

Nitrogen Pollution in Surface Water on Highway 544W: How This Impacts the Health and Safety of the Waccamaw River

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Introduction

Ammonia, nitrite, and nitrate are different chemical forms of nitrogen that can enter surface waters through pollutants carried by rainwater runoff. The main source of nitrogen pollution comes from agricultural fertilizers and manure. When this excess nitrogen, along with other chemicals in the fertilizer, infiltrate the aquatic ecosystem, the water quality deteriorates. The excess nitrogen could decimate the fish and wildlife population of the water source, fuel an overgrowth of algae, and cause deadly health conditions if consumed by humans. The purpose of this study is to analyze the concentration of ammonia, nitrite, and nitrate in the pond that is located next to highway 544 West. The data from the CCU Campus Volunteer Water Quality Monitoring Database will be used to determine the health of the body of water by comparing total nitrogen levels to the EPA(2000) standard of 0.87mg N/L. This is important because many of the surface waters located around CCU's campus send water off to the Waccamaw River where large numbers of people gather to fish, swim, and participate in other recreational activities. The Waccamaw River is also a primary source of drinking water for the area. Nitrogen pollution poses a health threat to both the aquatic wildlife living in the river and also to the people that fish and swim in it.

Methods & Materials

The sampling site for this study is located on 544 West across from CCU's football stadium shown in Figure 2. The CCU Campus Volunteer Water Quality Monitoring Database began documenting nitrogen levels at this location on October 13, 2011 and the latest data was collected on November 16, 2020. Ammonia, nitrite, and nitrate levels are measured using test strips. There is a color chart located on the side of each test strip bottle, shown in Figure 1, indicating the level of nitrogen that corresponds to each color on a test strip after it has been used. Once the test strip has been submerged in the vial of sample water and allowed sufficient time to develop, the color of the test strip is compared to the color indicators on the bottle and the results are recorded. The photo on the left shows the color indicators for nitrite and nitrate and the photo on the right shows the color indicators for ammonia.



Figure 1: The color charts located on the side of test strip bottles

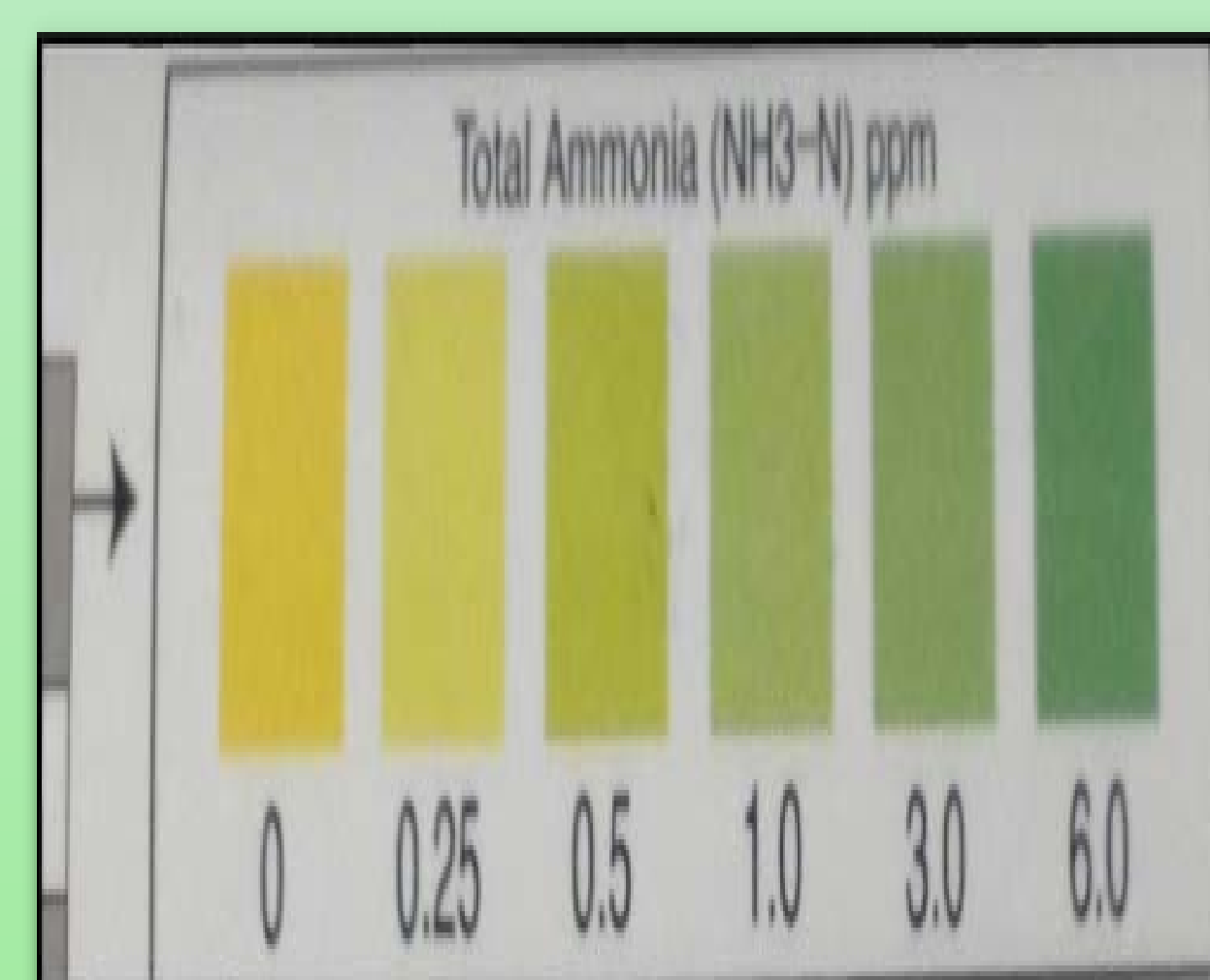


Figure 2: The location of the sampling site indicated by the red pinpoint

Results

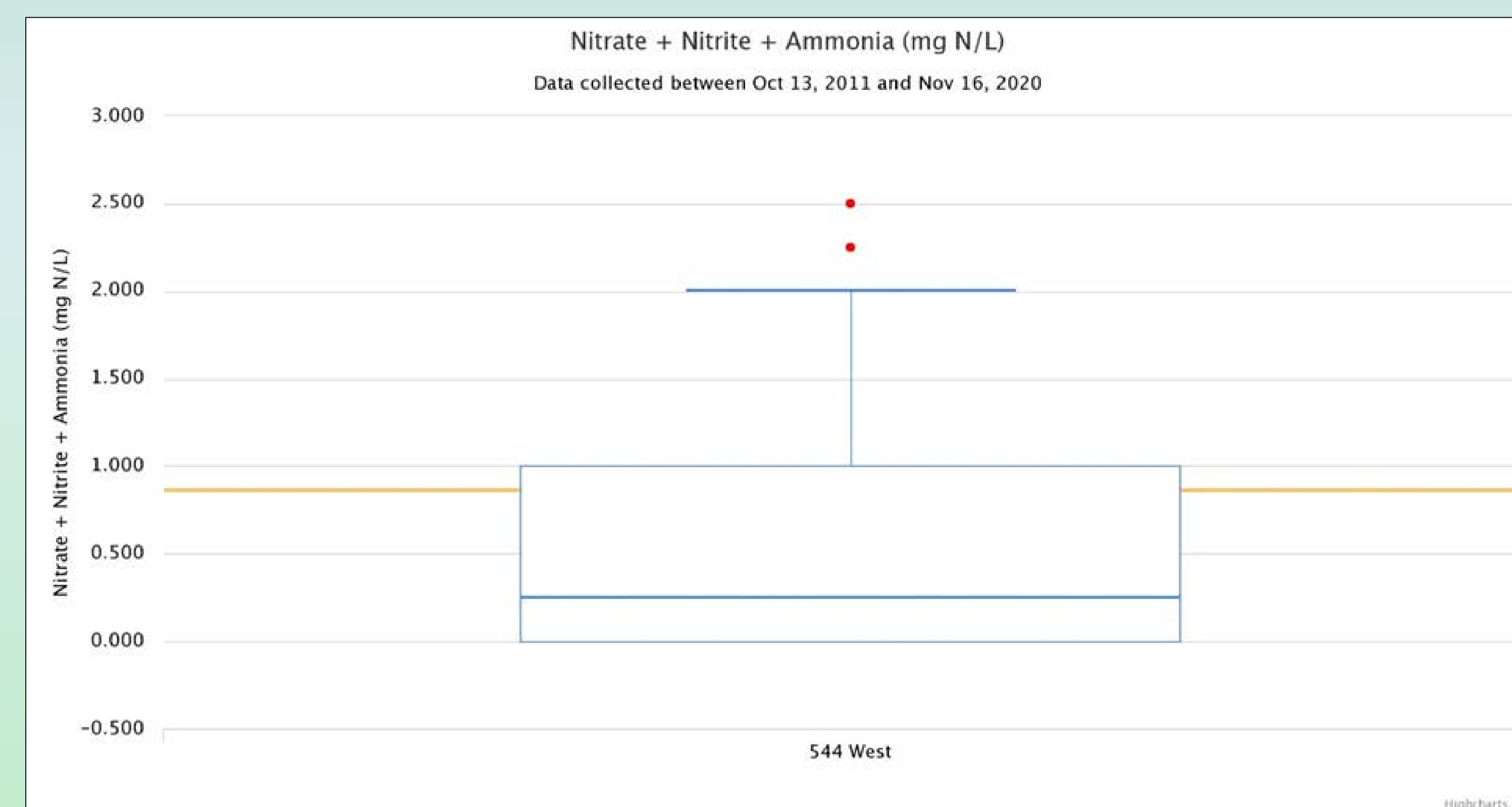


Figure 3: A box plot of the total nitrogen levels with outliers shown as red dots and the EPA(2000) water quality standard indicated by the yellow line (0.87mg N/L)

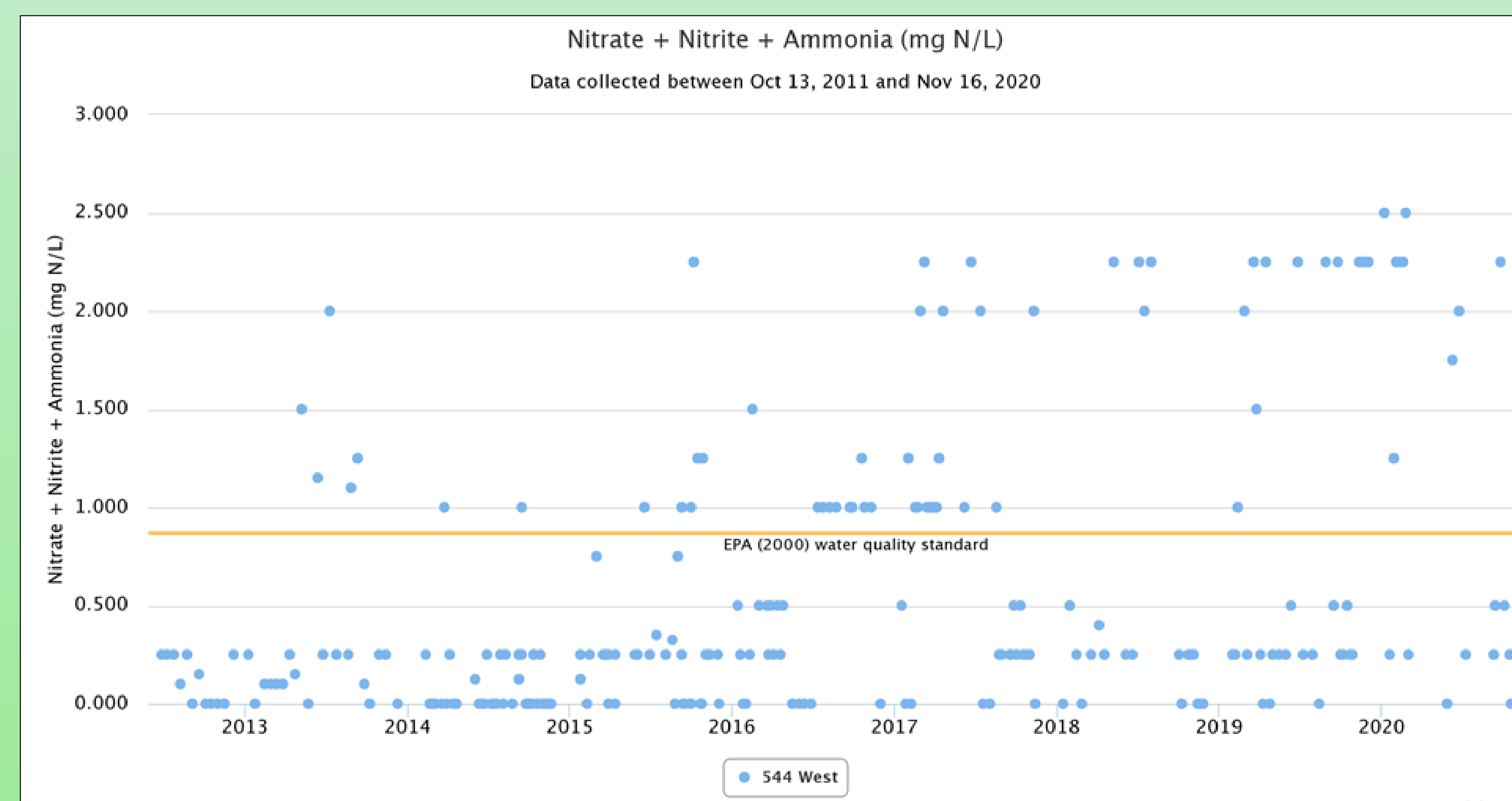


Figure 4: The blue dots represent a sample that was taken at a specific time with the EPA(2000) water quality standard indicated by the yellow line (0.87mg N/L)

Nitrate + Nitrite + Ammonia (mg N/L)

| Site Name: | # of Samples | Mean | S.D | Median | Max | Min | 10th | 25th | 75th | 90th |
|------------|--------------|-------|-------|--------|-------|-------|-------|-------|-------|-------|
| 544 West | 247 | 0.546 | 0.705 | 0.250 | 2.500 | 0.000 | 0.000 | 0.000 | 1.000 | 2.000 |

Table 1: Total nitrogen data for the samples collected, the EPA(2000) water quality standard is 0.87mg N/L

Conclusion

Nitrogen is an important component in many natural biological processes as well as an essential element for nearly every living organism to sustain life. Excess nitrogen in water causes an array of detrimental issues such as eutrophication, mass fish death, and can even cause sickness in humans if accidentally consumed. Data taken from a pond on the side of highway 544 from October 13, 2011 to November 16, 2020 show the majority of samples taken had total nitrogen levels below the EPA(2000) water quality standard, indicating the water was not contaminated with respect to nitrogen. However, there were occasional spikes in total nitrogen that exceed the EPA(2000) water quality standard. The data also showed an increase of high nitrogen levels within the last 2-3 years. This is a concern because the surface waters in this area send water into the Waccamaw river, which is inhabited by numerous wildlife populations and is a popular recreational area.

References

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