**BATIQUITOS 2021 ANNUAL REPORT**

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**Background**

The Batiquitos Lagoon in north San Diego County consists of 610 acres with a drainage basin of about 55,000 acres. The watershed basin includes the cities of Carlsbad, San Marcos, and Encinitas, with its primary freshwater tributaries being San Marcos Creek from the east and Encinitas Creek which flows north along Green Valley, entering the lagoon under El Camino Real and La Costa Avenue, respectively.[1] A dam built in 1952 to create Lake San Marcos in the upper watershed dramatically reduced the amount of freshwater flow into San Marcos creek and subsequently the lagoon. Consequently, accumulated silt has been filling up Batiquitos Lagoon, and the lagoon was expected to fill up within 50 years. In response, a dredging and enhancement project began in 1994 to allow tidal exchange with the ocean, thus slowing down the siltation process. Completed in 1997, the dredging project was funded by the Port of Los Angeles. Even so, Batiquitos Lagoon remains listed as a 303(D) - impaired waterbody under federal and state Clean Water Act regulations for sedimentation.

In addition, there have been numerous concerns regarding water quality in San Marcos Creek as a result of the release of water from Lake San Marcos. For example, during rainstorm events, lake operators have released "acre-feet of polluted water into the lower San Marcos Creek, ending up in the Batiquitos Lagoon Ecological Reserve and ocean".[2] The Batiquitos Lagoon Foundation believes the Lake San Marcos dam operations and water releases are among the most significant ongoing threats to the lagoon's water quality.[2] These concerns have been brought to the attention of the San Diego Regional Water Quality Control Board, underscoring the need for on-going water quality monitoring in the Batiquitos watershed (or "BTQ").

For the 10-year period 2009-2018, San Diego Coastkeeper (SDCK) monitored BTQ on a bimonthly schedule. Data for 2009-2016 are posted on the California Environmental Data Exchange Network (CEDEN). In the spring of 2019, Preserve Calavera created the North San Diego County Watershed Monitoring Program (NSDCWMP) to continue the decade-long work of SDCK of assessing the health of local surface waters. Water quality in three coastal watersheds, all of which are part of the Carlsbad Hydrologic Unit (Fig. 1) and including BTQ (Fig. 2), is evaluated by sampling water at multiple locations on a bimonthly basis and measuring basic physical (conductivity, turbidity), chemical (pH, dissolved oxygen, nutrient, and ammonia), and biological (total and pathogenic coliform bacteria) parameters.

NSDCWMP is an all-volunteer citizen science effort with a leadership management team comprised of two Preserve Calavera board members (also leaders of the Buena Vista Creek and Agua Hedionda Lagoon monitoring teams) and a representative from and leader of the BTQ team. Technical advisors from the California Water Resources Control Board as well as the San Diego Regional Water Quality Control Board (SDRWCB) provide guidance to the NSDCWMP. Data are posted at www.preservecalavera.org and on the CEDEN website and shared with SDRWCB and the city of Carlsbad.

Historically, SDCK monitored three sample sites within the BTQ (Fig. 3); two located on San Marcos Creek (BTQ020 and BTQ030), and the third on Encinitas Creek (BTQ010). Water is typically present year-round at BTQ010 and BTQ020; in contrast, BTQ030 is often dry during the summer and fall seasons. When water is present at BTQ030 during the dry season, it is the result of overflow or release from the San Marcos Lake Dam.

The NSDCWMP began in July 2019, with BTQ samples collected in July, September, and November of that year. Although dissolved oxygen, pH and conductivity were within ranges considered "normal" for such watersheds, some exceedances of macronutrients (nitrogen and phosphorus) and bacterial indicators were observed.[3] No samples were collected from BTQ030 due to lack of water at this site.

Figure 1. Image from Prioritizing Invasive Species Management in the Carlsbad Hydrologic Unit

http://www.escondido.org/Data/Sites/1/media/pdfs/pubworks/carlsbad/150423_Final_Draft_Carlsbad_WQIP_Submittal.pdf

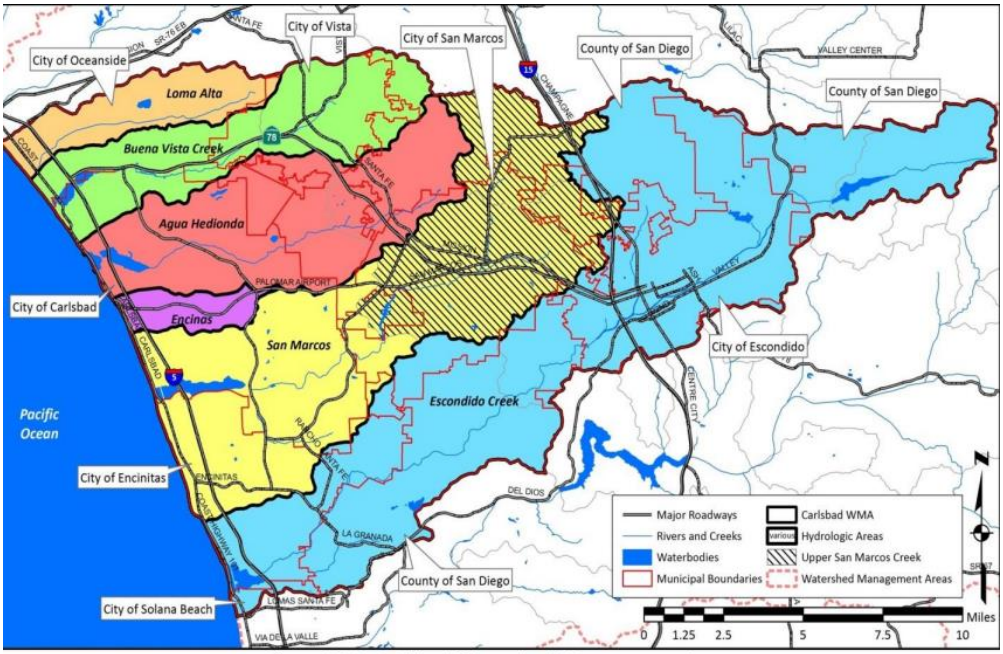
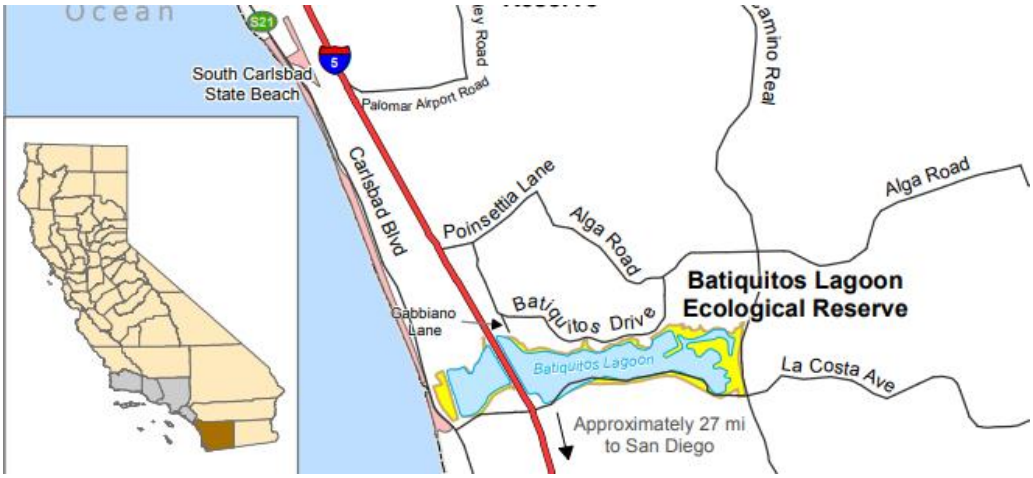



**Figure ES-1: Carlsbad Watershed Management Area**

Figure 2 Image from Batiquitos Lagoon Ecological Reserve

https://wildlife.ca.gov/Lands/Places-to-Visit/Batiquitos-Lagoon-ER

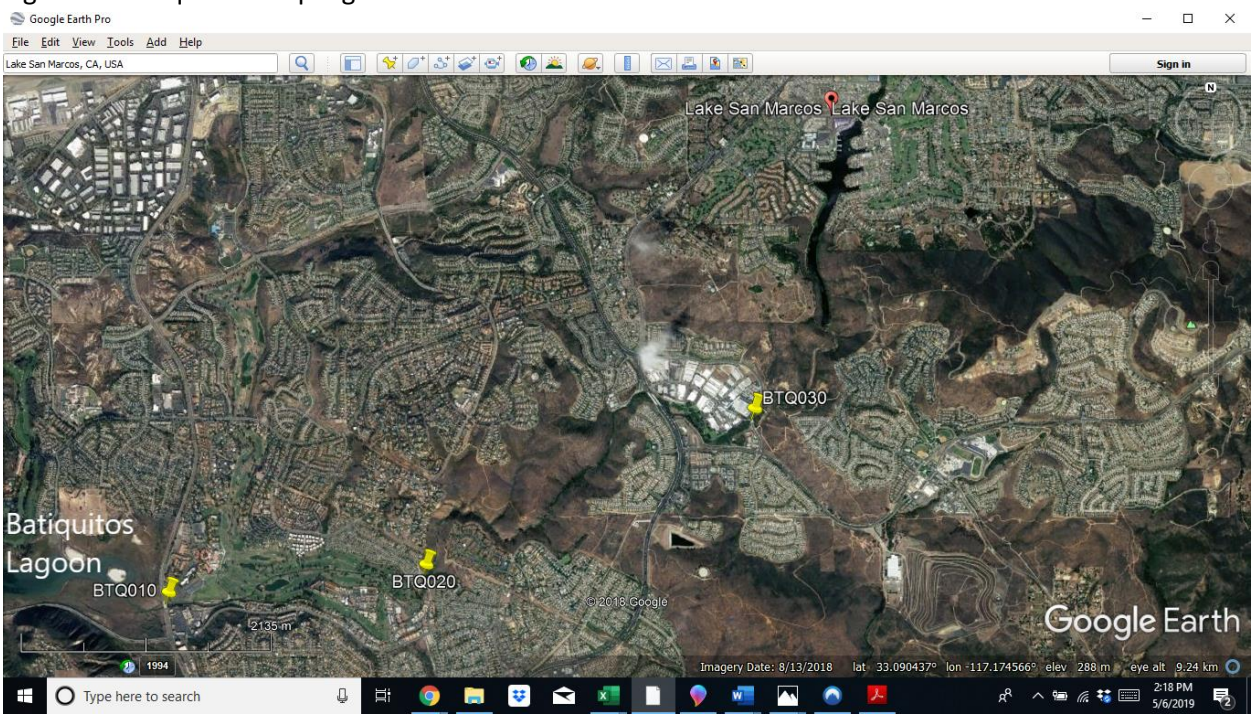



The purpose of this annual report is to 1) interpret the health of Batiquitos Lagoon for the testing period in 2021 and 2) look at historic trends (2009-present). Each parameter was evaluated for anomalies and trends against pre-established quality assurance/quality control (QA/QC) guidelines, including the analysis of field and lab blanks and sample duplicates. The overall state of the watershed compared with the previous year's (2020) monitoring data was summarized below for each parameter. Monitoring was conducted in January, March, May, July, September, and November of 2021.

**Sampling Sites**

The Batiquitos team sampled the same sites (BTQ 010, BTQ020, and BTQ030) as had been tested with SDCK identified in the map below. BTQ 030 was dry for the September sampling date, so there are no data present for BTQ030 in the charts and discussion below.

Figure 3 - Batiquitos sampling sites



**Field Parameters**

Dissolved oxygen was above the San Diego Basin Plan 3 threshold of 5.0 mg/L, except for BTQ030 in July 2021 which was below the threshold. These levels represent a healthy amount of oxygen in the water for aquatic animals for the period covered by these sampling events.

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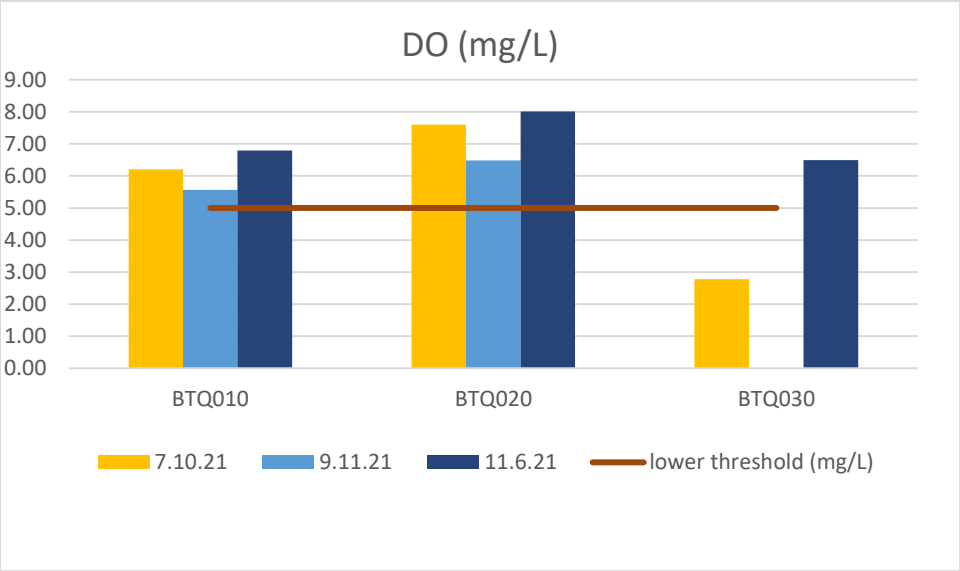
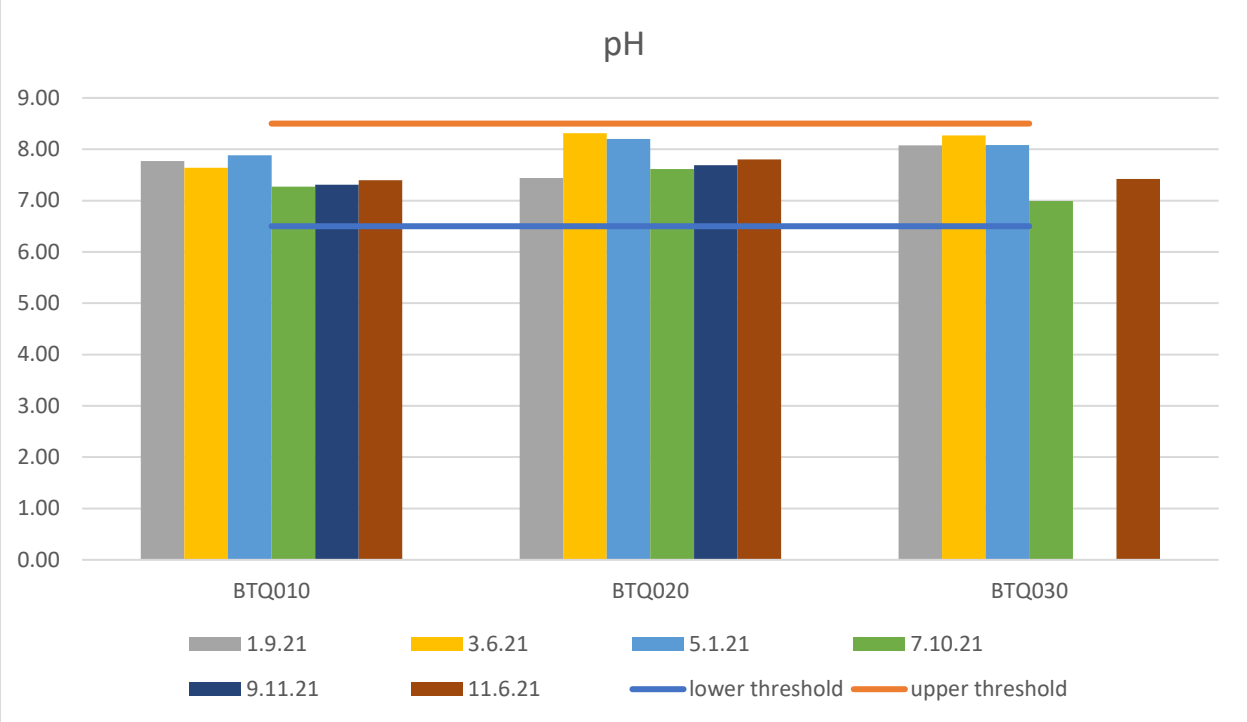
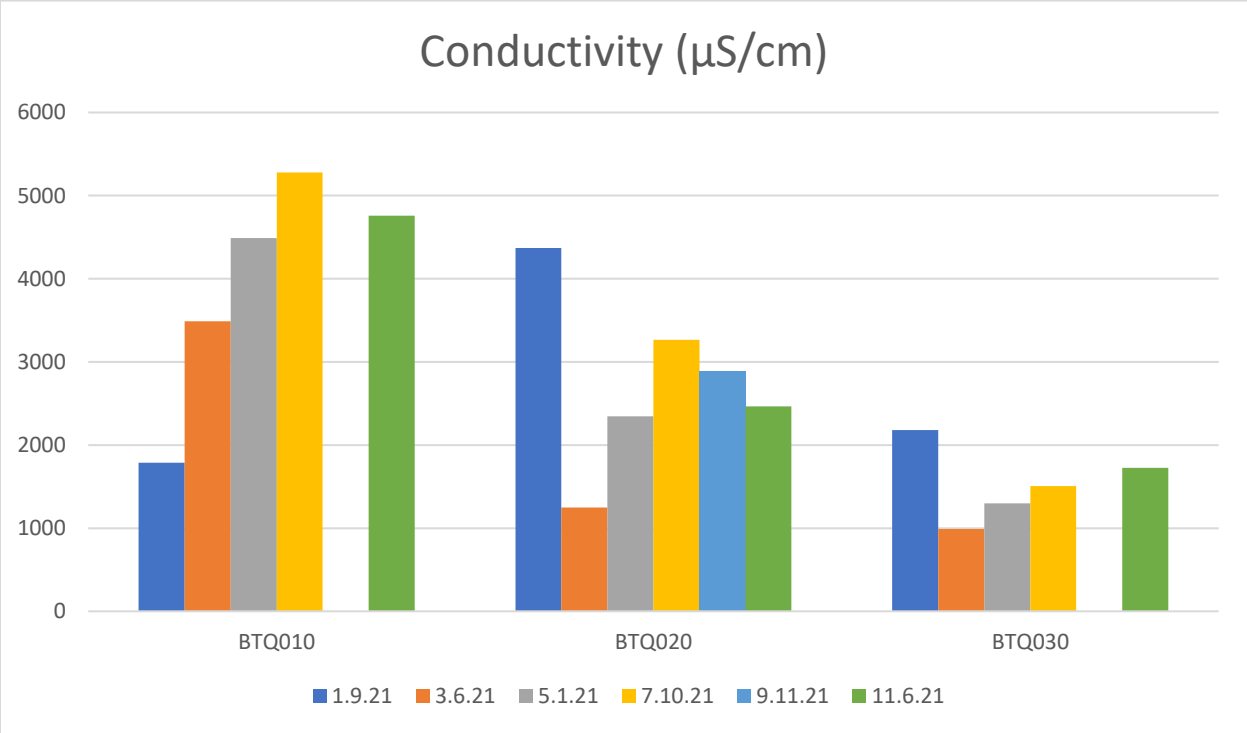


**PH** ranged between 7.0 and 8.5 at all sites for all three sampling sessions, within the acceptable range for the Basin Plan 3 of 6.5-8.5. The pH was not measured in September for BTQ030 due to lack of flow.



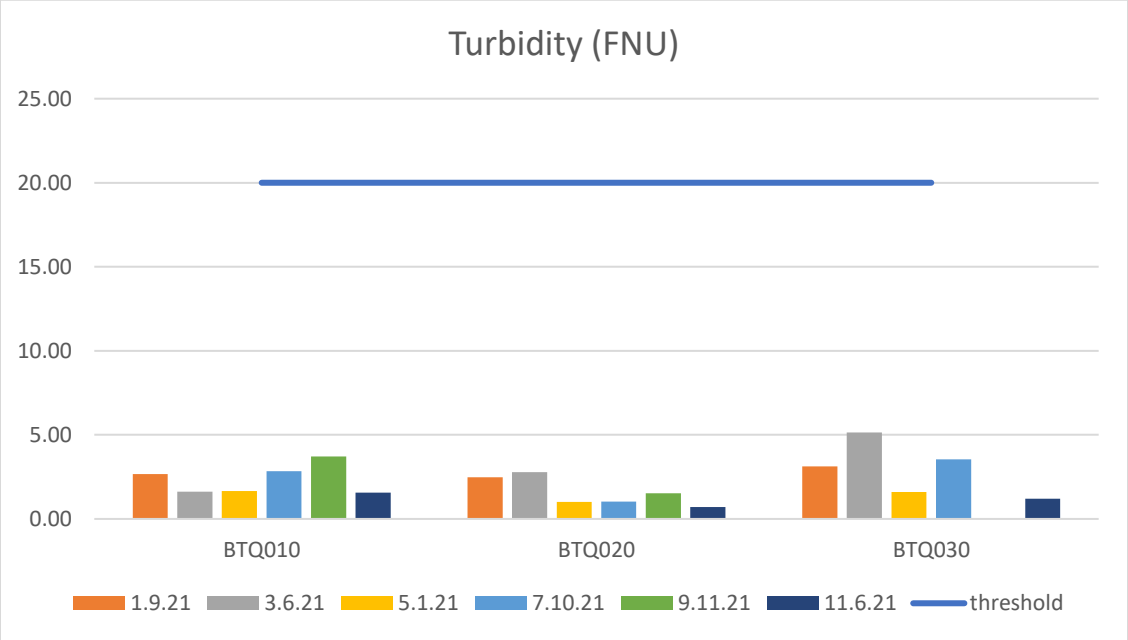
**Conductivity** fluctuated between 1500-5500 **µ**S/cm for BTQ010 (data missing in September), between 1200-4500 **µ**S/cm for BTQ020, and between 950-2200 **µ**S/cm for BTQ030 (no measurement in September due to no flow). The measurements this year show more variations when compared with historic data for this parameter. There is no threshold for conductivity, it merely reflects the amount of dissolved minerals in the water.



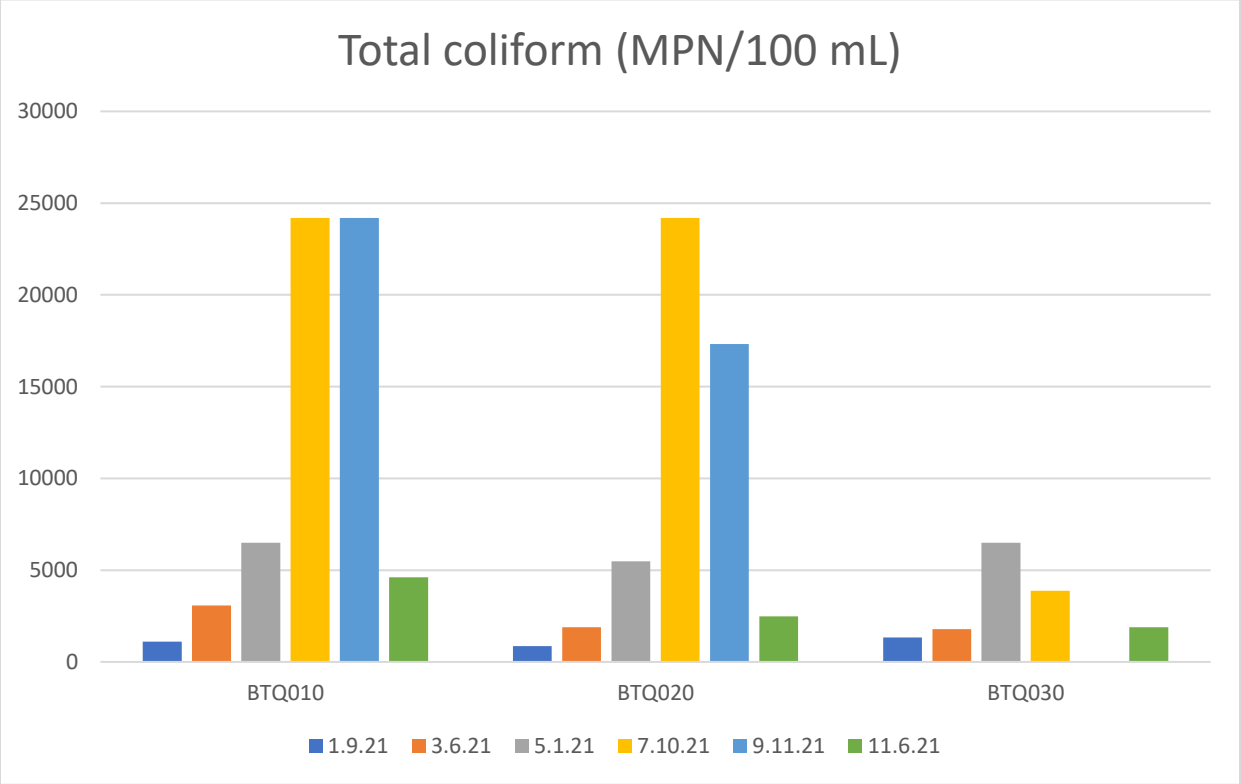
**Laboratory tests**

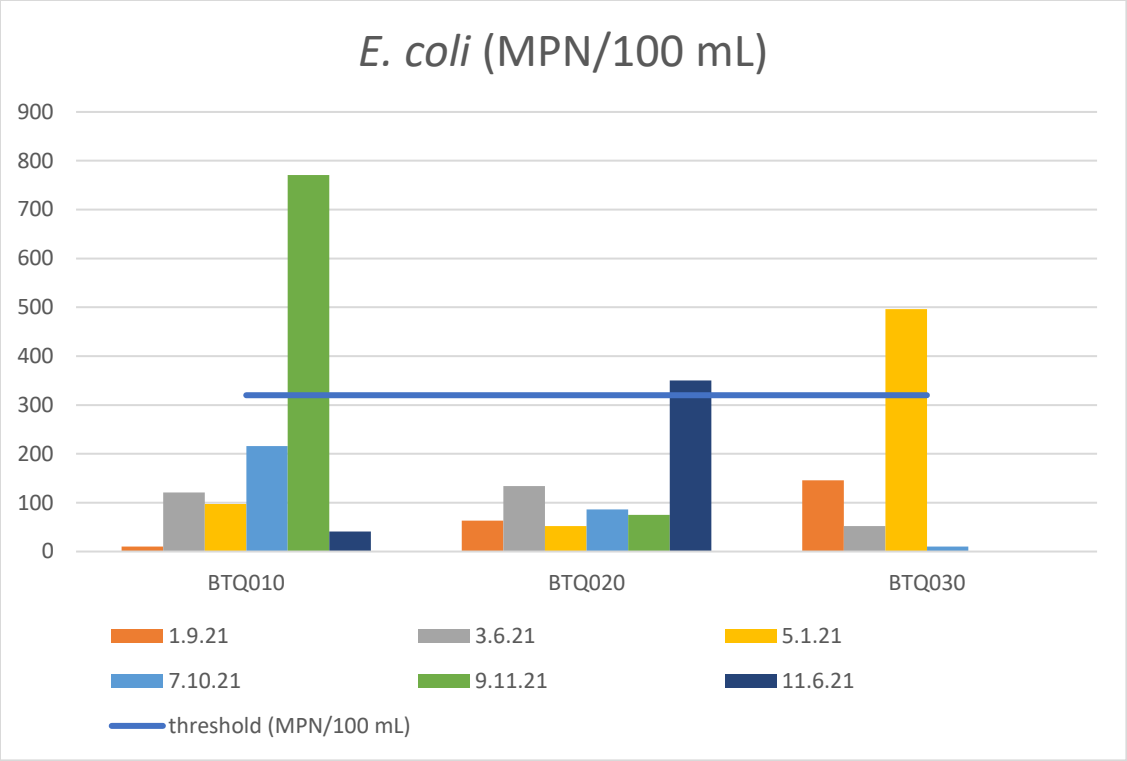
**Turbidity** (cloudiness), total coliform, E. coli, nitrates, total and reactive phosphorus, and ammonia are measured in the lab using 'grabbed' samples transported from the field.

High turbidity can hinder light penetrating water which may affect photosynthesis. The threshold is 20 FNU. The turbidity for these sites remained consistently way under threshold, unlike previous year (2020) which showed spikes far above threshold for BTQ010 and BTQ020 in November. The measure is missing for September at BTQ030 due to lack of flow.

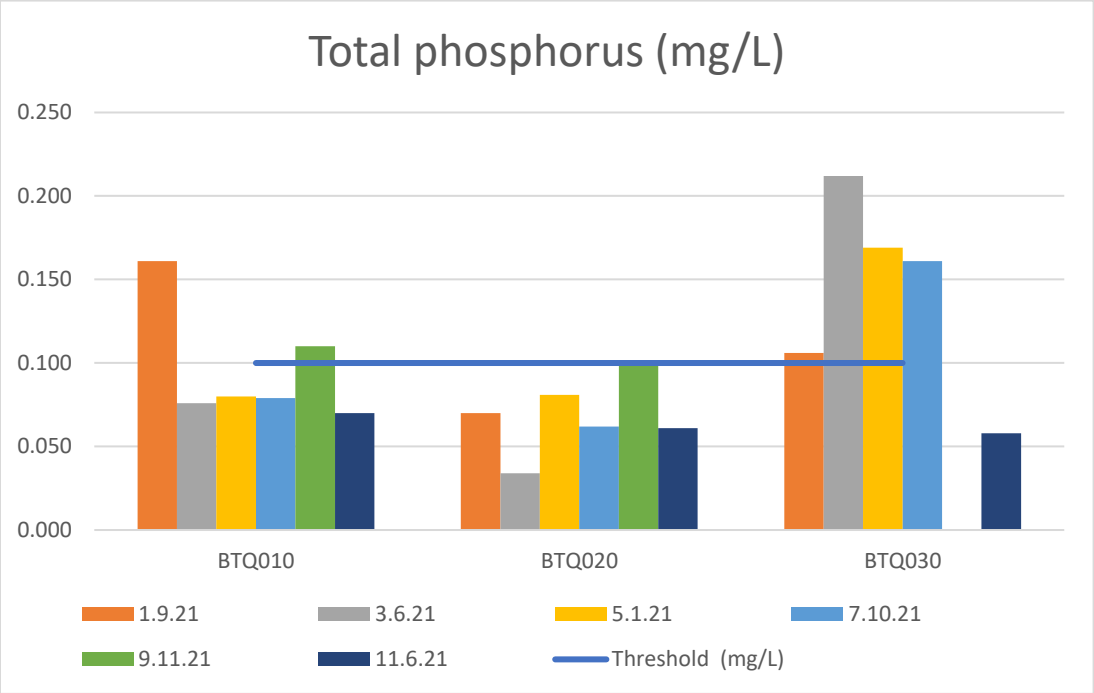


Coliforms are a group of bacteria found in the digestive tracts of animals, including humans and their wastes. They are also found in plant and soil material. They may or may not indicate pathogenic bacteria. There is no threshold for these bacteria due to the wide types of sources. E. coli, however, is much more indicative of potential concern as many strains are pathogenic. The test we run, using IDEXX Quanti-tray/Colilert, measures all E. coli, pathogenic or not. The threshold for this bacterium is 320 MPN/100 mL[3]. We had readings above threshold at BTQ010 in September (elevated E. coli level above 700 MPN/100 mL), at BTQ020 in November (E. coli at 350 MPN/100 mL), and at BTQ030 in May (E. coli at 496 MPN/100 mL). This might indicate fecal contamination, likely due to rain runoff around those sampling dates. Prior year (2020) showed similar spikes for BTQ010 and BTQ020. The other readings at these sites were below threshold.



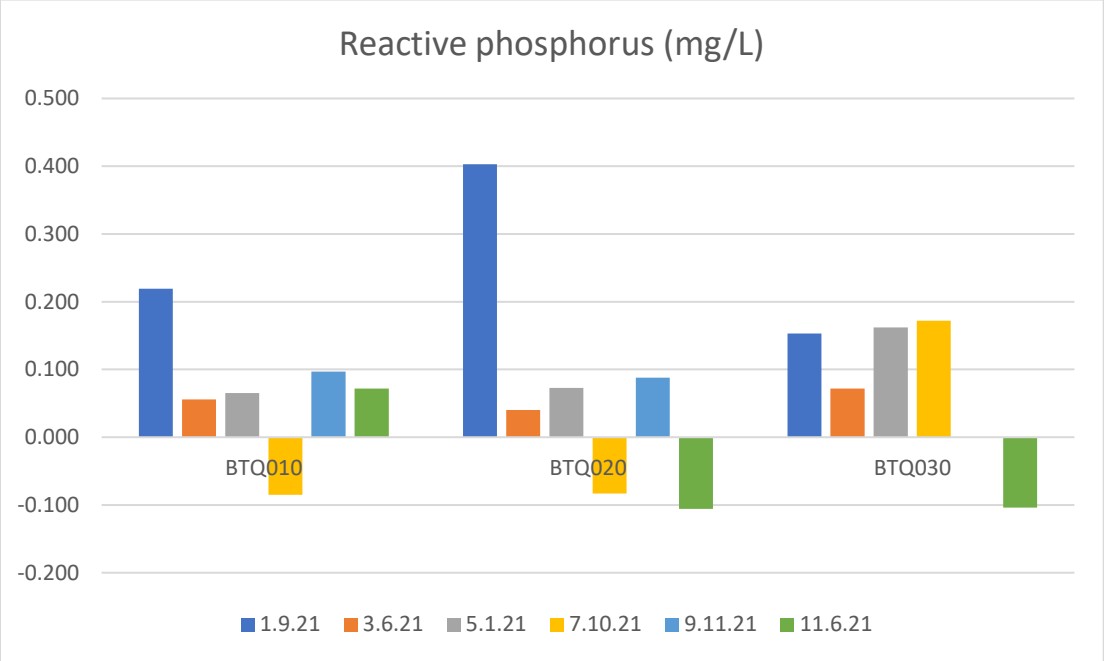

E. coli (MPN/100 mL)
900
800
700
600
500
400
300
200
100
0
BTQ010
BTQ020
BTQ030
1.9.21
3.6.21
5.1.21
7.10.21
9.11.21
11.6.21
threshold (MPN/100 mL)

Elevated phosphorus is often the result of fertilizer runoff and can lead to algal blooms. The threshold for San Diego watersheds is 0.1 mg/L[3]. The range for total phosphorus was above the threshold for BTQ010 in January and September, and BTQ030 for all readings except November. This could be a result of the large housing developments in close proximity to these sampling locations. Compared to previous year (2020), the level was overall lower, suggesting some improvements.

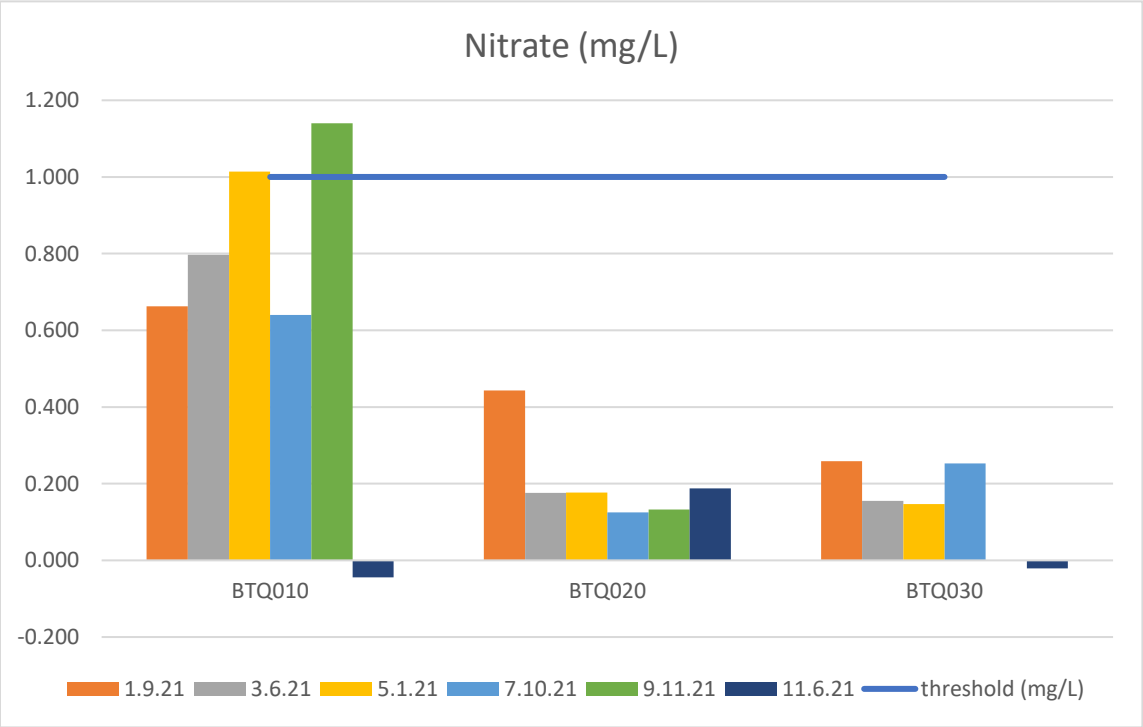


Reactive phosphorus (aka “polyphosphates”) is the ionic form of this element that is preferred by living organisms, otherwise known as “bioavailable” phosphorus. There is no water quality threshold for reactive phosphorus. Except in January for BTQ010 and BTQ020, levels remained consistently low, even negative.

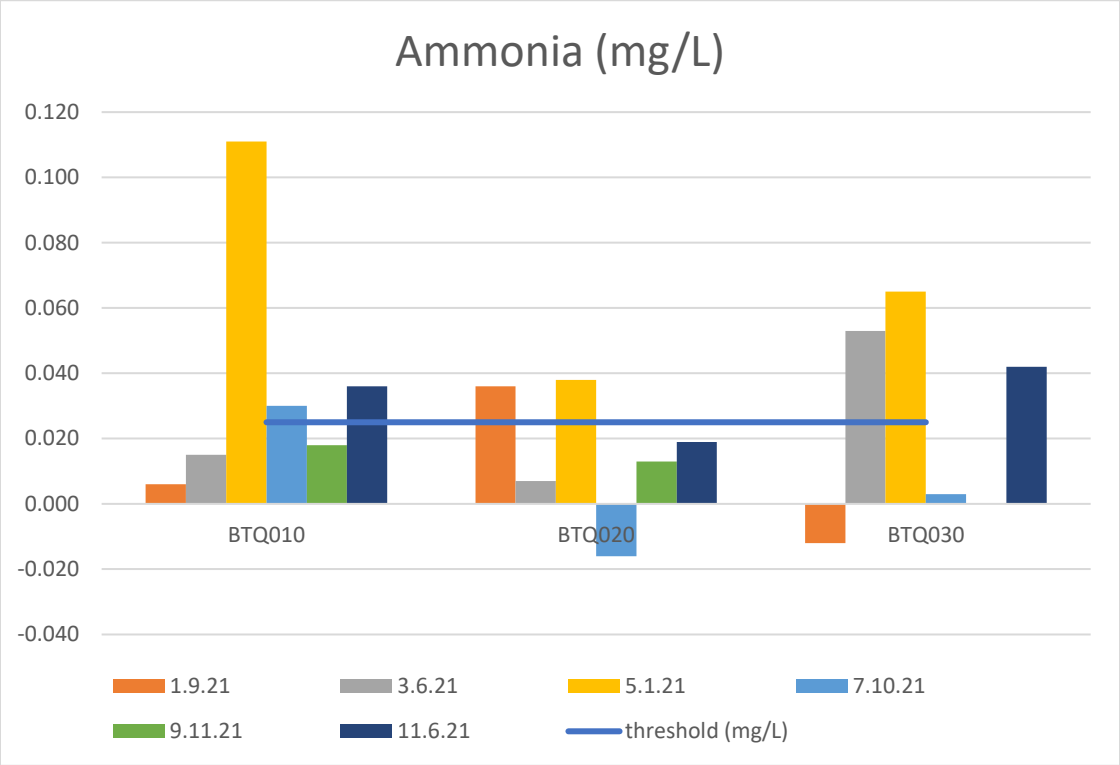
However, as noted previously for 2020, reactive phosphorus values may exceed total phosphorus values, a discrepancy that was not easily explained by results from QA samples. As a result, these data should be interpreted with caution.



Nitrates come from fertilizer runoff. BTQ010 had higher readings compared to the two other sites with a reading in September and May above the threshold of 1.0 mg/L[3]. Higher values for BTQ010 were also observed prior year (2020). BTQ020 and BTQ030 seemed to remain consistently at low level, in contrast to prior year, suggesting some improvement.



Lastly, for ammonia, the threshold is 0.025 mg/L. Compared to previous years, our readings showed an increased occurrence of elevated levels (presence of urine linked to homeless encampments?) above threshold at the three sites.




**Concluding thoughts**

It is difficult to explain some of the differences at our testing sites. The NSDCWMP is strictly a monitoring one, but one would like to understand the sources of the pollutants we see. Some of the elevated levels of nutrients and bacteria are tied to runoff in the rainy season. It is not surprising that these three sites show differing results as they are sampled from separate creeks or sources. The high bacterial level is a concern which we will continue to monitor, especially during rain events. Compared to 2020, some improvements were observed in turbidity, phosphorus content and nitrate, but elevated occurrences in nitrates. Conductivity showed a similar pattern across the sites.

[1]https://batiquitoslagoon.org/about.html
[2]https://batiquitoslagoon.org/blf_newsletter_2-2018.pdf
[3]https://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/docs/R9_Basin_Plan.pdf