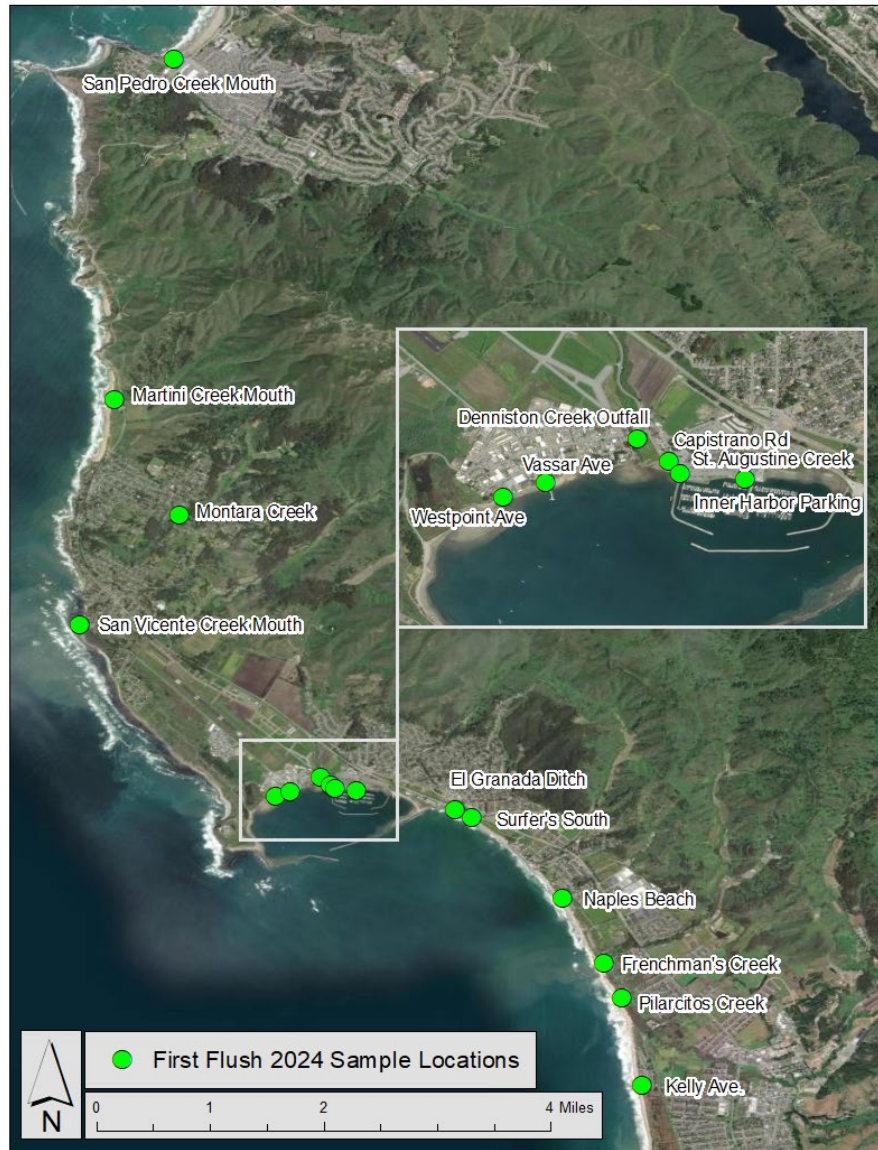


# 2024 First Flush Water Quality Results

Prepared by San Mateo Resource Conservation District  
March 2025



**Figure 1.** Map of First Flush 2024 Sample Sites in San Mateo County

## Executive Summary

First Flush is an annual community science program that monitors pollutants entering the Monterey Bay National Marine Sanctuary (MBNMS). It serves to engage and educate the public about water quality within our community, while simultaneously creating a long-term dataset that can inform conservation actions. Volunteers collect water samples from stormwater outfalls, creeks and creek mouths during the first big rain of the year<sup>1</sup>. First Flush provides a valuable snapshot of a likely worst-case scenario for water quality when contaminants that have built up on land during the dry season are washed into waterways. This information can then be used to identify remediation opportunities or areas for further investigation. The program is run in San Mateo and Monterey counties. The San Mateo Resource Conservation District (RCD) coordinates efforts in San Mateo County as part of the of the overall multi-county program managed by MBNMS.

This report presents and summarizes the results of sampling that occurred in San Mateo County during the first big rain after the 2024 dry season, with discussion of notable observations. Some highlights and key observations from First Flush 2024 include:

1. Nearly all sites showed elevated levels of Fecal Indicator Bacteria (*E. coli*, *Enterococcus*), except for Martini Creek Mouth and Inner Harbor Parking Outfall which were within recommended levels for *E. coli*.
2. West Point Ditch showed elevated levels of nearly all contaminants.
3. Montara Creek stood out in 2023 as having elevated contaminant levels in multiple categories. This site exhibited notable improvements in 2024, showing the lowest concentrations of several categories compared to other sites.
4. All 16 sites were within recommended levels for both total suspended solids and lead.

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<sup>1</sup> Defined as the first post-summer storm event that meets mobilization criteria (a minimum of 0.1 inches of rain, and sheeting water on roadways). This event often occurs in November.

## First Flush 2023 Methods

On November 11, 2024, seven volunteers<sup>2</sup> sampled creeks and stormwater outfalls at 16 sites (Table 1) between Pacifica and Half Moon Bay after 0.22 inches of rainfall.

**Table 1.** Detailed site information for First Flush 2024 sampling. Sites listed from north to south.

Site Name	Site Code	Latitude	Longitude
San Pedro Creek Mouth	202-SPCM-01	37.59620	-122.50561
Martini Creek Mouth	202-MOSD-04	37.55278	-122.51325
Montara Creek	202-MOSD-03	37.53812	-122.50496
San Vicente Creek Mouth	202-MBSD-05	37.52412	-122.51760
West Point Ditch	202-MBSD-04	37.50217	-122.49265
Vassar Outfall	202-EGSD-04	37.50278	-122.49083
Denniston Creek Outfall	202-PPSD-03	37.50465	-122.48693
Capistrano Outfall	202-EGSD-03	37.50371	-122.48560
St. Augustine Outfall	202-PPSD-04	37.50317	-122.48511
Inner Harbor Parking Outfall	202-PPSD-05	37.50293	-122.48234
El Granada Outfall	202-EGSD-01	37.50046	-122.46982
Surfer's South Outfall	202-EGSD-02	37.49959	-122.46769
Naples Beach Creek Mouth <sup>3</sup>	202-NBDO-22	37.48923	-122.45610
Frenchmans Creek Mouth	202-FRENC-11	37.48091	-122.45077
Pilarcitos Creek Mouth	202-PILAR-12	37.47656	-122.44857
Kelly Outfall	202-HMB-05	37.46531	-122.44591

Samples were analyzed for fecal indicator bacteria (FIB), heavy metals (copper, lead, zinc), nutrients (nitrate and orthophosphate), and total suspended solids (TSS) (Table 2). These testing categories will be referred to as “analytes.” Results are compared to established standards, and the term Water Quality Objective (WQO) refers to the threshold set in these standards. A WQO exceedance means that a given analyte is greater than its corresponding WQO, indicating that water quality is impaired. A more detailed description and list of all WQOs by analyte and source is provided in Appendix A.

<sup>2</sup> Volunteer turnout varies, sometimes including 20 or more participants.

<sup>3</sup> This site has historically been named “Naples Beach” in the First Flush program. Location sampled is the mouth of what may be more commonly known as Roosevelt Creek.

**Table 2.** Analytes tested in 2023.

<b>Analyte</b>	<b>Potential Sources</b>	<b>Effects</b>
Fecal Indicator Bacteria (FIB) ( <i>E. coli</i> , <i>Enterococcus</i> )	Feces of warm-blooded animals (humans, dogs, horses, wildlife, etc.)	Pathogens that can harm human health could be present alongside the bacteria (the bacteria themselves are not harmful).
Nutrients (nitrates and orthophosphates)	Fertilizers, pesticides, detergents	Ecosystem and recreation impacts. Excess nutrients can cause Harmful Algal Blooms (HABs) and/or oxygen depletion in waters.
Metals (copper, lead, zinc)	Gutters/roofs, brake pads, tires, industrial waste, treated lumber, paint, fires	Human health and environmental impacts from heavy metal toxicity (concentration-dependent), including reproductive effects and/or mortality of aquatic organisms.
Total Suspended Solids (TSS)	Construction, erosion, agricultural runoff, fires	Mobilization of contaminants, and aquatic organism impacts such as habitat sedimentation and respiratory inhibition.

## Key Findings

### Results Summary

A general overview is provided here. Detailed analysis of results is provided in the following sections. Raw data for all sites is provided in Appendix B.

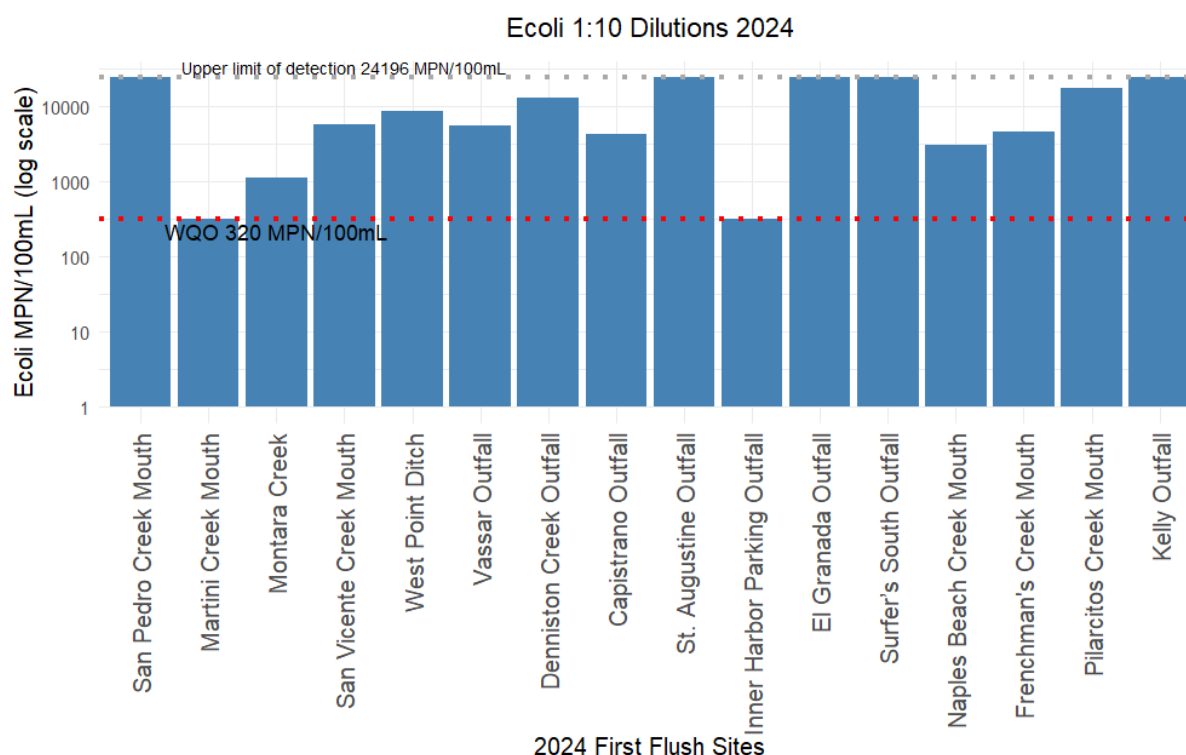
- Fecal Indicator Bacteria:
  - *E. coli* concentrations exceeded WQOs at 13 of 16 sites.
  - *Enterococcus* concentrations exceeded WQOs at all 16 sites.
- Nutrients:
  - Nitrate concentrations exceeded WQOs at one of 16 sites.
  - Orthophosphate was detected at five sites, and concentrations exceeded WQOs at all sites where it was detected.
- Heavy Metals:
  - Copper concentrations exceeded WQOs at four of 16 sites.
  - Lead concentrations were within recommended levels at all 16 sites.
  - Zinc concentrations exceeded WQOs at one of 16 sites.
- Total Suspended Solids (TSS) were within recommended levels at all 16 sites

- Site-specific observations:
  - Martini Creek Mouth and Inner Harbor Parking Outfall were within recommended levels for *E. coli* but still exceeded the WQO for *Enterococcus*.
  - Sites that drain to the Pillar Point Outer Harbor showed high levels of various metals and nutrients.
    - West Point Ditch exceeded WQOs for *E. coli*, *Enterococcus*, copper, zinc, nitrate, and orthophosphate, and exhibited the highest concentration in nearly all analytes except for orthophosphate and *E. coli* compared to other sites.
    - Vassar Outfall exceeded WQOs for copper and orthophosphate.
    - Capistrano Outfall exceeded the WQO for copper.
  - Montara Creek exhibited high concentrations for several analytes in 2023, but in 2024 had the lowest concentration of copper and lead when compared to other sites, and nitrate and orthophosphate were not detected. TSS at this site was the highest ever observed in this program in 2023 but fell to the median concentration in 2024 compared to other sites.
  - Kelly Outfall exhibited high concentrations of copper and orthophosphate.
  - Naples Beach Creek Mouth exhibited some of the lowest concentrations of metals, but the highest concentration of orthophosphate compared to other sites.

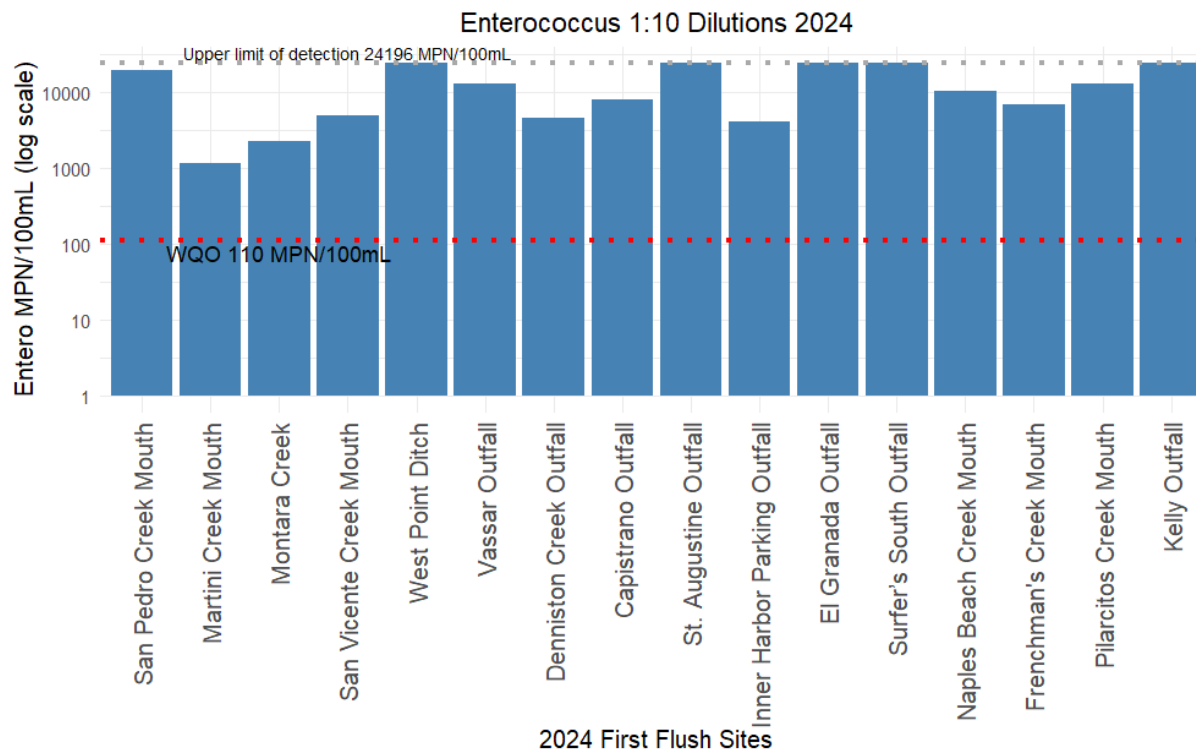
## Fecal Indicator Bacteria

Fecal indicator bacteria (FIB) serve as an indicator for the presence of the feces of warm-blooded animals, which indirectly indicates the potential presence of pathogens (e.g., viruses and bacteria) that can impact human health. Primary sources of FIB include humans, domesticated pets, and wildlife. Secondary sources include areas where bacteria may fester and proliferate outside of the gut biome of warm-blooded animals such as in sands, sediments, and biofilms. *E. coli* and *Enterococcus* are the two types of FIB that we test for in the First Flush program. Scientific guidelines recommend measuring *E. coli* in freshwater and *Enterococcus* in saltwater. This is because *Enterococci* can survive in saltwater whereas *E. coli* dies more quickly once they reach the ocean. Since the First Flush program is evaluating the nexus of these two systems, it is useful to test for the presence of both. Importantly, however, *E. coli* and *Enterococcus* results are not “apples to apples” and should not be directly compared to one another. This is exemplified by the differing WQOs between these two analytes. The WQOs for *E. coli* and *Enterococcus* are 320 MPN/100mL and 110 MPN/100mL, respectively.

*E. coli* was above recommended levels at 14 sites, and *Enterococcus* was above recommended levels at all 16 sites in 2024 (Figure 2, Figure 3). Since First Flush is designed to capture data on what is likely the worst day of the year for water quality, high bacterial concentrations are expected. This held true in 2024, except that *E. coli* at Martini Creek Mouth and Inner Harbor Parking were within recommended levels. Additionally, two-thirds of all *E. coli* and *Enterococcus* samples (21 out of 32) were below the upper limit of detection - the maximum concentration quantifiable using our lab methods. This is noteworthy because samples reported at the upper limit likely exceed that concentration. For comparison, in 2023, fewer than half of the samples (13 out of 30) were below this upper limit.

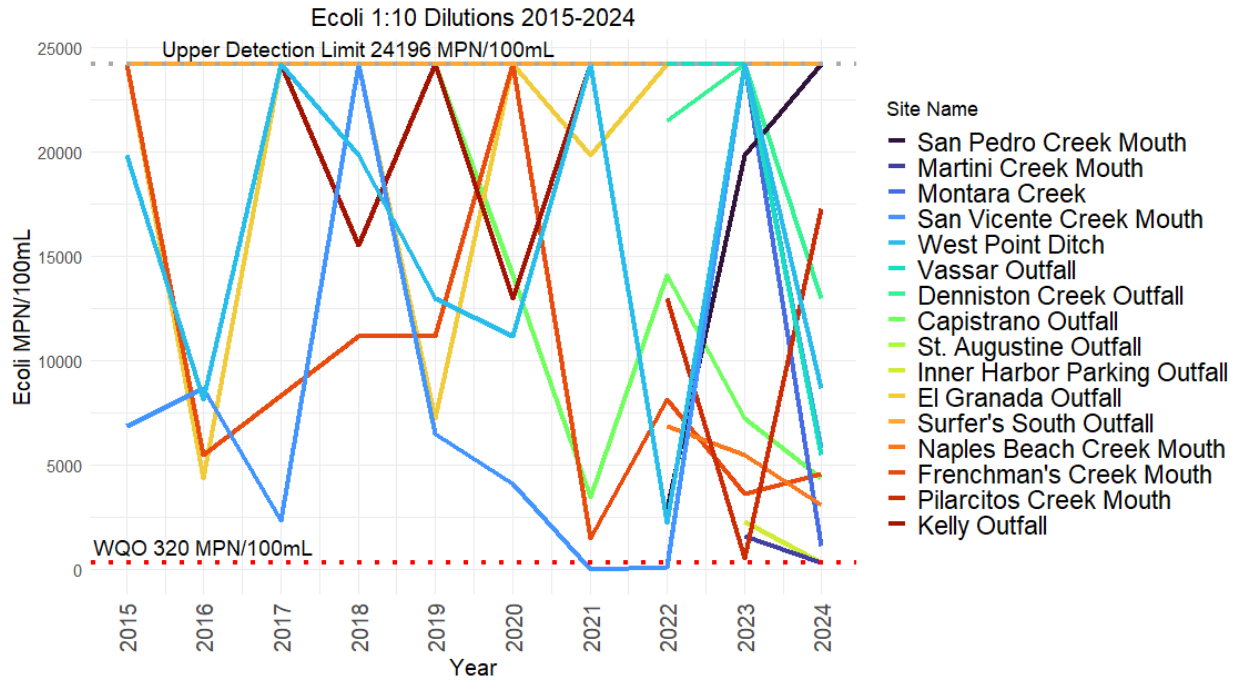


**Figure 2.** *E. coli* concentrations at a 1:10 dilution for First Flush 2024. Note the y-axis is on a logarithmic scale. Sites are arranged from north (left) to south (right).

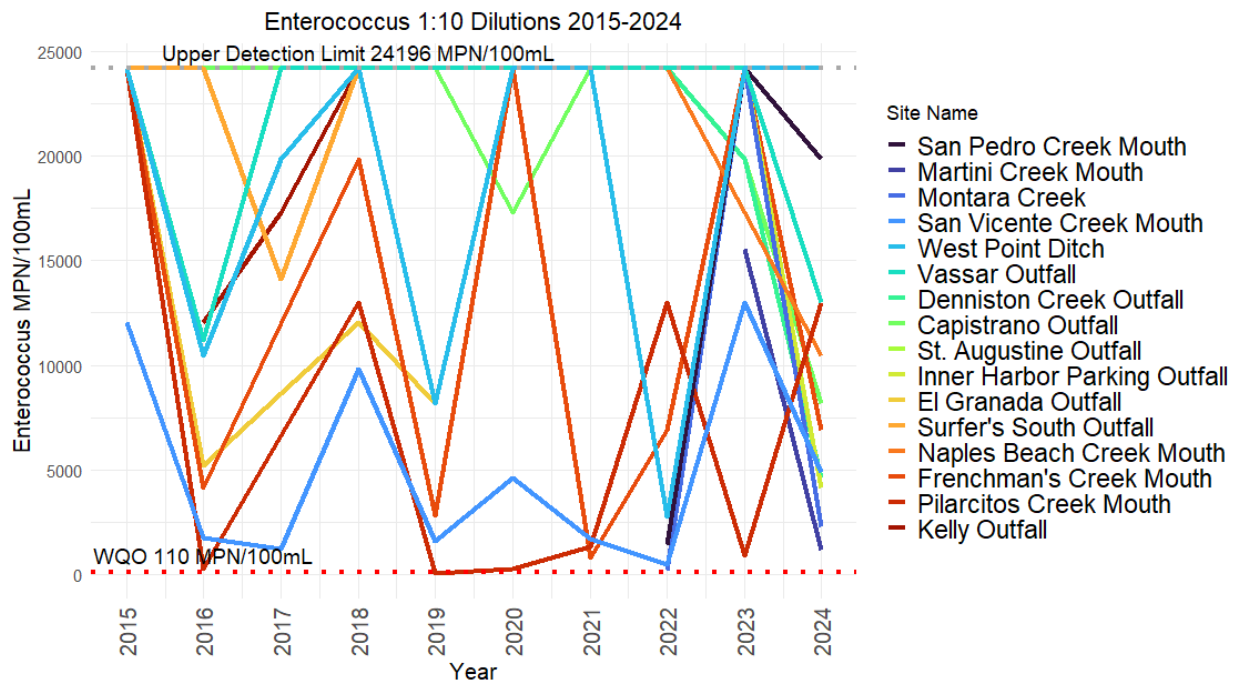


**Figure 3.** *Enterococcus* concentrations at a 1:10 dilution for First Flush 2024. Note the y-axis is on a logarithmic scale. Sites are arranged from north (left) to south (right).

Examining long-term trends, we see that all sites frequently exceed WQOs for FIB during First Flush. Prior to 2024, only three *E. coli* samples had fallen below the WQO since 2015 – at San Vicente Creek Mouth and Montara Creek – making it especially significant that two sites met recommended levels this year (Figure 4). *Enterococcus* levels have been more persistently high, with only one sample below the WQO since 2015. All sites showed a noticeable decrease in *Enterococcus* concentrations between 2023 and 2024, except for Pilarcitos Creek Mouth which showed an increase (Figure 5).



**Figure 4.** Historical *E. coli* First Flush concentrations at a 1:10 Dilution (2015-2024).



**Figure 5.** Historical *Enterococcus* First Flush concentrations at a 1:10 Dilution (2015-2024).

## Heavy Metals: Copper, Lead, and Zinc

Heavy metals can enter waterways from fires, gutters/roofs, brake pads, tires, industrial waste, treated lumber, paint, and other natural and anthropogenic sources. Heavy metals, which can be essential micronutrients<sup>4</sup> at appropriate doses, can also be linked to various human and ecological health impacts when present at high concentrations. The three heavy metals tested in the First Flush program are copper, lead, and zinc.

### Copper

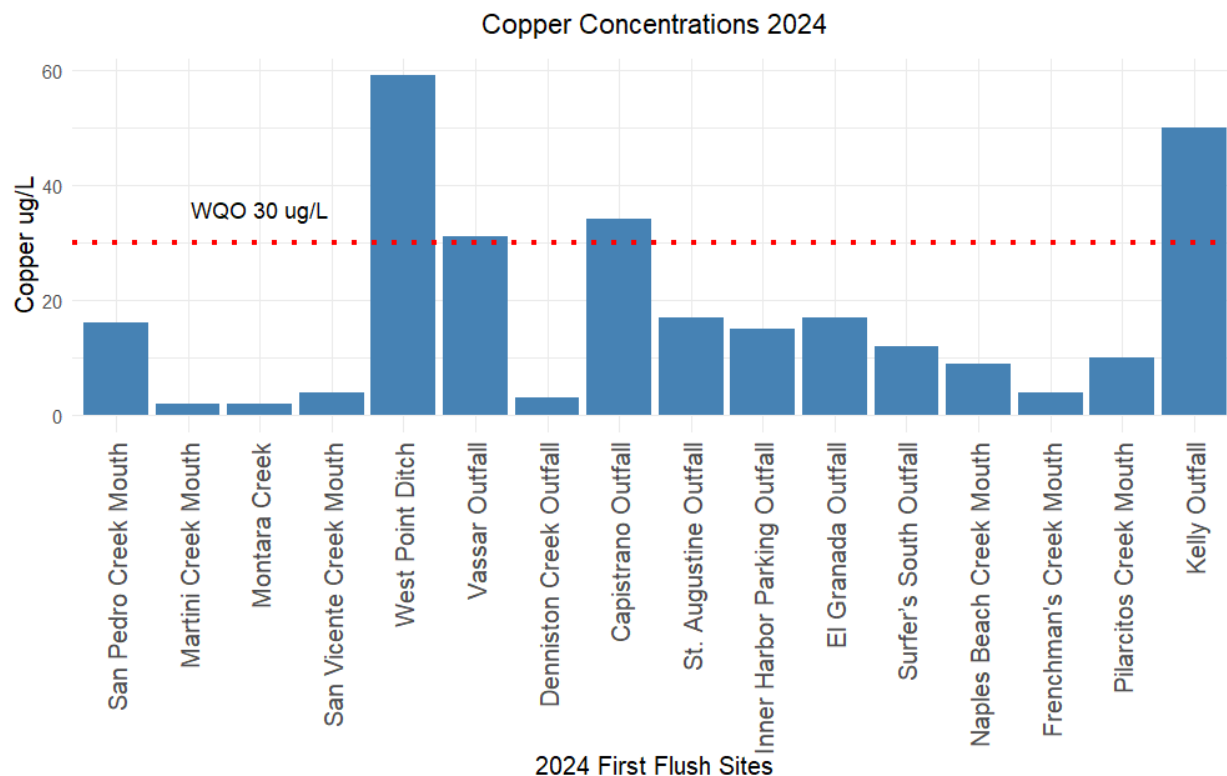
The WQO of 30 ug/L for copper represents the maximum concentration recommended for protection of aquatic life habitats<sup>5</sup>. Copper occurs in the environment due to both natural and human processes. It is an essential micronutrient at low concentrations but toxic to aquatic organisms at high concentrations. Copper can enter waterways when natural deposits are subject to weathering and erosion, or as a result of human activities. Copper is frequently used in siding and roofing materials, boat paint, lumber treatments, water pipes, and manufacturing processes due to its resistance to corrosion and fouling. It can enter waterways as these materials slowly degrade, or through other pathways such as industrial discharge or during activities such as sanding paint.

Copper was detected at all 16 sites and concentrations were above recommended levels at four sites in 2024 (Figure 6). West Point Ditch, Vassar Outfall, and Capistrano Outfall are all located in Princeton-by-the-Sea and drain a mix of industrial, residential, and agricultural stormwater into the Pillar Point Outer Harbor. Kelly Outfall is located within Half Moon Bay State Park and drains primarily residential stormwater onto the beach. The highest concentration was observed at West Point Ditch (59 ug/L) and the lowest concentration was observed at Montara Creek and Martini Creek Mouth (2 ug/L).

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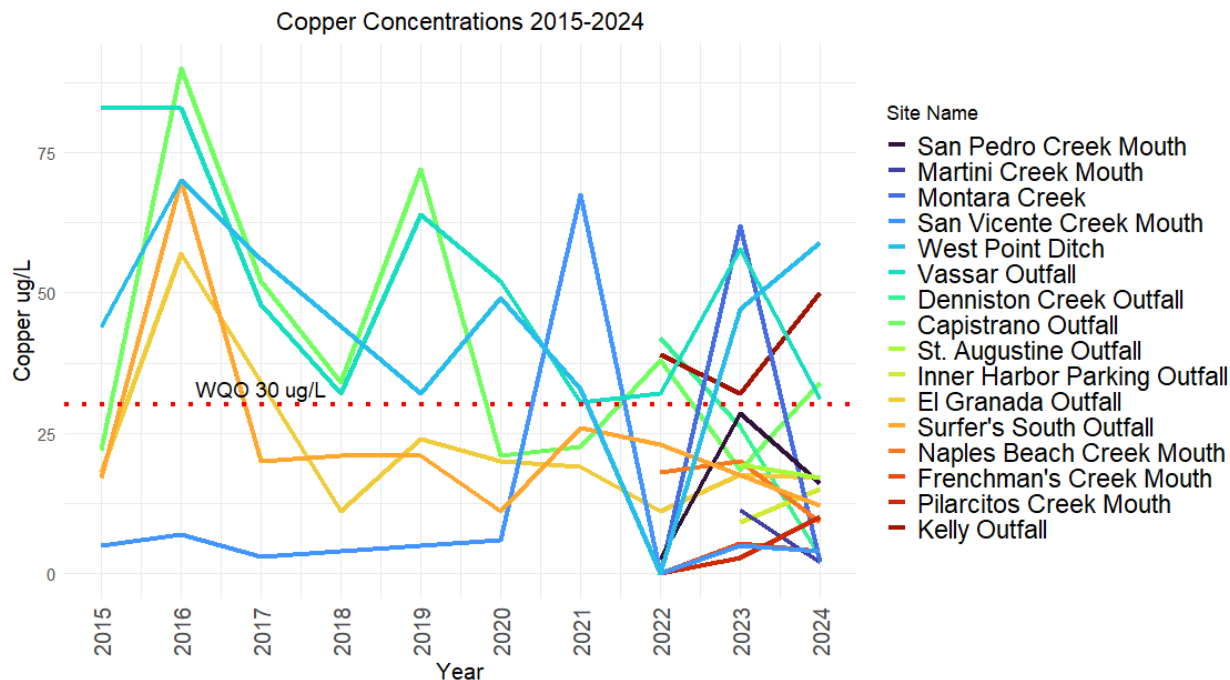
<sup>4</sup> Micronutrient: a chemical element or substance required in trace amounts for the normal growth and development of living organisms.

<sup>5</sup> [Water Quality Control Plan for the Central Coast Basin](#) (pg. 38)



**Figure 6.** Copper concentrations for First Flush 2024. Sites are arranged from north (left) to south (right).

Examining long-term trends, three sites appear to exceed the WQO for copper with some regularity: West Point Ditch, Vassar Outfall, and Capistrano Outfall (Figure 7). Based on these results, further evaluation may help identify and remediate potential sources of copper entering the ocean. There visually appears to be an overall decreasing trend at Capistrano Outfall since 2015. Kelly Outfall has only been sampled for three years but also stands out as consistently exceeding recommended levels. Montara Creek exhibited the highest concentration of copper in 2023, and the lowest concentration of copper in 2024. This may be a singular spike as observed at San Vicente Creek Mouth in 2021.



**Figure 7.** Historical copper First Flush concentrations (2015-2024).

## Lead

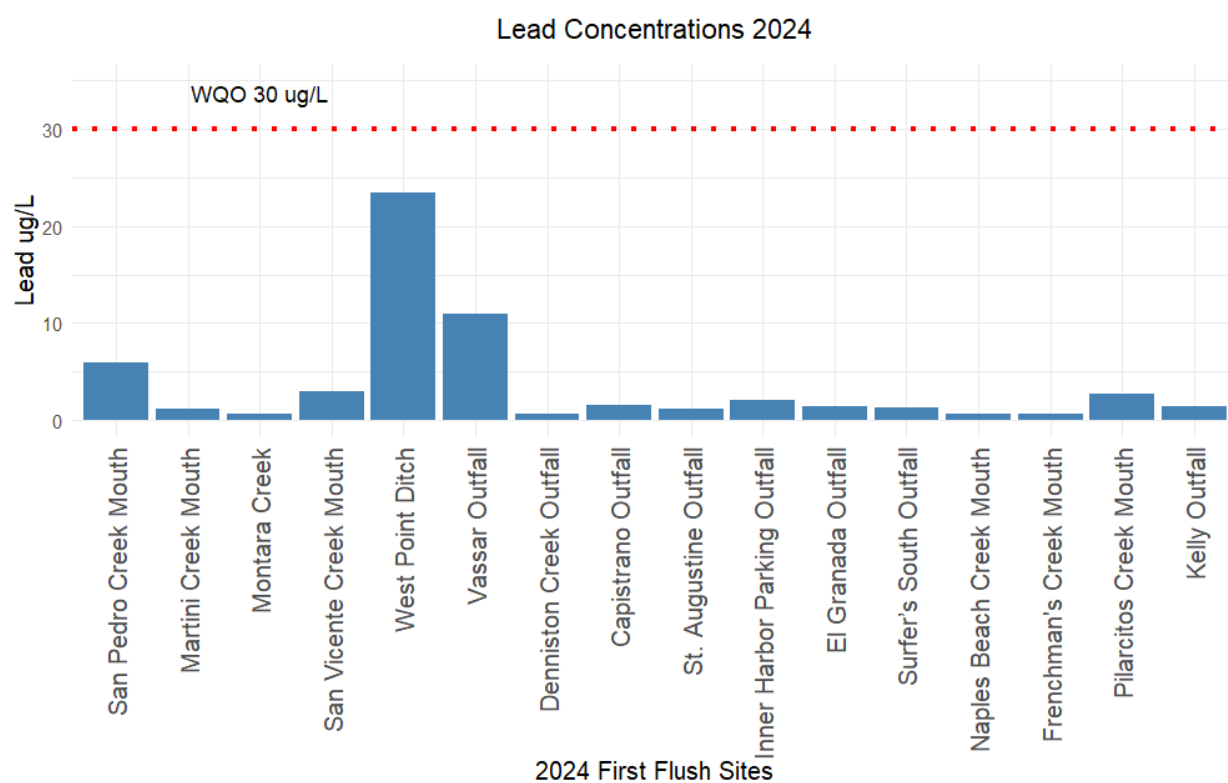
The WQO of 30 ug/L for lead represents the maximum concentration recommended for protection of aquatic life habitats<sup>6</sup>. Lead exposure can affect multiple body systems of humans and animals and is particularly harmful to young children. The occurrence of lead at elevated levels in streams and waterways is often the result of human activities. Lead persists in the environment from legacy uses such as fuel additives, ammunition, household paint, pipes, and fixtures, or as a byproduct of smelting or other industrial activities. While many of these legacy uses have been discontinued or are now more strictly regulated, lead is still commonly used in marine applications such as hull paint and ballast, and other industrial processes due to its density and resistance to fouling. Lead poisoning remains a significant issue, and the US EPA provides guidance on minimizing exposure in and around the household<sup>7</sup>.

Lead was detected at all 16 sites, but concentrations were within recommended levels at all sites in 2024 (Figure 8). The highest concentration was observed at West Point Ditch (23.4 ug/L) and the lowest concentration was observed at Montara Creek, Naples Beach Creek Mouth, and Frenchmans Creek Mouth (0.6 ug/L).

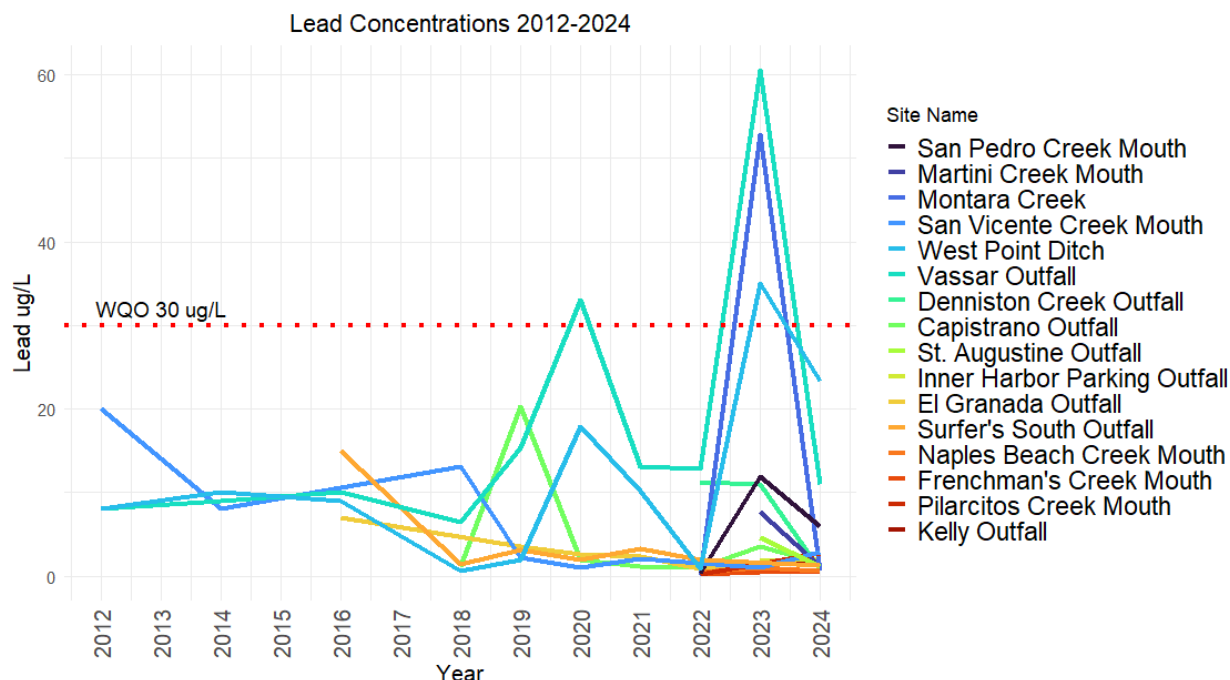
<sup>6</sup> [Water Quality Control Plan for the Central Coast Basin](#) (pg. 38)

<sup>7</sup> <https://www.epa.gov/lead/learn-about-lead#found>

Examining long-term trends, WQO exceedances for lead have been relatively uncommon (Figure 9). However, three notable exceedances occurred in 2023 at Montara Creek, West Point Ditch, and Vassar Outfall. Montara Creek showed a sharp spike that year, possibly linked to high TSS levels, but lead concentrations returned to near-zero in 2024. In contrast, West Point Ditch and Vassar Outfall have shown an increasingly consistent presence of lead since 2018, though levels in 2024 remained within recommended limits. Further evaluation during the dry season may help identify potential sources of lead in this area.



**Figure 8.** Lead concentrations for First Flush 2024. Sites are arranged from north (left) to south (right).



**Figure 9.** Historical lead First Flush concentrations (2012-2024).

## Zinc

The WQO of 200 ug/L for zinc represents the maximum concentration recommended for protection of aquatic life habitats<sup>8</sup>. Zinc occurs naturally in soils, air, water, and can be found in all foods. It is also an essential micronutrient commonly found in nutritional supplements but can cause health effects for people and animals at high concentrations. Zinc can enter waterways when natural deposits are subject to weathering and erosion, or as a result of human activities such as mining or other industrial processes. Zinc is used in the production of many goods, including galvanized metals, dry cell batteries, paints and ceramics, rubber, treated lumber, fabric dyes, and many household goods such as sun blocks, deodorants, diaper rash ointments, athlete’s foot treatments, and antidandruff shampoos<sup>9</sup>.

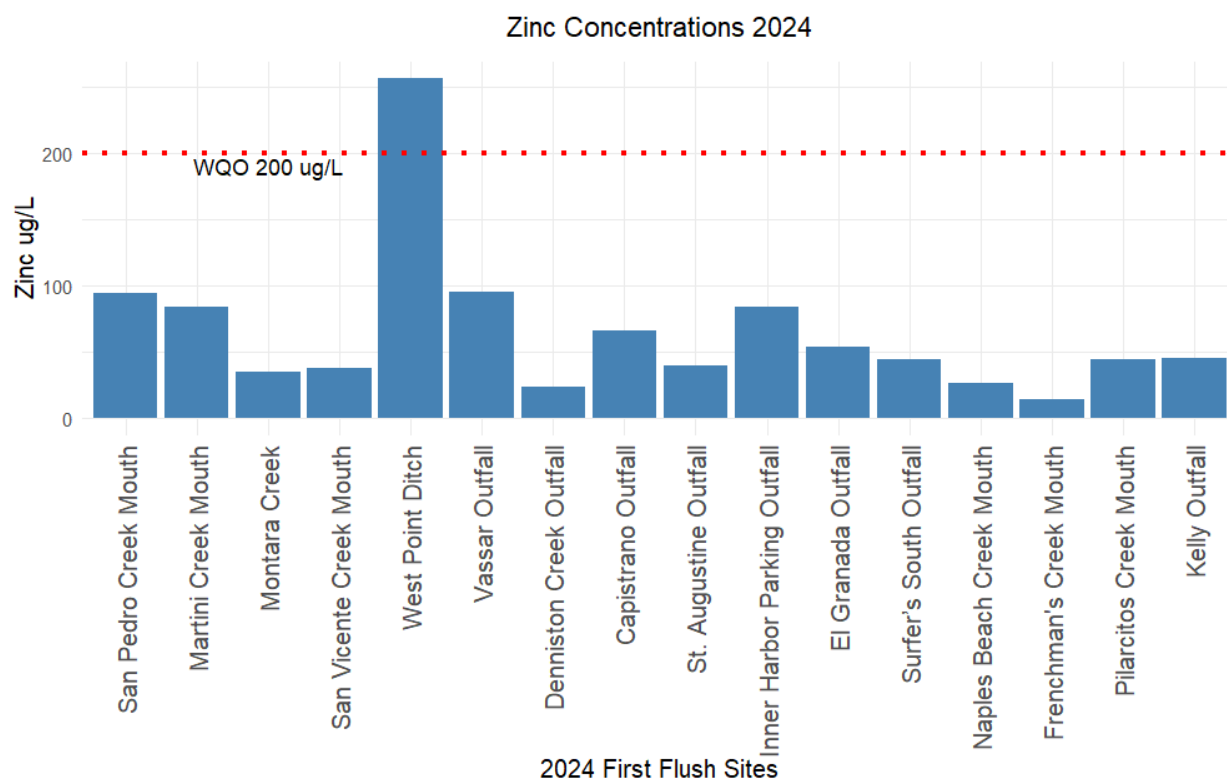
Zinc was detected at all 16 sites and concentrations were above recommended levels at one site in 2024 (Figure 10). The highest concentration was observed at West Point Ditch (256 ug/L) and the lowest concentration was observed at Frenchmans Creek Mouth (14 ug/L). West Point Ditch is located in Princeton-by-the-Sea and drains a mix of industrial, residential, and agricultural stormwater into the Pillar Point Outer

<sup>8</sup> [Water Quality Control Plan for the Central Coast Basin](#) (pg. 38)

<sup>9</sup> [US Dept. of Health and Human Services: Toxicological profile for Zinc](#)

Harbor. Frenchmans Creek Mouth is located Half Moon Bay and drains primarily agricultural and residential stormwater onto Half Moon Bay State Beach.

Examining long-term trends, zinc concentrations are generally low but appeared to spike across several sites in 2016, 2019, and 2023 (Figure 11). In 2023, Montara Creek exhibited the highest concentration of zinc ever observed in this program, but returned to low levels in 2024. This significant spike may or may not be related to a high TSS event that occurred at this site in 2023. Vassar Outfall showed a similar trend where it exceeded the WQO in 2023 and returned to low levels in 2024. West Point Ditch, however, exceeded the WQO in both 2023 and 2024. Further evaluation during the dry season may help identify potential sources of zinc in this area.



**Figure 10.** Zinc concentrations for First Flush 2024. Sites are arranged from north (left) to south (right).

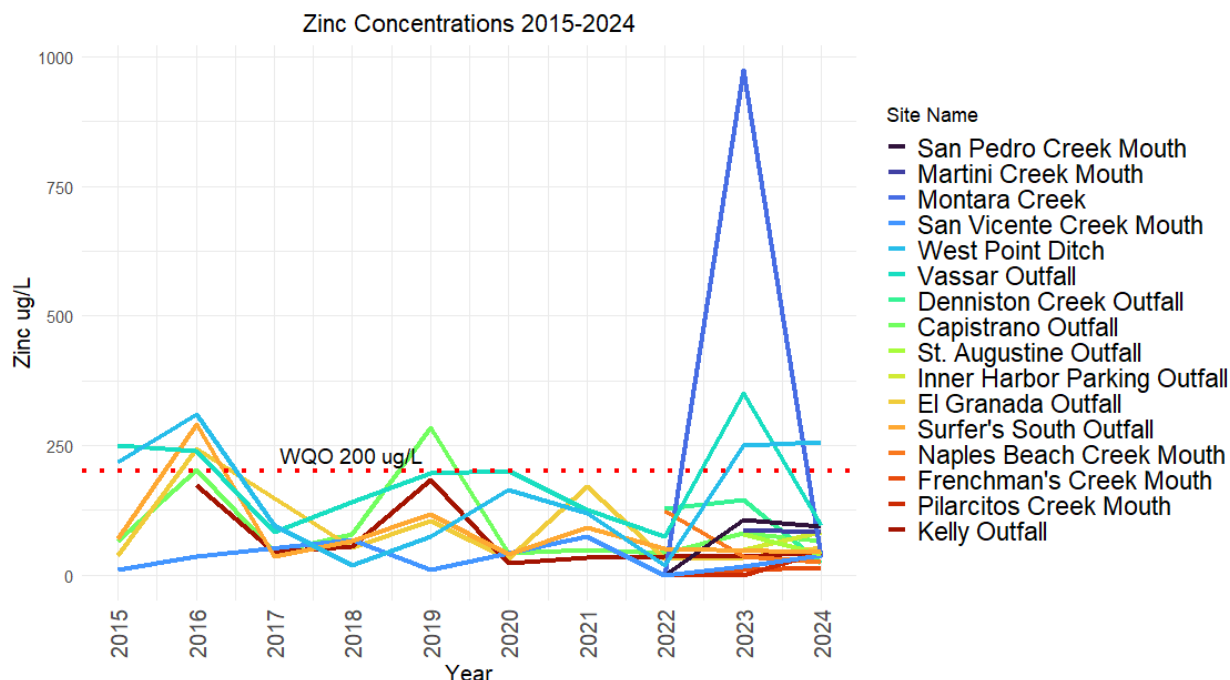


Figure 11. Historical zinc First Flush concentrations (2015-2024).

### Nutrients: Nitrates and Orthophosphates

Nutrients can be likened to plant “food” and are essential for their growth. There are 16 known essential nutrients that are sub-categorized based on the relative amount typically required for plants and algae. Primary macronutrients (required in greatest amount) are carbon, hydrogen, nitrogen, oxygen, phosphorus, and potassium. Secondary macronutrients (required in moderate amounts) are calcium, magnesium, and sulfur. Micronutrients (required in very small amounts) include boron, chlorine, copper, iron, manganese, molybdenum, and zinc<sup>10</sup>.

Since nutrients are essential to plant growth, fertilizers that contain them are frequently used in agriculture, residential gardens, and ornamental landscapes. Agricultural fertilizer use is regulated at the state level under the Irrigated Lands Regulatory Program<sup>11</sup>, whereas residential use is not regulated other than labeling requirements for these products. Other sources of nutrients include some pesticides, detergents, and human and animal waste.

Too many nutrients in rivers, lakes, or oceans can cause algae to reproduce and grow quickly, also known as a “bloom”. When algae blooms deplete the available nutrients, they die and break down, using up oxygen in the water through

<sup>10</sup> [Texas A&M AgriLife Extension: Essential Nutrients for Plants](#)

<sup>11</sup> [State Water Resources Control Board Irrigated Lands Regulatory Program](#)

decomposition which can make it hard for fish and other animals to survive. This process, called eutrophication<sup>12</sup>, can lead to large fish die-offs and change which species can live in the water.

The relationship between nutrient concentrations and water quality is highly complex. Nutrient chemistries in soil and water are heavily dependent on not only inputs, but also physical conditions such as temperature, soil type and pH, and biological interactions with microbes and algae. Natural background concentrations of nutrients can vary regionally, so thresholds for impairment are not necessarily consistent between waterbodies<sup>13</sup>. Nutrient WQOs are therefore most useful when identified through a regionally specific approach rather than using WQOs sourced from more far-reaching EPA policies.

Nitrogen and phosphorus are primary macronutrients<sup>14</sup> that are commonly evaluated when testing water quality, as they are two of the most important nutrients for plant and algae growth. These measurements allow us to gain a better understanding of habitat condition but cannot be used as the only metric to evaluate nutrient impairment. The First Flush program tests storm runoff for nitrate and orthophosphate concentrations as an indicator of potential impairment and can help us make informed decisions on where and how to manage land use or conduct further analyses.

## Nitrate

The WQO for nitrate as N (NO<sub>3</sub>-N) for the protection of aquatic habitats<sup>15</sup> is 2.25 mg-N/L. Nitrate was detected at 12 of 16 sites, and concentrations were above recommended levels at one site (Figure 12). The highest concentration was observed at West Point Ditch (7.2 mg/L), and nitrate was not detected at Martini Creek Mouth, Montara Creek, San Vicente Creek Mouth, and Denniston Creek Outfall.

Examining long-term trends, West Point Ditch and Vassar Outfall tend to exhibit higher concentrations of nitrate when compared to other sites (Figure 13). As stated above, the relationship between nutrient concentration and overall water quality depends heavily on site-specific factors, and higher concentrations don't necessarily mean that those waterbodies are less healthy. To that end, results that could indicate potential nutrient impairment include consistent WQO exceedances, a significant increasing trend, or a sudden shift to a new, higher, baseline level that persists over time. Only three sites have exceeded the WQO for nitrate since 2015:

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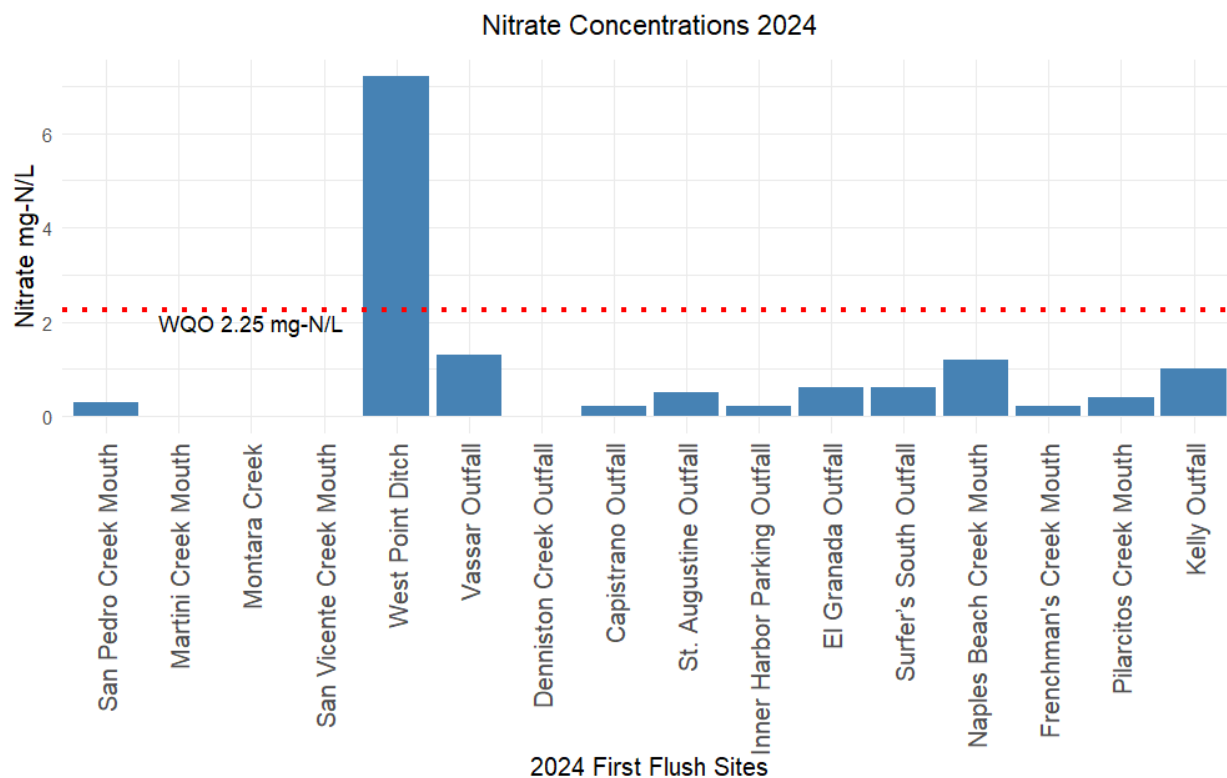
<sup>12</sup> [CalEPA Office of Environmental Health Hazard Assessment: Division 4.5, Title 22 \(Pg. 20\)](#)

<sup>13</sup> [USEPA Fact Sheet on Water Quality Parameters: Nutrients](#)

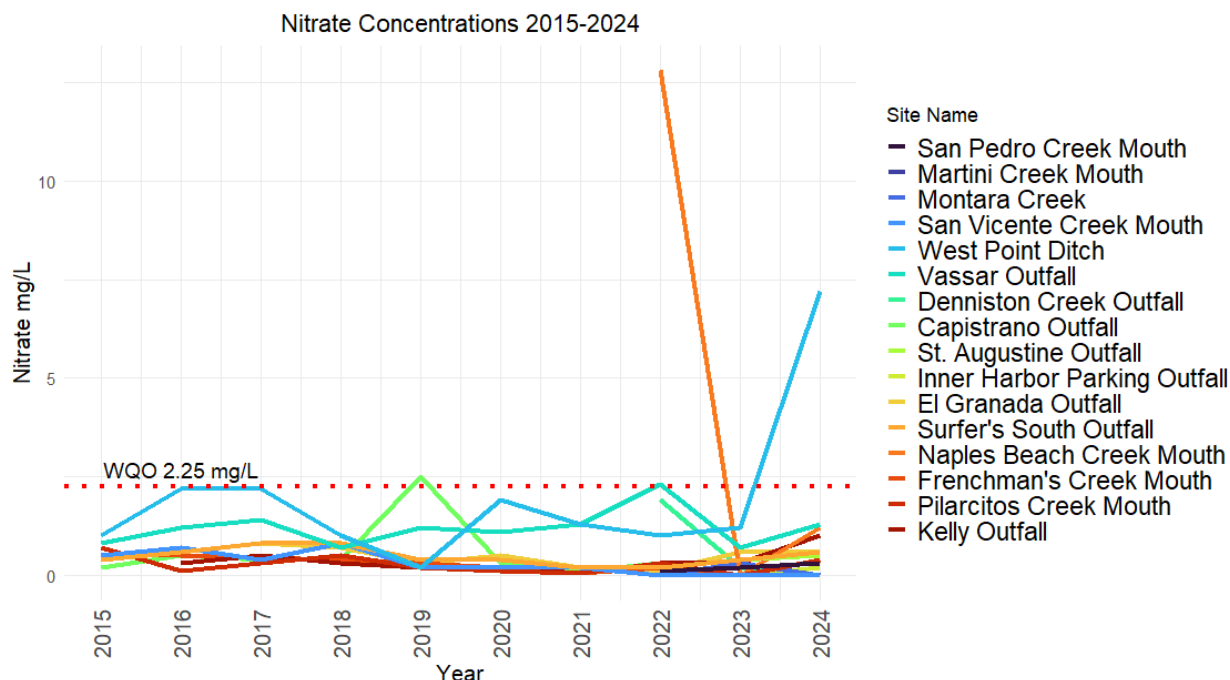
<sup>14</sup> Macronutrient: a chemical element or substance required in large amounts for the normal growth and development of living organisms.

<sup>15</sup> [CCAMP Pajaro River Watershed Characterization Report 1998, rev 2003](#) (pg. 9)

Capistrano Outfall (2019), Vassar Outfall (2022), and now West Point Ditch (2024). It's possible that West Point Ditch will return to baseline levels in 2025, as we saw with past exceedances at Capistrano and Vassar Outfalls. If West Point Ditch continues at 2024 levels into future years, this may be a sign of impairment. Martini Creek Mouth and San Vicente Creek Mouth appear to exhibit relatively low nitrate concentrations throughout the life of this program and were the only two sites where nitrate was not detected in both 2023 and 2024.



**Figure 12.** Nitrate concentrations for First Flush 2024. Sites are arranged from north (left) to south (right).



**Figure 13** Historical nitrate First Flush concentrations (2015-2024).

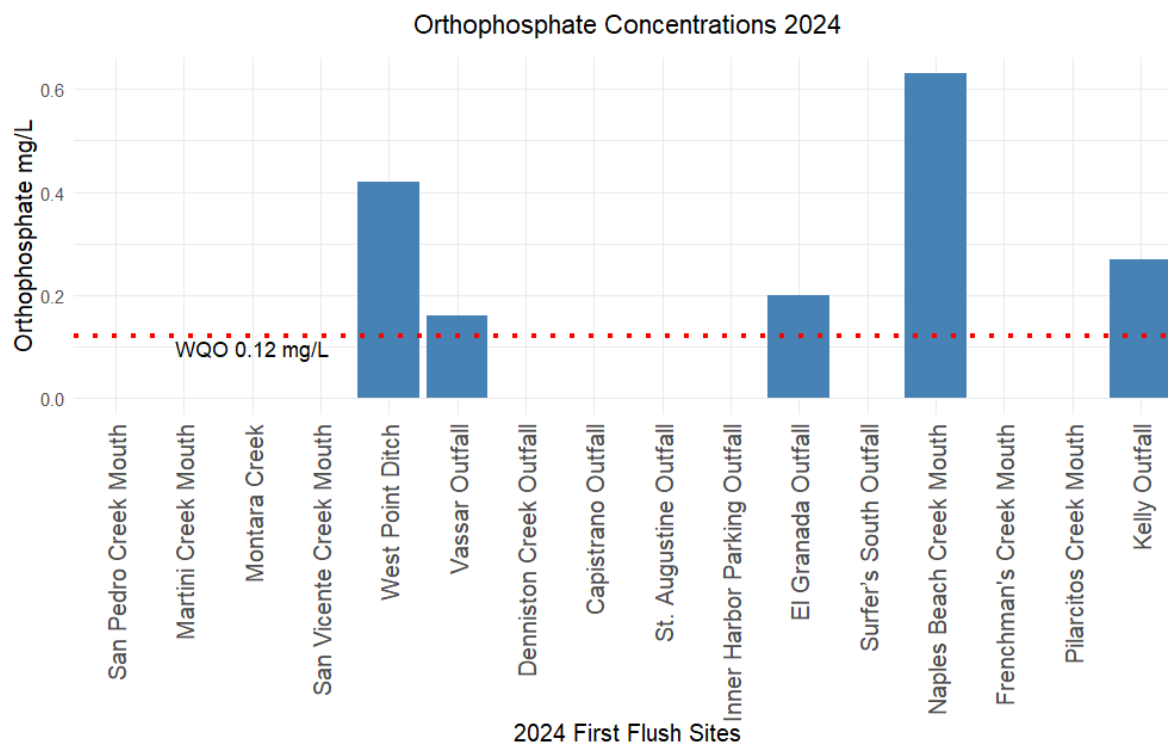
## Orthophosphate

The WQO for orthophosphate (PO<sub>4</sub>-P) for the protection of aquatic habitats<sup>16</sup> is 0.12 mg-P/L. Orthophosphate was detected at five of 16 sites, and concentrations were above recommended levels at all sites where it was detected (Figure 14). The highest concentration was observed at Naples Beach Creek Mouth (0.63 mg/L), and orthophosphate was not detected at San Pedro Creek Mouth, Martini Creek Mouth, Montara Creek, San Vicente Creek Mouth, Denniston Creek Outfall, Capistrano Outfall, St. Augustine Outfall, Inner Harbor Parking Outfall, Surfer’s South Outfall, Frenchmans Creek Mouth, and Pilarcitos Creek Mouth.

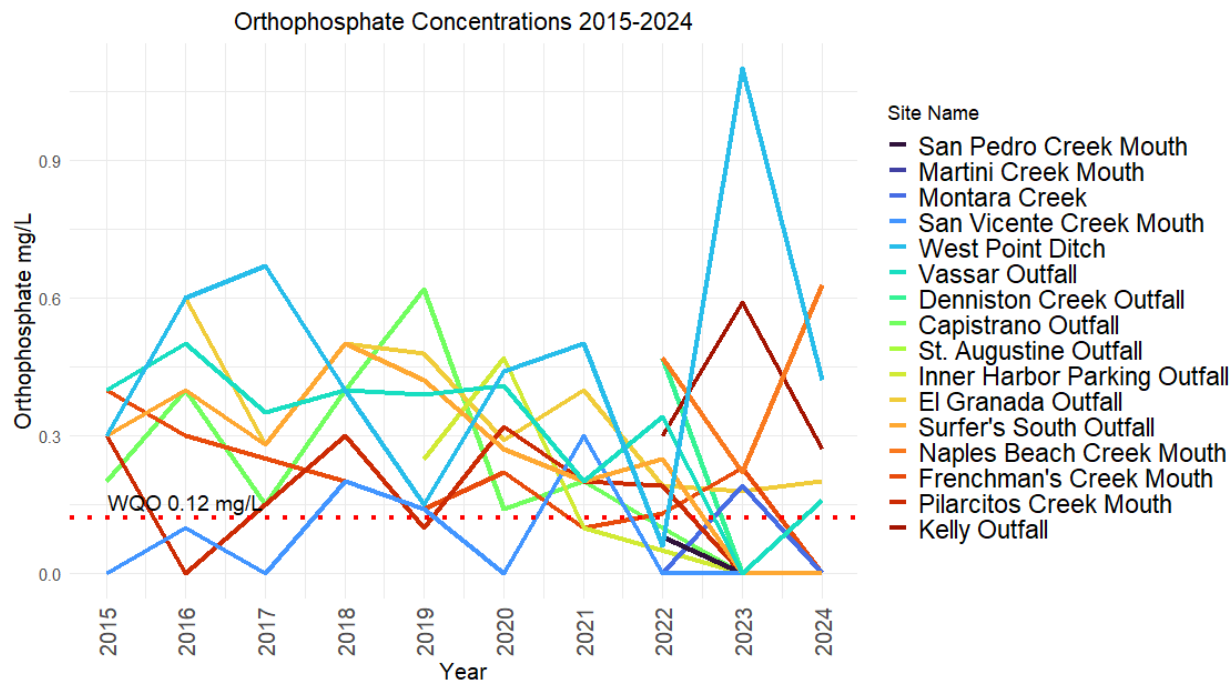
Examining long-term trends, it’s clear that the WQO for orthophosphate is frequently exceeded (Figure 15). It’s possible that this is in part due to the fact that the WQO for orthophosphate is relatively low compared to other analytes. This concentration threshold of 0.12 mg-P/L was determined for the protection of aquatic habitats through monitoring work conducted in the Pajaro River Watershed – so while there are some regionally-specific comparisons to be made, a WQO exceedance for orthophosphate in our local waterways may not necessarily indicate nutrient impairment. Additionally, the minimum quantifiable concentration under our EPA-approved laboratory methods for orthophosphate is 0.16 mg-p/L, which

<sup>16</sup> [CCAMP Pajaro River Watershed Characterization Report 1998, rev 2003](#) (pg. 9)

helps explain why nearly all sites show a concentration of either zero or exceeding the WQO. West Point Ditch exhibited the highest concentration of orthophosphate observed in this program’s history in 2023 but appears to have returned to baseline levels for that site in 2024.



**Figure 14.** Orthophosphate concentrations for First Flush 2024. Sites are arranged from north (left) to south (right).



**Figure 15.** Historical orthophosphate First Flush concentrations (2015-2024).

### Total Suspended Solids (TSS)

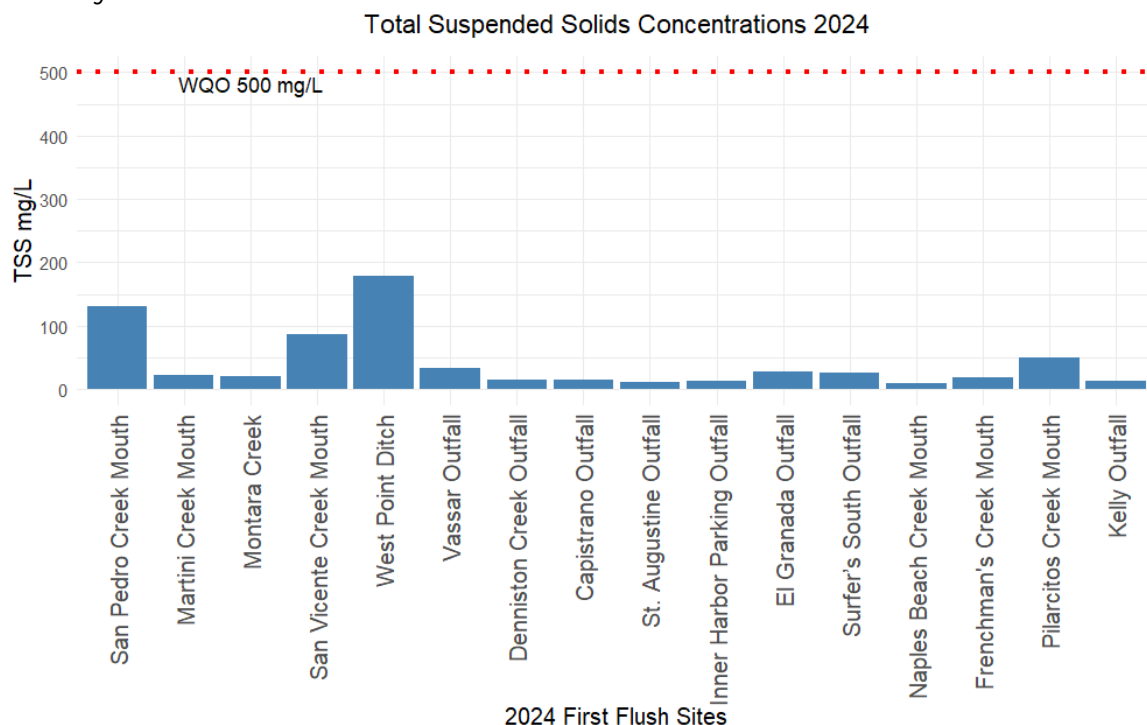
Total suspended solids (TSS) are particulate matter in water that attract charged particles which can often be pesticides and metals. TSS can originate from natural or accelerated rates of erosion, construction sites, agricultural runoff, fires, and other sources. TSS can impact the environment through attachment and mobilization of pollutants, habitat sedimentation, and reduction in the ability of certain aquatic organisms to breathe and/or eat. TSS are often associated with the presence of other contaminants such as FIB or heavy metals.

The WQO for TSS is 500ppm, as determined for the protection of aquatic habitats<sup>17</sup>. All 16 sites were below this recommended threshold in 2024 (Figure 16).

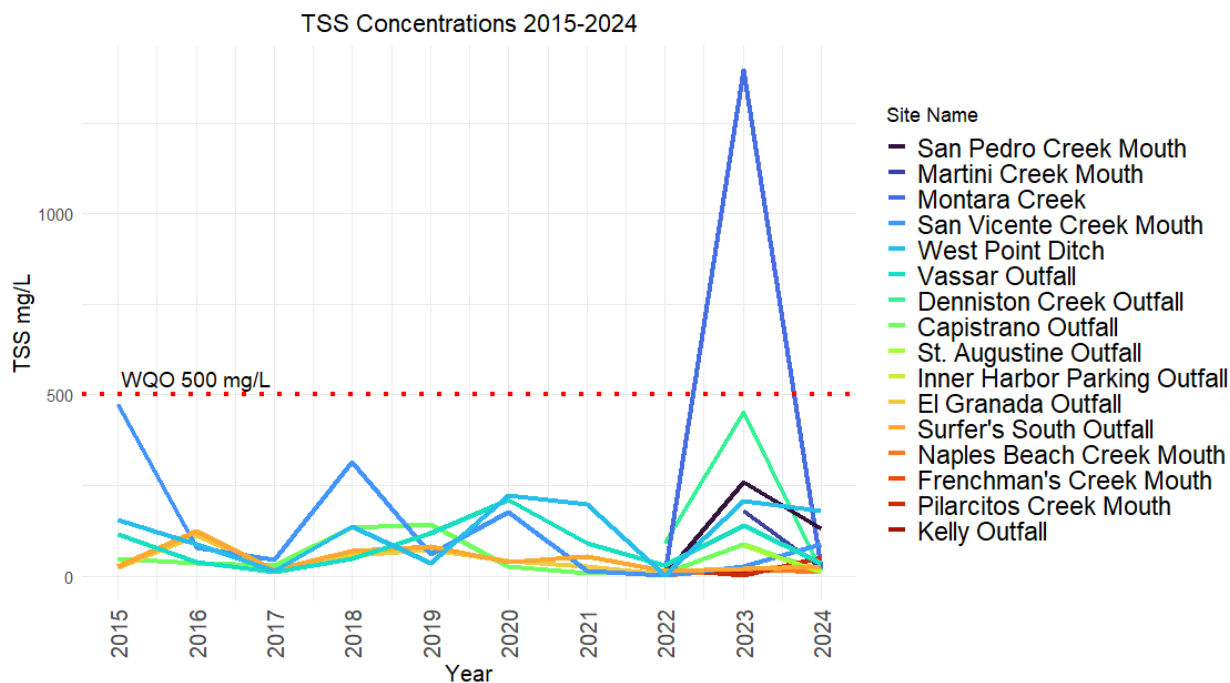
Examining long-term trends, we see that WQO exceedances for TSS are very rare (Figure 17). In 2023, the Montara Creek site exhibited the highest concentration of TSS ever observed in this program and appears to have returned to baseline levels in 2024. Before that, the only other WQO exceedance was at the San Vicente Creek Mouth site in 2012. This is generally a good sign for water quality in the region, as many pollutants can bind to and be transported by sediment particles. It also suggests that watersheds within the region are generally effective at capturing and

<sup>17</sup> [CCAMP Hydrologic Unit Report for the Salinas River Watershed Rotation Area \(1999-00\)](#) (pg. 30)

retaining sediments before reaching ocean discharge points during the first big rain of the year.



**Figure 16.** Total suspended solids concentrations for First Flush 2024. Sites are arranged from north (left) to south (right).



**Figure 17.** Historical total suspended solids (TSS) First Flush concentrations (2015-2024).

## Conclusions

Annual First Flush results provide a snapshot of water quality, helping guide remediation efforts and future investigations to identify contamination sources entering the ocean. The First Flush program has existed in San Mateo County since 2003, enabling an analysis of trends and drawing conclusions that reach beyond a single snapshot in time. First Flush results tell us about water quality during the first big rain of each year and typically does not reflect year-round conditions.

First Flush results are compared to established standards, or Water Quality Objectives, which are the recommended thresholds set for each pollutant. This provides a useful means for comparison and a benchmark to understand if water quality is impaired by a given analyte.

First Flush 2024 results showed high levels of some contaminants entering the ocean. This is consistent with expectations since the First Flush is known to be the likely worst day of the year for water quality. Importantly, however, there were also instances where good signs for water quality were observed. Specific observations are as follows:

1. As expected, nearly all sites exceeded WQOs for Fecal Indicator Bacteria (*E. coli*, *Enterococcus*). This result demonstrates the importance of avoiding water contact immediately after a rainstorm. Martini Creek Mouth and Inner Harbor Parking Outfall were, however, within recommended levels for *E. coli*. Prior to 2024, there had only been three instances across all sites and all years monitored where samples fell below the WQO. Consistent sampling across all weather conditions is typically required to evaluate overall impairment of a stream from FIB and inform effective management efforts.
2. West Point Ditch exhibited the highest concentrations of nearly all analytes in 2024: *Enterococcus*, copper, lead, zinc, nitrate, and TSS. This site also exhibited the second highest concentration of orthophosphate and an *E. coli* concentration above the median. This is the second year in a row that West Point Ditch exhibited high contaminant levels when compared to other sites. Two additional sites located near West Point Ditch, Vassar Outfall and Capistrano Outfall, have exhibited high concentrations of several analytes – both in 2024 and in past years. Testing sediments in and around this area during the dry season may help identify potential sources of contamination to inform remediation and management efforts.
3. Montara Creek stood out in 2023 with WQO exceedances for *E. coli*, *Enterococcus*, copper, lead, zinc, orthophosphate, and TSS. At the time it was theorized that these exceedances may have been associated with erosion or a similar source occurring at one or more locations upstream. This site exhibited notable improvements in 2024, showing the lowest concentrations of copper,

lead, nitrate, and orthophosphate when compared to other sites. It is possible that the cause of the exceedances in 2023 was not present when sampling occurred in 2024.

4. Kelly Outfall exhibited high concentrations of copper and orthophosphate, but did not exceed WQOs for other heavy metals or nitrate. This outfall is located within Half Moon Bay State Park and drains primarily residential stormwater onto the beach. A pattern of high orthophosphate and low nitrate can generally be considered a household wastewater signature because detergents, human waste, and food waste are rich in phosphorus. High copper concentrations additionally indicate potential residential inputs since this metal is commonly found in brake dust, pesticides, and building materials. Given this signature, it's possible that exceedances for copper and orthophosphate at Kelly Outfall are associated with diffuse residential inputs across the stormwater conveyance footprint rather than coming from a specific source.
5. Naples Beach Creek Mouth had some of the lowest concentrations of metals but exceeded the WQO for orthophosphate in 2024. Our interpretation of this result is not the same as Kelly Outfall because there is less of a difference in the relative concentrations of nitrate vs orthophosphate in this case.
6. All 16 sites were within recommended levels for both lead and TSS. This is generally a good sign for water quality in the region.

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## For more information

Visit the San Mateo RCD's webpage at <https://www.sanmateoRCD.org/> for further information about First Flush and other projects.

Visit <https://montereybay.noaa.gov/resourcepro/reports.html> for First Flush reports from the Monterey Bay National Marine Sanctuary summarizing findings from all participating counties for years 2000-2019.

## Want to get involved?

To participate in the First Flush program in San Mateo County, please email [FirstFlush@sanmateoRCD.org](mailto:FirstFlush@sanmateoRCD.org) or contact the San Mateo RCD water quality team:

- Clifton Herrmann, Water Quality Specialist: [Clifton@sanmateoRCD.org](mailto:Clifton@sanmateoRCD.org)
- Grace Allen, Water Quality Project Manager: [Grace@sanmateoRCD.org](mailto:Grace@sanmateoRCD.org)

To participate in the First Flush program in Santa Cruz or Monterey counties, please contact the California Marine Sanctuary Foundation at:

- [urbanwq@californiamsf.org](mailto:urbanwq@californiamsf.org)

## Appendix A. Water Quality Objectives

First Flush results are compared to receiving water standards set for beneficial uses<sup>18</sup> such as habitat or recreational contact in a stream, lake, or ocean, which in some cases were designated for specific regulatory purposes unrelated to the goals of this program. The term Water Quality Objective indicates the threshold set in these standards and is used to describe all standards or guidelines, despite having been sourced from varied regulations or recommendations, provided here.

Parameter (reporting units)	Water Quality Objectives	Source of criterion
Copper (ppb)	Not to exceed 30	Water Quality Control Plan for the Central Coast-RWQCB
<i>E. coli</i> (MPN/100ml)	Not to exceed 320	U.S. EPA Ambient Water Quality Criteria
<i>Enterococcus</i> (MPN/100ml)	Not to exceed 110	U.S. EPA Ambient Water Quality Criteria
Lead (ppb)	Not to exceed 30	Water Quality Control Plan for the Central Coast-RWQCB
Nitrate as N (NO <sub>3</sub> -N) (mg/L)	Not to exceed 2.25	Central Coast Ambient Monitoring Program (CCAMP)
Orthophosphate (PO <sub>4</sub> -P) (mg/L)	Not to exceed 0.12	Central Coast Ambient Monitoring Program (CCAMP)
Total Suspended Solids (TSS) (ppm)	Not to exceed 500	Central Coast Ambient Monitoring Program (CCAMP)
Zinc (ppb)	Not to exceed 200	Water Quality Control Plan for the Central Coast-RWQCB

<sup>18</sup> “Beneficial Use” explanation here: <https://mavensnotebook.com/glossary/beneficial-uses/>

**Appendix B.** First Flush 2024 raw data. Measurements that exceed WQOs are shown in red. Sites are arranged from north (top) to south (bottom).

Site Code	Site	E.coli 1:10	Entero 1:10	Copper Total (ug/L)	Zinc Total (ug/L)	Lead Total (ug/L)	Nitrate as N (mg/L)	Orthophosphate as P (mg/L)	Total Suspended Solids (mg/L)
202-SPCM-01	San Pedro Creek Mouth	24196	19863	16	94	5.9	0.3	ND	130
202-MOSD-04	Martini Creek Mouth	313	1153	2	84	1.2	ND	ND	23
202-MOSD-03	Montara Creek	1112	2247	2	35	0.6	ND	ND	21
202-MBSD-05	San Vicente Creek Mouth	5794	4884	4	38	2.9	ND	ND	86
202-MBSD-05- dup	San Vicente Creek Mouth DUP	4106	5172	3	32	2.7	ND	ND	84
202-MBSD-04	West Point Ditch	8664	24196	59	256	23.4	7.2	0.42	178
202-EGSD-04	Vassar Outfall	5475	12997	31	95	11	1.3	0.16	34
202-PPSD-03	Denniston Creek Outfall	12997	4611	3	24	0.7	ND	ND	15
202-EGSD-03	Capistrano Outfall	4352	8164	34	66	1.5	0.2	ND	14
202-PPSD-04	St. Augustine Outfall	24196	24196	17	40	1.1	0.5	ND	11
202-PPSD-05	Inner Harbor Parking Outfall	318	4106	15	84	2.1	0.2	ND	13
202-EGSD-01	El Granada Outfall	24196	24196	17	54	1.4	0.6	0.2	28
202-EGSD-02	Surfer's South Outfall	24196	24196	12	44	1.3	0.6	ND	26
202-NBDO-22	Naples Beach Creek Mouth	3076	10462	9	26	0.6	1.2	0.63	10
202-FRENC-11	Frenchman's Creek Mouth	4611	6867	4	14	0.6	0.2	ND	18
202-PILAR-12	Pilarcitos Creek Mouth	17329	12997	10	44	2.7	0.4	ND	50
202-HMB-05	Kelly Outfall	24196	24196	50	45	1.4	1	0.27	13
202-FF-BLANK	Blank	0	0	ND	ND	ND	0.3	0.1	ND
<b>Water Quality Objective</b>		<b>320</b>	<b>110</b>	<b>30</b>	<b>200</b>	<b>30</b>	<b>2.25</b>	<b>0.12</b>	<b>500</b>