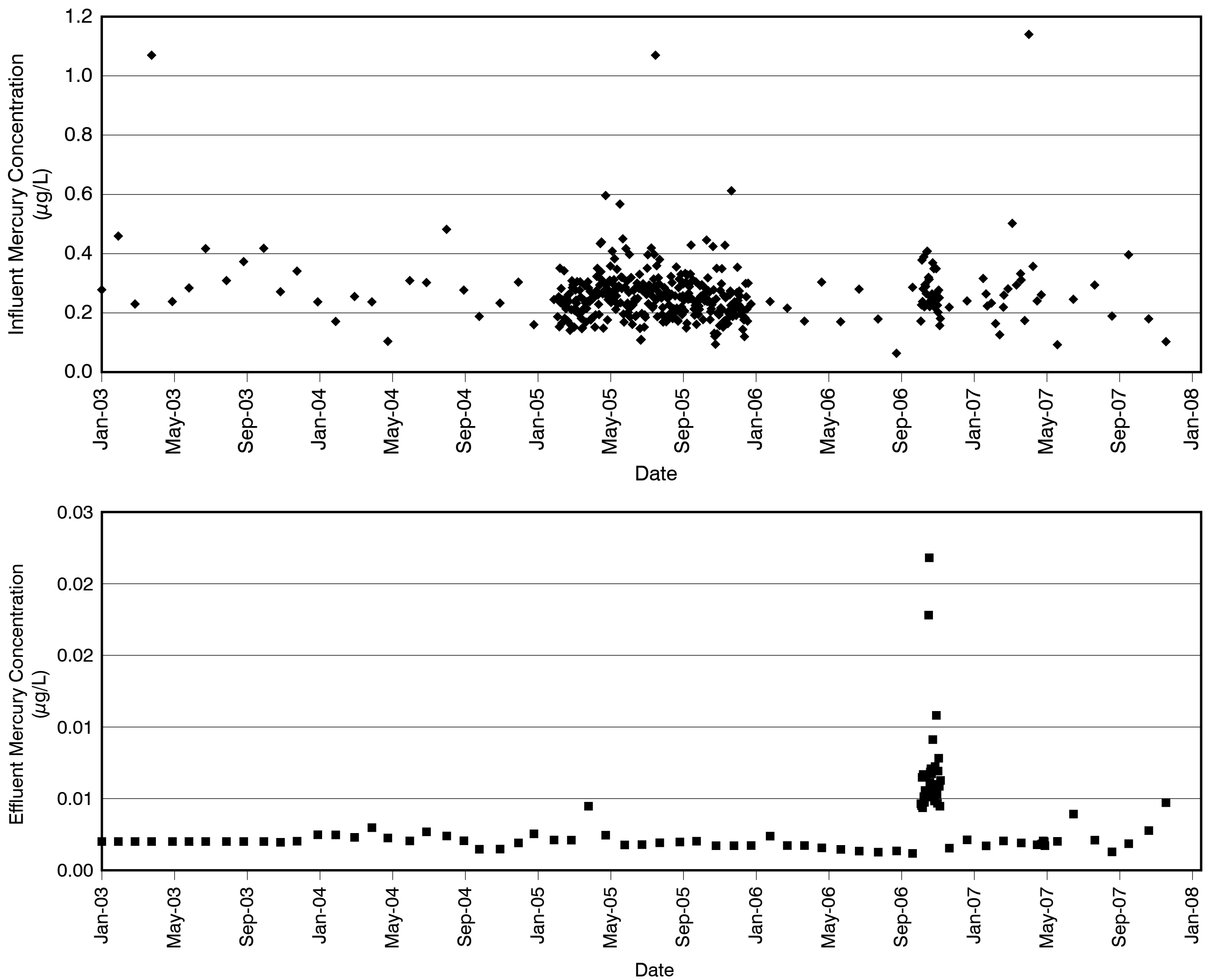

Figure 11
INFLUENT AND EFFLUENT MERCURY CONCENTRATIONS
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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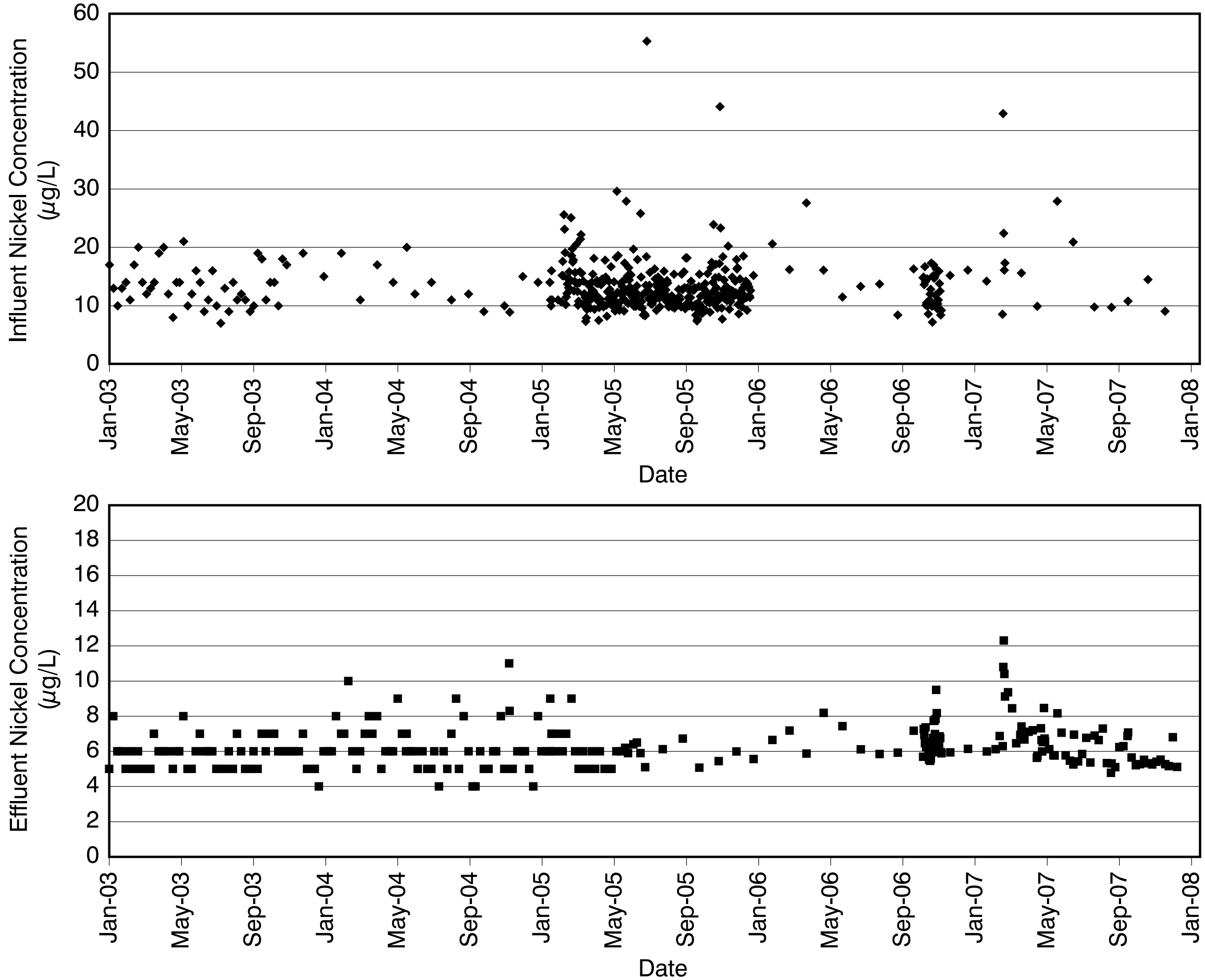

Figure 12
INFLUENT AND EFFLUENT NICKEL CONCENTRATIONS
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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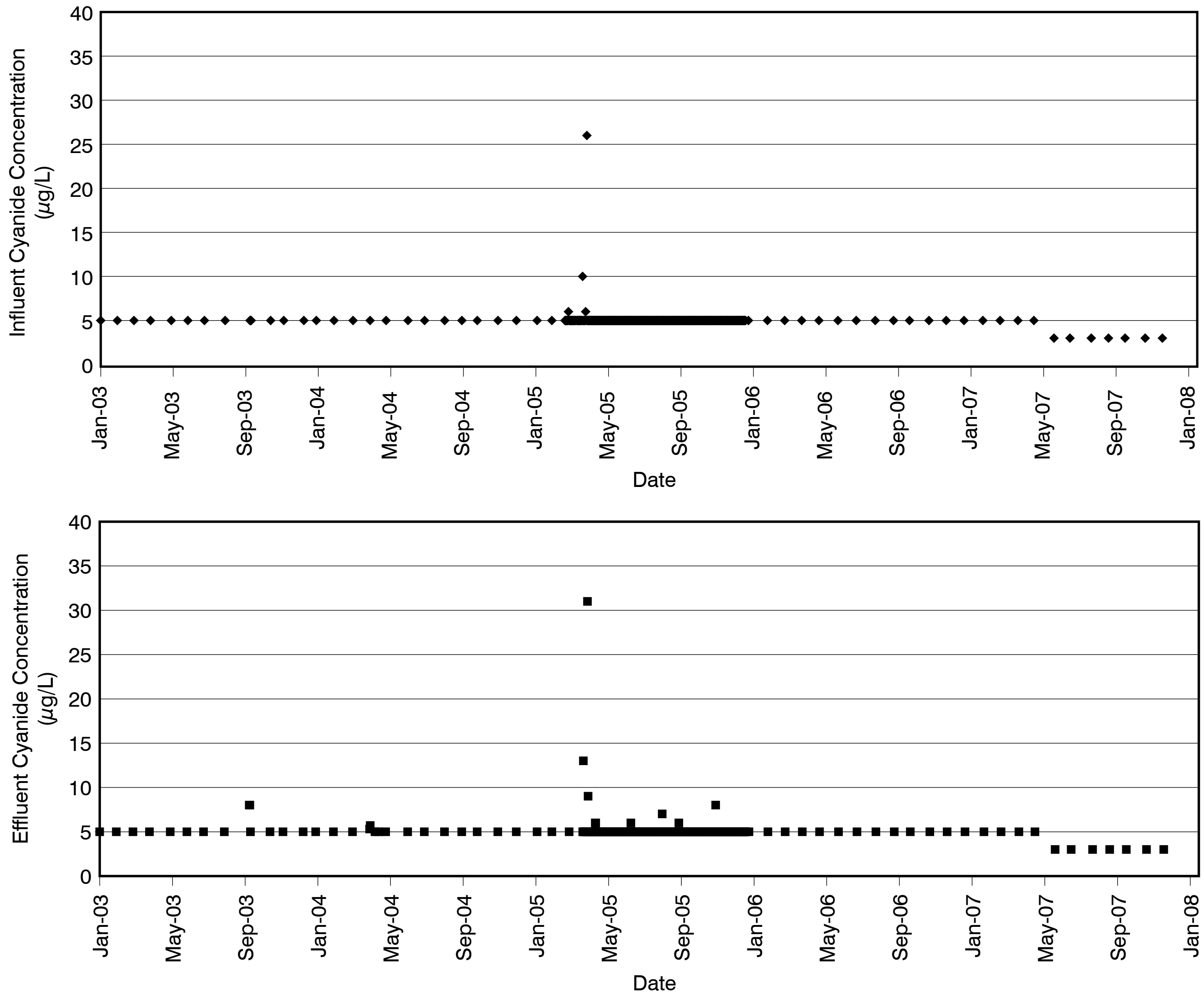

Figure 13
INFLUENT AND EFFLUENT CYANIDE CONCENTRATIONS
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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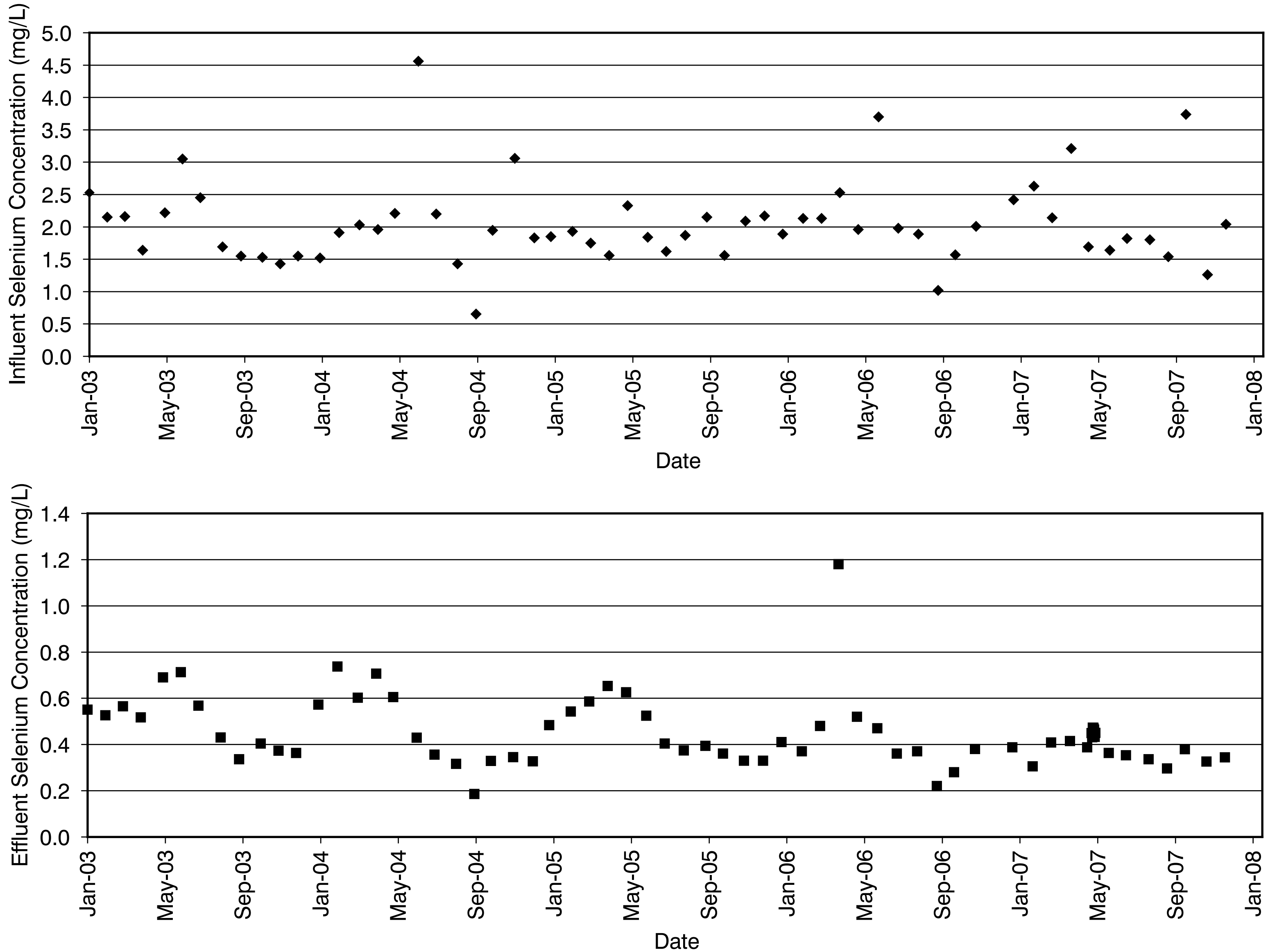

Figure 14
INFLUENT AND EFFLUENT SELENIUM CONCENTRATIONS
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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Copper, mercury, nickel, and selenium were detected in all influent samples that were collected. The effluent concentrations show that although these metals are reduced through the treatment process, detectable effluent concentrations are measured. Additional discussion of treatment process performance in included in PM 3.3.

Cyanide was not detected in most influent and effluent samples. The reporting limit for cyanide was 5 micrograms per liter (μg/L) for most of the data period. From June 2007 to December 2007 the reporting limit for cyanide was 3 μg/L. The average effluent cyanide concentration is greater than the average influent concentrations. As shown in Figure 13, the effluent concentrations are occasionally greater than the influent concentrations, suggesting that cyanide is produced in the wastewater stream as a result of the treatment. The production of cyanide is likely due to the use of chlorine for the purpose of disinfection. Studies have shown that chlorine application in the presence of nitrogen compounds can generate cyanide as a byproduct. Effluent cyanide spikes may also be correlated to the backwashing of the filters at certain times. Further discussion of the cyanide data is included in PM 3.3.

3.1.2 Organic Constituents

Influent and effluent data for selected organics were compiled for the years 2000 to 2007. Most of these compounds were sampled only two times per year. The data are summarized in Table 11. Analysis of the data is complicated by the number of below reporting limit values and the changes in the reporting limits that have occurred between 2000 and 2007. For the purpose of calculating these average concentrations, reporting limits were used for values reported as below the reporting limit. In some cases, all of the samples were below the reporting limits, and therefore the average has limited meaning since it is the average of the reporting limit values. In Table 11, the maximum concentrations are the maximum detected concentrations.

Table 11 shows that only tributyltin, PCBs, and dioxins were detected in the influent. Tributyltin was detected in 6 out of 7 influent samples, with an average concentration of 2.7 μg/L. PCBs were detected in 1 out of 6 influent samples. Dioxins were detected in 2 out of 2 influent samples with an average concentration of 1.04 μg/L. Detectable concentrations of dioxins, heptachlor, benzo(b)Fluoranthene, PCBs, indeno(1,2,3-cd)pyrene, and tributyltin were measured in the effluent.

3.2 Microbial Constituents

Effluent data for microbial constituents were compiled for the 10-year study period. There have been changes in the microbial constituents that have been reported to the RWQCB

Table 11 Influent and Effluent Characteristics of Organic Compounds, 2000 to 2007
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

	Number of Influent Samples	Number of Effluent Samples	Values Detected in Influent	Values Detected in Effluent	Reporting Limit	Average Influent Concentration (μg/L)	Average Effluent Concentration (μg/L)	Maximum Observed Effluent Concentration (μg/L)
4,4'-DDE	0	7	NA	0	(1)	NA	0.008(2)	--
Dieldrin	6	13	0	0	(3)	0.024(2)	0.013(2)	--
Heptachlor Epoxide	6	13	0	0	(4)	0.015(2)	0.012(2)	--
Benzo(b)Fluoranthene	0	8	NA	1	(5)	NA	0.243(2)	0.3
Indeno(1,2,3-cd)Pyrene	0	8	NA	1	(6)	NA	0.049(2)	0.05
Dioxin	2	10	2	9	(7)	1.04	0.108	0.394
Heptachlor	6	10	0	3	(8)	0.018(2)	0.014(2)	0.01
Tributyltin	7	36	6	1	(9)	2.6(2))	0.059(2)	0.004 (11)
PCBs	6	6	1	1	(10)	2.71(2)	2.24(2)	0.824 (11)

Notes:
NA = Not Available.
-- = No measured/observed values above reporting limit
(1) Reporting limits have ranged from 0.002 to 0.01 µg/L.
(2) Assumes the reporting limit for all values reported as below the reporting limit (RL).
(3) RLs have ranged from 0.005 to 0.05 µg/L.
(4) RLs have ranged from 0.001 to 0.025 µg/L.
(5) RLs have ranged from 0.03 to 0.3 µg/L.
(6) RLs have ranged from 0.04 to 0.05 µg/L.
(7) RLs for individual dioxin compounds have ranged from 0.10 to 6.27 pg/L
(8) RLs have ranged from 0.004 to 0.025 µg/L.
(9) RLs have ranged from 0.001 to 2 µg/L.
(10) RLs have ranged from 0.7 to 3.5 µg/L.
(11) Value presented is the maximum value observed above the RL. The average effluent concentration was calculated assuming that all values reported as below the reporting limit are at the RL.

during the 10-year study period. Tables 12 through 14 present the total coliform, fecal coliform, and enterococci data for the WPCP effluent. The microbial data are highly variable and for this reason the 5th and 95th percentile values are presented instead of the minimum and maximum values. The 5th percentile concentration indicates that 5 percent of the data are below this value. The 95th percentile concentration indicates that 95 percent of the data are below this value. Reporting limit values were used for samples reported as less than the reporting limit. Figure 15 shows the average total coliform effluent daily maximum and the fecal coliform effluent grab maximum (mpn/100ml). Figure 16 shows the average enterococci effluent daily maximum (CFU/100ml).

The total and fecal coliform data in Tables 12 and 13 show that there have been periods in 2000 and 2001 where elevated effluent microbial concentrations were measured. The enterococci data from 2004 through 2006, presented in Table 14, shows that the effluent quality has been more consistent during these recent years. Discussion of treatment effectiveness for microbial constituents is addressed in PM 3.3.

3.3 Other Constituents of Concern

Other constituents of concern include TDS, conductivity, and hardness. Table 15 includes the average and range of effluent concentrations for years 2000 to 2006. TDS, conductivity, and hardness concentrations have varied over the study period. Average TDS, conductivity, and hardness concentrations are 730 mg/L, 1200 µmhos/cm, and 250 mg/L as calcium carbonate ($CaCO_3$), respectively.

4.0 ONSITE STORMWATER

Onsite stormwater runoff from the WPCP is collected and directed to the headworks. The total area of the WPCP is 2,600 acres of which 150 acres is impervious. According to the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) (SCVURPP, 2004), a design rainfall of 0.17 inches per hour is used to estimate the onsite runoff which is the amount of runoff produced by a rain event equal to at least two times the 85th percentile hourly rainfall intensity for the applicable area. It is estimated that this rate of rainfall would result in treatment of, on average, 85 percent of the total average annual rainfall of a 50-year return period. The factor of 2 is intended to account for the fact that average rainfall intensities increase for shorter duration events, and intensities estimated from hourly data tend to under-predict flow rates in small catchments where the time of concentration is less than 1 hour.

A runoff coefficient represents the percent of water that will run off the ground surface during the storm for the area. For the purpose of this calculation the impervious area is assumed to be concrete and asphalt with a runoff coefficient of 0.75.

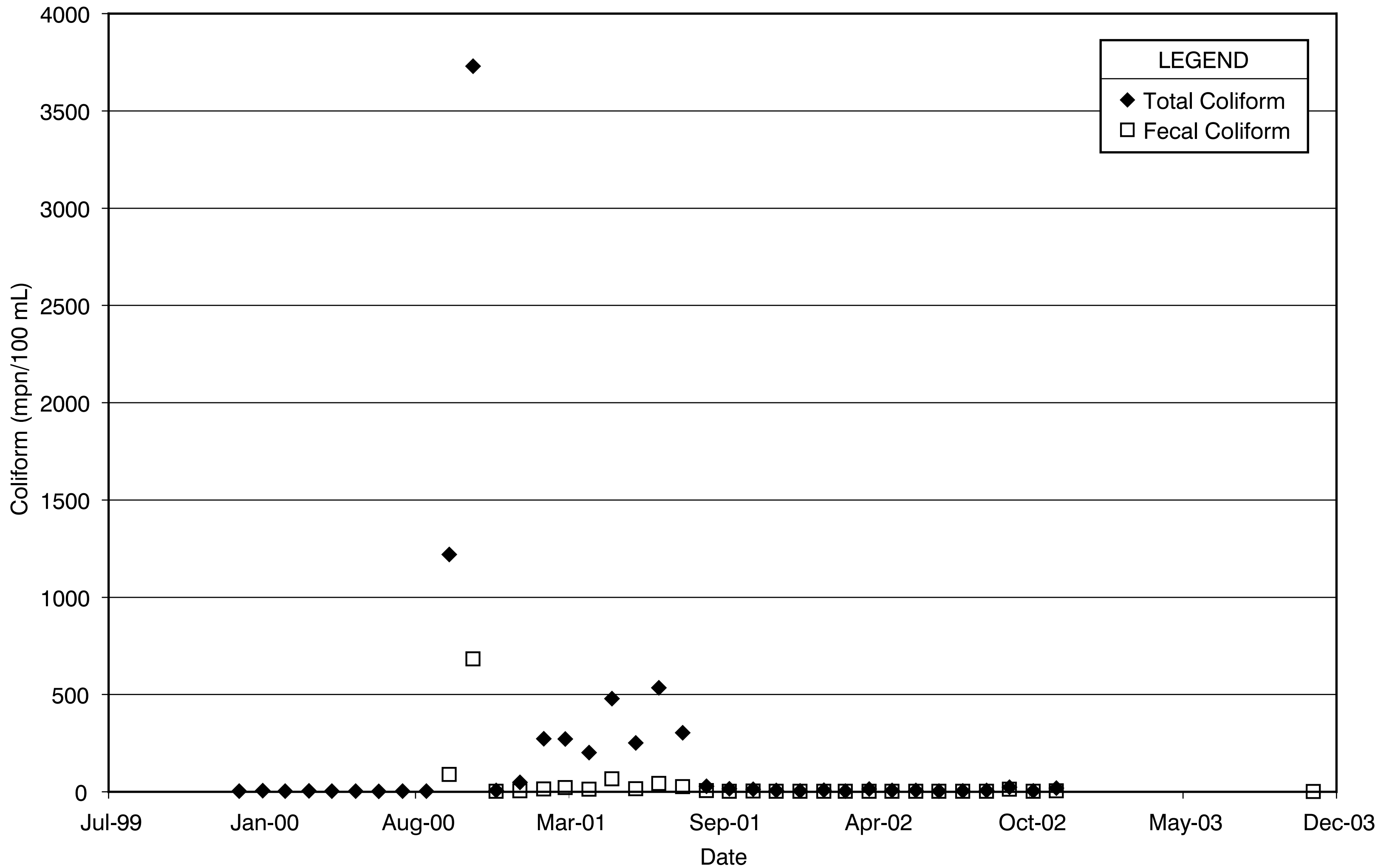

Figure 15
AVERAGE TOTAL COLIFORM EFFLUENT DAILY MAXIMUM AND FECAL COLIFORM EFFLUENT GRAB MAXIMUM (MPN/100ML)
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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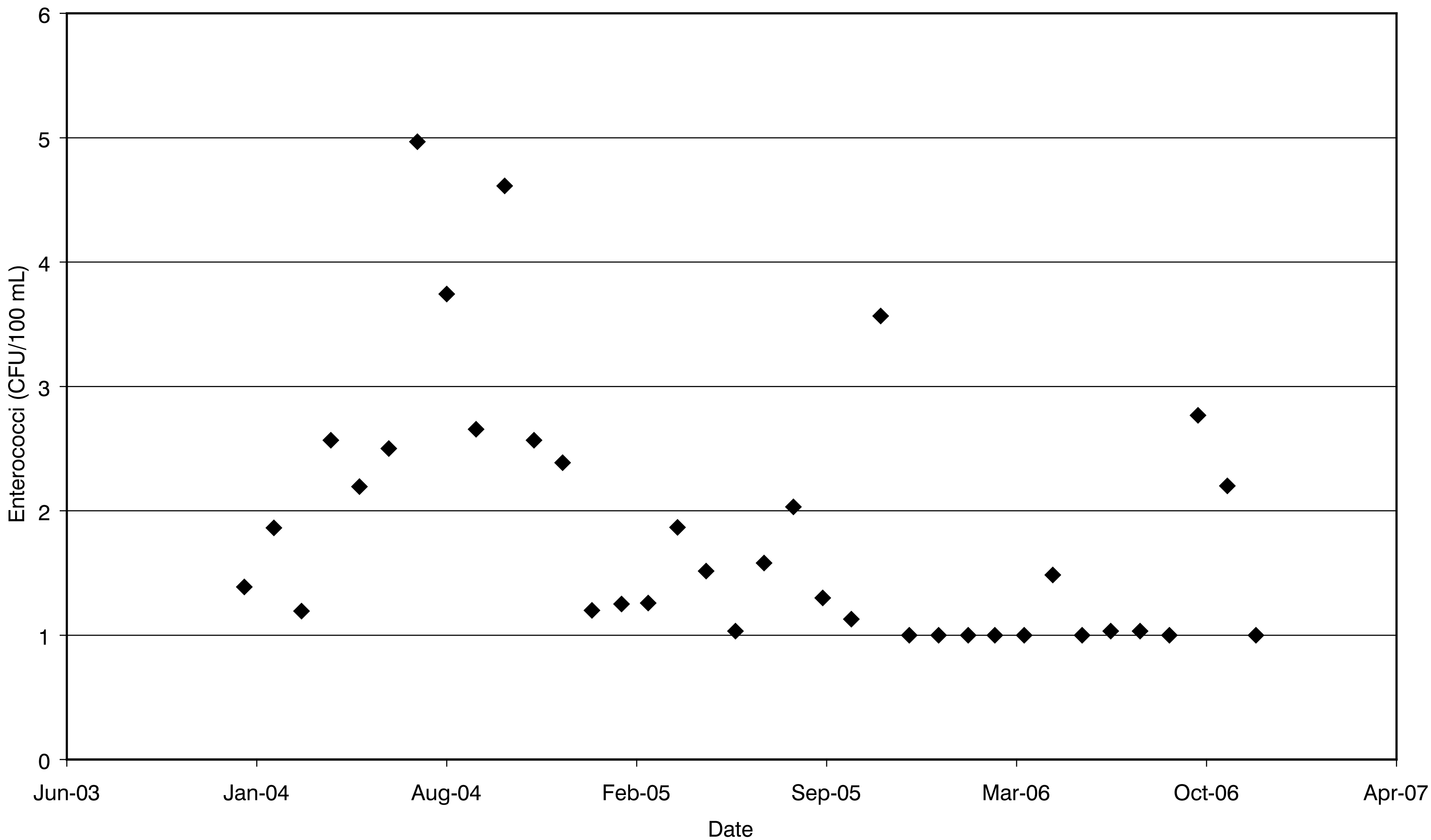

Figure 16
AVERAGE ENTEROCOCCI EFFLUENT DAILY MAXIMUM (CFU/100ML)
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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Table 12 Summary Effluent Total Coliform Concentrations
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

	2000			2001			2002		
Month	**Average (MPN/L)**	**5th (MPN/L)**	**95th (MPN/L)**	**Average (MPN/L)**	**5th (MPN/L)**	**95th (MPN/L)**	**Average (MPN/L)**	**5th (MPN/L)**	**95th (MPN/L)**
January	3	2	6	49	2	195	5	2	15
February	6	2	21	273	58	565	8	2	26
March	3	2	8	271	80	500	3	2	10
April	5	2	11	202	45	500	14	2	41
May	4	2	10	479	95	1600	7	2	15
June	4	2	8	252	59	500	8	2	16
July	3	2	4	535	105	1600	4	2	17
August	3	2	8	303	10	1535	5	2	14
September	3	2	5	28	5	75	7	2	20
October	1220	2	9000	15	2	40	23	2	40
November	3730	1	12850	12	2	50	5	2	14
December	7	2	26	7	2	22	19	2	65

Note:
MPN/L = Most Probable Number per Liter.

Table 13 Summary Effluent Fecal Coliform Concentrations
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Month	2000			2001			2002			2003		
	Average (MPN/L)	5th (MPN/L)	95th (MPN/L)	Average (MPN/L)	5th (MPN/L)	95th (MPN/L)	Average (MPN/L)	5th (MPN/L)	95th (MPN/L)	Average (MPN/L)	5th (MPN/L)	95th (MPN/L)
January	NA	NA	NA	5	1	14	2	2	2	NA	NA	NA
February	NA	NA	NA	14	2	30	2	2	2	NA	NA	NA
March	NA	NA	NA	22	5	50	2	2	2	NA	NA	NA
April	NA	NA	NA	13	4	26	2	2	3	NA	NA	NA
May	NA	NA	NA	67	15	185	2	2	3	NA	NA	NA
June	NA	NA	NA	15	4	38	2	2	3	NA	NA	NA
July	NA	NA	NA	42	5	148	2	2	3	NA	NA	NA
August	NA	NA	NA	26	2	112	2	2	4	NA	NA	NA
September	NA	NA	NA	6	2	17	2	2	2	NA	NA	NA
October	89	1	380	3	2	7	13	2	60	NA	NA	NA
November	683	2	1980	3	2	9	2	2	2	1	1	1
December	2	2	2	2	2	2	5	2	18	NA	NA	NA

Notes:
NA = Not Available.
MPN/L = Most Probable Number per Liter.

Table 14 Summary Effluent Enterococci Concentrations (CFU/L)
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Month	2004			2005			2006		
	Average (CFU/L)	5th (CFU/L)	95th (CFU/L)	Average (CFU/L)	5th (CFU/L)	95th (CFU/L)	Average (CFU/L)	5th (CFU/L)	95th (CFU/L)
January	1	1	3	1	1	2	1	1	1
February	2	1	4	1	1	2	1	1	1
March	1	1	3	1	1	2	1	1	1
April	3	1	6	2	1	5	1	1	1
May	2	1	7	2	1	3	1	1	3
June	3	1	7	1	1	1	1	1	1
July	5	1	10	2	1	4	1	1	1
August	4	1	9	2	1	6	1	1	1
September	3	1	6	1	1	2	1	1	1
October	5	1	15	1	1	2	3	1	1
November	3	1	6	4	1	3	2	1	8
December	2	1	6	1	1	1	1	1	1

Note:
CFU/L = Colony Forming Unit per Liter.

Table 15	**Effluent Concentrations of Other Constituents of Concern, 2000 to 2006 San José/Santa Clara Water Pollution Control Plant Master Plan City of San José**								
	TDS (mg/L)			**Conductivity (µmhos/cm)**			**Hardness (mg/L as $CaCO_3$)**		
Year	**Average**	**Min**	**Max**	**Average**	**Min**	**Max**	**Average**	**Min**	**Max**
2000	757	620	840	1248	1132	1315	246	216	294
2001	747	680	840	1282	1100	1450	245	220	270
2002	724	648	790	1231	1140	1320	238	219	270
2003	709	648	758	1205	1102	1282	244	223	261
2004	720	660	765	1214	1128	1328	247	228	270
2005	722	656	762	1220	1150	1284	248	217	289
2006	719	626	1339	NA	NA	NA	NA	NA	NA

Note:
NA = Not Available.

Utilizing the Rational Method, the rainfall intensity can be converted to a flow rate. The Rational Method, well known formula predicts flow rates based on rainfall intensity and drainage area characteristics. The following is the formula for the Rational Method:

$$Q = CiA$$

Where:
- Q = flow, cubic feet per second (cfs)
- C = runoff coefficient
- *i* = rainfall intensity, in/hr
- A = drainage area, acres

Based on this, the approximate onsite stormwater runoff is 19.1cfs (12.4 mgd). The onsite stormwater runoff is treated with the influent wastewater, hence, the WPCP does not characterize the quality nor measure the total amount of onsite stormwater runoff.

5.0 SITE GROUNDWATER

The WPCP's residual sludge management (RSM) facility is located immediately north and northeast of the WPCP. It consists of 56 sludge storage/thickening lagoons, 20 drying beds, 3 dried sludge stockpiles, and an operations center. To assess the impact of RSM facility processes on groundwater quality, 36 monitoring wells have been constructed at 20 locations across the RSM site and at one location south of the WPCP to monitor background conditions at the upstream end of RSM. Of the 36 monitoring wells, 21 wells have been constructed to a depth of the uppermost sandy soil (A-zone), 12 wells to a depth of the intermediate sandy soil (B-zone), and 3 wells to a depth of the deep sandy soils (C-zone). Groundwater quality information presented in this section is from a hydrogeologic report prepared by the City as required by the RWQCB (City of San José, 1992).

Water samples were collected from the 36 monitoring wells during four sampling events taken at three month intervals from 1991 to 1992. The samples were analyzed for general chemical parameters (specific conductance, pH, carbonate, bicarbonate, chloride, sulfate, and TDS), metals, coliform bacteria, volatile organic compounds, semi-volatile organic compounds, pesticides, and PCBs.

The groundwater quality in the area is not suitable for drinking. Some trace elements are above primary Maximum Contaminant Levels (MCLs) established for drinking water by the California Department of Public Health (CDPH) for antimony, arsenic, cadmium, chromium, and mercury as shown in Table 16. TDS is consistently above the secondary MCL for aesthetic quality as shown in Table 17.

Table 16 Metals Concentration Test Results from A, B, and C-zone Groundwater Monitoring Wells[(1)]
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Pollutant	Average Concentration in Background Well A-zone, B-zone, C-zone (mg/L)	Concentration Range in A-zone (average) (mg/L)	Concentration Range in B-zone (average) (mg/L)	Concentration range in C-zone (average) (mg/L)	Drinking Water Standards[(2)] (mg/L)
Antimony	NC, NC, NC	0 - 0.14 (0.09)	0.01 - 0.16 (0.08)	0.11	0.005
Arsenic	NC, NC, 0.002	0 - 0.07 (0.01)	0 - 0.18 (0.03)	0	0.05
Barium	NC, 0.29, 0.23	0.01 - 0.33 (0.16)	0.04 - 0.25 (0.13)	0.01 - 0.43 (0.22)	1
Cadmium	NC, NC, NC	0.01	0 - 0.05 (0.02)	0	0.005
Chromium	NC, 0.004, 0.0009	0 - 0.35 (0.03)	0	0 - 0.01 (0.01)	0.05
Copper	0.003, 0.002, NC	0 - 0.1 (0.01)	0 - 0.25 (0.03)	0.01 - 0.05 (0.03)	1.3
Cyanide	NC, NC, NC	0 - 0.05 (0.01)	0	0	0.15
Lead	NC, 0.005, NC	0 - 0.01 (0.004)	0 - 0.01 (0.00)	0.01	0.015
Mercury	NC, NC, NC	0 - 0.001 (0.0003)	0 - 0.01 (0.00)	0	0.002
Selenium	NC, NC, NC	0 - 0.02 (0.01)	0 - 0.03 (0.01)	0 - 0.01 (0.01)	0.05

Notes:

(1) More than 50 percent of the data were non-detects for each metal. Range and averages were calculated using numerical values.

(2) Based on MCL standards of California Department of Public Health Drinking Water Program.

NC Not Calculated (as noted in City of San José, 1992)

Table 17	TDS Concentration in A, B, and C-zone Groundwater Monitoring Wells San José/Santa Clara Water Pollution Control Plant Master Plan City of San José		
A-zone Range (mg/L)	**B-zone Range (mg/L)**	**C-zone Range (mg/L)**	**EPA Secondary MCL Standard (mg/L)**
1,808 - 90,409	1368 - 186518	10,326 - 74,652	500

TDS concentrations in the shallow A-zone monitoring wells directly correlate with the distance from the salt ponds as shown in Figure 17. The salt ponds are located northwest of the WPCP and to the east of the Artesian Slough. The greatest TDS concentration was found in the vicinity of the salt ponds and lowest concentrations furthest from the salt ponds, indicating the influence of salt pond water on the shallow groundwater. A similar trend was observed for chloride and sodium concentration in the shallow monitoring wells also shown in Figure 17.

All samples were below the E. coli detection limit of 2.2 colonies/100 milliliters (mL) detection limit. Sample pH values were neutral, ranging from 6.8 to 7.8. Volatile organic compounds (methylene chloride and toluene) and semi-volatile organic compounds (Bis[2-ethylhexyl] phthalate, Di-n-butylphthalate, Butylbenzylphthalate, and 1,1,1-trichloroethane) were sporadically reported in the samples, but were attributed to laboratory error due to presence of contaminants in the laboratory during extraction. Laboratory error was confirmed when the same compounds were detected in the water samples and in blanks. Pesticides and PCBs were not detected in the monitoring wells.

6.0 RECEIVING WATER QUALITY

The WPCP discharges treated effluent to the Artesian Slough (tributary to Coyote Creek) and Lower South San Francisco Bay (south of the Dumbarton Bridge). These receiving waters are indirectly regulated by the South Bay Action Plan.

The WPCP NPDES permit includes a 120 mgd ADWEF flow trigger or to levels that protect habitat for the amount of treated wastewater that can be discharged to the South San Francisco Bay, due to concerns related to conversion of saltwater marsh habitat to freshwater habitat. Approximately 10 percent of the wastewater that flows into the WPCP is recycled through the South Bay Water Recycling (SBWR) program to maintain effluent flows under 120 MG/d to the South San Francisco Bay. Flow restrictions due to receiving water impacts may play a significant role in shaping future discharge options and alternatives.

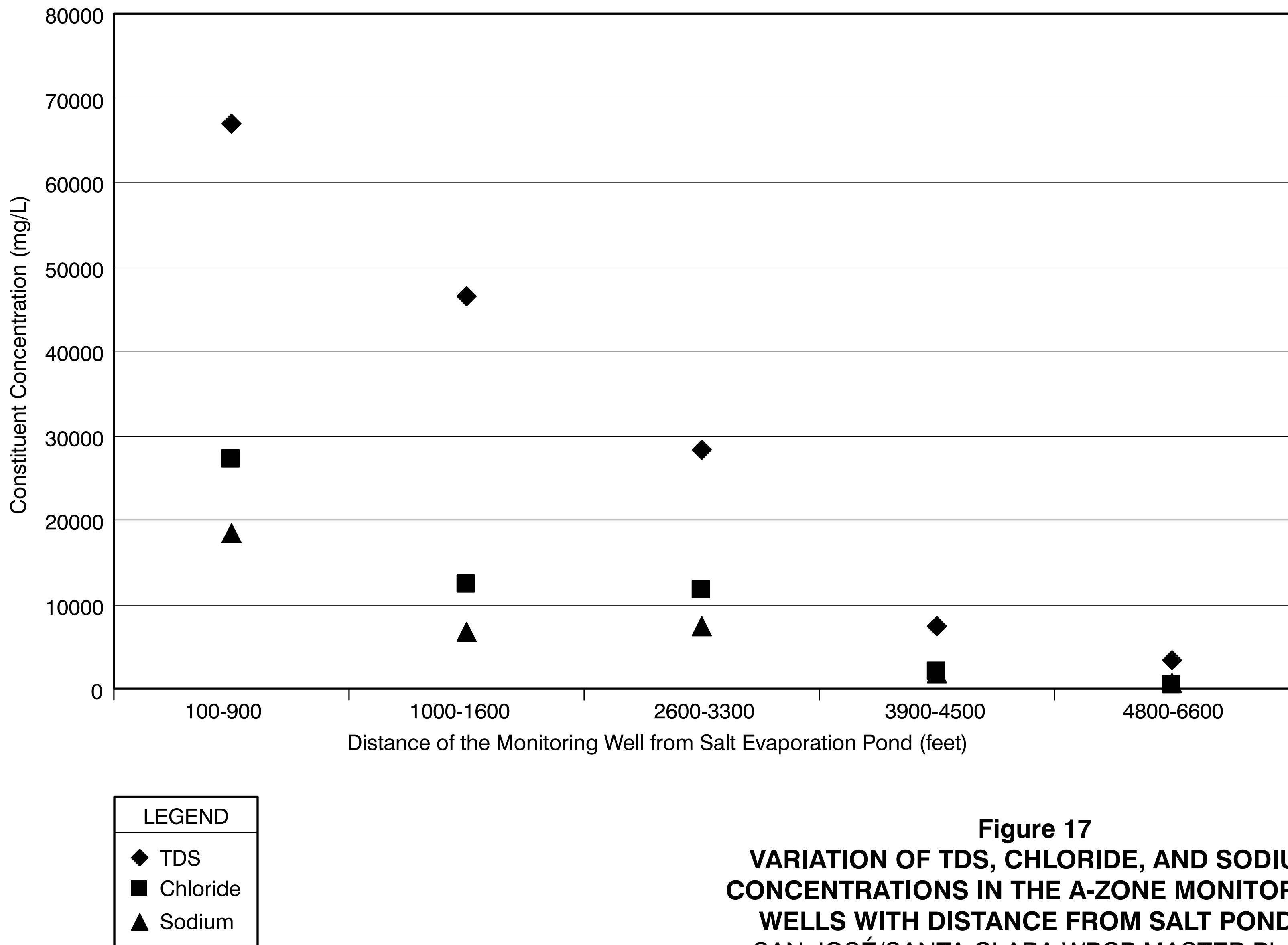

Figure 17
VARIATION OF TDS, CHLORIDE, AND SODIUM CONCENTRATIONS IN THE A-ZONE MONITORING WELLS WITH DISTANCE FROM SALT PONDS
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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Beyond discussion of flow considerations, the objective of this section is to provide an overview of receiving water quality and to highlight some of the water quality concerns with respect to the discharge of the WPCP into the South San Francisco Bay. Some of the constituents discussed in this section have been identified for the purpose of this master planning effort as POCs. These include copper, mercury, nickel, cyanide, dieldrin, dioxin, and PCBs. Detailed analysis of these constituents in the WPCP effluent and receiving water has been conducted as part of the RPAs. Additional information on the RPAs can be found in PMs 4.1 and 4.2.

Other constituents discussed in this section provide background information and a broader perspective on the water quality issues in the South San Francisco Bay. These pollutants do not necessarily present immediate concerns, but are important to consider in the planning process in addition to the POCs. These include fisheries habitat parameters (phytoplankton, nutrients and dissolved oxygen), pathogens and indicator organisms.

6.1 Receiving Water Monitoring Locations

The WPCP participates in the San Francisco Bay Regional Monitoring Program for Trace Substances (RMP), administered by the San Francisco Estuary Institute (SFEI). The RMP is responsible for collection, analysis, and reporting of data on pollutants and toxicity in water, sediment, and biota of the estuary. The RMP had five fixed stations as shown in Figure 18 that were monitored from 1993 to 2001 (BA10, BA20, BA30, C-3-0, and C-1-3). There were also two estuary interface stations located in the Alviso Slough (BW15) and Coyote Creek (BW10) from 1993 to 2001 as a special project of the RMP.

Beginning in 2002, the RMP was re-designed to a random, stratified sampling approach. The South San Francisco Bay is divided into segments, and each segment has a fixed number of stations that are located at random within the segment as shown in Figure 19. The stations are sampled during the low flow months of May to October. The new sampling design, which is still in use by the RMP, is intended to provide more representative assessments of South San Francisco Bay water quality than fixed station sampling would achieve (Lowe et al., 2002).

The City also conducts its own receiving water monitoring. Fixed stations for receiving water monitoring have been established (SB01 – SB11), some of which are co-located with historic RMP fixed stations (SB01 – SB03).

Monitoring data from the following two locations, wherever available, are summarized to provide a spatial representation of the receiving water quality:

- Receiving water closer to the WPCP discharge: Vicinity of the Artesian Slough (location SB04/C-3-0 in Figure 18).

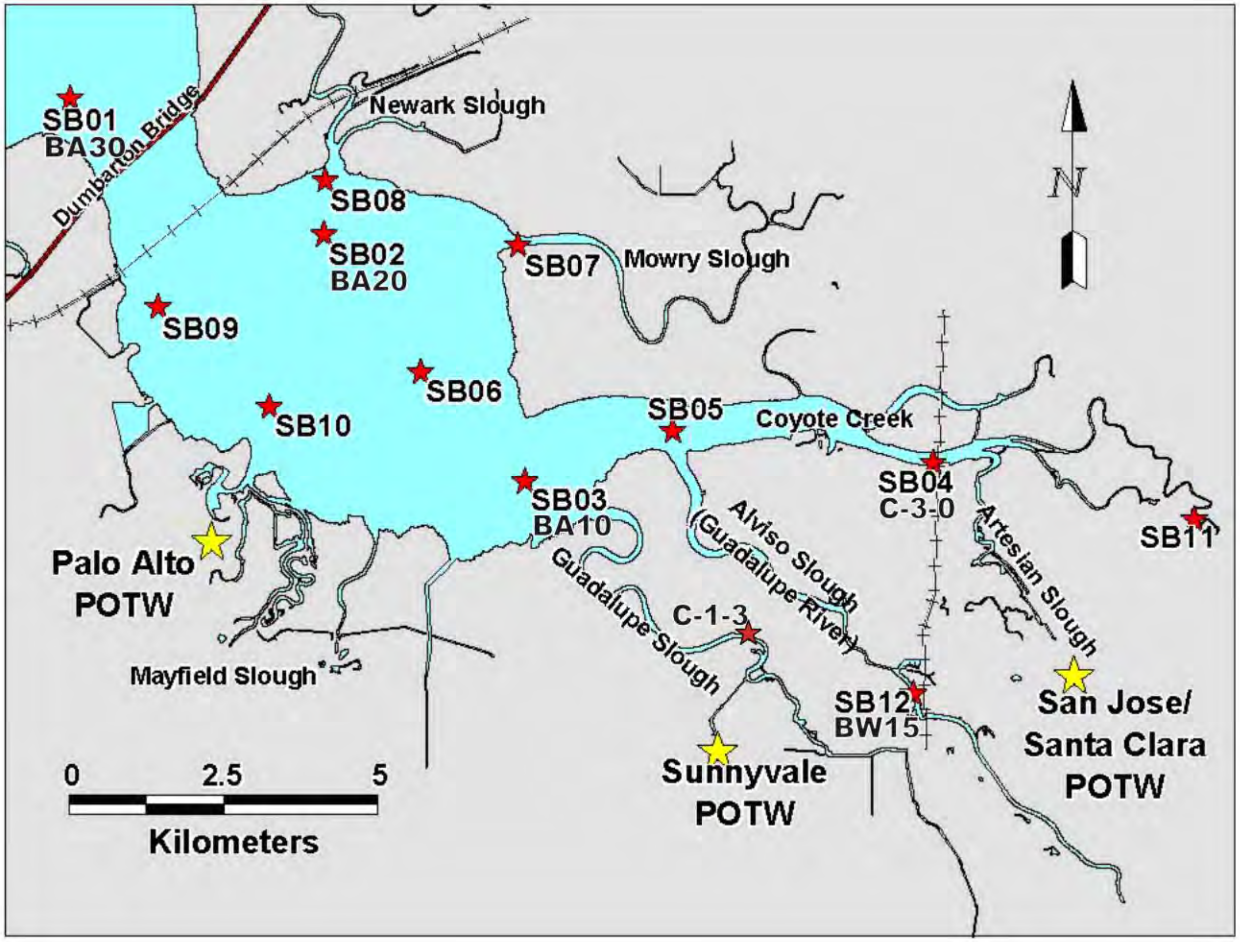

Figure 18
SAMPLING STATIONS IN THE SOUTH SAN FRANCISCO BAY MONITORED BY THE CITY OF SAN JOSÉ THROUGH THE SOUTH BAY MONITORING PROGRAM
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

Figure 19
RMP MONITORING LOCATIONS IN 2002
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

SOURCE:
Figure from San Francisco Estuary Institute, 2002.

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- Receiving water representing background conditions: Vicinity of the Dumbarton Bridge (location SB01/BA30 in Figure 18). Data from this site was used to represent background water quality in the RPAs.

6.2 Trace Metals in Receiving Waters

From the time that the Clean Water Act was implemented in 1972 through the present, there have been pollution prevention activities that have focused on reduction of many metals, including copper, nickel, silver, and lead. However, these constituents are still detected in samples collected from South San Francisco Bay.

Metals data from the RMP are presented in Table 18. The average metals concentrations were all below the regulatory thresholds. This finding is consistent with subsequent observations made after the RMP sampling approach was modified. The metals data from the South San Francisco Bay collected from random, stratified sample locations after 2002 (locations LSB007 to LSB011 in Figure 19) were also below the regulatory thresholds (RMP, 2006). Although trace metals are not currently considered by the RWQCB to be high priority pollutants that impair beneficial uses of the South San Francisco Bay, continued management through regional monitoring and pollution prevention can be expected in the foreseeable future because of regional policies implemented through NPDES permits regulating wastewater and stormwater.

The City's 2003 NPDES permit included effluent limits for copper, nickel, and mercury. However effluent limit for mercury has been removed from the 2008 NPDES permit. Mercury is now controlled by a basin-wide NPDES permit (CA0038849) that sets effluent limits for municipal and industrial wastewater discharges to the San Francisco Bay and its tributaries. In the receiving water close to WPCP discharge (C-3-0), Table 18 indicates that average copper concentrations were within the average background concentrations (BA 30). Average nickel and mercury concentrations in receiving water close to WPCP discharge were above the average background concentrations.

6.3 Bioaccumulative Pollutants in Receiving Waters

Pollutants that bioaccumulate tend to increase in concentration at each successive step in the food web. Relatively low concentrations of bioaccumulative pollutants in water or sediment typically enter the base of the food web by accumulation in plants, algae, or bacteria. Grazers that feed at the base of the food web retain the pollutants while metabolizing the proteins and lipids of their food, magnifying the pollutants concentration. Predators and foragers that feed on the grazers further magnify the concentration of bioaccumulative pollutants. One issue of concern common to all bioaccumulative pollutants is the quality of food available to people and wildlife that use the South San Francisco Bay as a source of food. Another issue that is common to many, but not all bioaccumulative pollutants, is the possibility of sediments containing bioaccumulative pollutants that can be

Table 18 Trace Metals of Concern in Receiving Water[1]
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Item	Sample Location	Mercury	Copper	Chromium	Nickel	Zinc	Selenium	Lead	Silver	Cadmium	Arsenic
Minimum observed concentration, µg/L	BA 30	0.004	1.4	0.1	1.5	0.5	0.05	0.02	0.002	0.02	1.5
	C-3-0	0.004	0.8	0.1	2.3	3.4	0.003	0.09	0.001	0.02	1.5
Maximum observed concentration, µg/L	BA 30	0.053	4.1	0.3	3.8	3.0	0.4	0.08	0.02	0.14	5.4
	C-3-0	0.190	4.1	0.7	10.4	22.6	2.1	0.34	0.003	0.07	3.8
Average observed concentration, µg/L	BA 30	0.01	2.6	0.2	2.9	1.5	0.2	0.05	0.006	0.08	2.9
	C-3-0	0.04	2.3	0.3	5.7	12.2	0.6	0.21	0.002	0.05	2.6
Regulatory Threshold (µg/L)		0.051[2]	6.9[3,5]	50[3]	11.9[3,5]	81[3]	5[3,6]	8.1[3]	1.9[4]	9.3[3]	36[3]
			10.8[4,5]	1100[4]	62.4[4,5]	90[4]	20[4,6]	210[4]		42[4]	69[4]

Notes:

(1) All values expressed as dissolved except mercury. Sample locations shown in Figure 18. Minimum, maximum, and averages were computed using data collected from 1998 to 2007 for mercury, copper, nickel, and selenium for both sample locations. Chromium, zinc, lead, silver, cadmium, and arsenic data were collected from 1998 to 2006 from location BA 30. For location C-3-0, data for chromium, zinc, lead, silver, cadmium, and arsenic was collected from 1998 to 2002. Some data was downloaded from the RMP available on the SFEI website (www.sfei.org) and others were provided by the City of San José from the RMP.

(2) Represents 30-day average in water. Based on California Toxics Rule (CTR) saltwater objective.

(3) Represents continuous 4-day average. Based on Basin Plan Surface Water Metals Criteria.

(4) Represents maximum 1-hour average. Based on Basin Plan Surface Water Metals Criteria.

(5) Based on RWQCB Water Quality Control Plan Amendment, San Francisco Bay Region.

(6) National Recommended Water Quality Criteria – Correction, United States Environmental Protection Agency (EPA), April 1999.

exposed and remobilized as a result of future project actions. In contrast to trace metals discussed in Section 6.2 above, the fact that the San Francisco Bay is listed as impaired due to many bioaccumulative pollutants will require continued monitoring and, in some instances (e.g., methylmercury) evaluation of potential control measures either in the WPCP or in discharges from Salt Pond A18.

Bioaccumulative pollutants include mercury, PCBs, organochlorine pesticides, dioxin, and selenium. The SFEI collected tissue samples of these bioaccumulative pollutants at specific locations in the South San Francisco Bay. Results for location BA 30 for tissue samples collected from 1998 to 2005 are presented in Table 19. Further discussion of each of these pollutants is included in the following sections.

Table 19 Bioaccumulative Pollutants[1] in Receiving Water at Location BA 30
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Item	Mercury (mg/kg)	PCBs (mg/kg)	DDT Metabolites (mg/kg)	Chlordane (mg/kg)	Dioxin (mg/kg)	Dieldrin (mg/kg)
Current Concentration in Fish	0.3	0.13	0.034	0.015	1.6×10^{-6} (4)	0.0091
Target Maximum Concentration in Fish	0.2(2)	0.00001(2)	0.065(3)	0.017(3)	0.17×10^{-6}(3)	0.0014(3)
Has a TMDL been adopted?	Yes	Adopted by RWQCB with an approval pending from EPA	No	No	No	No

Notes:

(1) Tissue based concentration.

(2) RWQCB objective for a South San Francisco Bay wide total maximum daily load (TMDL) – adopted for mercury, proposed to EPA for PCBs.

(3) Risk based screening levels established by Office of Environmental Health Hazard Assessment (OEHHA) assuming a consumption rate of 32 g/day (Connor et al., 2004; Connor et al., 2005).

(4) Average Toxicity Equivalent (TEQ) in White Croaker based on 2000 sampling in San Francisco Bay for dioxins and furans. White Croaker had the highest average TEQ. Striped Bass and Jacksmelt had lowest average TEQ of 0.2×10^{-6} mg/kg. Data from http://www.epa.gov/region09/water/dioxin/sfbay.html

As noted previously, mercury, PCBs, and dieldrin have been identified as POCs. Information on DDT metabolites and chlordane is included because these are bioaccumulative pollutants found in fish samples in the South San Francisco Bay.

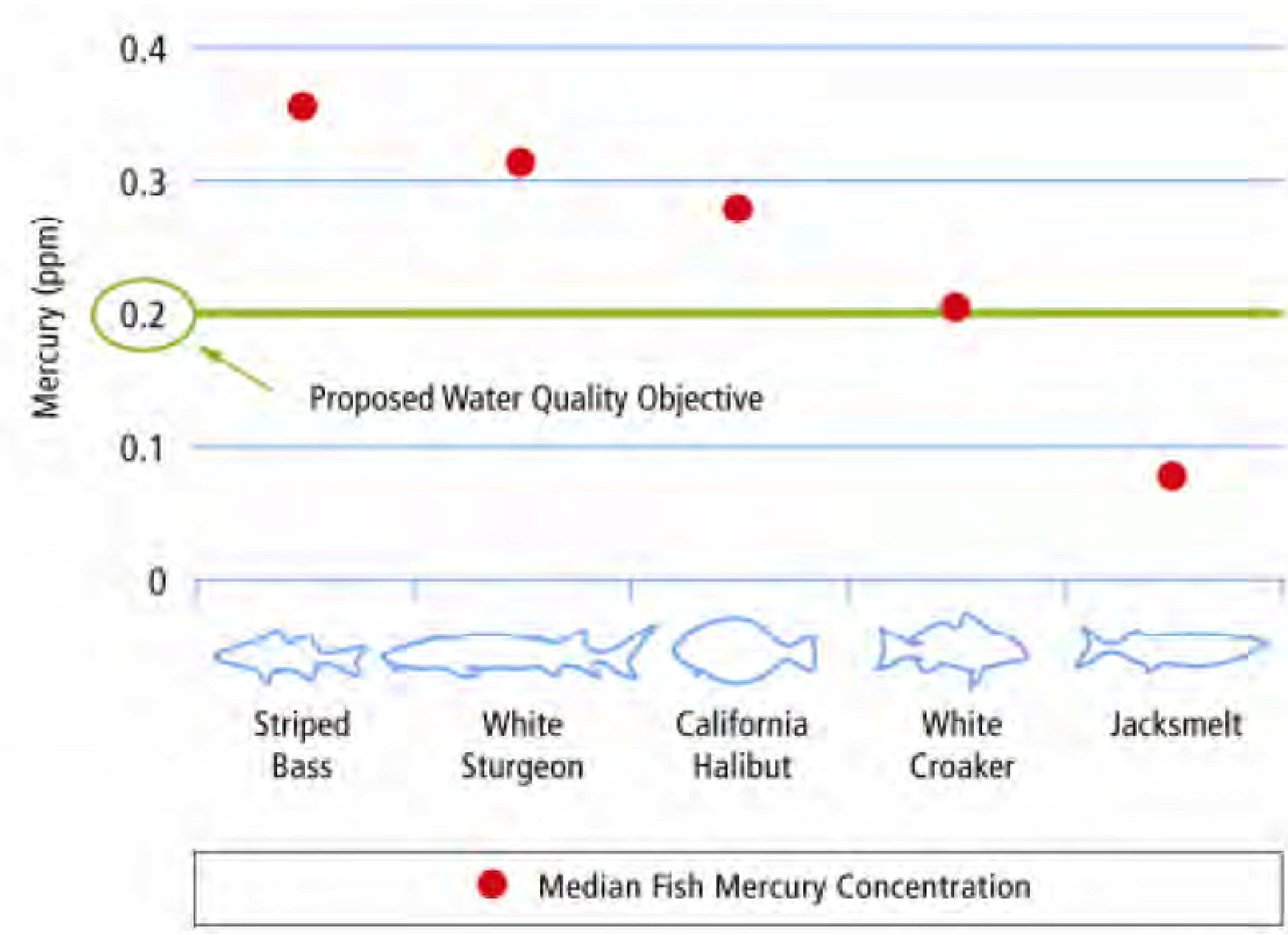
6.3.1 Mercury

Mercury exceeds risk assessment guidelines for human consumption of fish throughout the South San Francisco Bay. To be conservative, risk assessment guidelines account for the upper limits of consumption habits and target protection of the most sensitive populations, namely children and women of child-bearing age. To protect people who fish in the South San Francisco Bay for food, the RWQCB has adopted a water quality objective (WQO) of 0.2 milligrams per kilogram (mg/kg) mercury in fish. Figure 20 shows tissue concentrations of mercury in commonly consumed fish from the South San Francisco Bay. The mercury concentrations in most species exceed the WQO of 0.2 mg/kg (ppm). Attainment of the WQO will require a reduction by nearly half in the highest trophic level fish.

Mercury pollution in the South San Francisco Bay results from a variety of historic and contemporary sources (San Francisco Bay Regional Water Quality Control Board 2004, San Francisco Bay Regional Water Quality Control Board 2006). The concentration of mercury in the South San Francisco Bay sediments is elevated by approximately 5 to 10 fold compared to pre-industrial conditions, primarily as a result of mercury released from Coast Range mercury mines and Sierra Nevada foothills gold mines that used mercury to extract gold by amalgamation. No mercury mines are in operation and mercury is no longer used during gold mining. Trace amounts of mercury are present in treated municipal effluent discharges, accounting for approximately 1 to 3 percent of the total annual mercury loadings to San Francisco Bay.

The main contemporary sources of mercury are atmospheric emissions from combustion, refining, and other industrial processes that add to the natural atmospheric background established by volcanic emissions. These atmospheric sources are conveyed to San Francisco Bay by stormwater runoff. Atmospheric mercury sources conveyed by stormwater add to the existing legacy inventory of mercury in San Francisco Bay sediments. A high priority management question related to mercury is whether current atmospheric sources are a significantly greater factor affecting mercury concentrations in fish compared to legacy mercury already present in the Bay. This question is complicated due to the complexity of mercury fate and transport.

Mercury has a strong affinity for particles, and is therefore primarily transported with sediment. The San Francisco Bay is a dynamic system, where water and sediment are mixed by tides, wind, and tributary flows. As sediment moves through the San Francisco Bay, a portion may be transported to areas that favor methylmercury production. Mercury methylation is the conversion of inorganic mercury to organic methylmercury. Methylation occurs as a result of the normal metabolism of naturally occurring bacteria, primarily sulfate reducing bacteria that thrive under low oxygen conditions. Therefore, low dissolved oxygen



SOURCE:
Figure from San Francisco Estuary Institute, the Pulse of the Estuary, 2006.

Figure 20
MERCURY CONCENTRATIONS IN COMMONLY CONSUMED FISH FOUND IN SAN FRANCISCO BAY
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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in receiving waters is an important factor affecting mercury fate. Areas of low dissolved oxygen in the margins, sloughs, and mudflats of the Bay are known to have relatively higher concentrations of methylmercury in water, sediments, and small territorial indicator organisms compared to more open water areas of the Bay.

Another important risk factor for mercury methylation and bioaccumulation is the availability of different mercury sources to methylating bacteria. Some mercury sources may be more susceptible than others. For example, "new" mercury sources from atmospheric deposition and stormwater conveyance may be more susceptible to methylation compared to "older" legacy sources. The susceptibility of mercury can change. For example, atmospherically deposited mercury can convert to less available forms over time. Mercury in deep sediments, has been shown to have lower availability compared to surface sediments; bringing deep sediments to the surface can result in a transient "pulse" of available mercury as the sediments re-equilibrate. Frequent wetting and drying of sediments can enhance mercury availability for methylation.

Because the factors relating to mercury methylation and accumulation within the food web are complex and not fully understood, a simplifying assumption in the long term management strategy for mercury established by the TMDL is that reductions in mercury concentrations in sediments will, over time, result in proportional reductions in fish tissue residues (San Francisco Bay Regional Water Quality Control Board, 2004). At the same time, monitoring and research programs are under way or in development that will identify management actions which can help minimize mercury methylation and bioaccumulation to the extent practicable. Such studies are required of wastewater dischargers through the NPDES watershed permit for mercury, and are proposed for municipal stormwater dischargers through the pending Municipal Regional Permit for Urban Stormwater Discharges (MRP).

6.3.2 PCBs

PCBs are an environmental concern because they are bioaccumulative, potent carcinogens and toxins, and they are extremely persistent in the environment. In contrast to mercury, where microbial transformations are the key to bioaccumulation, biochemical transformation of PCBs is not a necessary precursor to biomagnification. Consequently, the conceptual model for management of PCBs in the South San Francisco Bay relies upon more direct food web models relating PCB concentrations in sediments to PCB concentrations in fish.

As with mercury, the fish tissue target for PCBs that has been proposed by the RWQCB for a South San Francisco Bay-wide total maximum daily load (TMDL) is based on protecting people and wildlife that eat fish from the South San Francisco Bay. The resulting proposed risk based target is 10 nanograms per gram (ng/g) (0.010 parts per billion [ppb]) PCBs in fish. The corresponding sediment target proposed by the RWQCB is 1 ppb (i.e., 1 microgram of

PCBs per kilogram of sediment). The RWQCB adopted the San Francisco Bay PCBs TMDL in February 2008, and approval of the TMDL by the state and EPA is pending.

In South San Francisco Bay, PCB concentrations in fish tissue typically exceed the risk-based target of10 ng/g as shown in Figure 21. This is why the South San Francisco Bay has been listed as impaired for PCBs by the RWQCB. To attain the proposed target in fish, PCB concentrations in the food web will need to be reduced by one to two orders of magnitude.

6.3.3 Legacy Organochlorine Pesticides

Legacy organochlorine pesticides of potential concern include DDT, chlordane, and dieldrin. This class of compounds are toxins and potential carcinogens that accumulate in fatty tissues and biomagnify in food webs. Like PCBs, the use of these compounds has been discontinued. Sediments are an important storage and transfer media for this class of compounds, although dieldrin is somewhat more soluble than the other organochlorine pesticides.

One important distinction between legacy organochlorines and PCBs is the degree of impairment. Unlike PCBs and mercury, impairment of wildlife by legacy organochlorines is considered to be unlikely, so protection of human health is the primary driver for managing this class of compounds. Legacy organochlorines appear to be much closer to attainment of risk-based screening values compared to PCBs. These screening values are established by Office of Environmental Health Hazard Assessment (OEHHA) and are based on assumptions about how much fish people eat on a daily basis. Because these compounds have been banned and the degree of impairment is less severe, TMDL development and resulting implementation strategies are proceeding on a less aggressive time scale.

OEHHA issued a fish consumption advisory for San Francisco Bay in 1994 due to fish concentrations of DDT, dieldrin, and chlordane, as well as PCBs, mercury, and dioxins. Water and fish tissue concentrations of DDT and dieldrin indicate that the fish consumption advisory is warranted, and is the basis for a finding of possible impairment. Figure 22 presents chlordane and dieldrin concentrations in South San Francisco Bay fish compared to screening levels established by OEHHA.

6.3.4 Dioxin

Dioxins and furans are inadvertent by-products formed during high temperature combustion processes in the presence of chlorine. Like PCBs, these compounds are potent carcinogens that accumulative in fatty tissues. While dioxins and furans have been detected in Bay fish, there are uncertainties about the risk level posed and hence the level of impairment. Dioxins and furans are on the 303(d) list for the Bay. The current level of knowledge indicates that stormwater is the primary conveyance of dioxins and furans to the Bay, although the most likely source to stormwater is atmospheric deposition. The United

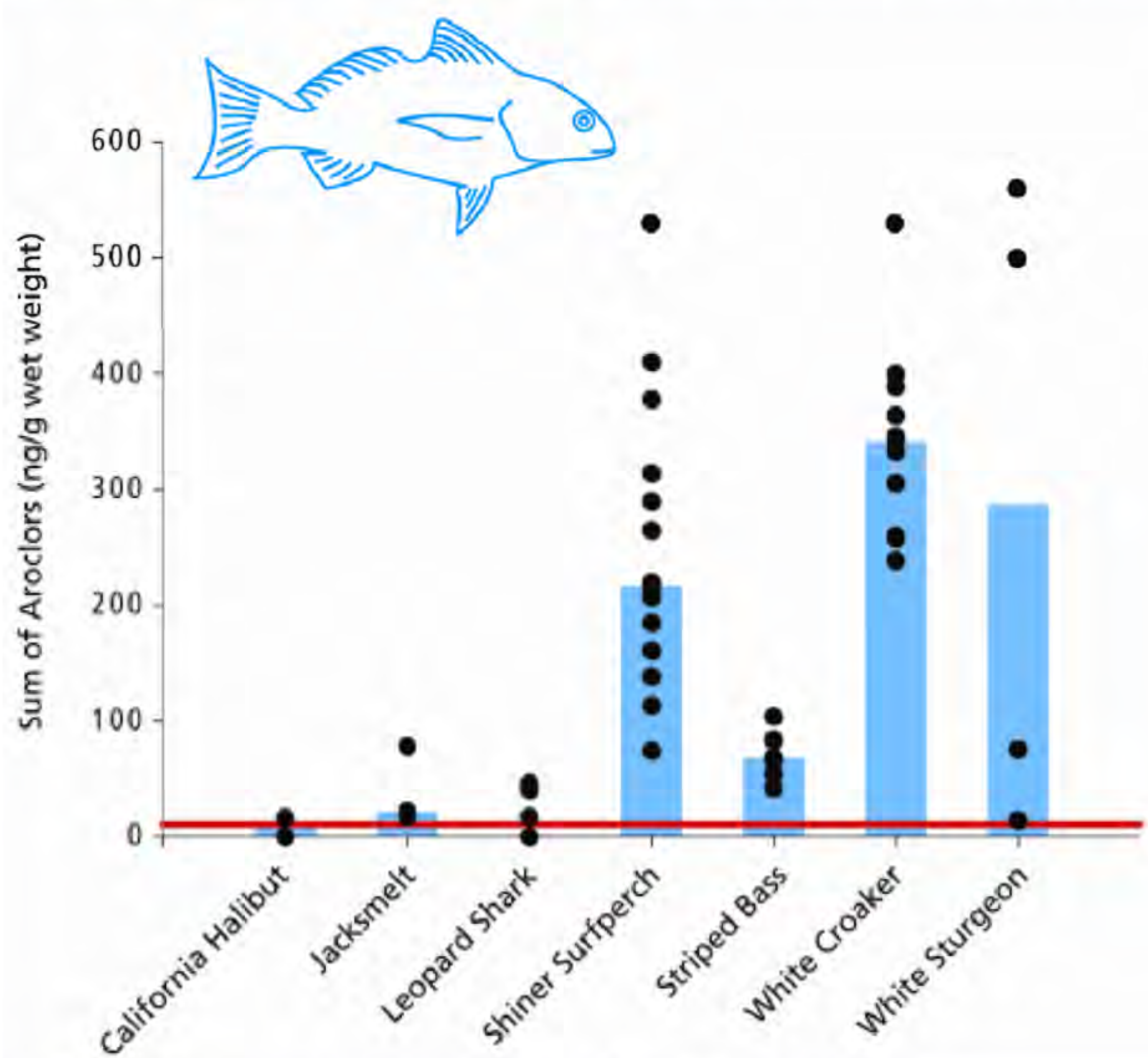

Figure 21
PCB CONCENTRATIONS IN FISH
IN SOUTH SAN FRANCISCO BAY
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

SOURCE:
Figure from San Francisco Estuary Institute, the Pulse of the Estuary, 2006.

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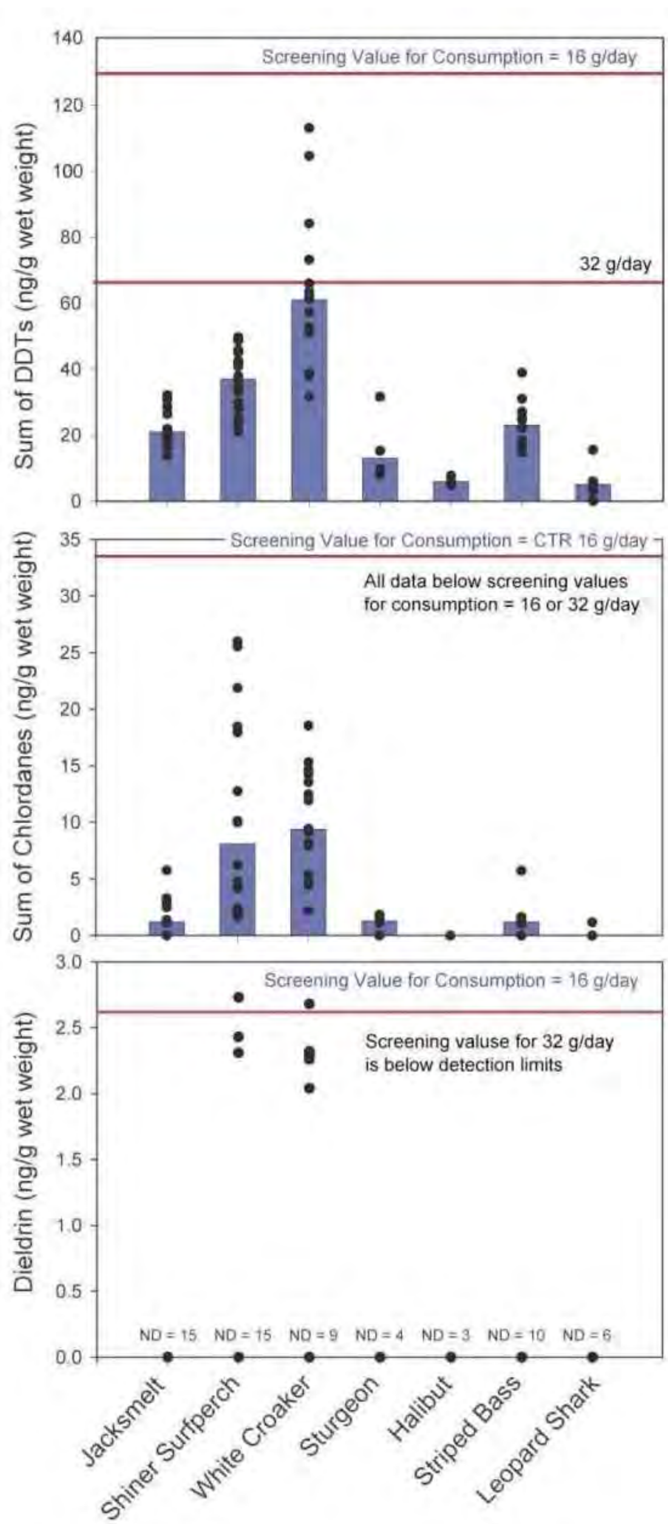

Figure 22
CHLORDANE AND DIELDRIN CONCENTRATIONS IN SOUTH SAN FRANCISCO BAY FISH COMPARED TO SCREENING LEVELS ESTABLISHED BY OEHHA
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

SOURCE:
Figure from Connor et al., 2004.

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States Environmental Protection Agency has summarized dioxin issues for San Francisco Bay at http://www.epa.gov/region9/water/dioxin/sfbay.html.

The RMP does not regularly monitor dioxins and furans in the Bay but SFEI did analyze samples for these compounds in 2002 and 2003. Samples were collected from three locations in the Bay including Dumbarton Bridge. Concentrations in all four samples collected over the two years at Dumbarton Bridge exceed the CTR and USEPA criteria (Connor et al. 2005).

No standards or criteria exist to evaluate sediment concentrations of dioxins and furans in the Bay. USEPA and NOAA analyzed 56 sediment samples collected around the Bay in 2000 for dioxins, furans, and dioxin-like, co-planar PCBs. They concluded that dioxin levels in San Francisco Bay were comparable to other urban bays and estuaries (Connor et al. 2005).

6.3.5 Selenium

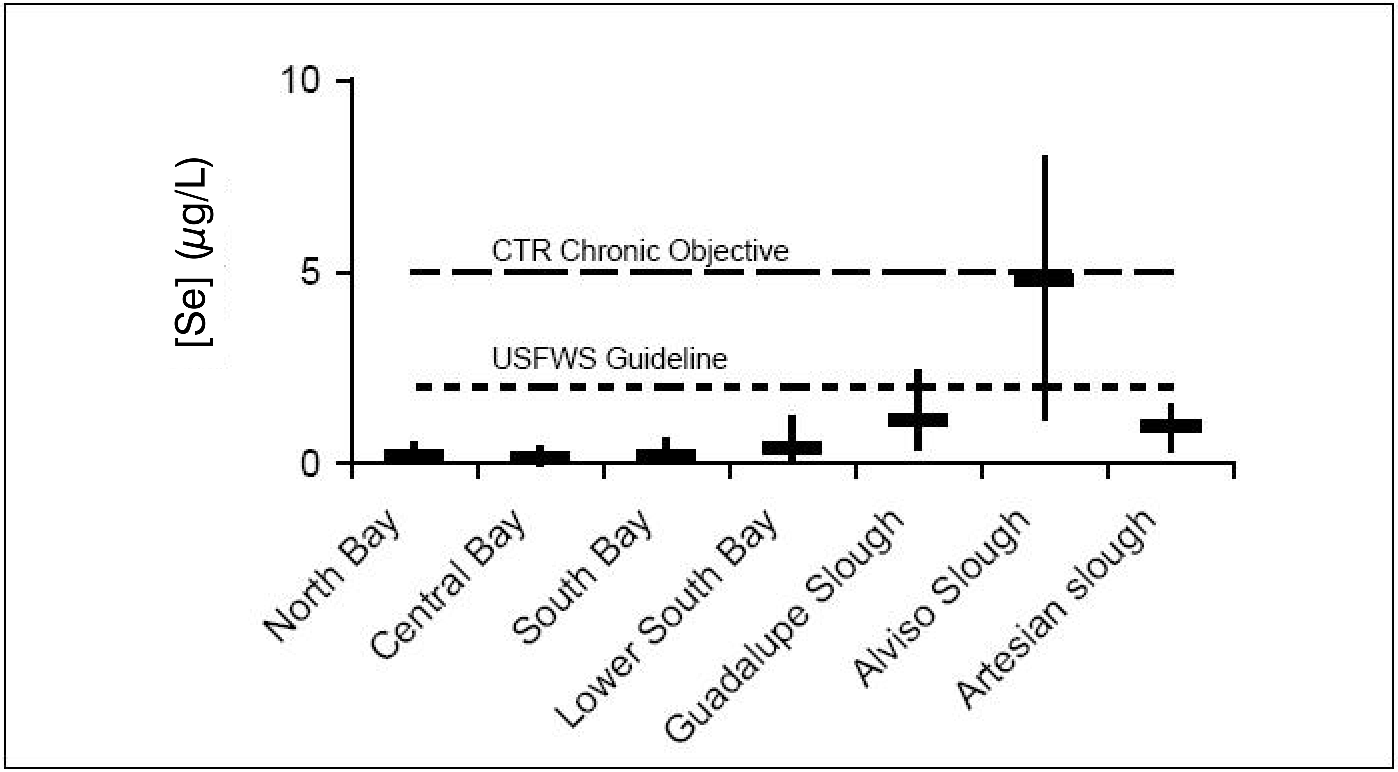
In the San Francisco Bay region, selenium concerns have been predominantly focused on the northern reach, in Suisun Bay and San Pablo Bay. In the South San Francisco Bay area of the regional setting, there is no documented evidence of selenium impairment in the food web.

The EPA has established the current WQO for selenium at 5 ug/L in water through the CTR. The EPA has also reserved this objective, and proposes to develop a more refined WQO that considers food web models developed specifically for the South San Francisco Bay ecosystem.

The only place in the South San Francisco Bay where selenium exceeds the 5 µg/L WQO is in the Alviso Slough as shown in Figure 23. The reason for this local peak concentration is unknown. Selenium concentrations (2-8 µg/L) in groundwater wells in the alluvial plain between Coyote Creek and the Guadalupe River are one potential explanation (Santa Clara Valley Water District, 1994).

6.4 Fisheries Habitat Parameters in Receiving Waters

Tidal waters such as the South San Francisco Bay and sloughs are designated in the Basin Plan as cold and warm water fish habitat. Traditional water quality parameters related to healthy habitat for fish include dissolved oxygen, turbidity, salinity, and temperature as shown in Tables 20 and 21. The salt ponds and former salt ponds in the greater South San Francisco Bay such as Salt Pond A18 are designated as estuarine habit. The definition of estuarine habitat in the Basin Plan recognizes that “estuarine habitat is generally associated with moderate seasonal fluctuations in dissolved oxygen, pH, and temperature and with a wide range in turbidity” (San Francisco Bay Regional Water Quality Control Board, 2007). Although dissolved oxygen, pH, temperature, and turbidity are not likely to be



SOURCE:
Figure from Abu-Saba and Ogle, 2005.

Figure 23
SELENIUM CONCENTRATIONS IN WATER MEASURED BY THE RMP
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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Table 20 Fisheries Habitat Parameters in Receiving Waters
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Item	Sample Location	Ammonia-Nitrogen(1)	Nitrate(2)	Nitrite(2)	Phosphate(2,3)	Dissolved Oxygen(4)	Chlorophyll-a(4)
Minimum observed concentration, (mg/L)	BA 30	0.00011	0.2	0.007	0.3	6.2	2.2
	C-3-0	0.00021	1.3	0.01	0.5	2.8	1.0
Maximum observed concentration, (mg/L)	BA 30	0.0126	8.8	0.06	4.2	10.1	34.2
	C-3-0	0.0153	10.5	0.3	10.9	8.5	131.5
Average observed concentration, (mg/L)	BA 30	0.0038	0.9	0.02	1.0	8.1	7.2
	C-3-0	0.0051	4.5	0.09	2.3	5.9	23.8
Regulatory Threshold(5)		NA	NA	NA	NA	5 mg/L(5)	NA

Notes:

NA = Not Available.

(1) Unionized ammonia (NH3-N) concentration. Data collected from 2003 - 2007 as part of South Bay Monitoring Program.

(2) Data collected from 2002 - 2007 as part of South Bay Monitoring Program.

(3) Total phosphate as PO4.

(4) Data from 1998 - 2006 was downloaded from RMP site.

(5) Basin Plan Objective.

Table 21 Salinity, TSS, and Temperature in the Receiving Waters
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Item	Sample Location	Salinity(1) (ppt)	TSS(2) (mg/L)	Temperature(1) (°C)
Minimum observed concentration or value	BA 30	14.5	11.3	8.7
	C-3-0	0.79	25.8	11.0
Maximum observed concentration or value	BA 30	31.8	182.0	23.4
	C-3-0	22.0	400.0	25.7
Average observed concentration or value	BA 30	28.1	38.4	16.8
	C-3-0	11.2	193.1	18.3
Regulatory Threshold		NA	NA	No more than 11 (= 20 °F) above background in discharge, elevation by no more than 2.2 (=4 °F) in above background receiving water

Notes:
NA = Not Available.
ppt = Parts Per Thousand
(1) Data collected from 1998 - 2007 from both RMP and South Bay Monitoring Program.
(2) Data collected from 1998 - 2001 from RMP.

regulatory drivers at the WPCP, salinity of receiving waters currently is and will likely remain a regulatory driver affecting both minimum and maximum allowable flow. Dissolved oxygen and the related issue of algal growth are the water quality factors most likely to affect the planning process with respect to Salt Pond A18.

This section provides information on the overall health of the South San Francisco Bay with respect to fisheries habitat. Pollutants from the WPCP that have the potential to impact fisheries habitat include BOD, turbidity, salinity, temperature, and nutrients. Of these, only ammonia has been identified as a POC, while the others do not appear to have the potential to impact fisheries habitat.

6.4.1 Phytoplankton and Nutrients

A sufficient but not excessive supply of phytoplankton is necessary to support the food-web and beneficial uses of the South San Francisco Bay. Chlorophyll concentrations are typically used as indicators of phytoplanktons in surface waters, as shown in Table 20. Incidences of rapid phytoplankton growth, known as blooms, occur when growth rates exceed mortality, predation, and external transport.

Nutrient availability is one factor that is known to stimulate phytoplankton growth in freshwater and deep ocean ecosystems. The South San Francisco Bay is nutrient-limited only about 15 percent of the time (Cloern, 1999). Summer phosphate concentrations in the South San Francisco Bay often exceed 10 micrograms per liter (µg/L), much greater than the typical <0.5 µg/L found in the adjacent Pacific Ocean (Van Geen and Luoma, 1993). Table 20 shows the range and average nutrient concentrations for ammonia, nitrate, nitrite, and phosphate observed in the receiving waters.

Guidance for developing nutrient numeric endpoints for protection of water quality in California estuaries has recently been developed by the EPA (Tetra Tech Inc., 2006). This guidance also notes that San Francisco Bay is light, rather than nutrient, limited. This condition can reasonably be expected to continue in the future. However, depending on how tidal marsh restoration projects proceed, certain near shore areas of the South San Francisco Bay could experience reduced turbidity and increased light penetration.

In that event, there may evolve an increased need for monitoring and management of nutrient inputs to South San Francisco Bay. It should be noted, however, that the likelihood of decreased turbidity as a result of ecosystem restoration is not certain. This process will be monitored and adaptively managed by the South Bay Salt Pond Restoration Project.

Average nutrient concentrations in receiving water closest to the WPCP effluent outfall (C-3-0) show that ammonia-nitrogen is slightly above the range of average background concentrations (BA 30). Ammonia-nitrogen has been identified as a POC. Average nitrate and phosphate concentrations in the WPCP effluent are elevated compared to average background levels.

6.4.2 Dissolved Oxygen

Dissolved oxygen in surface waters is required for survival and health of aquatic life. The Basin Plan sets the dissolved oxygen objective at 5 mg/L but periodically allows lower concentrations by acknowledging that a 3 month median concentration of 80 percent oxygen saturation (about 6.5 mg/L) is sufficient to protect beneficial uses of the area. In the salt ponds and tidal marshes of South San Francisco Bay, lower dissolved oxygen concentrations are a natural occurrence. Oxygen is consumed by chemical and biological processes. BOD and chemical oxygen demand (COD) loadings to the South San Francisco Bay have decreased substantially from 1962 through 1986 with improved wastewater treatment processes and changing land use in the watershed. This has helped restore the dissolved oxygen concentrations closer to ambient levels in the receiving waters as shown in Table 20.

In contrast to conventional and toxic pollutants discussed above, more general receiving water quality parameters such as salinity, TSS, and temperature do not have fixed numeric regulatory thresholds. Rather, as indicators of habitat quality, the potential for environmental impacts is gauged according to the potential for substantial changes in habitat. For this reason, flow from the WPCP is subject to both maximum constraints to avoid expansion of freshwater marsh and minimum constraints to avoid loss of freshwater habitat that some avian species depend on.

Temperature is regulated in receiving waters by the State Water Resources Control Board Thermal Plan. The WQOs for estuaries are expressed relative to background temperatures, as shown in Table 21. Average temperature in the receiving water close to WPCP outfall (C-3-0) was 1.5°C higher than the average background temperature (BA 30). This is within the range of temperature change established as water quality objectives in the State's Thermal Plan. It is important to note that the State Thermal Plan objectives for temperature are all expressed relative to background temperature. Background temperature in South San Francisco Bay is difficult to characterize, because temperature will vary both seasonally and daily due to warming by solar radiation, cooling by wind, and tidal mixing of cooler water from Central San Francisco Bay.

The WPCP is not specifically a thermal discharger. Water is heated due to inputs of warm water from domestic and industrial uses, and to some extent by solar radiation during the treatment process. Therefore, the only planning consideration where temperature would likely be a component would be in the unlikely event that the WPCP would accept cooling water from an industrial process.

6.5 Pathogens and Indicator Organisms

Pathogens and indicator organisms have not been identified as POCs. However, there are detectable concentrations of indicator organisms in the WPCP effluent. The following discussion provides information on receiving water quality with respect to microbial contaminants.

Regulatory standards for pathogens in receiving waters are based on the following uses:

- Drinking water.
- Water contact during recreational use.
- Shellfish harvesting.

South San Francisco Bay waters are not used for drinking and therefore the drinking water standards do not apply. Water contact is minimal in South San Francisco Bay, as much of the shoreline is not easily accessible for swimming or other water contact. All of San

Francisco Bay has shellfish harvesting listed as an existing or potential beneficial use. However there are currently no commercial shellfish beds in San Francisco Bay (Basin Plan Triennial Review, 2008).

The EPA promulgated bacteriological criteria (Environmental Protection Agency, 1986) for protection of human health due to contact recreation. The EPA recommended the use of criteria based on E. coli for fresh waters and Enterococci for fresh and marine waters. These criteria were presented in the Basin Plan for inland surface waters, enclosed bays and estuaries, and coastal lagoons as shown in Table 22.

Table 22 Standards for Pathogen and Indicator Concentrations in Receiving Water(1)
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Item	Fecal Coliform	Total Coliform	Enterococci
Water Contact During Recreational Use	Five samples for any 30-day period, shall not exceed a log mean of 200 MPN/100 mL, nor shall 10 percent of total samples during any 30-day period exceed 400 MPN/100 mL.	Less than 1,000/100 ml; provided that not more than 20 percent of the samples at any station, in any 30-day period, may exceed 1,000 MPN/100 mL and provided further that no single sample when verified by a repeat sample taken within 48 hours shall exceed 10,000 MPN/100 mL.	The geometric mean of Enterococci shall not exceed 35 colonies per 100 mL. The single sample maximum allowable density in designated beach areas is 104 colonies per 100 mL, in moderately or lightly used areas is 276 colonies per 100 mL, in infrequently used areas is 500 colonies per 100 mL.
Shellfish Harvesting	Not applicable	Median total coliform concentration throughout the water column for a 30-day period shall not exceed 70/100 ml nor shall more than 10 percent of the samples collected during any 30-day period exceed 230 MPN/100 mL for a five-tube decimal dilution test or 330 MPN/100 mL when a three-tube decimal dilution test is used.	Not applicable

Note:
(1) From the Basin Plan.

The Basin Plan identifies WQOs utilizing fecal coliforms as the indicator for pathogens, based on protection of commercial shellfish beds. Studies are currently being conducted by the RWQCB to identify where recreational shellfish harvesting occurs along the coast and within the estuary (Basin Plan Triennial Review, 2008).

The City initiated a monitoring study in 1997 to understand spatial and temporal trends in metals loading, water quality constituents, and microbiological parameters in the area south of the Dumbarton Bridge. Three sampling events were conducted in 1997 and the data were summarized in Watson et al., 1998. Mean concentrations of fecal coliform bacteria at the study sites indicated that the concentrations of fecal bacteria increased towards the estuary interfaces at the Alviso Slough and Coyote Creek, as shown in Table 23. This indicates land-based sources of fecal coliforms. The spatial variability observed bayward of the estuary interface stations may be due, in part, to sampling at different tidal stages, thereby collecting samples from different proportions of South San Francisco Bay and estuary water. The sampling frequency was not high enough to compare results to WQOs.

Table 23 Pathogen and Indicator Concentrations in Receiving Water
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Sample Location (See Figure 18)	Mean Fecal Coliform (MPN/100 mL)
SB01 (BA 30)	< 50
SB02 (BA 20)	100
SB03 (BA 10)	50
SB04 (C-3-0)	200
SB05	400
SB06	800
SB07	200
SB08	< 50
SB09	< 50
SB10	50
SB11 (BW 10)	1300
SB12 (BW 15)	1000

Fecal coliform concentration data from the WPCP (Tables 22 and 23), show that there have been periods when concentrations were well above the background (BA30) concentrations. However, the WPCP has the ability to produce effluent with very low fecal coliform concentrations. With the exception of October 2002, all 95th percentile values were below 18 most probable number (MPN)/100 mL, which is similar to the average background concentration of <50 MPN/100 mL.

The WPCP disinfects effluent prior to discharge. Therefore, pathogen indicators in receiving waters are not likely to be regulatory drivers for planning purposes related to the WPCP. However, pathogen indicators (e.g., coliform bacteria) can thrive in slow moving or stagnant waters, particularly when there are avian input sources. Therefore, planning for the management of Salt Pond A18 may need to consider how pathogen indicators in receiving will be affected by different options and alternatives.

7.0 CONCLUSIONS

The water quality characteristics of the WPCP influent and effluent wastewater, onsite stormwater, groundwater, and receiving water were examined in this PM. The evaluation of historical wastewater water quality will be used to develop projections of future water quality. The evaluation of onsite stormwater, groundwater, and receiving water provides a broad perspective on the water resources that may be affected by the WPCP.

Analysis of conventional pollutants in the WPCP discharge shows that BOD, TSS, and ammonia-nitrogen concentrations have varied over the 10-year period. Influent ammonia-nitrogen concentrations have increased over the 10-year period while effluent concentrations have decreased. Annual and seasonal influent BOD and TSS loads have slightly decreased over the 10-year period. There is not a distinct long term trend in the ammonia-nitrogen influent loads. The analysis of day of the week variations was limited by the available data, however, there does not appear to be significant difference between weekend and weekday loads.

Analysis of non-conventional pollutants showed that there are detectable concentrations of copper, mercury, and nickel in the WPCP's effluent. Cyanide is occasionally greater in the effluent than in the influent, and is likely due to the use of chlorine for disinfection. Analysis of the limited data for organic compounds indicates that detectable concentrations of dioxins, heptachlor, benzo(b)Fluoranthene, PCBs, indeno(1,2,3-cd)pyrene, and tributyltin were measured in the effluent. Analysis of the total and fecal coliform data indicates that there have been periods with elevated effluent levels of microbial pollutants. However, the data also show that the WPCP can produce an effluent with less than or near detection limit total and fecal coliform levels.

Stormwater is routed to the WPCP headworks for treatment. Onsite stormwater analysis was not conducted because water quality and flow data were not available.

Ongoing groundwater monitoring is conducted to determine if operation of the RSM facilities has affected groundwater quality. Analysis of onsite groundwater suggests that the salt ponds located northwest of the WPCP have impacted the groundwater TDS.

Characterization of receiving water quality included evaluation of trace metals, bioaccumulative pollutants, parameters related to fish habitat, and pathogen indicators. Average metals concentrations in the receiving water were all below regulatory thresholds. Average copper and mercury effluent concentrations are within the ranges of observed background concentrations. Average nickel effluent concentrations are above the range observed at the background concentrations.

Analysis of the bioaccumulative pollutants include mercury, PCBs, organochlorine pesticides, and selenium. Analysis showed that mercury and PCB concentrations in fish tissue exceed the RWQCB risk-based target concentrations. Analysis of organochlorine pesticides suggests that concentrations in fish are declining but that the fish consumption advisory associated with these compounds is warranted. Analysis of selenium concentrations shows that the WQO can be exceeded in some areas of the South San Francisco Bay.

Parameters related to fish habitat include phytoplankton, nutrients, dissolved oxygen, temperature, and salinity. The South San Francisco Bay is typically not a nutrient limited system. Ammonia-nitrogen effluent concentrations are within the range of observed background concentrations. Nitrate and phosphate concentrations in the WPCP effluent are elevated compared to background concentrations.

Fecal coliform data show that concentrations in South San Francisco Bay vary spatially and are likely influenced by land-based sources of fecal coliform. Comparison to WPCP effluent concentrations suggests that typical effluent concentrations are similar to background concentrations in the South San Francisco Bay.

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REFERENCES

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APPENDIX - PROCESS TRAIN SCHEMATICS

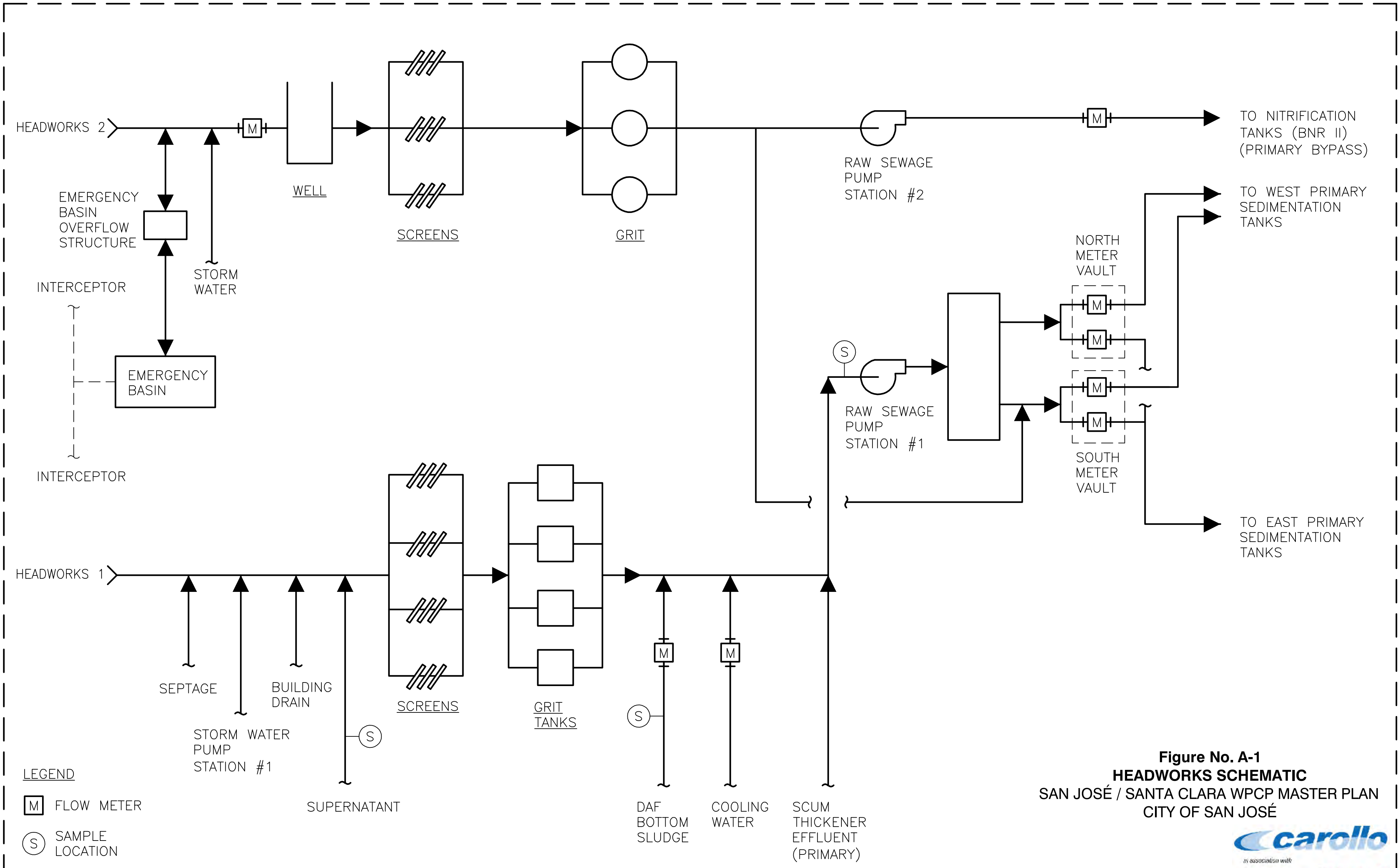

Figure No. A-1
HEADWORKS SCHEMATIC
SAN JOSÉ / SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

in association with

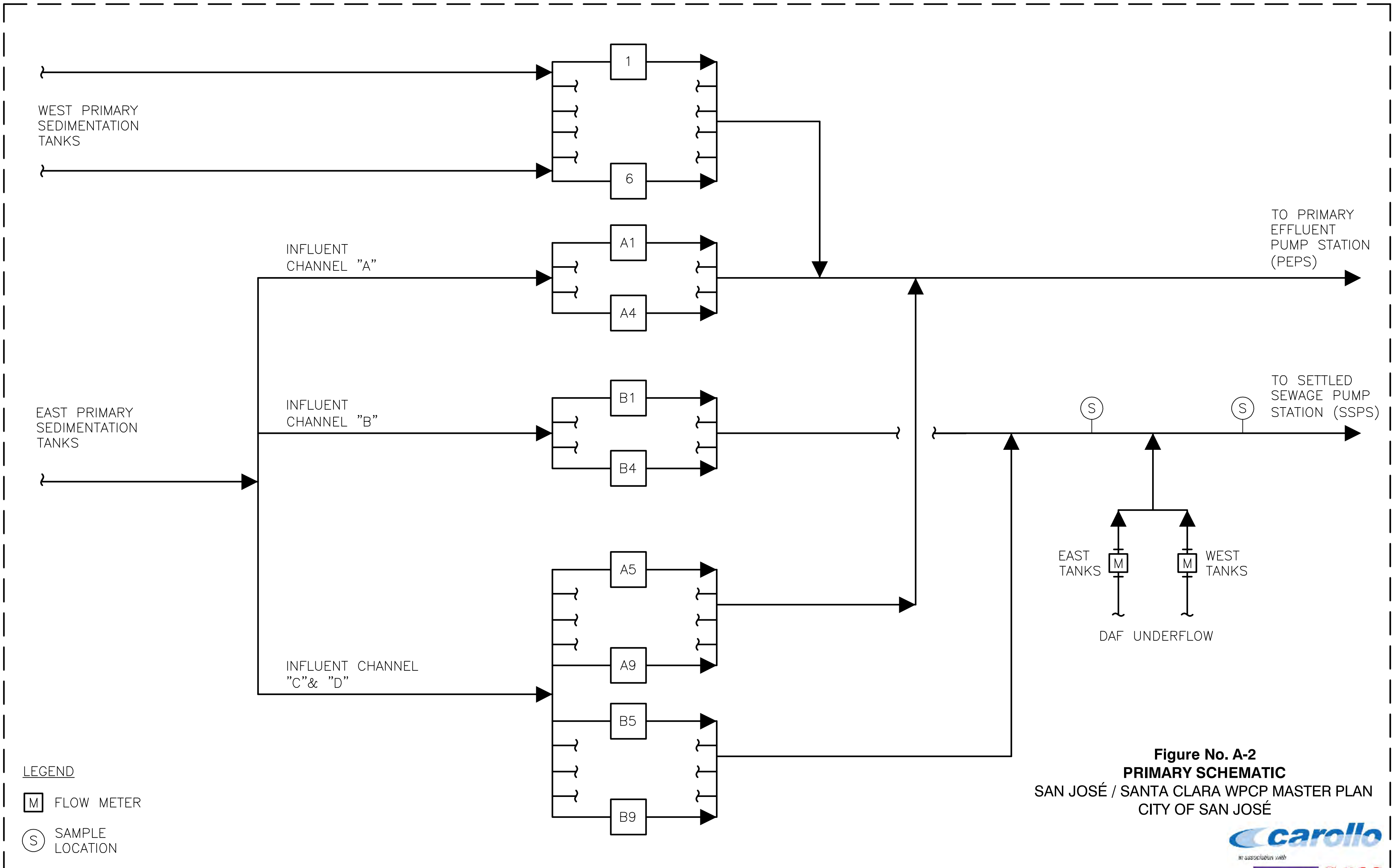

Figure No. A-2
PRIMARY SCHEMATIC
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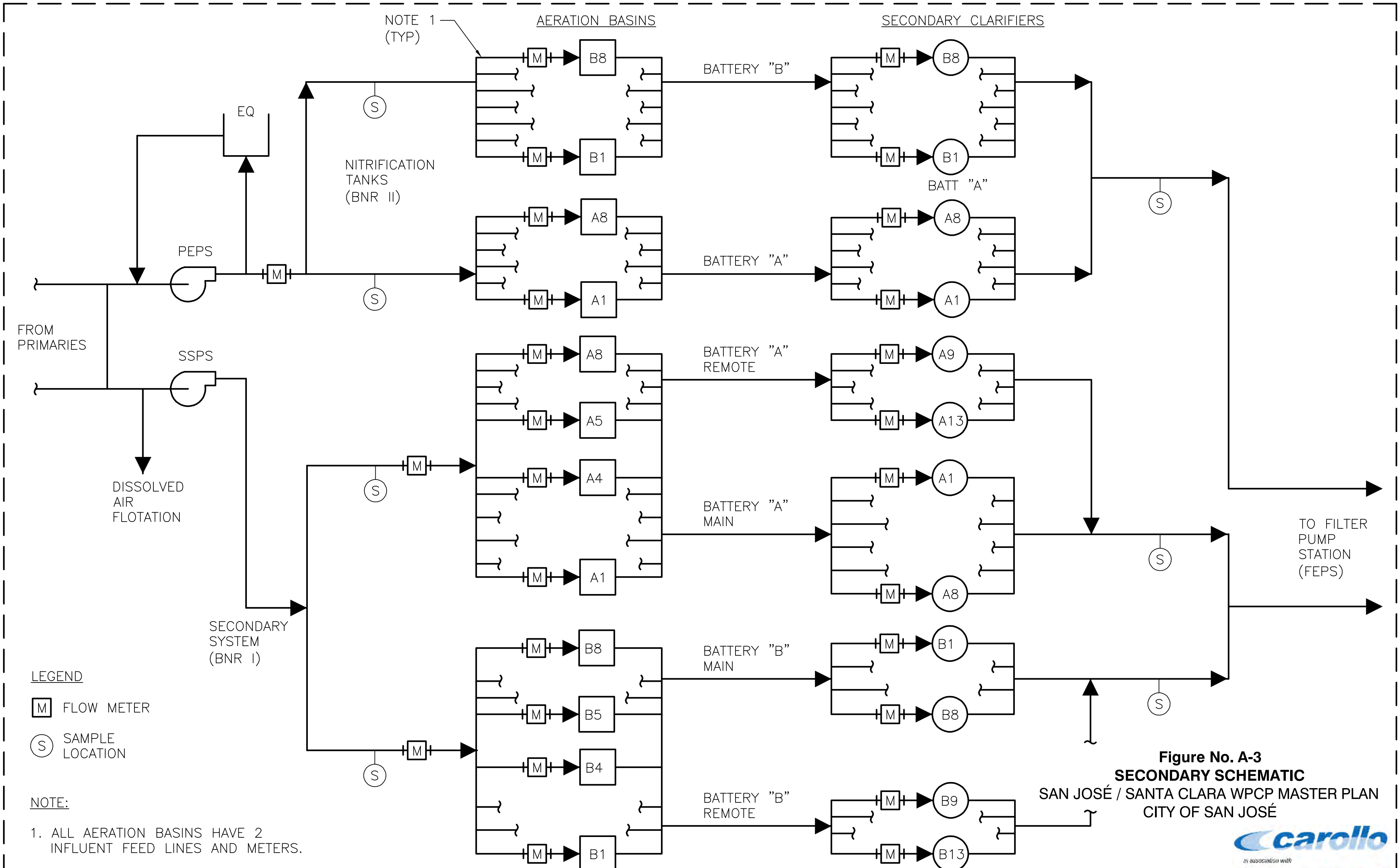
CITY OF SAN JOSÉ

carollo
in association with
BROWN AND CALDWELL SOM



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SECONDARY SCHEMATIC
SAN JOSÉ / SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

carollo in association with BROWN AND CALDWELL SOM

H:\Client\SanJose_WCO\7897A00\FIGURE\FIGURE 3 6-03-09 09:47am JRygh XREFS: CarolloBrownCaldwellSomLogo;

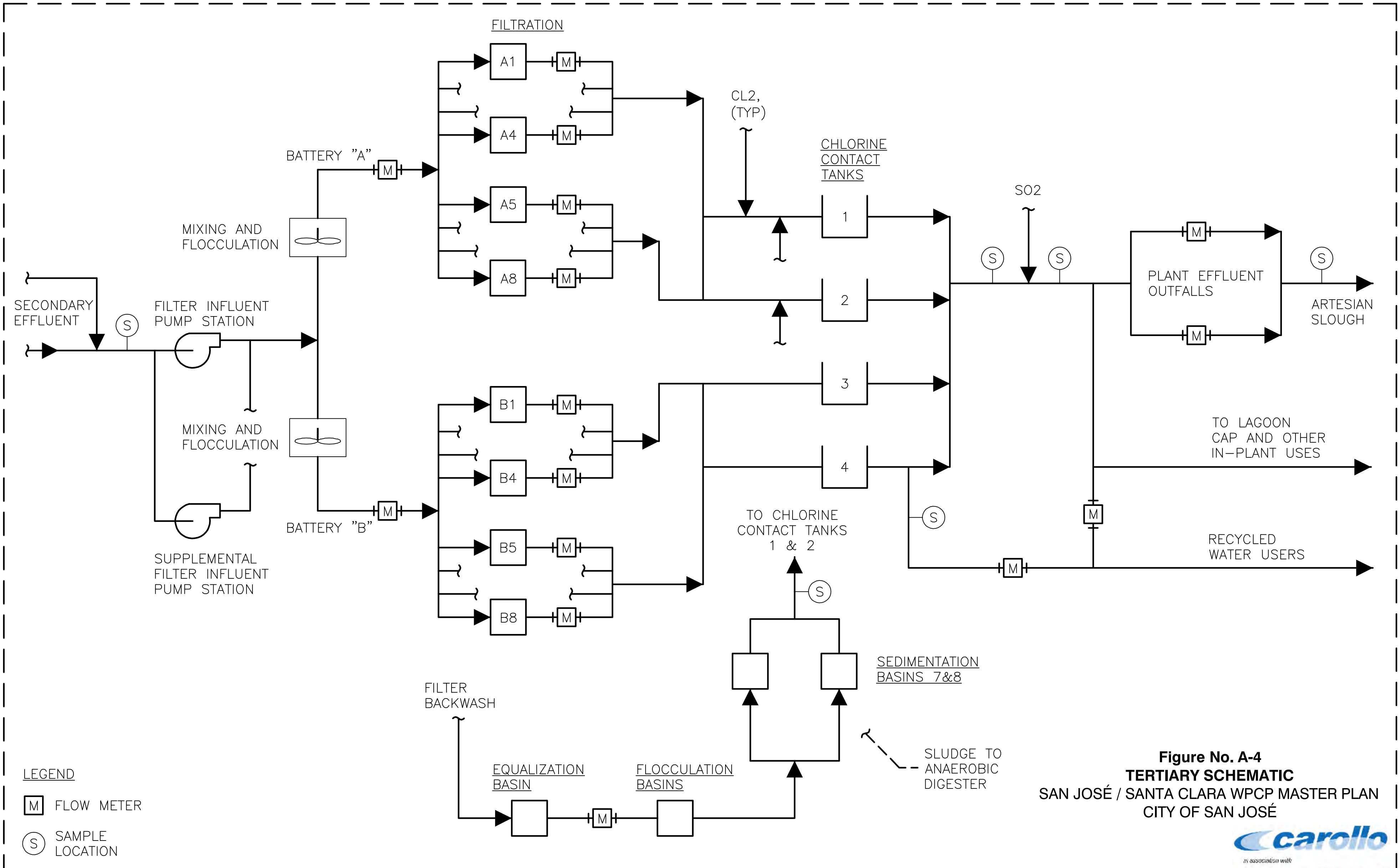

Figure No. A-4
TERTIARY SCHEMATIC
SAN JOSÉ / SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

carollo in association with BROWN AND CALDWELL SOM

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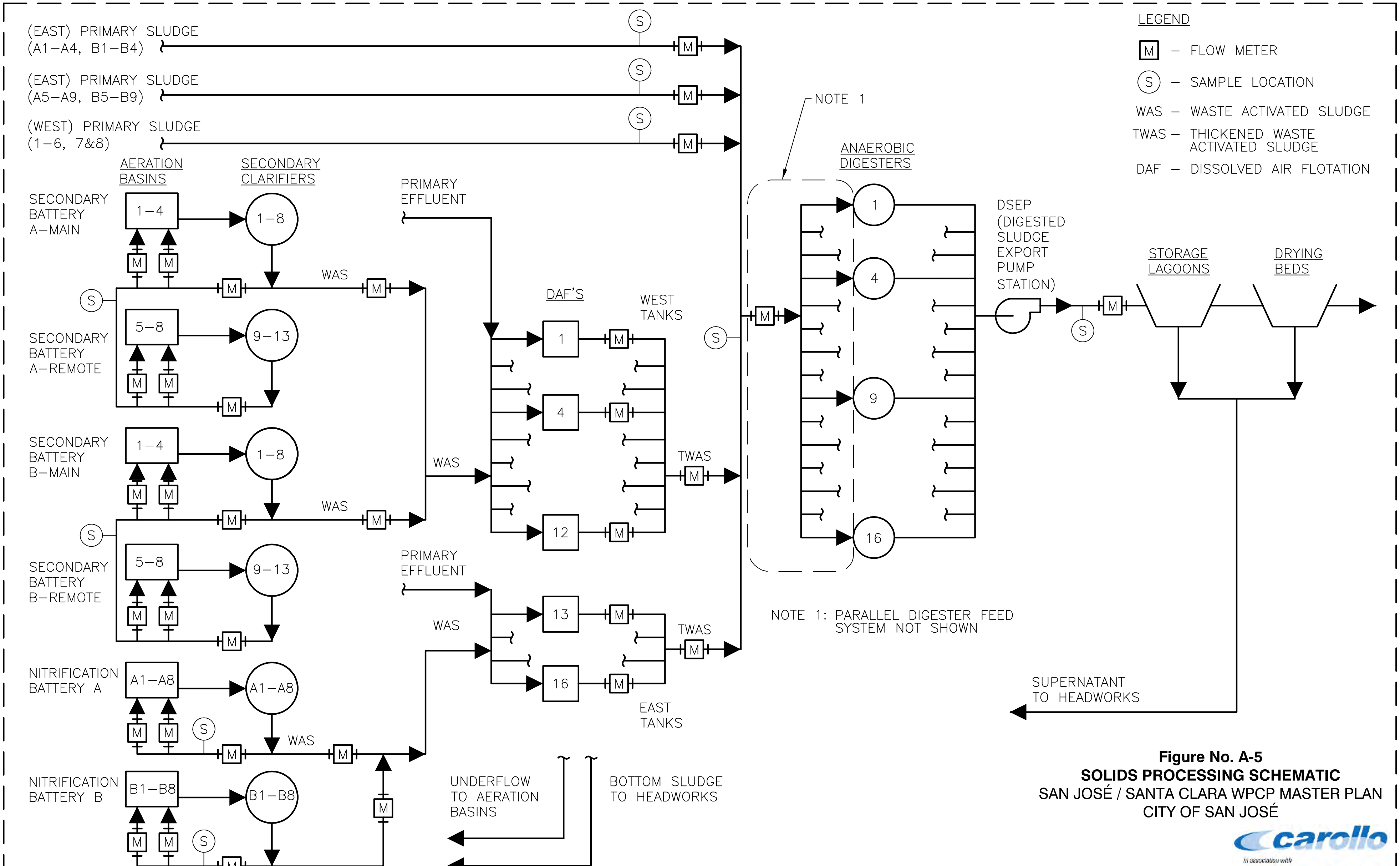

Figure No. A-5
SOLIDS PROCESSING SCHEMATIC
SAN JOSÉ / SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

carollo
in association with
BROWN AND CALDWELL SOM

H:\Client\SanJose_WCO\7897A00\FIGURE\FIGURE 5 6–03–09 09:48am JRygh XREFS: CarolloBrownCaldwellSomLogo;