Bay Area Clean Water Agencies
Nutrient Reduction Study

Group Annual Report

Nutrient Watershed Permit Annual Report

2020

February 1, 2021

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1 Introduction

On May 8, 2019, the San Francisco Bay Regional Water Quality Control Board (Regional Water Board) adopted the Nutrient Watershed Permit, also known as National Pollutant Discharge Elimination System (NPDES) Permit No. CA0038873, Regional Water Board Order No. R2-2019-0017. This permit replaces the previous permit under Order No. R2-2014-0014, which expired on June 30, 2019. The updated Nutrient Watershed Permit became effective on July 1, 2019, and it covers each municipal Publicly Owned Treatment Works (POTW) that discharges to the San Francisco Bay and its tributaries. The purpose of this Nutrient Watershed Permit is to track and evaluate treatment plant performance, fund nutrient research and monitoring programs, support load response modeling, and evaluate nutrient reduction potential of recycled water and natural systems.

One of the requirements of the Nutrient Watershed Permit is the reporting and analysis of influent and effluent nutrient monitoring data, and concentration and loading trends. Each agency's nutrient loads must also be compared to total POTW loads in their respective Subembayment, as defined in the permit. An annual report is required to provide an ongoing record of these data and analyses.

The purpose of this Group Annual Report is to fulfill the reporting and analysis requirement of the Nutrient Watershed Permit for the participating agencies for the period between Oct 1, 2012 and Sep 30, 2020. This report includes the following sections:

- **Section 2 – Background.** This section includes relevant background information on the requirements of the Nutrient Watershed Permit.
- **Section 3 – Approach.** This section presents the approach to obtain data, the constituents of interest, data confirmation, seasonality analysis, and statistical trending.
- **Section 4 – Influent Data Review Findings.** This section presents the influent data for each discharger as well as the annual and dry season averages for the Influent Flow, Total Ammonia, Nitrite plus Nitrate, Total Inorganic Nitrogen, and Total Phosphorus.
- **Section 5 – Discharge Data Review Findings.** This section presents the discharge data for each discharger as well as the annual and seasonal averages for the Discharge Flow, Total Ammonia, Nitrite plus Nitrate, Total Inorganic Nitrogen, and Total Phosphorus. In addition, the contributing flows and loads for each discharger are presented in comparison to the other dischargers in its respective Subembayment.
- **Section 6 – Discussion.** This section includes a discussion of the data presented in Sections 4 and 5.
- **Section 7 – Summary.** This section provides a brief summary of the findings, discussion, and recommendations that will improve the data collection and analysis in future years.
- **Appendix.** A separate section is provided in the appendix to present the data and analysis for each of the thirty-four dischargers.

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2 Background

The Nutrient Watershed Permit applies to the municipal wastewater dischargers and specific facilities identified in Table 2-1. In addition, the location of each discharger is shown in Figure 2-1.

Table 2-1. Municipal Wastewater Dischargers Included in the Nutrient Watershed Permit

Discharger Name (Abbreviation)	POTW Facility Name	Minor / Major[(a)]
American Canyon, City of (American Canyon)	Wastewater Treatment and Reclamation Facility	Major
Benicia, City of (Benicia)	Benicia Wastewater Treatment Plant	Major
Burlingame, City of (Burlingame)	Burlingame Wastewater Treatment Plant	Major
Central Contra Costa Sanitary District (CCCSD)	Central Contra Costa Sanitary District Wastewater Treatment Plant	Major
Central Marin Sanitation Agency (CMSA)	Central Marin Sanitation Agency Wastewater Treatment Plant	Major
Crockett Community Services District (Port Costa)	Port Costa Wastewater Treatment Plant	Minor
Delta Diablo (Delta Diablo)	Wastewater Treatment Plant	Major
East Bay Dischargers Authority (EBDA): Cities of Hayward and San Leandro; Oro Loma Sanitary District; Castro Valley Sanitary District; Union Sanitary District; East Bay Regional Parks District; Livermore-Amador Valley Water Management Agency; Dublin San Ramon Services District; and City of Livermore	EBDA Common Outfall	Major
	Hayward Water Pollution Control Facility	
	San Leandro Water Pollution Control Plant	
	Oro Loma/Castro Valley Sanitary Districts Water Pollution Control Plant	
	Raymond A. Boege Alvarado Wastewater Treatment Plant	
	Hayward Marsh	
	Livermore-Amador Valley Water Management Agency Export and Storage Facilities	
	Dublin San Ramon Services District Wastewater Treatment Plant	
	City of Livermore Water Reclamation Plant	
East Bay Municipal Utility District (EBMUD)	East Bay Municipal Utility District, Special District No. 1 Wastewater Treatment Plant	Major
Fairfield-Suisun Sewer District (FSSD)	Fairfield-Suisun Wastewater Treatment Plant	Major
Las Gallinas Valley Sanitary District (Las Gallinas)	Las Gallinas Valley Sanitary District Sewage Treatment Plant	Major
Marin County (Paradise Cove), Sanitary District No. 5 of	Paradise Cove Treatment Plant	Minor
Marin County (Tiburon), Sanitary District No. 5 of	Wastewater Treatment Plant	Minor
Millbrae, City of (Millbrae)	Water Pollution Control Plant	Major
Mt. View Sanitary District (Mt View)	Mt View Sanitary District Wastewater Treatment Plant	Major
Napa Sanitation District (Napa)	Soscol Water Recycling Facility	Major
Novato Sanitary District (Novato)	Novato Sanitary District Wastewater Treatment Plant	Major
Palo Alto, City of (Palo Alto)	Palo Alto Regional Water Quality Control Plant	Major

Discharger Name (Abbreviation)	POTW Facility Name	Minor / Major[a]
Petaluma, City of (Petaluma)	Municipal Wastewater Treatment Plant	Major
Pinole, City of (Pinole)	Pinole-Hercules Water Pollution Control Plant	Major
Rodeo Sanitary District (Rodeo)	Rodeo Sanitary District Water Pollution Control Facility	Major
San Francisco (San Francisco International Airport), City and County of (SFO Airport)	Mel Leong Treatment Plant, Sanitary Plant	Major
San Francisco (Southeast Plant), City and County of (SFPUC Southeast)	Southeast Water Pollution Control Plant	Major
San Jose/Santa Clara Water Pollution Control Plant and Cities of San Jose and Santa Clara (San Jose)	San Jose/Santa Clara Water Pollution Control Plant	Major
San Mateo, City of (San Mateo)	City of San Mateo Wastewater Treatment Plant	Major
Sausalito-Marin City Sanitary District (SMCSD)	Sausalito-Marin City Sanitary District Wastewater Treatment Plant	Major
Sewerage Agency of Southern Marin (SASM)	Sewerage Agency of Southern Marin Wastewater Treatment Plant	Major
Silicon Valley Clean Water (SVCW)	Silicon Valley Clean Water Wastewater Treatment Plant	Major
Sonoma Valley County Sanitary District (Sonoma Valley)	Municipal Wastewater Treatment Plant	Major
South San Francisco and San Bruno, Cities of (South SF)	South San Francisco and San Bruno Water Quality Control Plant	Major
Sunnyvale, City of (Sunnyvale)	Sunnyvale Water Pollution Control Plant	Major
U.S. Department of Navy (Treasure Island)	Treasure Island Wastewater Treatment Plant	Major
Vallejo Flood and Wastewater District (Vallejo)	Vallejo Wastewater Treatment Plant	Major
West County Agency (West County) (West County Wastewater District and City of Richmond Municipal Sewer District)	West County Agency Combined Outfall	Major
	West County Wastewater District Treatment Plant	
	Richmond Municipal Sewer District Water Pollution Control Plant	

(a) As defined in the Nutrient Watershed Permit (Minor dischargers have a permitted average dry weather flow (ADWF) capacity <1 mgd; Major dischargers have a permitted ADWF capacity ≥1 mgd).

The Nutrient Watershed Permit has specific influent and effluent monitoring requirements. Each agency covered by the Permit is required to monitor and report the following constituents in their effluent:

1. Flow
2. Ammonia as Nitrogen
3. Nitrate/Nitrite as Nitrogen
4. Total Inorganic Nitrogen as Nitrogen (Calculated Value)
5. Total Phosphorus

Each agency with a facility design flow of more than 10 million gallons per day (mgd) is required to monitor and report the following constituents in their influent:

1. Flow
2. Ammonia as Nitrogen
3. Nitrate/Nitrite as Nitrogen
4. Total Inorganic Nitrogen
5. Total Kjeldahl Nitrogen
6. Total Nitrogen
7. Total Phosphorus

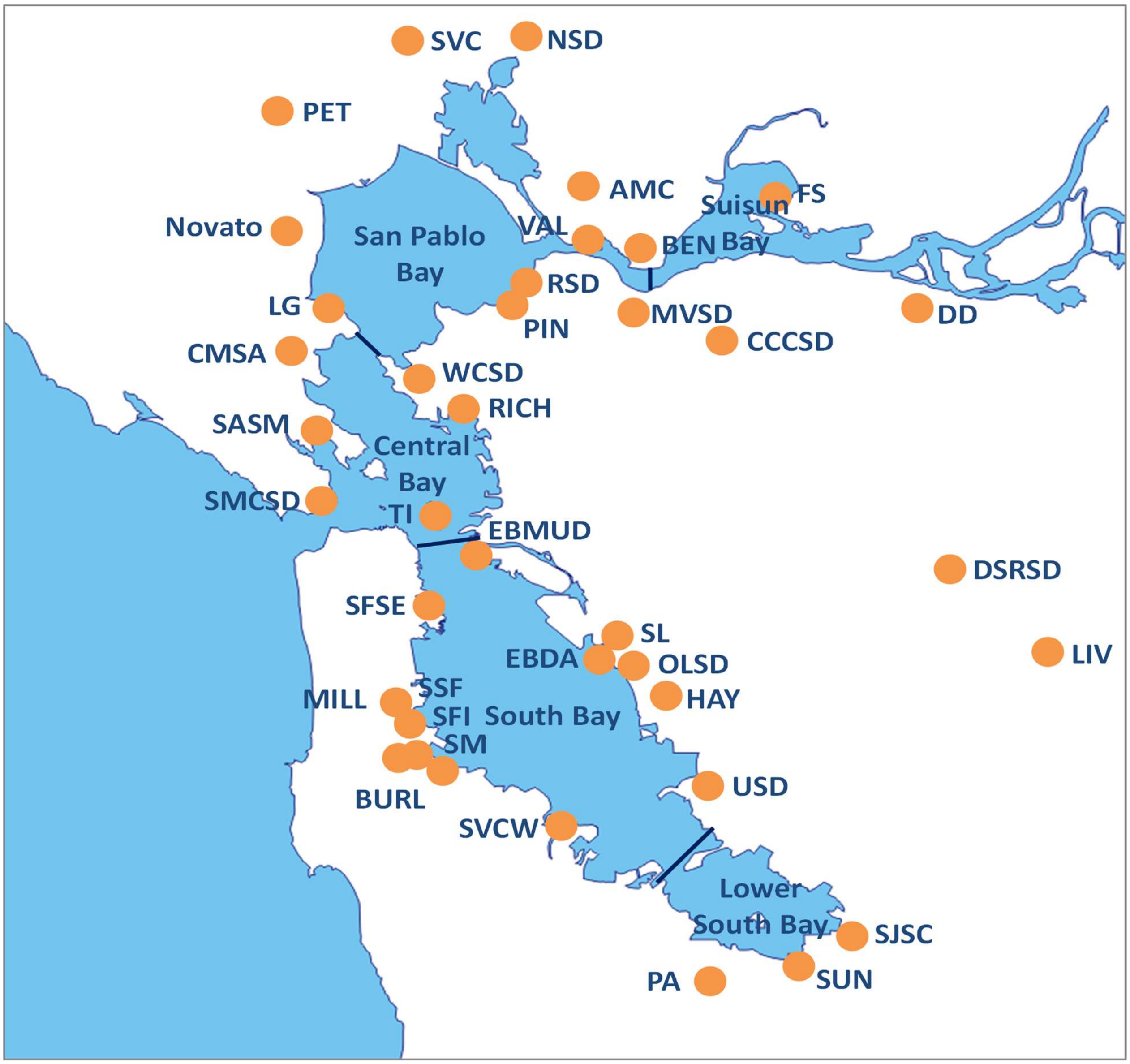

Figure 2-1. Location of Dischargers

Note: All Five Subembayments are shown with delineation by the dark blue solid line

Major municipal dischargers having a permitted or design flow greater than 10 mgd are required to sample effluent twice per month, and influent once per quarter. Major municipal dischargers having a flow greater than or equal to 1 mgd but less than or equal to 10 mgd are required to sample effluent once per month. Minor municipal discharges, defined as those with a flow less than 1 mgd, are required to monitor effluent twice per year. In addition, dischargers are required to sample only during the months of the year when they are discharging. The data collected must be submitted monthly on the Regional Water Board's California Integrated Water Quality System (CIWQS) online data reporting tool.

Prior to the sampling required under the Nutrient Watershed Permit, the dischargers were required to perform similar sampling and data collection. This early data collection was required under the Regional Water Board's Section 13267 Letter Data, dated March 2, 2012.[1]

Together, the Nutrient Watershed Permit data and the Section 13267 Letter Data, form the dataset for the analysis and reporting in this Group Annual Report. Additional information regarding the data sources and data confirmation is included in Section 3.

Per Attachment E, Section IV.B.1.b., of the Nutrient Watershed Permit, the Group Annual Report must include the following:

ii. Summary tables depicting the Discharger's annual and monthly flows, nutrient concentrations, and nutrient mass loads, calculated as described in Attachment G section VIII.A (Arithmetic Calculations) of individual NPDES permits. The summary tables shall cover October 1 before the preceding year through September 30 of the preceding year and at least the previous five years of available data. Each Discharger shall document its nutrient loads relative to other facilities covered by this Order that discharge into the same Subembayment (i.e., Suisun Bay, San Pablo Bay, Central Bay, South Bay, and Lower South Bay). These Subembayment delineations may be refined through Provision VI.C.4 of the Order, in which case each Discharger shall document loads relative to the most recent delineation. Nutrient data from other Dischargers may be obtained from the State Water Board's California Integrated Water Quality System (CIWQS) website (https://www.waterboards.ca.gov/ciwqs/index.html).

iii. Analysis of nutrient trends and load variability, and assessment as to whether nutrient mass discharges are increasing or decreasing.

iv. Status and plans for investigation if the trend analysis shows a significant change in nutrient loading. In such cases, the Discharger shall investigate the cause. In the annual reports, the Discharger shall set forth its plans for investigation and report its results, providing necessary updates in subsequent annual reports. The investigation shall include, at a minimum, whether treatment process changes, increasing or decreasing water reclamation, or changes in total influent flow related to water conservation, population growth, transient work community, new industry, or wet weather flows have reduced or increased nutrient discharges.

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[1] Wolfe, Bruce. (2012) Letter: Water Code Section 13267 Technical Report Order Requiring Submittal of Information on Nutrients in Wastewater Discharges. March 2, 2012. https://www.waterboards.ca.gov/sanfranciscobay/board_decisions/adopted_orders/2019/R2-2019-0017.pdf

3 Approach

The sources of data, as well as the approach for data confirmation, analysis of seasonality, and statistical trending are presented in the subsections herein.

3.1 Data Sources

Data from Oct 2012 to Sep 2020 were compiled from two different sources: the Section 13267 Letter Data requirements and the subsequent Nutrient Watershed Permits. The Section 13267 Letter Data include the initial two years (Oct 2012 through June 2014) and the Nutrient Watershed Permits data include the subsequent years (July 2014 through Sep 2020). The sampling requirements and frequency differ between the two datasets. The Nutrient Watershed Permit data collection requirements were updated as of July 1, 2019 per the second Nutrient Watershed Permit. The updated NPDES permit (R2-2019-0017) included the following significant changes:

1) The yearly reporting period has been changed from Jul-Jun to Oct-Sep. This was implemented to more accurately reflect the seasonal changes from year to year (see Section 3.4 for more discussion on Seasonality). As a result, the initial few months of the Section 13267 Letter Data (July 2012 through September 2013) were excluded from further analysis.
2) Soluble Reactive Phosphorus (Ortho-P) and TKN effluent data are no longer required.
3) Total Inorganic Nitrogen (TIN) will be calculated as the basis for effluent nitrogen concentration, as opposed to Total Nitrogen (TN).
4) Quarterly influent nutrient reporting is required for dischargers with a permitted or design flow of greater than 10 million gallons per day.

A comparison for the sampling requirements for each dataset is summarized in Table 3-1.

Table 3-1. Comparison of Sampling Requirements for the Section 13267 Letter Data and Nutrient Watershed Permits

Parameter	Section 13267 Letter Data	Nutrient Watershed Permit Data (2014; R2-2014-0014)	Nutrient Watershed Permit Data (2019; R2-2019-0017))
Major Dischargers and Sampling Frequency	1) Flows ≥5 mgd permitted capacity a. Year-round dischargers: Sample twice per month and two additional samples each wet season during peak wet weather flow conditions b. Seasonal dischargers: Sample twice per month during discharge (wet) season; sample once during non-discharge (dry) season 2) Flows between 1 and 5 mgd permitted capacity	1) Flows >10 mgd permitted capacity must sample effluent twice per month 2) Flows between 1 and 10 mgd permitted capacity must sample effluent once per month	1) Flows >10 mgd permitted capacity must sample effluent twice per month, and influent once per quarter. 2) Flows between 1 and 10 mgd permitted capacity must sample effluent once per month.

Parameter	Section 13267 Letter Data	Nutrient Watershed Permit Data (2014; R2-2014-0014)	Nutrient Watershed Permit Data (2019; R2-2019-0017))
	a. Year-round dischargers: Sample twice per month and two additional samples each wet season during peak wet weather flow conditions b. Seasonal dischargers: Sample twice per month during discharge (wet) season; sample once during non-discharge (dry) season		
Minor Dischargers and Sampling Frequency	1) Flows <1 mgd permitted capacity a. Year-round dischargers: Sample once per month b. Seasonal dischargers: Sample once per month during discharge (wet) season; sample once during non-discharge (dry) season	1) Flows <1 mgd permitted capacity must sample twice per year	1) Flows <1 mgd permitted capacity must sample twice per year
Non-Nutrient Sampling Parameters	Flow pH Temperature	Flow	Flow
Nitrogen Species and Sample Type	1) Total Ammonia (NH3 plus NH4+, reported as N) – Composite Sample 2) Total Dissolved Nitrogen (TDN, reported as N) – Composite Sample 3) Total Kjeldahl Nitrogen (TKN, reported as N) – Composite Sample 4) Soluble Kjeldahl Nitrogen (SKN, reported as N) – Composite Sample 5) Nitrate (NO3-, reported as N) – Composite Sample 6) Nitrite (NO2-, reported as N) – Composite Sample 7) Urea (limited to 5 largest dischargers, reported as N) – Composite Sample	1) Total Ammonia (NH3 plus NH4+, reported as N) – Composite Sample 2) Total Kjeldahl Nitrogen (TKN) – Composite Sample 3) Nitrate (NO3-) plus Nitrite (NO2-) (NOx, reported as N) – Composite Sample 4) Total Nitrogen (TN, calculated) – Composite Sample	Influent and Effluent: 1) Total Ammonia (NH3 plus NH4+, reported as N) – Composite Sample 2) Nitrate (NO3-) plus Nitrite (NO2-) (NOx, reported as N) – Composite Sample Influent Only: 1) Total Kjeldahl Nitrogen (TKN) – Composite Sample Effluent Only: 1) Total Inorganic Nitrogen (TIN) – Calculated, Total Ammonia + Nitrate and Nitrite

Parameter	Section 13267 Letter Data	Nutrient Watershed Permit Data (2014; R2-2014-0014)	Nutrient Watershed Permit Data (2019; R2-2019-0017))
Phosphorus Species and Sample Type	1) Total Phosphorus (TP) – Composite Sample 2) Soluble Total Phosphorus (STP; reported as P) – Composite Sample 3) Dissolved Orthophosphate (reported as P) – Composite or Grab Sample 4) Total Orthophosphate (reported as P) – Composite Sample	1) Soluble Reactive Phosphorus (SRP, reported as P) – Grab Sample 2) Total Phosphorus (TP) – Composite Sample	1) Total Phosphorus (TP) – Composite Sample

3.2 Measurement Methodologies

A list of the measurement methodologies is presented in Table 3-2.

Table 3-2. List of Parameters, Methodology, and Sample Type

Parameter	Location	Measured or Calculated	Sample Type	Method [a,b]	Calculation
Flow	Influent & Effluent	Both (plant specific)	Continuous	--	--
Total Ammonia	Influent/Effluent	Measured[c]	24-hr Composite	4500-NH3 EPA 300.1	--
TKN	Influent Only	Both (plant-specific) [c]	24-hr Composite	4500-N(org)	--
NOx	Influent/Effluent	Measured[c]	24-hr Composite	4500-N	--
TIN	Effluent Only	Calculated[c]	24-hr Composite	Calculated	$TIN = Ammonia + NOx$
TN	Influent Only	Calculated[c]	24-hr Composite	Calculated	$TN = TKN + NOx$
TP	Influent/Effluent	Measured[c]	24-hr Composite	4500-P	--

a. Standard Methods for the Examination of Water and Wastewater 2017-23rd Edition, American Public Health Association/American Water Works Association/Water Environment Federation, Washington, D.C.
b. Dischargers may propose other U.S. EPA-approved analytical methods, if available, with detection limits low enough to quantify concentrations in wastewater.
c. For plants with only flow and concentration values available, loads were manually calculated for daily values and/or using average monthly flow and concentration values.

3.3 Data Confirmation

Once the data from each discharger were collected and compiled, the data were summarized and provided to each participating discharger for review and confirmation. Effluent data were selected that only includes discharge flows and loads to the Bay (i.e., effluent flows and loads diverted to other locations, such as irrigation, were excluded). The data presented in this Group Annual Report reflect additions and corrections provided by the participating agencies.

3.4 Seasonality

The seasonal variations in the data were examined by dividing the data into a dry and wet season. Understanding seasonality is critical for the analysis of nutrient discharges because of the following factors:

- The dry season is reflective of the base sanitary flows and loads from residential population and industrial contributions to wastewater. In contrast, the increased flows during wet weather events is attributed to inflow and infiltration (I&I) during such events, which can bias the discharge results.
- Wastewater treatment facilities are better able to remove nutrient loads (if deemed necessary) during the warmer, dry season when the biological treatment kinetics are more favorable and there are fewer (if any) peak flow events.
- The Nutrient Management Strategy led by the San Francisco Estuary Institute (SFEI) is currently underway to evaluate San Francisco Bay's resilience to nutrients. It is expected to be less sensitive to nutrients during the wet season because the water is cooler, light irradiance in the Bay is reduced, turbidity in the Bay is elevated, and the hydraulic residence time in the Bay is reduced.

Seasonality is defined in the participating agencies' NPDES permits in different ways; furthermore, not all the permits have a seasonal definition. In order to provide a consistent basis for the purposes of this Group Annual Report, the seasonal definition presented in Table F-5 of the the 2nd Watershed Permit (R2-2019-0017; CA0038873. The wet and dry seasons are defined as follows:

- Dry season: May 1 through September 30
- Wet season: October 1 through April 30

3.5 Influent Data

Influent monitoring data are included for the first time as part of this 2020 Group Annual Report. The data are limited to plants that have a permitted ADWF capacity of greater than 10 mgd (n = 15). The influent sampling is required quarterly that began in July 2019. For instances where dischargers provided more than the minimum influent sampling data requested, that information is provided in this report.

The influent data review focuses on the flows and nutrient loads. As the dataset expands with future Group Annual Reports, the analysis will expand to consider trending analysis and reduction across the plant (if possible).

3.6 Trend Analysis

The Nutrient Watershed Permit requires trending analysis with each report. For this year's Group Annual Report, the trending analysis is limited to discharge as the influent dataset is still limited (n = 5 quarters over 15 months (July 2019 through September 2020)). Future Group Annual Reports will likely include influent trending analysis.

The discharge data were evaluated to identify evidence of trends over the past eight years. Due to the change in sampling frequency between the Section 13267 Letter Data and both Watershed

Permit requirements, there is an inconsistency in the reporting of flows and loads during the wet season. Specifically, the Section 13267 Letter Data required that in addition to normal monthly sampling, two additional samples be taken in the wet season during peak wet weather events. This requirement is not included in either Watershed Permits. As a result, an artificial bias has been introduced that was expected to overestimate the wet season load. A sensitivity analysis was performed for each Subembayment to confirm this bias. Based on that analysis, it was confirmed that the peak wet weather events do impact the trend analysis because the dataset is not large enough to offset such a load. For example, there are a few instances (e.g., Lower South Bay ammonia loading) with the Section 13267 Letter Data that are several times greater than the annual average values and can skew the trending analysis. As a result, the trend analysis was limited to the dry season, which best represents the actual base sanitary wastewater flows and loads for each plant.

The approach used to evaluate trend significance was the slope of a regression line. The slope was determined using the method of least squares.[2] The sample set size was 5 samples per year (n = 40 in total for the eight years of discharge data. An alpha of 0.05 was assumed which denotes that a 5 percent risk of concluding that a difference exists when there is no actual difference. A trend was denoted significant if the p-value was less than alpha. Furthermore, the percent change with respect to the initial three years of data was included to serve as a reference or baseline for the extent of change over time.

[2] Montgomery, D.C.; Peck, E.A.; Vining, G.G. (2012) Introduction to Linear Regression Analysis. Published by John Wiley and Sons, Inc. Hoboken, NJ. Pages 12-66.

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4 Influent Data Review Findings

This section presents a data discussion for the following Influent parameters:

1. Influent Flow
2. Total Ammonia (reported as N)
3. Nitrate plus Nitrite (NOx, reported as N)
4. Total Inorganic Nitrogen (reported as N)
5. Total Kjeldahl Nitrogen (TKN; reported as N)
6. Total Nitrogen (TN)
7. Total Phosphorus

The section presents the data in a tabular format by discharger and for each of the five Subembayments (limited to flow). The flow information also includes a historical influent plot for each Subembayment and the Bay. The data are presented for both the annual average (October 1 through September 30 of the following year) and dry season average (May 1 through September 30).

There are several limitations in the overall influent dataset as follows:

- Lack of an overall dataset (quarterly sampling began in July 2019; n = 5). Furthermore, the global pandemic impacts at least two of the sampling quarters.
- It does not capture influent loads across the Bay as is the data are limited to plants with a permitted ADWF capacity of greater than 10 mgd.
- Quarterly sampling was not conducted by all POTWs in the same month.
- Challenges with assembling data for dischargers that are made up of multiple treatment plants (e.g., East Bay Dischargers Authority). Such dischargers are still optimizing their sampling routine so that they occur during the same month and/or sampling day. This issue should improve as the influent sampling continues.
- The nutrient load totals and distribution by Subembayment were excluded due to missing data.

A discussion of the results is provided in Section 6.4.

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4.1 Influent Flow

The historical average monthly influent flows from July 2019 through September 2020 are presented in Figure 4-1. The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) influent flows were calculated based on reported flows in Table 4-1 and Table 4-2, respectively. In addition, the annual average and dry season average monthly influent flows for each Subembayment are provided in Table 4-3 and Table 4-4, respectively.

A summary of the influent data review findings is as follows:

- The 2018/2019 dataset is limited to July 2019 through September 2019. As a result, annual average values were excluded.
- The influent average monthly flows are the largest during the wet season (October 1 through April 30 of the following year; refer to Figure 4-1). This was anticipated as flows tend to increase during wet weather events. Given the relatively dry conditions since July 2019, the increase in flows during such wet weather events is not as pronounced as treatment plants have seen during wetter years (discussion provided in Section 6.2).
- All the dischargers were able to provide average monthly data for each month evaluated (July 2019 through September 2020; see Table 4-1 and Table 4-2).
- The impact on flows from the global pandemic (COVID-19) is unclear at this stage (discussion provided in Section 6.1).
- The South Bay and Lower South Bay accounts for over half of the influent flows, regardless of season (see Table 4-3 and Table 4-4).

A discussion of the results is provided in Section 6.4.

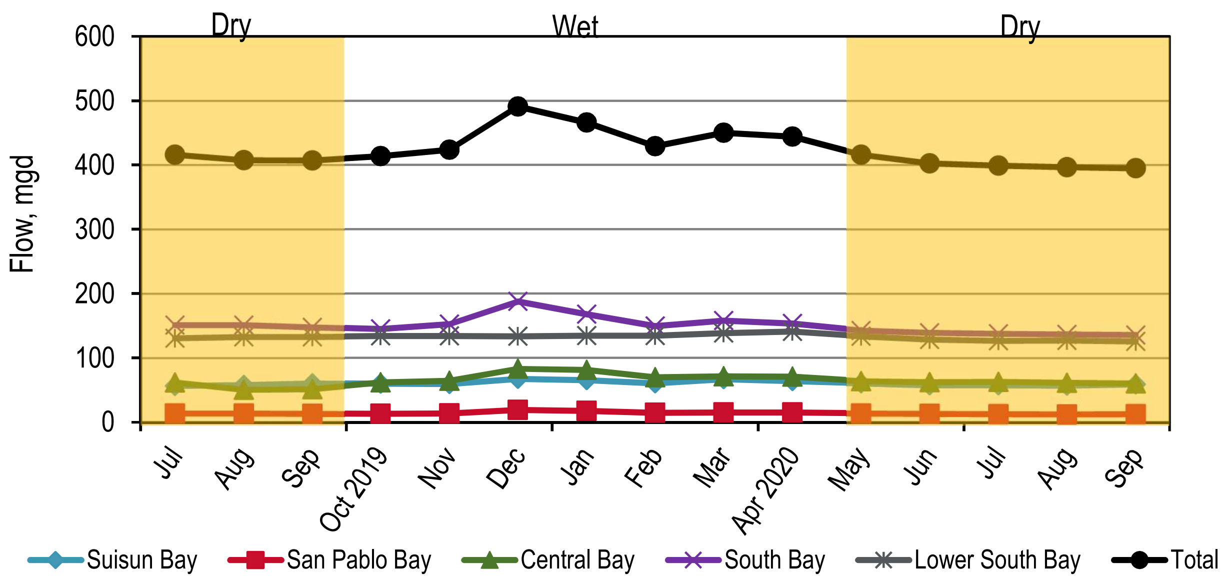

Figure 4-1. Influent: Historical Average Monthly Flow Values for Evaluation Period

Table 4-1. Influent: Annual Average Flows to each Plant (mgd)*

Discharger	Subembayment	Permitted Capacity [a]	2018/2019 [a], [b]	2019/2020 [a], [b]
American Canyon	San Pablo Bay	2.5	*	--
Benicia	San Pablo Bay	4.5	*	--
Burlingame	South Bay	5.5	*	--
CCCSD	Suisun Bay	53.8	*	36.1
CMSA	Central Bay	10	*	--
Port Costa	San Pablo Bay	0.033	*	--
Delta Diablo	Suisun Bay	19.5	*	12.7
EBDA	South Bay	107.8	*	65.5
EBMUD	Central Bay	120	*	53.8
FSSD	Suisun Bay	23.7	*	12.6
Las Gallinas[c]	San Pablo Bay	2.92	*	--
Paradise Cove	Central Bay	0.04	*	--
Tiburon	Central Bay	0.98	*	--
Millbrae	South Bay	3	*	--
Mt. View	Suisun Bay	3.2	*	--
Napa[c]	San Pablo Bay	15.4	*	6.27
Novato[c]	San Pablo Bay	7	*	--
Palo Alto	Lower South Bay	39	*	17.6
Petaluma[c]	San Pablo Bay	6.7	*	--
Pinole	San Pablo Bay	4.06	*	--
Rodeo	San Pablo Bay	1.14	*	--
SFO Airport	South Bay	2.2	*	--
SFPUC Southeast	South Bay	85.4	*	54.3
San Jose	Lower South Bay	167	*	102
San Mateo	South Bay	15.7	*	10.6
SMCSD	Central Bay	1.8	*	--
SASM	Central Bay	3.6	*	--
SVCW	South Bay	29	*	12.8
Sonoma Valley[c]	San Pablo Bay	3	*	--
South SF	South Bay	13	*	7.35
Sunnyvale	Lower South Bay	29.5	*	12.9
Treasure Island	Central Bay	2	*	--
Vallejo	San Pablo Bay	15.5	*	8.29
West County	Central Bay	28.5	*	14.1
Total [d]		**827**	*	**427**

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "-" indicates data were not available, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

Table 4-2. Influent: Dry Season Average Flows to each Plant (mgd)*

Discharger	Subembayment	Permitted Capacity [a]	2018/2019 [a], [b], *	2019/2020 [a], [b]
American Canyon	San Pablo Bay	2.5	--	--
Benicia	San Pablo Bay	4.5	--	--
Burlingame	South Bay	5.5	--	--
CCCSD	Suisun Bay	53.8	34.7	33.8
CMSA	Central Bay	10	--	--
Port Costa	San Pablo Bay	0.033	--	--
Delta Diablo	Suisun Bay	19.5	12.6	13.0
EBDA	South Bay	107.8	69.4	64.3
EBMUD	Central Bay	120	50.9	49.6
FSSD	Suisun Bay	23.7	11.4	12.0
Las Gallinas[c]	San Pablo Bay	2.92	--	--
Paradise Cove	Central Bay	0.04	--	--
Tiburon	Central Bay	0.98	--	--
Millbrae	South Bay	3	--	--
Mt. View	Suisun Bay	3.2	--	--
Napa[c]	San Pablo Bay	15.4	6.28	5.50
Novato[c]	San Pablo Bay	7	--	--
Palo Alto	Lower South Bay	39	18.5	16.3
Petaluma[c]	San Pablo Bay	6.7	--	--
Pinole	San Pablo Bay	4.06	--	--
Rodeo	San Pablo Bay	1.14	--	--
SFO Airport	South Bay	2.2	--	--
SFPUC Southeast	South Bay	85.4	51.6	45.3
San Jose	Lower South Bay	167	101	99.8
San Mateo	South Bay	15.7	9.38	9.93
SMCSD	Central Bay	1.8	--	--
SASM	Central Bay	3.6	--	--
SVCW	South Bay	29	12.5	12.1
Sonoma Valley[c]	San Pablo Bay	3	--	--
South SF	South Bay	13	7.29	6.97
Sunnyvale	Lower South Bay	29.5	12.6	12.6
Treasure Island	Central Bay	2	--	--
Vallejo	San Pablo Bay	15.5	7.74	7.75
West County	Central Bay	28.5	12.6	12.9
Total [d]		**827**	**419**	**402**

* 2018/2019 dataset limited to July through September compared against May through September for 2019/2020

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A “-“ indicates data were not available, whereas a “0” indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

Table 4-3. Influent: Annual Average Flows by Subembayment, Flow (mgd)*

Subembayment	Permitted Capacity [(a)]	2018/2019 [(a)]	2019/2020 [(a)]
Suisun Bay	100	*	61.4
San Pablo Bay	62.8	*	14.6
Central Bay	167	*	67.9
South Bay	262	*	151
Lower South Bay	236	*	133
Total	**827**	*	**427**

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

Table 4-4. Influent: Dry Season Average Flows by Subembayment, Flow (mgd)*

Subembayment	Permitted Capacity [(a)]	2018/2019 [(a),*]	2019/2020 [(a)]	Trend [(b)]
Suisun Bay	100	58.7	58.8	-- [(b)]
San Pablo Bay	62.8	14.0	13.2	-- [(b)]
Central Bay	167	63.6	62.6	-- [(b)]
South Bay	262	150	139	-- [(b)]
Lower South Bay	236	132	129	-- [(b)]
				-- [(b)]
Total	827	**419**	**402**	**-- [(b)]**

* 2018/2019 dataset limited to July through September compared against May through September for 2019/2020

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Trend analysis not performed due to a limited dataset. Future annual trending reports will incorporate trending analysis.

4.2 Total Ammonia

The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) influent loads were calculated based on reported flows and concentrations in Table 4-5 and Table 4-6, respectively.

A summary of the influent data review findings is as follows:

- The 2018/2019 dataset is limited to July 2019 through September 2019. As a result, annual average values were excluded.
- There are a few instances of missing data per plant (see Table 4-5 and Table 4-6).
- Missing data and a limited dataset preclude statements about trends.
- The impact on loads from the global pandemic (COVID-19) is unclear at this stage (discussion provided in Section 6.1).
- The impact on loads from the relatively dry year is unclear at this stage (discussion provided in Section 6.2).
- The flow-weighted ammonia concentrations (data not shown) ranges from 36.7 mg N/L (2020 dry season) to 38.4 mg N/L (2019 dry season). A summary of all the influent flows and nutrient concentrations is presented in Section 7.1.

A discussion of the results is provided in Section 6.4.

Table 4-5. Influent: Annual Average Loads to each Plant, Ammonia (kg N/d)

Discharger	Subembayment	Permitted Capacity [a]	2018/2019 [a], [b]	2019/2020 [a], [b]
American Canyon	San Pablo Bay	2.5	*	--
Benicia	San Pablo Bay	4.5	*	--
Burlingame	South Bay	5.5	*	--
CCCSD	Suisun Bay	53.8	*	5,100
CMSA	Central Bay	10	*	--
Port Costa	San Pablo Bay	0.033	*	--
Delta Diablo	Suisun Bay	19.5	*	1,840
EBDA	South Bay	107.8	*	9,390
EBMUD	Central Bay	120	*	7,460
FSSD	Suisun Bay	23.7	*	1,640
Las Gallinas[c]	San Pablo Bay	2.92	*	--
Paradise Cove	Central Bay	0.04	*	--
Tiburon	Central Bay	0.98	*	--
Millbrae	South Bay	3	*	--
Mt. View	Suisun Bay	3.2	*	--
Napa[c]	San Pablo Bay	15.4	*	832
Novato[c]	San Pablo Bay	7	*	--
Palo Alto	Lower South Bay	39	*	2,300
Petaluma[c]	San Pablo Bay	6.7	*	--
Pinole	San Pablo Bay	4.06	*	--
Rodeo	San Pablo Bay	1.14	*	--
SFO Airport	South Bay	2.2	*	--
SFPUC Southeast	South Bay	85.4	*	8,750
San Jose	Lower South Bay	167	*	14,300
San Mateo	South Bay	15.7	*	1,590
SMCSD	Central Bay	1.8	*	--
SASM	Central Bay	3.6	*	--
SVCW	South Bay	29	*	2,410
Sonoma Valley[c]	San Pablo Bay	3	*	--
South SF	South Bay	13	*	1,030
Sunnyvale	Lower South Bay	29.5	*	1,500
Treasure Island	Central Bay	2	*	--
Vallejo	San Pablo Bay	15.5	*	966
West County	Central Bay	28.5	*	1,850
Total [d]		**827**	*** [f]**	**-- [f]**

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A “-“ indicates data were not available, whereas a “0” indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Data not provided.

f. Totals not provided due to an incomplete dataset

Table 4-6. Influent: Dry Season Average Loads to each Plant, Ammonia (kg N/d)*

Discharger	Subembayment	Permitted Capacity [(a)]	2018/19 [(b),*]	2019/20 [(b)]
American Canyon	San Pablo Bay	2.5	--	--
Benicia	San Pablo Bay	4.5	--	--
Burlingame	South Bay	5.5	--	--
CCCSD	Suisun Bay	53.8	4,810	4,980
CMSA	Central Bay	10	--	--
Port Costa	San Pablo Bay	0.033	--	--
Delta Diablo	Suisun Bay	19.5	1,820	1,910
EBDA	South Bay	107.8	6,580	8,880
EBMUD	Central Bay	120	6,530	6,760
FSSD	Suisun Bay	23.7	1,680	1,530
Las Gallinas[(c)]	San Pablo Bay	2.92	--	--
Paradise Cove	Central Bay	0.04	--	--
Tiburon	Central Bay	0.98	--	--
Millbrae	South Bay	3	--	--
Mt. View	Suisun Bay	3.2	--	--
Napa[(c)]	San Pablo Bay	15.4	1,050	-- [(e)]
Novato[(c)]	San Pablo Bay	7	--	--
Palo Alto	Lower South Bay	39	-- [(e)]	2,110
Petaluma[(c)]	San Pablo Bay	6.7	--	--
Pinole	San Pablo Bay	4.06	--	--
Rodeo	San Pablo Bay	1.14	--	--
SFO Airport	South Bay	2.2	--	--
SFPUC Southeast	South Bay	85.4	10,000	8,330
San Jose	Lower South Bay	167	13,600	12,100
San Mateo	South Bay	15.7	1,440	1,430
SMCSD	Central Bay	1.8	--	--
SASM	Central Bay	3.6	--	--
SVCW	South Bay	29	2,550	2,090
Sonoma Valley[(c)]	San Pablo Bay	3	--	--
South SF	South Bay	13	1,020	988
Sunnyvale	Lower South Bay	29.5	1,820	1,180
Treasure Island	Central Bay	2	--	--
Vallejo	San Pablo Bay	15.5	1,060	988
West County	Central Bay	28.5	1,720	1,750
Total [(d)]		**827**	**--** [(f)]	**--** [(f)]

* 2018/2019 dataset limited to July through September compared against May through September for 2019/2020

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "-" indicates data were not available, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Data not provided.

f. Totals not provided due to an incomplete dataset

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4.3 Nitrate + Nitrite (NOx)

The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) influent loads were calculated based on reported flows and concentrations in Table 4-7 and Table 4-8, respectively.

A summary of the influent data review findings is as follows:

- Influent NOx loads and concentrations have the smallest relative contribution for the nitrogen species measured. On average, the influent NOx loads contribute less than 2 percent to the influent total nitrogen loads (data not shown).
- The 2018/2019 dataset is limited to July 2019 through September 2019. As a result, annual average values were excluded.
- There are a few instances of missing data per plant (see Table 4-7 and Table 4-8).
- Missing data and a limited dataset preclude statements about trends.
- The impact on loads from the global pandemic (COVID-19) is unclear at this stage (discussion provided in Section 6.1).
- The impact on loads from the relatively dry year is unclear at this stage (discussion provided in Section 6.2).
- While the 2018/2019 dry season dataset is limited (3 months), the SFPUC Southeast Plant dry season loads reduced from 2018/2019 to 2019/2020 by greater than 90 percent (see Table 4-8). It is unclear whether such a reduction relates to the limited sampling duration, the global pandemic (COVID-1), industry, relatively low precipitation, or others. Influent sampling for future Group Annual Report will inform such findings.
- The flow-weighted NOx concentrations (data not shown) ranges from 2.25 mg N/L (2019/2020 average annual) to 3.56 mg N/L (2019 dry season). A summary of all the influent flows and nutrient concentrations is presented in Section 7.1.

A discussion of the results is provided in Section 6.4.

Table 4-7. Influent: Annual Average Loads to each Plant, NOx (kg N/d)*

Discharger	Subembayment	Permitted Capacity [(a)]	2018/2019 [(a), (b)]	2019/2020 [(a), (b)]
American Canyon	San Pablo Bay	2.5	*	--
Benicia	San Pablo Bay	4.5	*	--
Burlingame	South Bay	5.5	*	--
CCCSD	Suisun Bay	53.8	*	1.89
CMSA	Central Bay	10	*	--
Port Costa	San Pablo Bay	0.033	*	--
Delta Diablo	Suisun Bay	19.5	*	12.8
EBDA	South Bay	107.8	*	46.9
EBMUD	Central Bay	120	*	520
FSSD	Suisun Bay	23.7	*	7.24
Las Gallinas[(c)]	San Pablo Bay	2.92	*	--
Paradise Cove	Central Bay	0.04	*	--
Tiburon	Central Bay	0.98	*	--
Millbrae	South Bay	3	*	--
Mt. View	Suisun Bay	3.2	*	--
Napa[(c)]	San Pablo Bay	15.4	*	2.30
Novato[(c)]	San Pablo Bay	7	*	--
Palo Alto	Lower South Bay	39	*	16.4
Petaluma[(c)]	San Pablo Bay	6.7	*	--
Pinole	San Pablo Bay	4.06	*	--
Rodeo	San Pablo Bay	1.14	*	--
SFO Airport	South Bay	2.2	*	--
SFPUC Southeast	South Bay	85.4	*	295
San Jose	Lower South Bay	167	*	982
San Mateo	South Bay	15.7	*	22.3
SMCSD	Central Bay	1.8	*	--
SASM	Central Bay	3.6	*	--
SVCW	South Bay	29	*	47.0
Sonoma Valley[(c)]	San Pablo Bay	3	*	--
South SF	South Bay	13	*	6.48
Sunnyvale	Lower South Bay	29.5	*	2.87
Treasure Island	Central Bay	2	*	--
Vallejo	San Pablo Bay	15.5	*	2.01
West County	Central Bay	28.5	*	23.7
Total [(d)]		**827**	* [(f)]	-- [(f)]

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A “-“ indicates data were not available, whereas a “0” indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Data not provided.

f. Totals not provided due to an incomplete dataset

Table 4-8. Influent: Dry Season Average Loads to each Plant, NOx (kg N/d)*

Discharger	Subembayment	Permitted Capacity [(a)]	2018/2019 [(a), (b), *]	2019/2020 [(a), (b)]
American Canyon	San Pablo Bay	2.5	--	--
Benicia	San Pablo Bay	4.5	--	--
Burlingame	South Bay	5.5	--	--
CCCSD	Suisun Bay	53.8	2.71	2.11
CMSA	Central Bay	10	--	--
Port Costa	San Pablo Bay	0.033	--	--
Delta Diablo	Suisun Bay	19.5	2.93	3.12
EBDA	South Bay	107.8	-- [(e)]	55.0
EBMUD	Central Bay	120	649	467
FSSD	Suisun Bay	23.7	7.18	11.1
Las Gallinas[(c)]	San Pablo Bay	2.92	--	--
Paradise Cove	Central Bay	0.04	--	--
Tiburon	Central Bay	0.98	--	--
Millbrae	South Bay	3	--	--
Mt. View	Suisun Bay	3.2	--	--
Napa[(c)]	San Pablo Bay	15.4		
Novato[(c)]	San Pablo Bay	7	--	--
Palo Alto	Lower South Bay	39	-- [(e)]	2.68
Petaluma[(c)]	San Pablo Bay	6.7	--	--
Pinole	San Pablo Bay	4.06	--	--
Rodeo	San Pablo Bay	1.14	--	--
SFO Airport	South Bay	2.2	--	--
SFPUC Southeast	South Bay	85.4	1,080	28.0
San Jose	Lower South Bay	167	1,020	1,130
San Mateo	South Bay	15.7	7.98	5.10
SMCSD	Central Bay	1.8	--	--
SASM	Central Bay	3.6	--	--
SVCW	South Bay	29	37.1	22.5
Sonoma Valley[(c)]	San Pablo Bay	3	--	--
South SF	South Bay	13	1.11	5.75
Sunnyvale	Lower South Bay	29.5	-- [(e)]	2.94
Treasure Island	Central Bay	2	--	--
Vallejo	San Pablo Bay	15.5	-- [(e)]	1.09
West County	Central Bay	28.5	25.2	18.3
Total [(d)]		**827**	**-- [(f)]**	**-- [(f)]**

* 2018/2019 dataset limited to July through September compared against May through September for 2019/2020

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "-" indicates data were not available, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Data not provided.

f. Totals not provided due to an incomplete dataset

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4.4 Total Inorganic Nitrogen (TIN)

TIN is calculated by adding the ammonia and NOx concentrations. The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) influent loads were calculated based on reported flows and concentrations in Table 4-9 and Table 4-10, respectively.

A summary of the influent data review findings is as follows:

- Influent TIN loads and concentrations contribute on average approximately two-thirds of the total nitrogen concentrations and loads (data not shown).
- The 2018/2019 dataset is limited to July 2019 through September 2019. As a result, annual average values were excluded.
- Missing data and a limited dataset preclude statements about trends.
- There are a few instances of missing data per plant that inform the TIN calculation (TIN = ammonia + nitrate + nitrite; refer Table 4-9 and Table 4-10).
- The impact on loads from the global pandemic (COVID-19) is unclear at this stage (discussion provided in Section 6.1).
- The impact on loads from the relatively dry year is unclear at this stage (discussion provided in Section 6.2).
- The flow-weighted TIN concentrations (data not shown) ranges from 38.4 mg N/L (2020 dry season) to 41.7 mg N/L (2019 dry season). A summary of all the influent flows and nutrient concentrations is presented in Section 7.1.

A discussion of the results is provided in Section 6.4.

Table 4-9. Influent: Annual Average Loads to each Plant, TIN (kg N/d)*

Discharger	Subembayment	Permitted Capacity [a]	2018/2019 [a], [b]	2019/2020 [a], [b]
American Canyon	San Pablo Bay	2.5	*	--
Benicia	San Pablo Bay	4.5	*	--
Burlingame	South Bay	5.5	*	--
CCCSD	Suisun Bay	53.8	*	5,100
CMSA	Central Bay	10	*	--
Port Costa	San Pablo Bay	0.033	*	--
Delta Diablo	Suisun Bay	19.5	*	1,850
EBDA	South Bay	107.8	*	9,250
EBMUD	Central Bay	120	*	8,260
FSSD	Suisun Bay	23.7	*	1,640
Las Gallinas[c]	San Pablo Bay	2.92	*	--
Paradise Cove	Central Bay	0.04	*	--
Tiburon	Central Bay	0.98	*	--
Millbrae	South Bay	3	*	--
Mt. View	Suisun Bay	3.2	*	--
Napa[c]	San Pablo Bay	15.4	*	815
Novato[c]	San Pablo Bay	7	*	--
Palo Alto	Lower South Bay	39	*	2,330
Petaluma[c]	San Pablo Bay	6.7	*	--
Pinole	San Pablo Bay	4.06	*	--
Rodeo	San Pablo Bay	1.14	*	--
SFO Airport	South Bay	2.2	*	--
SFPUC Southeast	South Bay	85.4	*	9,050
San Jose	Lower South Bay	167	*	15,300
San Mateo	South Bay	15.7	*	1,610
SMCSD	Central Bay	1.8	*	--
SASM	Central Bay	3.6	*	--
SVCW	South Bay	29	*	2,460
Sonoma Valley[c]	San Pablo Bay	3	*	--
South SF	South Bay	13	*	1,010
Sunnyvale	Lower South Bay	29.5	*	1,510
Treasure Island	Central Bay	2	*	--
Vallejo	San Pablo Bay	15.5	*	978
West County	Central Bay	28.5	*	1,910
Total [d]		**827**	* [f]	-- [f]

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "-" indicates data were not available, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Unable to calculate due to missing data that was not provided.

f. Totals not provided due to an incomplete dataset

BACWA BAY AREA CLEAN WATER AGENCIES

Table 4-10. Influent: Dry Season Average Loads to each Plant, TIN (kg N/d)*

Discharger	Subembayment	Permitted Capacity (a)	2018/2019 (a), (b), *	2019/2020 (a), (b)
American Canyon	San Pablo Bay	2.5	--	--
Benicia	San Pablo Bay	4.5	--	--
Burlingame	South Bay	5.5	--	--
CCCSD	Suisun Bay	53.8	4,810	4,980
CMSA	Central Bay	10	--	--
Port Costa	San Pablo Bay	0.033	--	--
Delta Diablo	Suisun Bay	19.5	1,820	1,910
EBDA	South Bay	107.8	-- (e)	9,330
EBMUD	Central Bay	120	7,180	7,450
FSSD	Suisun Bay	23.7	1,690	1,540
Las Gallinas(c)	San Pablo Bay	2.92	--	--
Paradise Cove	Central Bay	0.04	--	--
Tiburon	Central Bay	0.98	--	--
Millbrae	South Bay	3	--	--
Mt. View	Suisun Bay	3.2	--	--
Napa(c)	San Pablo Bay	15.4	-- (e)	-- (e)
Novato(c)	San Pablo Bay	7	--	--
Palo Alto	Lower South Bay	39	-- (e)	2,050
Petaluma(c)	San Pablo Bay	6.7	--	--
Pinole	San Pablo Bay	4.06	--	--
Rodeo	San Pablo Bay	1.14	--	--
SFO Airport	South Bay	2.2	--	--
SFPUC Southeast	South Bay	85.4	11,100	8,350
San Jose	Lower South Bay	167	14,600	13,200
San Mateo	South Bay	15.7	1,440	1,430
SMCSD	Central Bay	1.8	--	--
SASM	Central Bay	3.6	--	--
SVCW	South Bay	29	2,590	2,110
Sonoma Valley(c)	San Pablo Bay	3	--	--
South SF	South Bay	13	1,070	989
Sunnyvale	Lower South Bay	29.5	1,820	1,180
Treasure Island	Central Bay	2	--	--
Vallejo	San Pablo Bay	15.5	-- (e)	1,140
West County	Central Bay	28.5	1,900	1,900
Total (d)		**827**	**-- (f)**	**-- (f)**

* 2018/2019 dataset limited to July through September compared against May through September for 2019/2020

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "-" indicates data were not available, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Unable to calculate due to missing data that were not provided.

f. Totals not provided due to an incomplete dataset

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4.5 Total Kjeldahl Nitrogen (TKN)

The TKN represents the sum of the total ammonia and organic nitrogen species. The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) influent loads were calculated based on reported flows and concentrations in Table 4-11 and Table 4-12, respectively.

A summary of the influent data review findings is as follows:

- Influent TKN loads and concentrations have the largest relative contribution for the nitrogen species measured. On average, the influent TKN loads contribute greater than 92 percent to the influent total nitrogen loads (data not shown).
- The 2018/2019 dataset is limited to July 2019 through September 2019. As a result, annual average values were excluded.
- There are a few instances of missing data per plant (Table 4-11 and Table 4-12).
- Missing data and a limited dataset preclude statements about trends.
- The impact on loads from the global pandemic (COVID-19) is unclear at this stage (discussion provided in Section 6.1).
- The impact on loads from the relatively dry year is unclear at this stage (discussion provided in Section 6.2).
- The flow-weighted TKN concentrations (data not shown) ranges from 59.2 mg N/L (2019 dry season) to 61.2 N/L (2020 dry season). A summary of all the influent flows and nutrient concentrations is presented in Section 7.1.

A discussion of the results is provided in Section 6.4.

Table 4-11. Influent: Annual Average Loads to each Plant, TKN (kg N/d)*

Discharger	Subembayment	Permitted Capacity (a)	2018/2019 (a), (b)	2019/2020 (a), (b)
American Canyon	San Pablo Bay	2.5	*	--
Benicia	San Pablo Bay	4.5	*	--
Burlingame	South Bay	5.5	*	--
CCCSD	Suisun Bay	53.8	*	7,440
CMSA	Central Bay	10	*	--
Port Costa	San Pablo Bay	0.033	*	--
Delta Diablo	Suisun Bay	19.5	*	3,530
EBDA	South Bay	107.8	*	16,600
EBMUD	Central Bay	120	*	12,500
FSSD	Suisun Bay	23.7	*	3,100
Las Gallinas(c)	San Pablo Bay	2.92	*	--
Paradise Cove	Central Bay	0.04	*	--
Tiburon	Central Bay	0.98	*	--
Millbrae	South Bay	3	*	--
Mt. View	Suisun Bay	3.2	*	--
Napa(c)	San Pablo Bay	15.4	*	1,480
Novato(c)	San Pablo Bay	7	*	--
Palo Alto	Lower South Bay	39	*	4,070
Petaluma(c)	San Pablo Bay	6.7	*	--
Pinole	San Pablo Bay	4.06	*	--
Rodeo	San Pablo Bay	1.14	*	--
SFO Airport	South Bay	2.2	*	--
SFPUC Southeast	South Bay	85.4	*	12,000
San Jose	Lower South Bay	167	*	22,000
San Mateo	South Bay	15.7	*	2,500
SMCSD	Central Bay	1.8	*	--
SASM	Central Bay	3.6	*	--
SVCW	South Bay	29	*	2,840
Sonoma Valley(c)	San Pablo Bay	3	*	--
South SF	South Bay	13	*	1,420
Sunnyvale	Lower South Bay	29.5	*	2,360
Treasure Island	Central Bay	2	*	--
Vallejo	San Pablo Bay	15.5	*	1,600
West County	Central Bay	28.5	*	3,200
Total (d)		**827**	*** (f)**	**-- (f)**

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "-" indicates data were not available, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Data not provided.

f. Totals not provided due to an incomplete dataset

Table 4-12. Influent: Dry Season Loads to each Plant, TKN (kg N/d)*

Discharger	Subembayment	Permitted Capacity [(a)]	2018/2019 [(a), (b), *]	2019/2020 [(a), (b)]
American Canyon	San Pablo Bay	2.5	--	--
Benicia	San Pablo Bay	4.5	--	--
Burlingame	South Bay	5.5	--	--
CCCSD	Suisun Bay	53.8	6,890	6,950
CMSA	Central Bay	10	--	--
Port Costa	San Pablo Bay	0.033	--	--
Delta Diablo	Suisun Bay	19.5	3,250	3,980
EBDA	South Bay	107.8	-- [(e)]	18,500
EBMUD	Central Bay	120	10,800	11,400
FSSD	Suisun Bay	23.7	2,630	3,110
Las Gallinas[(c)]	San Pablo Bay	2.92	--	--
Paradise Cove	Central Bay	0.04	--	--
Tiburon	Central Bay	0.98	--	--
Millbrae	South Bay	3	--	--
Mt. View	Suisun Bay	3.2	--	--
Napa[(c)]	San Pablo Bay	15.4	-- [(e)]	-- [(e)]
Novato[(c)]	San Pablo Bay	7	--	--
Palo Alto	Lower South Bay	39	-- [(e)]	3,950
Petaluma[(c)]	San Pablo Bay	6.7	--	--
Pinole	San Pablo Bay	4.06	--	--
Rodeo	San Pablo Bay	1.14	--	--
SFO Airport	South Bay	2.2	--	--
SFPUC Southeast	South Bay	85.4	13,800	12,000
San Jose	Lower South Bay	167	20,800	19,000
San Mateo	South Bay	15.7	1,720	2,260
SMCSD	Central Bay	1.8	--	--
SASM	Central Bay	3.6	--	--
SVCW	South Bay	29	3,090	2,590
Sonoma Valley[(c)]	San Pablo Bay	3	--	--
South SF	South Bay	13	1,500	1,400
Sunnyvale	Lower South Bay	29.5	2,820	2,120
Treasure Island	Central Bay	2	--	--
Vallejo	San Pablo Bay	15.5	1,690	1,500
West County	Central Bay	28.5	3,760	3,120
Total [(d)]		**827**	**-- [(f)]**	**-- [(f)]**

* 2018/2019 dataset limited to July through September compared against May through September for 2019/2020

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "-" indicates data were not available, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Data not provided.

f. Totals not provided due to an incomplete dataset

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4.6 Total Nitrogen (TN)

Total nitrogen is included as a metric for the influent (but not discharge) as it captures the organic nitrogen loading into the plant. The majority of influent organic nitrogen is oxidized to ammonia in the treatment plant. A relatively small portion of this organic nitrogen leaves with discharge as residual organic nitrogen (typically about 1.5 to 3.5 mg N/L). While this represents a relatively small proportion of discharge, it is an important component for the nitrogen balance within the treatment plant. It is calculated by adding the TKN and NOx concentrations.

The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) influent loads were calculated based on reported flows and concentrations in Table 4-13 and Table 4-14, respectively.

A summary of the influent data review findings is as follows:

- The 2018/2019 dataset is limited to July 2019 through September 2019. As a result, annual average values were excluded.
- There are a few instances of missing data per plant that inform the TN calculation (TN = TKN + nitrate + nitrite; refer Table 4-13 and Table 4-14).
- There are a few instances of missing data per plant (see Table 4-13 and Table 4-14).
- Missing data and a limited dataset preclude statements about trends.
- The impact on loads from the global pandemic (COVID-19) is unclear at this stage (discussion provided in Section 6.1).
- The impact on loads from the relatively dry year is unclear at this stage (discussion provided in Section 6.2).
- The flow-weighted TN concentrations (data not shown) ranges from 61.0 mg N/L (2019/2020 average annual) to 62.4 mg N/L (2020 dry season). A summary of all the influent flows and nutrient concentrations is presented in Section 7.1.

A discussion of the results is provided in Section 6.4.

Table 4-13. Influent: Annual Average Loads to each Plant, TN (kg N/d)*

Discharger	Subembayment	Permitted Capacity (a)	2018/2019 (a), (b)	2019/2020 (a), (b)
American Canyon	San Pablo Bay	2.5	*	--
Benicia	San Pablo Bay	4.5	*	--
Burlingame	South Bay	5.5	*	--
CCCSD	Suisun Bay	53.8	*	7,440
CMSA	Central Bay	10	*	--
Port Costa	San Pablo Bay	0.033	*	--
Delta Diablo	Suisun Bay	19.5	*	3,540
EBDA	South Bay	107.8	*	16,600
EBMUD	Central Bay	120	*	13,000
FSSD	Suisun Bay	23.7	*	3,110
Las Gallinas(c)	San Pablo Bay	2.92	*	--
Paradise Cove	Central Bay	0.04	*	--
Tiburon	Central Bay	0.98	*	--
Millbrae	South Bay	3	*	--
Mt. View	Suisun Bay	3.2	*	--
Napa(c)	San Pablo Bay	15.4	*	1,570
Novato(c)	San Pablo Bay	7	*	--
Palo Alto	Lower South Bay	39	*	4,090
Petaluma(c)	San Pablo Bay	6.7	*	--
Pinole	San Pablo Bay	4.06	*	--
Rodeo	San Pablo Bay	1.14	*	--
SFO Airport	South Bay	2.2	*	--
SFPUC Southeast	South Bay	85.4	*	12,300
San Jose	Lower South Bay	167	*	23,000
San Mateo	South Bay	15.7	*	2,520
SMCSD	Central Bay	1.8	*	--
SASM	Central Bay	3.6	*	--
SVCW	South Bay	29	*	2,890
Sonoma Valley(c)	San Pablo Bay	3	*	--
South SF	South Bay	13	*	1,430
Sunnyvale	Lower South Bay	29.5	*	2,370
Treasure Island	Central Bay	2	*	--
Vallejo	San Pablo Bay	15.5	*	1,600
West County	Central Bay	28.5	*	3,220
Total (d)		**827**	*** (f)**	**-- (f)**

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "-" indicates data were not available, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Unable to calculate due to missing data that were not provided.

f. Totals not provided due to an incomplete dataset

Table 4-14. Influent: Dry Season Average Loads to each Plant, TN (kg N/d)*

Discharger	Subembayment	Permitted Capacity [(a)]	2018/2019 [(a), (b), *]	2019/2020 [(a), (b)]
American Canyon	San Pablo Bay	2.5	--	--
Benicia	San Pablo Bay	4.5	--	--
Burlingame	South Bay	5.5	--	--
CCCSD	Suisun Bay	53.8	6,890	6,950
CMSA	Central Bay	10	--	--
Port Costa	San Pablo Bay	0.033	--	--
Delta Diablo	Suisun Bay	19.5	3,250	3,980
EBDA	South Bay	107.8	-- [(e)]	18,500
EBMUD	Central Bay	120	11,400	11,800
FSSD	Suisun Bay	23.7	2,640	3,120
Las Gallinas[(c)]	San Pablo Bay	2.92	--	--
Paradise Cove	Central Bay	0.04	--	--
Tiburon	Central Bay	0.98	--	--
Millbrae	South Bay	3	--	--
Mt. View	Suisun Bay	3.2	--	--
Napa[(c)]	San Pablo Bay	15.4	-- [(e)]	-- [(e)]
Novato[(c)]	San Pablo Bay	7	--	--
Palo Alto	Lower South Bay	39	-- [(e)]	3,950
Petaluma[(c)]	San Pablo Bay	6.7	--	--
Pinole	San Pablo Bay	4.06	--	--
Rodeo	San Pablo Bay	1.14	--	--
SFO Airport	South Bay	2.2	--	--
SFPUC Southeast	South Bay	85.4	14,900	12,000
San Jose	Lower South Bay	167	21,800	20,200
San Mateo	South Bay	15.7	1,720	2,260
SMCSD	Central Bay	1.8	--	--
SASM	Central Bay	3.6	--	--
SVCW	South Bay	29	3,130	2,610
Sonoma Valley[(c)]	San Pablo Bay	3	--	--
South SF	South Bay	13	1,510	1,410
Sunnyvale	Lower South Bay	29.5	2,820	2,120
Treasure Island	Central Bay	2	--	--
Vallejo	San Pablo Bay	15.5	-- [(e)]	1,500
West County	Central Bay	28.5	3,790	3,140
Total [(d)]		**827**	**--** [(f)]	**--** [(f)]

* 2018/2019 dataset limited to July through September compared against May through September for 2019/2020

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "-" indicates data were not available, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Unable to calculate due to missing data that were not provided.

f. Totals not provided due to an incomplete dataset

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4.7 Total Phosphorus (TP)

The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) influent loads were calculated based on reported flows and concentrations in Table 4-15 and Table 4-16, respectively.

A summary of the influent data review findings is as follows:

- The 2018/2019 dataset is limited to July 2019 through September 2019. As a result, annual average values were excluded.
- There are a few instances of missing data per plant (refer to Table 4-15 and Table 4-16).
- Missing data and a limited dataset preclude statements about trends.
- The impact on loads from the global pandemic (COVID-19) is unclear at this stage (discussion provided in Section 6.1).
- The impact on loads from the relatively dry year is unclear at this stage (discussion provided in Section 6.2).
- The flow-weighted TP concentrations (data not shown) ranges from 7.26 mg P/L (2020 dry season) to 7.49 mg P/L (2019 dry season). A summary of all the influent flows and nutrient concentrations is presented in Section 7.1.

A discussion of the results is provided in Section 6.4.

Table 4-15. Influent: Annual Average Loads to each Plant, TP (kg P/d)

Discharger	Subembayment	Permitted Capacity [a]	2018/2019 [a], [b]	2019/2020 [a], [b]
American Canyon	San Pablo Bay	2.5	*	--
Benicia	San Pablo Bay	4.5	*	--
Burlingame	South Bay	5.5	*	--
CCCSD	Suisun Bay	53.8	*	981
CMSA	Central Bay	10	*	--
Port Costa	San Pablo Bay	0.033	*	--
Delta Diablo	Suisun Bay	19.5	*	339
EBDA	South Bay	107.8	*	1,620
EBMUD	Central Bay	120	*	1,960
FSSD	Suisun Bay	23.7	*	369
Las Gallinas[c]	San Pablo Bay	2.92	*	--
Paradise Cove	Central Bay	0.04	*	--
Tiburon	Central Bay	0.98	*	--
Millbrae	South Bay	3	*	--
Mt. View	Suisun Bay	3.2	*	--
Napa[c]	San Pablo Bay	15.4	*	146
Novato[c]	San Pablo Bay	7	*	--
Palo Alto	Lower South Bay	39	*	410
Petaluma[c]	San Pablo Bay	6.7	*	--
Pinole	San Pablo Bay	4.06	*	--
Rodeo	San Pablo Bay	1.14	*	--
SFO Airport	South Bay	2.2	*	--
SFPUC Southeast	South Bay	85.4	*	1,330
San Jose	Lower South Bay	167	*	2,940
San Mateo	South Bay	15.7	*	246
SMCSD	Central Bay	1.8	*	--
SASM	Central Bay	3.6	*	--
SVCW	South Bay	29	*	387
Sonoma Valley[c]	San Pablo Bay	3	*	--
South SF	South Bay	13	*	234
Sunnyvale	Lower South Bay	29.5	*	283
Treasure Island	Central Bay	2	*	--
Vallejo	San Pablo Bay	15.5	*	173
West County	Central Bay	28.5	*	347
Total [d]		**827**	* [f]	-- [f]

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "-" indicates data were not available, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Data not provided.

f. Totals not provided due to an incomplete dataset

Table 4-16. Influent: Dry Season Average Loads to each Plant, TP (kg P/d)*

Discharger	Subembayment	Permitted Capacity [(a)]	2018/2019 [(a), (b),*]	2019/2020 [(a), (b)]
American Canyon	San Pablo Bay	2.5	--	--
Benicia	San Pablo Bay	4.5	--	--
Burlingame	South Bay	5.5	--	--
CCCSD	Suisun Bay	53.8	1,030	875
CMSA	Central Bay	10	--	--
Port Costa	San Pablo Bay	0.033	--	--
Delta Diablo	Suisun Bay	19.5	361	367
EBDA	South Bay	107.8	-- [(e)]	1,670
EBMUD	Central Bay	120	1,800	1,690
FSSD	Suisun Bay	23.7	372	371
Las Gallinas[(c)]	San Pablo Bay	2.92	--	--
Paradise Cove	Central Bay	0.04	--	--
Tiburon	Central Bay	0.98	--	--
Millbrae	South Bay	3	--	--
Mt. View	Suisun Bay	3.2	--	--
Napa[(c)]	San Pablo Bay	15.4	-- [(e)]	-- [(e)]
Novato[(c)]	San Pablo Bay	7	--	--
Palo Alto	Lower South Bay	39		352
Petaluma[(c)]	San Pablo Bay	6.7	--	--
Pinole	San Pablo Bay	4.06	--	--
Rodeo	San Pablo Bay	1.14	--	--
SFO Airport	South Bay	2.2	--	--
SFPUC Southeast	South Bay	85.4	1,300	1,550
San Jose	Lower South Bay	167	2,770	2,460
San Mateo	South Bay	15.7	223	218
SMCSD	Central Bay	1.8	--	--
SASM	Central Bay	3.6	--	--
SVCW	South Bay	29	329	367
Sonoma Valley[(c)]	San Pablo Bay	3	--	--
South SF	South Bay	13	209	228
Sunnyvale	Lower South Bay	29.5	322	245
Treasure Island	Central Bay	2	--	--
Vallejo	San Pablo Bay	15.5	175	167
West County	Central Bay	28.5	321	333
Total [(d)]		**827**	**-- [(f)]**	**-- [(f)]**

* 2018/2019 dataset limited to July through September compared against May through September for 2019/2020

a. Based on ADWF permitted capacity. Influent flow and load analysis required for plants with a permitted capacity greater than 10 mgd.

b. Data are presented in detail and summarized for each plant in the Appendix. A "-" indicates data were not available, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all of the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

e. Data not provided.

f. Totals not provided due to an incomplete dataset

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5 Discharge Data Review Findings

This section presents a discussion of the data for the following discharge parameters:

1. Discharge Flow
2. Total Ammonia (reported as N)
3. Nitrate plus Nitrite (NOx, reported as N)
4. Total Inorganic Nitrogen (reported as N)
5. Total Phosphorus

Data are summarized for each discharger, as well as for each of the five Subembayments. The data are also presented for both the annual average and dry season average. Data are presented based on the period of collection; for example, 2012/2013 represents the period between October 1, 2012 and September 30, 2013.

Following the subsections for each parameter, there is a subsection on the relative contribution of flow and loads by Subembayment for each discharger. This was not included with the influent as the data do not include all the POTWs.

There are several limitations in the overall dataset for the period between October 2012 and September 2020. The sampling frequency requirements vary by size of discharger, ranging from once per dry season for minor plants to twice per month for plants larger than 10 mgd. It is further complicated by the earlier Section 13267 Letter Data requirement to sample an additional two times during peak wet weather events. This variation in data collection creates inconsistencies in the datasets and presents limitations on statistical analysis for the purposes of trending.

As previously described, the trend analysis presented in the following subsections is based on the Dry Season (n = 5 for influent and n = 40 for most discharge).

Since the first Group Annual Report submitted in 2015, there have been several data amendments within CIWQS as well as the Group Annual Reports as follows:

- Data from the City of Palo Alto, the City of San Mateo, and Napa Sanitation District submitted under the 2015 Group Annual Report Submittal were initially updated in the 2016 Report with updated data that are reflected in this report.
- Data from the Rodeo Sanitary District 2014-2016 datasets were updated with values that are reflected in this report.
- Ammonia data for June 2017 from Sausalito Marin City Sanitation District were updated with values that are reflected in this report.
- Flow data from Tiburon for the 2014/2015 and 2015/2016 were inaccurately reported in the 2017 Group Annual Report. This report reflects the accurate data from CIWQS.
- Flow data for Mt View Sanitary District for a portion of the 2018 dry season and the 2018/2019 dataset were inaccurately reported in the 2018 and 2019 Group Annual Reports. This report reflects the accurate data since updated in CIWQS.

5.1 Discharge Flow

The historical average monthly discharge flows from October 2012 through September 2020 are presented in Figure 5-1. The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) discharge flows were calculated based on reported flows in Table 5-1 and Table 5-2, respectively. In addition, the annual average and dry season average monthly discharge flows for each Subembayment are provided in Table 5-3 and Table 5-4, respectively.

A summary of the discharge data review findings is as follows:

- The total annual average discharge flows (refer to Table 5-3) were the lowest since sampling began in 2012. It is well documented that influent/discharge flows typically increase with precipitation (discussed in Section 6.2). During relatively wet years (e.g., 2016/2017), the average monthly discharge flows were the highest since sampling began in 2012. In contrast, the relatively dry year (2019/2020) resulted in the lowest average monthly wet season discharge flows.
- Besides precipitation, the impact on flows from the global pandemic (COVID-19) is unclear at this stage (discussion provided in Section 6.1).
- Despite a reduction in flows, no Subembayments or total flows showed any statistically significant trending for the discharge dry season flows. This trending is based on the least squares correlation test selected as the basis for trends analysis over the entire dry season dataset since sampling began in 2012 (see Section 3.5).
- The South Bay and Lower South Bay Subembayments account for over half of discharge flow to San Francisco Bay (refer to Figure 5-1 and/or Table 5-3). The dry season discharge flows show an overall decrease compared to the wet season for all Subembayments.

A discussion of the results is provided in Section 6.6.

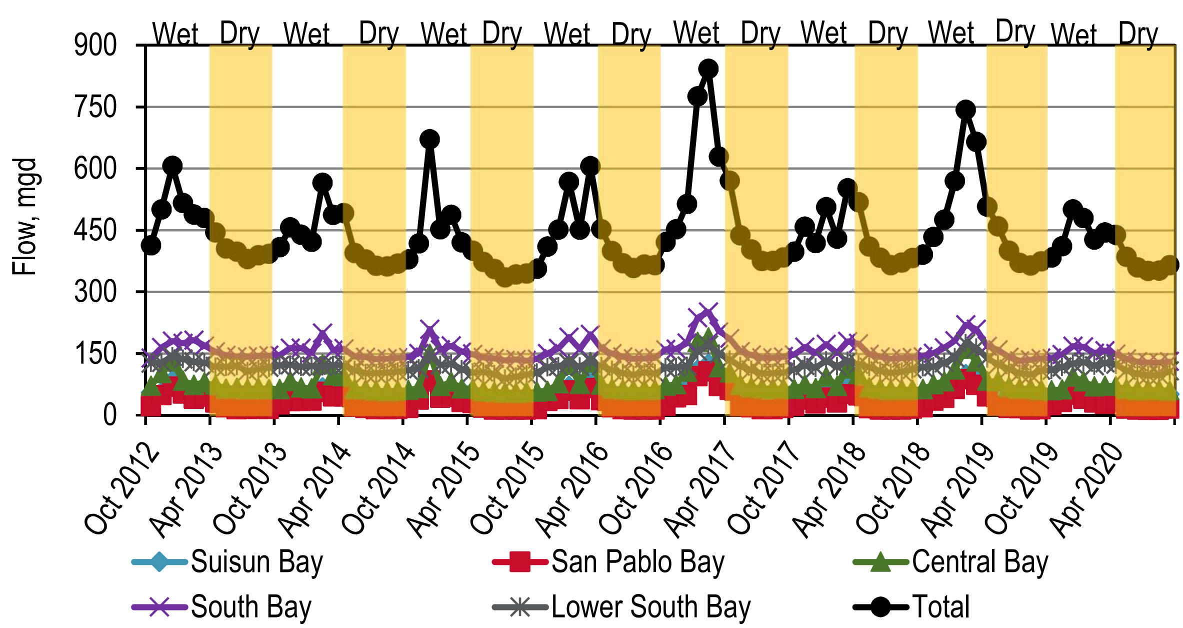

Figure 5-1. Discharge: Average Monthly Discharge Flows for Evaluation Period

Table 5-1. Discharge: Annual Average Flows by Discharger (mgd)

Discharger	Subembayment	Permitted Capacity [a]	2012/13 [b]	2013/14 [b]	2014/15 [b]	2015/16 [b]	2016/17 [b]	2017/18 [b]	2018/19 [b]	2019/20 [b]
American Canyon	San Pablo Bay	2.5	1.47	1.36	1.45	1.44	1.77	1.39	1.58	1.22
Benicia	San Pablo Bay	4.5	2.18	2.04	1.98	2.00	2.46	1.99	2.23	1.80
Burlingame	South Bay	5.5	3.03	2.91	2.96	2.84	3.62	2.74	2.99	2.44
CCCSD	Suisun Bay	53.8	37.5	35.5	32.8	33.7	43.5	34.9	38.6	33.3
CMSA	Central Bay	10	7.66	5.84	6.97	8.05	13.4	9.16	12.0	9.01
Port Costa	San Pablo Bay	0.033	0.00682	0.00630	0.0102	0.0165	0.0308	0.0197	0.0240	0.0296
Delta Diablo	Suisun Bay	19.5	6.83	6.12	7.38	7.21	9.88	9.04	8.74	8.17
EBDA	South Bay	107.8	62.2	58.5	59.1	61.0	68.1	60.5	65.0	62.1
EBMUD	Central Bay	120	58.3	56.2	51.5	53.4	66.1	52.0	58.0	48.1
FSSD	Suisun Bay	23.7	13.2	12.4	12.1	13.0	17.0	13.4	15.4	12.9
Las Gallinas[c]	San Pablo Bay	2.92	1.37	1.19	1.25	1.66	2.86	1.35	2.62	1.93
Paradise Cove	Central Bay	0.04	0.0144	0.0138	0.0135	0.0129	0.0148	0.0159	0.0166	0.0149
Tiburon	Central Bay	0.98	0.587	0.592	0.665	0.551	0.791	0.641	0.670	0.573
Millbrae	South Bay	3	1.58	1.65	1.35	1.49	1.87	1.48	1.73	1.48
Mt. View	Suisun Bay	3.2	1.34	1.27	1.26	1.20	1.53	1.27	1.36	1.19
Napa[c]	San Pablo Bay	15.4	5.05	4.60	5.30	6.04	8.94	4.55	7.42	3.54
Novato[c]	San Pablo Bay	7	3.18	2.89	3.33	2.94	5.08	2.98	4.78	2.75
Palo Alto	Lower South Bay	39	21.5	19.2	18.9	22.4	23.2	19.1	21.9	19.5
Petaluma[c]	San Pablo Bay	6.7	3.67	4.32	3.18	2.83	4.63	3.18	4.02	2.89
Pinole	San Pablo Bay	4.06	2.57	2.60	2.39	2.40	2.98	2.50	2.78	2.27
Rodeo	San Pablo Bay	1.14	0.650	0.593	0.603	0.601	0.805	0.587	0.680	0.551
SFO Airport	South Bay	2.2	1.13	1.17	1.02	1.10	1.25	1.15	1.22	0.943
SFPUC Southeast	South Bay	85.4	56.9	58.9	55.3	56.6	63.0	56.5	55.5	46.8
San Jose	Lower South Bay	167	91.5	84.3	81.3	80.3	90.4	87.5	93.8	84.4
San Mateo	South Bay	15.7	10.8	9.73	10.2	10.3	12.3	10.4	11.6	9.92
SMCSD	Central Bay	1.8	1.52	1.25	1.19	1.27	1.52	1.14	1.30	1.03
SASM	Central Bay	3.6	2.19	2.69	2.35	2.49	3.09	2.26	2.67	2.14
SVCW	South Bay	29	12.9	12.2	12.8	14.1	16.0	13.9	15.6	13.7
Sonoma Valley[c]	San Pablo Bay	3	1.59	1.29	0.317	0.567	2.22	0	1.48	0
South SF	South Bay	13	8.99	8.68	8.43	8.25	8.98	7.60	8.55	7.34

Discharger	Subembayment	Permitted Capacity [a]	2012/13 [b]	2013/14 [b]	2014/15 [b]	2015/16 [b]	2016/17 [b]	2017/18 [b]	2018/19 [b]	2019/20 [b]
Sunnyvale	Lower South Bay	29.5	10.8	10.8	10.2	10.2	11.9	10.5	11.6	10.1
Treasure Island	Central Bay	2	0.312	0.323	0.324	0.330	0.375	0.313	0.412	0.285
Vallejo	San Pablo Bay	15.5	10.4	9.14	10.0	9.70	12.6	9.06	10.1	8.51
West County	Central Bay	28.5	8.32	8.27	7.40	10.1	13.1	9.93	13.3	7.37
Total [d]		**827**	**451**	**428**	**415**	**430**	**515**	**433**	**480**	**408**

a. Based on ADWF permitted capacity.
b. Data are presented in detail and summarized for each plant in the Appendix. A "-" indicates data were not available, whereas a "0" indicates a value of zero.
c. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.
d. The total values might vary from the sum of the listed values by plant due to rounding.

Table 5-2. Discharge: Dry Season Flows by Discharger (mgd)

Discharger	Subembayment	Permitted Capacity [a]	2012/2013 [b]	2013/2014 [b]	2014/2015 [b]	2015/2016 [b]	2016/2017 [b]	2017/2018 [b]	2018/2019 [b]	2019/2020 [b]
American Canyon	San Pablo Bay	2.5	1.19	1.18	1.14	1.04	1.12	1.09	1.17	0.949
Benicia	San Pablo Bay	4.5	1.99	1.85	1.68	1.83	1.92	1.82	1.90	1.68
Burlingame	South Bay	5.5	2.82	2.55	2.57	2.54	2.84	2.49	2.49	2.20
CCCSD	Suisun Bay	53.8	34.1	32.6	28.1	30.1	33.9	31.2	32.8	31.5
CMSA	Central Bay	10	5.59	4.97	4.71	5.72	7.49	6.93	7.96	7.14
Port Costa	San Pablo Bay	0.033	0.00496	0.00400	0.00868	0.0157	0.0147	0.0208	0.0149	0.0149
Delta Diablo	Suisun Bay	19.5	6.19	5.72	5.89	6.24	8.81	7.43	8.28	8.00
EBDA	South Bay	107.8	55.6	50.8	51.3	53.3	53.0	54.9	56.4	56.4
EBMUD	Central Bay	120	50.0	47.1	43.5	45.4	48.1	45.9	48.3	45.3
FSSD	Suisun Bay	23.7	10.3	10.2	9.12	10.2	12.2	11.7	12.8	11.3
Las Gallinas[c]	San Pablo Bay	2.92	0	0	0	0	0.407	0	0.750	0.405
Paradise Cove	Central Bay	0.04	0.0140	0.0130	0.0126	0.0129	0.0125	0.0183	0.0149	0.0154
Tiburon	Central Bay	0.98	0.532	0.542	0.545	0.551	0.558	0.547	-	0.537
Millbrae	South Bay	3	1.53	1.25	1.19	1.40	1.42	1.30	1.48	1.37
Mt. View	Suisun Bay	3.2	1.14	1.21	1.12	1.22	1.25	1.19	1.20	1.11
Napa[c]	San Pablo Bay	15.4	0	1.20	0	0	0	0	0	0
Novato[c]	San Pablo Bay	7	0.806	0.743	0.736	0.763	2.28	0.779	2.30	0.503
Palo Alto	Lower South Bay	39	22.5	19.6	18.5	21.6	18.9	19.5	17.4	17.5
Petaluma[c]	San Pablo Bay	6.7	0	0	0	0	0	0	0	0
Pinole	San Pablo Bay	4.06	2.50	2.33	2.09	2.20	2.36	2.27	2.50	2.22
Rodeo	San Pablo Bay	1.14	0.572	0.551	0.491	0.523	0.552	0.526	0.550	0.540
SFO Airport	South Bay	2.2	1.07	1.13	0.949	1.06	1.14	1.12	1.17	0.665
SFPUC Southeast	South Bay	85.4	53.3	56.0	52.8	54.6	57.1	52.9	49.6	42.0
San Jose	Lower South Bay	167	83.6	77.2	72.1	74.6	80.1	81.9	83.4	77.2
San Mateo	South Bay	15.7	10.0	9.18	8.52	9.18	9.63	9.68	9.97	9.52
SMCSD	Central Bay	1.8	1.22	1.06	1.03	1.11	1.13	1.02	1.06	0.943
SASM	Central Bay	3.6	1.95	1.87	1.74	1.77	1.94	1.79	1.70	1.98
SVCW	South Bay	29	11.8	11.0	11.9	12.5	13.1	12.5	13.3	12.6
Sonoma Valley[c]	San Pablo Bay	3	0	0	0	0	0.0549	0	0	0
South SF	South Bay	13	8.43	8.34	7.46	7.41	7.13	7.21	7.50	6.97
Sunnyvale	Lower South Bay	29.5	9.02	8.94	7.71	8.04	9.34	8.54	9.06	8.38

Discharger	Subembayment	Permitted Capacity [a]	2012/2013 [b]	2013/2014 [b]	2014/2015 [b]	2015/2016 [b]	2016/2017 [b]	2017/2018 [b]	2018/2019 [b]	2019/2020 [b]
Treasure Island	Central Bay	2	0.281	0.296	0.275	0.273	0.277	0.306	0.307	0.253
Vallejo	San Pablo Bay	15.5	8.75	8.73	8.21	8.40	8.70	7.94	8.10	7.75
West County	Central Bay	28.5	6.55	6.09	5.61	8.74	8.65	8.67	10.2	6.16
Total [d]		**827**	**393**	**374**	**351**	**372**	**396**	**383**	**394**	**363**

a. Based on ADWF permitted capacity.

b. Data are presented in detail and summarized for each plant in the Appendix. A "-" indicates data were not available, whereas a "0" indicates a value of zero.

c. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.

d. The total values might vary from the sum of the listed values by plant due to rounding.

Table 5-3. Discharge: Annual Average by Subembayment, Flow (mgd)

Subembayment	Permitted Capacity [(a)]	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Suisun Bay	100	58.9	58.1	53.5	55.1	71.9	58.6	64.1	55.6
San Pablo Bay	62.8	32.1	32.0	29.8	30.2	44.4	27.6	37.7	25.5
Central Bay	167	78.9	77.6	70.3	75.9	98.3	75.3	88.4	68.5
South Bay	262	157	156	151	156	175	154	162	145
Lower South Bay	236	124	122	110	113	125	117	127	114
Total	**827**	**451**	**446**	**415**	**430**	**515**	**433**	**480**	**408**

a. Based on ADWF permitted capacity.

Table 5-4. Discharge: Dry Season by Subembayment, Flow (mgd)

Subembayment	Permitted Capacity [(a)]	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	Trend [(b,c)]
Suisun Bay	100	51.7	49.8	44.2	47.8	56.1	51.6	55.1	51.9	None
San Pablo Bay	62.8	15.8	15.5	14.4	14.8	17.4	14.5	17.3	14.1	None
Central Bay	167	66.1	63.1	57.3	63.5	68.2	64.9	69.5	62.4	None
South Bay	262	145	141	137	142	145	142	142	132	None
Lower South Bay	236	115	111	98.3	104	108	110	110	103	None
Total	**827**	**393**	**380**	**351**	**372**	**396**	**383**	**394**	**363**	**None**

a. Based on ADWF permitted capacity.
b. Trend analysis is based on average monthly values. Discernible trends were identified based on the slope of a regression line determined using the method of least squares to fit the data (alpha = 0.05). Sample size is 40. Where "None" is stated, the limited dataset does not indicate a statistically relevant trend.
c. The percent change represents the change per year as a percentage of the average value over the entire dataset (2012-2019) (not considered if trend is "None").

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5.2 Total Ammonia

The historical average monthly discharge loads from October 2012 through September 2020 are presented in Figure 5-2. The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) discharge loads were calculated based on reported loads in Table 5-5 and Table 5-6, respectively. In addition, the annual average and dry season average monthly discharge loads and concentrations for each Subembayment are provided in Table 5-7 through Table 5-10, respectively.

A summary of the discharge data review findings is as follows:

- The total annual average and dry season ammonia discharge increased from 2012/2013 to 2016/2017 season (refer to Table 5-5 and Table 5-6, respectively), remained relatively steady between 2016/2017 and 2018/2019, followed by a decline in 2019/2020 period. The decline from 2018/2019 to 2019/2020 was more pronounced for the dry season average compared against the annual average.
- The impact on loads from the global pandemic (COVID-19) is unclear at this stage (discussion provided in Section 6.1).
- On a dry season basis, ammonia loads appear to be trending upwards for Suisun Bay, San Pablo Bay, and Central Bay Subembayments based on the least squares correlation analysis (refer to Table 5-8).
- The Suisun Bay ammonia loads increased from 2018/2019 to 2019/2020. The San Pablo Bay ammonia loads were flat from 2018/2019 to 2019/2020. Despite an upward trend, Central Bay had a decline in ammonia loads from 2018/2019 to 2019/2020. Furthermore, the overall Baywide dry season loads suggest an upward trend (see Section 3.5) despite a one-year decline in ammonia loads (2018/2019 to 2019/2020). The South Bay Subembayment accounts for over half of the load discharged to the Bay, regardless of annual or dry season average (refer to Figure 5-2, Table 5-7, or Table 5-8).
- The nutrient concentrations are calculated based on flow-weighted values (refer to Table 5-9 and Table 5-10). The most recent dataset has concentrations that are at or near the highest levels since sampling began in 2012. The most recent relatively high Baywide concentrations is likely attributed to the relatively dry year in 2019/2020 as the loads have declined since the 2018/2019 dataset. Central Bay has the highest concentrations of the Subembayments. Several of the Central Bay Subembayments received trucked waste which can increase discharge concentrations/loads.

An overall discussion of the results is provided in Section 6.7.

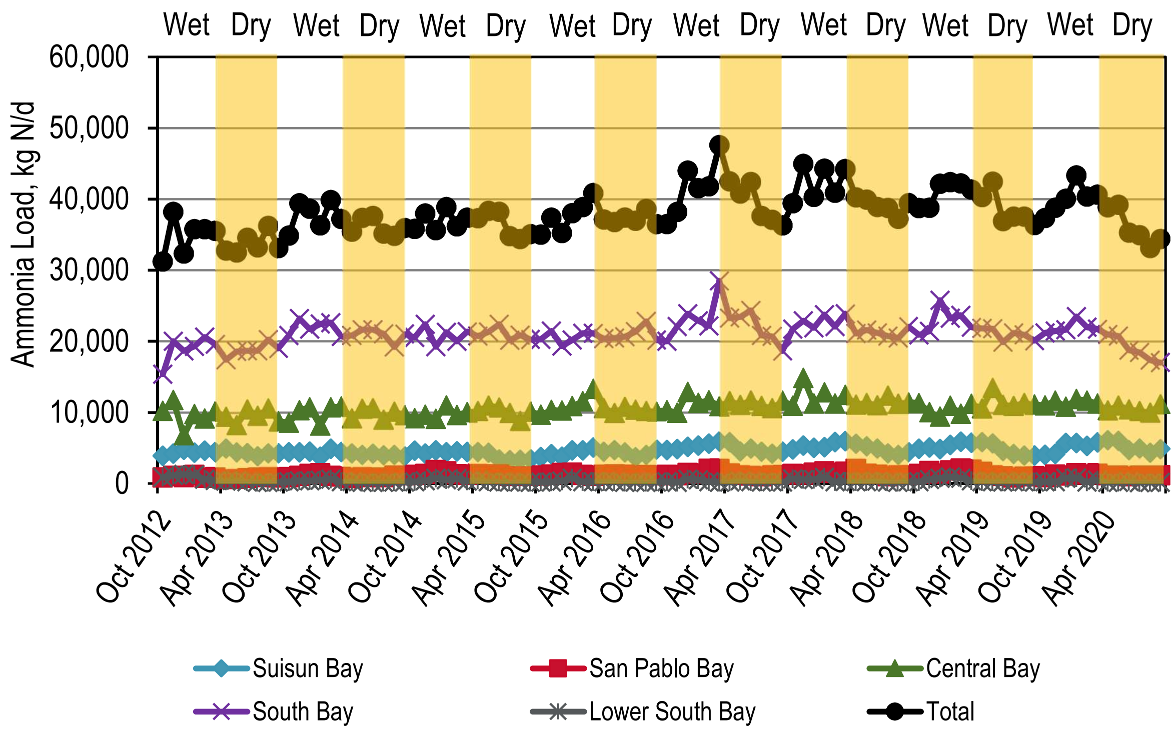

Figure 5-2. Discharge: Average Monthly Discharge Ammonia Loads for Evaluation Period

Table 5-5. Discharge: Annual Average by Discharger, Ammonia (kg N/d)

Discharger	Subembayment	2012/13 [(a)]	2013/14 [(a)]	2014/15 [(a)]	2015/16 [(a)]	2016/17 [(a)]	2017/18 [(a)]	2018/19 [(a)]	2019/20 [(a)]
American Canyon	San Pablo Bay	1.77	5.43	3.25	1.54	2.31	4.83	4.12	1.33
Benicia	San Pablo Bay	190	159	186	194	175	216	187	174
Burlingame	South Bay	305	251	259	274	323	320	351	240
CCCSD	Suisun Bay	3,610	3,510	3,210	3,490	3,610	3,560	3,530	3,870
CMSA	Central Bay	720	779	603	753	1,010	861	1,060	1,070
Port Costa	San Pablo Bay	0.255	0.337	0.344	0.431	0.716	0.885	0.565	3.65
Delta Diablo	Suisun Bay	757	740	903	873	1,420	1,500	1,480	1,290
EBDA	South Bay	6,820	7,010	7,320	7,330	7,320	7,830	7,680	8,070
EBMUD	Central Bay	8,070	8,350	8,630	9,010	9,390	10,100	8,810	8,920
FSSD	Suisun Bay	1.45	1.68	1.56	1.91	2.67	7.66	9.09	5.17
Las Gallinas[(b)]	San Pablo Bay	10.7	14.8	11.6	23.4	34.7	34.6	54.1	31.8
Paradise Cove	Central Bay	0.443	0.249	0.0102	1.35	0.0386	0.0197	0.0452	0.0624
Tiburon	Central Bay	40.2	48.3	53.0	55.0	33.6	55.1	48.7	29.4
Millbrae	South Bay	237	233	237	265	292	260	284	281
Mt. View	Suisun Bay	3.09	0.824	2.08	3.80	2.61	2.53	4.25	3.60
Napa[(b)]	San Pablo Bay	44.1	17.0	6.35	16.5	103	38.1	158	25.0
Novato[(b)]	San Pablo Bay	7.25	10.0	17.5	6.92	40.6	16.5	57.1	23.1
Palo Alto	Lower South Bay	13.4	12.8	17.7	17.6	12.0	15.8	10.6	8.90
Petaluma[(b)]	San Pablo Bay	3.22	7.17	2.82	5.43	2.57	3.15	7.47	2.94
Pinole	San Pablo Bay	187	202	229	258	242	273	115	171
Rodeo	San Pablo Bay	3.47	5.05	3.76	6.96	9.30	3.84	4.78	18.5
SFO Airport	South Bay	227	242	132	141	212	115	82.4	3.75
SFPUC Southeast	South Bay	7,280	9,580	8,630	8,400	9,780	8,460	8,380	7,110
San Jose	Lower South Bay	280	204	197	232	183	206	215	197
San Mateo	South Bay	1,320	1,300	1,210	1,110	1,250	1,320	1,520	1,210
SMCSD	Central Bay	51.0	41.6	50.2	44.7	73.7	94.8	72.8	73.2
SASM	Central Bay	49.5	45.5	39.0	62.2	26.7	67.2	107	85.6
SVCW	South Bay	1,900	1,980	2,240	2,540	2,390	2,670	2,610	2,560
Sonoma Valley[(b)]	San Pablo Bay	1.53	2.45	0.178	0.130	0.788	0	0.411	0
South SF	South Bay	772	828	863	746	1,030	1,000	1,010	943

Discharger	Subembayment	2012/13 [(a)]	2013/14 [(a)]	2014/15 [(a)]	2015/16 [(a)]	2016/17 [(a)]	2017/18 [(a)]	2018/19 [(a)]	2019/20 [(a)]
Sunnyvale	Lower South Bay	305	86.5	163	30.0	101	171	196	116
Treasure Island	Central Bay	0.883	2.61	8.36	8.51	5.09	4.76	4.44	3.64
Vallejo	San Pablo Bay	426	622	854	749	784	845	849	732
West County	Central Bay	650	651	620	812	720	705	877	769
Total [(c)]		**34,300**	**37,000**	**36,700**	**37,500**	**40,600**	**40,800**	**39,800**	**38,000**

a. Data are presented in detail and summarized for each plant in the Appendix. A "-" indicates data were not available, whereas a "0" indicates a value of zero.

b. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.

c. The total values might vary from the sum of the listed values by plant due to rounding.

Table 5-6. Discharge: Dry Season by Discharger, Ammonia (kg N/d)

Discharger	Subembayment	2012/2013 [(a)]	2013/2014 [(a)]	2014/2015 [(a)]	2015/2016 [(a)]	2016/2017 [(a)]	2017/2018 [(a)]	2018/2019 [(a)]	2019/2020 [(a)]
American Canyon	San Pablo Bay	1.56	2.21	2.06	1.13	1.74	2.93	1.93	0.990
Benicia	San Pablo Bay	190	149	143	192	195	195	140	188
Burlingame	South Bay	311	209	241	246	220	366	224	219
CCCSD	Suisun Bay	3,540	3,390	2,960	3,510	3,240	3,250	3,170	3,740
CMSA	Central Bay	740	780	619	915	1,020	815	1,020	1,060
Port Costa	San Pablo Bay	0.319	0.0381	0.133	-	0.290	0.296	0.461	0.749
Delta Diablo	Suisun Bay	709	674	650	858	1,320	1,360	1,310	1,280
EBDA	South Bay	6,290	6,500	7,210	6,620	6,250	7,320	7,260	6,820
EBMUD	Central Bay	8,020	8,490	8,770	8,480	9,340	9,770	9,460	8,610
FSSD	Suisun Bay	0.938	1.27	1.02	1.26	1.84	6.83	7.41	3.18
Las Gallinas[(b)]	San Pablo Bay	0	0	0	0	2.32	0	11.2	0.722
Paradise Cove	Central Bay	0.0284	0.249	0.0119	1.35	0.0169	0.0197	0.0677	0.121
Tiburon	Central Bay	32.2	48.3	46.2	55.0	29.4	57.2	-	27.5
Millbrae	South Bay	243	206	235	292	290	249	305	266
Mt. View	Suisun Bay	1.31	0.754	2.21	3.66	1.19	3.49	4.39	3.40
Napa[(b)]	San Pablo Bay	0	0.415	0	0	0	0	0	0
Novato[(b)]	San Pablo Bay	0.305	2.39	1.20	0.902	18.0	2.40	20.5	5.15
Palo Alto	Lower South Bay	15.1	13.1	17.3	25.8	13.3	26.1	8.29	8.32
Petaluma[(b)]	San Pablo Bay	0	0	0	0	0	0	0	0
Pinole	San Pablo Bay	210	203	220	332	191	266	60.9	174
Rodeo	San Pablo Bay	0.780	3.66	2.14	5.44	5.24	1.26	3.80	36.2
SFO Airport	South Bay	234	263	142	192	337	48.9	146	3.84
SFPUC Southeast	South Bay	7,910	9,580	8,930	9,300	10,100	8,670	7,980	6,730
San Jose	Lower South Bay	229	158	182	162	197	211	222	172
San Mateo	South Bay	1,530	1,480	1,200	1,290	1,190	1,420	1,550	1,240
SMCSD	Central Bay	49.3	50.2	45.8	59.3	105	132	126	66.3
SASM	Central Bay	54.4	32.7	25.1	49.8	22.1	100	132	94.6
SVCW	South Bay	1,760	1,900	2,310	2,470	2,390	2,300	2,480	2,320
Sonoma Valley[(b)]	San Pablo Bay	0	0	0	0	0.0182	0	0	0

Discharger	Subembayment	2012/2013 [(a)]	2013/2014 [(a)]	2014/2015 [(a)]	2015/2016 [(a)]	2016/2017 [(a)]	2017/2018 [(a)]	2018/2019 [(a)]	2019/2020 [(a)]
South SF	South Bay	781	827	775	716	852	882	864	895
Sunnyvale	Lower South Bay	16.8	11.8	12.5	15.6	60.8	9.43	2.97	5.38
Treasure Island	Central Bay	1.23	4.55	10.5	4.16	4.05	6.65	3.41	3.81
Vallejo	San Pablo Bay	435	645	795	705	752	767	791	722
West County	Central Bay	653	639	665	815	725	678	871	712
Total [(c)]		**34,000**	**36,300**	**36,200**	**37,300**	**38,900**	**38,900**	**38,200**	**35,400**

a. Data are presented in detail and summarized for each plant in the Appendix. A "-" indicates data were not available, whereas a "0" indicates a value of zero.

b. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.

c. The total values might vary from the sum of the listed values by plant due to rounding.

Table 5-7. Discharge: Annual Average by Subembayment, Ammonia (kg N/d)

Subembayment	2012/13 [(a)]	2013/14 [(a)]	2014/15 [(a)]	2015/16 [(a)]	2016/17 [(a)]	2017/18 [(a)]	2018/19 [(a)]	2019/20 [(a)]
Suisun Bay	4,380	4,250	4,120	4,370	5,030	5,080	5,020	5,170
San Pablo Bay	874	1,040	1,320	1,260	1,390	1,440	1,440	1,180
Central Bay	9,570	9,870	9,960	10,700	11,200	11,900	11,000	11,000
South Bay	18,900	21,400	20,900	20,800	22,600	22,000	21,900	20,400
Lower South Bay	598	303	378	280	296	393	421	321
Total	**34,300**	**36,900**	**36,700**	**37,400**	**40,500**	**40,800**	**39,800**	**38,000**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/13 represents the period between October 1, 2012 and September 30, 2013.

Table 5-8. Discharge: Dry Season by Subembayment, Ammonia (kg N/d)

Subembayment	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	Trend [(a,b)]
Suisun Bay	4,250	4,070	3,610	4,380	4,570	4,620	4,500	5,020	Up (2.9%/yr)
San Pablo Bay	835	1,000	1,160	1,240	1,160	1,230	1,030	1,130	Up (2.5%/yr)
Central Bay	9,540	10,000	10,200	10,300	11,200	11,600	11,600	10,600	Up (2.2%/yr)
South Bay	19,100	21,000	21,000	21,100	21,600	21,300	20,800	18,500	None
Lower South Bay	260	183	212	203	271	246	233	186	None
Total	**34,000**	**36,200**	**36,200**	**37,300**	**38,900**	38,900	38,200	35,400	**Up (1.0%/yr)**

a. Trend analysis is based on average monthly values. Discernible trends were identified based on the slope of a regression line determined using the method of least squares to fit the data (alpha = 0.05). Sample size is 40. Where “None” is stated, the limited dataset does not indicate a statistically relevant trend.
b. The percent change represents the change per year as a percentage of the average value over the entire dataset (2012-2020) (not considered if trend is “None”).

Table 5-9. Discharge: Annual Average by Subembayment, Ammonia (mg N/L)

Subembayment	2012/13 [a]	2013/14 [a]	2014/15 [a]	2015/16 [a]	2016/17 [a]	2017/18 [a]	2018/19 [a]	2019/20 [a]	8 Year Average [b]
Suisun Bay	19.6	20.3	20.3	21.0	18.5	22.9	20.7	24.5	20.9
San Pablo Bay	7.21	9.20	11.7	11.0	8.31	13.7	10.1	12.3	10.2
Central Bay	32.1	34.8	37.6	37.2	30.3	41.6	32.8	42.2	35.7
South Bay	31.6	36.8	36.5	35.3	34.1	37.6	35.7	37.3	35.6
Lower South Bay	1.28	0.701	0.905	0.654	0.624	0.886	0.875	0.745	0.836
Total	**20.1**	**22.8**	**23.4**	**23.0**	**20.8**	**24.9**	**21.9**	**24.6**	**22.6**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/13 represents the period between October 1, 2012 and September 30, 2013.

b. Calculation based on a flow-weighted average values.

Table 5-10. Discharge: Dry Season by Subembayment, Ammonia (mg N/L)

Subembayment	2012/13 [a]	2013/14 [a]	2014/15 [a]	2015/16 [a]	2016/17 [a]	2017/18 [a]	2018/19 [a]	2019/20 [a]	8 Year Average [b]
Suisun Bay	21.7	21.6	21.6	24.2	21.5	23.7	21.6	25.6	22.7
San Pablo Bay	14.0	16.0	21.4	22.1	17.7	22.6	15.7	21.2	18.6
Central Bay	38.2	42.9	46.8	43.1	43.6	46.9	44.1	44.8	43.7
South Bay	34.9	39.5	40.7	39.3	39.3	39.5	38.8	37.1	38.6
Lower South Bay	0.598	0.458	0.569	0.516	0.662	0.592	0.560	0.476	0.555
Total	**22.9**	**25.6**	**27.3**	**26.5**	**26.0**	**26.9**	**25.7**	**25.8**	**25.8**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/13 represents the period between October 1, 2012 and September 30, 2013.

b. Calculation based on a flow-weighted average values.

5.3 Nitrate + Nitrite (NOx)

The historical average monthly discharge loads from October 2012 through September 2020 are presented in Figure 5-3. The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) discharge loads were calculated based on reported loads in Table 5-11 and Table 5-12, respectively. In addition, the annual average and dry season average monthly discharge loads and concentrations for each Subembayment are provided in Table 5-13 through Table 5-16, respectively.

A summary of the discharge data review findings is as follows:

- Both annual average and dry season average total NOx loads for the 2019/2020 dataset reflect the lowest loads in the evaluation period (i.e., October 2012 through September 2020; refer to Table 5-11, Table 5-12, Table 5-13, and Table 5-14).
- The impact on loads from the global pandemic (COVID-19) is unclear at this stage (discussion provided in Section 6.1).
- Overall, NOx dry season average monthly loads appear to be trending downward for the Suisun Bay, San Pablo Bay, Central Bay, South Bay Subembayments, as well as Baywide.
- Despite an approximately 10 percent decline in NOx discharge loads from 2018/2019 to 2019/2020, the Lower South Bay Subembayment had no emerging dry season trend (refer to Table 5-14). Note: The Lower South Bay accounts for over half of the NOx discharged to the San Francisco Bay (refer to Figure 5-3 or Table 5-14).
- The nutrient concentrations are calculated based on flow-weighted values (refer to Table 5-15 and Table 5-16). The most recent dataset has concentrations that are lower than the average since sampling began in 2012. The Lower South Bay has the highest concentrations because all of the agencies that discharge fully nitrify (i.e., biologically convert ammonia to nitrite plus nitrate). Both Suisun Bay and San Pablo Bay have concentrations greater than 5 mg N/L as both Subembayments have agencies that fully nitrify and convert the ammonia to nitrite plus nitrate.

A discussion of the results is provided in Section 6.8.

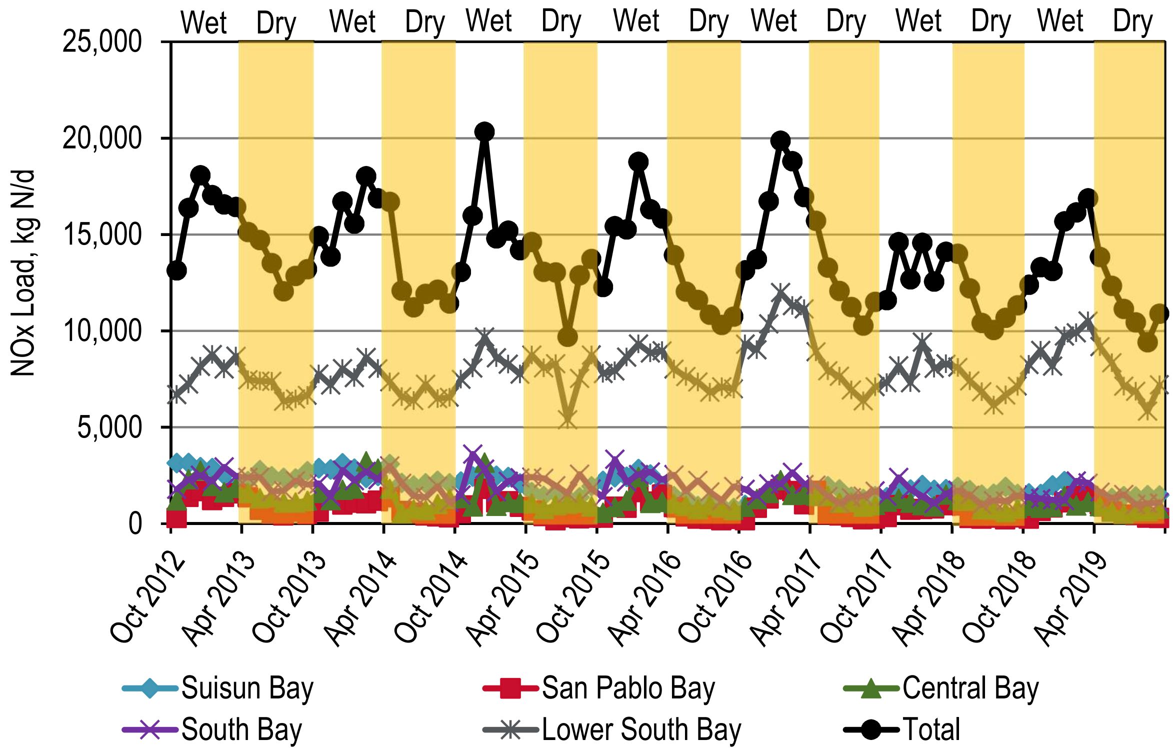

Figure 5-3. Discharge: Average Monthly Discharge NOx Loads for Evaluation Period

Table 5-11. Discharge: Annual Average Values by Discharger, NOx (kg N/d)

Discharger	Subembayment	2012/13 [a]	2013/14 [a]	2014/15 [a]	2015/16 [a]	2016/17 [a]	2017/18 [a]	2018/19 [a]	2019/20 [a]
American Canyon	San Pablo Bay	68.6	74.9	41.2	30.6	39.1	31.9	33.2	31.8
Benicia	San Pablo Bay	35.1	45.5	47.5	39.3	67.9	35.2	34.5	37.3
Burlingame	South Bay	92.9	182	33.2	18.0	43.0	39.2	115	220
CCCSD	Suisun Bay	270	293	461	309	392	284	255	108
CMSA	Central Bay	124	67.2	158	115	171	125	58.4	95.2
Port Costa	San Pablo Bay	0	0	0	1.30	1.13	0.700	0.143	0.573
Delta Diablo	Suisun Bay	936	774	382	450	31.4	34.1	48.2	46.1
EBDA	South Bay	1,050	822	994	1,070	1,000	852	818	748
EBMUD	Central Bay	1,120	1,090	763	521	517	573	517	391
FSSD	Suisun Bay	1,310	1,330	1,030	874	914	1,290	1,120	1,030
Las Gallinas[b]	San Pablo Bay	118	104	85.9	97.7	104	101	114	136
Paradise Cove	Central Bay	1.64	0	2.53	0.180	2.21	2.11	1.77	1.65
Tiburon	Central Bay	18.6	7.78	4.81	7.60	11.5	0.382	1.04	22.5
Millbrae	South Bay	3.37	1.30	2.14	2.14	2.28	0.766	2.10	6.85
Mt. View	Suisun Bay	118	128	117	119	139	122	111	116
Napa[b]	San Pablo Bay	129	158	165	154	156	123	149	127
Novato[b]	San Pablo Bay	137	126	150	132	157	114	124	85.3
Palo Alto	Lower South Bay	2,340	2,150	2,110	2,630	2,550	2,160	2,300	2,220
Petaluma[b]	San Pablo Bay	22.0	4.61	20.4	10.1	13.8	1.72	16.7	3.74
Pinole	San Pablo Bay	114	93.1	48.4	51.4	78.1	44.1	104	60.3
Rodeo	San Pablo Bay	32.9	25.6	29.5	23.4	35.1	28.7	33.5	20.1
SFO Airport	South Bay	23.6	15.4	22.0	20.6	13.6	23.8	24.6	21.5
SFPUC Southeast	South Bay	645	757	963	648	484	401	399	122
San Jose	Lower South Bay	4,520	4,570	5,390	4,760	5,610	4,720	5,290	4,680
San Mateo	South Bay	129	102	94.8	190	105	112	12.7	121
SMCSD	Central Bay	77.4	76.2	76.8	87.6	62.3	41.4	62.3	50.5
SASM	Central Bay	162	158	134	172	138	110	92.7	115
SVCW	South Bay	75.7	67.3	62.3	53.0	68.8	23.3	25.9	23.9
Sonoma Valley[b]	San Pablo Bay	27.9	6.76	23.1	10.5	81.2	0	29.5	0
South SF	South Bay	211	104	76.8	151	44.1	34.0	32.7	61.0
Sunnyvale	Lower South Bay	589	611	563	562	852	707	769	694

Discharger	Subembayment	2012/13 [a]	2013/14 [a]	2014/15 [a]	2015/16 [a]	2016/17 [a]	2017/18 [a]	2018/19 [a]	2019/20 [a]
Treasure Island	Central Bay	9.96	11.2	10.6	8.91	11.2	7.22	8.73	17.3
Vallejo	San Pablo Bay	341	224	106	153	122	95.0	105	114
West County	Central Bay	114	150	56.0	144	434	169	121	40.6
Total [c]		**15,000**	**14,300**	**14,200**	**13,600**	**14,500**	**12,400**	**12,900**	**11,600**

a. Data are presented in detail and summarized for each plant in the Appendix. A "-" indicates data were not available, whereas a "0" indicates a value of zero.

b. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.

c. The total values might vary from the sum of the listed values by plant due to rounding.

Table 5-12. Discharge: Dry Season Discharges by Discharger, NOx (kg N/d)

Discharger	Subembayment	2012/2013 [(a)]	2013/2014 [(a)]	2014/2015 [(a)]	2015/2016 [(a)]	2016/2017 [(a)]	2017/2018 [(a)]	2018/2019 [(a)]	2019/2020 [(a)]
American Canyon	San Pablo Bay	109	77.5	28.7	19.0	23.0	28.6	27.3	18.4
Benicia	San Pablo Bay	36.0	50.0	54.8	39.3	45.8	41.0	56.5	33.6
Burlingame	South Bay	125	78.2	31.6	27.9	50.6	22.7	227	243
CCCSD	Suisun Bay	181	243	417	196	368	302	247	154
CMSA	Central Bay	104	60.5	103	48.8	196	139	68.5	105
Port Costa	San Pablo Bay	-	0	-	-	-	-	0.203	0.769
Delta Diablo	Suisun Bay	925	807	219	69.0	27.0	47.2	51.0	47.4
EBDA	South Bay	880	696	656	821	685	712	616	821
EBMUD	Central Bay	888	581	614	478	418	472	421	368
FSSD	Suisun Bay	1,360	968	806	653	1,080	1,230	1,010	966
Las Gallinas[(b)]	San Pablo Bay	0	0	0	0	6.67	0	42.9	46.1
Paradise Cove	Central Bay	2.49	0.0374	2.60	0.180	2.60	2.11	2.09	0.848
Tiburon	Central Bay	14.5	7.78	6.99	7.60	15.6	0.339		26.3
Millbrae	South Bay	4.31	1.20	1.58	0.672	0.887	0.923	2.32	9.60
Mt. View	Suisun Bay	99.6	112	101	118	115	107	101	123
Napa[(b)]	San Pablo Bay	0	49.7	0	0	0	0	0	0
Novato[(b)]	San Pablo Bay	39.6	39.9	36.3	37.3	80.1	40.7	62.0	17.9
Palo Alto	Lower South Bay	2,530	2,130	2,210	2,620	2,110	2,190	1,940	1,920
Petaluma[(b)]	San Pablo Bay	0	0	0	0	0	0	0	0
Pinole	San Pablo Bay	133	103	47.2	9.16	44.2	55.8	109	68.4
Rodeo	San Pablo Bay	25.6	24.4	24.8	22.8	26.3	28.2	32.0	10.2
SFO Airport	South Bay	23.1	21.8	23.3	13.1	6.26	40.3	23.1	15.6
SFPUC Southeast	South Bay	738	688	1,100	581	455	381	267	49.2
San Jose	Lower South Bay	3,990	4,180	5,100	4,250	4,530	4,290	4,540	4,030
San Mateo	South Bay	6.26	5.81	77.9	78.9	94.1	61.4	4.83	76.8
SMCSD	Central Bay	83.8	72.5	88.9	81.6	42.4	15.2	32.5	56.0
SASM	Central Bay	136	130	126	140	132	79.0	43.7	140
SVCW	South Bay	121	40.6	74.1	45.3	55.2	18.4	26.6	30.1
Sonoma Valley[(b)]	San Pablo Bay	0	0	0	0	4.20	0	0	0
South SF	South Bay	135	79.3	104	198	66.4	49.2	43.4	79.9
Sunnyvale	Lower South Bay	344	359	312	325	569	382	614	385

Discharger	Subembayment	2012/2013 [a]	2013/2014 [a]	2014/2015 [a]	2015/2016 [a]	2016/2017 [a]	2017/2018 [a]	2018/2019 [a]	2019/2020 [a]
Treasure Island	Central Bay	8.69	9.76	10.4	9.86	10.6	6.94	10.7	16.7
Vallejo	San Pablo Bay	317	206	104	131	118	86.5	110	98.3
West County	Central Bay	9.57	23.9	18.2	102	315	128	84.2	45.9
Total [c]		**13,400**	**11,800**	**12,500**	**11,100**	**11,700**	**11,000**	**10,800**	**10,000**

a. Data are presented in detail and summarized for each plant in the Appendix. A "-" indicates data were not available, whereas a "0" indicates a value of zero.

b. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.

c. The total values might vary from the sum of the listed values by plant due to rounding.

Table 5-13. Discharge: Annual Average by Subembayment, NOx (kg N/d)

Subembayment	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Suisun Bay	2,630	2,530	1,990	1,750	1,480	1,730	1,580	1,300
San Pablo Bay	986	828	718	702	854	575	748	616
Central Bay	1,630	1,560	1,200	1,050	1,350	1,030	863	734
South Bay	2,230	2,050	2,250	2,150	1,770	1,490	1,430	1,320
Lower South Bay	7,450	7,330	8,070	7,960	9,010	7,590	8,350	7,590
Total	**14,900**	**14,300**	**14,200**	**13,600**	**14,500**	**12,400**	**12,900**	**11,600**

Table 5-14. Discharge: Dry Season by Subembayment, NOx (kg N/d)

Subembayment	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	Trend [a,b]
Suisun Bay	2,560	2,130	1,540	1,040	1,590	1,690	1,410	1,290	Down (-8.1%/yr)
San Pablo Bay	572	479	296	259	348	281	440	294	Down (-9.4%/yr)
Central Bay	1,240	879	965	862	1,120	843	663	758	Down (-6.0%/yr)
South Bay	2,030	1,610	2,070	1,770	1,410	1,290	1,210	1,330	Down (-7.2%/yr)
Lower South Bay	6,870	6,660	7,620	7,190	7,210	6,860	7,090	6,340	None
Total	**13,300**	**11,800**	**12,500**	**11,100**	**11,700**	**11,000**	**10,800**	**10,000**	**Down (-3.4%/yr)**

a. Trend analysis is based on average monthly values. Discernible trends were identified based on the slope of a regression line determined using the method of least squares to fit the data (alpha = 0.05). Sample size is 40. Where “None” is stated, the limited dataset does not indicate a statistically relevant trend.
b. The percent change represents the change per year as a percentage of the average value over the entire dataset (2012-2019) (not considered if trend is “None”).

Table 5-15. Discharge: Annual Average by Subembayment, NOx (mg N/L)

Subembayment	2012/13 [(a)]	2013/14 [(a)]	2014/15 [(a)]	2015/16 [(a)]	2016/17 [(a)]	2017/18 [(a)]	2018/19 [(a)]	2019/20 [(a)]	8 Year Average [(b)]
Suisun Bay	11.8	12.1	9.81	8.41	5.43	7.82	6.32	6.18	8.35
San Pablo Bay	8.44	7.59	6.36	6.15	5.08	5.51	5.24	6.38	6.27
Central Bay	5.46	5.49	4.52	3.66	3.62	3.60	2.58	2.83	3.94
South Bay	3.75	3.53	3.93	3.65	2.66	2.55	2.33	2.42	3.09
Lower South Bay	15.9	17.0	19.3	18.6	19.0	17.1	17.3	17.6	17.7
Total	**8.78**	**8.85**	**9.06**	**8.38**	**7.42**	**7.58**	**7.13**	**7.49**	**8.05**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/13 represents the period between October 1, 2012 and September 30, 2013.

b. Calculation based on a flow-weighted average values.

Table 5-16. Discharge: Dry Season by Subembayment, NOx (mg N/L)

Subembayment	2012/13 [(a)]	2013/14 [(a)]	2014/15 [(a)]	2015/16 [(a)]	2016/17 [(a)]	2017/18 [(a)]	2018/19 [(a)]	2019/20 [(a)]	8 Year Average [(b)]
Suisun Bay	13.1	11.3	9.22	5.73	7.49	8.64	6.76	6.57	8.58
San Pablo Bay	11.0	8.78	5.45	4.63	5.28	5.13	6.72	5.52	6.63
Central Bay	4.98	3.78	4.46	3.61	4.38	3.42	2.52	3.21	3.78
South Bay	3.72	3.04	3.99	3.28	2.57	2.39	2.25	2.66	2.99
Lower South Bay	15.8	16.7	20.5	18.2	17.6	16.5	17.0	16.2	17.3
Total	**8.99**	**8.37**	**9.42**	**7.90**	**7.82**	**7.57**	**7.26**	**7.29**	**8.06**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/13 represents the period between October 1, 2012 and September 30, 2013.

b. Calculation based on a flow-weighted average values.

5.4 Total Inorganic Nitrogen (TIN)

The historical average monthly discharge loads from October 2012 through September 2020 are presented in Figure 5-4. The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) discharge loads were calculated based on reported loads in Table 5-17 and Table 5-18, respectively. In addition, the annual average and dry season average monthly discharge loads and concentrations for each Subembayment are provided in Table 5-19 through Table 5-22, respectively.

A summary of the discharge data review findings is as follows:

- The total annual average and dry season TIN discharge increased from 2012/2013 to 2016/2017 season (refer to Table 5-17 and Table 5-18, respectively), remained relatively steady between 2016/2017 and 2018/2019, followed by a decline in 2019/2020 period. The decline from 2018/2019 to 2019/2020 was more pronounced for the dry season average compared against the annual average.
- The 2019/2020 annual average total loads are similar to the loads measured in 2012/2013 (refer to Table 5-17). The 2019/2020 dry season total loads are the lowest since nutrient sampling began in 2012 (refer to Table 5-18).
- The impact on loads from the global pandemic (COVID-19) is unclear at this stage (discussion provided in Section 6.1).
- The TIN loads do not show any emerging dry season trends, except for the Central Bay. The Central Bay dry season loads suggest an upward trend (see Section 3.5) despite a decline in TIN loads from 2018/2019 to 2019/2020.
- The South Bay Subembayment accounts for nearly half of the load discharged to San Francisco Bay (refer to Figure 5-4 and/or Table 4-15).
- The nutrient concentrations are calculated based on flow-weighted values (refer to Table 5-21 and Table 5-22). The most recent average annual dataset has concentrations that are at or near the highest levels since sampling began in 2012. In contrast, the Baywide dry season concentrations are similar to the average since sampling began in 2012. Central Bay has the highest concentrations of the Subembayments. Several of the Central Bay Subembayments received trucked waste which can increase discharge concentrations/loads.

A discussion of the results is provided in Section 6.9.

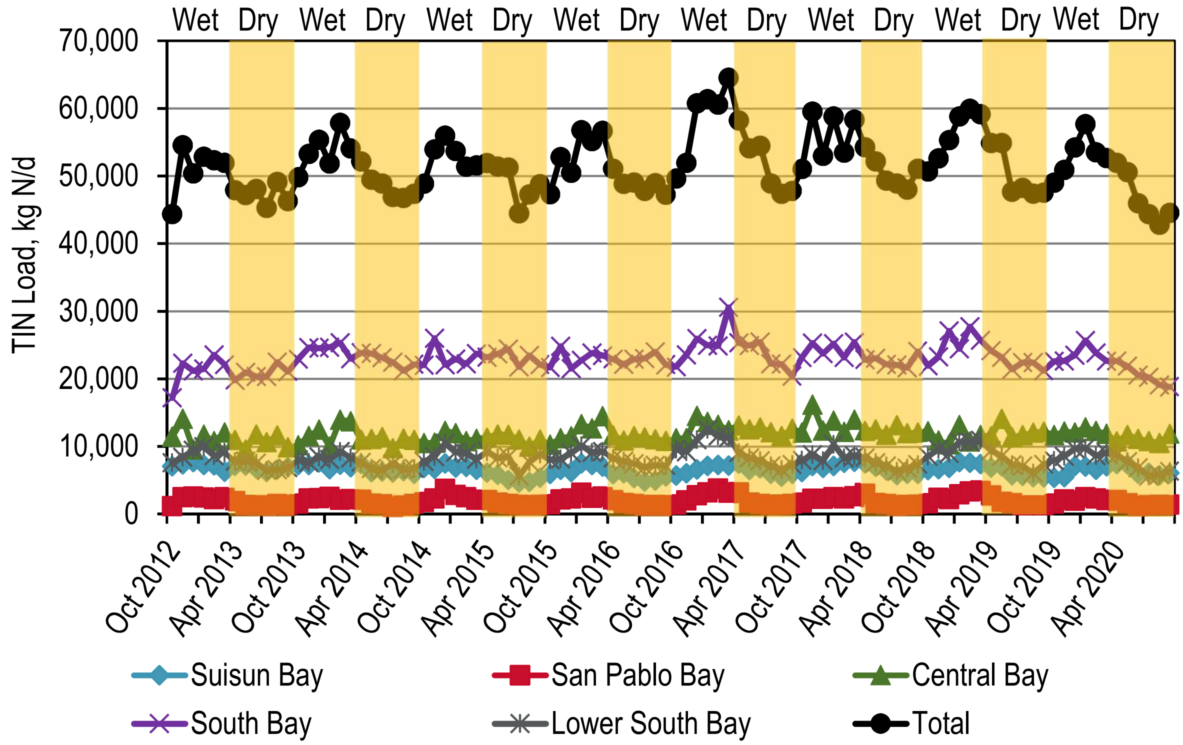

Figure 5-4. Discharge: Average Monthly Discharge TIN Loads for Evaluation Period

Table 5-17. Discharge: Annual Average by Discharger, TIN (kg N/d)

Discharger	Subembayment	2012/13 [(a)]	2013/14 [(a)]	2014/15 [(a)]	2015/16 [(a)]	2016/17 [(a)]	2017/18 [(a)]	2018/19 [(a)]	2019/20 [(a)]
American Canyon	San Pablo Bay	70.4	80.3	44.4	32.2	41.4	36.8	37.3	33.1
Benicia	San Pablo Bay	225	205	234	233	243	251	222	211
Burlingame	South Bay	397	433	292	292	366	359	466	460
CCCSD	Suisun Bay	3,880	3,810	3,680	3,800	4,000	3,840	3,790	3,980
CMSA	Central Bay	844	846	761	869	1,180	986	1,120	1,170
Port Costa	San Pablo Bay	0	0	0	1.52	2.06	1.99	0.705	1.45
Delta Diablo	Suisun Bay	1,690	1,510	1,290	1,320	1,450	1,520	1,500	1,330
EBDA	South Bay	7,880	7,830	8,320	8,400	8,320	8,700	8,570	8,950
EBMUD	Central Bay	9,190	9,440	9,390	9,530	9,910	10,700	9,340	9,320
FSSD	Suisun Bay	1,310	1,330	1,030	876	916	1,320	1,130	1,040
Las Gallinas[(b)]	San Pablo Bay	129	118	97.5	121	138	135	153	160
Paradise Cove	Central Bay	2.08	0.287	2.54	1.53	2.25	2.11	1.80	1.89
Tiburon	Central Bay	58.8	56.1	57.8	62.6	45.1	55.5	49.7	33.7
Millbrae	South Bay	241	234	239	267	294	261	286	288
Mt. View	Suisun Bay	121	129	119	122	142	125	115	112
Napa[(b)]	San Pablo Bay	173	175	172	170	259	161	309	152
Novato[(b)]	San Pablo Bay	144	136	167	139	197	130	198	112
Palo Alto	Lower South Bay	2,360	2,160	2,130	2,650	2,560	2,180	2,310	2,220
Petaluma[(b)]	San Pablo Bay	25.3	11.8	24.8	15.6	16.3	4.87	24.2	6.68
Pinole	San Pablo Bay	301	289	278	309	320	317	227	232
Rodeo	San Pablo Bay	36.4	30.6	33.3	30.4	45.4	32.6	38.3	38.7
SFO Airport	South Bay	250	257	154	162	226	139	107	25.2
SFPUC Southeast	South Bay	7,920	10,300	9,590	9,050	10,300	8,860	8,850	7,210
San Jose	Lower South Bay	4,800	4,770	5,590	5,000	5,790	4,920	5,500	4,880
San Mateo	South Bay	1,450	1,400	1,310	1,300	1,350	1,430	1,530	1,330
SMCSD	Central Bay	128	118	127	132	136	137	134	124
SASM	Central Bay	212	204	173	234	164	187	211	219
SVCW	South Bay	1,970	2,050	2,300	2,590	2,460	2,690	2,640	2,590
Sonoma Valley[(b)]	San Pablo Bay	29.5	9.21	23.3	10.6	82.0	0	29.9	0
South SF	South Bay	983	933	940	897	1,070	1,060	1,310	1,160

Discharger	Subembayment	2012/13 [(a)]	2013/14 [(a)]	2014/15 [(a)]	2015/16 [(a)]	2016/17 [(a)]	2017/18 [(a)]	2018/19 [(a)]	2019/20 [(a)]
Sunnyvale	Lower South Bay	894	697	726	592	952	878	964	810
Treasure Island	Central Bay	10.8	13.9	19.0	17.4	16.3	12.0	13.9	20.9
Vallejo	San Pablo Bay	768	846	961	901	906	931	928	851
West County	Central Bay	764	801	676	956	1,150	873	997	799
Total [(c)]		**49,300**	**51,300**	**50,900**	**51,100**	**55,000**	**53,200**	**53,100**	**49,900**

a. Data are presented in detail and summarized for each plant in the Appendix. A "-" indicates data were not available, whereas a "0" indicates a value of zero.

b. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.

c. The total values might vary from the sum of the listed values by plant due to rounding.

Table 5-18. Discharge: Dry Season by Discharger, TIN (kg N/d)

Discharger	Subembayment	2013 [(a)]	2014 [(a)]	2015 [(a)]	2016 [(a)]	2017 [(a)]	2018 [(a)]	2019 [(a)]	2020 [(a)]
American Canyon	San Pablo Bay	111	79.7	30.7	20.1	24.7	31.8	29.2	19.4
Benicia	San Pablo Bay	226	199	198	231	240	236	197	221
Burlingame	South Bay	436	288	273	273	271	389	450	462
CCCSD	Suisun Bay	3,720	3,630	3,380	3,710	3,610	3,550	3,420	3,890
CMSA	Central Bay	844	841	721	964	1,220	954	1,090	1,170
Port Costa	San Pablo Bay	-	0.0381	-	-	-	-	0.552	2.15
Delta Diablo	Suisun Bay	1,630	1,480	869	927	1,350	1,370	1,310	1,320
EBDA	South Bay	7,170	7,190	7,870	7,440	6,940	8,080	7,880	7,700
EBMUD	Central Bay	8,910	9,070	9,390	8,960	9,760	10,200	9,900	8,960
FSSD	Suisun Bay	1,360	969	807	655	1,080	1,270	1,020	969
Las Gallinas[(b)]	San Pablo Bay	0	0	0	0	8.99	0	51.4	47.1
Paradise Cove	Central Bay	2.52	0.287	2.61	1.53	2.62	2.11	2.13	1.31
Tiburon	Central Bay	46.8	56.1	53.2	62.6	45.0	57.6		27.7
Millbrae	South Bay	247	207	236	293	291	250	307	276
Mt. View	Suisun Bay	101	112	103	122	116	110	106	108
Napa[(b)]	San Pablo Bay	0	50.1	0	0	0	0	0	0
Novato[(b)]	San Pablo Bay	39.9	42.3	37.5	38.2	98.2	43.1	100.0	23.1
Palo Alto	Lower South Bay	2,550	2,140	2,230	2,640	2,120	2,210	1,950	1,930
Petaluma[(b)]	San Pablo Bay	0	0	0	0	0	0	0	0
Pinole	San Pablo Bay	342	287	267	341	235	322	170	243
Rodeo	San Pablo Bay	26.4	28.1	26.9	28.2	31.9	29.4	35.8	46.2
SFO Airport	South Bay	257	285	165	205	343	89.2	169	19.4
SFPUC Southeast	South Bay	8,650	10,300	10,000	9,880	10,600	9,050	8,260	6,780
San Jose	Lower South Bay	4,220	4,330	5,280	4,410	4,730	4,510	4,760	4,200
San Mateo	South Bay	1,540	1,490	1,280	1,370	1,280	1,480	1,560	1,320
SMCSD	Central Bay	133	123	135	141	148	148	155	123
SASM	Central Bay	191	162	151	190	154	203	187	253
SVCW	South Bay	1,880	1,940	2,380	2,510	2,440	2,320	2,500	2,350
Sonoma Valley[(b)]	San Pablo Bay	0	0	0	0	4.21	0	0	0
South SF	South Bay	916	906	879	915	919	995	1,020	1,250
Sunnyvale	Lower South Bay	360	371	324	341	630	392	617	391

Discharger	Subembayment	2013 (a)	2014(a)	2015 (a)	2016 (a)	2017 (a)	2018 (a)	2019 (a)	2020 (a)
Treasure Island	Central Bay	9.92	14.3	20.9	14.0	14.6	13.6	14.1	20.5
Vallejo	San Pablo Bay	751	851	899	837	870	831	900	821
West County	Central Bay	663	663	683	918	1,040	806	955	731
Total (c)		**47,300**	**48,100**	**48,700**	**48,400**	**50,600**	**50,000**	**49,100**	**45,700**

a. Data are presented in detail and summarized for each plant in the Appendix. A "-" indicates data were not available, whereas a "0" indicates a value of zero.

b. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.

c. The total values might vary from the sum of the listed values by plant due to rounding.

Table 5-19. Discharge: Annual Average by Subembayment, TIN (kg N/d)

Subembayment	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Suisun Bay	7,010	6,780	6,110	6,120	6,510	6,800	6,540	6,460
San Pablo Bay	1,860	1,830	2,030	1,960	2,250	2,000	2,170	1,800
Central Bay	11,200	11,400	11,200	11,700	12,600	12,900	11,900	11,700
South Bay	21,100	23,500	23,100	23,000	24,400	23,500	23,800	22,000
Lower South Bay	8,050	7,630	8,440	8,240	9,310	7,980	8,770	7,910
Total	**49,200**	**51,200**	**50,900**	**51,000**	**55,000**	**53,200**	**53,100**	**49,900**

Table 5-20. Discharge: Dry Season by Subembayment, TIN (kg N/d)

Subembayment	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	Trend [a,b]
Suisun Bay	6,810	6,200	5,160	5,410	6,160	6,300	5,850	6,290	None
San Pablo Bay	1,410	1,390	1,460	1,500	1,510	1,490	1,480	1,420	None
Central Bay	10,800	10,900	11,100	11,200	12,300	12,400	12,300	11,300	Up (1.6%/yr)
South Bay	21,100	22,600	23,100	22,900	23,100	22,700	22,200	20,200	None
Lower South Bay	7,130	6,850	7,840	7,390	7,480	7,110	7,320	6,520	None
Total	**47,200**	**47,900**	**48,700**	**48,400**	**50,600**	**50,000**	**49,100**	**45,700**	**None**

a. Trend analysis is based on average monthly values. Discernible trends were identified based on the slope of a regression line determined using the method of least squares to fit the data (alpha = 0.05). Sample size is 40. Where “None” is stated, the limited dataset does not indicate a statistically relevant trend.
b. The percent change represents the change per year as a percentage of the average value over the entire dataset (2012-2019) (not considered if trend is “None”).

Table 5-21. Discharge: Annual Average by Subembayment, TIN (mg N/L)

Subembayment	2012/13 [a]	2013/14 [a]	2014/15 [a]	2015/16 [a]	2016/17 [a]	2017/18 [a]	2018/19 [a]	2019/20 [a]	8 Year Average [b]
Suisun Bay	31.4	32.4	30.2	29.4	23.9	30.7	26.9	30.7	29.2
San Pablo Bay	15.6	16.7	18.0	17.2	13.4	19.2	15.2	18.6	16.5
Central Bay	37.6	40.3	42.1	40.9	33.9	45.2	35.5	45.0	39.7
South Bay	35.4	40.4	40.4	38.9	36.7	40.3	38.7	40.2	38.8
Lower South Bay	17.2	17.7	20.2	19.3	19.6	18.0	18.2	18.3	18.5
Total	**28.9**	**31.7**	**32.5**	**31.4**	**28.3**	**32.5**	**29.3**	**32.3**	**30.7**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/13 represents the period between October 1, 2012 and September 30, 2013.

b. Calculation based on a flow-weighted average values.

Table 5-22. Discharge: Dry Season by Subembayment, TIN (mg N/L)

Subembayment	2012/13 [a]	2013/14 [a]	2014/15 [a]	2015/16 [a]	2016/17 [a]	2017/18 [a]	2018/19 [a]	2019/20 [a]	8 Year Average [b]
Suisun Bay	34.8	32.9	30.8	29.9	29.0	32.3	28.0	32.0	31.2
San Pablo Bay	25.0	24.5	26.9	26.8	23.0	27.3	22.7	26.7	25.2
Central Bay	43.2	46.6	51.3	46.8	48.0	50.3	46.7	47.8	47.5
South Bay	38.6	42.5	44.7	42.6	41.9	42.1	41.3	40.5	41.7
Lower South Bay	16.4	17.1	21.1	18.7	18.3	17.1	17.6	16.7	17.8
Total	**31.8**	**34.0**	**36.7**	**34.4**	**33.8**	**34.5**	**33.0**	**33.3**	**33.9**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/13 represents the period between October 1, 2012 and September 30, 2013.

b. Calculation based on a flow-weighted average values.

5.5 Total Phosphorus (TP)

The historical average monthly discharge loads from October 2012 through September 2020 are presented in Figure 5-5. The annual average (i.e., twelve months from October 1 to September 30) and dry season average monthly (i.e., May 1 through September 30) discharge loads were calculated based on reported loads in Table 5-23 and Table 5-24, respectively. In addition, the annual average and dry season average monthly discharge loads and concentrations for each Subembayment are provided in Table 5-25 and Table 5-28, respectively.

A summary of the discharge data review findings is as follows:

- The 2018/2019 annual average and dry season total loads were the highest since nutrient sampling began in 2012 (refer to Table 5-23 and Table 5-24, respectively). The total loads declined in 2019/2020 for both the annual average and dry season average. The decline from 2018/2019 to 2019/2020 is more pronounced for the dry season average compared to the annual average.
- The impact on loads from the global pandemic (COVID-19) is unclear at this stage (discussion provided in Section 6.1).
- The dry season TP loads discharged to the Bay exhibit suggest a dry season upward trend for Suisun Bay, Central Bay, and South Bay Subembayments, as well as Baywide (refer to Table 5-26) based on the least-squares method (see Section 3.5). For those Subembayments and Baywide exhibiting an upward trend, they all showed a decline in dry season discharge TP loads from 2018/2019 to 2019/2020.
- The South Bay Subembayment received the largest TP load and accounts for approximately one-third of the TP load discharged to the San Francisco Bay (refer to Figure 5-5 or Table 4-19).
- The nutrient concentrations are calculated based on flow-weighted values (refer to Table 5-27 and Table 5-28). The most recent dataset has concentrations that are at or near the highest levels since sampling began in 2012. Central Bay has the highest concentrations of the Subembayments. Agencies across the Bay reduce phosphorus loads through a combination of chemical and biological processes.

A discussion of the results is provided in Section 6.10.

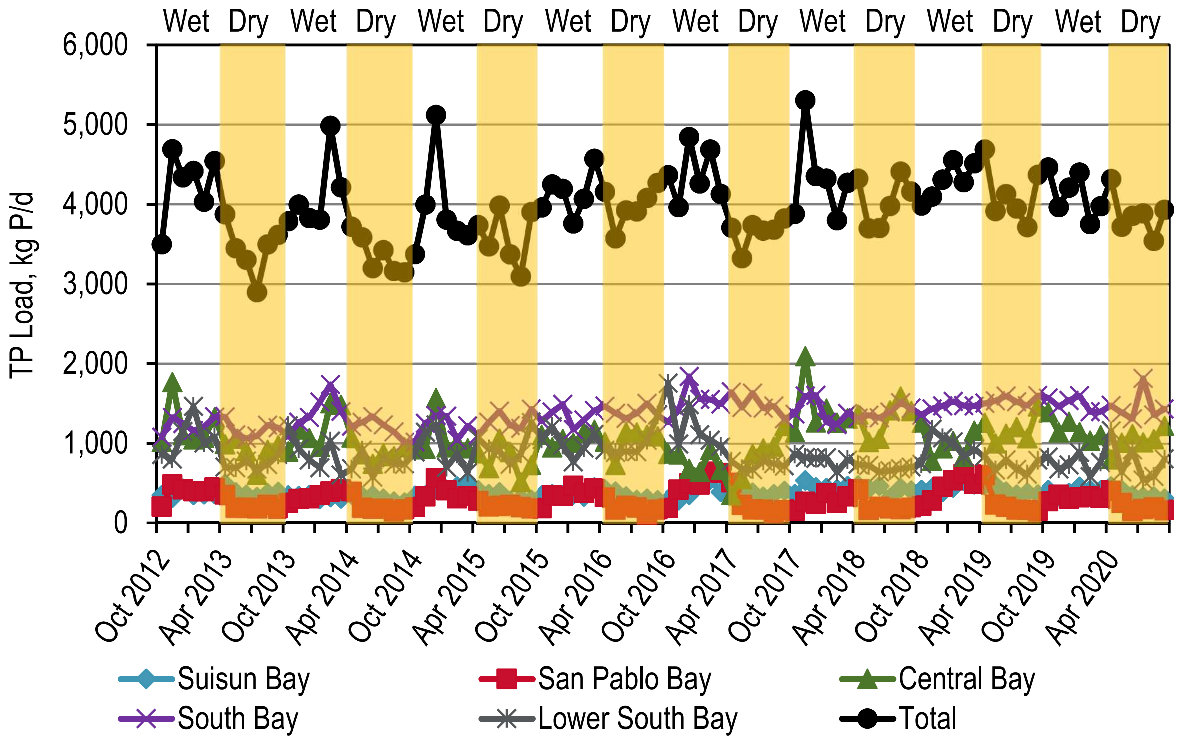

Figure 5-5. Discharge: Average Monthly Discharge TP Loads for Evaluation Period

Table 5-23. Discharge: Annual Average by Discharger, TP (kg P/d)

Discharger	Subembayment	2012/13 [(a)]	2013/14 [(a)]	2014/15 [(a)]	2015/16 [(a)]	2016/17 [(a)]	2017/18 [(a)]	2018/19 [(a)]	2019/20 [(a)]
American Canyon	San Pablo Bay	29.0	17.9	28.7	27.6	24.0	26.0	23.4	24.7
Benicia	San Pablo Bay	25.2	25.7	26.2	15.1	16.5	15.7	19.2	15.9
Burlingame	South Bay	101	110	25.4	22.2	29.2	32.4	31.0	36.1
CCCSD	Suisun Bay	133	87.7	127	109	127	122	137	121
CMSA	Central Bay	92.4	81.7	94.2	84.5	106	100	108	123
Port Costa	San Pablo Bay	0	0	0	0.598	0.479	0.352	0.226	0.777
Delta Diablo	Suisun Bay	31.1	27.1	36.7	29.4	51.5	60.6	42.6	50.3
EBDA	South Bay	544	534	501	551	642	534	534	583
EBMUD	Central Bay	843	824	718	827	538	1,100	818	856
FSSD	Suisun Bay	194	190	198	200	197	235	235	201
Las Gallinas[(b)]	San Pablo Bay	19.7	17.2	14.6	22.6	21.5	16.5	23.8	27.8
Paradise Cove	Central Bay	0.270	0	0.358	0.223	0.495	0.490	0.246	0.301
Tiburon	Central Bay	8.36	7.88	8.44	9.20	8.56	7.84	6.21	5.60
Millbrae	South Bay	16.5	13.5	13.0	12.0	11.9	7.41	17.9	19.8
Mt. View	Suisun Bay	18.2	17.0	16.2	15.4	13.5	15.2	10.0	12.0
Napa[(b)]	San Pablo Bay	22.5	14.4	25.3	34.6	58.7	22.4	86.1	37.8
Novato[(b)]	San Pablo Bay	15.7	10.9	20.6	9.59	12.9	2.74	13.9	6.62
Palo Alto	Lower South Bay	346	352	352	445	397	362	372	343
Petaluma[(b)]	San Pablo Bay	27.5	31.0	24.6	19.1	24.7	16.1	21.3	11.5
Pinole	San Pablo Bay	29.6	17.3	15.2	16.4	24.6	29.2	33.4	29.6
Rodeo	San Pablo Bay	8.36	8.01	7.95	8.37	8.75	7.58	9.43	9.17
SFO Airport	South Bay	17.5	13.4	8.97	9.69	16.2	32.0	35.5	18.2
SFPUC Southeast	South Bay	67.2	164	205	271	332	287	389	279
San Jose	Lower South Bay	354	246	370	368	322	154	243	220
San Mateo	South Bay	128	127	122	142	125	133	114	130
SMCSD	Central Bay	23.4	18.5	17.0	17.2	16.5	19.3	14.8	13.4
SASM	Central Bay	45.2	45.6	40.5	51.6	38.1	40.5	37.5	37.9
SVCW	South Bay	174	172	189	213	218	234	242	244
Sonoma Valley[(b)]	San Pablo Bay	16.5	10.5	2.83	2.51	21.3	0	5.35	0
South SF	South Bay	149	160	171	150	133	138	134	168
Sunnyvale	Lower South Bay	200	214	213	193	257	225	231	198

Discharger	Subembayment	2012/13 [a]	2013/14 [a]	2014/15 [a]	2015/16 [a]	2016/17 [a]	2017/18 [a]	2018/19 [a]	2019/20 [a]
Treasure Island	Central Bay	1.57	3.01	3.70	4.10	4.50	3.32	3.08	3.32
Vallejo	San Pablo Bay	126	129	123	121	139	110	107	107
West County	Central Bay	53.4	60.7	46.6	67.6	88.5	101	110	71.9
Total [c]		**3,860**	**3,750**	**3,770**	**4,070**	**4,020**	**4,190**	**4,210**	**4,010**

a. Data are presented in detail and summarized for each plant in the Appendix. A "-" indicates data were not available, whereas a "0" indicates a value of zero.

b. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.

c. The total values might vary from the sum of the listed values by plant due to rounding.

Table 5-24. Discharge: Dry Season by Discharger, TP (kg P/d)

Discharger	Subembayment	2013 [(a)]	2014 [(a)]	2015 [(a)]	2016 [(a)]	2017 [(a)]	2018 [(a)]	2019 [(a)]	2020 [(a)]
American Canyon	San Pablo Bay	47.4	8.23	29.1	15.4	14.5	24.8	16.2	19.9
Benicia	San Pablo Bay	23.9	23.9	20.4	16.4	8.96	9.68	13.1	15.0
Burlingame	South Bay	125	32.4	31.5	13.9	18.1	26.4	27.5	31.4
CCCSD	Suisun Bay	125	90.3	112	108	107	116	111	93.6
CMSA	Central Bay	101	79.6	89.3	87.5	127	112	109	129
Port Costa	San Pablo Bay	-	0	-	-	-	-	0.138	0.587
Delta Diablo	Suisun Bay	27.7	27.2	27.8	28.1	51.1	51.2	47.0	49.5
EBDA	South Bay	490	494	480	546	533	505	555	592
EBMUD	Central Bay	668	668	576	813	643	1,030	938	820
FSSD	Suisun Bay	201	174	172	175	211	233	227	196
Las Gallinas[(b)]	San Pablo Bay	0	0	0	0	0.844	0	10.8	8.69
Paradise Cove	Central Bay	0.334	0.0384	0.377	0.223	0.592	0.490	0.305	0.303
Tiburon	Central Bay	7.62	7.88	8.34	9.20	8.18	8.90		4.61
Millbrae	South Bay	19.2	13.0	14.2	11.8	15.1	7.83	22.4	20.0
Mt. View	Suisun Bay	17.8	17.6	18.2	16.8	11.3	14.7	9.47	13.0
Napa[(b)]	San Pablo Bay	0	3.77	0	0	0	0	0	0
Novato[(b)]	San Pablo Bay	1.06	1.62	0.800	1.24	2.46	0.305	1.71	0.229
Palo Alto	Lower South Bay	386	381	381	450	354	382	311	296
Petaluma[(b)]	San Pablo Bay	0	0	0	0	0	0	0	0
Pinole	San Pablo Bay	30.6	18.7	17.6	16.3	21.1	34.2	33.4	30.7
Rodeo	San Pablo Bay	6.98	7.73	9.24	8.63	6.23	7.07	9.71	10.6
SFO Airport	South Bay	25.0	8.95	8.79	4.12	21.6	42.4	33.7	8.42
SFPUC Southeast	South Bay	24.0	184	263	322	395	321	433	287
San Jose	Lower South Bay	185	196	384	397	111	113	151	216
San Mateo	South Bay	128	136	129	137	129	139	127	122
SMCSD	Central Bay	24.8	20.0	18.5	18.9	19.0	19.3	17.2	13.9
SASM	Central Bay	50.3	43.3	40.5	43.0	40.2	40.9	32.9	43.0
SVCW	South Bay	185	161	217	191	211	237	226	225
Sonoma Valley[(b)]	San Pablo Bay	0	0	0	0	0.711	0	0	0
South SF	South Bay	145	170	163	161	140	127	124	176
Sunnyvale	Lower South Bay	180	183	177	172	256	189	248	189

Discharger	Subembayment	2013 [(a)]	2014 [(a)]	2015 [(a)]	2016 [(a)]	2017 [(a)]	2018 [(a)]	2019 [(a)]	2020 [(a)]
Treasure Island	Central Bay	1.27	2.84	3.99	4.46	4.74	3.61	2.80	3.34
Vallejo	San Pablo Bay	125	123	133	116	120	110	101	104
West County	Central Bay	45.5	42.0	46.5	75.2	72.9	94.1	72.4	73.3
Total [(c)]		**3,400**	**3,320**	**3,570**	**3,960**	**3,660**	**4,000**	**4,010**	**3,790**

a. Data are presented in detail and summarized for each plant in the Appendix. A "-" indicates data were not available, whereas a "0" indicates a value of zero.

b. No discharge during a portion or all the dry season months, except when necessary due to wet conditions.

c. The total values might vary from the sum of the listed values by plant due to rounding.

Table 5-25. Discharge: Annual Average by Subembayment, TP (kg P/d)

Subembayment	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/2020
Suisun Bay	377	322	378	354	389	434	426	385
San Pablo Bay	307	275	289	277	352	247	343	270
Central Bay	1,070	1,030	923	1,050	793	1,370	1,100	1,110
South Bay	1,200	1,300	1,220	1,370	1,510	1,400	1,500	1,480
Lower South Bay	900	811	935	1,010	976	741	846	760
Total	**3,850**	**3,740**	**3,740**	**4,060**	**4,020**	**4,190**	**4,210**	**4,010**

Table 5-26. Discharge: Dry Season Average by Subembayment, TP (kg P/d)

Subembayment	2013	2014	2015	2016	2017	2018	2019	2020	Trend [a,b]
Suisun Bay	372	309	330	328	381	415	394	352	Up (2.0%/yr)
San Pablo Bay	197	177	210	174	175	186	186	189	None
Central Bay	894	858	778	1,040	909	1,310	1,170	1,090	Up (5.1%/yr)
South Bay	1,140	1,200	1,260	1,390	1,460	1,410	1,550	1,460	Up (3.8%/yr)
Lower South Bay	750	760	943	1,020	721	684	710	701	None
Total	**3,350**	**3,300**	**3,520**	**3,950**	**3,650**	**4,000**	**4,010**	**3,790**	**Up (2.3%/yr)**

a. Trend analysis is based on average monthly values. Discernible trends were identified based on the slope of a regression line determined using the method of least squares to fit the data (alpha = 0.05). Sample size is 40. Where “None” is stated, the limited dataset does not indicate a statistically relevant trend.

b. The percent change represents the change per year as a percentage of the average value over the entire dataset (2012-2019) (not considered if trend is “None”).

Table 5-27. Discharge: Annual Average by Subembayment, TP (mg P/L)

Subembayment	2012/13 [(a)]	2013/14 [(a)]	2014/15 [(a)]	2015/16 [(a)]	2016/17 [(a)]	2017/18 [(a)]	2018/19 [(a)]	2019/20 [(a)]	8 Year Average [(b)]
Suisun Bay	1.69	1.54	1.87	1.70	1.43	1.96	1.75	1.83	1.71
San Pablo Bay	2.63	2.48	2.56	2.43	2.10	2.36	2.41	2.80	2.45
Central Bay	3.58	3.66	3.49	3.68	2.15	4.79	3.28	4.29	3.55
South Bay	2.01	2.23	2.16	2.32	2.27	2.40	2.44	2.70	2.31
Lower South Bay	1.92	1.88	2.24	2.35	2.06	1.67	1.76	1.76	1.95
Total	**2.26**	**2.32**	**2.40**	**2.50**	**2.07**	**2.56**	**2.32**	**2.60**	**2.37**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/13 represents the period between October 1, 2012 and September 30, 2013.

b. Calculation based on a flow-weighted average values.

Table 5-28. Discharge: Dry Season by Subembayment, TP (mg P/L)

Subembayment	2012/13 [(a)]	2013/14 [(a)]	2014/15 [(a)]	2015/16 [(a)]	2016/17 [(a)]	2017/18 [(a)]	2018/19 [(a)]	2019/20 [(a)]	8 Year Average [(b)]
Suisun Bay	1.90	1.64	1.97	1.81	1.79	2.13	1.89	1.79	1.86
San Pablo Bay	3.93	2.99	3.88	3.11	2.65	3.41	2.84	3.56	3.27
Central Bay	3.59	3.69	3.60	4.37	3.55	5.29	4.46	4.61	4.15
South Bay	2.08	2.26	2.52	2.58	2.66	2.61	2.88	2.93	2.56
Lower South Bay	1.72	1.90	2.53	2.58	1.76	1.64	1.71	1.80	1.94
Total	**2.28**	**2.35**	**2.69**	**2.81**	**2.44**	**2.76**	**2.69**	**2.76**	**2.59**

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/13 represents the period between October 1, 2012 and September 30, 2013.

b. Calculation based on a flow-weighted average values.

5.6 Flows and Nutrient Loads Distribution by Subembayment

Flows and nutrient discharge loading for select nitrogen species and total phosphorus has been analyzed by Subembayment to demonstrate the relative contributions for each discharger. In this section, loading diagrams illustrate the discharge loads over time for the past eight years (Oct 2012 through Sep 2020).

The cumulative figures in the following subsections are organized by Subembayment and present the relative contribution of each discharger within its respective Subembayment for flow, ammonia, total inorganic nitrogen and total phosphorus.

5.6.1 Suisun Bay

The average monthly discharge to Suisun Bay by discharger for flow, ammonia, TIN and TP is provided in Figure 5-6 through Figure 5-9. Flows to Suisun Bay are dominated by the CCCSD discharge and followed, in terms of magnitude, by FSSD and Delta Diablo. CCCSD also discharges the largest loads of ammonia and total inorganic nitrogen. FSSD discharges the largest phosphorus load to Suisun Bay, followed by CCCSD.

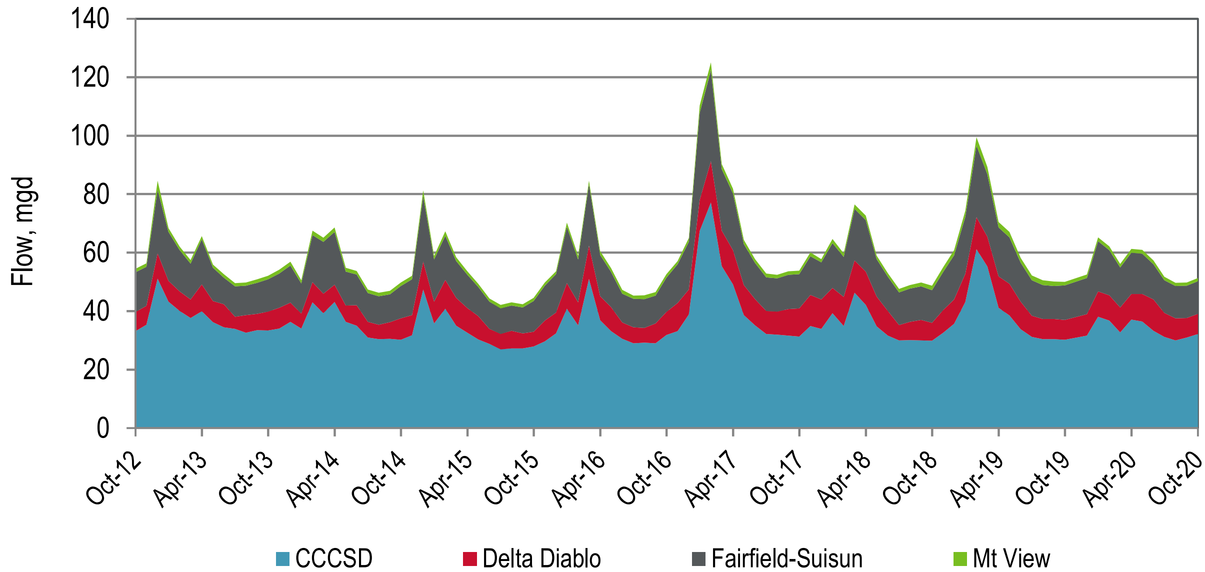

Figure 5-6. Flow Contribution by Discharger to Suisun Bay

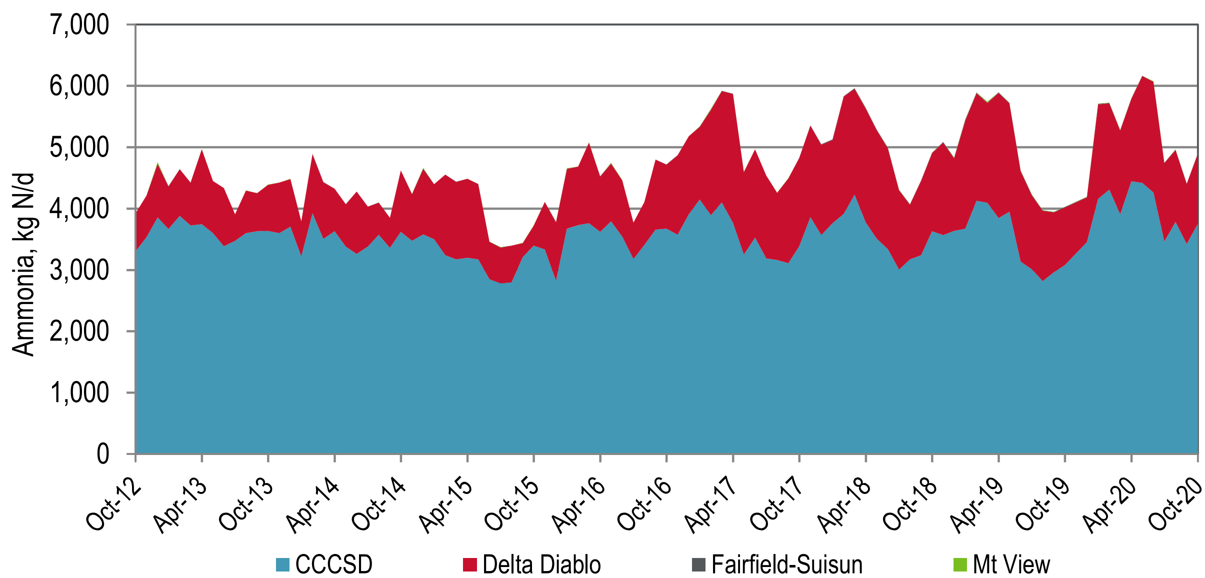

Figure 5-7. Ammonia Load Contribution by Discharger to Suisun Bay

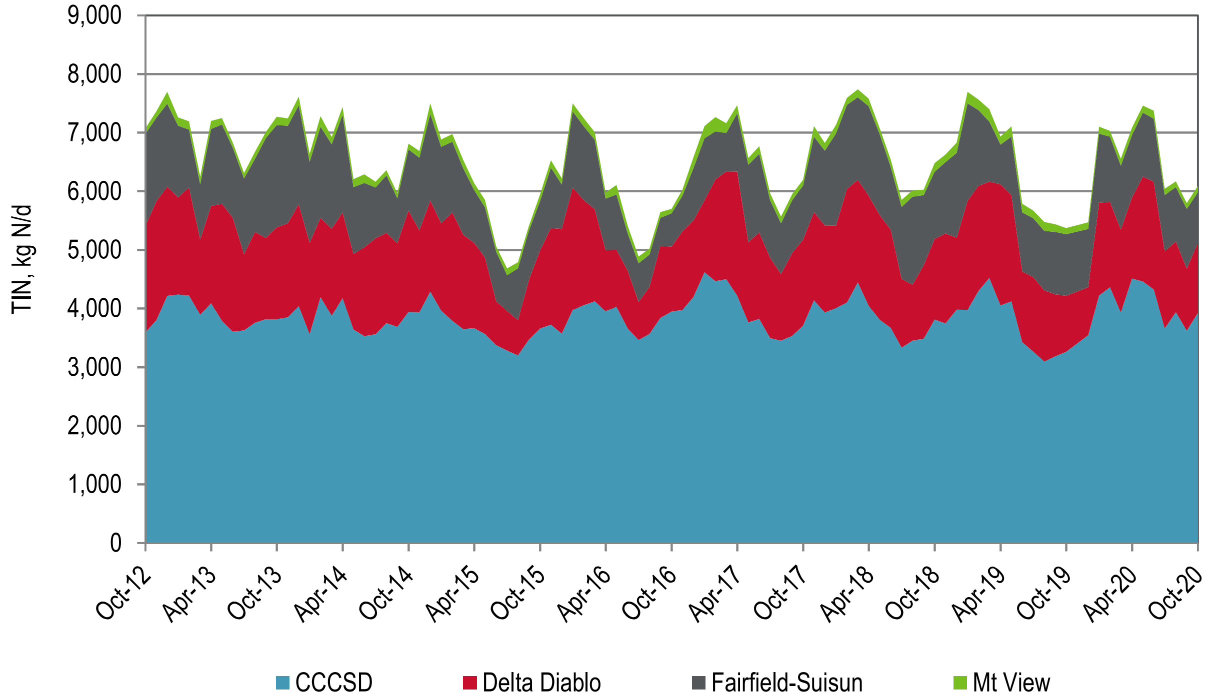

Figure 5-8. TIN Load Contribution by Discharger to Suisun Bay

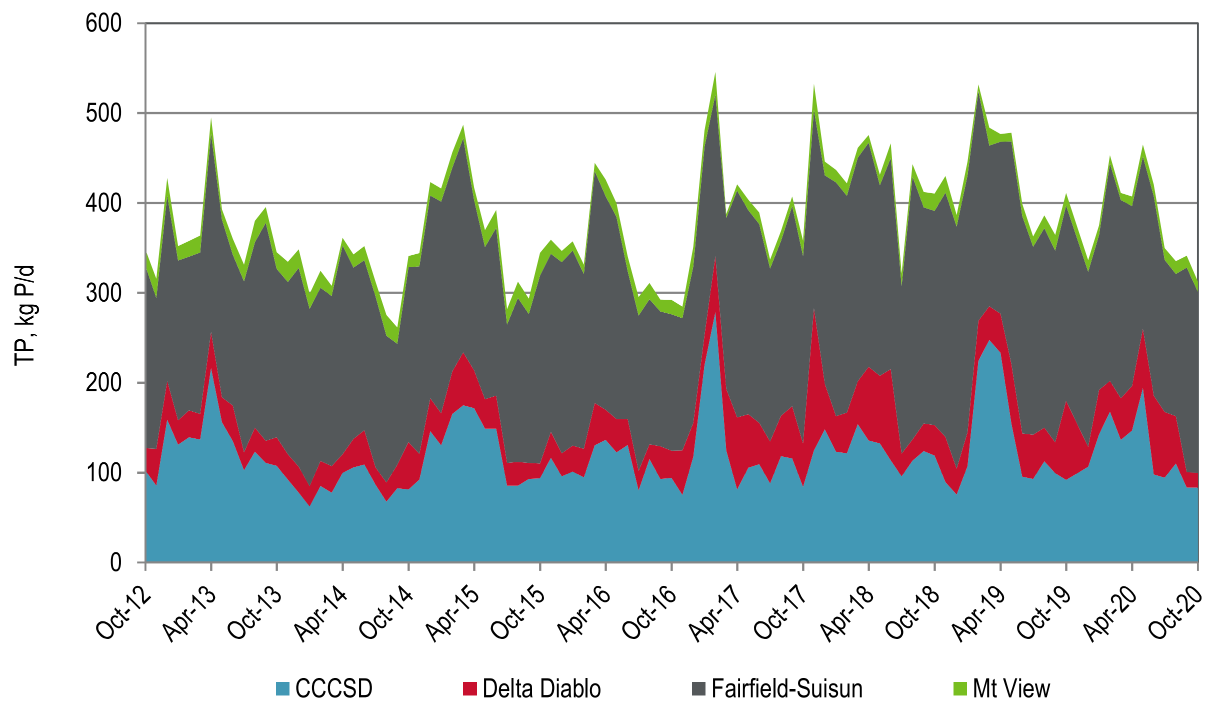

Figure 5-9. TP Load Contribution by Discharger to Suisun Bay

5.6.2 San Pablo Bay

The average monthly discharge to San Pablo Bay by discharger for discharge flows and loads are provided in Figure 5-10 through Figure 5-13. Figure 5-10 clearly demonstrates the seasonal discharges at Las Gallinas, Napa, Petaluma, and Sonoma Valley. Similar to flow, total inorganic nitrogen and total phosphorus loads to San Pablo Bay appear to exhibit a significant seasonal pattern with higher wintertime loads.

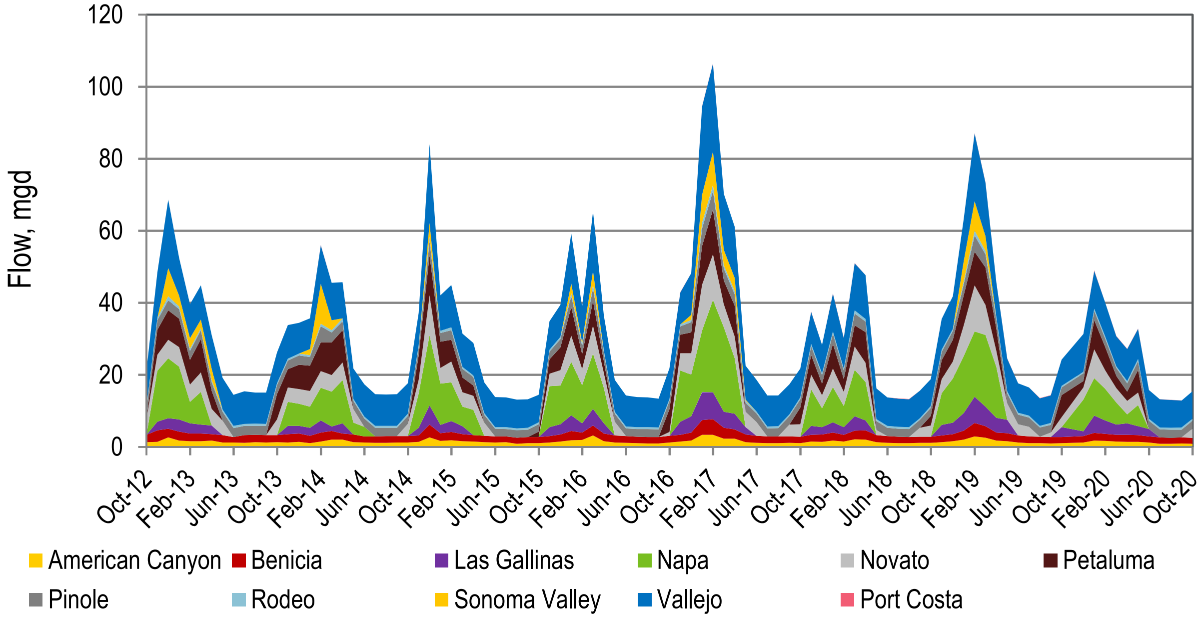

Figure 5-10. Flow Contribution by Discharger to San Pablo Bay

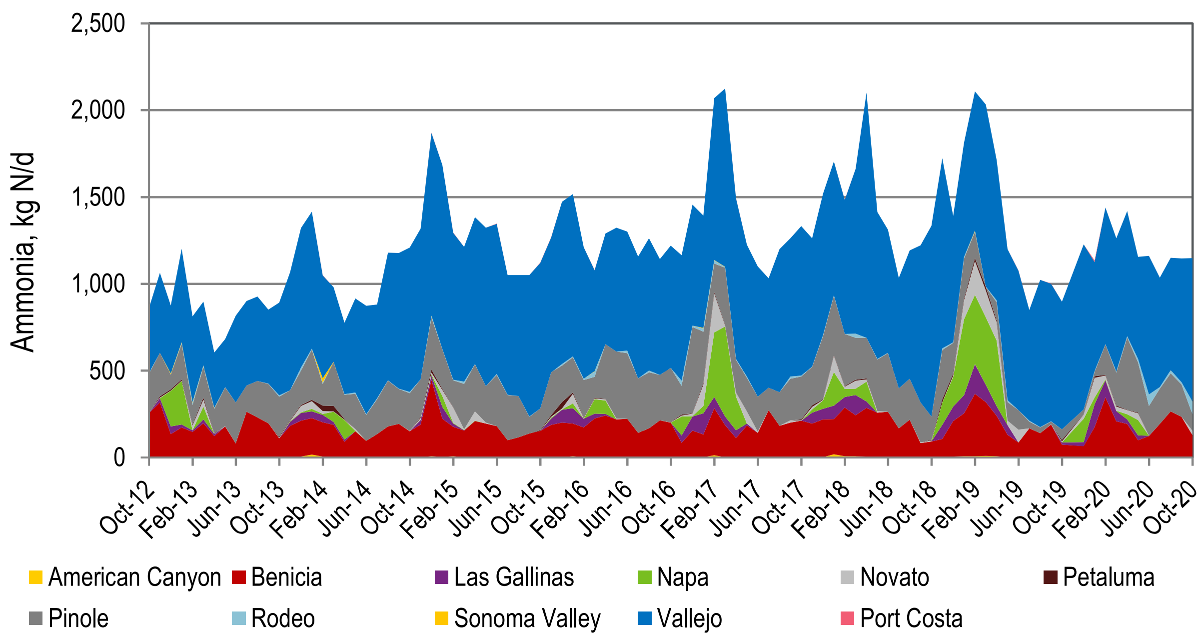

Figure 5-11. Ammonia Load Contribution by Discharger to San Pablo Bay

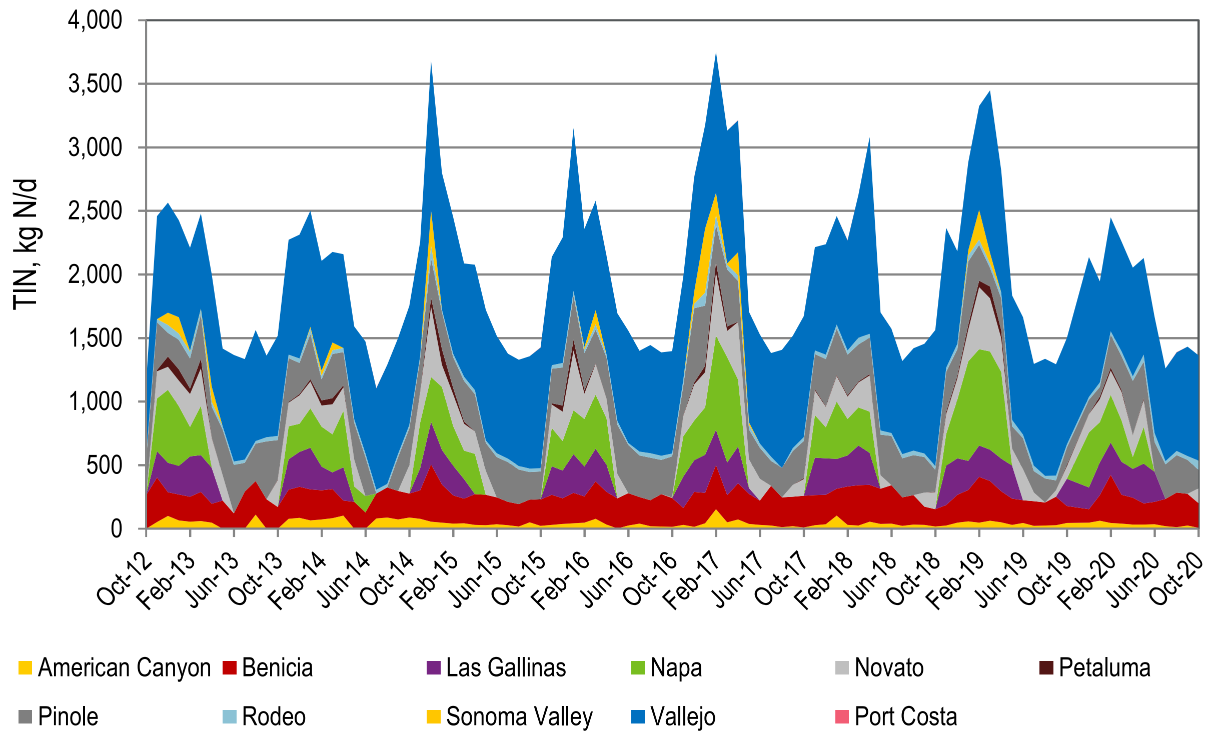

Figure 5-12. TIN Load Contribution by Discharger to San Pablo Bay

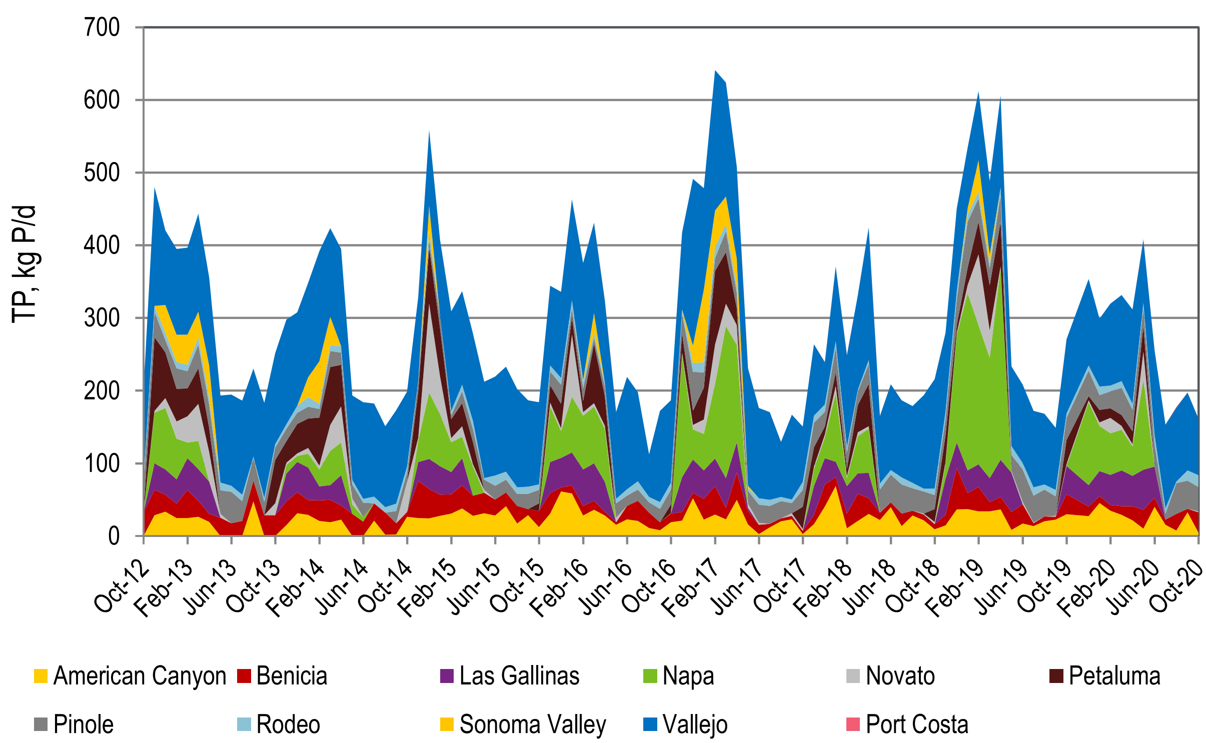

Figure 5-13. TP Load Contribution by Discharger to San Pablo Bay

5.6.3 Central Bay

The average monthly discharge to Central Bay by discharger for discharge flows and loads are provided in Figure 5-14 through Figure 5-17. Discharge flows and loads to the Central Bay are dominated by EBMUD.

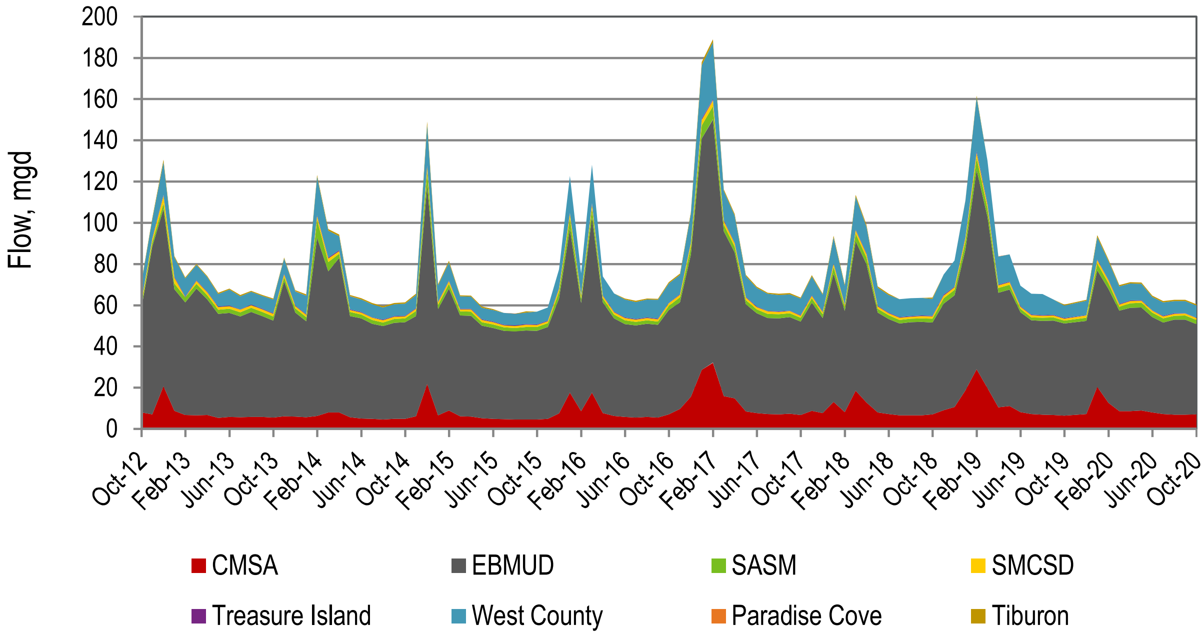

Figure 5-14. Flow Contribution by Discharger to Central Bay

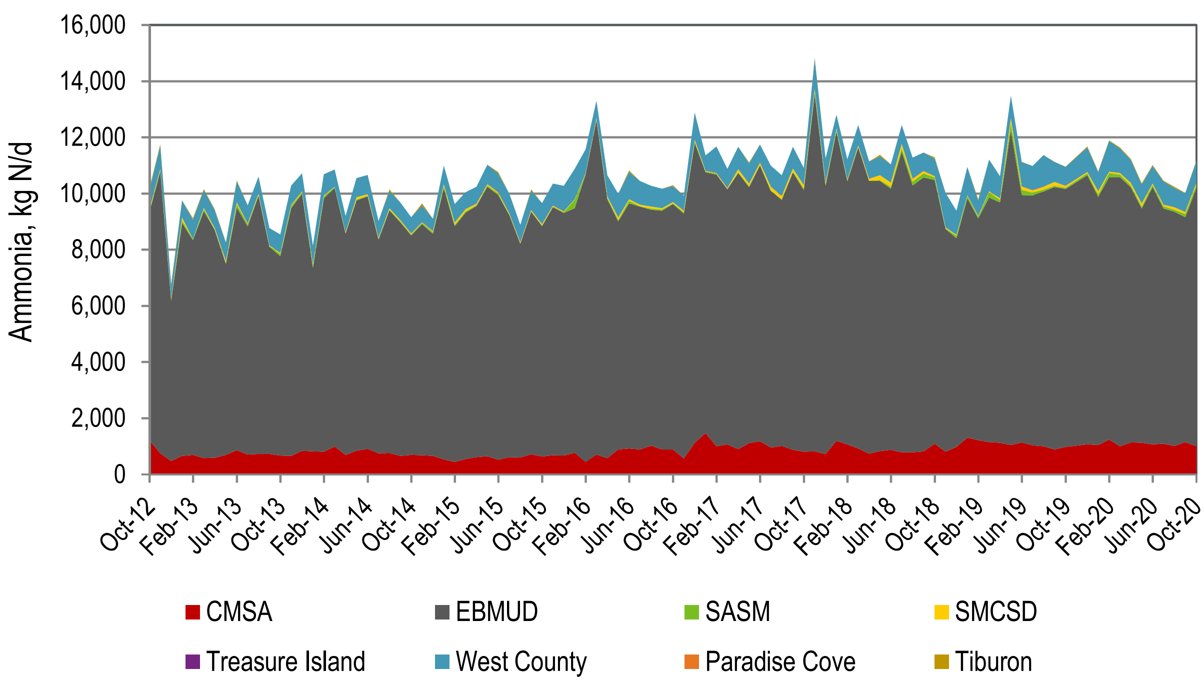

Figure 5-15. Ammonia Load Contribution by Discharger to Central Bay

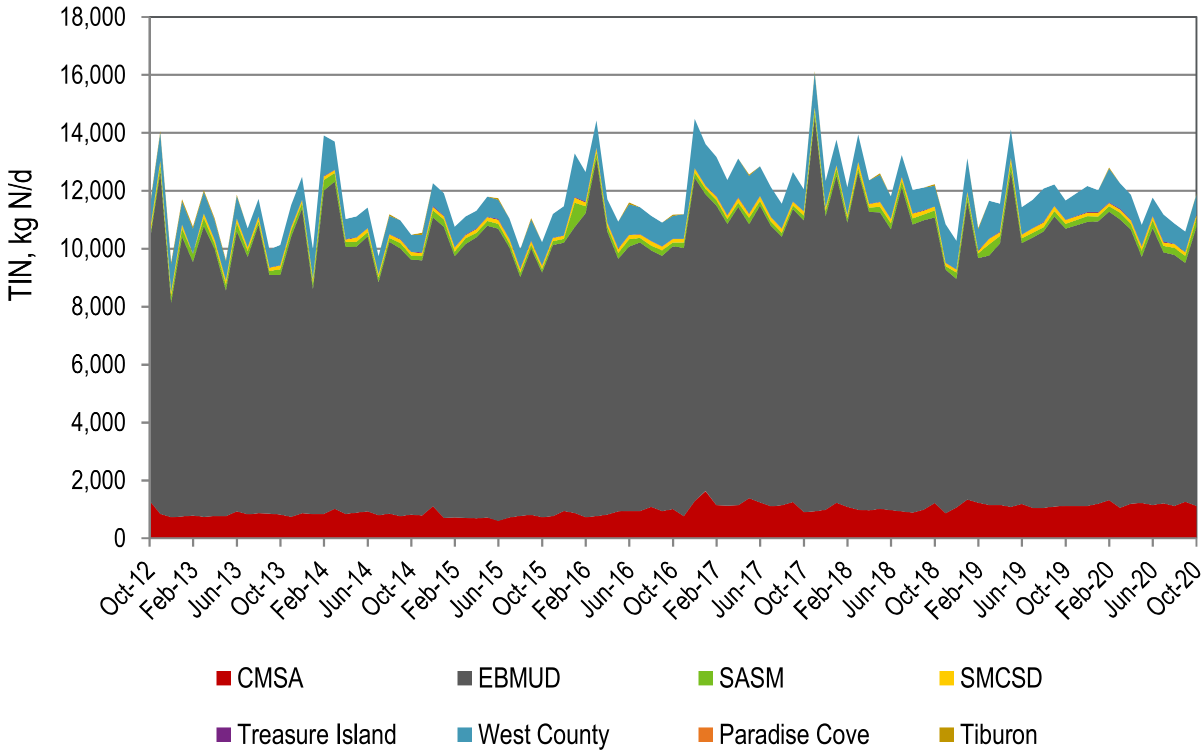

Figure 5-16. TIN Load Contribution by Discharger to Central Bay

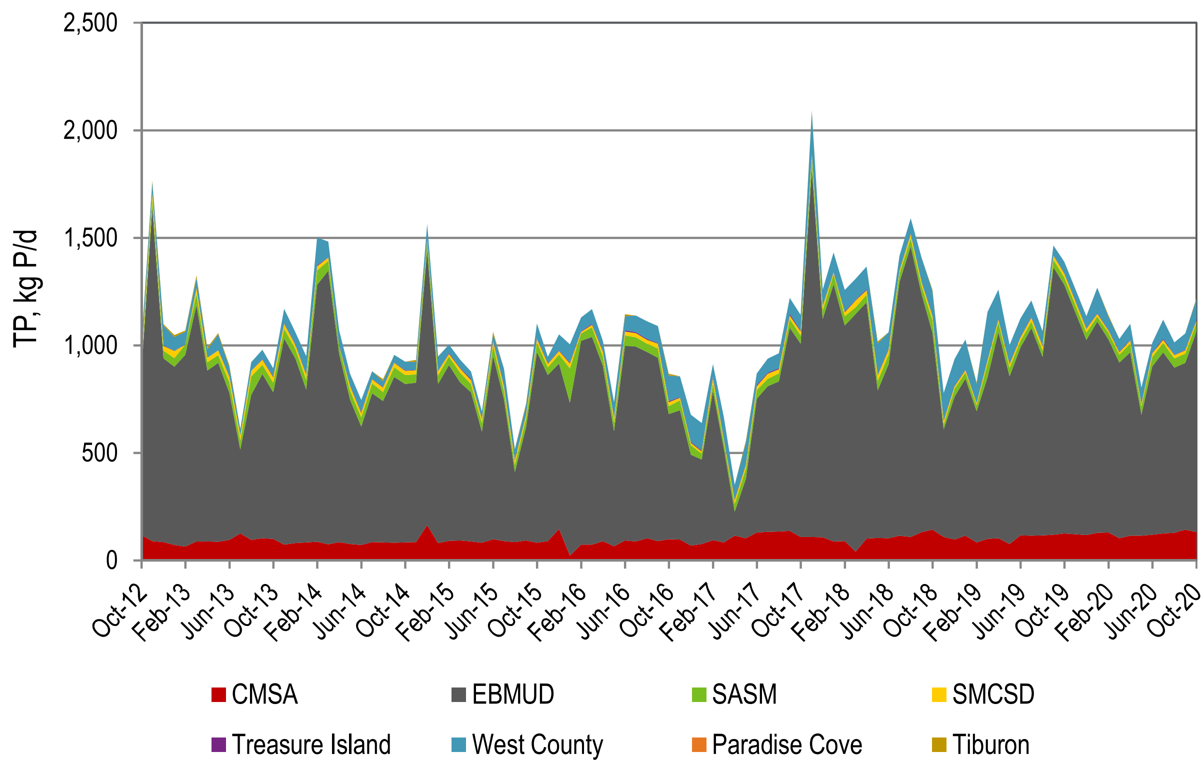

Figure 5-17. TP Load Contribution by Discharger to Central Bay

5.6.4 South Bay

The average monthly discharge to South Bay by discharger for discharge flows and loads are provided in Figure 5-18 through Figure 5-21. In the South Bay, the largest wastewater discharges are from the SFPUC Southeast Plant and EBDA. Ammonia and total inorganic nitrogen loads to the South Bay are also largest from the SFPUC Southeast Plant and EBDA. The total phosphorus discharges to the South Bay have the largest contribution from EBDA, followed by relatively equal contributions between SFPUC Southeast Plant, San Mateo, SVCW, and South SF. SFPUC's total phosphorus loads are a lower proportion of the total compared to flow, ammonia, and total nitrogen.

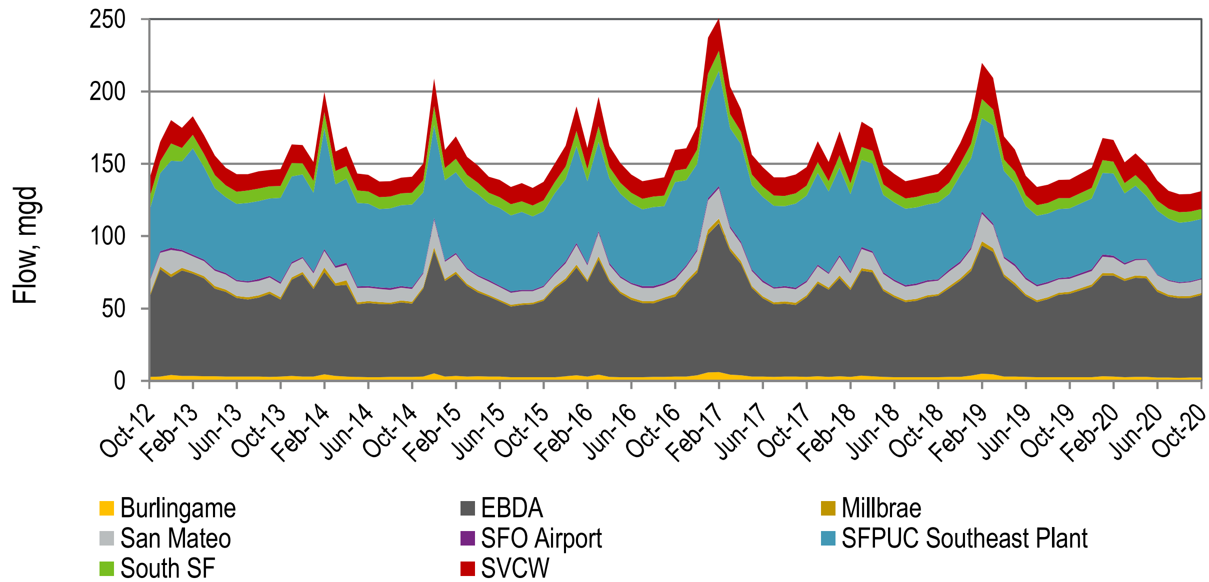

Figure 5-18. Flow Contribution by Discharger to South Bay

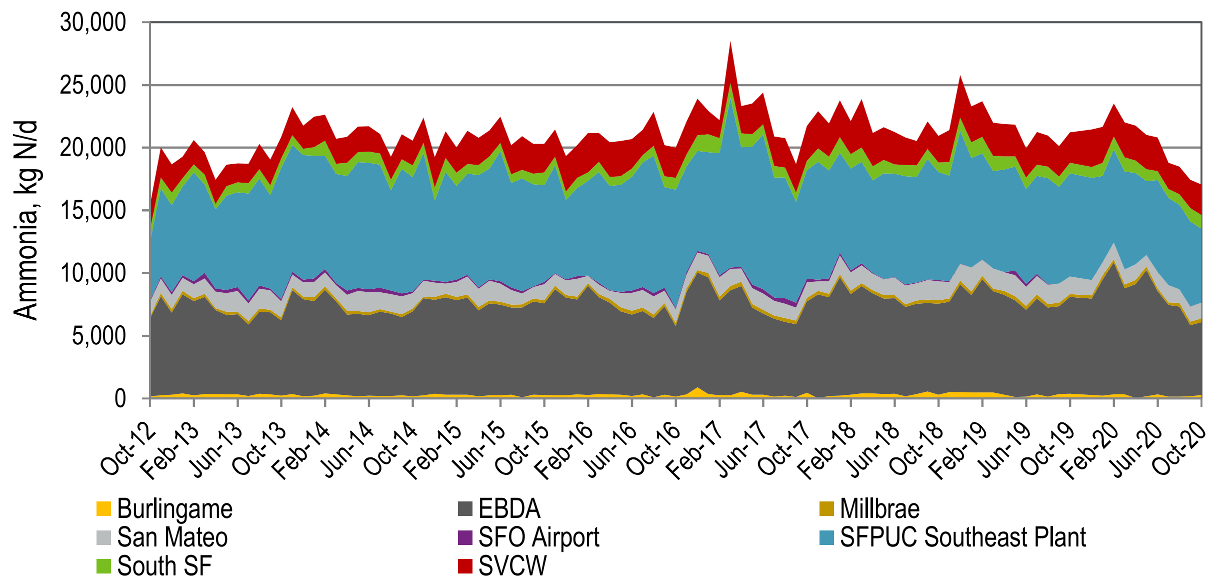

Figure 5-19. Ammonia Load Contribution by Discharger to South Bay

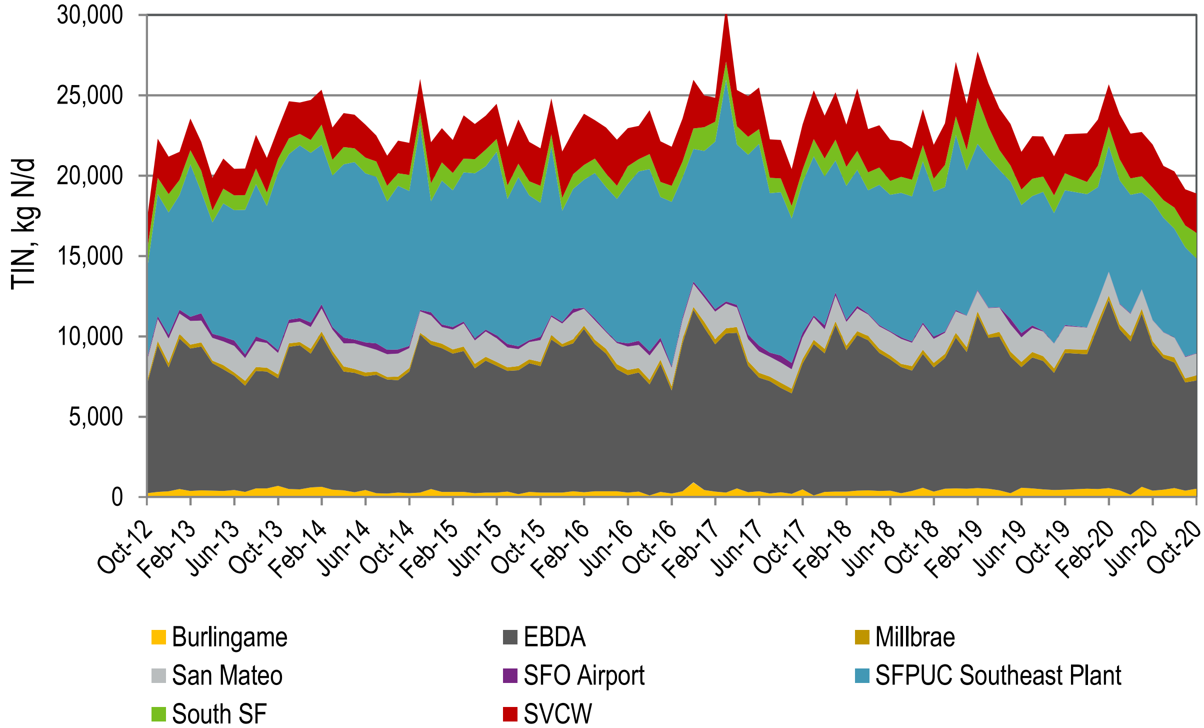

Figure 5-20. TIN Load Contribution by Discharger to South Bay

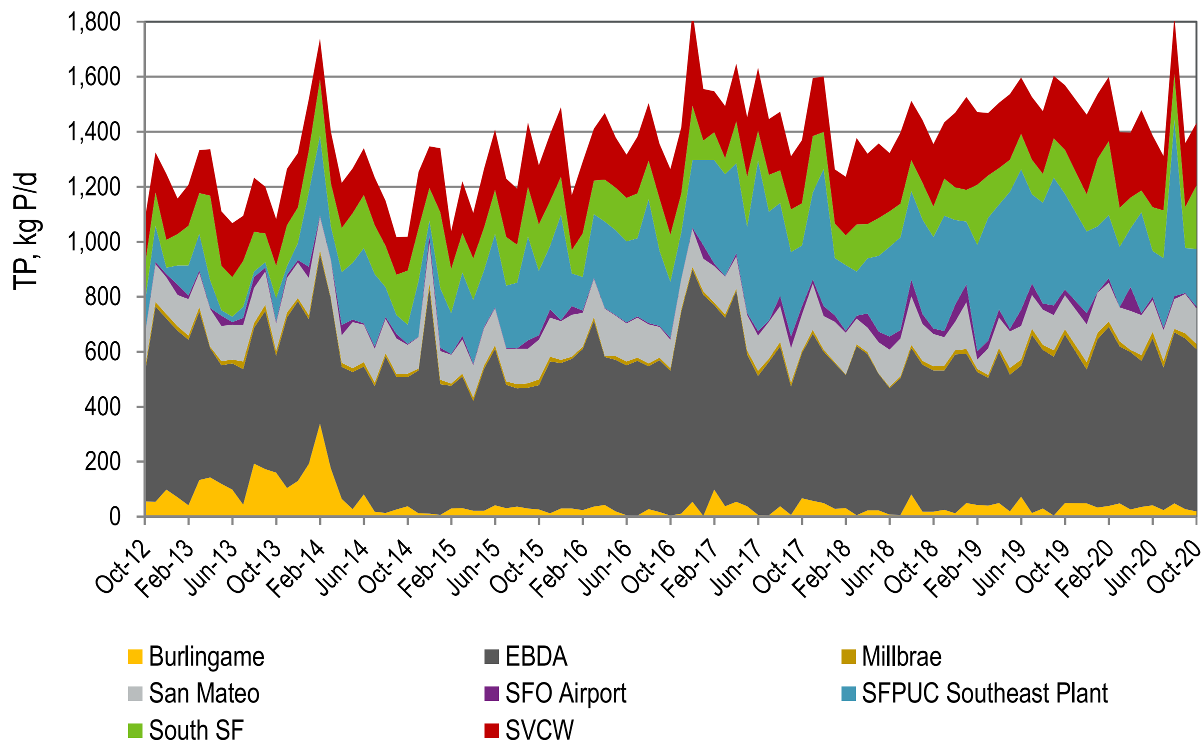

Figure 5-21. TP Load Contribution by Discharger to South Bay

5.6.5 Lower South Bay

The average monthly discharge to Lower South Bay by discharger for discharge flows and loads are provided in Figure 5-22 through Figure 5-25. Lower South Bay wastewater flows are dominated by San Jose. San Jose also discharges the largest TIN load. Sunnyvale and San Jose's ammonia loads exhibit a significant seasonal pattern. San Jose's TIN loads are sporadic (e.g., July 2015), which is likely attributed to the biological nitrogen removal step feed process. Palo Alto is the largest discharger of TP to Lower South Bay, followed by San Jose and Sunnyvale.

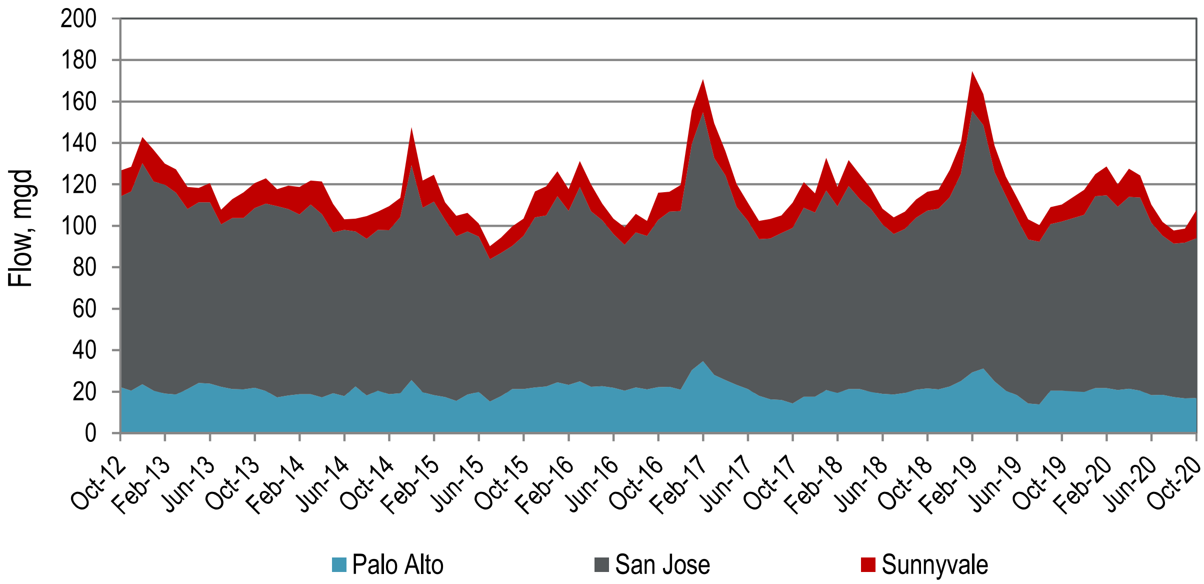

Figure 5-22. Flow Contribution by Discharger to Lower South Bay

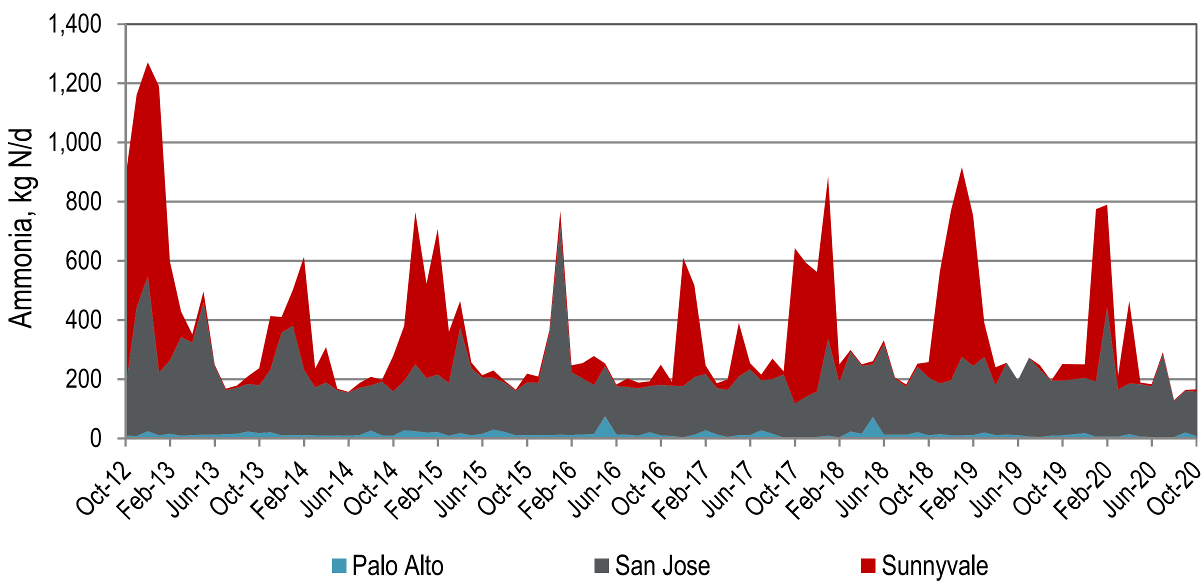

Figure 5-23. Ammonia Load Contribution by Discharger to Lower South Bay

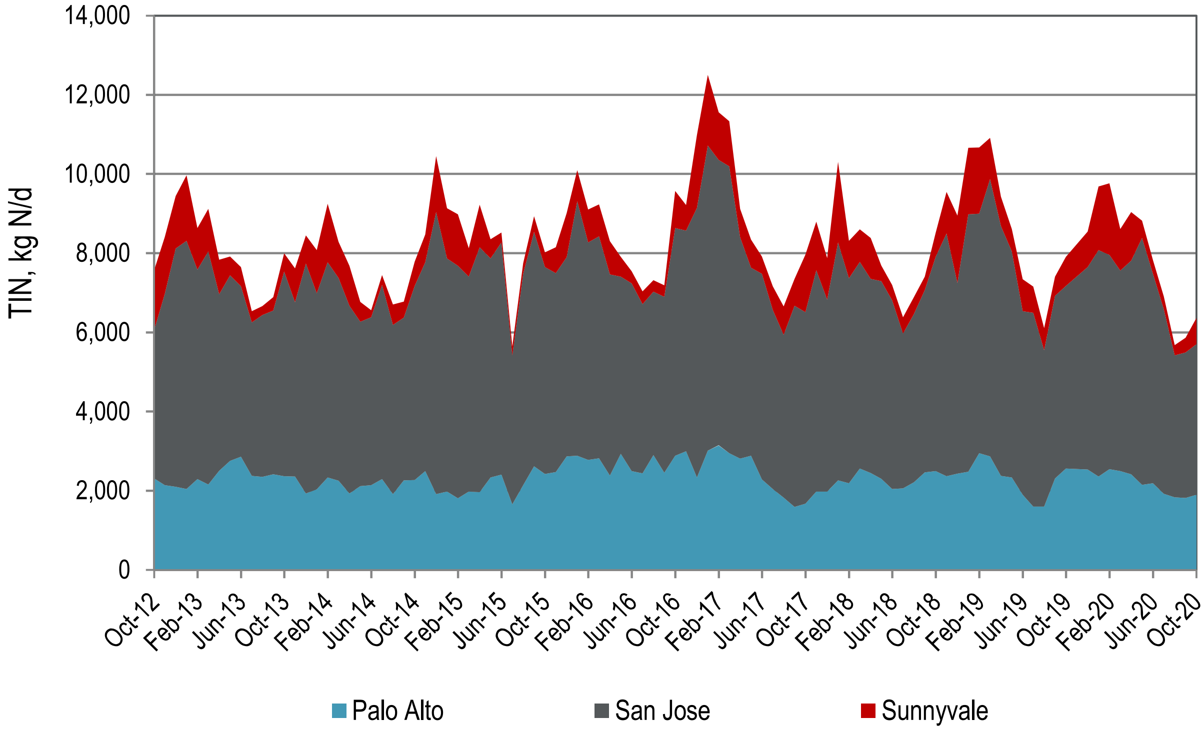

Figure 5-24. TIN Load Contribution by Discharger to Lower South Bay

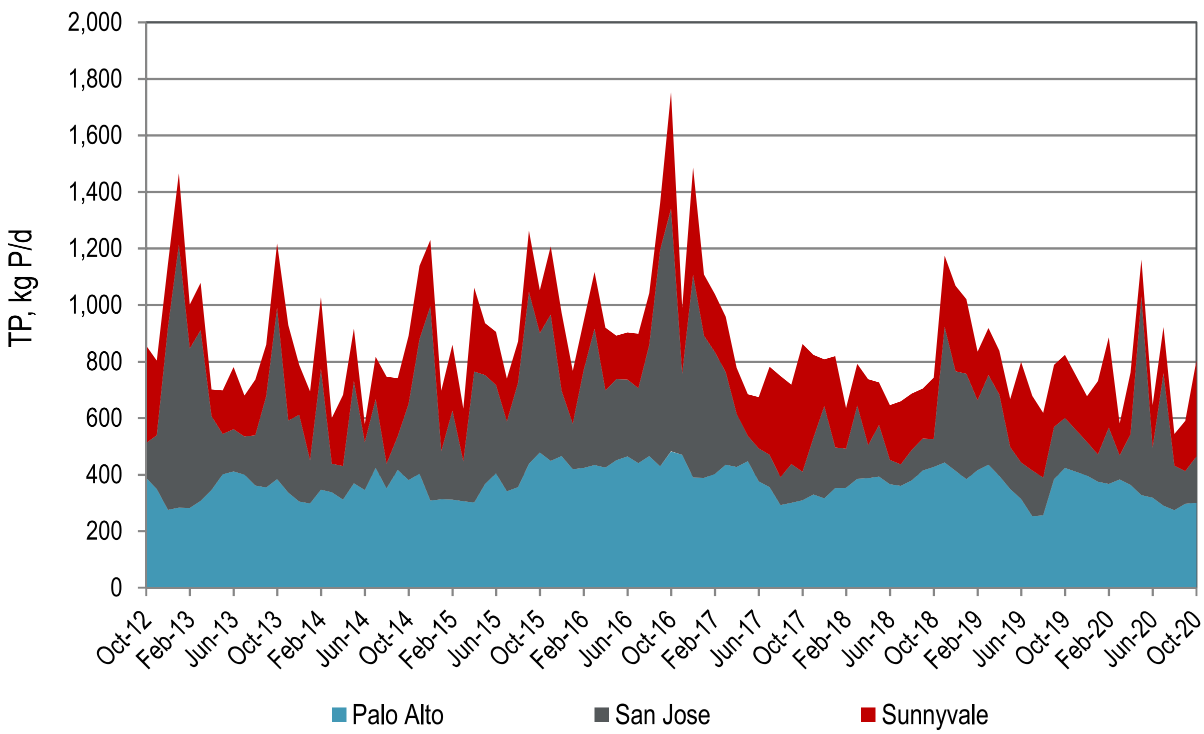

Figure 5-25. TP Load Contribution by Discharger to Lower South Bay

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6 Discussion

A plot of the historical average monthly daily discharge flow, ammonia, NOx, TIN, and TP loads are presented in Figure 6-1. In general, the 2019/2020 flows and loads decreased from the 2018/2019 dataset. This overall reduction is attributed to a combination of the i) global pandemic, ii) several treatment plants implementing nutrient load reduction strategies (e.g., Pinole), and iii) a relatively dry year (implications focused on the wet season).

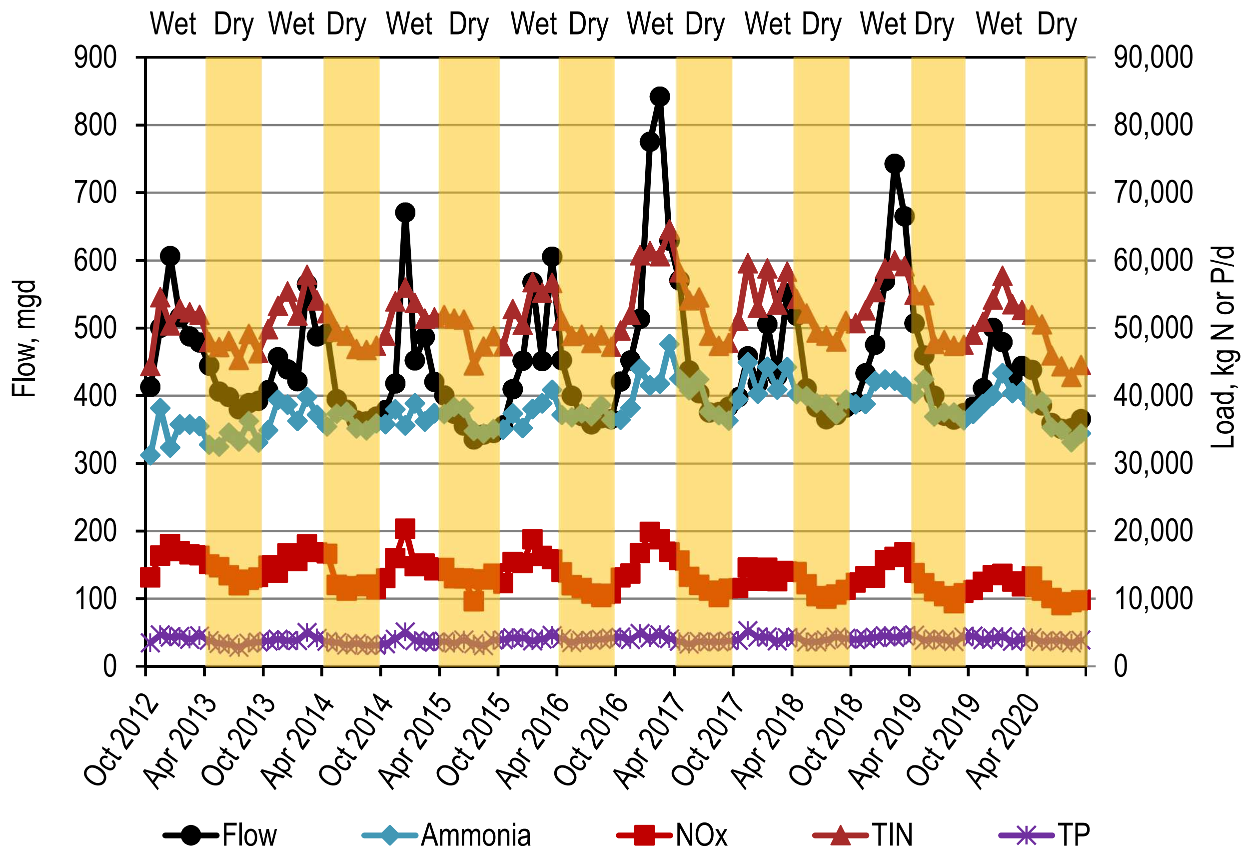

Figure 6-1. Historical Average Monthly Daily Discharge Flows and Loads

While the trending analysis suggests an increase in ammonia and TP since sampling began in 2012, the 2019/2020 dataset included some of the lowest flows and loads since 2012. For example, the annual average flows, ammonia, and NOx are the lowest and TIN is the second lowest since sampling began.

Historically, the ammonia, NOx, and TIN loads tend to track with the flows. For example, during peak wet weather events, both the flow and total nitrogen loads typically increase. However, the limited dataset restricts confidence in the strength of this relationship. It is unknown whether the trend would be as evident with increased sampling frequency where the impacts from an initial scouring event in the collection system due to wet weather would be reduced and dilution increased (similar to the “first flush” in stormwater collection systems). Additional data are needed to further understand the correlation between flow and loads during peak wet weather events.

The following subsections present a discussion of how the global pandemic may have impacted the flows and loads, observations of the newly added influent data, and finally, observations of each parameter considered, including outliers, seasonality, and the role of the largest dischargers.

6.1 Global Pandemic (COVID-19)

The Bay Area experienced the on-going Global Pandemic with the 2019/2020 dataset with shelter in place beginning in March 2020. During the pandemic, there are numerous changes in our daily lives that would likely impact wastewater generation rates, as well as a shift from one geographic location to another. While these changes and their implications will likely be the subject of numerous future studies, some anecdotal examples are as follows:

- New safety measures and guidelines (e.g., frequent hand washing and more disinfection) may lead to increased wastewater generation rates and new loads associated with such cleaning products.
- A reduction in commuters that would typically travel into the Bay Area for work may reduce generation rates or shift geographical locations.
- Distance learning for schools might impact geographic locations.
- Shutdown or a reduction in commercial and industrial users, such as restaurants, office complexes, etc. that normally would contribute flows and loads to treatment plants.
- Reduction in travelers/tourist that typically visit the Bay Area, especially during the summer months.
- Bay Area residents leaving temporarily and/or permanently due to the lack of need to work in person.
- Reduction of and/or no events, such as sporting events, that normally would attract a population and contribute flows and loads to treatment plants.
- Others

It is unclear when life will return to pre-pandemic conditions (if ever). Given that, the future of influent/discharge flows and loads is unclear and the trends that have been tracked for the past several years may be impacted. Future group annual reports will address this issue as the global pandemic evolves.

6.2 Annual Precipitation

A plot of the historical precipitation for the nutrient sampling period (2012 to present) is provided in Figure 6-2. Based on the data source, the October 2019 through September 2020 precipitation dataset is lowest since sampling began in 2012. Note: the amount of rainfall seen across the Bay Area will vary and the data in Figure 6-2 are limited to a single location. However, the overall trends are relatively stable across the Bay Area.

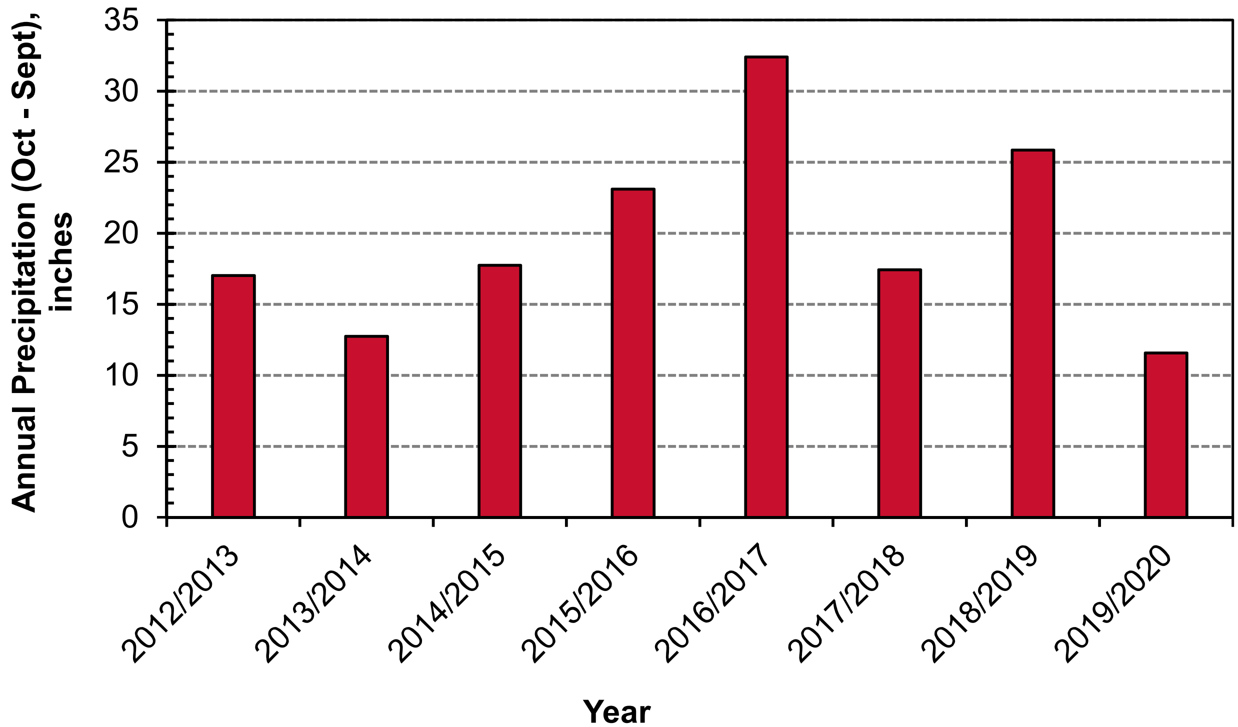

Figure 6-2. Historical Annual Precipitation in the Bay Area (Adapted from Golden Gate Weather Services)

The impacts of relatively low precipitation are well-documented on wastewater treatment plants. The most notable impact is relatively low peak flows with respect to ADWF. While the influent data should capture such variability, the available dataset is limited so it is more prudent to review the discharge flow data. While several agencies do not discharge all of their influent, it remains a reasonable metric for comparing the impact of historical precipitation.

A review of Figure 5-1 suggests that 2019/2020 dataset had the lowest discharge annual volume since data collection began in 2012. The lack of rain influenced the relatively flat average monthly peaking factors which reduced the average monthly discharge flows during the wet season. A majority of the agencies had their lowest average monthly peak flow with respect to ADWF since sampling began in 2012. Furthermore, the total dry season discharge volumes were the second lowest since sampling began in 2012. Another relatively dry year would likely result in dry season flows at a comparable or lower level than the lowest year seen (2015) since sampling began in 2012.

6.3 Trending Statistics

The method of least squares trend analysis is intended to identify potential significant trends. Verifying the trends would require a more rigorous statistical approach than applied for this report. While effective as a first step for identifying potential significant trends, the method of least squares does not verify whether regression assumptions of normality and independence of errors have been satisfied. The recommended next steps if trend verification is required are as follows:

1) Verify the correlation of errors (e.g., Durbin-Watson correlation of errors).

2) Evaluate whether the data need to be transformed (e.g., natural log) to provide context on whether data are conforming to the distributional assumptions of the modeling errors. A probability plot of errors will provide context on whether data are conforming to the errors.
3) Use the Cochrane–Orkut regression model to adjust the data for a time series correlation in the error term.

Given that 2019/2020 was such an outlier (due to the global pandemic), all of the identified trends will need to be carefully watched in the coming years to see how they evolve.

6.4 Agencies that have Implemented Nutrient Load Management Upgrades

Multiple agencies have designed and implemented nutrient load management upgrades over the last several years as follows:

- Oro Loma/Castro Valley Sanitary Districts Water Pollution Control Plant: Implemented an ammonia and TIN load reduction technology by modifying and expanding their existing activated sludge system in Summer of 2020. The technology upgrade is known as the Modified Ludzack-Ettinger system.
- Pinole-Hercules Water Pollution Control Plant: Implemented an ammonia and TIN load reduction technology by modifying and expanding their existing activated sludge system in Spring 2019. The technology upgrade is known as the Modified Ludzack-Ettinger system.

This list is limited to agencies that have commissioned their nutrient load management upgrades. There are several agencies that are in the process of designing and/or construction nutrient load management upgrades.

This subsection will be updated each Group Annual Report with agencies that have implemented such upgrades.

6.5 Influent Analysis

The influent analysis was limited to 15-months of data (July 2019 through September 2020), whereby 6-months of that data occurred with shelter in place orders associated with the global pandemic (see Section 6.1). Given this limited dataset coupled with the lack of certainty from the global pandemic, this Group Annual Report does not include discussion on the influent data.

6.6 Discharge Flow Analysis

Although the total ADWF permitted capacity of the POTW dischargers in the San Francisco Bay is 827 mgd, the total annual average discharge ranged from 408 mgd to 515 mgd for the eight-year period. The ADWF total flows declined from 2012/2013 to 2014/2015, increased in 2015/2016 and 2016/2017, and have stayed relatively steady until 2018/2019. Average annual flows peaked in 2016/2017 with a smaller but significant peak again in 2018/2019, primarily due to the unusually high precipitation during these periods. The ADWF total flows declined in 2019/2020 and has been the lowest in the eight-year period. The decline in 2019/2020 is attributed to a combination of relative dry year and the global pandemic.

The South Bay and Lower South Bay Subembayments received the highest flows, making up approximately 60 percent of the total flow discharged to the Bay. The largest discharger is San Jose, followed by SFPUC Southeast, EBDA, and EBMUD. San Pablo Bay has the largest portion of recycled water diversion during the dry season; several plants divert all flow and have a zero dry season discharge.

The dry season flow trends for all Subembayments are not statistically significant. While several Subembayments had been previously identified as having a significant downward dry season trend (e.g., Suisun and Lower South Bay), dry season flows since the 2016/2017 season have rebounded such that there is no longer a significant dry season trend.

6.7 Discharge Total Ammonia Analysis

The total annual average ammonia discharge ranged from approximately 34,300 kg N/d to 40,800 kg N/d for the eight-year period. The Central Bay and South Bay Subembayments receive the highest ammonia loads, making up over 80 percent of the total ammonia discharged to the Bay. The largest overall ammonia discharger is the SFPUC Southeast Plant, followed by EBMUD and EBDA. Suisun Bay had the largest increase in ammonia discharge loads from 2018/2019. This increase is primarily attributed to the discharge load increase at Central San.

The total dry season ammonia loads appear to be statistically increasing Baywide and for all Subembayments other than the Lower South Bay and South Bay. Despite receiving the second highest flows, the Lower South Bay ammonia loads are about an order of magnitude lower than any other Subembayment, making up less than one percent of the total ammonia load to the Bay. This is because the three dischargers that make up the Lower South Bay are required to fully nitrify at their plants due to their shallow water discharges. Ammonia removal addresses ammonia related toxicity; however, a portion of the nitrogen is still present as NOx in the discharge.

The seasonal variation of discharged ammonia load from the wet to the dry season (based on the percent difference) are most pronounced for the Lower South Bay and San Pablo Bay. The Lower South Bay has the most significant seasonal load reduction as evidenced by about a 40 percent reduction from the wet to the dry season. Similar to the seasonal variation in flow, these seasonal load variations are attributed to a combination of seasonal diversion of recycled water, pond dredging, colder temperatures, and seasonal nitrification. Nitrification is less effective at the cooler wet season temperatures; as a result, a few of the dischargers appear to experience increased ammonia concentrations during the wet season. Additionally, recycling water has the potential to divert loads from the Bay when used for consumptive purposes (e.g., irrigation).

Agencies with nitrifying trickling filters (e.g., Sunnyvale), have variable wet weather ammonia concentrations which are attributed to temperature variations that impact the nitrification process. As a result, these plants appear to have difficulty maintaining a consistent discharge ammonia load during winter months.

There are several agencies that have either optimized their existing ammonia/TIN load reduction systems, brought online new systems (e.g., Pinole), and/or are in the design/construction phase (e.g., San Mateo). Such changes should result in current and future load reductions at such POTWs.

6.8 Discharge Nitrate + Nitrite (NOx) Analysis

The total annual average NOx discharge ranged from approximately 11,600 kg N/d to 15,000 kg N/d for the eight-year period. Despite year-to-year increases in the 2016/2017 and 2018/2019 data, NOx loads have an overall downward dry season trend, with the 2018/2019 showing a decrease of over 10% compared to the first year of data collection (2012/2013), followed by another 10% decrease in 2019/2020 compared with the first year of data collection (2012/2013). The basis for this reduction for 2018/2019 is unclear and should be further evaluated in future nutrient trending reports. One possible reason is a reduction in influent loads. While the influent data are limited (7/2019-10/2020), the SFPUC Southeast Plant had a greater than 90% reduction in influent NOx loads. Other possible reasons could include an influent load reduction from industry due to the global pandemic, a reduction in nitrification for plants with intermittent nitrification or enhanced denitrification for plants that are denitrifying, or others.

The Lower South Bay receives the highest NOx load, making up approximately 65 percent of the total NOx load discharged to the Bay. The largest overall discharger of NOx is San Jose, averaging 4,943 kg N/d for the eight-year period, which is about 35 percent of the total NOx load to the Bay. As previously stated, this relatively large NOx load is attributed to nitrification of ammonia at all three plants in the Lower South bay. A portion of the ammonia converted to NOx is discharged as NOx. The overwhelming majority of NOx discharged is nitrate.

The seasonal variation of discharged NOx load from the wet to the dry season (based on the percent difference) is most pronounced on a percentile load basis for San Pablo Bay, Central Bay, and South Bay, in that order. San Pablo Bay has the largest variation due to the lack of dry season dischargers coupled with several of the plants in San Pablo Bay performing nitrification. There are also occasional spikes of NOx in the dry season from agencies that have intermittent nitrification, specifically for under-loaded trickling filter plants.

There are several agencies that have brought online new systems (e.g., Pinole) and/or are in the design/construction phase (e.g., San Mateo) for ammonia/TIN load reduction. Such changes should result in current and future load increases of NOx loads at such POTWs (albeit with ammonia and TIN loads reduction).

6.9 Discharge Total Inorganic Nitrogen (TIN) Analysis

The total annual average TIN discharge ranged from 49,300 kg N/d to 55,000 kg N/d for the eight-year period. The Central Bay and South Bay Subembayments receive the highest TIN loads, making up approximately 70 percent of the TIN load discharged to the Bay. The largest overall discharger of TIN on an annual average basis is EBMUD, followed by SFPUC Southeast and EBDA.

There are instances where the TIN values do not necessarily reflect ammonia plus NOx equals TIN (as provided in Section 3.2). Such instances occur when agencies sample for only one of the nitrogen species that are used to calculated TIN (ammonia and NOx). In most cases, the agencies sample more frequently for ammonia. The average monthly ammonia loads are based on the average for each sampling event during that particular month. In contrast, TIN loads are only calculated for sampling days when both ammonia and NOx are sampled. Such a discrepancy in sampling frequency can result in average monthly values where TIN does not equal ammonia plus NOx.

The last three years of data have been relatively stable, with a decrease in TIN loads this past year (2019/2020). The Subembayments that previously showed a statistically significant increase (e.g., San Pablo Bay South Bay) now show no significant trend. Central Bay is the only Subembayment that shows an emerging upward trend based on the least squares method.

The seasonal difference in TIN discharges from the wet to the dry season (based on the percent difference) are most pronounced in San Pablo Bay and the Central Bay. San Pablo Bay has the most significant seasonal load reduction as evidenced by an approximately 30 percent reduction from the wet to the dry season. Similar to and ammonia, this is attributed to a combination of more effective nitrification/denitrification during the dry season and seasonal use of recycled water, which diverts loads. A large portion of POTWs that discharge to San Pablo Bay do not discharge during the dry season (e.g., Petaluma).

There are several agencies that have either optimized their existing ammonia/TIN load reduction systems, brought online new systems (e.g., Pinole), and/or are in the design/construction phase (e.g., San Mateo). Such changes should result in current and future load reductions at such POTWs.

6.10 Discharge Total Phosphorus (TP) Analysis

The total annual average TP discharge ranged from approximately 3,750 kg P/d to 4,210 kg P/d for the eight-year period. TP sampling is a composite for both the Section 13267 Letter Data and the Nutrient Watershed Permit. However, the Section 13267 Letter Data required sampling during peak flows, as previously discussed.

The South Bay receives the largest TP load of all Subembayments at approximately 40 percent of the total load, followed by the Central Bay at approximately 30 percent. Both Subembayments, as well as Suisun Bay, have an emerging dry season upward trend. Baywide dry season TP loads are also trending upward. Such upward trends may be in part due to the different sampling standards between the Section 13267 Letter Data and the Nutrient Watershed Permit data, as the TP data show a significant jump between the 2014/2015 and the 2015/2016 years. The largest overall discharger of TP based on annual average loads is EBMUD, followed by EBDA and Palo Alto.

The seasonal variation of TP discharge loads from the wet to dry season (based on the percent difference) are most pronounced for San Pablo Bay, Central Bay, and Lower South Bay Subembayments. In contrast, the South Bay and Suisun Subembayments do not appear to have a significant variation in TP loading between the wet and dry season.

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7 Summary

The 2020 Group Annual Report includes data from October 2012 through September 2020. Additionally, this is the first Group Annual Report that includes influent data. Influent flows and loads are now required under the new permit for plants with a permitted ADWF capacity of over 10 mgd. The influent dataset is limited because the new permit came into effect in July 2019. Subsequent reports will include an influent analysis once more data are available.

It is important to recognize that a portion of the 2019/2020 dataset includes data since the global pandemic (COVID-19) started. Given that, the trend analyzes will need to be carefully considered in the coming years to evaluate whether the 2019/2020 dataset was an outlier. It is unclear when life will return to pre-pandemic conditions (if ever). As a result, the future of influent/discharge flows and loads is unclear and the trends that have been tracked for the past several years may be impacted. Future group annual reports will address this issue as the global pandemic evolves.

The 2019/2019 dataset includes data for a relatively dry year in terms of precipitation. Since sampling for this report began in 2012, the 2019/2020 dataset had the lowest amount of precipitation on average across the Bay Area. Such low precipitation can impact both flows and loads. As previously stated in Section 6.2, the total dry season discharge volumes were the second lowest since sampling began in 2012. Another relatively dry year would likely result in dry season flows at a comparable or lower level than the lowest year seen (2015) since sampling began in 2012.

7.1 Influent

Table 7-1 and Table 7-2 present a summary of the dry season and annual average constituent concentrations, respectively, between July 2019 and September 2020. The concentrations were calculated by a flow-weighted average for the appropriate averaging period.

As previously noted, the influent data are limited both in timeframe (July 2019 through September 2020), sampling frequency (required quarterly), and the sample set only includes POTWs that have a permitted ADWF capacity of greater than 10 mgd.

Table 7-1. Influent: Summary of Average Annual Flow and Concentrations to each Plant *

Constituent	2018 / 2019 [a] [b] *	2019 / 2020 [a] [b] [c] [d]
Flow, mgd	*	403
Ammonia, mg N/L	*	37.7
NOx, mg N/L	*	2.25
TIN, mg N/L	*	39.0
TKN, mg N/L	*	59.7
TN, mg N/L	*	61.0
TP, mg P/L	*	7.28

* Values for 2018/2019 are not shown as they are limited to July 2019 through September 2019.

a. Limited to POTWs with a permitted capacity greater than 10 mgd.

b. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2019/2020 represents the period between October 1, 2019 and September 30, 2020.

c. The concentrations calculation is based on a flow-weighted average (limited to agencies that provided load data for the averaging period).

d. The TIN values do not necessarily equal ammonia plus NOx due to instances when ammonia was sampled more frequently than NOx.

Table 7-2. Influent: Summary of Dry Season Flow and Concentrations to each Plant *

Constituent	2019 [a] [b] [c] [d] *	2020 [a] [b] [c] [d]	Trend [e]
Flow, mgd	395	379	-- [d]
Ammonia, mg N/L	38.4	36.7	-- [d]
NOx, mg N/L	3.56	2.83	-- [d]
TIN, mg N/L	41.7	38.4	-- [d]
TKN, mg N/L	59.2	61.2	-- [d]
TN, mg N/L	61.6	62.4	-- [d]
TP, mg P/L	7.49	7.26	-- [d]

* 2019 dataset limited to July through September compared against May through September for 2019/2020

a. Limited to POTWs with a permitted capacity greater than 10 mgd.

b. The dry season represents May 1 through September 30 for each calendar year.

c. The concentrations calculation is based on a flow-weighted average (limited to agencies that provided load data for the averaging period).

d. The TIN values do not necessarily equal ammonia plus NOx due to instances when ammonia was sampled more frequently than NOx.

e. Trend analysis not performed due to a limited dataset. Future annual trending reports will incorporate trending analysis.

7.2 Discharge

Table 7-3 and Table 7-4 present an overall summary of the annual average and dry season discharge flows and nutrient loads discharged to the San Francisco Bay, respectively, between October 2012 and September 2020. Similarly, Table 7-5 and Table 7-6 present a summary of the corresponding dry season and annual average constituent concentrations, respectively, for the same period. The concentrations were calculated by dividing the loads by the flows for the appropriate averaging period.

The largest dischargers dominate the nutrient loading. Generally, three to four large dischargers contribute more than 70 percent of the nutrient loads. The loading of ammonia and NOx is impacted by plants that nitrify. Those plants that nitrify have the lowest ammonia discharge concentrations and the highest NOx concentrations.

Seasonal variations are pronounced. Dry season loads are generally lower than wet season loads. This is attributed to two factors. First, the higher flows and sampling procedures amplify the wet season discharges. Secondly, during the dry season, water reuse diverts nutrient loads away from the Bay. In some instances, agencies have achieved zero discharge during the summer months. It is recommended that in future years, agencies report the flow diverted for recycled water use as well as any return streams (e.g., cooling tower blow down, advanced purification concentrate, etc.) such that the total quantity of recycled water can be clearly quantified, as well as the associated nutrient loads being diverted from the San Francisco Bay.

As for overall trends, the flows and loads reached the highest levels for both dry season average and average annual for the 2016/2017 dataset. The 2016/2017 dataset represents one of the wettest years on record for Northern California (refer to Section 6.2). As such, it represents the highest annual average flow for the data period which also lead to higher groundwater levels and in turn higher flows during the dry season. Since 2016/2017, the loads remained relatively stable until the decline for all parameters in 2019/2020. As previously stated, the decline in flows and loads from 2018/2019 to 2019/2020 needs to be carefully considered in the coming years to evaluate whether the 2019/2020 dataset was an outlier. It is unclear when life will return to pre-pandemic conditions (if ever; refer to Section 6.1). Future group annual reports will address this issue as the global pandemic evolves.

Table 7-3. Discharge: Summary of Average Annual Flow and Loads to the Bay

Constituent	2012/ 2013 [(a)]	2013/ 2014 [(a)]	2014/ 2015 [(a)]	2015/ 2016 [(a)]	2016/ 2017 [(a)]	2017/ 2018 [(a)]	2018/ 2019 [(a)]	2019/ 2020 [(a)]	8 Year Avg
Flow, mgd	451	428	415	430	515	433	480	408	445
Ammonia, kg N/d	34,300	37,000	36,700	37,500	40,600	40,800	39,800	38,000	38,100
NOx, kg N/d	15,000	14,300	14,200	13,600	14,500	12,400	13,000	11,600	13,600
TIN, kg N/d [(b)]	49,300	51,300	50,900	51,100	55,000	53,200	53,100	49,900	51,700
TP, kg P/d	3,860	3,750	3,770	4,070	4,020	4,190	4,210	4,010	3,990

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/13 represents the period between October 1, 2012 and September 30, 2013.

b. The TIN values do not necessarily equal ammonia plus NOx due to a combination of rounding and instances when ammonia was sampled more frequently than NOx.

Table 7-4. Discharge: Summary of Dry Season Flow and Loads to the Bay

Constituent	2013 [(a)]	2014 [(a)]	2015 [(a)]	2016 [(a)]	2017 [(a)]	2018 [(a)]	2019 [(a)]	2020 [(a)]	Trend [(b,c)]	8 Year Avg
Flow, mgd	393	374	351	372	396	383	394	363	None	378
Ammonia, kg N/d	34,000	36,300	36,200	37,300	38,900	38,900	38,200	35,400	Up (1.0%/yr)	36,900
NOx, kg N/d	13,400	11,800	12,500	11,100	11,700	11,000	10,900	10,000	Down (-3.4%/yr)	11,500
TIN, kg N/d [(d)]	47,300	48,100	48,700	48,400	50,600	50,000	49,200	45,700	None	48,500
TP, kg P/d	3,400	3,320	3,570	3,960	3,660	4,000	4,010	3,790	Up (2.3%/yr)	3,710

a. The dry season represents May 1 through September 30 for each calendar year.

b. Trend analysis is based on average monthly values. Discernible trends were identified based on the slope of a regression line determined using the method of least squares to fit the data (alpha = 0.05). Sample size is 40. Where “None” is stated, the limited dataset does not indicate a statistically relevant trend.

c. The percent change represents the change per year as a percentage of the average value over the entire dataset (2012-2019) (not considered if trend is “None”).

d. The TIN values do not necessarily equal ammonia plus NOx due to a combination of rounding and instances when ammonia was sampled more frequently than NOx.

Table 7-5. Discharge: Summary of Average Annual Flow and Concentrations to the Bay

Constituent	2012/ 2013 [a]	2013/ 2014 [a]	2014/ 2015 [a]	2015/ 2016 [a]	2016/ 2017 [a]	2017/ 2018 [a]	2018/ 2019 [a]	2019/ 2020 [a]	8 Year Avg
Flow, mgd	451	446	415	430	515	433	480	408	445
Ammonia, mg NL	20.1	21.9	23.4	23.0	20.8	24.9	21.9	24.6	22.6
NOx, mg N/L	8.78	8.51	9.06	8.38	7.42	7.58	7.15	7.49	8.06
TIN, mg N/L [b]	28.9	30.4	32.5	31.4	28.3	32.5	29.3	32.3	30.7
TP, mg P/L	2.26	2.23	2.40	2.50	2.07	2.56	2.32	2.60	2.37

a. Each reporting year represents the period between October 1 of the first year and September 30 of the second year. For example, 2012/13 represents the period between October 1, 2012 and September 30, 2013.

b. The TIN values do not necessarily equal ammonia plus NOx due to instances when ammonia was sampled more frequently than NOx.

Table 7-6. Discharge: Summary of Dry Season Flow and Concentrations to the Bay

Constituent	2013 [a]	2014 [a]	2015 [a]	2016 [a]	2017 [a]	2018 [a]	2019 [a]	2020 [a]	Trend [b,c]	8 Year Avg
Flow, mgd	393	380	351	372	396	383	393	363	None	22.7
Ammonia, mg NL	22.9	25.2	27.3	26.5	26.0	26.9	22.9	25.8	Up (0.9%/yr)	18.6
NOx, mg N/L	8.99	8.24	9.42	7.90	7.82	7.57	8.99	7.29	Down (-3.4%/yr)	43.7
TIN, mg N/L [d]	31.8	33.5	36.7	34.4	33.8	34.5	31.8	33.3	None	38.6
TP, mg P/L	2.28	2.31	2.69	2.81	2.44	2.76	2.28	2.76	Up (2.2%/yr)	2.60

a. The dry season represents May 1 through September 30 for each calendar year.

b. Trend analysis is based on average monthly values. Discernible trends were identified based on the slope of a regression line determined using the method of least squares to fit the data (alpha = 0.05). Sample size is 40. Where “None” is stated, the limited dataset does not indicate a statistically relevant trend.

c. The percent change represents the change per year as a percentage of the average value over the entire dataset (2012-2019) (not considered if trend is “None”).

d. The TIN values do not necessarily equal ammonia plus NOx due to instances when ammonia was sampled more frequently than NOx.

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Appendix A. Discharge Evaluation for Individual Dischargers

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Contents

Tables

Figures

1 City of American Canyon

American Canyon discharges to San Pablo Bay, and it serves approximately 5,562 connections. The plant is rated for an ADWF capacity of 2.5 mgd and a peak permitted wet weather flow of 5 mgd. It has a current ADWF flow of approximately 1.11 mgd, since data collection began. The plant is a nitrifying and denitrifying MBR plant.

The following observations are made based upon the figures and table in the subsequent pages:

- There are 8 missing monthly average nutrient load samples per nutrient up to June 2014, which may be attributed to seasonal discharge restrictions.
- The wet season average monthly flow values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
- Based on the table and figures with the average monthly values, flow, nitrate+nitrite, and TIN loads appear to be trending down for the dry season. The ammonia and phosphorus loads do not appear to have any emerging dry season trends.
- NOx is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant nitrifies.
- Total phosphorus concentrations are wide ranging with values from less than 1 mg P/L to over 11 mg P/L.

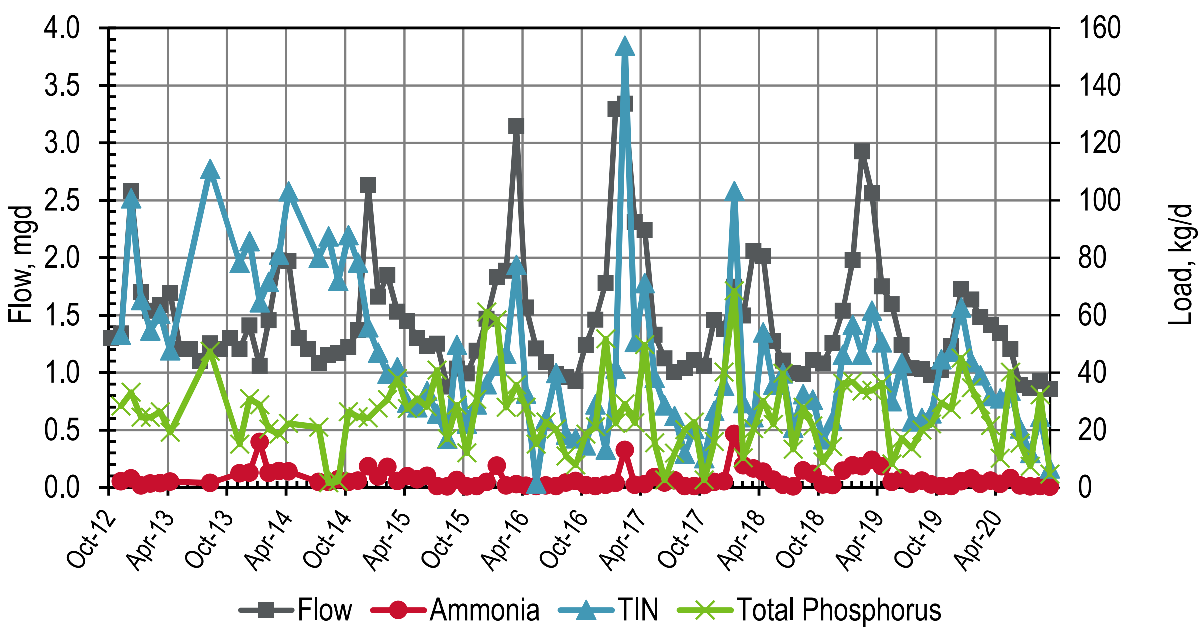

Figure 1-1. Discharge: American Canyon Monthly Flows and Loads

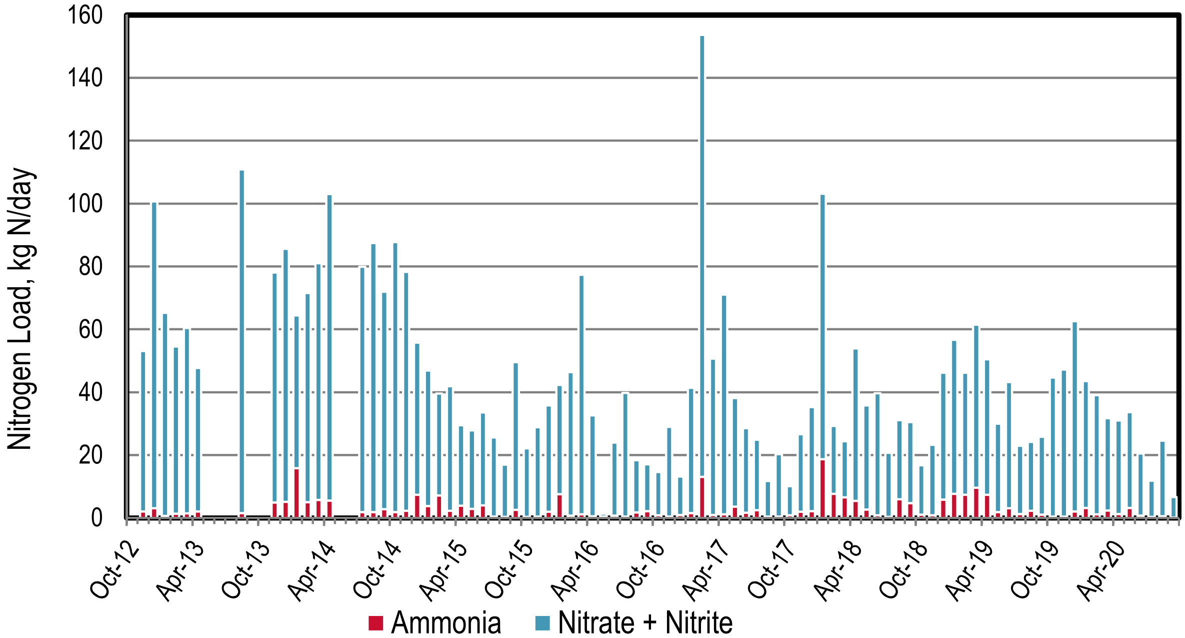

Figure 1-2. Discharge: American Canyon Monthly Nitrogen Loads

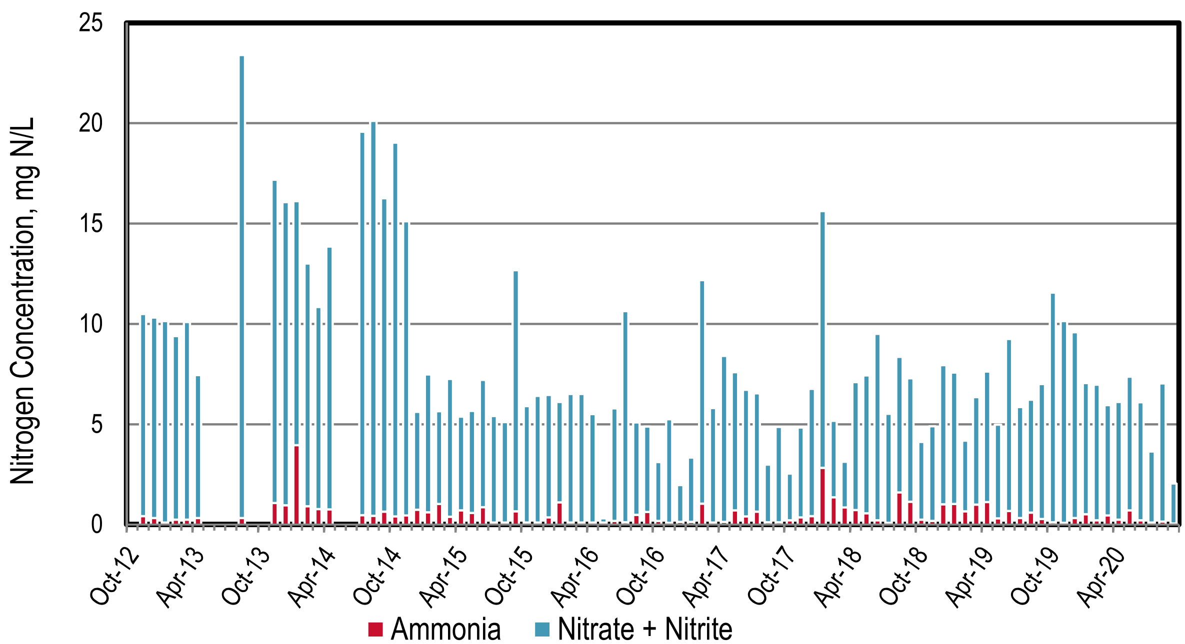

Figure 1-3. Discharge: American Canyon Monthly Nitrogen Concentrations

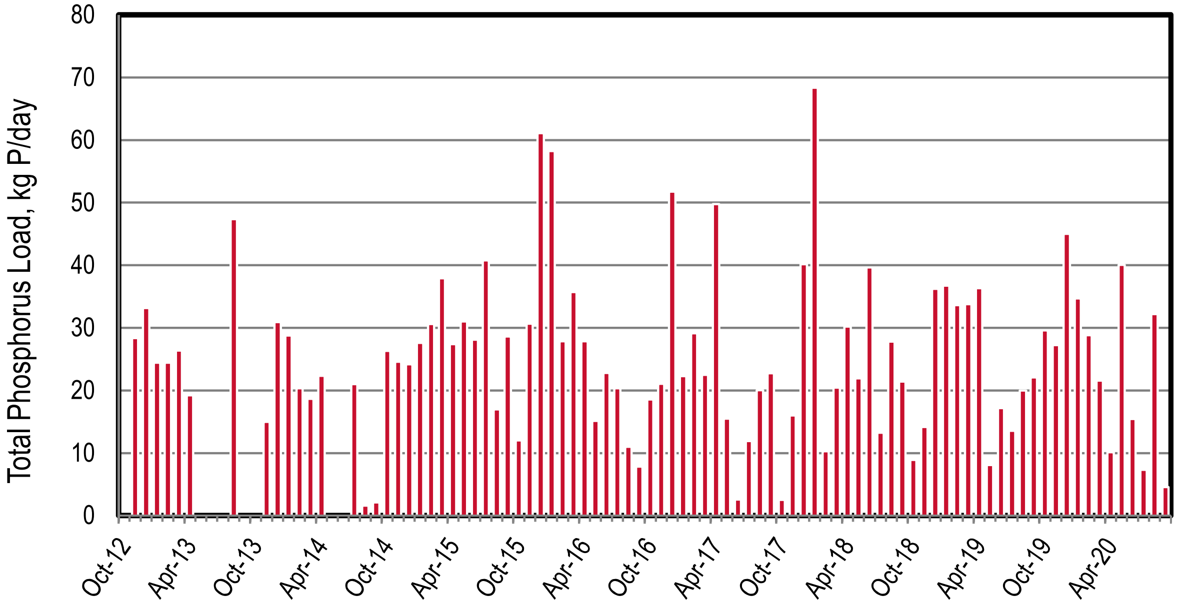

Figure 1-4. Discharge: American Canyon Monthly Phosphorus Loads

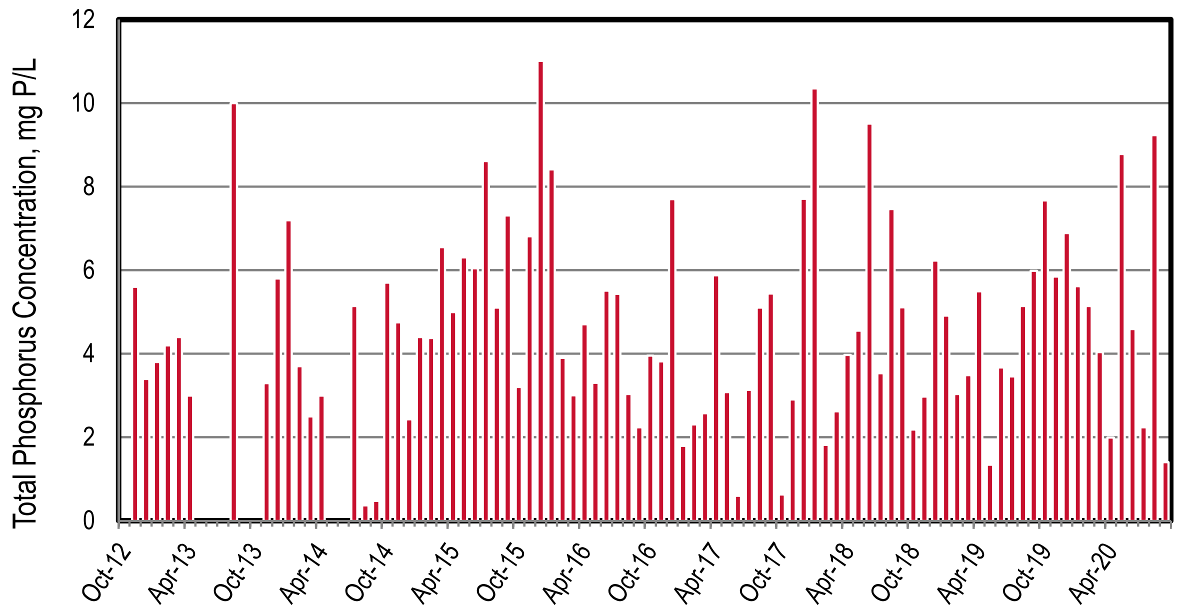

Figure 1-5. Discharge: American Canyon Monthly Phosphorus Concentrations

Table 1-1. Discharge: American Canyon Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	1.30				
Nov-12	1.34	2.13	51.0	53.1	28.4
Dec-12	2.58	3.12	97.5	101	33.2
Jan-13	1.70	0.643	64.6	65.2	24.4
Feb-13	1.54	1.40	53.2	54.6	24.4
Mar-13	1.59	1.50	59.0	60.5	26.4
Apr-13	1.69	2.05	45.7	47.7	19.2
May-13	1.20				
Jun-13	1.20				
Jul-13	1.10				
Aug-13	1.25	1.56	109	111	47.4
Sep-13	1.20				
Oct-13	1.30				
Nov-13	1.20	4.91	73.2	78.1	15.0
Dec-13	1.41	5.12	80.5	85.6	30.9
Jan-14	1.06	15.8	48.6	64.4	28.8
Feb-14	1.46	5.06	66.4	71.5	20.3
Mar-14	1.98	5.75	75.3	81.0	18.7
Apr-14	1.97	5.58	97.5	103	22.3
May-14	1.30				
Jun-14	1.20				
Jul-14	1.08	1.88	78.0	79.9	21.0
Aug-14	1.15	1.91	85.5	87.4	1.60
Sep-14	1.17	2.83	69.1	71.9	2.10
Oct-14	1.22	1.89	85.9	87.8	26.3
Nov-14	1.37	2.33	75.9	78.2	24.6
Dec-14	2.63	7.36	48.4	55.8	24.2
Jan-15	1.66	3.83	43.1	46.9	27.6
Feb-15	1.85	7.13	32.4	39.5	30.6
Mar-15	1.53	2.26	39.7	42.0	37.9
Apr-15	1.45	3.89	25.6	29.5	27.4
May-15	1.30	2.85	25.0	27.9	31.0
Jun-15	1.23	4.04	29.5	33.5	28.1
Jul-15	1.25	0.474	25.1	25.6	40.8
Aug-15	0.879	0.333	16.6	17.0	17.0
Sep-15	1.04	2.59	47.0	49.6	28.6

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	0.993	0.376	21.8	22.2	12.0
Nov-15	1.19	0.451	28.4	28.9	30.7
Dec-15	1.47	1.94	33.9	35.8	61.1
Jan-16	1.83	7.63	34.7	42.3	58.3
Feb-16	1.89	0.714	45.7	46.4	27.9
Mar-16	3.15	1.19	76.2	77.4	35.7
Apr-16	1.57	0.593	32.0	32.6	27.9
May-16	1.21	0.458	0.916	1.37	15.1
Jun-16	1.10	0.746	23.2	24.0	22.8
Jul-16	0.989	0.462	39.3	39.7	20.3
Aug-16	0.958	1.74	16.7	18.4	11.0
Sep-16	0.927	2.22	14.9	17.1	7.85
Oct-16	1.24	0.825	13.7	14.6	18.6
Nov-16	1.46	0.438	28.5	28.9	21.0
Dec-16	1.78	0.941	12.2	13.2	51.7
Jan-17	3.29	1.59	39.8	41.4	22.3
Feb-17	3.34	13.1	141	154	29.1
Mar-17	2.31	0.938	49.7	50.6	22.5
Apr-17	2.24	1.18	69.9	71.1	49.7
May-17	1.33	3.57	34.5	38.1	15.5
Jun-17	1.12	1.70	26.8	28.5	2.56
Jul-17	1.01	2.45	22.4	24.9	11.9
Aug-17	1.04	0.488	11.2	11.7	20.0
Sep-17	1.11	0.484	19.9	20.3	22.8
Oct-17	1.06	0.846	9.31	10.2	2.54
Nov-17	1.46	1.94	24.7	26.6	16.0
Dec-17	1.38	2.17	33.1	35.3	40.2
Jan-18	1.75	18.6	84.5	103	68.4
Feb-18	1.50	7.71	21.6	29.3	10.3
Mar-18	2.06	6.59	17.8	24.4	20.4
Apr-18	2.01	5.49	48.5	54.0	30.2
May-18	1.27	2.68	33.1	35.8	21.9
Jun-18	1.10	0.881	38.8	39.7	39.7
Jul-18	0.993	0.324	20.4	20.7	13.3
Aug-18	0.986	5.98	25.2	32.5	27.8
Sep-18	1.11	4.76	25.8	30.5	21.4
Oct-18	1.08	1.02	15.8	16.8	8.90

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	1.26	0.832	22.5	23.3	14.1
Dec-18	1.54	5.85	40.3	46.2	36.3
Jan-19	1.98	7.66	49.0	56.7	36.8
Feb-19	2.93	7.35	38.9	46.2	33.6
Mar-19	2.56	9.65	51.9	61.5	33.8
Apr-19	1.75	7.42	43.0	50.4	36.4
May-19	1.59	1.91	28.1	30.0	8.10
Jun-19	1.24	3.13	40.1	43.3	17.2
Jul-19	1.04	1.29	21.6	22.9	13.6
Aug-19	1.03	2.31	21.9	24.2	20.0
Sep-19	0.975	1.02	24.8	25.8	22.1
Oct-19	1.02	0.442	44.2	44.6	29.6
Nov-19	1.23	0.425	46.8	47.2	27.2
Dec-19	1.73	2.11	60.5	62.6	45.0
Jan-20	1.64	3.16	40.4	43.6	34.7
Feb-20	1.48	1.20	37.8	39.0	28.8
Mar-20	1.41	2.40	29.4	31.8	21.6
Apr-20	1.35	1.27	29.8	31.0	10.1
May-20	1.21	3.22	30.4	33.6	40.1
Jun-20	0.890	0.718	19.8	20.5	15.4
Jul-20	0.865	0.305	11.6	11.9	7.32
Aug-20	0.923	0.511	24.0	24.5	32.2
Sep-20	0.858	0.190	6.46	6.65	4.56
Dry Season Average	**1.11**	**1.82**	**31.4**	**33.2**	**19.8**
Dry Season Trend	**Down**	**None**	**Down**	**Down**	**None**
Wet Season Average	**1.71**	**3.85**	**47.8**	**51.6**	**28.6**
Average Annual	**1.46**	**3.07**	**41.4**	**44.5**	**25.2**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

2 City of Benicia

Benicia discharges to San Pablo Bay, and serves approximately 9,569 service connections. The plant has a permitted ADWF capacity of 4.5 mgd and 18 mgd one-hour peak wet weather design flow capacity. It has a current ADWF flow of approximately 1.8 mgd. The plant performs secondary treatment using a combination of activated sludge and rotating biological contractors.

The following observations are made based upon the figures and table in the subsequent pages:

- Based on the table and figures with the average monthly values, there appears to be an emerging dry season downward trend for total phosphorus loads.
- The wet season average monthly flow values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
- Total inorganic nitrogen (TIN) loads increase with flow during wet weather events.
- Wet season loads are greater and more variable year to year than the dry season loads.
- Ammonia is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant does not nitrify.
- Ammonia concentrations vary in the range of 8 to 46 mg N/L throughout the year.
- Total phosphorus concentrations range from less than 1 mg P/L to over 7 mg P/L.

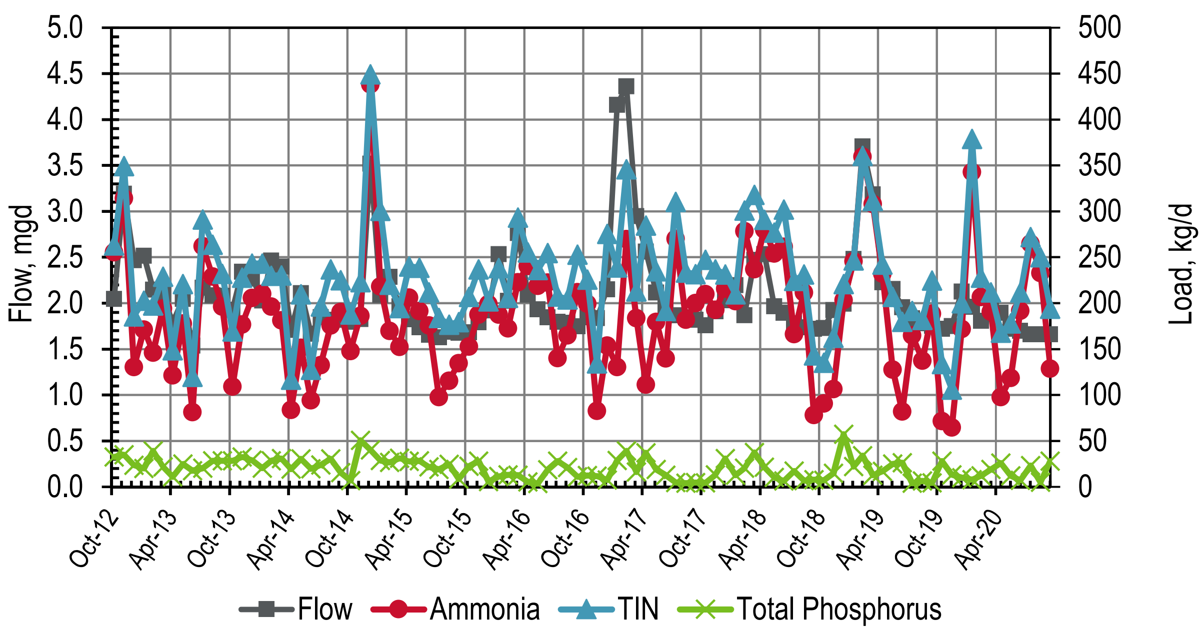

Figure 2-1. Discharge: Benicia Monthly Flows and Loads

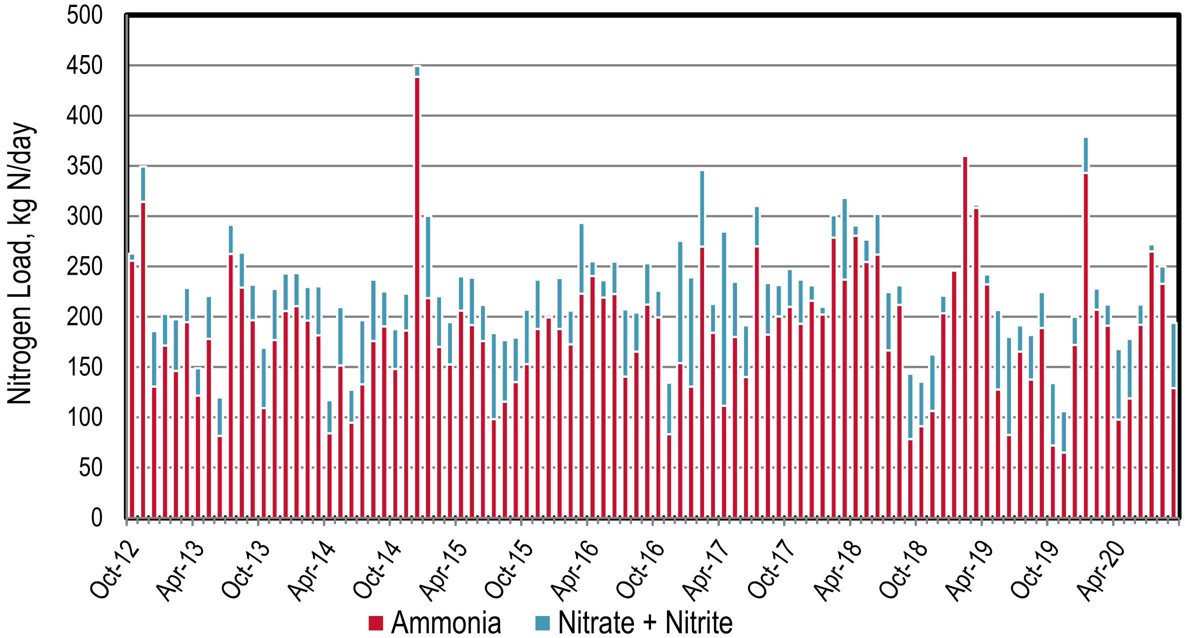

Figure 2-2. Discharge: Benicia Monthly Nitrogen Loads

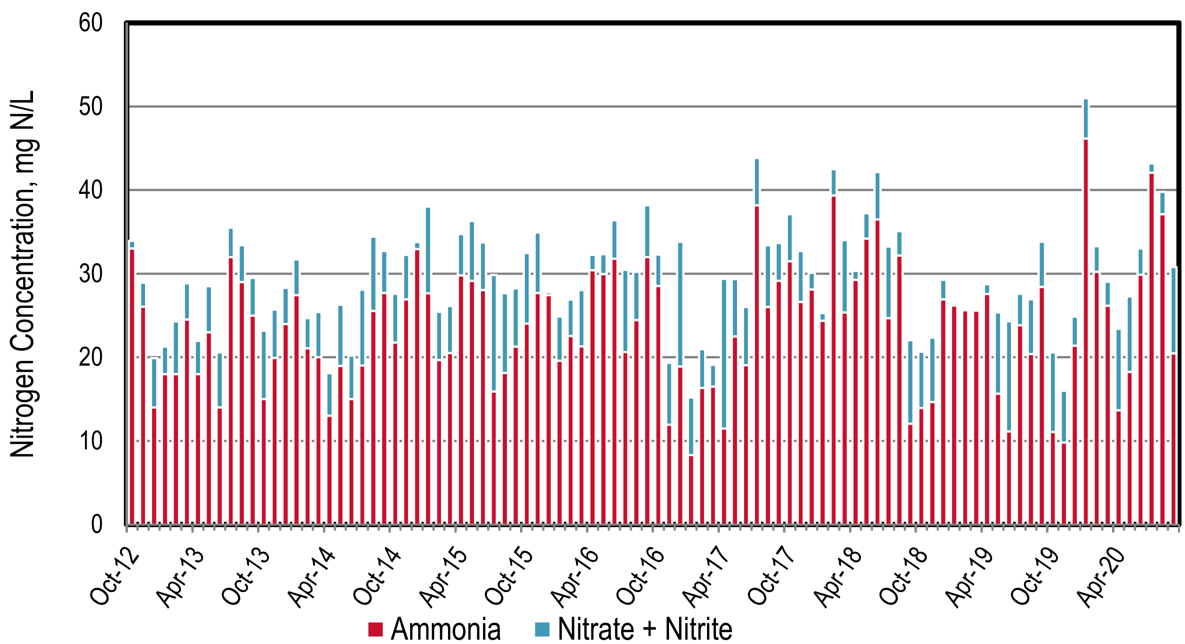

Figure 2-3. Discharge: Benicia Monthly Nitrogen Concentrations

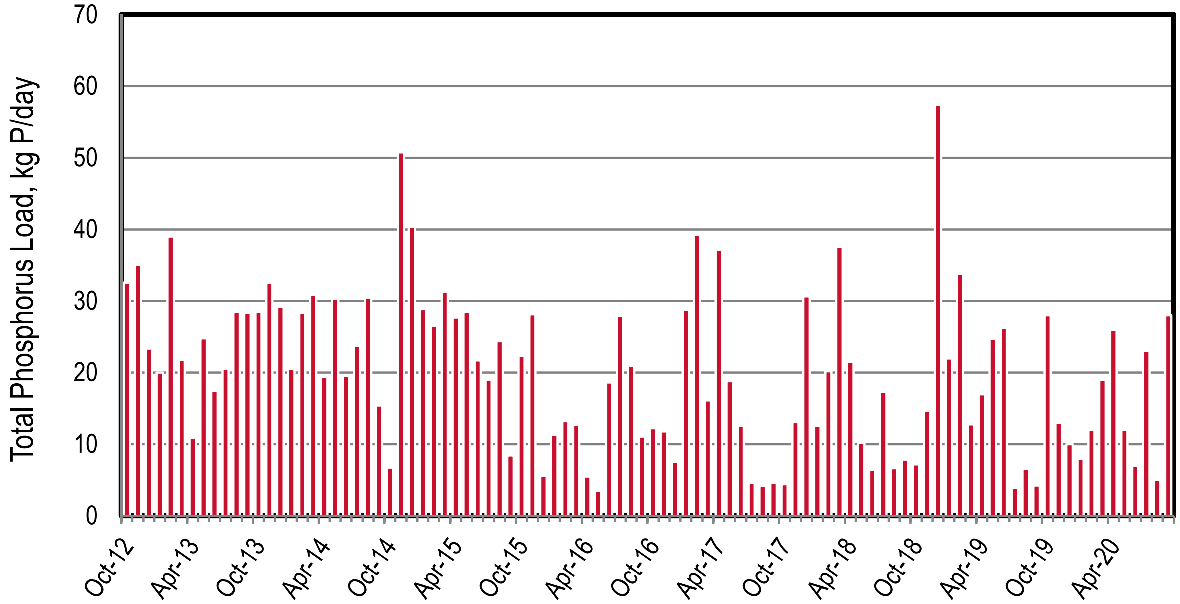

Figure 2-4. Discharge: Benicia Monthly Phosphorus Loads

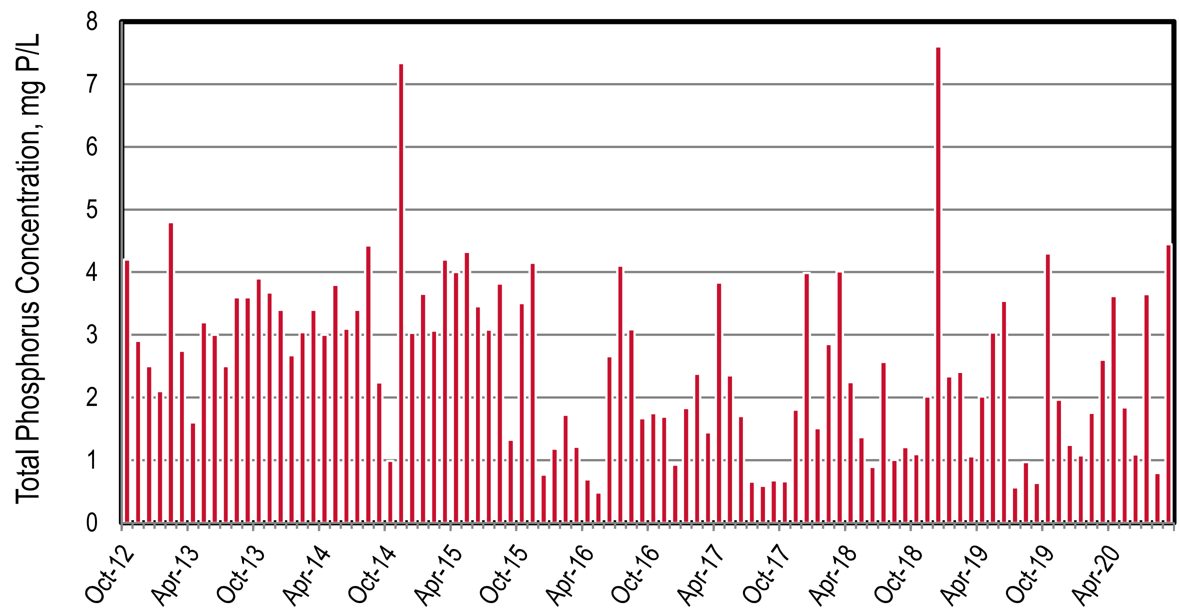

Figure 2-5. Discharge: Benicia Monthly Phosphorus Concentrations

Table 2-1. Discharge: Benicia Monthly Flows and Loads*

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	2.05	256	7.13	263	32.5
Nov-12	3.20	314	34.9	349	35.1
Dec-12	2.47	131	55.1	186	23.3
Jan-13	2.52	171	31.3	203	20.0
Feb-13	2.15	146	51.2	197	39.0
Mar-13	2.10	195	34.3	229	21.8
Apr-13	1.79	122	26.9	149	10.8
May-13	2.05	178	42.5	221	24.8
Jun-13	1.54	81.5	38.4	120	17.5
Jul-13	2.17	262	28.8	291	20.5
Aug-13	2.09	229	34.8	264	28.4
Sep-13	2.08	197	35.3	232	28.3
Oct-13	1.93	109	59.8	169	28.5
Nov-13	2.35	177	51.0	228	32.6
Dec-13	2.27	206	37.2	243	29.2
Jan-14	2.03	210	32.8	243	20.5
Feb-14	2.47	196	33.4	230	28.3
Mar-14	2.40	181	49.0	230	30.8
Apr-14	1.71	84.0	32.9	117	19.4
May-14	2.11	152	58.2	210	30.3
Jun-14	1.67	94.7	32.8	128	19.6
Jul-14	1.85	133	63.6	197	23.8
Aug-14	1.82	176	61.0	237	30.5
Sep-14	1.82	191	34.5	225	15.4
Oct-14	1.80	148	39.7	188	6.73
Nov-14	1.83	186	36.6	223	50.8
Dec-14	3.52	438	10.9	449	40.3
Jan-15	2.09	218	82.1	300	28.9
Feb-15	2.29	170	50.2	220	26.5
Mar-15	1.97	153	42.0	195	31.3
Apr-15	1.83	206	34.1	240	27.7
May-15	1.74	192	47.0	239	28.4
Jun-15	1.66	176	35.9	212	21.7
Jul-15	1.63	98.1	85.9	184	19.0
Aug-15	1.69	116	60.9	177	24.4
Sep-15	1.68	135	44.4	179	8.41

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	1.68	153	54.0	207	22.3
Nov-15	1.79	188	49.1	237	28.2
Dec-15	1.92	199	2.69	202	5.58
Jan-16	2.54	188	50.5	238	11.3
Feb-16	2.03	173	33.3	206	13.2
Mar-16	2.77	223	70.4	293	12.7
Apr-16	2.09	241	14.7	255	5.48
May-16	1.93	219	17.3	236	3.52
Jun-16	1.85	223	32.2	255	18.6
Jul-16	1.80	141	66.8	207	27.9
Aug-16	1.79	165	39.1	204	20.9
Sep-16	1.75	212	41.0	253	11.1
Oct-16	1.85	199	26.4	226	12.2
Nov-16	1.84	83.1	51.3	134	11.8
Dec-16	2.15	154	122	275	7.53
Jan-17	4.16	131	109	239	28.8
Feb-17	4.36	270	76.0	346	39.2
Mar-17	2.95	184	28.8	213	16.1
Apr-17	2.56	111	173	285	37.1
May-17	2.12	180	54.8	235	18.8
Jun-17	1.95	140	51.4	192	12.5
Jul-17	1.87	270	40.1	310	4.64
Aug-17	1.85	182	51.5	234	4.13
Sep-17	1.82	200	31.2	232	4.65
Oct-17	1.76	210	37.3	247	4.40
Nov-17	1.92	193	44.0	237	13.1
Dec-17	2.03	216	15.3	231	30.6
Jan-18	2.20	202	7.55	210	12.5
Feb-18	1.87	279	22.3	301	20.2
Mar-18	2.47	237	81.0	318	37.5
Apr-18	2.53	280	10.3	291	21.5
May-18	1.97	254	22.5	277	10.2
Jun-18	1.90	262	40.4	302	6.41
Jul-18	1.79	167	58.0	224	17.3
Aug-18	1.74	212	19.2	231	6.62
Sep-18	1.72	78.6	64.8	143	7.86
Oct-18	1.73	91.1	44.3	135	7.16

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	1.93	107	56.0	163	14.7
Dec-18	2.00	203	17.4	221	57.4
Jan-19	2.48	246	0.615	246	22.0
Feb-19	3.71	360	0.763	360	33.8
Mar-19	3.19	308	3.08	312	12.8
Apr-19	2.23	232	9.83	242	17.0
May-19	2.16	128	79.1	207	24.8
Jun-19	1.96	82.4	97.4	180	26.2
Jul-19	1.84	165	26.2	192	3.93
Aug-19	1.79	138	44.1	182	6.54
Sep-19	1.76	189	35.8	225	4.23
Oct-19	1.72	72.0	62.0	134	28.0
Nov-19	1.75	65.0	41.0	106	13.0
Dec-19	2.13	172	28.0	200	10.0
Jan-20	1.97	343	36.0	379	8.00
Feb-20	1.81	207	21.0	228	12.0
Mar-20	1.93	191	21.0	212	19.0
Apr-20	1.90	98.0	70.0	168	26.0
May-20	1.73	119	59.0	178	12.0
Jun-20	1.70	192	20.0	212	7.00
Jul-20	1.67	265	7.00	272	23.0
Aug-20	1.66	233	17.0	250	5.00
Sep-20	1.67	129	65.0	194	28.0
Dry Season Average	**1.83**	**174**	**44.6**	**219**	**16.4**
Dry Season Trend* **	**None**	**None**	**None**	**None**	**Down**
Wet Season Average	**2.26**	**193**	**41.5**	**235**	**22.4**
Average Annual	**2.08**	**185**	**42.8**	**228**	**19.9**

* The City of Benicia has sampled more intensively since September 2015 than required under the Nutrient Watershed Permit. This data represents the average monthly loads during this intensive sampling period.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

3 City of Burlingame

Burlingame discharges to South Bay, and serves approximately 16,000 service connections. The plant has a permitted ADWF capacity of 5.5 mgd and a peak permitted wet weather flow of 16 mgd. It has a current ADWF flow of approximately 2.6 mgd. The plant performs secondary treatment using activated sludge.

The following observations are made based upon the figures and table in the subsequent pages:

- The wet season average monthly flow values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
- Based on the table and figures with the average monthly values, there appears to be a dry season downward trend for flow and TP loads, with a stark TP load reduction beginning in spring 2014.
- Both nitrogen and phosphorus loads increase with flow during wet weather events.
- Wet season loads are greater and more variable year to year than the dry season loads.
- Ammonia is typically the majority of the nitrogen species discharged, regardless of season. However, from about August 2013 through June 2014 and June 2019 onward, the NOx load and concentration is significantly higher than in the preceding or subsequent year, indicating the potential occurrence of nitrification.
- Ammonia concentrations are relatively consistent throughout the year (with the exception of January 2017).
- Total phosphorus concentrations were typically above 10 mg P/L in the first two reporting years and then dropped to less than 5 mg P/L in the following years. This decrease in concentration is largely attributed to the change in sampling methodology between the Section 13267 Letter data and the Nutrient Watershed Permit dataset.

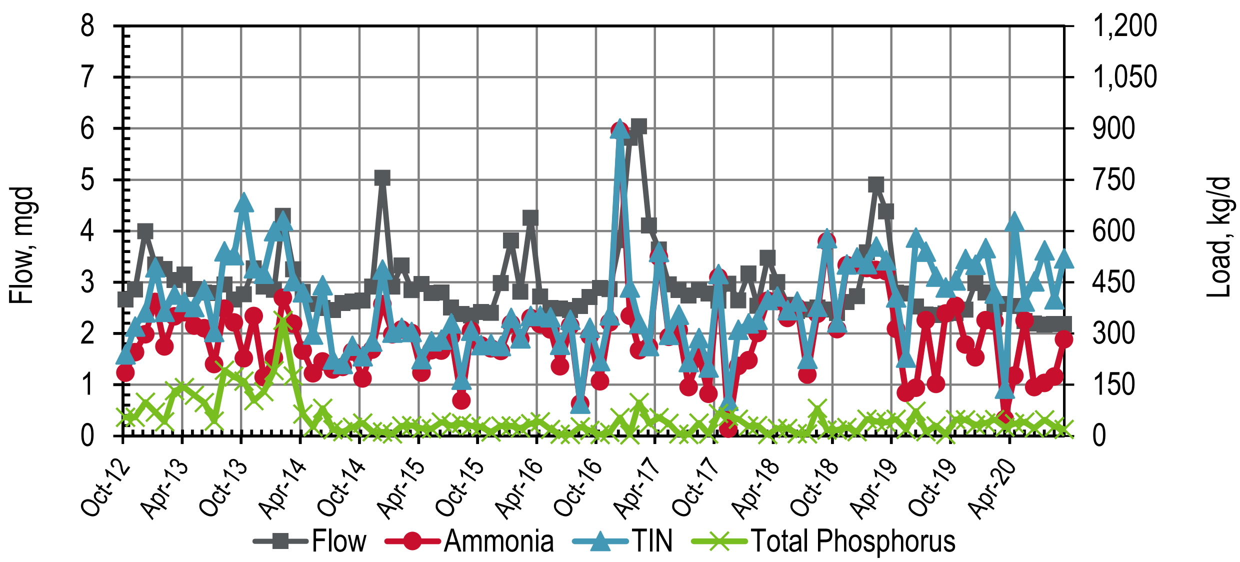

Figure 3-1. Discharge: Burlingame Monthly Flows and Loads

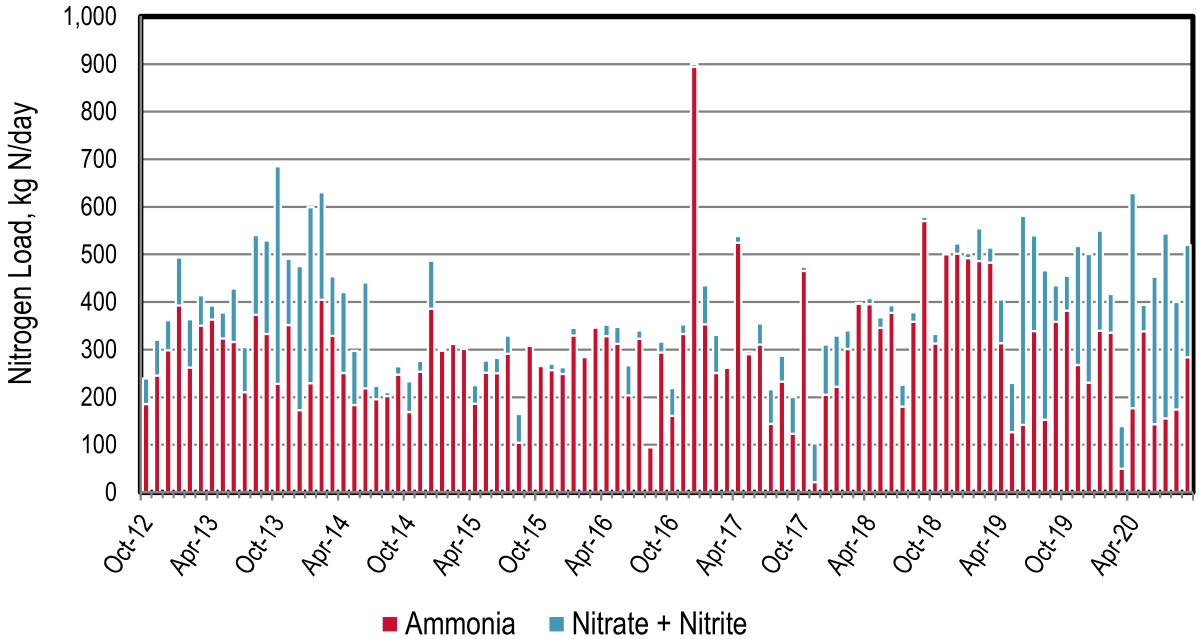

Figure 3-2. Discharge: Monthly Nitrogen Loads

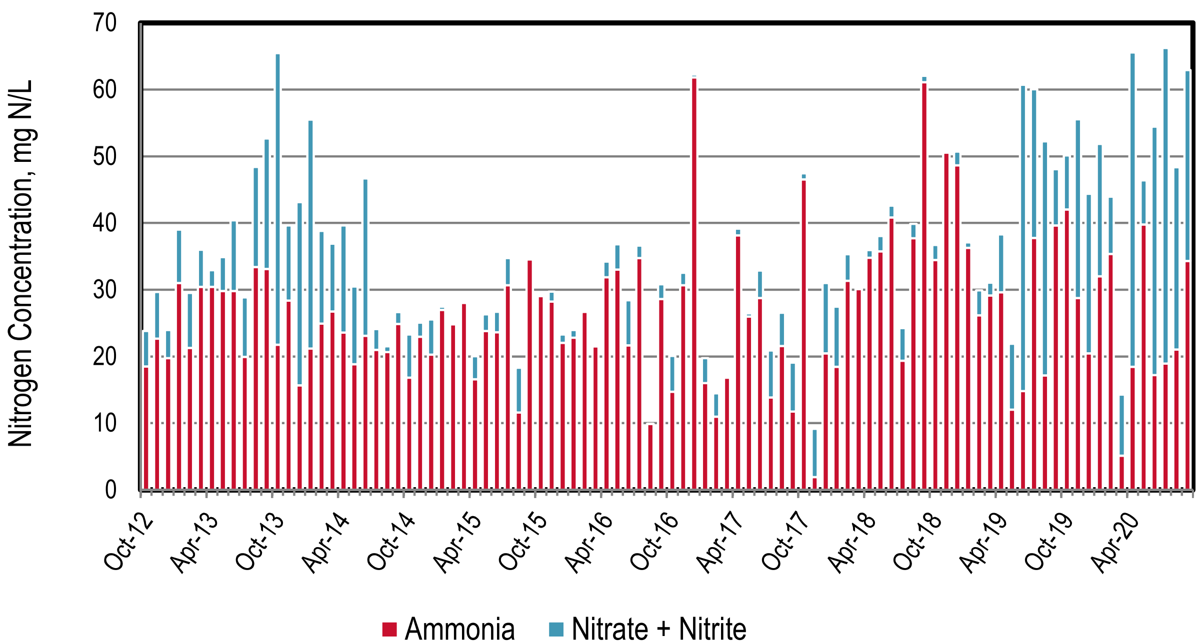

Figure 3-3. Discharge: Burlingame Monthly Nitrogen Concentrations

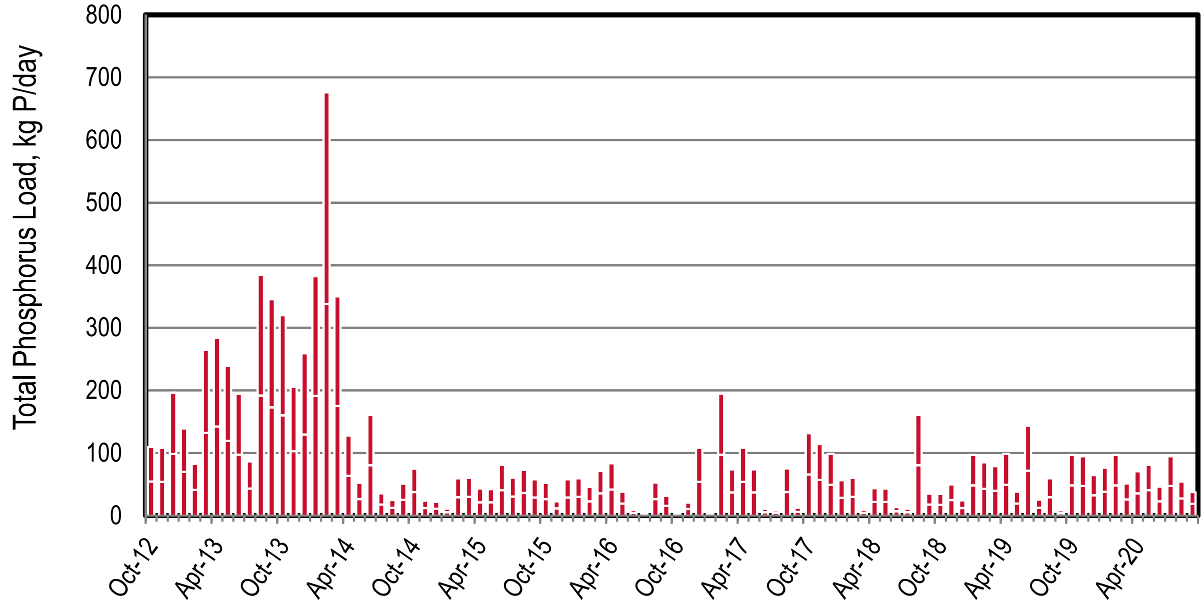

Figure 3-4. Discharge: Burlingame Monthly Phosphorus Loads

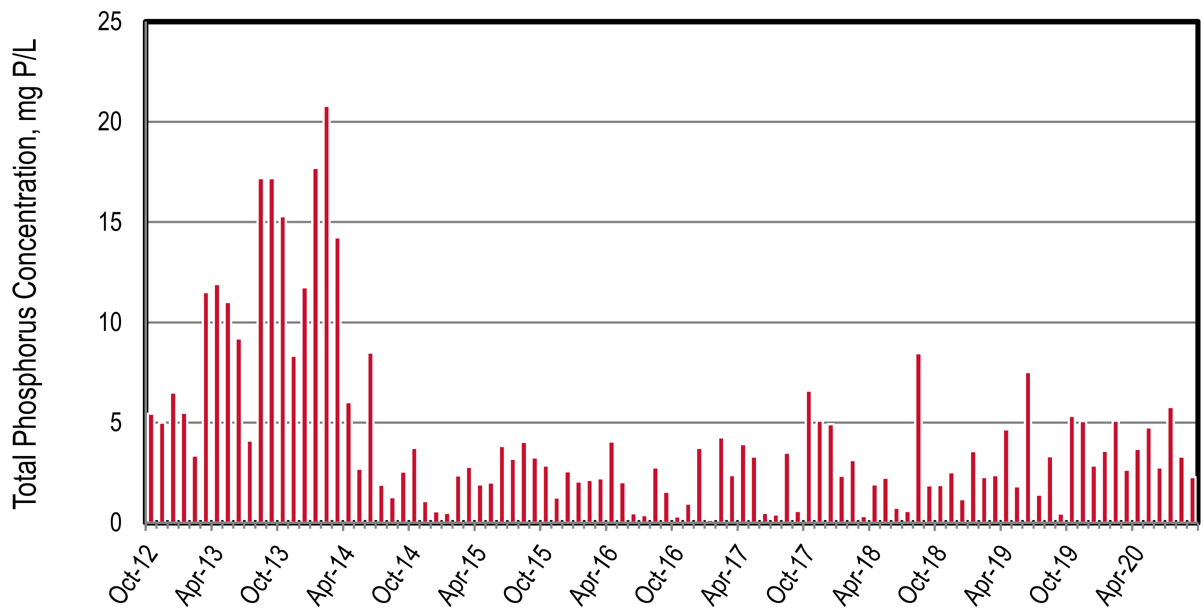

Figure 3-5. Discharge: Burlingame Monthly Phosphorus Concentrations

Table 3-1. Discharge: Burlingame Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	2.66	186	53.5	239	54.7
Nov-12	2.86	245	75.7	321	54.1
Dec-12	4.00	299	63.6	362	98.3
Jan-13	3.35	393	101	494	69.6
Feb-13	3.26	263	101	364	41.4
Mar-13	3.04	350	64.0	414	132
Apr-13	3.16	363	29.3	392	142
May-13	2.87	323	54.7	378	119
Jun-13	2.80	316	112	428	97.5
Jul-13	2.80	211	94.2	305	43.3
Aug-13	2.96	373	168	541	192
Sep-13	2.66	333	197	529	173
Oct-13	2.77	228	457	685	160
Nov-13	3.28	351	139	491	103
Dec-13	2.92	173	303	475	130
Jan-14	2.86	229	370	599	191
Feb-14	4.30	405	226	631	338
Mar-14	3.25	329	125	454	175
Apr-14	2.81	251	171	421	63.9
May-14	2.58	184	114	297	26.3
Jun-14	2.50	218	223	441	80.3
Jul-14	2.46	195	28.9	224	17.7
Aug-14	2.59	202	8.56	211	12.5
Sep-14	2.63	248	17.3	265	25.4
Oct-14	2.65	169	65.0	234	37.4
Nov-14	2.92	254	22.9	276	12.0
Dec-14	5.04	386	101	487	11.0
Jan-15	2.92	298	5.15	303	5.50
Feb-15	3.33	312	4.73	317	29.7
Mar-15	2.85	302	2.69	305	30.1
Apr-15	2.97	186	39.0	225	21.5
May-15	2.79	251	25.8	277	21.2
Jun-15	2.80	250	32.4	283	40.6
Jul-15	2.51	291	38.7	330	30.3
Aug-15	2.38	105	60.2	165	36.3
Sep-15	2.36	308	0.727	309	29.1

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	2.42	266	0.683	266	26.2
Nov-15	2.41	257	13.6	270	11.5
Dec-15	2.99	249	14.1	263	29.1
Jan-16	3.82	329	16.7	346	29.7
Feb-16	2.82	284	1.76	286	22.8
Mar-16	4.26	346	5.12	351	35.7
Apr-16	2.72	328	24.2	352	41.7
May-16	2.50	312	35.7	348	19.2
Jun-16	2.49	204	63.2	267	4.60
Jul-16	2.46	323	17.4	340	3.56
Aug-16	2.54	94.6	0.185	94.8	26.5
Sep-16	2.72	294	23.1	317	15.8
Oct-16	2.89	161	58.5	219	3.53
Nov-16	2.87	333	20.1	353	10.4
Dec-16	3.83	894	6.25	901	53.9
Jan-17	5.82	353	82.0	435	3.35
Feb-17	6.05	251	79.7	331	97.4
Mar-17	4.11	261	1.92	263	36.9
Apr-17	3.64	525	14.3	539	54.1
May-17	2.96	291	5.33	296	37.1
Jun-17	2.86	311	44.4	355	5.39
Jul-17	2.74	144	72.8	217	4.33
Aug-17	2.86	233	53.9	287	37.7
Sep-17	2.78	123	76.8	200	6.19
Oct-17	2.64	465	8.83	474	65.9
Nov-17	2.97	21.5	81.5	103	57.2
Dec-17	2.65	205	106	311	49.2
Jan-18	3.18	222	108	330	28.2
Feb-18	2.55	302	38.4	340	30.2
Mar-18	3.48	396	2.27	398	4.41
Apr-18	3.01	396	12.6	408	21.9
May-18	2.56	346	22.2	368	21.7
Jun-18	2.44	377	16.2	393	6.88
Jul-18	2.47	181	45.7	226	5.51
Aug-18	2.51	359	20.3	379	80.4
Sep-18	2.47	570	9.05	579	17.5
Oct-18	2.40	313	20.5	333	17.2

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	2.62	501	1.36	502	25.0
Dec-18	2.73	502	21.3	523	12.3
Jan-19	3.59	492	11.0	503	48.5
Feb-19	4.91	486	68.8	555	42.5
Mar-19	4.38	483	32.2	515	39.4
Apr-19	2.80	314	91.9	406	49.3
May-19	2.78	126	103	230	19.1
Jun-19	2.53	142	439	581	71.9
Jul-19	2.38	339	201	540	12.6
Aug-19	2.36	153	313	466	29.7
Sep-19	2.40	359	76.3	435	4.14
Oct-19	2.40	382	73.6	455	48.4
Nov-19	2.47	268	250	518	47.3
Dec-19	2.99	231	270	501	32.3
Jan-20	2.81	340	210	550	38.1
Feb-20	2.51	336	81.0	417	48.4
Mar-20	2.57	49.8	89.2	139	25.8
Apr-20	2.54	177	452	629	35.4
May-20	2.25	338	56.0	394	40.5
Jun-20	2.20	143	310	453	23.1
Jul-20	2.17	155	388	544	47.5
Aug-20	2.19	174	226	400	27.4
Sep-20	2.18	284	236	520	18.9
Dry Season Average	**2.56**	**255**	**101**	**355**	**38.3**
Dry Season Trend **	**Down**	**None**	**None**	**None**	**Down**
Wet Season Average	**3.21**	**316**	**87.3**	**403**	**55.8**
Average Annual	**2.94**	**290**	**92.9**	**383**	**48.5**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

4 Central Contra Costa Sanitary District (Central San)

Central San discharges to Suisun Bay, and serves approximately 118,000 service connections. The plant has a permitted ADWF capacity of 53.8 mgd and a peak wet weather influent design flow of 250 mgd. It has a current ADWF discharge flow of approximately 32 mgd. The plant performs secondary treatment using activated sludge.

The following observations are made based upon the figures and table in the subsequent pages:

- Influent and Load Reduction Across the Plant
  - Note: influent flow and loads limited to data since July 2019; quarterly sampling is required but agency samples at a higher frequency for various parameters.
  - Based on the average monthly values table below, there are no emerging dry season trends.
  - The monthly average flow reduction across the plant ranges from 3 to 19 percent. This reduction is attributed to recycled water, water bound with biosolids, evaporation, etc.
  - The monthly average nitrogen load reduction values across the plant ranges from 40 to 60 percent. This load reduction is attributed primarily to biological assimilation in the activated sludge system and load diversion with recycled water.
  - The monthly average phosphorus load reduction across the plant ranges from 80 to 93 percent. This reduction is primarily attributed to biological phosphorus removal in the activated sludge system occurring as a result of operating an anaerobic selector for improved settleability.
- Discharge
  - The wet season average monthly flow values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012. This is attributed to a combination of the global pandemic and a relatively dry year.
  - Based on the table and figures with the average monthly values, there are no trends for flow or nutrient loads. While the statistical analyzes suggest no trends, the ammonia and TIN dataset for 2019/2020 suggests an increase in loads (refer to Figure 4-3 and Table 4-2).
  - Ammonia and TIN loads increase with flow during wet weather events.
  - Wet season loads are typically greater than the dry season loads.
  - Ammonia is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant is not designed to nitrify.
  - Ammonia concentrations are greatest during the dry season and it becomes more pronounced towards the end of the dry season.
  - Total phosphorus concentrations are generally less than 2 mg P/L. This indicates the plant is reliably removing phosphorus.

Influent

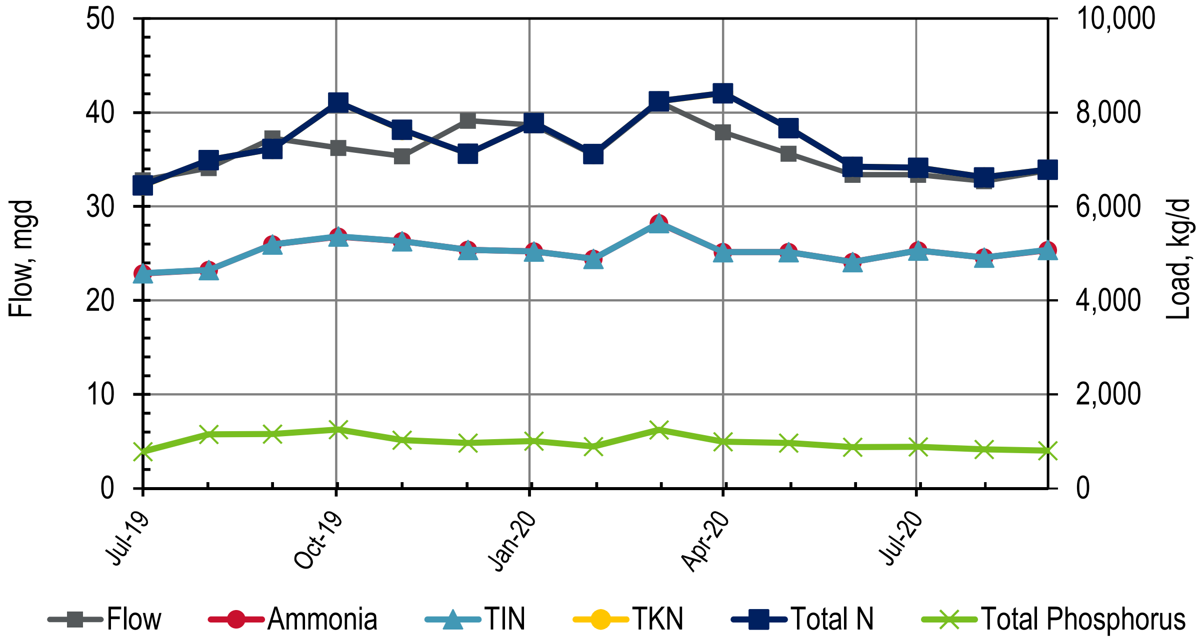

Figure 4-1. Influent: Central San Monthly Flows and Loads

Note: the ammonia/TIN loads and TKN/Total N loads are comparable. The ammonia and TKN values are located behind TIN and Total N loads and thus are not visible.

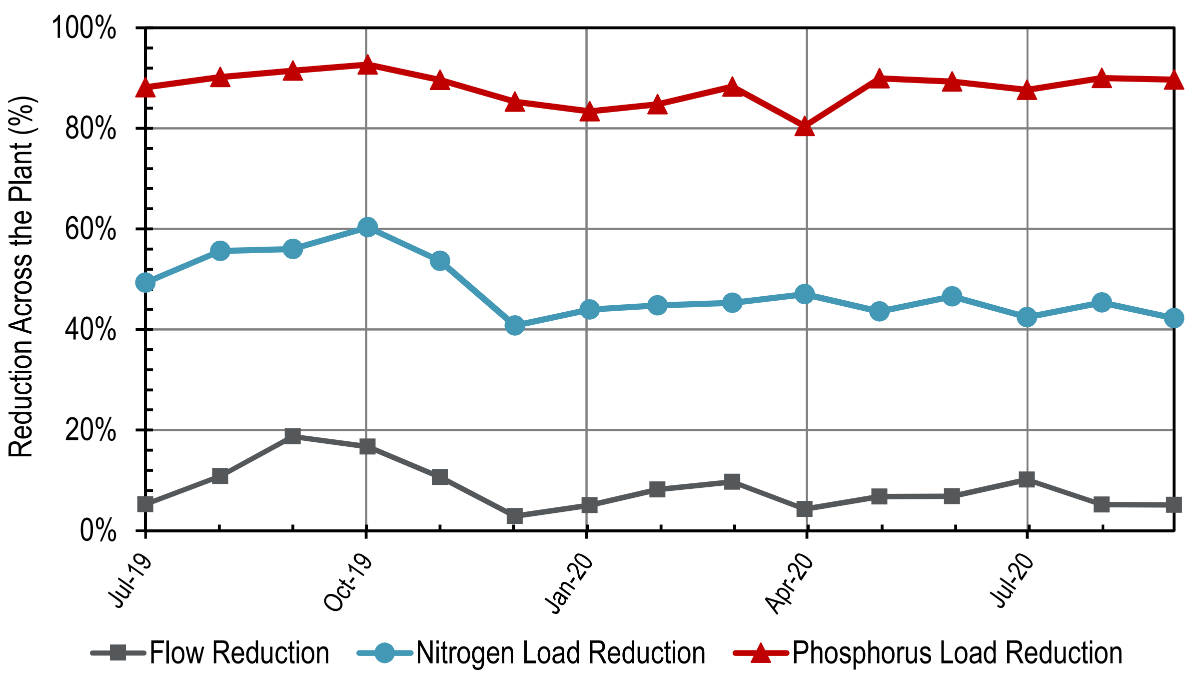

Figure 4-2. Influent: Central San Monthly Reductions Across the Plant

Note: Influent Total N was compared against Discharge TIN for calculating nitrogen load reduction.

Table 4-1. Influent: Central San Monthly Flows and Loads*

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	32.8	4,580	4.73	4,580	6,450	6,450	784
Aug-19	34.1	4,650	0.591	4,650	6,990	6,990	1,150
Sep-19	37.3	5,190	2.82	5,190	7,230	7,230	1,160
Oct-19	36.2	5,360	2.50	5,360	8,210	8,210	1,250
Nov-19	35.4	5,260	1.17	5,260	7,630	7,630	1,030
Dec-19	39.1	5,080	1.14	5,080	7,130	7,130	965
Jan-20	38.7	5,040	2.24	5,040	7,780	7,780	1,010
Feb-20	35.5	4,890	1.08	4,890	7,120	7,120	895
Mar-20	41.1	5,650	2.68	5,650	8,240	8,240	1,240
Apr-20	37.9	5,030	1.34	5,030	8,410	8,420	993
May-20	35.6	5,030	0.959	5,030	7,670	7,670	970
Jun-20	33.4	4,820	0.950	4,820	6,850	6,850	882
Jul-20	33.4	5,060	1.12	5,060	6,830	6,830	889
Aug-20	32.7	4,910	3.16	4,920	6,620	6,630	829
Sep-20	33.8	5,070	4.36	5,070	6,790	6,790	806
Dry Season Average	**34.1**	**4,910**	**2.34**	**4,920**	**6,930**	**6,930**	**934**
Dry Season Trend * **	**None**	**None**	**None**	**None**	**None**	**None**	**None**
Wet Season Average	**37.7**	**5,190**	**1.73**	**5,190**	**7,790**	**7,790**	**1,060**
Average Annual	**35.8**	**5,040**	**2.05**	**5,040**	**7,330**	**7,330**	**991**

* Central San typically samples more than the required influent quarterly sampling. This dataset includes this additional sampling.

** The Total Inorganic Nitrogen value is calculated by adding the "Ammonia" and "Nitrate + Nitrite" values. The Total Nitrogen value is calculated by adding "TKN" and "Nitrate + Nitrite".

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

Discharge

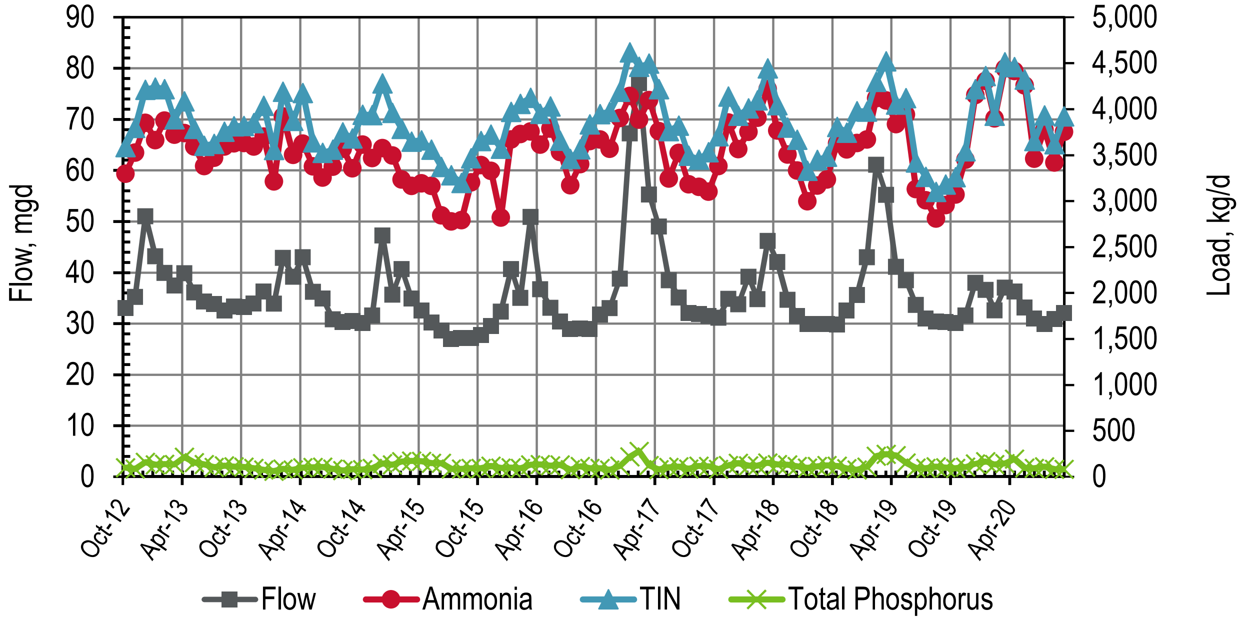

Figure 4-3. Discharge: Central San Monthly Flows and Loads

Table 4-2. Discharge: Central San Monthly Flows and Loads

Month, Year	Flow	Ammonia***	Nitrate + Nitrite	TIN*, ***	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	33.1	3,300	290	3,590	102
Nov-12	35.3	3,530	269	3,800	85.5
Dec-12	51.1	3,850	357	4,210	159
Jan-13	43.2	3,670	569	4,240	131
Feb-13	40.0	3,880	340	4,220	139
Mar-13	37.6	3,720	170	3,890	137
Apr-13	39.9	3,740	344	4,090	216
May-13	36.1	3,600	191	3,790	156
Jun-13	34.4	3,380	220	3,600	135
Jul-13	33.9	3,470	149	3,620	102
Aug-13	32.6	3,600	160	3,760	123
Sep-13	33.4	3,630	184	3,810	111
Oct-13	33.3	3,640	182	3,820	108
Nov-13	34.0	3,600	255	3,850	92.0
Dec-13	36.3	3,700	336	4,040	77.5
Jan-14	34.0	3,220	342	3,560	62.5
Feb-14	42.9	3,920	270	4,190	85.0

Month, Year	Flow	Ammonia***	Nitrate + Nitrite	TIN*, ***	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Mar-14	39.2	3,500	370	3,870	77.5
Apr-14	43.0	3,630	550	4,180	99.5
May-14	36.3	3,380	264	3,640	106
Jun-14	35.0	3,260	268	3,530	109
Jul-14	30.9	3,380	182	3,560	86.5
Aug-14	30.4	3,570	178	3,750	67.6
Sep-14	30.5	3,360	325	3,680	82.7
Oct-14	30.2	3,620	323	3,940	81.1
Nov-14	31.7	3,470	465	3,940	92.1
Dec-14	47.3	3,580	705	4,280	146
Jan-15	35.7	3,500	463	3,960	130
Feb-15	40.7	3,240	550	3,790	165
Mar-15	35.0	3,170	479	3,650	175
Apr-15	32.6	3,200	467	3,660	172
May-15	30.3	3,170	395	3,560	149
Jun-15	28.7	2,850	524	3,370	149
Jul-15	27.0	2,780	501	3,280	85.2
Aug-15	27.2	2,790	406	3,200	85.5
Sep-15	27.2	3,210	260	3,470	92.9
Oct-15	27.8	3,400	260	3,660	93.6
Nov-15	29.6	3,330	393	3,720	116
Dec-15	32.4	2,820	747	3,570	95.7
Jan-16	40.7	3,670	302	3,970	101
Feb-16	35.1	3,730	327	4,060	94.7
Mar-16	50.9	3,760	365	4,120	130
Apr-16	36.8	3,620	333	3,950	136
May-16	33.1	3,790	239	4,030	122
Jun-16	30.5	3,540	120	3,660	130
Jul-16	29.0	3,180	283	3,460	80.0
Aug-16	29.1	3,410	159	3,560	115
Sep-16	28.9	3,660	178	3,830	92.7
Oct-16	31.8	3,670	277	3,950	93.9
Nov-16	33.1	3,570	402	3,970	75.1
Dec-16	38.8	3,910	284	4,190	117
Jan-17	67.3	4,140	475	4,620	219
Feb-17	77.1	3,890	574	4,460	278
Mar-17	55.4	4,100	397	4,500	124

Month, Year	Flow	Ammonia***	Nitrate + Nitrite	TIN*, ***	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Apr-17	49.1	3,760	454	4,220	81.2
May-17	38.6	3,250	515	3,760	105
Jun-17	35.1	3,520	296	3,820	109
Jul-17	32.1	3,190	309	3,490	87.7
Aug-17	32.0	3,160	293	3,450	118
Sep-17	31.6	3,110	428	3,530	116
Oct-17	31.2	3,390	323	3,710	83.9
Nov-17	34.9	3,860	282	4,140	125
Dec-17	33.8	3,570	363	3,930	148
Jan-18	39.2	3,760	252	4,010	123
Feb-18	34.8	3,910	188	4,100	121
Mar-18	46.2	4,220	221	4,440	154
Apr-18	42.1	3,770	274	4,050	136
May-18	34.7	3,510	292	3,800	132
Jun-18	31.6	3,340	333	3,670	114
Jul-18	29.9	3,000	362	3,330	95.7
Aug-18	30.0	3,170	277	3,450	113
Sep-18	30.0	3,240	247	3,480	124
Oct-18	29.9	3,630	178	3,810	119
Nov-18	32.6	3,560	180	3,740	89.2
Dec-18	35.7	3,630	336	3,980	75.5
Jan-19	43.1	3,670	303	3,980	107
Feb-19	61.2	4,120	156	4,300	224
Mar-19	55.2	4,100	425	4,520	247
Apr-19	41.1	3,840	252	4,050	233
May-19	38.5	3,940	177	4,120	154
Jun-19	33.7	3,130	289	3,420	95.4
Jul-19	31.1	3,010	257	3,270	92.8
Aug-19	30.4	2,810	287	3,100	113
Sep-19	30.3	2,960	223	3,180	99.4
Oct-19	30.2	3,070	187	3,260	91.8
Nov-19	31.6	3,450	90.6	3,540	107
Dec-19	38.0	4,160	62.1	4,220	142
Jan-20	36.7	4,310	52.4	4,360	168
Feb-20	32.6	3,900	28.3	3,930	136
Mar-20	37.1	4,440	65.0	4,510	146
Apr-20	36.3	4,420	44.6	4,460	194

Month, Year	Flow	Ammonia***	Nitrate + Nitrite	TIN*, ***	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
May-20	33.2	4,260	62.7	4,330	97.8
Jun-20	31.1	3,460	191	3,660	94.2
Jul-20	30.0	3,780	152	3,930	110
Aug-20	31.0	3,420	199	3,620	83.1
Sep-20	32.2	3,760	166	3,920	83.2
Dry Season Average	**31.8**	**3,350**	**264**	**3,610**	**108**
Dry Season Trend **	**None**	**None**	**None**	**None**	**None**
Wet Season Average	**39.4**	**3,690**	**321**	**4,010**	**130**
Average Annual	**36.2**	**3,550**	**297**	**3,850**	**121**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

*** The statistical analysis does not capture the ammonia and TIN load increase associated with the 2020 dry season.

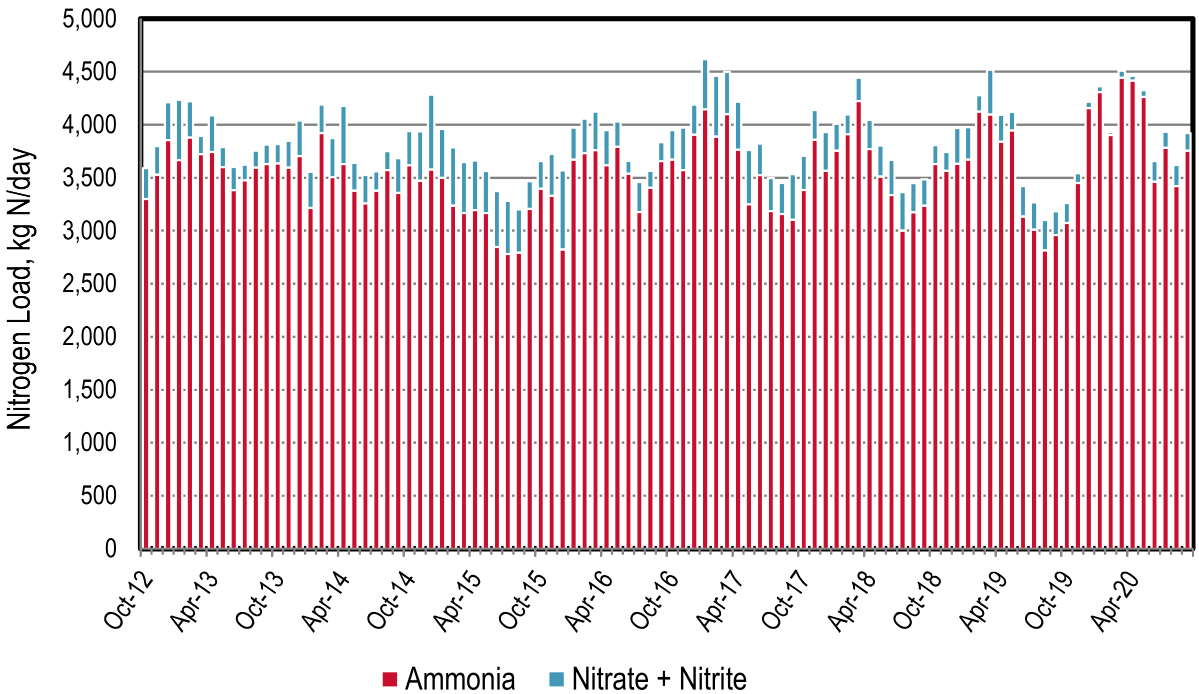

Figure 4-4. Discharge: Central San Monthly Nitrogen Loads

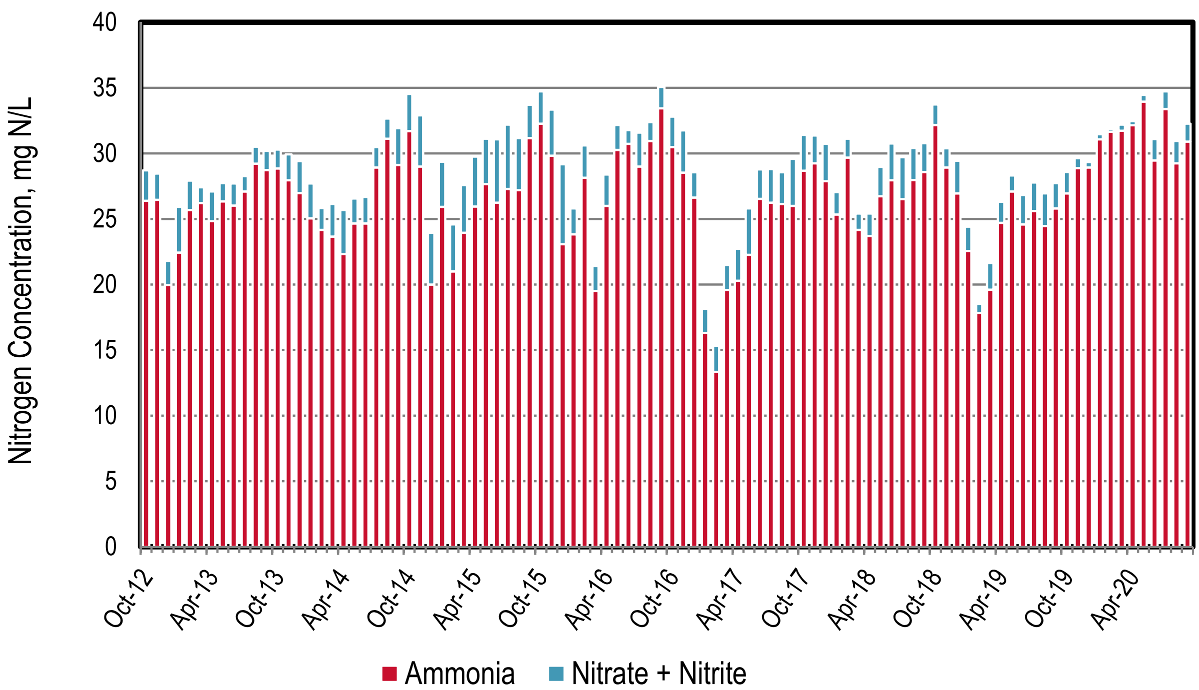

Figure 4-5. Discharge: Central San Monthly Nitrogen Concentrations

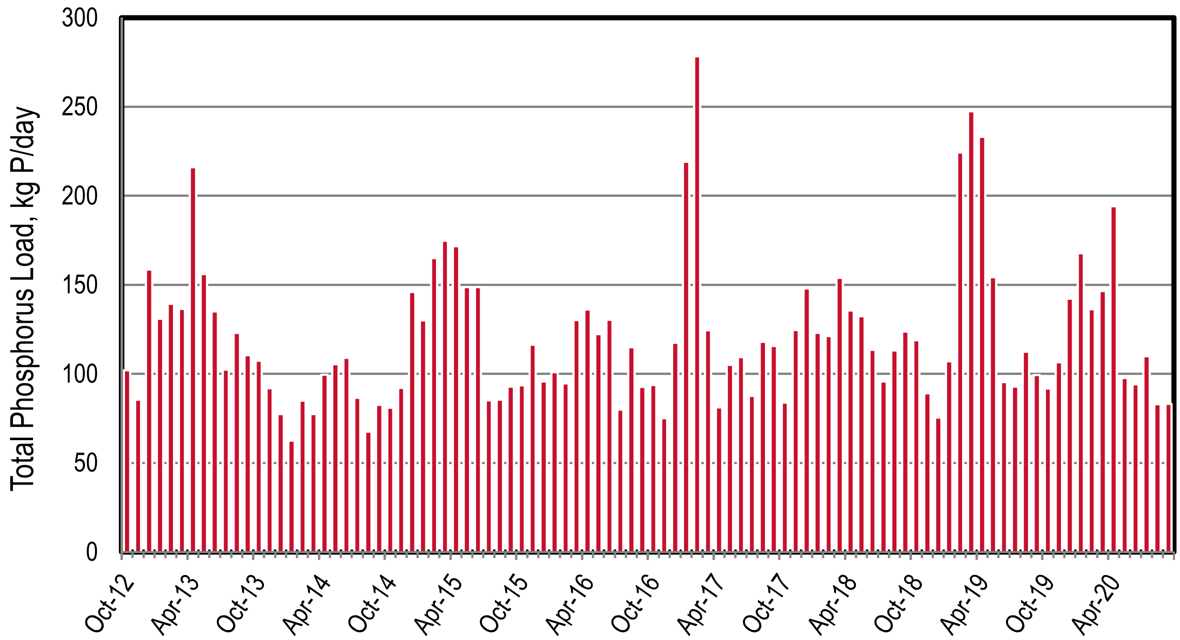

Figure 4-6. Discharge: Central San Monthly Phosphorus Loads

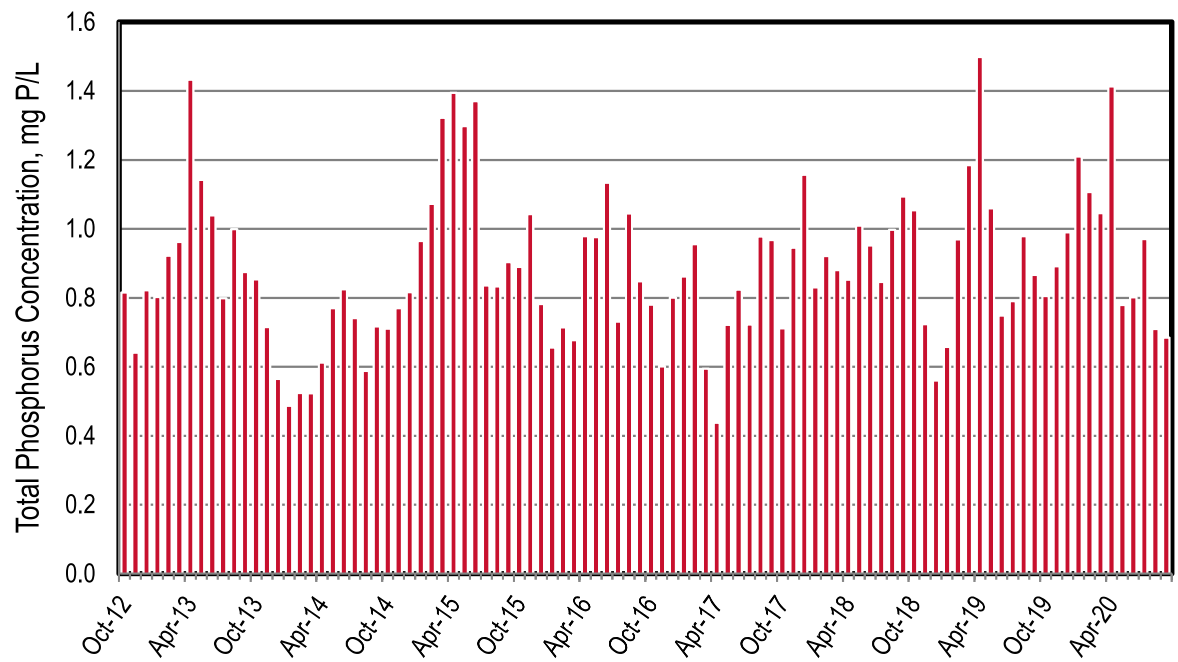

Figure 4-7. Discharge: Central San Monthly Phosphorus Concentrations

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5 Central Marin Sanitation Agency (CMSA)

CMSA discharges to the Central Bay Subembayment and serves approximately 105,000 people via 52,200 service connections. The plant has a permitted ADWF capacity of 10.0 mgd. It has a current ADWF flow of approximately 6.3 mgd. The plant performs secondary treatment using a trickling filter and activated sludge process.

The following observations are made based upon the figures and table in the subsequent pages:

- Both nitrogen and phosphorus loads increase with flow during wet weather events.
- Based on the table and figures with the average monthly values, there appears to be an upward dry season trend for flow and all the nutrient species analyzed (except for NOx).
- Ammonia is the majority of the nitrogen species discharged, regardless of season. This would be expected since the plant was not designed to nitrify (some nitrification does occur in the secondary process, most likely in the biotowers).
- Ammonia and TIN concentrations increase during the dry weather season as flows decrease and temperatures increase.
- Total phosphorus concentrations range from less than 1 mg P/L to 6 mg P/L.

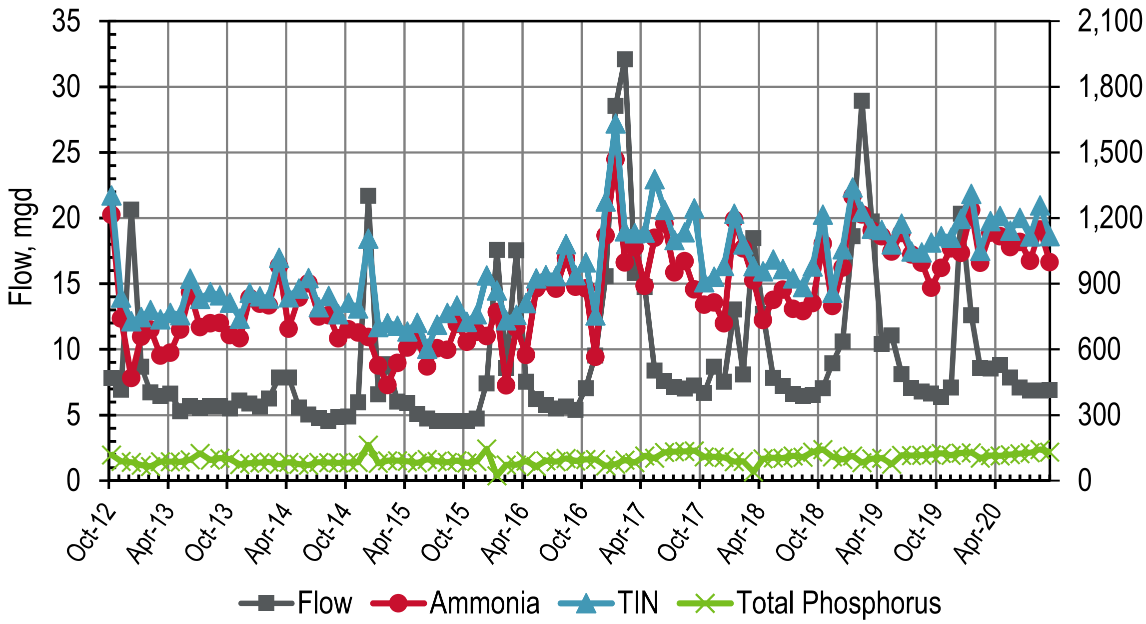

Figure 5-1. Discharge: CMSA Monthly Flows and Loads

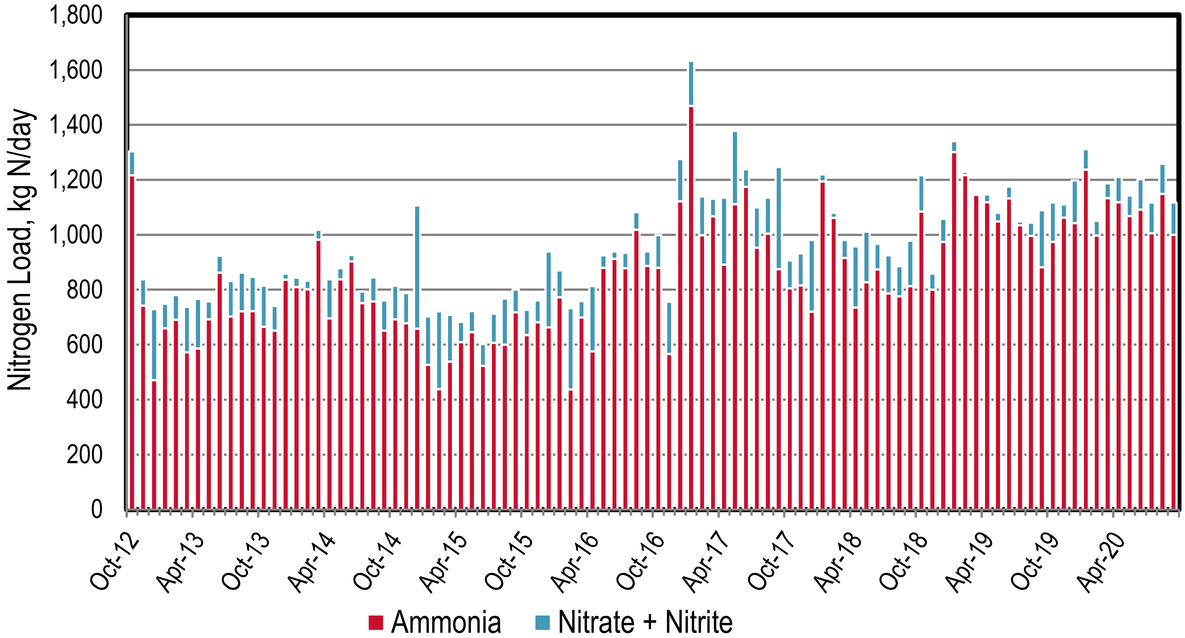

Figure 5-2. Discharge: CMSA Monthly Nitrogen Loads

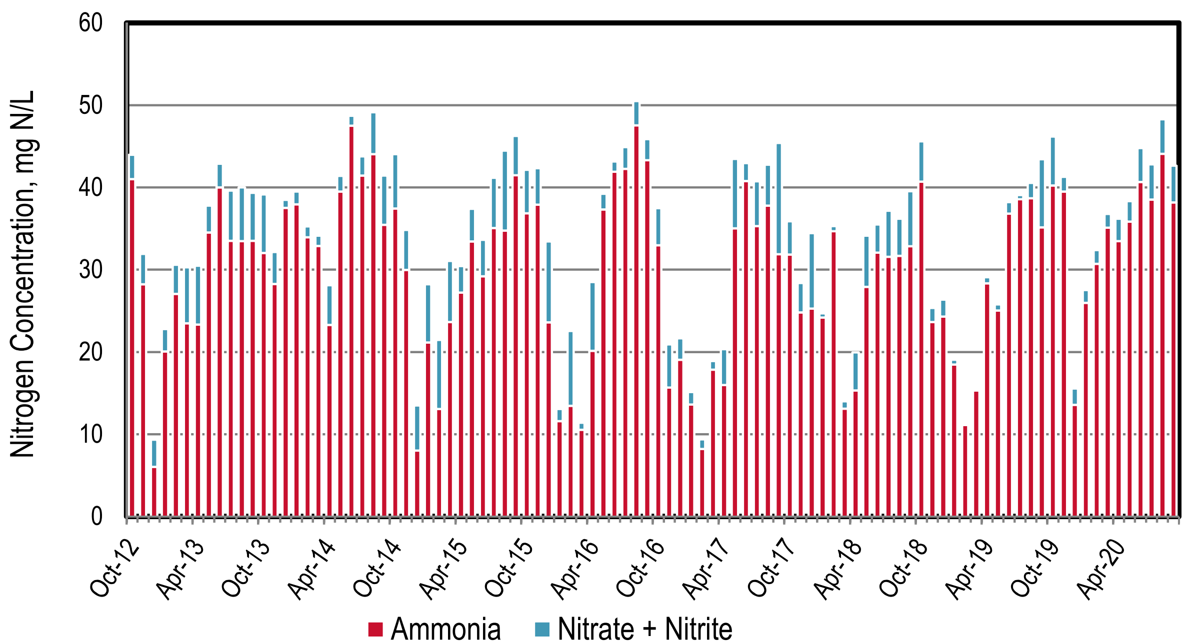

Figure 5-3. Discharge: CMSA Monthly Nitrogen Concentrations

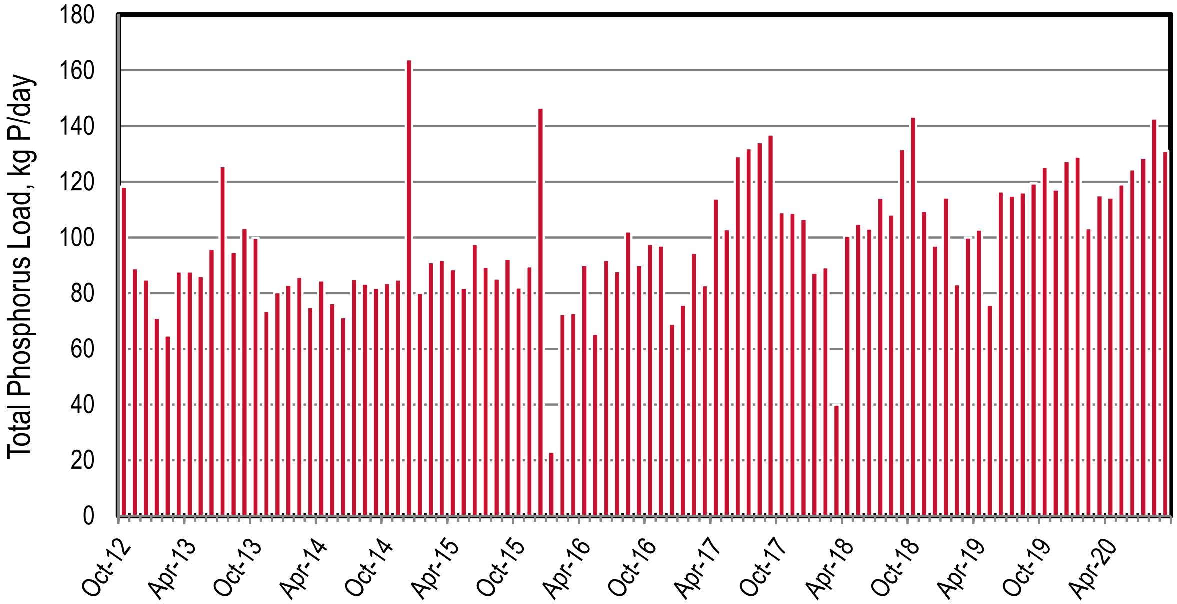

Figure 5-4. Discharge: CMSA Monthly Phosphorus Loads

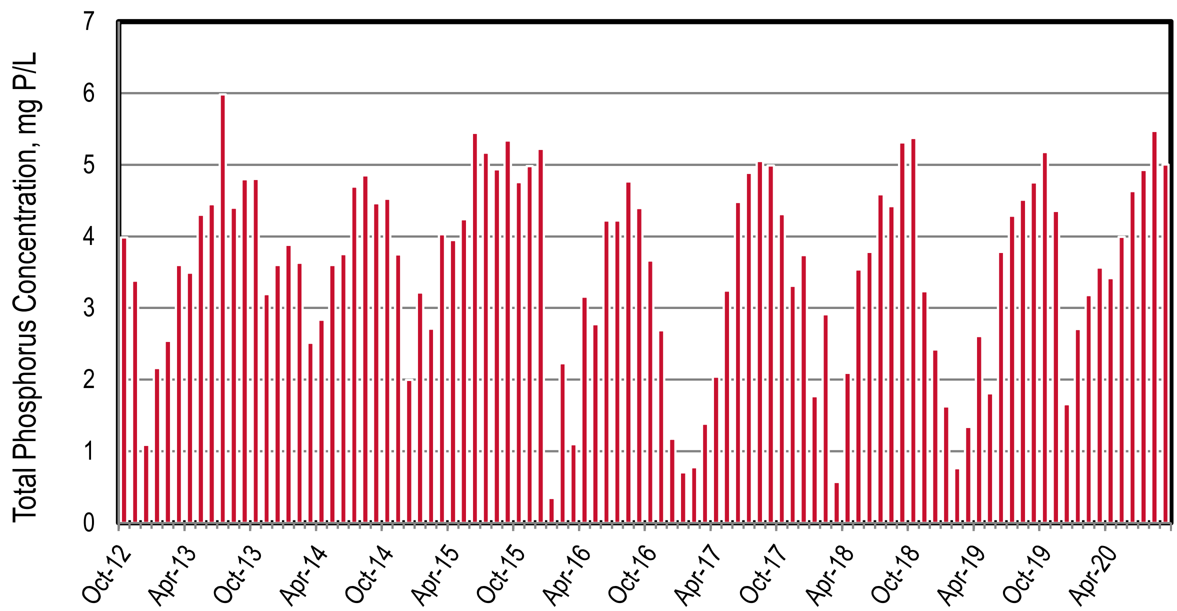

Figure 5-5. Discharge: CMSA Monthly Phosphorus Concentrations

Table 5-1. Discharge: CMSA Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	7.85	1,220	87.5	1,300	118
Nov-12	6.95	742	96.3	838	88.9
Dec-12	20.7	471	258	729	84.9
Jan-13	8.70	660	89.3	749	71.1
Feb-13	6.75	691	90.2	781	64.8
Mar-13	6.45	573	165	738	87.7
Apr-13	6.65	586	180	767	87.8
May-13	5.30	692	65.2	757	86.1
Jun-13	5.70	862	61.6	923	95.9
Jul-13	5.55	703	128	831	126
Aug-13	5.70	721	140	862	94.8
Sep-13	5.70	722	125	847	103
Oct-13	5.50	666	148	814	99.8
Nov-13	6.10	652	89.5	741	73.7
Dec-13	5.90	836	22.4	859	80.3
Jan-14	5.65	810	32.8	843	82.9
Feb-14	6.25	802	31.0	833	85.8
Mar-14	7.90	982	36.5	1,020	75.0
Apr-14	7.90	695	143	838	84.6
May-14	5.61	838	40.6	878	76.3
Jun-14	5.03	903	22.6	926	71.3
Jul-14	4.80	752	41.9	794	85.1
Aug-14	4.55	757	87.6	845	83.4
Sep-14	4.86	651	110	761	82.0
Oct-14	4.89	692	122	814	83.7
Nov-14	5.99	678	110	788	84.9
Dec-14	21.7	658	449	1,110	164
Jan-15	6.59	527	176	703	80.1
Feb-15	8.89	439	283	721	91.2
Mar-15	6.03	539	169	708	91.9
Apr-15	5.93	610	72.4	682	88.5
May-15	5.11	645	77.0	722	81.9
Jun-15	4.74	524	79.5	603	97.6
Jul-15	4.58	607	106	713	89.5
Aug-15	4.57	600	168	768	85.2
Sep-15	4.58	718	82.6	800	92.4

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	4.56	636	91.4	727	82.1
Nov-15	4.76	681	79.6	761	89.6
Dec-15	7.43	663	277	939	147
Jan-16	17.6	772	98.1	870	23.1
Feb-16	8.59	438	296	733	72.4
Mar-16	17.6	700	58.8	758	72.8
Apr-16	7.55	575	238	813	90.1
May-16	6.24	880	45.1	925	65.4
Jun-16	5.76	913	26.8	940	92.0
Jul-16	5.51	879	55.7	935	87.9
Aug-16	5.67	1,020	63.8	1,080	102
Sep-16	5.42	887	52.5	939	90.0
Oct-16	7.05	880	120	999	97.7
Nov-16	9.56	567	189	756	97.1
Dec-16	15.6	1,120	154	1,280	69.0
Jan-17	28.6	1,470	163	1,630	75.8
Feb-17	32.1	999	141	1,140	94.4
Mar-17	15.8	1,070	63.7	1,130	82.8
Apr-17	14.8	892	243	1,130	114
May-17	8.39	1,110	267	1,380	103
Jun-17	7.62	1,170	63.5	1,240	129
Jul-17	7.15	953	147	1,100	132
Aug-17	7.03	1,000	132	1,140	134
Sep-17	7.26	875	371	1,250	137
Oct-17	6.69	805	102	907	109
Nov-17	8.69	816	117	932	109
Dec-17	7.54	720	261	982	107
Jan-18	13.1	1,190	25.5	1,220	87.3
Feb-18	8.10	1,060	18.6	1,080	89.2
Mar-18	18.5	916	64.3	981	39.9
Apr-18	12.7	736	222	957	101
May-18	7.84	828	184	1,010	105
Jun-18	7.21	874	93.3	967	103
Jul-18	6.59	786	139	926	114
Aug-18	6.48	776	110	886	108
Sep-18	6.55	813	166	979	132
Oct-18	7.06	1,090	131	1,220	143

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	8.96	800	58.5	859	109
Dec-18	10.6	974	83.3	1,060	97.1
Jan-19	18.6	1,300	39.5	1,340	114
Feb-19	28.9	1,220	11.3	1,230	83.1
Mar-19	19.8	1,150	7.27	1,150	100.0
Apr-19	10.4	1,120	28.4	1,150	103
May-19	11.1	1,050	31.0	1,080	75.8
Jun-19	8.14	1,130	43.4	1,180	116
Jul-19	7.10	1,030	13.4	1,050	115
Aug-19	6.82	997	47.5	1,040	116
Sep-19	6.64	882	207	1,090	119
Oct-19	6.40	974	144	1,120	125
Nov-19	7.12	1,060	47.6	1,110	117
Dec-19	20.3	1,040	155	1,200	127
Jan-20	12.6	1,240	73.8	1,310	129
Feb-20	8.59	997	54.5	1,050	103
Mar-20	8.54	1,130	53.4	1,190	115
Apr-20	8.85	1,120	91.6	1,210	114
May-20	7.88	1,070	74.6	1,140	119
Jun-20	7.10	1,090	110	1,200	124
Jul-20	6.90	1,010	111	1,120	129
Aug-20	6.89	1,150	109	1,260	143
Sep-20	6.93	1,000	118	1,120	131
Dry Season Average	**6.31**	**872**	**103**	**975**	**104**
Dry Season Trend**	**Up**	**Up**	**None**	**Up**	**Up**
Wet Season Average	**10.9**	**847**	**122**	**970**	**94.6**
Average Annual	**9.02**	**858**	**114**	**972**	**98.7**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.
** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

6 Crockett Community Services District - Port Costa

The Crockett Community Services District serves two distinct separate communities, the town of Crockett and the town of Port Costa, each with their own treatment plant facilities. The Crockett Sanitary Department is excluded from the requirements of the Nutrient NPDES Order No. R2-2014-0014 as it shares use of an industrial wastewater treatment plant with C&H Sugar which has submitted its own sampling plan. The town of Port Costa has its own municipal wastewater treatment plant which is covered under the Nutrient NPDES Order. This analysis focuses on Port Costa.

The Community of Port Costa uses the Port Costa Wastewater Treatment Plant to discharge to the Carquinez Straight, which is connected to San Pablo Bay. The service area population is approximately 250 people. The plant has a permitted ADWF capacity of 0.033 mgd. It has a current ADWF flow of approximately 0.012 mgd. The plant performs secondary treatment using a septic tank for solids separation, followed by filtration and disinfection.

Port Costa was exempt from the Section 13267 Letter sampling requirements due to their permitted capacity flow (<1 mgd). The following observations are made based upon the available data presented in figures and table in the subsequent pages:

- The dataset is limited to flow, ammonia a few times per year, and most recently a few TIN and TP samples. Based on the average monthly values in the table and figures below, there appears to be an emerging upward dry season trend for flow. There is insufficient dry season nutrient data to perform trend analysis.
- Ammonia loads typically increase with flow during wet weather events. There is insufficient TIN and TP data to comment on trends.

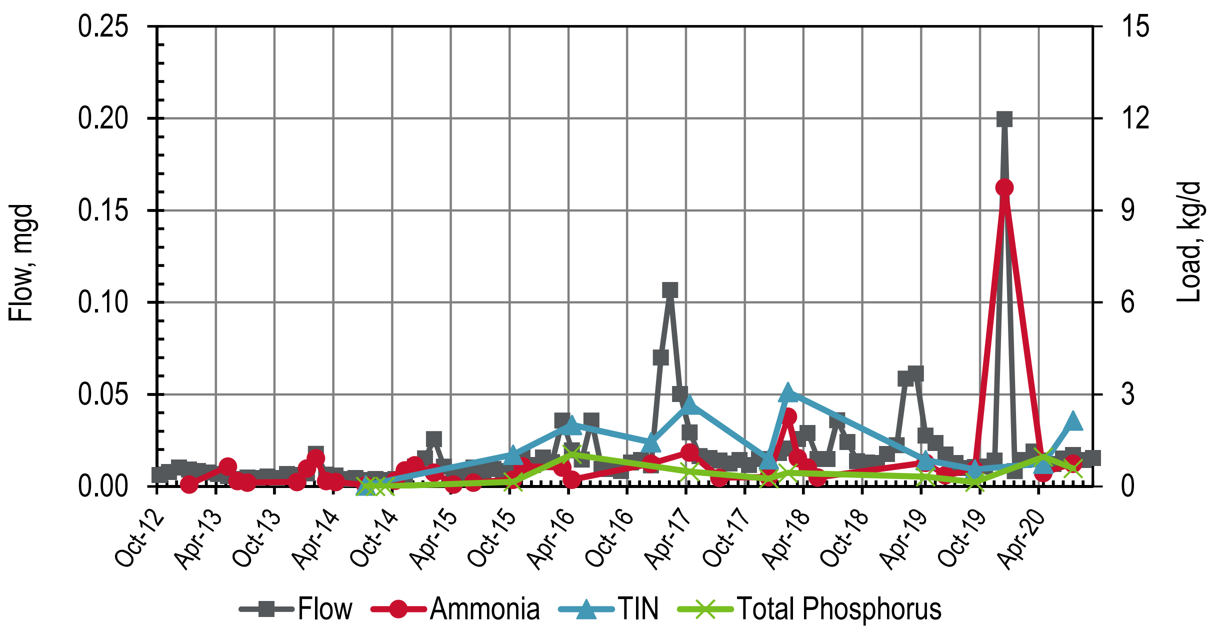

Figure 6-1. Discharge: Port Costa Monthly Flows and Loads

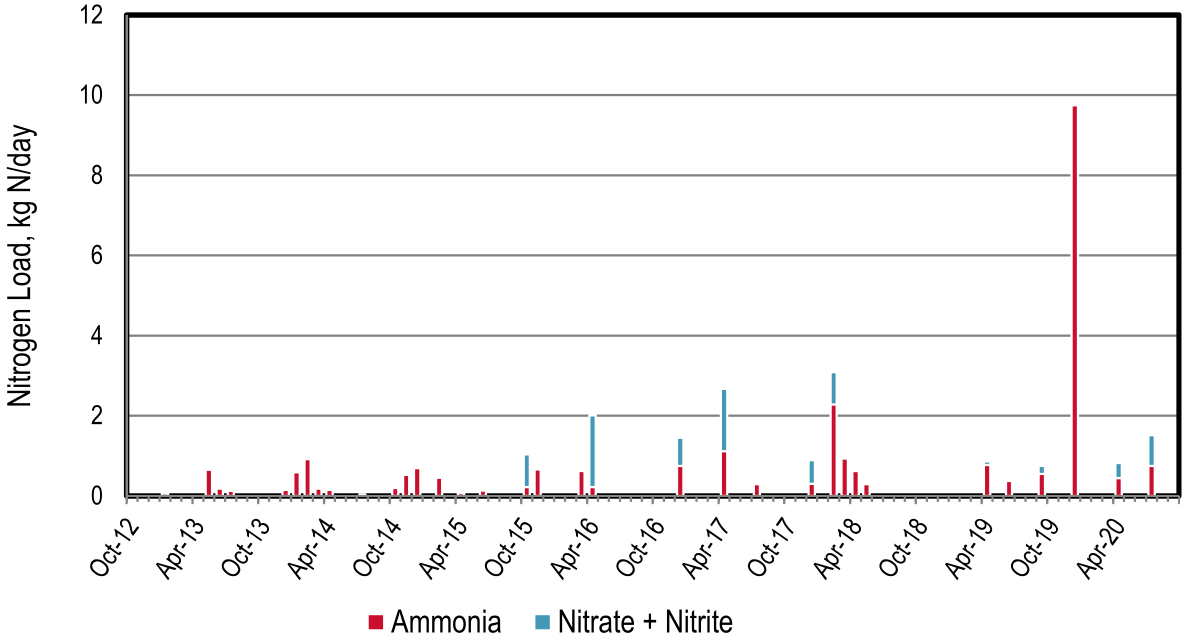

Figure 6-2. Discharge: Port Costa Monthly Ammonia Loads

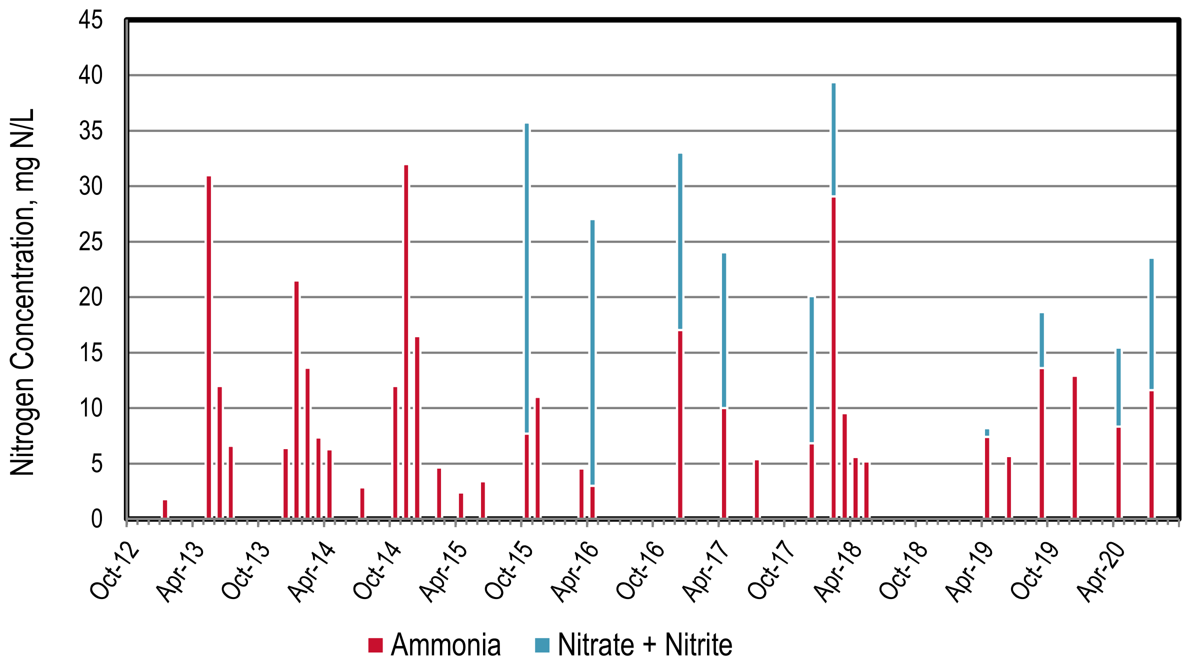

Figure 6-3. Discharge: Port Costa Monthly Ammonia Concentrations

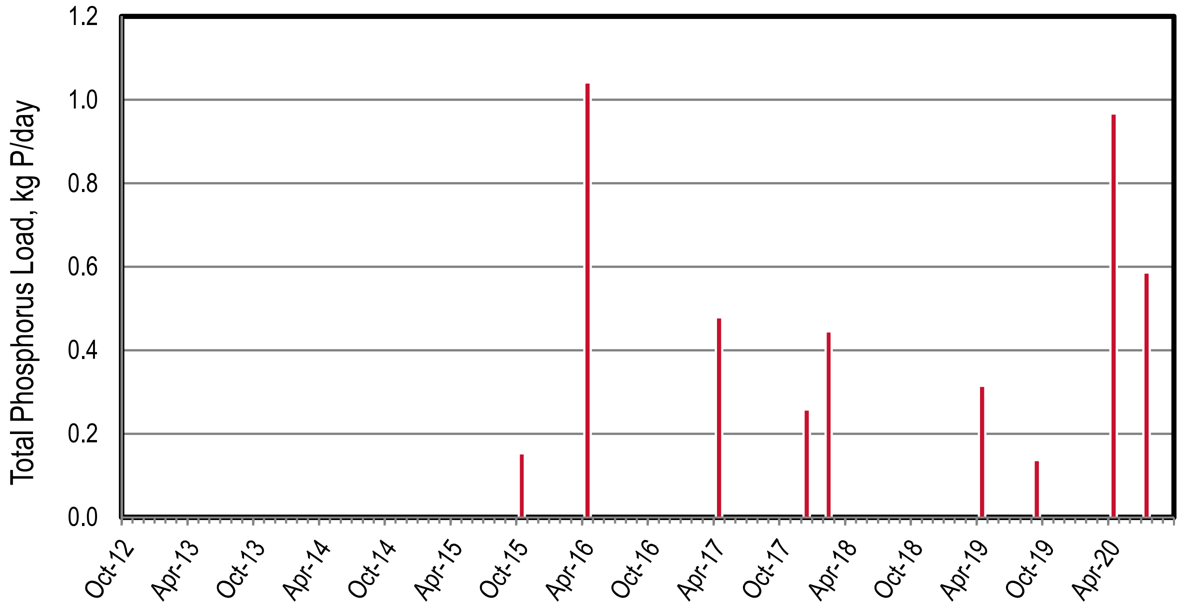

Figure 6-4. Discharge: Port Costa Monthly Phosphorus Loads

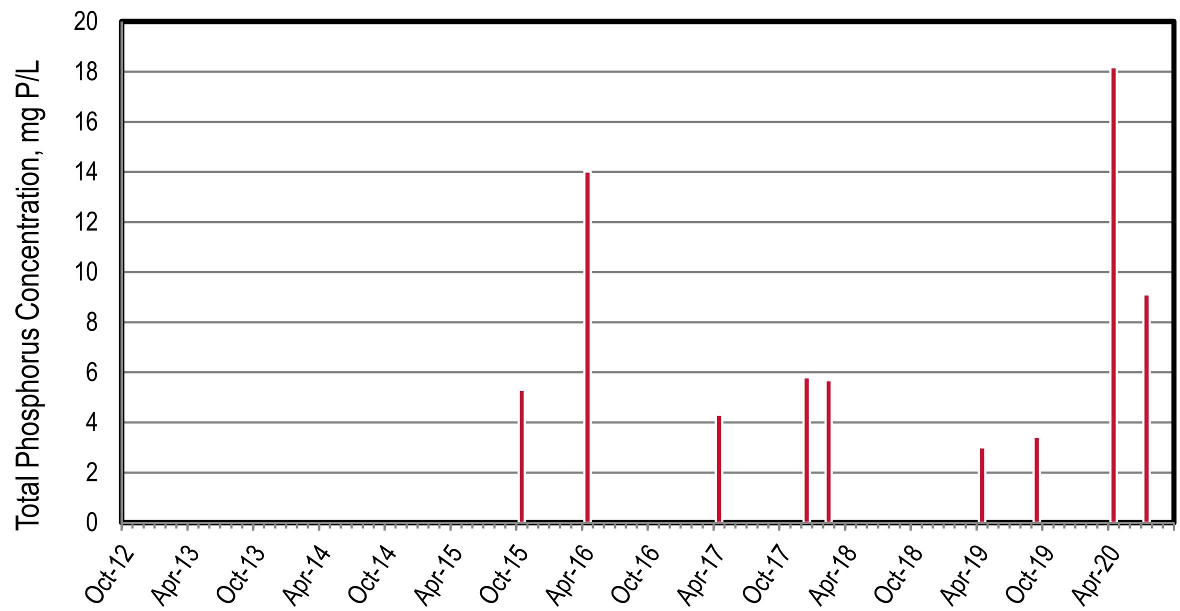

Figure 6-5. Discharge: Port Costa Monthly Phosphorus Concentrations

Table 6-1. Discharge: Port Costa Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	0.00640				
Nov-12	0.00795				
Dec-12	0.0103				
Jan-13	0.00934	0.0636			
Feb-13	0.00855				
Mar-13	0.00780				
Apr-13	0.00680				
May-13	0.00555	0.650			
Jun-13	0.00405	0.184			
Jul-13	0.00497	0.124			
Aug-13	0.00483				
Sep-13	0.00538				
Oct-13	0.00473				
Nov-13	0.00688				
Dec-13	0.00631	0.153			
Jan-14	0.00720	0.585			
Feb-14	0.0179	0.920			
Mar-14	0.00644	0.179			
Apr-14	0.00622	0.148			
May-14	0.00409				
Jun-14	0.00456				
Jul-14	0.00354	0.0381		0.0381	
Aug-14	0.00419				
Sep-14	0.00361				
Oct-14	0.00430	0.195			
Nov-14	0.00433	0.524			
Dec-14	0.0111	0.691			
Jan-15	0.0153				
Feb-15	0.0259	0.455			
Mar-15	0.0108				
Apr-15	0.00747	0.0678			
May-15	0.00695				
Jun-15	0.0103	0.133			
Jul-15	0.00829				
Aug-15	0.00941				
Sep-15	0.00838				

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	0.00765	0.223	0.810	1.03	0.153
Nov-15	0.0159	0.660			
Dec-15	0.0118				
Jan-16	0.0159				
Feb-16	0.0133				
Mar-16	0.0359	0.618			
Apr-16	0.0197	0.223	1.79	2.01	1.04
May-16	0.0147				
Jun-16	0.0359				
Jul-16	0.00966				
Aug-16	0.00964				
Sep-16	0.00859				
Oct-16	0.0132				
Nov-16	0.0142				
Dec-16	0.0116	0.746	0.702	1.45	
Jan-17	0.0702				
Feb-17	0.107				
Mar-17	0.0503				
Apr-17	0.0294	1.11	1.56	2.67	0.479
May-17	0.0166				
Jun-17	0.0156				
Jul-17	0.0142	0.290			
Aug-17	0.0127				
Sep-17	0.0143				
Oct-17	0.0117				
Nov-17	0.0151				
Dec-17	0.0118	0.304	0.591	0.896	0.259
Jan-18	0.0182				
Feb-18	0.0207	2.28	0.808	3.09	0.445
Mar-18	0.0258	0.932			
Apr-18	0.0292	0.618			
May-18	0.0151	0.296			
Jun-18	0.0150				
Jul-18	0.0361				
Aug-18	0.0242				
Sep-18	0.0138				
Oct-18	0.0131				

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	0.0127				
Dec-18	0.0176				
Jan-19	0.0224				
Feb-19	0.0587				
Mar-19	0.0614				
Apr-19	0.0277	0.775	0.0824	0.858	0.315
May-19	0.0237				
Jun-19	0.0174	0.374			
Jul-19	0.0128				
Aug-19	0.0100				
Sep-19	0.0106	0.547	0.203	0.552	0.138
Oct-19	0.0110				
Nov-19	0.0141				
Dec-19	0.200	9.75			
Jan-20	0.00847				
Feb-20	0.0144				
Mar-20	0.0193				
Apr-20	0.0141	0.444	0.378	0.746	0.968
May-20	0.0123				
Jun-20	0.0152				
Jul-20	0.0170	0.749	0.769	2.15	0.587
Aug-20	0.0144				
Sep-20	0.0155				
Dry Season Average	**0.0123**	**0.339**	**0.194**	**0.913**	**0.145**
Dry Season Trend,***	**Up**	**--**	**--**	**--**	**--**
Wet Season Average	**0.0221**	**0.944**	**0.840**	**1.59**	**0.523**
Average Annual	**0.0180**	**0.766**	**0.591**	**1.41**	**0.365**

* The Total Inorganic Nitrogen value is calculated by adding the "Ammonia" and "Nitrate + Nitrite" values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis. There is insufficient data for a trending analysis for nutrients other than Ammonia.

*** Insufficient sampling to perform trending analysis.

7 Delta Diablo

Delta Diablo discharges to New York Slough (part of the Suisun Bay) and serves approximately 57,700 service connections throughout Antioch, Pittsburg and Bay Point. The plant has a permitted ADWF capacity of 19.5 mgd. It has a current ADWF discharge of approximately 7.1 mgd. The plant performs secondary treatment using trickling filters, followed by activated sludge. Secondary effluent (up to 12.8 mgd) is diverted upstream of the disinfection process and sent for tertiary treatment prior to distribution to recycled water users. Approximately 90% of the recycled water is sent to two power plants for use in their cooling towers. The blowdown from the cooling towers is returned to the secondary treatment plant, blended with secondary effluent, and disinfected prior to discharge.

The following observations on influent and discharge are made based upon the figures and table in the subsequent pages:

- Influent
  - Note: limited to data since July 2019; quarterly required but more provided for various parameters.
  - Based on the average monthly values table below, there is an emerging dry season upward trend for flow. This might be attributed to shelter in place orders associated with COVID-19.
  - The overall plant reduction in effluent flow ranges from 16 to 50 percent, depending on the quantity of water diverted to the cooling towers and other recycled water customers.
  - The nitrogen loads are reduced approximately 45 to 80 percent. This is largely attributed to a combination of biological assimilation and recycled water.
  - The total phosphorus load reductions across the plant are on the order of 80 to 90 percent (with the exception of October 2019). This is largely attributed to a combination of chemical precipitation and removal at the plant, biological assimilation and recycled water.
- Discharge
  - The variability of the distribution of the nitrogen species in the effluent is due to the power plant cooling towers going in and out of nitrification and possible denitrification occurring sporadically. Since the summer of 2016, the predominant form of nitrogen has been the ammonia species due to the cessation of nitrification in the power plant cooling towers.
  - Both nitrogen and phosphorus loads typically increase with flow during wet weather events.
  - TN concentrations are variable, ranging from 30 to 82 mg N/L. This is largely due to the variability associated with the ratio of blowdown to secondary effluent.
  - TP concentrations are generally less than 2 mg P/L, which is lower than typical effluent concentrations of 4 to 6 mg P/L. This indicates the plant is removing phosphorus.

Influent

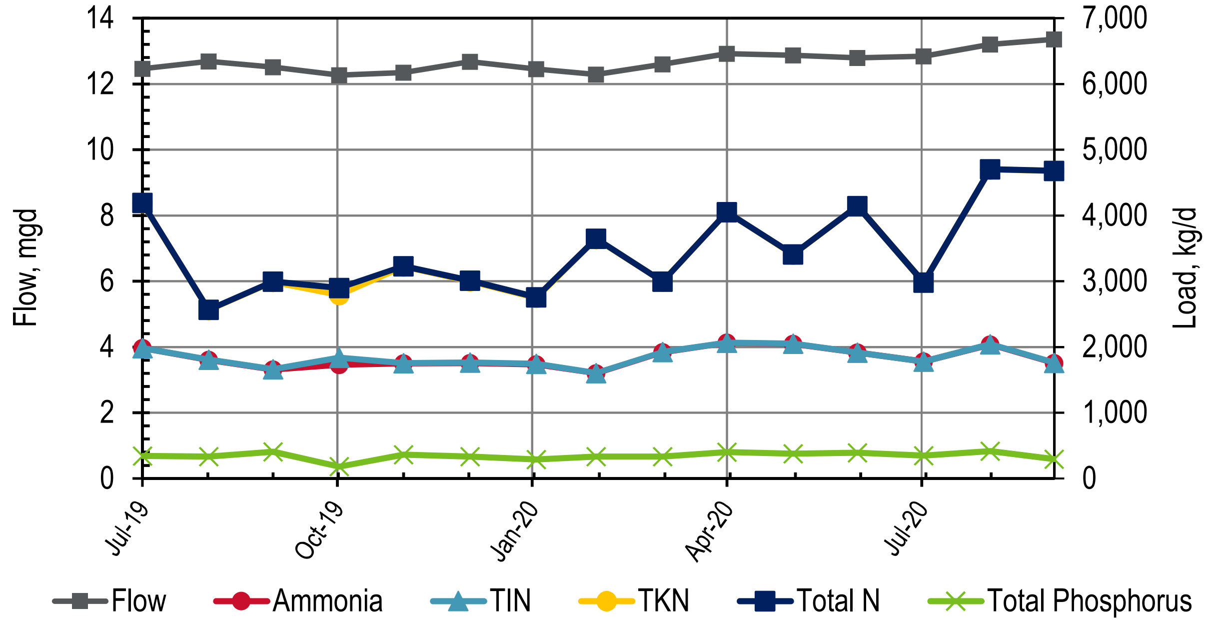

Figure 7-1. Influent: Delta Diablo Monthly Flows and Loads

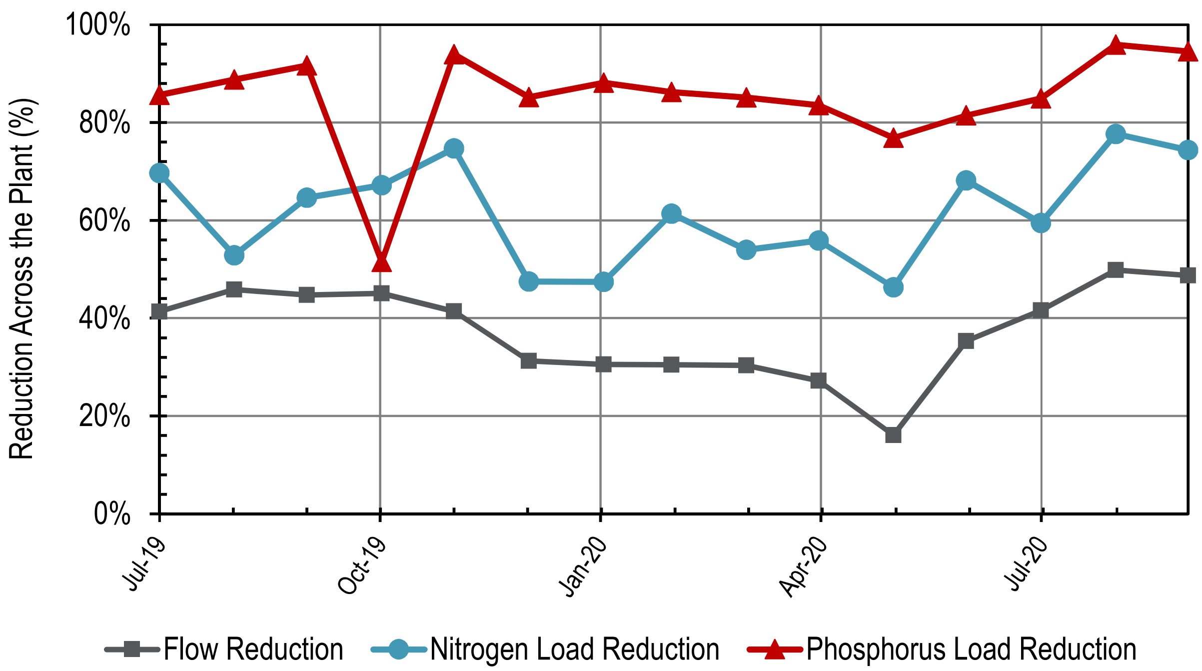

Figure 7-2. Influent: Delta Diablo Monthly Reductions Across the Plant

Note: Influent TN was compared against Discharge TIN for calculating nitrogen load reduction.

Table 7-1. Influent: Delta Diablo Monthly Flows and Loads

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	12.5	1,980	3.27	1,980	4,188	4,190.81	343.6
Aug-19	12.7	1,800	3.35	1,810	2,562	2,565.80	333.0
Sep-19	12.5	1,660	2.18	1,660	2,992	2,994.03	406.6
Oct-19	12.3	1,730	106	1,840	2,793	2,899	181.6
Nov-19	12.4	1,750	4.72	1,760	3,222	3,227	361.6
Dec-19	12.7	1,760	9.47	1,770	3,000	3,009	333.8
Jan-20	12.4	1,730	9.95	1,740	2,748	2,758	288.5
Feb-20	12.3	1,600	2.58	1,600	3,645	3,647	334.8
Mar-20	12.6	1,920	3.74	1,930	2,994	2,997	334.5
Apr-20	12.9	2,060	2.25	2,070	4,051	4,053	400.6
May-20	12.9	2,050	2.31	2,050	3,407	3,408.81	379.9
Jun-20	12.8	1,910	1.90	1,920	4,144	4,145.53	394.4
Jul-20	12.8	1,780	1.92	1,780	2,981	2,982.61	348.5
Aug-20	13.2	2,040	5.42	2,040	4,698	4,702.99	417.6
Sep-20	13.4	1,750	4.03	1,760	4,677	4,681.35	295.8
Dry Season Average	**12.8**	**1,870**	**3.05**	**1,880**	**3,710**	**3,710**	**365**
Dry Season Trend * **	**Up**	**None**	**None**	**None**	**None**	**None**	**None**
Wet Season Average	**12.5**	**1,790**	**19.8**	**1,810**	**3,210**	**3,230**	**319**
Average Annual	**12.7**	**1,840**	**10.9**	**1,850**	**3,470**	**3,480**	**344**

* Delta Diablo typically samples more than the required influent quarterly sampling. This dataset includes this additional sampling.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

Discharge

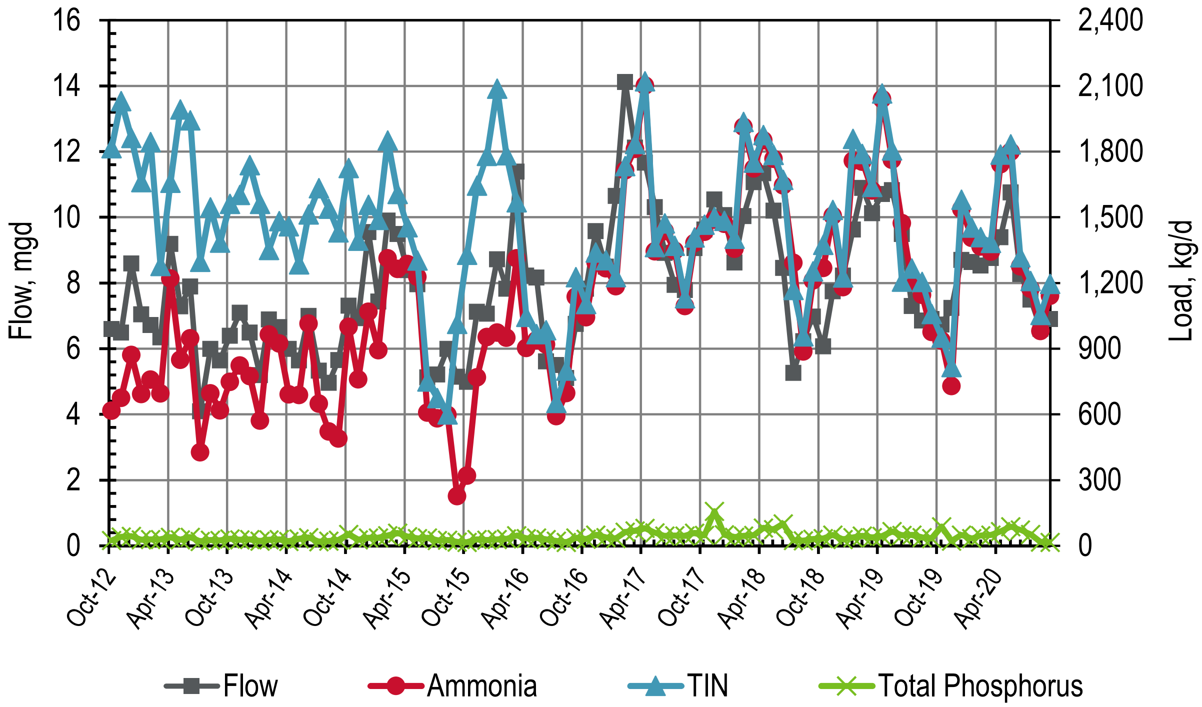

Figure 7-3. Discharge: Delta Diablo Monthly Flows and Loads

Table 7-2. Discharge: Delta Diablo Monthly Flows and Loads

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	6.60	618	1,200	1,820	24.9
Nov-12	6.50	677	1,350	2,030	40.9
Dec-12	8.60	872	991	1,860	43.2
Jan-13	7.05	694	967	1,660	27.2
Feb-13	6.73	760	1,080	1,840	29.7
Mar-13	6.35	697	582	1,280	28.7
Apr-13	9.20	1,220	437	1,660	40.2
May-13	7.30	850	1,140	1,990	27.6
Jun-13	7.90	948	995	1,940	39.4
Jul-13	4.10	429	868	1,300	20.1
Aug-13	6.00	697	850	1,550	26.7
Sep-13	5.65	619	767	1,390	24.7
Oct-13	6.40	750	812	1,560	31.5
Nov-13	7.10	824	778	1,600	28.3

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-13	6.50	776	963	1,740	28.9
Jan-14	5.20	573	990	1,560	22.5
Feb-14	6.90	966	385	1,350	27.8
Mar-14	6.67	925	559	1,480	29.6
Apr-14	6.00	693	767	1,460	20.8
May-14	5.65	690	596	1,290	31.8
Jun-14	7.00	1,020	498	1,510	38.0
Jul-14	5.34	651	982	1,630	19.0
Aug-14	4.97	524	1,020	1,540	21.5
Sep-14	5.66	490	942	1,430	25.7
Oct-14	7.32	1,000	725	1,730	52.7
Nov-14	6.94	761	633	1,390	28.4
Dec-14	9.56	1,070	488	1,560	36.8
Jan-15	7.44	894	595	1,490	35.9
Feb-15	9.91	1,310	538	1,850	47.3
Mar-15	9.50	1,270	341	1,610	58.8
Apr-15	8.40	1,290	167	1,450	41.9
May-15	7.97	1,230	73.8	1,300	33.0
Jun-15	5.13	609	142	751	36.8
Jul-15	5.22	583	92.7	676	25.4
Aug-15	6.00	599	1.43	601	26.2
Sep-15	5.15	228	787	1,010	17.6
Oct-15	4.99	322	1,010	1,330	16.2
Nov-15	7.13	771	875	1,650	28.6
Dec-15	7.07	954	828	1,780	25.7
Jan-16	8.73	975	1,110	2,090	29.0
Feb-16	7.83	951	834	1,780	31.8
Mar-16	11.4	1,310	256	1,570	47.0
Apr-16	8.23	905	141	1,050	33.6
May-16	8.18	940	28.2	968	37.2
Jun-16	5.62	921	64.4	985	29.1
Jul-16	5.51	593	59.9	653	21.6
Aug-16	5.11	699	102	801	16.2
Sep-16	6.76	1,140	89.9	1,230	36.4
Oct-16	7.83	1,040	60.0	1,100	30.2
Nov-16	9.59	1,300	43.5	1,340	49.5
Dec-16	8.50	1,270	36.7	1,310	37.9

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Jan-17	10.7	1,190	41.1	1,230	33.5
Feb-17	14.1	1,720	18.9	1,730	62.4
Mar-17	12.1	1,810	22.5	1,840	68.4
Apr-17	11.7	2,100	19.5	2,120	80.2
May-17	10.3	1,350	19.5	1,370	59.6
Jun-17	8.92	1,440	34.7	1,470	45.8
Jul-17	7.95	1,350	22.1	1,370	47.0
Aug-17	7.79	1,100	34.7	1,130	44.8
Sep-17	9.07	1,380	23.8	1,410	58.1
Oct-17	9.63	1,440	32.0	1,470	48.5
Nov-17	10.6	1,490	11.1	1,500	158
Dec-17	10.1	1,470	12.8	1,480	50.6
Jan-18	8.64	1,360	45.8	1,400	39.6
Feb-18	10.0	1,910	21.7	1,940	45.3
Mar-18	11.1	1,720	26.3	1,750	47.6
Apr-18	11.4	1,850	23.6	1,880	81.8
May-18	10.2	1,770	17.6	1,790	75.1
Jun-18	8.47	1,650	25.6	1,670	101
Jul-18	5.27	1,290	82.6	1,170	25.4
Aug-18	6.24	888	69.2	957	23.6
Sep-18	6.98	1,210	40.8	1,250	30.6
Oct-18	6.08	1,270	104	1,370	33.8
Nov-18	7.76	1,510	26.2	1,530	50.3
Dec-18	8.23	1,180	43.2	1,230	28.7
Jan-19	9.64	1,760	71.9	1,860	37.7
Feb-19	10.9	1,750	36.2	1,790	44.6
Mar-19	10.1	1,620	16.6	1,640	37.5
Apr-19	10.7	2,040	25.3	2,070	43.6
May-19	10.8	1,760	27.8	1,810	66.3
Jun-19	9.49	1,480	25.0	1,210	48.0
Jul-19	7.31	1,210	61.8	1,270	49.3
Aug-19	6.87	1,150	58.2	1,210	37.4
Sep-19	6.91	977	82.2	1,060	34.0
Oct-19	6.74	938	13.6	952	88.1
Nov-19	7.24	730	86.9	817	22.0
Dec-19	8.71	1,540	42.7	1,580	49.6
Jan-20	8.65	1,410	46.7	1,450	34.3

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Feb-20	8.54	1,370	42.0	1,410	46.1
Mar-20	8.77	1,340	39.3	1,380	49.8
Apr-20	9.40	1,740	44.8	1,790	66.0
May-20	10.8	1,800	33.2	1,830	87.8
Jun-20	8.28	1,280	41.3	1,320	73.3
Jul-20	7.50	1,170	35.2	1,210	52.7
Aug-20	6.62	982	72.9	1,050	17.2
Sep-20	6.91	1,140	54.5	1,200	16.3
Dry Season Average	**7.07**	**1,020**	**274**	**1,280**	**38.7**
Dry Season Trend * **	**Up**	**Up**	**Down**	**None**	**Up**
Wet Season Average	**8.53**	**1,190**	**383**	**1,570**	**42.9**
Average Annual	**7.92**	**1,120**	**338**	**1,450**	**41.2**

* Delta Diablo typically samples each month more than the required frequency for ammonia. This dataset includes this additional sampling.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

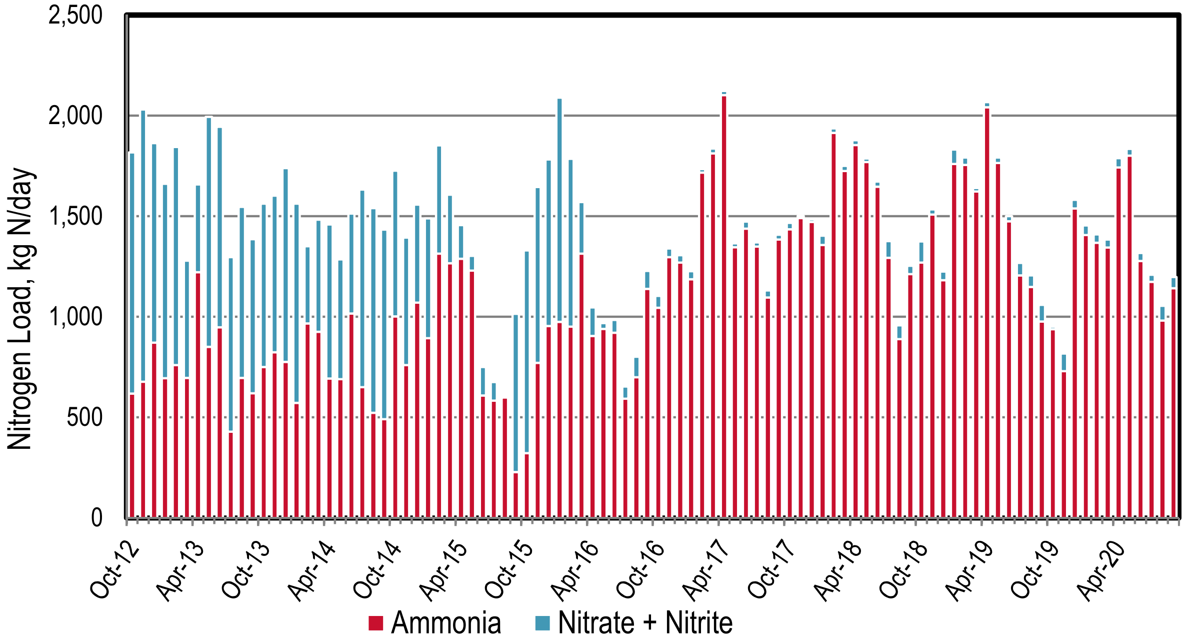

Figure 7-4. Discharge: Delta Diablo Monthly Nitrogen Loads

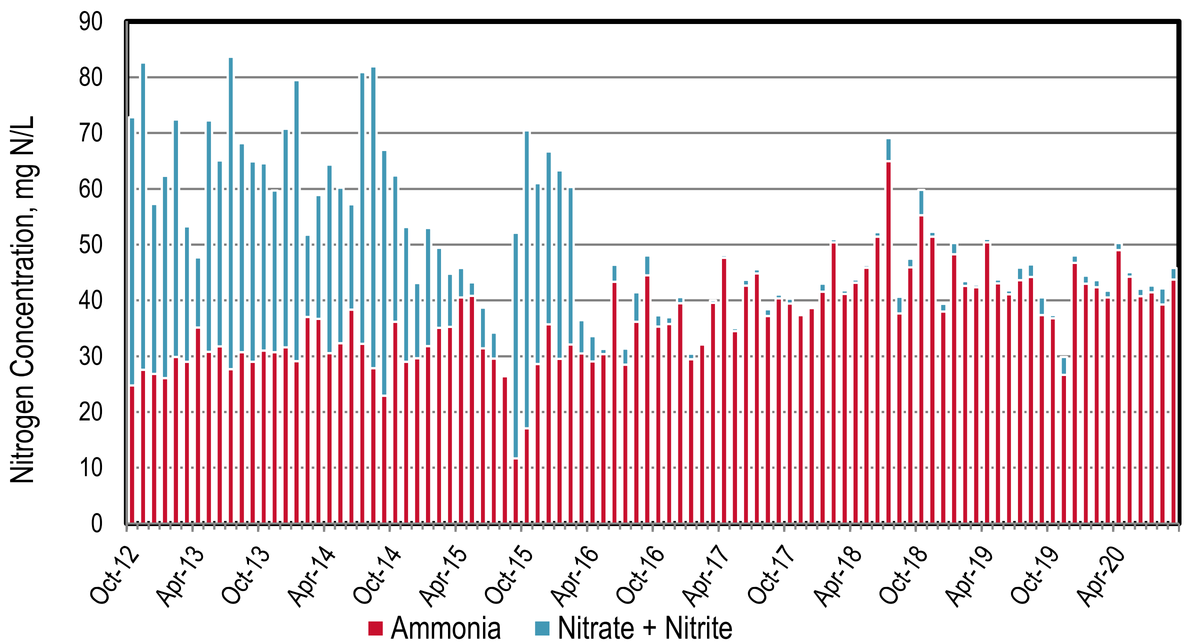

Figure 7-5. Discharge: Delta Diablo Monthly Nitrogen Concentrations

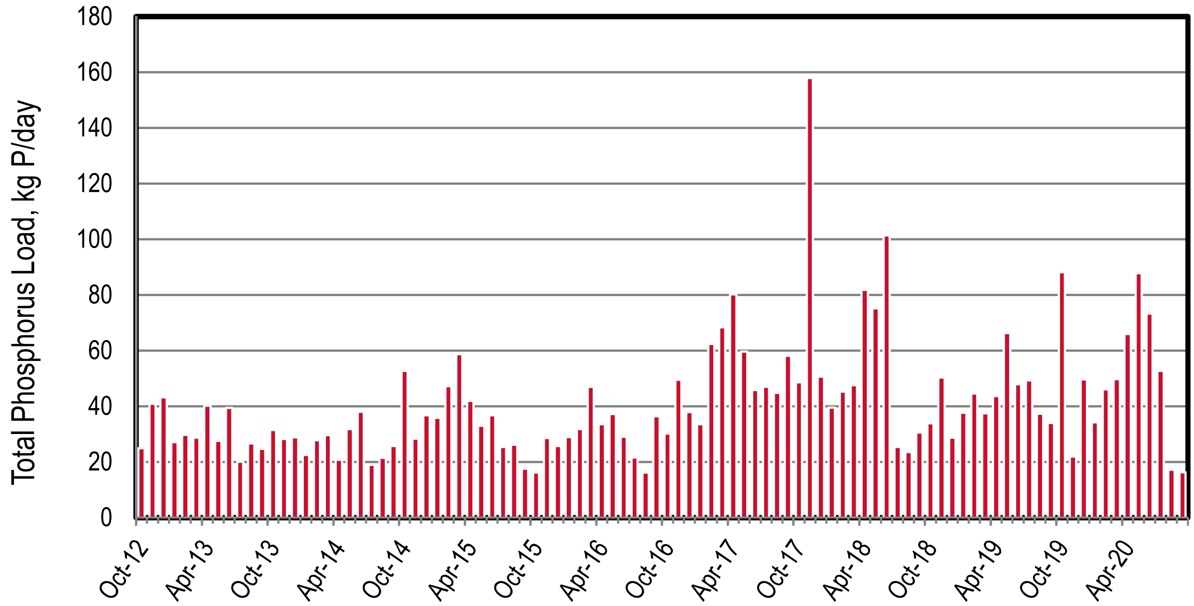

Figure 7-6. Discharge: Delta Diablo Monthly Phosphorus Loads

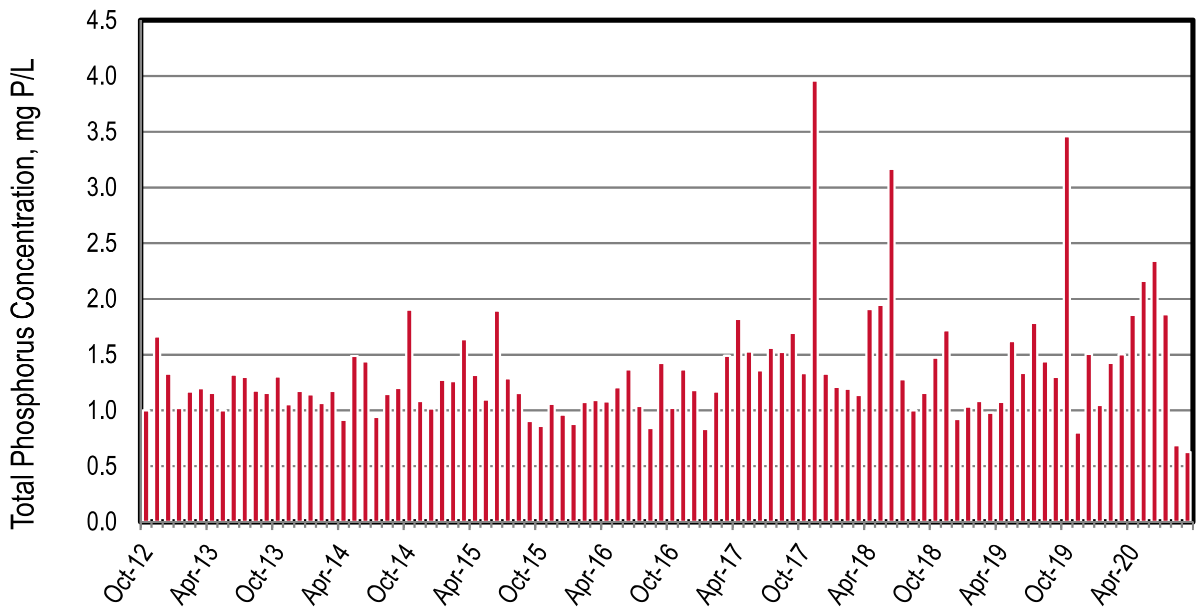

Figure 7-7. Discharge: Delta Diablo Monthly Phosphorus Concentrations

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8 East Bay Dischargers Authority (EBDA)

EBDA discharges to the South Bay. EBDA has a permitted ADWF capacity of 107.8 mgd and a peak wet weather capacity of 189.1 mgd. It has a current ADWF discharge flow of approximately 54 mgd. EBDA's discharge is a combined flow from six wastewater treatment plants: EBDA members City of Hayward, Oro Loma/Castro Valley Sanitary District, City of San Leandro, and Union Sanitary District, and Livermore-Amador Valley Water Management Agency members City of Livermore and Dublin-San Ramon Services District. The contributing plants have various types of secondary treatment.

The following observations are made based upon the figures and tables in the subsequent pages:

- Influent
  - Note: limited to data since July 2019; quarterly required but more provided for certain parameters (e.g., ammonia).
  - Based on the limited average monthly values table below, there is an emerging dry season downward trend for flow (nutrient loads not considered given the limited dataset).
  - Given the inherent challenges with sampling influent from six different agencies and comparing against the EBDA discharge, no analysis was performed comparing load reduction across the plants.
- Discharge
  - The wet season average monthly flow values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
  - The flows reduce 10 to 20 mgd from the wet to the dry season due to a combination of recycled water demand during the dry season and a lack of inflow and infiltration.
  - Based on the average monthly values table, there appears to be a slight upward dry season trend for ammonia and total phosphorus loads. For both nutrients, the upward increase is marginal and not necessarily apparent while reviewing the provided historical data plots and tables.
  - Ammonia, total nitrogen, and phosphorus loads typically increase with flow during wet weather events. The increase in loads during a wet weather event is less pronounced with months where there are back-to-back months with storms, such as December 2014 and January 2015. This is attributed to a lack of scouring in the collection system during the latter month.
  - Wet season loads are greater and more variable than the dry season loads.
  - Ammonia is the majority of the nitrogen species discharged, regardless of season. This would be expected since the EBDA plants were not designed to nitrify (with the exception of the recent upgrades at Oro Loma/Castro Valley Sanitary District).
  - Total phosphorus concentrations are relatively flat and range from approximately 2 mg P/L to 3 mg P/L. Several of the EBDA plants perform either biological P removal using an anaerobic selector or chemical removal at the headworks, primaries, or filters.

Influent

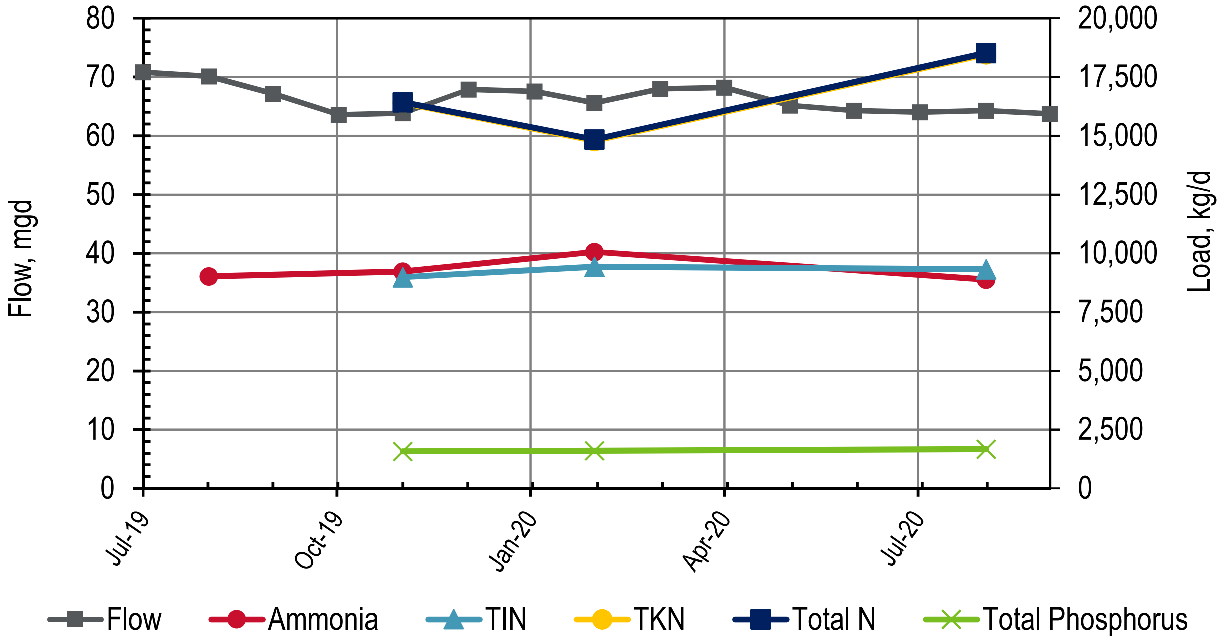

Figure 8-1. Influent: EBDA Monthly Flows and Loads

Note 1: Agencies that Contribute to EBDA: City of Hayward, Oro Loma/Castro Valley Sanitary District, City of San Leandro, and Union Sanitary District, and Livermore-Amador Valley Water Management Agency members City of Livermore and Dublin-San Ramon Services District.

Note 2: Values are only provided for months when all six agencies sampled.

Note 3: The TKN/Total N loads are comparable. The TKN values are located behind the Total N load lines.

Table 8-1. Influent: EBDA Members Monthly Flows and Loads*

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN **	TKN	Total N **	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	70.8	--	--	--	--	--	--
Aug-19	70.1	9,020	--	--	--	--	--
Sep-19	67.2	--	--	--	--	--	--
Oct-19	63.6	--	--	--	--	--	--
Nov-19	63.9	9,230	28.4	8,990	16,400	16,400	1,580
Dec-19	67.9	--	--	--	--	--	--
Jan-20	67.6	--	--	--	--	--	--
Feb-20	65.6	10,100	57.4	9,430	14,800	14,800	1,600
Mar-20	68.0	--	--	--	--	--	--
Apr-20	68.2	--	--	--	--	--	--
May-20	65.2	--	--	--	--	--	--
Jun-20	64.3	--	--	--	--	--	--
Jul-20	64.0	--	--	--	--	--	--
Aug-20	64.3	8,880	55.0	9,330	18,500	18,500	1,670
Sep-20	63.8	--	--	--	--	--	--
Dry Season Average	**66.2**	**8,950**	**55.0**	**9,330**	**18,500**	**18,500**	**1,670**
Dry Season Trend * **	**Down**	***	***	***	***	***	***
Wet Season Average	**66.4**	**9,650**	**42.9**	**9,210**	**15,600**	**15,600**	**1,590**
Average Annual	**66.3**	**9,300**	**46.9**	**9,250**	**16,600**	**16,600**	**1,620**

* Agencies that Contribute to EBDA: City of Hayward, Oro Loma/Castro Valley Sanitary District, City of San Leandro, and Union Sanitary District, and Livermore-Amador Valley Water Management Agency members City of Livermore and Dublin-San Ramon Services District. Values are only provided for months when all six agencies sampled.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis. Insufficient samples to perform statistical trending on nutrient loads.

Discharge

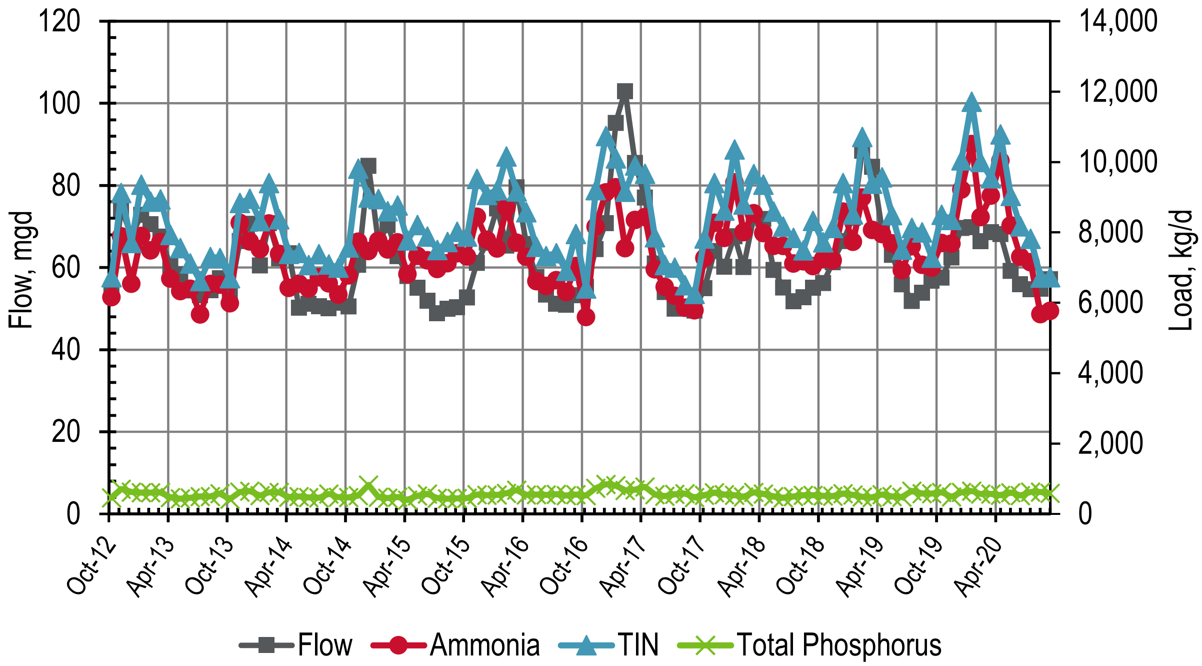

Figure 8-2. Discharge: EBDA Monthly Flows and Loads

Table 8-2. Discharge: EBDA Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	54.5	6,160	568	6,730	462
Nov-12	74.3	7,900	1,230	9,130	710
Dec-12	67.5	6,550	1,150	7,700	621
Jan-13	72.9	7,900	1,460	9,360	606
Feb-13	70.7	7,490	1,390	8,880	601
Mar-13	67.6	7,730	1,210	8,940	613
Apr-13	60.6	6,690	1,240	7,930	469
May-13	58.5	6,340	1,220	7,560	431
Jun-13	54.5	6,400	719	7,120	459
Jul-13	53.3	5,670	953	6,620	493
Aug-13	54.5	6,540	763	7,300	494
Sep-13	57.5	6,520	750	7,270	575
Oct-13	53.4	5,990	715	6,700	425
Nov-13	66.5	8,270	567	8,840	621
Dec-13	70.7	7,740	1,220	8,960	654

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Jan-14	60.6	7,530	789	8,320	526
Feb-14	70.9	8,260	1,150	9,410	616
Mar-14	62.3	7,400	986	8,380	616
Apr-14	63.5	6,430	966	7,390	480
May-14	50.3	6,550	873	7,420	499
Jun-14	51.2	6,410	660	7,070	465
Jul-14	50.7	6,730	649	7,380	456
Aug-14	50.2	6,560	534	7,090	570
Sep-14	51.5	6,240	765	7,000	481
Oct-14	50.6	6,780	795	7,570	470
Nov-14	60.7	7,740	2,070	9,810	520
Dec-14	84.9	7,470	1,520	8,990	821
Jan-15	65.9	7,770	1,180	8,950	476
Feb-15	70.4	7,520	1,080	8,600	446
Mar-15	62.8	7,720	1,050	8,770	479
Apr-15	58.0	6,820	948	7,770	399
May-15	55.2	7,340	874	8,210	517
Jun-15	51.9	7,220	667	7,880	569
Jul-15	48.8	6,970	540	7,510	448
Aug-15	50.0	7,130	594	7,730	429
Sep-15	50.3	7,410	609	8,020	439
Oct-15	52.8	7,320	564	7,880	452
Nov-15	61.2	8,440	1,080	9,530	552
Dec-15	66.1	7,790	1,270	9,070	529
Jan-16	74.4	7,550	1,660	9,200	543
Feb-16	65.4	8,710	1,450	10,200	586
Mar-16	79.6	7,710	1,450	9,170	676
Apr-16	65.8	7,310	1,260	8,580	539
May-16	57.7	6,620	972	7,590	550
Jun-16	53.5	6,480	845	7,330	545
Jul-16	51.2	6,650	763	7,410	562
Aug-16	51.0	6,310	608	6,920	520
Sep-16	53.3	7,040	916	7,960	552
Oct-16	55.3	5,600	802	6,410	527
Nov-16	64.5	8,170	1,040	9,200	736
Dec-16	70.9	9,140	1,600	10,700	845
Jan-17	95.3	9,290	819	10,100	803

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Feb-17	103	7,560	1,600	9,160	672
Mar-17	85.5	8,360	1,540	9,910	687
Apr-17	77.1	8,440	1,220	9,670	767
May-17	61.0	6,960	905	7,860	552
Jun-17	54.1	6,460	617	7,080	506
Jul-17	50.0	6,200	797	7,000	559
Aug-17	50.5	5,870	638	6,500	580
Sep-17	49.6	5,790	467	6,260	466
Oct-17	55.0	7,280	559	7,830	528
Nov-17	64.1	8,280	1,130	9,410	608
Dec-17	60.3	7,850	767	8,620	550
Jan-18	67.7	9,420	937	10,400	529
Feb-18	60.2	8,010	785	8,800	485
Mar-18	72.4	8,550	1,110	9,660	615
Apr-18	71.9	7,980	1,370	9,360	569
May-18	59.5	7,620	972	8,590	497
Jun-18	55.2	7,620	545	8,160	461
Jul-18	51.8	7,120	686	7,850	498
Aug-18	52.8	7,190	415	7,490	533
Sep-18	55.1	7,040	942	8,330	535
Oct-18	56.3	7,240	849	7,720	514
Nov-18	61.3	7,210	647	8,130	506
Dec-18	66.5	8,590	810	9,400	577
Jan-19	72.2	7,740	777	8,520	544
Feb-19	88.5	9,000	1,430	10,700	483
Mar-19	84.6	8,080	1,120	9,390	465
Apr-19	69.1	7,960	1,110	9,570	549
May-19	63.1	7,690	872	8,490	497
Jun-19	55.9	6,930	665	7,510	476
Jul-19	51.9	7,610	473	8,130	648
Aug-19	53.9	7,090	523	8,000	576
Sep-19	56.9	7,000	548	7,280	577
Oct-19	57.6	7,700	629	8,510	613
Nov-19	62.6	7,690	722	8,360	488
Dec-19	69.7	9,220	823	10,000	614
Jan-20	69.9	10,500	667	11,700	652
Feb-20	66.5	8,440	804	10,000	571

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Mar-20	68.6	9,050	483	9,540	572
Apr-20	68.2	10,000	745	10,800	531
May-20	59.3	8,200	843	9,050	607
Jun-20	55.9	7,310	602	8,180	519
Jul-20	54.7	7,160	663	7,820	623
Aug-20	54.9	5,680	1,040	6,720	621
Sep-20	56.9	5,780	956	6,730	590
Dry Season Average	**54.0**	**6,790**	**736**	**7,540**	**524**
Dry Season Trend **	**None**	**Up**	**None**	**Up**	**Up**
Wet Season Average	**67.8**	**7,880**	**1,050**	**8,970**	**573**
Average Annual	**62.1**	**7,420**	**920**	**8,370**	**553**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.
** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

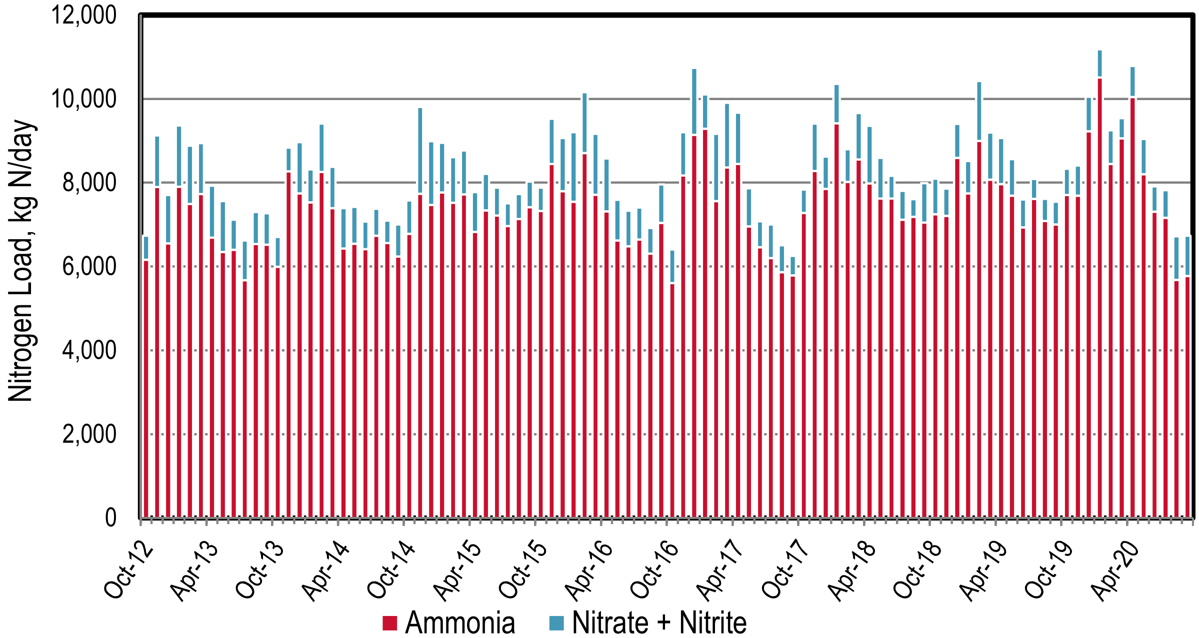

Figure 8-3. Discharge: EBDA Monthly Nitrogen Loads

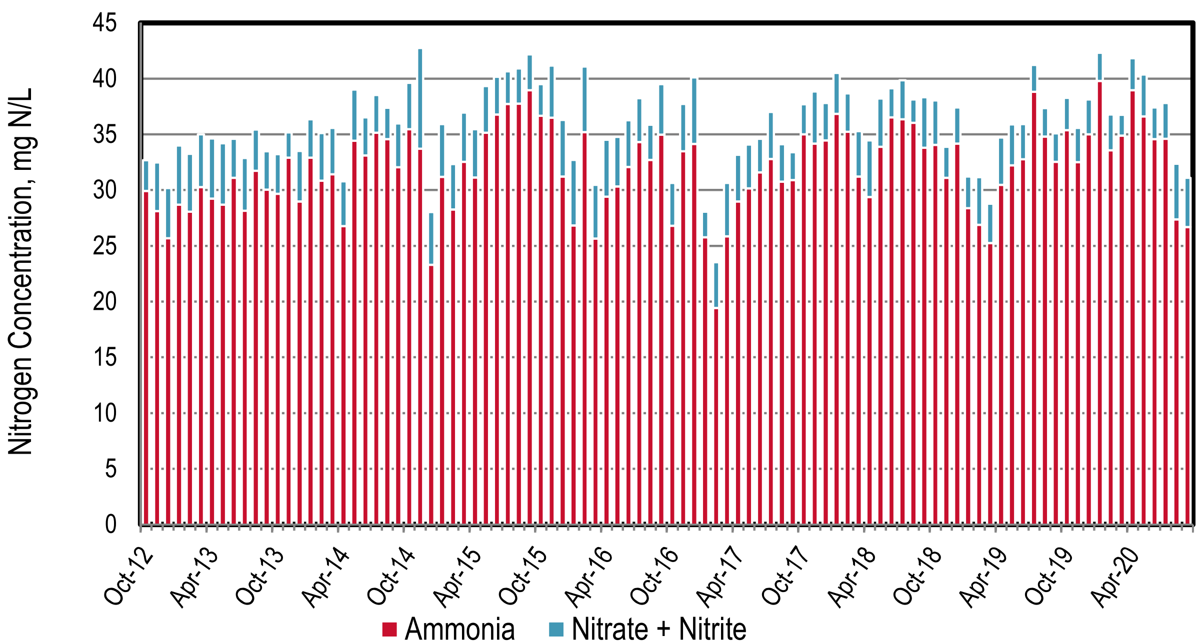

Figure 8-4. Discharge: EBDA Monthly Nitrogen Concentrations

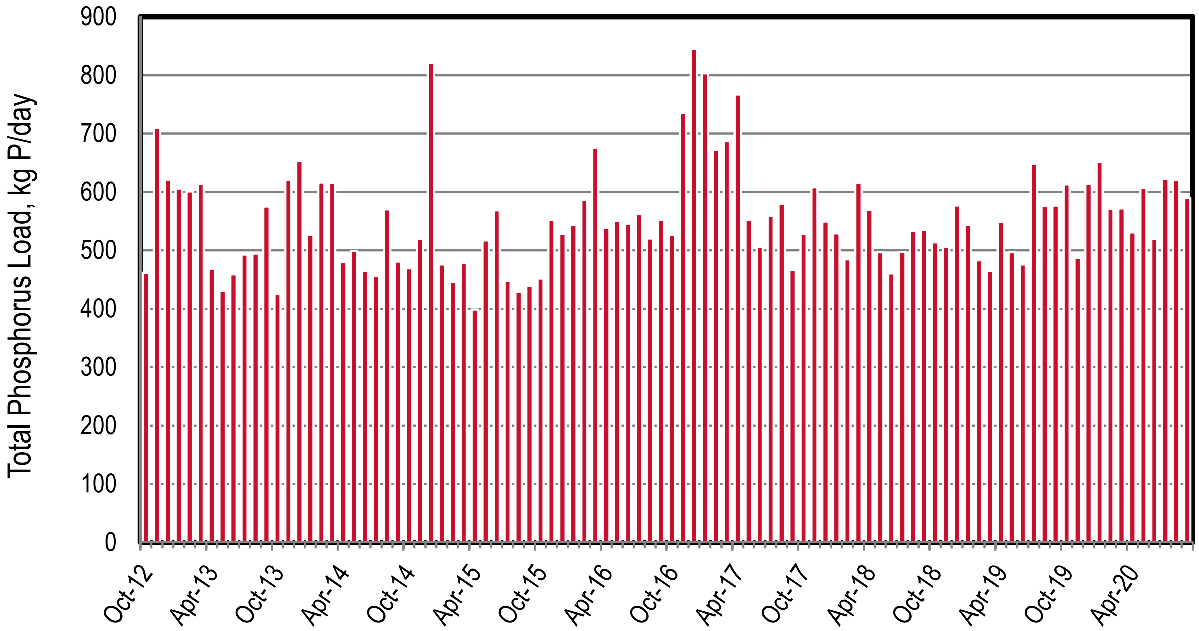

Figure 8-5. Discharge: EBDA Monthly Phosphorus Loads

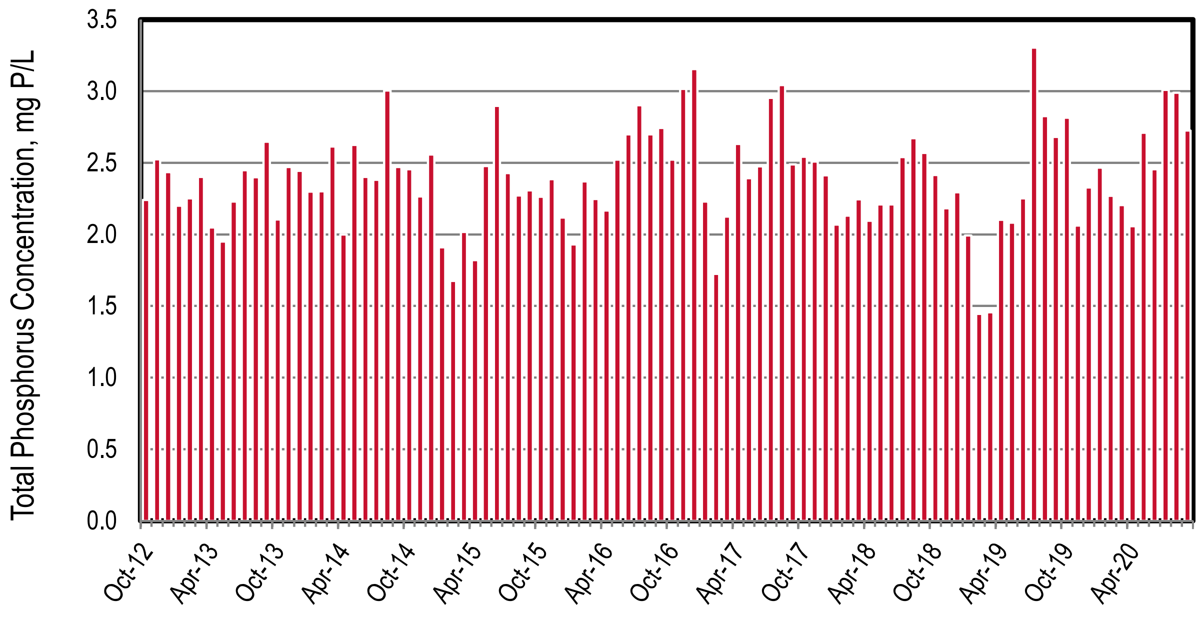

Figure 8-6. Discharge: EBDA Monthly Phosphorus Concentrations

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9 East Bay Municipal Utility District (EBMUD)

EBMUD discharges to the Central Bay. They have an ADWF permitted capacity of 120 mgd and a peak wet weather capacity of 320 mgd. It has a current dry season discharge flow of approximately 47 mgd. The plant performs secondary treatment using a high purity oxygen system. This plant accepts high-strength (organic) trucked wastes to its anaerobic digesters for renewable energy production. These wastes contribute to the plant discharge nutrient loads.

The following observations are made based upon the figures and table in the subsequent pages:

- Influent
  - Note: limited to sampling since July 2019; quarterly sampling required at a minimum.
  - The influent flows and loads do not include the high-strength (organic) trucked wastes that are sent to EBMUD's anaerobic digesters for renewable energy production.
- Discharge
  - The wet season average monthly flow and load values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
  - Based on the average monthly values table and figures below, there appears to be an upward dry season trend for ammonia, TIN, and total phosphorus. There appears to be a downward dry season trend for NOx loads.
  - Wet season loads are typically greater and more variable than the dry season loads.
  - Nitrogen loads typically increase with flow during wet weather events.
  - The effluent TIN concentrations are relatively strong with rare exceedance of 60 mg N/L.
  - Ammonia is the majority of the nitrogen species discharged, regardless of season since EBMUD does not nitrify.
- Load Reduction Across the Plant: not performed for EBMUD as data on the high-strength (organic) trucked waste is not captured in the influent values. This calculation would not reflect actual load reduction across the plant.

Influent

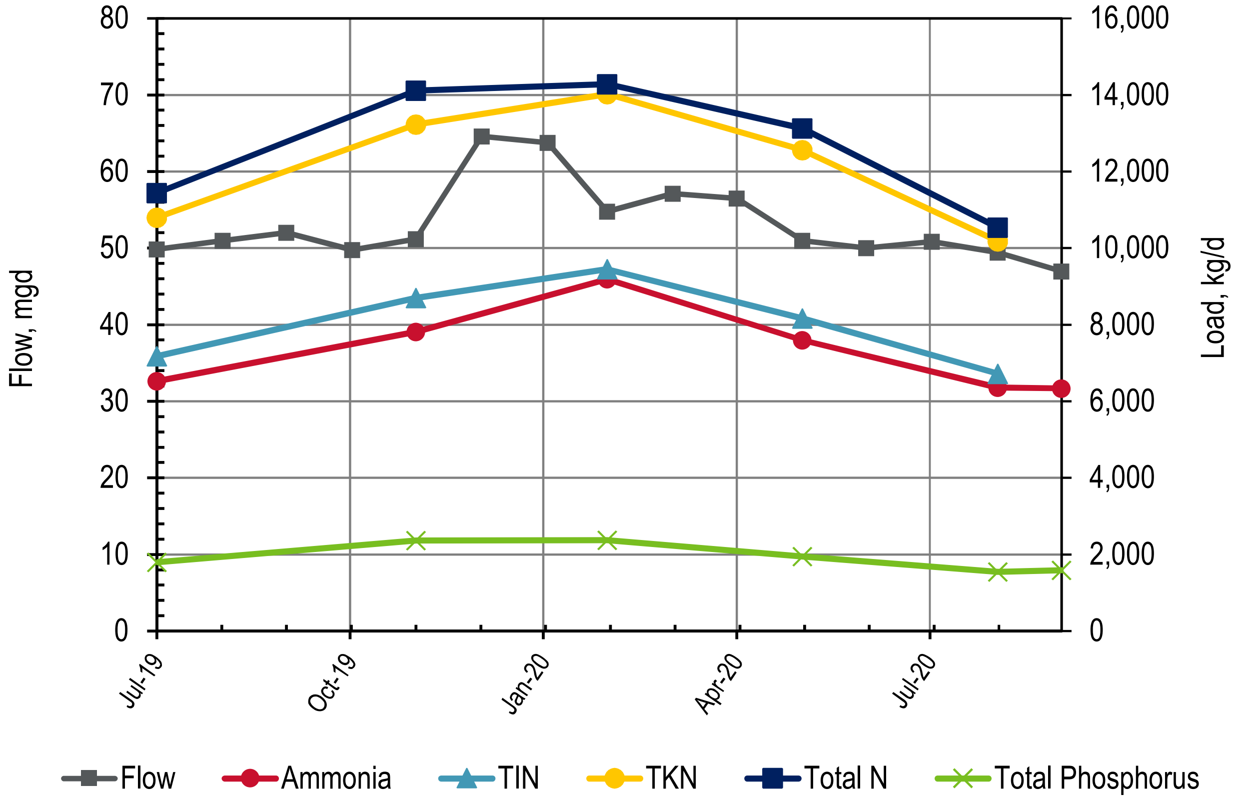

Figure 9-1. Influent: EBMUD Monthly Flows and Loads

Table 9-1. Influent: EBMUD Monthly Flows and Loads*

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	49.8	6,530	649	7,180	10,800	11,400	1,800
Aug-19	51.0	--	--	--	--	--	--
Sep-19	52.0	--	--	--	--	--	--
Oct-19	49.8	--	--	--	--	--	--
Nov-19	51.2	7,810	886	8,700	13,200	14,100	2,360
Dec-19	64.6	--	--	--	--	--	--
Jan-20	63.8	--	--	--	--	--	--
Feb-20	54.8	9,190	259	9,450	14,000	14,300	2,370
Mar-20	57.1	--	--	--	--	--	--
Apr-20	56.5	--	--	--	--	--	--
May-20	51.0	7,600	571	8,170	12,600	13,100	1,950
Jun-20	50.0	--	--	--	--	--	--
Jul-20	50.8	--	--	--	--	--	--
Aug-20	49.4	6,360	363	6,720	10,200	10,500	1,540
Sep-20	47.0	6,340	--	--	--	--	1,580
Dry Season Average	**50.1**	**6,710**	**528**	**7,360**	**11,200**	**11,700**	**1,720**
Dry Season Trend * **	***	***	***	***	***	***	***
Wet Season Average	**56.8**	**8,500**	**572**	**9,070**	**13,600**	**14,200**	**2,370**
Average Annual	**53.2**	**7,300**	**546**	**8,040**	**12,200**	**12,700**	**1,940**

* EBMUD typically samples more than the required influent quarterly sampling. This dataset includes this additional sampling.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis. Insufficient sample set to perform any statistical analysis this year. Future Group Annual Reports will consider dry season trending.

Discharge

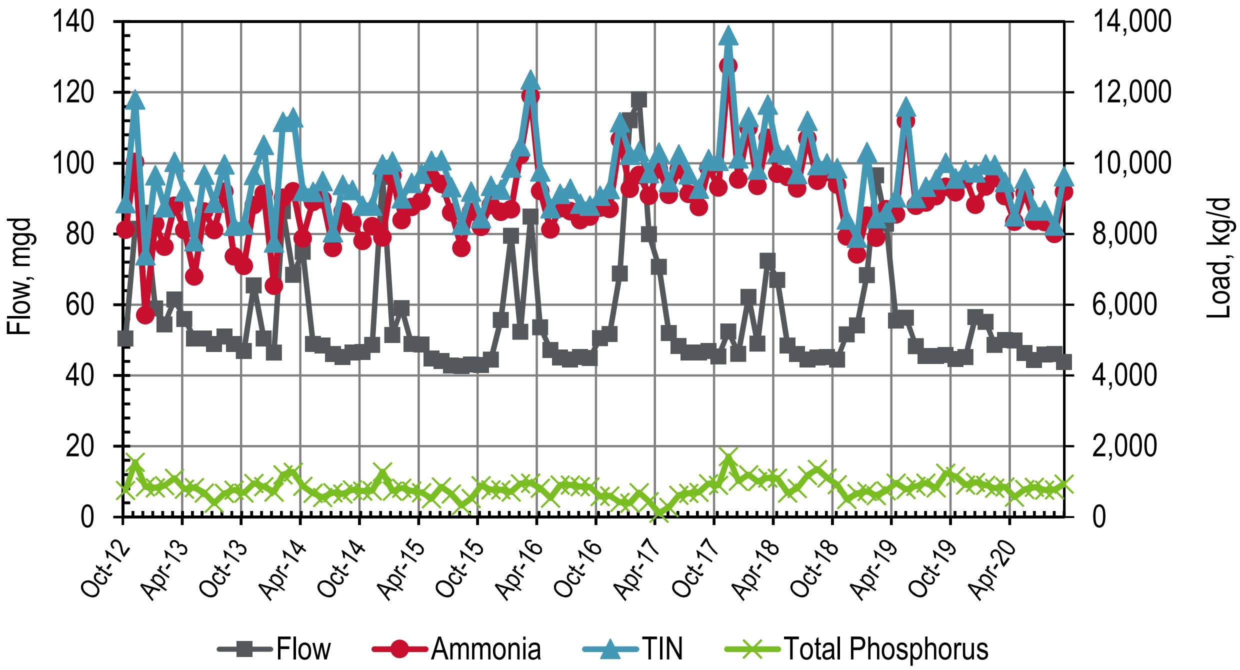

Figure 9-2. Discharge: EBMUD Monthly Flows and Loads

Table 9-2. Discharge: EBMUD Monthly Flows and Loads

Month, Year	Flow	Ammonia *	Nitrate + Nitrite *	TIN *,**	Total P *
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	50.5	8,120	756	8,880	752
Nov-12	81.5	10,000	1,770	11,800	1,550
Dec-12	86.0	5,710	1,690	7,400	854
Jan-13	59.0	8,290	1,370	9,660	829
Feb-13	54.5	7,640	1,120	8,760	891
Mar-13	61.5	8,800	1,240	10,000	1,100
Apr-13	56.0	8,110	1,090	9,210	794
May-13	50.5	6,800	996	7,800	832
Jun-13	50.5	8,640	1,050	9,680	683
Jul-13	49.0	8,120	767	8,880	389
Aug-13	51.0	9,200	771	9,970	675
Sep-13	49.0	7,380	858	8,230	762
Oct-13	47.0	7,100	1,170	8,270	681
Nov-13	65.5	8,820	847	9,670	958
Dec-13	50.5	9,150	1,380	10,500	859
Jan-14	46.5	6,550	1,220	7,770	711

Month, Year	Flow	Ammonia *	Nitrate + Nitrite *	TIN *,**	Total P *
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Feb-14	86.5	9,020	2,150	11,200	1,200
Mar-14	68.5	9,200	2,090	11,300	1,270
Apr-14	75.0	7,880	1,340	9,220	874
May-14	49.0	8,910	277	9,190	671
Jun-14	48.5	8,990	509	9,500	551
Jul-14	46.1	7,610	444	8,050	691
Aug-14	45.2	8,640	749	9,390	658
Sep-14	46.5	8,320	927	9,240	771
Oct-14	46.7	7,810	992	8,800	737
Nov-14	48.7	8,230	574	8,800	742
Dec-14	96.2	7,910	2,060	9,970	1,280
Jan-15	51.5	9,660	392	10,100	740
Feb-15	59.1	8,390	623	9,010	816
Mar-15	49.0	8,770	679	9,450	736
Apr-15	48.9	8,940	765	9,710	693
May-15	44.8	9,590	479	10,100	516
Jun-15	44.2	9,420	664	10,100	854
Jul-15	42.9	8,620	708	9,320	658
Aug-15	42.7	7,600	652	8,260	326
Sep-15	43.1	8,630	570	9,200	526
Oct-15	43.0	8,200	247	8,450	887
Nov-15	44.6	8,820	543	9,370	772
Dec-15	55.8	8,630	624	9,260	769
Jan-16	79.5	8,700	1,170	9,880	709
Feb-16	52.4	10,200	259	10,500	948
Mar-16	85.0	11,900	457	12,400	966
Apr-16	53.7	9,210	557	9,770	814
May-16	47.3	8,130	595	8,730	535
Jun-16	45.0	8,730	400	9,130	905
Jul-16	44.6	8,650	629	9,280	906
Aug-16	45.2	8,400	458	8,860	866
Sep-16	45.0	8,500	309	8,810	852
Oct-16	50.6	8,740	340	9,080	583
Nov-16	51.8	8,720	554	9,270	600
Dec-16	68.8	10,700	494	11,200	422
Jan-17	112	9,290	953	10,200	393
Feb-17	118	9,670	669	10,300	695

Month, Year	Flow	Ammonia *	Nitrate + Nitrite *	TIN *,**	Total P *
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Mar-17	80.0	9,080	640	9,720	438
Apr-17	70.7	9,840	463	10,300	112
May-17	52.1	9,110	357	9,470	277
Jun-17	48.4	9,820	423	10,200	622
Jul-17	46.6	9,140	555	9,690	677
Aug-17	46.5	8,770	511	9,280	698
Sep-17	47.0	9,870	243	10,100	945
Oct-17	45.4	9,320	742	10,100	898
Nov-17	52.5	12,800	867	13,600	1,710
Dec-17	46.2	9,550	593	10,100	1,020
Jan-18	62.3	11,000	303	11,300	1,200
Feb-18	49.0	9,360	458	9,820	1,000
Mar-18	72.5	10,700	945	11,700	1,110
Apr-18	67.1	9,700	606	10,300	1,100
May-18	48.5	9,620	622	10,200	686
Jun-18	46.0	9,290	409	9,700	809
Jul-18	44.5	10,700	499	11,200	1,180
Aug-18	45.2	9,510	394	9,950	1,350
Sep-18	45.3	9,750	435	9,990	1,110
Oct-18	44.5	9,400	467	9,860	915
Nov-18	51.7	7,930	484	8,420	500
Dec-18	54.2	7,430	468	7,900	663
Jan-19	68.4	8,520	1,030	10,300	731
Feb-19	96.6	7,890	552	8,450	610
Mar-19	82.9	8,710	614	8,610	749
Apr-19	55.5	8,560	477	9,030	959
May-19	56.4	11,200	406	11,600	780
Jun-19	48.3	8,810	380	9,010	874
Jul-19	45.5	8,890	440	9,330	965
Aug-19	45.5	9,070	467	9,540	830
Sep-19	45.9	9,340	413	10,000	1,240
Oct-19	44.7	9,190	387	9,570	1,160
Nov-19	45.3	9,580	357	9,810	908
Dec-19	56.6	8,830	409	9,740	982
Jan-20	55.2	9,350	568	9,970	898
Feb-20	48.7	9,580	373	9,950	816
Mar-20	50.1	9,080	394	9,470	852

Month, Year	Flow	Ammonia *	Nitrate + Nitrite *	TIN *,**	Total P *
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Apr-20	49.9	8,350	369	8,500	563
May-20	46.4	9,150	418	9,570	783
Jun-20	44.5	8,370	298	8,670	843
Jul-20	46.0	8,350	317	8,660	768
Aug-20	46.0	8,010	348	8,240	775
Sep-20	43.8	9,190	459	9,630	932
Dry Season Average	**46.7**	**8,870**	**530**	**9,400**	**769**
Dry Season Trend * **	**None**	**Up**	**Down**	**Up**	**Up**
Wet Season Average	**61.7**	**8,940**	**799**	**9,740**	**848**
Average Annual	**55.4**	**8,910**	**687**	**9,600**	**815**

* Numbers in this table are slightly different compared to those reported in the CIWQS, due to rounding of conversion factors used.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

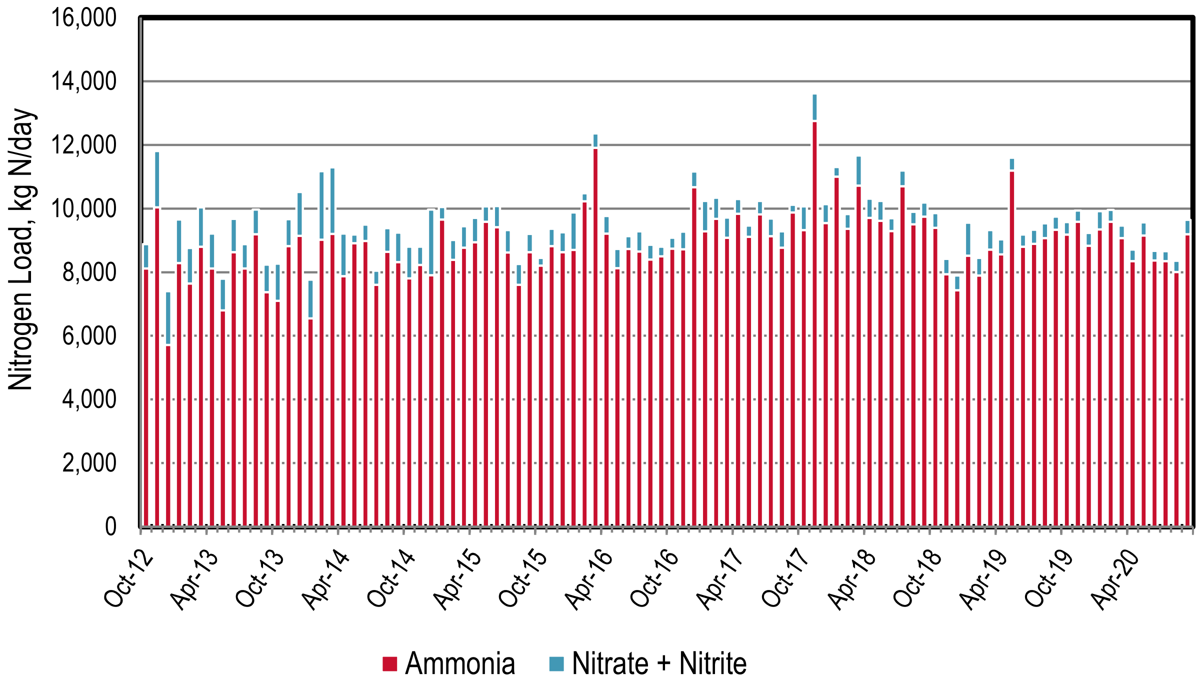

Figure 9-3. Discharge: EBMUD Monthly Nitrogen Loads

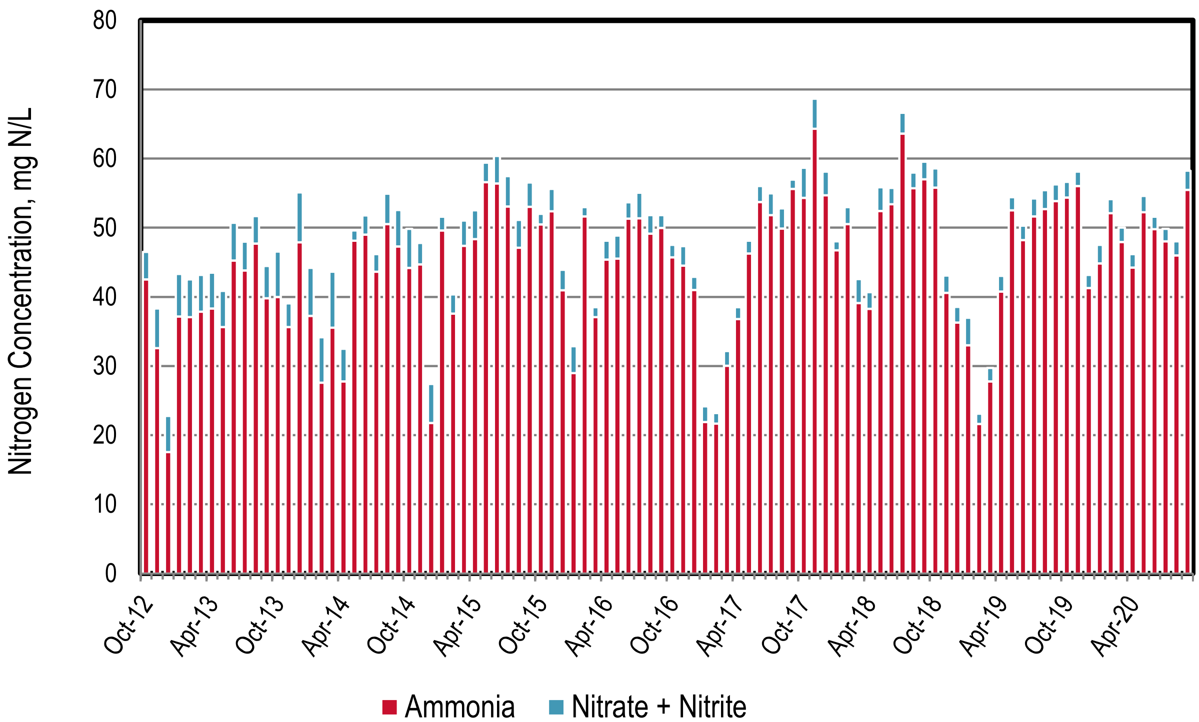

Figure 9-4. Discharge: EBMUD Monthly Nitrogen Concentrations

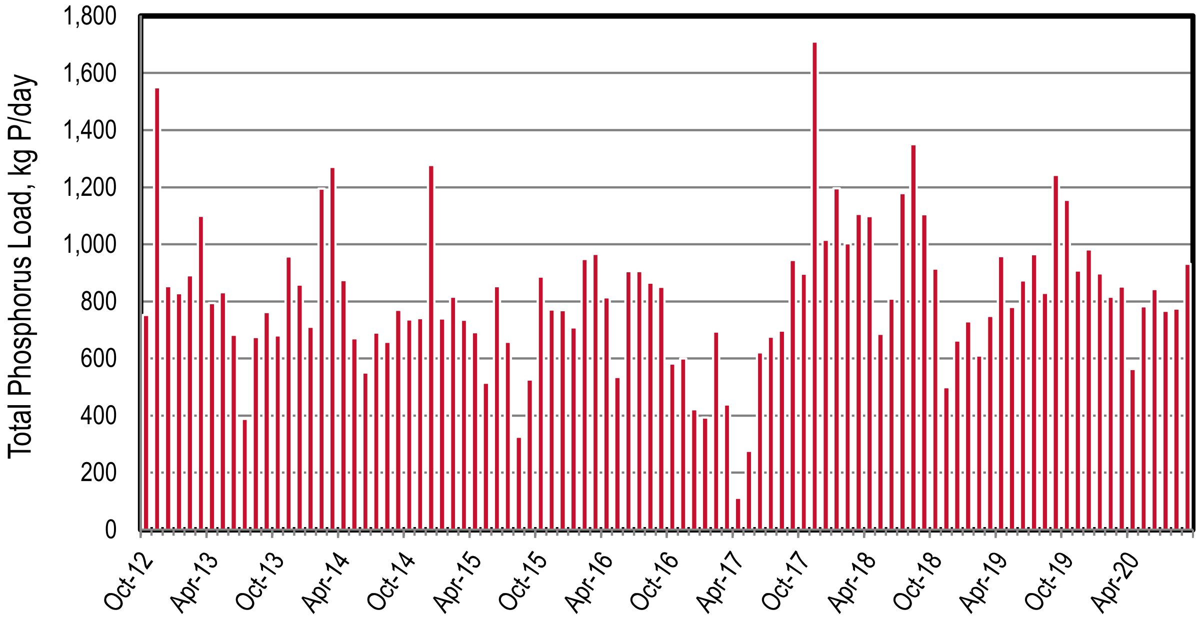

Figure 9-5. Discharge: EBMUD Monthly Phosphorus Loads (Refer to Table 9-2)**

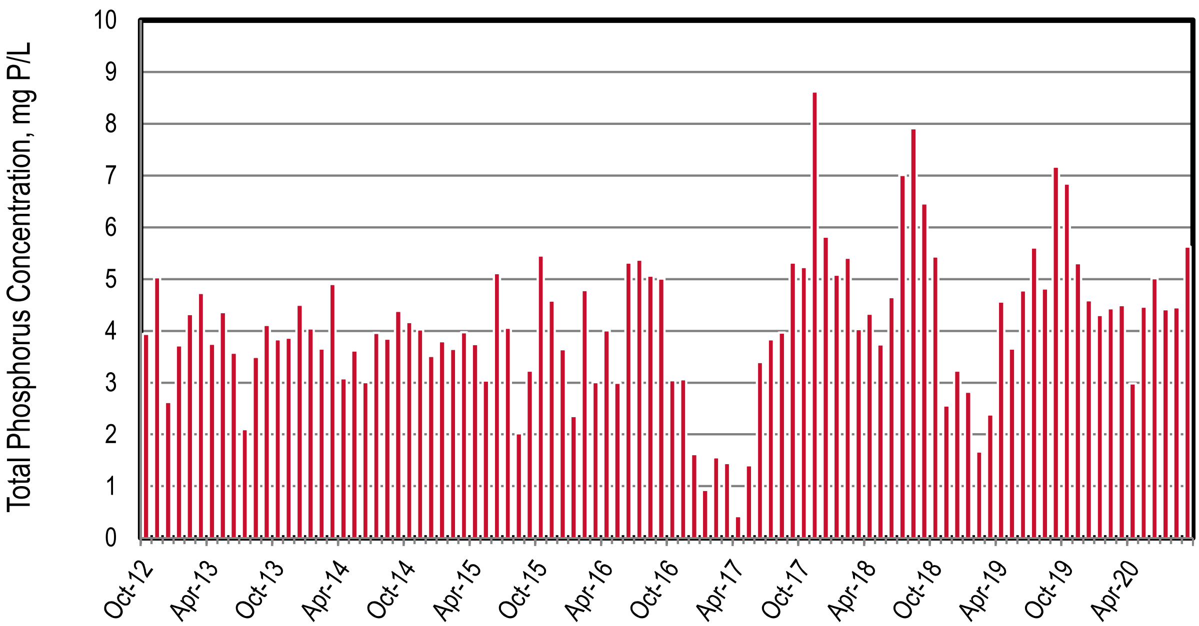

Figure 9-6. Discharge: EBMUD Monthly Phosphorus Concentrations ** (Refer to Table 9-2)

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10 Fairfield-Suisun Sewer District (FSSD)

FSSD discharges to waterways in the Suisun Marsh that flow more than 13 miles before reaching Suisun Bay. FSSD serves approximately 40,300 service connections. The plant has a permitted ADWF capacity of 23.7 mgd. The current ADWF discharge flow is approximately 11 mgd. The plant fully nitrifies and partially denitrifies using activated sludge.

The following observations are made based upon the figures and table in the subsequent pages:

- Influent
  - Note: limited to sampling since July 2019; quarterly sampling required at a minimum.
  - Based on the average monthly values table below, there are no emerging dry season trends.
  - The flow reduction across the plant is less than 10 percent. This reduction is primarily attributed to water bound with biosolids and evaporation.
  - The nitrogen load reduction values across the plant ranges from approximately 55 to 80 percent. This load reduction is attributed primarily to a combination of biological assimilation and nutrient load reduction in the activated sludge system.
  - The phosphorus load reduction across the plant ranges from approximately 35 to 55 percent. This reduction is primarily attributed to a combination of chemical removal, biological assimilation, and biological phosphorus removal in the activated sludge system.
- Discharge
  - The wet season average monthly flow and load values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
  - Based on the table with the average monthly values, there appears to be an emerging dry season upward trend for flow and total phosphorus loads.
  - Nitrogen loads typically increase with flow during wet weather events, whereas the phosphorus loads are relatively flat year-round.
  - Nitrogen wet season loads are typically greater and more variable than the dry season loads.
  - NOx is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant reliably nitrifies year-round.
  - Total phosphorus concentrations are wide ranging from approximately 1.5 to 6.8 mg P/L. Typical effluent TP concentrations are 3 to 6 mg P/L.

Influent

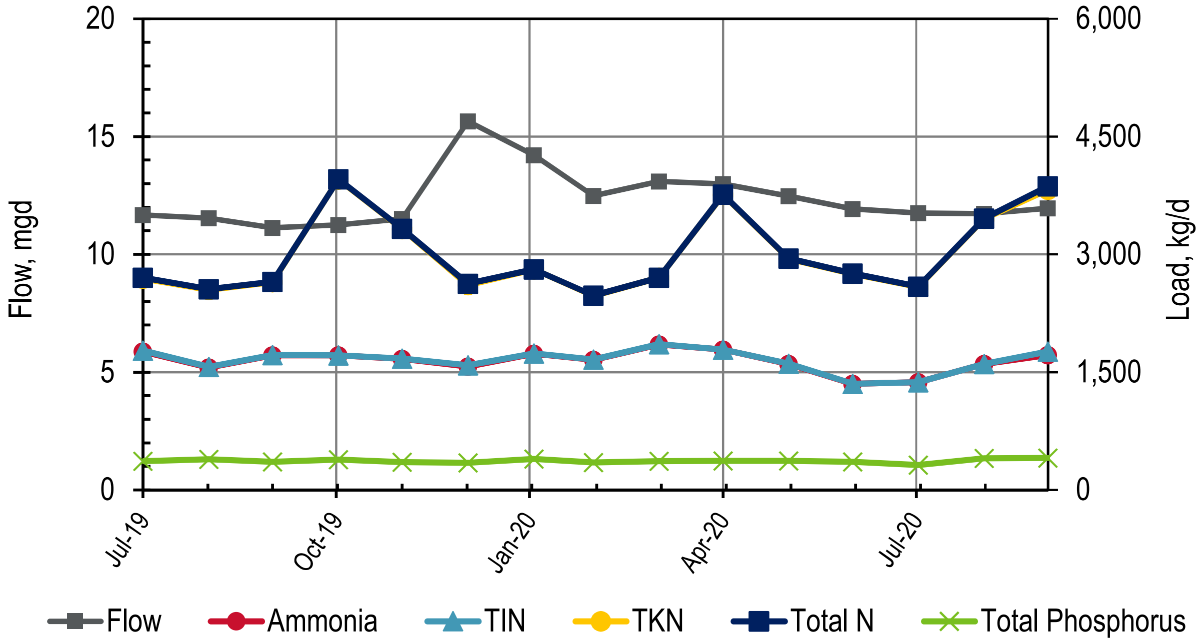

Figure 10-1. Influent: Fairfield-Suisun Sewer District Monthly Flows and Loads

Note: the ammonia/TIN loads and TKN/Total N loads are comparable. The ammonia and TKN values are located behind TIN and Total N loads and thus are not visible.

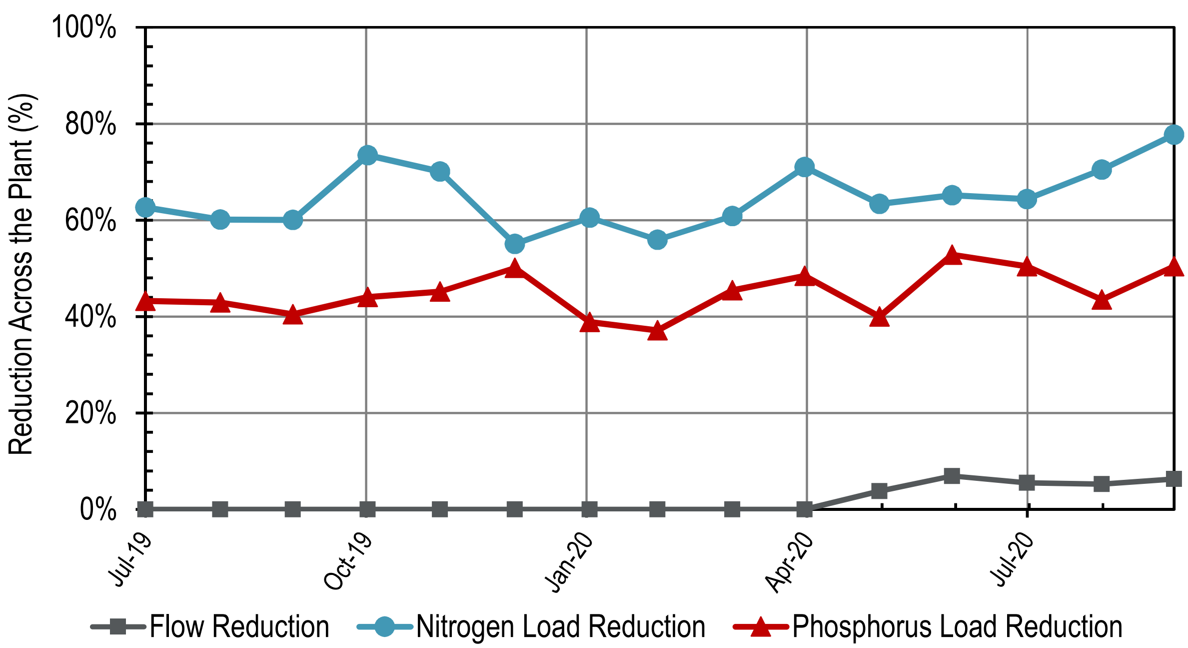

Figure 10-2. Influent: Fairfield-Suisun Sewer District Monthly Reductions Across the Plant

Note: Influent Total N was compared against Discharge TIN for calculating nitrogen load reduction.

Table 10-1. Influent: Fairfield-Suisun Sewer District Monthly Flows and Loads

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	11.7	1,760	10.2	1,770	2,690	2,700	368
Aug-19	11.5	1,560	8.34	1,570	2,550	2,560	389
Sep-19	11.1	1,710	3.00	1,720	2,650	2,650	359
Oct-19	11.2	1,710	1.74	1,720	3,950	3,960	388
Nov-19	11.5	1,670	2.62	1,670	3,320	3,330	356
Dec-19	15.7	1,570	17.2	1,590	2,610	2,630	344
Jan-20	14.2	1,740	2.40	1,740	2,810	2,810	396
Feb-20	12.5	1,660	2.15	1,660	2,470	2,470	350
Mar-20	13.1	1,850	2.57	1,860	2,700	2,700	367
Apr-20	13.0	1,790	2.63	1,790	3,760	3,760	372
May-20	12.5	1,600	4.90	1,610	2,940	2,950	370
Jun-20	11.9	1,350	2.11	1,350	2,750	2,750	358
Jul-20	11.7	1,370	1.73	1,370	2,590	2,590	319
Aug-20	11.7	1,600	2.67	1,610	3,450	3,460	404
Sep-20	12.0	1,720	44.2	1,760	3,820	3,870	405
Dry Season Average	**11.8**	**1,590**	**9.64**	**1,600**	**2,930**	**2,940**	**372**
Dry Season Trend ***	**None**	**None**	**None**	**None**	**None**	**None**	**None**
Wet Season Average	**13.0**	**1,710**	**4.48**	**1,720**	**3,090**	**3,090**	**368**
Average Annual	**12.4**	**1,640**	**7.23**	**1,650**	**3,010**	**3,010**	**370**

* Fairfield-Suisun Sewer District typically samples more than the required influent quarterly sampling. This dataset includes this additional sampling.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

Discharge

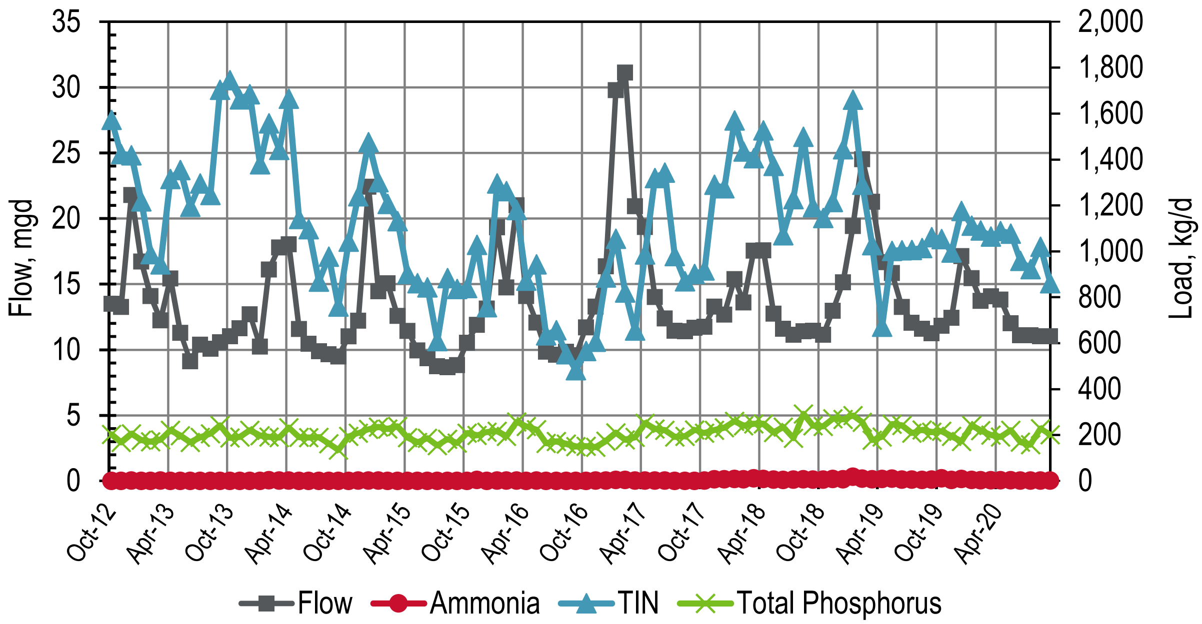

Figure 10-3. Discharge: Fairfield-Suisun Sewer District Monthly Flows and Loads

Table 10-2. Discharge: Fairfield-Suisun Sewer District Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	13.5	1.26	1,570	1,570	203
Nov-12	13.3	1.81	1,420	1,420	168
Dec-12	21.8	2.74	1,420	1,420	206
Jan-13	16.7	1.90	1,220	1,220	177
Feb-13	14.1	1.60	987	989	171
Mar-13	12.2	1.95	941	943	179
Apr-13	15.4	1.46	1,310	1,320	221
May-13	11.3	0.855	1,350	1,350	198
Jun-13	9.15	0.691	1,190	1,190	168
Jul-13	10.4	0.787	1,300	1,300	190
Aug-13	10.1	0.940	1,240	1,250	206
Sep-13	10.6	1.42	1,700	1,700	243
Oct-13	11.1	1.25	1,740	1,750	187
Nov-13	11.7	1.50	1,660	1,660	192
Dec-13	12.7	0.962	1,680	1,690	221
Jan-14	10.3	0.775	1,380	1,380	197
Feb-14	16.1	3.57	1,550	1,560	193

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Mar-14	17.8	2.89	1,440	1,440	189
Apr-14	18.1	2.82	1,660	1,670	232
May-14	11.6	1.75	1,140	1,140	191
Jun-14	10.5	0.982	1,100	1,100	189
Jul-14	9.88	1.12	868	869	190
Aug-14	9.67	1.18	977	978	163
Sep-14	9.50	1.32	759	761	135
Oct-14	11.0	1.83	1,040	1,040	195
Nov-14	12.2	2.00	1,240	1,240	209
Dec-14	22.4	3.12	1,470	1,480	225
Jan-15	14.5	2.18	1,300	1,300	235
Feb-15	15.1	1.78	1,210	1,210	227
Mar-15	12.6	1.45	1,130	1,130	238
Apr-15	11.5	1.34	901	902	190
May-15	9.95	1.18	860	861	169
Jun-15	9.35	1.07	842	843	187
Jul-15	8.75	0.924	608	609	154
Aug-15	8.70	1.03	883	884	183
Sep-15	8.85	0.896	836	837	166
Oct-15	10.6	1.17	840	842	209
Nov-15	11.9	4.73	1,020	1,030	198
Dec-15	13.2	1.36	756	757	213
Jan-16	19.3	2.38	1,290	1,300	217
Feb-16	14.8	2.69	1,260	1,260	194
Mar-16	21.0	2.77	1,180	1,180	258
Apr-16	14.1	1.58	871	873	238
May-16	12.1	1.99	942	944	225
Jun-16	9.86	1.01	634	635	164
Jul-16	9.65	1.04	657	658	173
Aug-16	9.88	0.910	552	553	161
Sep-16	9.60	1.33	482	483	150
Oct-16	11.7	1.76	565	566	152
Nov-16	13.3	2.52	604	607	147
Dec-16	16.4	2.15	885	887	174
Jan-17	29.8	4.77	1,050	1,060	210
Feb-17	31.1	5.60	815	821	179
Mar-17	20.9	3.24	653	656	190

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Apr-17	19.4	2.83	984	987	252
May-17	14.0	1.96	1,320	1,320	227
Jun-17	12.4	2.10	1,340	1,340	221
Jul-17	11.5	1.58	979	980	192
Aug-17	11.4	1.73	868	870	195
Sep-17	11.7	1.84	900	902	223
Oct-17	11.8	1.94	916	918	208
Nov-17	13.3	7.91	1,280	1,290	221
Dec-17	12.7	7.81	1,270	1,280	232
Jan-18	15.4	9.74	1,560	1,570	260
Feb-18	13.6	8.61	1,430	1,440	241
Mar-18	17.6	12.0	1,390	1,410	249
Apr-18	17.6	9.75	1,520	1,530	249
May-18	12.8	7.29	1,370	1,370	212
Jun-18	11.6	5.97	1,070	1,070	235
Jul-18	11.2	6.74	1,040	1,230	186
Aug-18	11.4	7.57	1,490	1,500	293
Sep-18	11.4	6.56	1,190	1,190	240
Oct-18	11.2	6.63	1,140	1,150	238
Nov-18	13.0	9.32	1,210	1,220	272
Dec-18	15.2	8.32	1,440	1,450	269
Jan-19	19.4	19.9	1,640	1,660	286
Feb-19	24.5	10.6	1,280	1,290	256
Mar-19	21.3	7.67	1,020	1,030	179
Apr-19	16.7	9.60	663	672	191
May-19	15.9	11.4	991	1,000	248
Jun-19	13.3	6.98	998	1,010	242
Jul-19	12.1	6.36	1,000	1,010	209
Aug-19	11.6	5.73	1,010	1,020	222
Sep-19	11.3	6.57	1,060	1,060	214
Oct-19	11.8	12.0	1,040	1,050	217
Nov-19	12.5	6.04	989	995	195
Dec-19	17.2	9.73	1,170	1,180	172
Jan-20	15.5	5.95	1,110	1,110	242
Feb-20	13.8	3.98	1,090	1,090	220
Mar-20	14.1	4.18	1,060	1,060	200
Apr-20	13.8	4.22	1,080	1,090	192

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
May-20	12.0	3.52	1,070	1,080	222
Jun-20	11.1	2.96	956	959	169
Jul-20	11.1	3.01	920	923	158
Aug-20	11.1	3.15	1,020	1,020	228
Sep-20	11.2	3.24	859	862	201
Dry Season Average	**11.0**	**2.97**	**1,010**	**1,020**	**198**
Dry Season Trend **	**Up**	***	**None**	**None**	**Up**
Wet Season Average	**15.6**	**4.57**	**1,180**	**1,190**	**212**
Average Annual	**13.7**	**3.90**	**1,110**	**1,120**	**206**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

*** Ammonia was not considered in the trending as the plant reliably fully nitrifies and the majority of samples are non-detects

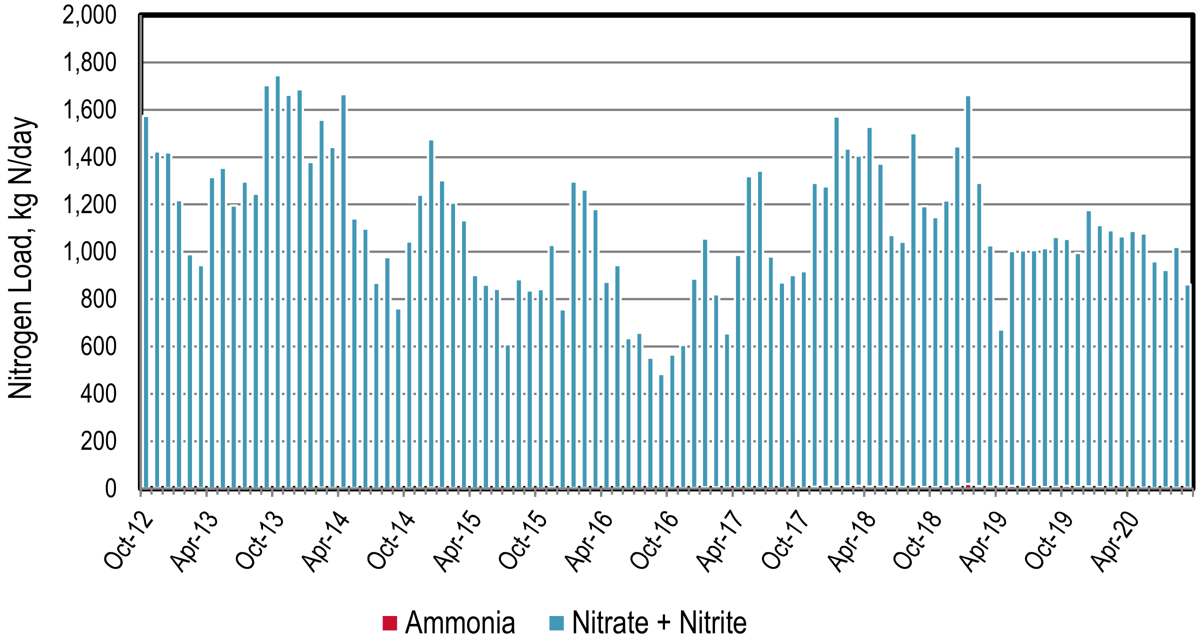

Figure 10-4. Discharge: Fairfield-Suisun Sewer District Monthly Nitrogen Loads

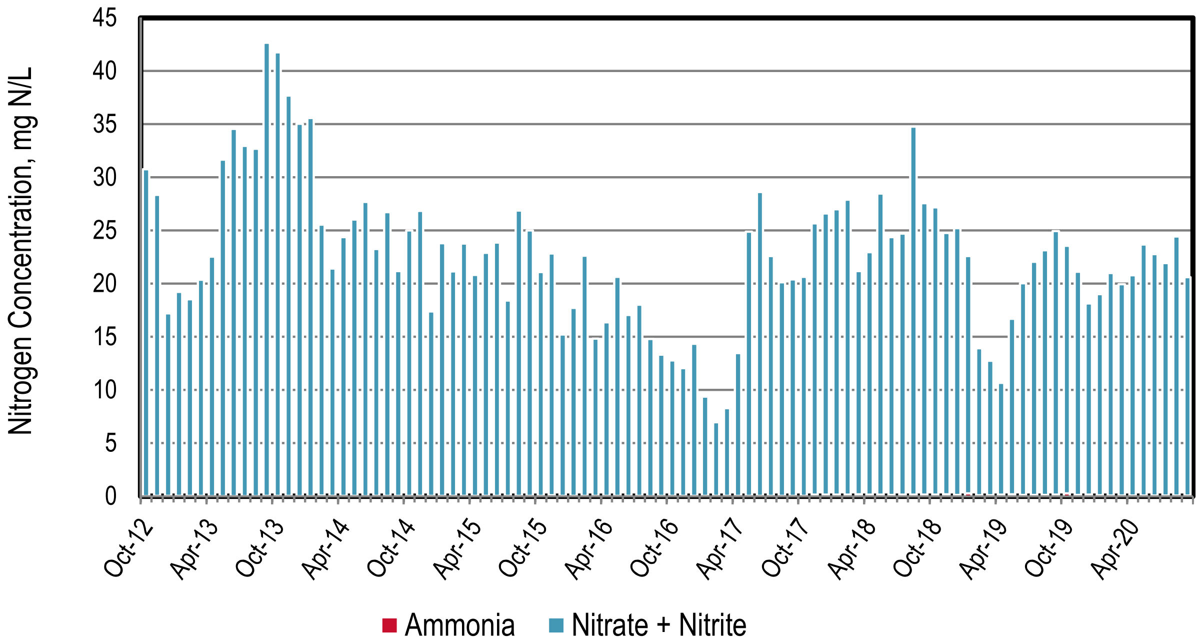

Figure 10-5. Discharge: Fairfield-Suisun Sewer District Monthly Nitrogen Concentrations

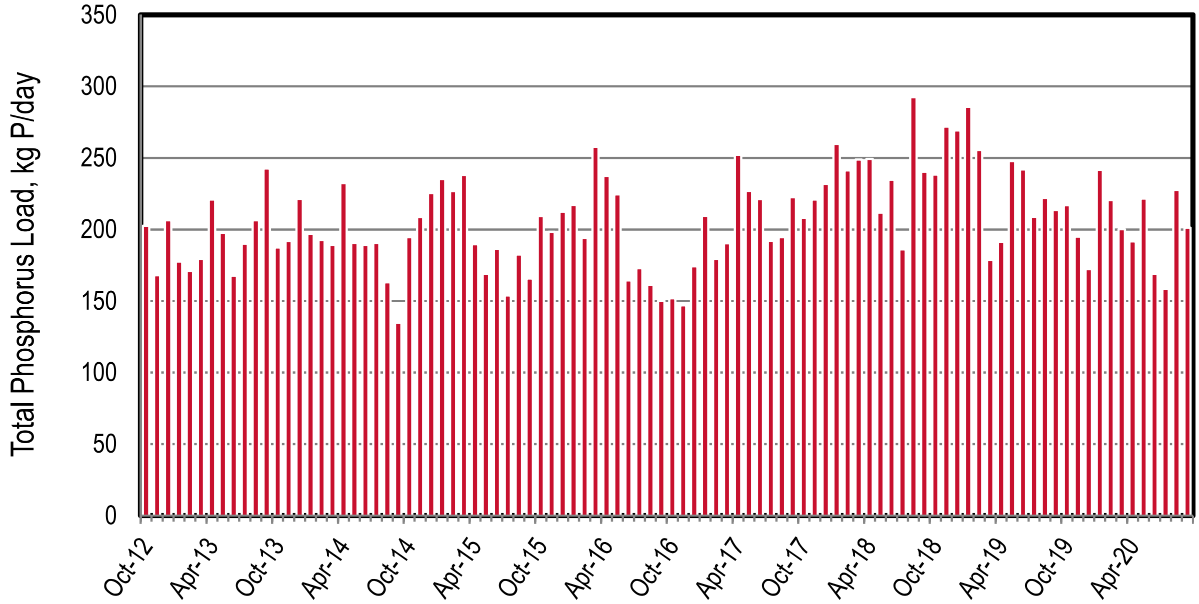

Figure 10-6. Discharge: Fairfield-Suisun Sewer District Monthly Phosphorus Loads

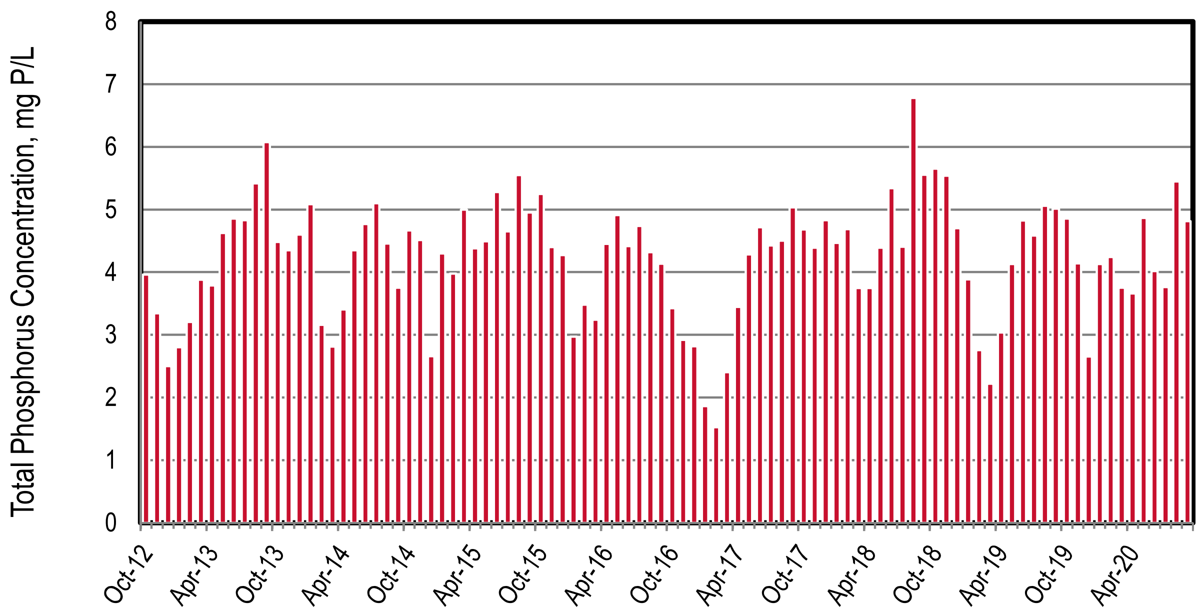

Figure 10-7. Discharge: Fairfield-Suisun Sewer District Monthly Phosphorus Concentrations

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11 Las Gallinas Valley Sanitary District

Las Gallinas discharges to Miller Creek that is connected to San Pablo Bay. The plant has approximately 15,800 service connections; it has a permitted capacity of 2.92 mgd ADWF and a peak wet weather secondary treatment capacity of 8.0 mgd. The plant performs secondary treatment using two rock trickling filters and nitrification using a third trickling filter equipped with plastic media. Discharge to Miller Creek is prohibited June 1 through October 31.

The following observations are made based upon the figures and table in the subsequent pages:

- Based on the average monthly values table, there are no emerging dry season trends as Las Gallinas does not typically discharge during the dry season.
- TIN loads are relatively consistent over the years shown.
- NOx is the majority of the nitrogen species discharged as would be expected since this plant nitrifies. A portion of ammonia bleeds through during the colder months. This increases the ammonia contribution during such months.
- Total phosphorus concentrations range from 0.5 to 6.0 mg P/L. This suggests occasional P removal as typical effluent TP concentrations are 4 to 6 mg P/L.

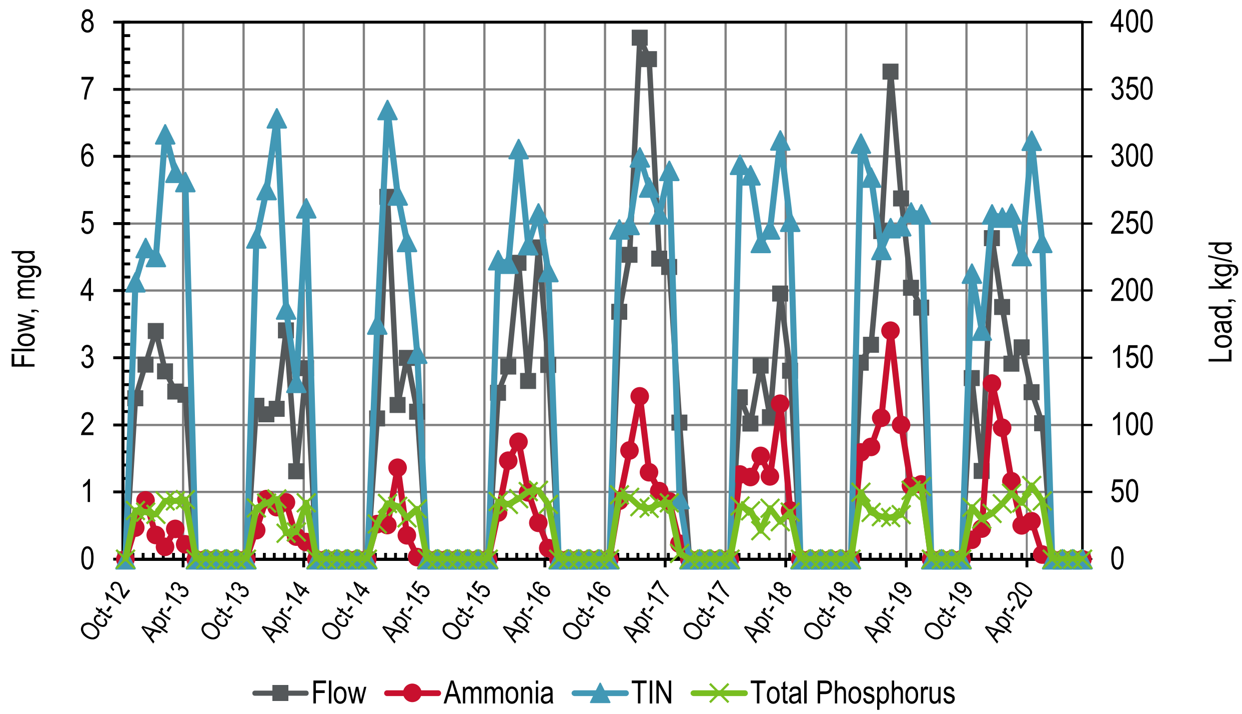

Figure 11-1. Discharge: Las Gallinas Monthly Flows and Loads

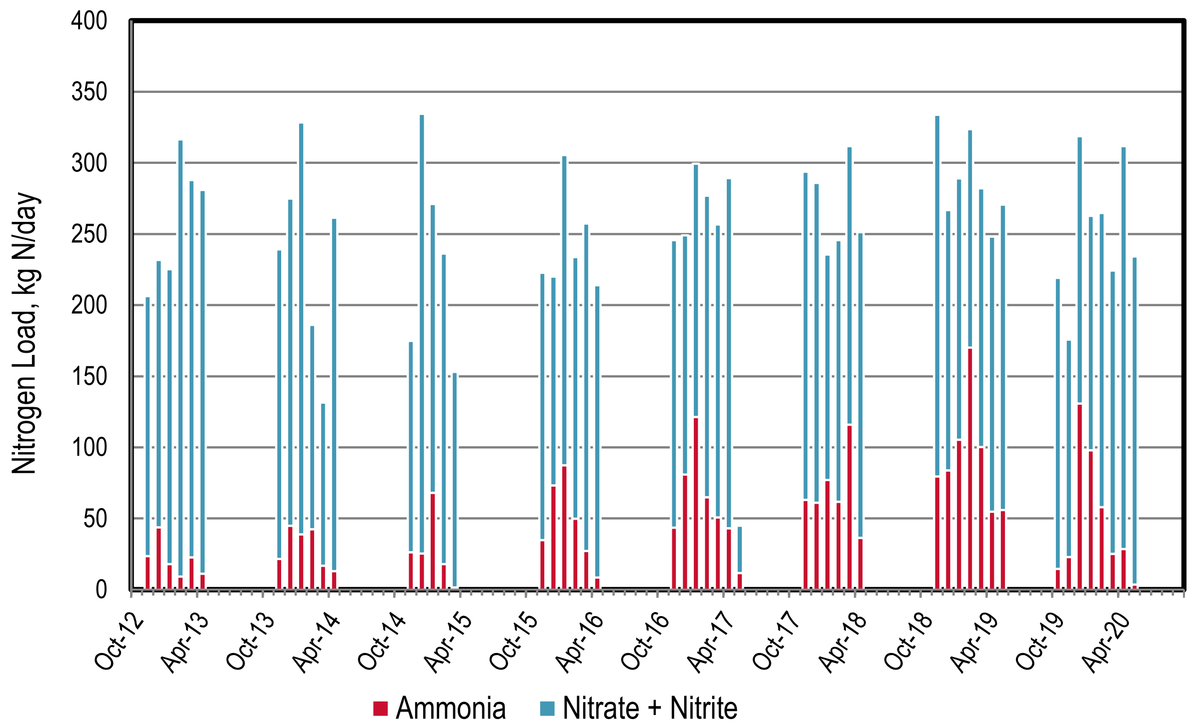

Figure 11-2. Discharge: Las Gallinas Monthly Nitrogen Loads

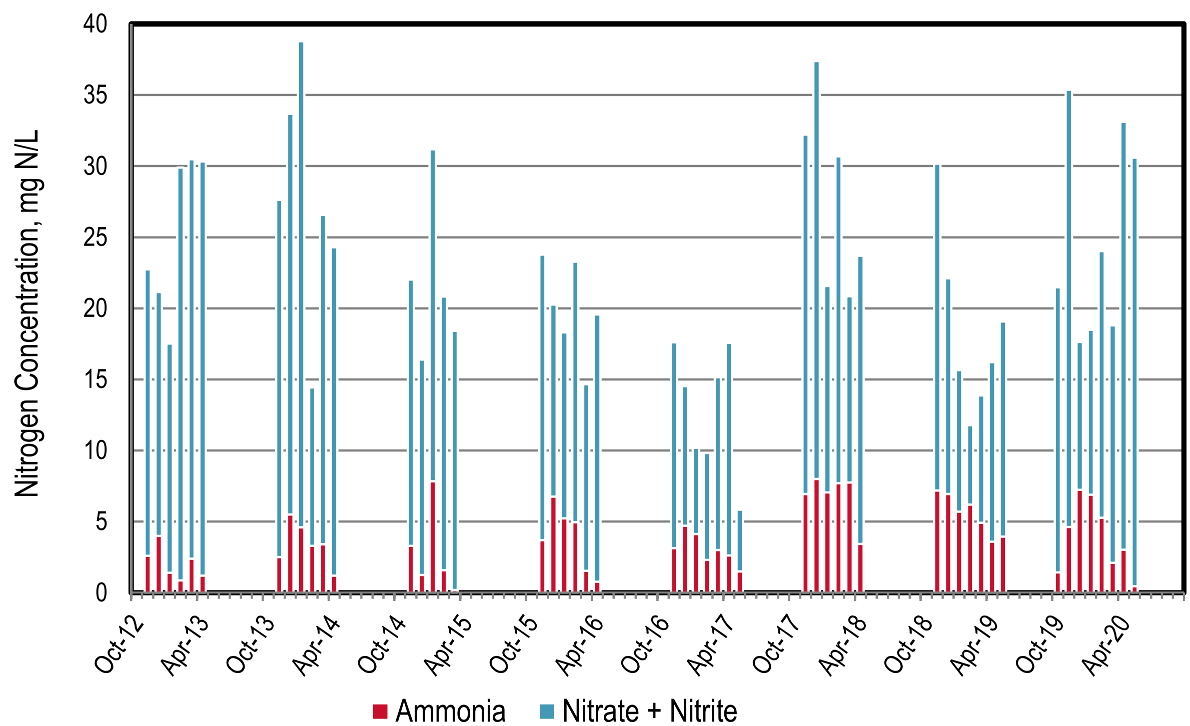

Figure 11-3. Discharge: Las Gallinas Monthly Nitrogen Concentrations

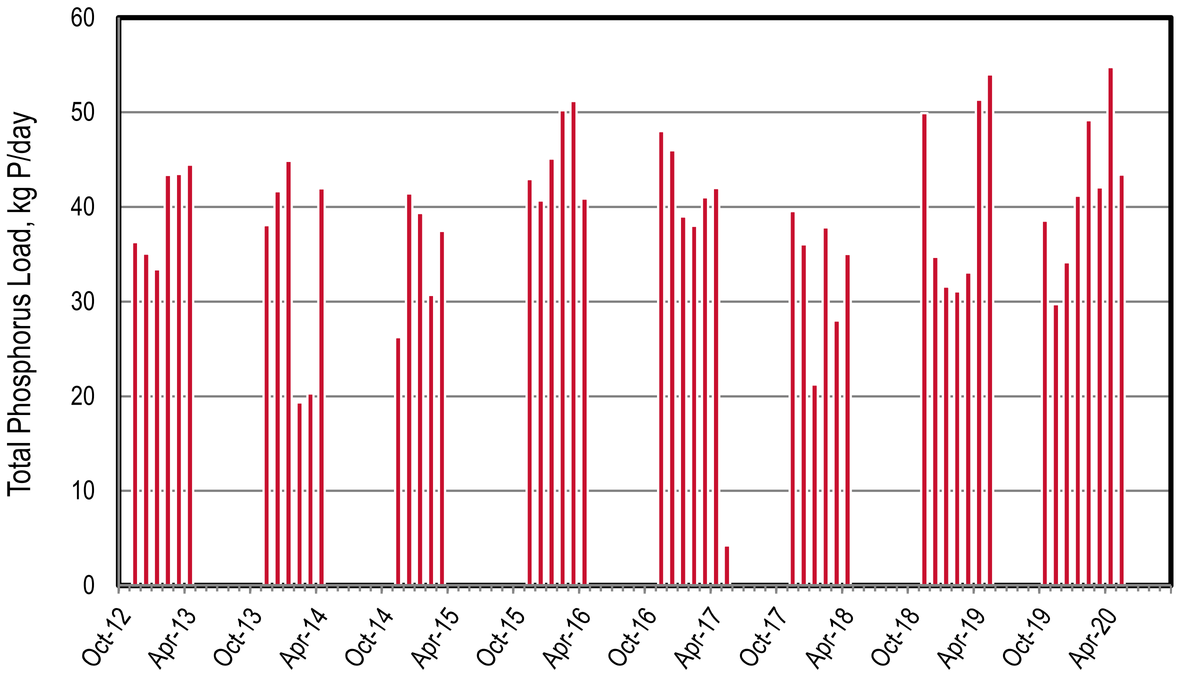

Figure 11-4. Discharge: Las Gallinas Monthly Phosphorus Loads

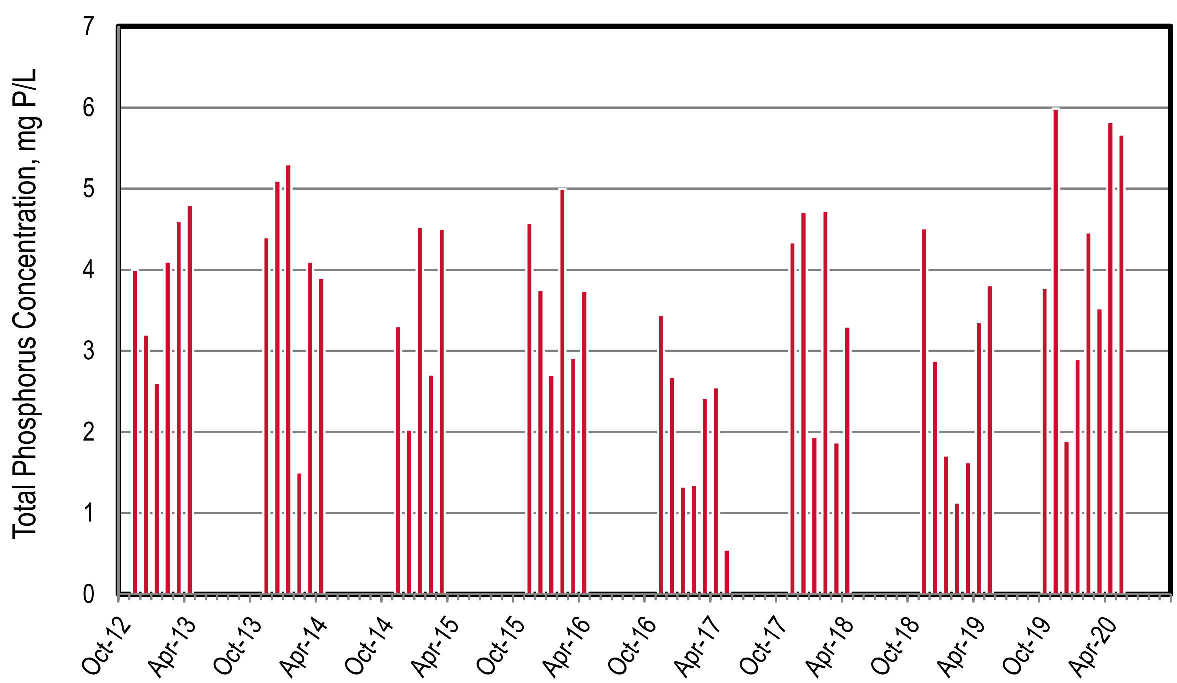

Figure 11-5. Discharge: Las Gallinas Monthly Phosphorus Concentrations

Table 11-1. Discharge: Las Gallinas Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	0	0	0	0	0
Nov-12	2.40	23.6	183	206	36.3
Dec-12	2.90	43.8	188	232	35.1
Jan-13	3.40	18.0	207	225	33.4
Feb-13	2.80	9.21	307	316	43.4
Mar-13	2.50	22.7	265	288	43.5
Apr-13	2.45	11.1	270	281	44.5
May-13	0	0	0	0	0
Jun-13	0	0	0	0	0
Jul-13	0	0	0	0	0
Aug-13	0	0	0	0	0
Sep-13	0	0	0	0	0
Oct-13	0	0	0	0	0
Nov-13	2.29	21.6	217	239	38.1
Dec-13	2.16	44.9	230	275	41.6
Jan-14	2.24	38.9	289	328	44.9
Feb-14	3.41	42.5	144	186	19.3
Mar-14	1.31	16.8	115	132	20.3
Apr-14	2.85	12.9	249	262	42.0
May-14	0	0	0	0	0
Jun-14	0	0	0	0	0
Jul-14	0	0	0	0	0
Aug-14	0	0	0	0	0
Sep-14	0	0	0	0	0
Oct-14	0	0	0	0	0
Nov-14	2.10	26.2	149	175	26.2
Dec-14	5.40	25.4	309	335	41.4
Jan-15	2.30	68.1	203	271	39.4
Feb-15	3.00	17.9	218	236	30.7
Mar-15	2.20	1.60	152	153	37.5
Apr-15	0	0	0	0	0
May-15	0	0	0	0	0
Jun-15	0	0	0	0	0
Jul-15	0	0	0	0	0
Aug-15	0	0	0	0	0
Sep-15	0	0	0	0	0

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	0	0	0	0	0
Nov-15	2.48	34.8	188	223	42.9
Dec-15	2.87	73.3	147	220	40.7
Jan-16	4.42	87.4	218	305	45.1
Feb-16	2.66	49.8	184	234	50.2
Mar-16	4.65	27.2	230	257	51.2
Apr-16	2.89	8.42	206	214	40.9
May-16	0	0	0	0	0
Jun-16	0	0	0	0	0
Jul-16	0	0	0	0	0
Aug-16	0	0	0	0	0
Sep-16	0	0	0	0	0
Oct-16	0	0	0	0	0
Nov-16	3.69	43.6	202	246	48.0
Dec-16	4.54	81.0	168	249	46.0
Jan-17	7.77	121	178	299	39.0
Feb-17	7.45	64.9	212	277	38.0
Mar-17	4.48	50.8	206	257	41.0
Apr-17	4.36	43.3	246	289	42.0
May-17	2.04	11.6	33.3	44.9	4.22
Jun-17	0	0	0	0	0
Jul-17	0	0	0	0	0
Aug-17	0	0	0	0	0
Sep-17	0	0	0	0	0
Oct-17	0	0	0	0	0
Nov-17	2.41	63.2	231	294	39.6
Dec-17	2.02	61.2	225	286	36.0
Jan-18	2.89	77.1	159	236	21.2
Feb-18	2.12	61.7	184	246	37.8
Mar-18	3.96	116	196	312	28.0
Apr-18	2.81	36.5	215	251	35.0
May-18	0	0	0	0	0
Jun-18	0	0	0	0	0
Jul-18	0	0	0	0	0
Aug-18	0	0	0	0	0
Sep-18	0	0	0	0	0
Oct-18	0	0	0	0	0

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	2.93	79.5	254	310	49.9
Dec-18	3.19	83.7	183	284	34.7
Jan-19	4.89	105	184	230	31.6
Feb-19	7.27	170	154	247	31.1
Mar-19	5.38	100	182	248	33.1
Apr-19	4.05	54.8	193	258	51.3
May-19	3.75	55.9	215	257	54.0
Jun-19	0	0	0	0	0
Jul-19	0	0	0	0	0
Aug-19	0	0	0	0	0
Sep-19	0	0	0	0	0
Oct-19	2.70	14.6	205	213	38.6
Nov-19	1.31	23.0	153	170	29.7
Dec-19	4.79	131	188	257	34.2
Jan-20	3.76	97.9	165	254	41.2
Feb-20	2.92	58.1	207	257	49.2
Mar-20	3.16	25.1	199	226	42.1
Apr-20	2.49	28.4	283	312	54.8
May-20	2.03	3.61	231	236	43.4
Jun-20	0	0	0	0	0
Jul-20	0	0	0	0	0
Aug-20	0	0	0	0	0
Sep-20	0	0	0	0	0
Dry Season Average	**0.195**	**1.78**	**12.0**	**13.4**	**2.54**
Dry Season Trend **, ***	**--**	**--**	**--**	**--**	**--**
Wet Season Average	**2.91**	**45.0**	**176**	**216**	**33.2**
Average Annual	**1.78**	**27.0**	**107**	**132**	**20.4**

* The Total Inorganic Nitrogen value is calculated by adding the "Ammonia" and "Nitrate + Nitrite" values.

** The dry season average is so much lower than the wet season due to only having one month with a dry season discharge (May 2017).

*** No dry season trending analysis was performed on Las Gallinas as discharge is prohibited from June through October.

12 City of Millbrae

Millbrae discharges to the South Bay. The plant has approximately 6,500 service connections and it has a permitted capacity of 3.0 mgd ADWF. The current plant flows are approximately 1.4 mgd ADWF. The plant performs secondary treatment using an activated sludge process.

The following observations are made based upon the figures and table in the subsequent pages:

- The wet season average monthly flow values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
- Based on the table with the average monthly values, there appears to be an emerging dry season upward trend for ammonia and total inorganic nitrogen loads.
- Both nitrogen and phosphorus loads typically increase with flow during wet weather events. However, the loads typically stay elevated after the flows decline back to typical values.
- Ammonia is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant does not nitrify.
- Total phosphorus concentrations range from 0.5 to 4.8 mg P/L. This suggests occasional P removal as typical effluent TP concentrations are 4 to 6 mg P/L. The removal mechanism is thought to be the anaerobic selector in the activated sludge process.

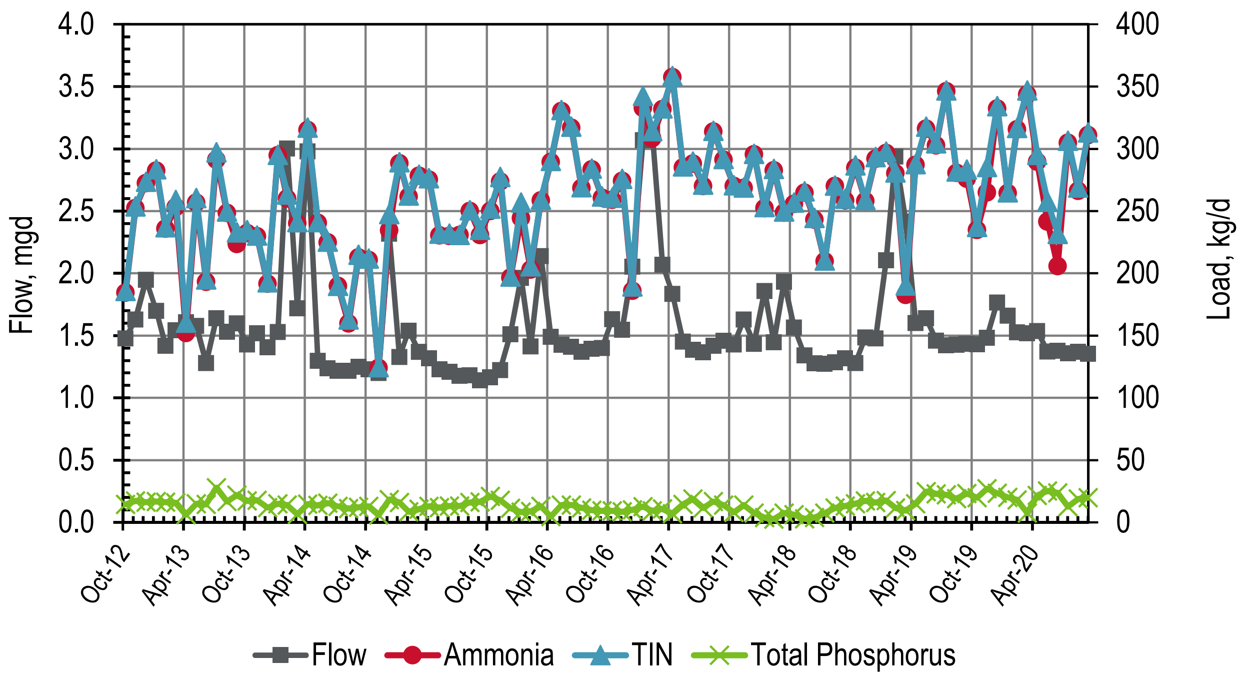

Figure 12-1. Discharge: Millbrae Monthly Flows and Loads

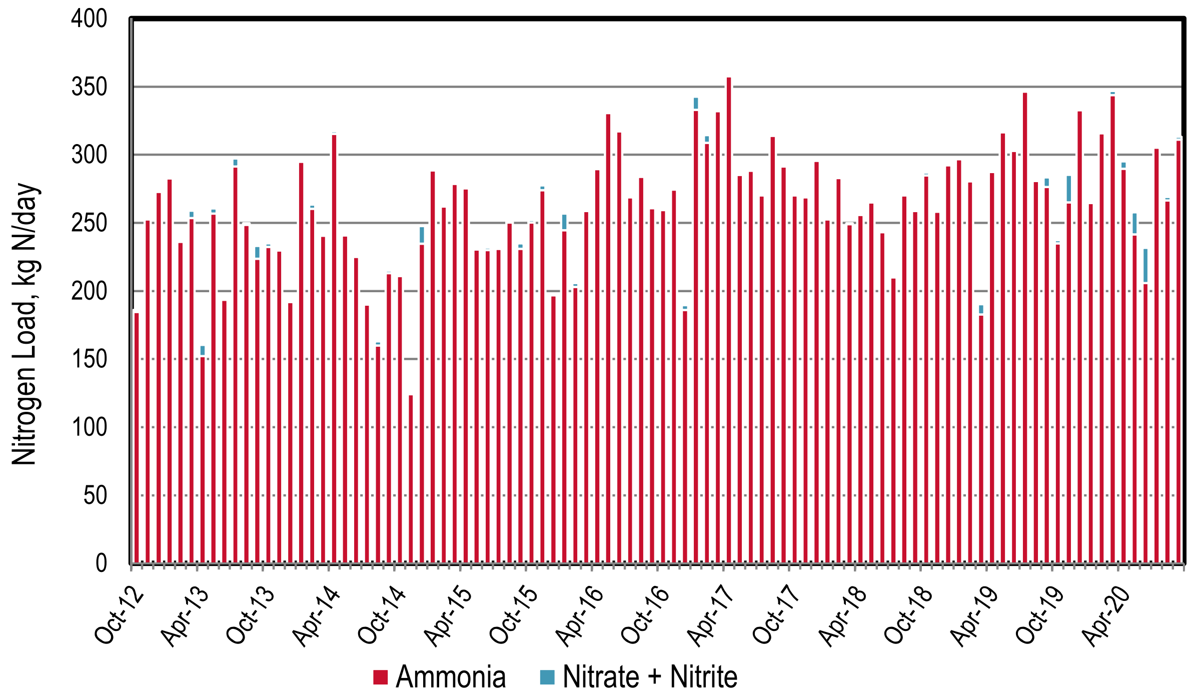

Figure 12-2. Discharge: Millbrae Monthly Nitrogen Loads

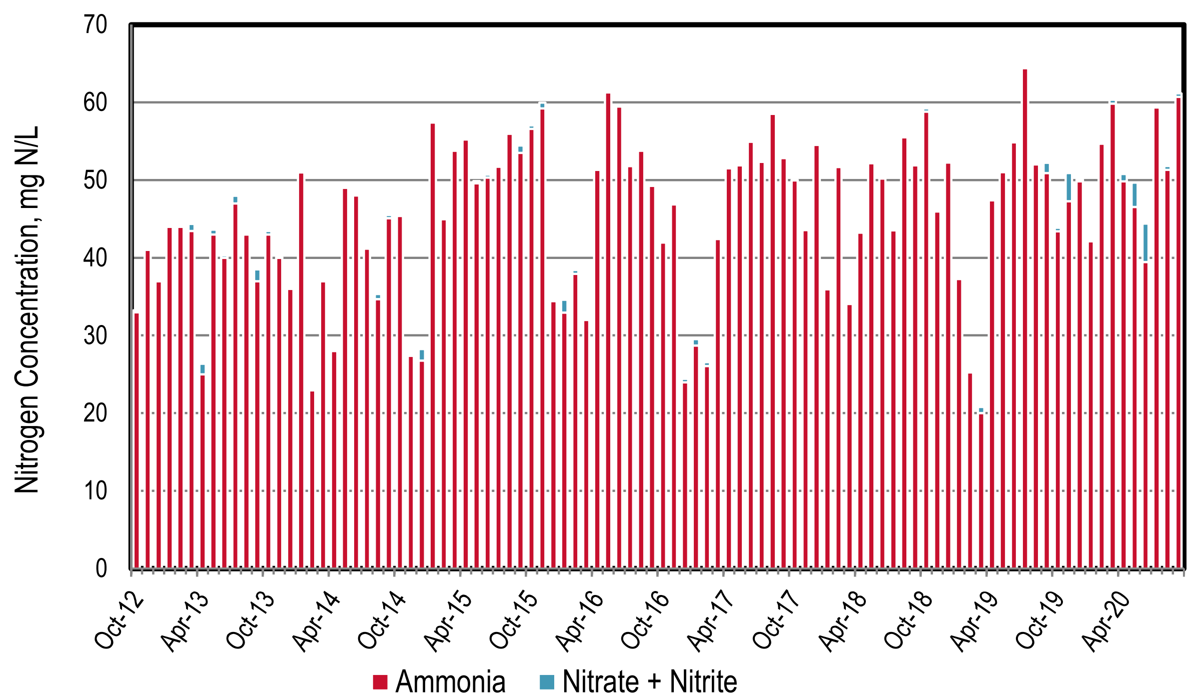

Figure 12-3. Discharge: Millbrae Monthly Nitrogen Concentrations

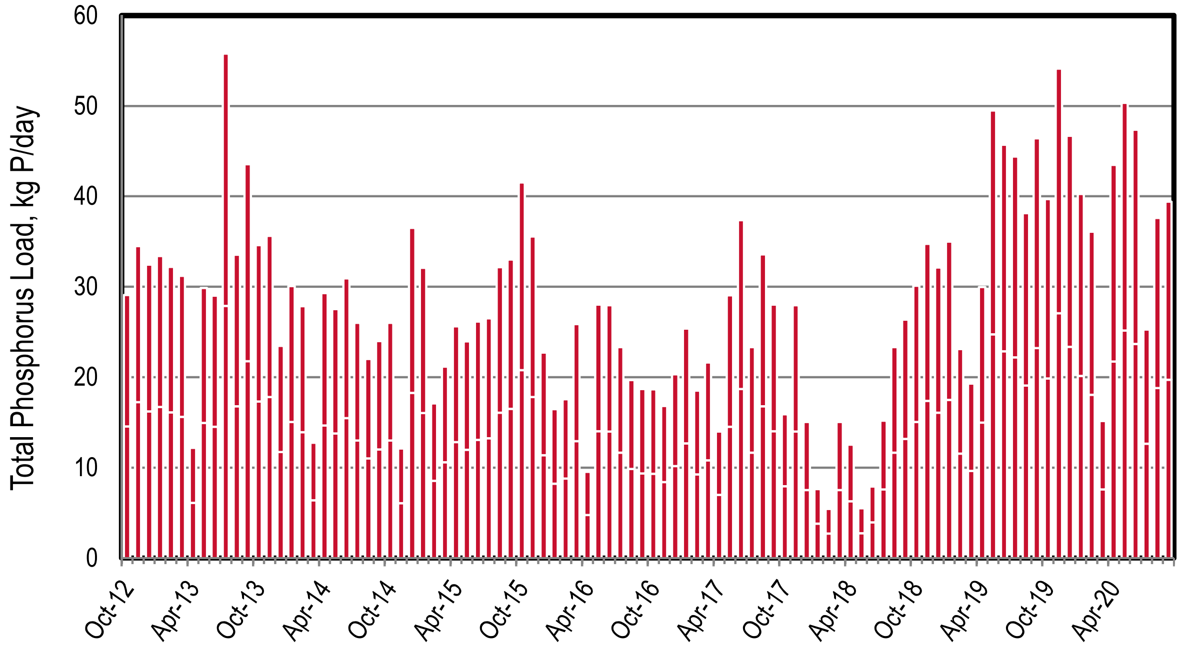

Figure 12-4. Discharge: Millbrae Monthly Phosphorus Loads

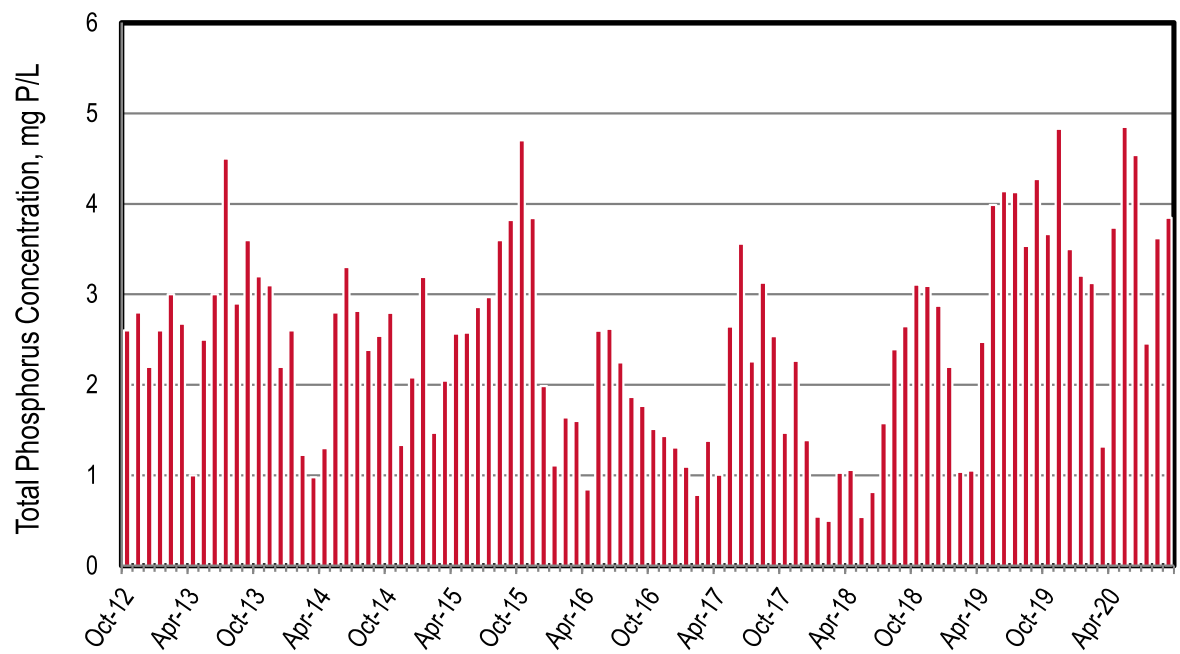

Figure 12-5. Discharge: Millbrae Monthly Phosphorus Concentrations

Table 12-1. Millbrae Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	1.48	185	1.40	186	14.5
Nov-12	1.63	253	1.11	254	17.3
Dec-12	1.95	273	0.855	274	16.2
Jan-13	1.70	283	0.945	284	16.7
Feb-13	1.42	236	0.896	237	16.1
Mar-13	1.54	253	5.46	259	15.6
Apr-13	1.61	152	8.23	160	6.09
May-13	1.58	257	3.72	261	14.9
Jun-13	1.28	194	1.55	195	14.5
Jul-13	1.64	291	5.95	297	27.9
Aug-13	1.53	249	1.15	250	16.8
Sep-13	1.60	224	9.19	233	21.8
Oct-13	1.43	232	2.43	235	17.3
Nov-13	1.52	230	0.718	231	17.8
Dec-13	1.41	192	0.933	193	11.7
Jan-14	1.53	295	0.197	295	15.0
Feb-14	3.01	260	2.96	263	13.9
Mar-14	1.72	241	0.592	241	6.37
Apr-14	2.98	315	1.72	317	14.6
May-14	1.30	241	0.457	241	13.8
Jun-14	1.24	225	0.502	225	15.5
Jul-14	1.22	190	0.0650	190	13.0
Aug-14	1.22	160	3.00	163	11.0
Sep-14	1.25	213	2.00	215	12.0
Oct-14	1.23	211	1.00	212	13.0
Nov-14	1.20	124	0.670	125	6.05
Dec-14	2.32	235	13.0	248	18.3
Jan-15	1.33	289	0.750	289	16.0
Feb-15	1.54	262	0.690	263	8.55
Mar-15	1.37	279	0.780	279	10.6
Apr-15	1.32	276	0.900	276	12.8
May-15	1.23	231	1.33	232	12.0
Jun-15	1.21	230	1.76	232	13.1
Jul-15	1.18	231	0.0856	231	13.3
Aug-15	1.18	250	0.715	251	16.1
Sep-15	1.14	231	4.00	235	16.5

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	1.17	250	1.91	252	20.8
Nov-15	1.22	274	3.46	277	17.8
Dec-15	1.51	197	0.644	197	11.4
Jan-16	1.96	245	12.4	257	8.24
Feb-16	1.42	203	2.63	206	8.78
Mar-16	2.14	259	0.600	259	12.9
Apr-16	1.49	290	0.738	290	4.77
May-16	1.43	331	0.672	331	14.0
Jun-16	1.41	317	0.753	318	14.0
Jul-16	1.37	269	0.492	269	11.7
Aug-16	1.40	284	0.510	284	9.85
Sep-16	1.40	261	0.935	262	9.35
Oct-16	1.63	259	1.40	261	9.33
Nov-16	1.55	275	1.46	276	8.40
Dec-16	2.05	186	3.55	190	10.2
Jan-17	3.07	333	9.52	343	12.7
Feb-17	3.13	309	5.66	314	9.26
Mar-17	2.07	332	0.440	332	10.8
Apr-17	1.84	358	0.874	359	7.00
May-17	1.45	285	0.778	286	14.5
Jun-17	1.39	288	1.55	290	18.7
Jul-17	1.37	270	0.954	271	11.7
Aug-17	1.42	314	0.595	315	16.8
Sep-17	1.46	291	0.560	292	14.0
Oct-17	1.43	270	0.472	271	7.95
Nov-17	1.63	269	0.349	269	14.0
Dec-17	1.43	296	0.296	296	7.53
Jan-18	1.86	253	0.699	253	3.82
Feb-18	1.45	283	1.07	284	2.72
Mar-18	1.93	249	0.811	250	7.53
Apr-18	1.57	256	0.888	257	6.27
May-18	1.34	265	0.899	266	2.74
Jun-18	1.28	243	1.38	245	3.96
Jul-18	1.28	210	0.581	210	7.59
Aug-18	1.29	270	0.435	271	11.7
Sep-18	1.32	259	1.32	260	13.2
Oct-18	1.28	285	1.99	287	15.0

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	1.49	258	0.751	259	17.4
Dec-18	1.48	292	1.31	294	16.1
Jan-19	2.11	297	0.989	298	17.5
Feb-19	2.94	281	0.611	281	11.6
Mar-19	2.42	183	7.48	190	9.64
Apr-19	1.60	287	0.500	288	15.0
May-19	1.64	316	1.44	318	24.7
Jun-19	1.46	303	1.49	304	22.9
Jul-19	1.42	346	0.417	347	22.2
Aug-19	1.43	281	1.06	282	19.1
Sep-19	1.44	276	7.18	283	23.2
Oct-19	1.43	235	2.25	237	19.8
Nov-19	1.48	265	20.3	285	27.1
Dec-19	1.77	333	1.77	334	23.4
Jan-20	1.66	265	0.57	265	20.1
Feb-20	1.53	316	1.02	317	18.0
Mar-20	1.52	344	2.91	347	7.58
Apr-20	1.54	290	5.40	295	21.7
May-20	1.37	242	16.1	258	25.2
Jun-20	1.38	206	25.7	232	23.7
Jul-20	1.36	305	1.32	306	12.6
Apr-20	1.37	266	2.61	269	18.8
Sep-20	1.36	311	2.23	313	19.7
Dry Season Average	**1.37**	**261**	**2.69**	**263**	**15.4**
Dry Season Trend**	**None**	**Up**	**None**	**Up**	**None**
Wet Season Average	**1.73**	**262**	**2.57**	**264**	**13.0**
Average Annual	**1.58**	**261**	**2.62**	**264**	**14.0**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

13 Mt. View Sanitary District

Mt. View Sanitary District discharges to Suisun Bay. The plant has approximately 10,500 service connections; it has a permitted capacity of 3.2 mgd ADWF and a peak wet weather capacity of 8.5 mgd. The current flow is 1.2 mgd ADWF. The plant performs nitrification using a series of trickling filters. Flow data for a portion of the 2018 dry season and the 2018/2019 dataset were inaccurately reported in the 2018 and 2019 Group Annual Reports. The data that follows reflects the accurate data since updated in CIWQS.

The following observations are made based upon the figures and table in the subsequent pages:

- The wet season average monthly flow values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
- Based on average monthly values, there appears to be a downward dry season trend for Total Phosphorus loads, and an upward trend for ammonia loads. Despite an emerging upward ammonia trend, it is important to note that the plant fully nitrifies with ammonia concentrations reliably less than 3 mg N/L since sampling began in 2012.
- Both nitrogen and phosphorus loads typically increase with flow during wet weather events.
- Wet season nitrogen loads are greater and more variable than the dry season loads.
- NOx is the majority of the nitrogen species discharged as would be expected since this plant nitrifies. A portion of ammonia bleeds through during the colder months. This increases the ammonia contribution during such months.
- Total phosphorus concentrations range from 0.6 to 6.2 mg P/L, which suggests occasional P removal as typical effluent TP concentrations are 4 to 6 mg P/L.

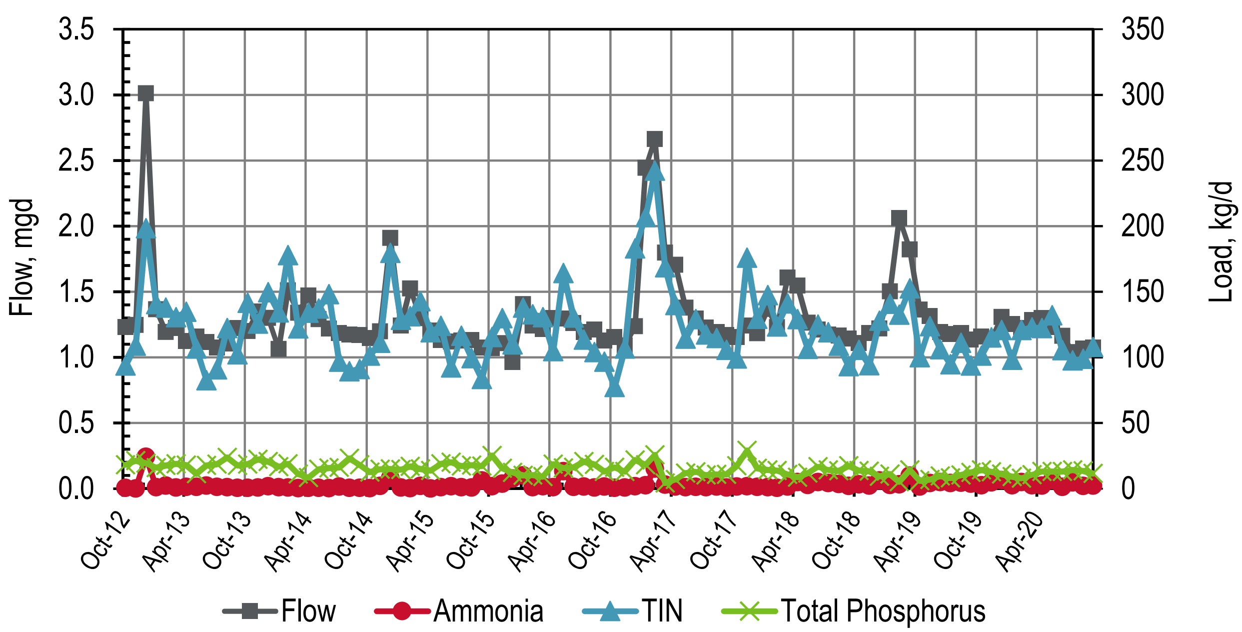

Figure 13-1. Discharge: Mt. View Sanitary District Monthly Flows and Loads

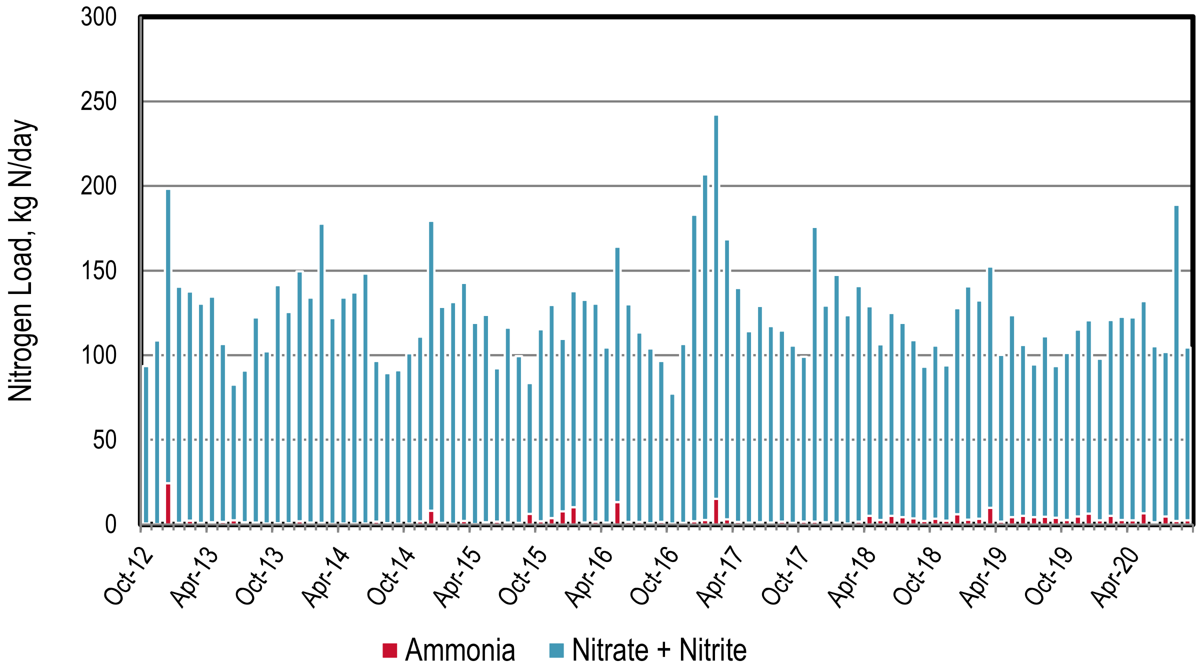

Figure 13-2. Discharge: Mt. View Sanitary District Monthly Nitrogen Loads

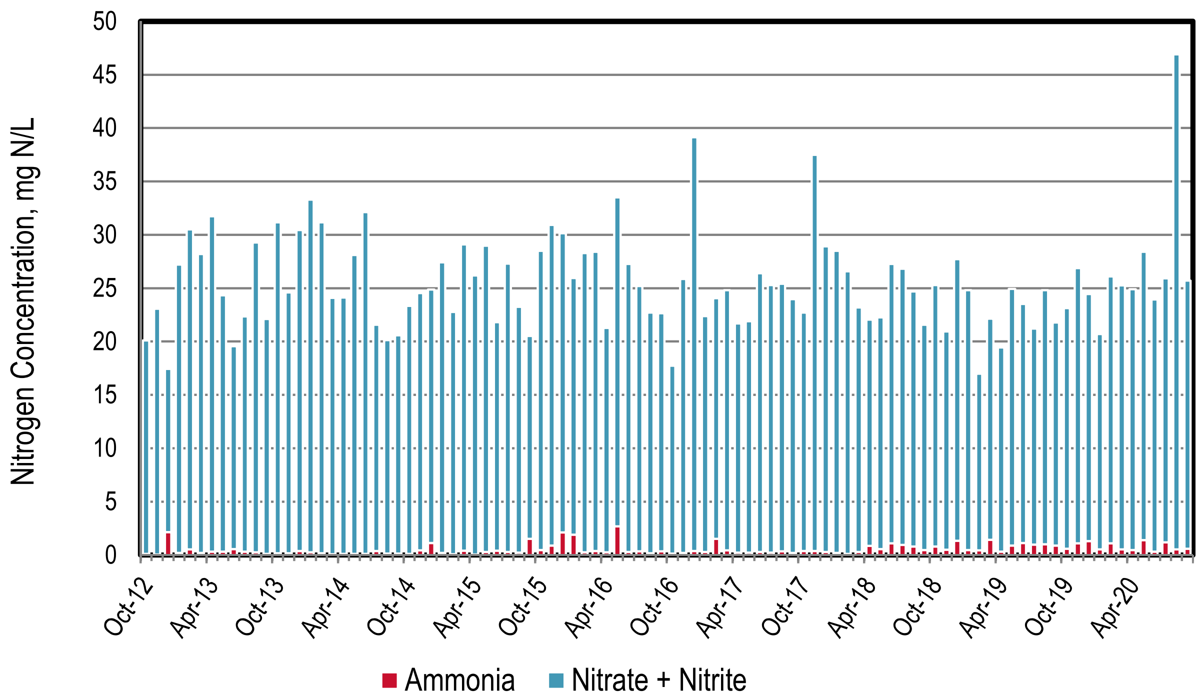

Figure 13-3. Discharge: Mt. View Sanitary District Monthly Nitrogen Concentrations

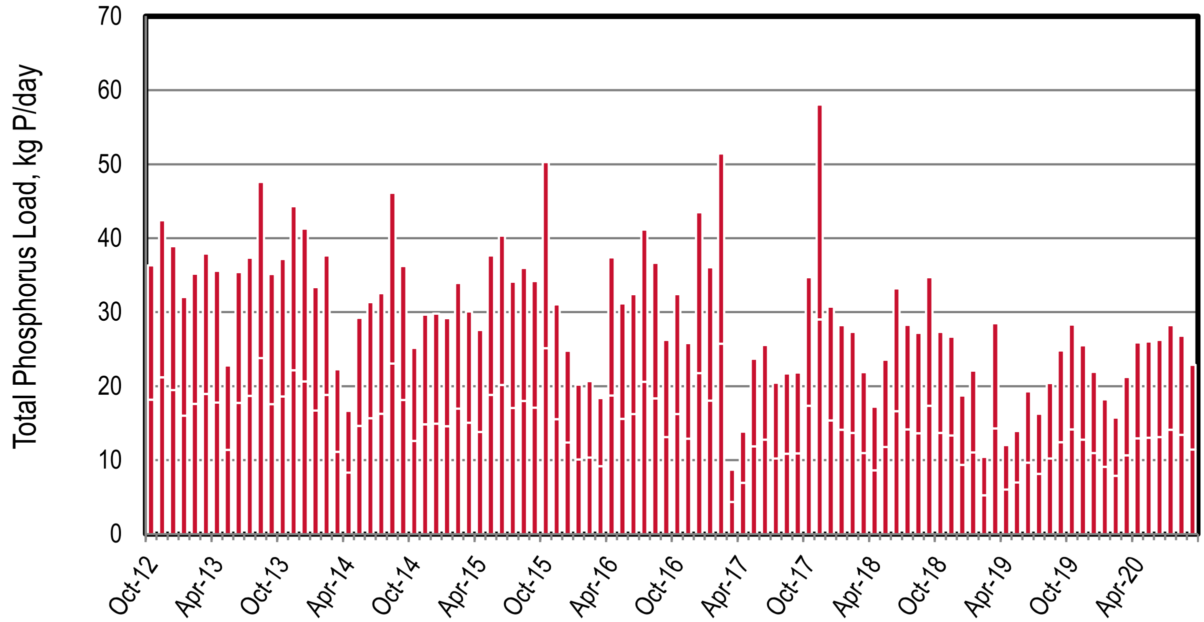

Figure 13-4. Discharge: Mt. View Sanitary District Monthly Phosphorus Loads

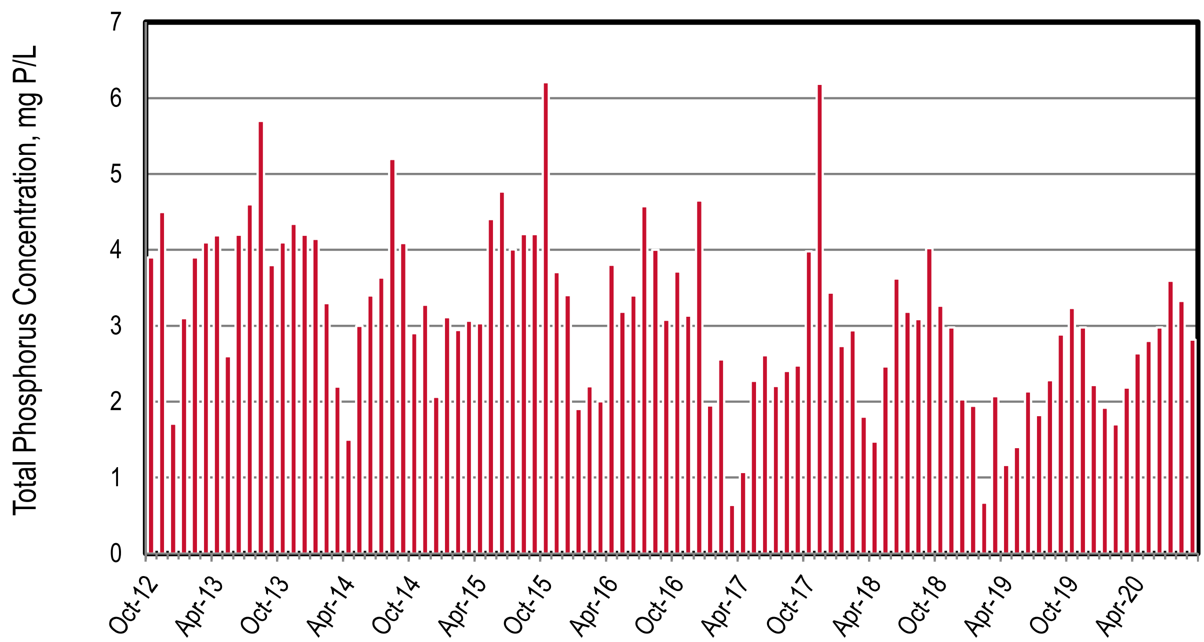

Figure 13-5. Discharge: Mt. View Sanitary District Monthly Phosphorus Concentrations

Table 13-1. Discharge: Mt. View Sanitary District Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	1.23	0.461	93.2	93.7	18.2
Nov-12	1.25	0.189	109	109	21.2
Dec-12	3.01	24.3	174	198	19.5
Jan-13	1.37	0.982	140	141	16.0
Feb-13	1.19	2.30	135	138	17.6
Mar-13	1.22	0.879	130	130	19.0
Apr-13	1.12	1.34	133	135	17.8
May-13	1.16	1.40	105	107	11.4
Jun-13	1.12	2.32	80.2	82.6	17.7
Jul-13	1.08	1.30	89.6	90.9	18.7
Aug-13	1.11	1.00	121	122	23.8
Sep-13	1.22	0.509	102	102	17.6
Oct-13	1.20	0.680	141	141	18.6
Nov-13	1.35	0.771	125	126	22.2
Dec-13	1.30	1.77	148	150	20.6
Jan-14	1.07	1.03	133	134	16.7
Feb-14	1.51	0.913	177	178	18.8
Mar-14	1.34	0.334	122	122	11.1
Apr-14	1.47	0.611	133	134	8.33
May-14	1.29	0.483	137	137	14.6
Jun-14	1.22	0.457	148	148	15.7
Jul-14	1.19	1.67	94.9	96.6	16.3
Aug-14	1.17	0.620	88.8	89.4	23.1
Sep-14	1.17	0.540	90.6	91.1	18.1
Oct-14	1.15	0.460	101	101	12.6
Nov-14	1.20	1.94	109	111	14.8
Dec-14	1.91	8.07	171	180	14.9
Jan-15	1.24	0.910	128	129	14.6
Feb-15	1.53	0.370	131	131	17.0
Mar-15	1.30	2.01	141	143	15.1
Apr-15	1.20	0.190	119	119	13.8
May-15	1.13	1.19	123	124	18.8
Jun-15	1.12	1.72	90.6	92.3	20.2
Jul-15	1.13	1.15	115	116	17.1
Aug-15	1.13	0.899	98.5	99.4	18.0
Sep-15	1.08	6.11	77.4	83.5	17.1

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	1.07	1.82	114	115	25.1
Nov-15	1.11	3.74	126	130	15.5
Dec-15	0.963	7.66	102	110	12.4
Jan-16	1.41	10.1	128	138	10.1
Feb-16	1.24	1.18	132	133	10.3
Mar-16	1.22	1.70	129	130	9.20
Apr-16	1.30	1.18	103	105	18.7
May-16	1.30	13.2	151	164	15.6
Jun-16	1.26	1.39	129	130	16.2
Jul-16	1.19	1.52	112	113	20.6
Aug-16	1.21	0.715	103	104	18.3
Sep-16	1.13	1.44	95.2	96.6	13.1
Oct-16	1.15	0.555	76.8	77.3	16.2
Nov-16	1.09	0.861	106	107	12.9
Dec-16	1.24	1.81	181	183	21.7
Jan-17	2.44	2.52	204	207	18.0
Feb-17	2.66	15.1	227	242	25.7
Mar-17	1.80	3.03	166	169	4.35
Apr-17	1.70	1.45	138	140	6.92
May-17	1.38	1.13	113	114	11.8
Jun-17	1.29	1.33	128	129	12.8
Jul-17	1.23	1.07	116	117	10.2
Aug-17	1.19	1.58	113	115	10.8
Sep-17	1.17	0.831	105	106	10.9
Oct-17	1.15	1.61	97.4	99.0	17.4
Nov-17	1.24	1.74	174	176	29.0
Dec-17	1.18	1.24	128	129	15.4
Jan-18	1.37	1.06	146	147	14.1
Feb-18	1.23	0.501	123	124	13.7
Mar-18	1.61	1.64	139	141	10.9
Apr-18	1.55	5.06	124	129	8.62
May-18	1.26	2.69	104	106	11.8
Jun-18	1.21	5.07	120	125	16.6
Jul-18	1.17	4.24	115	119	14.1
Aug-18	1.17	3.51	105	109	13.6
Sep-18	1.14	1.95	91.2	93.1	17.4
Oct-18	1.11	3.29	102	106	13.7

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	1.19	2.21	91.7	93.9	13.3
Dec-18	1.22	6.09	122	128	9.36
Jan-19	1.50	2.71	138	141	11.0
Feb-19	2.06	3.32	129	132	5.22
Mar-19	1.82	9.81	143	152	14.3
Apr-19	1.36	1.64	98.5	100	6.02
May-19	1.31	4.32	119	124	6.96
Jun-19	1.19	5.05	101	106	9.64
Jul-19	1.18	4.29	90.3	94.6	8.13
Aug-19	1.19	4.44	107	111	10.2
Sep-19	1.14	3.85	89.8	93.7	12.4
Oct-19	1.16	2.58	98.7	101	14.2
Nov-19	1.13	4.68	111	115	12.8
Dec-19	1.31	6.40	114	121	11.0
Jan-20	1.25	2.46	95.5	98.0	9.10
Feb-20	1.22	5.09	116	121	7.87
Mar-20	1.29	2.59	120	123	10.6
Apr-20	1.30	2.35	120	122	13.0
May-20	1.23	6.51	125	132	13.0
Jun-20	1.16	1.36	104	105	13.1
Jul-20	1.04	4.65	97.2	97.7	14.1
Aug-20	1.07	2.09	187	98.7	13.4
Sep-20	1.08	2.39	102	108	11.4
Dry Season Average	**1.18**	**2.55**	**110**	**110**	**14.9**
Dry Season Trend **	**None**	**Up**	**None**	**None**	**Down**
Wet Season Average	**1.39**	**3.06**	**130**	**133**	**14.6**
Average Annual	**1.30**	**2.85**	**121**	**123**	**14.7**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.
** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

14 Napa Sanitation District

Napa Sanitation District discharges to the Napa River that is connected to San Pablo Bay. The plant has a permitted capacity of 15.4 mgd ADWF. The plant performs nitrogen removal using a step-feed activated sludge process with anoxic zones coupled with oxidation ponds which also serves as equalization during peak flow. Discharge is prohibited July 1 through September 30.

The following observations are made based upon the figures and table in the subsequent pages:

- Influent
  - Note: limited to data since July 2019; quarterly required but more provided for various parameters. Napa Sanitation District is missing a few quarterly data points for nutrient species as they were not discharging for several quarters since sampling began.
  - The flow reduction across the plant is heavily seasonal based as it ranges from 0 to 100 percent. Periods with 100 percent load reduction is attributed to no discharge as they recycle all their water during such periods.
  - The nutrient load reduction during the wet season is unclear as the dataset is limiting. Such information will be evaluated as the dataset grows in the future.
- Discharge
  - The wet season average monthly flow values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
  - There are no emerging dry season trends as Napa has only discharged for a portion of two dry season months (May and June 2014) since sampling began in 2012.
  - Both nitrogen and phosphorus loads generally increase with flow during wet weather events.
  - NOx is the majority of the nitrogen discharged as the Activated Sludge system is operated to nitrify. During the wet season months partially nitrified pond effluent may be clarified then comingled with nitrified Activated Sludge effluent prior to discharge which may increase the ammonia levels during such months.
  - Based on average monthly values, the plant discharge currently meets Level 2 TIN limits (i.e., 15 mg N/L) developed under the Scoping and Evaluation Plan.
  - The plant discharge average monthly total phosphorus concentrations ranging from 0.3 to 5.6 mg P/L. This suggests a portion of P is removed as typical influent TP concentrations are 4 to 6 mg P/L. The removal mechanism is most likely from ferric chloride addition.

Influent

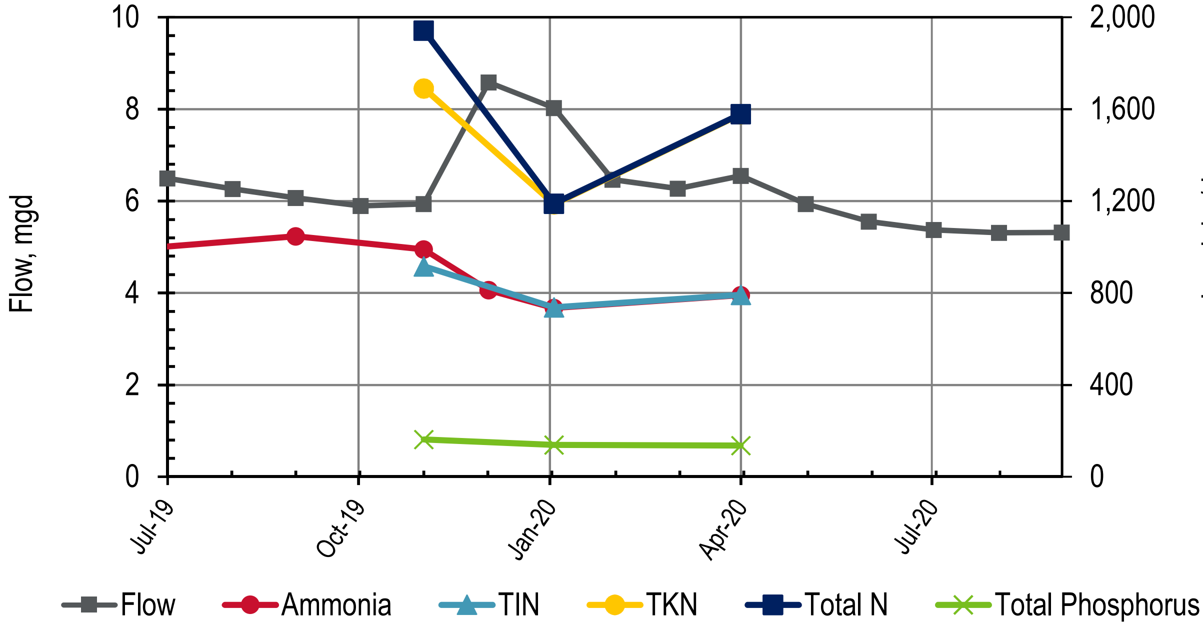

Figure 14-1. Influent: Napa Sanitation District Monthly Flows and Loads

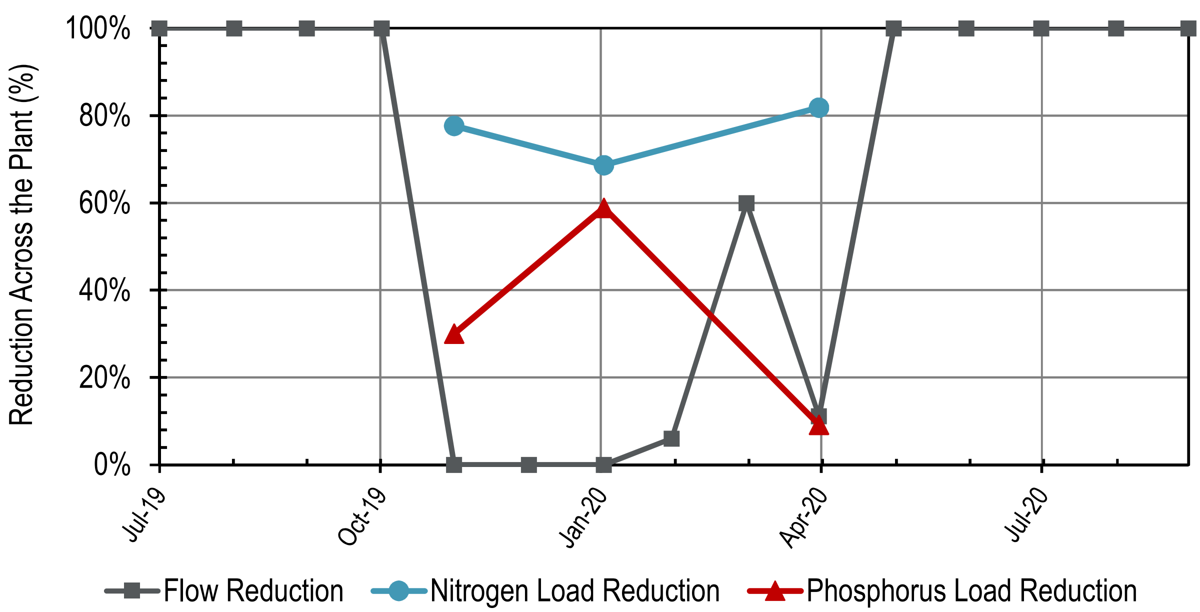

Figure 14-2. Influent: Napa Sanitation District Monthly Reductions Across the Plant

Note: Influent TN was compared against Discharge TIN for calculating nitrogen load reduction.

Table 14-1. Influent: Napa Sanitation District Monthly Flows and Loads*

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	TKN	Total N*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	6.50	--	--	--	--	--	--
Aug-19	6.27	--	--	--	--	--	--
Sep-19	6.07	1,050	--	--	--	--	--
Oct-19	5.90	--	--	--	--	--	--
Nov-19	5.94	990	2.93	917	1,690	1,940	163
Dec-19	8.59	813	--	--	--	--	--
Jan-20	8.02	735	2.78	737	1,190	1,190	139
Feb-20	6.47	--	--	--	--	--	--
Mar-20	6.27	--	--	--	--	--	--
Apr-20	6.55	791	1.18	792	1,580	1,580	137
May-20	5.94	--	--	--	--	--	--
Jun-20	5.56	--	--	--	--	--	--
Jul-20	5.38	--	--	--	--	--	--
Aug-20	5.31	--	--	--	--	--	--
Sep-20	5.32	--	--	--	--	--	--
Dry Season Average	**5.79**	**1,050**	***	***	***	***	***
**Dry Season Trend ** **	**Down**	***	***	***	***	***	***
Wet Season Average	**6.82**	**832**	**2.30**	**815**	**1,480**	**1,570**	**146**
Average Annual	**6.27**	**875**	**2.30**	**815**	**1,480**	**1,570**	**146**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

*** Insufficient dry season sampling to perform analysis.

Discharge

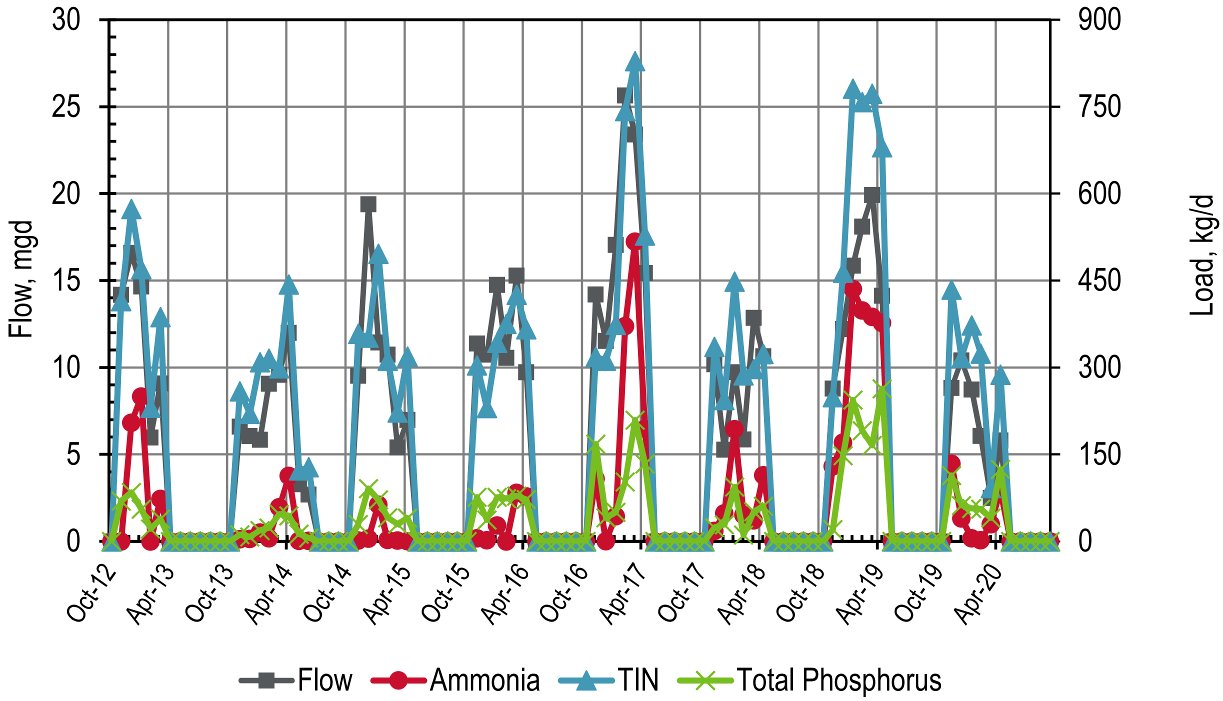

Figure 14-3. Discharge: Napa Sanitation District Monthly Flows and Loads

Table 14-2. Discharge: Napa Sanitation District Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	0	0	0	0	0
Nov-12	14.2	0.268	414	415	69.8
Dec-12	16.6	205	369	574	84.4
Jan-13	14.7	250	220	470	55.8
Feb-13	5.99	0.113	231	231	21.5
Mar-13	9.10	73.6	314	387	38.9
Apr-13	0	0	0	0	0
May-13	0	0	0	0	0
Jun-13	0	0	0	0	0
Jul-13	0	0	0	0	0
Aug-13	0	0	0	0	0
Sep-13	0	0	0	0	0
Oct-13	0	0	0	0	0
Nov-13	6.61	3.77	255	259	11.6
Dec-13	6.08	4.25	216	220	8.04

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Jan-14	5.85	15.4	294	309	18.7
Feb-14	9.09	5.49	310	315	23.5
Mar-14	9.60	59.3	239	299	47.0
Apr-14	12.0	113	330	443	44.5
May-14	3.30	0.988	122	122	12.8
Jun-14	2.70	1.09	127	128	6.06
Jul-14	0	0	0	0	0
Aug-14	0	0	0	0	0
Sep-14	0	0	0	0	0
Oct-14	0	0	0	0	0
Nov-14	9.53	1.91	356	358	29.3
Dec-14	19.4	5.30	347	352	91.0
Jan-15	11.5	63.8	433	497	71.8
Feb-15	10.8	2.73	309	312	41.1
Mar-15	5.42	1.51	221	223	29.8
Apr-15	7.00	0.900	319	319	40.4
May-15	0	0	0	0	0
Jun-15	0	0	0	0	0
Jul-15	0	0	0	0	0
Aug-15	0	0	0	0	0
Sep-15	0	0	0	0	0
Oct-15	0	0	0	0	0
Nov-15	11.4	5.66	298	304	76.1
Dec-15	10.7	2.26	228	231	37.0
Jan-16	14.8	27.7	315	343	76.5
Feb-16	10.6	0	376	376	74.3
Mar-16	15.3	84.3	342	426	78.3
Apr-16	9.74	78.1	288	366	72.6
May-16	0	0	0	0	0
Jun-16	0	0	0	0	0
Jul-16	0	0	0	0	0
Aug-16	0	0	0	0	0
Sep-16	0	0	0	0	0
Oct-16	0	0	0	0	0
Nov-16	14.2	109	210	319	168
Dec-16	11.5	0.778	311	312	41.1
Jan-17	17.1	43.5	330	374	50.3

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Feb-17	25.7	372	371	743	103
Mar-17	23.4	517	311	829	209
Apr-17	15.4	194	333	528	134
May-17	0	0	0	0	0
Jun-17	0	0	0	0	0
Jul-17	0	0	0	0	0
Aug-17	0	0	0	0	0
Sep-17	0	0	0	0	0
Oct-17	0	0	0	0	0
Nov-17	10.2	18.1	317	336	23.6
Dec-17	5.29	48.8	195	244	28.8
Jan-18	9.74	194	255	449	93.9
Feb-18	5.88	46.1	241	287	10.9
Mar-18	12.9	36.3	262	298	51.4
Apr-18	10.7	114	209	323	60.7
May-18	0	0	0	0	0
Jun-18	0	0	0	0	0
Jul-18	0	0	0	0	0
Aug-18	0	0	0	0	0
Sep-18	0	0	0	0	0
Oct-18	0	0	0	0	0
Nov-18	8.79	130	119	249	20.7
Dec-18	12.2	171	312	464	148
Jan-19	15.9	436	345	781	244
Feb-19	18.1	399	359	758	191
Mar-19	19.9	388	385	772	166
Apr-19	14.1	377	263	680	264
May-19	0	0	0	0	0
Jun-19	0	0	0	0	0
Jul-19	0	0	0	0	0
Aug-19	0	0	0	0	0
Sep-19	0	0	0	0	0
Oct-19	0	0	0	0	0
Nov-19	8.84	134	300	434	114
Dec-19	10.4	39.9	268	317	62.2
Jan-20	8.75	5.78	375	373	57.1
Feb-20	6.30	2.19	334	336	58.0

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Mar-20	5.57	66.6	138	205	89.6
Apr-20	7.59	114	261	375	162
May-20	0	0	0	0	0
Jun-20	0	0	0	0	0
Jul-20	0	0	0	0	0
Aug-20	0	0	0	0	0
Sep-20	0	0	0	0	0
Dry Season Average	**0.150**	**0.0519**	**6.21**	**6.26**	**0.472**
Dry Season Trend **	**	**	**	**	**
Wet Season Average	**9.63**	**87.5**	**244**	**332**	**64.3**
Average Annual	**5.68**	**51.0**	**145**	**196**	**37.7**

* The Total Inorganic Nitrogen value is calculated by adding the "Ammonia" and "Nitrate + Nitrite" values.

** No dry season trending analysis was performed on Napa as there are only two months (May and June 2014) that discharged since sampling began in 2012.

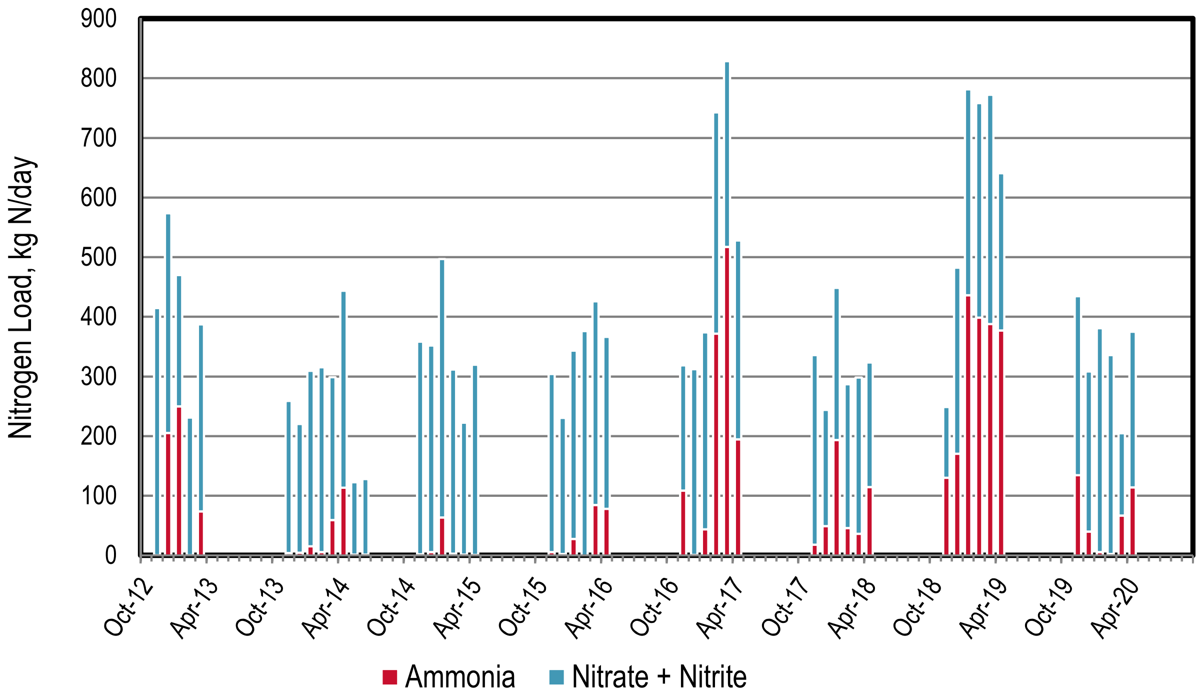

Figure 14-4. Discharge: Napa Sanitation District Monthly Nitrogen Loads

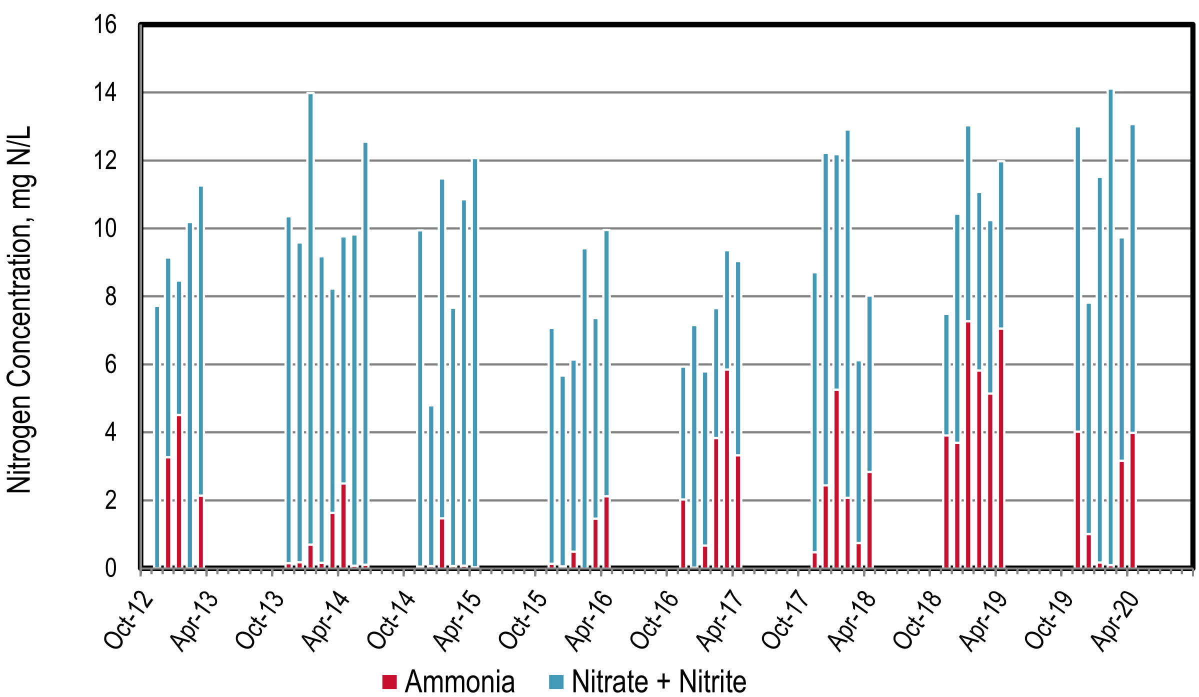

Figure 14-5. Discharge: Napa Sanitation District Monthly Nitrogen Concentrations

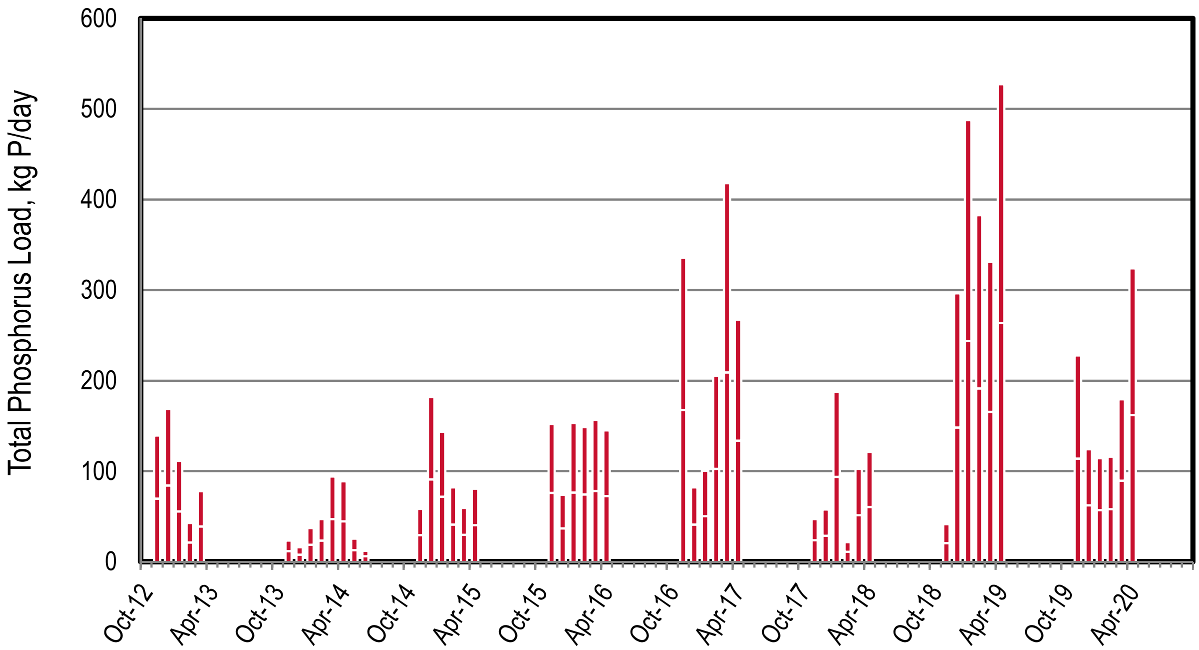

Figure 14-6. Discharge: Napa Sanitation District Monthly Phosphorus Loads

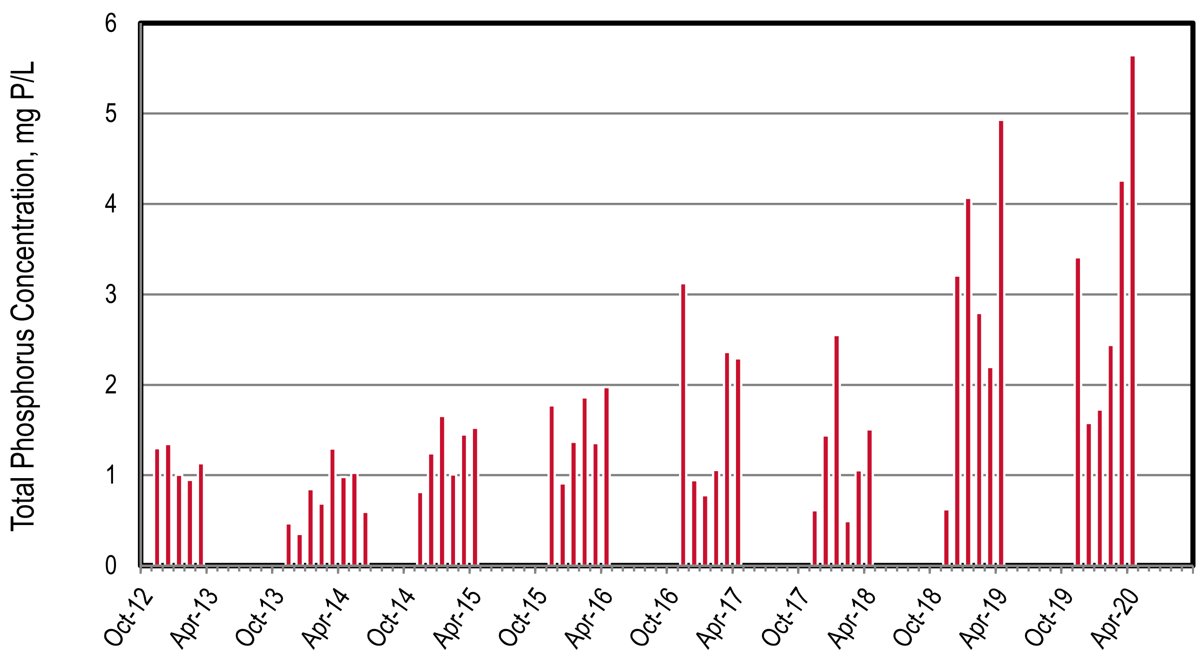

Figure 14-7. Discharge: Napa Sanitation District Monthly Phosphorus Concentrations

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15 Novato Sanitary District

Novato discharges to San Pablo Bay. The plant has approximately 28,500 service connections; it has a permitted capacity of 7.0 mgd ADWF and a peak wet weather capacity of 47 mgd. The plant performs nitrogen removal using activated sludge. The Districts recently issued NPDES permit (September, 2020) allows for year-round discharged to San Pablo Bay. The District will be transitioning to year-round discharge over the next few years as it winds down its ranching/irrigation spray field operation.

The following observations are made based upon the figures and table in the subsequent pages:

- There are no emerging dry season trends as Novato does not typically discharge during the dry season.
- Both nitrogen and phosphorus loads typically increase with flow during wet weather events.
- NOx is the majority of the nitrogen species discharged as would be expected since this plant nitrifies. A portion of ammonia bleeds through during the colder months. This increases the ammonia contribution during such months.
- The plant nearly meets Level 2 TIN concentration limits (i.e., 15 mg N/L) developed under the Scoping and Evaluation Plan with values reliably less than 20 mg N/L.
- Total phosphorus concentrations range from 0.1 to 3.3 mg P/L. This suggests a portion of P is removed as typical effluent TP concentrations for similar treatment plants are 4 to 6 mg P/L. The removal mechanism might be attributed to a combination of ferric chloride addition to the digester influent and/or biological P removal.

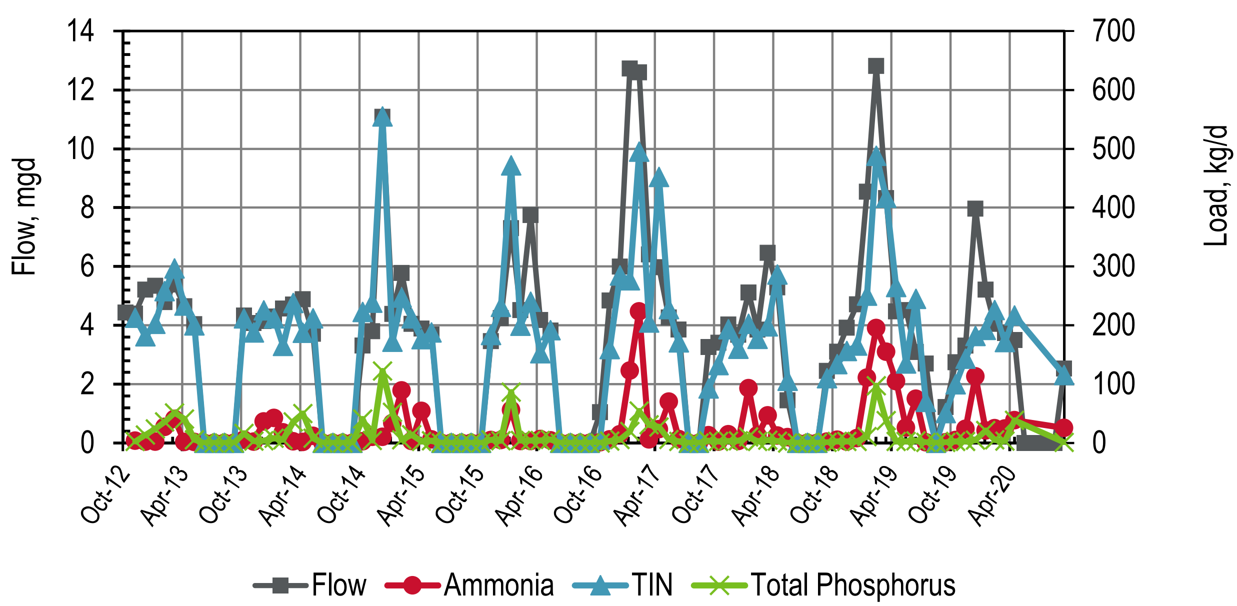

Figure 15-1. Discharge: Novato Monthly Flows and Loads

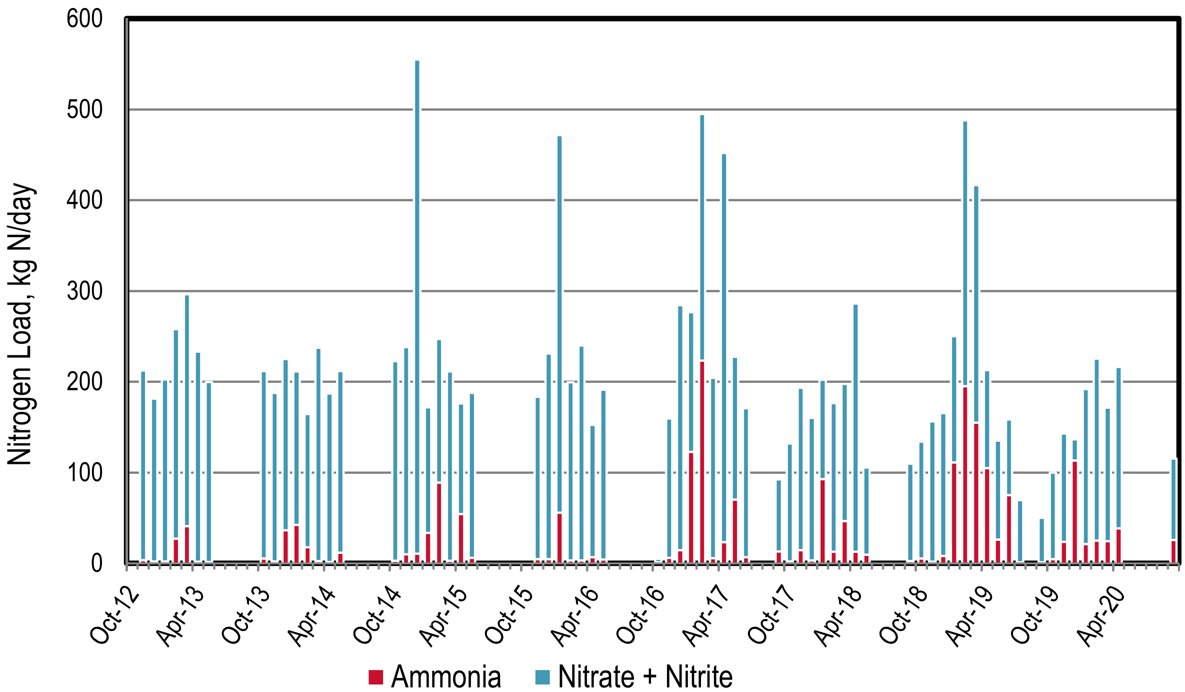

Figure 15-2. Discharge: Novato Monthly Nitrogen Loads

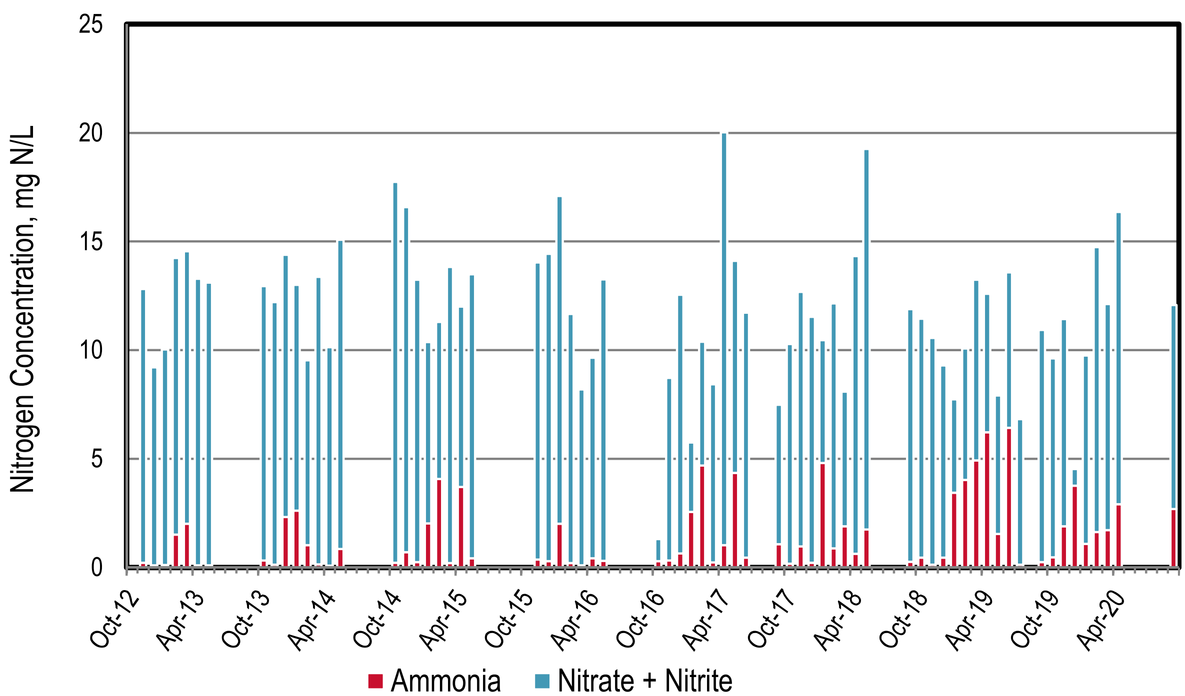

Figure 15-3. Discharge: Novato Monthly Nitrogen Concentrations

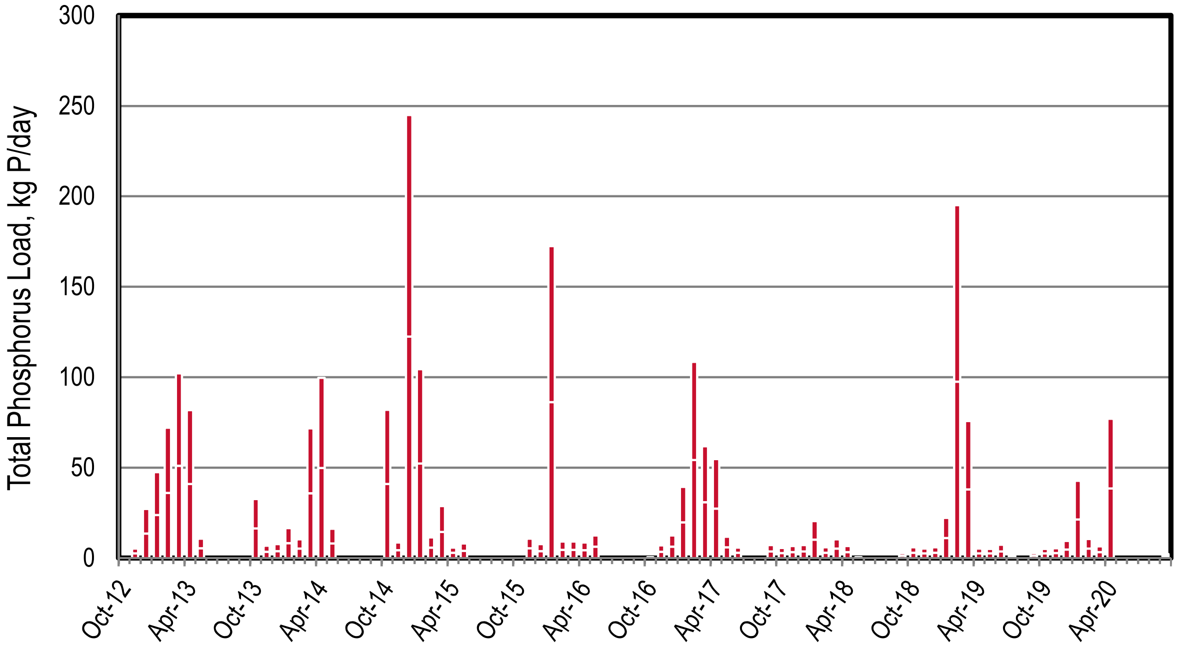

Figure 15-4. Discharge: Novato Monthly Phosphorus Loads

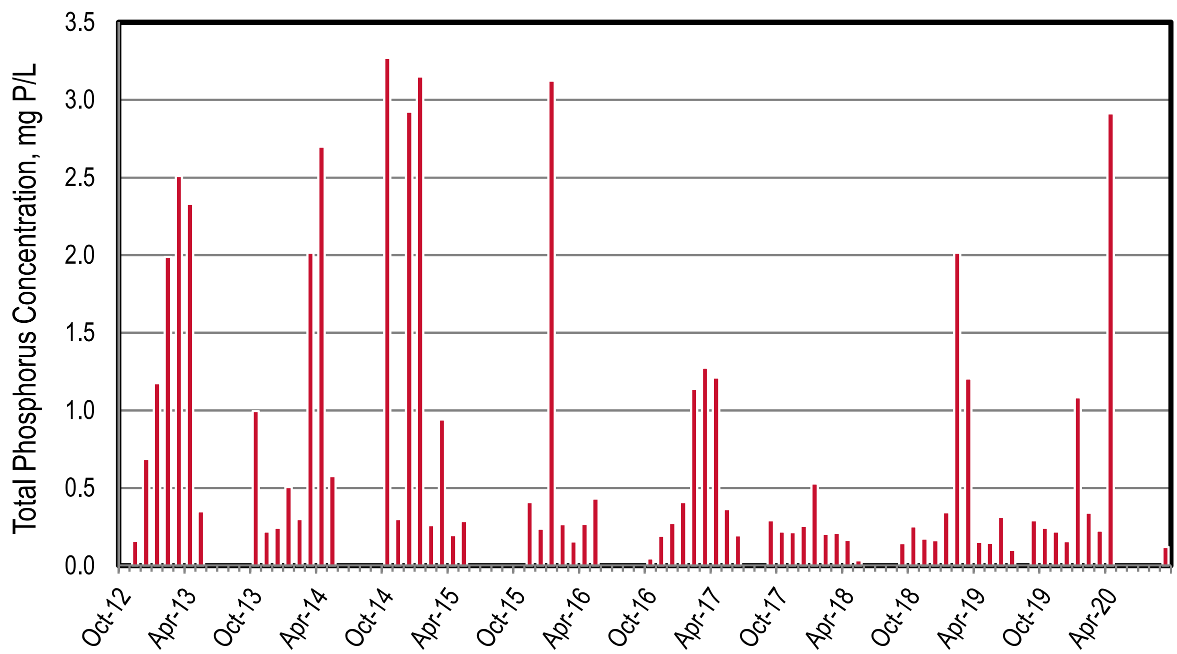

Figure 15-5. Discharge: Novato Monthly Phosphorus Concentrations

Table 15-1. Discharge: Novato Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	4.44	--	--	--	--
Nov-12	4.39	3.63	209	213	2.65
Dec-12	5.21	2.16	179	181	13.6
Jan-13	5.34	2.30	200	203	23.7
Feb-13	4.79	27.3	231	258	36.0
Mar-13	5.39	41.0	255	296	51.1
Apr-13	4.64	1.85	231	233	40.9
May-13	4.03	1.52	198	200	5.32
Jun-13	0	0	0	0	0
Jul-13	0	0	0	0	0
Aug-13	0	0	0	0	0
Sep-13	0	0	0	0	0
Oct-13	4.33	5.24	207	212	16.3
Nov-13	4.07	2.16	186	188	3.39
Dec-13	4.14	36.4	189	225	3.82
Jan-14	4.30	42.6	169	211	8.23
Feb-14	4.57	17.8	147	165	5.18
Mar-14	4.70	2.52	235	238	35.8
Apr-14	4.88	1.66	185	187	49.8
May-14	3.71	11.9	200	212	8.09
Jun-14	0	0	0	0	0
Jul-14	0	0	0	0	0
Aug-14	0	0	0	0	0
Sep-14	0	0	0	0	0
Oct-14	3.32	2.88	220	222	41.0
Nov-14	3.80	10.1	228	238	4.30
Dec-14	11.1	10.6	544	555	123
Jan-15	4.38	33.6	138	172	52.2
Feb-15	5.78	89.0	158	247	5.70
Mar-15	4.05	3.10	208	212	14.4
Apr-15	3.88	54.3	122	176	2.90
May-15	3.68	6.00	182	188	4.00
Jun-15	0	0	0	0	0
Jul-15	0	0	0	0	0
Aug-15	0	0	0	0	0
Sep-15	0	0	0	0	0

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	0	0	0	0	0
Nov-15	3.46	4.81	179	183	5.36
Dec-15	4.24	4.67	227	231	3.82
Jan-16	7.30	55.8	416	472	86.2
Feb-16	4.52	3.43	196	199	4.57
Mar-16	7.75	3.16	237	240	4.58
Apr-16	4.18	6.68	146	152	4.25
May-16	3.82	4.51	187	191	6.22
Jun-16	0	0	0	0	0
Jul-16	0	0	0	0	0
Aug-16	0	0	0	0	0
Sep-16	0	0	0	0	0
Oct-16***	1.05	1.19	4.01	5.20	0.182
Nov-16	4.84	6.01	154	160	3.51
Dec-16	5.99	14.7	270	284	6.22
Jan-17	12.7	123	154	276	19.7
Feb-17	12.6	223	271	495	54.3
Mar-17	6.41	5.74	199	204	30.9
Apr-17	5.97	23.4	429	452	27.4
May-17	4.27	70.3	157	228	5.86
Jun-17	3.85	6.71	164	171	2.83
Jul-17	0	0	0	0	0
Aug-17	0	0	0	0	0
Sep-17	3.27	13.2	79.2	92.5	3.60
Oct-17	3.40	2.38	130	132	2.81
Nov-17	4.03	14.7	179	193	3.27
Dec-17	3.67	3.14	157	160	3.57
Jan-18	5.11	93.0	109	202	10.2
Feb-18	3.85	12.9	164	177	2.98
Mar-18	6.46	46.5	151	198	5.15
Apr-18	5.28	12.7	273	286	3.32
May-18***	1.45	9.61	96.1	106	0.186
Jun-18	0	0	0	0	0
Jul-18	0	0	0	0	0
Aug-18	0	0	0	0	0
Sep-18	2.44	2.41	107	110	1.34
Oct-18	3.10	5.28	129	134	2.96

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	3.91	2.06	154	156	2.57
Dec-18	4.71	8.23	157	165	2.93
Jan-19	8.54	111	139	250	11.1
Feb-19	12.8	195	293	488	97.6
Mar-19	8.32	155	262	417	37.9
Apr-19	4.47	105	108	265	2.58
May-19	4.51	26.3	109	135	2.51
Jun-19	3.09	75.1	83.5	245	3.66
Jul-19	2.70	1.35	68.4	69.7	1.03
Aug-19	0	0	0	0	0
Sep-19***	1.22	1.16	49.2	50.4	1.34
Oct-20	2.74	4.85	94.9	99.8	2.52
Nov-19	3.30	23.8	119	143	2.74
Dec-19	7.96	113	23.2	182	4.75
Jan-20	5.21	21.3	171	192	21.3
Feb-20	4.05	25.1	201	226	5.22
Mar-20	3.74	24.3	147	172	3.19
Apr-20	3.50	38.5	178	216	38.5
May-20	0	0	0	0	0
Jun-20	0	0	0	0	0
Jul-20	0	0	0	0	0
Aug-20	0	0	0	0	0
Sep-20	2.51	25.8	89.7	116	1.15
Dry Season Average	**1.11**	**6.40**	**44.2**	**52.8**	**1.18**
Dry Season Trend **	**None**	**None**	**None**	**None**	**None**
Wet Season Average	**5.19**	**33.7**	**187**	**222**	**18.8**
Average Annual	**3.49**	**22.5**	**129**	**153**	**11.6**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** No dry season trending analysis was performed on Novato as the facility does not discharge during most dry season months.

*** Lower than typical monthly averages due to discharge to the Bay only occurring during a portion of the month.

16 City of Palo Alto

Palo Alto discharges to the Lower South Bay. The plant serves an estimated population of 217,000 and it has a permitted ADWF capacity of 39 mgd and a peak wet weather capacity of 80 mgd. The current ADWF discharge flow is approximately 19 mgd. The plant performs ammonia and limited nitrogen removal using a combination of trickling filters and activated sludge.

The following observations are made based upon the figures and table in the subsequent pages:

- Influent
    - Note: limited to data since July 2019; quarterly required but more provided for various parameters.
    - Based on the limited average monthly values table below, there is an emerging dry season downward trend for flow.
    - The flow reduction across the plant ranges was up to 25 percent in 2019. Since the 2019/2020 sampling began, there has been little or no flow reduction across the plant.
    - The nitrogen load reduction values across the plant ranges from approximately 35 to 60 percent. This load reduction is attributed primarily to a combination of biological assimilation and biological load reduction in the trickling filter/activated sludge system.
    - The phosphorus load reduction across the plant ranges from approximately 10 to 40 percent. Since the 2019/2020 sampling began, the phosphorus load reduction across the plant has been less than 20 percent. Such a load reduction is attributed to biological assimilation.
- Discharge
    - The wet season average monthly flow values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
    - There is an emerging downward dry season trend for all parameters analyzed (except ammonia has no emerging dry season trend). The plant fully nitrifies and removes ammonia (values reliably <0.3 mg N/L).
    - NOx is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant reliably nitrifies year round.
    - TN loads in general increase with flows.
    - TP discharge concentrations range from 3.1 to 5.9 mg P/L. This is within the range of typical effluent TP concentrations (4 to 6 mg P/L).

Influent

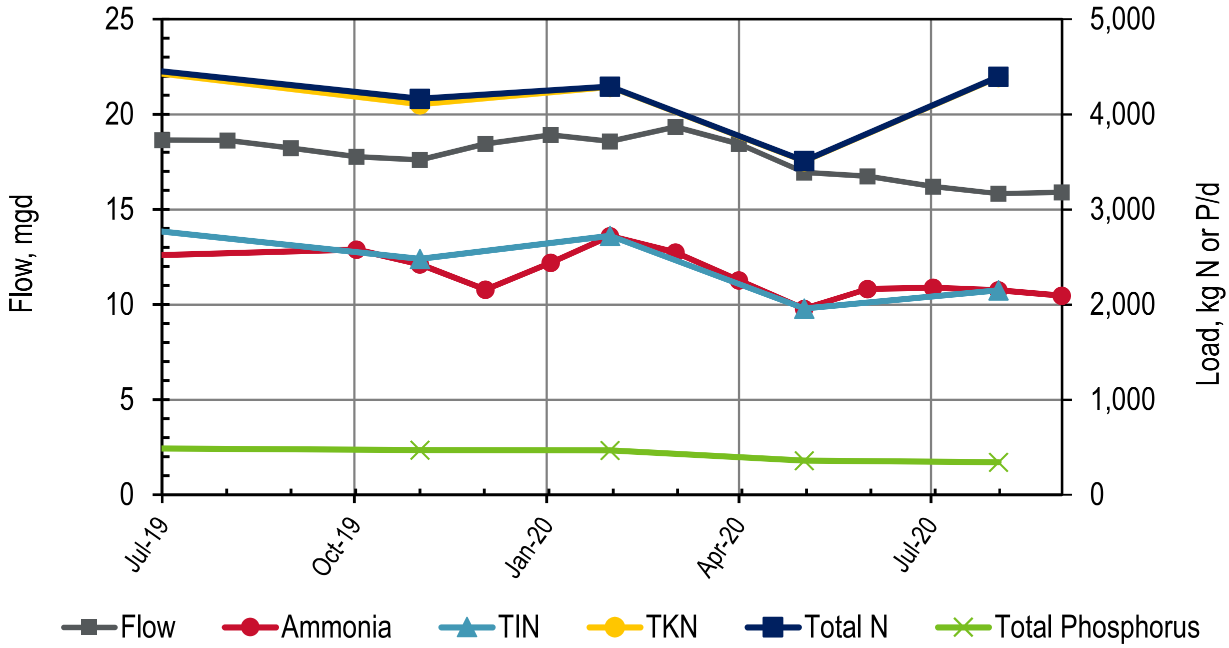

Figure 16-1. Influent: Palo Alto Monthly Flows and Loads

Note: the ammonia/TIN loads and TKN/Total N loads are comparable. The ammonia and TKN values are located behind TIN and Total N load lines, respectively.

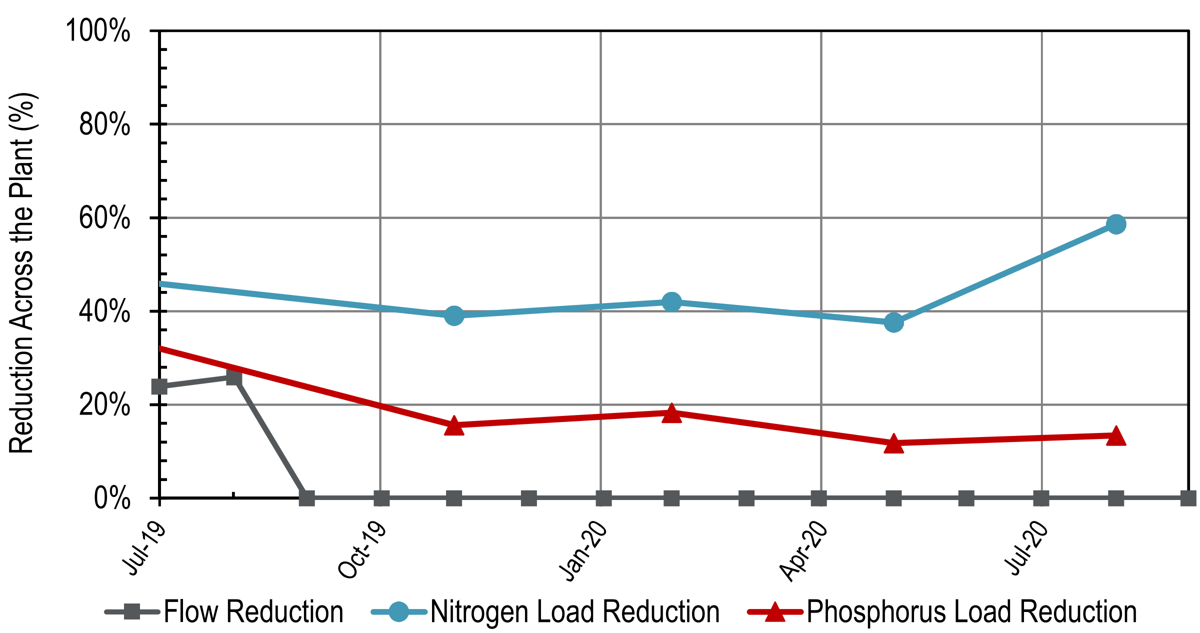

Figure 16-2. Influent: Palo Alto Monthly Reductions Across the Plant

Note: Influent TN was compared against Discharge TIN for calculating nitrogen load reduction.

Table 16-1. Influent: Palo Alto Monthly Flows and Loads*

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	18.7	--	--	--	--	--	--
Aug-19	18.6	--	--	--	--	--	--
Sep-19	18.2	--	--	--	--	--	--
Oct-19	17.8	2,580	--	--	--	--	--
Nov-19	17.6	2,420	57.2	2,480	4,110	4,160	469
Dec-19	18.5	2,160	--	--	--	--	--
Jan-20	18.9	2,440	--	--	--	--	--
Feb-20	18.6	2,720	2.81	2,720	4,290	4,290	467
Mar-20	19.3	2,550	--	--	--	--	--
Apr-20	18.4	2,250	--	--	--	--	--
May-20	16.9	1,960	2.60	1,960	3,510	3,510	360
Jun-20	16.7	2,160	--	--	--	--	--
Jul-20	16.2	2,180	--	--	--	--	--
Aug-20	15.8	2,150	2.77	2,150	4,390	4,400	343
Sep-20	15.9	2,090	--	--	--	--	--
Dry Season Average	**17.1**	**2,110**	**2.68**	**2,050**	**3,950**	**3,950**	**352**
Dry Season Trend * **	**Down**	**None**	***	***	***	***	***
Wet Season Average	**18.4**	**2,450**	**30.0**	**2,600**	**4,200**	**4,230**	**468**
Average Annual	**17.7**	**2,300**	**16.4**	**2,330**	**4,070**	**4,090**	**410**

* Palo Alto typically samples more than the required influent ammonia quarterly sampling. This dataset includes this additional sampling.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis. Insufficient samples to perform statistical trending on nutrient loads (except for ammonia)

Discharge

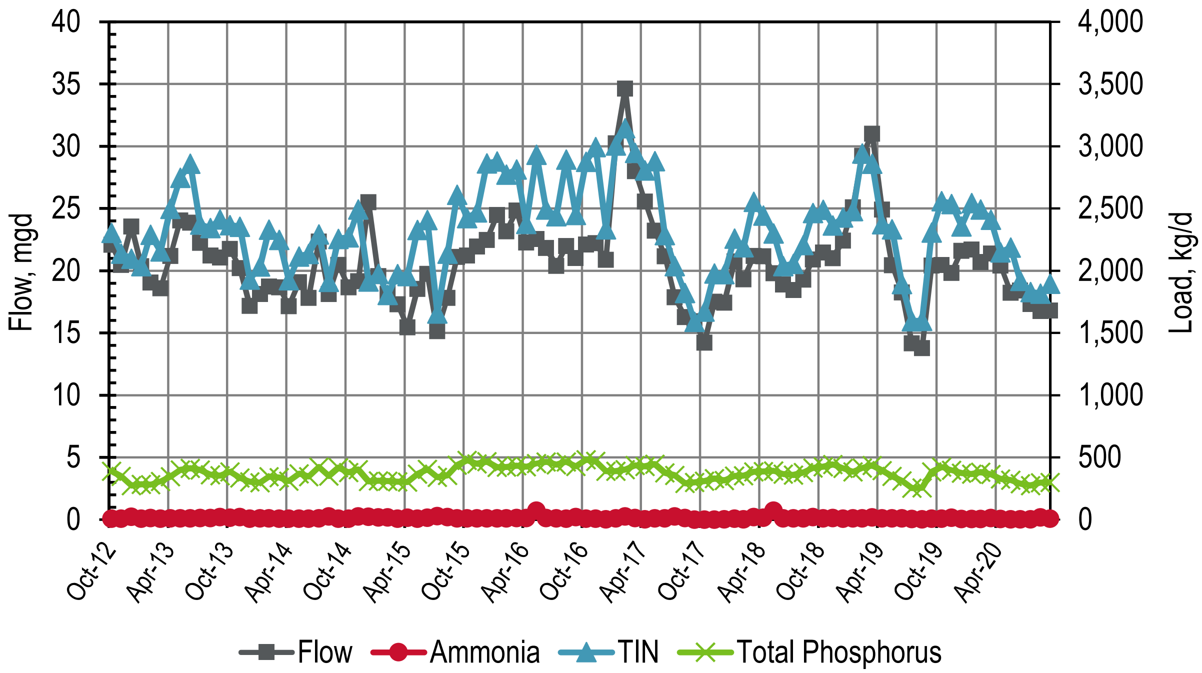

Figure 16-3. Discharge: Palo Alto Monthly Flows and Loads

Table 16-2. Discharge: Palo Alto Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	22.1	8.36	2,300	2,310	389
Nov-12	20.5	7.75	2,130	2,140	349
Dec-12	23.6	23.9	2,070	2,100	275
Jan-13	20.4	9.88	2,030	2,040	283
Feb-13	19.1	15.3	2,280	2,290	282
Mar-13	18.6	9.16	2,150	2,160	306
Apr-13	21.2	10.4	2,490	2,500	345
May-13	24.1	11.8	2,740	2,750	401
Jun-13	23.9	11.8	2,850	2,860	411
Jul-13	22.3	14.3	2,360	2,370	400
Aug-13	21.2	14.9	2,330	2,340	362
Sep-13	21.1	22.8	2,390	2,410	355
Oct-13	21.8	17.7	2,350	2,370	383
Nov-13	20.2	21.0	2,330	2,350	336
Dec-13	17.2	10.0	1,920	1,930	304

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Jan-14	18.1	10.4	2,030	2,040	298
Feb-14	18.8	11.4	2,320	2,330	347
Mar-14	18.7	9.42	2,240	2,250	337
Apr-14	17.2	8.45	1,920	1,920	311
May-14	19.1	9.40	2,110	2,120	370
Jun-14	17.8	8.78	2,130	2,140	345
Jul-14	22.4	11.0	2,280	2,290	423
Aug-14	18.1	26.2	1,890	1,910	351
Sep-14	20.5	10.1	2,250	2,260	417
Oct-14	18.7	8.94	2,260	2,270	380
Nov-14	19.2	27.7	2,470	2,490	403
Dec-14	25.5	23.8	1,890	1,910	307
Jan-15	19.6	19.3	1,960	1,980	312
Feb-15	18.2	20.4	1,790	1,810	311
Mar-15	17.3	8.52	1,970	1,970	306
Apr-15	15.5	17.5	1,940	1,960	301
May-15	18.6	9.47	2,320	2,330	367
Jun-15	19.8	15.6	2,390	2,410	404
Jul-15	15.2	29.6	1,630	1,660	341
Aug-15	17.8	21.6	2,120	2,140	355
Sep-15	21.1	10.4	2,600	2,610	438
Oct-15	21.3	10.5	2,410	2,420	477
Nov-15	22.0	10.8	2,460	2,470	449
Dec-15	22.5	11.1	2,850	2,860	465
Jan-16	24.5	12.1	2,870	2,880	419
Feb-16	23.2	11.4	2,760	2,770	423
Mar-16	24.9	12.9	2,800	2,810	434
Apr-16	22.3	13.9	2,360	2,380	425
May-16	22.6	73.4	2,860	2,930	450
Jun-16	21.8	13.6	2,480	2,490	465
Jul-16	20.4	12.1	2,430	2,440	441
Aug-16	22.0	8.89	2,890	2,890	465
Sep-16	21.0	21.1	2,430	2,450	429
Oct-16	22.1	9.67	2,870	2,880	482
Nov-16	22.2	8.12	2,990	3,000	470
Dec-16	20.9	3.86	2,330	2,330	390
Jan-17	30.2	11.5	3,000	3,010	388

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Feb-17	34.7	27.0	3,120	3,150	402
Mar-17	28.0	13.6	2,930	2,950	435
Apr-17	25.6	4.20	2,800	2,810	427
May-17	23.2	11.0	2,870	2,880	447
Jun-17	21.2	10.6	2,280	2,290	376
Jul-17	17.9	27.7	2,010	2,040	356
Aug-17	16.3	14.9	1,810	1,820	292
Sep-17	15.9	2.14	1,590	1,590	300
Oct-17	14.2	2.02	1,670	1,670	309
Nov-17	17.5	2.13	1,980	1,980	329
Dec-17	17.4	4.22	1,970	1,970	316
Jan-18	20.8	8.38	2,250	2,260	352
Feb-18	19.3	3.91	2,190	2,190	353
Mar-18	21.2	22.8	2,530	2,560	384
Apr-18	21.2	15.6	2,430	2,440	387
May-18	19.8	72.7	2,230	2,300	393
Jun-18	18.9	12.4	2,030	2,040	366
Jul-18	18.5	12.4	2,040	2,060	360
Aug-18	19.3	12.1	2,200	2,210	379
Sep-18	20.9	21.0	2,440	2,460	414
Oct-18	21.5	10.3	2,480	2,490	427
Nov-18	21.0	14.0	2,350	2,360	443
Dec-18	22.4	10.1	2,420	2,430	414
Jan-19	25.1	10.2	2,470	2,480	384
Feb-19	29.2	10.4	2,930	2,940	416
Mar-19	31.0	19.7	2,840	2,860	435
Apr-19	24.9	10.8	2,360	2,370	395
May-19	20.5	11.6	2,320	2,330	349
Jun-19	18.3	11.4	1,880	1,890	313
Jul-19	14.2	5.75	1,590	1,590	252
Aug-19	13.8	4.40	1,590	1,600	256
Sep-19	20.4	8.35	2,300	2,310	384
Oct-20	20.5	9.73	2,550	2,560	424
Nov-19	19.8	17.8	2,520	2,540	396
Dec-19	21.6	6.03	2,350	2,360	375
Jan-20	21.7	5.88	2,540	2,540	367
Feb-20	20.7	5.76	2,490	2,490	382

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Mar-20	21.4	14.7	2,400	2,410	363
Apr-20	20.4	5.37	2,140	2,150	327
May-20	18.2	4.78	2,180	2,190	318
Jun-20	18.4	4.80	1,910	1,920	290
Jul-20	17.3	4.41	1,820	1,830	274
Aug-20	16.8	19.6	1,800	1,820	297
Sep-20	16.8	7.98	1,890	1,900	301
Dry Season Average	**19.4**	**15.9**	**2,210**	**2,220**	**368**
Dry Season Trend **	**Down**	**None**	**Down**	**Down**	**Down**
Wet Season Average	**21.6**	**12.0**	**2,380**	**2,390**	**374**
Average Annual	**20.7**	**13.6**	**2,310**	**2,320**	**371**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

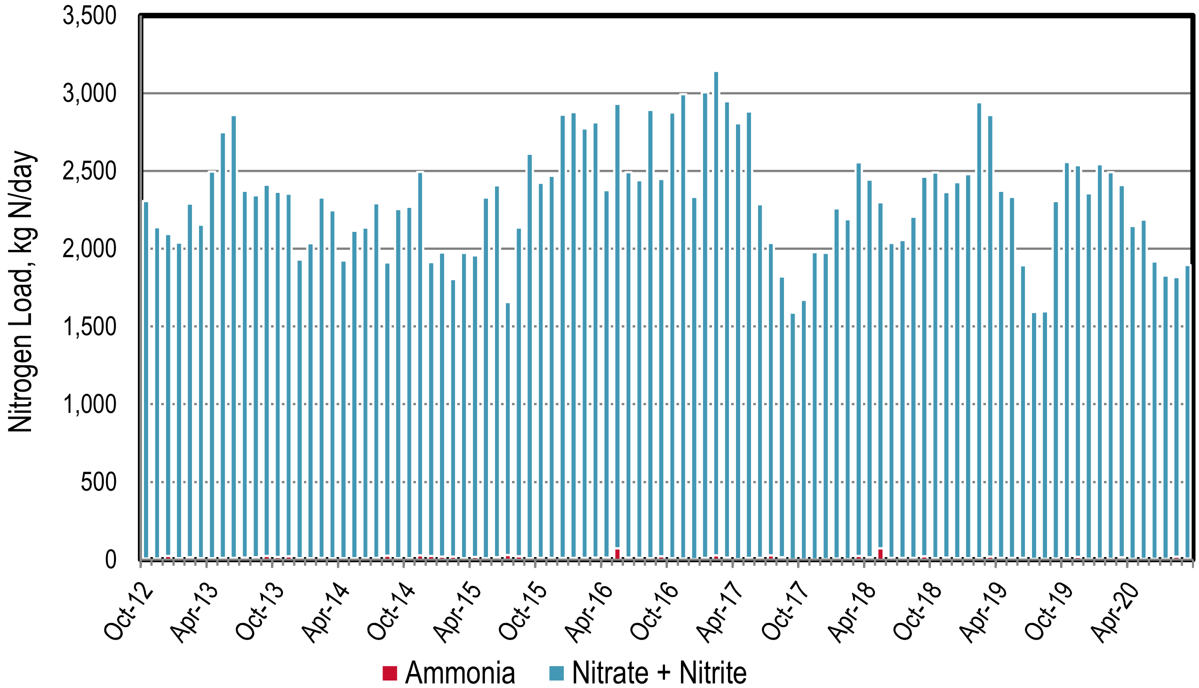

Figure 16-4. Discharge: Palo Alto Monthly Nitrogen Loads

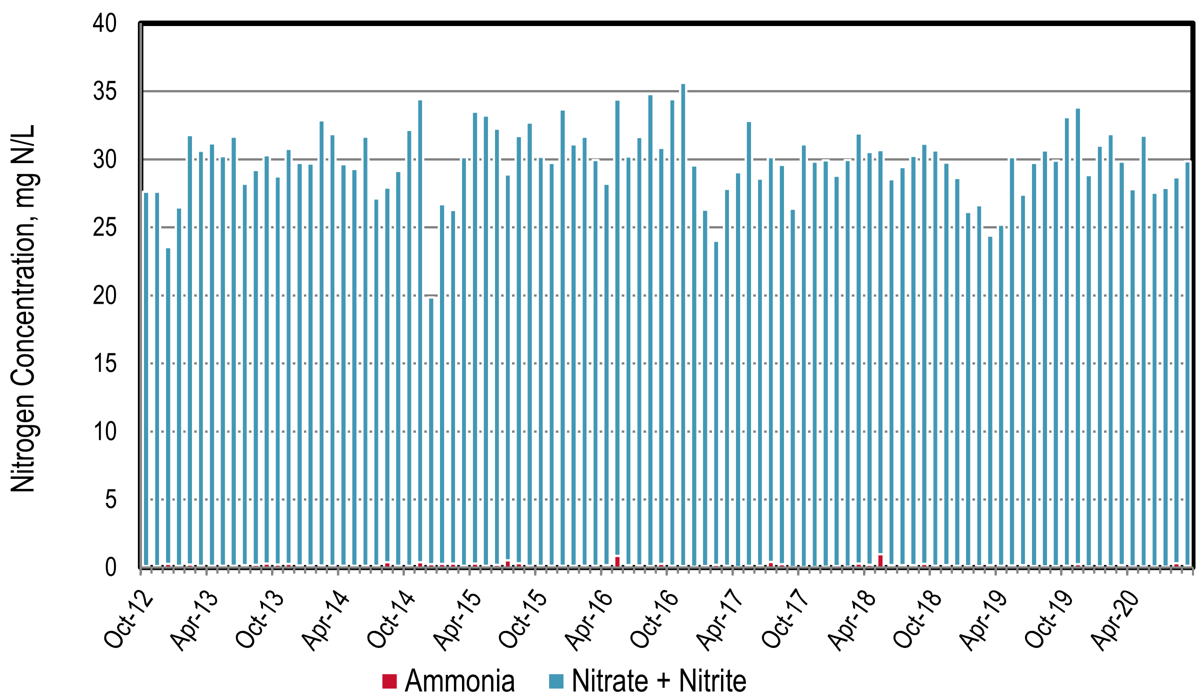

Figure 16-5. Discharge: Palo Alto Monthly Nitrogen Concentrations

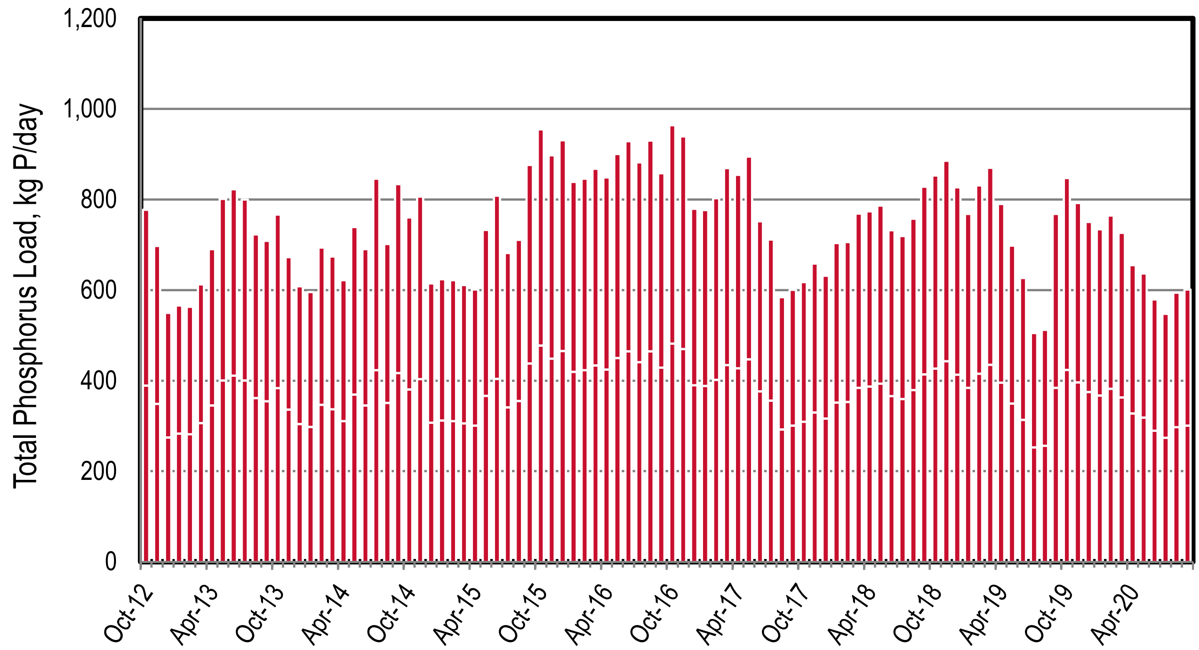

Figure 16-6. Discharge: Palo Alto Monthly Phosphorus Loads

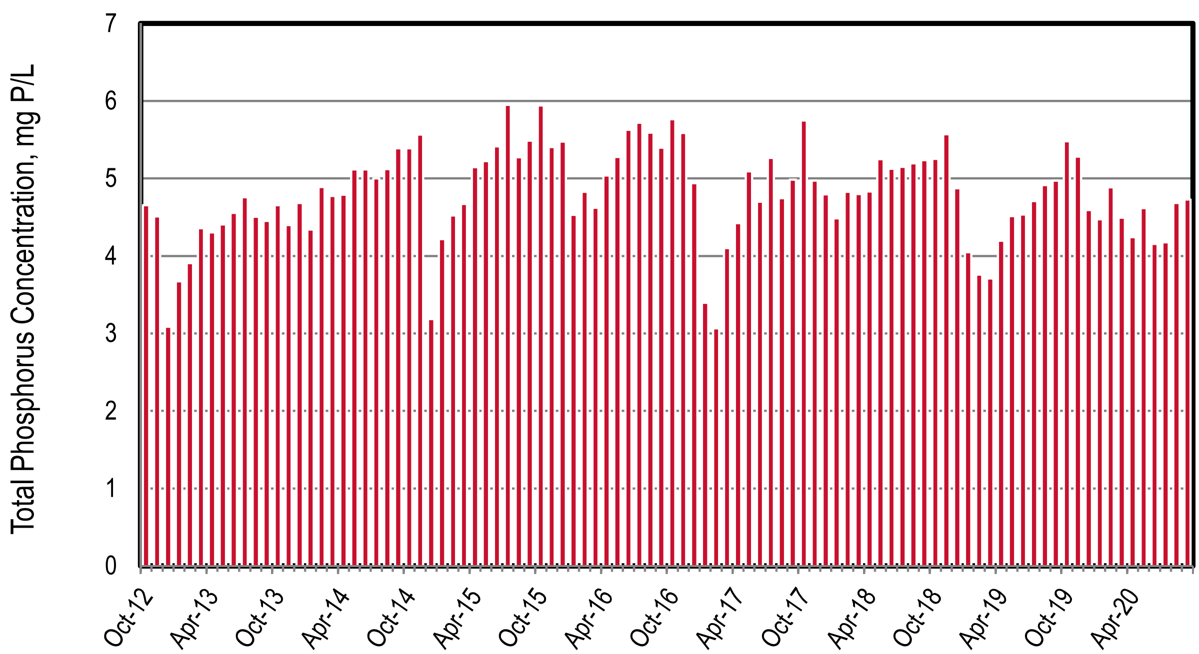

Figure 16-7. Discharge: Palo Alto Monthly Phosphorus Concentrations

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17 Sanitary District No. 5 of Marin County - Paradise Cove Treatment Plant

The Paradise Cove Treatment Plant discharges to the Central Bay. The service area has approximately 65 service connections. The plant has a permitted ADWF capacity of 0.040 mgd and it has currents flows of approximately 0.014 mgd ADWF. The plant performs secondary treatment using an activated sludge treatment process.

The plant is classified as a minor discharger (<1 mgd permitted capacity) and thus not required to sample as frequently as the major dischargers (>1 mgd permitted capacity). The minor dischargers are required to sample twice per year under the Nutrient Watershed Permit. As a result, there are several months of nutrient data gaps.

The following observations are made based upon the figures and table in the subsequent pages:

- Flow values are provided over the entire study period. The remaining nutrient species only have monthly sampling for the first year of sampling, followed by occasional sampling thereafter.
- The plant occasionally nitrifies as evidenced by ammonia values of less than 0.2 mg N/L.
- During months of nitrification, NOx is the majority of the nitrogen species discharged. During months of no nitrification, ammonia is the majority of the nitrogen species discharged.
- Total phosphorus concentrations are wide ranging from approximately 2.2 to 16 mg P/L. Typical effluent TP concentrations range from 4 to 6 mg P/L.

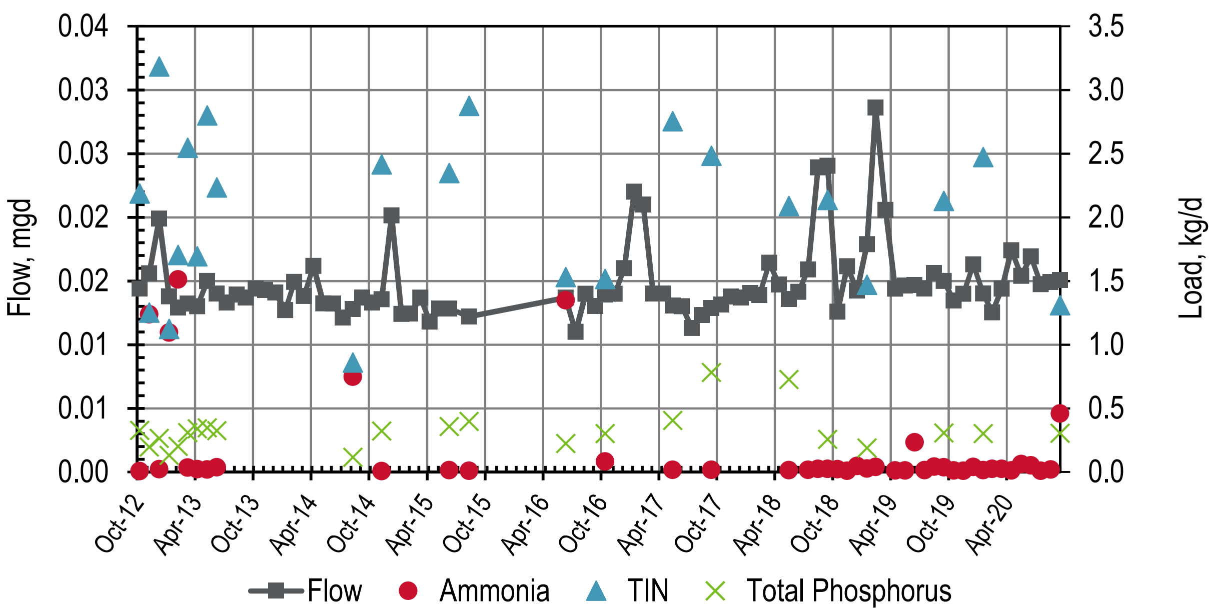

Figure 17-1. Discharge: Paradise Cove Monthly Flows and Loads

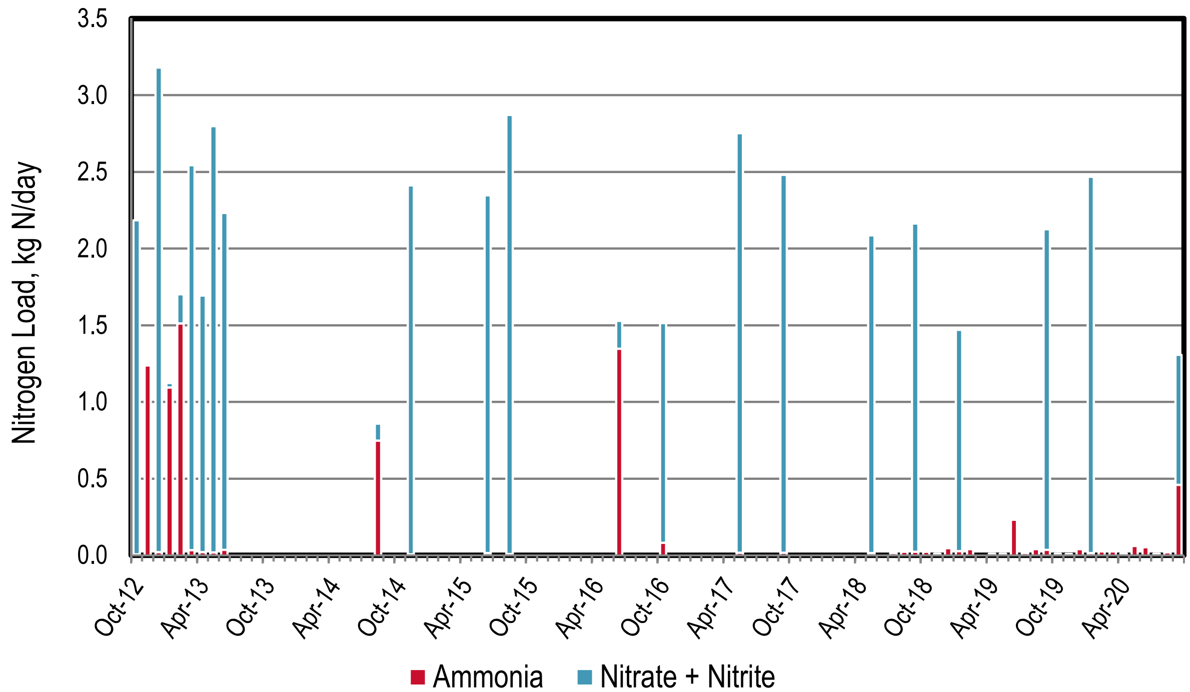

Figure 17-2. Discharge: Paradise Cove Monthly Nitrogen Loads

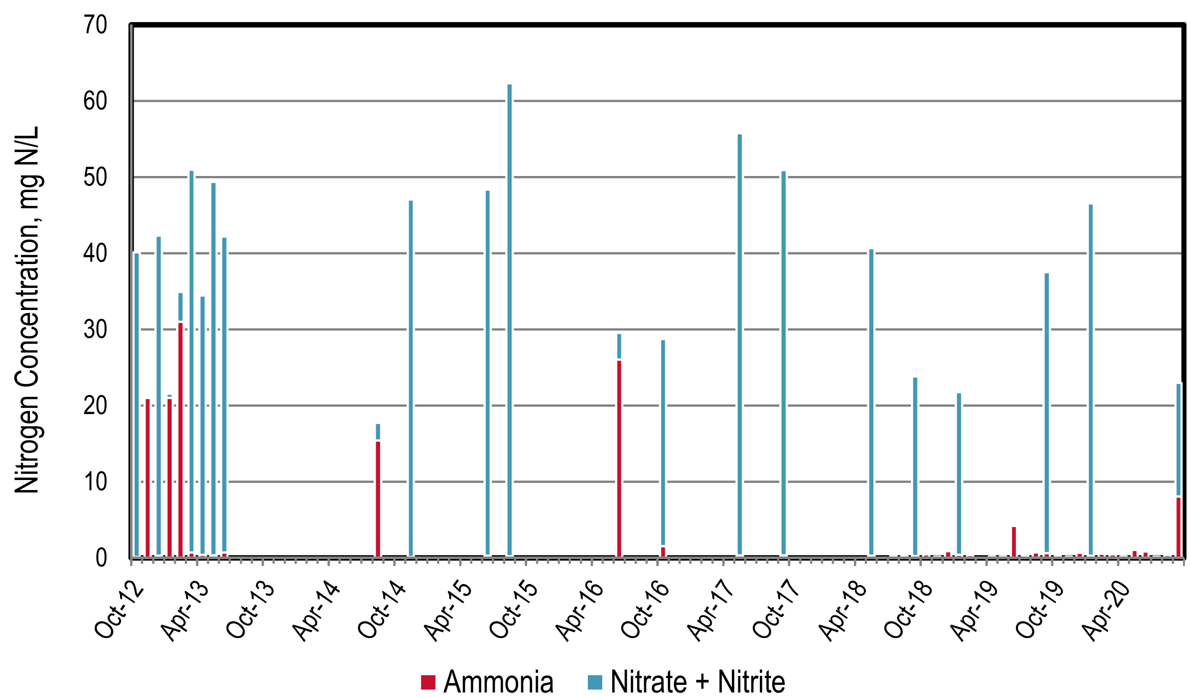

Figure 17-3. Discharge: Paradise Cove Monthly Nitrogen Concentrations

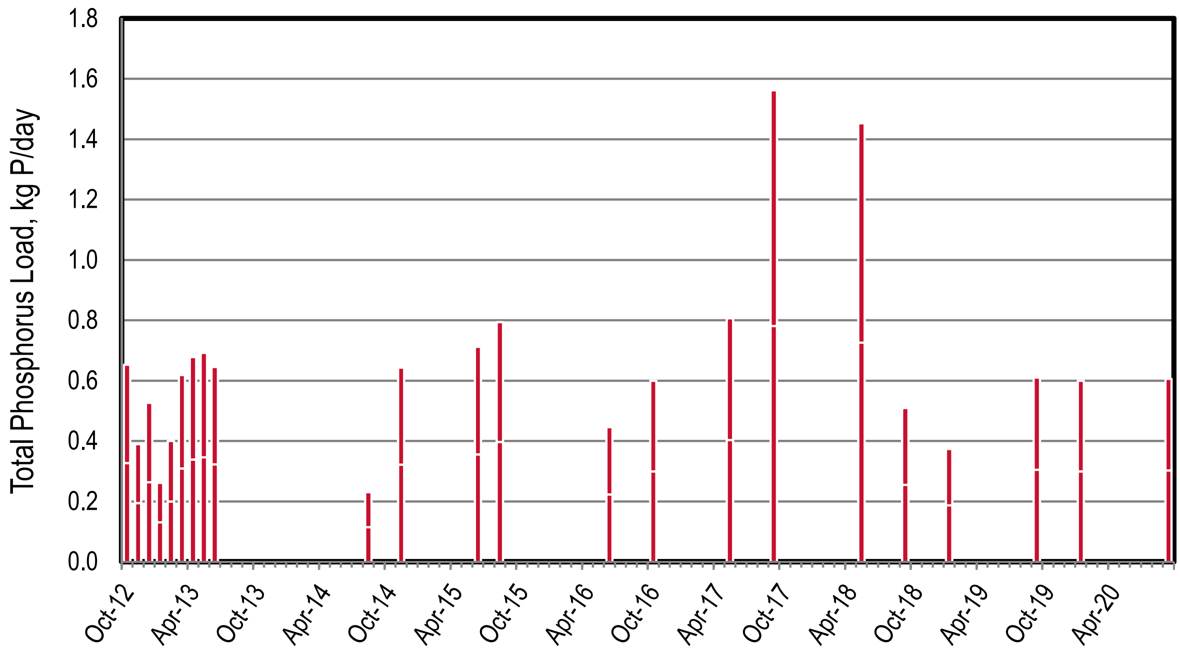

Figure 17-4. Discharge: Paradise Cove Monthly Phosphorus Loads

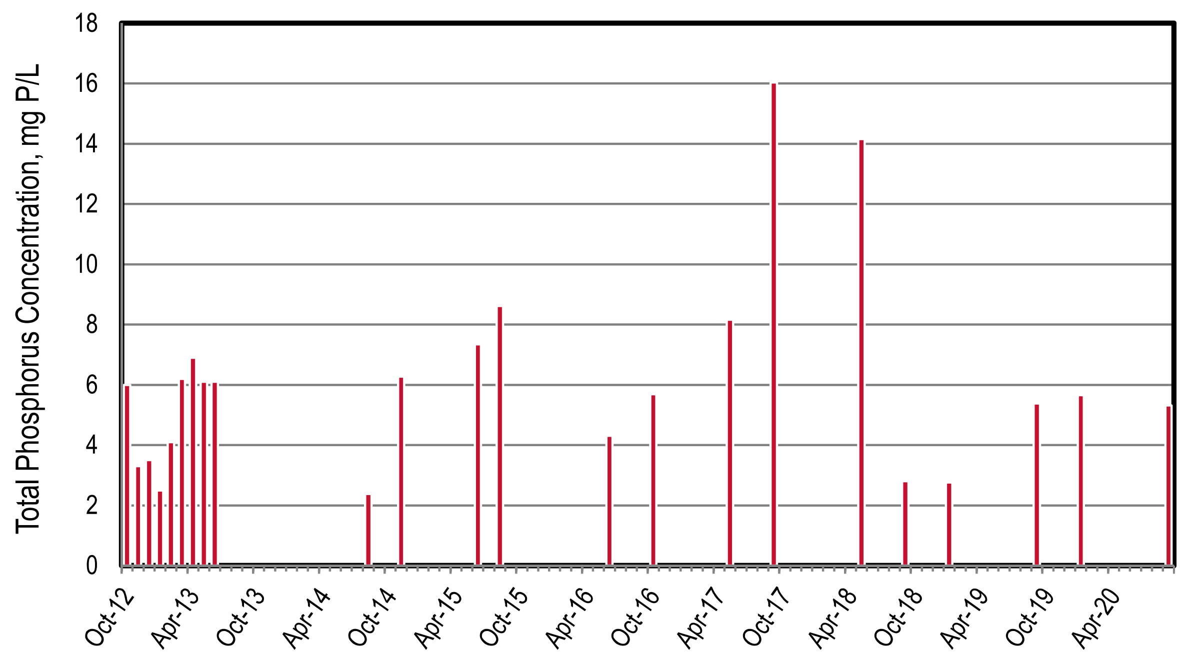

Figure 17-5. Discharge: Paradise Cove Monthly Phosphorus Concentrations

Table 17-1. Discharge: Paradise Cove Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	0.0144	0.00708	2.18	2.19	0.327
Nov-12	0.0156	1.24	0.0113	1.25	0.195
Dec-12	0.0199	0.0218	3.16	3.18	0.263
Jan-13	0.0138	1.10	0.0282	1.12	0.130
Feb-13	0.0129	1.51	0.191	1.70	0.200
Mar-13	0.0132	0.0349	2.51	2.54	0.309
Apr-13	0.0130	0.0216	1.67	1.69	0.339
May-13	0.0150	0.0198	2.78	2.80	0.346
Jun-13	0.0140	0.0370	2.20	2.23	0.323
Jul-13	0.0133	--	--	--	--
Aug-13	0.0139	--	--	--	--
Sep-13	0.0137	--	--	--	--
Oct-13	0.0144	--	--	--	--
Nov-13	0.0143	--	--	--	--
Dec-13	0.0141	--	--	--	--
Jan-14	0.0127	--	--	--	--
Feb-14	0.0149	--	--	--	--
Mar-14	0.0138	--	--	--	--
Apr-14	0.0162	--	--	--	--
May-14	0.0132	--	--	--	--
Jun-14	0.0132	--	--	--	--
Jul-14	0.0121	--	--	--	--
Aug-14	0.0128	0.748	0.112	0.860	0.115
Sep-14	0.0137	--	--	--	--
Oct-14	0.0133	--	--	--	--
Nov-14	0.0136	0.00689	2.41	2.41	0.321
Dec-14	0.0202	--	--	--	--
Jan-15	0.0124	--	--	--	--
Feb-15	0.0124	--	--	--	--
Mar-15	0.0137	--	--	--	--
Apr-15	0.0118	--	--	--	--
May-15	0.0128	--	--	--	--
Jun-15	0.0128	0.0146	2.33	2.35	0.356
Jul-15	--	--	--	--	--
Aug-15	0.0122	0.00924	2.86	2.87	0.397
Sep-15	--	--	--	--	--

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	--	--	--	--	--
Nov-15	--	--	--	--	--
Dec-15	--	--	--	--	--
Jan-16	--	--	--	--	--
Feb-16	--	--	--	--	--
Mar-16	--	--	--	--	--
Apr-16	--	--	--	--	--
May-16	--	--	--	--	--
Jun-16	0.0137	1.35	0.180	1.53	0.223
Jul-16	0.0110	--	--	--	--
Aug-16	0.0140	--	--	--	--
Sep-16	0.0130	--	--	--	--
Oct-16	0.0139	0.0818	1.43	1.51	0.300
Nov-16	0.0140	--	--	--	--
Dec-16	0.0160	--	--	--	--
Jan-17	0.0220	--	--	--	--
Feb-17	0.0210	--	--	--	--
Mar-17	0.0140	--	--	--	--
Apr-17	0.0140	--	--	--	--
May-17	0.0131	0.0165	2.74	2.75	0.403
Jun-17	0.0130	--	--	--	--
Jul-17	0.0113	--	--	--	--
Aug-17	0.0123	--	--	--	--
Sep-17	0.0129	0.0174	2.46	2.48	0.781
Oct-17	0.0131	--	--	--	--
Nov-17	0.0138	--	--	--	--
Dec-17	0.0137	--	--	--	--
Jan-18	0.0141	--	--	--	--
Feb-18	0.0139	--	--	--	--
Mar-18	0.0164	--	--	--	--
Apr-18	0.0147	--	--	--	--
May-18	0.0136	0.0149	2.07	2.09	0.726
Jun-18	0.0142	--	--	--	--
Jul-18	0.0159	0.0159	--	--	--
Aug-18	0.0239	0.0239	--	--	--
Sep-18	0.0240	0.0240	2.14	2.13	0.255
Oct-18	0.0126	0.0229	--	--	--

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	0.0162	0.0102	--	--	--
Dec-18	0.0142	0.0469	--	--	--
Jan-19	0.0179	0.0277	1.44	1.47	0.187
Feb-19	0.0286	0.0401			
Mar-19	0.0206	--	--	--	--
Apr-19	0.0144	0.0114	--	--	--
May-19	0.0147	0.0113	--	--	--
Jun-19	0.0147	0.233	--	--	--
Jul-19	0.0144	0.0158	--	--	--
Aug-19	0.0156	0.0413	--	--	--
Sep-19	0.0150	0.0368	2.09	2.13	0.305
Oct-19	0.0135	0.0120	--	--	--
Nov-19	0.0140	0.0101	--	--	--
Dec-19	0.0163	0.0407	--	--	--
Jan-20	0.0140	0.0158	2.45	2.47	0.300
Feb-20	0.0125	0.0256	--	--	--
Mar-20	0.0144	0.0254	--	--	--
Apr-20	0.0174	0.0130	--	--	--
May-20	0.0154	0.0616	--	--	--
Jun-20	0.0169	0.0531	--	--	--
Jul-20	0.0147	0.0106	--	--	--
Aug-20	0.0149	0.0204	--	--	--
Sep-20	0.0151	0.460	0.848	1.31	0.303
Dry Season Average	**0.0143**	**0.147**	**1.90**	**2.13**	**0.378**
Dry Season Trend **	**Up**	***	***	***	***
Wet Season Average	**0.0151**	**0.196**	**1.59**	**1.96**	**0.261**
Average Annual	**0.0148**	**0.172**	**1.75**	**2.05**	**0.322**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

*** No statistical dry season trending analysis was performed on nutrient species due to the limited number of samples required for minor dischargers.

18 City of Petaluma

Petaluma discharges to Petaluma River that is connected to San Pablo Bay. The plant has approximately 25,300 service connections and it has a permitted capacity of 6.7 mgd ADWF. The plant performs nitrogen and phosphorus removal using oxidation ditches coupled with treatment wetlands and oxidation ponds. The oxidation ponds also serve as equalization during peak wet weather flow. Effluent flow that is not discharged to the Petaluma River is diverted to recycled water whenever possible. Discharge to Petaluma River is prohibited May 1 through October 20, except when the Facility inflow exceeds the recycled water distribution and storage system capacity.

The following observations are made based upon the figures and table in the subsequent pages:

- There are no emerging dry season trends as Petaluma does not discharge during the dry season.
- Wet season trends analyzed (data not shown) and there are no emerging trends.
- Both nitrogen and phosphorus loads typically increase with flow during wet weather events.
- NOx and organic nitrogen are the majority of the nitrogen species discharged as would be expected since this plant nitrifies. The plant has reduced their total inorganic nitrogen and NOx discharge loads since 2017/2018 due to enhanced denitrification.
- The plant meets Level 3 TIN concentration limits (i.e., 6 mg N/L) developed under the Bay Area Clean Water Agencies Scoping and Evaluation Plan for the whole dataset.
- Total phosphorus concentrations range from 0.5 to 3.8 mg P/L, which suggests P removal. The removal mechanism is attributed to biological P removal in the oxidation ditch.

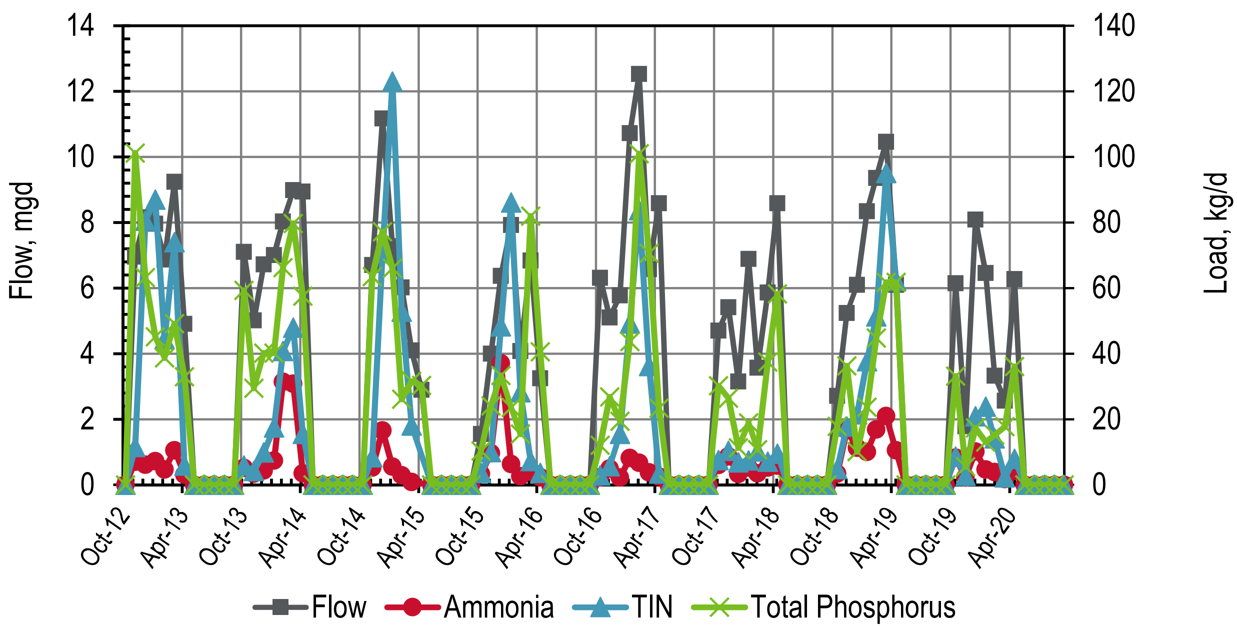

Figure 18-1. Discharge: Petaluma Monthly Flows and Loads

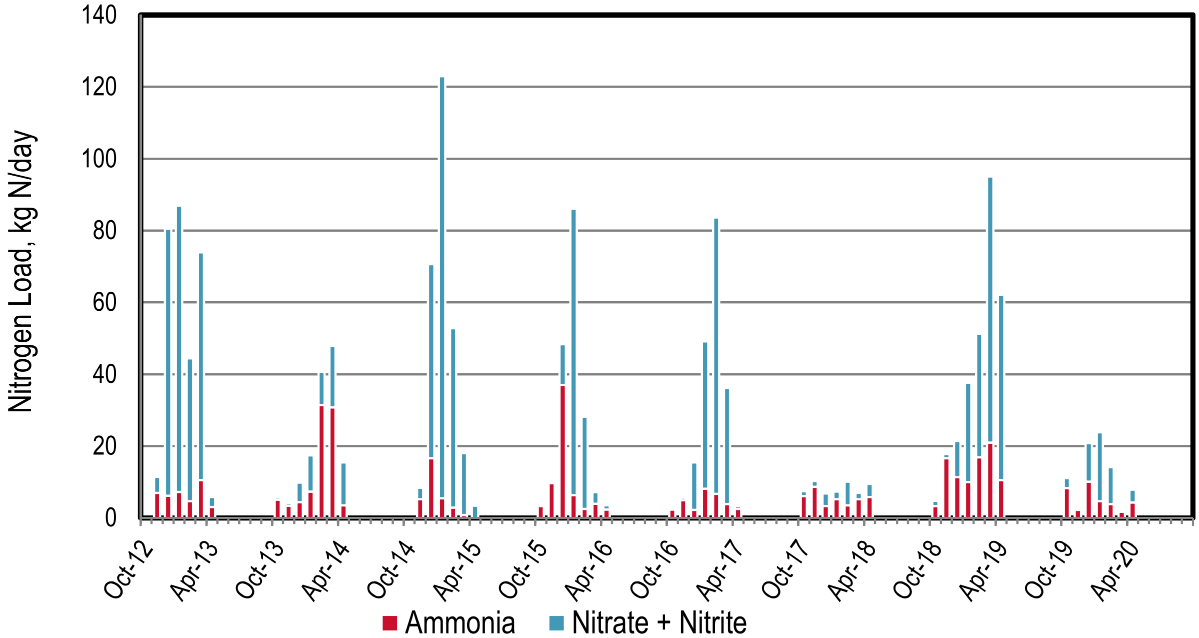

Figure 18-2. Discharge: Petaluma Monthly Nitrogen Loads

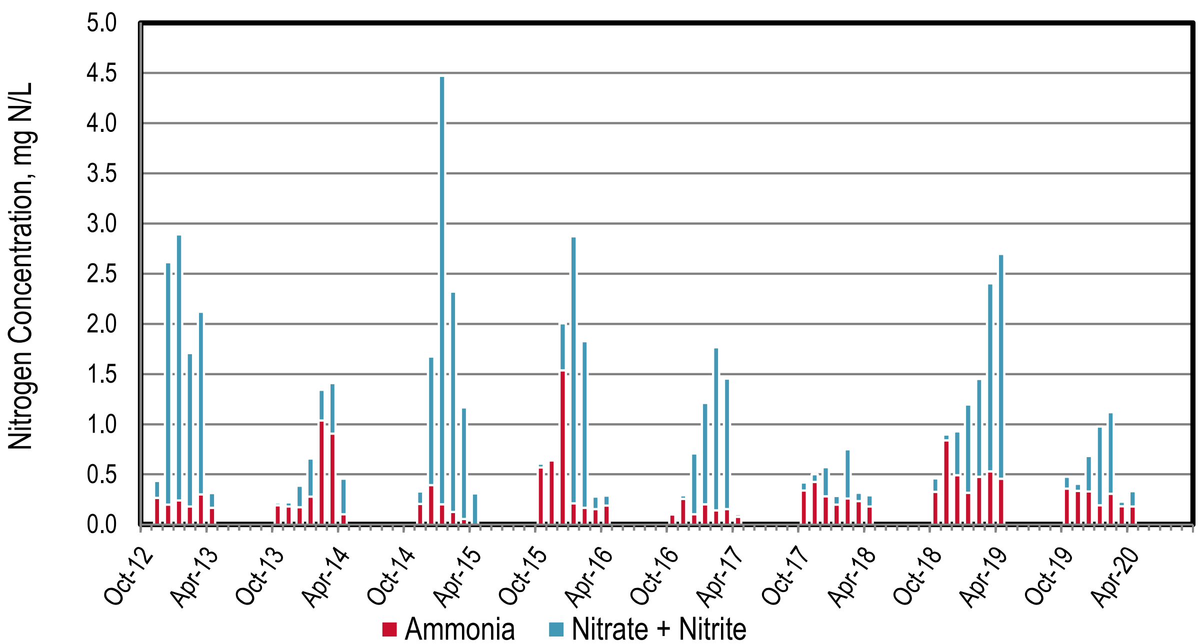

Figure 18-3. Discharge: Petaluma Monthly Nitrogen Concentrations

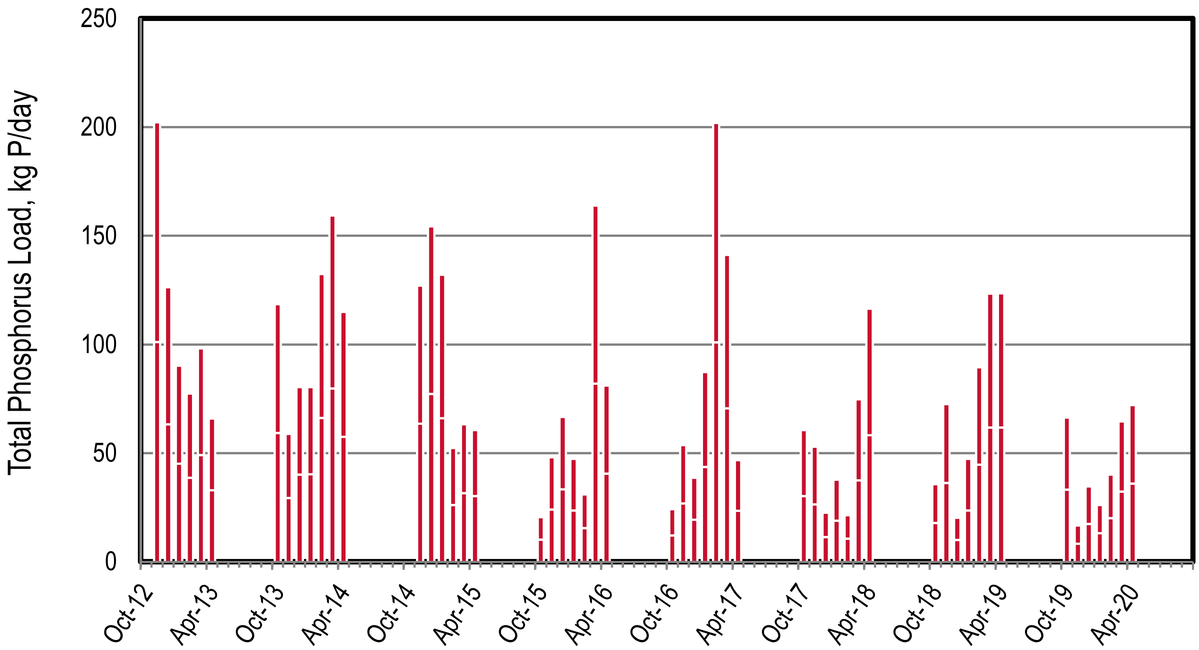

Figure 18-4. Discharge: Petaluma Monthly Phosphorus Loads

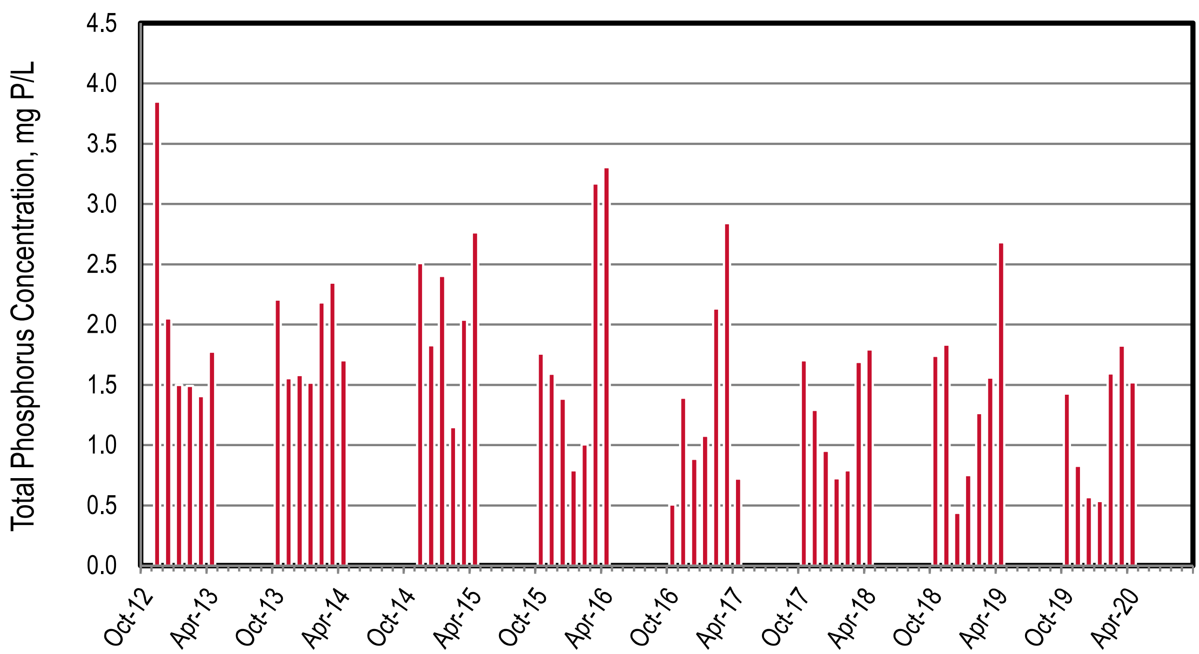

Figure 18-5. Discharge: Petaluma Monthly Phosphorus Concentrations

Table 18-1. Discharge: Petaluma Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	0	0	0	0	0
Nov-12	6.95	6.98	4.47	11.4	101
Dec-12	8.15	6.16	74.4	80.5	63.2
Jan-13	7.96	7.23	79.7	87.0	45.1
Feb-13	6.87	4.65	39.7	44.4	38.7
Mar-13	9.24	10.5	63.5	74.0	49.1
Apr-13	4.91	3.11	2.68	5.79	32.9
May-13	0	0	0	0	0
Jun-13	0	0	0	0	0
Jul-13	0	0	0	0	0
Aug-13	0	0	0	0	0
Sep-13	0	0	0	0	0
Oct-13	7.11	5.16	0.691	5.85	59.3
Nov-13	5.01	3.42	0.760	4.18	29.4
Dec-13	6.72	4.36	5.46	9.82	40.2
Jan-14	7.01	7.37	10.0	17.4	40.2
Feb-14	8.03	31.4	9.31	40.7	66.2
Mar-14	8.98	30.8	17.1	47.9	79.7
Apr-14	8.94	3.50	12.0	15.5	57.5
May-14	0	0	0	0	0
Jun-14	0	0	0	0	0
Jul-14	0	0	0	0	0
Aug-14	0	0	0	0	0
Sep-14	0	0	0	0	0
Oct-14	0	0	0	0	0
Nov-14	6.70	5.20	3.18	8.37	63.5
Dec-14	11.2	16.6	54.0	70.6	77.2
Jan-15	7.27	5.51	117	123	66.1
Feb-15	6.02	2.85	49.9	52.8	26.2
Mar-15	4.10	0.870	17.2	18.1	31.6
Apr-15	2.90		3.41		30.3
May-15	0	0	0	0	0
Jun-15	0	0	0	0	0
Jul-15	0	0	0	0	0
Aug-15	0	0	0	0	0
Sep-15	0	0	0	0	0

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	1.54	3.31	0.234	3.54	10.3
Nov-15	4.00	9.62	0.344	9.97	24.1
Dec-15	6.37	37.0	11.3	48.3	33.3
Jan-16	7.92	6.32	79.7	86.0	23.6
Feb-16	4.07	2.56	25.6	28.2	15.5
Mar-16	6.84	3.97	3.23	7.20	81.9
Apr-16	3.24	2.33	1.20	3.54	40.5
May-16	0	0	0	0	0
Jun-16	0	0	0	0	0
Jul-16	0	0	0	0	0
Aug-16	0	0	0	0	0
Sep-16	0	0	0	0	0
Oct-16	6.31	2.35	0.406	2.76	12.1
Nov-16	5.10	4.92	0.686	5.61	26.8
Dec-16	5.77	2.26	13.2	15.5	19.4
Jan-17	10.7	8.19	40.9	49.1	43.7
Feb-17	12.5	6.73	76.9	83.6	101
Mar-17	6.57	3.82	32.4	36.2	70.6
Apr-17	8.58	2.51	0.841	3.35	23.4
May-17	0	0	0	0	0
Jun-17	0	0	0	0	0
Jul-17	0	0	0	0	0
Aug-17	0	0	0	0	0
Sep-17	0	0	0	0	0
Oct-17	4.70	6.05	1.39	7.44	30.3
Nov-17	5.41	8.67	1.62	10.3	26.4
Dec-17	3.15	3.33	3.48	6.81	11.3
Jan-18	6.89	5.21	2.17	7.37	18.9
Feb-18	3.57	3.51	6.62	10.1	10.7
Mar-18	5.86	5.20	1.79	6.98	37.4
Apr-18	8.58	5.82	3.63	9.45	58.2
May-18	0	0	0	0	0
Jun-18	0	0	0	0	0
Jul-18	0	0	0	0	0
Aug-18	0	0	0	0	0
Sep-18	0	0	0	0	0
Oct-18	2.71	3.36	1.36	4.72	17.8

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	5.23	16.6	1.12	17.7	36.2
Dec-18	6.10	11.3	10.1	21.4	10.1
Jan-19	8.34	10.0	27.7	37.7	23.7
Feb-19	9.36	16.9	34.4	51.3	44.7
Mar-19	10.5	21.0	74.1	95.0	61.7
Apr-19	6.10	10.5	51.6	62.1	61.8
May-19	0	0	0	0	0
Jun-19	0	0	0	0	0
Jul-19	0	0	0	0	0
Aug-19	0	0	0	0	0
Sep-19	0	0	0	0	0
Oct-19	6.15	8.29	2.76	11.1	33.2
Nov-19	1.78	2.26	0.466	2.72	5.56
Dec-19	8.08	10.1	10.7	20.8	17.4
Jan-20	6.46	4.67	19.1	23.8	13.1
Feb-20	3.32	3.87	10.2	14.1	15.2
Mar-20	2.57	1.77	0.438	2.21	17.7
Apr-20	6.27	4.28	3.60	7.88	36.0
May-20	0	0	0	0	0
Jun-20	0	0	0	0	0
Jul-20	0	0	0	0	0
Aug-20	0	0	0	0	0
Sep-20	0	0	0	0	0
Dry Season Average	**0**	**0**	**0**	**0**	**0**
Dry Season Trend**	**--**	**--**	**--**	**--**	**--**
Wet Season Average	**6.15**	**7.53**	**20.0**	**27.8**	**37.7**
Average Annual	**3.59**	**4.36**	**11.7**	**16.1**	**22.0**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** No dry season trending analysis was performed on Petaluma as the facility does not discharge during dry season months.

19 City of Pinole

The Pinole-Hercules Water Pollution Control Plant discharges to San Pablo Bay. The plant has approximately 11,215 service connections; it has a permitted capacity of 4.06 mgd ADWF and a peak wet weather capacity of 20.0 mgd. The current flow averages about 2.3 mgd ADWF.

The following observations are made based upon the figures and table in the subsequent pages:

- They completed a $45 Mil plant upgrade project that included the ability to remove ammonia and TIN loads during the dry season (commissioned in 2019). They are still optimizing the system.
- The wet season average monthly flow values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
- Based on the table with the average monthly values, there appears to be an emerging dry season downward trend for TIN loads. It is anticipated that the ammonia loads will also trend downwards in future years once the plant upgrade is further optimized.
- Nitrogen and phosphorus loads do not track with the flows as seen at most other plants.
- With the exception of ammonia, nutrient species were not sampled in July and August 2014.
- Total phosphorus concentrations from 0.5 to 5.1 mg P/L.

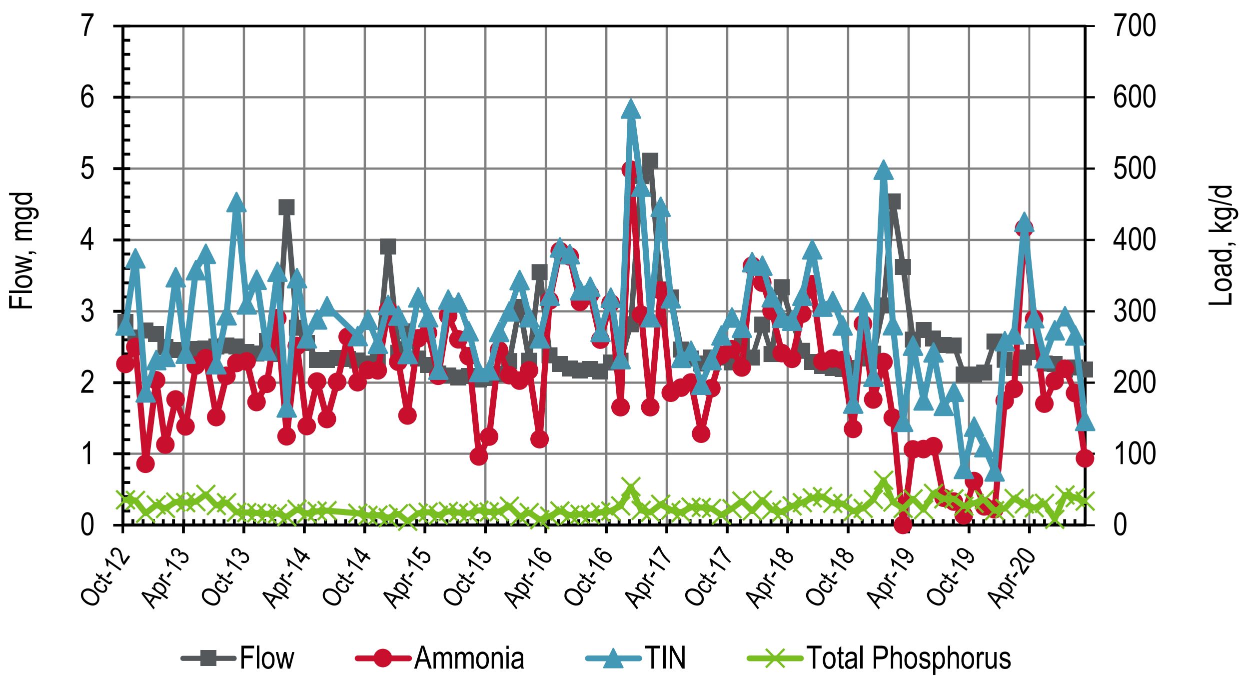

Figure 19-1. Discharge: Pinole Monthly Flows and Loads

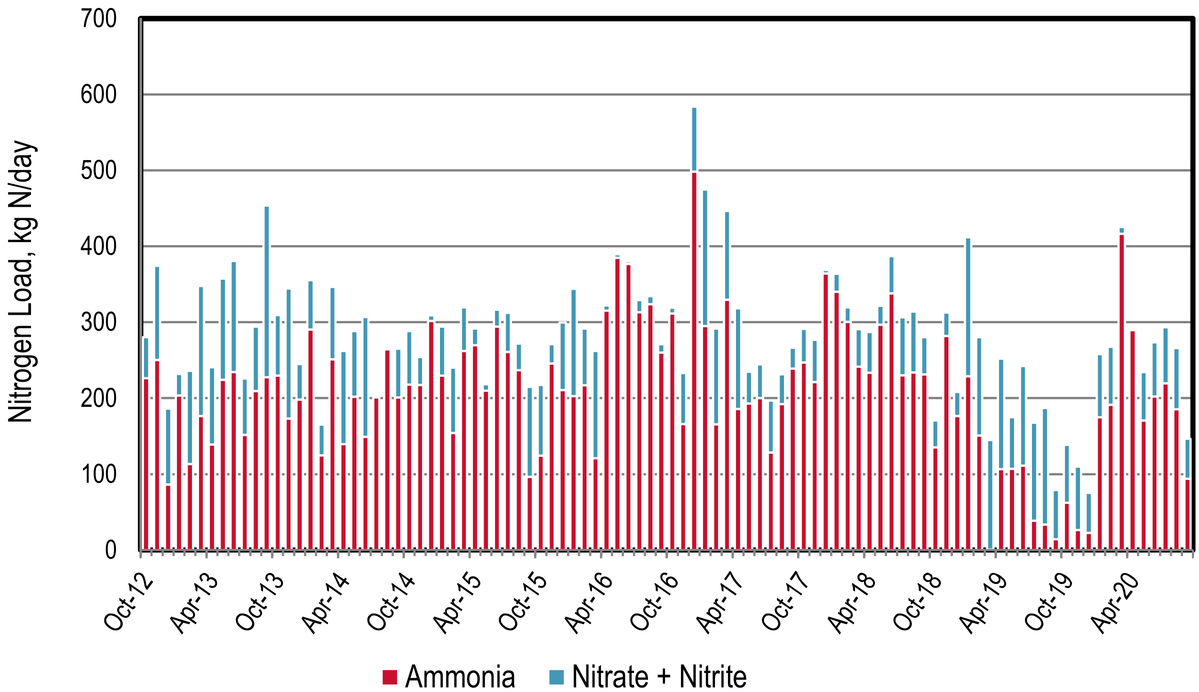

Figure 19-2. Discharge: Pinole Monthly Nitrogen Loads

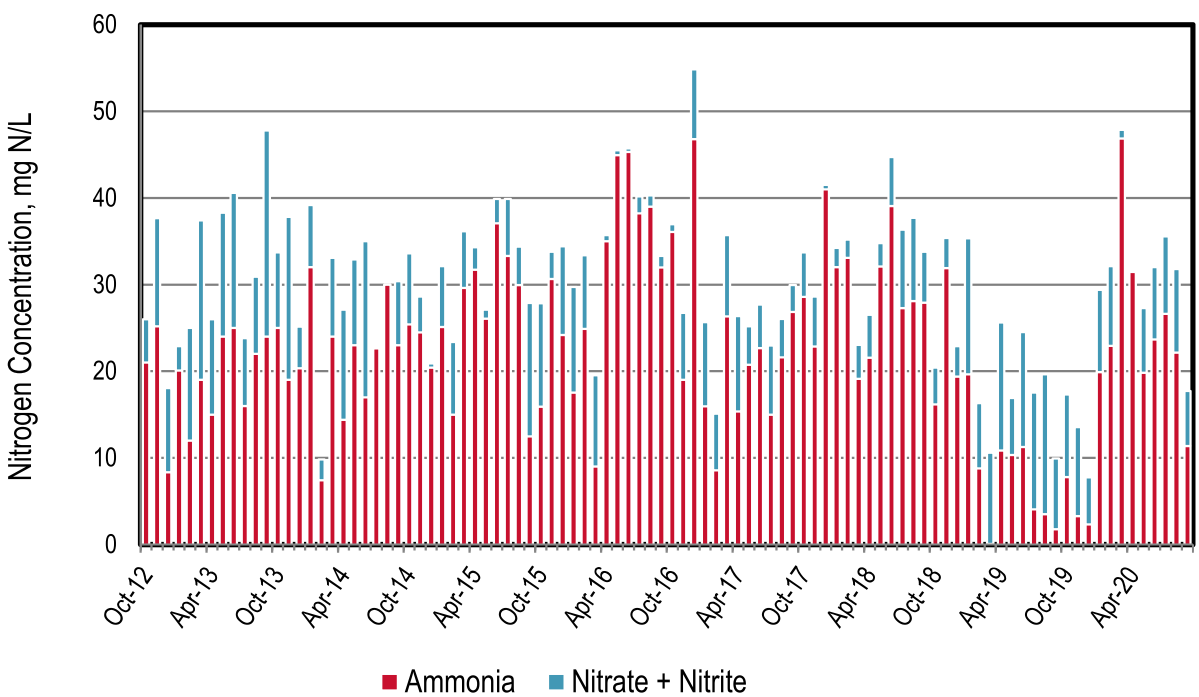

Figure 19-3. Discharge: Pinole Monthly Nitrogen Concentrations

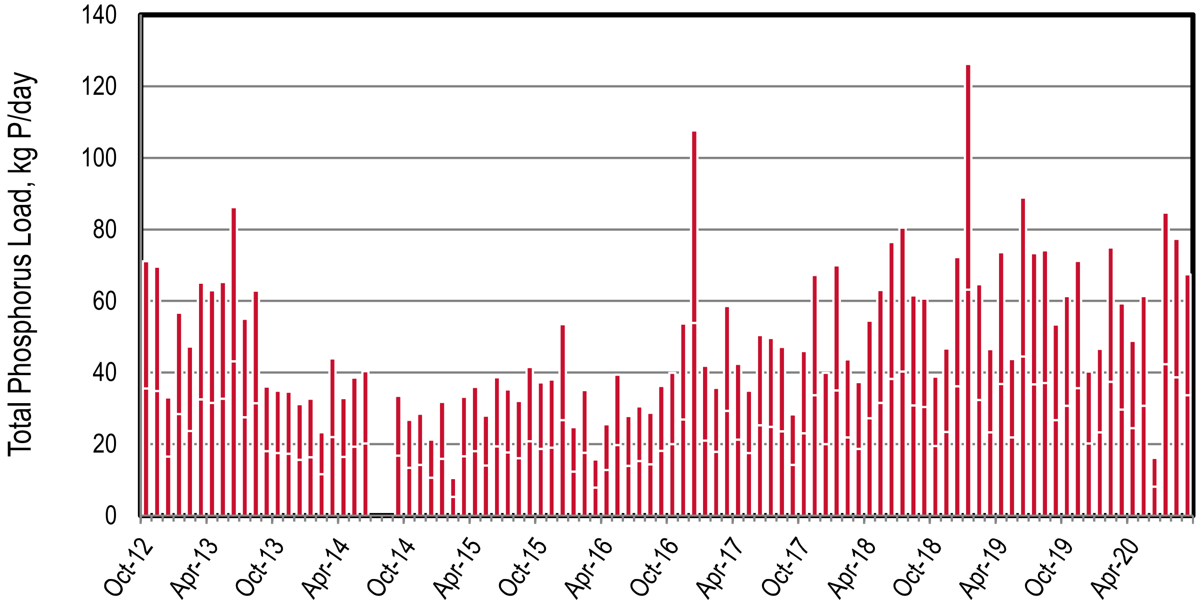

Figure 19-4. Discharge: Pinole Monthly Phosphorus Loads

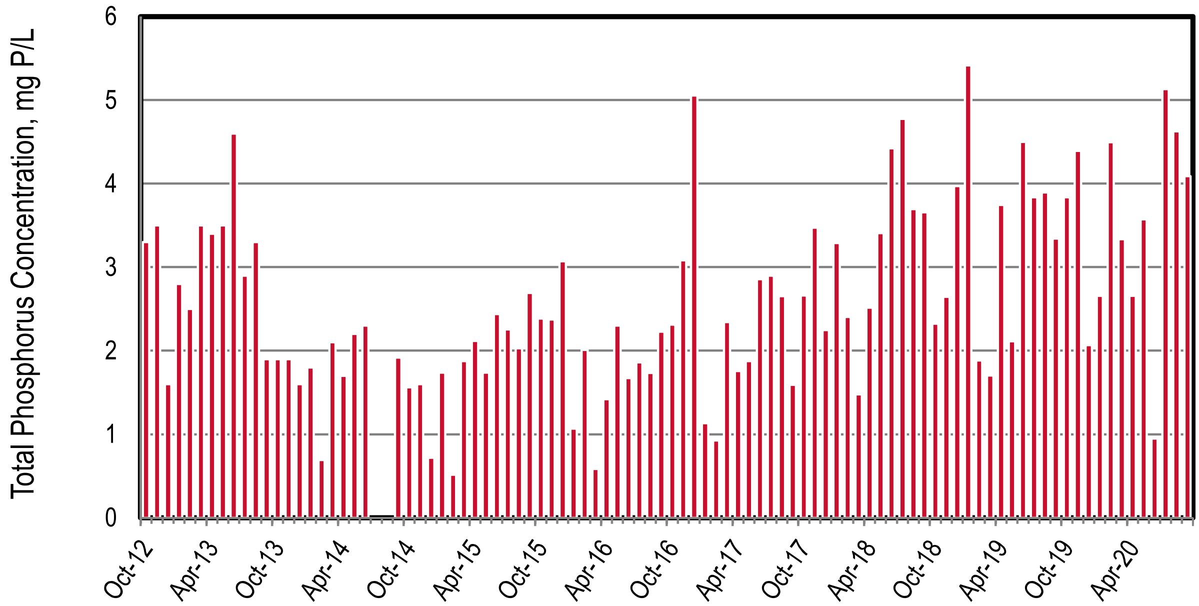

Figure 19-5. Discharge: Pinole Monthly Phosphorus Concentrations

Table 19-1. Discharge: Pinole Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	2.85	226	54.0	280	35.6
Nov-12	2.63	250	124	374	34.8
Dec-12	2.73	86.2	100	186	16.5
Jan-13	2.68	203	28.4	232	28.4
Feb-13	2.50	113	123	236	23.6
Mar-13	2.46	177	171	348	32.5
Apr-13	2.45	139	102	241	31.5
May-13	2.47	224	134	358	32.7
Jun-13	2.48	234	146	381	43.1
Jul-13	2.51	152	74.0	226	27.5
Aug-13	2.52	210	84.8	294	31.4
Sep-13	2.51	228	226	454	18.0
Oct-13	2.43	230	79.9	310	17.5
Nov-13	2.41	173	171	344	17.3
Dec-13	2.58	198	46.8	245	15.6
Jan-14	2.40	290	65.3	356	16.3
Feb-14	4.46	125	40.5	165	11.6
Mar-14	2.77	251	95.3	347	22.0
Apr-14	2.56	139	123	262	16.5
May-14	2.32	202	86.8	289	19.3
Jun-14	2.32	149	158	307	20.2
Jul-14	2.35	201			
Aug-14	2.33	264			
Sep-14	2.31	201	64.5	265	16.7
Oct-14	2.27	218	70.4	288	13.4
Nov-14	2.35	218	36.8	254	14.2
Dec-14	3.91	302	7.06	309	10.6
Jan-15	2.42	230	64.5	294	15.9
Feb-15	2.72	154	86.2	240	5.28
Mar-15	2.34	262	57.7	320	16.6
Apr-15	2.25	270	22.1	292	18.0
May-15	2.13	210	8.55	218	14.0
Jun-15	2.10	294	22.5	317	19.4
Jul-15	2.07	261	51.4	312	17.7
Aug-15	2.09	237	35.2	272	16.0
Sep-15	2.04	96.4	119	215	20.8

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	2.07	124	93.2	217	18.6
Nov-15	2.12	246	25.4	271	19.0
Dec-15	2.30	211	89.1	300	26.7
Jan-16	3.06	203	141	344	12.3
Feb-16	2.31	217	74.4	292	17.5
Mar-16	3.55	121	141	262	7.84
Apr-16	2.38	315	6.65	322	12.8
May-16	2.26	385	4.56	389	19.7
Jun-16	2.20	377	3.36	380	13.9
Jul-16	2.17	313	16.1	329	15.3
Aug-16	2.20	324	10.8	334	14.4
Sep-16	2.15	260	11.0	271	18.1
Oct-16	2.28	312	7.51	319	20.0
Nov-16	2.31	166	67.1	233	26.9
Dec-16	2.82	498	85.7	584	53.8
Jan-17	4.89	295	180	475	20.9
Feb-17	5.11	166	126	292	17.8
Mar-17	3.31	330	117	447	29.3
Apr-17	3.20	186	133	318	21.2
May-17	2.46	193	41.4	235	17.5
Jun-17	2.34	200	44.4	245	25.2
Jul-17	2.27	128	68.5	197	24.8
Aug-17	2.35	192	39.3	232	23.6
Sep-17	2.35	239	27.4	266	14.2
Oct-17	2.29	247	44.3	291	23.0
Nov-17	2.56	221	55.8	277	33.6
Dec-17	2.35	364	4.51	369	19.9
Jan-18	2.81	340	23.6	364	35.0
Feb-18	2.40	301	19.1	320	21.9
Mar-18	3.34	242	49.4	291	18.7
Apr-18	2.86	233	53.5	287	27.2
May-18	2.45	297	25.0	322	31.5
Jun-18	2.29	338	48.9	387	38.3
Jul-18	2.23	230	76.4	306	40.2
Aug-18	2.20	234	80.0	314	30.8
Sep-18	2.19	232	48.7	280	30.3
Oct-18	2.21	135	35.5	170	19.4

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	2.34	282	30.6	313	23.4
Dec-18	2.41	176	31.9	208	36.1
Jan-19	3.08	229	183	499	63.1
Feb-19	4.54	151	129	280	32.4
Mar-19	3.62	0.765	144	145	23.3
Apr-19	2.60	107	145	252	36.8
May-19	2.74	107	68.0	175	21.9
Jun-19	2.62	111	131	243	44.5
Jul-19	2.53	38.7	129	168	36.7
Aug-19	2.52	33.5	154	187	37.1
Sep-19	2.11	14.1	65.2	79.3	26.7
Oct-19	2.12	62.2	76.3	138	30.7
Nov-19	2.14	26.5	83.3	110	35.6
Dec-19	2.58	22.6	52.8	75.5	20.1
Jan-20	2.32	175	83.3	258	23.3
Feb-20	2.20	191	76.5	268	37.5
Mar-20	2.35	417	8.78	425	29.7
Apr-20	2.43	289	1.09	291	24.4
May-20	2.27	170	63.9	234	30.7
Jun-20	2.26	202	71.2	274	8.09
Jul-20	2.18	220	73.7	293	42.3
Aug-20	2.21	185	80.6	266	38.7
Sep-20	2.18	94.1	52.5	147	33.7
Dry Season Average	**2.31**	**207**	**69.6**	**275**	**25.7**
Dry Season Trend **	**None**	**None**	**None**	**Down**	**None**
Wet Season Average	**2.74**	**212**	**76.6**	**290**	**23.8**
Average Annual	**2.56**	**210**	**73.8**	**284**	**24.6**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

20 Rodeo Sanitary District

Rodeo discharges to San Pablo Bay. The plant services approximately 8,900 people and it has a permitted capacity of 1.14 mgd ADWF. The current plant flows are approximately 0.53 mgd. The plant performs nitrification and phosphorus removal using an activated sludge process.

The following observations are made based upon the figures and table in the subsequent pages:

- The wet season average monthly flow values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
- Based on average monthly values, there appears to be an emerging upward trend for ammonia and TIN nitrogen species. The plant had an aeration operational issue in July 2020 that has since been addressed (discussed in their self-monitoring report (SMR)). Rodeo has noticed an increase in influent flows and loads during the global pandemic.
- Total nitrogen loads generally increase with flow during wet weather events.
- NOx is the majority of the nitrogen species discharged as would be expected since this plant nitrifies (with the exception of the latter half of the 2019/2020 season). A portion of ammonia occasionally bleeds through year round.
- Total phosphorus concentrations range from 0.3 to 7.9 mg P/L. This suggests occasional P removal as typical effluent TP concentrations are 4 to 6 mg P/L. The removal mechanism is thought to be the anaerobic selector in the activated sludge process.

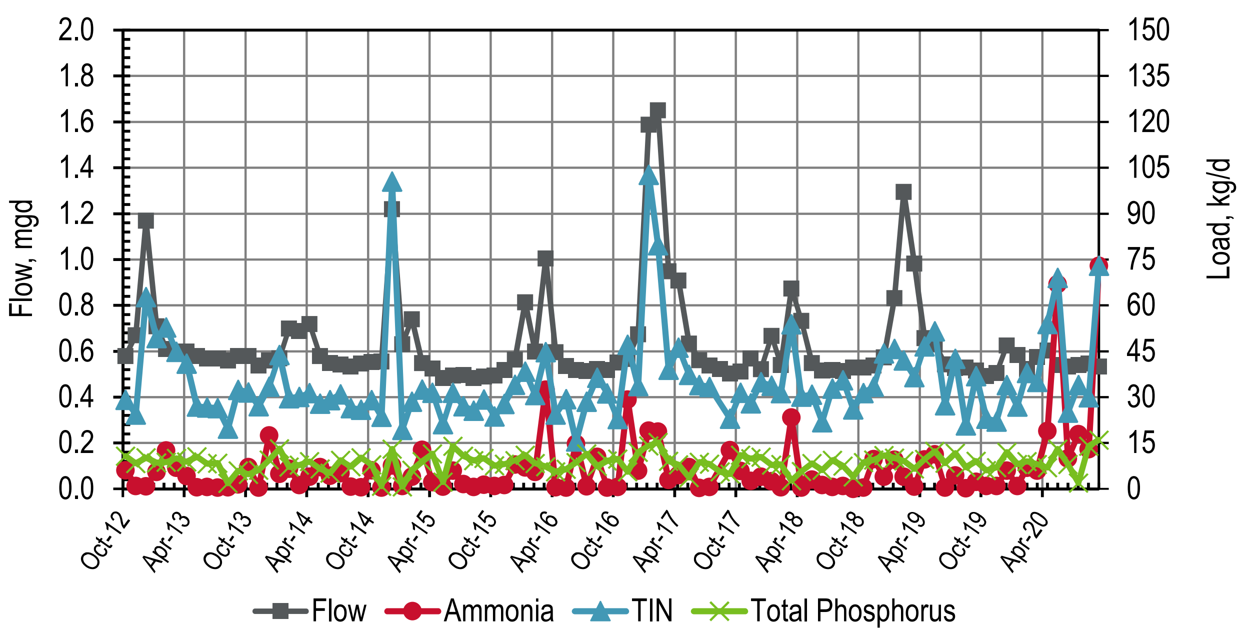

Figure 20-1. Discharge: Rodeo Monthly Flows and Loads

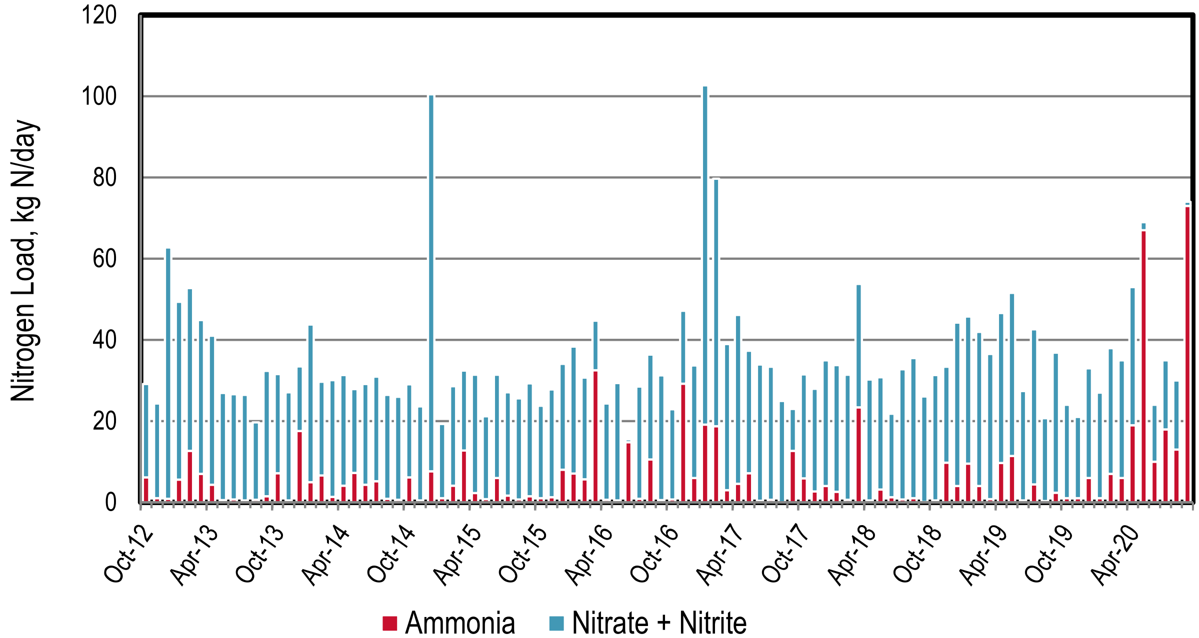

Figure 20-2. Discharge: Rodeo Monthly Nitrogen Loads

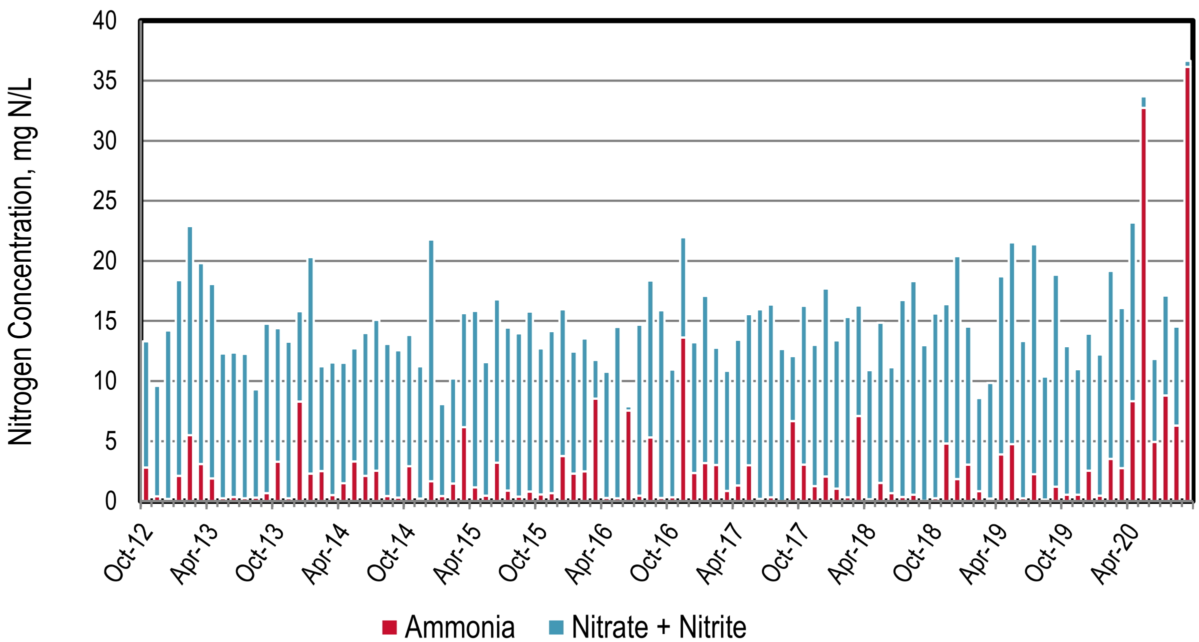

Figure 20-3. Discharge: Rodeo Monthly Nitrogen Concentrations

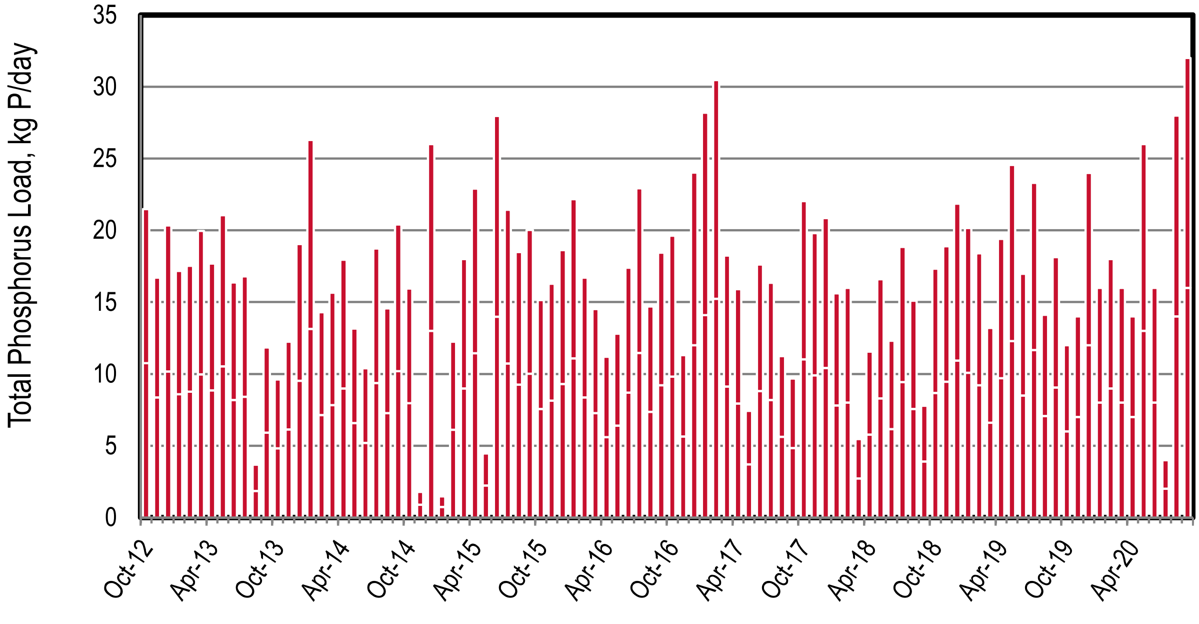

Figure 20-4. Discharge: Rodeo Monthly Phosphorus Loads

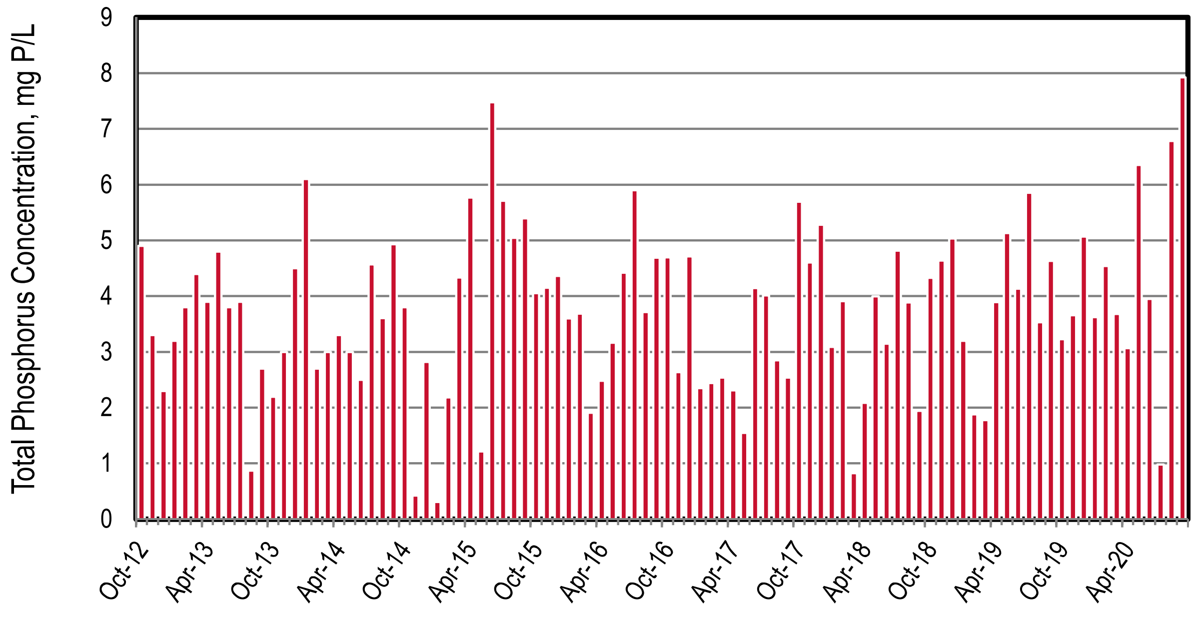

Figure 20-5. Discharge: Rodeo Monthly Phosphorus Concentrations

Table 20-1. Discharge: Rodeo Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	0.580	6.14	23.0	29.2	10.7
Nov-12	0.670	1.01	23.3	24.3	8.36
Dec-12	1.17	0.885	61.9	62.8	10.2
Jan-13	0.710	5.64	43.7	49.4	8.59
Feb-13	0.610	12.7	40.1	52.8	8.76
Mar-13	0.600	7.03	37.9	44.9	9.98
Apr-13	0.600	4.31	36.7	41.0	8.85
May-13	0.580	0.548	26.4	26.9	10.5
Jun-13	0.570	0.733	25.9	26.7	8.19
Jul-13	0.570	0.517	25.9	26.4	8.40
Aug-13	0.560	0.614	19.1	19.7	1.84
Sep-13	0.580	1.49	30.9	32.4	5.92
Oct-13	0.580	7.21	24.3	31.6	4.81
Nov-13	0.540	0.510	26.6	27.1	6.12
Dec-13	0.560	17.6	15.9	33.4	9.53
Jan-14	0.570	4.96	38.8	43.8	13.1
Feb-14	0.700	6.65	23.1	29.7	7.14
Mar-14	0.690	1.36	28.8	30.1	7.82
Apr-14	0.720	4.08	27.3	31.4	8.98
May-14	0.580	7.23	20.7	27.9	6.58
Jun-14	0.550	4.37	24.7	29.1	5.20
Jul-14	0.543	5.20	25.8	31.0	9.37
Aug-14	0.535	0.846	25.6	26.4	7.28
Sep-14	0.547	0.625	25.3	26.0	10.2
Oct-14	0.555	6.13	22.9	29.0	7.97
Nov-14	0.556	0.444	23.2	23.6	0.888
Dec-14	1.22	7.68	92.8	100	13.0
Jan-15	0.631	1.04	18.2	19.3	0.739
Feb-15	0.741	4.08	24.5	28.6	6.12
Mar-15	0.549	12.8	19.7	32.5	9.00
Apr-15	0.525	2.29	29.1	31.4	11.4
May-15	0.485	0.816	20.4	21.2	2.23
Jun-15	0.495	6.00	25.4	31.4	14.0
Jul-15	0.496	1.67	25.4	27.1	10.7
Aug-15	0.485	0.712	24.9	25.6	9.25
Sep-15	0.491	1.48	27.8	29.3	10.0

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	0.494	1.06	22.7	23.8	7.57
Nov-15	0.519	1.31	26.5	27.8	8.14
Dec-15	0.565	8.01	26.1	34.1	9.31
Jan-16	0.815	7.11	31.3	38.4	11.1
Feb-16	0.600	5.64	25.1	30.7	8.36
Mar-16	1.01	32.5	12.2	44.7	7.26
Apr-16	0.597	0.625	23.7	24.3	5.60
May-16	0.536	0.475	28.9	29.4	6.41
Jun-16	0.520	14.8	0.692	15.5	8.69
Jul-16	0.514	0.869	27.7	28.5	11.5
Aug-16	0.524	10.5	25.8	36.4	7.35
Sep-16	0.520	0.527	30.7	31.3	9.22
Oct-16	0.552	0.685	22.2	22.9	9.81
Nov-16	0.568	29.2	17.9	47.2	5.65
Dec-16	0.674	6.00	27.7	33.7	12.0
Jan-17	1.59	19.1	83.6	103	14.1
Feb-17	1.65	18.8	61.0	79.7	15.2
Mar-17	0.950	3.04	35.9	39.0	9.12
Apr-17	0.910	4.54	41.6	46.2	7.95
May-17	0.634	7.19	30.2	37.4	3.71
Jun-17	0.562	0.377	33.6	33.9	8.81
Jul-17	0.539	0.675	32.7	33.4	8.18
Aug-17	0.522	--***	25.0	--***	5.62
Sep-17	0.504	12.7	10.3	23.0	4.84
Oct-17	0.512	5.91	25.6	31.5	11.0
Nov-17	0.569	2.72	25.2	28.0	9.90
Dec-17	0.522	4.05	30.9	34.9	10.4
Jan-18	0.668	2.60	31.2	33.8	7.80
Feb-18	0.542	0.636	30.8	31.4	8.00
Mar-18	0.874	23.4	30.4	53.8	2.73
Apr-18	0.733	0.456	29.8	30.2	5.78
May-18	0.549	3.16	27.7	30.8	8.30
Jun-18	0.518	1.31	20.5	21.8	6.16
Jul-18	0.518	0.702	32.1	32.8	9.43
Aug-18	0.514	1.04	34.5	35.6	7.55
Sep-18	0.530	0.0742	26.0	26.0	3.89
Oct-18	0.530	0.501	30.8	31.3	8.67

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	0.539	9.81	23.6	33.4	9.45
Dec-18	0.574	4.03	40.3	44.3	10.9
Jan-19	0.833	9.57	36.2	45.8	10.1
Feb-19	1.30	4.03	38.0	42.0	9.21
Mar-19	0.983	0.770	35.8	36.5	6.60
Apr-19	0.659	9.70	36.9	46.6	9.70
May-19	0.633	11.4	40.2	51.6	12.3
Jun-19	0.544	0.497	26.9	27.4	8.49
Jul-19	0.527	4.45	38.2	42.6	11.7
Aug-19	0.529	0.297	20.4	20.7	7.06
Sep-19	0.517	2.37	34.5	36.9	9.06
Oct-19	0.492	1.00	23.0	23.0	6.00
Nov-19	0.506	1.00	20.0	22.0	7.00
Dec-19	0.626	6.00	27.0	34.0	12.0
Jan-20	0.585	1.00	26.0	27.0	8.00
Feb-20	0.524	7.00	31.0	38.0	9.00
Mar-20	0.575	6.00	29.0	35.0	8.00
Apr-20	0.604	19.0	34.0	54.0	7.00
May-20	0.541	67.0	2.00	69.0	13.0
Jun-20	0.536	10.0	14.0	25.0	8.00
Jul-20	0.541	18.0	17.0	34.0	2.00
Aug-20	0.546	13.0	17.0	30.0	14.0
Sep-20	0.534	73.0	1.00	73.0	16.0
Dry Season Average	**0.538**	**7.37**	**24.3**	**31.6**	**8.27**
Dry Season Trend **	**None**	**Up**	**None**	**Up**	**None**
Wet Season Average	**0.702**	**6.63**	**31.7**	**38.4**	**8.58**
Average Annual	**0.634**	**6.93**	**28.6**	**35.6**	**8.45**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

*** Missing data due to Caltest missing request for ammonia analysis. (See letter below).

NELAP/ORELAP Certification 4036

Caltest ANALYTICAL LABORATORY
ENVIRONMENTAL ANALYSES

ELAP Certification 1664

September 29, 2017

Andrew Alva
Rodeo Sanitary District
800 San Pablo Ave
Rodeo, CA 94572

RECEIVED
OCT 03 2017
BY: S&B

RE: Missed Ammonia Analysis

Dear Andrew Alva,

On August 14, 2017, Caltest received two water samples from Rodeo Sanitary District. One of the samples had TKN, NH3, Total Phosphate, and Nitrate/Nitrite analyses clearly requested on the accompanying Chain of Custody form. Unfortunately, the request for NH3 analysis was missed by Caltest and was not performed on the sample received. This request was not noticed until the client brought it to my attention on September 27, 2017, by then the sample was beyond the method prescribed 28 day holding time.

I apologize for this error; missed analysis requests are quite an anomaly here at Caltest and are something we take very seriously. I've alerted our staff of this unfortunate event to decrease the likelihood of this error occurring again.

Please feel free to contact me if you have any questions or need any further assistance.

Thank you,

Sincerely,
Caltest Analytical Laboratory

Sandralyn Luna
Project Manager
Caltest Analytical Laboratory

1885 North Kelly Road • Napa, California 94558
(707) 258-4000 • Fax: (707) 226-1001 • e-mail: info@caltestlabs.com

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21 San Jose-Santa Clara Regional Wastewater Facility

The San Jose-Santa Clara Regional Wastewater Facility discharges to the Lower South Bay, and serves an estimated population of 1.5 million with approximately 17,000 commercial and industrial connections. The plant has a permitted ADWF capacity of 167 mgd and a peak wet weather capacity of 261 mgd. The current ADWF discharge flows are approximately 79 mgd. The process includes advanced treatment with a Biological Nutrient Removal (BNR) activated sludge system for N and P removal.

The following observations are made based upon the figures and table in the subsequent pages:

- Influent
  - Note: limited to data since July 2019; quarterly required but more provided for various parameters.
  - Based on the average monthly values table below, there are no emerging dry season trends.
  - The flow reduction across the plant ranges from approximately 10 to 25 percent. This reduction is attributed to recycled water, water bound with biosolids, evaporation, etc.
  - The nitrogen load reduction values across the plant ranges from approximately 70 to 85 percent. This load reduction is attributed primarily to biological assimilation and nutrient load reduction in the activated sludge system, as well as load diversion associated with recycled water.
  - The phosphorus load reduction across the plant ranges from approximately 80 to 95 percent. This reduction is primarily attributed to biological assimilation in the activate sludge, enhanced phosphorus load reduction capabilities, and load diversion associated with recycled water.
- Discharge
  - The wet season average monthly flow values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
  - The flows reduce 10 to 20 mgd from the wet to the dry season due to a combination of recycled water demand and a lack of inflow and infiltration during the dry season.
  - There appears to be no statistically significant dry season trend for flow or nutrient loads.
  - Both total nitrogen and total phosphorus loads generally increase with flow during wet weather events.
  - Wet season loads are greater and more variable than the dry season loads.
  - NOx is the majority of the nitrogen species discharged, regardless of season. This would be expected since the plant fully nitrifies year-round and discharges very little ammonia.
  - Since April 2017, the facility has enhanced the total phosphorus load reduction capabilities as evidenced by total phosphorus concentrations typically below 1 mg P/L.

Influent

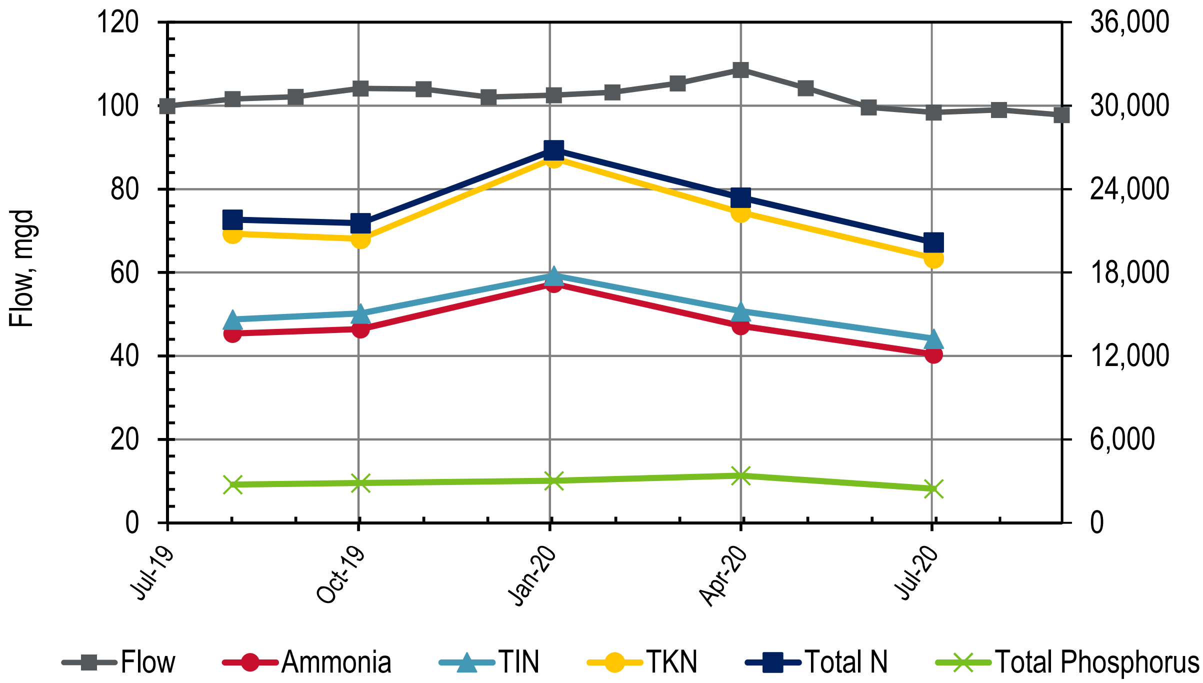

Figure 21-1. Influent: San Jose Monthly Flows and Loads

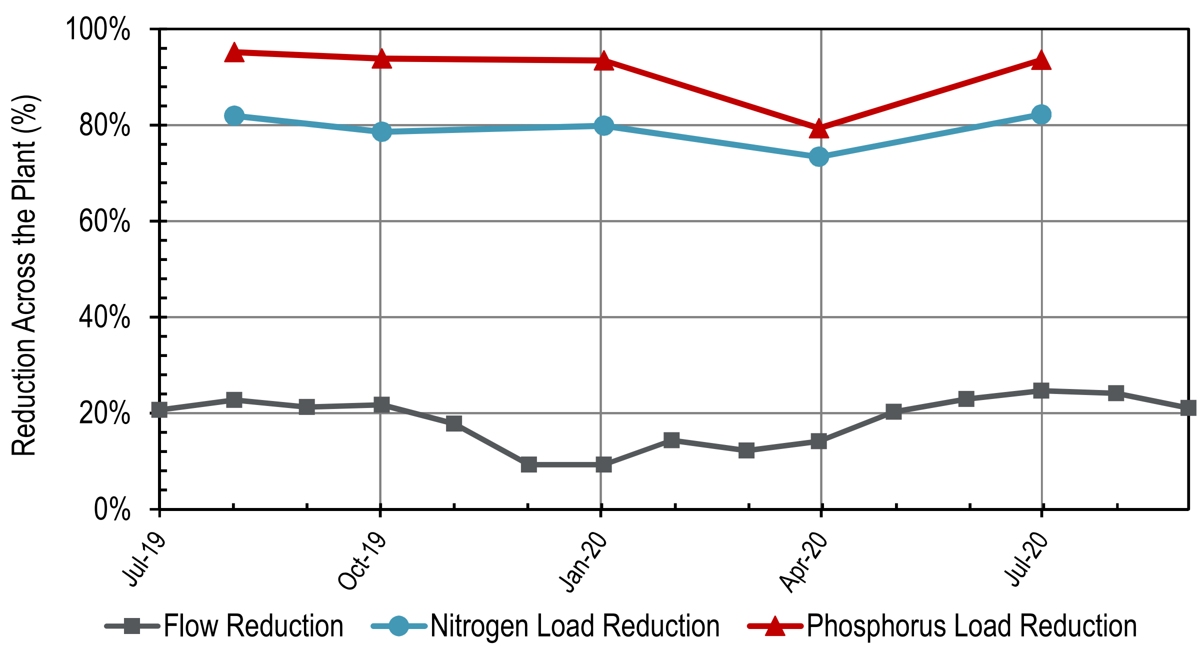

Figure 21-2. Influent: San Jose Monthly Reductions Across the Plant

Note: Influent TN was compared against Discharge TIN for calculating nitrogen load reduction.

Table 21-1. Influent: San Jose Monthly Flows and Loads*

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	TKN	Total N *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	99.9	--	--	--	--	--	--
Aug-19	102	13,600	1,020	14,600	20,800	21,800	2,770
Sep-19	102	--	--	--	--	--	--
Oct-19	104	13,900	1,130	15,100	20,400	21,500	2,870
Nov-19	104	--	--	--	--	--	--
Dec-19	102	--	--	--	--	--	--
Jan-20	103	17,200	594	17,800	26,200	26,800	3,040
Feb-20	103	--	--	--	--	--	--
Mar-20	105	--	--	--	--	--	--
Apr-20	109	14,200	1,070	15,200	22,300	23,400	3,410
May-20	104	--	--	--	--	--	--
Jun-20	99.6	--	--	--	--	--	--
Jul-20	98.4	12,100	1,130	13,200	19,000	20,200	2,460
Aug-20	99.0	--	--	--	--	--	--
Sep-20	97.8	--	--	--	--	--	--
Dry Season Average	**100**	**12,900**	**1,080**	**13,900**	**19,900**	**21,000**	**2,610**
Dry Season Trend **	**None**	***	***	***	***	***	***
Wet Season Average	**104**	**15,100**	**931**	**16,000**	**23,000**	**23,900**	**3,110**
Average Annual	**102**	**14,200**	**989**	**15,200**	**21,800**	**22,700**	**2,910**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

*** Insufficient sample set to perform any statistical analysis.

Discharge

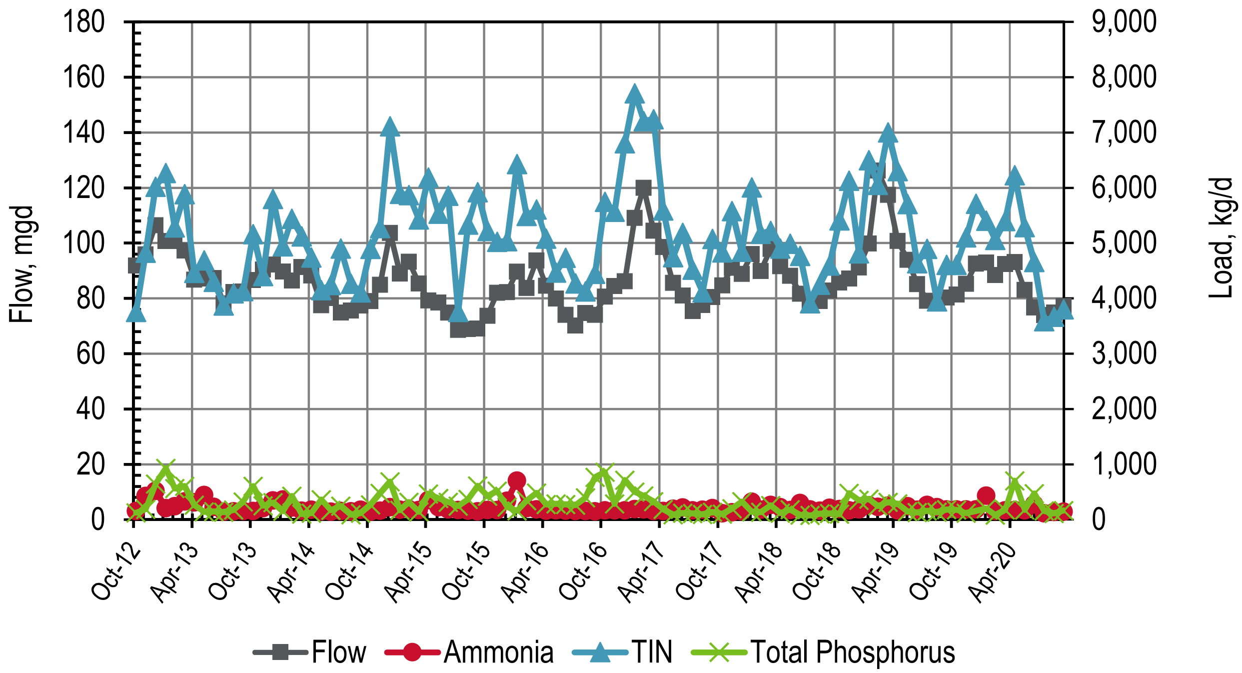

Figure 21-3. Discharge: San Jose Monthly Flows and Loads

Table 21-2. Discharge: San Jose Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	91.9	157	3,600	3,760	124
Nov-12	96.0	433	4,390	4,830	190
Dec-12	107	523	5,490	6,020	646
Jan-13	101	211	6,060	6,270	930
Feb-13	101	247	5,040	5,290	565
Mar-13	97.3	332	5,560	5,890	605
Apr-13	86.9	313	4,150	4,460	261
May-13	87.2	446	4,240	4,690	143
Jun-13	87.5	232	4,070	4,300	149
Jul-13	78.3	148	3,730	3,870	134
Aug-13	82.4	156	3,940	4,090	177
Sep-13	82.6	161	3,970	4,140	323
Oct-13	86.8	161	5,000	5,160	606
Nov-13	90.4	211	4,190	4,410	254
Dec-13	92.3	347	5,450	5,800	307

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Jan-14	89.9	370	4,580	4,950	152
Feb-14	86.7	220	5,220	5,440	426
Mar-14	91.5	162	4,960	5,120	101
Apr-14	88.4	180	4,560	4,740	120
May-14	77.6	153	4,000	4,150	361
Jun-14	80.2	146	4,100	4,240	169
Jul-14	74.9	160	4,740	4,900	244
Aug-14	75.6	152	4,110	4,270	86.8
Sep-14	77.5	181	3,930	4,110	118
Oct-14	79.1	149	4,750	4,900	270
Nov-14	84.9	166	5,110	5,270	475
Dec-14	104	226	6,890	7,120	688
Jan-15	89.0	184	5,710	5,890	171
Feb-15	93.3	195	5,680	5,870	315
Mar-15	85.5	178	5,250	5,430	141
Apr-15	79.4	356	5,830	6,190	463
May-15	78.7	227	5,310	5,530	385
Jun-15	74.9	190	5,670	5,860	312
Jul-15	68.6	175	3,580	3,760	246
Aug-15	69.0	167	5,170	5,340	370
Sep-15	69.2	151	5,770	5,920	608
Oct-15	73.8	178	5,050	5,220	423
Nov-15	82.1	177	4,850	5,030	518
Dec-15	82.4	343	4,690	5,030	231
Jan-16	89.8	710	5,720	6,430	160
Feb-16	83.8	212	5,280	5,490	346
Mar-16	93.8	190	5,420	5,610	483
Apr-16	84.7	166	4,910	5,080	273
May-16	80.1	170	4,300	4,470	287
Jun-16	74.1	163	4,570	4,740	272
Jul-16	70.3	161	4,110	4,270	265
Aug-16	74.7	159	3,970	4,130	394
Sep-16	74.1	156	4,290	4,450	766
Oct-16	80.7	171	5,580	5,750	857
Nov-16	84.6	169	5,400	5,570	287
Dec-16	86.2	172	6,640	6,810	716
Jan-17	109	196	7,510	7,710	502

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Feb-17	120	190	7,020	7,210	432
Mar-17	105	157	7,080	7,240	327
Apr-17	98.7	159	5,430	5,590	187
May-17	85.7	198	4,550	4,750	89.9
Jun-17	81.1	222	4,960	5,190	117
Jul-17	75.5	168	4,360	4,520	114
Aug-17	77.6	185	3,930	4,110	97.8
Sep-17	80.5	214	4,870	5,080	137
Oct-17	84.8	117	4,720	4,840	101
Nov-17	91.1	138	5,440	5,580	201
Dec-17	88.9	154	4,690	4,850	326
Jan-18	96.2	327	5,680	6,010	144
Feb-18	90.0	185	4,990	5,170	139
Mar-18	98.0	269	4,950	5,220	260
Apr-18	91.7	229	4,670	4,900	117
May-18	88.2	177	4,810	4,990	182
Jun-18	81.7	305	4,470	4,770	85.3
Jul-18	77.4	189	3,720	3,910	75.8
Aug-18	79.1	162	4,090	4,250	108
Sep-18	82.9	220	4,380	4,600	114
Oct-18	85.8	195	5,220	5,410	98.7
Nov-18	87.2	171	5,960	6,130	480
Dec-18	91.3	186	4,630	4,820	352
Jan-19	100.0	265	6,240	6,500	372
Feb-19	126	234	5,820	6,050	247
Mar-19	117	255	6,750	7,000	317
Apr-19	101	168	6,130	6,300	288
May-19	94.0	244	5,460	5,710	148
Jun-19	85.2	185	4,450	4,640	129
Jul-19	79.2	267	4,630	4,900	162
Aug-19	78.5	227	3,720	3,950	134
Sep-19	80.4	186	4,420	4,610	185
Oct-19	81.5	185	4,420	4,610	176
Nov-19	85.4	186	4,920	5,110	118
Dec-19	92.6	185	5,530	5,710	
Jan-20	93.0	436	4,970	5,410	199
Feb-20	88.4	159	4,900	5,060	84.9

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Mar-20	92.5	171	5,230	5,400	179
Apr-20	93.2	178	6,050	6,230	704
May-20	83.1	171	5,120	5,290	176
Jun-20	76.8	279	4,380	4,660	469
Jul-20	74.1	121	3,470	3,590	158
Aug-20	75.1	140	3,530	3,670	115
Sep-20	77.2	150	3,650	3,800	164
Dry Season Average	**78.8**	**192**	**4,360**	**4,560**	**219**
Dry Season Trend **	**None**	**None**	**None**	**None**	**None**
Wet Season Average	**92.3**	**230**	**5,360**	**5,590**	**336**
Average Annual	**86.7**	**214**	**4,940**	**5,160**	**287**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

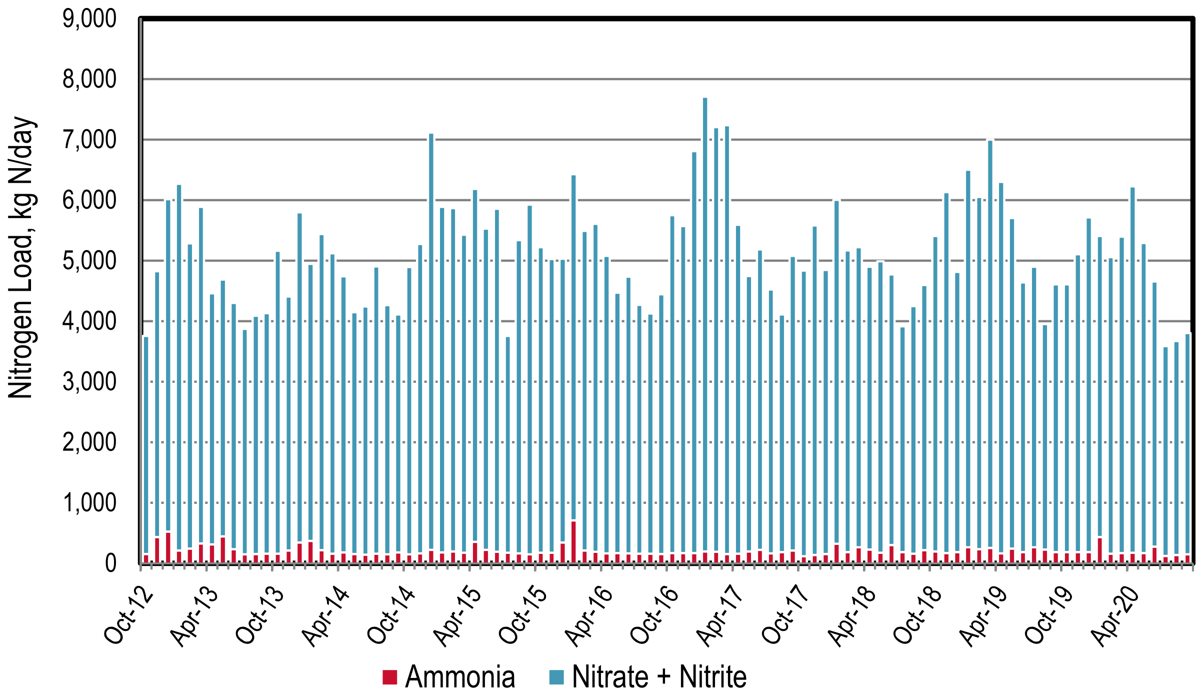

Figure 21-4. Discharge: San Jose Monthly Nitrogen Loads

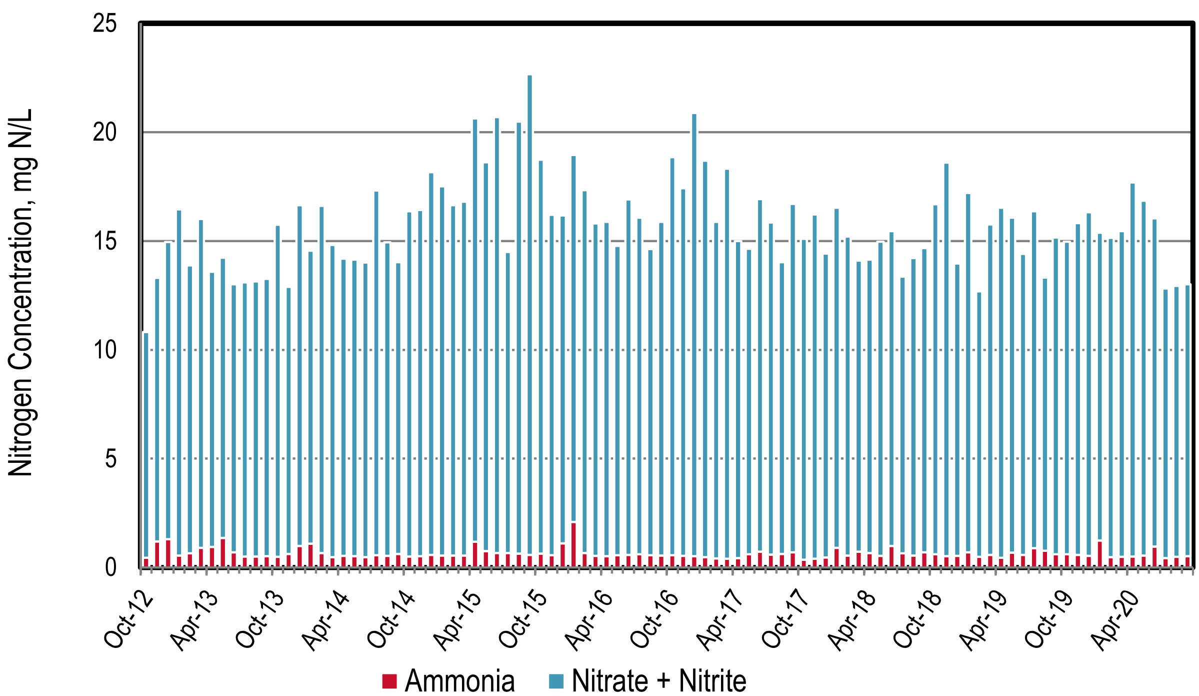

Figure 21-5. Discharge: San Jose Monthly Nitrogen Concentrations

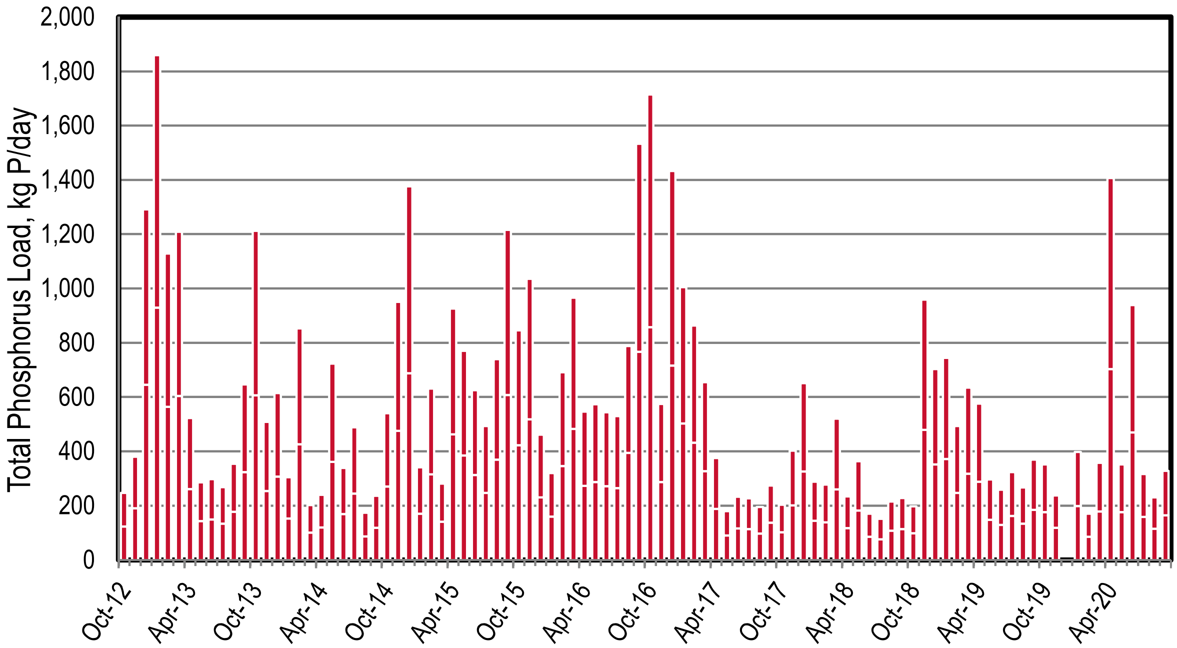

Figure 21-6. Discharge: San Jose Monthly Phosphorus Loads

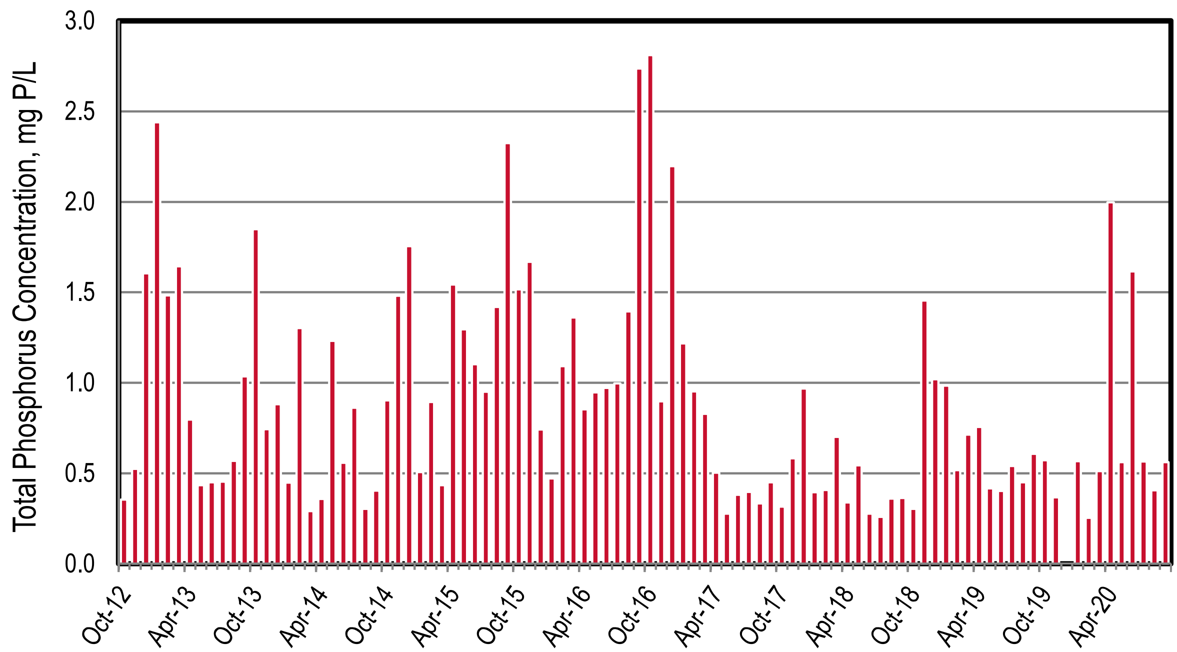

Figure 21-7. Discharge: San Jose Monthly Phosphorus Concentrations

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22 City of San Mateo

San Mateo discharges to the South Bay and it has approximately 41,434 service connections. The plant has a permitted ADWF capacity of 15.7 mgd and a peak wet weather capacity of 60 mgd. The current discharge flows are approximately 9.5 mgd ADWF. The plant performs secondary treatment using activated sludge.

The following observations are made based upon the figures and table in the subsequent pages:

- Influent and Reduction Across the Plant
  - Note: limited to data since July 2019; quarterly required but more provided for various parameters.
  - Based on the limited average monthly values table below, there are no emerging dry season trends (limited to flow due to a limited dataset). It is worth noting that the annual flow volumes have decreased for 2020 compared to previous years (data not shown). Future group annual reports will capture future flow trends.
  - The flow reduction across the plant is negligible.
  - The nitrogen load reduction values across the plant is upwards of approximately 25 percent. This load reduction is attributed to a combination of biological assimilation, biosolids management, and/or biological load reduction in the activated sludge system.
  - The phosphorus load reduction across the plant is upwards of approximately 45 percent. Such a load reduction is attributed to a combination of biological assimilation, biosolids management, and/or chemical precipitation associated with chemical addition in the collection system, headworks, and/or during solids thickening.
- Discharge
  - The wet season average monthly flow and load values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
  - Based on the average monthly values table below, there appears to be no emerging trend for dry season flows or loads.
  - Nitrogen species concentrations are typically highest during the dry season.
  - Ammonia is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant does not nitrify.
  - Total phosphorus concentrations range from 0.5 to 5.6 mg P/L across the entire dataset (0.5 to 4.8 mg P/L for the 2019/2020 dataset). This suggests a portion of P is removed as typical effluent TP concentrations are 4 to 6 mg P/L. The removal mechanism is most likely from ferric chloride addition to solids thickening. San Mateo increased ferric chloride dose from 2018/2019 to 2019/2020 for odor control which has had a co-benefit of additional TP load reduction.

Influent

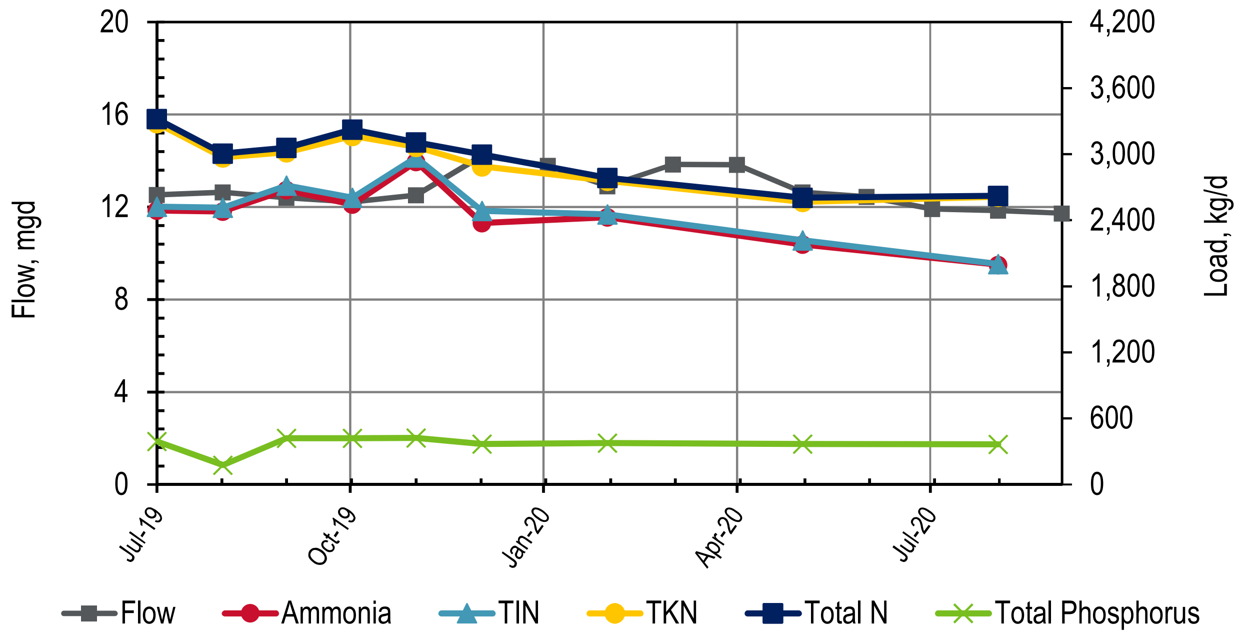

Figure 22-1. Influent: San Mateo Monthly Flows and Loads

Note: the ammonia/TIN loads and TKN/Total N loads are comparable. The ammonia and TKN values are located behind TIN and Total N load lines, respectively.

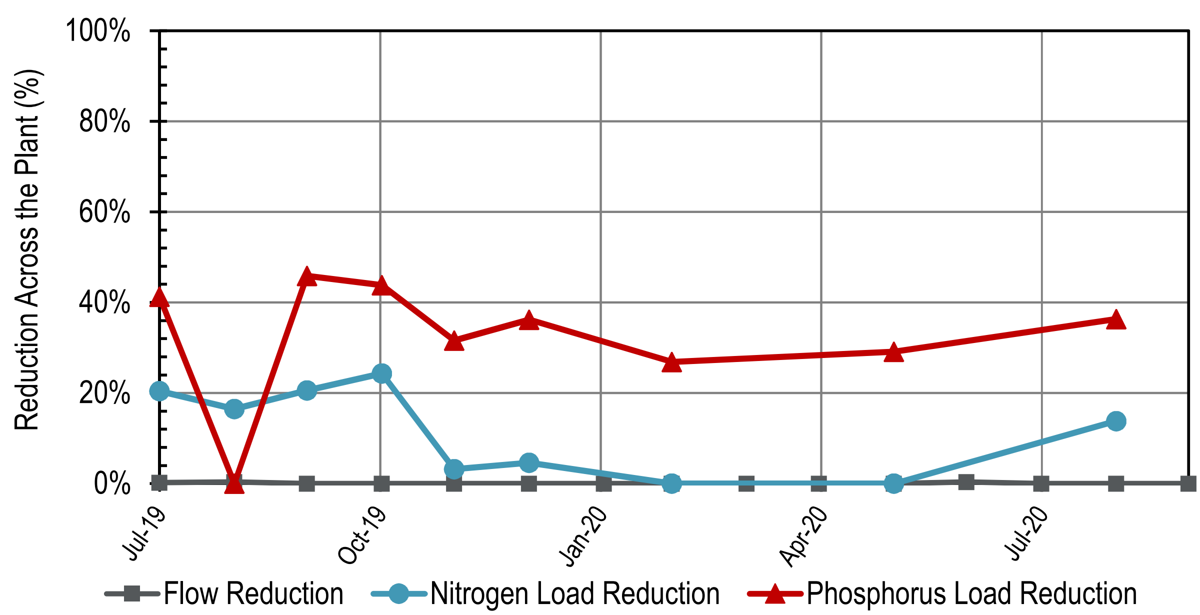

Figure 22-2. Influent: San Mateo Monthly Reductions Across the Plant

Note: Influent TN was compared against Discharge TIN for calculating nitrogen load reduction.

Table 22-1. Influent: San Mateo Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	9.44	1,440	7.98	1,440	1,720	1,720	223
Aug-19	9.47	--	--	--	--	--	--
Sep-19	9.24	--	--	--	--	--	--
Oct-19	10.1	1,560	3.86	1,560	2,780	2,790	247
Nov-19	10.4	--	--	--	--	--	--
Dec-19	12.2	--	--	--	--	--	--
Jan-20	11.4	1,760	7.80	1,770	2,460	2,470	263
Feb-20	10.2	--	--	--	--	--	--
Mar-20	11.1	--	--	--	--	--	--
Apr-20	11.7	1,620	72.6	1,690	2,490	2,570	257
May-20	10.6	--	--	--	--	--	--
Jun-20	10.0	--	--	--	--	--	--
Jul-20	9.84	1,430	5.10	1,430	2,260	2,260	218
Aug-20	9.56	--	--	--	--	--	--
Sep-20	9.65	--	--	--	--	--	--
Dry Season Average	**9.73**	**1,430**	**6.54**	**1,440**	**1,990**	**1,990**	**221**
Dry Season Trend **	**None**	**	**	**	**	**	**
Wet Season Average	**11.0**	**1,650**	**28.1**	**1,670**	**2,580**	**2,610**	**256**
Average Annual	**10.3**	**1,560**	**19.5**	**1,580**	**2,340**	**2,360**	**242**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis. Insufficient samples to perform statistical trending on nutrient loads.

Discharge

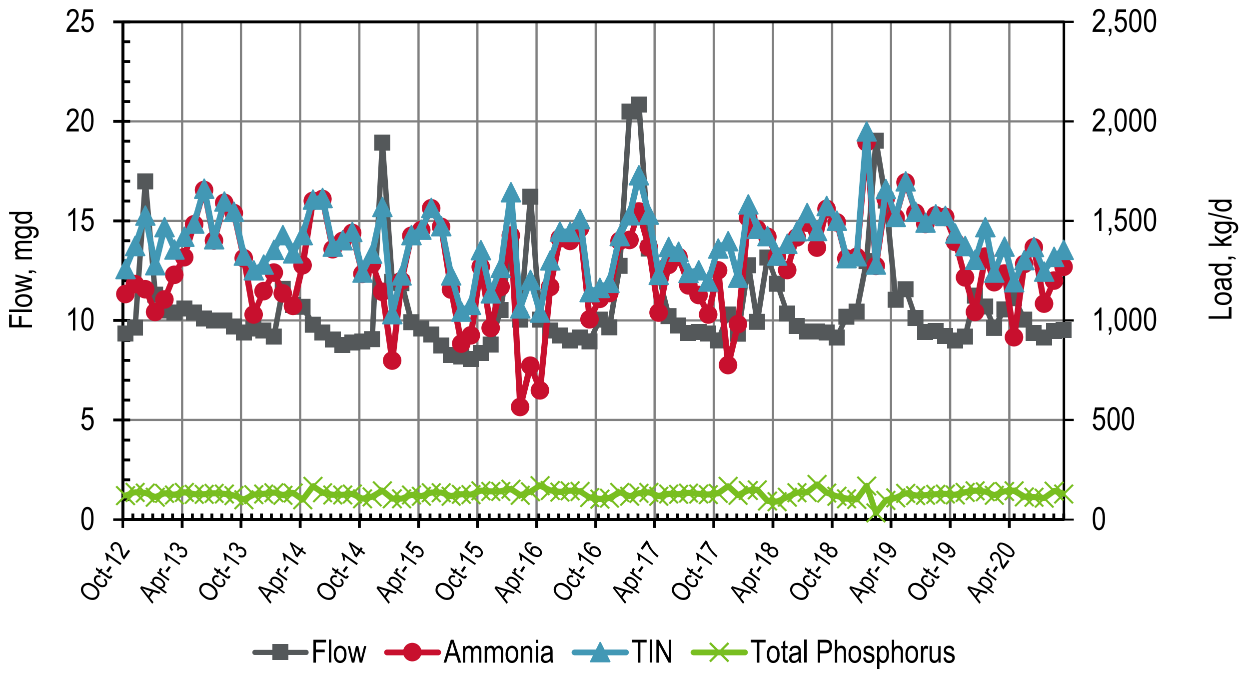

Figure 22-3. Discharge: San Mateo Monthly Flows and Loads

Table 22-2. Discharge: San Mateo Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	9.37	1,130	126	1,260	121
Nov-12	9.65	1,180	192	1,380	137
Dec-12	17.0	1,160	371	1,530	134
Jan-13	11.3	1,040	235	1,280	114
Feb-13	10.5	1,110	362	1,470	132
Mar-13	10.4	1,230	127	1,360	125
Apr-13	10.6	1,320	104	1,420	138
May-13	10.4	1,480	4.45	1,490	128
Jun-13	10.1	1,660	6.85	1,660	127
Jul-13	10.0	1,400	6.42	1,410	132
Aug-13	10.0	1,590	5.84	1,600	129
Sep-13	9.70	1,540	7.72	1,550	122
Oct-13	9.40	1,310	14.1	1,330	100
Nov-13	9.60	1,030	221	1,250	125
Dec-13	9.50	1,150	135	1,280	129

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Jan-14	9.20	1,240	115	1,360	135
Feb-14	11.6	1,140	294	1,430	122
Mar-14	10.8	1,070	263	1,340	134
Apr-14	10.7	1,280	151	1,430	100
May-14	9.80	1,600	5.87	1,610	168
Jun-14	9.40	1,610	3.53	1,620	137
Jul-14	9.05	1,360	12.1	1,370	124
Aug-14	8.76	1,400	2.57	1,400	125
Sep-14	8.89	1,440	4.97	1,450	130
Oct-14	8.95	1,230	7.47	1,240	105
Nov-14	9.07	1,290	50.8	1,340	115
Dec-14	18.9	1,150	425	1,570	146
Jan-15	12.0	800	233	1,030	105
Feb-15	11.9	1,200	26.7	1,230	105
Mar-15	9.93	1,430	3.91	1,430	125
Apr-15	9.62	1,450	1.75	1,460	119
May-15	9.30	1,560	1.95	1,570	137
Jun-15	8.75	1,470	2.84	1,470	135
Jul-15	8.28	1,160	71.4	1,230	119
Aug-15	8.21	885	161	1,050	128
Sep-15	8.07	927	153	1,080	126
Oct-15	8.38	1,270	84.2	1,350	145
Nov-15	8.80	963	173	1,140	142
Dec-15	10.5	1,170	95.8	1,270	142
Jan-16	13.7	1,430	217	1,650	153
Feb-16	10.1	567	495	1,060	123
Mar-16	16.2	775	430	1,200	140
Apr-16	10.0	651	389	1,040	170
May-16	9.51	1,170	134	1,300	146
Jun-16	9.27	1,410	33.1	1,450	139
Jul-16	9.01	1,400	44.4	1,450	146
Aug-16	9.16	1,460	46.7	1,510	143
Sep-16	8.96	1,010	136	1,140	111
Oct-16	10.1	1,110	53.9	1,160	103
Nov-16	9.67	1,140	51.6	1,190	108
Dec-16	12.7	1,400	24.5	1,430	137
Jan-17	20.5	1,410	124	1,530	118

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Feb-17	20.9	1,550	182	1,730	133
Mar-17	13.6	1,370	162	1,530	137
Apr-17	12.2	1,040	190	1,230	118
May-17	10.2	1,280	90.0	1,370	129
Jun-17	9.76	1,320	27.1	1,350	128
Jul-17	9.38	1,180	63.4	1,240	134
Aug-17	9.45	1,130	124	1,250	130
Sep-17	9.34	1,030	166	1,200	126
Oct-17	9.02	1,250	109	1,360	132
Nov-17	10.3	778	621	1,400	168
Dec-17	9.34	983	233	1,220	123
Jan-18	12.8	1,520	67.5	1,580	147
Feb-18	9.93	1,460	2.59	1,460	151
Mar-18	13.2	1,420	3.92	1,420	93.4
Apr-18	11.8	1,320	5.13	1,330	90.0
May-18	10.4	1,250	132	1,390	113
Jun-18	9.73	1,420	29.2	1,450	135
Jul-18	9.46	1,490	47.2	1,540	137
Aug-18	9.46	1,370	82.6	1,450	177
Sep-18	9.40	1,560	15.5	1,580	134
Oct-18	9.16	1,490	9.07	1,500	118
Nov-18	10.2	1,310	2.58	1,310	105
Dec-18	10.4	1,320	2.88	1,320	103
Jan-19	13.0	1,900	54.5	1,950	170
Feb-19	19.0	1,280	6.80	1,280	34.0
Mar-19	16.0	1,610	49.0	1,660	97.3
Apr-19	11.0	1,520	2.96	1,520	110
May-19	11.6	1,700	3.84	1,700	132
Jun-19	10.1	1,540	4.55	1,550	122
Jul-19	9.44	1,490	6.55	1,490	123
Aug-19	9.47	1,530	5.47	1,530	128
Sep-19	9.24	1,520	3.76	1,530	129
Oct-19	9.01	1,400	42.5	1,440	124
Nov-19	9.20	1,220	158	1,370	137
Dec-19	11.3	1,040	261	1,310	145
Jan-20	10.7	1,320	147	1,470	141
Feb-20	9.63	1,190	48.4	1,240	123

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Mar-20	10.6	1,240	135	1,370	143
Apr-20	11.1	917	277	1,190	145
May-20	10.1	1,290	19.2	1,300	114
Jun-20	9.38	1,370	1.43	1,370	113
Jul-20	9.16	1,090	160	1,250	108
Aug-20	9.49	1,200	118	1,320	143
Sep-20	9.53	1,270	85.6	1,360	129
Dry Season Average	**9.47**	**1,360**	**50.7**	**1,410**	**131**
Dry Season Trend **	**None**	**None**	**None**	**None**	**None**
Wet Season Average	**11.5**	**1,220**	**149**	**1,370**	**126**
Average Annual	**10.7**	**1,280**	**108**	**1,390**	**128**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

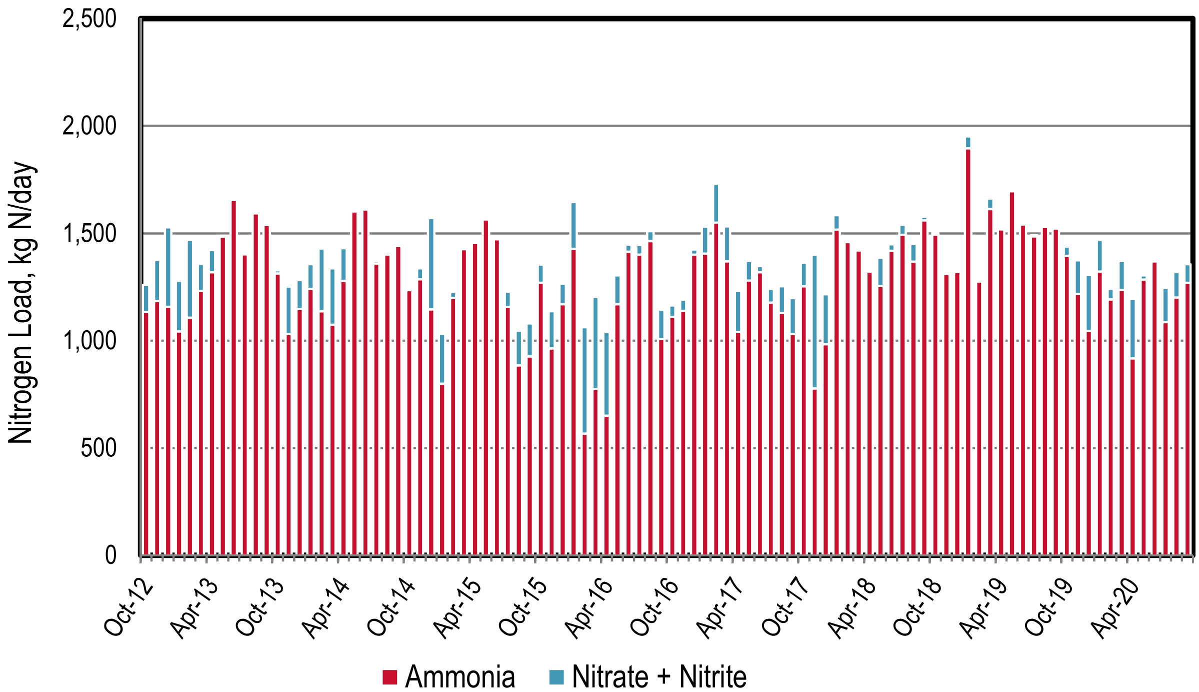

Figure 22-4. Discharge: San Mateo Monthly Nitrogen Loads

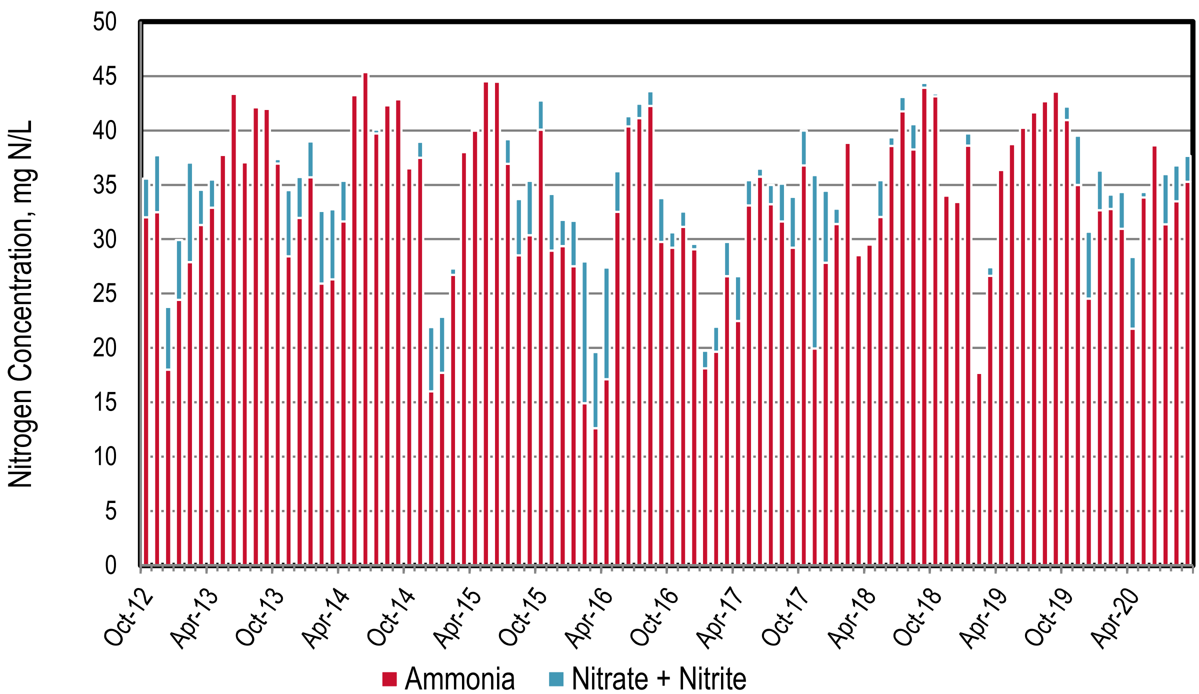

Figure 22-5. Discharge: San Mateo Monthly Nitrogen Concentrations

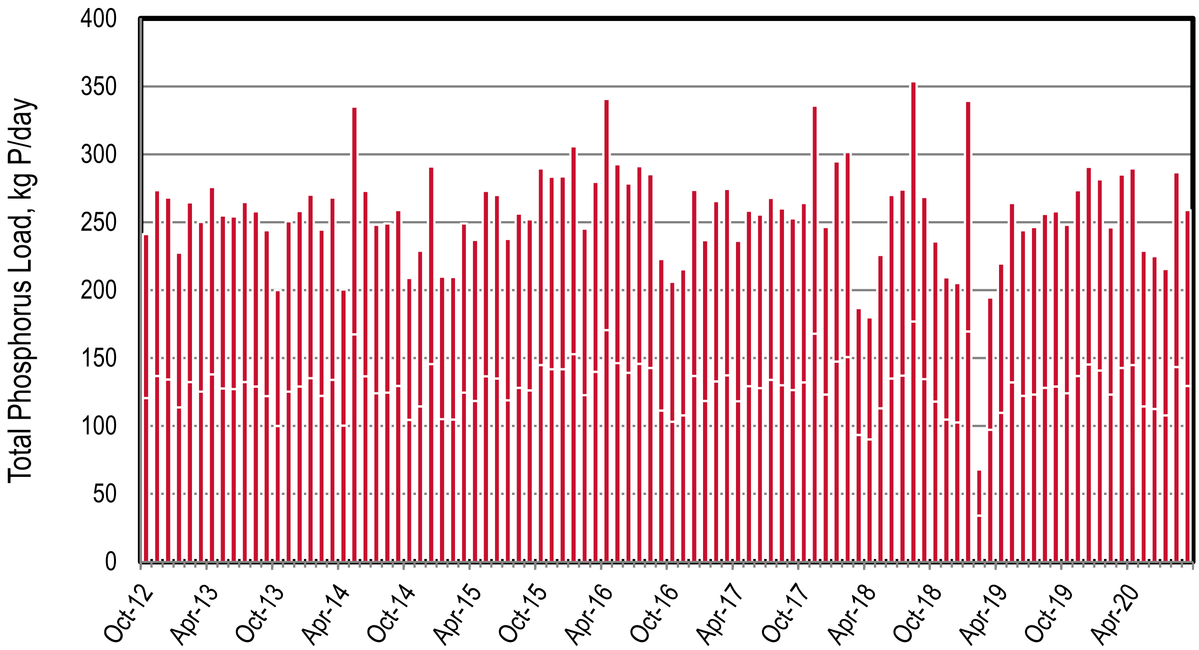

Figure 22-6. Discharge: San Mateo Monthly Phosphorus Loads

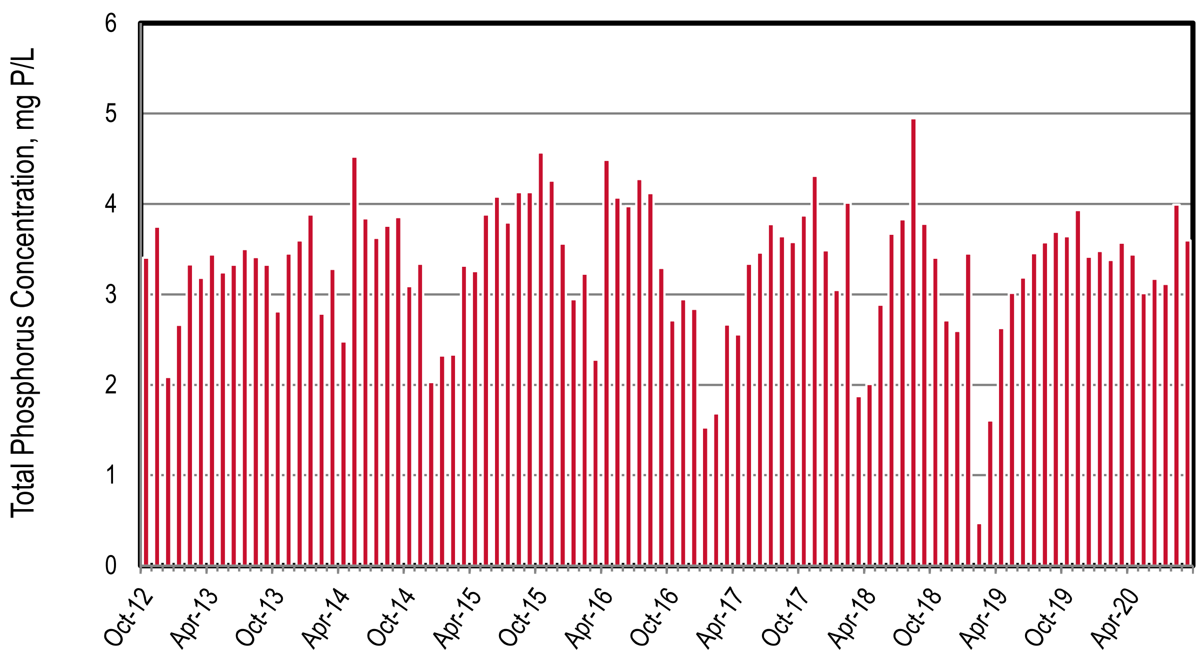

Figure 22-7. Discharge: San Mateo Monthly Phosphorus Concentrations

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23 Sewerage Agency of Southern Marin (SASM)

SASM discharges to the Central Bay. The plant has approximately 14,800 service connections and it has a permitted capacity of 3.6 mgd ADWF. The current plant flow is approximately 1.8 mgd ADWF. The plant currently performs nitrification using under-loaded trickling filters.

The following observations are made based upon the figures and table in the subsequent pages:

- Based on the table with the average monthly discharge values, dry season ammonia and TIN loads are trending up, while NOx and total phosphorus loads are trending down. The upward trends are attributed to a deficiency in the nitrification process at SASM.
- The wet season average monthly flow values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
- NOx is the majority of the nitrogen species discharged as would be expected since this plant nitrifies. However, a portion of ammonia occasionally bleeds through year-round which has been more pronounced the last two years. This recent ammonia bleed through is attributed to a combination of construction (primary clarifiers and trickling filters during summers of 2018/2019) and new trickling filters media. After completing the rehabilitation of the trickling filters by fall of 2019, the agency identified that the new trickling filters media does not provide sufficient nitrification for desired ammonia reduction.
- Total phosphorus concentrations range from 1.1 to 11 mg P/L (<7 mg P/L since November 2018). This suggests occasional P removal as typical municipal effluent TP concentrations for plants that do not remove phosphorus are on the order of 4 to 6 mg P/L.

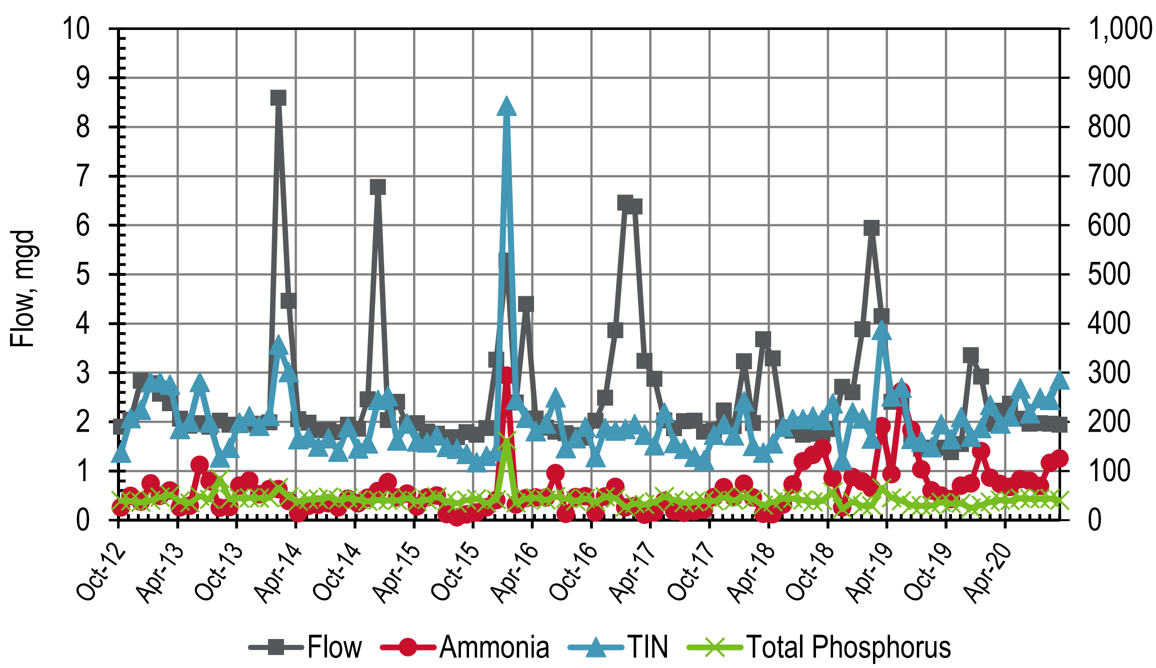

Figure 23-1. Discharge: SASM Monthly Flows and Loads

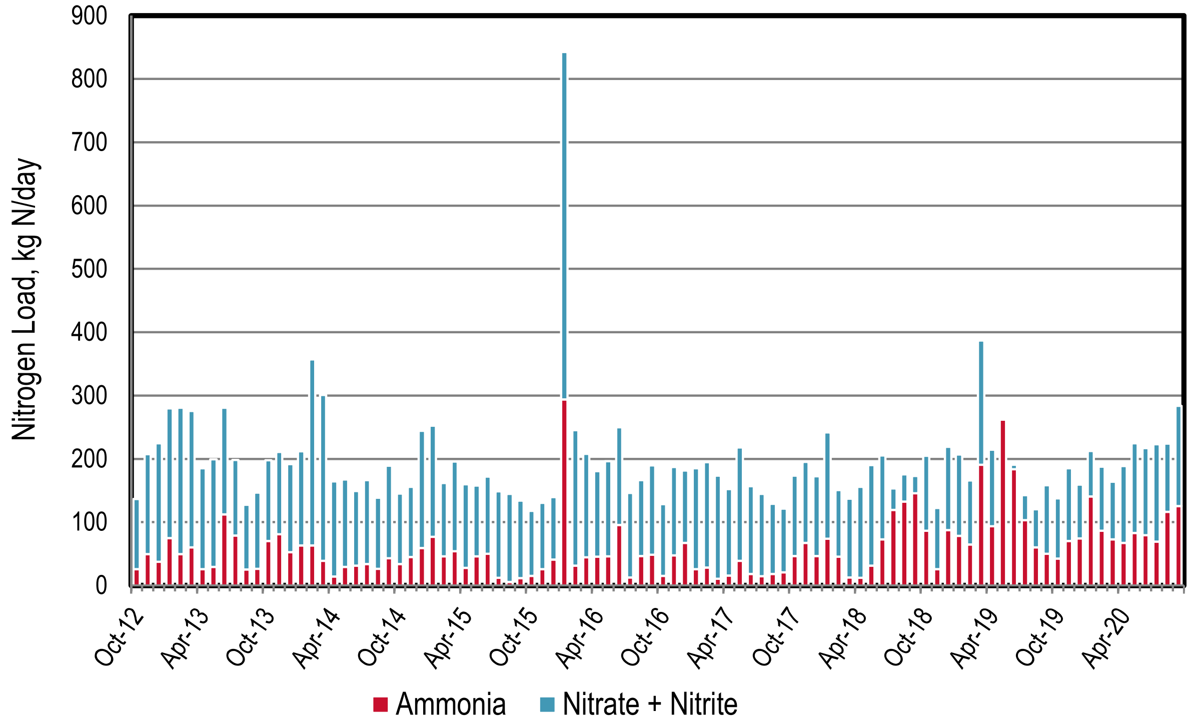

Figure 23-2. Discharge: SASM Monthly Nitrogen Loads

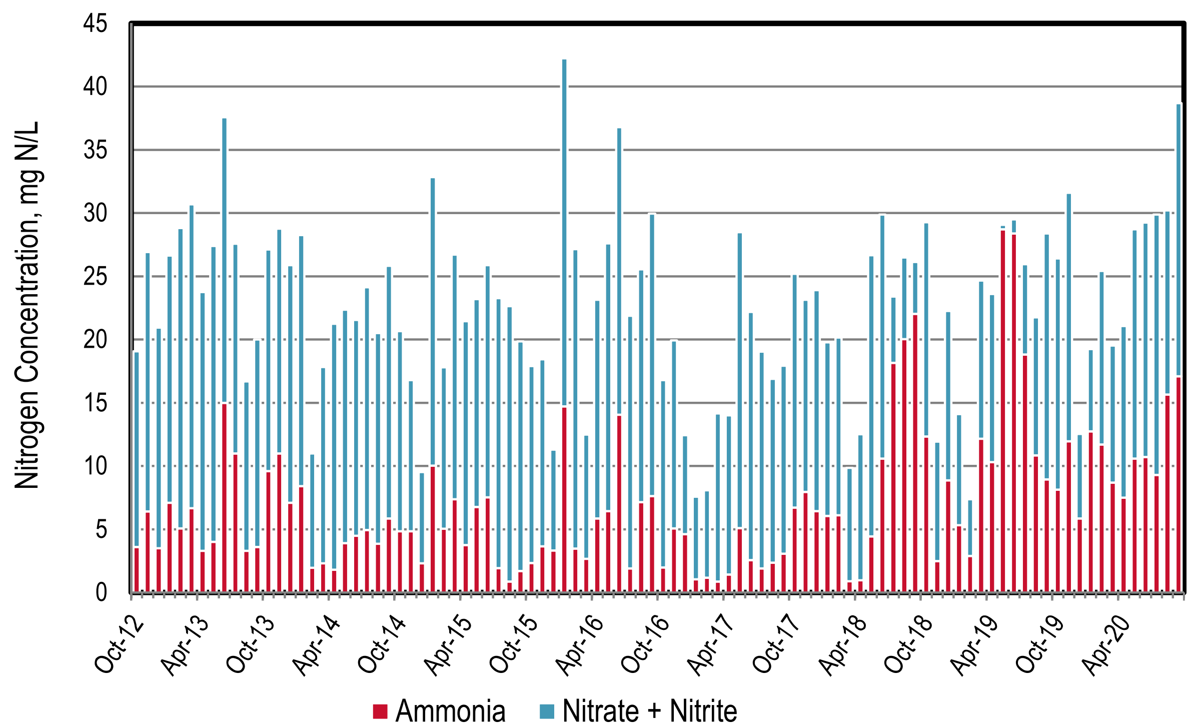

Figure 23-3. Discharge: SASM Monthly Nitrogen Concentrations

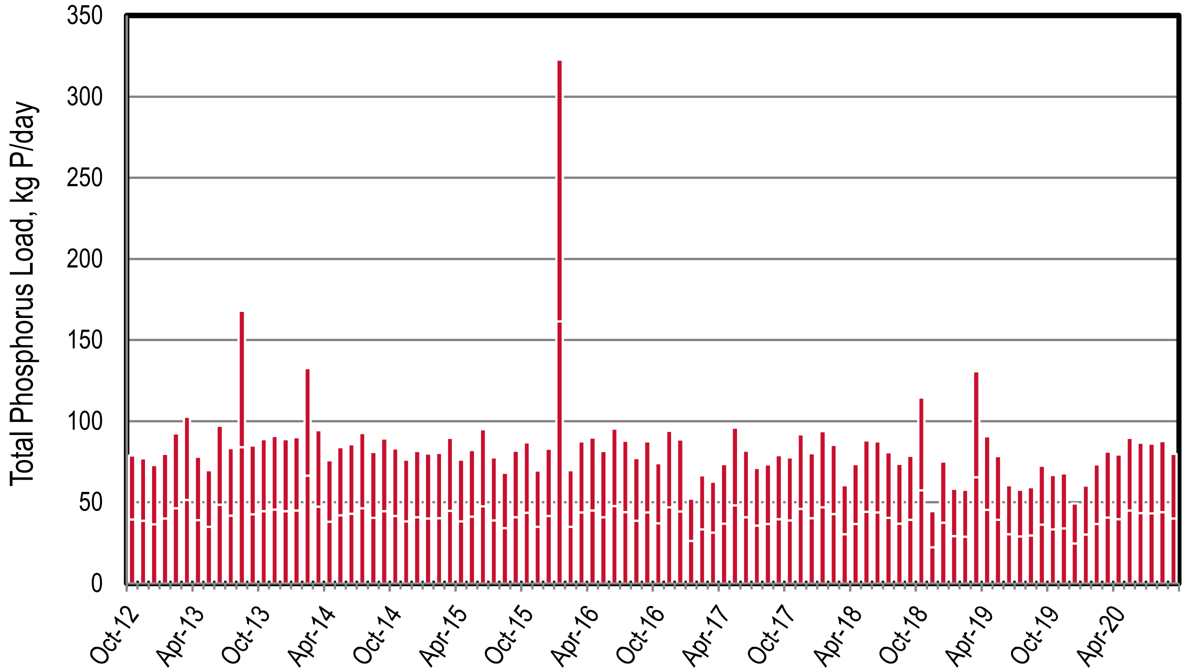

Figure 23-4. Discharge: SASM Monthly Phosphorus Loads

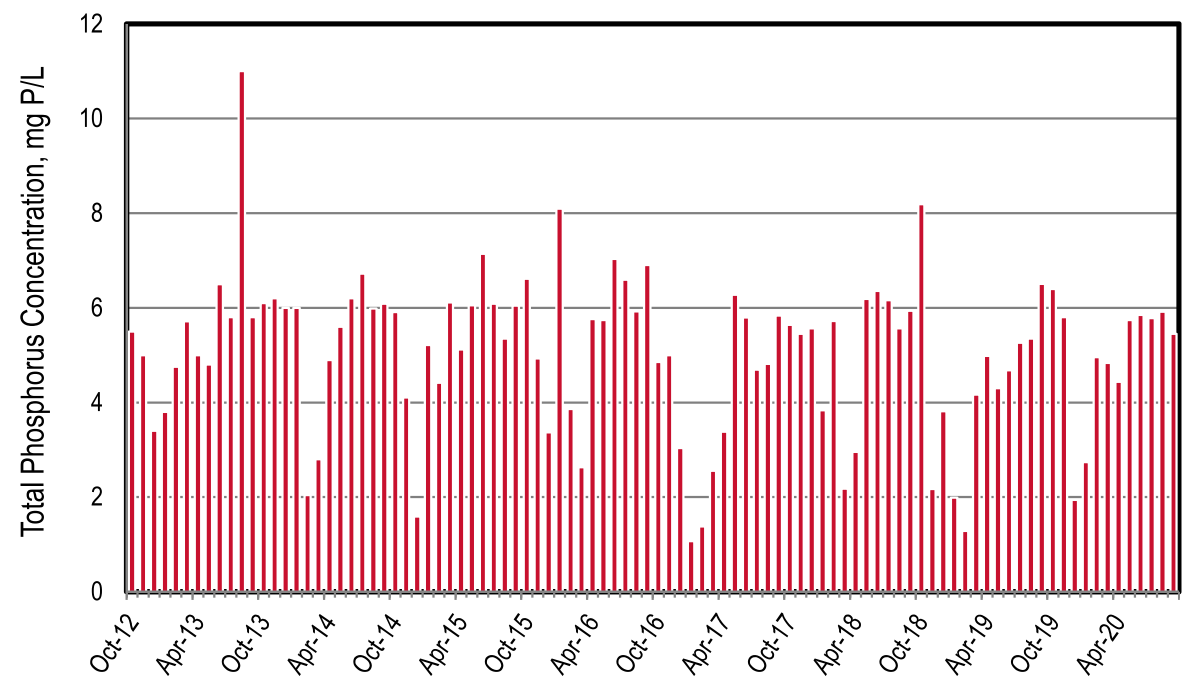

Figure 23-5. Discharge: SASM Monthly Phosphorus Concentrations

Table 23-1. Discharge: SASM Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	1.90	25.8	111	137	39.4
Nov-12	2.04	49.3	158	208	38.5
Dec-12	2.83	37.5	187	224	36.4
Jan-13	2.78	74.6	205	280	39.9
Feb-13	2.58	49.5	231	280	46.3
Mar-13	2.38	60.0	216	276	51.4
Apr-13	2.06	25.7	159	185	39.0
May-13	1.93	29.1	170	199	34.9
Jun-13	1.98	112	169	281	48.6
Jul-13	1.90	79.0	119	198	41.7
Aug-13	2.02	25.2	102	128	84.0
Sep-13	1.94	26.4	120	147	42.5
Oct-13	1.93	70.0	128	198	44.5
Nov-13	1.94	80.7	130	211	45.5
Dec-13	1.96	52.6	139	192	44.5
Jan-14	1.99	63.0	149	212	45.0
Feb-14	8.59	63.1	294	357	66.3
Mar-14	4.46	38.8	262	301	47.2
Apr-14	2.05	13.9	151	165	38.0
May-14	1.98	29.2	138	167	42.0
Jun-14	1.83	31.1	118	149	42.9
Jul-14	1.82	34.0	132	166	46.3
Aug-14	1.79	26.0	113	139	40.5
Sep-14	1.94	43.0	146	189	44.6
Oct-14	1.86	34.0	111	145	41.6
Nov-14	2.46	45.0	111	156	38.1
Dec-14	6.78	59.0	185	244	40.8
Jan-15	2.03	77.0	175	252	40.0
Feb-15	2.41	46.0	116	162	40.2
Mar-15	1.94	54.0	142	196	44.8
Apr-15	1.97	28.0	132	160	38.2
May-15	1.80	46.0	112	158	41.2
Jun-15	1.76	50.0	122	172	47.5
Jul-15	1.69	12.3	136	149	38.8
Aug-15	1.69	5.50	139	145	34.1
Sep-15	1.79	11.6	123	134	40.9

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	1.74	15.4	102	118	43.5
Nov-15	1.87	25.8	104	130	34.8
Dec-15	3.26	40.8	98.6	139	41.5
Jan-16	5.28	294	549	843	161
Feb-16	2.39	31.5	214	245	34.9
Mar-16	4.40	44.5	163	208	43.8
Apr-16	2.06	45.7	135	181	45.0
May-16	1.88	45.8	150	196	40.8
Jun-16	1.80	95.5	154	250	47.7
Jul-16	1.76	12.7	133	146	44.0
Aug-16	1.73	46.6	120	167	38.6
Sep-16	1.68	48.3	142	190	43.8
Oct-16	2.02	15.1	113	128	37.1
Nov-16	2.49	47.7	140	187	47.0
Dec-16	3.86	67.3	114	182	44.4
Jan-17	6.46	25.7	159	185	26.1
Feb-17	6.38	28.5	166	195	33.3
Mar-17	3.24	10.7	163	174	31.3
Apr-17	2.88	15.4	137	152	36.8
May-17	2.02	39.1	179	218	48.0
Jun-17	1.87	18.0	139	157	40.9
Jul-17	2.01	14.4	130	145	35.6
Aug-17	2.02	18.0	111	129	36.7
Sep-17	1.79	20.9	101	122	39.6
Oct-17	1.82	46.2	127	174	38.9
Nov-17	2.23	67.0	128	195	46.0
Dec-17	1.91	46.5	126	172	40.2
Jan-18	3.23	74.0	168	242	46.9
Feb-18	1.98	45.7	105	151	42.7
Mar-18	3.68	12.5	125	137	30.2
Apr-18	3.29	12.0	144	156	36.7
May-18	1.88	31.5	158	190	44.1
Jun-18	1.82	72.9	132	205	43.7
Jul-18	1.74	119	34.3	206	40.4
Aug-18	1.75	133	42.9	210	36.8
Sep-18	1.75	146	27.1	203	39.3
Oct-18	1.85	86.3	119	237	57.3

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	2.71	25.6	96.6	122	22.3
Dec-18	2.60	87.2	132	219	37.5
Jan-19	3.88	78.2	129	207	29.1
Feb-19	5.95	64.9	101	166	28.8
Mar-19	4.15	191	196	387	65.4
Apr-19	2.40	93.6	121	252	45.3
May-19	2.41	262	3.29	269	39.2
Jun-19	1.71	184	7.27	165	30.3
Jul-19	1.45	103	39.2	159	28.9
Aug-19	1.46	60.1	60.4	148	29.6
Sep-19	1.47	49.9	108	195	36.3
Oct-19	1.38	42.4	95.4	164	33.4
Nov-19	1.55	70.0	115	209	34.0
Dec-19	3.35	74.3	84.8	170	24.6
Jan-20	2.92	140	71.9	187	30.2
Feb-20	1.96	86.5	101	234	36.6
Mar-20	2.22	72.9	91.0	196	40.6
Apr-20	2.37	67.2	121	211	39.7
May-20	2.07	82.7	142	268	44.9
Jun-20	1.96	79.5	137	217	43.4
Jul-20	1.97	69.4	153	248	43.1
Aug-20	1.96	116	108	245	43.9
Sep-20	1.94	125	158	286	39.9
Dry Season Average	**1.84**	**63.8**	**116**	**186**	**41.7**
Dry Season Trend **	**None**	**Up**	**Down**	**Up**	**Down**
Wet Season Average	**2.94**	**57.9**	**149**	**211**	**42.4**
Average Annual	**2.48**	**60.3**	**135**	**200**	**42.1**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

24 San Francisco International Airport – MLTP (SFO)

SFO discharges to the South Bay. The plant has a permitted capacity of 3.4 mgd ADWF. The current flow is approximately 1.0 mgd ADWF. The process includes two separate treatment processes. Domestic water from the airport facilities are collected through the sanitary sewer collection system and treated with a sequential batch reactor (SBR). Industrial wastewater and storm run-off is treated in the Industrial plant, which includes a trickling filter.

The following observations are made based upon the figures and table in the subsequent pages:

- The wet season average monthly flow values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
- The facility made numerous process changes over the last few years (completed in 2018) to accomplish ammonia/total nitrogen load reduction (emphasis on the dry season).
- Based on the average monthly values table below, there appears to be an emerging dry season downward trend for ammonia and TIN loads.
- Phosphorus loads generally increase with flow during wet weather events.
- Total phosphorus concentrations range from <1 to 26.9 mg P/L. This wide range is attributed to a combination of highly variable industrial waste and/or occasional P removal (typical municipal discharge TP concentrations are 4 to 6 mg P/L).

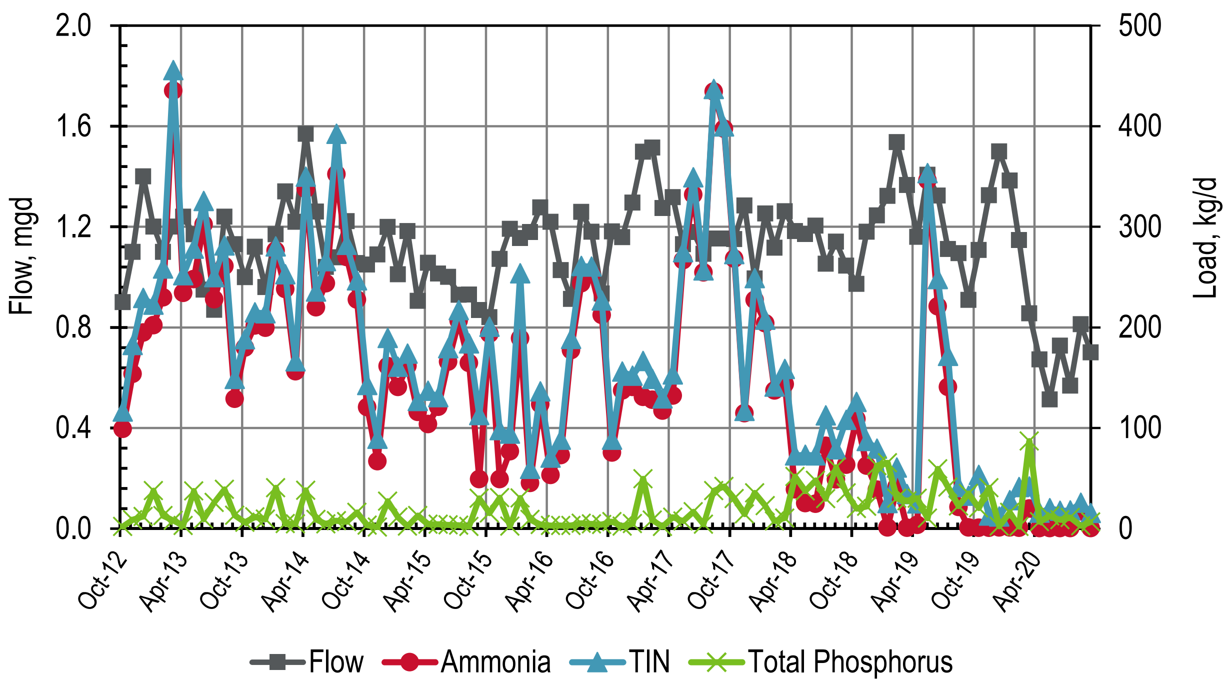

Figure 24-1. Discharge: SFO Airport Monthly Flows and Loads

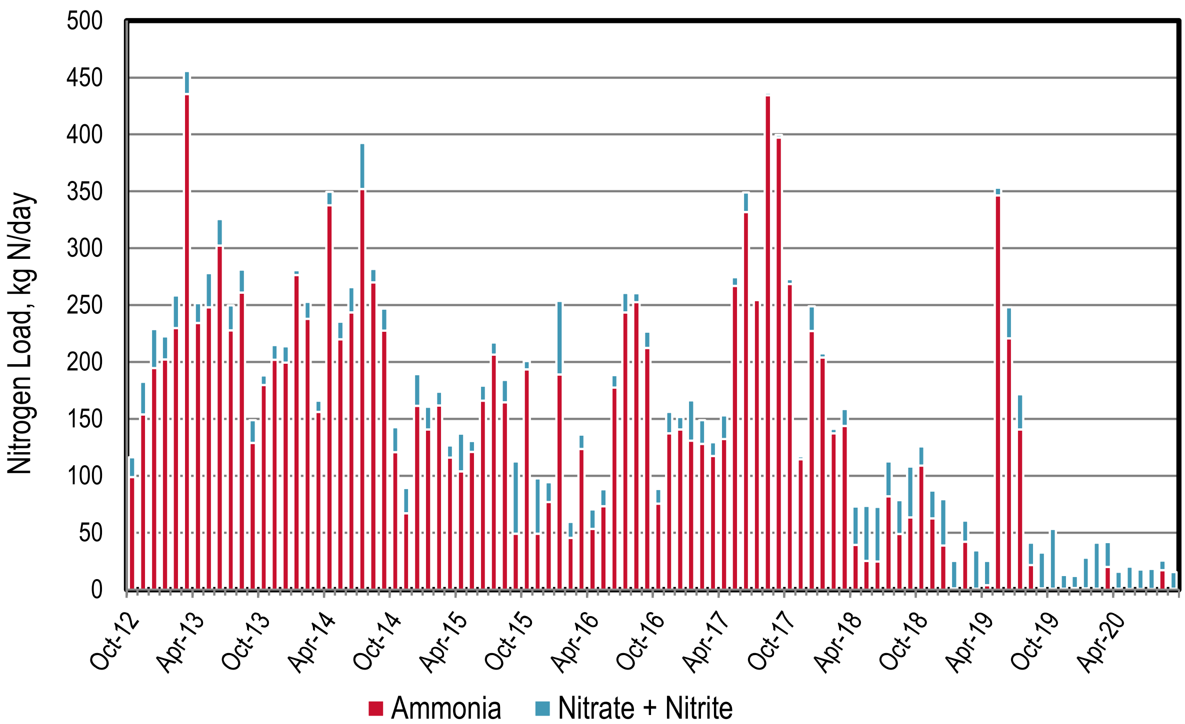

Figure 24-2. Discharge: SFO Airport Monthly Nitrogen Loads

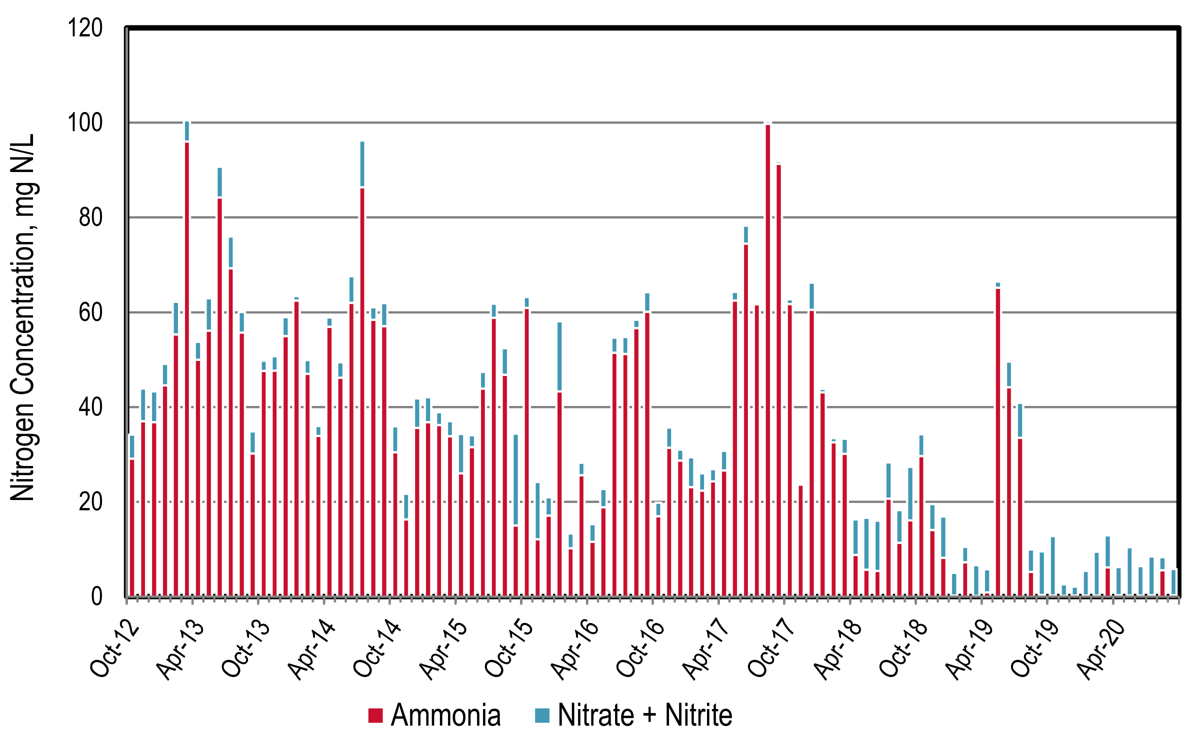

Figure 24-3. Discharge: SFO Airport Monthly Nitrogen Concentrations

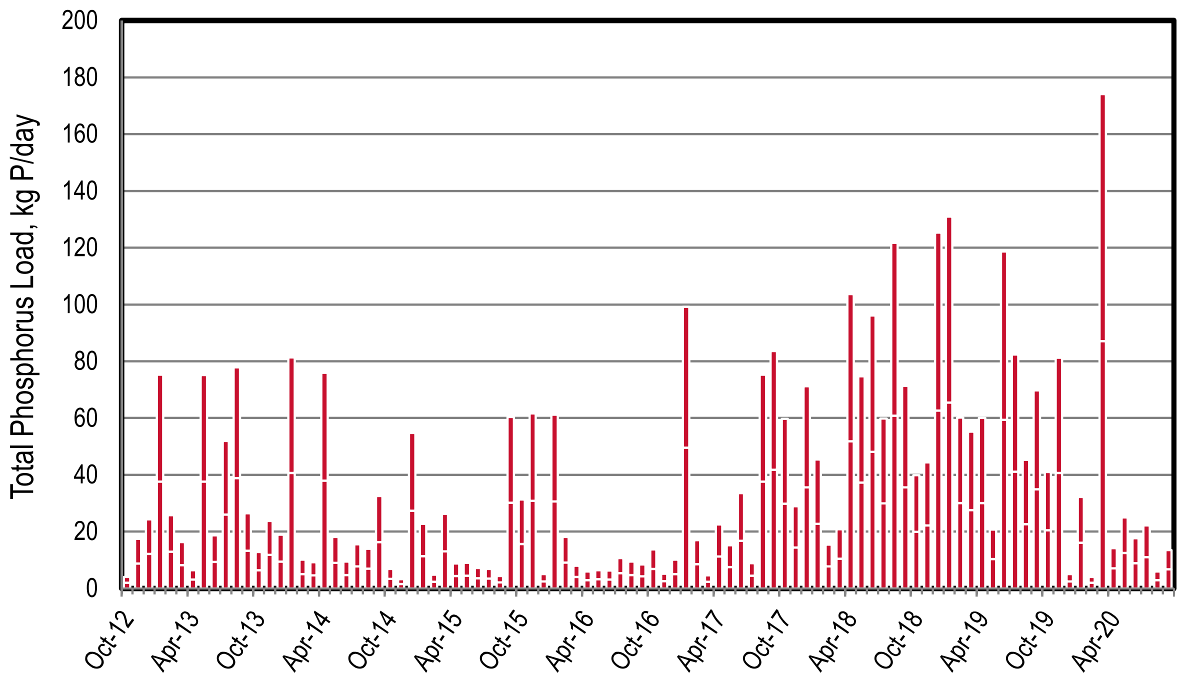

Figure 24-4. Discharge: SFO Airport Monthly Phosphorus Loads

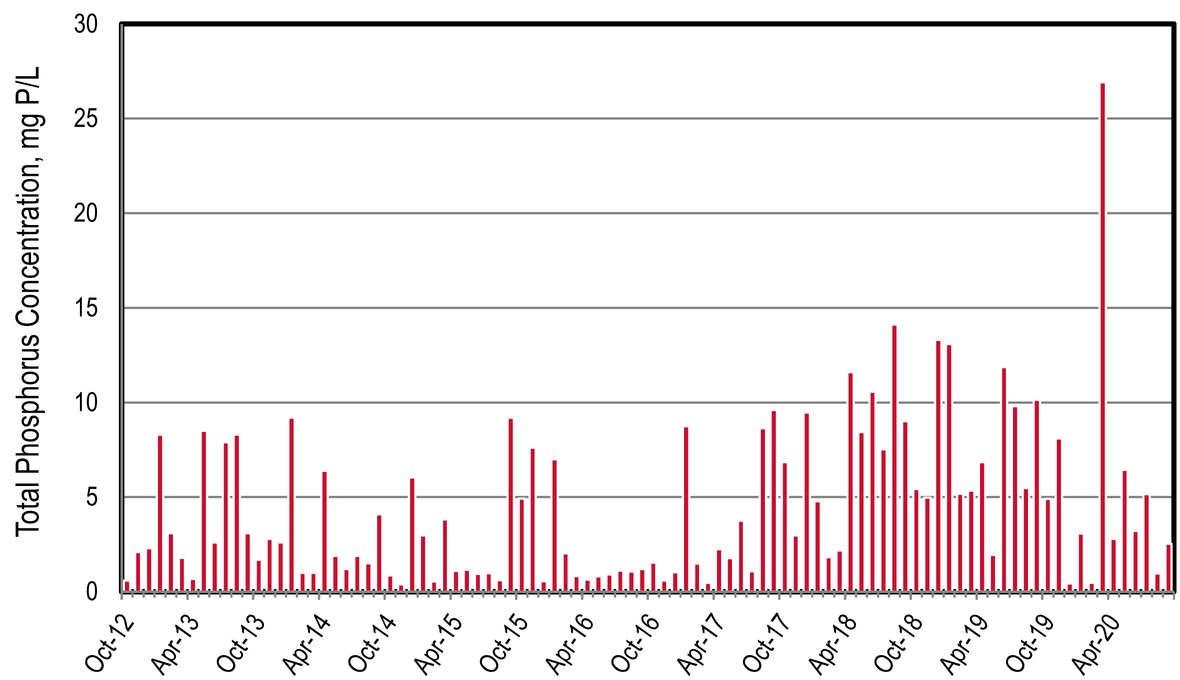

Figure 24-5. Discharge: SFO Airport Monthly Phosphorus Concentrations

Table 24-1. Discharge: SFO Airport Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	0.900	99.0	17.3	116	2.01
Nov-12	1.10	154	28.7	183	8.73
Dec-12	1.40	195	34.3	229	12.2
Jan-13	1.20	202	20.4	223	37.6
Feb-13	1.10	230	28.6	259	12.9
Mar-13	1.20	435	20.2	456	8.16
Apr-13	1.24	234	17.5	252	3.19
May-13	1.17	248	30.1	278	37.6
Jun-13	0.950	302	23.4	326	9.34
Jul-13	0.870	228	22.0	250	26.0
Aug-13	1.24	261	20.2	281	38.9
Sep-13	1.13	129	19.9	149	13.2
Oct-13	1.00	180	8.32	188	6.43
Nov-13	1.12	202	12.9	215	11.9
Dec-13	0.960	200	14.3	214	9.43
Jan-14	1.17	276	4.16	281	40.7
Feb-14	1.34	238	14.7	253	5.07
Mar-14	1.22	156	9.78	166	4.61
Apr-14	1.57	338	11.9	350	38.0
May-14	1.26	220	15.5	236	9.05
Jun-14	1.04	244	22.0	266	4.72
Jul-14	1.08	352	40.3	393	7.74
Aug-14	1.22	270	12.1	282	6.96
Sep-14	1.06	228	19.3	247	16.3
Oct-14	1.05	121	21.9	143	3.40
Nov-14	1.09	67.0	22.3	89.3	1.60
Dec-14	1.20	162	28.0	190	27.4
Jan-15	1.01	141	20.1	161	11.4
Feb-15	1.18	162	12.0	174	2.40
Mar-15	0.906	116	10.8	127	13.1
Apr-15	1.06	104	33.2	137	4.40
May-15	1.01	121	9.52	131	4.50
Jun-15	1.00	166	13.2	179	3.60
Jul-15	0.930	207	10.5	217	3.45
Aug-15	0.930	165	19.6	184	2.17
Sep-15	0.868	49.3	63.4	113	30.2

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	0.841	194	7.19	201	15.7
Nov-15	1.07	49.1	48.7	97.9	30.8
Dec-15	1.19	77.0	17.5	94.5	2.51
Jan-16	1.16	189	64.7	254	30.6
Feb-16	1.18	45.4	14.0	59.4	9.08
Mar-16	1.28	124	12.8	136	4.00
Apr-16	1.22	53.4	17.1	70.5	2.96
May-16	1.03	73.2	15.0	88.2	3.19
Jun-16	0.913	178	11.0	189	3.14
Jul-16	1.26	244	17.2	261	5.34
Aug-16	1.18	253	7.79	261	4.72
Sep-16	0.934	212	14.5	227	4.22
Oct-16	1.18	75.7	12.7	88.4	6.88
Nov-16	1.16	137	18.7	156	2.57
Dec-16	1.30	141	11.1	152	5.09
Jan-17	1.50	131	35.5	166	49.6
Feb-17	1.51	128	20.7	149	8.49
Mar-17	1.27	117	12.1	129	2.31
Apr-17	1.32	132	20.8	153	11.2
May-17	1.13	267	7.76	275	7.57
Jun-17	1.18	332	17.0	349	16.8
Jul-17	1.09	255	1.99	257	4.47
Aug-17	1.15	434	2.30	437	37.6
Sep-17	1.15	397	2.26	400	41.8
Oct-17	1.15	268	4.41	273	29.8
Nov-17	1.28	115	2.37	117	14.4
Dec-17	0.995	227	21.6	249	35.6
Jan-18	1.25	204	3.47	208	22.7
Feb-18	1.12	137	3.82	141	7.72
Mar-18	1.26	144	14.9	159	10.4
Apr-18	1.18	39.2	33.7	72.9	51.9
May-18	1.17	25.2	48.3	73.6	37.3
Jun-18	1.20	24.8	48.1	72.9	48.1
Jul-18	1.05	82.2	30.4	113	29.9
Aug-18	1.14	48.8	29.9	78.8	60.9
Sep-18	1.05	63.6	44.5	108	35.6
Oct-18	0.972	109	17.0	126	19.9

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	1.18	62.7	24.4	87.1	22.2
Dec-18	1.25	38.7	40.7	79.4	62.7
Jan-19	1.32	1.13	24.1	25.2	65.4
Feb-19	1.54	42.0	18.7	60.7	30.1
Mar-19	1.37	0.866	33.6	34.4	27.6
Apr-19	1.16	3.83	21.3	25.1	30.0
May-19	1.41	346	6.74	353	10.4
Jun-19	1.32	221	27.1	248	59.3
Jul-19	1.11	141	30.7	172	41.2
Aug-19	1.09	21.6	19.6	41.2	22.6
Sep-19	0.910	1.18	31.5	32.7	34.9
Oct-19	1.11	0.842	52.6	53.5	20.5
Nov-19	1.33	0.878	12.1	13.0	40.6
Dec-19	1.50	1.28	10.7	12.0	2.50
Jan-20	1.38	1.15	27.0	28.2	16.1
Feb-20	1.15	0.946	40.2	41.2	2.03
Mar-20	0.855	20.0	21.8	41.8	87.1
Apr-20	0.672	0.674	15.2	15.8	7.07
May-20	0.514	0.431	19.8	20.3	12.5
Jun-20	0.728	0.553	17.1	17.7	8.84
Jul-20	0.568	0.568	17.6	18.2	11.1
Aug-20	0.813	17.0	8.61	25.6	2.95
Sep-20	0.701	0.674	14.8	15.5	6.74
Dry Season Average	**1.04**	**171**	**20.8**	**192**	**19.1**
Dry Season Trend **	**None**	**Down**	**None**	**Down**	**None**
Wet Season Average	**1.18**	**125**	**20.5**	**146**	**18.8**
Average Annual	**1.12**	**144**	**20.6**	**165**	**18.9**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

25 SFPUC Southeast Plant

SFPUC has a combined collection system, discharges to the South Bay, and serves approximately 450,000 service connections. The plant has a permitted ADWF capacity of 85.4 mgd and a peak wet weather capacity of 250 mgd (150 mgd secondary, 100 mgd primary). The plant currently discharges at approximately 52.3 mgd during the dry season and performs secondary treatment using a high purity oxygen system.

The following observations are made based upon the figures and table in the subsequent pages:

- Influent and Reduction Across the Plant
  - Note: limited to data since July 2019 (quarterly sampling required).
  - No significant flow and load reductions across the plant are expected because the facility does not recycle water. Note: calculating flow and load reductions across the plant cannot be easily quantified because the permit has separate permit-designated monitoring locations for dry and wet weather effluent.
- Discharge
  - The wet season and dry season average monthly flow values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
  - Based on the average monthly loads since 2012, there appears to be a dry season downward trend for flow and NOx (i.e., nitrite + nitrate) loads. There appears to be a dry season upward trend for total phosphorus. Note: the ammonia loads have declined on average over the last two years.
  - Ammonia and TIN loads do not always increase with elevated flows typically associated with rain events during the wet season.
  - Ammonia is the majority of the nitrogen species discharged, regardless of season. This is expected because this plant does not nitrify.

Influent

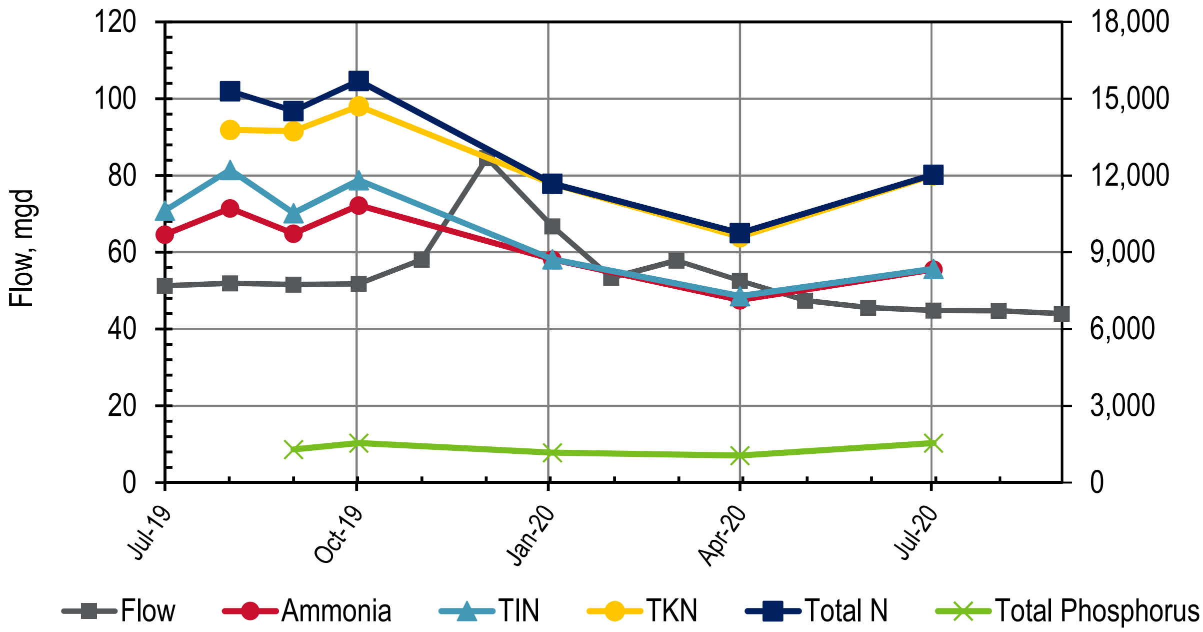

Figure 25-1. Influent: SFPUC Southeast Monthly Flows and Loads

Table 25-1. Influent: SFPUC Southeast Monthly Flows and Loads*

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN *	TKN	Total N *	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	51.3	9,700	940	10,600	--	--	--
Aug-19	51.9	10,700	1,500	12,200	13,800	15,300	--
Sep-19	51.6	9,730	797	10,500	13,700	14,500	1,300
Oct-19	51.8	10,800	986	11,800	14,700	15,700	1,550
Nov-19	58.1	--	--	--	--	--	--
Dec-19	84.5	--	--	--	--	--	--
Jan-20	66.8	8,720	8.74	8,730	11,700	11,700	1,170
Feb-20	53.3	--	--	--	--	--	--
Mar-20	57.9	--	--	--	--	--	--
Apr-20	52.6	7,130	158	7,290	9,600	9,750	1,060
May-20	47.5	--	--	--	--	--	--
Jun-20	45.6	--	--	--	--	--	--
Jul-20	44.8	8,330	28.0	8,350	12,000	12,000	1,550
Aug-20	44.8	--	--	--	--	--	--
Sep-20	44.0	--	--	--	--	--	--
Dry Season Average	**47.7**	**9,620**	**815**	**10,400**	**13,200**	**14,000**	**1,420**
Dry Season Trend **	***	***	***	***	***	***	***
Wet Season Average	**60.7**	**8,900**	**384**	**9,280**	**12,000**	**12,400**	**1,260**
Average Annual	**53.8**	**9,310**	**631**	**9,940**	**12,600**	**13,200**	**1,330**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

*** Insufficient sample set to perform any statistical analysis. Future Group Annual Reports will consider dry season trending.

Discharge

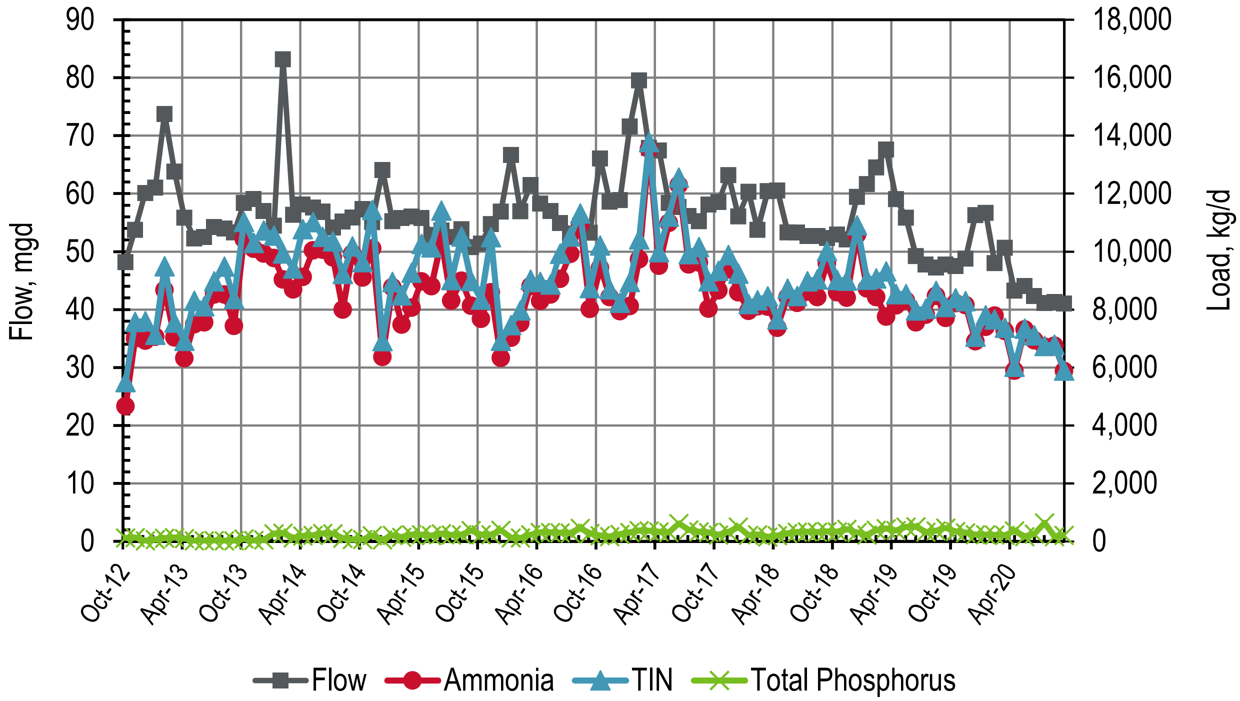

Figure 25-2. Discharge: SFPUC Southeast Monthly Flows and Loads

Table 25-2. Discharge: SFPUC Southeast Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	48.2	4,670	832	5,510	118
Nov-12	53.8	7,010	570	7,580	131
Dec-12	60.2	6,940	663	7,600	22.7
Jan-13	61.1	7,070	65.0	7,130	69.9
Feb-13	73.8	8,680	810	9,490	110
Mar-13	63.8	7,050	506	7,560	134
Apr-13	55.9	6,330	600	6,930	100
May-13	52.3	7,500	813	8,310	19.8
Jun-13	52.6	7,560	550	8,110	19.9
Jul-13	54.3	8,530	451	8,980	39.9
Aug-13	54.0	8,530	956	9,480	20.4
Sep-13	53.4	7,450	920	8,370	20.2
Oct-13	58.4	10,400	600	11,000	84.9
Nov-13	59.1	10,100	194	10,300	32.2
Dec-13	57.1	9,930	804	10,700	61.1

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Jan-14	54.5	9,780	769	10,600	272
Feb-14	83.2	9,040	895	9,940	289
Mar-14	56.4	8,700	726	9,420	119
Apr-14	58.2	9,130	1,650	10,800	192
May-14	57.7	10,100	973	11,000	207
Jun-14	56.9	10,100	452	10,500	274
Jul-14	54.2	9,810	549	10,400	263
Aug-14	55.2	8,010	1,230	9,240	109
Sep-14	55.9	9,940	235	10,200	69.0
Oct-14	57.3	9,110	528	9,640	70.0
Nov-14	55.1	10,100	1,330	11,400	203
Dec-14	64.1	6,370	544	6,920	53.0
Jan-15	55.3	8,780	168	8,950	217
Feb-15	55.8	7,490	997	8,490	148
Mar-15	56.1	8,070	1,210	9,280	230
Apr-15	55.8	8,980	1,300	10,300	231
May-15	52.9	8,810	1,340	10,200	206
Jun-15	53.7	10,400	1,050	11,400	266
Jul-15	52.6	8,310	714	9,030	226
Aug-15	53.9	9,000	1,520	10,500	239
Sep-15	50.8	8,140	856	8,990	377
Oct-15	51.4	7,690	668	8,360	234
Nov-15	54.8	8,600	1,900	10,500	230
Dec-15	56.9	6,340	591	6,930	384
Jan-16	66.7	7,040	425	7,460	120
Feb-16	57.0	7,540	427	7,970	122
Mar-16	61.5	8,810	217	9,030	232
Apr-16	58.3	8,310	643	8,950	315
May-16	57.1	8,530	344	8,870	309
Jun-16	55.0	9,070	856	9,930	295
Jul-16	53.1	9,930	591	10,500	284
Aug-16	54.6	10,900	388	11,300	450
Sep-16	53.3	8,030	723	8,750	273
Oct-16	66.1	9,440	777	10,200	204
Nov-16	58.6	8,440	263	8,710	169
Dec-16	58.9	7,950	287	8,240	246
Jan-17	71.6	8,130	828	8,960	310

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Feb-17	79.6	9,740	686	10,400	377
Mar-17	67.9	13,500	236	13,800	370
Apr-17	67.5	9,520	458	9,980	328
May-17	58.4	11,000	213	11,200	314
Jun-17	57.7	12,300	253	12,600	619
Jul-17	56.1	9,570	349	9,920	396
Aug-17	55.3	9,630	524	10,200	338
Sep-17	58.2	8,040	938	8,980	308
Oct-17	58.6	8,670	680	9,350	221
Nov-17	63.3	9,390	495	9,890	317
Dec-17	56.1	8,600	641	9,240	498
Jan-18	60.4	7,960	239	8,200	209
Feb-18	53.8	8,120	211	8,330	239
Mar-18	60.4	8,110	359	8,470	160
Apr-18	60.6	7,380	284	7,660	200
May-18	53.3	8,430	291	8,730	276
Jun-18	53.3	8,240	235	8,470	327
Jul-18	52.7	8,630	346	8,980	338
Aug-18	52.7	8,440	607	9,040	321
Sep-18	52.4	9,590	423	10,000	344
Oct-18	53.0	8,610	419	9,030	333
Nov-18	52.1	8,420	579	9,000	419
Dec-18	59.5	10,600	317	10,900	308
Jan-19	61.7	8,740	290	9,030	228
Feb-19	64.5	8,440	636	9,080	386
Mar-19	67.7	7,760	825	9,320	448
Apr-19	59.1	8,150	388	8,540	382
May-19	55.9	8,310	222	8,530	498
Jun-19	49.3	7,560	357	7,970	510
Jul-19	47.8	7,830	207	8,030	324
Aug-19	47.3	8,480	167	8,650	366
Sep-19	47.8	7,720	384	8,100	464
Oct-19	47.5	8,230	160	8,390	348
Nov-19	48.8	8,160	140	8,300	297
Dec-19	56.3	6,910	159	7,070	239
Jan-20	56.7	7,410	393	7,800	230
Feb-20	48.0	7,800	211	7,670	219

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Mar-20	50.7	7,270	12.9	7,380	214
Apr-20	43.3	5,890	138	6,030	367
May-20	44.1	7,330	20.6	7,350	166
Jun-20	42.3	6,950	171	7,120	253
Jul-20	41.2	6,730	19.1	6,750	643
Aug-20	41.3	6,760	28.9	6,790	163
Sep-20	41.0	5,890	6.83	5,900	209
Dry Season Average	**52.3**	**8,650**	**532**	**9,180**	**279**
Dry Season Trend **	**Down**	**None**	**Down**	**None**	**Up**
Wet Season Average	**59.0**	**8,310**	**567**	**8,890**	**228**
Average Annual	**56.2**	**8,450**	**552**	**9,010**	**249**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.
** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

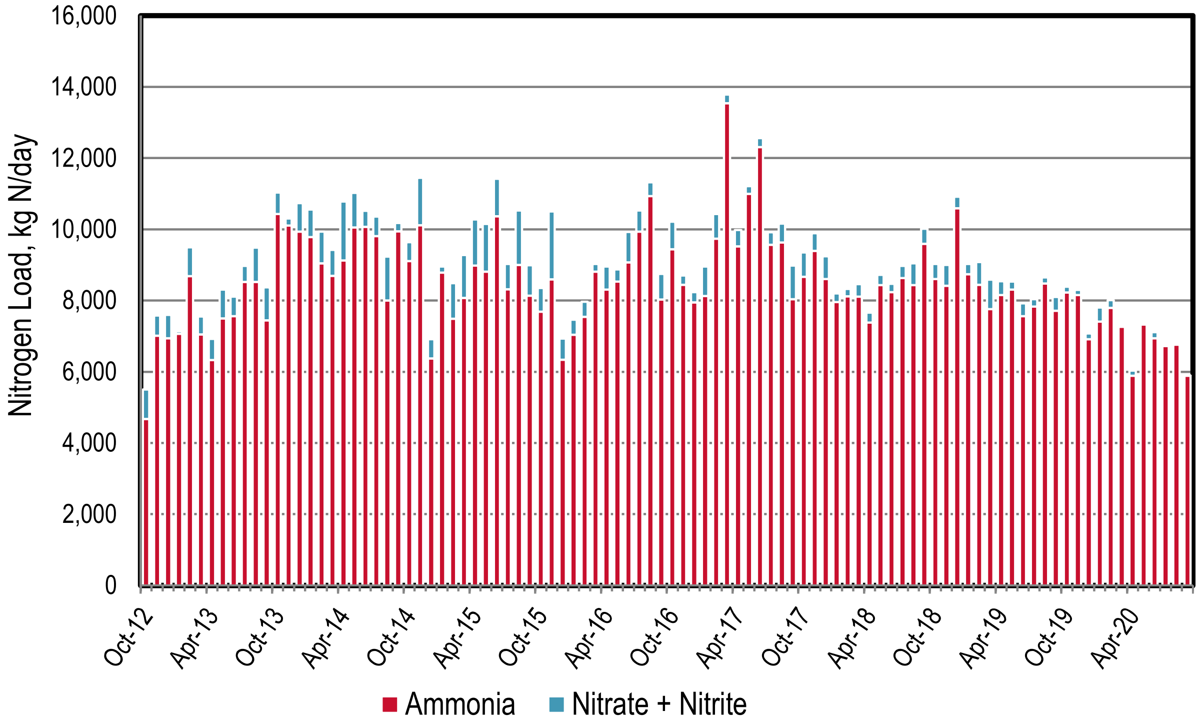

Figure 25-3. Discharge: SFPUC Southeast Monthly Nitrogen Loads

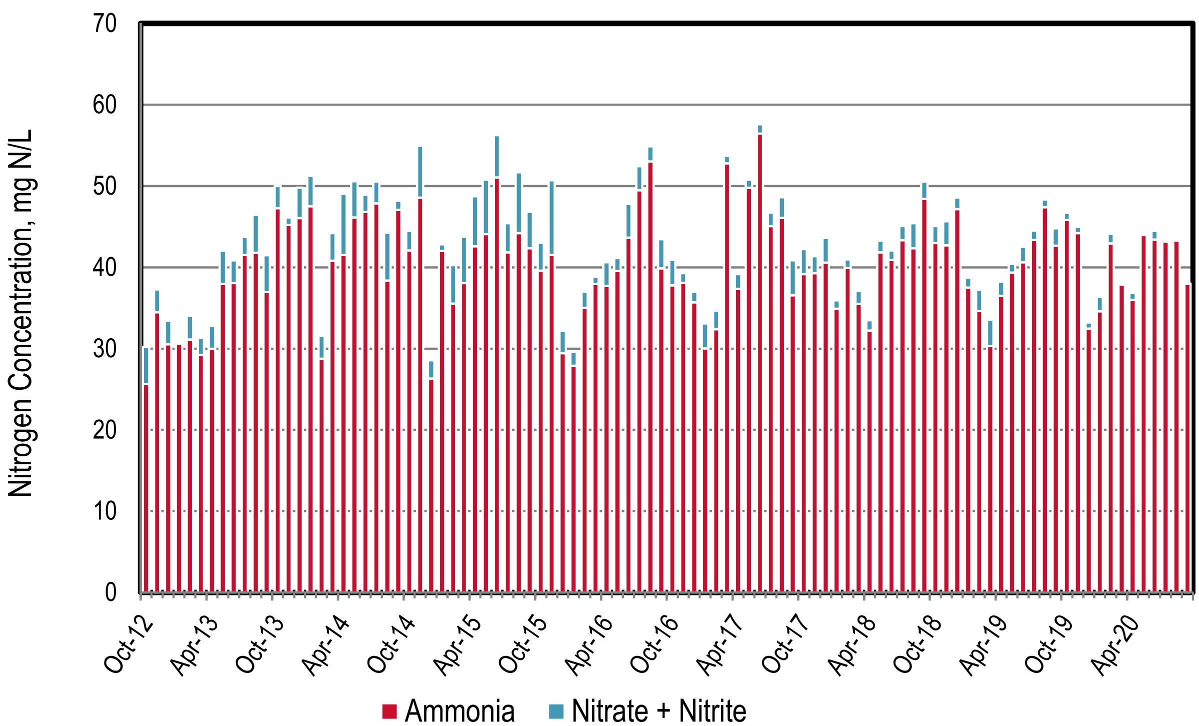

Figure 25-4. Discharge: SFPUC Southeast Monthly Nitrogen Concentrations

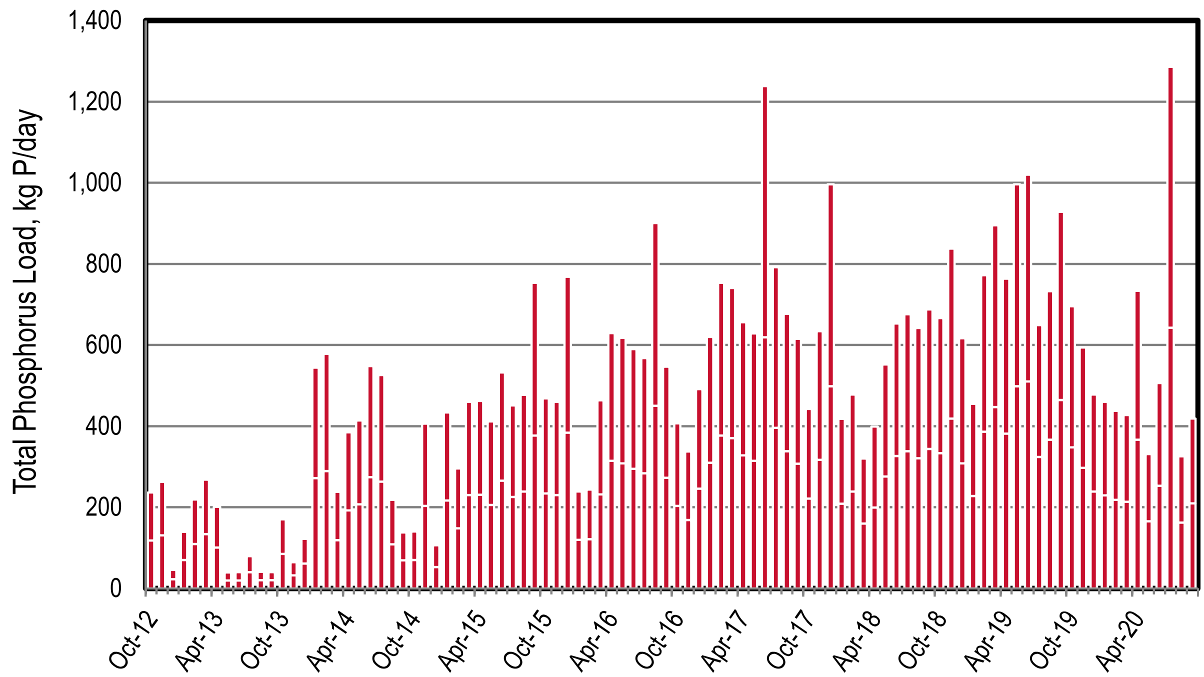

Figure 25-5. Discharge: SFPUC Southeast Monthly Phosphorus Loads

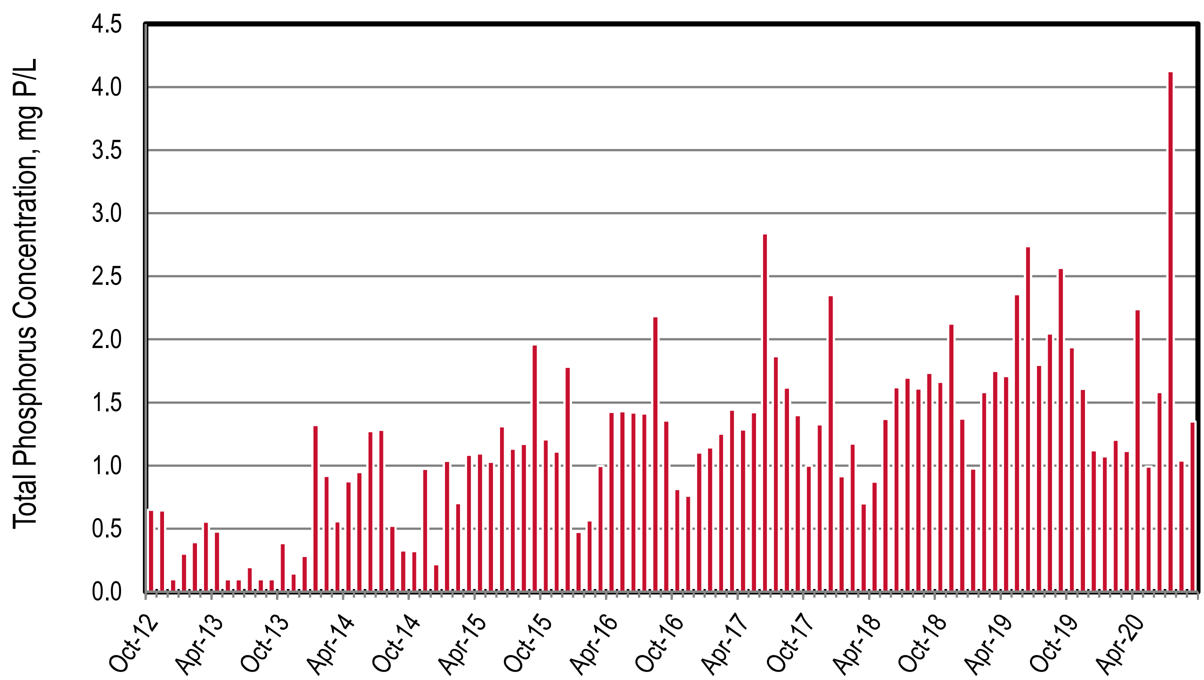

Figure 25-6. Discharge: SFPUC Southeast Monthly Phosphorus Concentrations

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26 Sausalito-Marin City Sanitary District (SMCSD)

SMCSD discharges to the Central Bay. The plant has approximately 6,500 service connections and permitted capacity of 1.8 mgd ADWF. The current flows are approximately 1.1 mgd ADWF. The plant performs partial nitrification using a trickling filter.

The following observations are made based upon the figures and table in the subsequent pages:

- The wet season average monthly flow values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
- The plant was under construction from May 2017 to July 2018 with upgrades to improve treatment capacity and performance. During this period, the plant used one of two sedimentation tanks and fixed film reactors which compromised treatment performance.
- Based on the table with average monthly values, there appears to be an emerging downward trend for flow, NOx, and total phosphorus loads. There appears to be an emerging upward trend for ammonia loads. Note: the statistical analysis excluded data while the plant was under construction.
- Nitrogen and phosphorus loads do not appear to track with flows during wet weather events.
- Historically, NOx has represented the majority of the nitrogen species discharged as would be expected since this plant nitrifies. Over the last couple years, the distribution between ammonia and NOx has been more evenly split.
- Total phosphorus concentrations range from 0.8 to 6.3 mg P/L with values reliably less than 5 mg P/L over the last two years. This suggests occasional P removal as typical effluent TP concentrations are 4 to 6 mg P/L. The removal mechanism is most likely from metal salt addition at the front of the plant with removal in the primary clarifiers.

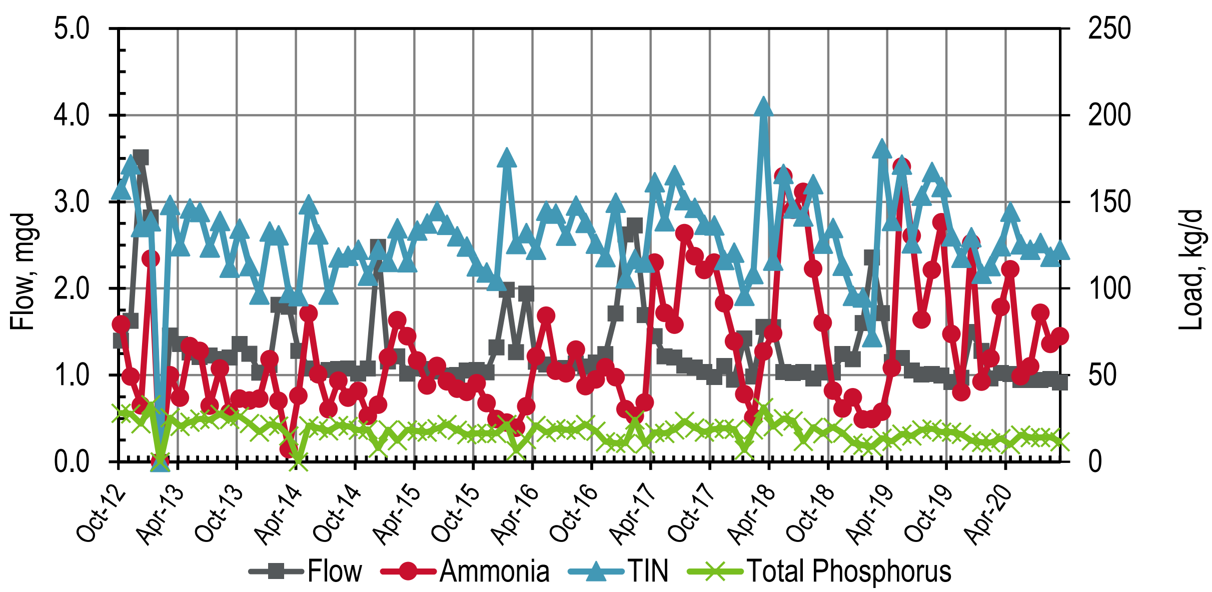

Figure 26-1. Discharge: SMCSD Monthly Flows and Loads

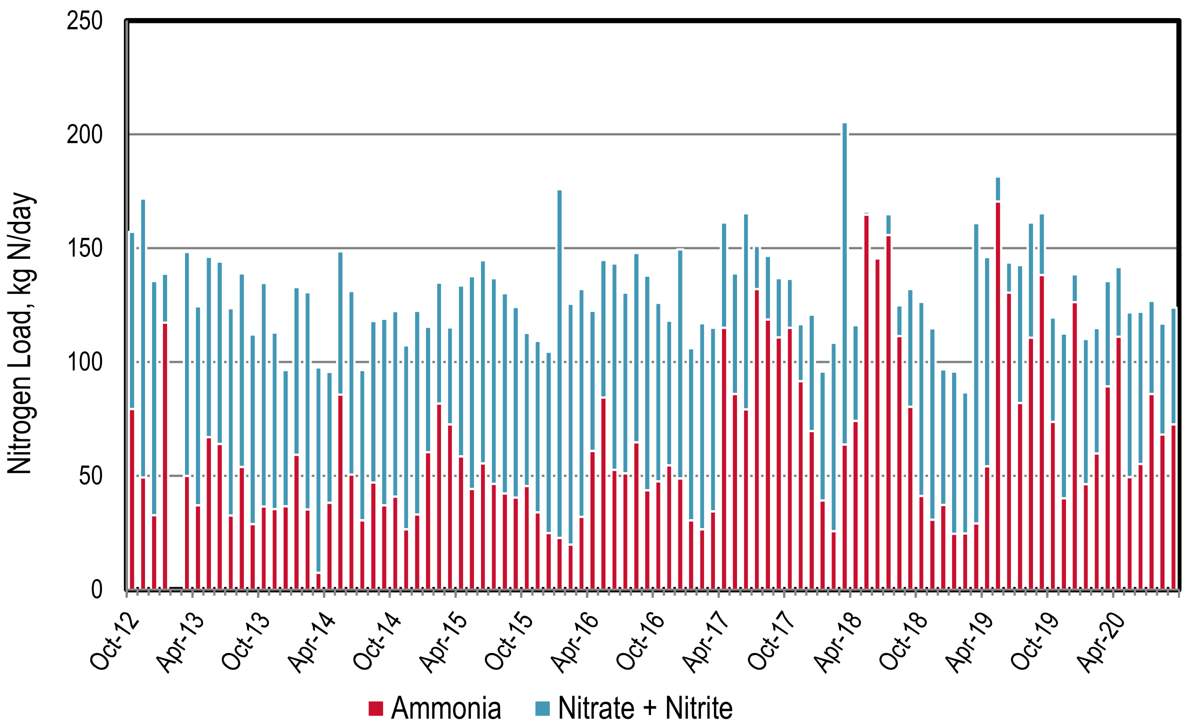

Figure 26-2. Discharge: SMCSD Monthly Nitrogen Loads

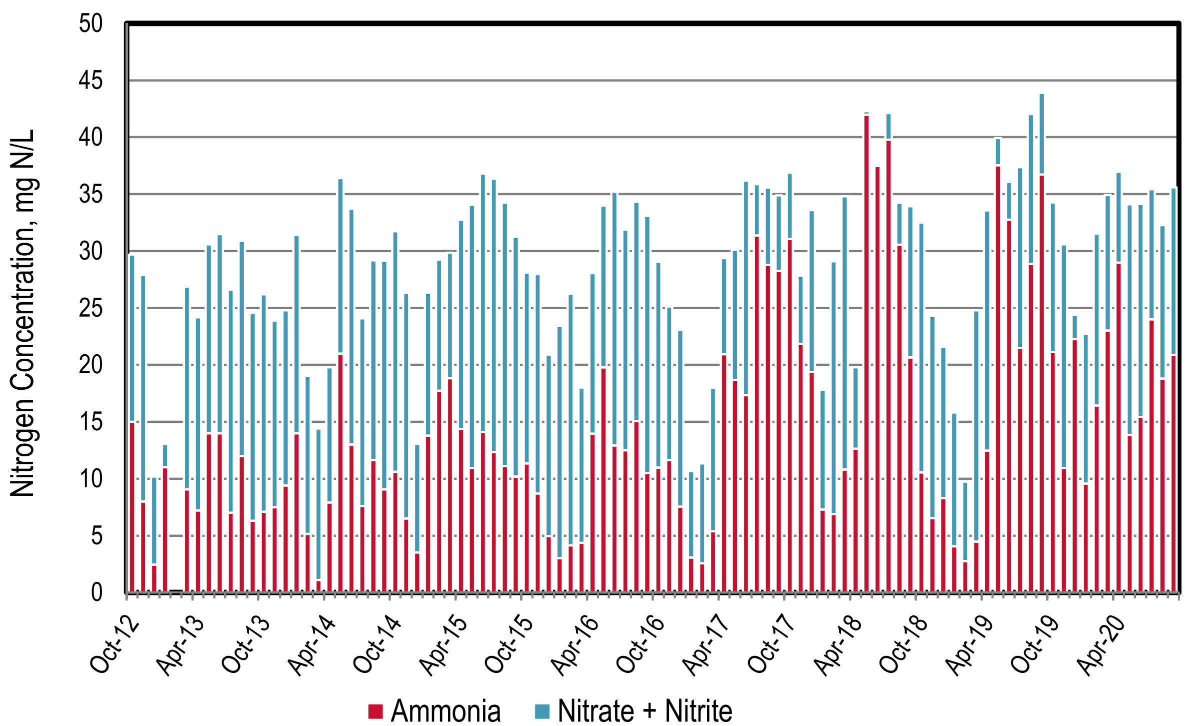

Figure 26-3. Discharge: SMCSD Monthly Nitrogen Concentrations

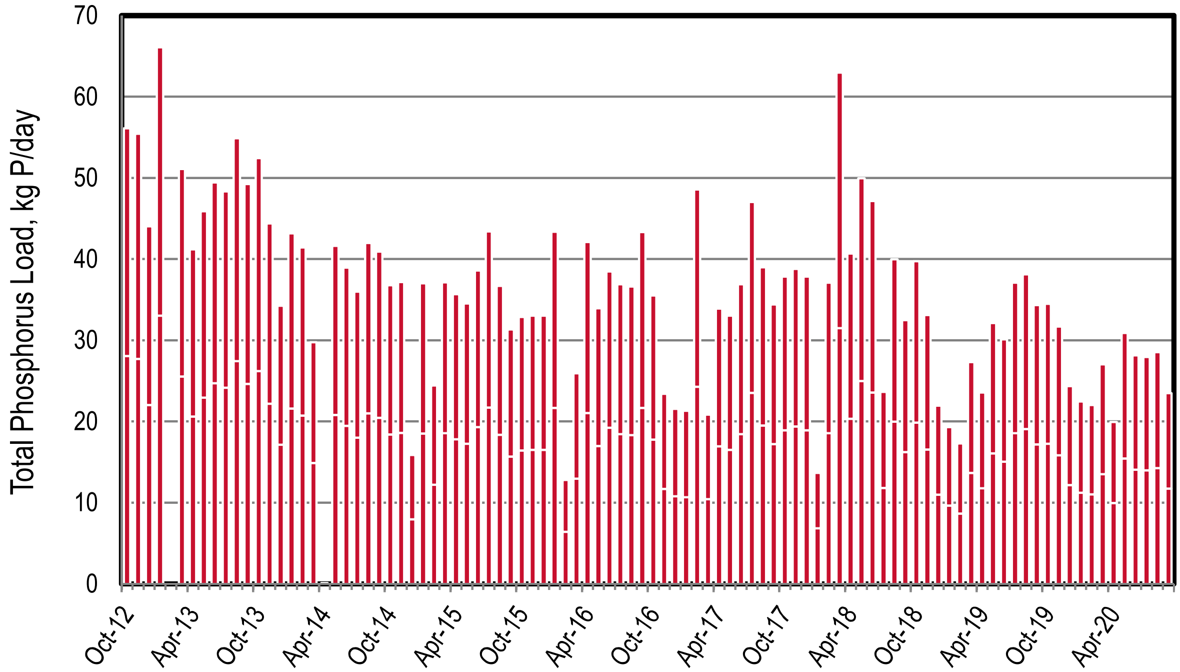

Figure 26-4. Discharge: SMCSD Monthly Phosphorus Loads

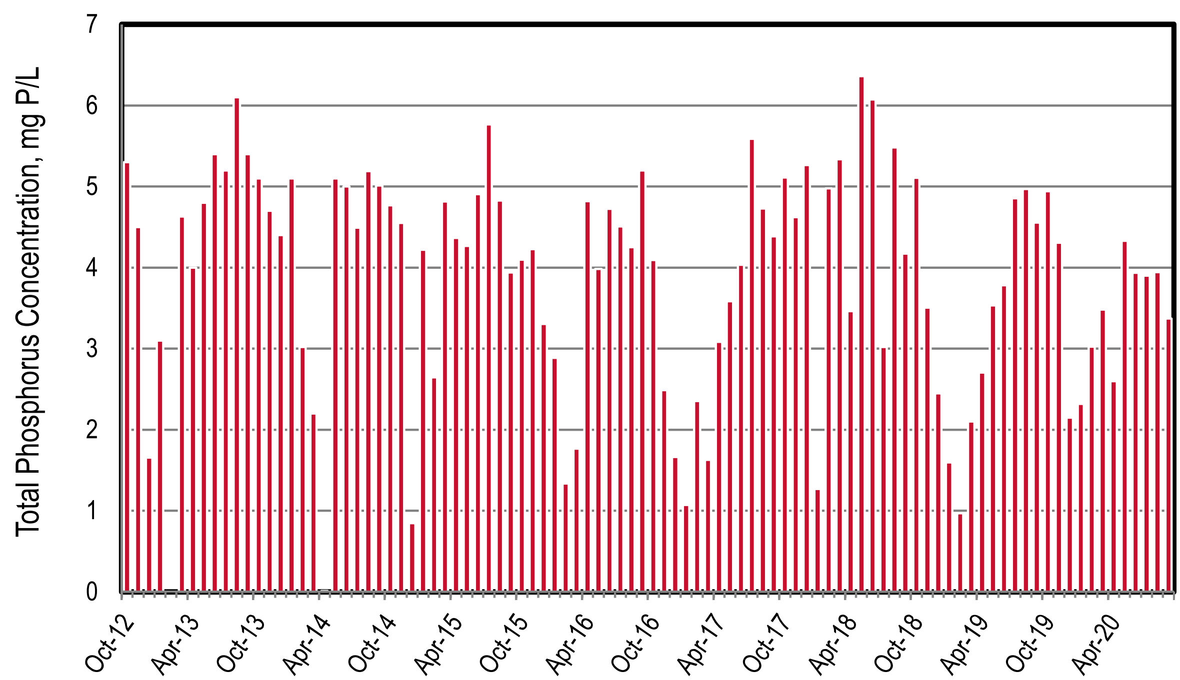

Figure 26-5. Discharge: SMCSD Monthly Phosphorus Concentrations

Table 26-1. Discharge: SMCSD Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	1.40	79.4	77.8	157	28.0
Nov-12	1.63	49.3	122	172	27.7
Dec-12	3.52	32.7	103	136	22.0
Jan-13	2.82	117	21.5	139	33.0
Feb-13	--	--	--	--	--
Mar-13	1.46	50.0	98.3	148	25.6
Apr-13	1.36	37.1	87.4	124	20.6
May-13	1.27	66.9	79.4	146	23.0
Jun-13	1.21	64.1	80.1	144	24.7
Jul-13	1.23	32.5	91.1	124	24.2
Aug-13	1.19	54.0	85.0	139	27.4
Sep-13	1.21	28.7	83.4	112	24.6
Oct-13	1.36	36.5	98.2	135	26.2
Nov-13	1.25	35.4	77.5	113	22.2
Dec-13	1.03	36.6	60.0	96.6	17.1
Jan-14	1.12	59.3	73.7	133	21.6
Feb-14	1.82	35.3	95.4	131	20.7
Mar-14	1.79	7.44	90.1	97.6	14.9
Apr-14	1.28	38.2	57.4	95.7	0.0484
May-14	1.08	85.7	62.9	149	20.8
Jun-14	1.03	50.6	80.6	131	19.5
Jul-14	1.06	30.5	66.0	96.5	18.0
Aug-14	1.07	47.0	71.0	118	21.0
Sep-14	1.08	37.1	81.9	119	20.5
Oct-14	1.02	40.9	81.4	122	18.4
Nov-14	1.08	26.6	80.8	107	18.6
Dec-14	2.48	33.1	89.4	123	7.94
Jan-15	1.16	60.5	55.0	115	18.5
Feb-15	1.22	81.8	53.1	135	12.2
Mar-15	1.02	72.6	42.5	115	18.6
Apr-15	1.08	58.6	75.0	134	17.8
May-15	1.07	44.2	93.5	138	17.3
Jun-15	1.04	55.5	89.2	145	19.3
Jul-15	0.996	46.5	90.4	137	21.7
Aug-15	1.01	42.2	87.9	130	18.4
Sep-15	1.05	40.5	83.7	124	15.7

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	1.06	45.5	67.3	113	16.4
Nov-15	1.03	34.0	75.3	109	16.5
Dec-15	1.32	24.8	79.7	105	16.5
Jan-16	1.99	22.7	153	176	21.7
Feb-16	1.27	19.9	106	126	6.40
Mar-16	1.94	32.1	100	132	13.0
Apr-16	1.16	60.9	61.6	123	21.1
May-16	1.13	84.4	60.5	145	17.0
Jun-16	1.08	52.7	90.7	143	19.2
Jul-16	1.08	51.1	79.4	131	18.5
Aug-16	1.14	64.8	83.1	148	18.3
Sep-16	1.10	43.7	94.3	138	21.7
Oct-16	1.15	47.6	78.4	126	17.8
Nov-16	1.24	54.6	63.5	118	11.7
Dec-16	1.71	48.9	101	150	10.8
Jan-17	2.63	30.5	75.5	106	10.7
Feb-17	2.73	26.5	90.5	117	24.3
Mar-17	1.69	34.4	80.7	115	10.4
Apr-17	1.45	115	46.3	161	16.9
May-17	1.22	86.0	52.9	139	16.5
Jun-17	1.21	79.3	86.1	165	18.4
Jul-17	1.11	132	19.0	151	23.5
Aug-17	1.09	119	28.0	147	19.5
Sep-17	1.04	111	26.0	137	17.2
Oct-17	0.979	115	21.5	137	18.9
Nov-17	1.11	91.6	24.9	117	19.4
Dec-17	0.951	69.7	51.1	121	18.9
Jan-18	1.42	39.2	56.6	95.9	6.83
Feb-18	0.986	25.7	82.7	108	18.5
Mar-18	1.56	63.7	142	205	31.5
Apr-18	1.55	74.2	42.0	116	20.4
May-18	1.04	165	1.29	166	25.0
Jun-18	1.03	146	0.669	146	23.6
Jul-18	1.04	156	9.16	142	11.8
Aug-18	0.965	111	13.5	160	20.0
Sep-18	1.03	80.3	51.7	126	16.2
Oct-18	1.03	41.1	85.3	135	19.9

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	1.25	30.8	83.9	113	16.6
Dec-18	1.19	37.2	59.5	95.8	11.0
Jan-19	1.60	24.5	71.2	94.9	9.66
Feb-19	2.36	24.7	62.0	72.0	8.64
Mar-19	1.72	29.1	132	181	13.7
Apr-19	1.15	54.3	91.9	139	11.8
May-19	1.20	170	11.0	172	16.1
Jun-19	1.05	131	13.2	126	15.1
Jul-19	1.01	82.1	60.6	154	18.5
Aug-19	1.01	111	50.6	167	19.1
Sep-19	0.997	138	27.0	159	17.2
Oct-19	0.923	73.8	45.8	130	17.2
Nov-19	0.973	40.2	72.3	118	15.8
Dec-19	1.50	126	12.2	130	12.2
Jan-20	1.28	46.4	63.7	109	11.2
Feb-20	0.963	59.8	55.1	113	11.0
Mar-20	1.03	89.4	46.3	125	13.5
Apr-20	1.01	111	30.6	144	9.96
May-20	0.945	49.5	72.3	125	15.5
Jun-20	0.947	55.2	66.9	122	14.1
Jul-20	0.947	86.0	40.9	126	14.0
Aug-20	0.958	68.1	48.8	118	14.3
Sep-20	0.921	72.6	51.2	122	11.7
Dry Season Average	**1.07**	**79.3**	**59.1**	**138**	**18.9**
Dry Season Trend **,***	**Down**	**Up**	**Down**	**None**	**Down**
Wet Season Average	**1.43**	**51.0**	**72.3**	**123**	**16.5**
Average Annual	**1.28**	**62.8**	**66.8**	**129**	**17.5**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

*** The plant was under construction May 2017 to July 2018 with upgrades to improve treatment capacity and performance. During this period, the plant has been using one of two sedimentation tanks and fixed film reactors which has compromised the overall treatment performance. As a result, this data was excluded from the statistical analysis as it is not reflective of plant treatment capacity and performance.

27 Sonoma Valley County Sanitation District

Sonoma Valley discharges to Schell Slough, Ringstrom Bay, and various restoration management units which are connected to San Pablo Bay. The plant has approximately 17,200 service connections and a permitted capacity of 3.0 mgd ADWF. The plant has a wet weather discharge to Schell Slough at a capacity of 16 mgd. The plant performs nitrogen removal using an activated sludge process.

The following observations are made based upon the figures and table in the subsequent pages:

- Sonoma Valley has not discharged since March 2019.
- There are no emerging dry season trends as Sonoma Valley is prohibited from discharging to Schell Slough during the dry season. There is one exception in May 2017, where discharge was for 3 days due to the relatively wet month. Sonoma Valley is only allowed to discharge if flows entering the plant exceed 6 mgd and storage is 50% or more full.
- There are only 21 out of 96 months in which they discharged to Schell Slough. The water was all recycled during the other months.
- Both nitrogen and phosphorus loads increase with flow during wet weather events.
- NOx is the majority of the nitrogen species discharged, as would be expected since this plant fully nitrifies. The highest average monthly effluent ammonia concentration was 0.6 mg N/L.
- The plant meets Level 2 total nitrogen concentration limits (i.e., 15 mg N/L) developed under the Scoping and Evaluation Plan for the 1st Watershed Permit (R2-2014-0014) for all but four months. Three of these months are in the July 2016 through June 2017 dataset due to the relatively high levels of precipitation during that wet season.
- Total phosphorus concentrations range from 1.3 to 4.5 mg P/L, which suggests a portion of P is removed as typical effluent TP concentrations are 4 to 6 mg P/L. The removal mechanism is unclear at this stage.

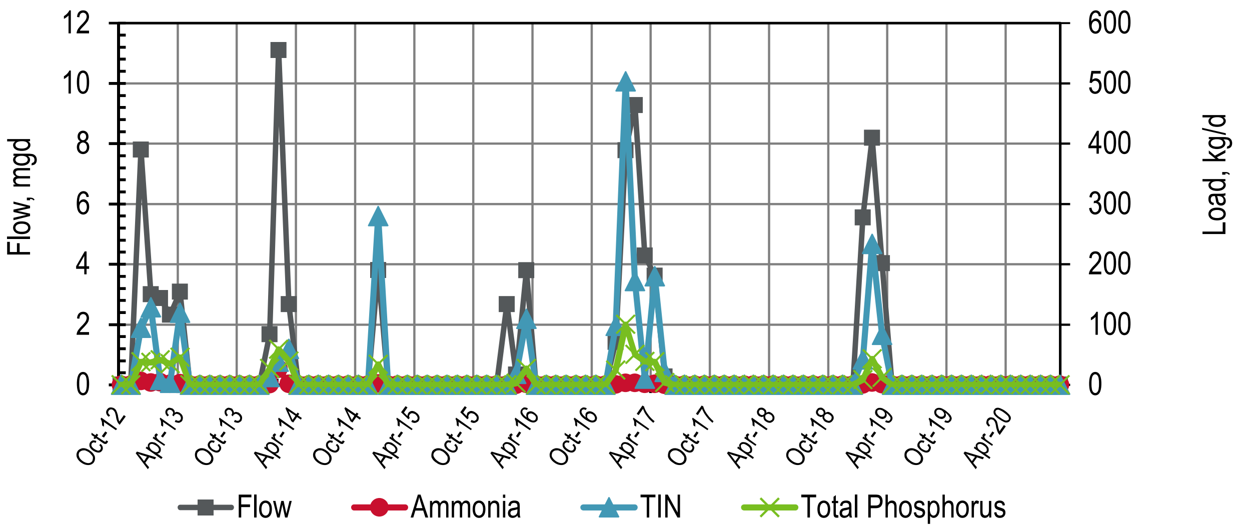

Figure 27-1. Discharge: Sonoma Valley Monthly Flows and Loads

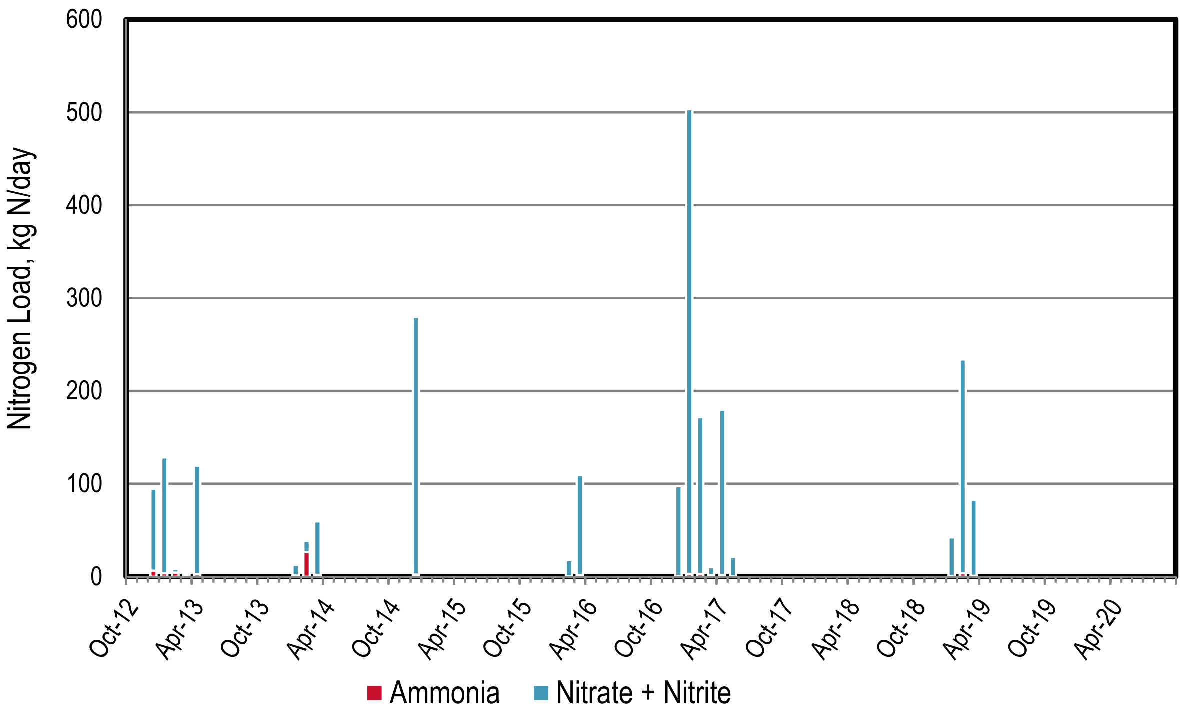

Figure 27-2. Discharge: Sonoma Valley Monthly Nitrogen Loads

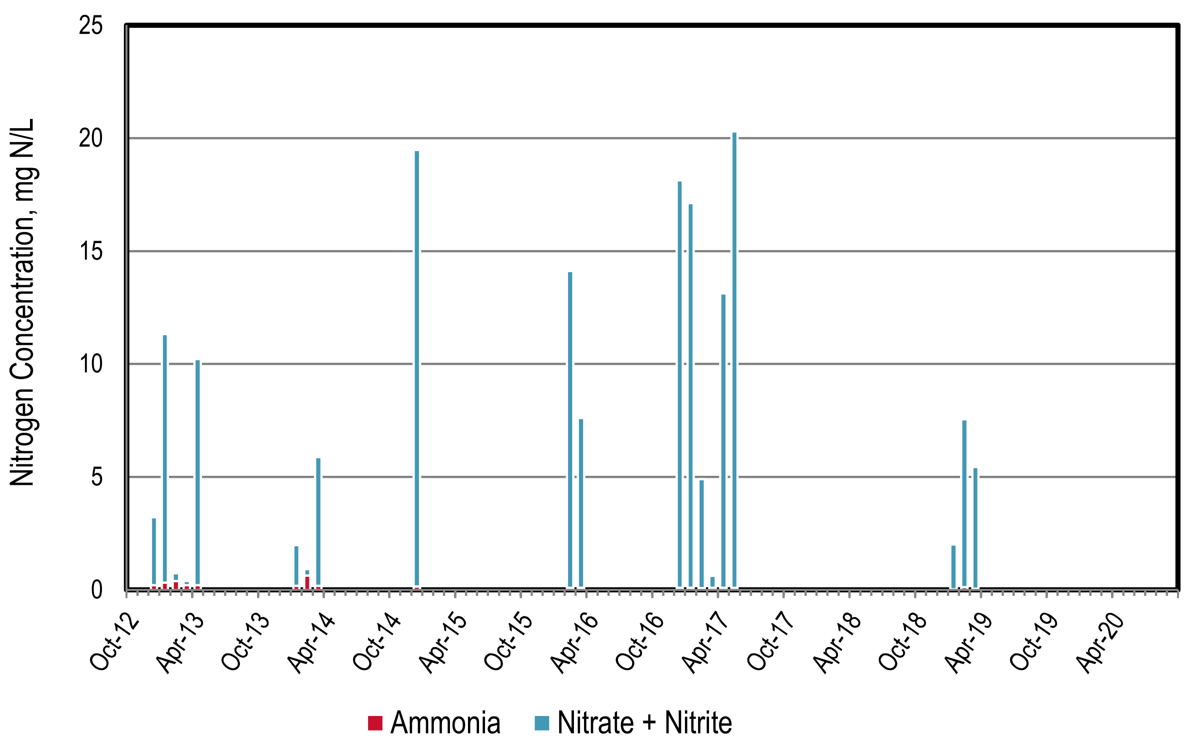

Figure 27-3. Discharge: Sonoma Valley Monthly Nitrogen Concentrations

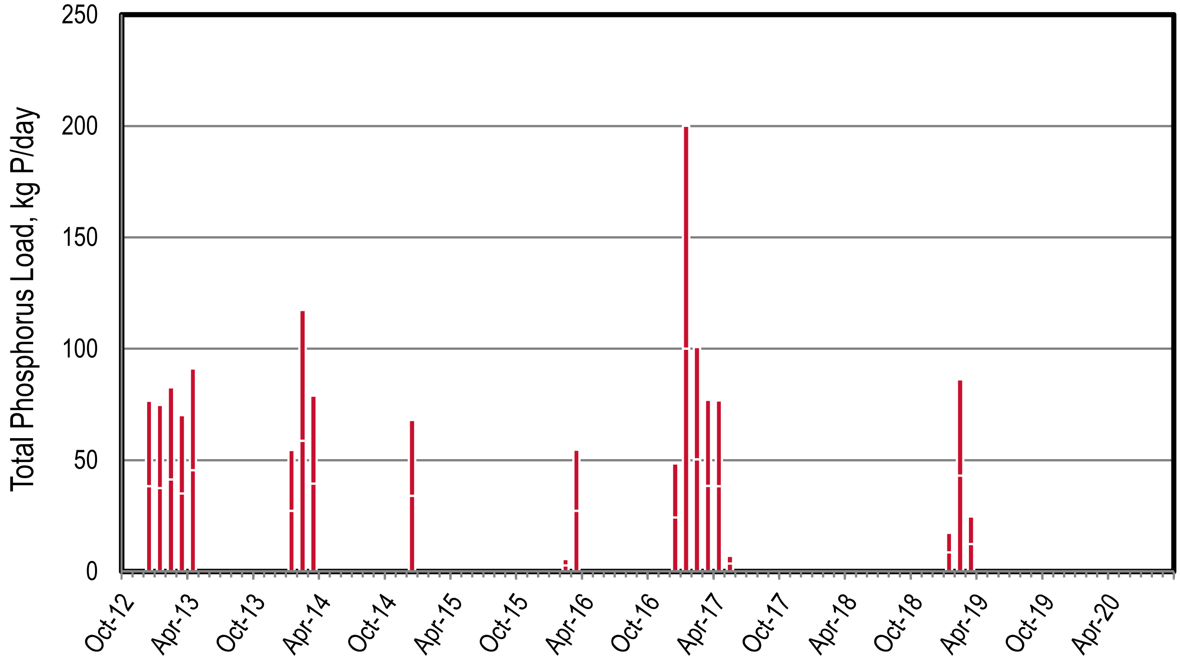

Figure 27-4. Discharge: Sonoma Valley Monthly Phosphorus Loads

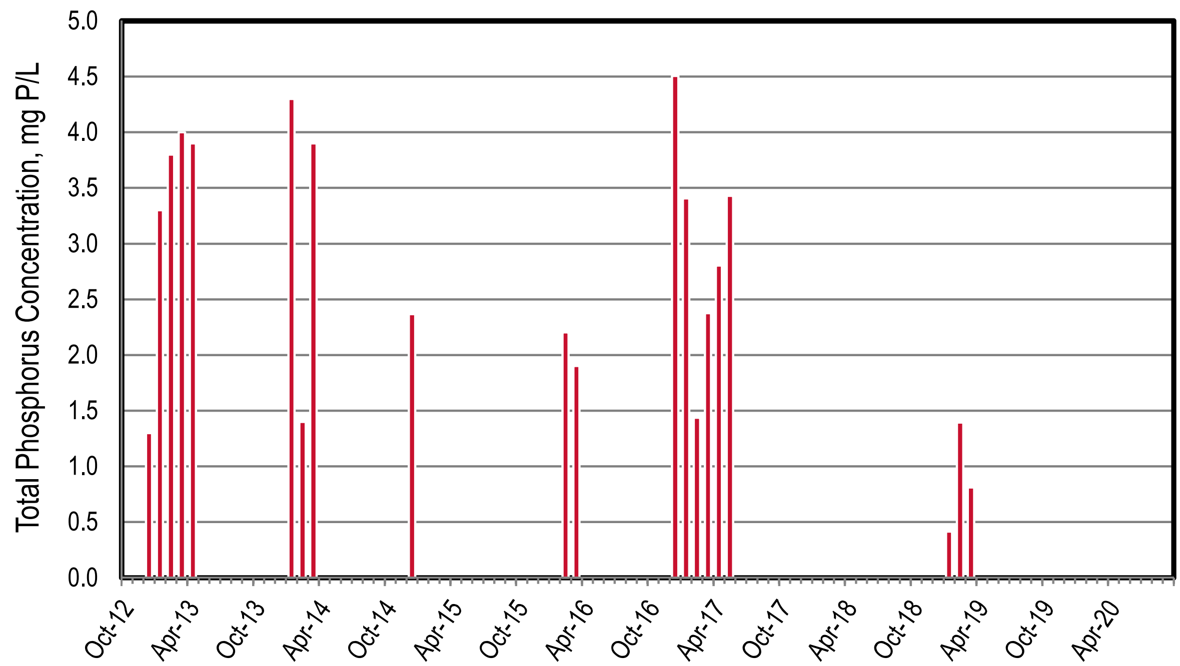

Figure 27-5. Discharge: Sonoma Valley Monthly Phosphorus Concentrations

Table 27-1. Discharge: Sonoma Valley Monthly Flows and Loads

Month, Year	Average Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	0	0	0	0	0
Nov-12	0	0	0	0	0
Dec-12	7.80	6.19	88.5	94.7	38.3
Jan-13	3.00	3.63	125	128	37.4
Feb-13	2.88	4.25	3.67	7.92	41.4
Mar-13	2.32	1.84	1.55	3.39	35.1
Apr-13	3.09	2.45	117	119	45.6
May-13	0	0	0	0	0
Jun-13	0	0	0	0	0
Jul-13	0	0	0	0	0
Aug-13	0	0	0	0	0
Sep-13	0	0	0	0	0
Oct-13	0	0	0	0	0
Nov-13	0	0	0	0	0
Dec-13	0	0	0	0	0
Jan-14	1.68	1.14	11.5	12.6	27.3
Feb-14	11.1	26.4	11.9	38.3	58.7
Mar-14	2.68	1.82	57.8	59.6	39.5
Apr-14	0	0	0	0	0
May-14	0	0	0	0	0
Jun-14	0	0	0	0	0
Jul-14	0	0	0	0	0
Aug-14	0	0	0	0	0
Sep-14	0	0	0	0	0
Oct-14	0	0	0	0	0
Nov-14	0	0	0	0	0
Dec-14	3.80	2.14	278	280	34.0
Jan-15	0	0	0	0	0
Feb-15	0	0	0	0	0
Mar-15	0	0	0	0	0
Apr-15	0	0	0	0	0
May-15	0	0	0	0	0
Jun-15	0	0	0	0	0
Jul-15	0	0	0	0	0
Aug-15	0	0	0	0	0
Sep-15	0	0	0	0	0

Month, Year	Average Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	0	0	0	0	0
Nov-15	0	0	0	0	0
Dec-15	0	0	0	0	0
Jan-16	2.67	--	--	--	--
Feb-16	0.335	0.127	17.8	17.9	2.79
Mar-16	3.80	1.44	108	109	27.3
Apr-16	0	0	0	0	0
May-16	0	0	0	0	0
Jun-16	0	0	0	0	0
Jul-16	0	0	0	0	0
Aug-16	0	0	0	0	0
Sep-16	0	0	0	0	0
Oct-16	0	0	0	0	0
Nov-16	0	0	0	0	0
Dec-16	1.42	0.539	96.9	97.5	24.2
Jan-17	7.78	2.94	500	503	100
Feb-17	9.27	2.96	169	172	50.4
Mar-17	4.29	1.54	8.48	10.0	38.6
Apr-17	3.62	1.37	178	180	38.4
May-17	0.275	0.0912	21.0	21.1	3.56
Jun-17	0	0	0	0	0
Jul-17	0	0	0	0	0
Aug-17	0	0	0	0	0
Sep-17	0	0	0	0	0
Oct-17	0	0	0	0	0
Nov-17	0	0	0	0	0
Dec-17	0	0	0	0	0
Jan-18	0	0	0	0	0
Feb-18	0	0	0	0	0
Mar-18	0	0	0	0	0
Apr-18	0	0	0	0	0
May-18	0	0	0	0	0
Jun-18	0	0	0	0	0
Jul-18	0	0	0	0	0
Aug-18	0	0	0	0	0
Sep-18	0	0	0	0	0
Oct-18	0	0	0	0	0

Month, Year	Average Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	0	0	0	0	0
Dec-18	0	0	0	0	0
Jan-19	5.55	0.458	41.7	42.1	8.70
Feb-19	8.19	3.60	230	234	43.1
Mar-19	4.03	0.881	82.0	82.9	12.3
Apr-19	0	0	0	0	0
May-19	0	0	0	0	0
Jun-19	0	0	0	0	0
Jul-19	0	0	0	0	0
Aug-19	0	0	0	0	0
Sep-19	0	0	0	0	0
Oct-19	0	0	0	0	0
Nov-19	0	0	0	0	0
Dec-19	0	0	0	0	0
Jan-20	0	0	0	0	0
Feb-20	0	0	0	0	0
Mar-20	0	0	0	0	0
Apr-20	0	0	0	0	0
May-20	0	0	0	0	0
Jun-20	0	0	0	0	0
Jul-20	0	0	0	0	0
Aug-20	0	0	0	0	0
Sep-20	0	0	0	0	0
Dry Season Average	**0.00686**	**0.00228**	**0.524**	**0.527**	**0.0889**
Dry Season Trend **	**--**	**--**	**--**	**--**	**--**
Wet Season Average	**1.59**	**1.17**	**38.0**	**39.1**	**12.6**
Average Annual	**0.933**	**0.686**	**22.4**	**23.1**	**7.36**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** No dry season trending analysis was performed on Sonoma Valley as the facility has only discharged once during the dry season since sampling began in 2012.

28 South San Francisco-San Bruno

South SF-San Bruno discharges to Lower San Francisco Bay (referred to as South Bay in the Group Annual Report). The plant has a permitted capacity of 13 mgd ADWF and a peak wet weather capacity of 30 mgd, with blending above 30 mgd allowable. The current flow is approximately 7.6 mgd ADWF. The process includes a conventional activated sludge system.

The following observations are made based upon the figures and table in the subsequent pages:

- Influent and Load Reduction Across the Plant
  - Note: limited to data since July 2019; quarterly required but more provided for various parameters.
  - Based on the limited average monthly values table below, there is an emerging downward dry season trend for flow.
  - The flow reduction across the plant is negligible.
  - The nitrogen load reduction values across the plant ranges from approximately 5 to 50 percent. This load reduction is attributed primarily to a combination of biosolids management, biological assimilation, and/or occasional load reduction in the activated sludge system.
  - The phosphorus load reduction across the plant ranges from approximately 25 to 50 percent. Such a load reduction is attributed to a combination of biological assimilation for growth, chemical precipitation, biosolids management, and biological removal.
- Discharge
  - The wet season average monthly flow values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
  - Based on the average monthly values table below, there is an emerging dry season downward trend for flows and NOx (nitrite + nitrate) loads. There is an emerging dry season upward trend for TIN loads.
  - TIN loads generally increase with flow during wet weather events.
  - Ammonia is the majority of the nitrogen species discharged, regardless of season. This would be expected since they do not nitrify.
  - Ammonia loads are occasionally greater than TIN loads, and TIN monthly loads occasionally differ from the sum of Ammonia and NOx monthly loads. This is attributed to sampling frequency, whereby ammonia is sampled daily and other nitrogen species bimonthly.
  - Total phosphorus concentrations range from 1.3 to 9 mg P/L, which suggests a portion of P might be removed as typical effluent TP concentrations are 4 to 6 mg P/L. The majority of the samples fall within the typical effluent TP concentrations though so the occasional lower concentrations might be sampling artifacts.

Influent

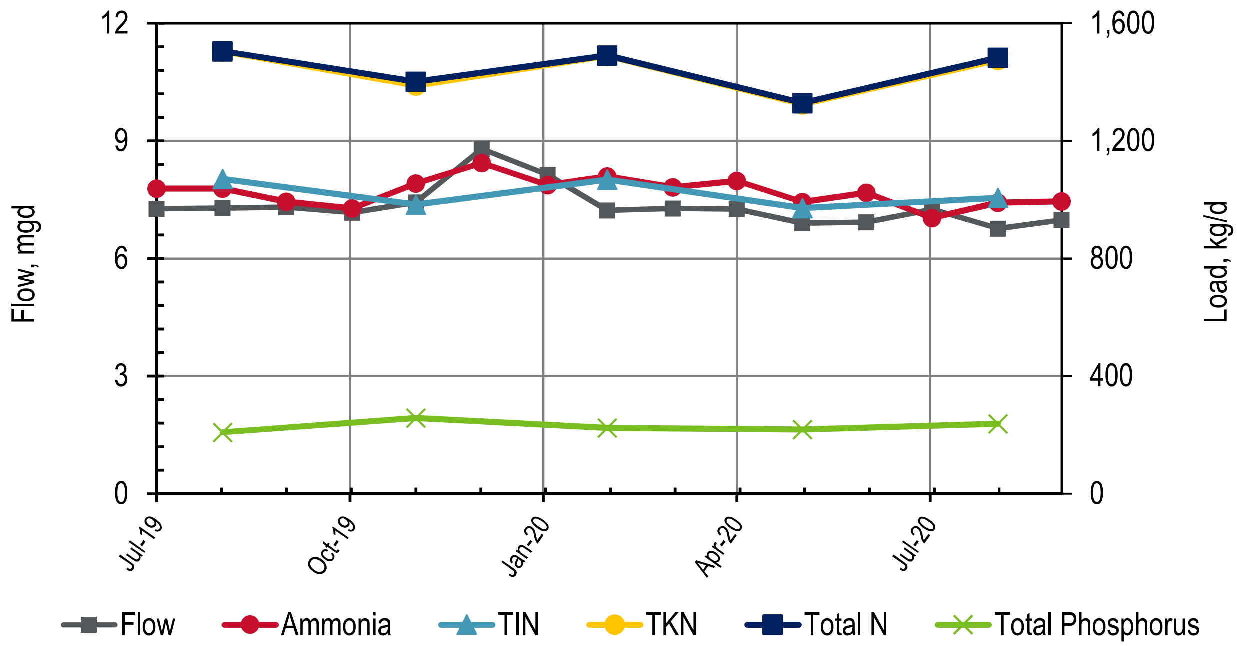

Figure 28-1. Influent: South SF-San Bruno Monthly Flows and Loads

Note: the ammonia/TIN loads and TKN/Total N loads are comparable. The ammonia and TKN values are located behind TIN and Total N load lines, respectively.

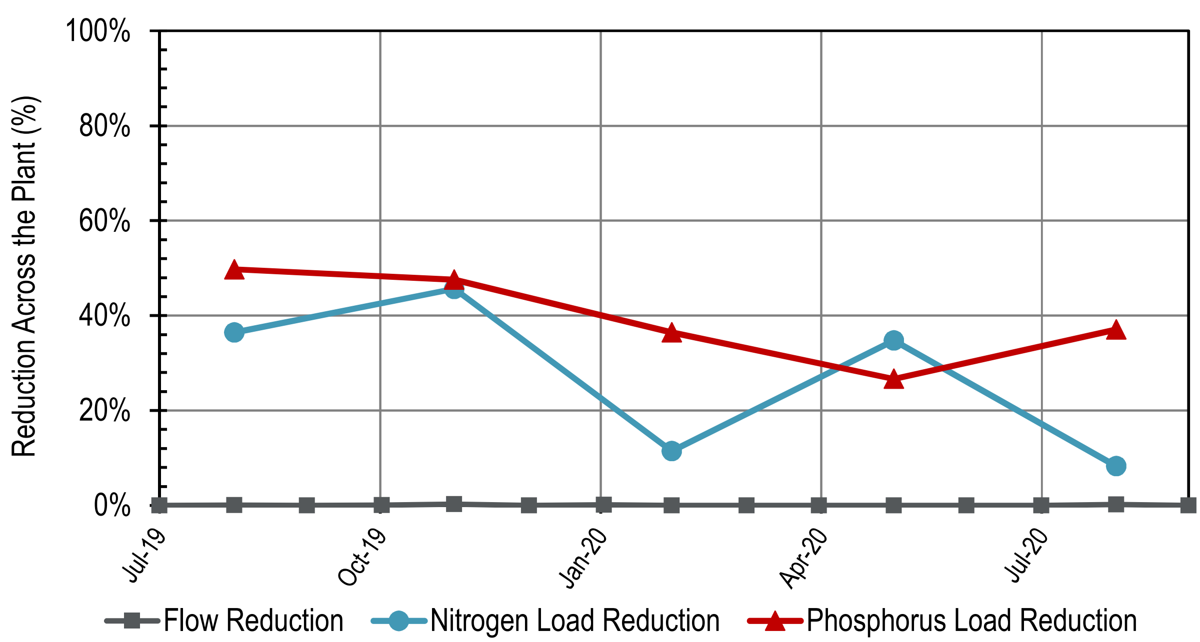

Figure 28-2. Influent: South SF-San Bruno Monthly Reductions Across the Plant

Note: Influent TN was compared against Discharge TIN for calculating nitrogen load reduction.

Table 28-1. Influent: South SF-San Bruno Monthly Flows and Loads*

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN **	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	7.27	1,040	--	--	--	--	--
Aug-19	7.29	1,040	1.11	1,070	1,500	1,510	209
Sep-19	7.32	994	--	--	--	--	--
Oct-19	7.17	971	--	--	--	--	--
Nov-19	7.43	1,060	13.3	984	1,390	1,400	257
Dec-19	8.80	1,120	--	--	--	--	--
Jan-20	8.14	1,050	--	--	--	--	--
Feb-20	7.23	1,080	1.10	1,070	1,490	1,490	223
Mar-20	7.28	1,040	--	--	--	--	--
Apr-20	7.26	1,060	--	--	--	--	--
May-20	6.91	992	4.41	972	1,320	1,330	218
Jun-20	6.93	1,020	--	--	--	--	--
Jul-20	7.26	938	--	--	--	--	--
Aug-20	6.76	990	7.09	1,010	1,480	1,480	238
Sep-20	6.98	995	--	--	--	--	--
Dry Season Average	**7.09**	**1,000**	**4.21**	**1,020**	**1,430**	**1,440**	**222**
Dry Season Trend * **	**Down**	**None**	***	***	***	***	***
Wet Season Average	**7.62**	**1,060**	**7.21**	**1,030**	**1,440**	**1,450**	**240**
Average Annual	**7.33**	**1,030**	**5.41**	**1,020**	**1,440**	**1,440**	**229**

* South SF-San Bruno typically samples more than the required influent ammonia quarterly sampling. This dataset includes this additional sampling.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis. Insufficient samples to perform statistical trending on nutrient loads (except for ammonia)

Discharge

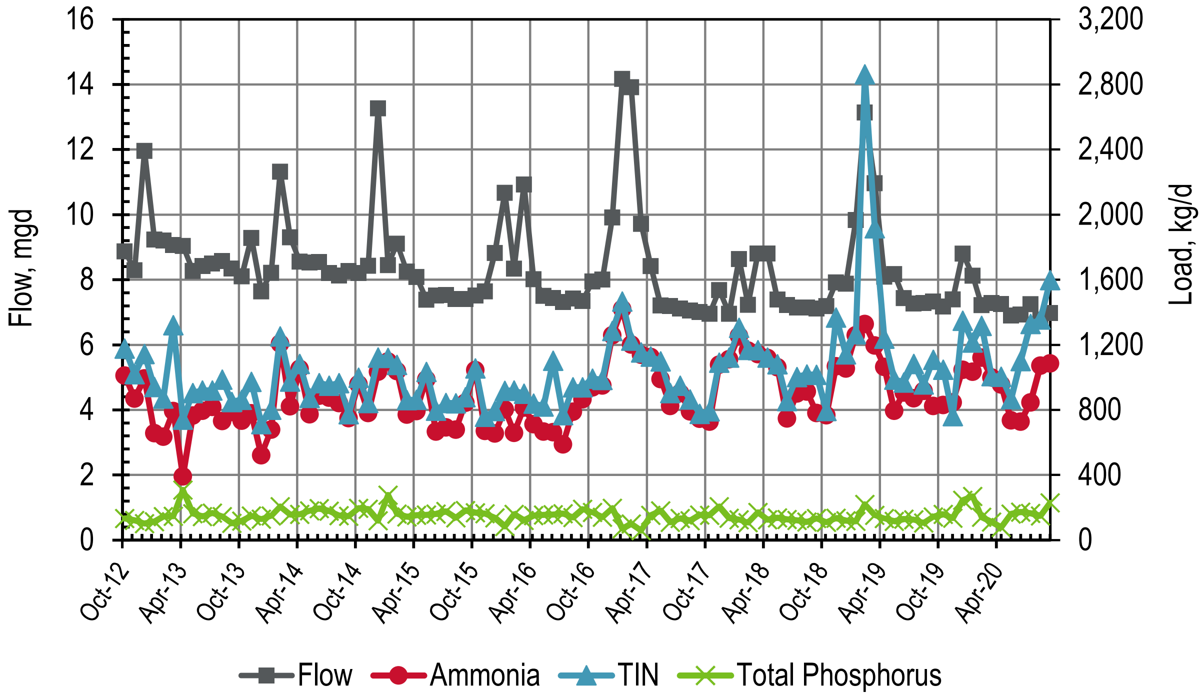

Figure 28-3. Discharge: South SF-San Bruno Monthly Flows and Loads

Table 28-2. Discharge: South SF-San Bruno Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	8.88	1,010	164	1,180	134
Nov-12	8.30	870	151	1,020	121
Dec-12	12.0	995	149	1,140	101
Jan-13	9.24	658	284	942	114
Feb-13	9.21	637	233	870	144
Mar-13	9.08	793	527	1,320	147
Apr-13	9.04	393	349	742	308
May-13	8.28	766	139	905	162
Jun-13	8.43	797	124	920	145
Jul-13	8.51	820	99.6	919	167
Aug-13	8.58	733	254	986	144
Sep-13	8.35	789	59.9	849	104
Oct-13	8.11	736	127	862	118
Nov-13	9.29	779	193	972	149
Dec-13	7.65	523	191	714	130

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Jan-14	8.21	681	121	802	150
Feb-14	11.3	1,210	42.7	1,250	206
Mar-14	9.31	824	150	975	157
Apr-14	8.56	1,050	29.4	1,080	160
May-14	8.53	774	100	874	181
Jun-14	8.55	889	77.4	966	194
Jul-14	8.22	876	74.4	950	178
Aug-14	8.13	844	122	966	151
Sep-14	8.28	752	22.8	774	147
Oct-14	8.22	960	39.2	999	197
Nov-14	8.43	783	59.7	843	191
Dec-14	13.3	1,040	87.7	1,120	119
Jan-15	8.45	1,100	23.5	1,120	276
Feb-15	9.11	1,040	36.8	1,080	162
Mar-15	8.26	774	88.0	861	144
Apr-15	8.09	794	68.5	863	152
May-15	7.39	989	45.2	1,030	155
Jun-15	7.52	669	127	796	162
Jul-15	7.54	693	150	843	178
Aug-15	7.41	680	161	842	138
Sep-15	7.42	845	34.1	879	182
Oct-15	7.52	1,050	10.9	1,060	169
Nov-15	7.64	673	86.8	759	164
Dec-15	8.83	657	137	794	138
Jan-16	10.7	803	115	919	85.0
Feb-16	8.35	661	258	919	159
Mar-16	10.9	817	82.8	899	122
Apr-16	8.02	714	125	839	152
May-16	7.51	668	153	822	155
Jun-16	7.44	665	438	1,100	158
Jul-16	7.31	590	178	768	164
Aug-16	7.42	791	149	940	140
Sep-16	7.35	868	73.0	940	191
Oct-16	7.95	940	53.3	993	171
Nov-16	8.01	951	34.1	986	140
Dec-16	9.92	1,260	25.5	1,290	197
Jan-17	14.2	1,420	44.9	1,470	70.8

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Feb-17	13.9	1,200	24.9	1,230	101
Mar-17	9.73	1,140	11.9	1,150	58.9
Apr-17	8.43	1,130	2.79	1,130	152
May-17	7.22	990	108	1,100	181
Jun-17	7.21	826	78.7	904	110
Jul-17	7.12	904	44.6	949	134
Aug-17	7.06	793	72.4	865	119
Sep-17	7.02	748	28.4	776	154
Oct-17	6.96	730	62.2	792	154
Nov-17	7.68	1,080	10.9	1,090	205
Dec-17	6.96	1,110	10.1	1,120	135
Jan-18	8.64	1,260	48.2	1,310	125
Feb-18	7.23	1,170	3.93	1,170	108
Mar-18	8.81	1,140	23.5	1,170	172
Apr-18	8.82	1,120	3.25	1,120	125
May-18	7.39	1,060	17.7	1,080	138
Jun-18	7.24	749	105	855	129
Jul-18	7.15	901	51.9	1,000	122
Aug-18	7.15	913	31.7	1,020	113
Sep-18	7.12	783	39.0	1,020	134
Oct-18	7.19	769	45.7	794	110
Nov-18	7.92	1,070	30.6	1,370	135
Dec-18	7.88	1,060	20.7	1,140	119
Jan-19	9.84	1,260	20.0	1,270	116
Feb-19	13.1	1,330	17.4	2,860	220
Mar-19	11.0	1,200	18.0	1,920	153
Apr-19	8.10	1,070	23.3	1,240	133
May-19	8.17	795	66.4	987	116
Jun-19	7.44	909	26.8	969	129
Jul-19	7.27	873	61.1	1,080	126
Aug-19	7.28	919	24.5	957	105
Sep-19	7.34	826	38.3	1,110	144
Oct-19	7.17	832	57.7	1,050	159
Nov-19	7.41	846	84.4	762	135
Dec-19	8.81	1,050	63.9	1,350	245
Jan-20	8.13	1,040	23.4	1,220	269
Feb-20	7.23	1,120	11.8	1,320	142

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Mar-20	7.28	1,000	13.9	1,010	112
Apr-20	7.26	957	77.0	1,000	79.3
May-20	6.91	738	86.7	867	160
Jun-20	6.94	730	104	1,100	173
Jul-20	7.26	848	170	1,330	165
Aug-20	6.75	1,070	26.2	1,360	150
Sep-20	6.99	1,090	12.3	1,600	230
Dry Season Average	**7.55**	**824**	**94.4**	**975**	**151**
Dry Season Trend**	**Down**	**None**	**Down**	**Up**	**None**
Wet Season Average	**8.92**	**951**	**85.7**	**1,090**	**150**
Average Annual	**8.35**	**898**	**89.3**	**1,040**	**150**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.
** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

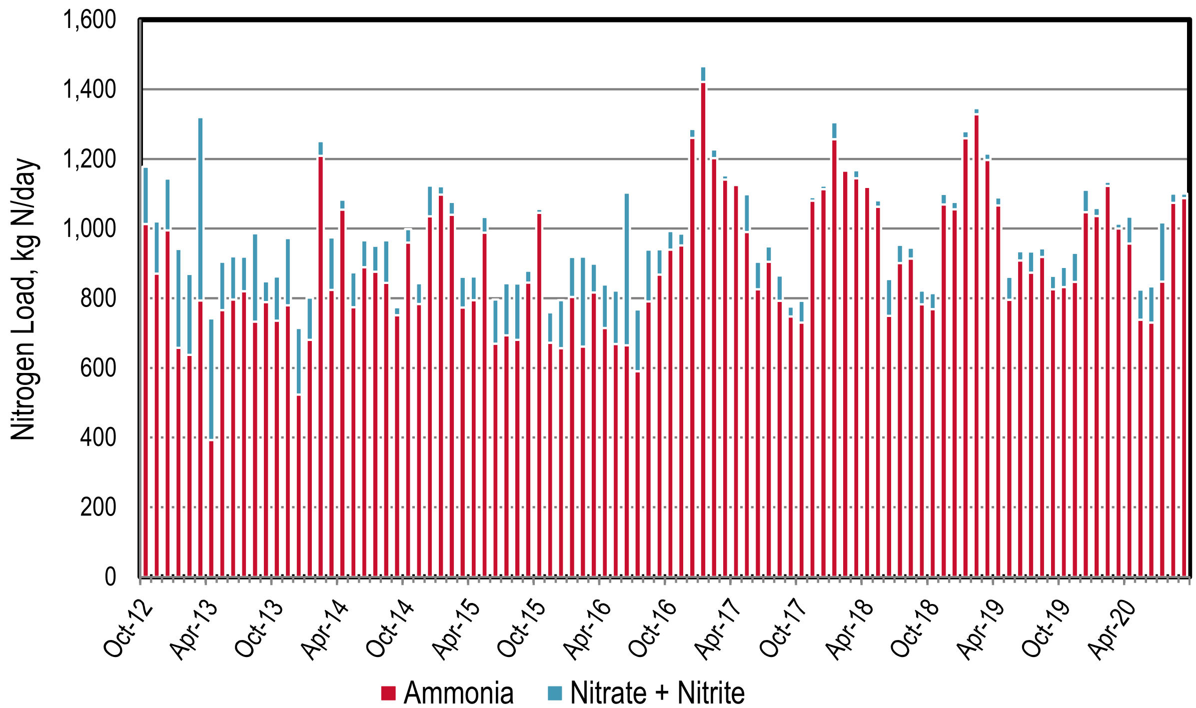

Figure 28-4. Discharge: South SF-San Bruno Monthly Nitrogen Loads

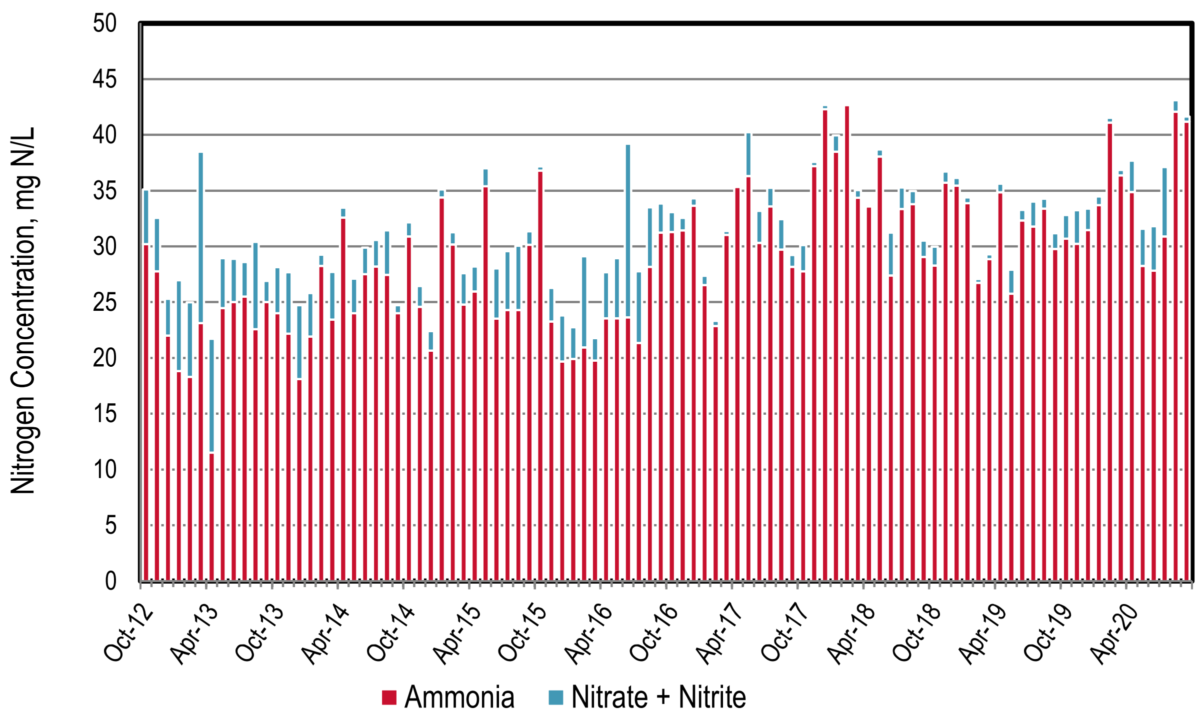

Figure 28-5. Discharge: South SF-San Bruno Monthly Nitrogen Concentrations

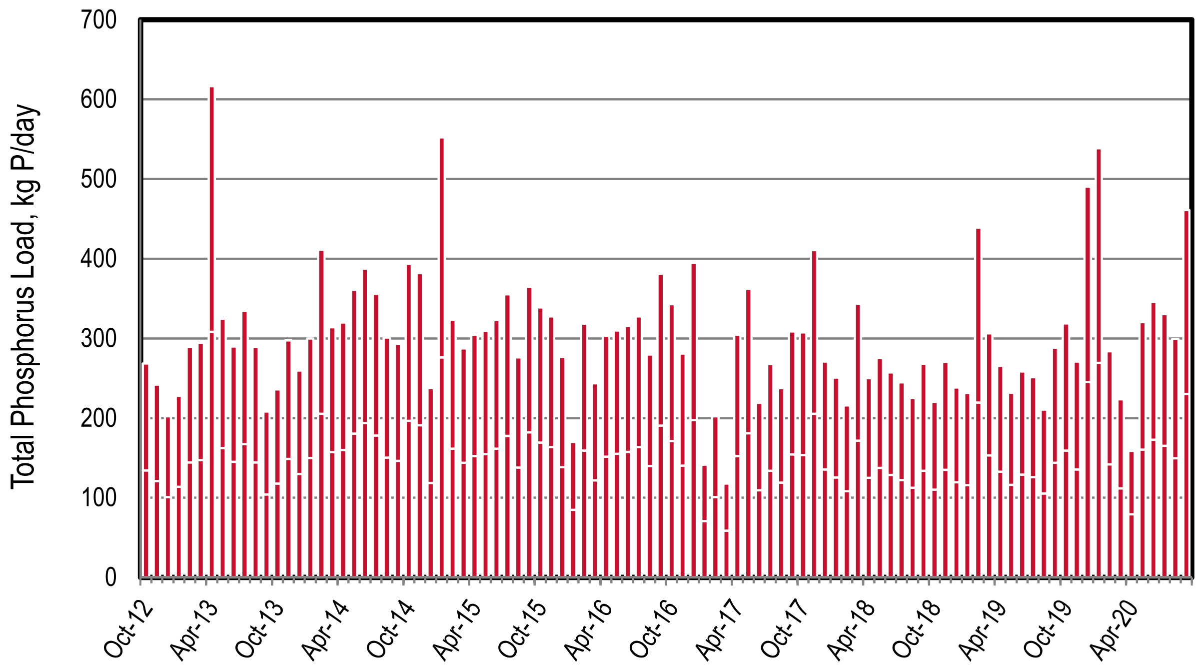

Figure 28-6. Discharge: South SF-San Bruno Monthly Phosphorus Loads

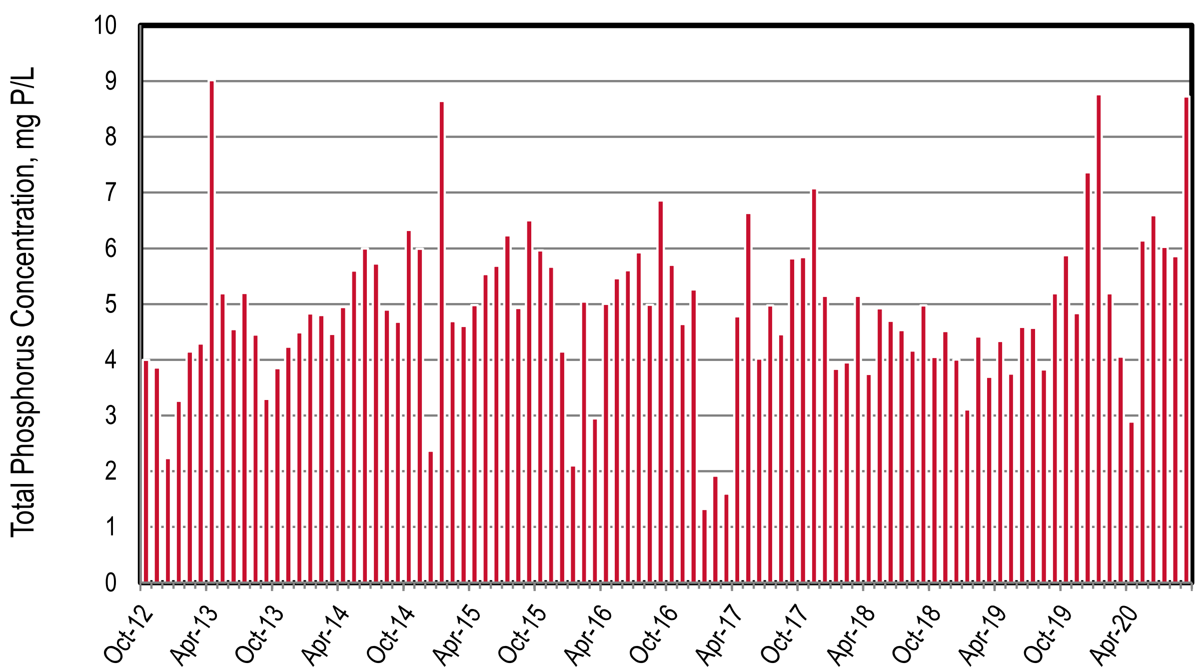

Figure 28-7. Discharge: South SF-San Bruno Monthly Phosphorus Concentrations

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29 City of Sunnyvale

Sunnyvale discharges to a tributary of the Lower South Bay. It has approximately 28,300 service connections with a permitted ADWF capacity of 29.5 mgd and a peak wet weather flow capacity of 40 mgd. The permitted ADWF capacity will be reduced to 19.5 mgd as part of the ongoing plant upgrades design. The current discharge flows are approximately 8.6 mgd ADWF. This value excludes effluent that is diverted to Sunnyvale's recycling water network. The plant currently nitrifies using oxidation ponds followed by nitrifying trickling filters and has filtration. Significant denitrification occurs in the oxidation ponds primarily during the ADWF period.

The following observations are made based upon the figures and table in the subsequent pages:

- Influent and Reduction Across the Plant
    - Note: limited to data since July 2019; quarterly required but more provided for various parameters.
    - Based on the limited average monthly values table below, there is an emerging dry season downward trend for flow.
    - The flow reduction across the plant ranges is upwards of approximately 50 percent. The reduction is attributed to a combination of recycled water, evaporation in the ponds, and/or biosolids management.
    - The nitrogen load reduction values across the plant ranges from approximately 30 to 90 percent. This load reduction is attributed primarily to biological assimilation, biosolids management, load reduction in the ponds, and load diversion with recycled water.
    - The phosphorus load reduction across the plant ranges from approximately 0 to 65 percent. This load reduction is attributed primarily to biological assimilation, chemical precipitation, and load diversion associated with recycled water.
- Discharge
    - The wet season average monthly flow values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
    - Based on the average monthly values table below, there do not appear to be any emerging dry season trends for any of the parameters considered. Seasonal flow variation is attributed to rainfall inputs to and evaporation from the oxidation ponds and recycled water production.
    - Nitrogen and phosphorus loads typically increase with flow during wet weather events and are typically greater and more variable than the dry season loads.
    - The trickling filters typically experience a decline in performance during colder months as evidenced by occasional ammonia spikes. This is a common phenomenon for nitrifying trickling filters exacerbated by occasional cold temperatures in the oxidation ponds.
    - The plant has seasonal denitrification as evidenced by ADWF TIN values that typically range from 10 to 20 mg N/L as compared with the 50 to 60 mg N/L measured in the influent. Denitrification occurs in the oxidation ponds during the summer months.

- NOx is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant nitrifies year-round (except for colder months, when only partial nitrification occurs).
- Total phosphorus concentrations are wide ranging, from approximately 2.3 to 10.2 mg P/L.

Influent

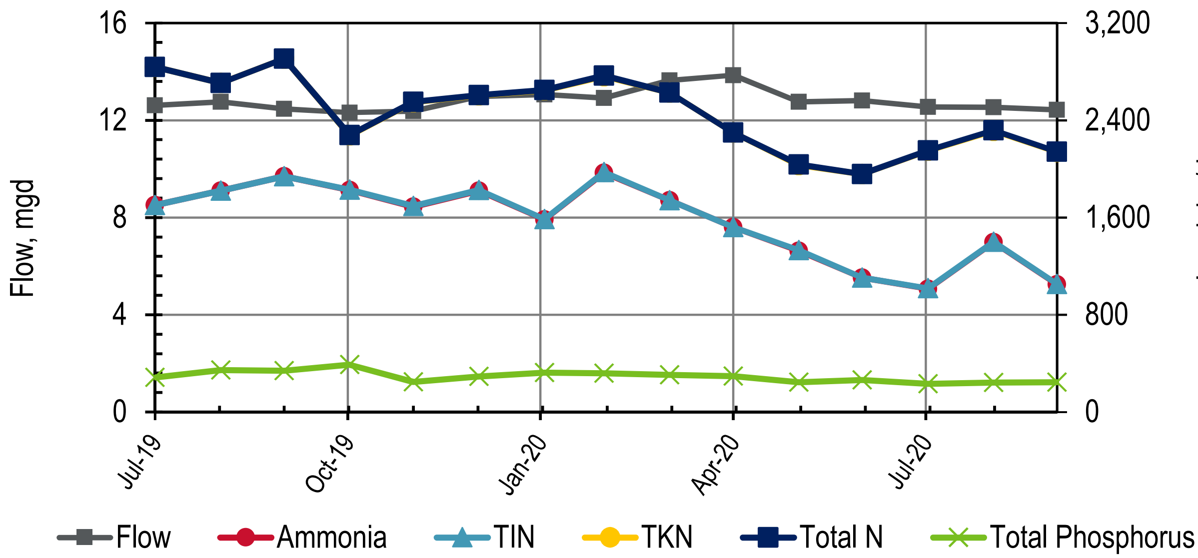

Figure 29-1. Influent: Sunnyvale Monthly Flows and Loads

Note: the ammonia/TIN loads and TKN/Total N loads are comparable. The ammonia and TKN values are located behind TIN and Total N load lines, respectively.

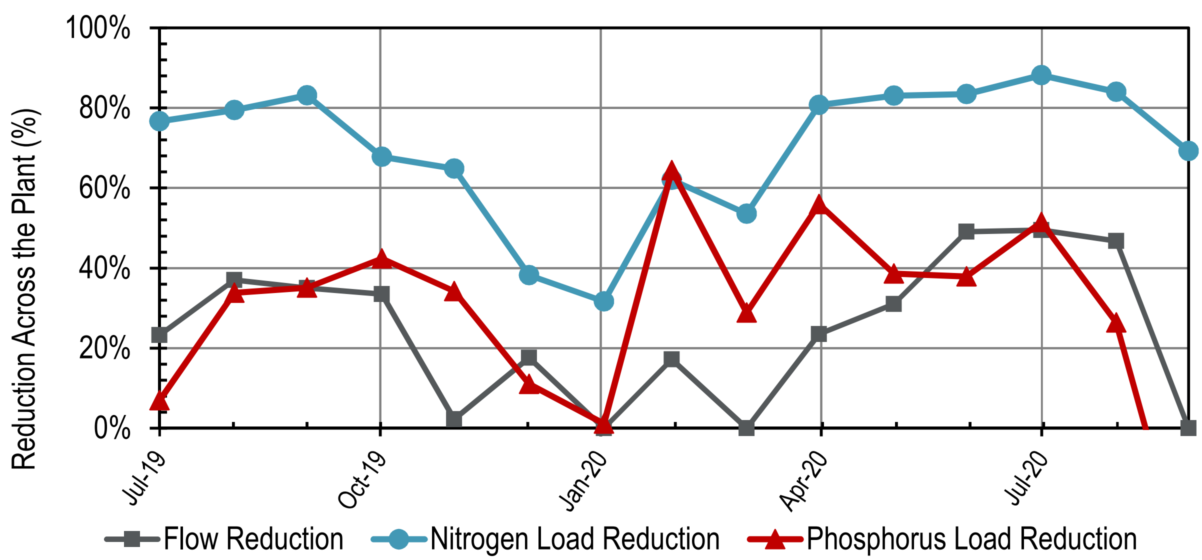

Figure 29-2. Influent: Sunnyvale Monthly Reductions Across the Plant

Note: Influent TN was compared against Discharge TIN for calculating nitrogen load reduction.

Table 29-1. Influent: Sunnyvale Monthly Flows and Loads*

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	12.6	1,700	--	1,700	2,840	2,840	284
Aug-19	12.8	1,820	--	1,820	2,710	2,710	344
Sep-19	12.5	1,940	--	1,940	2,910	2,910	339
Oct-19	12.3	1,830	1.70	1,830	2,280	2,280	389
Nov-19	12.4	1,690	4.22	1,690	2,550	2,550	246
Dec-19	13.0	1,820	4.43	1,830	2,600	2,610	292
Jan-20	13.1	1,580	1.23	1,590	2,650	2,650	324
Feb-20	12.9	1,970	4.96	1,970	2,760	2,770	318
Mar-20	13.6	1,740	0.394	1,740	2,630	2,630	307
Apr-20	13.9	1,520	--	1,520	2,300	2,300	295
May-20	12.8	1,330	4.29	1,330	2,030	2,040	246
Jun-20	12.8	1,100	0.388	1,110	1,960	1,960	263
Jul-20	12.6	1,010	3.29	1,020	2,150	2,150	231
Aug-20	12.5	1,400	3.50	1,400	2,310	2,320	242
Sep-20	12.4	1,050	3.22	1,050	2,140	2,140	246
Dry Season Average	**12.6**	**1,420**	**2.94**	**1,420**	**2,380**	**2,380**	**274**
Dry Season Trend * **	**None**	***	***	***	***	***	***
Wet Season Average	**13.0**	**1,740**	**2.82**	**1,740**	**2,540**	**2,540**	**310**
Average Annual	**12.8**	**1,570**	**2.87**	**1,570**	**2,450**	**2,460**	**291**

* Sunnyvale typically samples more than the required influent quarterly nutrient sampling. This dataset includes this additional sampling.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis. The dataset is too limited for a statistical trending analysis at this stage.

Discharge

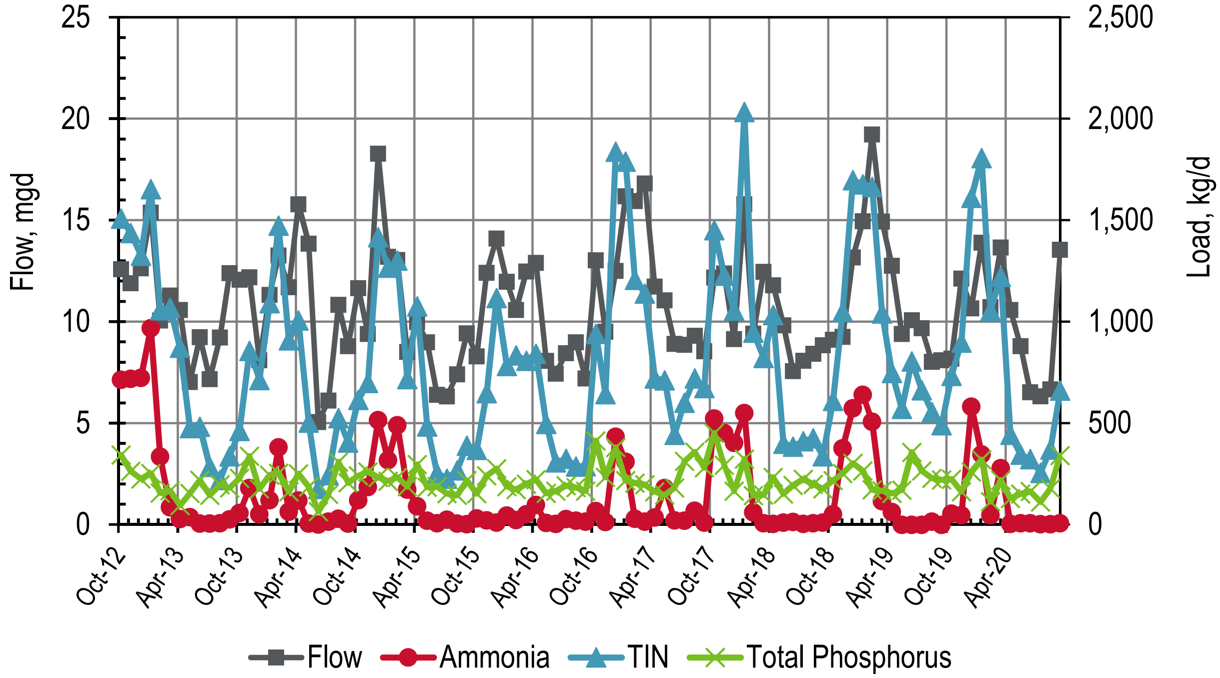

Figure 29-3. Discharge: Sunnyvale Monthly Flows and Loads

Table 29-2. Discharge: Sunnyvale Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	12.6	714	795	1,510	343
Nov-12	11.9	719	718	1,440	263
Dec-12	12.6	724	600	1,320	226
Jan-13	15.4	968	685	1,650	252
Feb-13	10.1	336	720	1,060	155
Mar-13	11.3	86.3	983	1,070	167
Apr-13	10.6	28.8	844	872	94.3
May-13	7.04	37.9	439	477	154
Jun-13	9.25	5.51	477	482	220
Jul-13	7.19	5.62	279	285	145
Aug-13	9.23	8.30	212	220	198
Sep-13	12.4	26.7	310	337	181
Oct-13	12.6	58.5	404	463	228
Nov-13	11.9	181	675	856	338
Dec-13	12.6	52.4	661	714	177
Jan-14	15.4	121	971	1,090	244

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Feb-14	10.1	382	1,090	1,470	254
Mar-14	11.3	64.7	843	908	162
Apr-14	10.6	120	887	1,010	251
May-14	7.04	5.24	498	503	185
Jun-14	9.25	1.91	175	177	64.4
Jul-14	6.12	16.2	228	244	149
Aug-14	10.8	29.5	495	524	309
Sep-14	8.81	6.36	399	405	206
Oct-14	11.7	120	495	615	241
Nov-14	9.40	186	512	698	260
Dec-14	18.3	515	901	1,420	234
Jan-15	13.2	319	948	1,270	214
Feb-15	13.1	491	811	1,300	234
Mar-15	8.52	173	544	717	187
Apr-15	9.99	91.1	985	1,080	297
May-15	8.99	19.9	465	485	184
Jun-15	6.40	7.57	246	253	188
Jul-15	6.33	25.5	201	227	152
Aug-15	7.41	6.27	262	268	145
Sep-15	9.43	3.37	386	390	217
Oct-15	8.29	30.5	338	368	152
Nov-15	12.4	21.0	627	648	241
Dec-15	14.1	10.9	1,110	1,120	276
Jan-16	12.0	45.8	737	783	188
Feb-16	10.6	23.8	810	834	173
Mar-16	12.5	51.5	756	808	200
Apr-16	12.9	97.9	744	842	222
May-16	8.08	9.09	488	497	155
Jun-16	7.44	4.69	303	308	166
Jul-16	8.45	28.3	296	324	192
Aug-16	8.99	20.0	267	287	183
Sep-16	7.22	16.0	273	289	165
Oct-16	13.0	68.1	872	940	413
Nov-16	9.51	13.2	631	644	233
Dec-16	12.5	434	1,400	1,840	380
Jan-17	16.2	310	1,480	1,790	217
Feb-17	16.0	29.0	1,180	1,210	205

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Mar-17	16.8	15.8	1,120	1,140	196
Apr-17	11.7	36.4	685	721	163
May-17	11.1	182	530	711	146
Jun-17	8.91	22.4	421	444	181
Jul-17	8.87	19.7	582	602	312
Aug-17	9.33	69.8	651	721	359
Sep-17	8.55	10.7	663	673	281
Oct-17	12.2	524	928	1,450	451
Nov-17	12.4	453	774	1,230	293
Dec-17	9.15	404	652	1,060	166
Jan-18	15.8	550	1,480	2,030	323
Feb-18	9.43	61.5	885	946	144
Mar-18	12.5	7.03	816	823	147
Apr-18	11.8	4.99	1,030	1,030	233
May-18	9.82	11.0	388	399	151
Jun-18	7.57	13.2	372	385	194
Jul-18	8.07	4.20	408	412	224
Aug-18	8.42	7.67	417	425	199
Sep-18	8.83	11.1	326	337	176
Oct-18	9.12	52.2	559	611	217
Nov-18	9.27	377	673	1,050	252
Dec-18	13.2	574	1,120	1,700	303
Jan-19	15.0	641	1,040	1,680	264
Feb-19	19.2	509	1,160	1,660	172
Mar-19	14.9	116	924	1,040	167
Apr-19	12.8	62.1	685	747	155
May-19	9.39	0	571	571	170
Jun-19	10.1	0	804	804	356
Jul-19	9.68	0	663	663	264
Aug-19	8.03	14.9	541	556	228
Sep-19	8.11	0	490	490	220
Oct-19	8.19	55.6	678	733	224
Nov-19	12.1	46.3	852	898	162
Dec-19	10.7	582	1,030	1,610	260
Jan-20	13.9	348	1,460	1,810	320
Feb-20	10.7	47.4	1,010	1,050	113
Mar-20	13.7	278	944	1,220	218

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Apr-20	10.6	4.76	438	443	130
May-20	8.81	6.90	338	345	151
Jun-20	6.52	6.84	317	324	163
Jul-20	6.34	2.93	252	255	112
Aug-20	6.67	3.39	366	370	178
Sep-20	13.6	6.86	653	660	340
Dry Season Average	**8.63**	**16.9**	**411**	**428**	**199**
Dry Season Trend **	**None**	**None**	**None**	**None**	**None**
Wet Season Average	**12.3**	**238**	**852**	**1,090**	**228**
Average Annual	**10.8**	**146**	**668**	**814**	**216**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

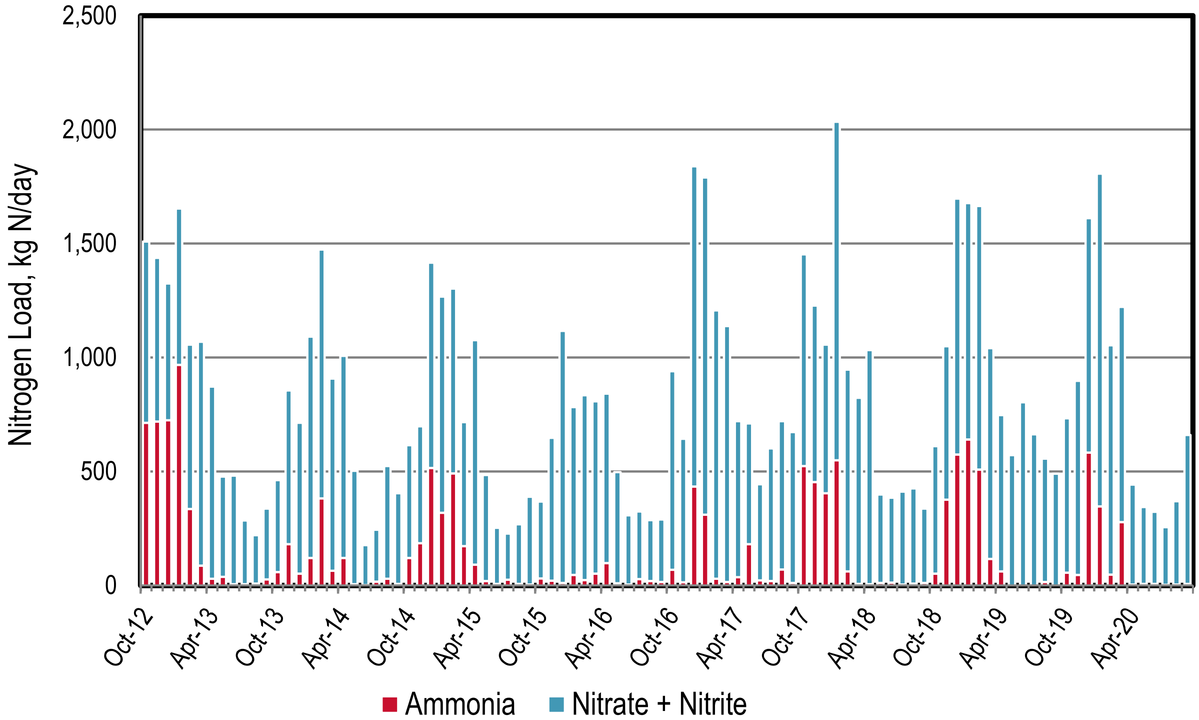

Figure 29-4. Discharge: Sunnyvale Monthly Nitrogen Loads

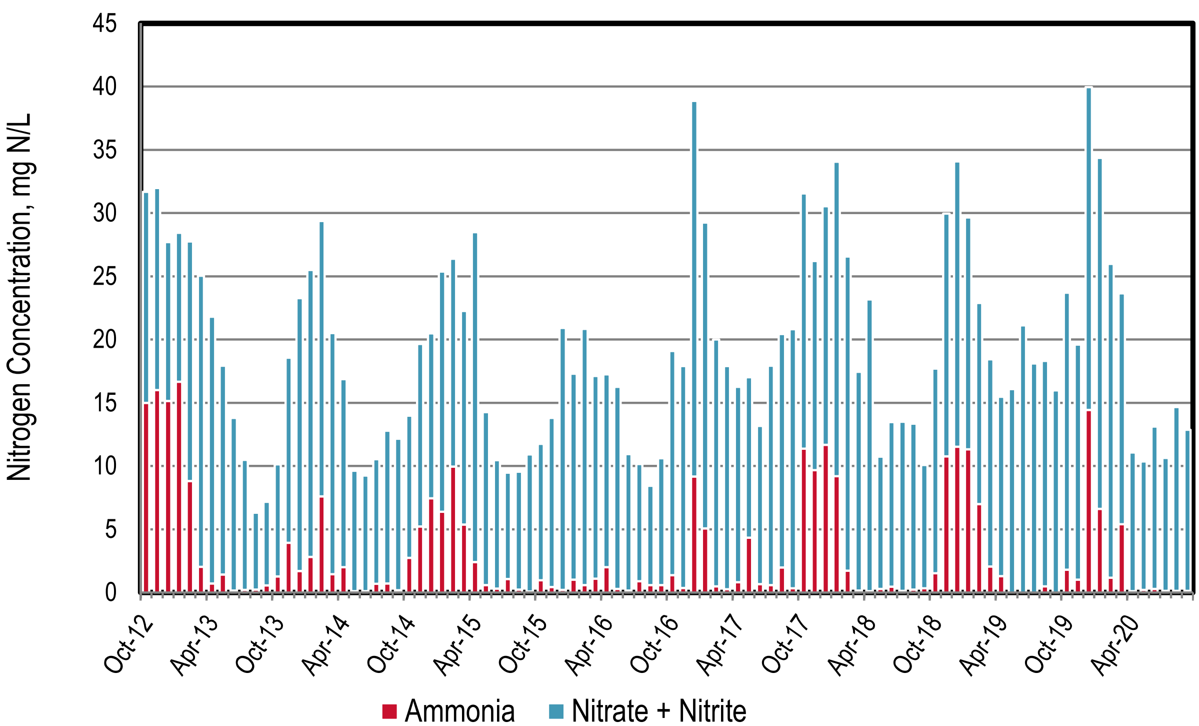

Figure 29-5. Discharge: Sunnyvale Monthly Nitrogen Concentrations

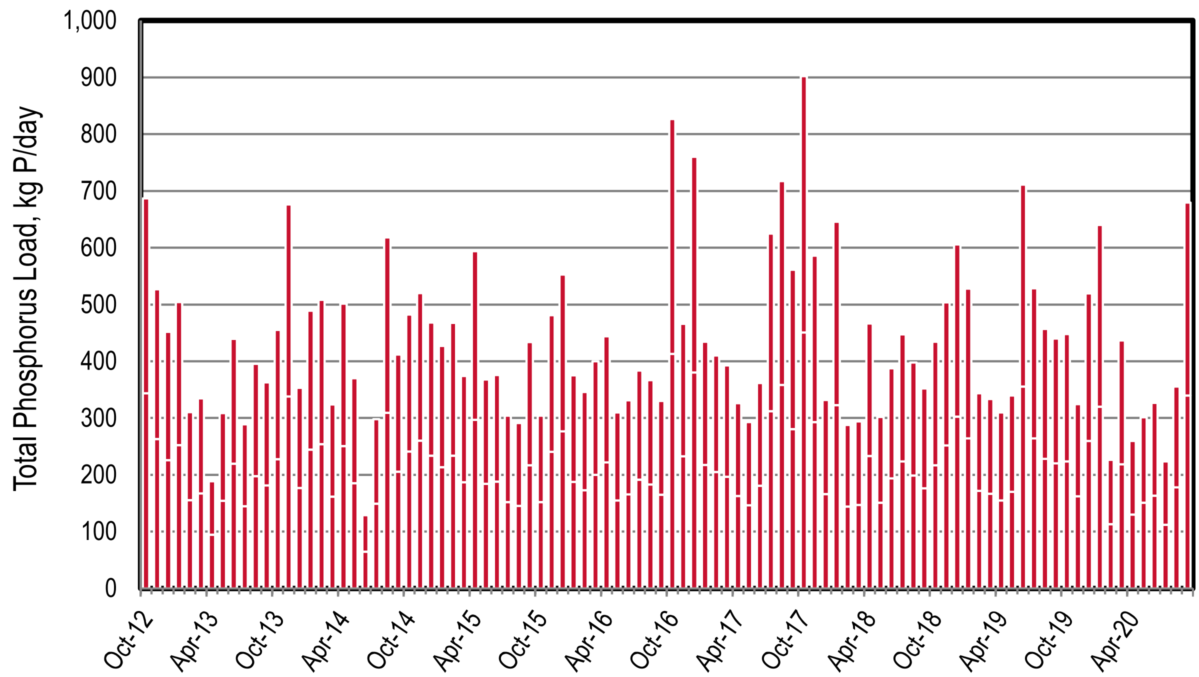

Figure 29-6. Discharge: Sunnyvale Monthly Phosphorus Loads

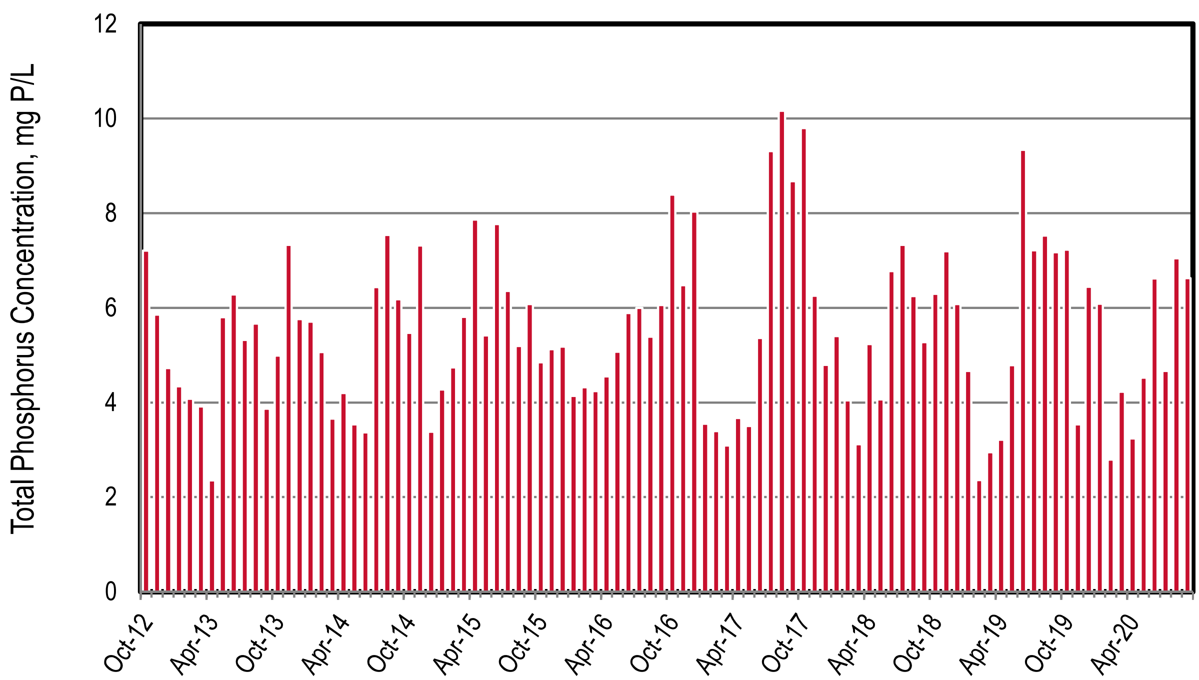

Figure 29-7. Discharge: Sunnyvale Monthly Phosphorus Concentrations

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30 Silicon Valley Clean Water (SVCW)

SVCW discharges to the South Bay. The plant services a population of approximately 200,000 and has a permitted ADWF capacity of 29 mgd. The current flows are approximately 12.3 mgd ADWF. The plant performs tertiary treatment using a trickling filter complemented with an activated sludge system followed by mono-media or dual-media filtration.

The following observations are made based upon the figures and table in the subsequent pages:

- Influent and Reduction Across the Plant
  - Note: limited to data since July 2019; quarterly required but more provided for various parameters.
  - Based on the limited average monthly values table below, there is an emerging dry season downward trend for flow, ammonia, TIN, TKN, and TN.
  - The flow reduction across the plant is negligible.
  - The nitrogen load reduction values across the plant is upwards of approximately 25 percent. This load reduction is attributed primarily to biological assimilation and biosolids management.
  - The phosphorus load reduction across the plant is upwards of approximately 50 percent. This load reduction is attributed primarily to a combination of chemical precipitation and biological assimilation.
- Discharge
  - The wet season average monthly flow values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
  - Based on the table with the average monthly values, there is an emerging slight upward dry season trend for flow, Ammonia, TIN, and total phosphorus. There is a slight downward trend for NOx loads.
  - Nitrogen loads typically increases with flow during wet weather events.
  - Nitrogen wet season loads are typically greater and more variable than the dry season loads. The plant is subjected to lower loads in the dry season and the warmer temperature lends itself to nitrifying a portion of the ammonia load.
  - Ammonia is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant does not nitrify.
  - Total phosphorus concentrations are wide ranging, from approximately 1.7 to 5.7 mg P/L. Typical effluent TP concentrations range from 4 to 6 mg P/L.

Influent

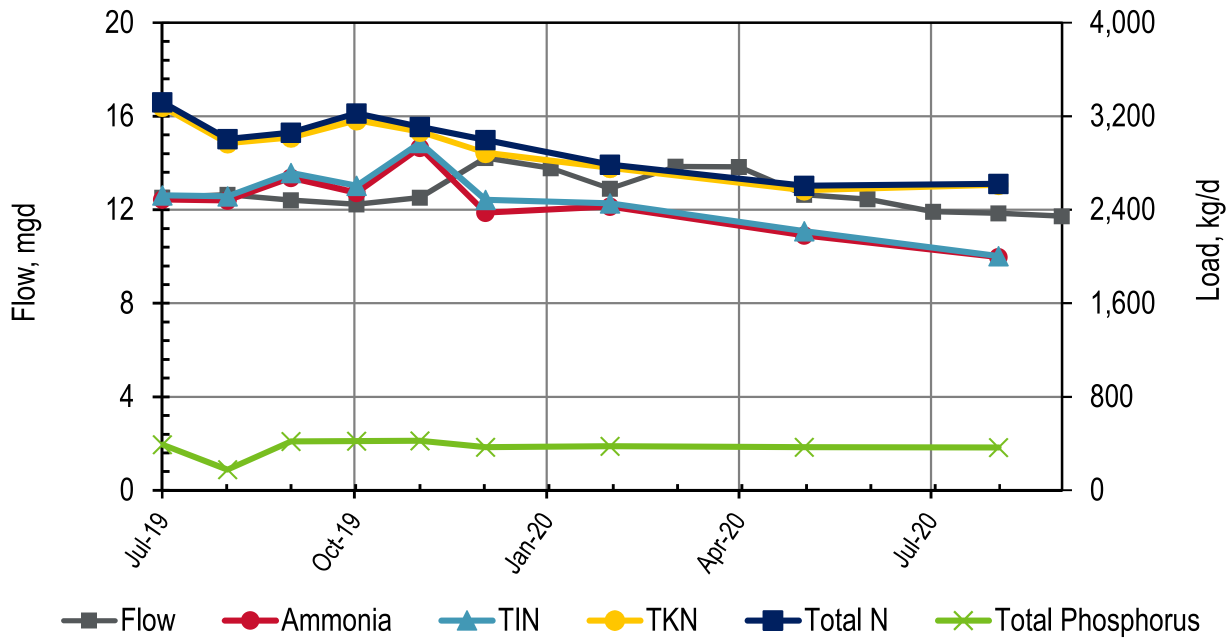

Figure 30-1. Influent: SVCW Monthly Flows and Loads

Note: the ammonia/TIN loads and TKN/Total N loads are comparable. The ammonia and TKN values are located behind TIN and Total N load lines, respectively.

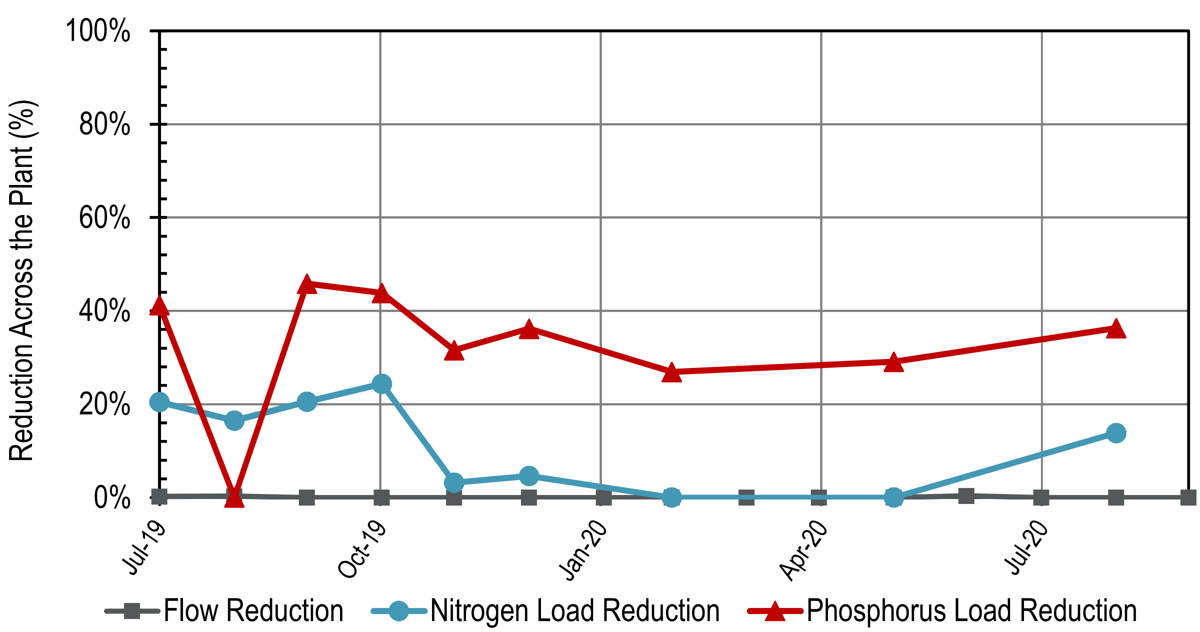

Figure 30-2. Influent: SVCW Monthly Reductions Across the Plant

Note: Influent TN was compared against Discharge TIN for calculating nitrogen load reduction.

Table 30-1. Influent: SVCW Monthly Flows and Loads*

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN **	TKN	Total N **	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	12.5	2,490	36.1	2,520	3,280	3,320	390
Aug-19	12.6	2,480	34.7	2,520	2,970	3,010	177
Sep-19	12.4	2,680	40.3	2,720	3,020	3,060	419
Oct-19	12.2	2,540	59.8	2,600	3,170	3,230	420
Nov-19	12.5	2,930	40.9	2,970	3,070	3,110	424
Dec-19	14.2	2,380	109	2,480	2,890	3,000	368
Jan-20	13.8	--	--	--	--	--	--
Feb-20	12.9	2,430	27.4	2,450	2,760	2,790	376
Mar-20	13.9	--	--	--	--	--	--
Apr-20	13.8	--	--	--	--	--	--
May-20	12.6	2,180	37.2	2,220	2,570	2,600	368
Jun-20	12.4	--	--	--	--	--	--
Jul-20	11.9	--	--	--	--	--	--
Aug-20	11.9	2,000	7.80	2,000	2,610	2,620	366
Sep-20	11.7	--	--	--	--	--	--
Dry Season Average	**12.3**	**2,360**	**31.2**	**2,400**	**2,890**	**2,920**	**344**
Dry Season Trend ***	**Down**	**Down**	**None**	**Down**	**Down**	**Down**	**None**
Wet Season Average	**13.3**	**2,570**	**59.3**	**2,630**	**2,970**	**3,030**	**397**
Average Annual	**12.8**	**2,460**	**43.7**	**2,500**	**2,930**	**2,970**	**368**

* SVCW typically samples more than the required influent ammonia quarterly sampling. This dataset includes this additional sampling.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

Discharge

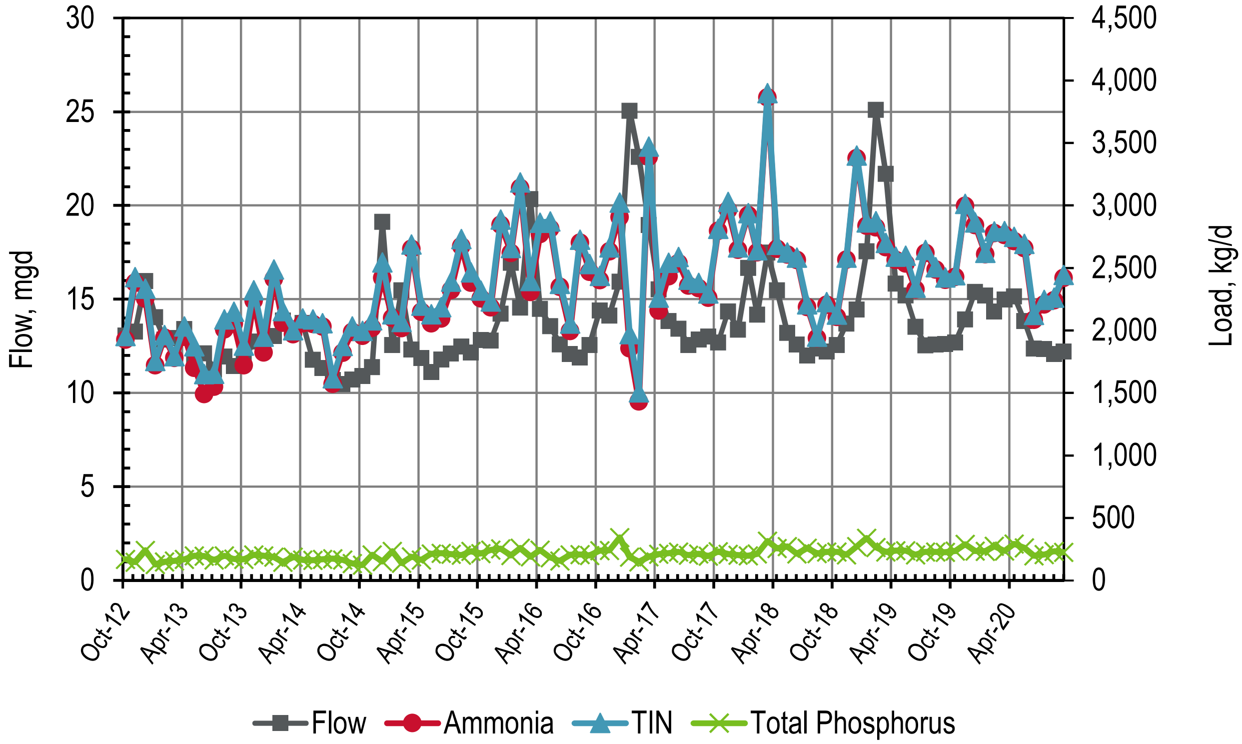

Figure 30-3. Discharge: SVCW Monthly Flows and Loads

Table 30-2. Discharge: SVCW Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	13.1	1,930	30.2	1,960	171
Nov-12	13.3	2,380	44.2	2,430	146
Dec-12	16.0	2,260	80.0	2,340	240
Jan-13	14.1	1,720	33.4	1,760	130
Feb-13	12.9	1,940	19.4	1,960	149
Mar-13	13.0	1,780	14.6	1,800	156
Apr-13	13.4	1,950	81.0	2,030	170
May-13	12.0	1,700	171	1,870	197
Jun-13	12.1	1,490	159	1,650	195
Jul-13	11.3	1,550	103	1,660	164
Aug-13	12.0	2,010	77.7	2,090	196
Sep-13	11.5	2,060	94.7	2,150	171
Oct-13	11.7	1,720	157	1,880	170
Nov-13	12.8	2,240	81.6	2,320	204

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Dec-13	12.7	1,820	127	1,950	198
Jan-14	13.0	2,420	74.1	2,490	187
Feb-14	13.9	2,060	94.0	2,160	147
Mar-14	13.3	1,970	32.4	2,000	188
Apr-14	13.8	2,060	38.7	2,100	164
May-14	11.8	2,050	35.4	2,090	163
Jun-14	11.3	2,030	24.4	2,060	169
Jul-14	10.7	1,580	43.4	1,620	174
Aug-14	10.5	1,820	54.2	1,880	163
Sep-14	10.7	1,990	45.4	2,030	136
Oct-14	10.9	1,960	38.9	2,000	123
Nov-14	11.4	2,020	59.4	2,080	206
Dec-14	19.1	2,420	122	2,550	152
Jan-15	12.6	2,100	28.0	2,130	233
Feb-15	15.5	2,020	48.6	2,070	138
Mar-15	12.3	2,660	32.8	2,690	189
Apr-15	11.9	2,150	47.7	2,200	165
May-15	11.1	2,060	71.8	2,130	214
Jun-15	11.8	2,100	91.6	2,190	219
Jul-15	12.1	2,320	67.9	2,390	--
Aug-15	12.5	2,680	57.2	2,730	204
Sep-15	12.2	2,380	81.9	2,470	233
Oct-15	12.8	2,260	62.6	2,320	215
Nov-15	12.8	2,190	46.9	2,230	243
Dec-15	14.2	2,850	39.8	2,890	253
Jan-16	16.9	2,620	40.3	2,660	200
Feb-16	14.6	3,140	42.5	3,190	260
Mar-16	20.3	2,310	87.8	2,400	189
Apr-16	14.5	2,770	89.3	2,860	243
May-16	13.6	2,820	57.8	2,870	182
Jun-16	12.6	2,350	23.6	2,370	158
Jul-16	12.1	2,000	61.0	2,060	206
Aug-16	11.9	2,700	23.1	2,730	209
Sep-16	12.6	2,470	60.9	2,530	199
Oct-16	14.4	2,400	32.6	2,440	239
Nov-16	14.1	2,630	32.1	2,670	242
Dec-16	15.9	2,910	115	3,020	344

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Jan-17	25.1	1,860	115	1,970	187
Feb-17	22.6	1,430	72.1	1,510	149
Mar-17	19.0	3,390	80.6	3,470	190
Apr-17	15.5	2,160	103	2,270	209
May-17	13.9	2,440	106	2,540	217
Jun-17	13.4	2,540	49.6	2,590	228
Jul-17	12.6	2,360	46.8	2,410	203
Aug-17	12.8	2,340	41.8	2,380	213
Sep-17	13.0	2,260	31.7	2,300	194
Oct-17	12.7	2,800	15.9	2,820	230
Nov-17	14.4	2,970	62.0	3,030	210
Dec-17	13.4	2,650	16.5	2,670	202
Jan-18	16.7	2,920	14.2	2,940	197
Feb-18	14.2	2,630	16.6	2,640	213
Mar-18**	17.5	3,870	33.7	3,900	315
Apr-18	15.5	2,660	29.2	2,690	256
May-18	13.2	2,610	16.7	2,630	272
Jun-18	12.6	2,570	20.0	2,590	212
Jul-18	12.0	2,190	21.4	2,210	259
Aug-18	12.4	1,940	12.3	1,950	216
Sep-18	12.2	2,210	21.5	2,230	228
Oct-18	12.6	2,110	17.6	2,130	228
Nov-18	13.7	2,570	13.8	2,580	205
Dec-18	14.5	3,380	18.8	3,400	271
Jan-19	17.6	2,840	24.4	2,870	338
Feb-19	25.1	2,830	46.9	2,870	265
Mar-19	21.7	2,670	32.9	2,700	228
Apr-19	15.8	2,570	23.7	2,590	238
May-19	15.2	2,540	61.4	2,600	238
Jun-19	13.5	2,330	11.8	2,340	205
Jul-19	12.5	2,620	23.2	2,640	229
Aug-19	12.6	2,490	17.5	2,510	228
Sep-19	12.6	2,410	19.0	2,430	227
Oct-19	12.7	2,430	12.4	2,440	236
Nov-19	13.9	3,000	15.8	3,010	290
Dec-19	15.4	2,840	20.1	2,860	235
Jan-20	15.2	2,610	10.9	2,620	233

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Feb-20	14.4	2,780	13.5	2,790	275
Mar-20	15.0	2,770	31.0	2,800	237
Apr-20	15.2	2,720	32.7	2,750	293
May-20	13.8	2,660	34.2	2,690	261
Jun-20	12.4	2,090	37.7	2,120	198
Jul-20	12.3	2,210	36.5	2,250	208
Aug-20	12.1	2,240	19.2	2,260	233
Sep-20	12.2	2,420	23.1	2,440	227
Dry Season Average	**12.3**	**2,240**	**51.4**	**2,290**	**206**
Dry Season Trend * **	**Up**	**Up**	**Down**	**Up**	**Up**
Wet Season Average	**15.0**	**2,450**	**49.0**	**2,500**	**214**
Average Annual	**13.9**	**2,360**	**50.0**	**2,410**	**211**

* The Total Inorganic Nitrogen value is calculated by adding the "Ammonia" and "Nitrate + Nitrite" values.

** One of the monthly nutrient sampling events (n=2) occurred during the maximum daily flow for that month. The loads are atypically high for this particular day due to a likely flushing phenomenon in the collection system.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

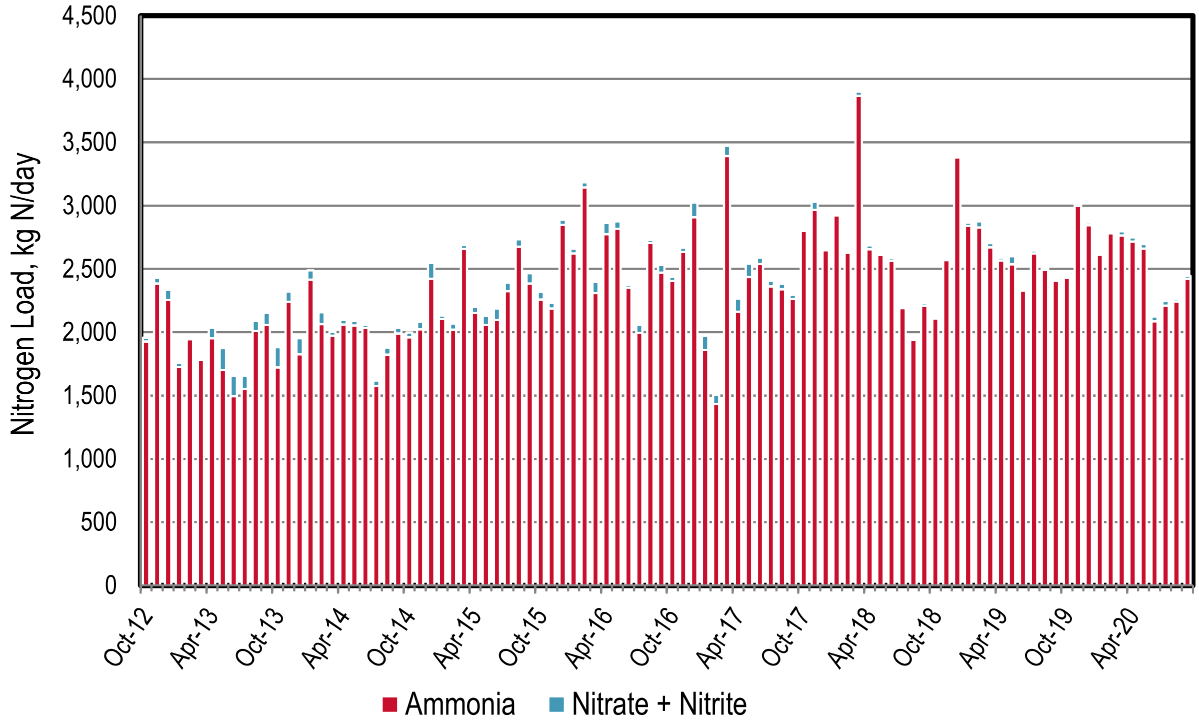

Figure 30-4. Discharge: SVCW Monthly Nitrogen Loads

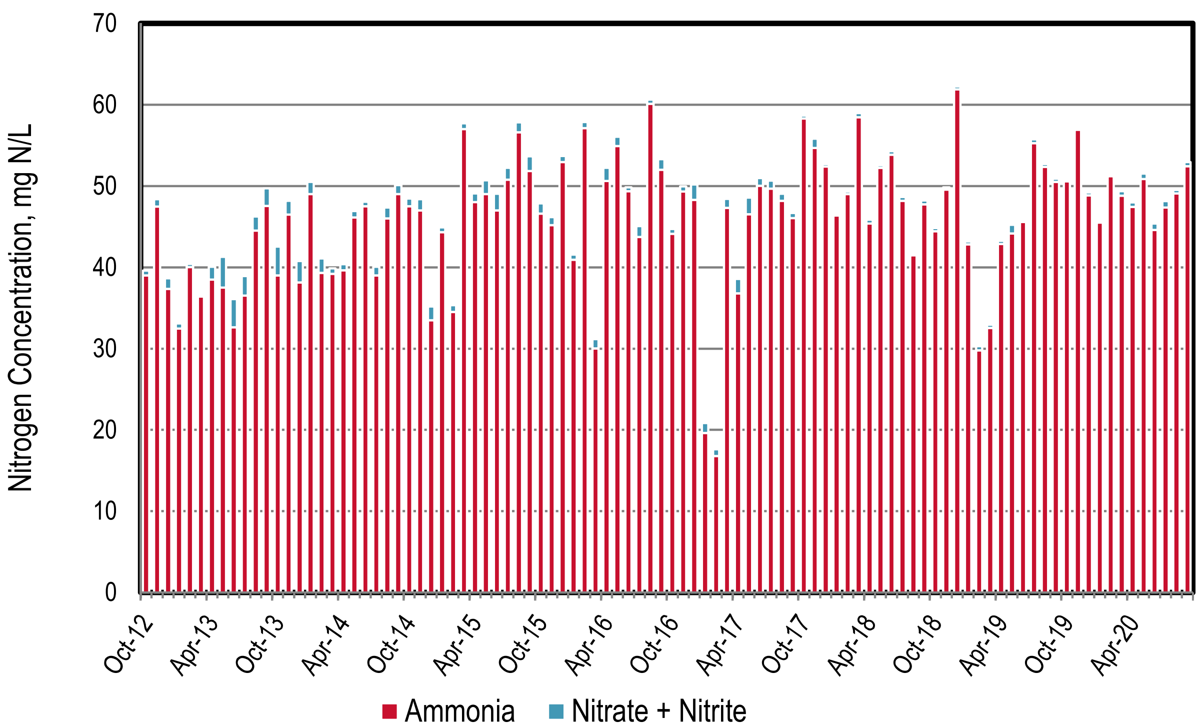

Figure 30-5. Discharge: SVCW Monthly Nitrogen Concentrations

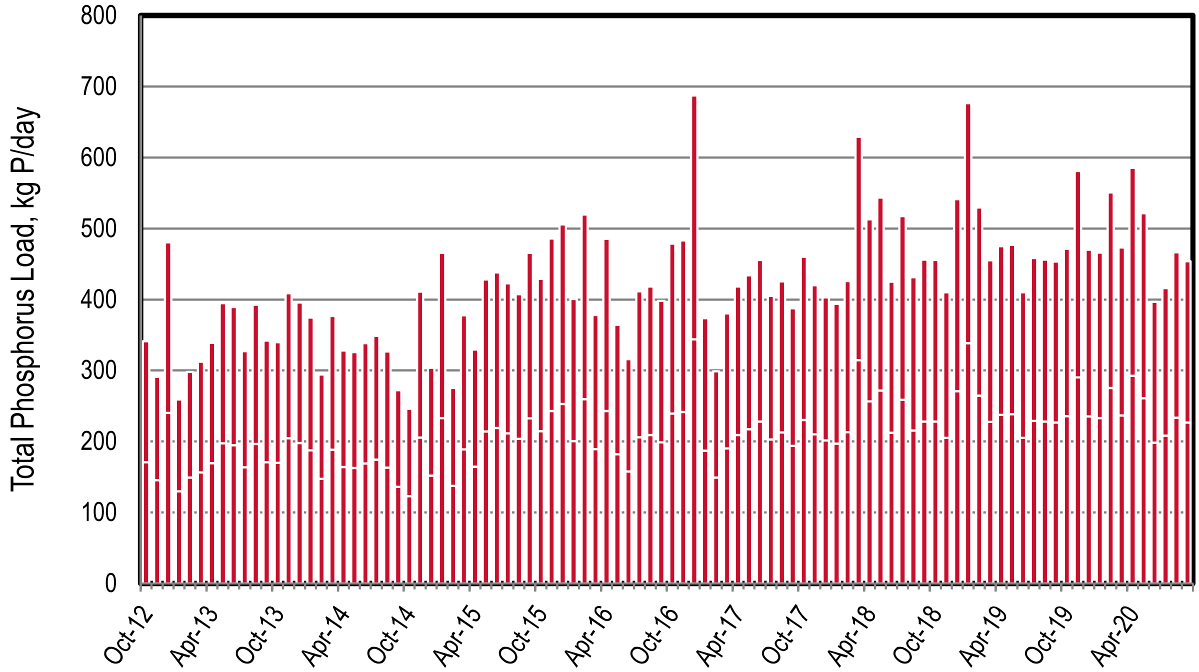

Figure 30-6. Discharge: SVCW Monthly Phosphorus Loads

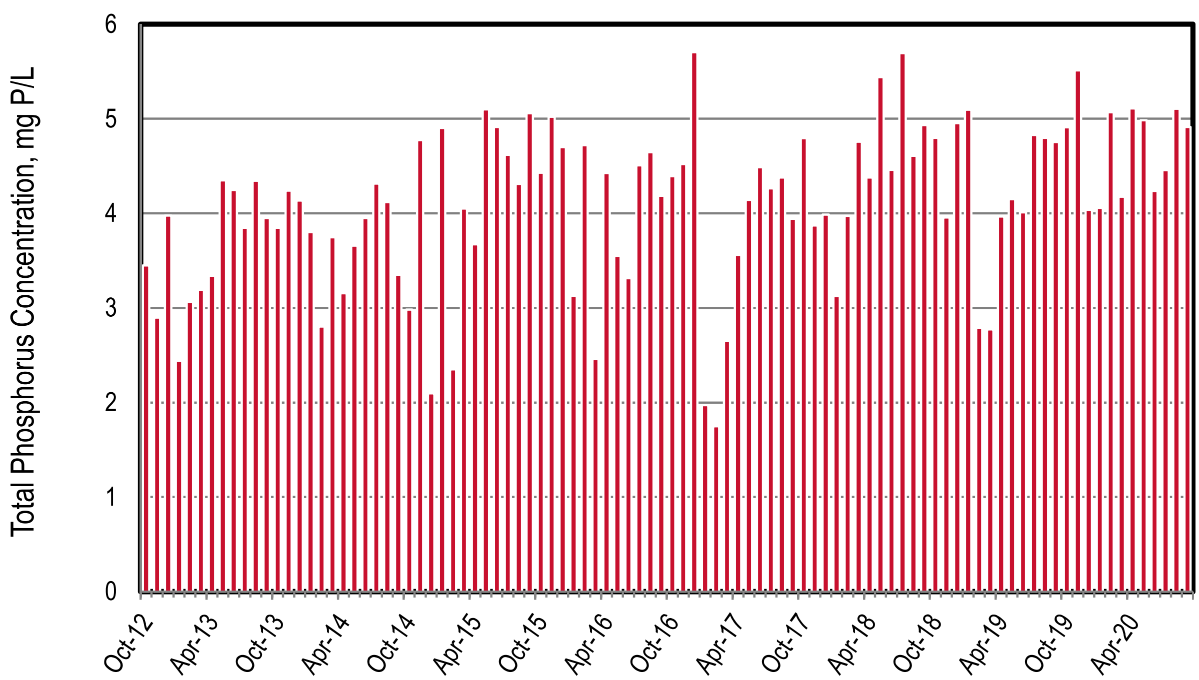

Figure 30-7. Discharge: SVCW Monthly Phosphorus Concentrations

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31 Sanitary District No. 5 of Marin County – Tiburon Treatment Plant

The Tiburon Treatment Plant discharges to the Central Bay. The service area has a population of approximately 8,400. The plant has a permitted ADWF capacity of 0.98 mgd and a peak wet weather capacity of 2.3 mgd. It has currents flows of approximately 0.54 mgd ADWF. The plant performs secondary treatment using an activated sludge treatment process.

The plant is classified as a minor discharger (<1 mgd permitted capacity) and thus not required to sample as frequently as the major dischargers (>1 mgd permitted capacity). The minor dischargers are required to sample twice per year under the Nutrient Watershed Permit. As a result, there are several months of nutrient data gaps.

The following observations are made based upon the figures and table in the subsequent pages:

- Flow values are provided over the entire study period. The remaining nutrient species only have monthly sampling for the first year of sampling, followed by occasional sampling thereafter (e.g., ammonia samples are more frequent).
- Based on the table with the average monthly values, there appears to be no emerging trend for flows (trends for nutrients not considered given the limited dataset).
- With the exception of January 2013, ammonia is the majority of the nitrogen species discharged, regardless of season. This would be expected since this plant does not nitrify.
- Total phosphorus concentrations are wide ranging from approximately 1.4 to 6.5 mg P/L. Typical effluent TP concentrations range from 4 to 6 mg P/L.

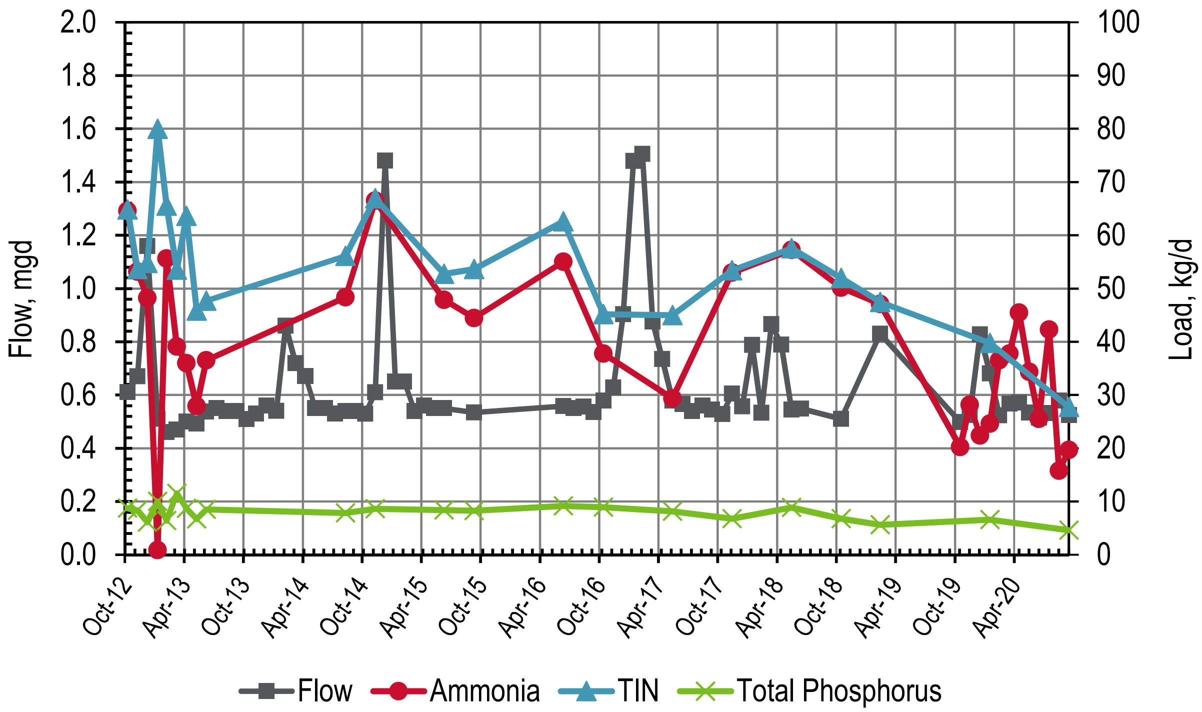

Figure 31-1. Discharge: Tiburon Monthly Flows and Loads

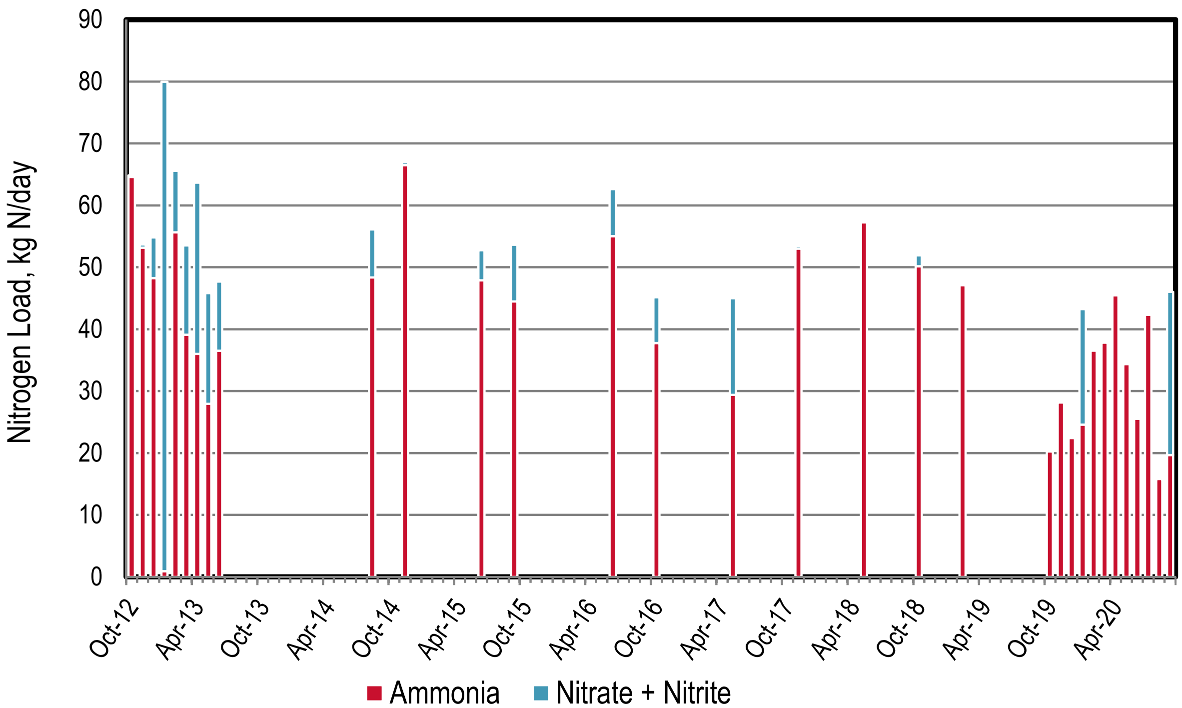

Figure 31-2. Discharge: Tiburon Monthly Nitrogen Loads

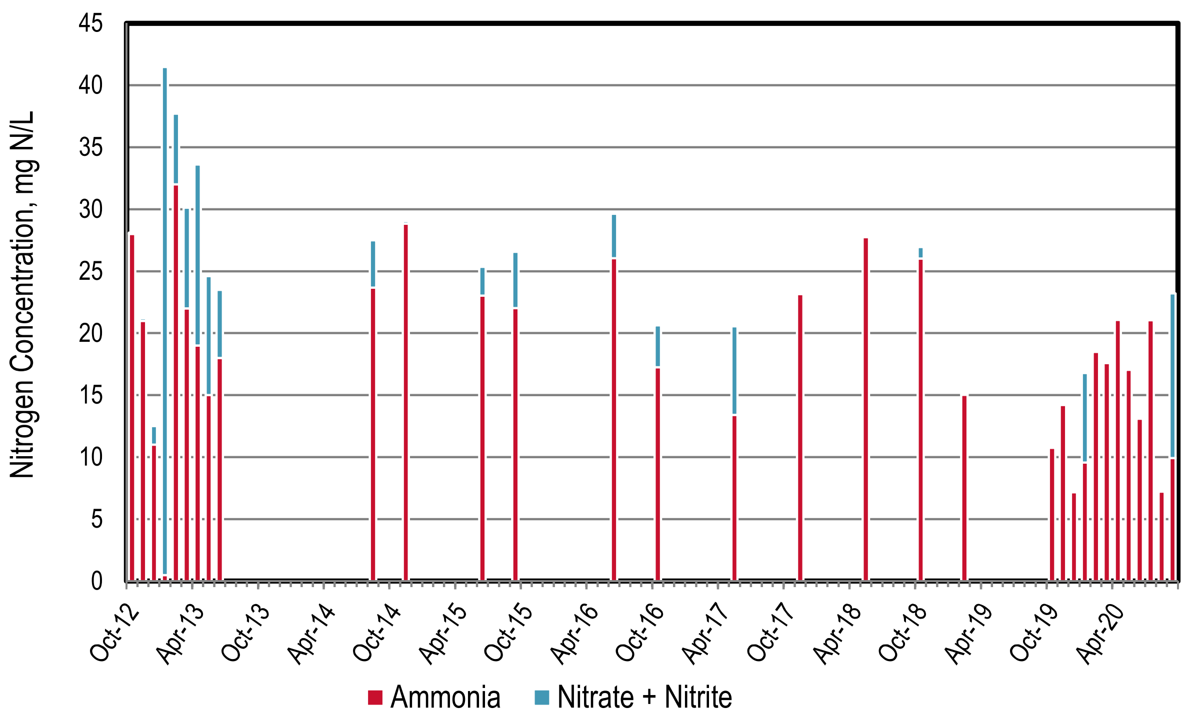

Figure 31-3. Discharge: Tiburon Monthly Nitrogen Concentrations

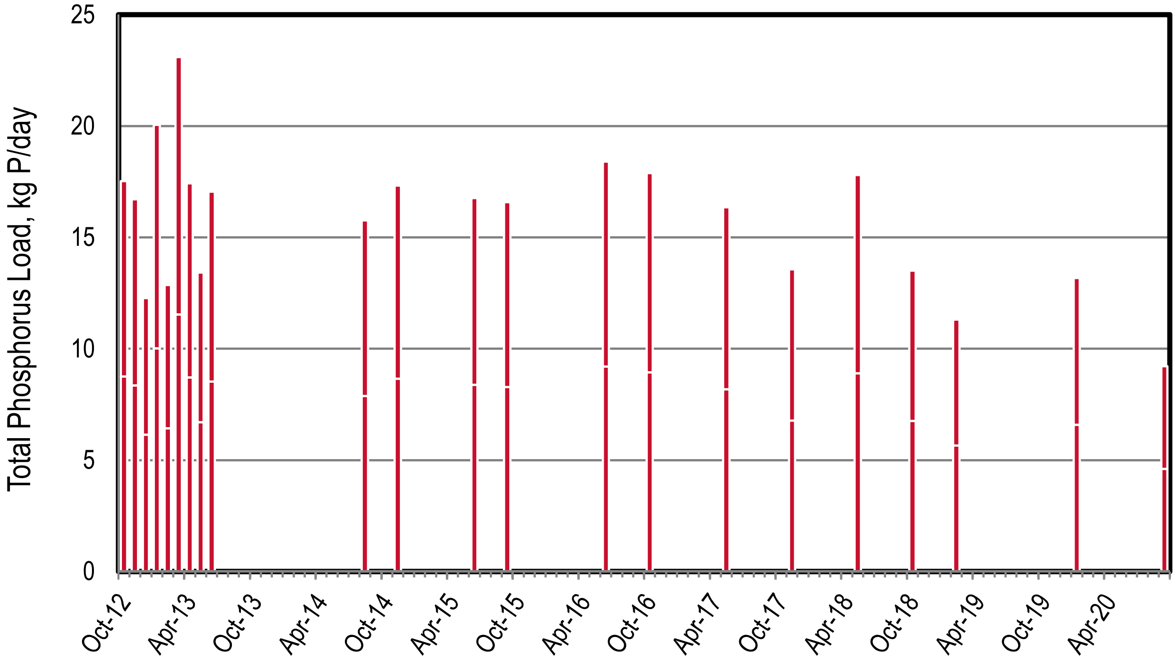

Figure 31-4. Discharge: Tiburon Monthly Phosphorus Loads

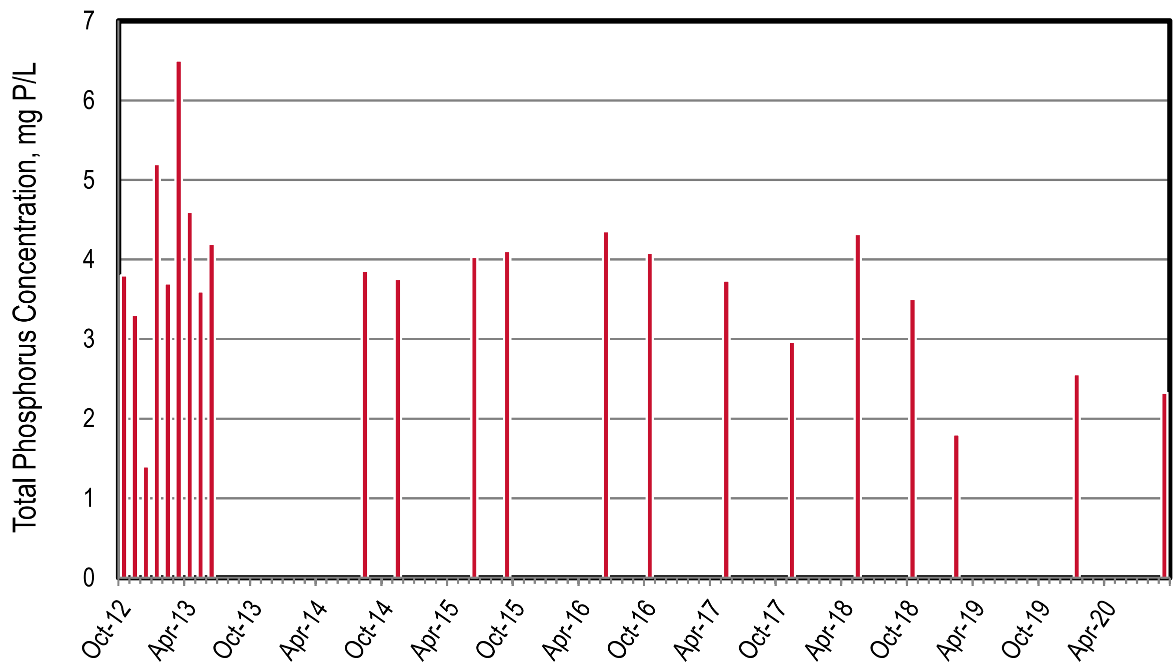

Figure 31-5. Discharge: Tiburon Monthly Phosphorus Concentrations

Table 31-1. Discharge: Tiburon Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	0.610	64.6	0.284	64.8	8.76
Nov-12	0.670	53.2	0.484	53.7	8.36
Dec-12	1.16	48.2	6.58	54.8	6.14
Jan-13	0.510	0.906	79.1	80.0	10.0
Feb-13	0.460	55.6	9.91	65.6	6.43
Mar-13	0.470	39.1	14.4	53.5	11.5
Apr-13	0.501	36.0	27.6	63.6	8.71
May-13	0.493	28.0	17.9	45.8	6.71
Jun-13	0.537	36.5	11.2	47.7	8.53
Jul-13	0.550				
Aug-13	0.540				
Sep-13	0.540				
Oct-13	0.510				
Nov-13	0.530				
Dec-13	0.560				
Jan-14	0.540				
Feb-14	0.860				
Mar-14	0.720				
Apr-14	0.670				
May-14	0.550				
Jun-14	0.550				
Jul-14	0.530				
Aug-14	0.540	48.3	7.78	56.1	7.88
Sep-14	0.540				
Oct-14	0.530				
Nov-14	0.610	66.5	0.455	66.9	8.66
Dec-14	1.48				
Jan-15	0.650				
Feb-15	0.650				
Mar-15	0.540				
Apr-15	0.560				
May-15	0.550				
Jun-15	0.550	47.9	4.83	52.7	8.38
Jul-15					
Aug-15					
Sep-15	0.534	44.5	9.16	53.6	8.29

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15					
Nov-15					
Dec-15					
Jan-16					
Feb-16					
Mar-16					
Apr-16					
May-16					
Jun-16	0.559	55.0	7.60	62.6	9.20
Jul-16	0.550				
Aug-16	0.557				
Sep-16	0.536				
Oct-16	0.579	37.8	7.41	45.2	8.94
Nov-16	0.628				
Dec-16	0.904				
Jan-17	1.48				
Feb-17	1.51				
Mar-17	0.876				
Apr-17	0.735				
May-17	0.579	29.4	15.6	45.0	8.18
Jun-17	0.566				
Jul-17	0.540				
Aug-17	0.559				
Sep-17	0.546				
Oct-17	0.529				
Nov-17	0.606	53.0	0.424	53.4	6.78
Dec-17	0.558				
Jan-18	0.788				
Feb-18	0.534				
Mar-18	0.866				
Apr-18	0.790				
May-18	0.545	57.2	0.339	57.6	8.90
Jun-18	0.549				
Jul-18					
Aug-18					
Sep-18					
Oct-18	0.510	50.2	1.76	51.9	6.76

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18					
Dec-18					
Jan-19					
Feb-19	0.830	47.1	0.314	47.4	5.65
Mar-19					
Apr-19					
May-19					
Jun-19					
Jul-19					
Aug-19					
Sep-19					
Oct-19	0.499	20.2			
Nov-19	0.524	28.1			
Dec-19	0.828	22.4			
Jan-20	0.681	24.6	18.6	39.7	6.59
Feb-20	0.523	36.5			
Mar-20	0.568	37.8			
Apr-20	0.571	45.5			
May-20	0.533	34.3			
Jun-20	0.515	25.5			
Jul-20	0.532	42.3			
Aug-20	0.578	15.8			
Sep-20	0.524	19.7	26.3	27.7	4.61
Dry Season Average	**0.544**	**37.3**	**11.2**	**49.9**	**7.85**
Dry Season Trend,***	**None**	***	***	***	***
Wet Season Average	**0.698**	**40.4**	**12.9**	**57.0**	**7.95**
Average Annual	**0.637**	**39.1**	**12.2**	**54.1**	**7.91**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

*** No statistical dry season trending analysis was performed on nutrient species due to the limited number of samples required for minor dischargers.

32 Treasure Island

Treasure Island discharges to the Central Bay. The plant has a permitted capacity of 2.0 mgd ADWF and a peak wet weather capacity of 4.4 mgd. The current plant flow is approximately 0.28 mgd ADWF. The plant currently nitrifies using trickling filters.

The following observations are made based upon the figures and table in the subsequent pages:

- The wet season average monthly flow values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
- Based on the average monthly values table below, flow and nutrient loads have no statistical trend. Note: total phosphorus loads have stabilized the last several years and appear to be declining (exception for June 2020).
- The plant fully nitrified through April 2015 at which time one of the plant's two trickling arm filters became inoperable until March 2016. While the arm was inoperable, the discharge ammonia concentrations increased but have since recovered.
- NOx represents the majority of nitrogen species discharged as would be expected since this plant nitrifies (with the exception of the period when the trickling filter arm was inoperable).

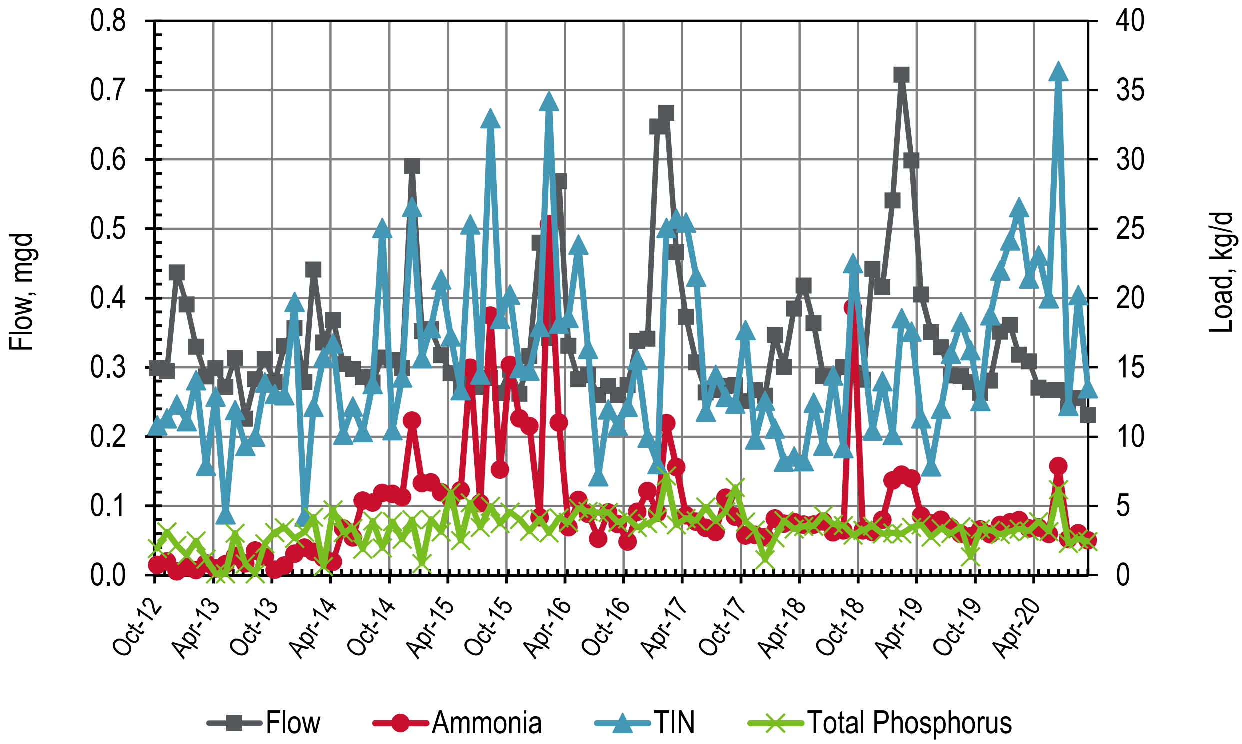

Figure 32-1. Discharge: Treasure Island Monthly Flows and Loads

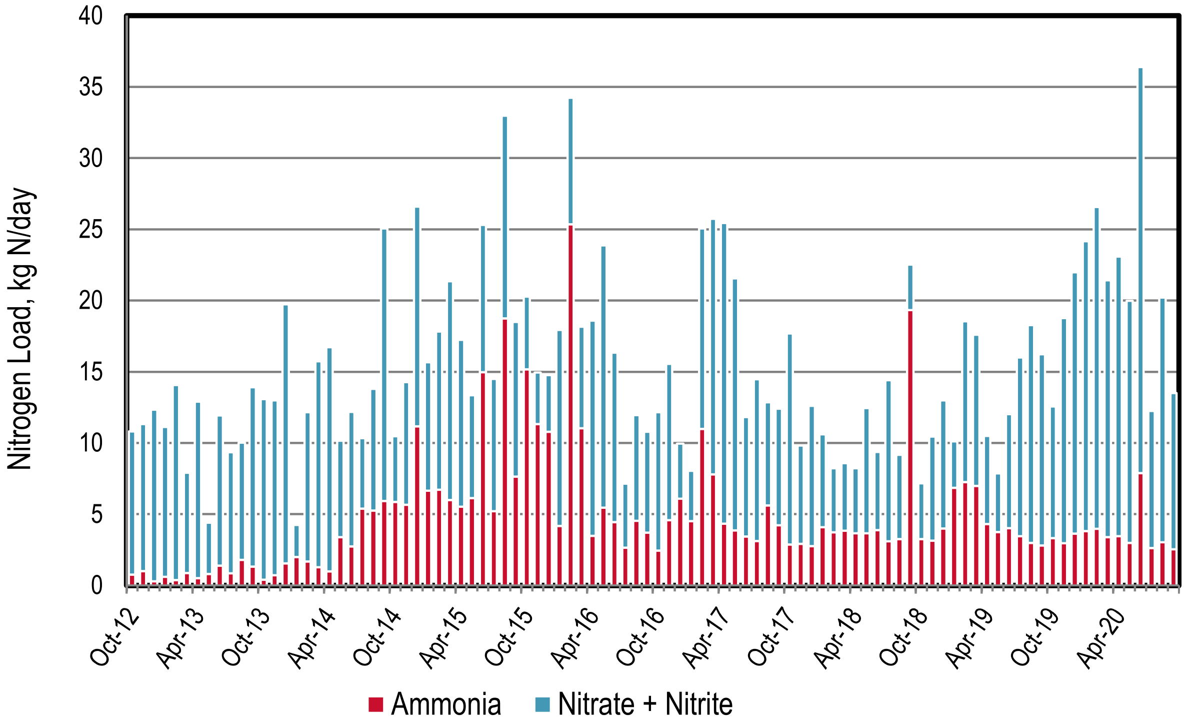

Figure 32-2. Discharge: Treasure Island Monthly Nitrogen Loads

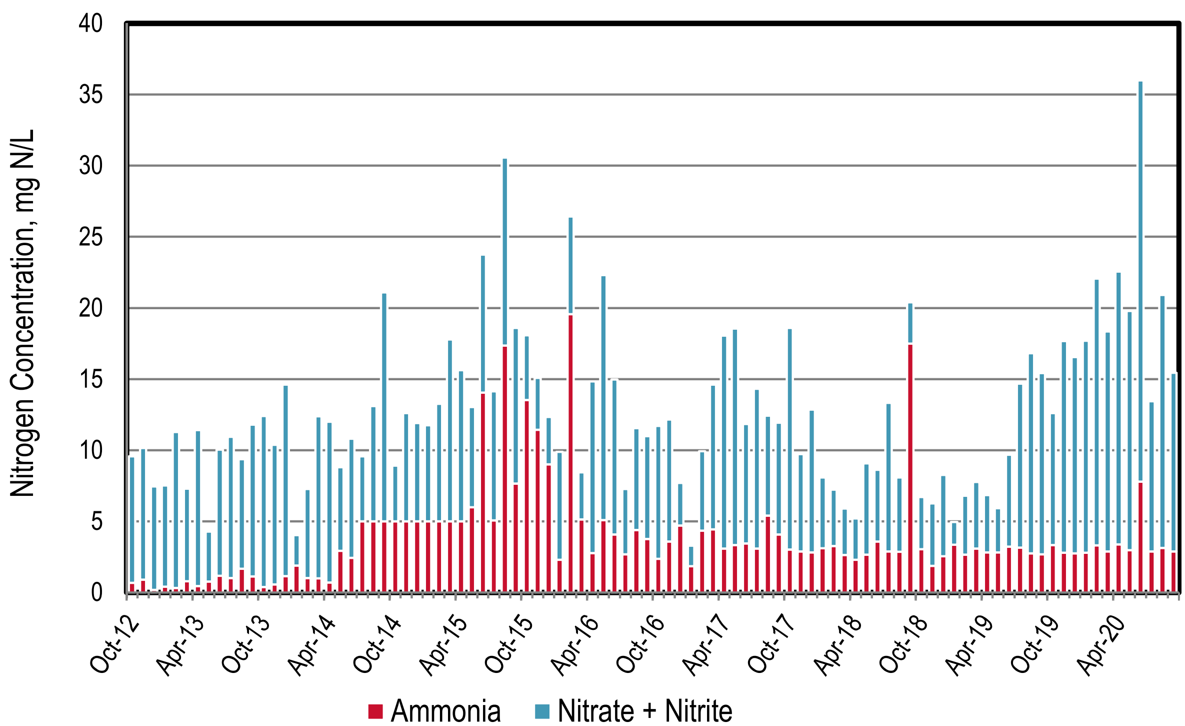

Figure 32-3. Discharge: Treasure Island Monthly Nitrogen Concentrations

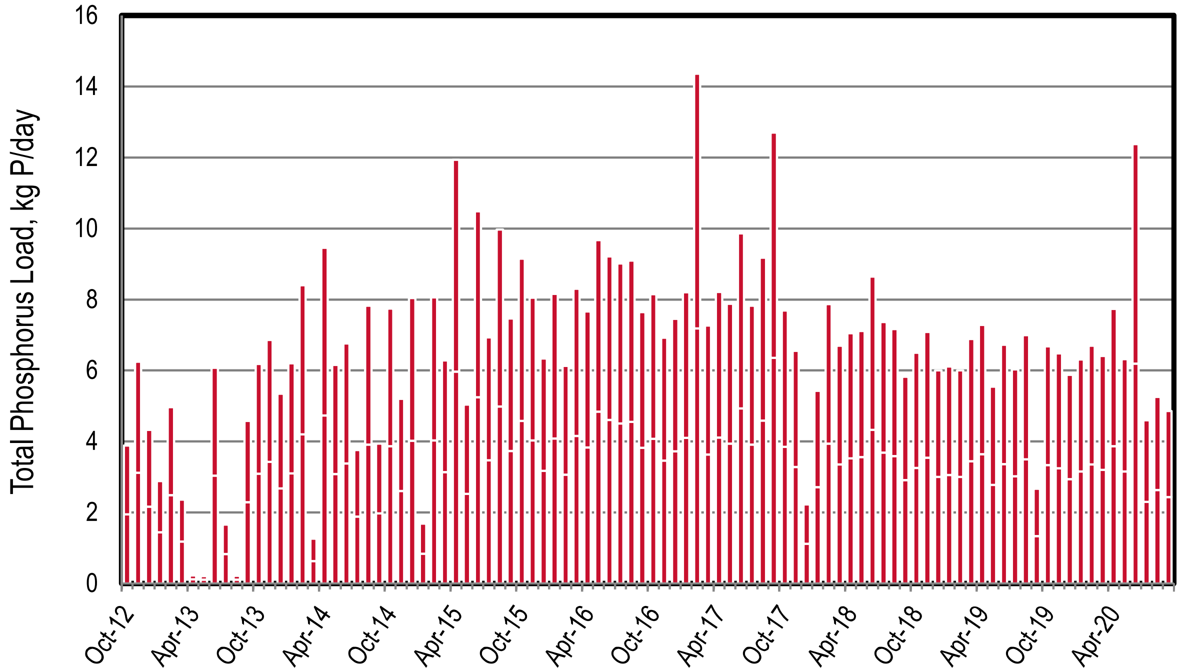

Figure 32-4. Discharge: Treasure Island Monthly Phosphorus Loads

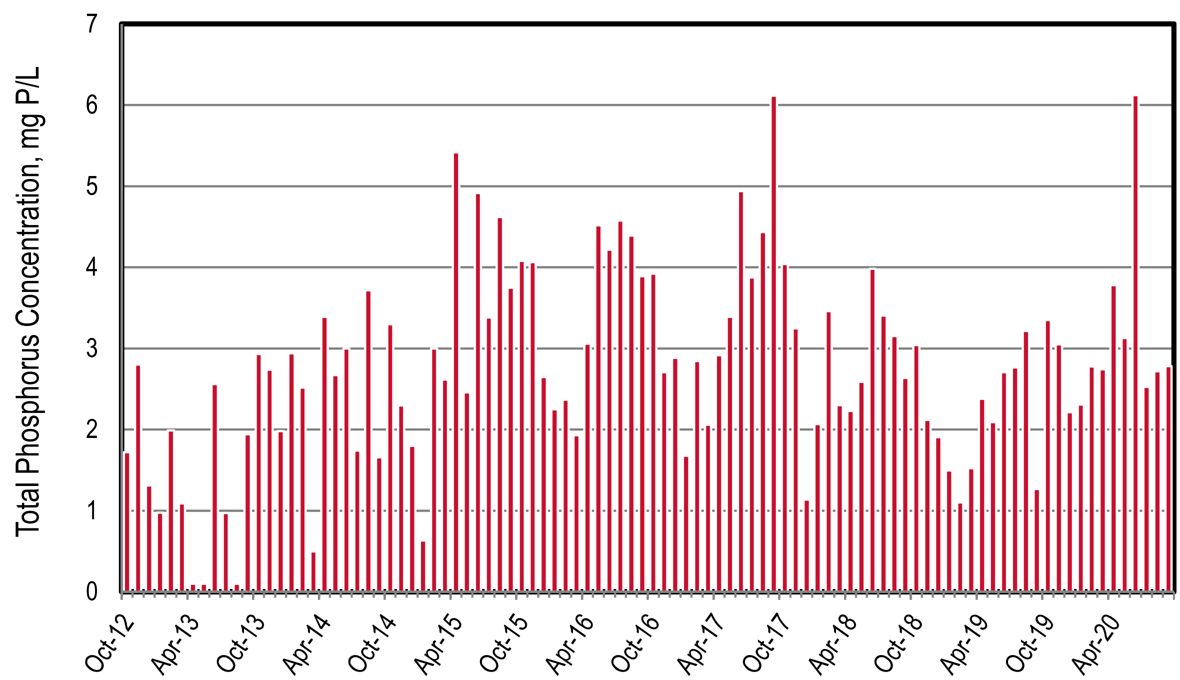

Figure 32-5. Discharge: Treasure Island Monthly Phosphorus Concentrations

Table 32-1. Discharge: Treasure Island Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	0.299	0.757	10.1	10.8	1.94
Nov-12	0.295	1.00	10.3	11.3	3.12
Dec-12	0.437	0.297	12.0	12.3	2.16
Jan-13	0.391	0.602	10.5	11.1	1.44
Feb-13	0.330	0.387	13.7	14.1	2.48
Mar-13	0.287	0.872	7.04	7.91	1.18
Apr-13	0.299	0.509	12.4	12.9	0.113
May-13	0.272	0.802	3.59	4.40	0.103
Jun-13	0.314	1.40	10.5	11.9	3.04
Jul-13	0.226	0.863	8.49	9.35	0.829
Aug-13	0.283	1.79	8.23	10.0	0.107
Sep-13	0.312	1.32	12.6	13.9	2.29
Oct-13	0.299	0.411	12.7	13.1	3.09
Nov-13	0.295	0.713	12.3	13.0	3.43
Dec-13	0.437	1.55	18.2	19.7	2.67
Jan-14	0.391	1.99	2.25	4.25	3.10
Feb-14	0.330	1.69	10.5	12.2	4.20
Mar-14	0.287	1.27	14.5	15.7	0.630
Apr-14	0.299	0.976	15.7	16.7	4.73
May-14	0.272	3.39	6.77	10.2	3.08
Jun-14	0.314	2.75	9.43	12.2	3.38
Jul-14	0.286	5.40	4.94	10.3	1.88
Aug-14	0.278	5.26	8.53	13.8	3.91
Sep-14	0.314	5.94	19.1	25.1	1.97
Oct-14	0.311	5.87	4.60	10.5	3.87
Nov-14	0.299	5.66	8.62	14.3	2.60
Dec-14	0.591	11.2	15.4	26.6	4.02
Jan-15	0.352	6.66	9.01	15.7	0.840
Feb-15	0.356	6.72	11.1	17.8	4.03
Mar-15	0.317	6.00	15.4	21.4	3.14
Apr-15	0.292	5.52	11.7	17.2	5.97
May-15	0.271	6.14	7.22	13.4	2.52
Jun-15	0.282	15.0	10.3	25.3	5.24
Jul-15	0.271	5.20	9.30	14.5	3.47
Aug-15	0.285	18.7	14.2	33.0	4.98
Sep-15	0.263	7.63	10.9	18.5	3.73

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-15	0.297	15.2	5.09	20.3	4.58
Nov-15	0.262	11.3	3.62	15.0	4.03
Dec-15	0.317	10.8	3.98	14.8	3.17
Jan-16	0.480	4.19	13.7	17.9	4.08
Feb-16	0.343	25.3	8.90	34.2	3.07
Mar-16	0.569	11.0	7.14	18.2	4.15
Apr-16	0.331	3.48	15.1	18.6	3.83
May-16	0.283	5.45	18.4	23.9	4.84
Jun-16	0.289	4.45	11.9	16.3	4.60
Jul-16	0.260	2.65	4.51	7.16	4.51
Aug-16	0.274	4.55	7.42	12.0	4.55
Sep-16	0.260	3.71	7.09	10.8	3.82
Oct-16	0.275	2.45	9.70	12.2	4.07
Nov-16	0.338	4.58	11.0	15.5	3.46
Dec-16	0.342	6.10	3.85	9.95	3.73
Jan-17	0.648	4.52	3.52	8.04	4.10
Feb-17	0.668	11.0	14.1	25.1	7.18
Mar-17	0.466	7.81	17.9	25.7	3.63
Apr-17	0.373	4.34	21.1	25.5	4.11
May-17	0.307	3.87	17.7	21.6	3.94
Jun-17	0.264	3.44	8.38	11.8	4.93
Jul-17	0.267	3.12	11.3	14.5	3.91
Aug-17	0.274	5.61	7.26	12.9	4.59
Sep-17	0.275	4.23	8.17	12.4	6.35
Oct-17	0.252	2.88	14.8	17.7	3.85
Nov-17	0.267	2.92	6.90	9.82	3.28
Dec-17	0.259	2.76	9.85	12.6	1.11
Jan-18	0.347	4.09	6.50	10.6	2.71
Feb-18	0.301	3.72	4.49	8.22	3.94
Mar-18	0.385	3.84	4.75	8.59	3.35
Apr-18	0.418	3.66	4.57	8.23	3.52
May-18	0.364	3.67	8.79	12.5	3.56
Jun-18	0.287	3.88	5.49	9.37	4.32
Jul-18	0.286	3.11	11.3	14.4	3.68
Aug-18	0.301	3.26	5.92	9.18	3.58
Sep-18	0.292	19.3	3.21	22.5	2.91
Oct-18	0.283	3.26	3.92		3.25

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Nov-18	0.442	3.13	7.32	10.5	3.54
Dec-18	0.416				
Jan-19	0.541	6.85	3.27	10.1	3.06
Feb-19	0.723	7.27	11.3	18.6	3.00
Mar-19	0.599	6.98	10.6	17.6	3.45
Apr-19	0.405	4.31	6.19	11.3	3.64
May-19	0.351	3.75	4.12	7.87	2.77
Jun-19	0.329	4.02	8.01	12.0	3.36
Jul-19	0.288	3.45	12.5	16.0	3.01
Aug-19	0.288	3.00	15.3	18.3	3.50
Sep-19	0.278	2.82	13.4	16.2	1.33
Oct-19	0.264	3.32	9.25	12.6	3.34
Nov-19	0.281	2.96	15.8	18.8	3.24
Dec-19	0.352	3.64	18.3	22.0	2.94
Jan-20	0.361	3.82	20.3	24.2	3.15
Feb-20	0.319	3.99	22.6	26.6	3.35
Mar-20	0.309	3.38	18.0	21.4	3.20
Apr-20	0.271	3.46	19.6	23.1	3.87
May-20	0.267	3.00	17.0	20.0	3.16
Jun-20	0.267	7.88	28.5	36.4	6.19
Jul-20	0.241	2.62	9.62	12.2	2.30
Aug-20	0.256	3.03	17.2	20.2	2.63
Sep-20	0.231	2.53	11.0	13.5	2.43
Dry Season Average	**0.284**	**4.80**	**10.4**	**15.2**	**3.38**
Dry Season Trend**	**None**	**None**	**None**	**None**	**None**
Wet Season Average	**0.371**	**4.77**	**10.8**	**15.7**	**3.28**
Average Annual	**0.334**	**4.78**	**10.6**	**15.5**	**3.32**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

33 Vallejo Flood and Wastewater District

Vallejo discharges to San Pablo Bay and it has approximately 37,845 service connections. The plant has a permitted ADWF capacity of 15.5 mgd and a peak wet weather capacity of 60 mgd. The current discharge flows are approximately 8.3 mgd ADWF. The plant performs secondary treatment using a trickling filter/solids contact process.

The following observations are made based upon the figures and table in the subsequent pages:

- Influent and Reduction Across the Plant
  - Note: limited to data since July 2019; quarterly required but more provided for various parameters.
  - Based on the limited average monthly values table below, there are no emerging dry season trends.
  - The flow reduction across the plant is negligible.
  - The nitrogen load reduction values across the plant ranges from approximately 45 to 55 percent. This load reduction is attributed primarily to a combination of biological assimilation, biosolids management, and/or biological load reduction in the trickling filter/solids contact process.
  - The phosphorus load reduction across the plant ranges from approximately 35 to 50 percent. Such a load reduction is attributed to a combination of chemical precipitation, biological assimilation, and/or biosolids management.
- Discharge
  - The wet season average monthly flow values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
  - Previous year's data indicated a downward trend for flows in the dry season, which may be attributed to a combination of increased water conservation, lack of precipitation, and the global pandemic.
  - There appears to be an upward dry season trend for all nitrogen species except for NOx, which is downward trending.
  - TIN was comprised of approximately even parts Ammonia and NOx during the first two years of data. In subsequent years, ammonia makes up the majority of the nitrogen species. It appears that the plant performed partial nitrification up until the influent loads exceed nitrification capacity.
  - Phosphorus loads had remained relatively flat over the years, but recent data indicates a downward trend.
  - The phosphorus concentrations range from 1.3 to 5.3 mg P/L, which suggests occasional phosphorus load reduction at the plant.

Influent

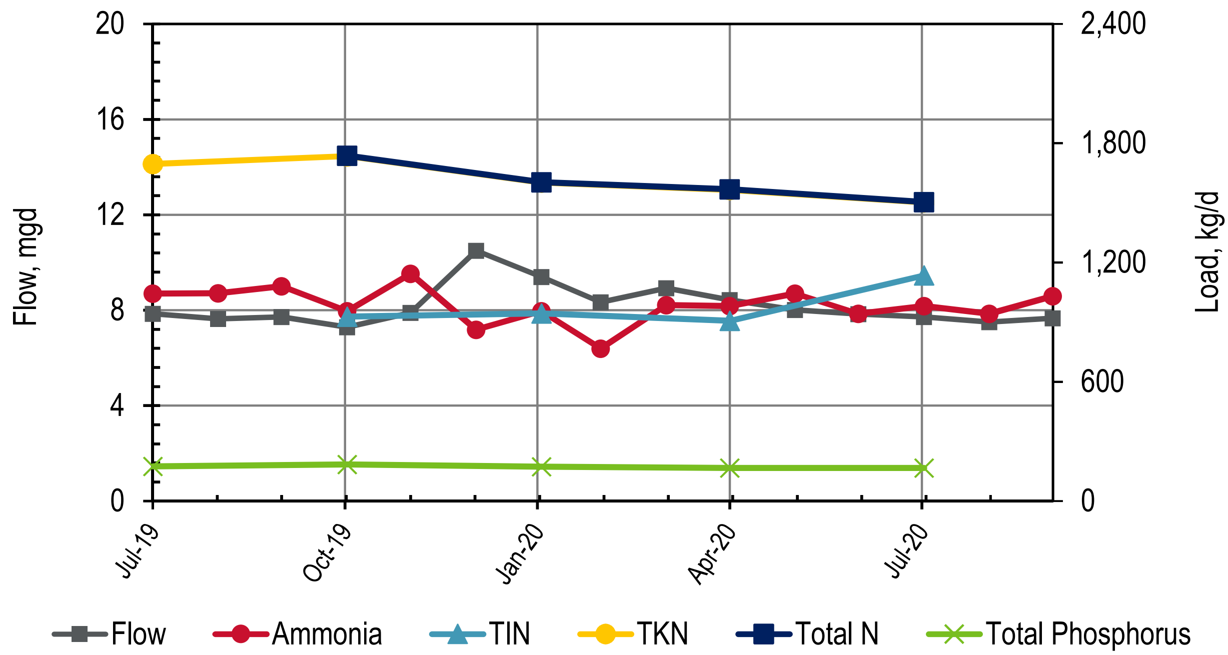

Figure 33-1. Influent: Vallejo Monthly Flows and Loads

Note: the ammonia/TIN loads and TKN/Total N loads are comparable. The ammonia and TKN values are located behind TIN and Total N load lines, respectively.

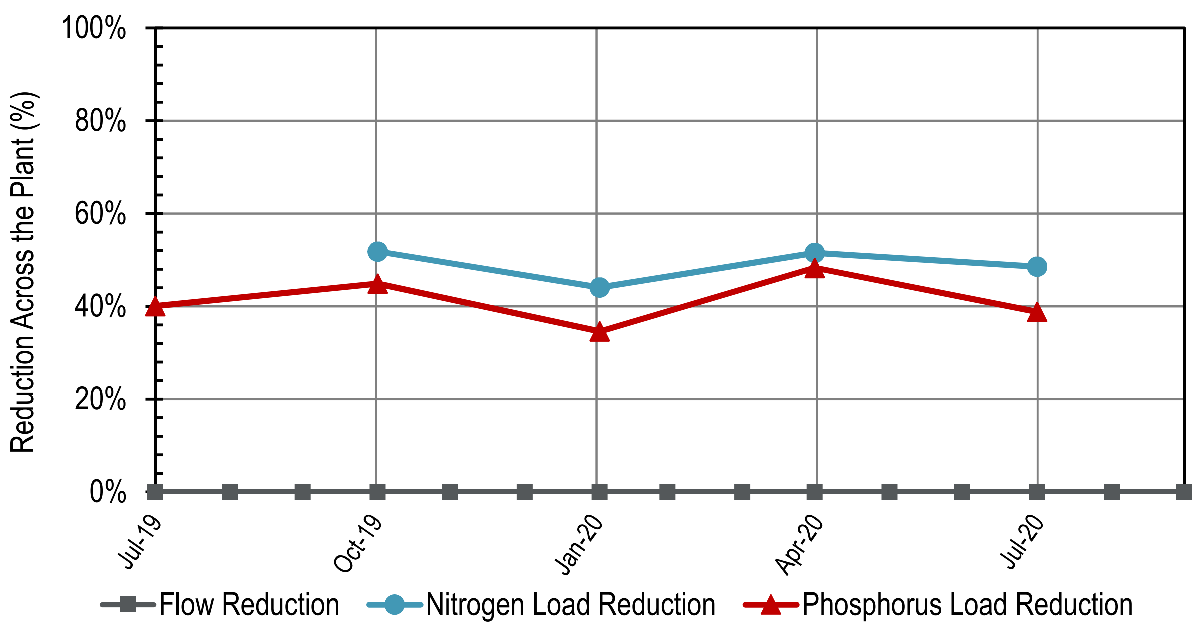

Figure 33-2. Influent: Vallejo Monthly Reductions Across the Plant

Note: Influent Total N was compared against Discharge TIN for calculating nitrogen load reduction.

Table 33-1. Influent: Vallejo Monthly Flows and Loads*

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	7.86	1,040	Non-Detect	**	1,690	**	175
Aug-19	7.63	1,050	--	--	--	--	--
Sep-19	7.72	1,080	--	--	--	--	--
Oct-19	7.29	956	2.14	927	1,740	1,740	185
Nov-19	7.90	1,140	--	--	--	--	--
Dec-19	10.5	861	--	--	--	--	--
Jan-20	9.40	955	1.26	944	1,600	1,600	173
Feb-20	8.34	767	--	--	--	--	--
Mar-20	8.93	986	--	--	--	--	--
Apr-20	8.42	982	3.57	907	1,570	1,570	167
May-20	8.01	1,040	--	--	--	--	--
Jun-20	7.84	943	--	--	--	--	--
Jul-20	7.72	982	1.09	1,140	1,500	1,500	167
Aug-20	7.50	942	--	--	--	--	--
Sep-20	7.67	1,030	--	--	--	--	--
Dry Season Average	**7.75**	**1,010**	**1.09**	**1,140**	**1,600**	**1,500**	**171**
Dry Season Trend * **	**None**	**None**	***	***	***	***	***
Wet Season Average	**8.68**	**950**	**2.32**	**926**	**1,630**	**1,640**	**175**
Average Annual	**8.18**	**984**	**2.01**	**978**	**1,620**	**1,600**	**173**

* Vallejo typically samples more than the required influent ammonia quarterly sampling. This dataset includes this additional sampling.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values for days when sampling occurred. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite” for days when sampling occurred. For instances when ammonia, nitrate + nitrite, or TKN are non-detect, the TIN and Total N values were not calculated. Note: the ammonia sampling is more frequent than the other nitrogen species which can lead to average monthly ammonia values being greater than average monthly TIN values.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis. Insufficient samples to perform statistical trending on nutrient loads (except for ammonia)

Discharge

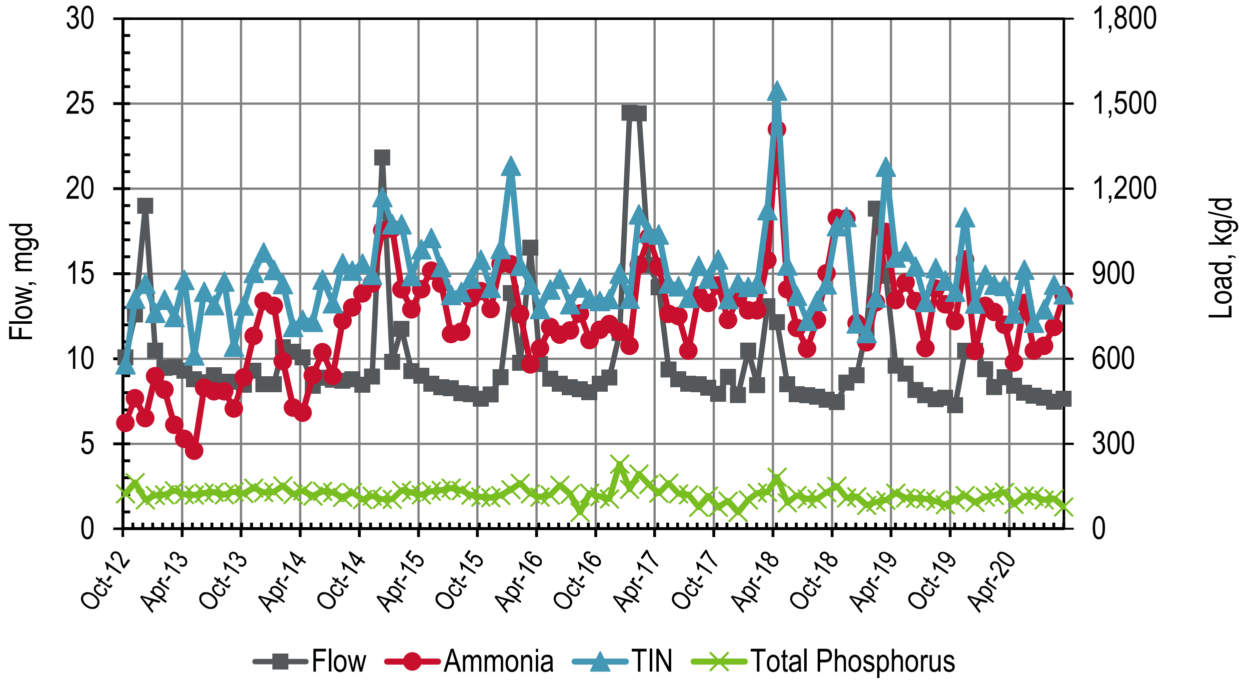

Figure 33-3. Discharge: Vallejo Monthly Flows and Loads

Table 33-2. Discharge: Vallejo Monthly Flows and Loads

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Oct-12	10.1	374	206	580	123
Nov-12	12.6	461	352	813	164
Dec-12	19.0	391	474	865	103
Jan-13	10.5	539	224	762	118
Feb-13	9.48	492	317	809	120
Mar-13	9.51	368	379	747	135
Apr-13	9.30	318	561	879	121
May-13	8.80	276	336	612	120
Jun-13	8.63	499	338	837	126
Jul-13	9.04	486	304	790	130
Aug-13	8.65	486	387	873	121
Sep-13	8.65	426	218	643	131
Oct-13	8.49	535	253	788	125
Nov-13	9.31	681	222	903	144
Dec-13	8.52	804	171	975	129

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Jan-14	8.51	788	126	913	130
Feb-14	10.7	592	272	864	152
Mar-14	10.4	428	285	713	122
Apr-14	10.1	410	327	738	134
May-14	8.43	542	188	731	116
Jun-14	8.92	624	256	880	133
Jul-14	8.77	540	256	796	128
Aug-14	8.73	736	201	937	112
Sep-14	8.81	781	131	912	129
Oct-14	8.49	831	105	936	103
Nov-14	8.97	867	30.4	897	116
Dec-14	21.8	1,050	118	1,170	104
Jan-15	9.83	1,060	15.9	1,080	105
Feb-15	11.8	846	229	1,070	137
Mar-15	9.28	775	117	892	129
Apr-15	9.01	846	142	987	120
May-15	8.53	911	115	1,030	132
Jun-15	8.32	865	58.6	924	136
Jul-15	8.28	688	138	826	144
Aug-15	7.99	696	140	836	135
Sep-15	7.93	815	68.0	883	119
Oct-15	7.65	839	111	950	113
Nov-15	7.92	776	74.3	850	110
Dec-15	8.92	935	52.9	988	118
Jan-16	13.9	934	348	1,280	138
Feb-16	9.77	758	170	928	161
Mar-16	16.6	580	281	862	124
Apr-16	9.69	637	139	776	113
May-16	8.84	713	131	844	119
Jun-16	8.56	686	197	883	155
Jul-16	8.32	701	91.8	793	122
Aug-16	8.23	760	91.1	851	58.4
Sep-16	8.04	667	145	812	126
Oct-16	8.55	703	102	805	114
Nov-16	8.90	722	88.4	811	106
Dec-16	11.5	696	205	901	229
Jan-17	24.5	646	166	812	140

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Feb-17	24.4	931	178	1,110	193
Mar-17	15.5	1,030	16.8	1,050	157
Apr-17	14.2	924	114	1,040	126
May-17	9.37	760	107	867	161
Jun-17	8.81	751	106	856	124
Jul-17	8.54	629	187	815	121
Aug-17	8.51	824	104	928	76.0
Sep-17	8.30	797	86.0	883	117
Oct-17	7.95	860	91.7	951	76.5
Nov-17	8.94	737	73.7	811	98.2
Dec-17	7.87	815	53.5	868	58.2
Jan-18	10.5	771	82.3	853	103
Feb-18	8.46	771	94.5	865	126
Mar-18	13.1	948	176	1,120	130
Apr-18	12.2	1,410	136	1,550	182
May-18	8.51	846	83.4	930	92.8
Jun-18	7.94	709	113	822	118
Jul-18	7.87	636	116	734	106
Aug-18	7.78	738	66.6	805	106
Sep-18	7.59	903	54.0	863	129
Oct-18	7.45	1,100	12.7	1,070	151
Nov-18	8.60	1,100	6.07	1,100	109
Dec-18	9.05	727	50.6	725	114
Jan-19	11.8	659	106	691	83.1
Feb-19	18.8	800	150	817	94.9
Mar-19	14.9	1,050	230	1,280	101
Apr-19	9.61	807	151	958	127
May-19	9.13	870	109	979	109
Jun-19	8.17	804	122	926	108
Jul-19	7.86	638	163	801	105
Aug-19	7.63	848	72.1	920	97.5
Sep-19	7.72	793	82.6	876	85.3
Oct-19	7.29	733	104	837	102
Nov-19	10.5	951	149	1,100	119
Dec-19	10.5	628	168	796	93.2
Jan-20	9.40	787	110	897	113
Feb-20	8.34	766	95.9	862	118

Month, Year	Flow	Ammonia	Nitrate + Nitrite	TIN*	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg P/day
Mar-20	8.93	721	49.6	857	130
Apr-20	8.42	588	195	761	86.6
May-20	8.01	798	92.6	915	116
Jun-20	7.84	629	124	728	115
Jul-20	7.72	646	153	774	102
Aug-20	7.50	713	76.9	862	107
Sep-20	7.67	825	45.5	828	78.2
Dry Season Average	**8.32**	**701**	**146**	**845**	**117**
Dry Season Trend **	**Down**	**Up**	**Down**	**Up**	**Down**
Wet Season Average	**11.1**	**755**	**165**	**916**	**123**
Average Annual	**9.93**	**733**	**157**	**887**	**120**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values for days when sampling occurred. Note: the ammonia sampling is typically more frequent than the other nitrogen species which can lead to average monthly ammonia values being greater than average monthly TIN values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

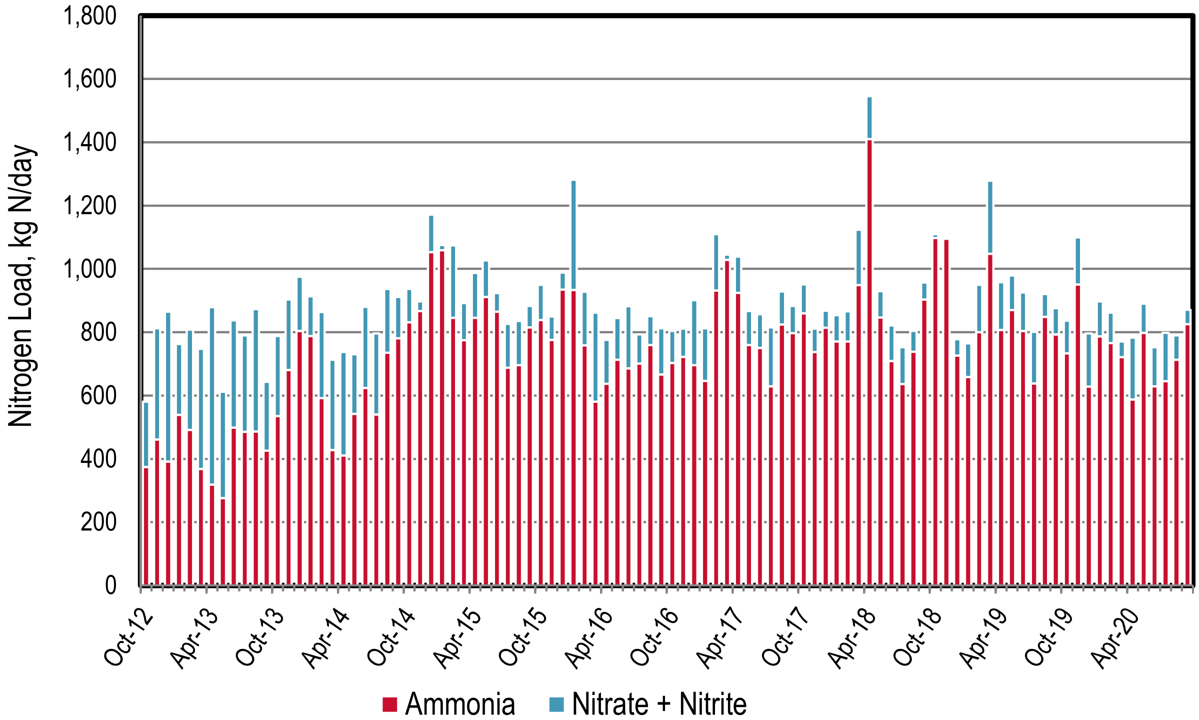

Figure 33-4. Discharge: Vallejo Monthly Nitrogen Loads

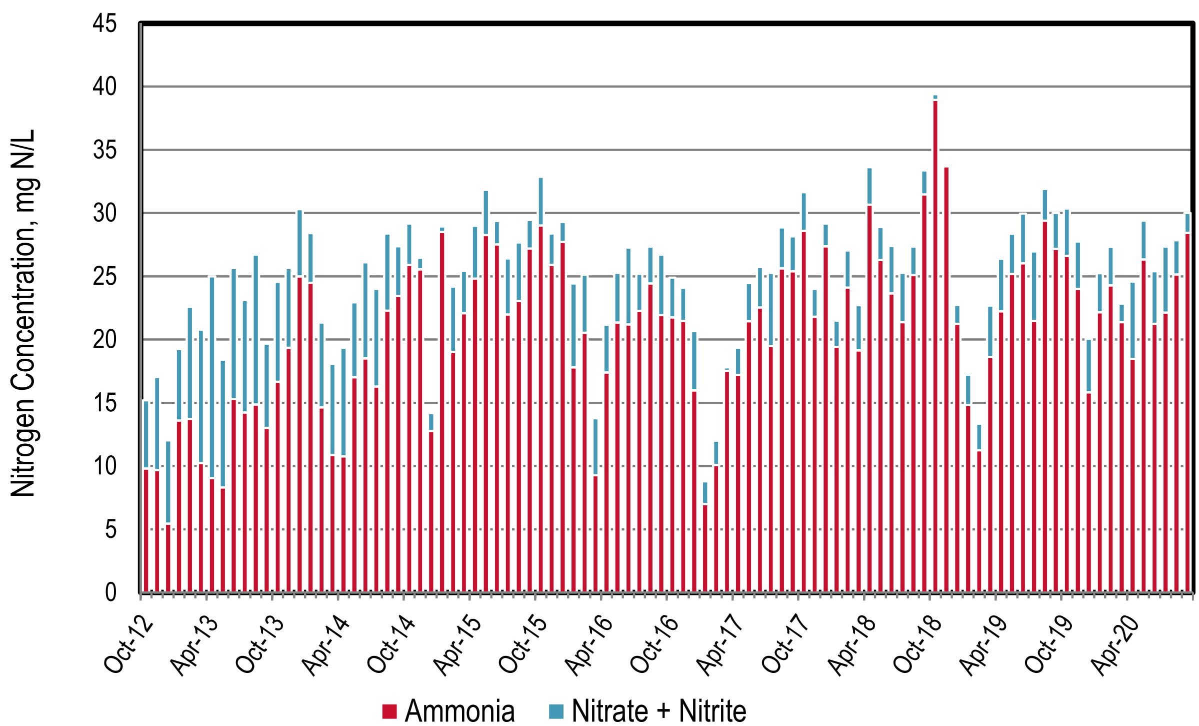

Figure 33-5. Discharge: Vallejo Monthly Nitrogen Concentrations

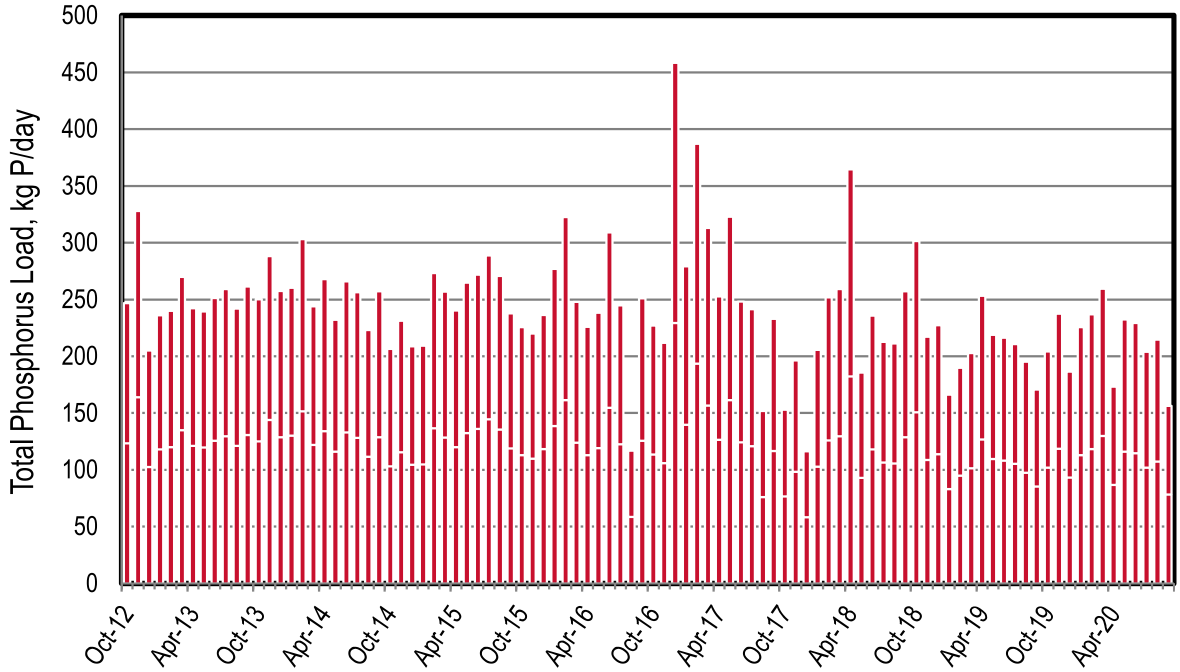

Figure 33-6. Discharge: Vallejo Monthly Phosphorus Loads

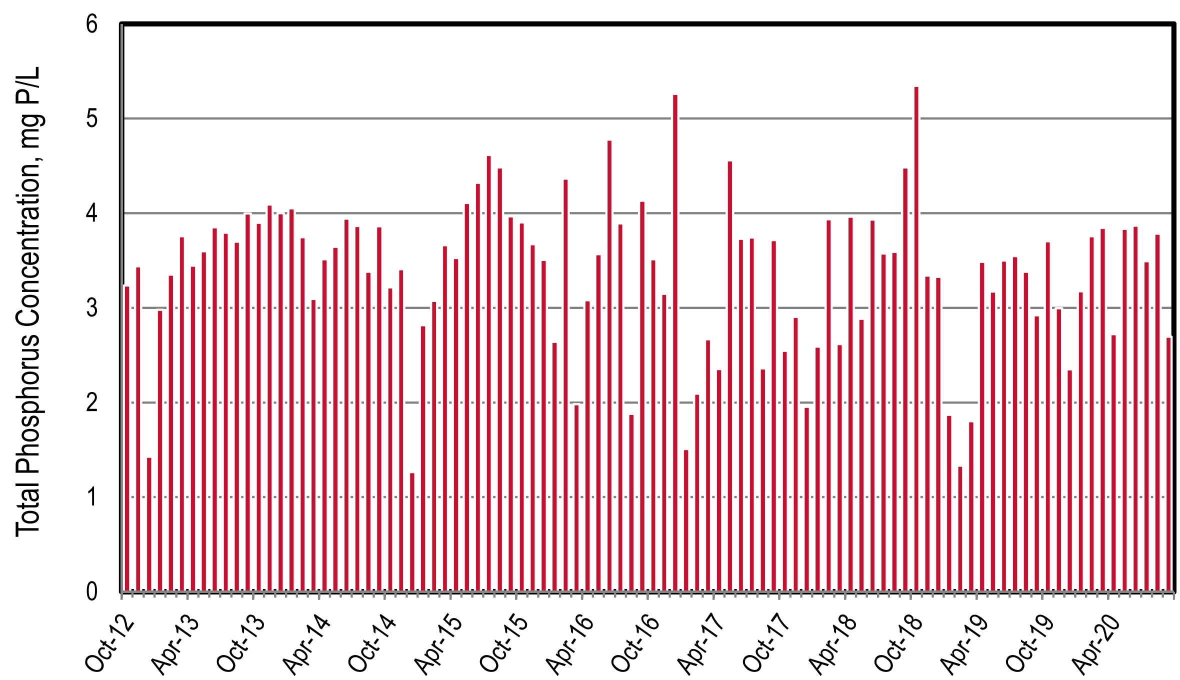

Figure 33-7. Discharge: Vallejo Monthly Phosphorus Concentrations

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34 West County Agency Outfall

West County is a common outfall and discharge permit between West County and the City of Richmond which discharges to the Central Bay. They have a combined permitted capacity of 28.5 mgd ADWF (12.5 mgd ADWF for West County and 16.0 mgd ADWF for the City of Richmond) and a combined wet weather capacity of 41 mgd (21 mgd for West County and 20.0 mgd for the City of Richmond). The Richmond plant has wet weather capacity greater than 20 mgd though only 20 mgd for full secondary treatment. The current dry season discharge flows are approximately 7.6 mgd. The Richmond plant performs secondary treatment using activated sludge, whereas the West County plant recently completed a Modified Ludzack-Ettinger (MLE) activated sludge process upgrade.

The following observations are made based upon the figures and table in the subsequent pages:

- Influent: limited to data since July 2019; quarterly required but more provided for various parameters.
- Discharge
  - The Richmond Plant represents the majority of the discharge flow and load (data not shown). The West County Plant recycles a majority of their flows year-round.
  - The wet season average monthly flow values for 2019/2020 are the lowest since nutrient sampling was initiated under the Section 13267 Letter Data in 2012.
  - Based on the table with the average monthly values, there appears to be an emerging dry season upward trend for flow and all nutrient loads.
  - Wet season nitrogen and phosphorus loads are typically greater and more variable than the dry season loads.
  - Ammonia is the majority of the nitrogen species discharged, regardless of season. This would be expected since the Richmond Plant represents the majority of the discharge load and they do not nitrify. Additionally, the West County Landfill sends Class II leachate, somewhat high in ammonia from the landfill to the City of Richmond plant which contributes to the discharge loading.
  - Total phosphorus concentrations vary between 0.6 to 5.8 mg P/L. Such values suggest occasional P removal as typical effluent TP concentrations range from 4 to 6 mg P/L. There are no P removal facilities at the Richmond Plant so additional sampling is recommended to confirm where P removal is occurring.
- Reduction Across the Plant
  - The flow reduction across the plants is greater than 40% for the 2019/2020 dataset.
  - The nitrogen and phosphorus load reduction values across the plant are reliably above 70 percent. This load reduction is attributed to a combination of recycled water through the Richmond Advanced Recycled Expansion (RARE) Project, biological assimilation, biosolids management, and/or biological load reduction at both plants.

Influent

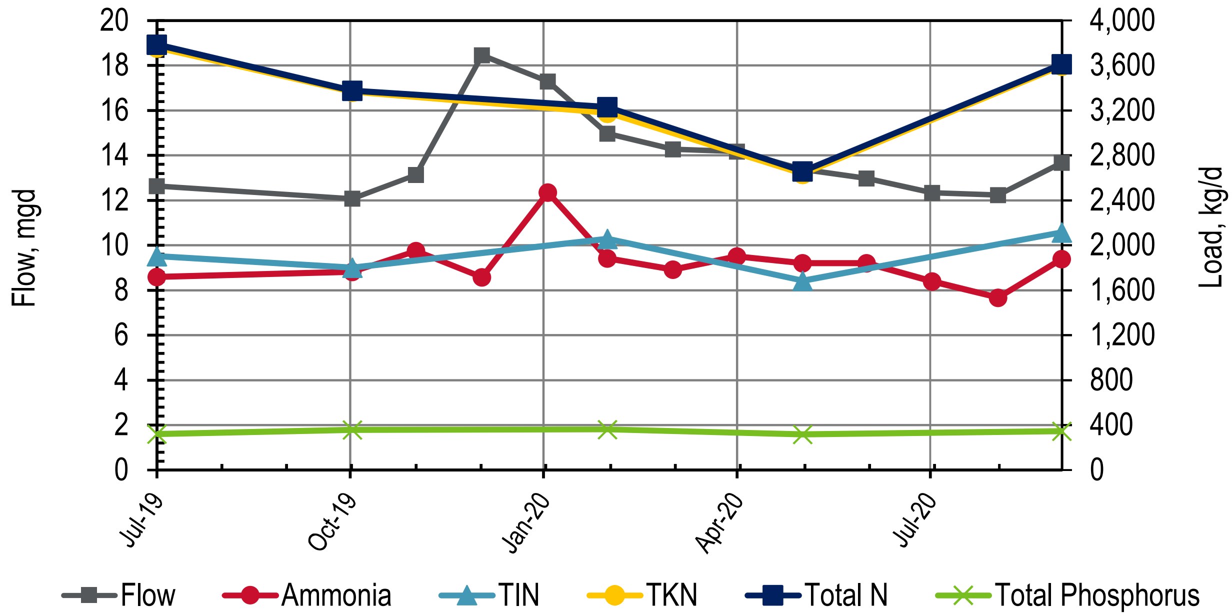

Figure 34-1. Influent: West County Monthly Flows and Loads

Note: the TKN/Total N loads are comparable. The TKN values is located behind the Total N load line.

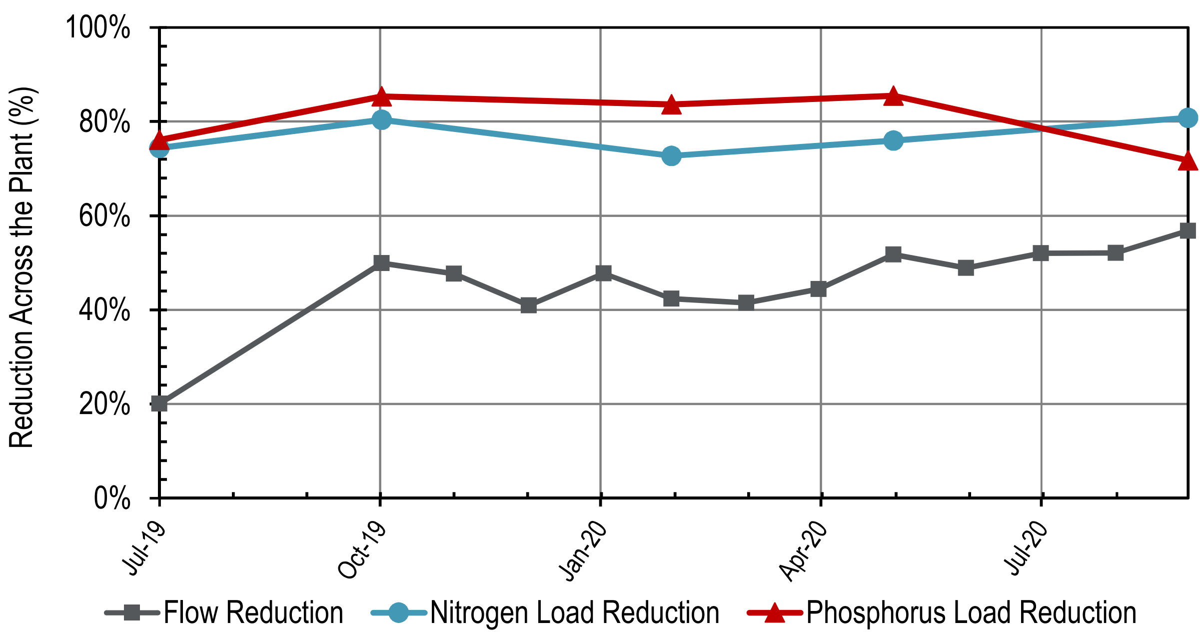

Figure 34-2. Influent: West County Monthly Reductions Across the Plant

Note: Influent Total N was compared against Discharge TIN for calculating nitrogen load reduction.

Table 34-1. Influent: West County Monthly Flows and Loads*

Month, Year	Flow	Ammonia*	Nitrate + Nitrite	TIN**	TKN	Total N**	Total P
	mgd	kg N/day	kg N/day	kg N/day	kg N/d	kg N/d	kg P/day
Jul-19	12.6	1,720	25.2	1,900	3,760	3,790	321
Aug-19	--	--	--	--	--	--	--
Sep-19	--	--	--	--	--	--	--
Oct-19	12.1	1,770	8.27	1,800	3,370	3,380	359
Nov-19	13.1	1,950	--	--	--	--	--
Dec-19	18.5	1,720	--	--	--	--	--
Jan-20	17.3	2,470	--	--	--	--	--
Feb-20	15.0	1,880	50.0	2,060	3,180	3,230	362
Mar-20	14.3	1,780	--	--	--	--	--
Apr-20	14.2	1,900	--	--	--	--	--
May-20	13.4	1,840	22.0	1,690	2,640	2,660	318
Jun-20	13.0	1,840	--	--	--	--	--
Jul-20	12.3	1,680	--	--	--	--	--
Aug-20	12.2	1,530	--	--	--	--	--
Sep-20	13.7	1,880	14.5	2,120	3,600	3,610	347
Dry Season Average	**12.9**	**1,750**	**20.6**	**1,900**	**3,330**	**3,350**	**329**
Dry Season Trend ***	***	***	***	***	***	***	***
Wet Season Average	**14.9**	**1,920**	**29.1**	**1,930**	**3,270**	**3,300**	**361**
Average Annual	**14.0**	**1,840**	**24.0**	**1,910**	**3,310**	**3,330**	**341**

* West County typically samples more than the required influent ammonia quarterly sampling. This dataset includes this additional sampling.

** The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values. The Total Nitrogen value is calculated by adding “TKN” and “Nitrate + Nitrite”.

*** Refer to the Section 3.5 in the main body for a description on the statistical analysis. Insufficient samples to perform statistical trending on the dataset.

Discharge

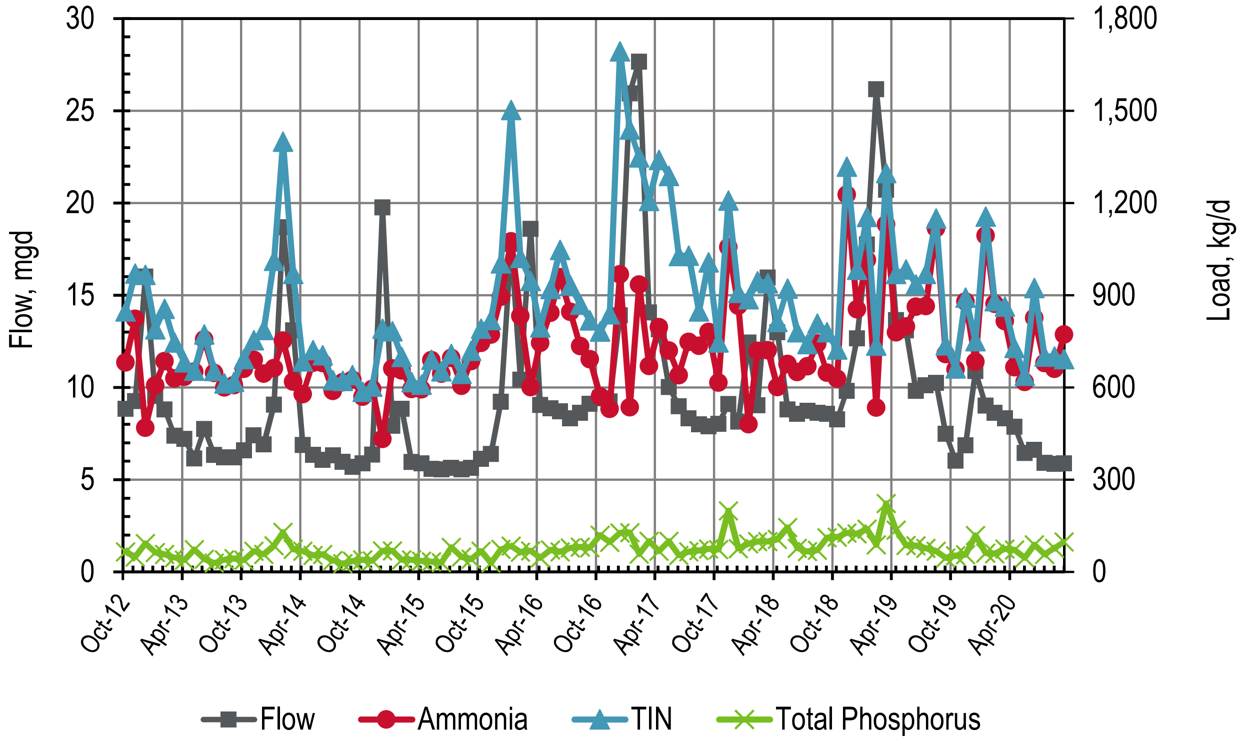

Figure 34-3. Discharge: West County Monthly Flows and Loads

Table 34-2. Discharge: West County Monthly Flows and Loads

Month, Year	Flow mgd	Ammonia kg N/day	Nitrate + Nitrite kg N/day	TIN* kg N/day	Total P kg P/day
Oct-12	8.85	682	166	848	65.5
Nov-12	9.27	824	147	971	49.0
Dec-12	16.0	470	497	967	92.6
Jan-13	9.55	607	182	789	63.4
Feb-13	8.81	686	169	856	57.4
Mar-13	7.40	631	116	747	47.3
Apr-13	7.22	635	47.0	682	38.5
May-13	6.16	652	3.26	655	73.4
Jun-13	7.77	758	15.3	773	41.7
Jul-13	6.36	648	6.13	654	28.8
Aug-13	6.23	601	12.7	613	39.8
Sep-13	6.24	608	10.4	618	43.6
Oct-13	6.60	662	30.3	692	38.0
Nov-13	7.42	690	63.6	754	67.3

Month, Year	Flow mgd	Ammonia kg N/day	Nitrate + Nitrite kg N/day	TIN* kg N/day	Total P kg P/day
Dec-13	6.93	646	141	787	57.6
Jan-14	9.09	664	348	1,010	85.2
Feb-14	18.7	753	647	1,400	129
Mar-14	13.1	620	349	969	73.7
Apr-14	6.89	579	106	685	67.3
May-14	6.16	681	40.4	722	53.9
Jun-14	7.77	680	25.6	706	56.9
Jul-14	6.33	590	34.5	624	37.0
Aug-14	5.98	618	3.84	622	26.8
Sep-14	5.71	626	15.0	641	35.7
Oct-14	5.88	571	15.0	586	39.4
Nov-14	6.37	596	7.47	604	36.5
Dec-14	19.8	433	358	791	68.3
Jan-15	7.93	662	121	783	68.5
Feb-15	8.85	656	43.2	700	39.4
Mar-15	5.98	596	21.9	617	39.0
Apr-15	5.91	595	14.7	610	35.1
May-15	5.60	689	1.51	691	33.1
Jun-15	5.57	646	6.68	653	29.8
Jul-15	5.66	697	11.6	709	79.9
Aug-15	5.58	606	38.2	645	48.4
Sep-15	5.66	686	32.9	719	41.5
Oct-15	6.15	745	46.5	792	67.9
Nov-15	6.41	772	47.0	819	29.5
Dec-15	9.24	896	108	1,000	73.9
Jan-16	17.8	1,080	427	1,500	84.8
Feb-16	10.4	833	189	1,020	64.3
Mar-16	18.6	602	344	946	68.8
Apr-16	9.06	745	50.2	795	46.2
May-16	8.87	843	77.4	921	71.6
Jun-16	8.71	960	88.0	1,050	66.0
Jul-16	8.35	846	86.0	932	78.2
Aug-16	8.64	736	134	869	81.2
Sep-16	9.12	693	126	819	78.9
Oct-16	9.42	572	210	782	120
Nov-16	9.25	531	308	839	96.7
Dec-16	13.9	968	725	1,690	127

Month, Year	Flow mgd	Ammonia kg N/day	Nitrate + Nitrite kg N/day	TIN* kg N/day	Total P kg P/day
Jan-17	25.9	536	903	1,440	128
Feb-17	27.7	935	414	1,350	58.3
Mar-17	14.1	671	536	1,210	100
Apr-17	13.2	796	544	1,340	67.4
May-17	10.0	721	567	1,290	99.8
Jun-17	8.99	641	388	1,030	54.2
Jul-17	8.32	749	280	1,030	65.6
Aug-17	8.01	736	112	848	70.1
Sep-17	7.91	781	226	1,010	75.0
Oct-17	8.04	616	131	747	72.4
Nov-17	9.12	1,060	151	1,210	199
Dec-17	8.16	867	41.8	908	76.5
Jan-18	12.5	481	406	887	91.3
Feb-18	9.04	720	226	946	99.1
Mar-18	16.0	722	218	939	98.6
Apr-18	13.0	602	211	814	106
May-18	8.83	677	245	922	145
Jun-18	8.57	651	129	780	76.5
Jul-18	8.73	670	71.9	741	66.9
Aug-18	8.65	744	64.3	808	70.7
Sep-18	8.60	649	131	780	111
Oct-18	8.29	629	117	724	114
Nov-18	9.82	1,230	89.8	1,320	127
Dec-18	12.7	855	128	983	124
Jan-19	17.8	1,020	139	1,150	139
Feb-19	26.2	536	201	736	88.1
Mar-19	20.7	1,130	167	1,300	223
Apr-19	13.7	780	190	970	137
May-19	13.1	799	186	984	86.9
Jun-19	9.82	864	71.7	935	85.3
Jul-19	10.1	866	104	969	76.8
Aug-19	10.3	1,120	32.0	1,150	67.3
Sep-19	7.49	709	28.1	737	45.9
Oct-19	6.05	659	3.30	663	52.6
Nov-19	6.87	880	12.9	893	56.7
Dec-19	10.9	684	67.0	751	119
Jan-20	9.03	1,090	61.8	1,160	61.8

Month, Year	Flow mgd	Ammonia kg N/day	Nitrate + Nitrite kg N/day	TIN* kg N/day	Total P kg P/day
Feb-20	8.63	873	17.6	881	59.2
Mar-20	8.35	816	32.2	864	75.2
Apr-20	7.88	666	63.0	729	72.1
May-20	6.46	619	19.8	639	46.2
Jun-20	6.63	827	96.6	923	88.1
Jul-20	5.92	680	20.4	701	57.1
Aug-20	5.86	661	39.7	701	77.1
Sep-20	5.91	773	53.3	693	98.0
Dry Season Average	**7.58**	**720**	**90.9**	**807**	**65.2**
Dry Season Trend **	**Up**	**Up**	**Up**	**Up**	**Up**
Wet Season Average	**11.3**	**729**	**199**	**928**	**81.8**
Average Annual	**9.72**	**725**	**154**	**878**	**74.9**

* The Total Inorganic Nitrogen value is calculated by adding the “Ammonia” and “Nitrate + Nitrite” values.

** Refer to the Section 3.5 in the main body for a description on the statistical analysis.

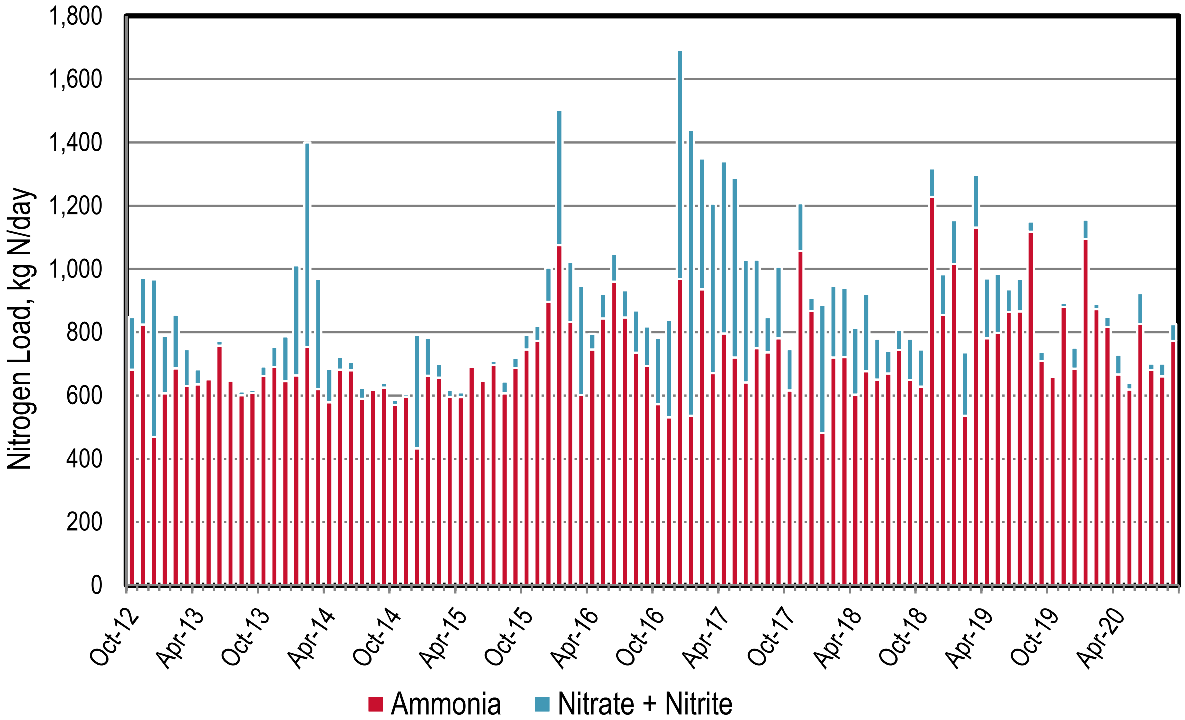

Figure 34-4. Discharge: West County Monthly Nitrogen Loads

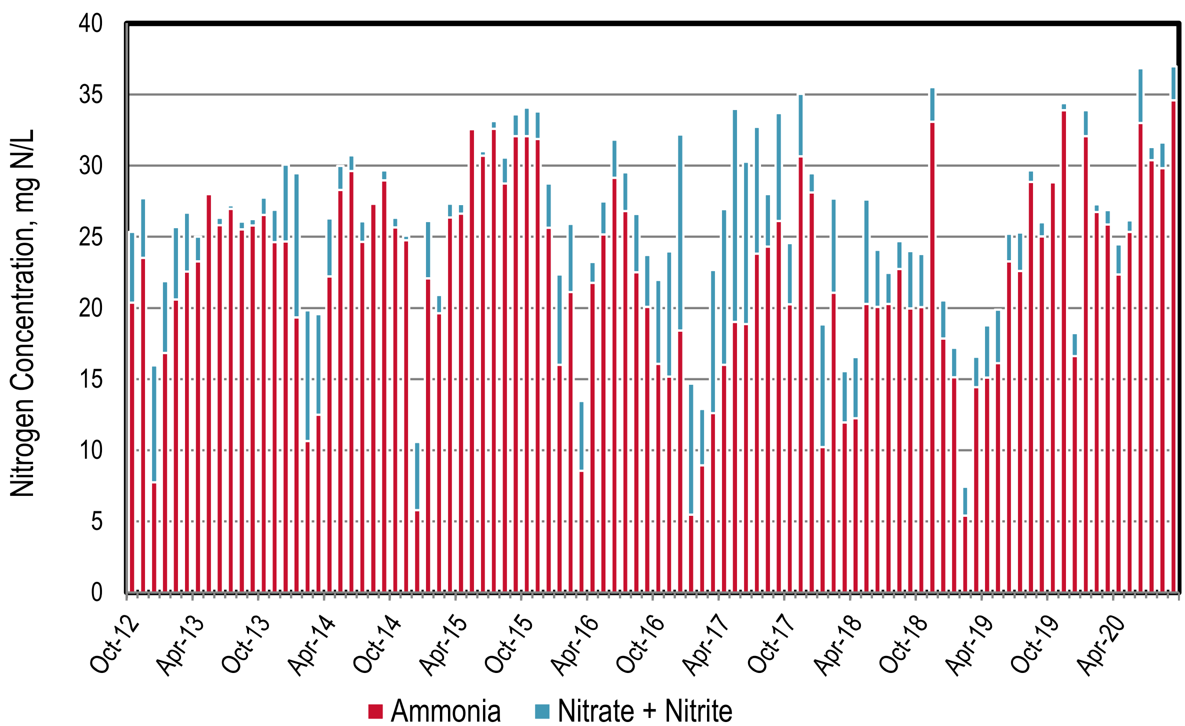

Figure 34-5. Discharge: West County Monthly Nitrogen Concentrations

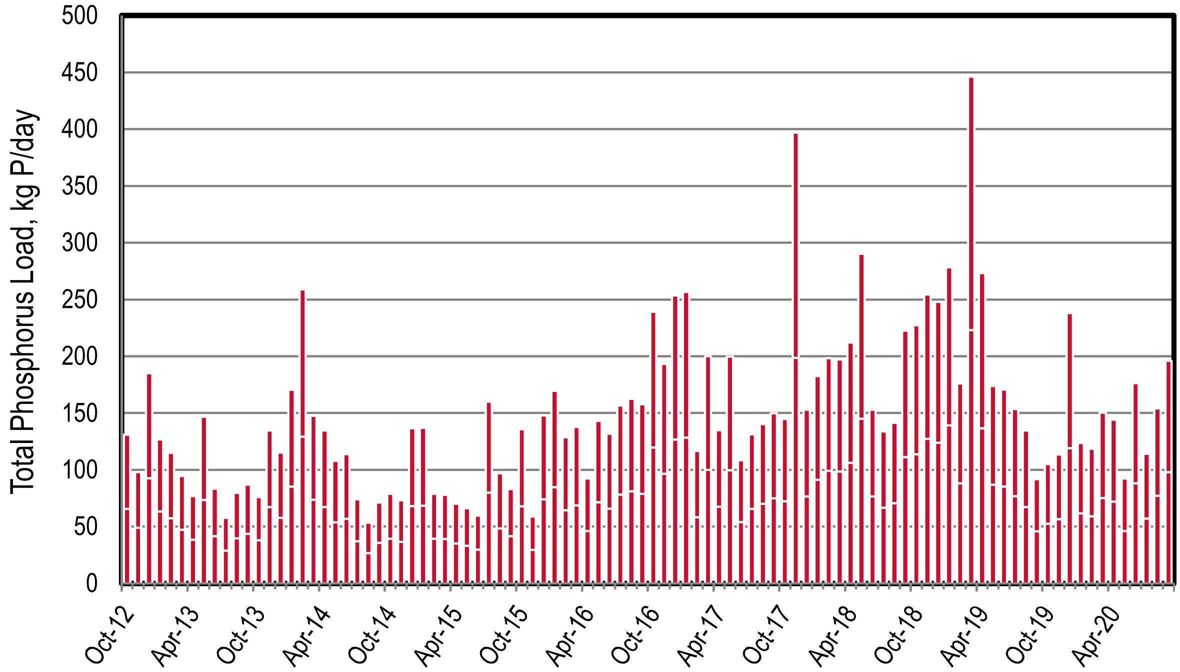

Figure 34-6. Discharge: West County Monthly Phosphorus Loads

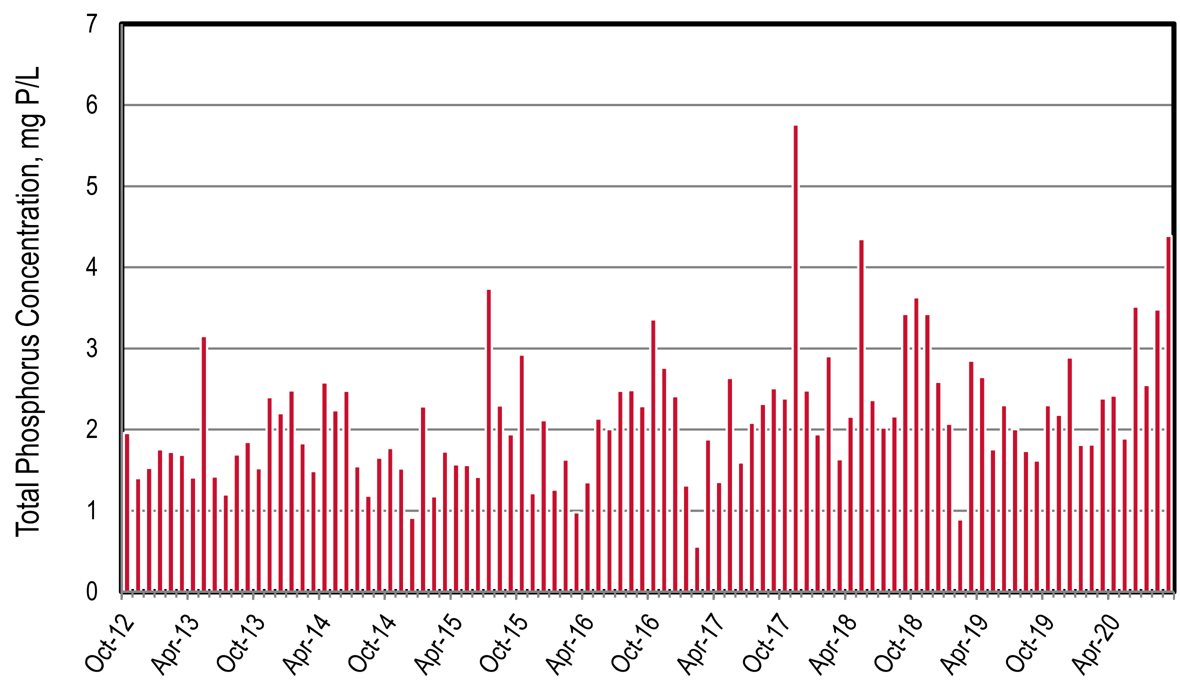

Figure 34-7. Discharge: West County Monthly Phosphorus Concentrations