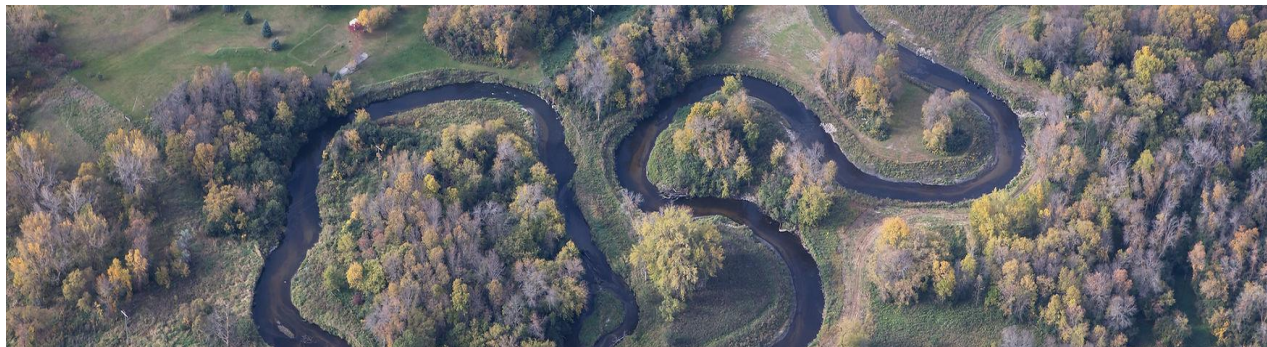




**BUFFALO – RED RIVER
WATERSHED DISTRICT**



2022 Buffalo-Red River Watershed District Water Quality Report



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PROTECTING • MANAGING • EDUCATING

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Introduction

The Buffalo-Red River Watershed District (BRRWD) is a political subdivision of the State of Minnesota, operating under Chapter 103D of Minnesota Statutes. BRRWD encompasses 1,786 square miles and the boundaries of the District extend into four counties. Clay County makes up the largest portion of BRRWD at 45%, followed by Wilkin County at 31%, with smaller portions made up of Becker (16%), and Otter Tail (8%) Counties. The Mission Statement of BRRWD is to alleviate flooding and to manage water resources of the District in a manner that best protects this valuable resource. Several of our goals include reducing and alleviating damage caused by floodwaters, protect and/or improve water quality of the surface and groundwater resources, and endeavor to inform and educate residents about water and soil resource issues and the importance of protecting these crucial resources.

BRRWD supports the Red River Basin River Watch Program. The program is intended to provide direct, field-based experiential water quality opportunities for students and citizens to enhance watershed understanding and awareness. BRRWD partners with the International Water Institute (IWI), Barnesville High School, and RMB Environmental Laboratories to conduct water quality work and sampling. IWI is a nonprofit organization working to facilitate research, education, training, and information dissemination centered on the Red River of the North Basin (Red River). Barnesville High School has partnered with BRRWD since 2011, offering opportunities that intend to help students interact with hands-on water quality work in the field and to inform them about the importance of our water within our District. BRRWD also partners with RMB Environmental Laboratories, an analytical laboratory whose mission is to improve our water resources and increase the community's health. RMB Labs helps collect these samples and test them at their Detroit Lakes, MN office.

In 2022, water quality samples were taken at 34 separate sites from 15 tributaries within BRRWD boundaries. Tributaries and number of sites along those tributaries are shown in Exhibit No. 1 and are listed out as follows; Buffalo River (9), South Branch Buffalo River (5), Otter Tail River (3), Whiskey Creek (3), Hay Creek (2), Stony Creek (2), Whiskey Creek (2), Becker County Ditch No. 15 (1), Blue Eagle Lake (1), Deerhorn Creek (1), Unnamed Creek (1), Wilkin-Otter Tail Judicial Ditch No. 2 (1), Wilkin County Ditch No. 3 (1), Wilkin County Ditch No. 31 (1), and Wolverton Creek (1). All data collected can be searched for and found at [\(MPCA Surface Water Monitoring Stations\)](#).

Surface Water Data Collection Stations Within BRRWD

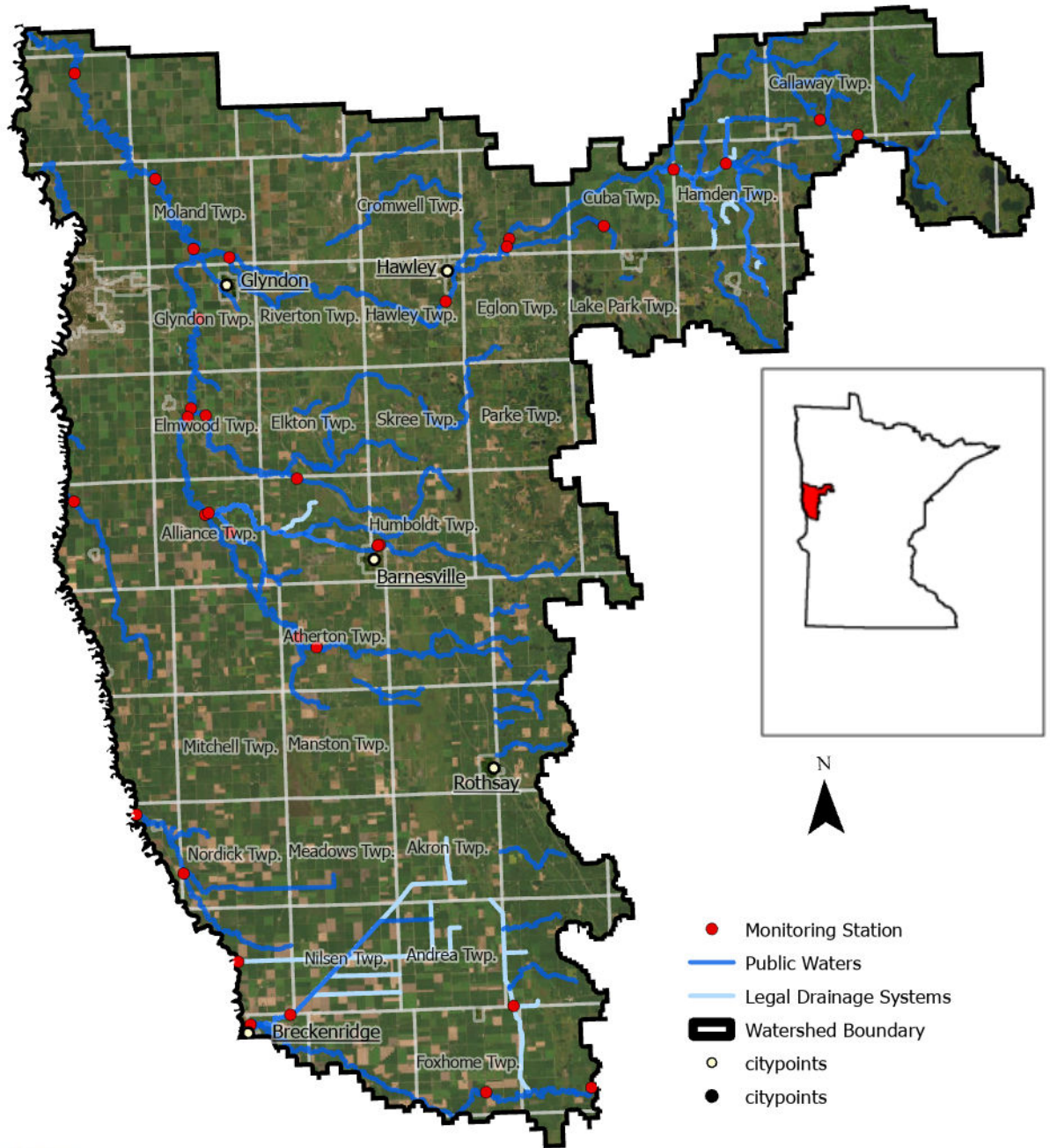


Exhibit No. 1. BRRWD boundary, rivers, ditches, and monitoring stations.

Sample Collection and Analytes Measured

Sample dates and number of samples collected varied from site to site. Samples were generally collected between April and October by IWI, Barnesville High School, and RMB Environmental Laboratories. All samples were tested for Ammonia Nitrogen, Total Phosphorous, Nitrate/Nitrite, Total Kjeldahl Nitrogen, Total Suspended Solids, and Escherichia Coli Bacteria. Several samples were also tested for Chlorophyll-a, Pheophytin Corrected. Samples were graphed and compared to water quality standards set by either the Minnesota Pollution Control Agency (MPCA) or the Environmental Protection Agency (EPA).

1. Ammonia Nitrogen

Ammonia Nitrogen (NH_4+NH_3) is the combination of Ionized Ammonium (NH_4) and unionized Ammonium (NH_3). Ammonia Nitrogen is an important pollutant to monitor due to the high toxicity of the unionized form to fish and other aquatic creatures. Ammonia is commonly produced from wastes, fertilizers, and other natural processes. Maintaining the pH levels of water is important when monitoring Ammonia since the increase in pH favors an increase for the unionized toxic form. Agricultural runoff, manure application, septic seepage, and overflow from water impoundments are common ways Ammonia can enter a water body ([EPA](#)).

2. Total Phosphorous

Total Phosphorous (TP) is the measure of all dissolved and particulate forms of phosphorous. Phosphorous is commonly found in manure, organic debris such as branches, fallen leaves, and yard trimmings, and fertilizers used to boost the productivity of agricultural crops (IWI, 2021). Bank erosion during overland flooding also commonly contributes phosphorous into water bodies ([USGS](#)).

3. Nitrate/Nitrite

Nitrate/Nitrite as N ($\text{N}+\text{N}$) is the combination of Nitrate (NO_3) and Nitrite (NO_2). Nitrate is essential for plant growth and is commonly used in fertilizer in the agricultural industry. Nitrate is more commonly found than Nitrite, which means most of the $\text{N}+\text{N}$ value consists of Nitrate. $\text{N}+\text{N}$ finds its way into water bodies by runoff from agricultural fields treated with nitrogen fertilizer and manure ([EPA](#)).

4. Total Kjeldahl Nitrogen

Total Kjeldahl Nitrogen (TKN) is the sum of total organic nitrogen and total ammonia. Manure and sewer discharges can lead to increased levels of TKN (IWI, 2021).

5. Total Suspended Solids

Total Suspended Solids (TSS) are suspended particles that are not dissolved in water, including inorganic and organic materials larger than two microns in size that can be measured. In our region, common TSS comes from agricultural erosion, bank erosion and

growth of algae (IWI, 2023).

6. Escherichia Coli Bacteria

While some strains of Escherichia Coli Bacteria (E. Coli) are harmless, other forms can cause adverse health effects to humans. E. Coli is prevalent within our rivers and streams and it is difficult to manage since it comes from the digestive tracts of animals using the water source ([USGS](#)).

7. Chlorophyll-a, Pheophytin Corrected

Chlorophyll-a, Pheophytin Corrected (Chl-a) is the measure of amount of algae growing in a waterbody. Algae is a naturally occurring organism but can cause aesthetic problems when too much is produced. Waters containing large quantities of nutrients from fertilizers can have high concentrations of Chl-a, which can lead to excess amounts of algae ([EPA](#)).

All samples were measured in mg/L except E. Coli, which was measured in MPN/100mL. MPN stands for most probable number and is a method used to determine the presence of microorganisms in a water sample. Some of the above listed analytes had concentrations that were very low, which makes an accurate reading difficult. In those cases, a less than symbol (<) was used when an exact value was not determined. Analytes and their respective concentrations that had these issues include E. Coli (<1 MPN/100mL), Ammonia (<.02 mg/L), Nitrate/Nitrite (<.03 mg/L), and some Total Suspended Solids had a value of (<2 mg/L). It is important to note that while the graphs use lines of best fit, continuous recording is not present at any of our sites. That is, the lines between the collection dates may not be 100% accurate because samples were only taken roughly once a month.

Planning Regions

In the Buffalo-Red River Watershed Comprehensive Watershed Management Plan, BRRWD is split into nine separate sectors called Planning Regions. Planning regions are based on three distinguishing characteristics: ecoregions, hydrology, and land use. The planning regions include Central, Lakes, Mainstem, Moorhead, Northern, Otter Tail, Southern, Upper Red, and Western. Planning regions can be found on the interactive map on our website. Once the map is opened, a layer labeled “planning regions” should be available to view under the layer list.

1. Central

The Central planning region is the largest planning region with 326 square miles (18% of the District). Located in this region are the communities of Barnesville, Rollag, and Downer. Topography of this landscape varies from undulating in the east to flat in the west, as this region is located along a beach ridge of the historical Glacial Lake Agassiz. The South Branch Buffalo River, Stony Creek, and Whisky Creek all run through the Central planning region. Agriculture is the predominant land use at 68.5%. Along with its large size, the Central planning region also had the most sampling stations with 11.

2. Lakes

The Lakes planning region covers the farthest northeastern part of our District spanning 106 square miles (6% of the District). Only two (2) out of the 34 sampling stations were within the Lakes planning region. The topography of the land is undulating with many small lakes and wetlands located throughout. The headwaters of the Buffalo River are located within this region. The only region where the primary land use is not agriculture is the Lakes planning region, with deciduous forest being the predominant use (40.1%).

3. Mainstem

The Mainstem planning region is the second largest region with an area of 304 square miles, making up 17% of the District. It also held the second highest number of sampling stations with seven. The towns within this planning region include Callaway, Audubon, Lake Park, Hawley, and Glyndon. Becker County Ditch No. 15, Hay Creek and very large portion of the Buffalo River runs through this region. Once again, topography is undulating to the east, becoming flatter to the west. The predominant land use is agriculture at 67.3%.

4. Moorhead

The Moorhead planning region is the smallest of the nine planning regions at only 63 square miles (3%). Topography of the land is flat, with the Red River making the western border of this region. While the cities of Moorhead and Dilworth are within the planning region, agriculture is still the most common land use at 65.4%. This was the only planning region without a monitoring station.

5. Northern

The Northern planning region has three monitoring stations and is in the northwestern part of our District encompassing 225 square miles (13%). Communities in the Northern planning region are Georgetown, Kragnes, and a portion of Hitterdahl. Topography of the land is flat, and this is the last planning region the Buffalo River travels through prior to depositing into the Red River. This planning region is mainly used for agriculture with 85% of the land being farmed.

6. Otter Tail

The Otter Tail planning region is the farthest south region in our District, with an area of 178 square miles (10%). This region has five monitoring stations, and the topography of this region again is undulating in the east, gradually becoming flatter as you move west. Orwell Dam and the lower reaches of the Otter Tail River, to the confluence of the Red River, are located within this region. Wilkin-Otter Tail Judicial Ditch No. 2 and Wilkin County Ditch No. 3 are also within this region. The communities included in this planning region are Foxhome and the portion of Breckenridge north of the Burlington Northern Railroad. Land use is predominantly agriculture at 86.6%.

7. Southern

Located between the Central and Upper Red planning regions, the Southern planning region is nearly identical to the Otter Tail planning region in relation to size at 175 square miles (10%). This planning region includes Manston Slough and Rothsay Wildlife Management Area, along with two monitoring stations. Topography is undulating to the east, and flat to the west. Headwaters of the South Branch Buffalo River are within this planning region, along with Deerhorn Creek. The predominant land use in the Southern planning region is agricultural land (77.4%).

8. Upper Red

The third largest planning region in BRRWD is the Upper Red planning region with an area of 244 square miles (14%). Topography is undulating to the east, and flat to the west. The communities of Kent and Rothsay are located within this planning region. The Red River forms the western border of this planning region and includes Whiskey Creek and Wilkin County Ditch No. 31. Agriculture is the predominant land use, with 87% of the lands in agricultural production. There are three monitoring stations in the Upper Red planning region.

9. Western

The Western planning region has an area of 165 square miles (9%) including the towns of Wolverton, Comstock, and Sabin. The Red River forms the western border of this region with topography of the land being flat with very few wetlands. Agriculture makes up most of the land use with 92.8% in agricultural production. There is only one monitoring station within this region, located on Wolverton Creek.

Sites and Stations

1. Buffalo River

The Buffalo River is the longest stream located all within BRRWD boundaries. The Buffalo River also has the most sampling stations for one river in BRRWD with nine: three in Becker County and six in Clay County. The Buffalo River meanders generally west, starting north of Rochert and running through 16 separate townships before depositing into the Red River northwest of Georgetown. The Buffalo River also runs through three planning regions: Lakes, Mainstem, and Northern. Stations listed below will start with an S followed by a six-digit code.

- a) S007-457: Located just north of Richwood where the Buffalo River crosses underneath Somdahl Road, S007-457 is the farthest upstream sampling station along the Buffalo River and is located within the Lakes planning region.

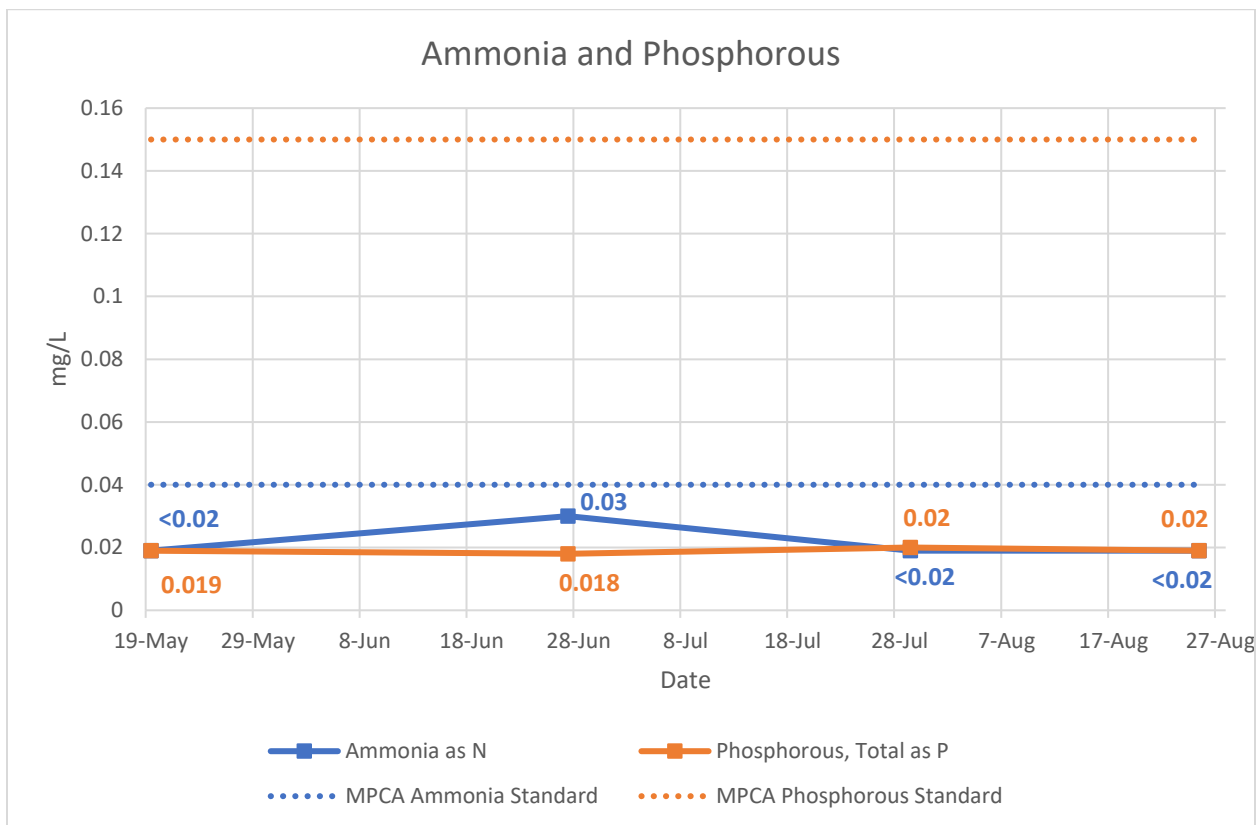


Figure 1. Ammonia and Phosphorous samples collected at S007-457.

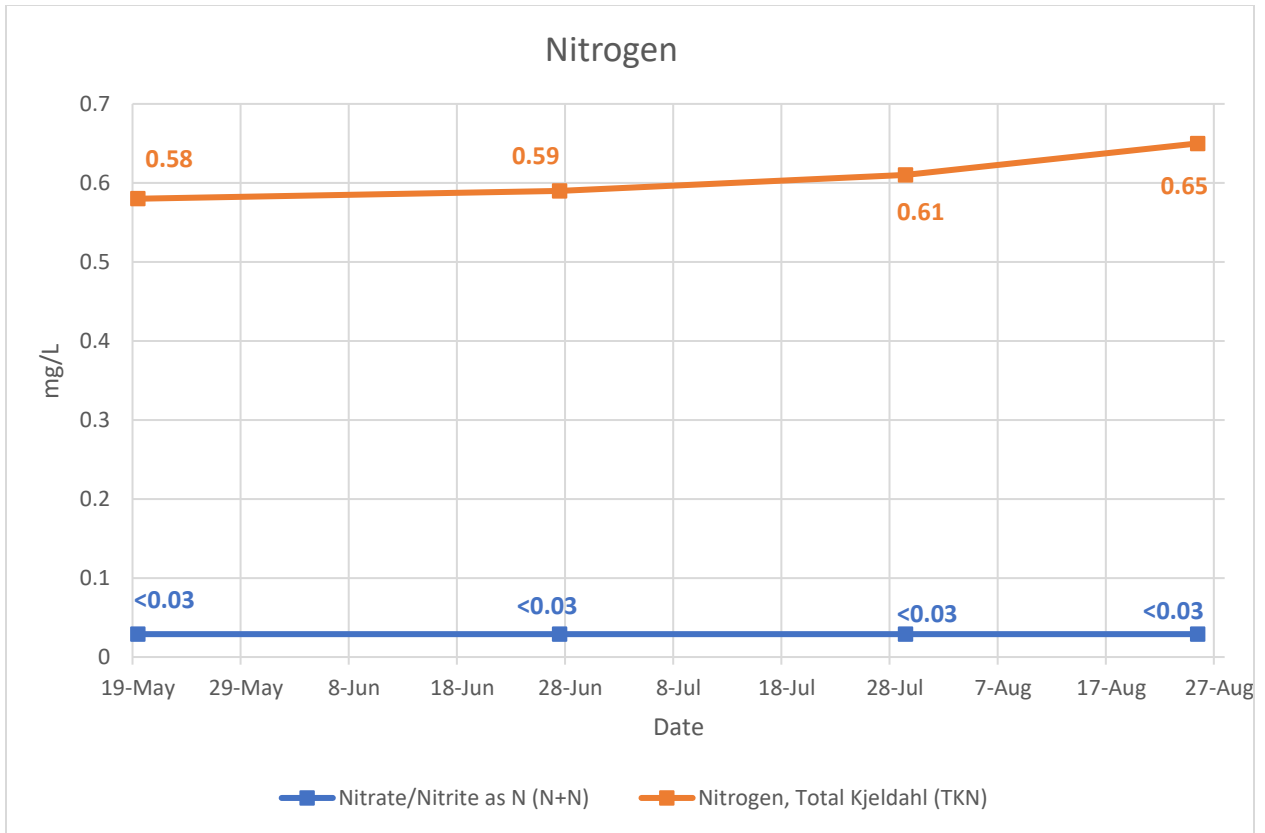


Figure 2. Nitrogen samples collected at S007-457 (MPCA and EPA standards are 10 mg/L).

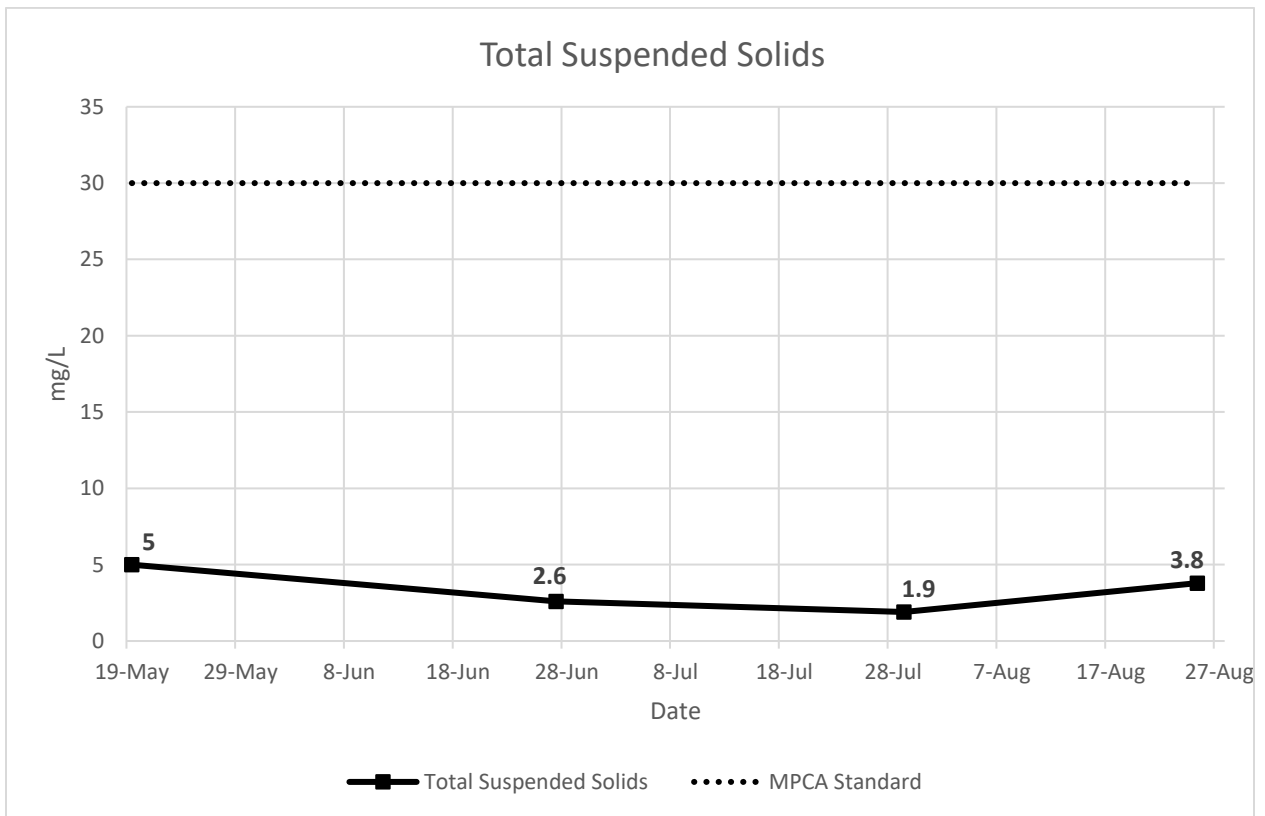


Figure 3. Total Suspended Solids samples collected at S007-457.

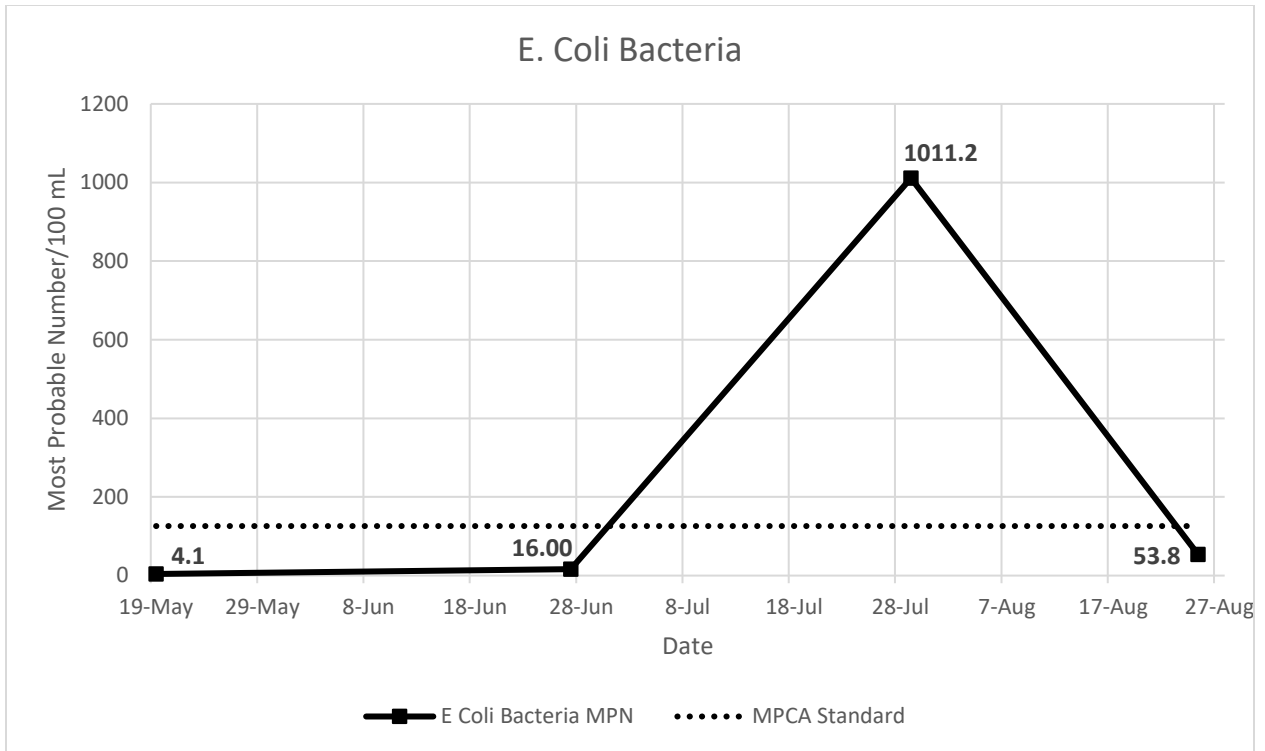


Figure 4. E. Coli Bacteria samples collected at S007-457.

b) S004-105: Located east of Callaway within the Lakes planning region, S004-105 is sampled as the Buffalo River crosses underneath County Highway 14.

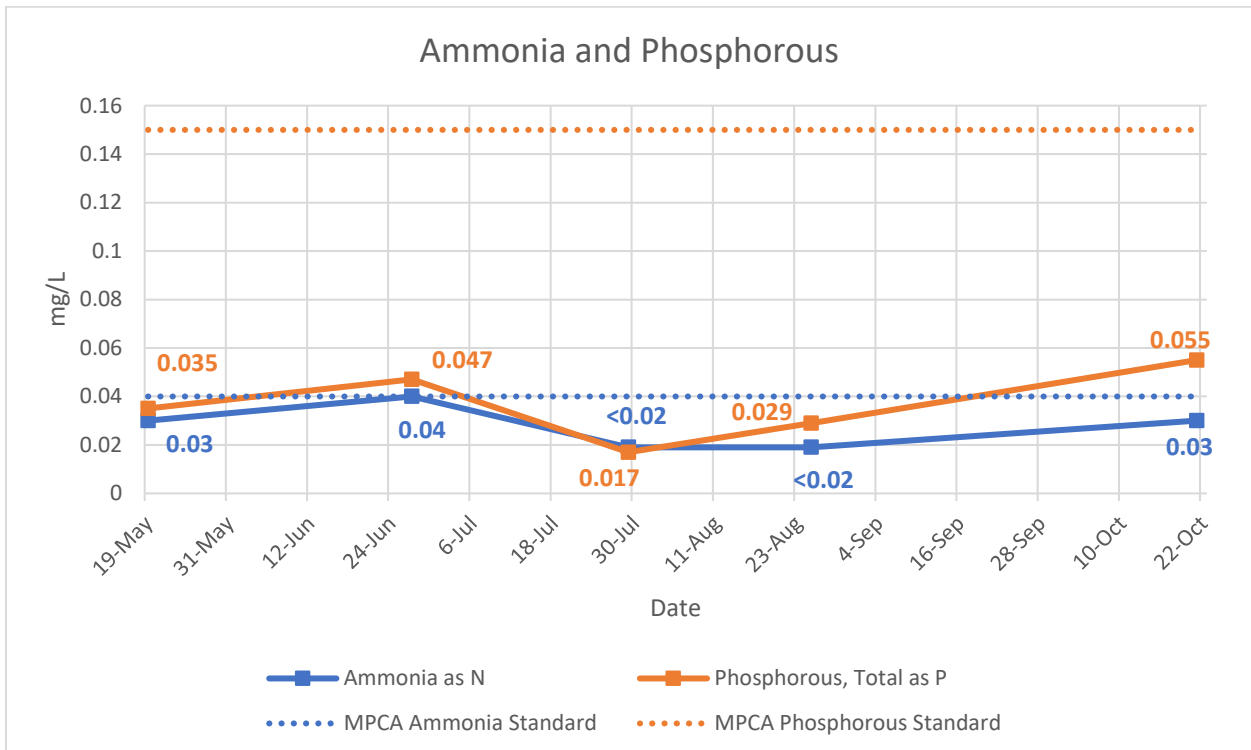


Figure 5. Ammonia and Phosphorous samples collected at S004-105.

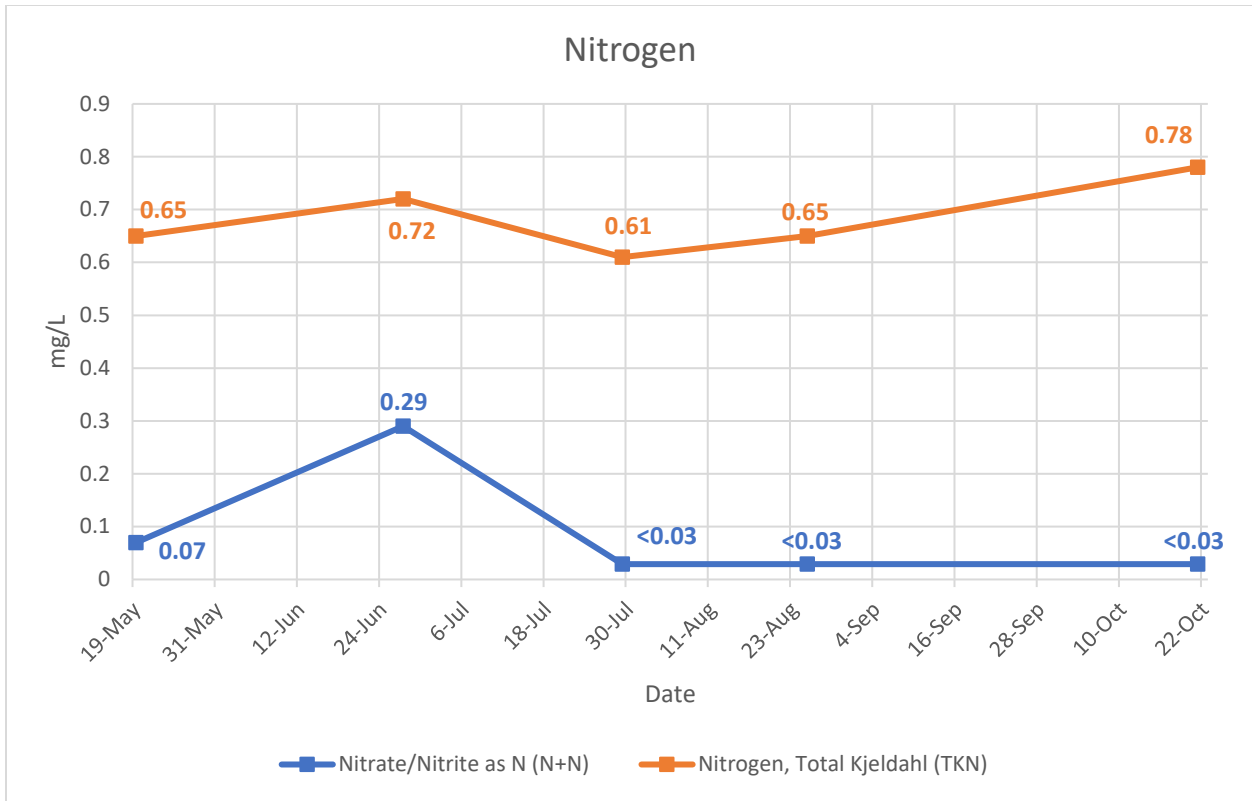


Figure 6. Nitrogen samples collected at S004-105 (MPCA and EPA standards are 10 mg/L).

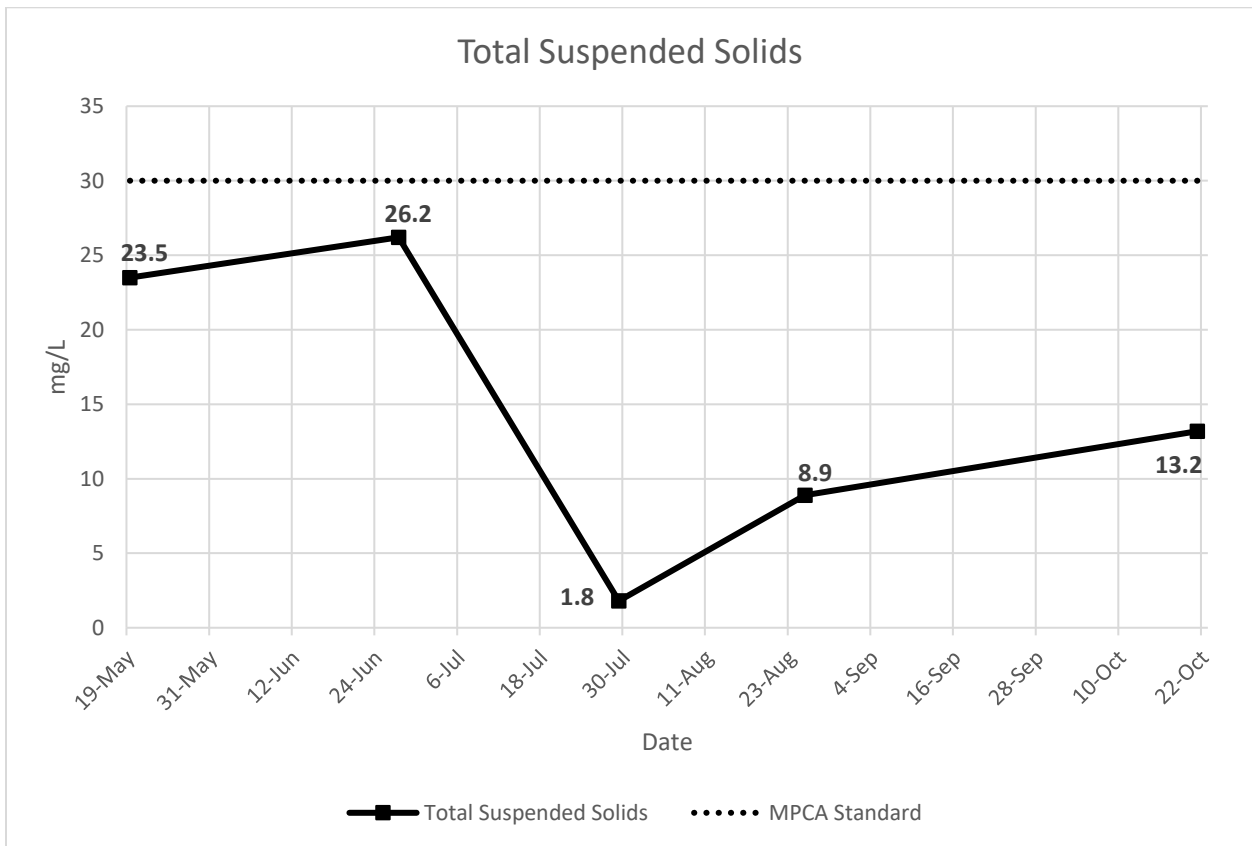


Figure 7. Total Suspended Solids samples collected at S004-105.

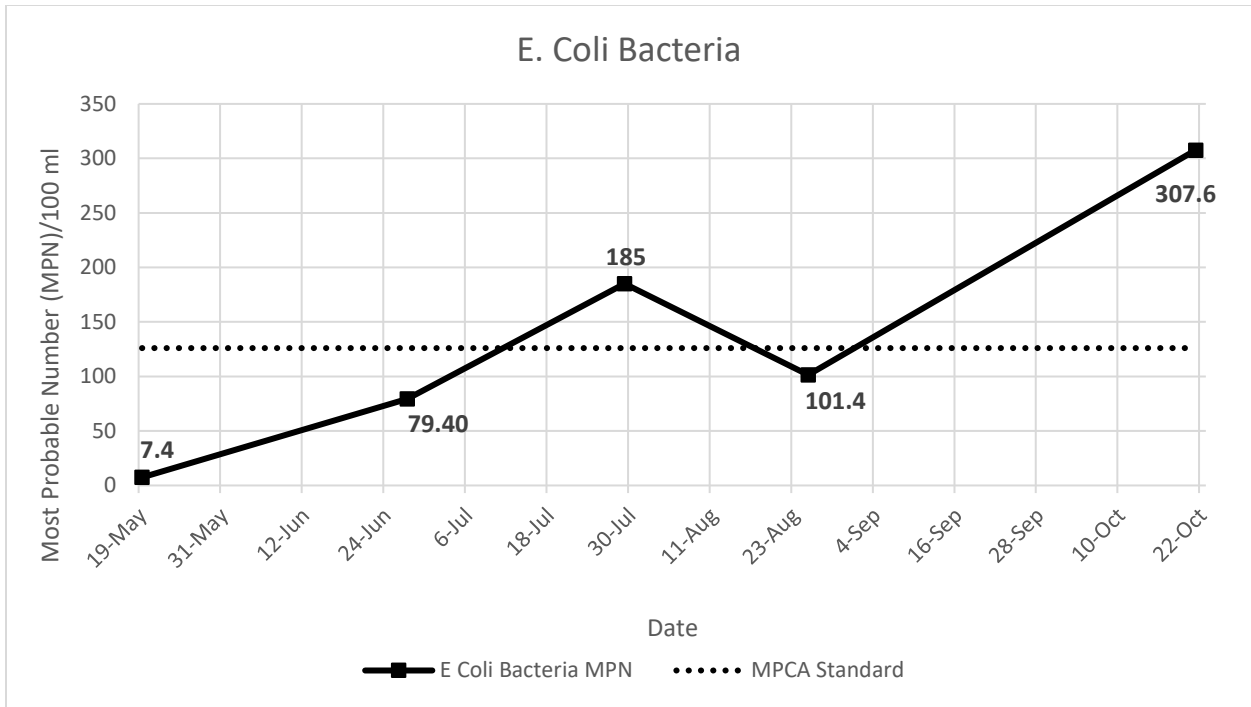


Figure 8. E. Coli Bacteria samples collected at S004-105.

c) S004-145: Between Sections 11 and 12 of Cuba Township in the Mainstem planning region, S004-145 is located where the Buffalo River crosses underneath County Highway 9.

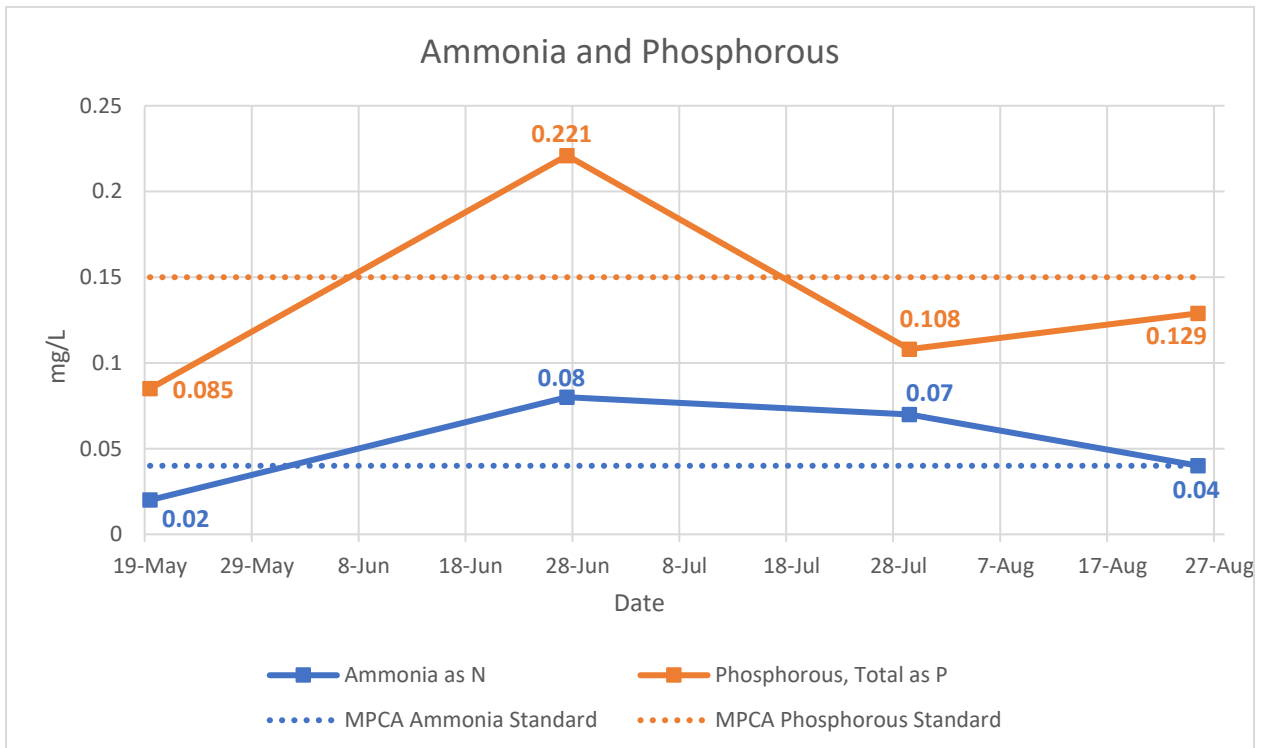


Figure 9. Ammonia and Phosphorous samples collected at S004-145.

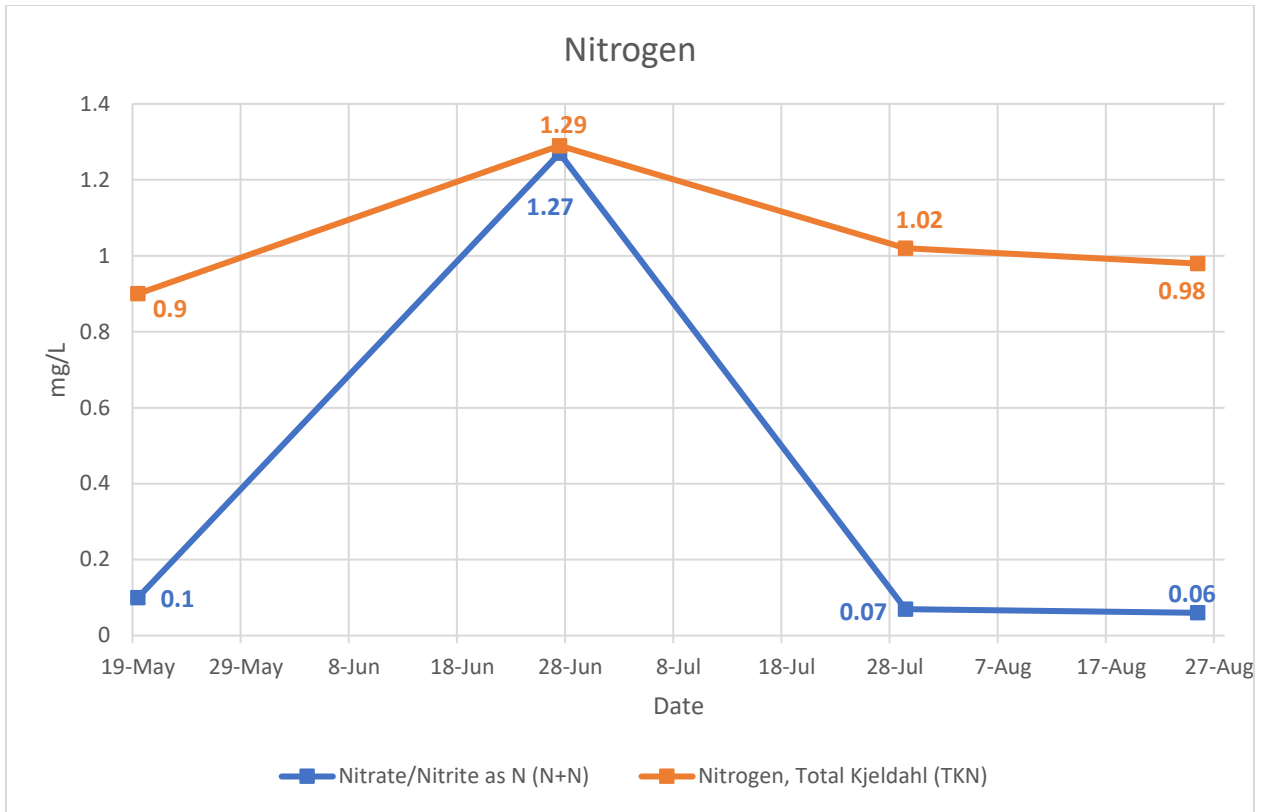


Figure 10. Nitrogen samples collected at S004-145 (MPCA and EPA standards are 10 mg/L).

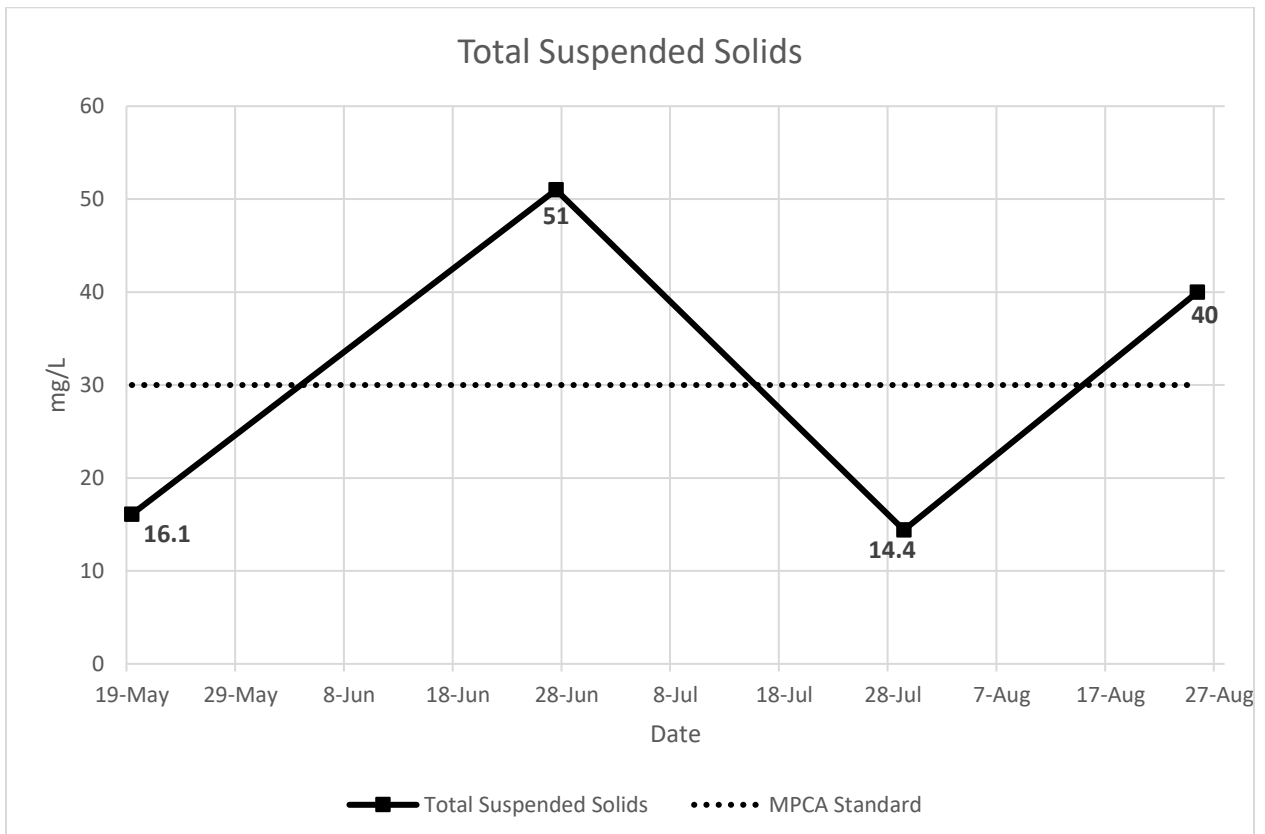


Figure 11. Total Suspended Solids samples collected at S004-145.

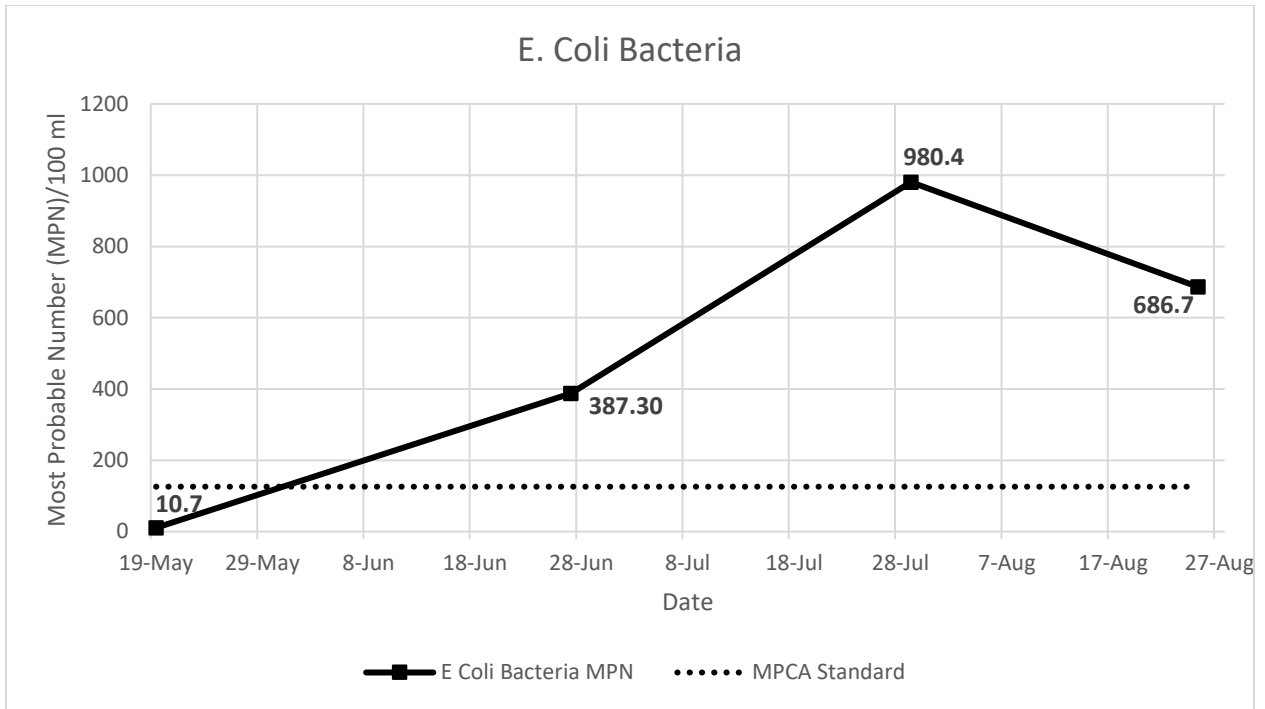


Figure 12. E. Coli Bacteria samples collected at S004-145.

d) S003-155: Located within the Mainstem planning region, S003-155 is located north of Winnipeg Junction, before the Buffalo River goes underneath 28th Ave N in Highland Grove Township.

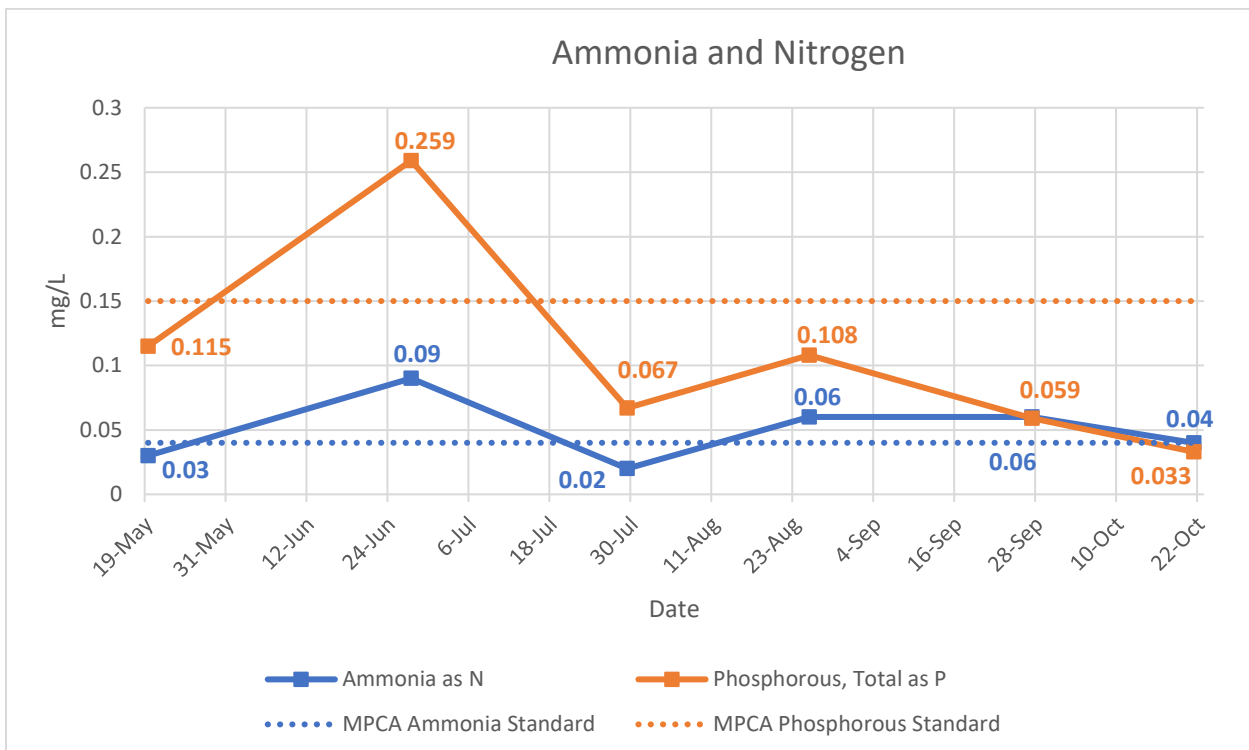


Figure 13. Ammonia and Phosphorous samples collected at S003-155.

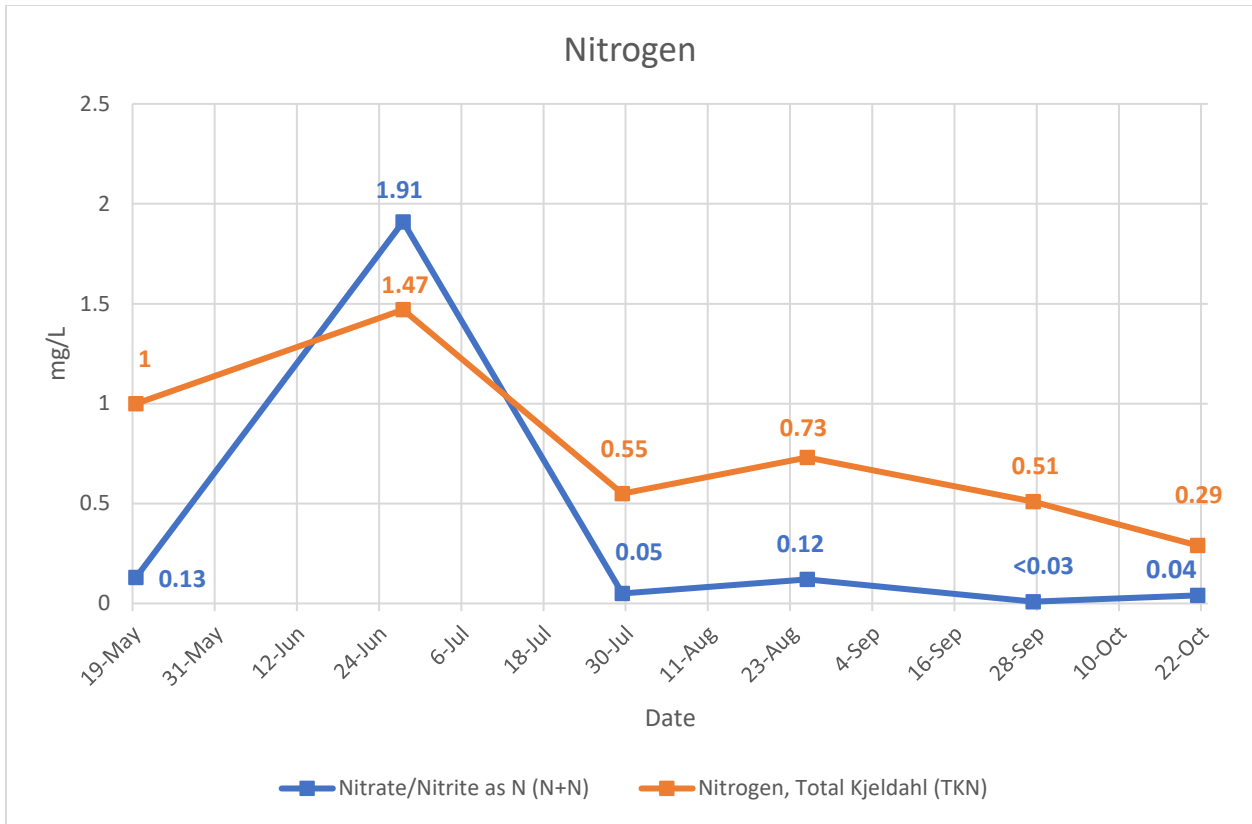


Figure 14. Nitrogen samples collected at S003-155 (MPCA and EPA standards are 10 mg/L).

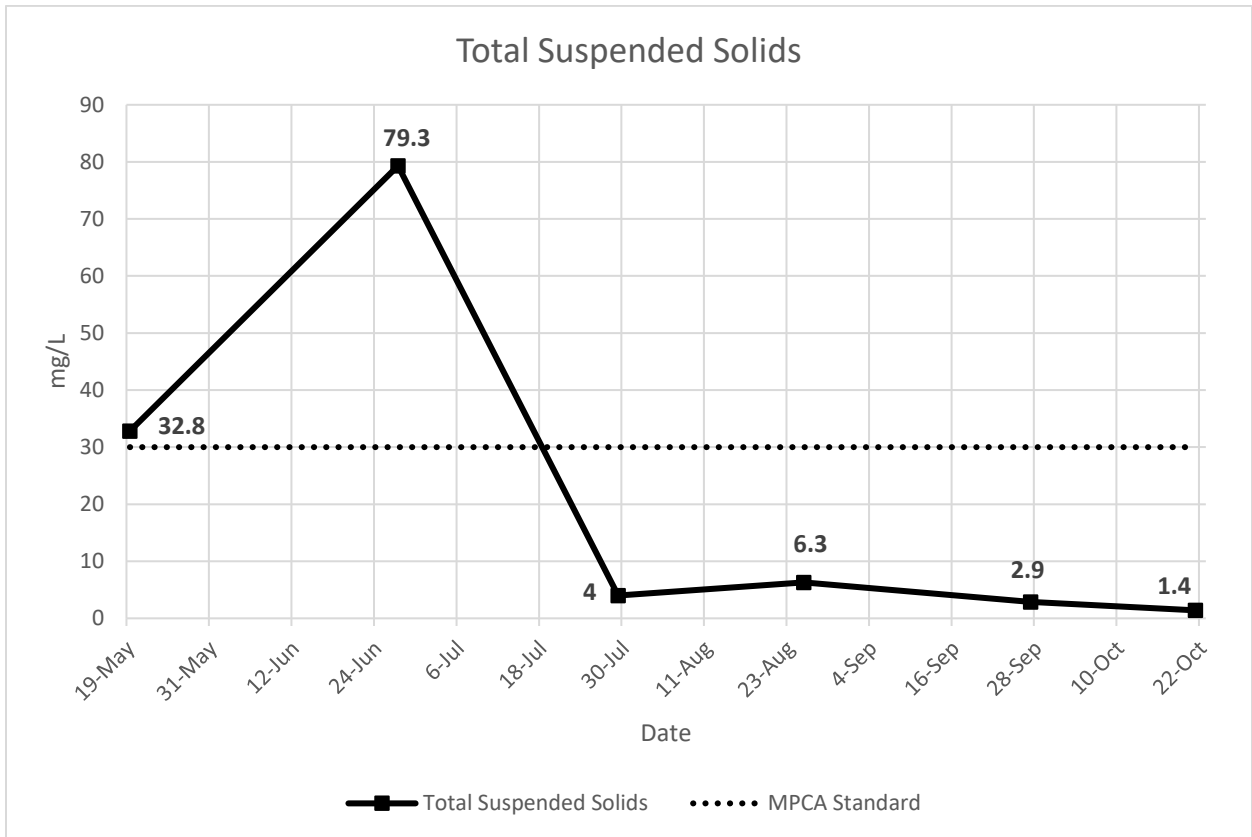


Figure 15. Total Suspended Solids samples collected at S003-155.

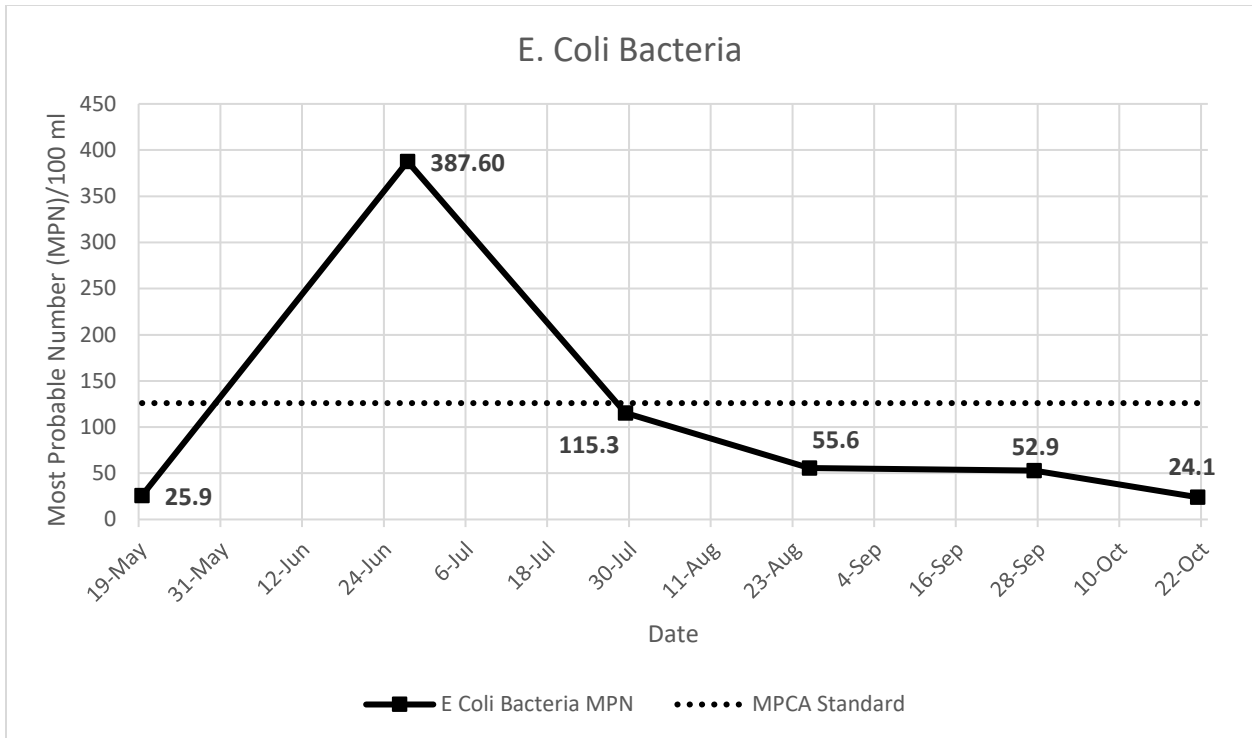


Figure 16. E. Coli Bacteria samples collected at S003-155.

e) S003-152: Just south of Hawley, S003-152 is along the east side of Highway 31. This station is in the Mainstem planning region.

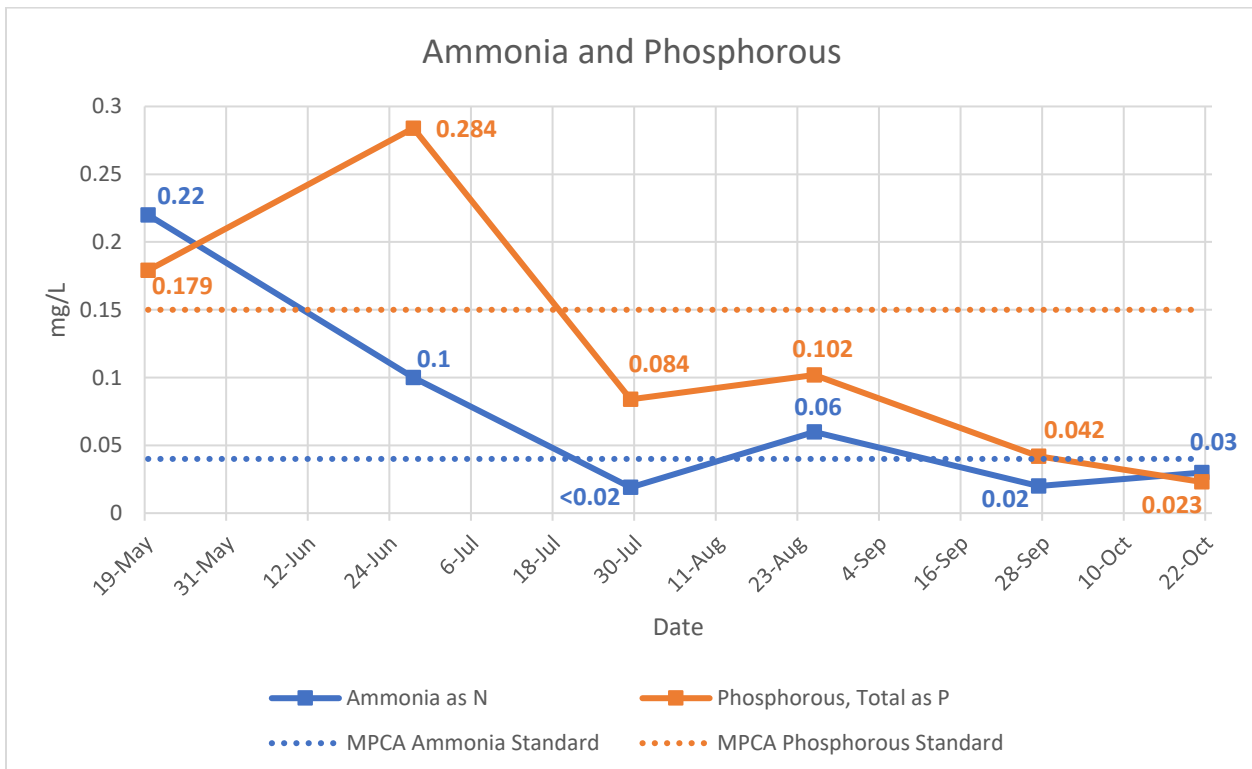


Figure 17. Ammonia and Phosphorous samples collected at S003-152.

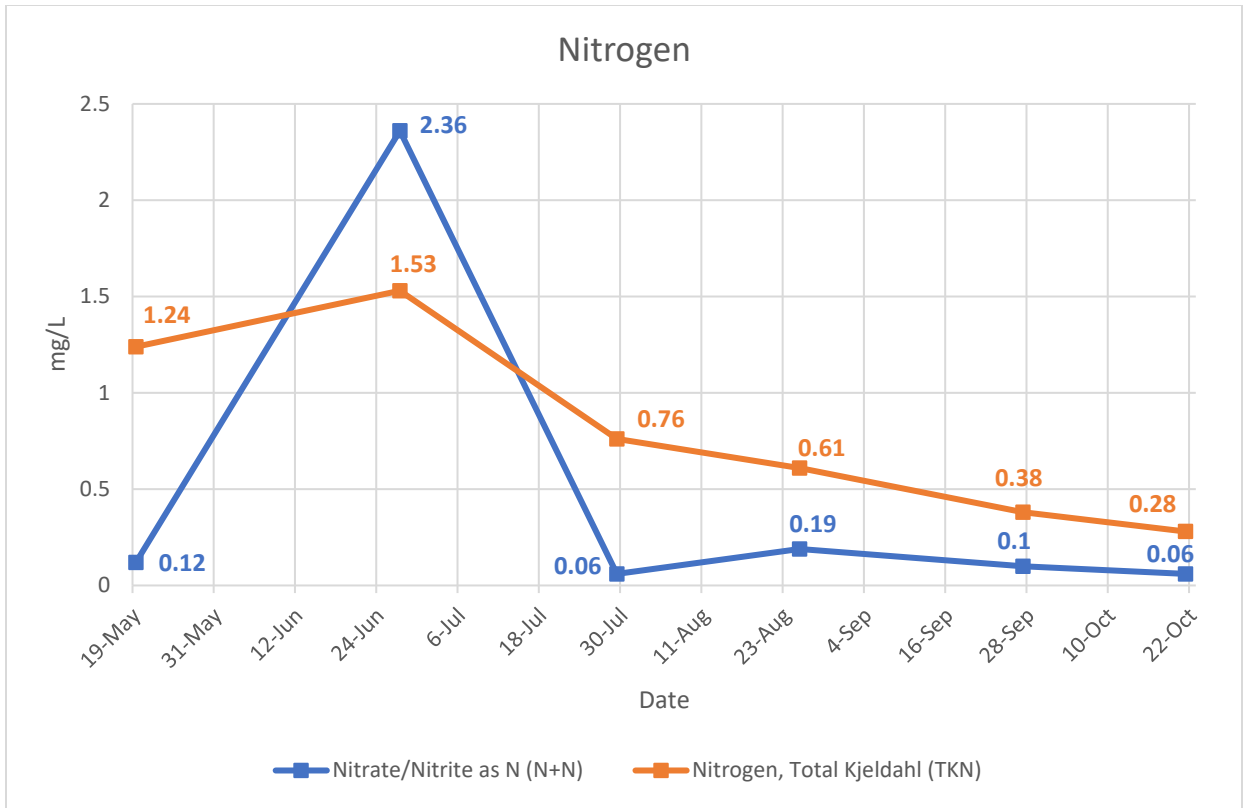


Figure 18. Nitrogen samples collected at S003-152 (MPCA and EPA standards are 10 mg/L).

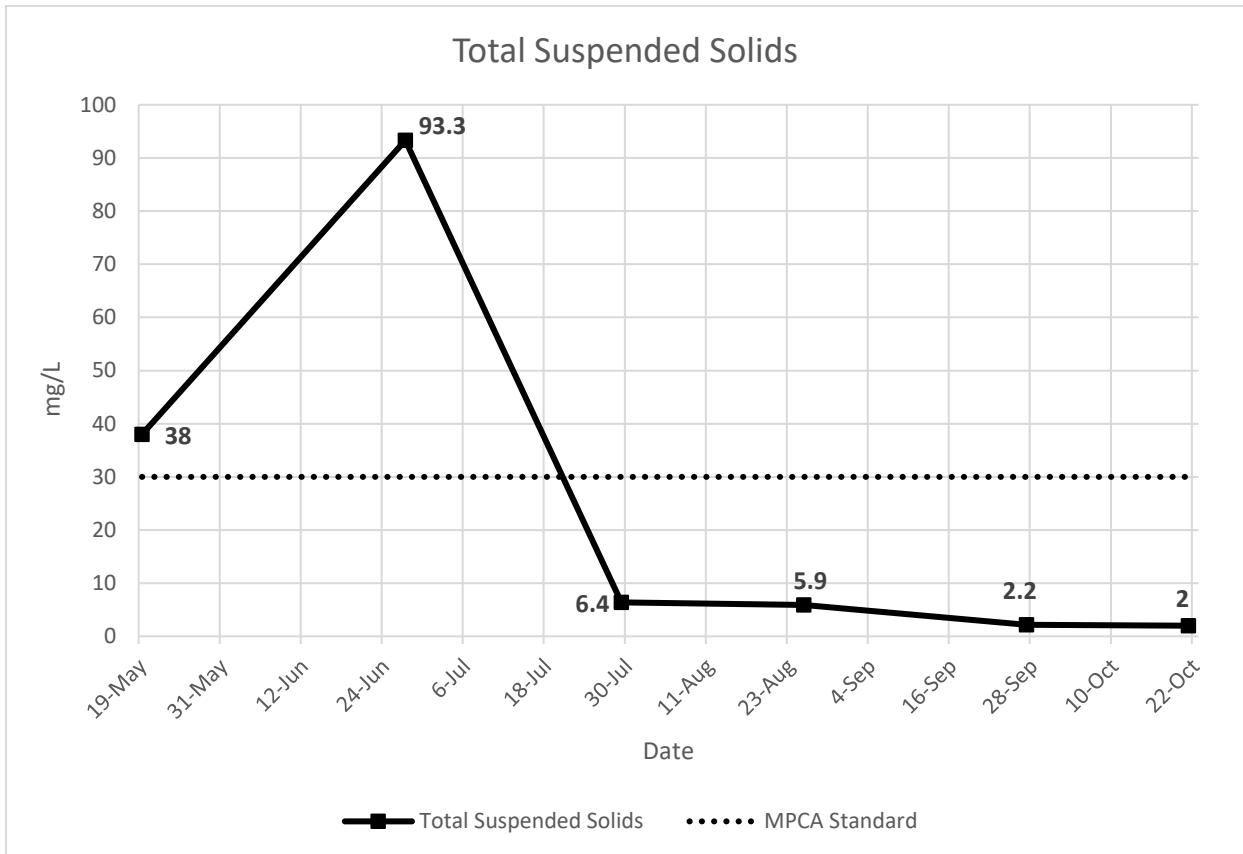


Figure 19. Total Suspended Solids samples collected at S003-152.

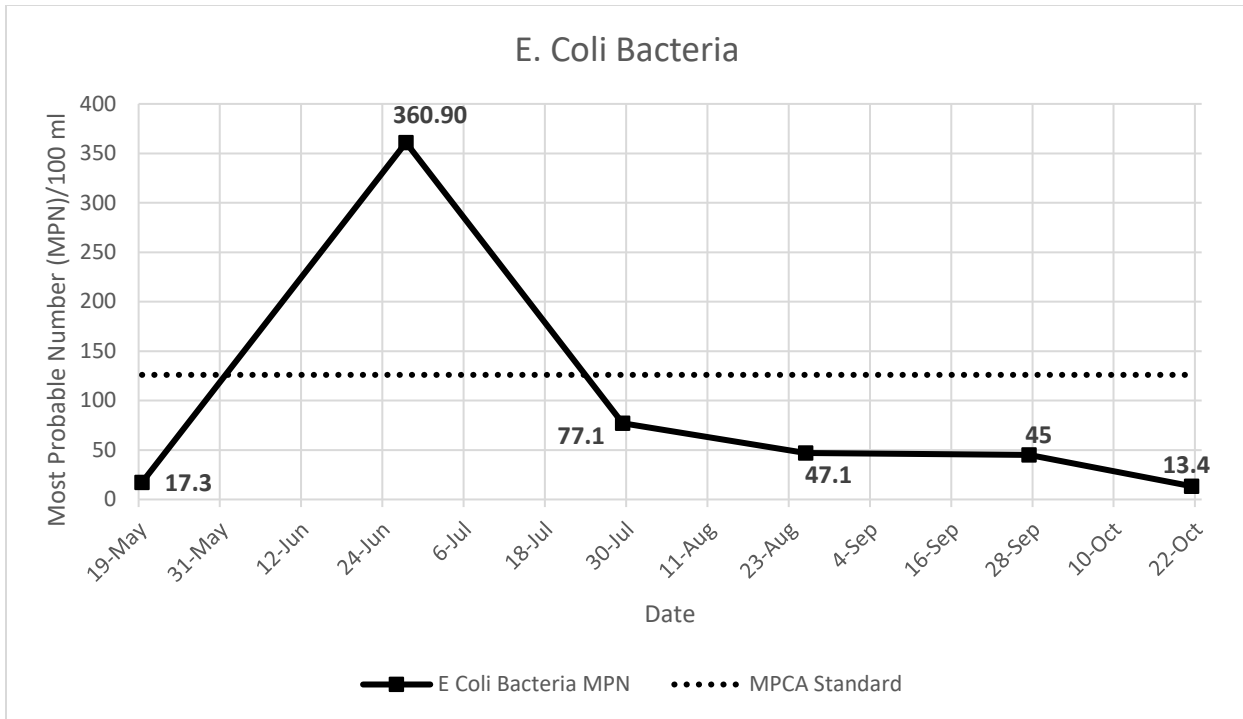


Figure 20. E. Coli Bacteria samples collected at S003-152.

f) S007-586: Roughly 25 river miles downstream from the station S003-152, S007-586 is located directly north of Glyndon along the east side of County Highway 19 and is the farthest downstream sampling station along the Buffalo River within the Mainstem planning region.

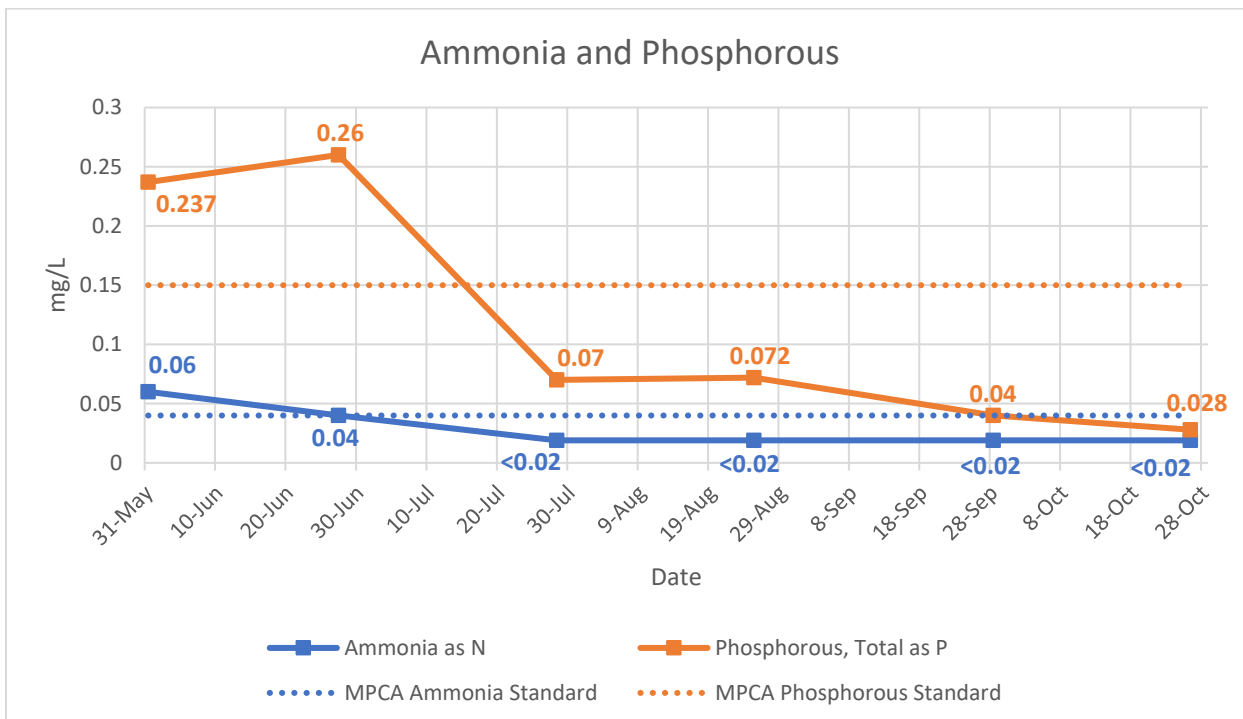


Figure 21. Ammonia and Phosphorous samples collected at S007-586.

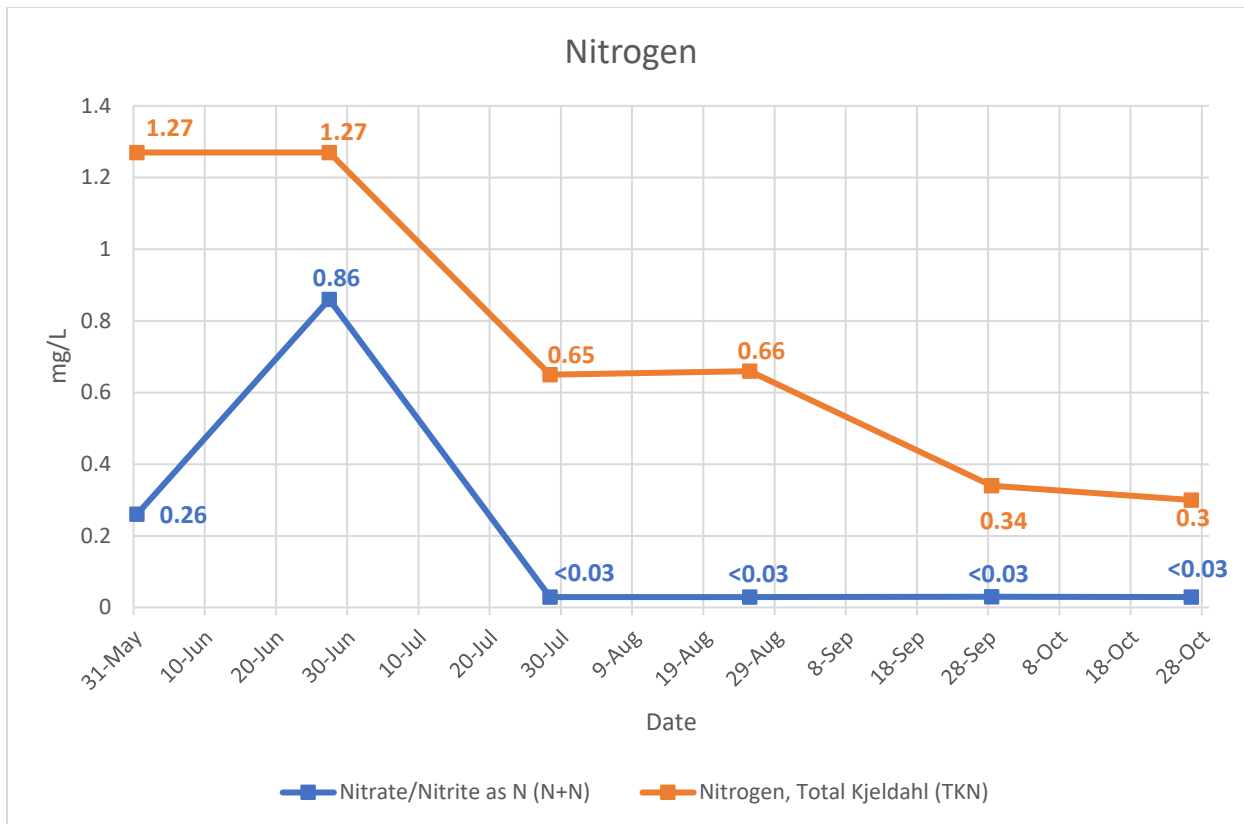


Figure 22. Nitrogen samples collected at S007-586 (MPCA and EPA standards are 10 mg/L).

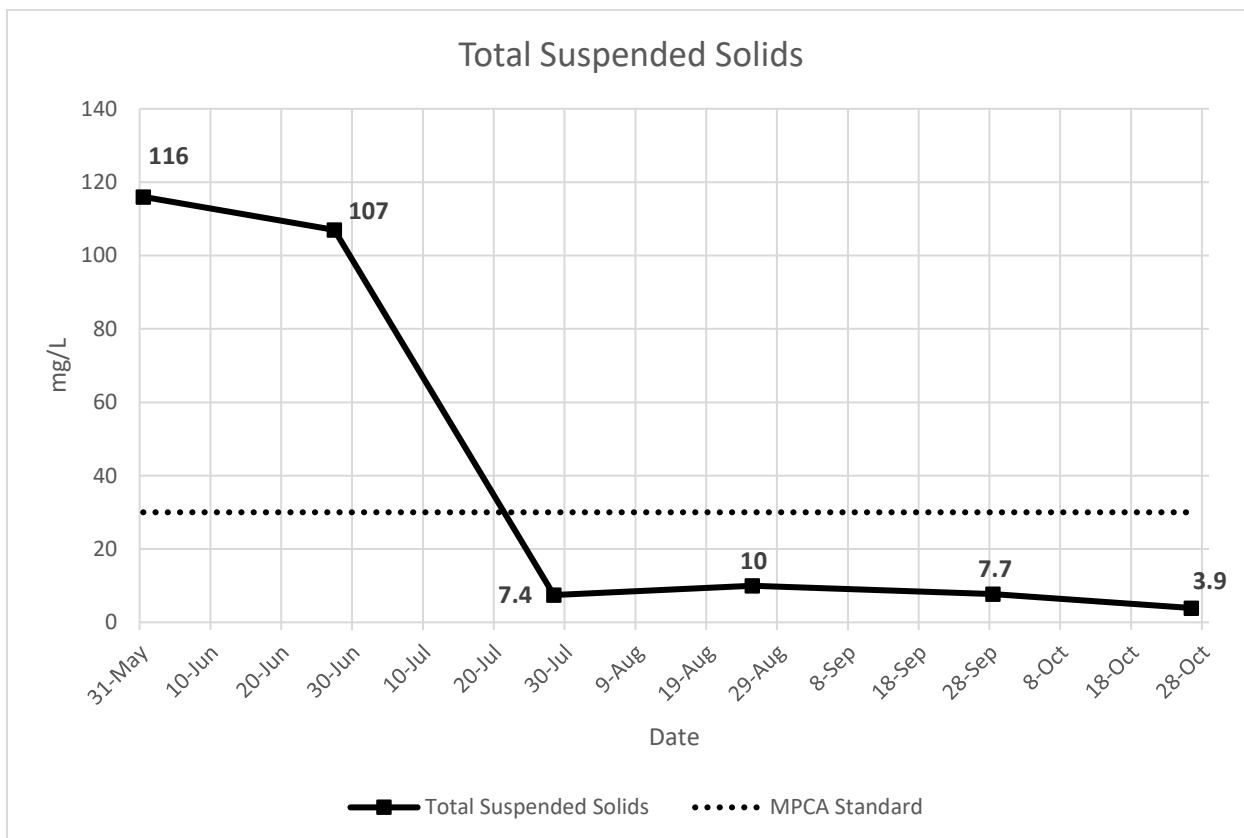


Figure 23. Total Suspended Solids samples collected at S007-586.

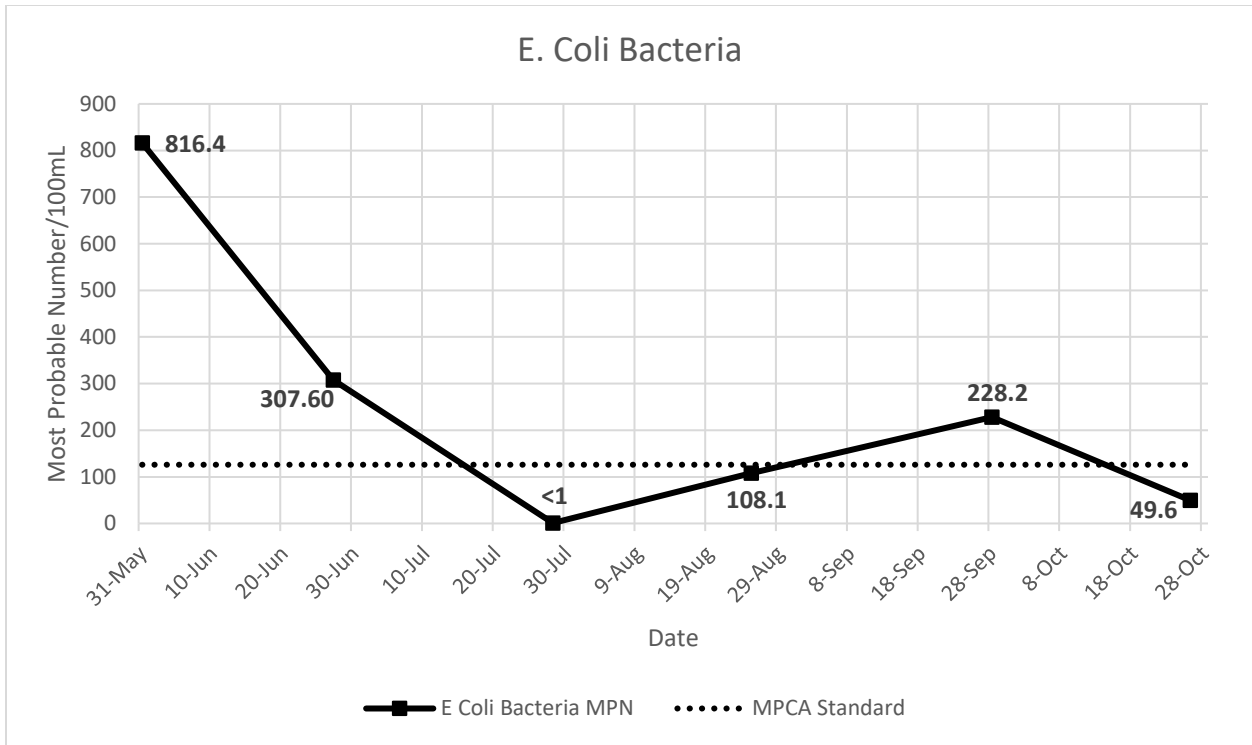


Figure 24. E. Coli Bacteria samples collected at S007-586.

g) S003-693: The furthest upstream station along the Buffalo River in the Northern planning region is S003-693, located 2 miles north between Glyndon and Dilworth along 28th Ave N.

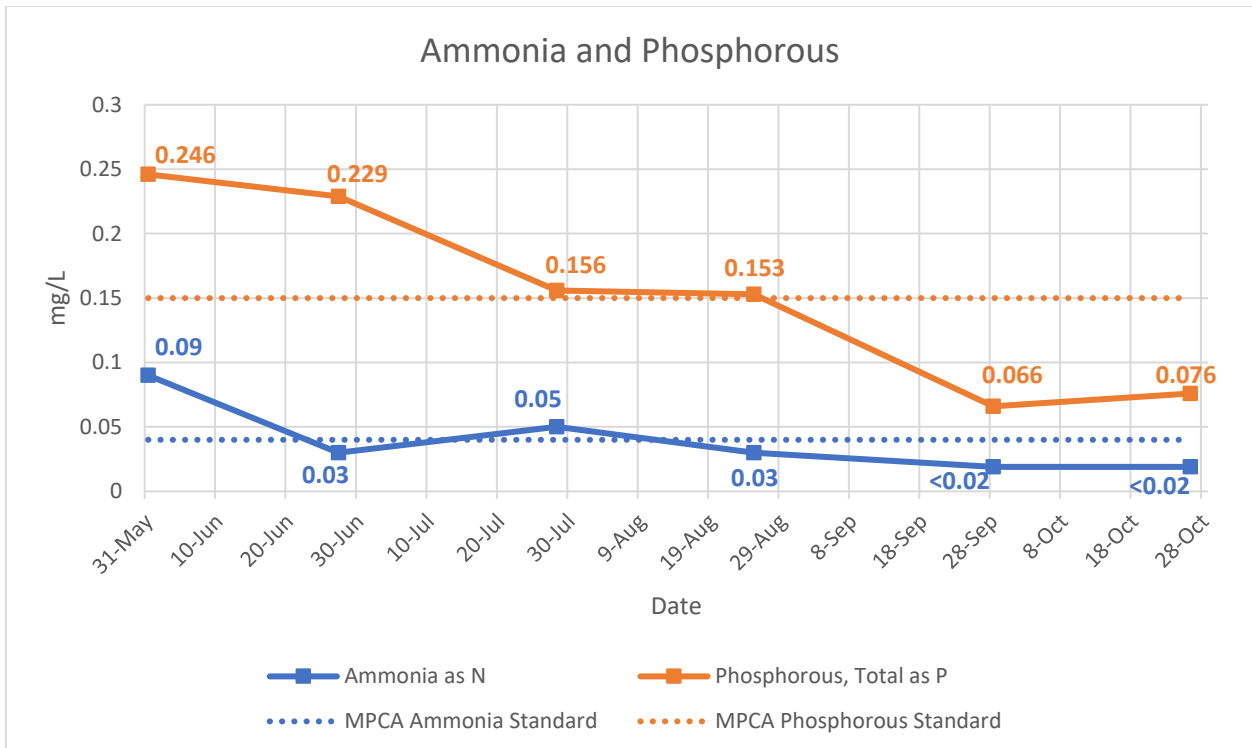


Figure 25. Ammonia and Phosphorous samples collected at S003-693.

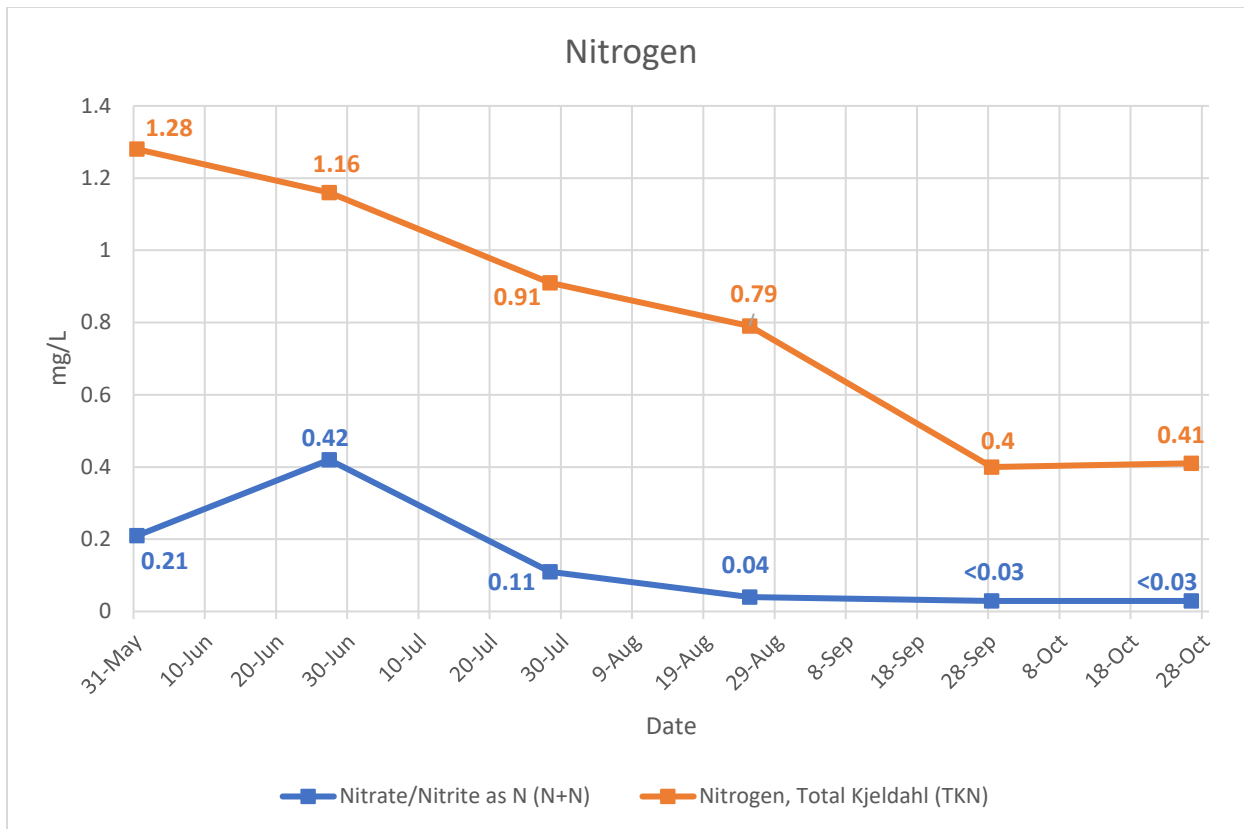


Figure 26. Nitrogen samples collected at S003-693 (MPCA and EPA standards are 10 mg/L).

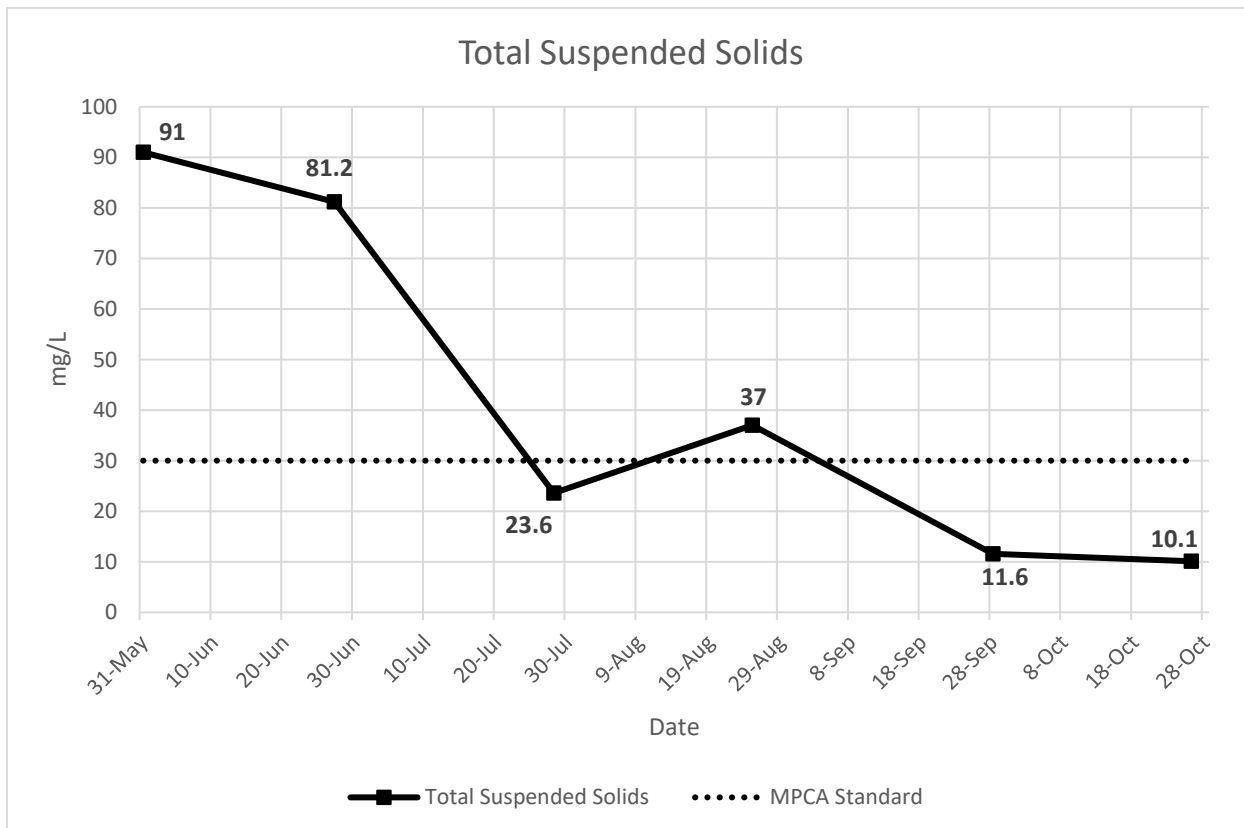


Figure 27. Total Suspended Solids samples collected at S003-693.

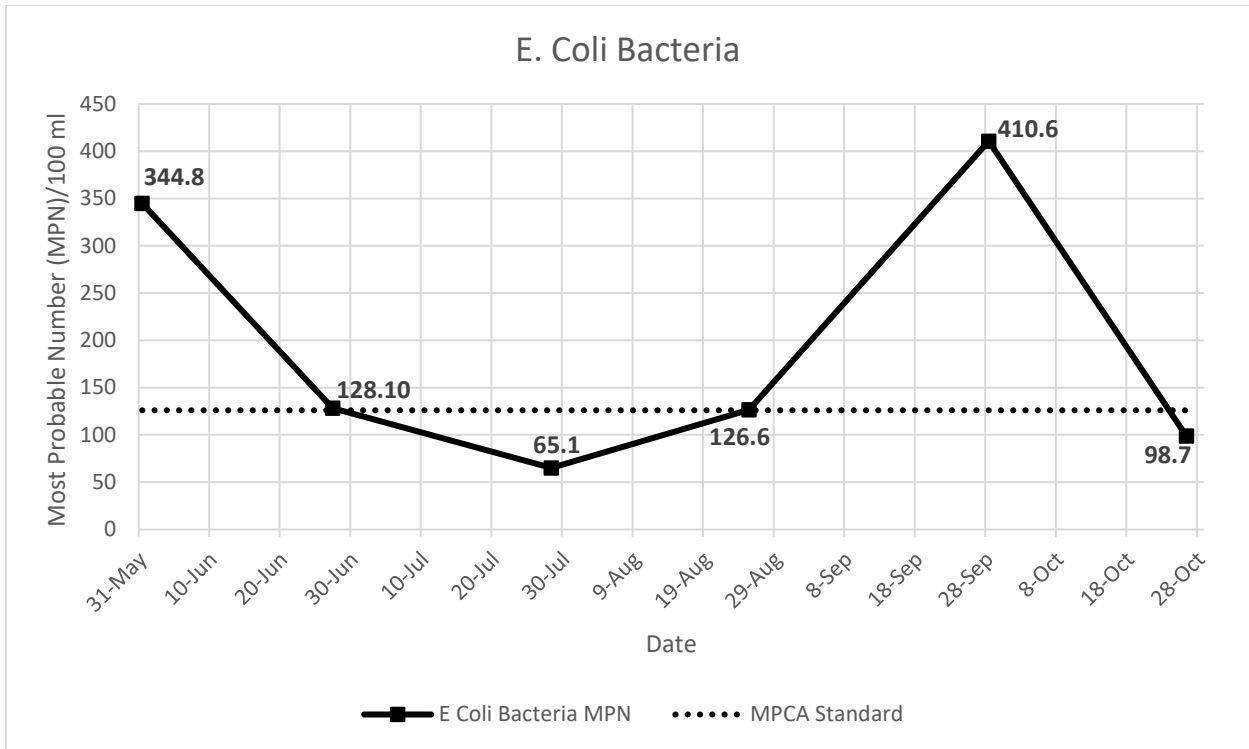


Figure 28. E. Coli Bacteria samples collected at S003-693.

h) S002-708: Located in Section 7, Moland Township before the Buffalo River runs underneath 80th Ave N in the Northern planning region.

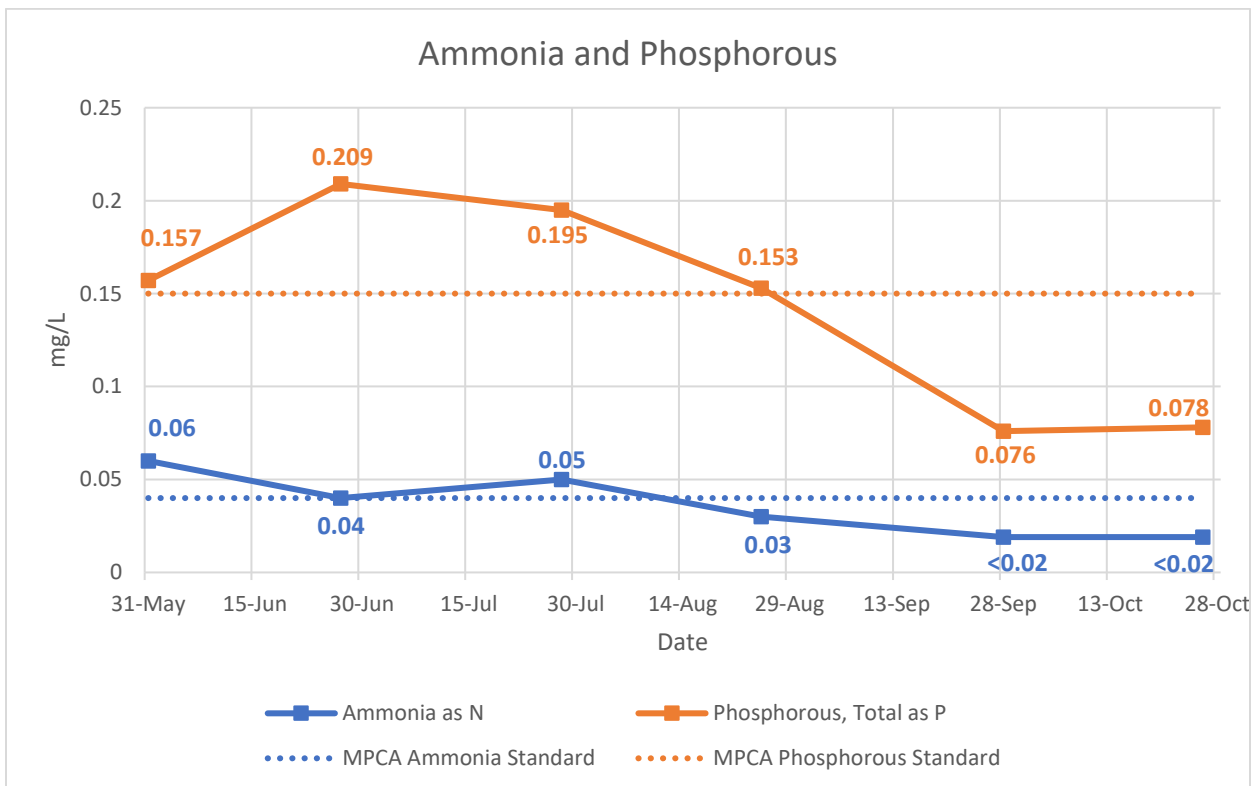


Figure 29. Ammonia and Phosphorous samples collected at S002-708.

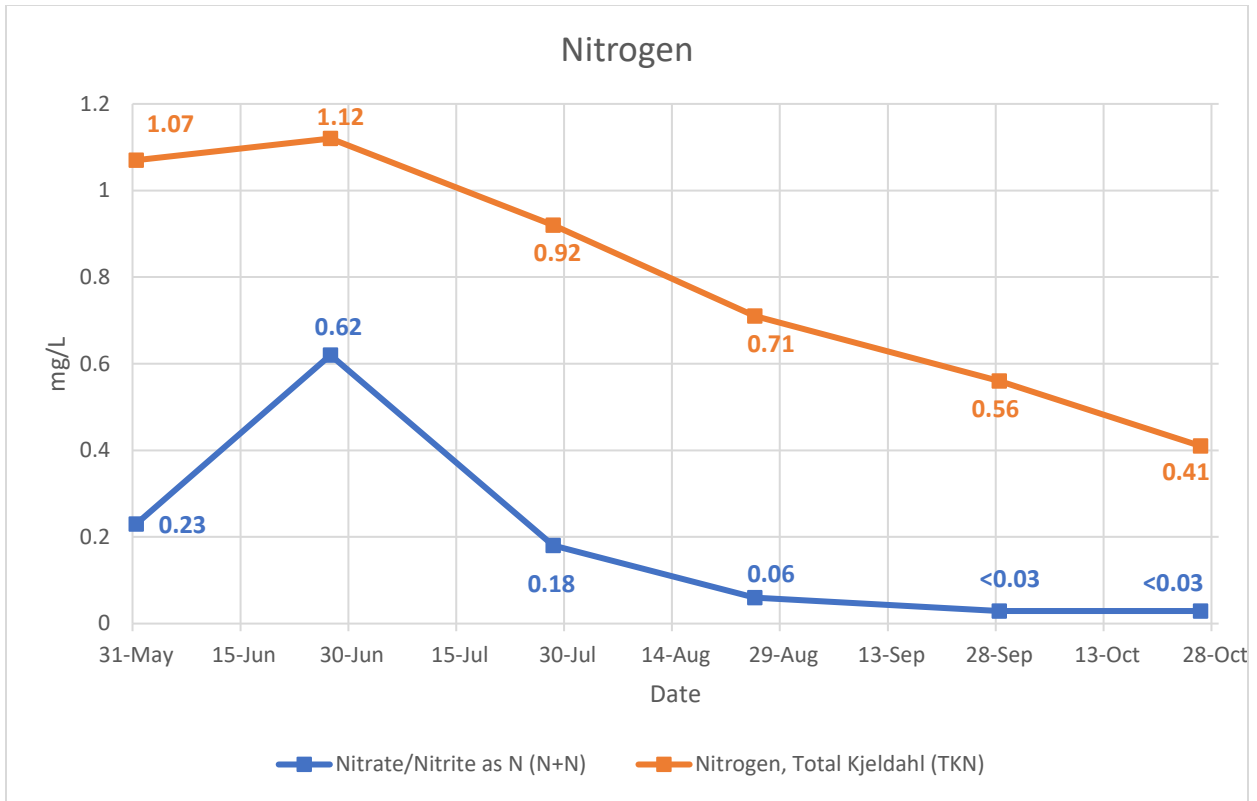


Figure 30. Nitrogen samples collected at S002-708 (MPCA and EPA standards are 10 mg/L).

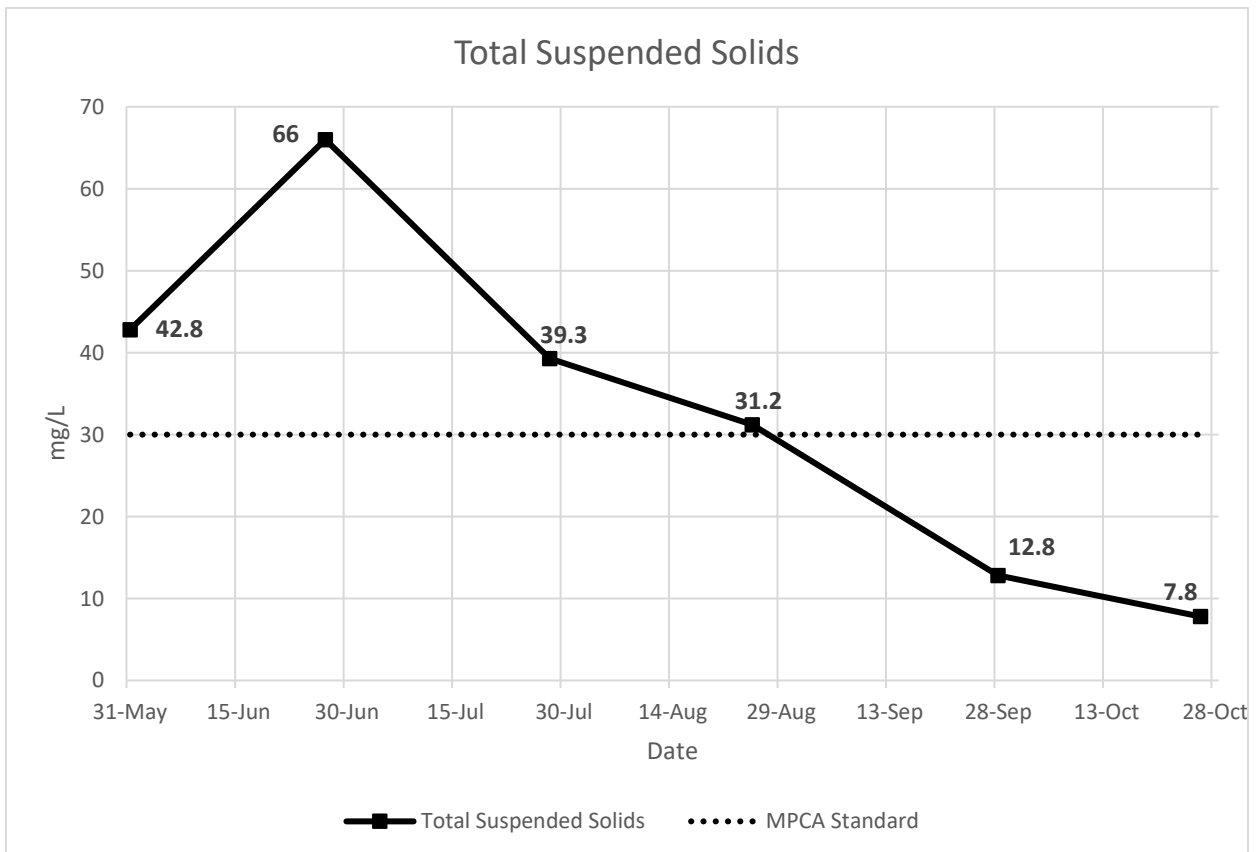


Figure 31. Total Suspended Solids samples collected at S002-708.

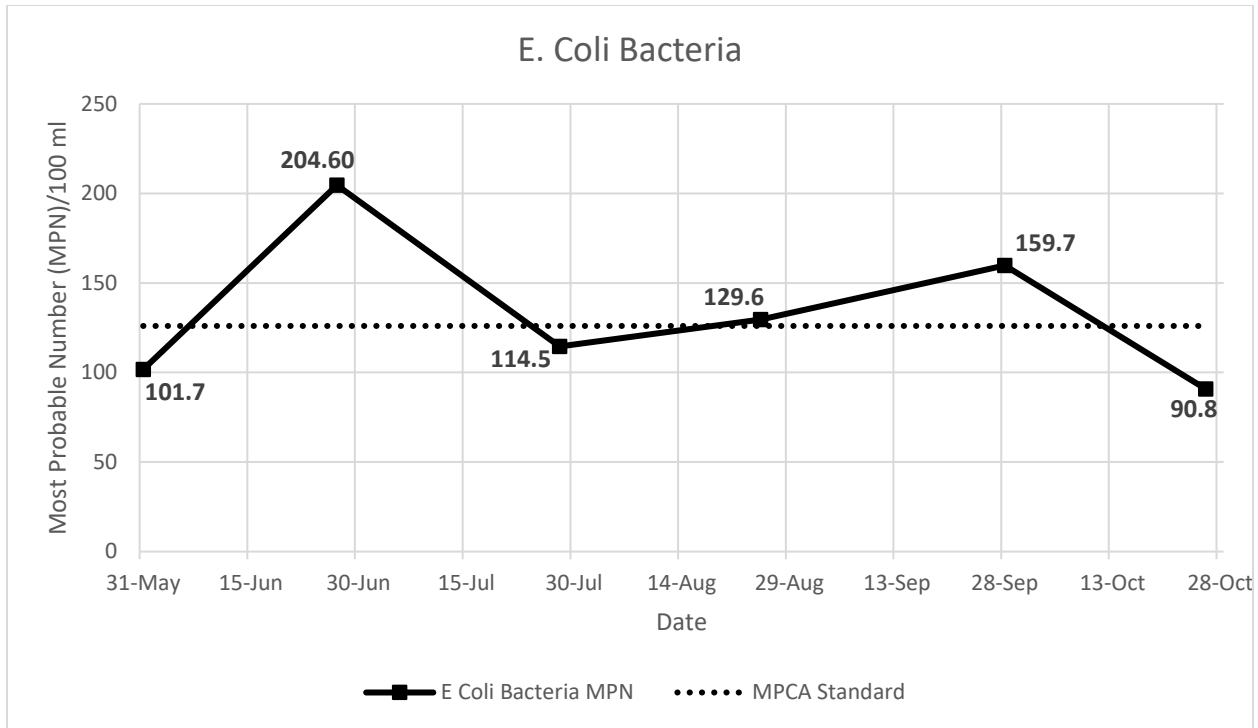


Figure 32. E. Coli Bacteria samples collected at S002-708.

- i) S002-125: Located along the south side of 140th Ave N, S002-125 is located a little over 10 river miles upstream before the Buffalo River deposits into the Red River. This station is the last monitoring station along the Buffalo River within the Northern planning region.

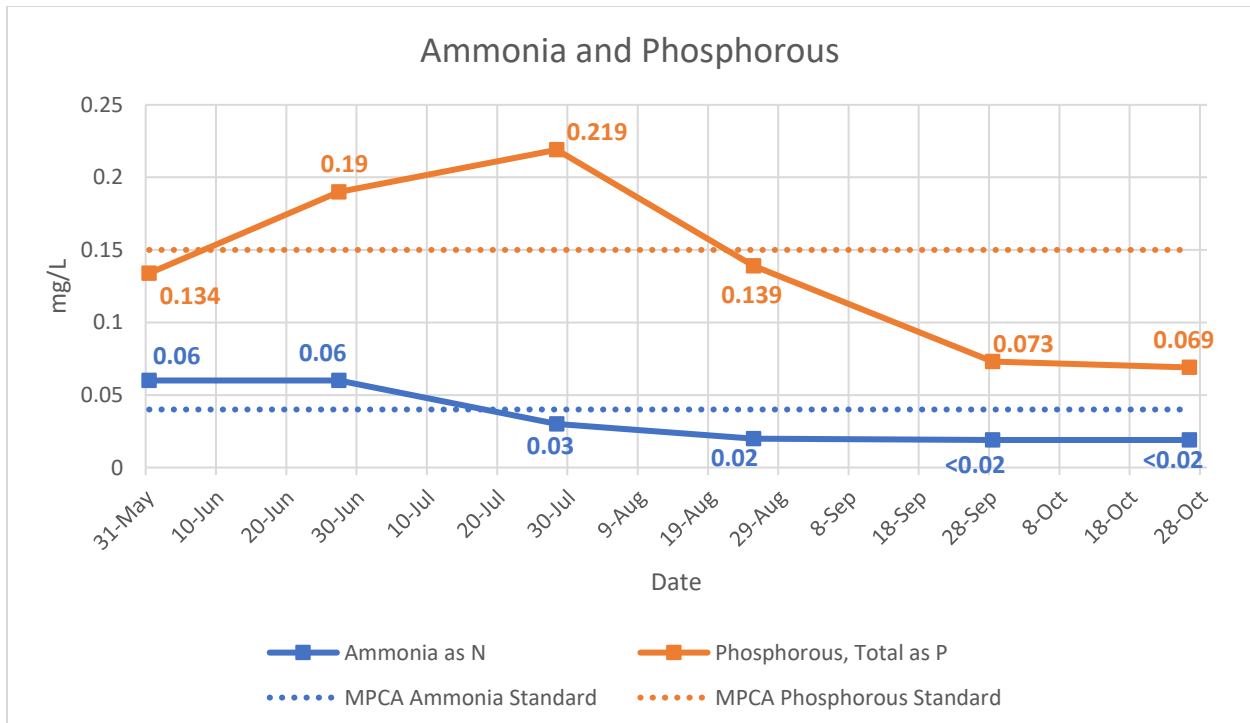


Figure 33. Ammonia and Phosphorous samples collected at S002-125.

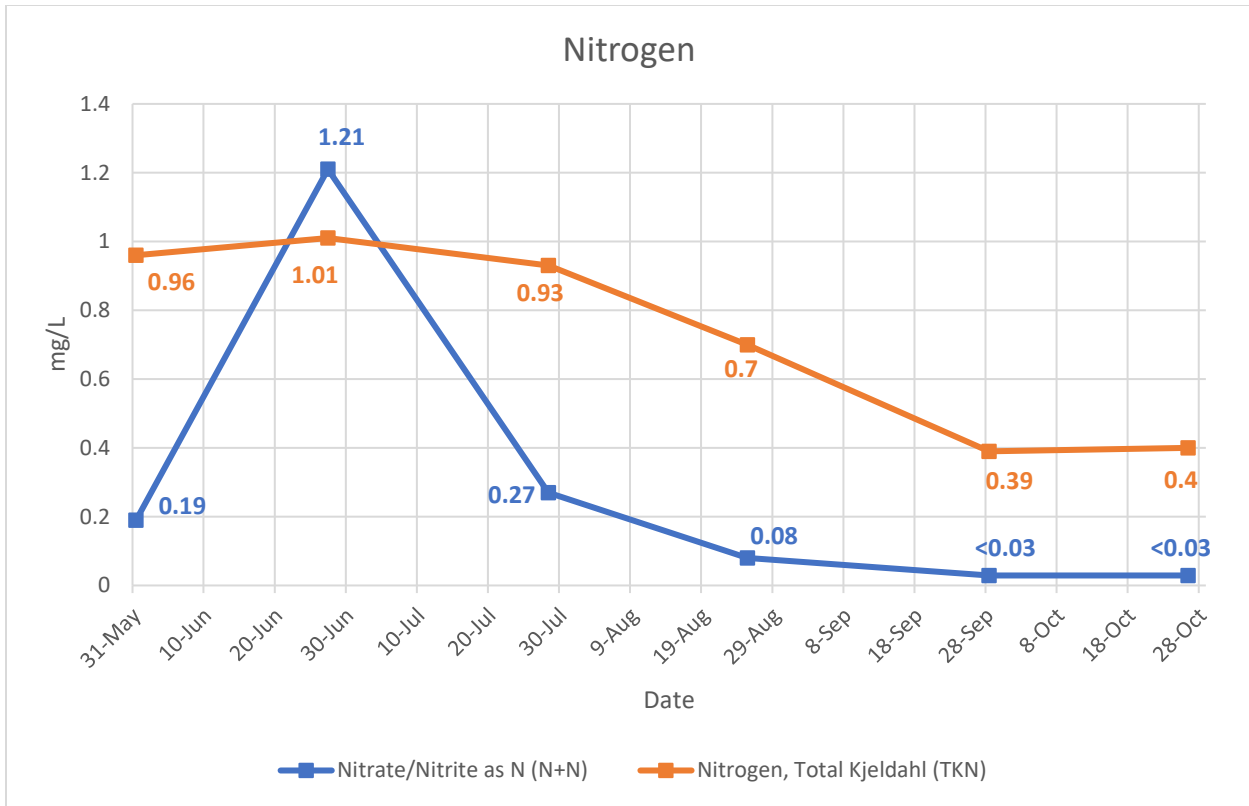


Figure 34. Nitrogen samples collected at S002-125 (MPCA and EPA standards are 10 mg/L)

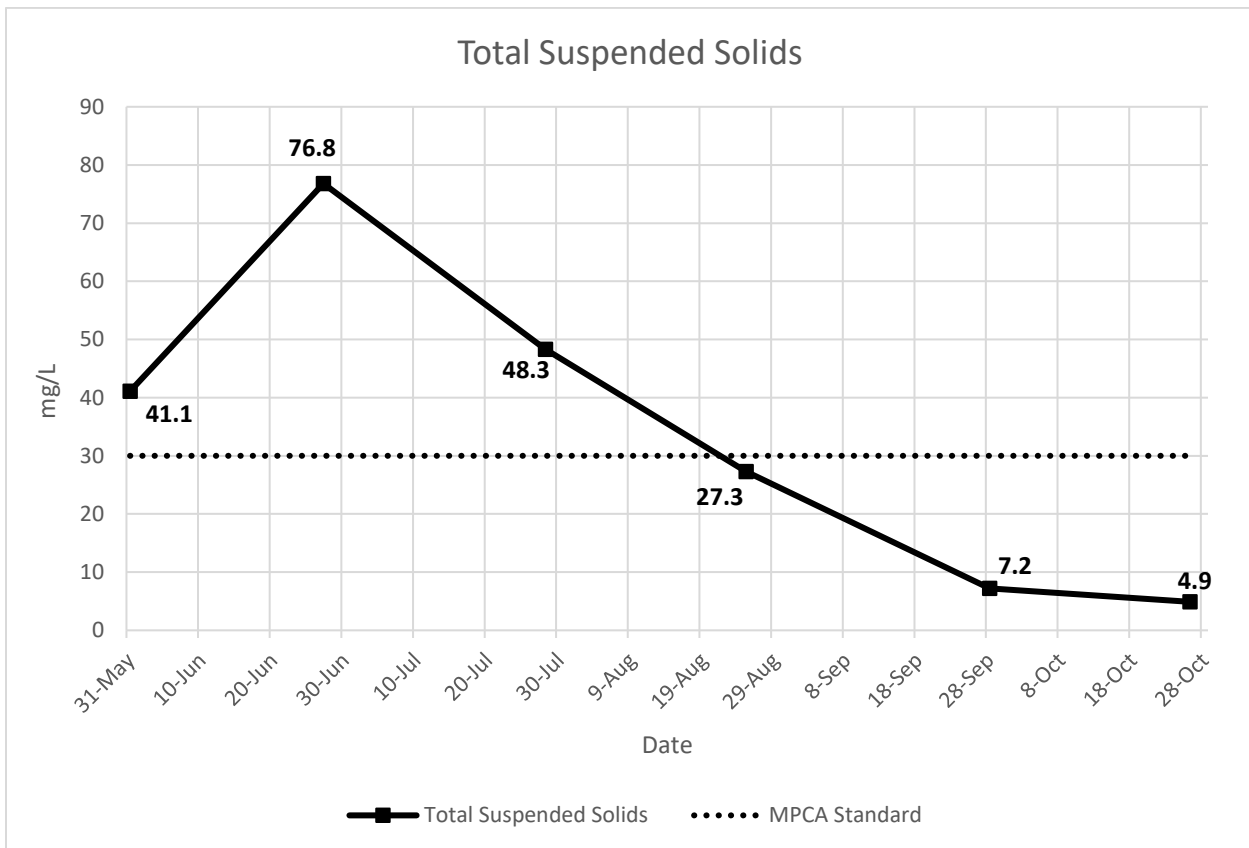


Figure 35. Total Suspended Solids samples collected at S002-125.

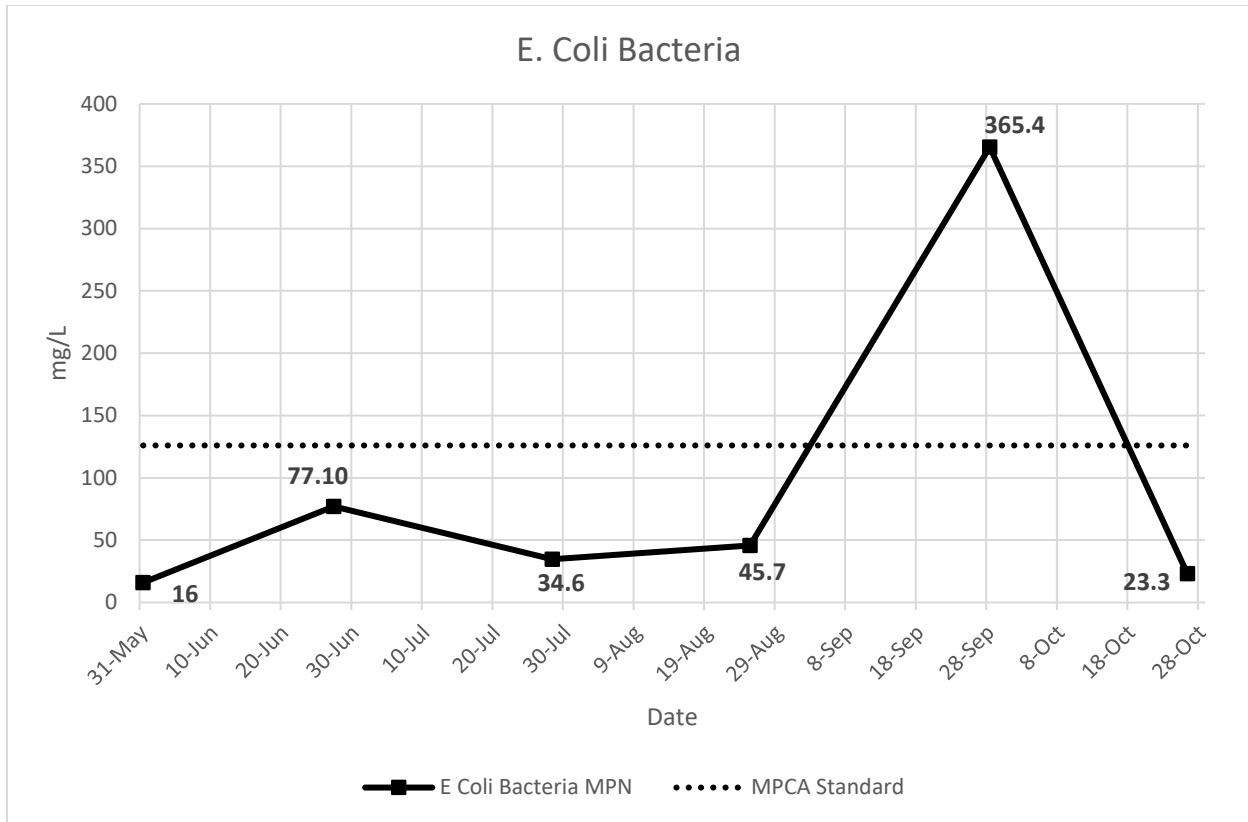


Figure 36. E. Coli Bacteria samples collected at S002-125.

2. South Branch Buffalo River

The South Branch Buffalo River starts roughly five miles northwest of Rothsay in Wilkin County, moving north/northwest for over 60 river miles before connecting with the Buffalo River two miles northwest of Glyndon within Clay County. The South Branch Buffalo River runs through eight separate townships, four in Wilkin County (Tanberg, Manston, Atherton, and Deerhorn) and four in Clay County (Alliance, Elmwood, Glyndon, and Moland). There are five sampling stations along the South Branch Buffalo River: one station in the Southern planning region and the remaining four stations are in the Central planning region.

- a) S015-046: Located in Section 18, Atherton Township within the Southern planning region, this station is the farthest upstream sampling station along the South Branch Buffalo River.

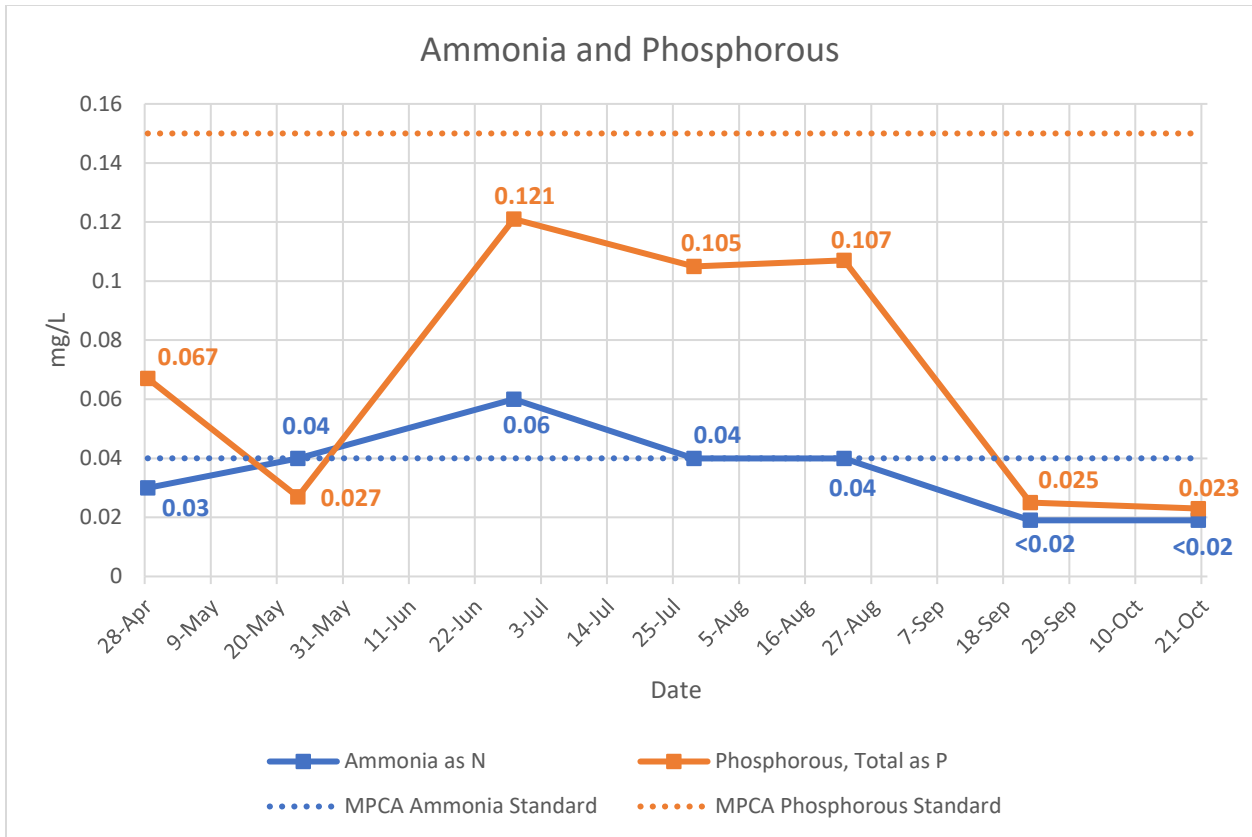


Figure 37. Ammonia and Phosphorous samples collected at S015-046.

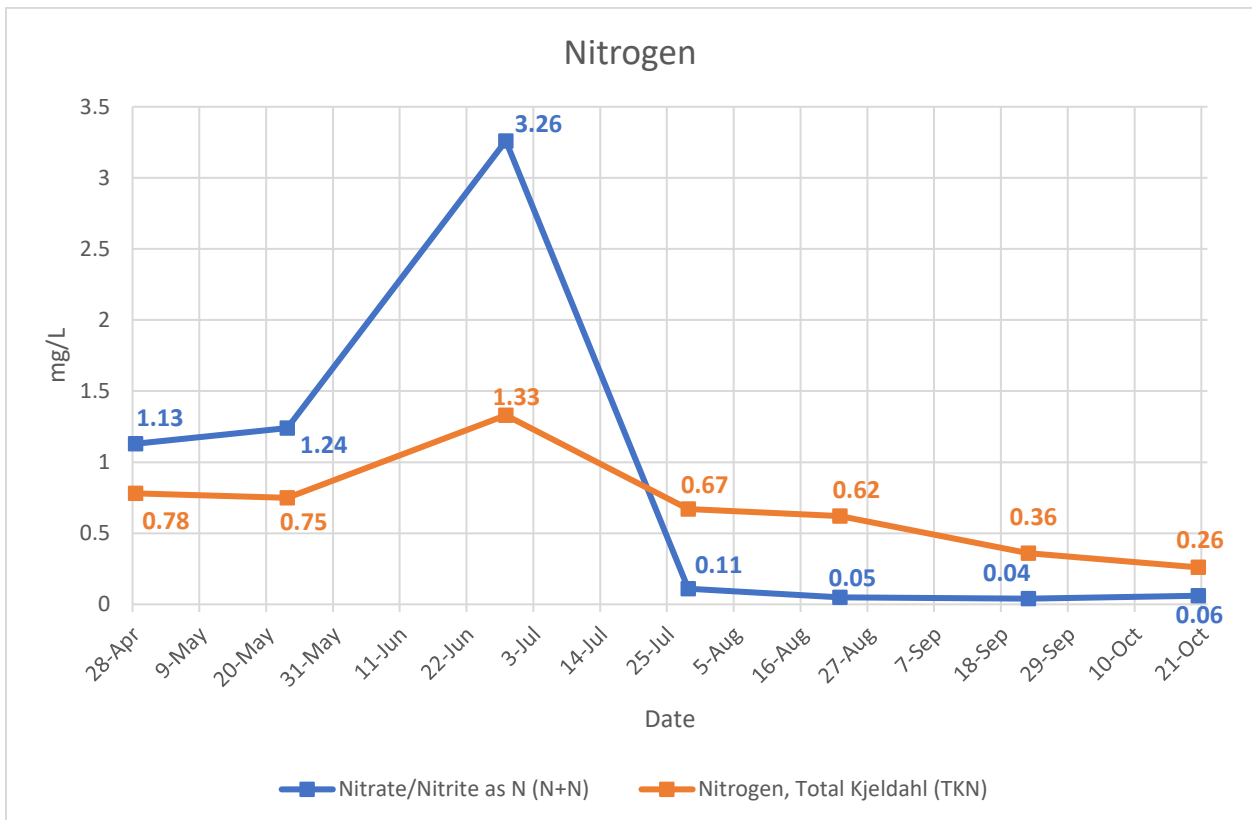


Figure 38. Nitrogen samples collected at S015-046 (MPCA and EPA standards are 10 mg/L).

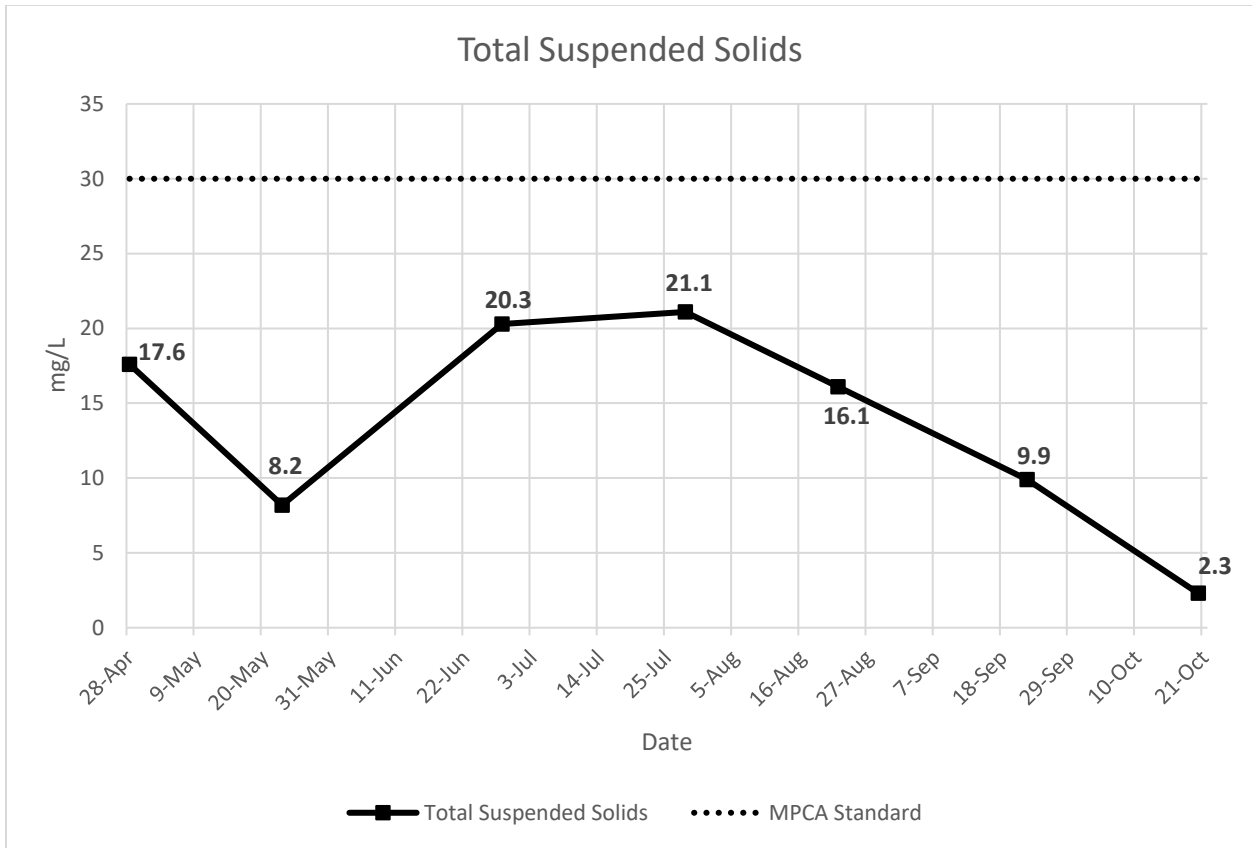


Figure 39. Total Suspended Solids samples collected at S015-046.

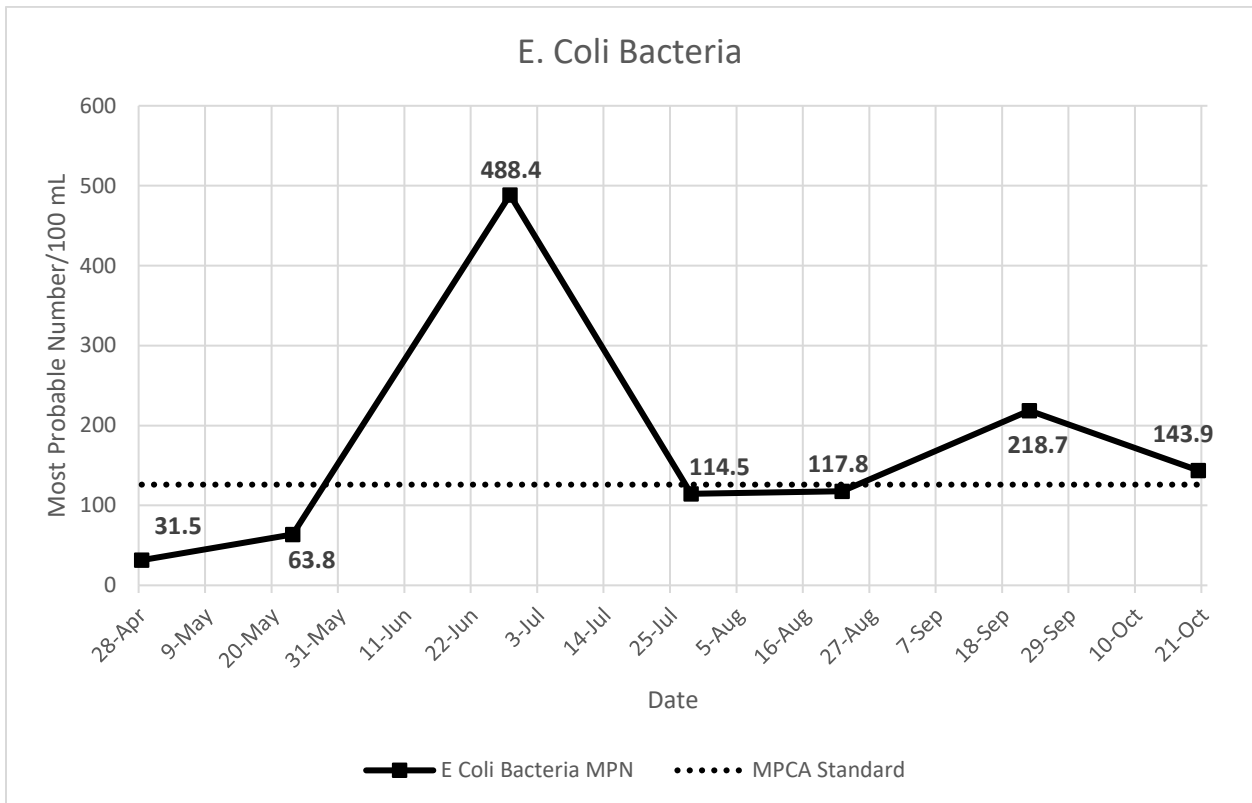


Figure 40. E. Coli Bacteria samples collected at S015-046.

b) S006-563: Located about 20 river miles downstream from station S015-046, this station is in Section 9, Alliance Township in the Central planning region.

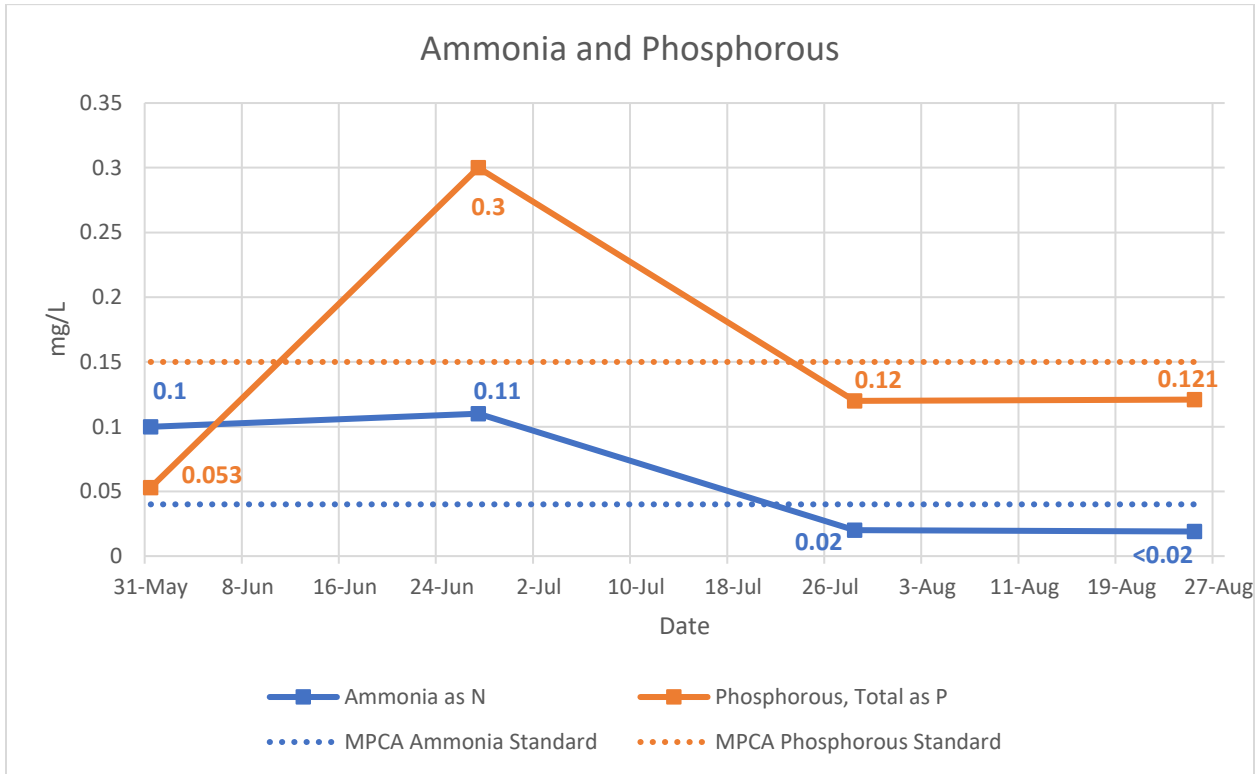


Figure 41. Ammonia and Phosphorous samples collected at S006-563.

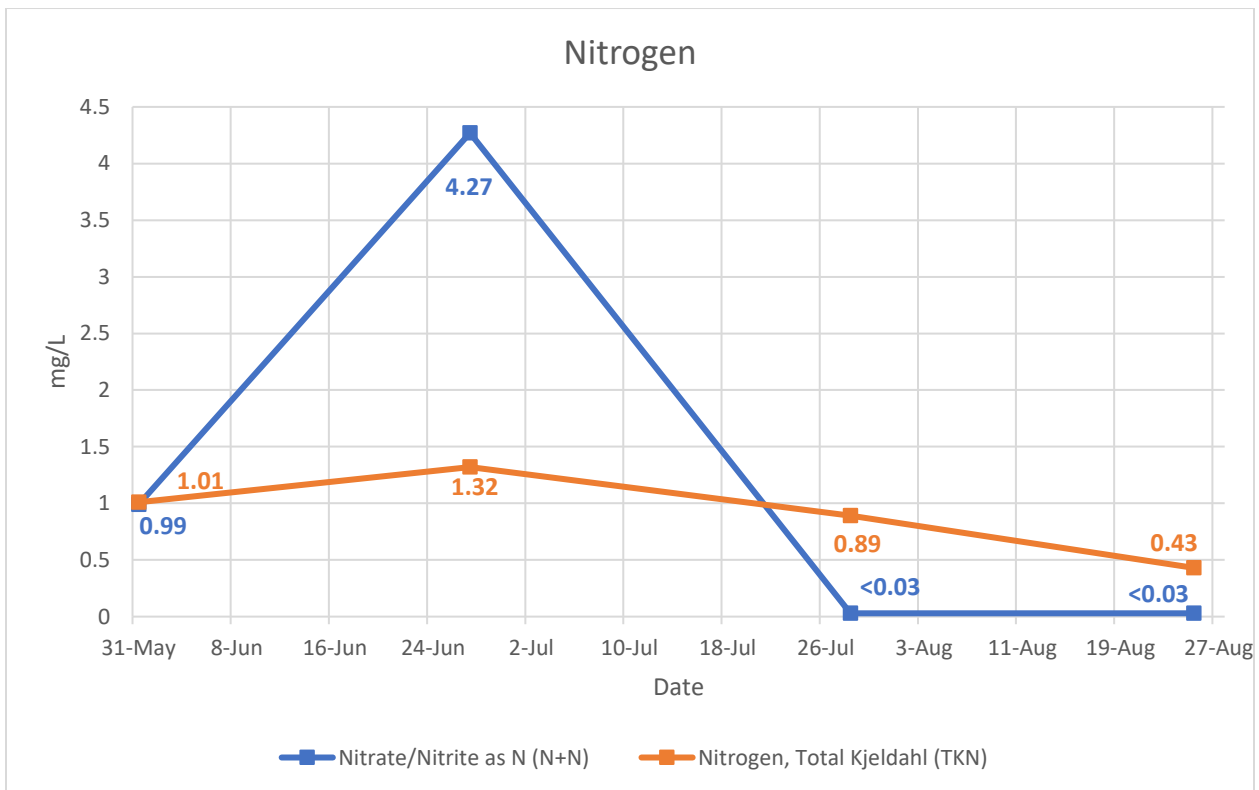


Figure 42. Nitrogen samples collected at S006-563 (MPCA and EPA standards are 10 mg/L).

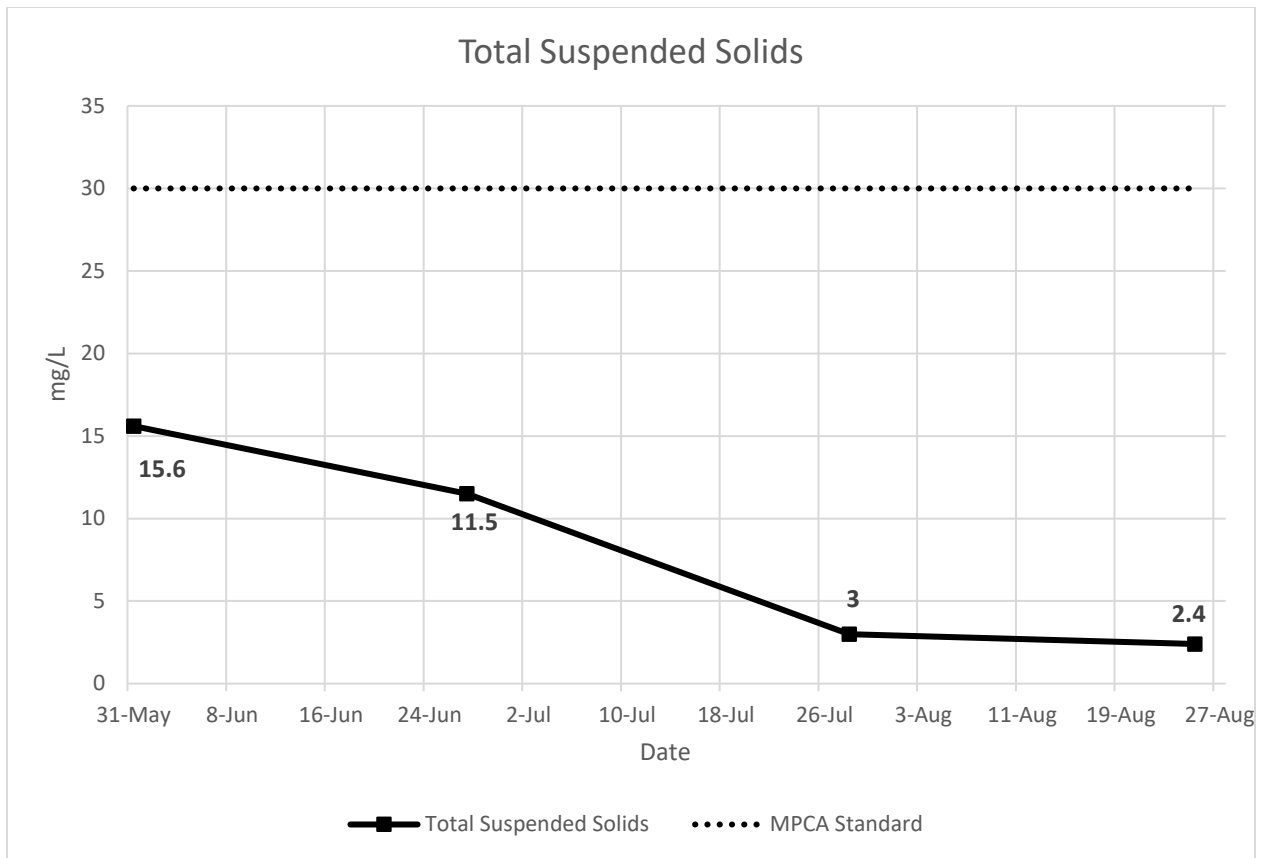


Figure 43. Total Suspended Solids samples collected at S006-563.

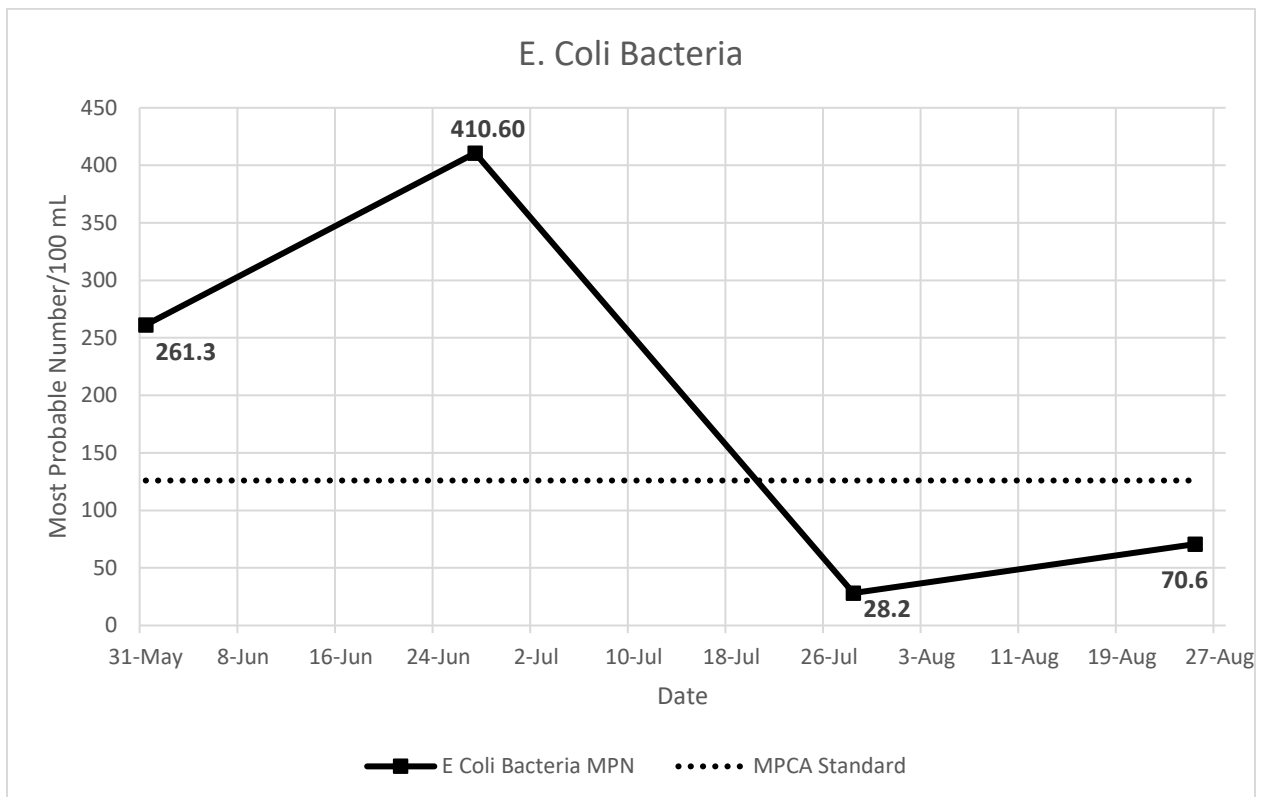


Figure 44. E. Coli Bacteria samples collected at S006-563.

c) S004-147: Located between Sections 16 and 17, Elmwood Township, S004-147 is located along 80th St S, just southeast of Sabin in the Central planning region.

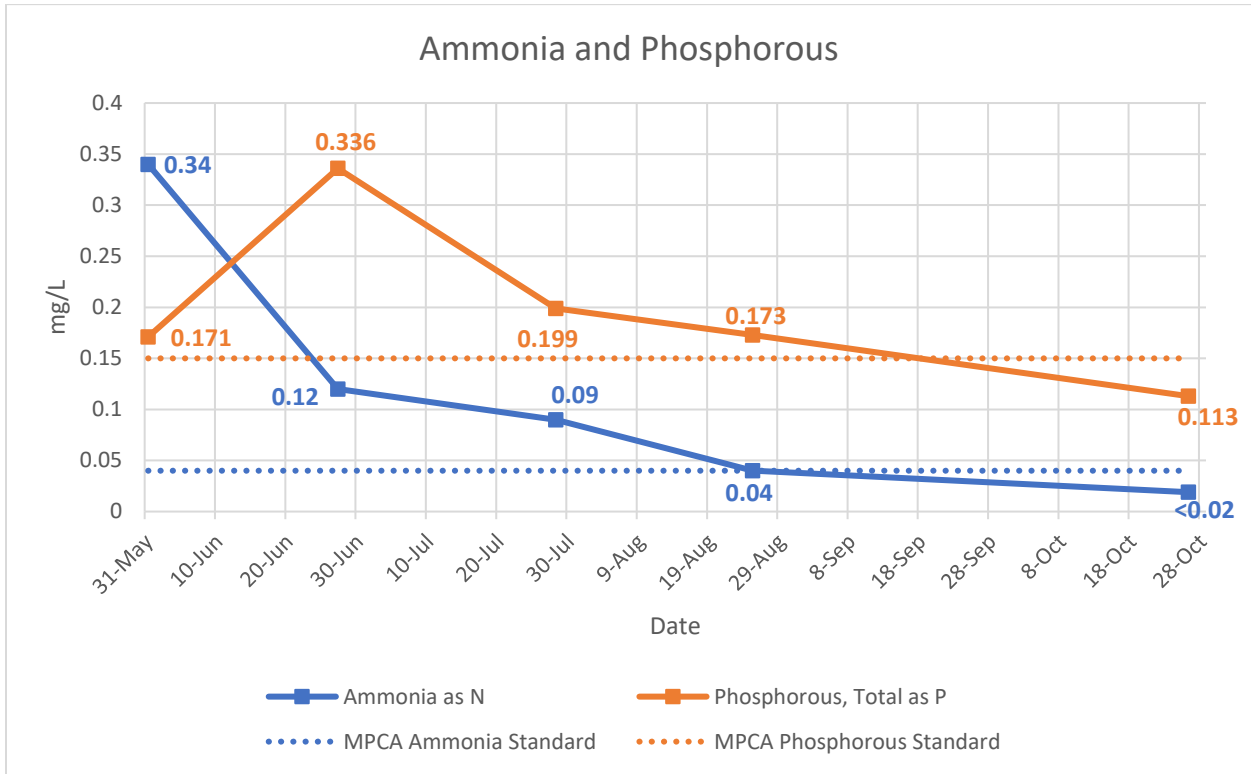


Figure 45. Ammonia and Phosphorous samples collected at S004-147.

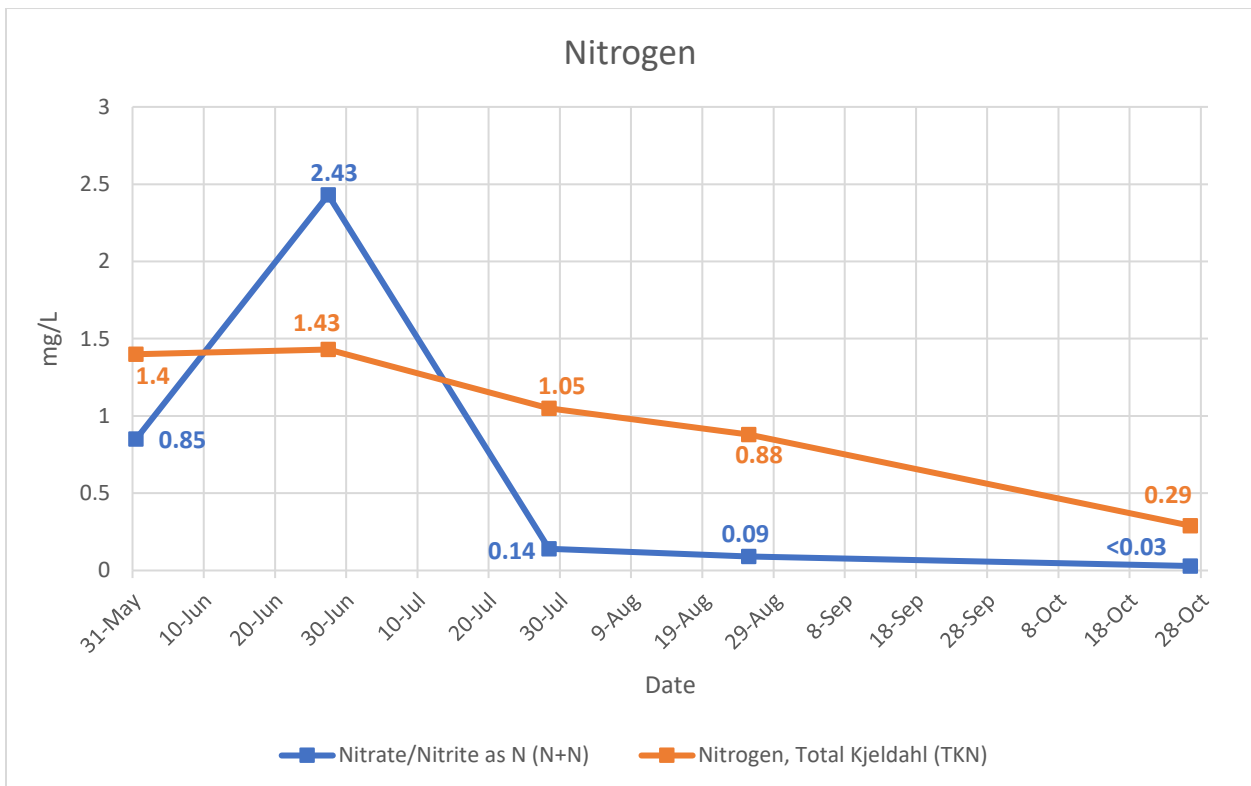


Figure 46. Nitrogen samples collected at S004-147 (MPCA and EPA standards are 10 mg/L).

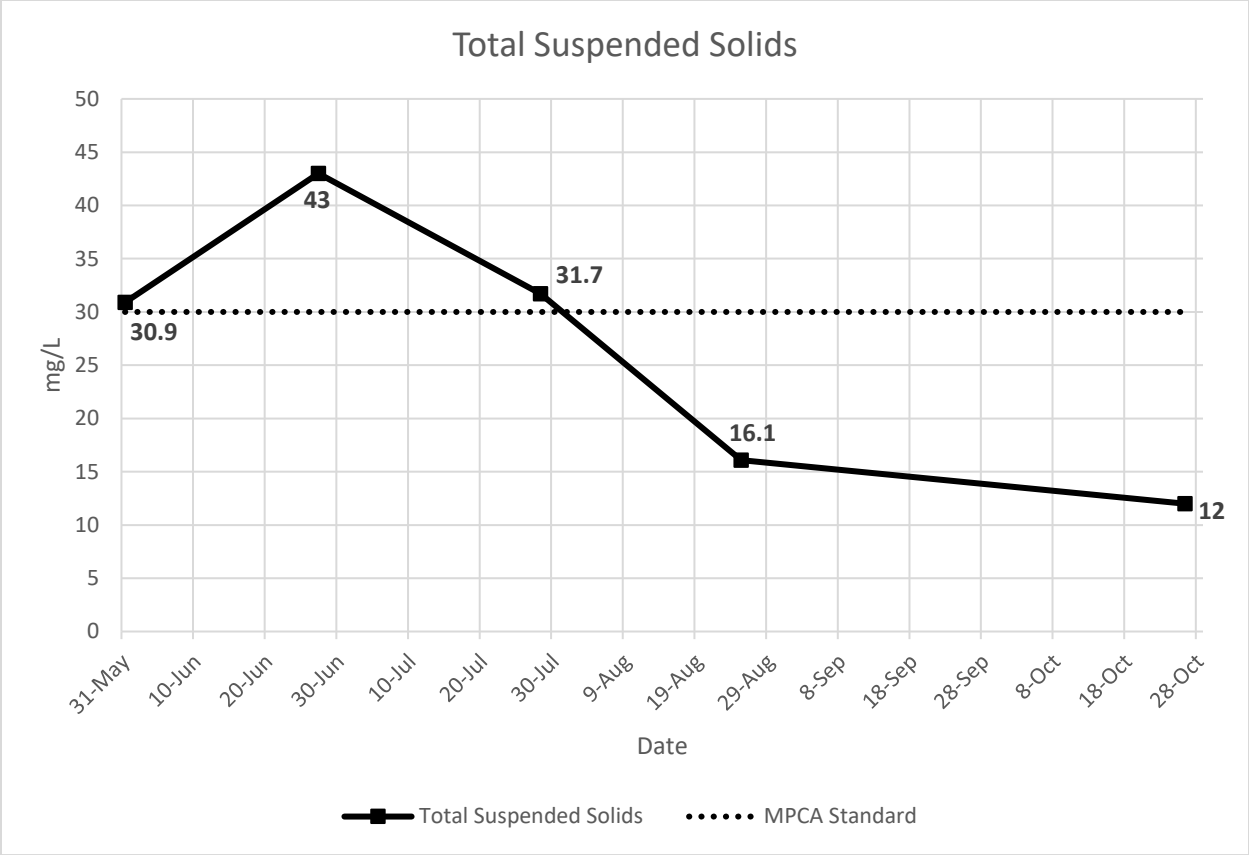


Figure 47. Total Suspended Solids samples collected at S004-147.

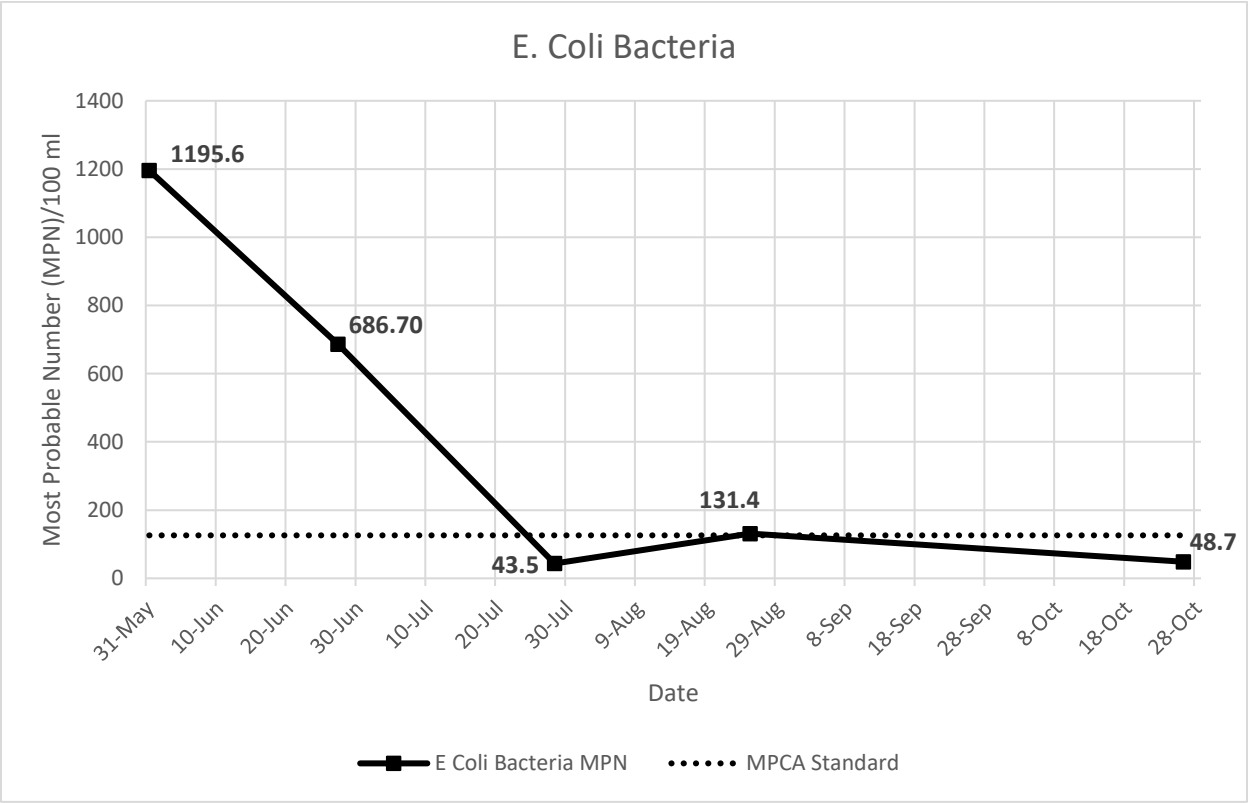


Figure 48. E. Coli Bacteria samples collected at S004-147.

d) S002-709: Located just over one river mile downstream from station S004-147, this station is east of Sabin where the South Branch runs underneath 80th Ave S in the Central planning region.

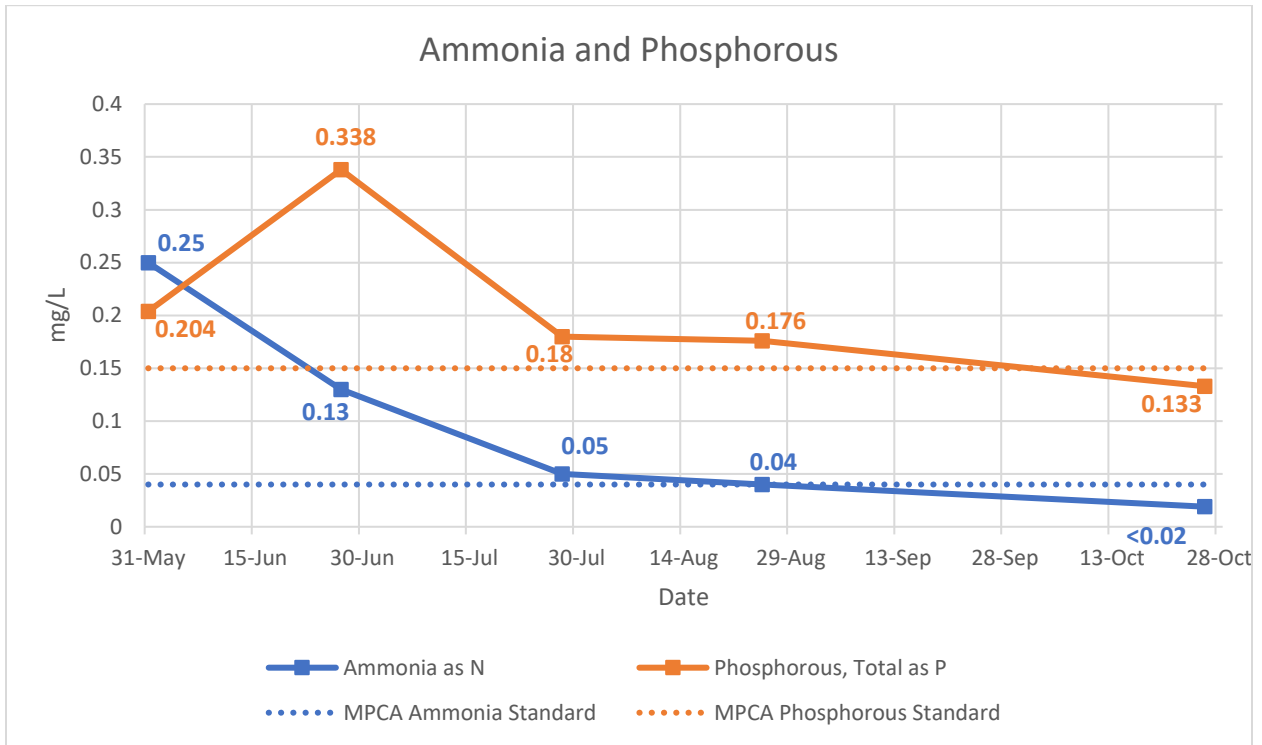


Figure 49. Ammonia and Phosphorous samples collected at S002-709.

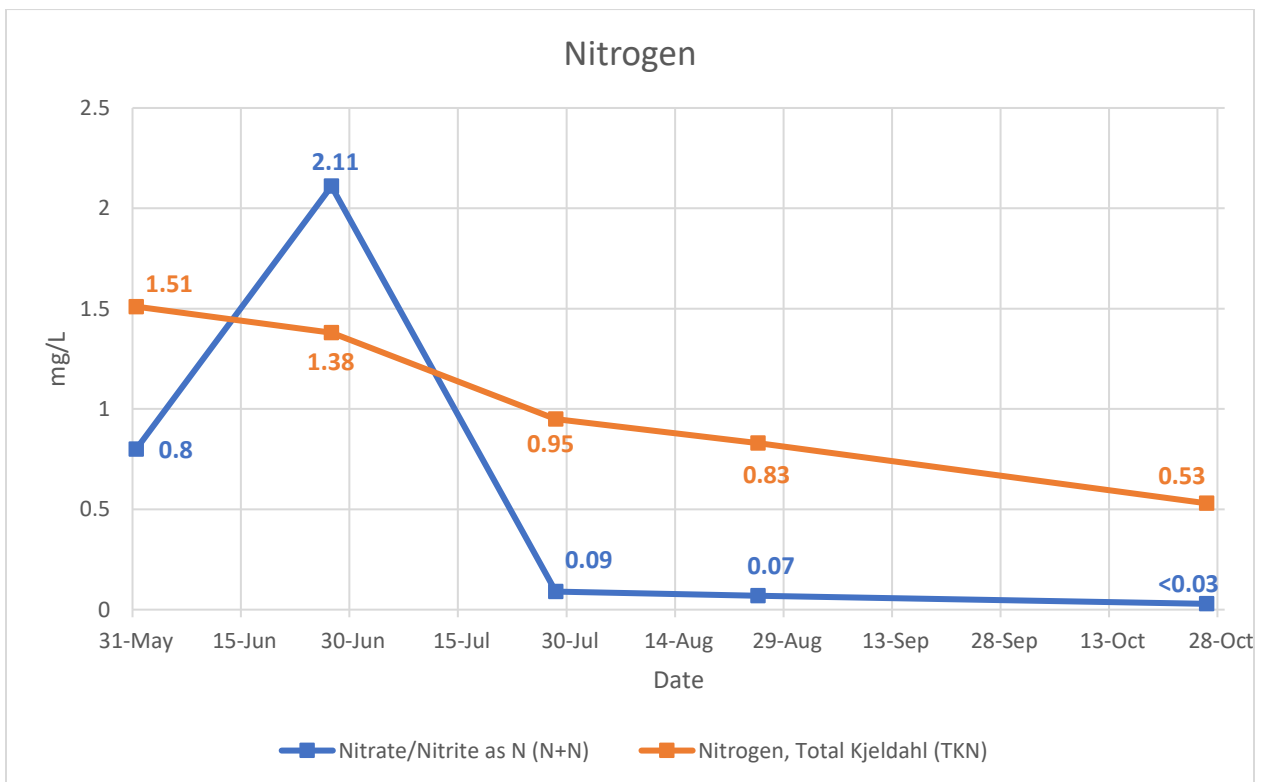


Figure 50. Nitrogen samples collected at S002-709 (MPCA and EPA standards are 10 mg/L).

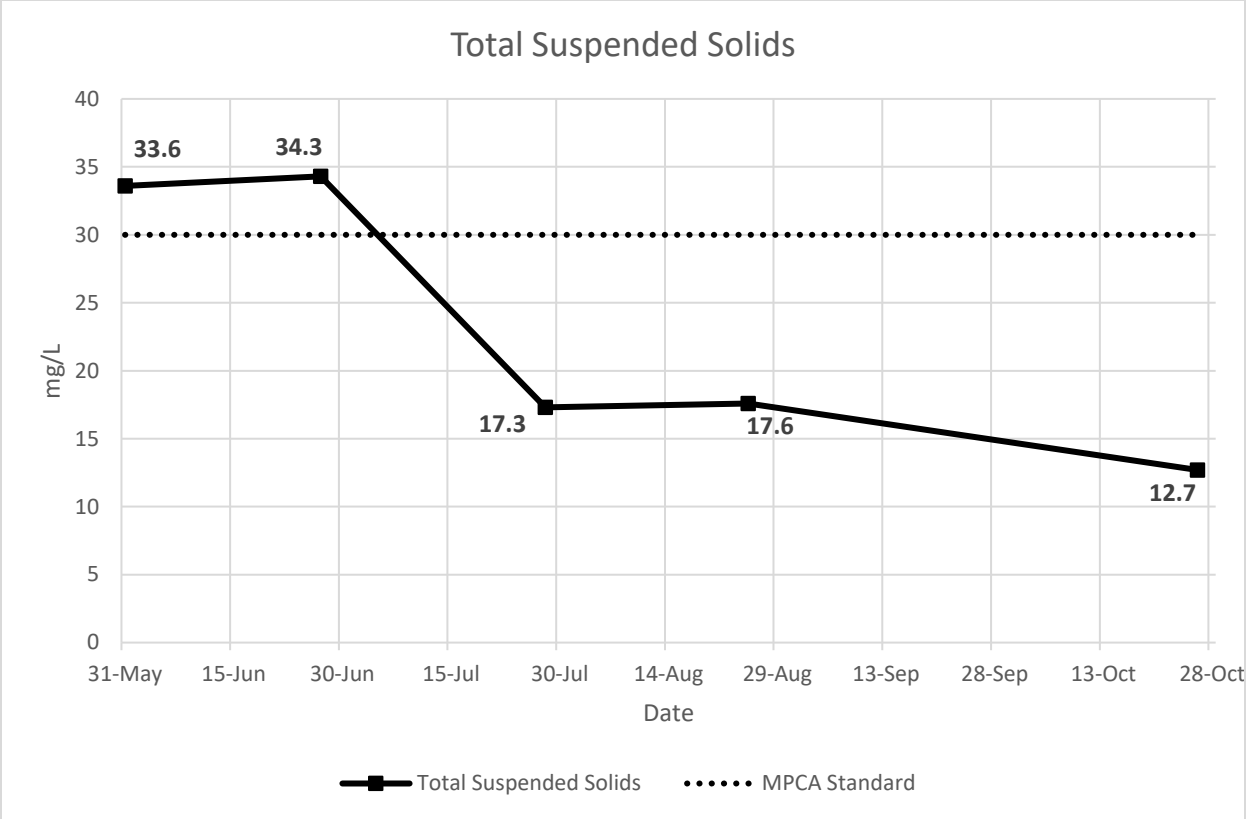


Figure 51. Total Suspended Solids samples collected at S002-709.

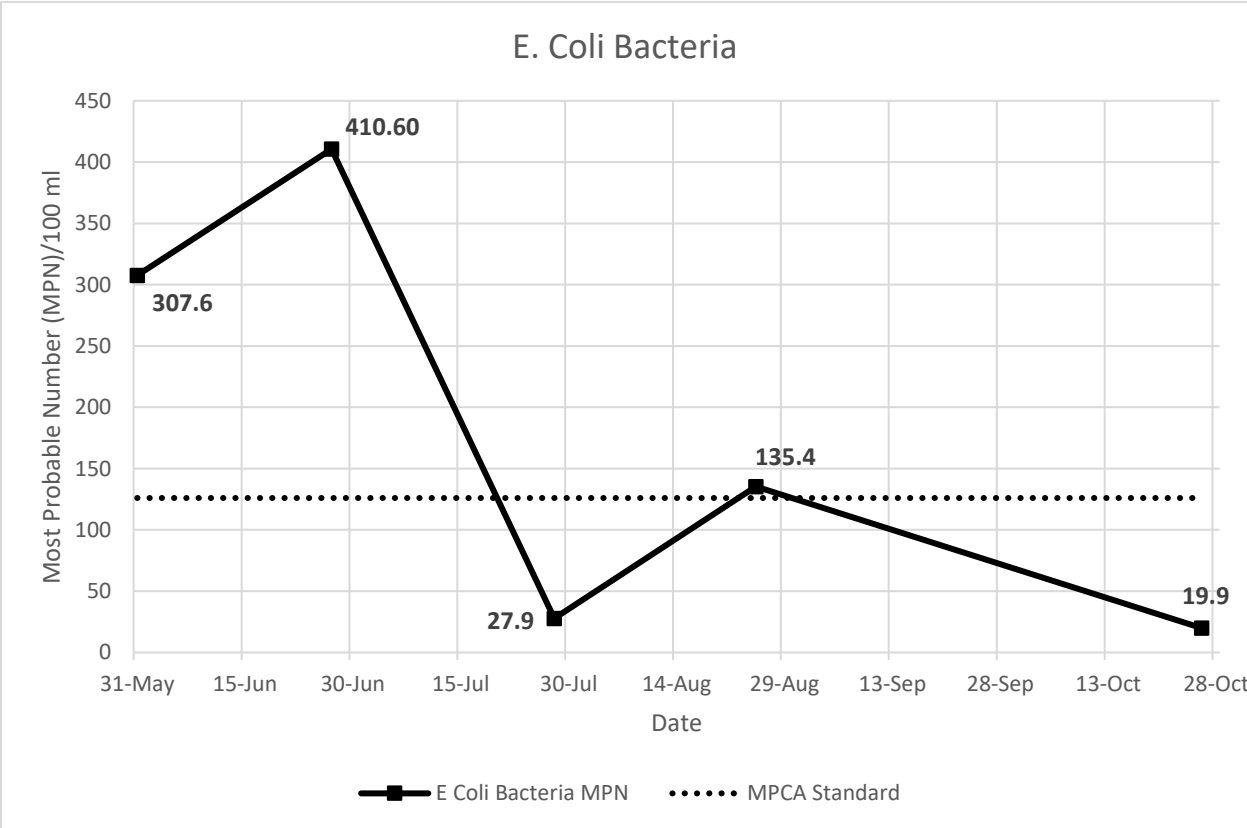


Figure 52. E. Coli Bacteria samples collected at S002-709.

- e) S004-148: Located approximately seven miles before the South Branch Buffalo River outlets into the Buffalo River in Glyndon Township between Sections 16 and 21 within the Central planning region.

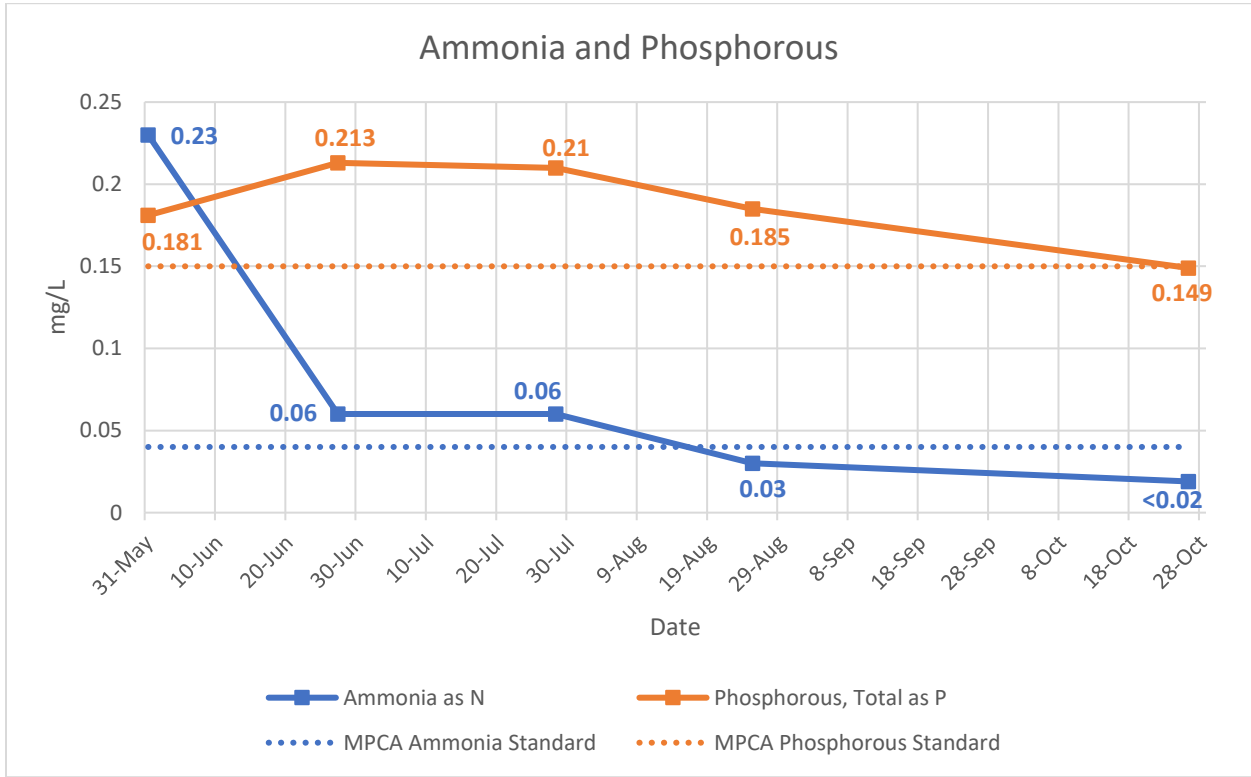


Figure 53. Ammonia and Phosphorous samples collected at S004-148.

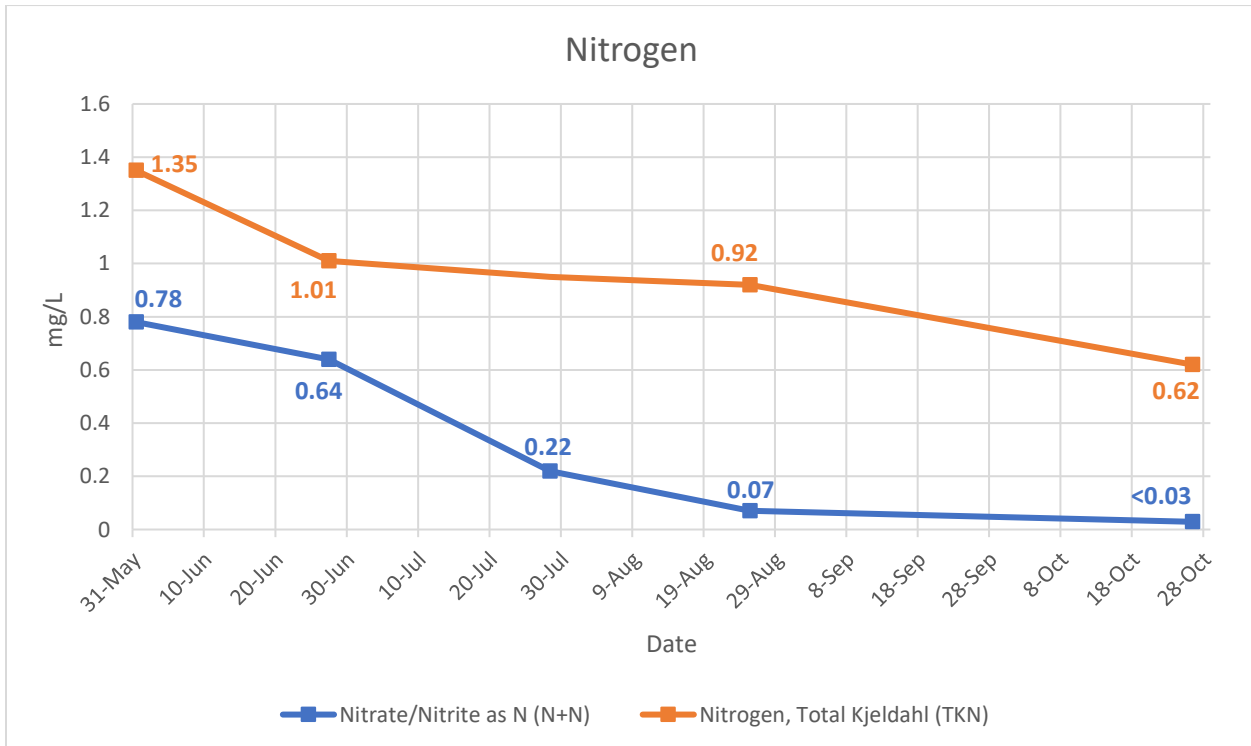


Figure 54. Nitrogen samples collected S004-148.

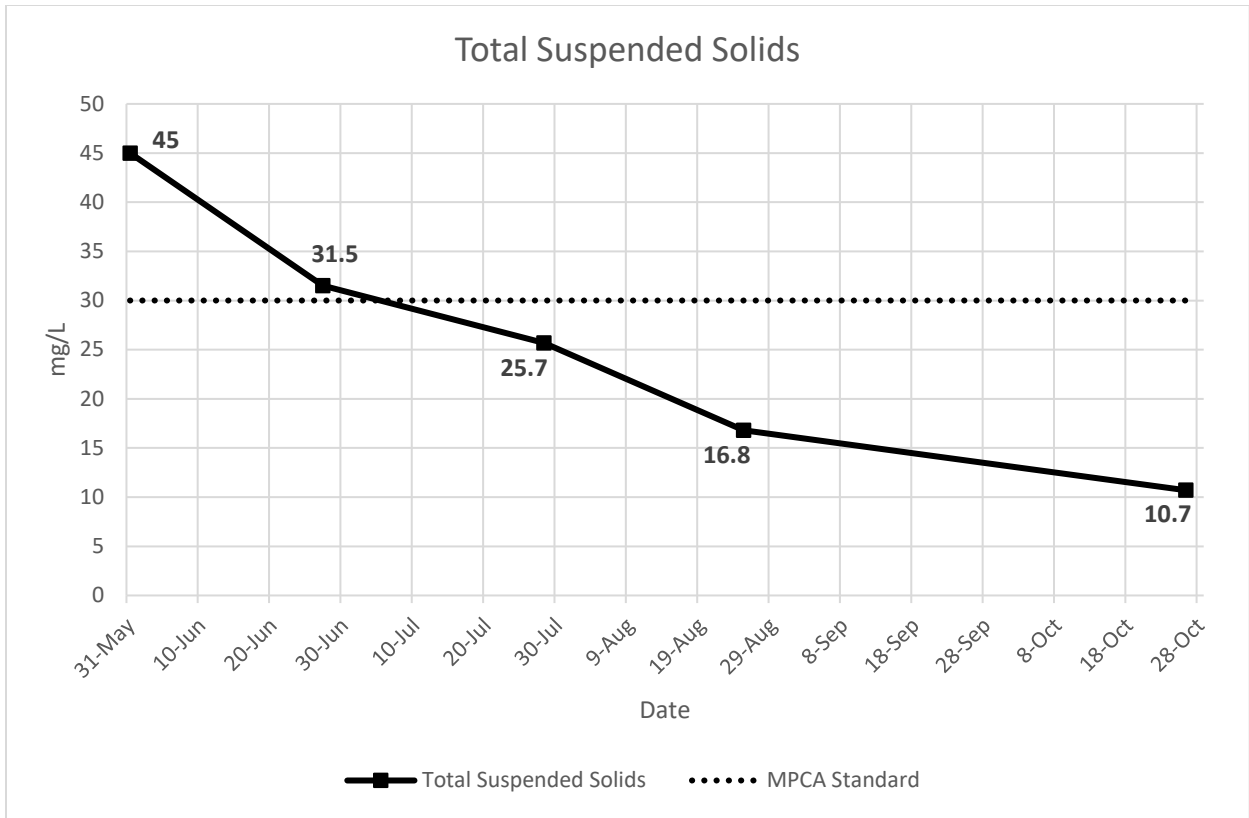


Figure 55. Total Suspended Solids samples collected at S004-148.

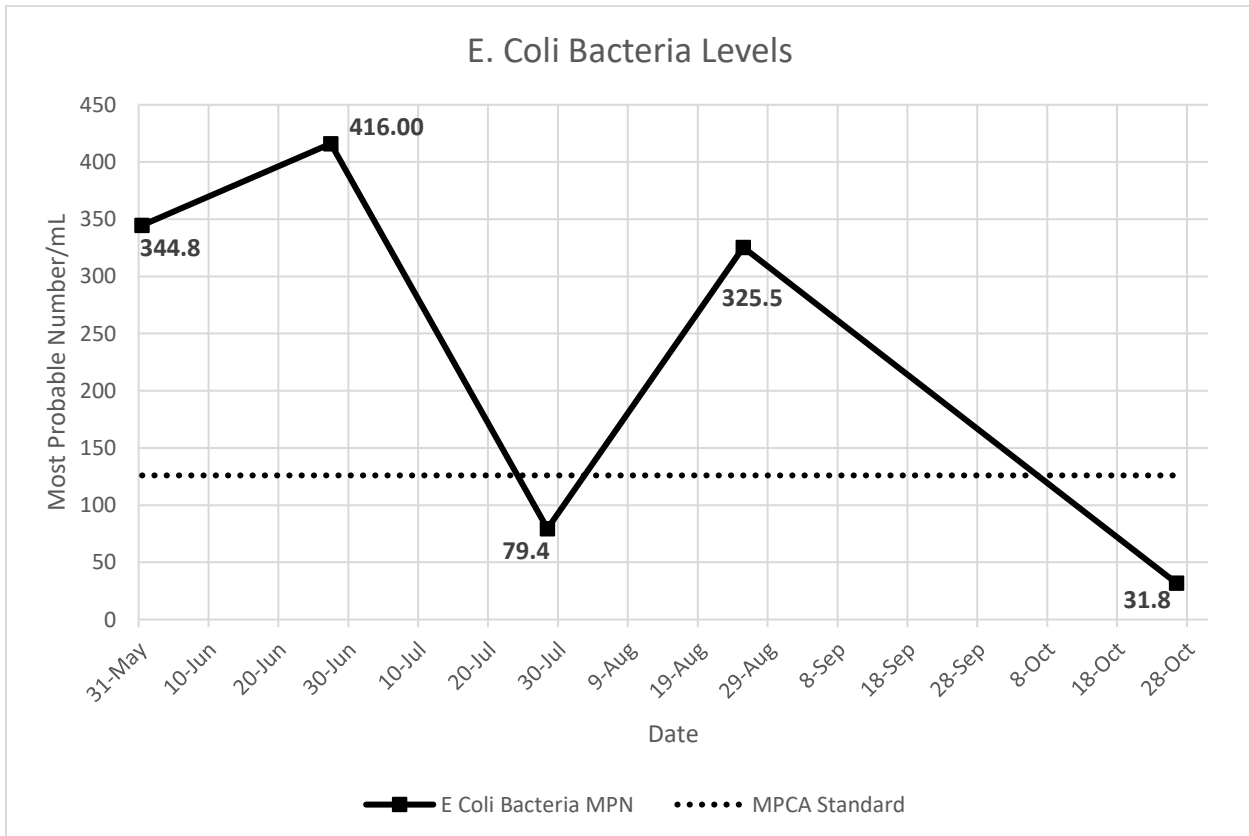


Figure 56. E. Coli Bacteria samples collected at S004-148.

3. Otter Tail River

The lower portion of the Otter Tail River consists of roughly 35 river miles within BRRWD boundaries starting on the downstream end of Orwell Dam. The Otter Tail River runs west through Orwell, Foxhome, Sunnyside, and Breckenridge Townships until it connects with the Bois de Sioux River at the confluence of the Red River. There are three sampling stations along the Otter Tail River, all are located within the Otter Tail planning region.

- a) S002-003: This station is the farthest upstream sampling station on the Otter Tail River. This station is located downstream of Orwell Dam where the Otter Tail River crosses under County Road 15.

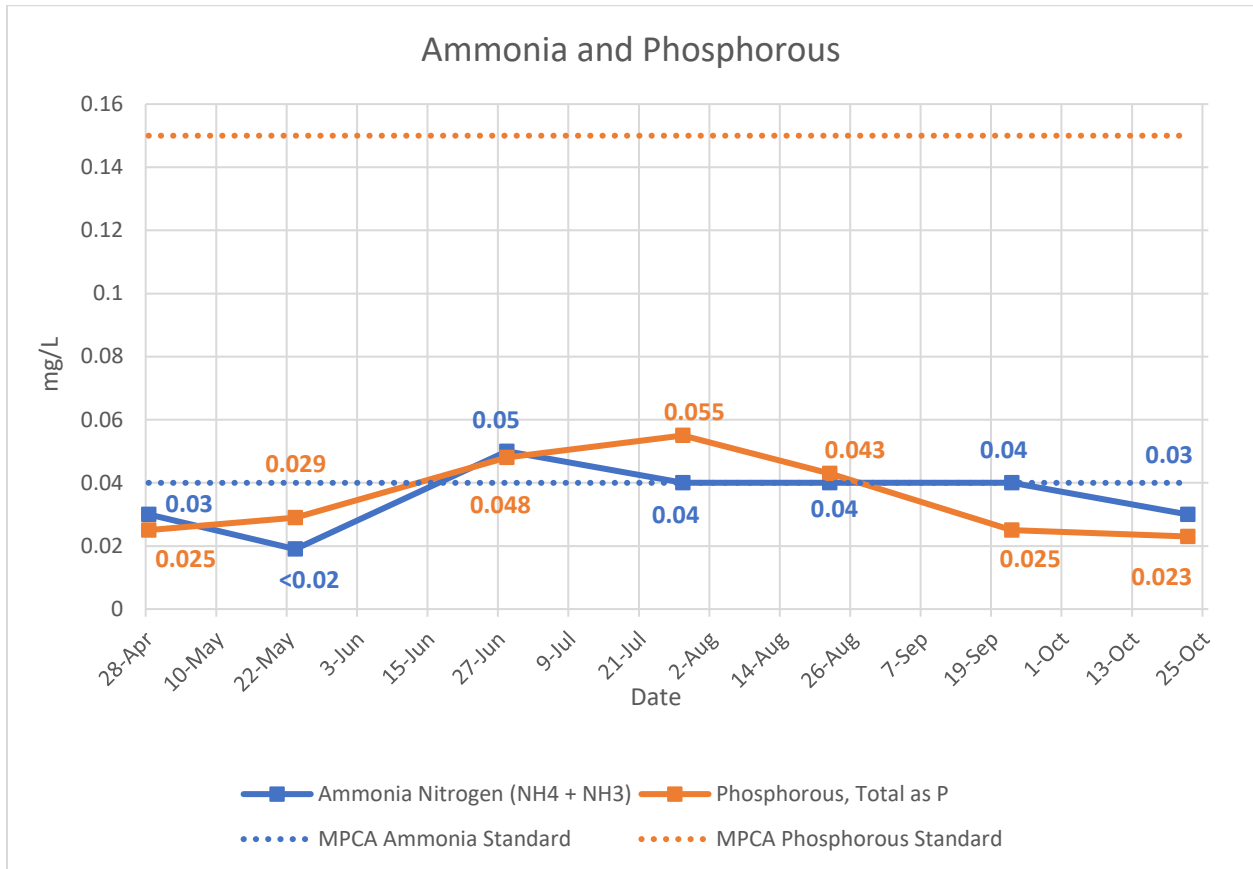


Figure 57. Ammonia and Phosphorous samples collected at S002-003.

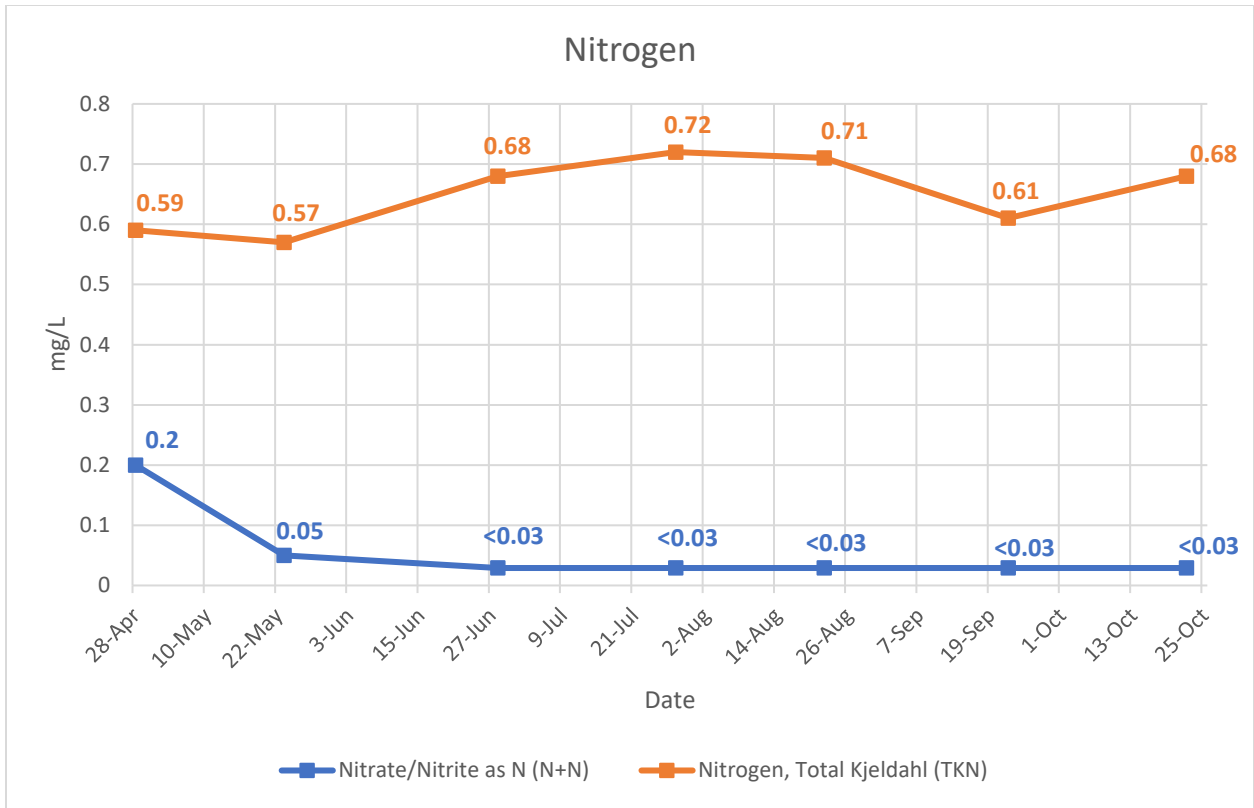


Figure 58. Nitrogen samples collected at S002-003 (MPCA and EPA standards are 10 mg/L).

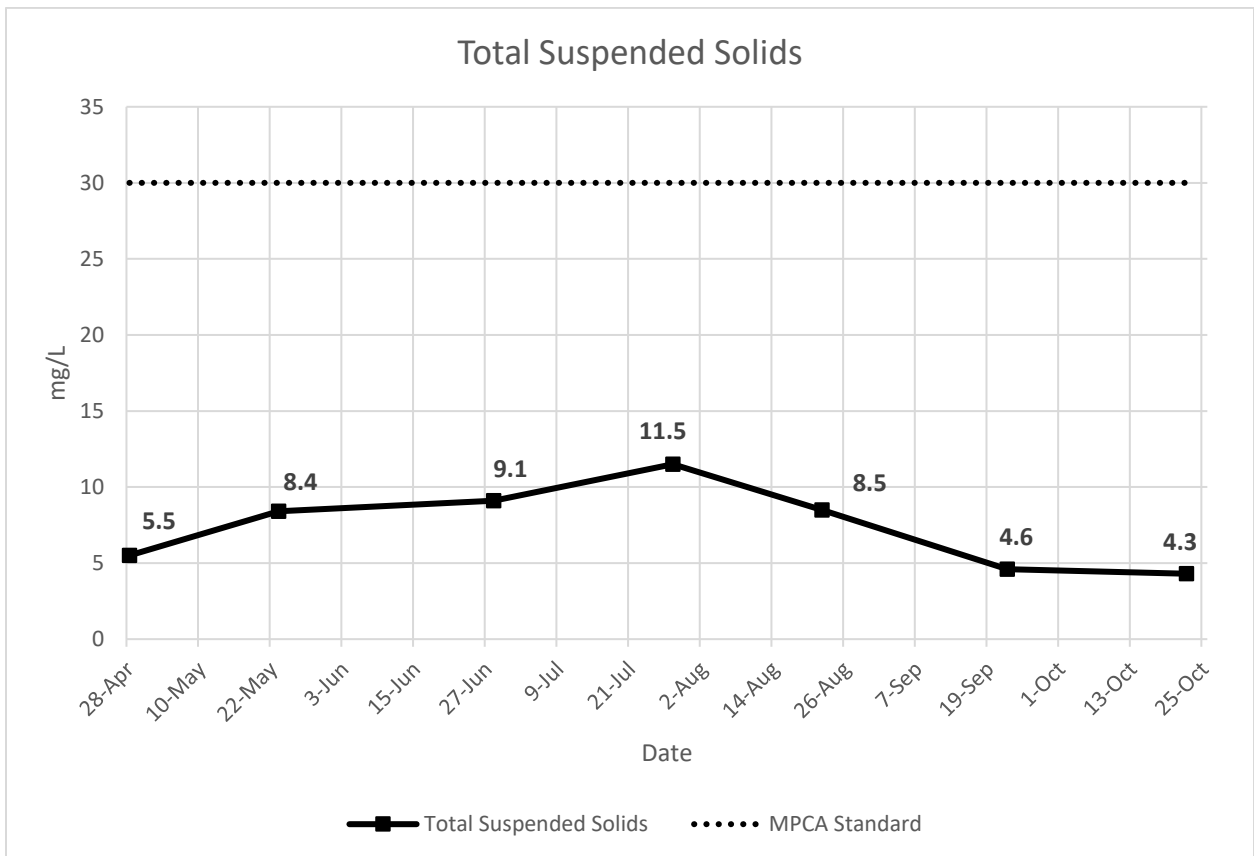


Figure 59. Total Suspended Solids samples collected at S002-003.

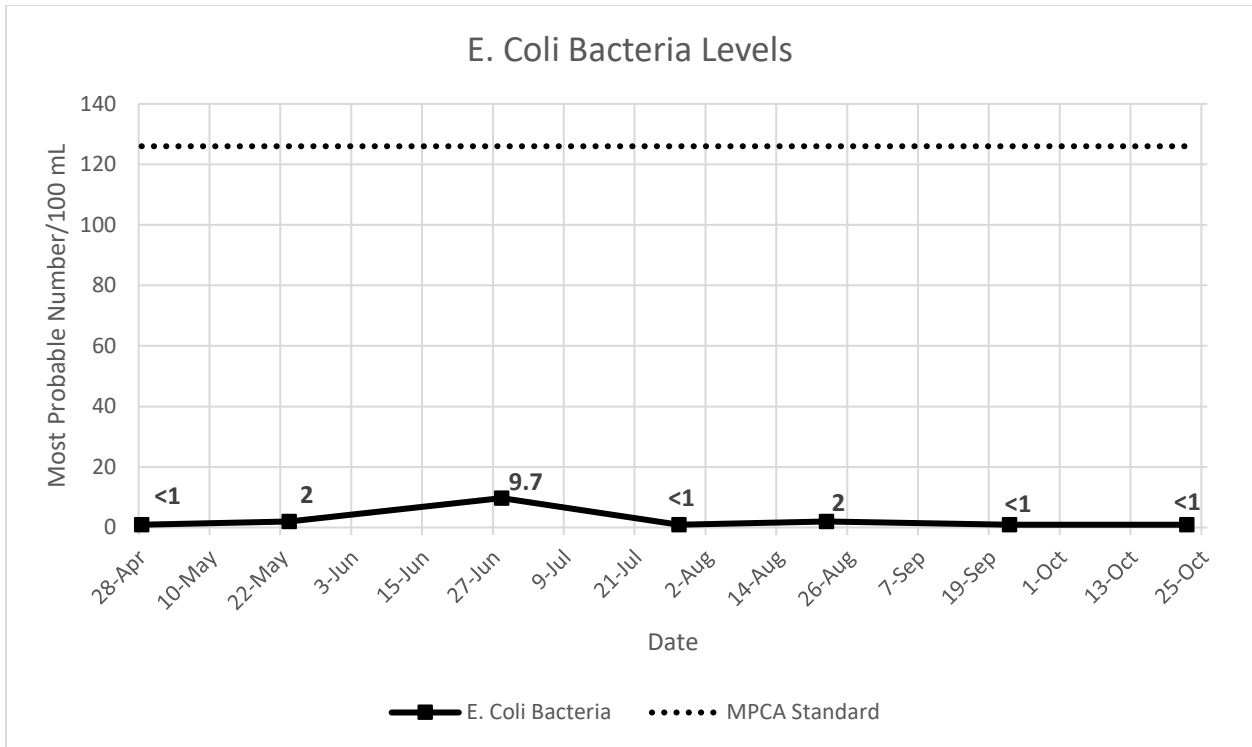


Figure 60. E. Coli Bacteria samples collected at S002-003.

b) S003-166: About 10 miles downstream of the Orwell Dam, this station is located between Sections 26 and 27, Foxhome Township.

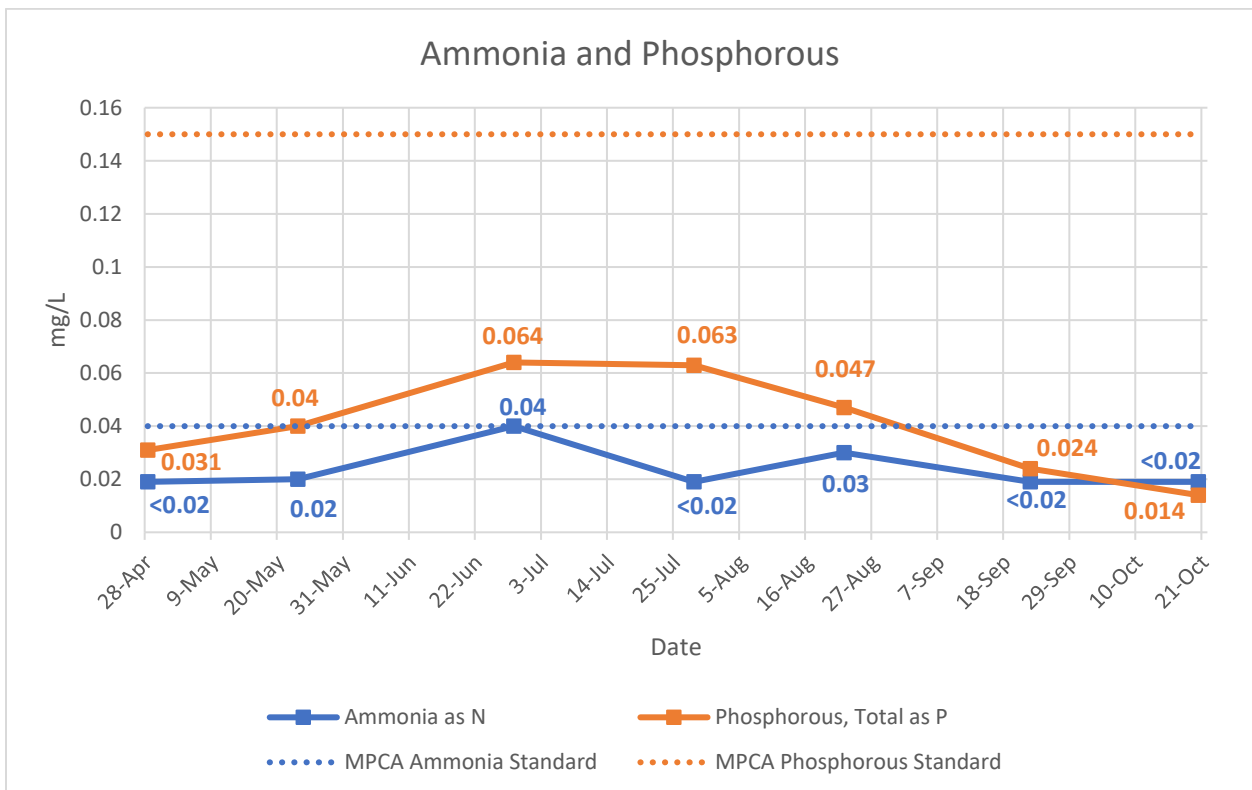


Figure 61. Ammonia and Phosphorous samples collected at S003-166.

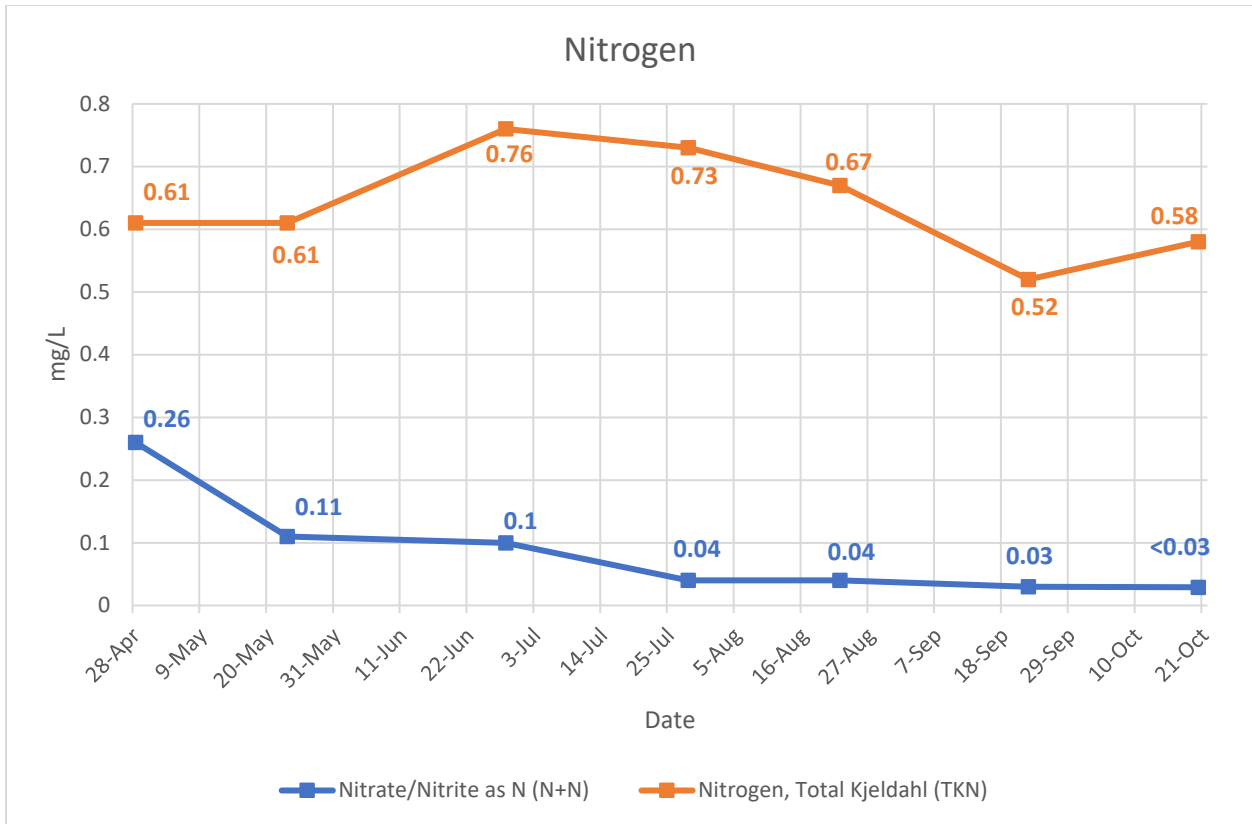


Figure 62. Nitrogen samples collected at S003-166 (MPCA and EPA standards are 10 mg/L).

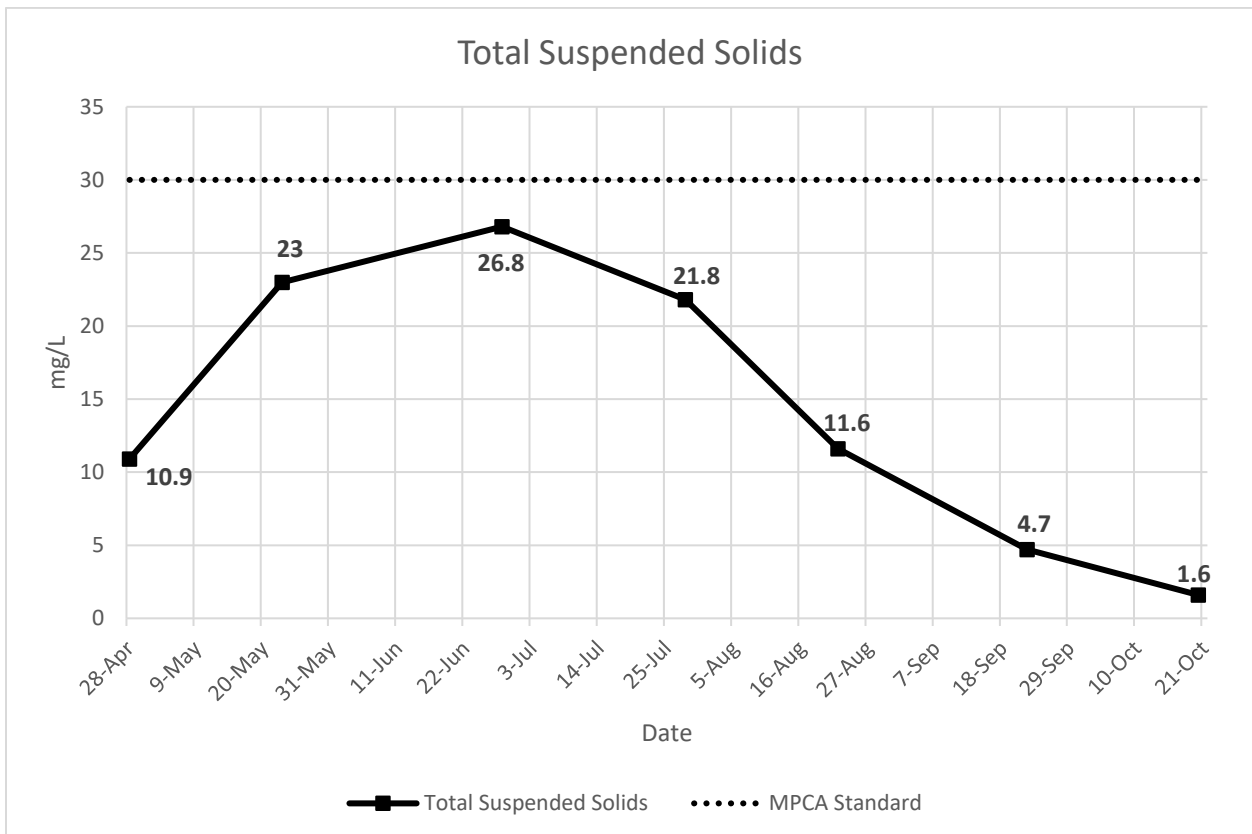


Figure 63. Total Suspended Solids samples collected at S003-166.

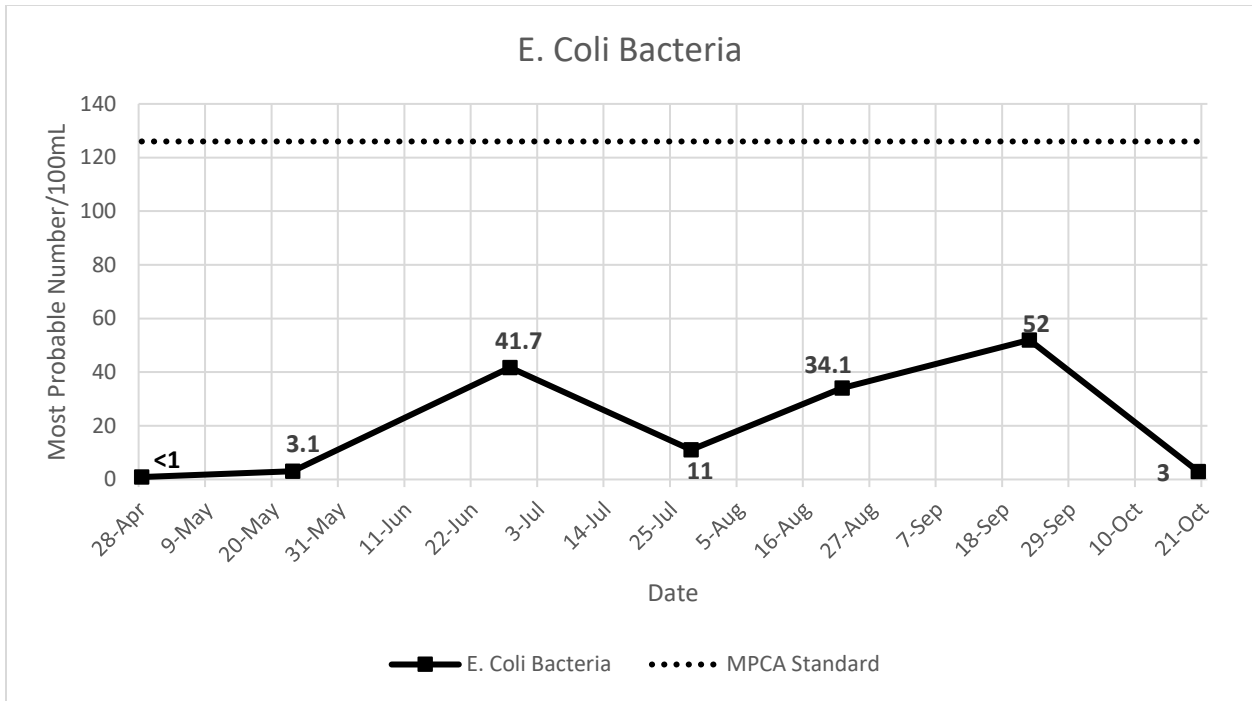


Figure 64. E. Coli Bacteria samples collected at S003-166.

- c) S002-000: The most downstream monitoring station along the Otter Tail is S002-000. Located along County Road 16, this station is roughly three miles upstream of the confluence of the Red River.

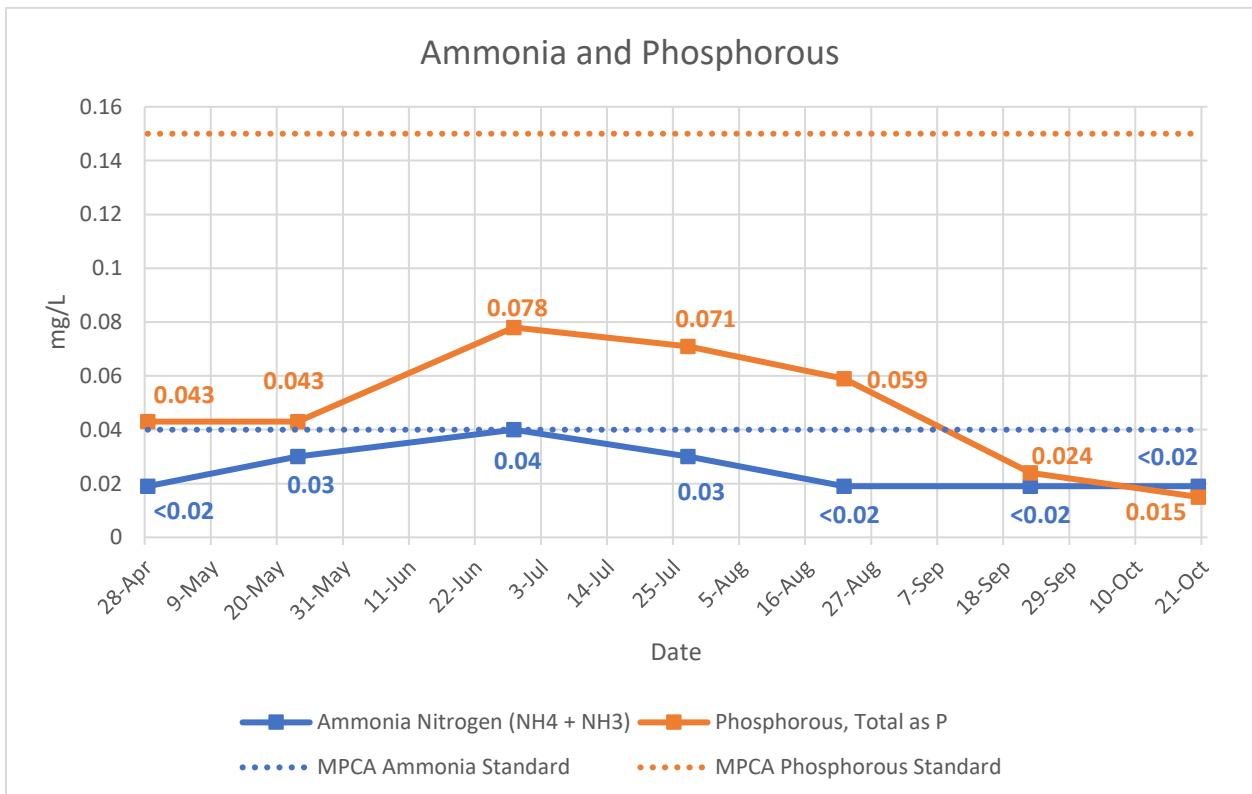


Figure 65. Ammonia and Phosphorous samples collected at S002-000.

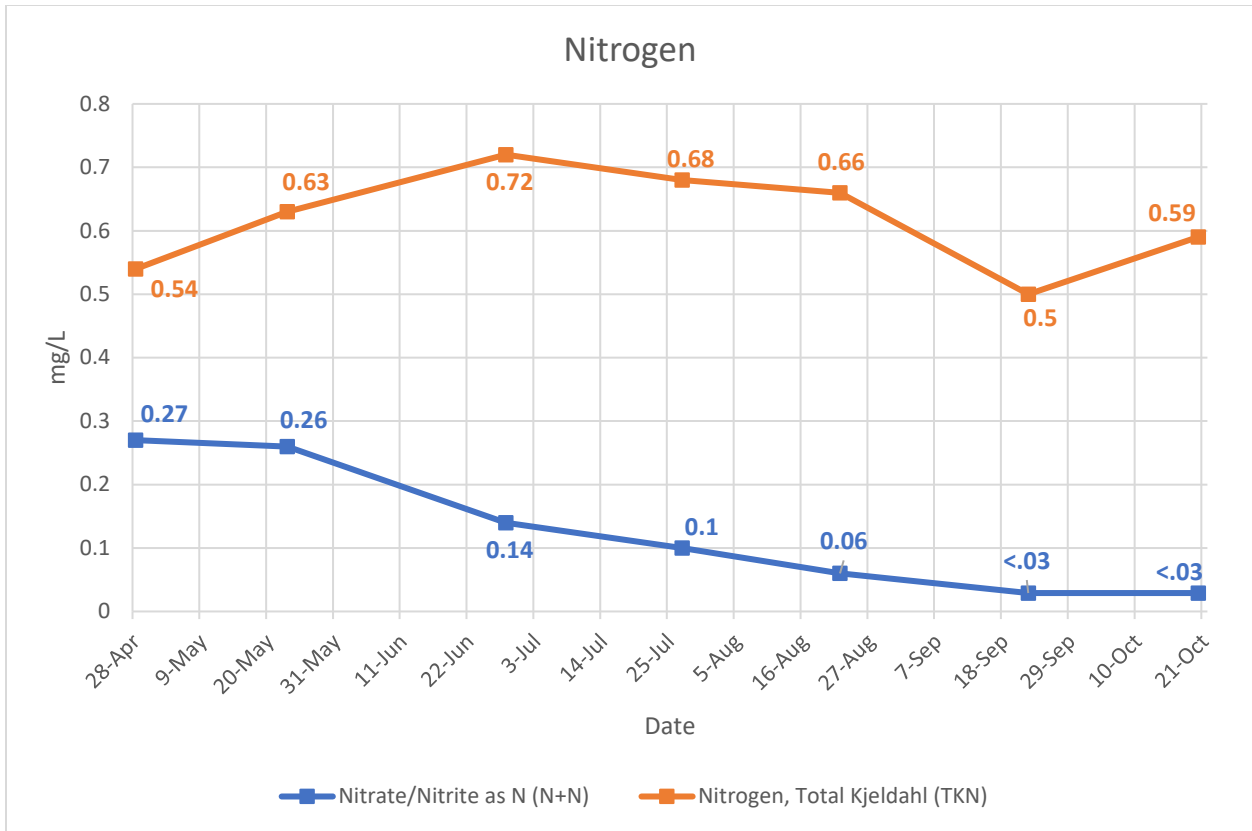


Figure 66. Nitrogen samples collected at S002-000 (MPCA and EPA standards are 10 mg/L).

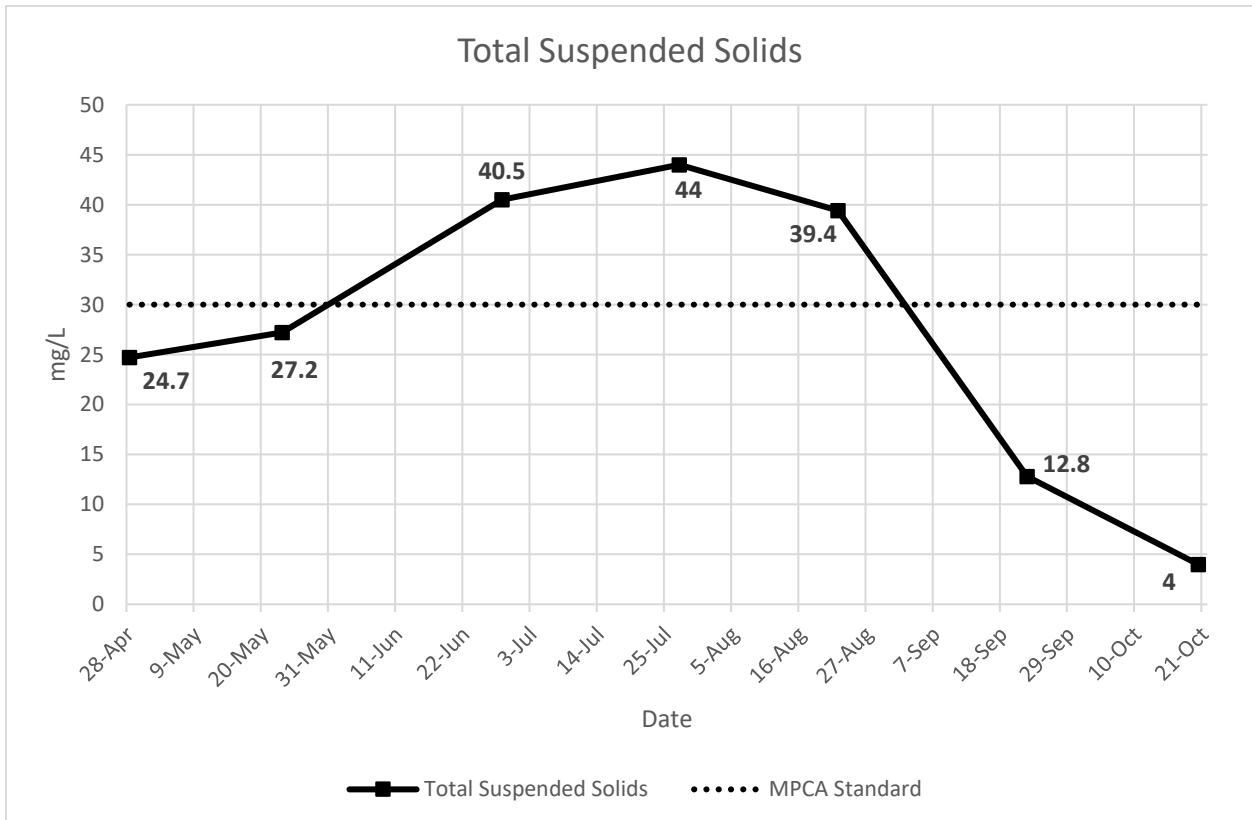


Figure 67. Total Suspended Solids samples collected at S002-000.

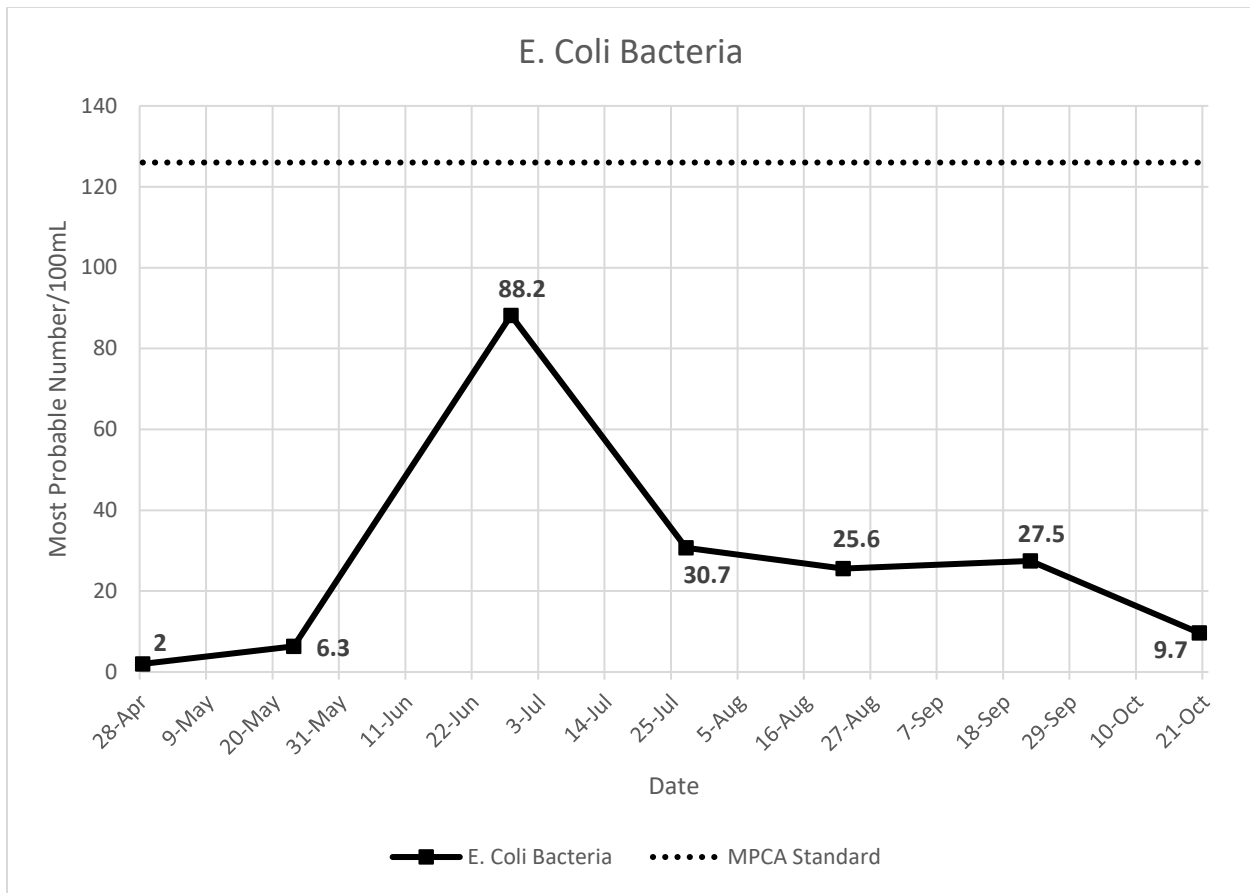


Figure 68. E. Coli Bacteria samples collected at S002-000.

4. Whisky Creek

Whisky Creek is a tributary to the South Branch Buffalo River, beginning at Whisky Lake between Sections 25 and 36, Tansem Township, Clay County. The first sample site on Whisky Creek is located near Barnesville, approximately 20 miles downstream from the headwaters. In Barnesville, Whisky Creek runs underneath State Highway 34 and deposits into a pond that catches sediment from entering Blue Eagle Lake. Rock riffles were installed on the west side of this pond, where Whisky Creek continues westward until it connects with the South Branch Buffalo River in Section 9, Alliance Township. The portion of Whisky Creek downstream of County Highway 2 west of Barnesville is also known as Clay County Ditch No. 34.

- a) S004-998: Located in Section 19, Barnesville Township along the north side of State Highway 34 before Whisky Creek connects with the sediment catchment pond, in the Central planning region.

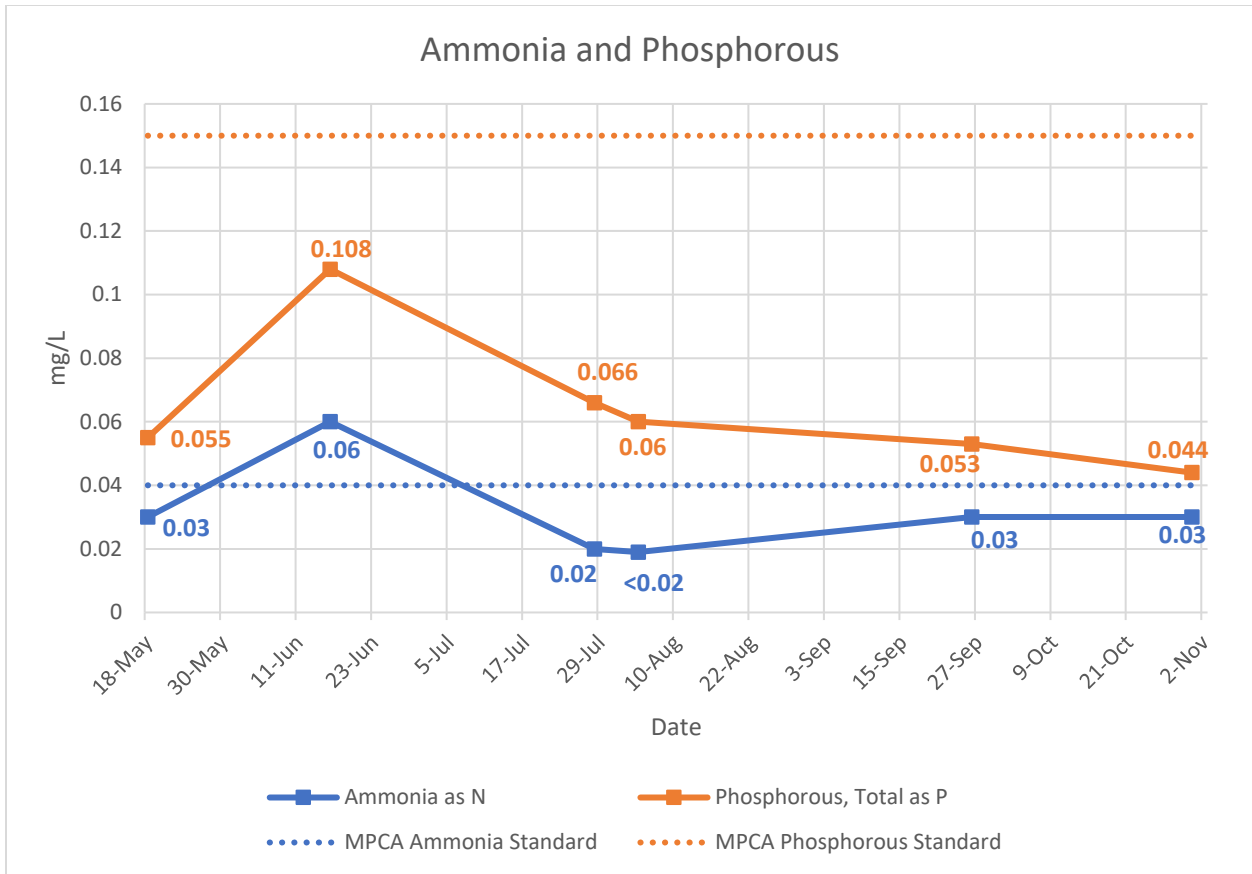


Figure 69. Ammonia and Phosphorous samples collected at S004-998.

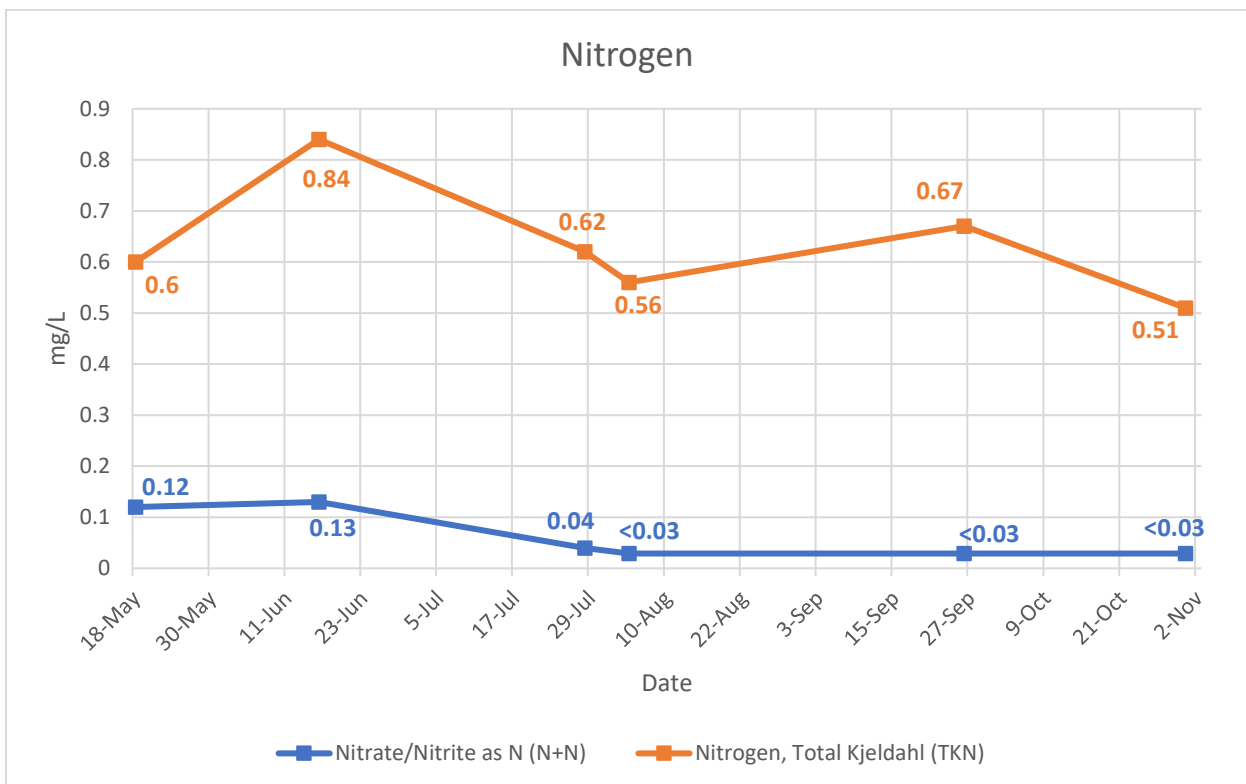


Figure 70. Nitrogen samples collected at S004-998 (MPCA and EPA standards are 10 mg/L).

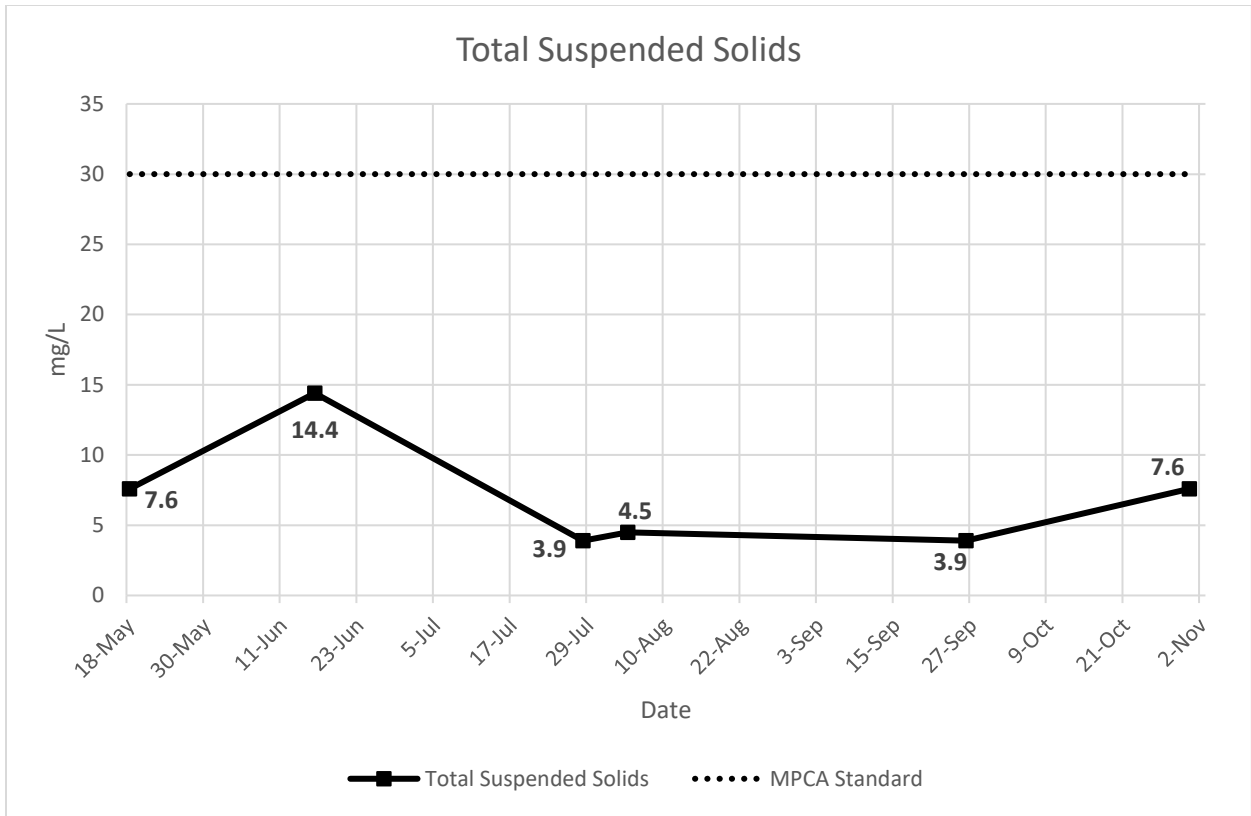


Figure 71. Total Suspended Solids samples collected at S004-998.

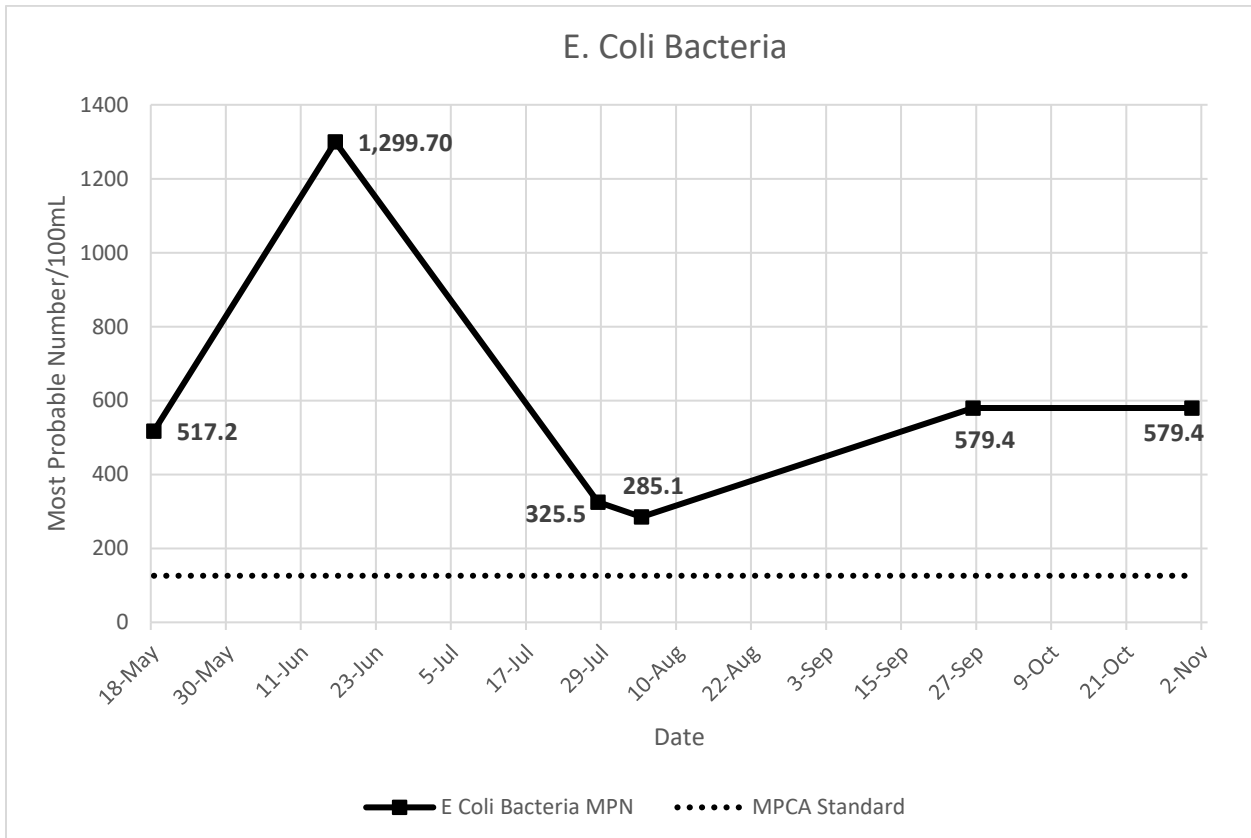


Figure 72. E. Coli Bacteria samples collected at S004-998.

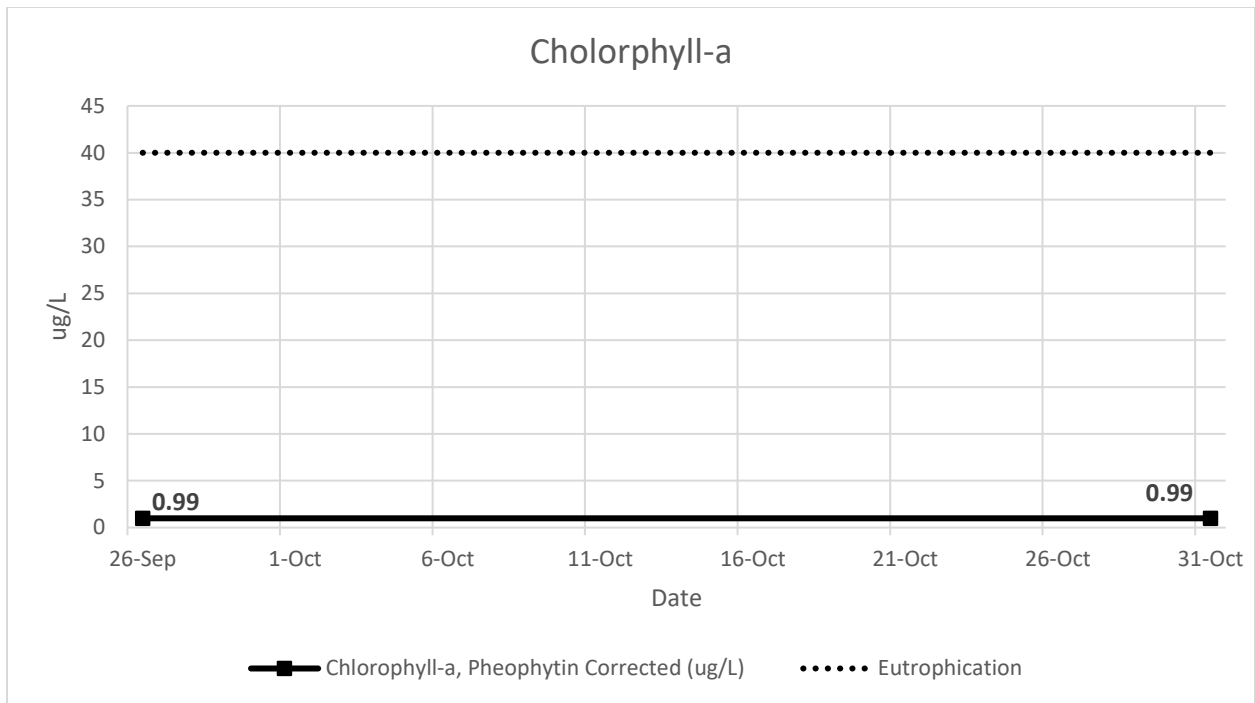


Figure 73. Chlorophyll samples collected at S004-998.

b) S007-455: Located along the rock riffles at the outlet side of the sediment catchment pond near Blue Eagle Lake in Barnesville in the Central planning region.

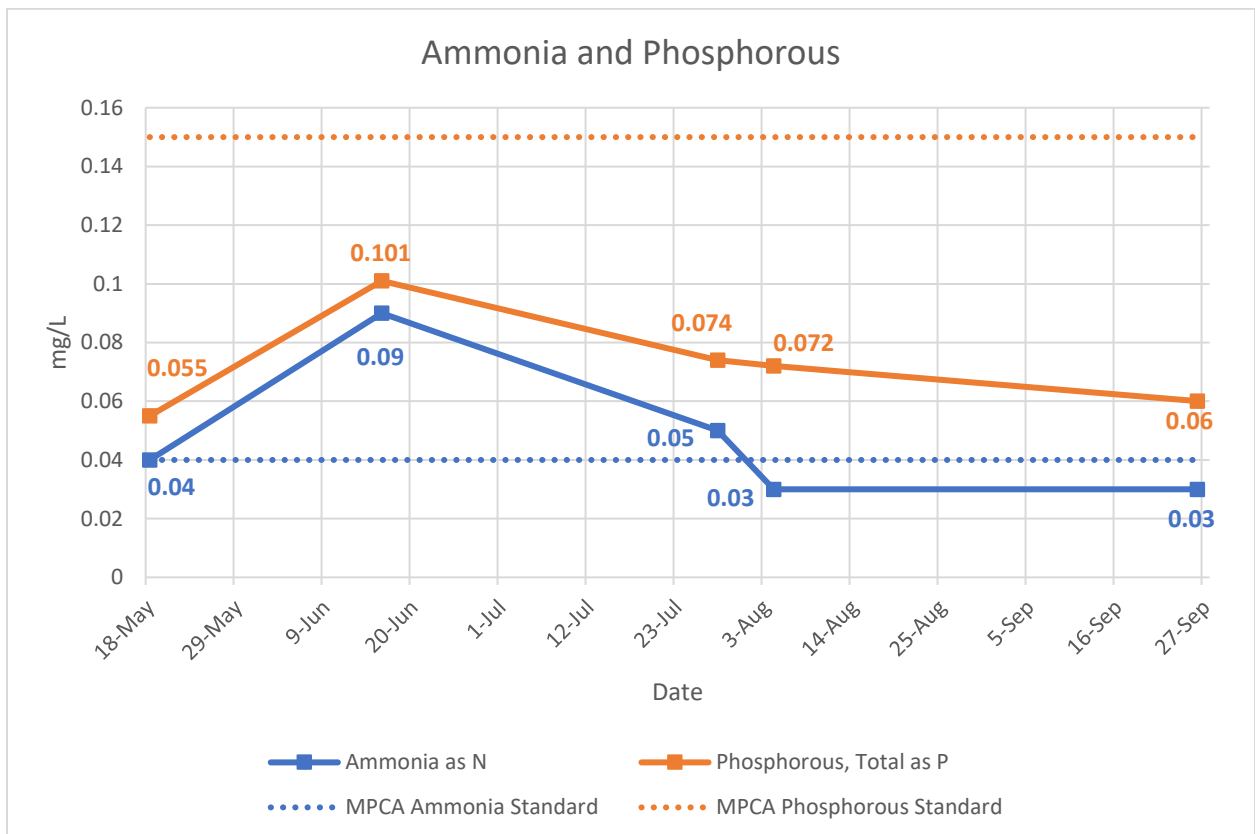


Figure 74. Ammonia and Phosphorous samples collected at S007-455.

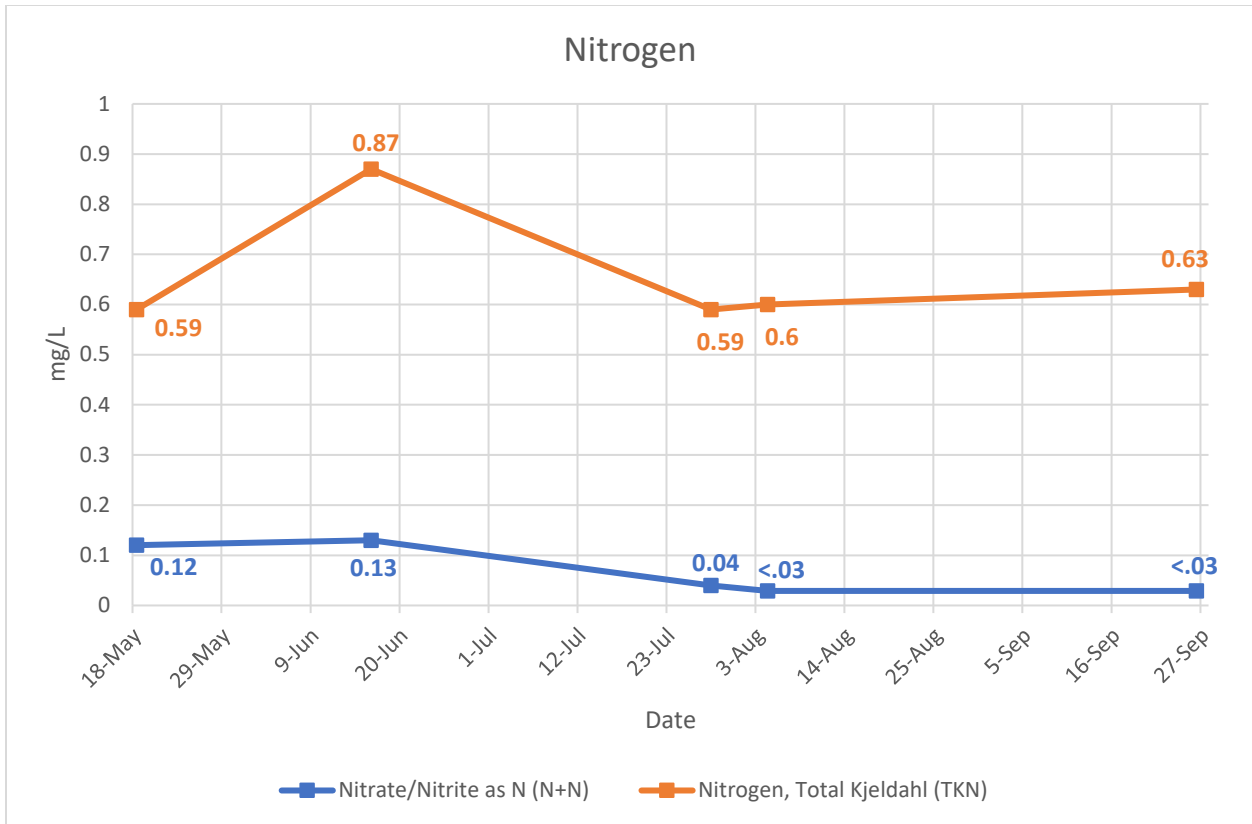


Figure 75. Nitrogen samples collected at S007-455 (MPCA and EPA standards are 10 mg/L).

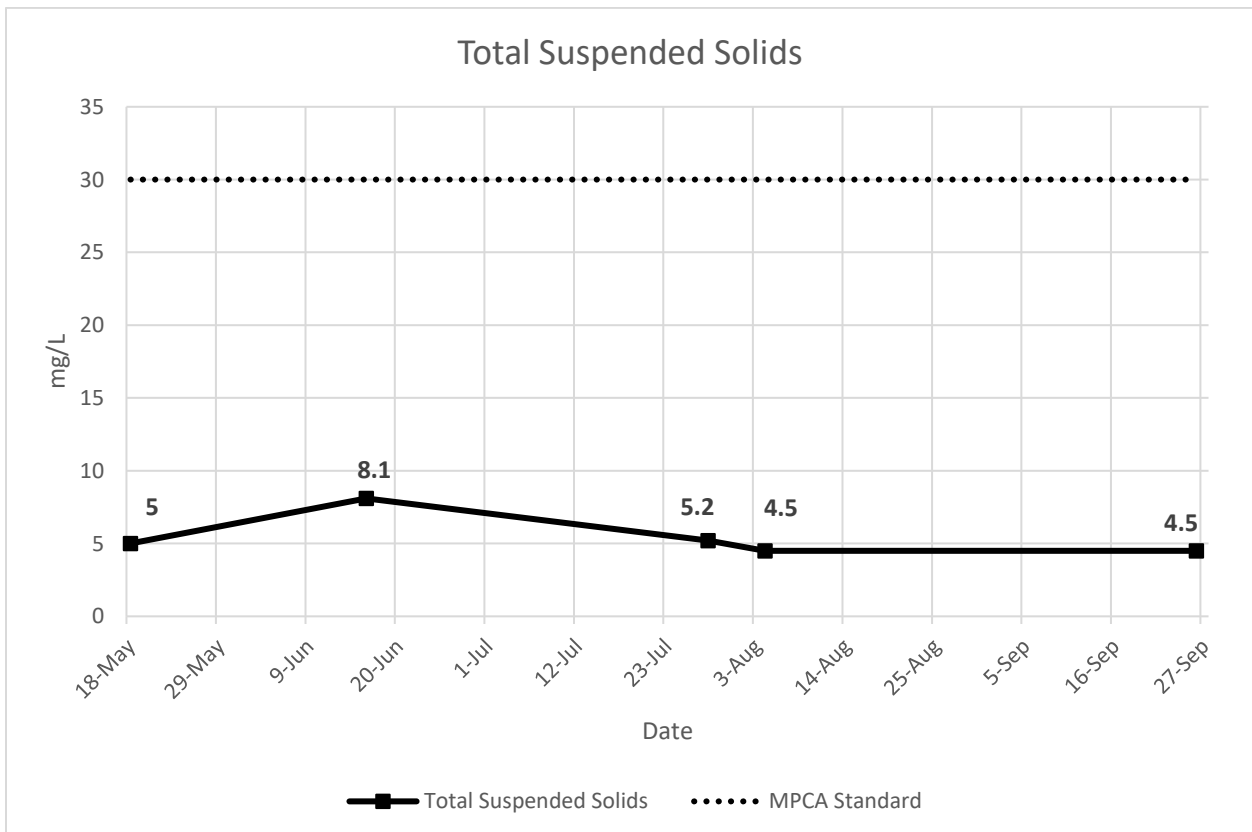


Figure 76. Total Suspended Solids samples collected at S007-455.

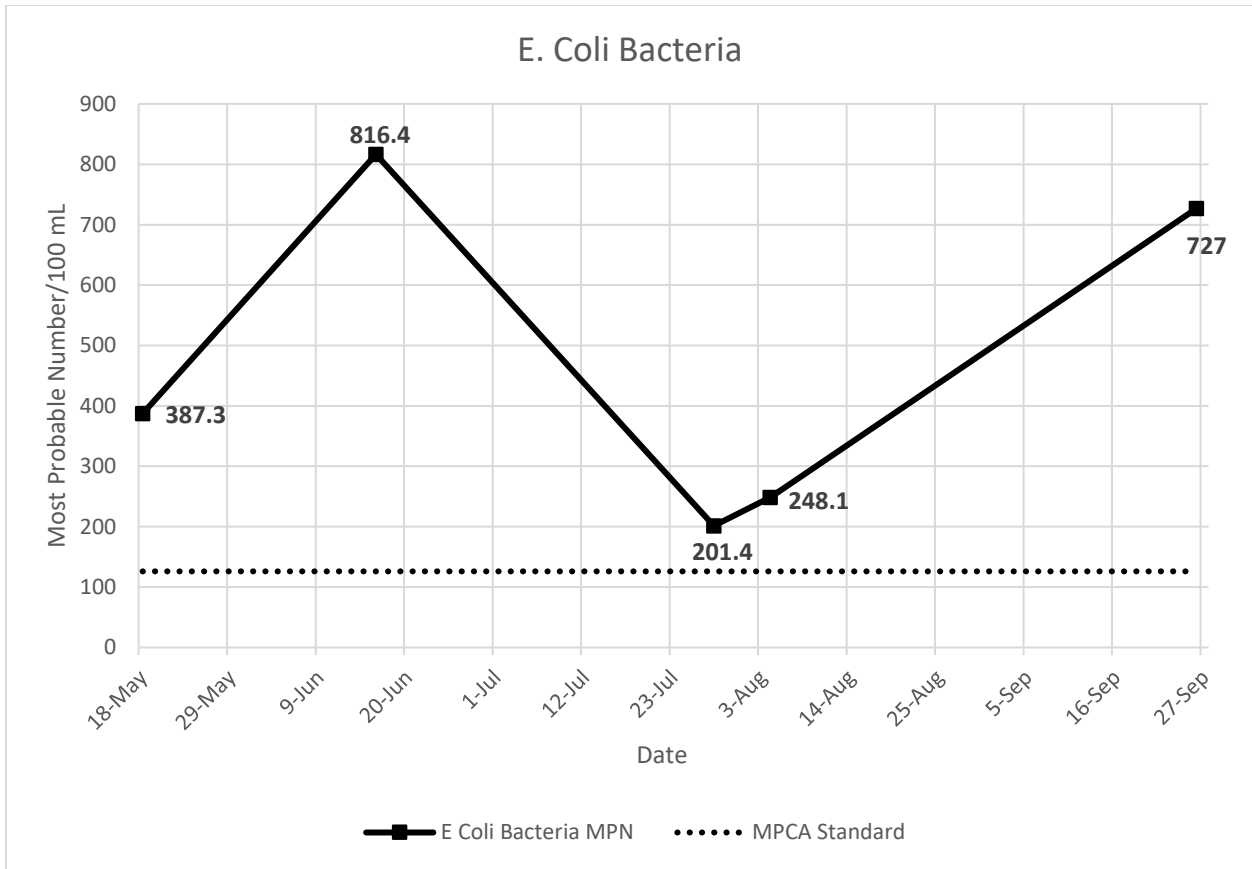


Figure 77. E. Coli Bacteria samples collected at S007-455.

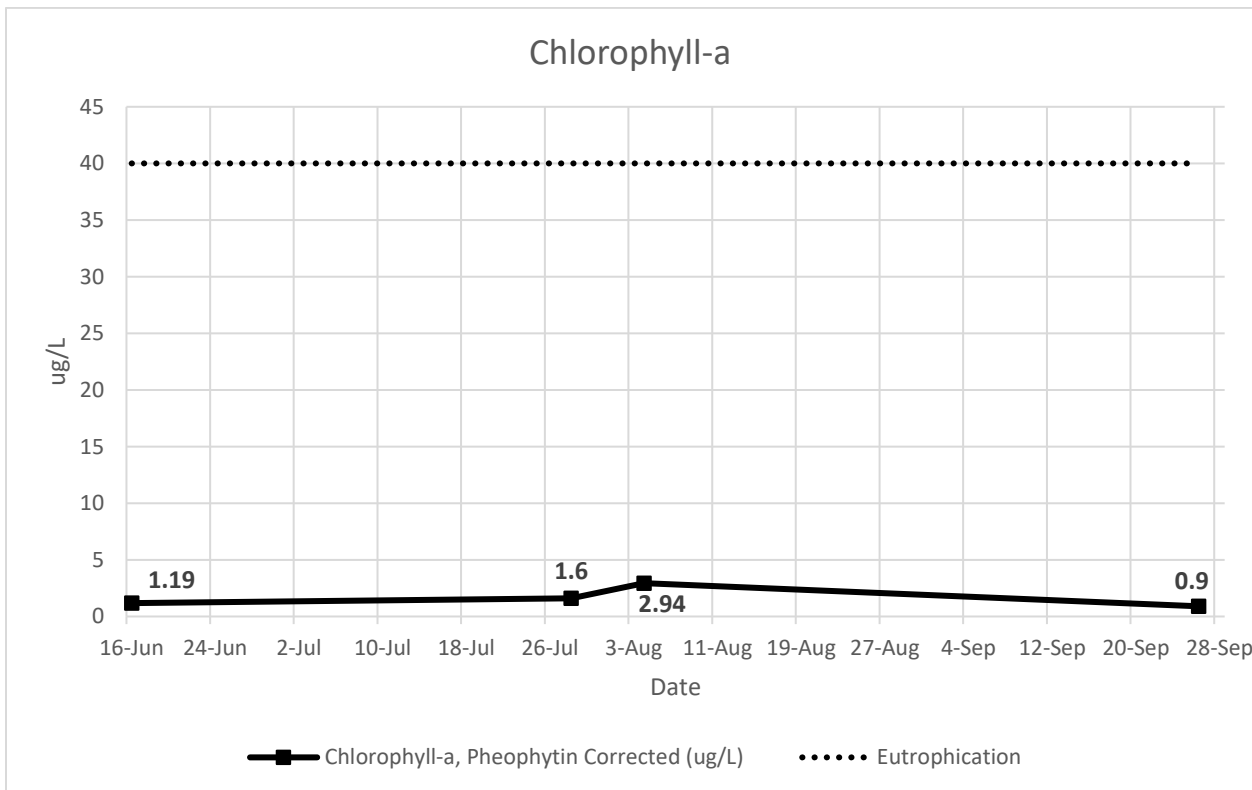


Figure 78. Chlorophyll samples collected at S007-455.

c) S005-607: Located about 15 river miles downstream of S007-455, this station is located upstream of where Whisky Creek outlets into the South Branch Buffalo River in Section 9, Alliance Township in the Central planning region.

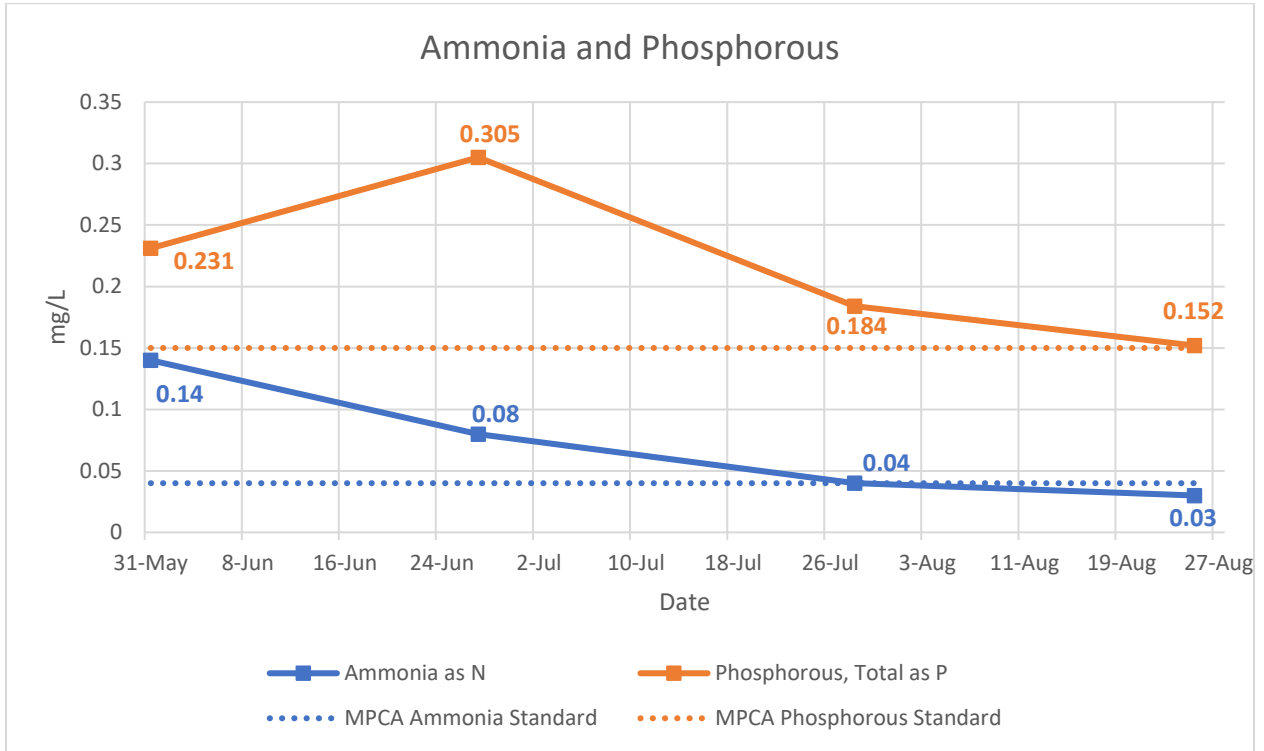


Figure 79. Ammonia and Phosphorous samples collected at S005-607.

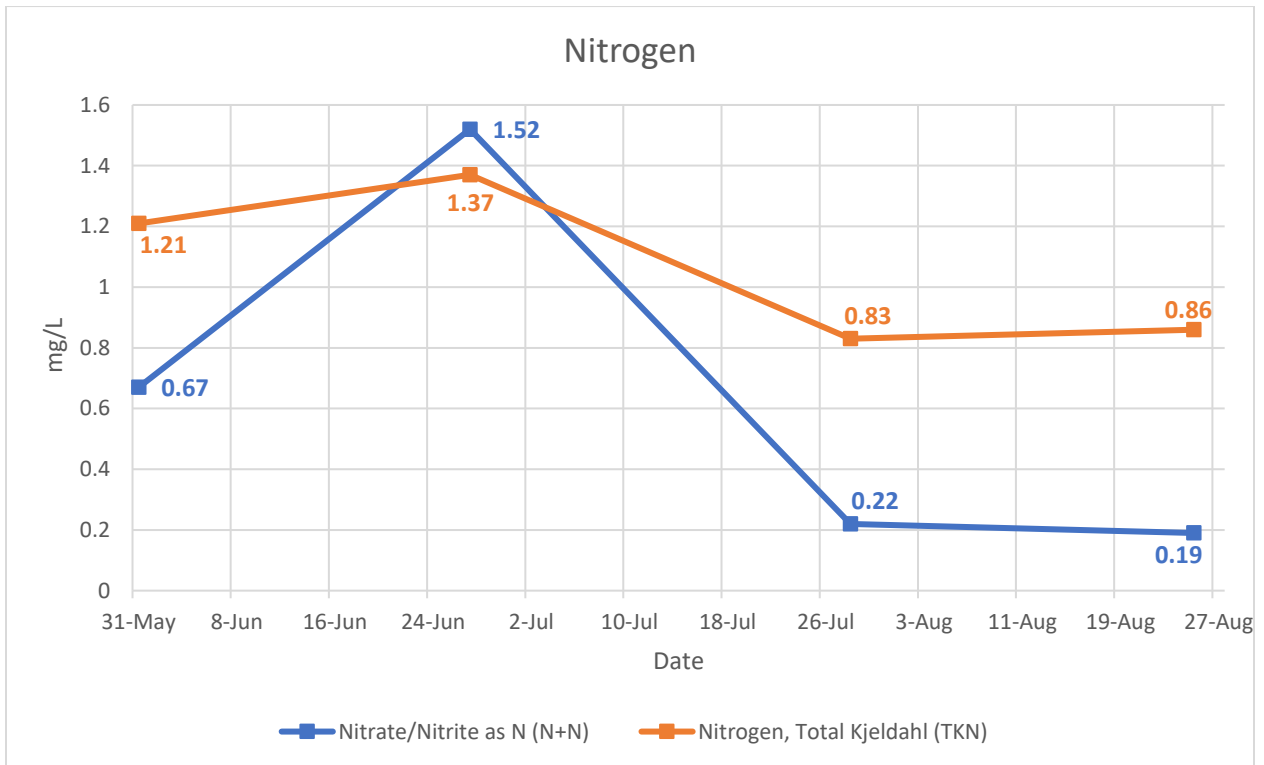


Figure 80. Nitrogen samples collected at S005-607 (MPCA and EPA standards are 10 mg/L).

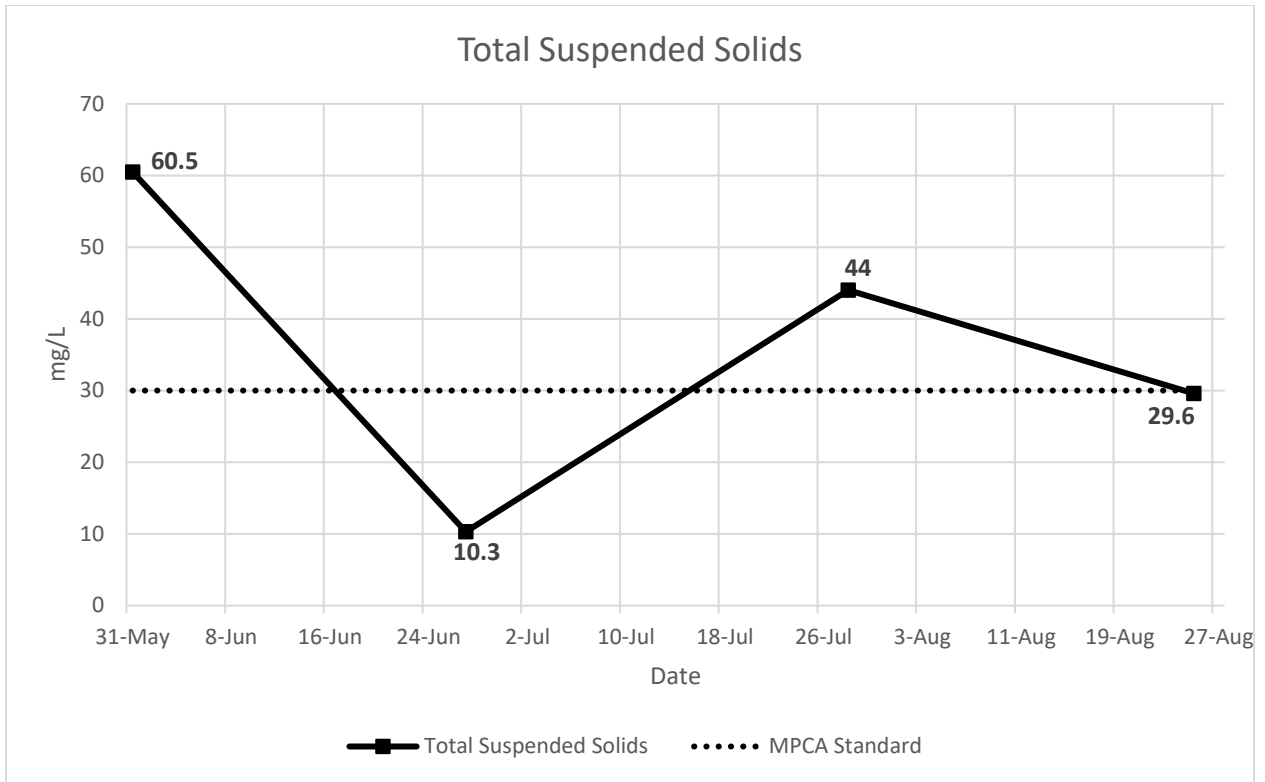


Figure 81. Total Suspended Solids samples collected at S005-607.

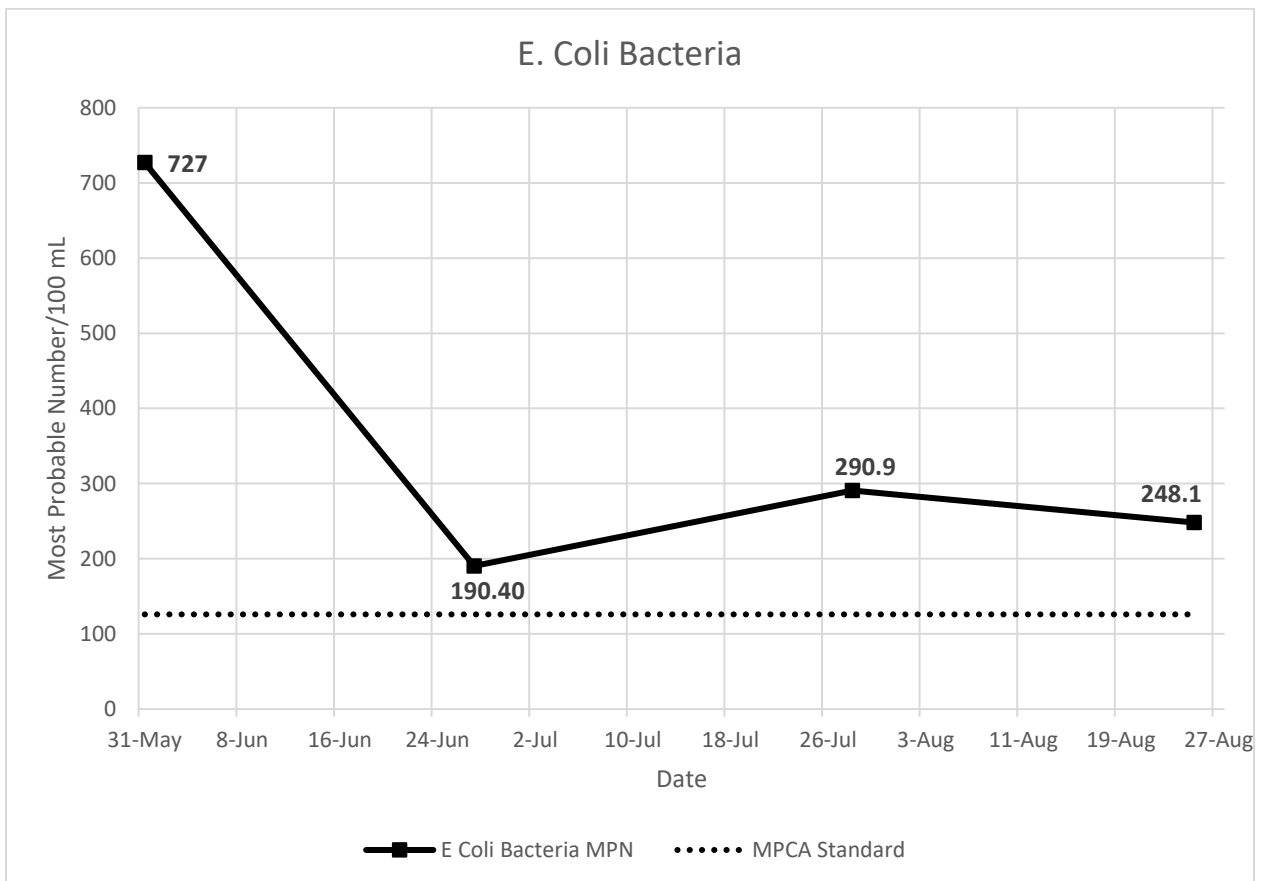


Figure 82. E. Coli Bacteria samples collected at S005-607.

5. Hay Creek

Hay Creek is a small tributary starting three miles south of Lake Park. This tributary is the outlet of Stakke Lake, flowing north and west for roughly 15 miles, running through Roberg Lake, Stinking Lake, and several wetlands prior to connecting with the Buffalo River at Winnipeg Junction. There are two sampling stations along Hay Creek, both are located within the Mainstem planning region.

- a) S005-133: Located where Hay Creek crosses under 130th Ave to the east of Stinking Lake.

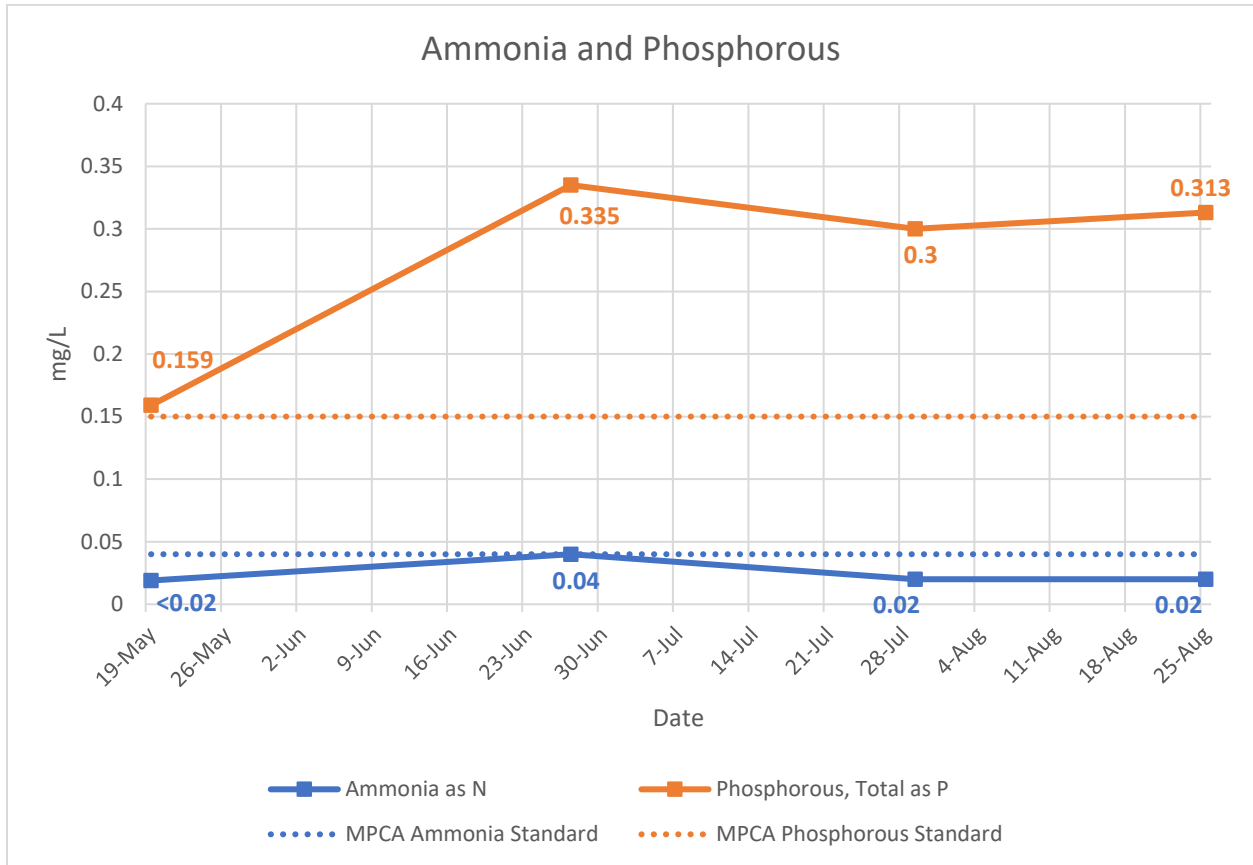


Figure 83. Ammonia and Phosphorous samples collected at S005-133.

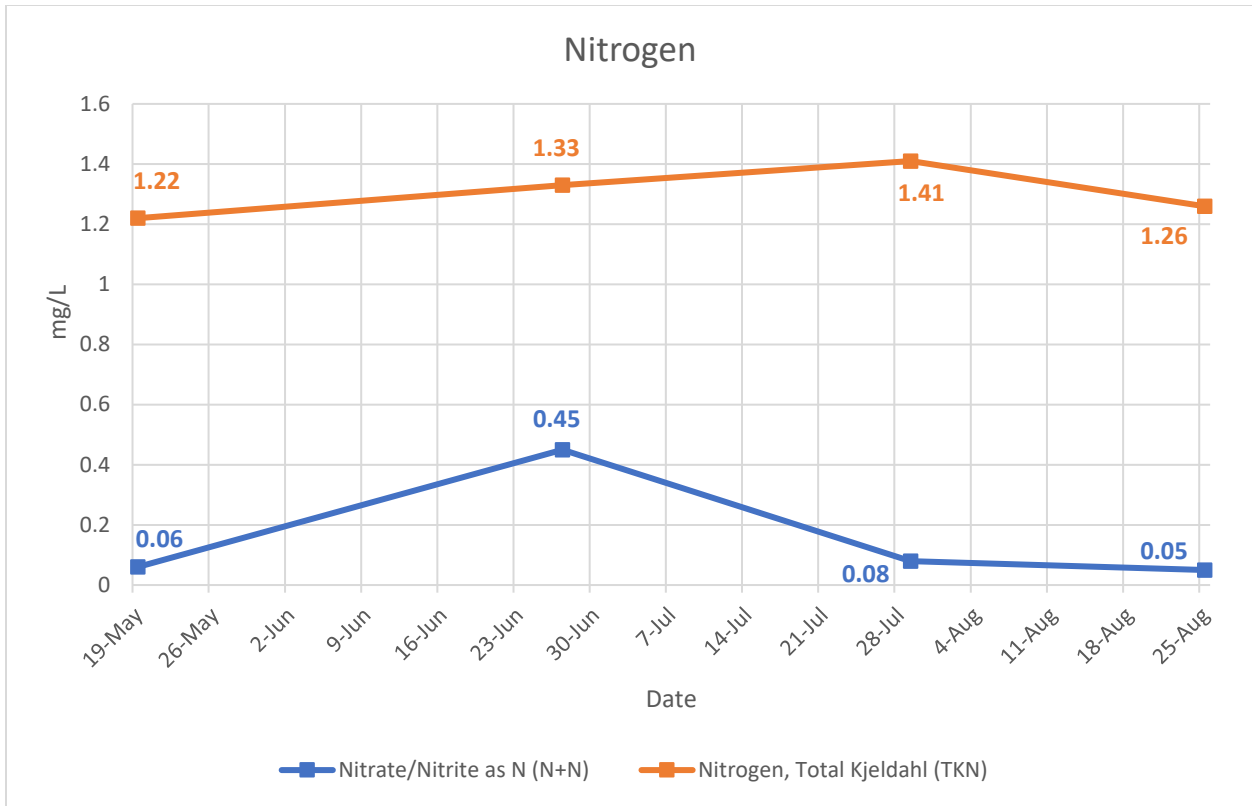


Figure 84. Nitrogen samples collected at S005-133 (MPCA and EPA standards are 10 mg/L).

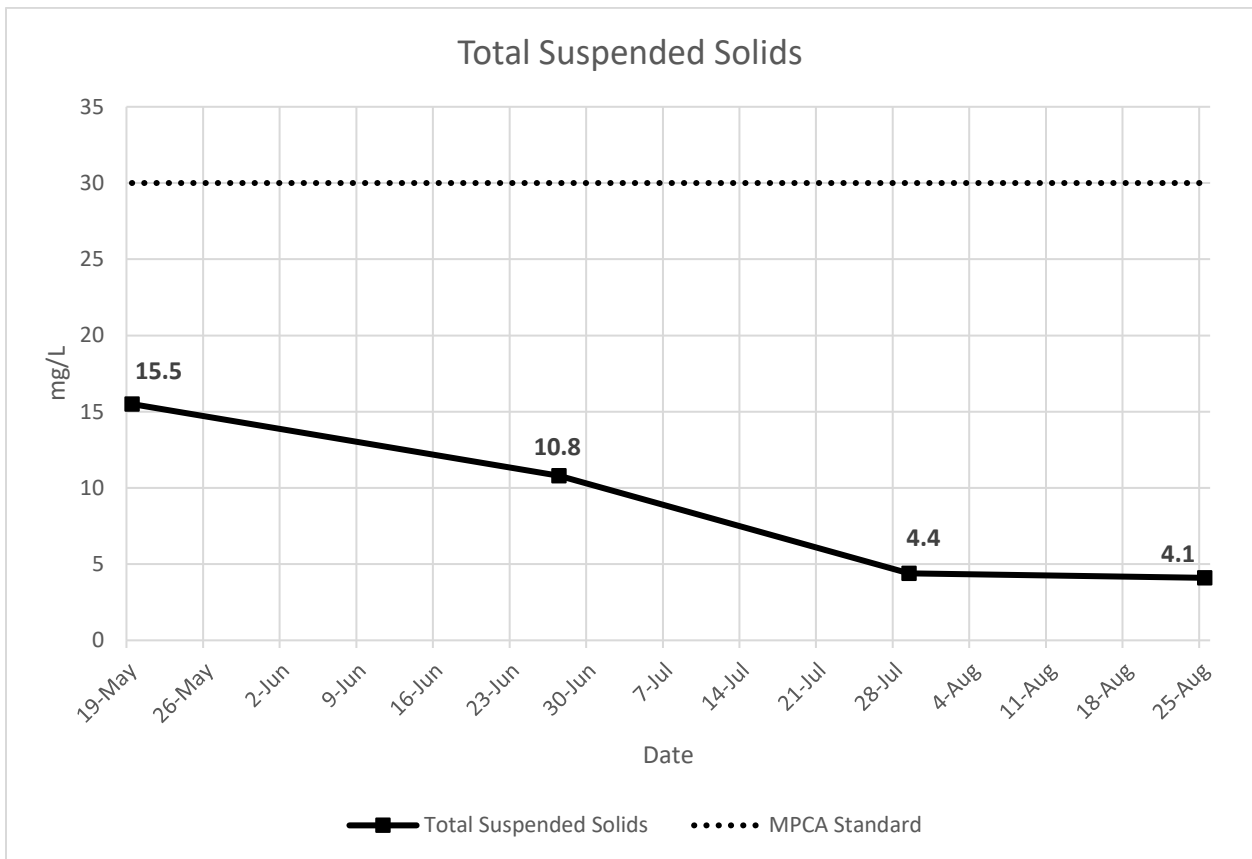


Figure 85. Total Suspended Solids samples collected at S005-133.

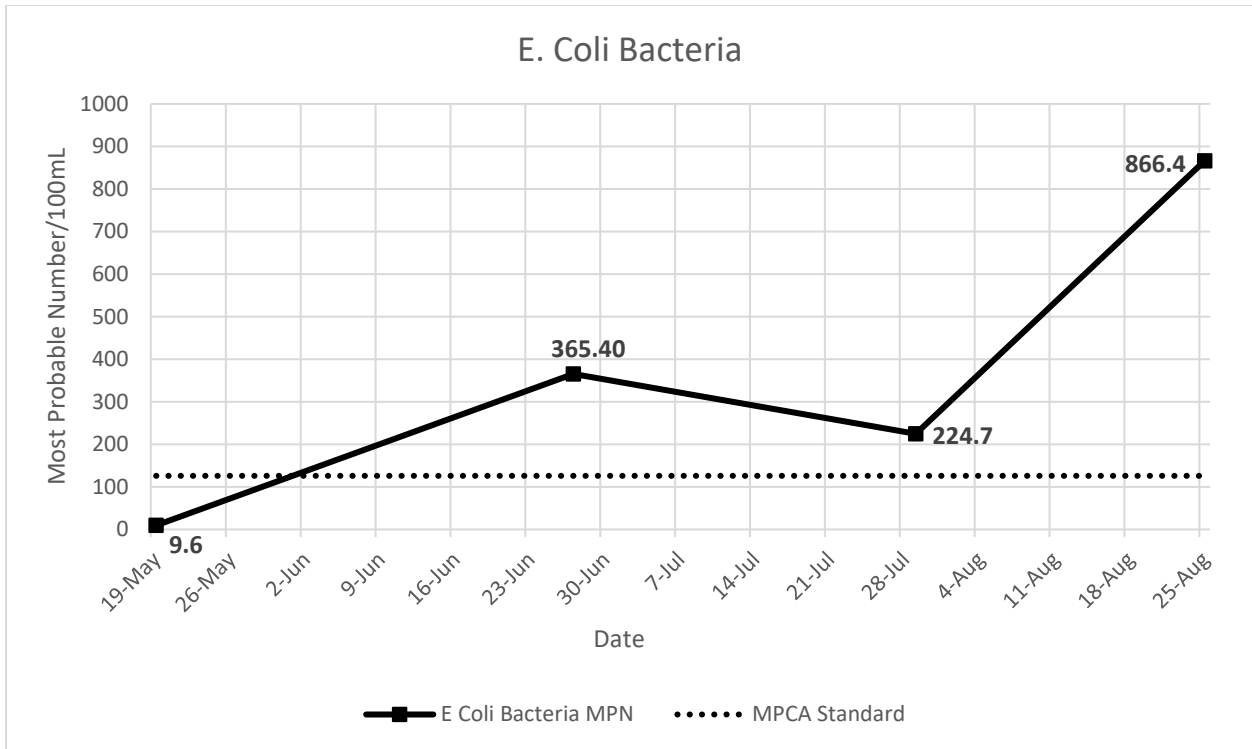


Figure 86. E. Coli Bacteria samples collected at S005-133.

b) S005-606: Located along 265th St N, roughly 0.25 miles before Hay Creek connects with the Red River.

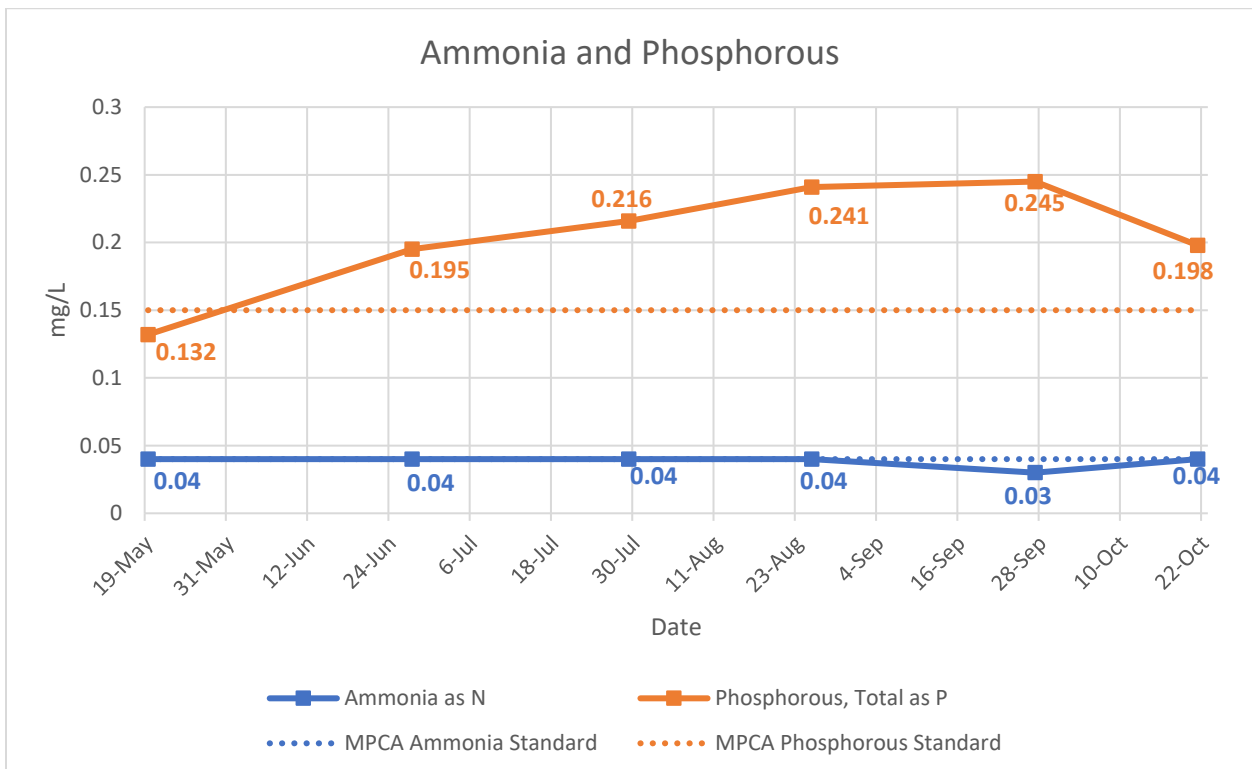


Figure 87. Ammonia and Phosphorous samples collected at S005-606.

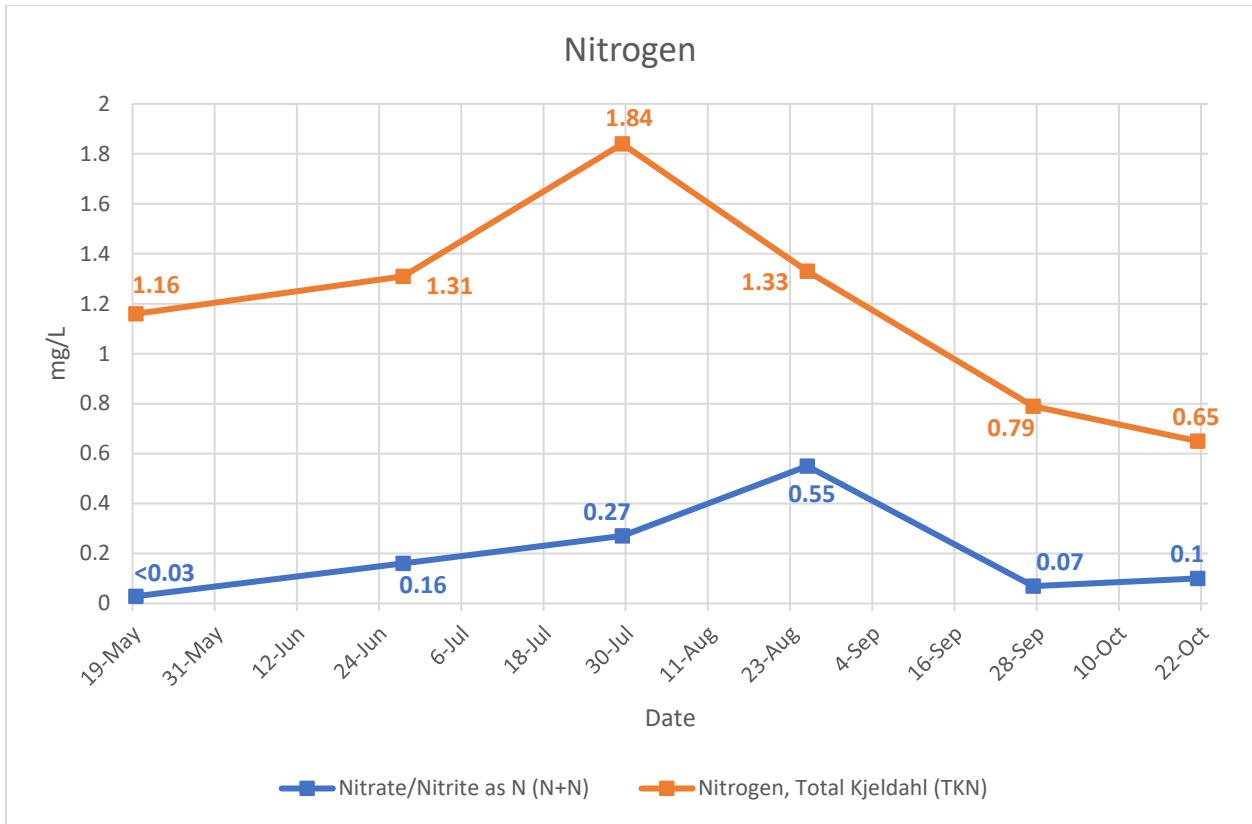


Figure 88. Nitrogen samples collected at S005-606.

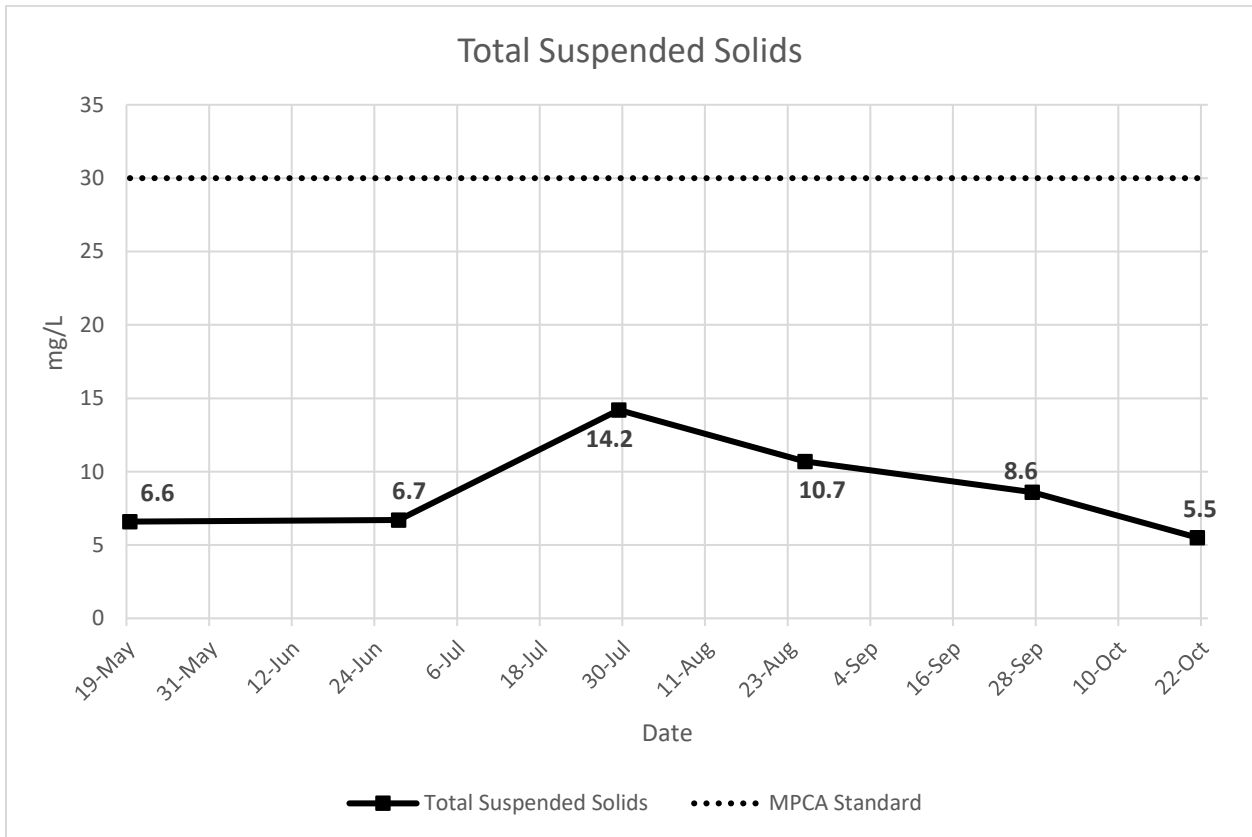


Figure 89. Total Suspended Solids samples collected at S005-606.

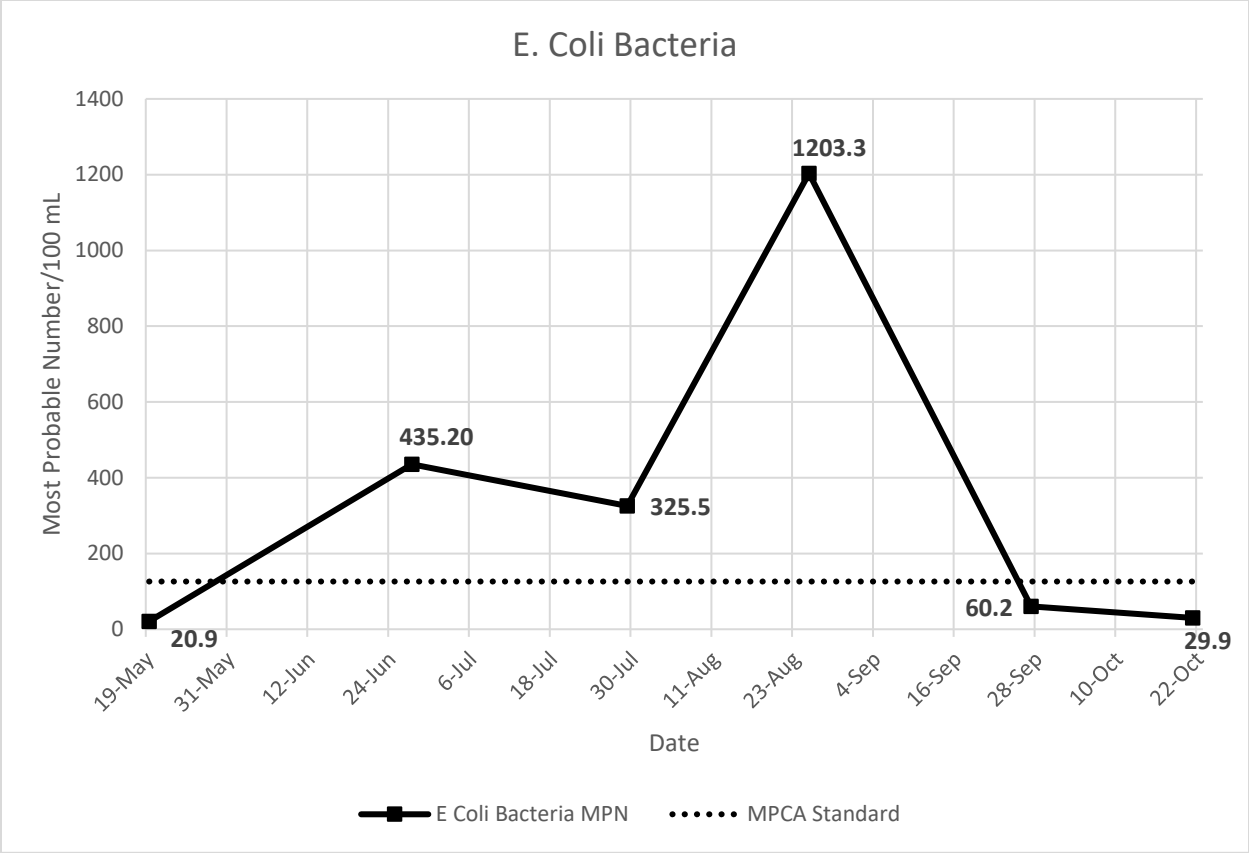


Figure 90. E. Coli Bacteria samples collected at S005-606.

6. Stony Creek

Stony Creek is a mid-sized tributary that outlets into the South Branch Buffalo River near Sabin. Stony Creek starts from the body of water on the west side of Barnesville Management Area in Section 12, Elkton Township, flowing mostly westward for nearly 40 miles through Humboldt, Barnesville, and Elmwood Townships until connecting with the South Branch in Section 16, Elmwood Township. There are two monitoring stations along Stony Creek, both within the Central planning region.

- a) S003-312: Located along 140th St S between Sections 4 and 5, Barnesville Township.

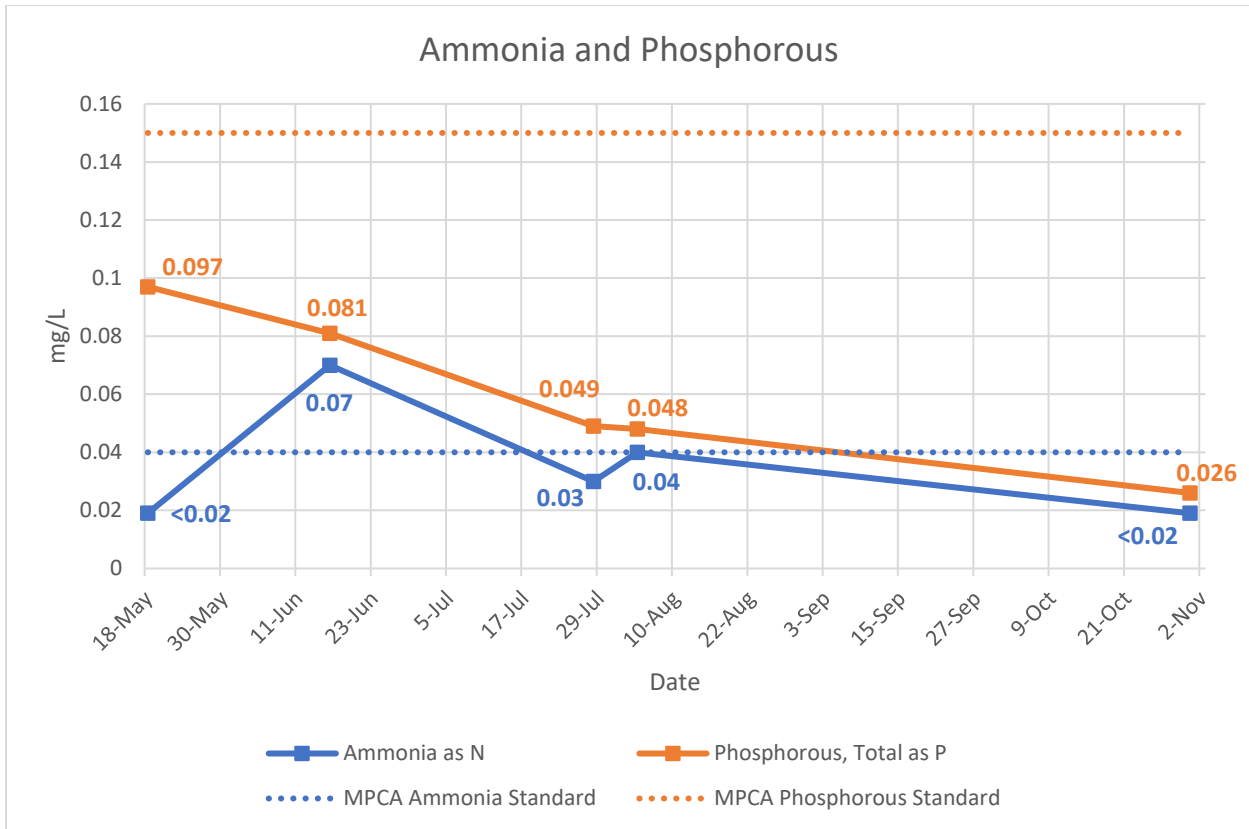


Figure 91. Ammonia and Phosphorous samples collected at S003-312.

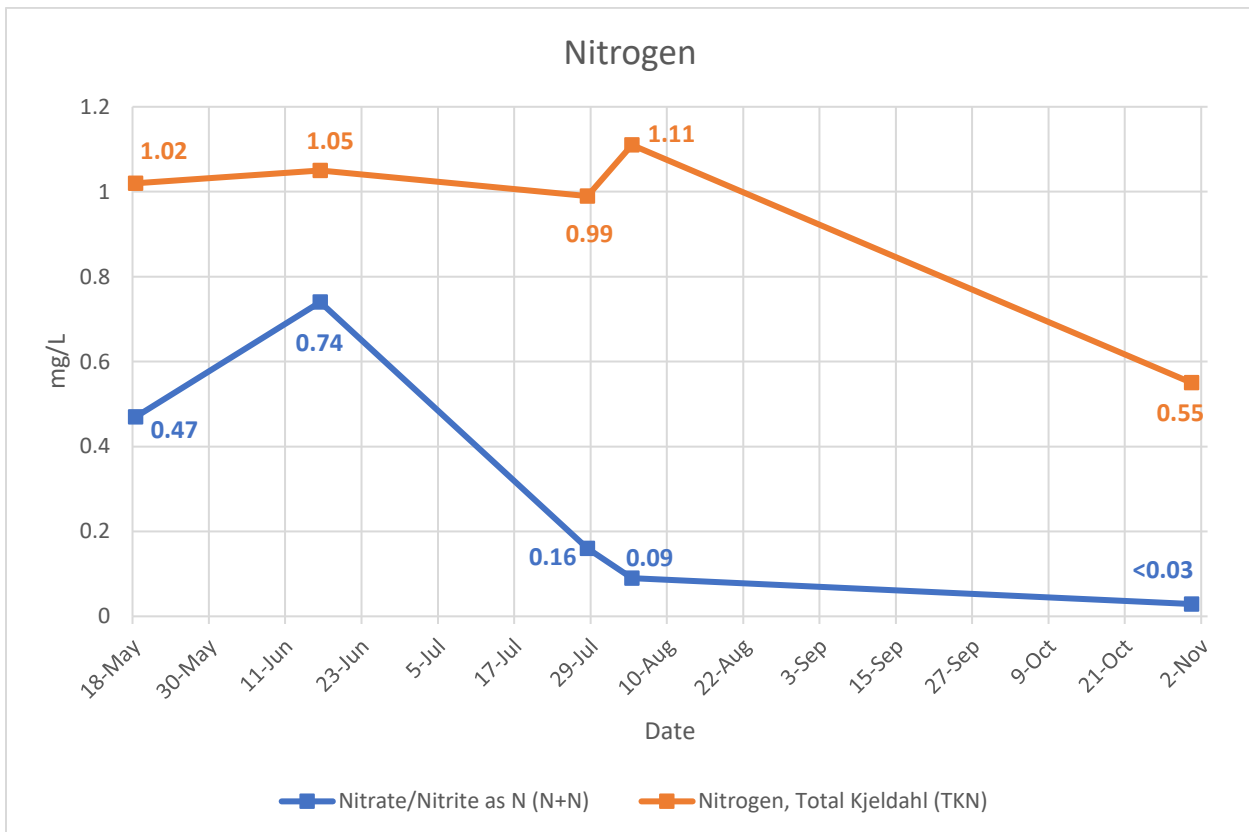


Figure 92. Nitrogen samples collected at S003-312 (MPCA and EPA standards are 10 mg/L).

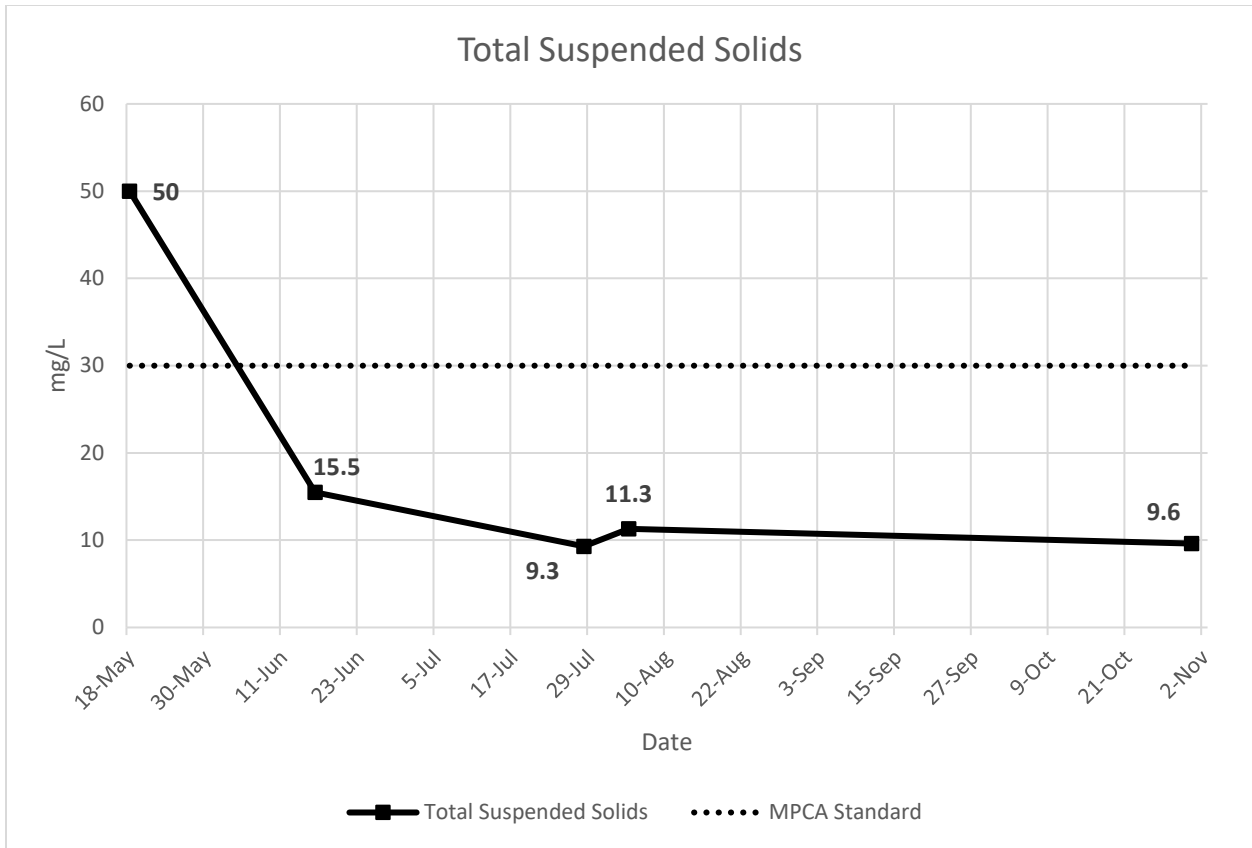


Figure 93. Total Suspended Solids samples collected at S003-312.

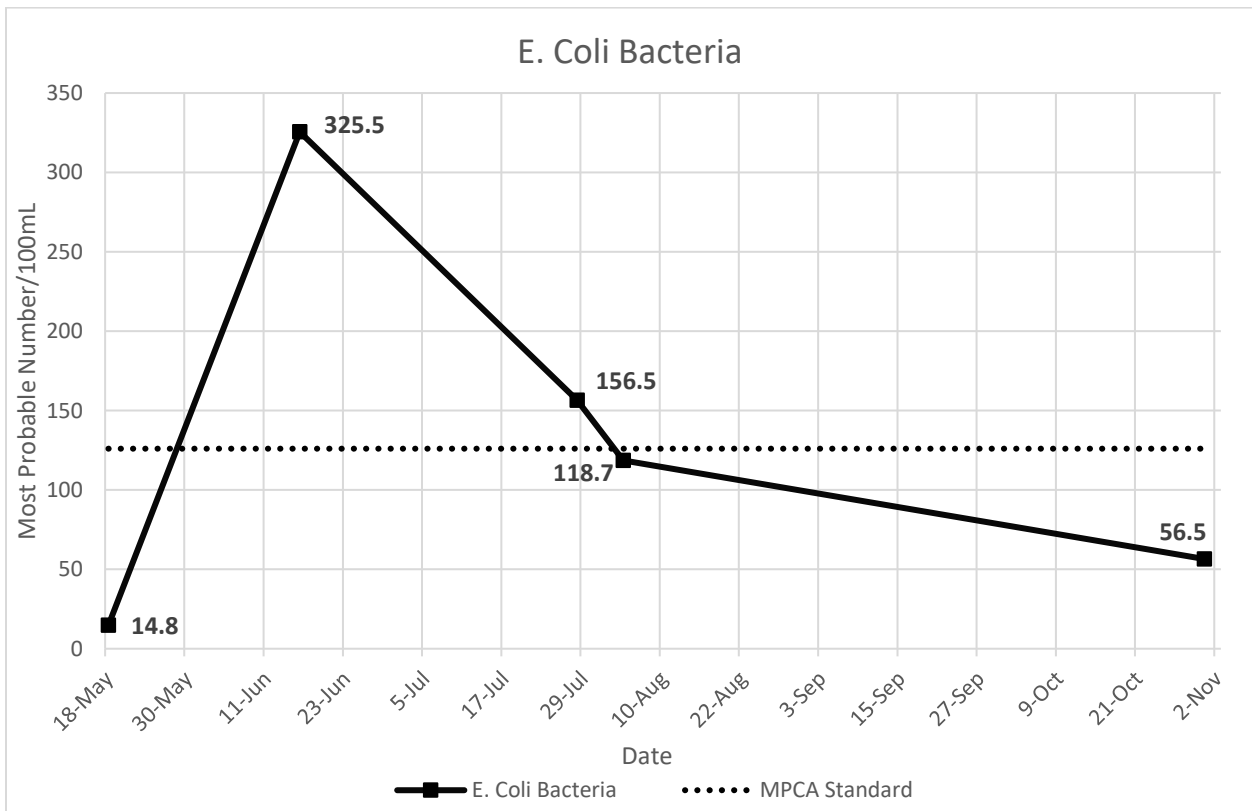


Figure 94. E. Coli Bacteria samples collected at S003-312.

b) S002-711: Located roughly 1.5 miles upstream of where Stony Creek outlets into the South Branch Buffalo River in Section 16, Elmwood Township.

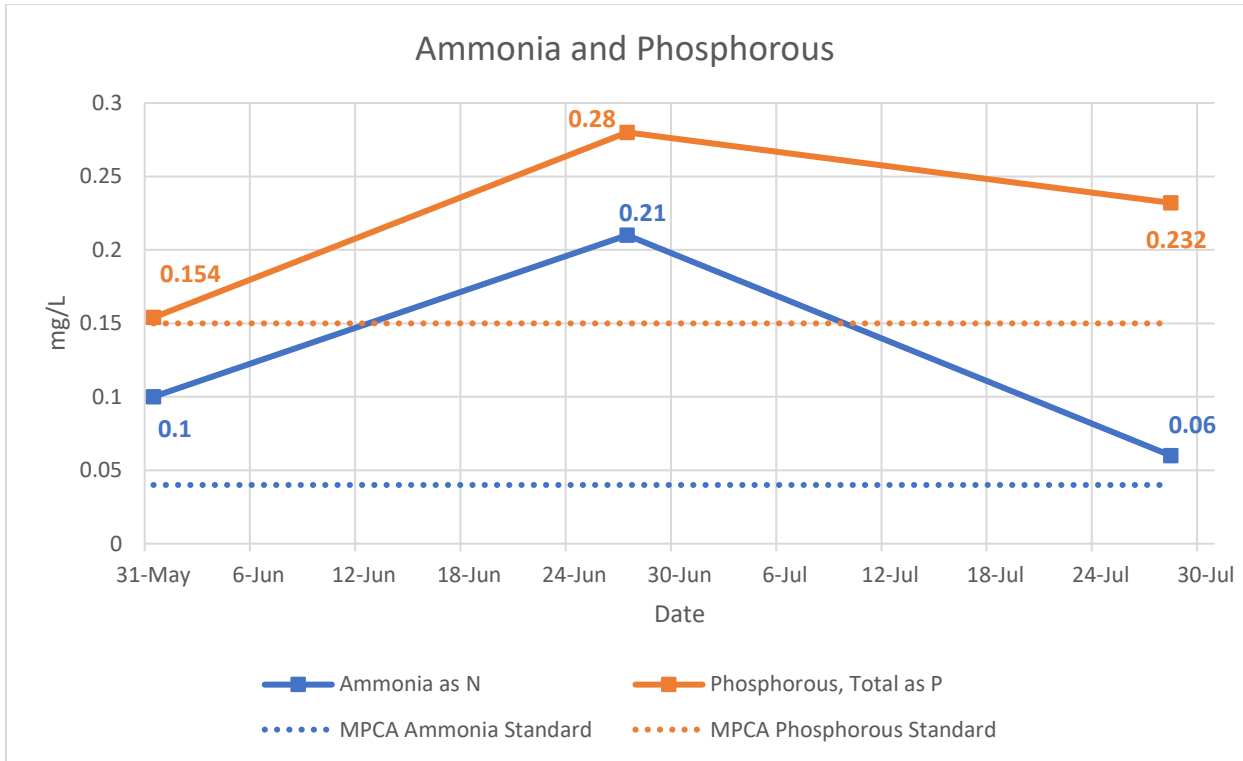


Figure 95. Ammonia and Phosphorous samples collected at S002-711.

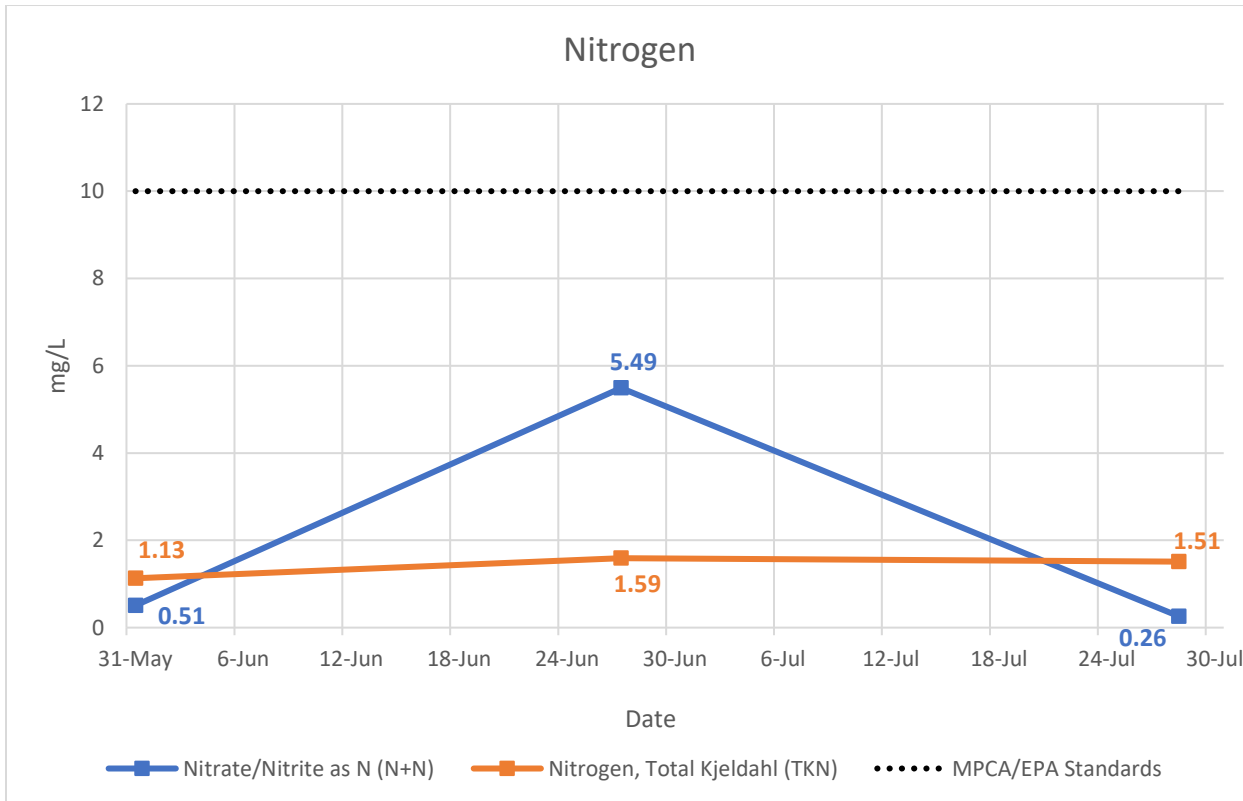


Figure 96. Nitrogen samples collected at S002-711.

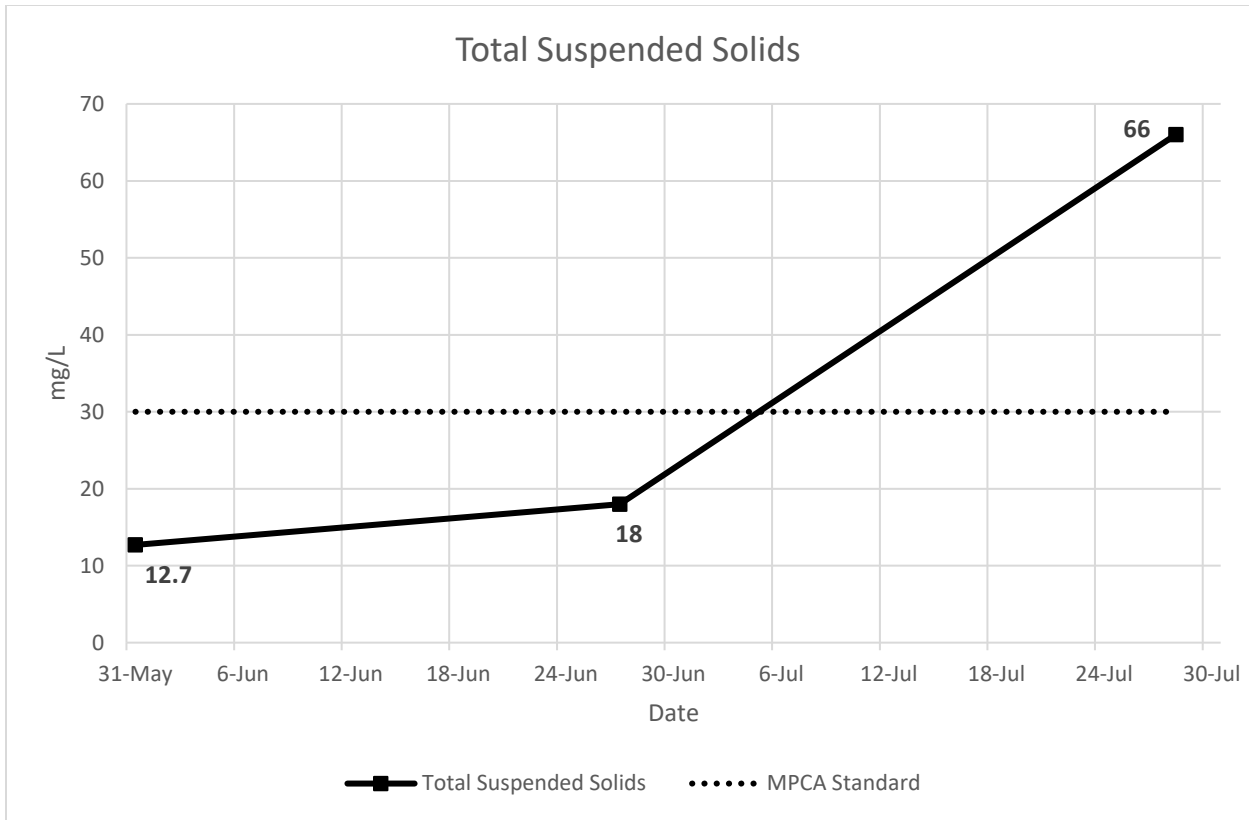


Figure 97. Total Suspended Solids samples collected at S002-711.

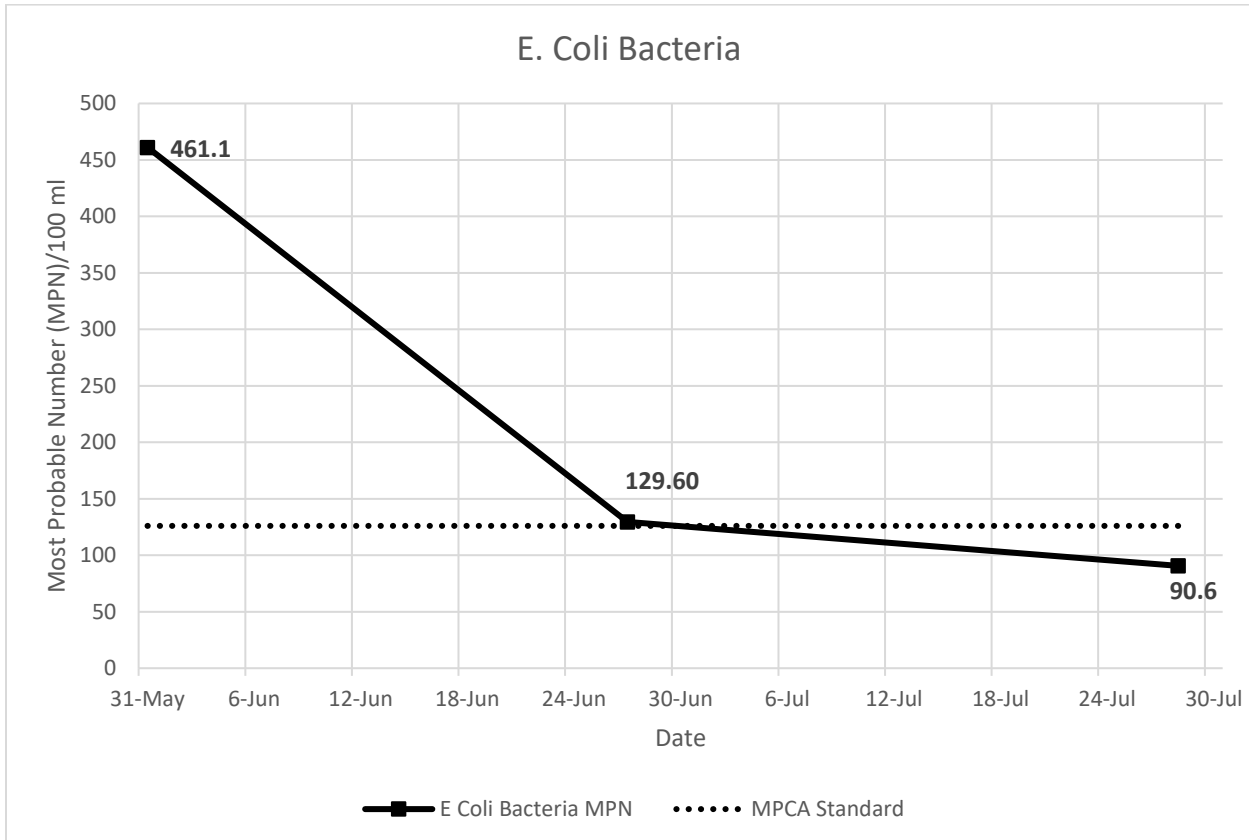


Figure 98. E. Coli Bacteria samples collected at S002-711.

7. Whiskey Creek

Whiskey Creek is a medium-sized tributary that starts in Section 18, Nilsen Township, running mostly north and west for a little over 20 miles through Nilsen, Connelly, Nordick, and McCauleyville Townships before it outlets into the Red River. There are two stations along Whiskey Creek, both are in the Upper Red planning region.

- a) S002-004: Located in Section 19, Nordick Township, this station was only sampled once in 2022 on April 28.

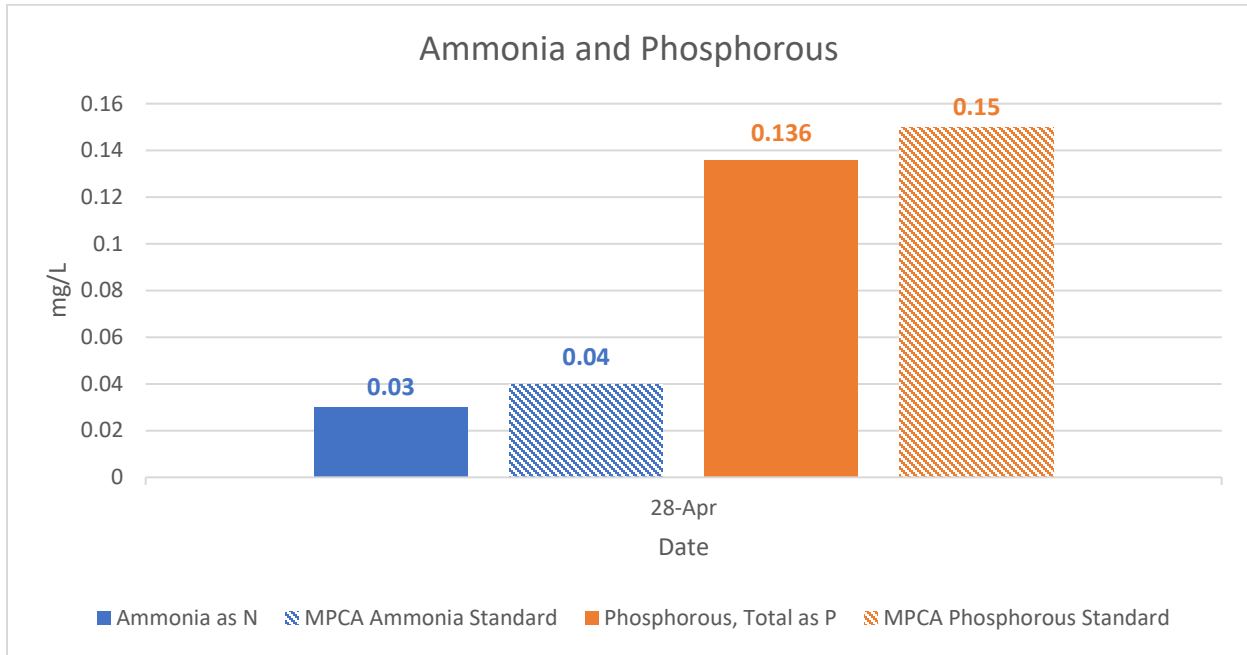


Figure 99. Ammonia and Phosphorous samples collected at S002-004.

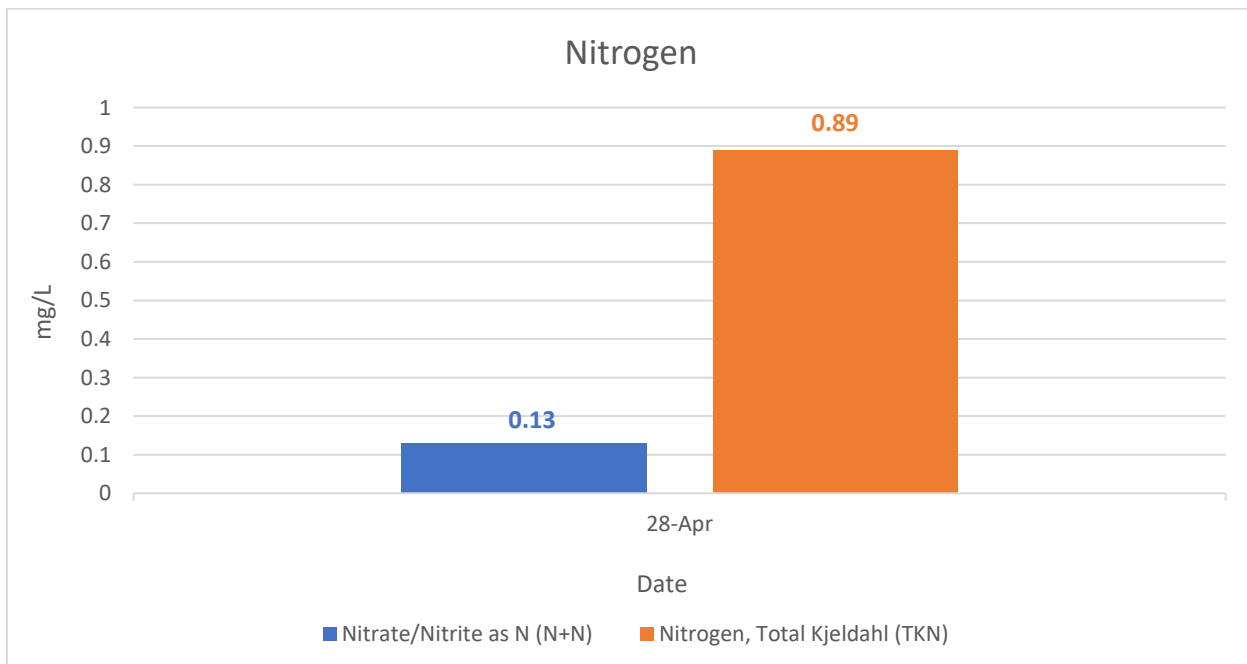


Figure 100. Nitrogen samples collected at S002-004 (MPCA and EPA standards are 10 mg/L).

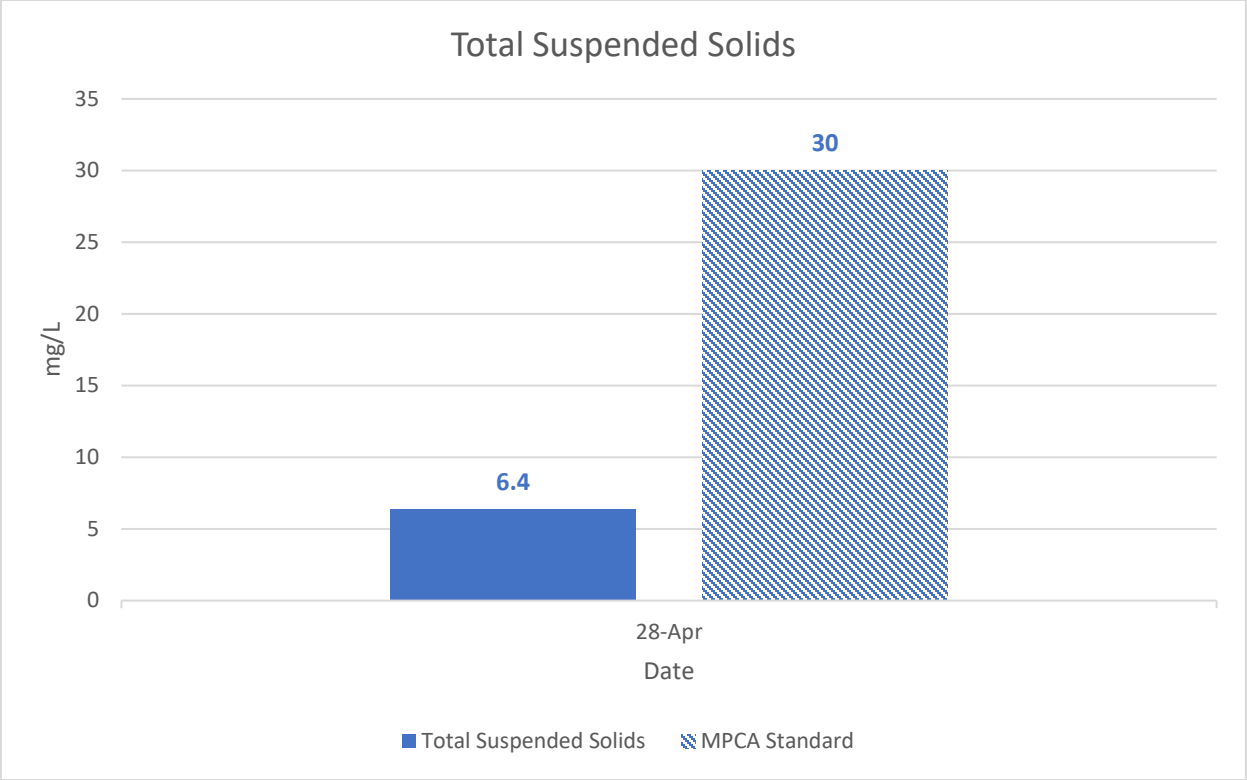


Figure 101. Totals Suspended Solids samples collected at S002-004.

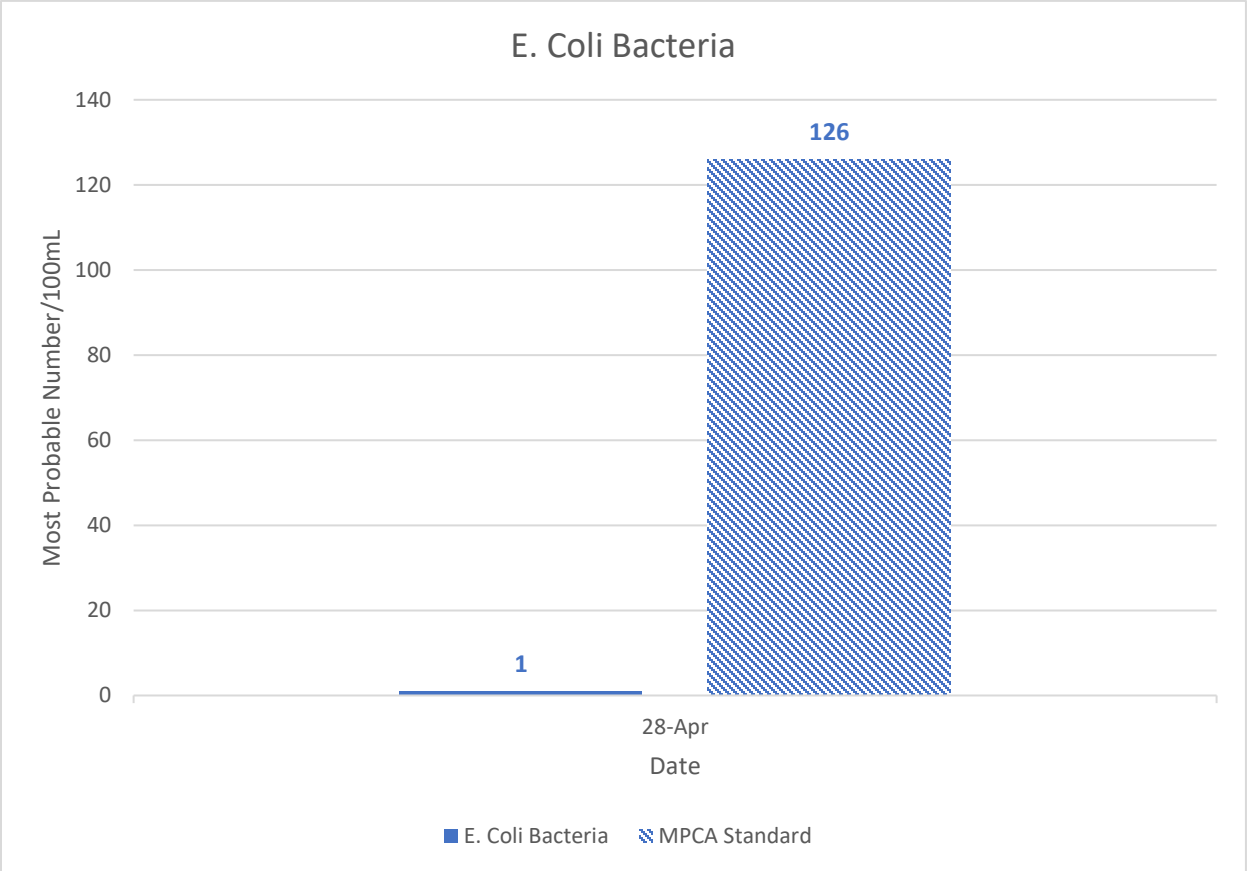


Figure 102. E. Coli Bacteria samples collected at S002-004.

b) S001-060: Located just north of McCauleyville along County Highway 1, about 1.5 miles upstream of the outlet of Whiskey Creek.

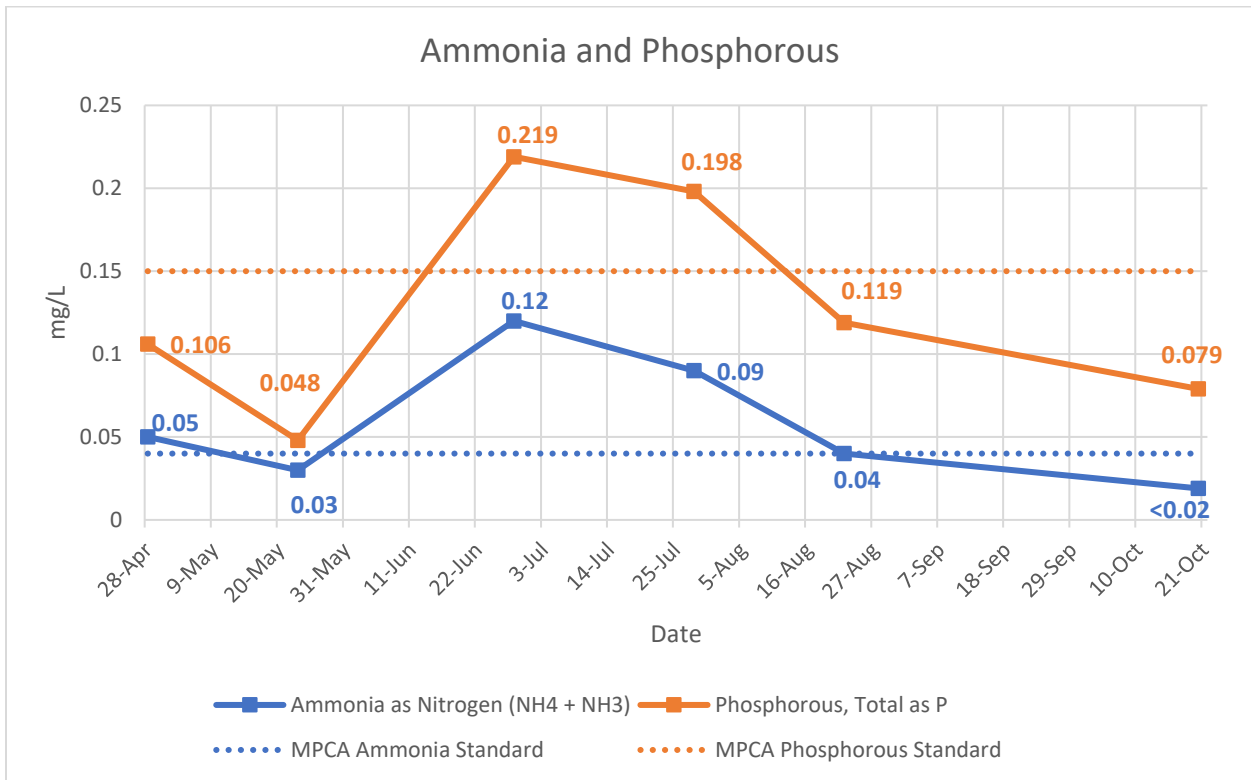


Figure 103. Ammonia and Phosphorous samples collected at S001-060.

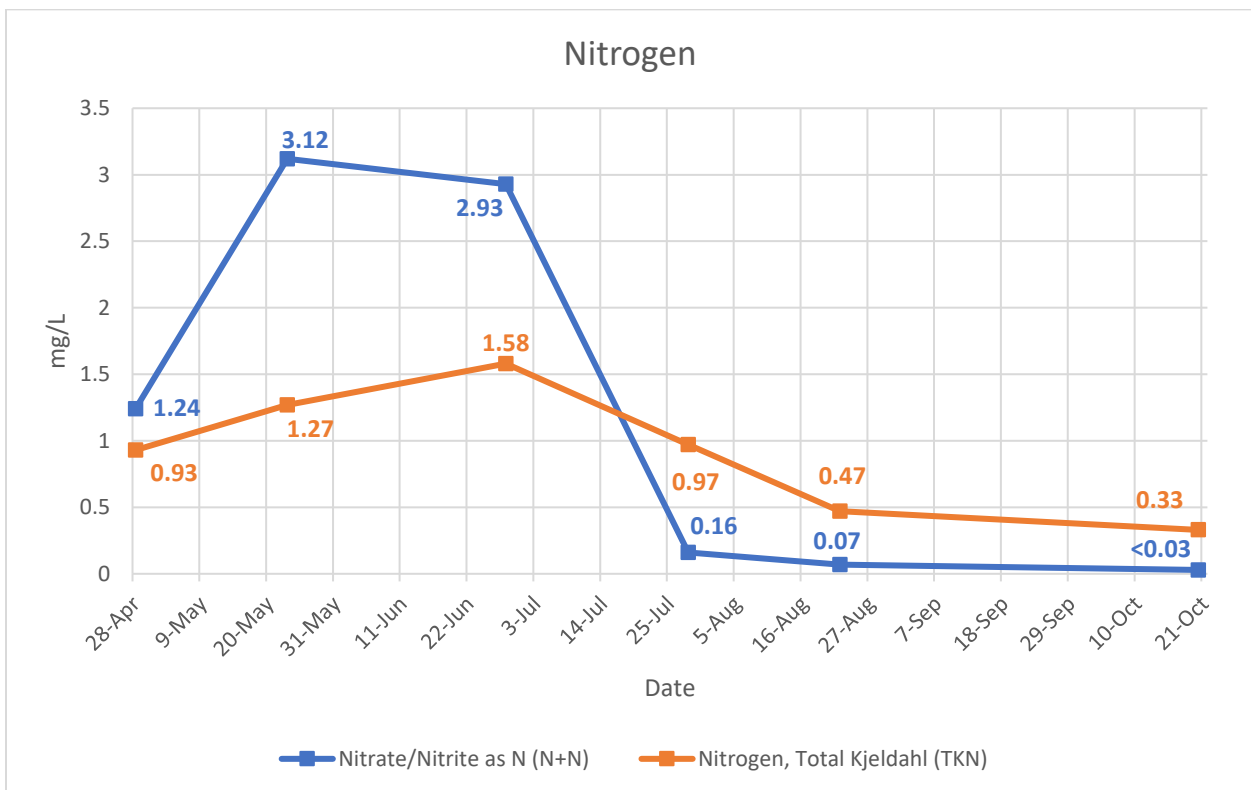


Figure 104. Nitrogen samples collected at S001-060 (MPCA and EPA standards are 10 mg/L).

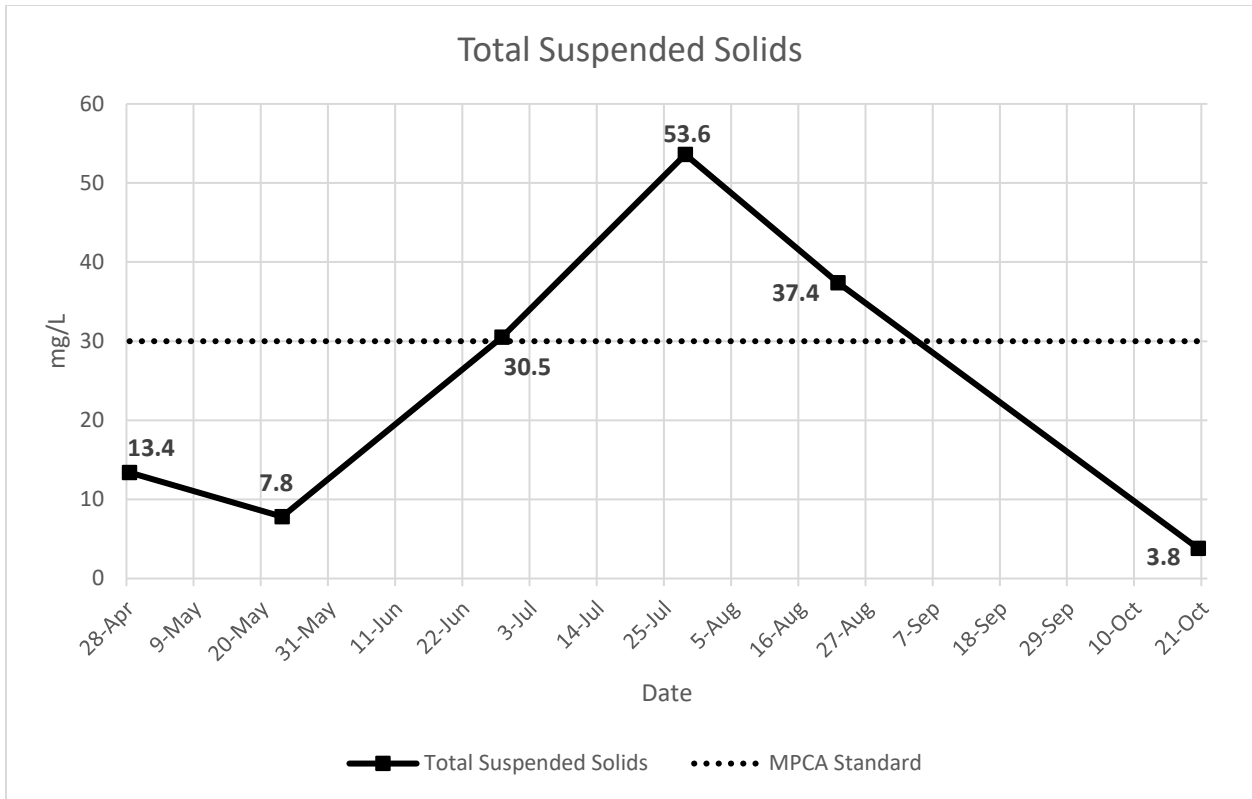


Figure 105. Total Suspended Solids samples collected at S001-060.

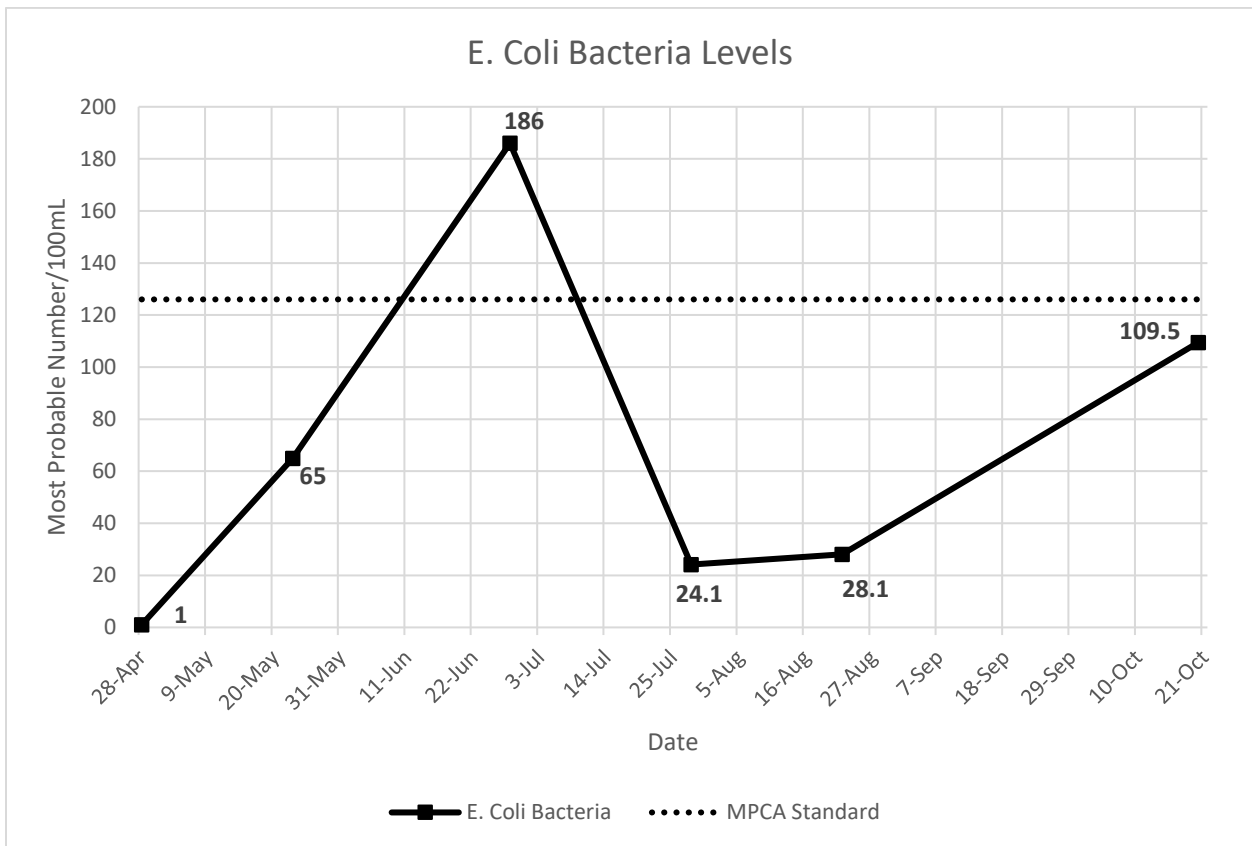


Figure 106. E. Coli Bacteria samples collected at S001-060.

8. Becker County Ditch No. 15

Becker County Ditch No. 15 is one of BRRWD's most unique ditch systems with many different branches. The ditch spans nearly 10 miles north to south, and 5.5 miles east to west in between Lake Park, Audubon, and Callaway. There is only one sampling station located on Becker County Ditch No. 15, which is in the Mainstem planning region.

- a) S005-135: Located where the ditch runs underneath 170th Ave, just over one mile before outletting into the Buffalo River. This station was only sampled twice in 2022 on May 19 and June 27.

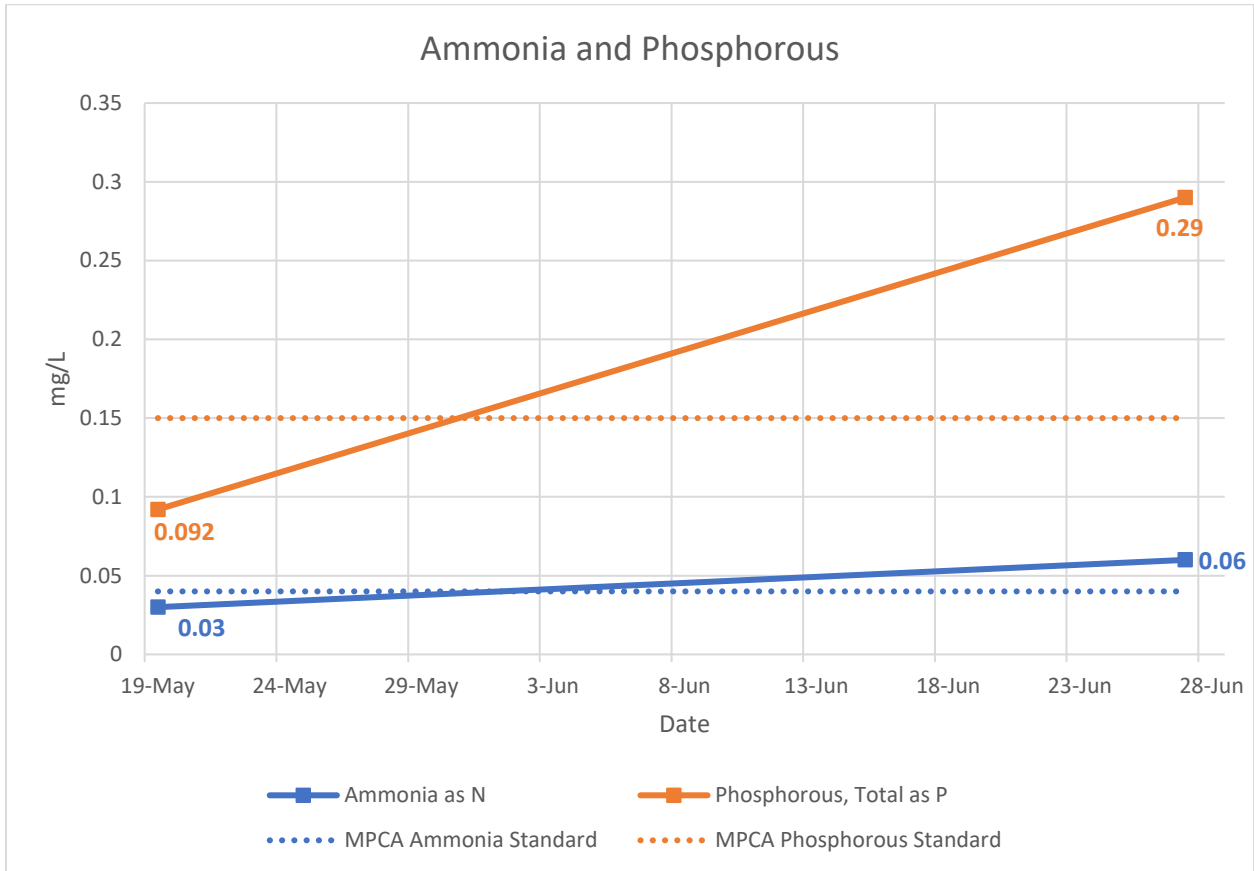


Figure 107. Ammonia and Phosphorous samples collected at S005-135.

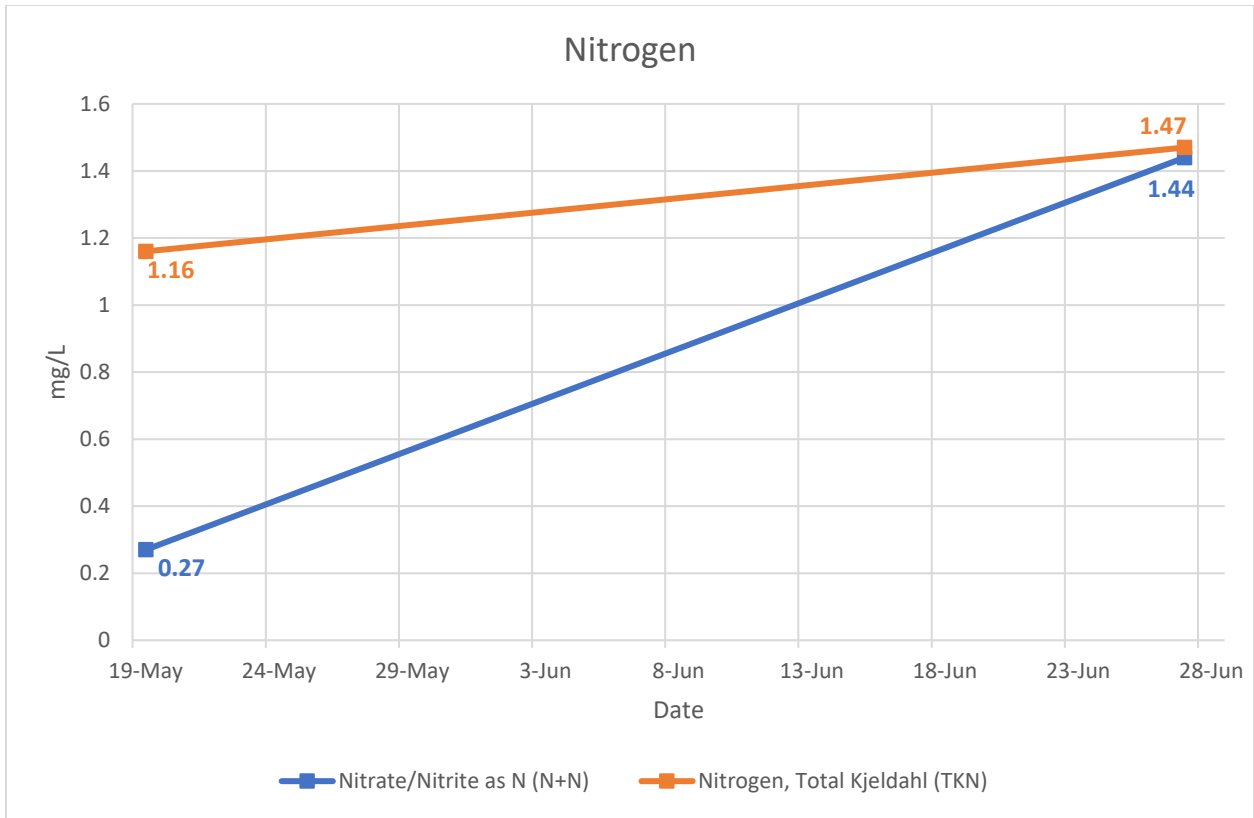


Figure 108. Nitrogen samples collected at S005-135 (MPCA and EPA standards are 10 mg/L).

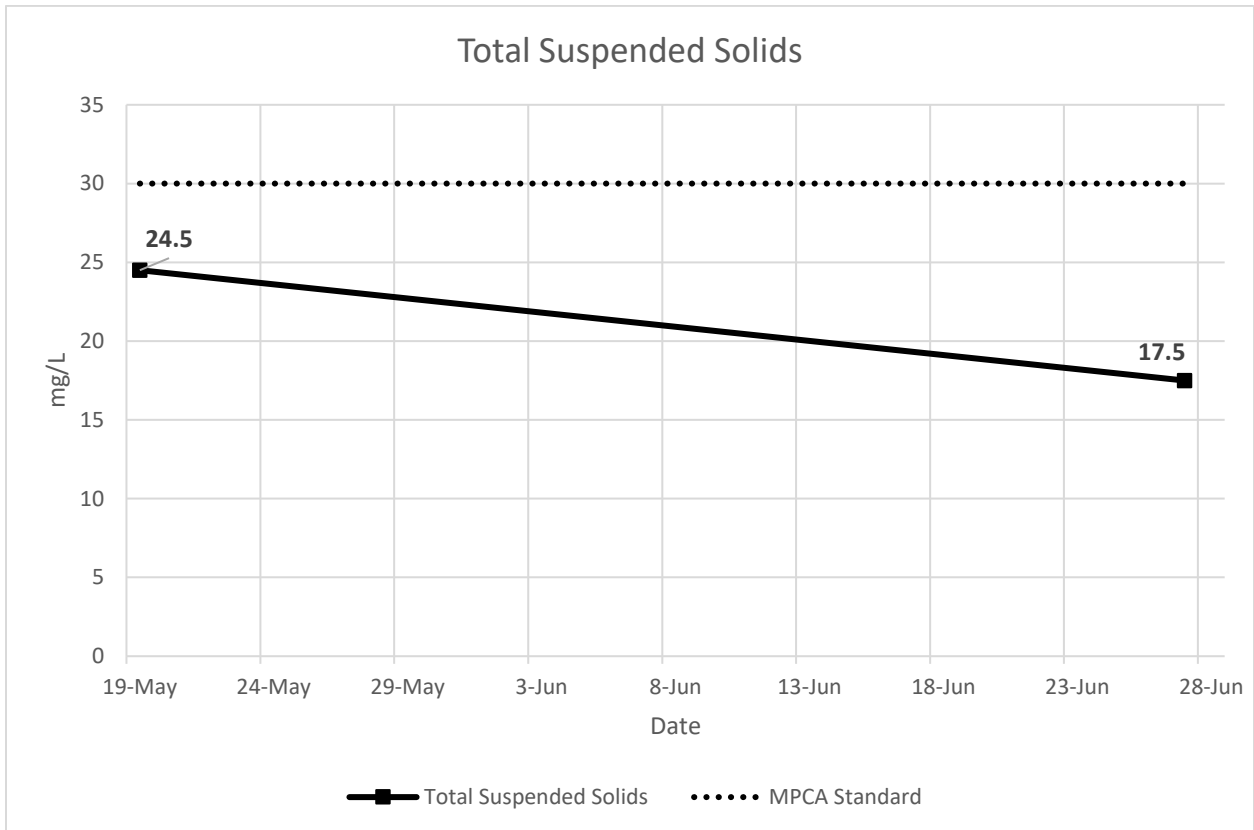


Figure 109. Total Suspended Solids samples collected at S005-135.

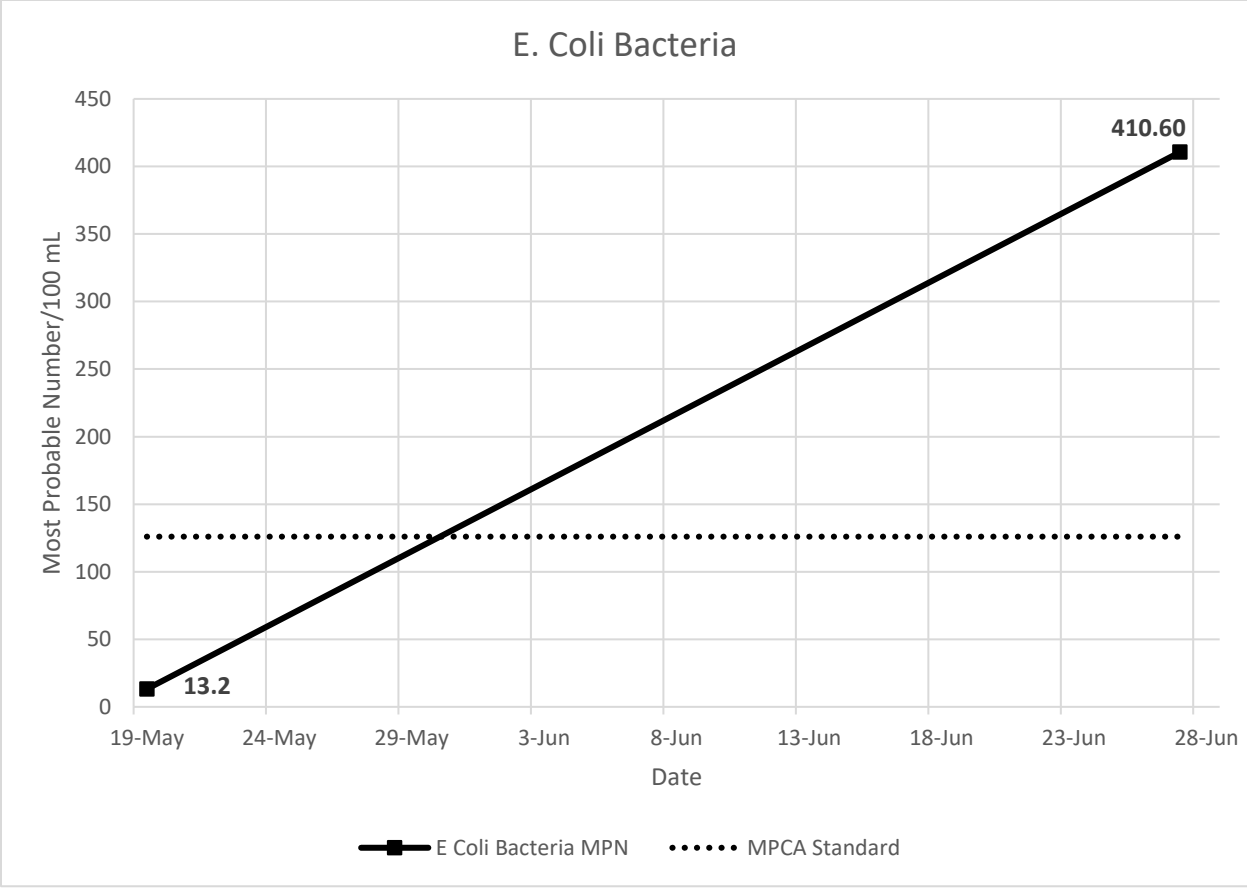


Figure 110. E. Coli Bacteria samples collected at S005-135.

9. Blue Eagle Lake

Blue Eagle Lake is a small man-made lake in Barnesville. The lake is roughly 9 acres and receives flow from Whisky Creek through a sediment pond that separates the two bodies of water. Blue Eagle Lake is in the Central planning region.

- a) 14-0093-00-201: Samples were taken from Blue Eagle Lake six times between May 18 and October 31 in 2022.

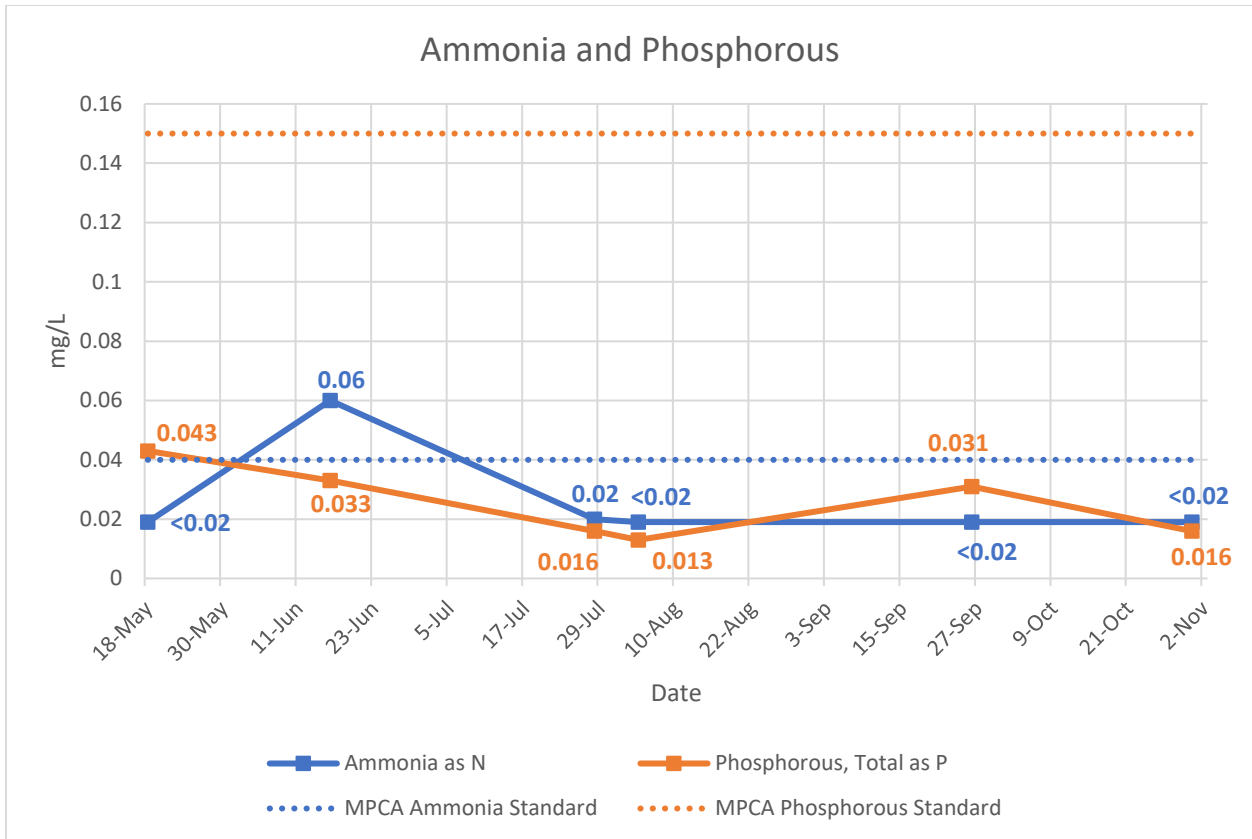


Figure 111. Ammonia and Phosphorous samples collected at 14-0093-00-201.

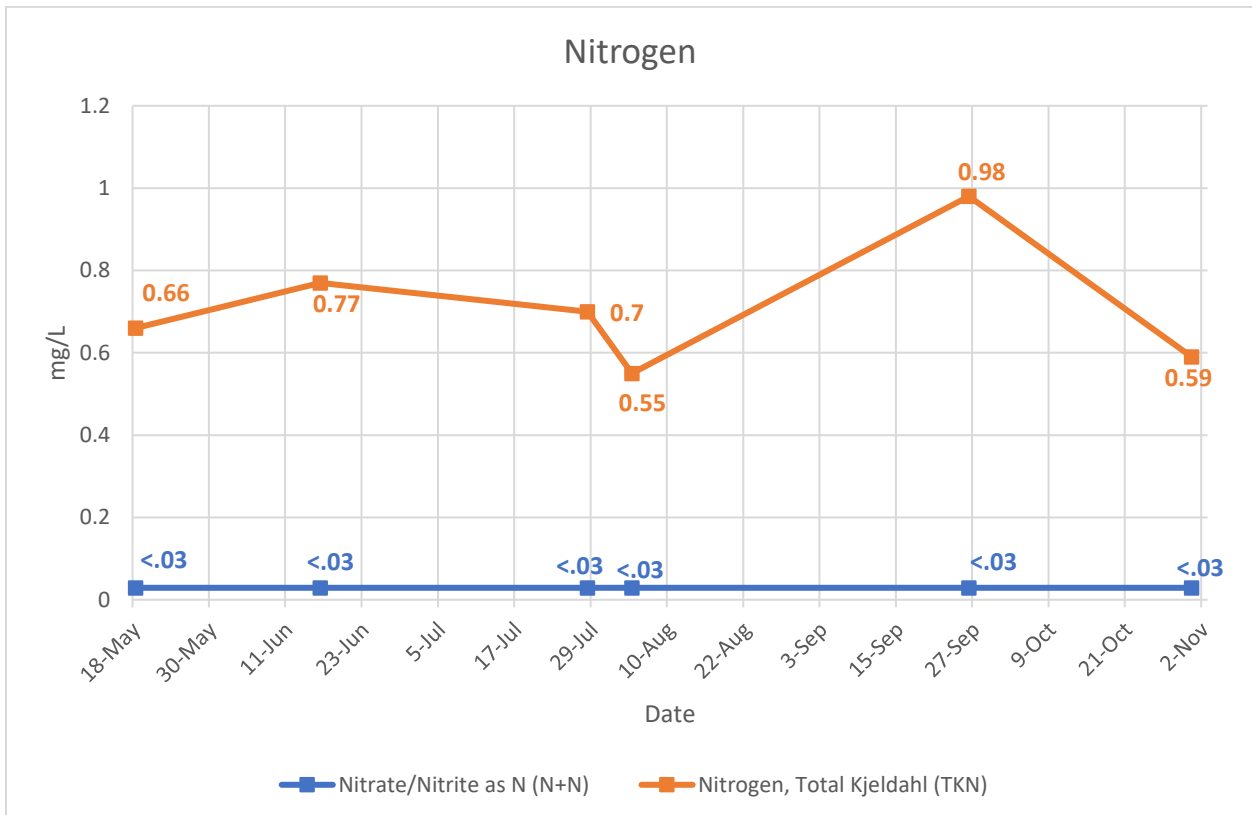


Figure 112. Nitrogen samples collected at 14-0093-00-201 (MPCA and EPA standards are 10 mg/L).

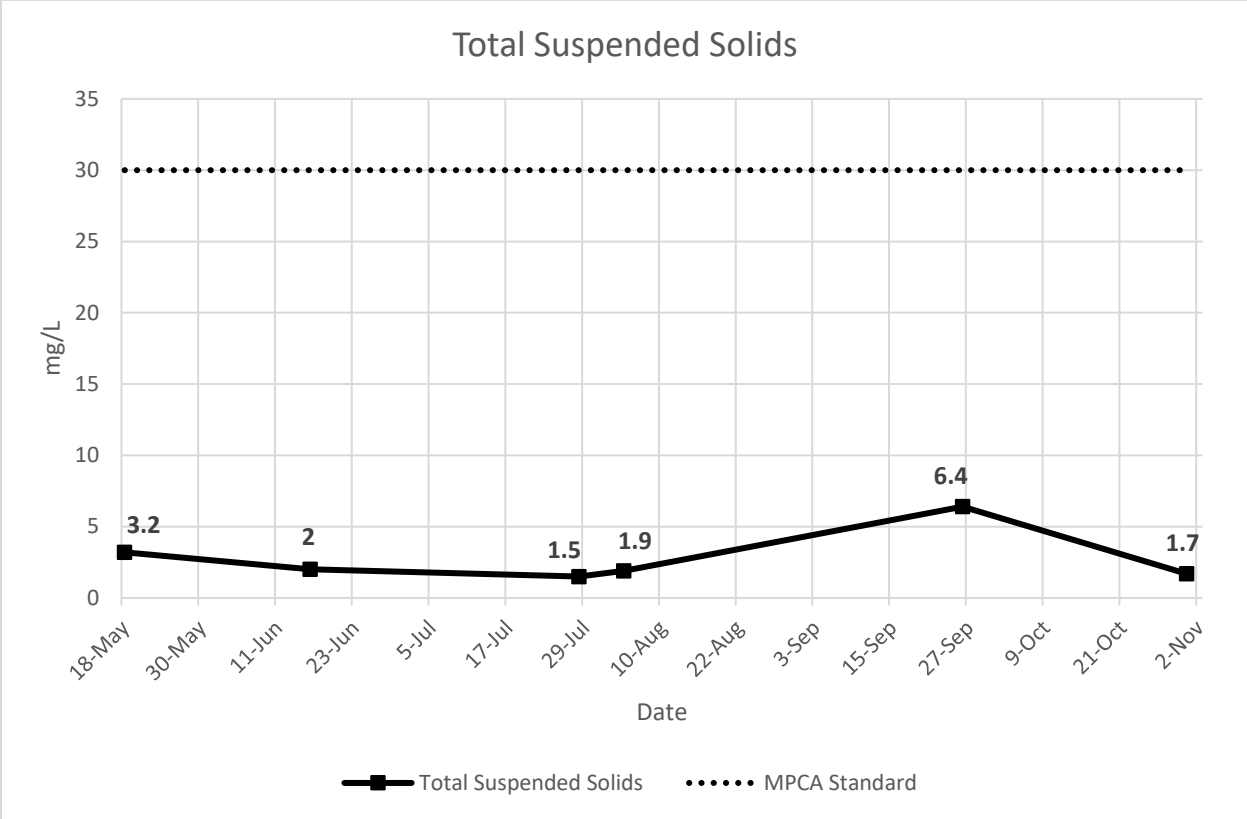


Figure 113. Total Suspended Solids samples collected at 14-0093-00-201.

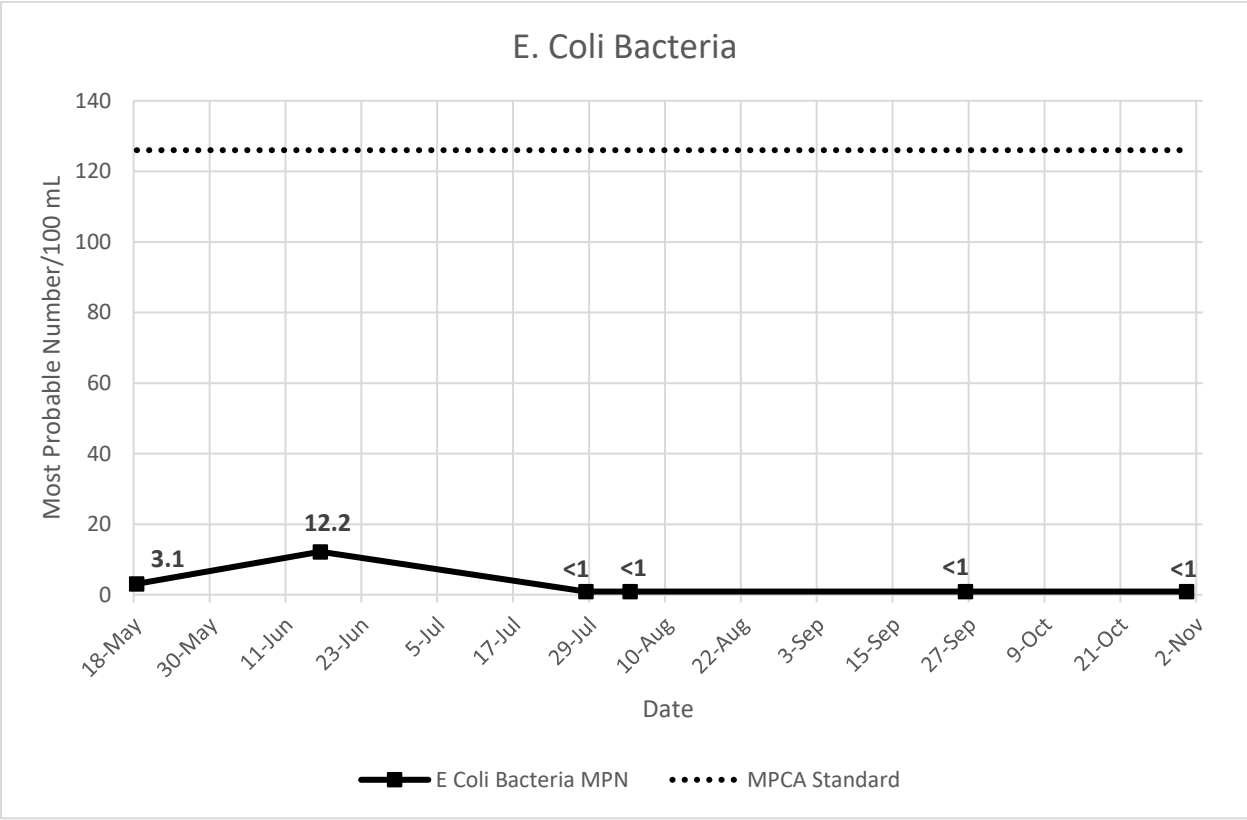


Figure 114. E. Coli Bacteria samples collected at 14-0093-00-201.

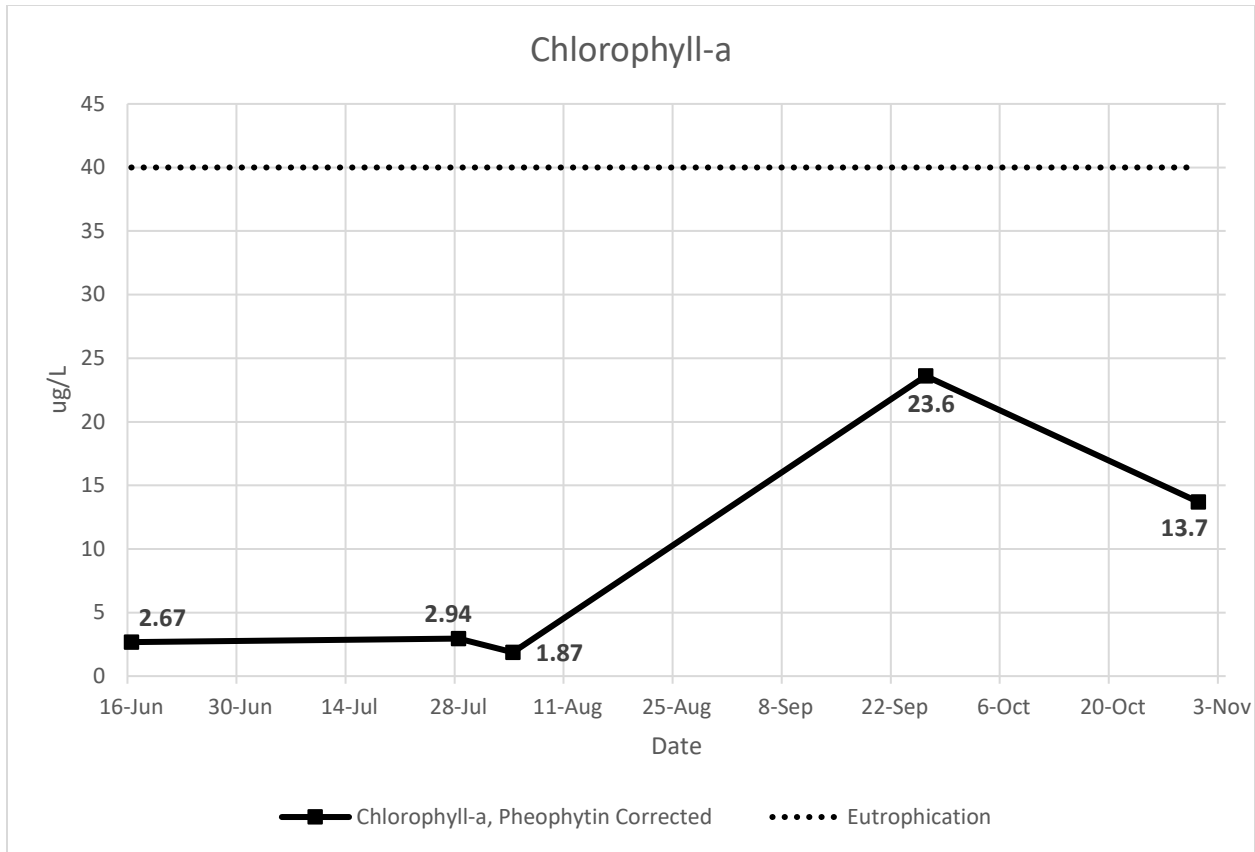


Figure 115. Chlorophyll-a samples collected at 14-0093-00-201.

10. Deerhorn Creek

Starting in Section 21, Norwegian Grove Township, Deerhorn Creek meanders mostly west through Prairie View and Atherton Townships prior to outletting into the South Branch Buffalo River in Section 20, Atherton Township.

- a) S003-151: This is the only station along Deerhorn Creek and is located nearly at the outlet of the creek between Sections 20 and 21, Atherton Township in the Southern planning region.

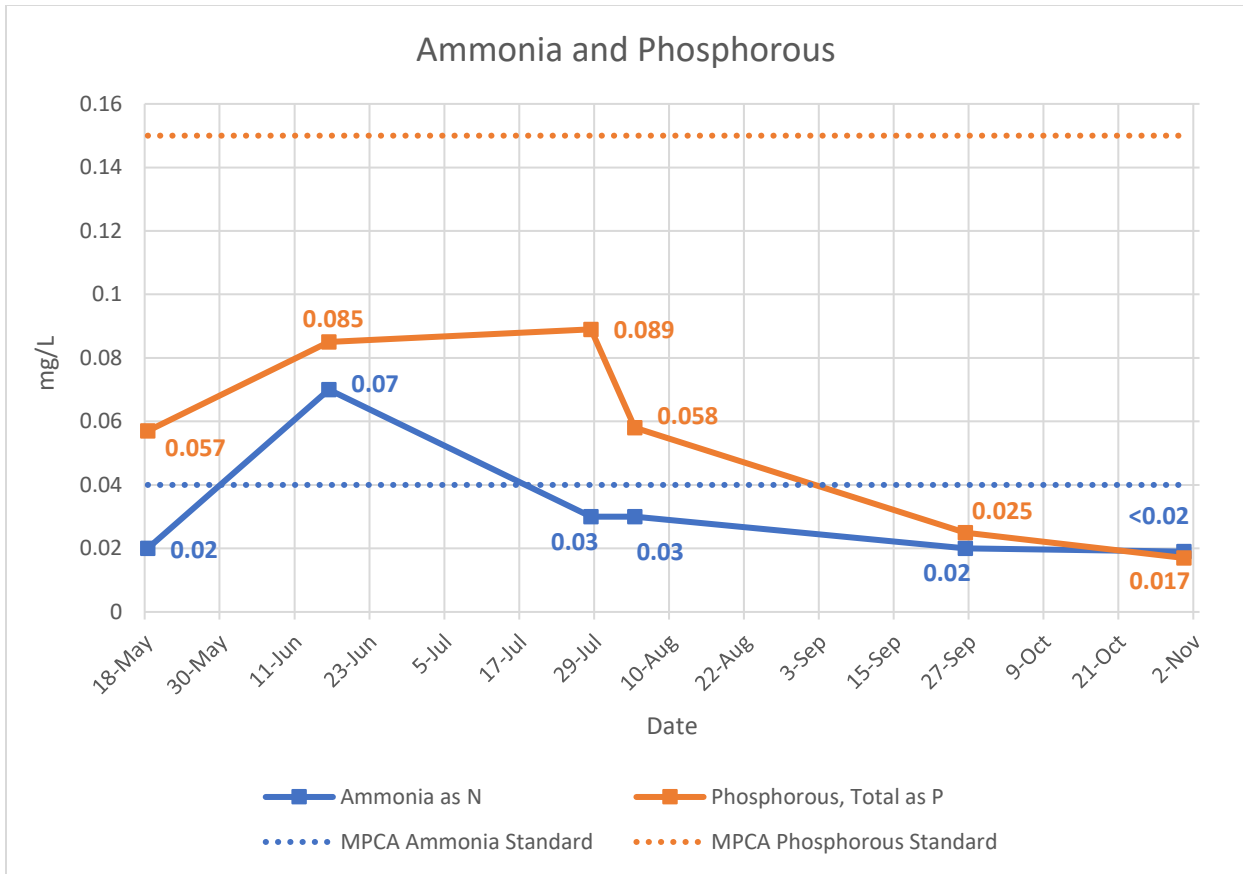


Figure 116. Ammonia and Phosphorous samples collected at S003-151.

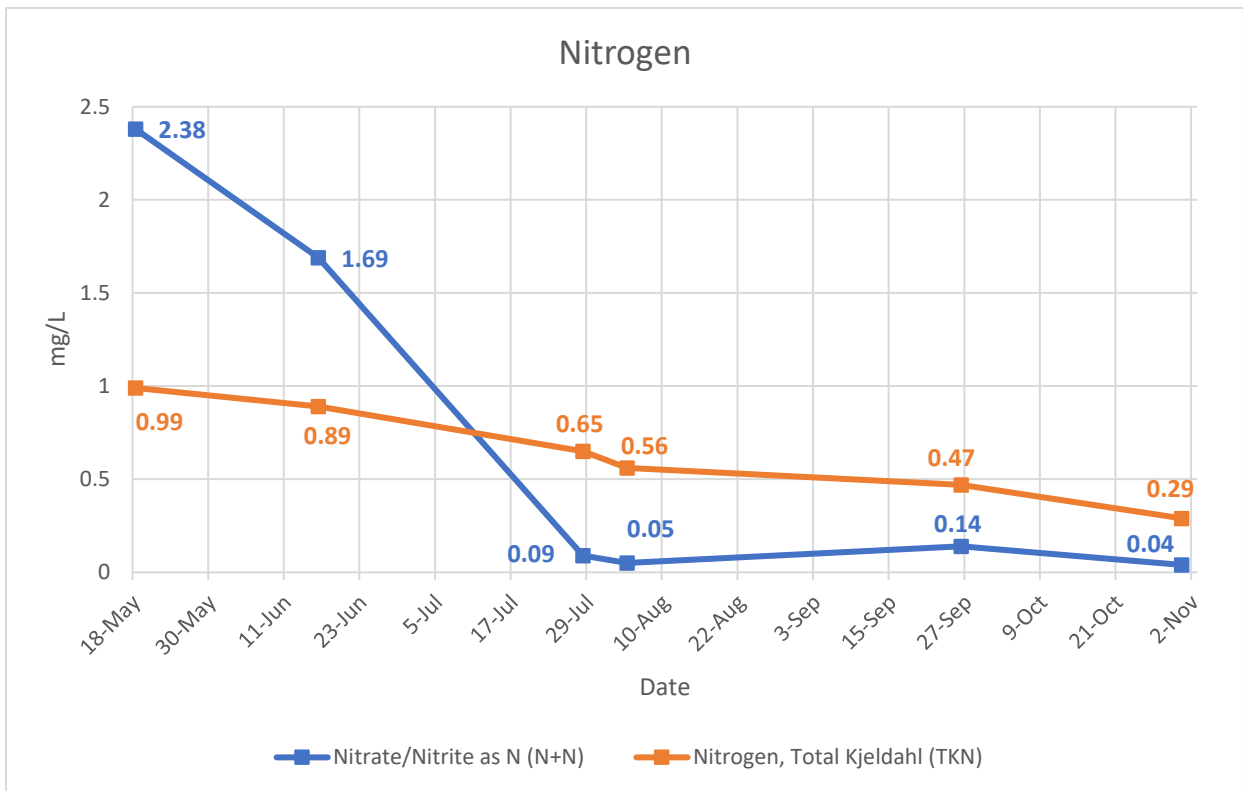


Figure 117. Nitrogen samples collected at S003-151 (MPCA and EPA standards are 10 mg/L).

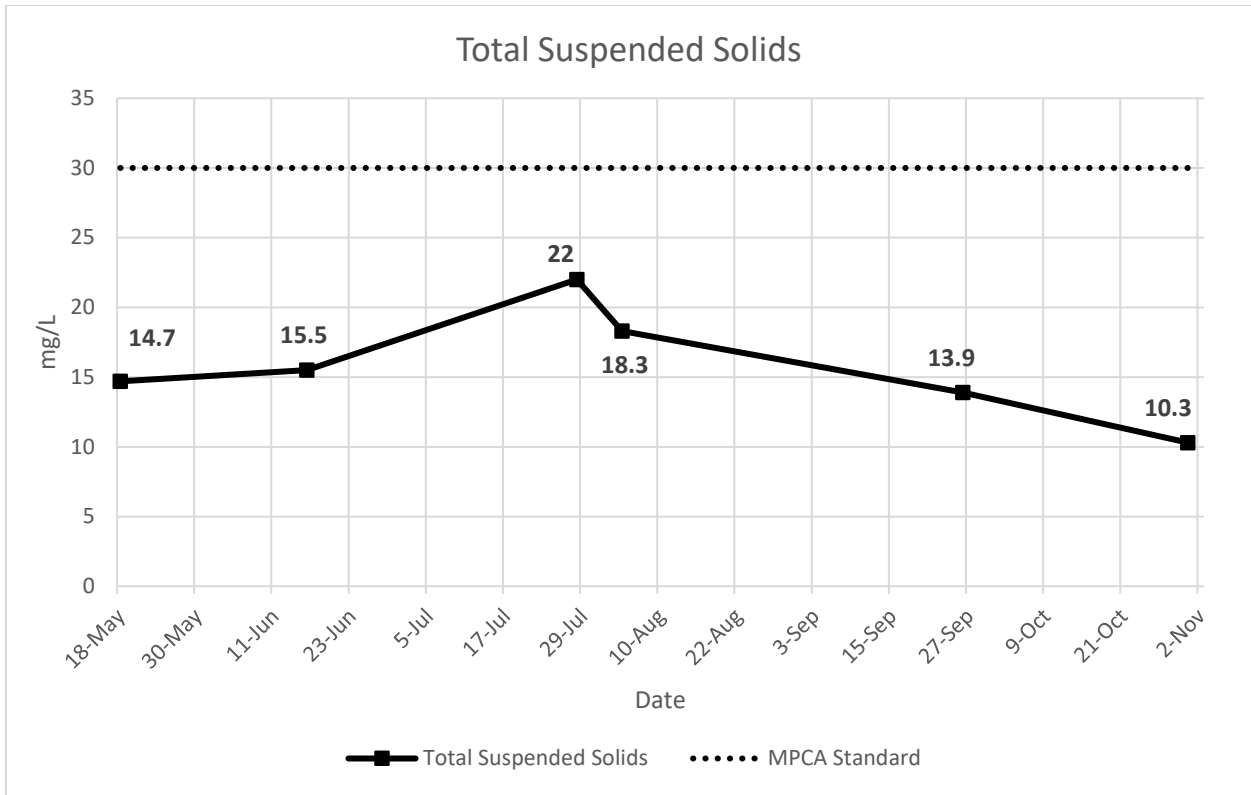


Figure 118. Total Suspended Solids samples collected at S003-151.

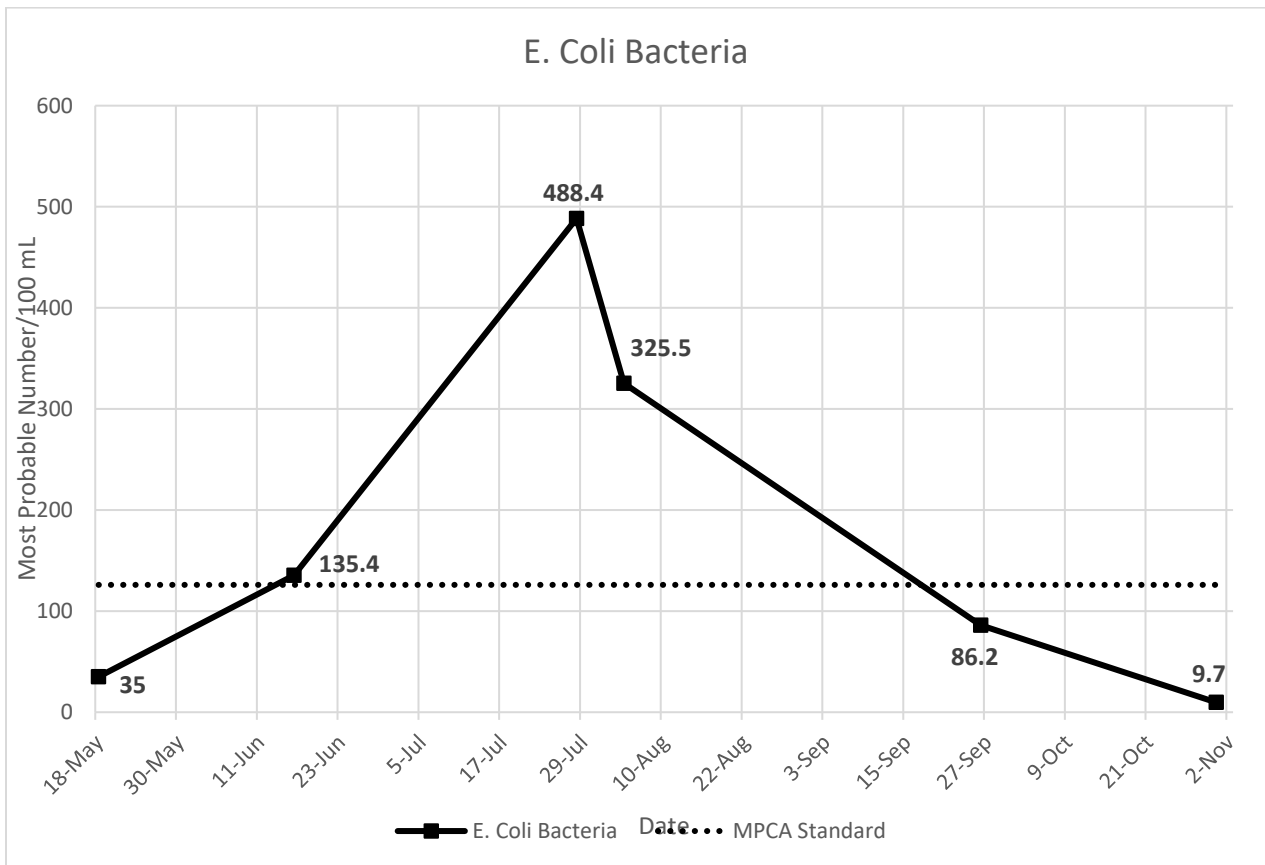


Figure 119. E. Coli Bacteria samples collected at S003-151.

11. Unnamed Creek

This unnamed creek starts in Atherton Township and runs northwest until it connects with Whisky Creek/Clay County Ditch No. 34. This small creek has several arms and receives drainage from Clay County Ditch No. 54.

- a) S005-592: Located between Sections 14 and 23, Alliance Township, this station is located just under 2 miles before it connects with Whisky Creek in the Central planning region.

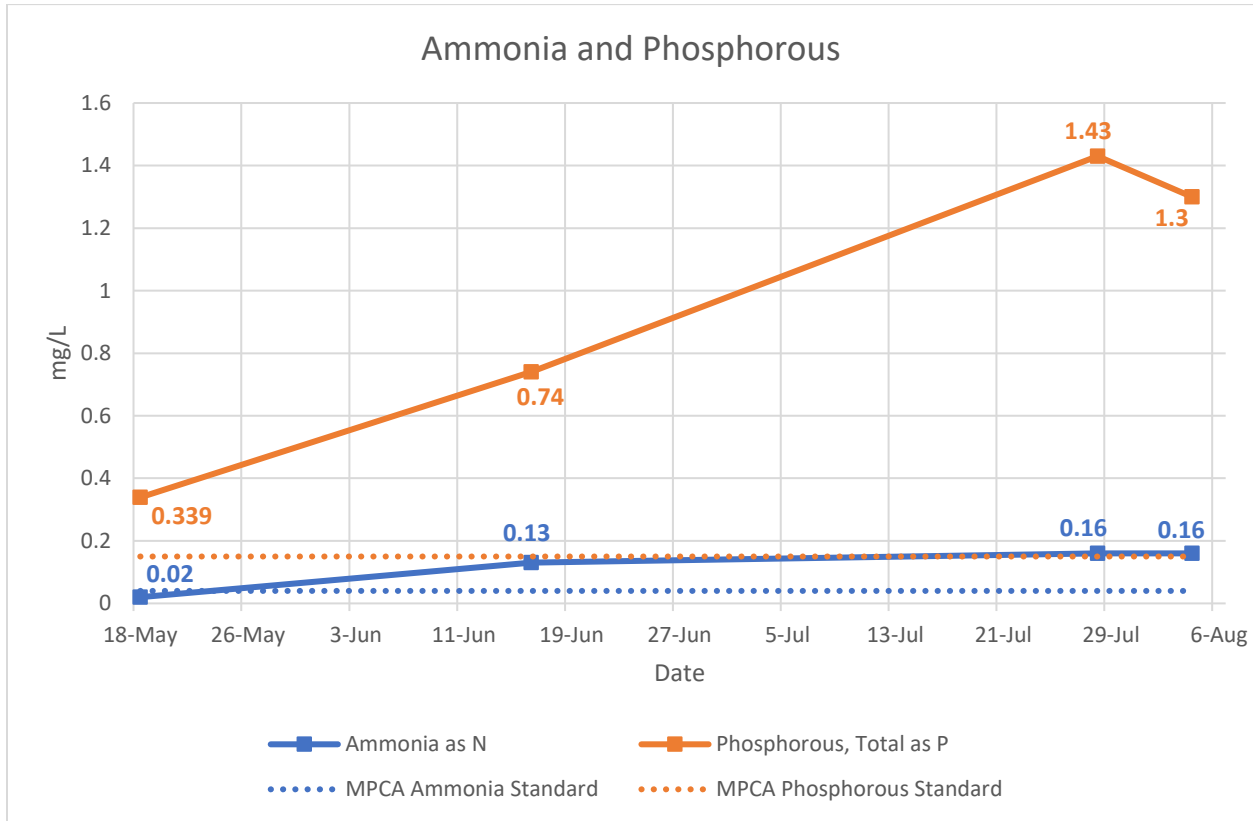


Figure 120. Ammonia and Phosphorous samples collected at S005-592.

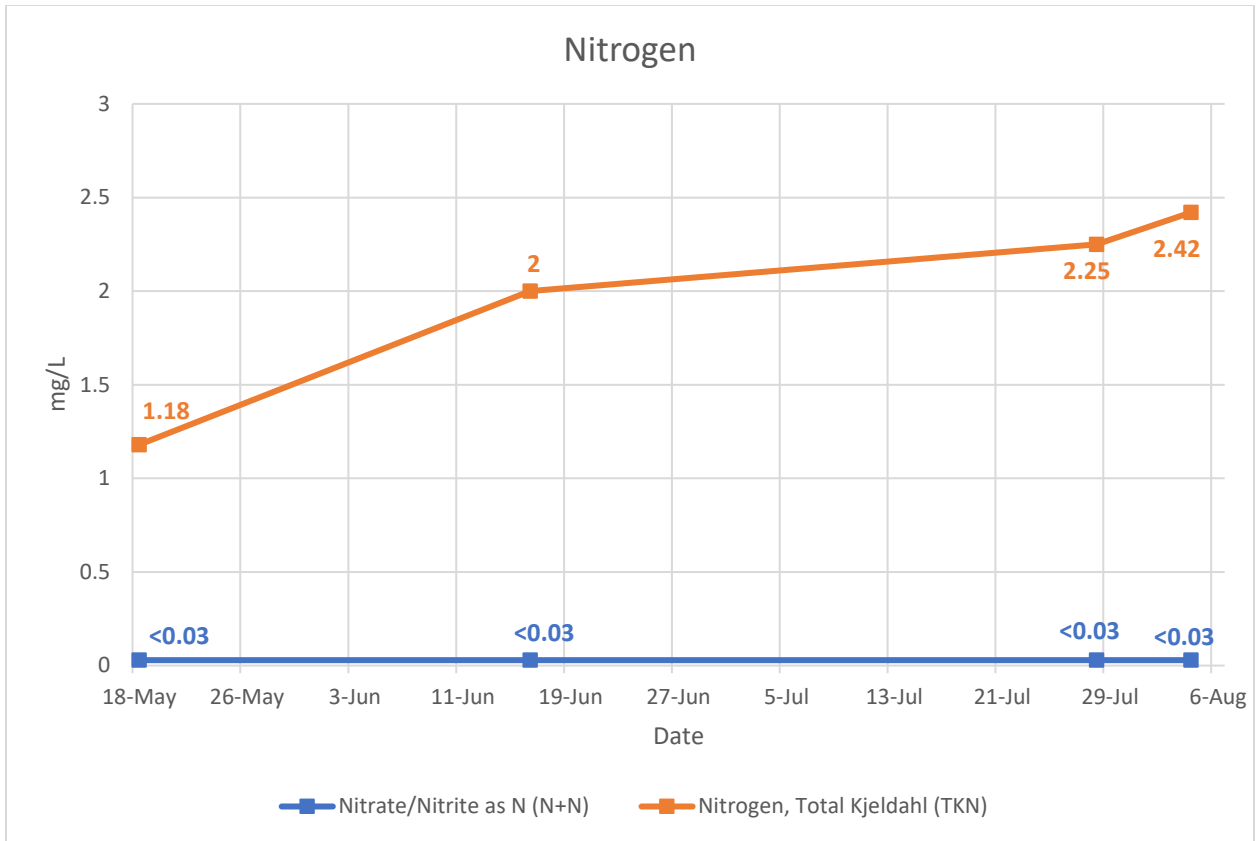


Figure 121. Nitrogen samples collected at S005-592 (MPCA and EPA standards are 10 mg/L).

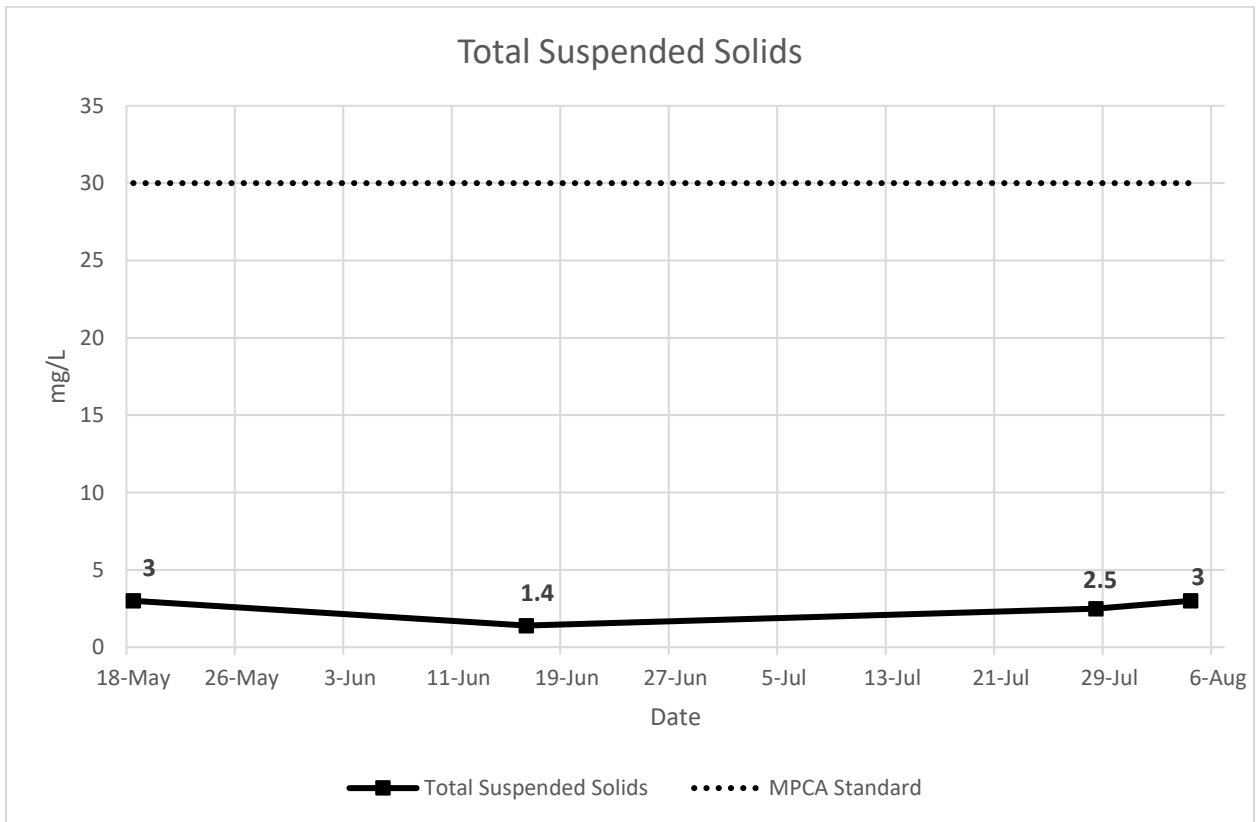


Figure 122. Total Suspended Solids samples collected at S005-592.

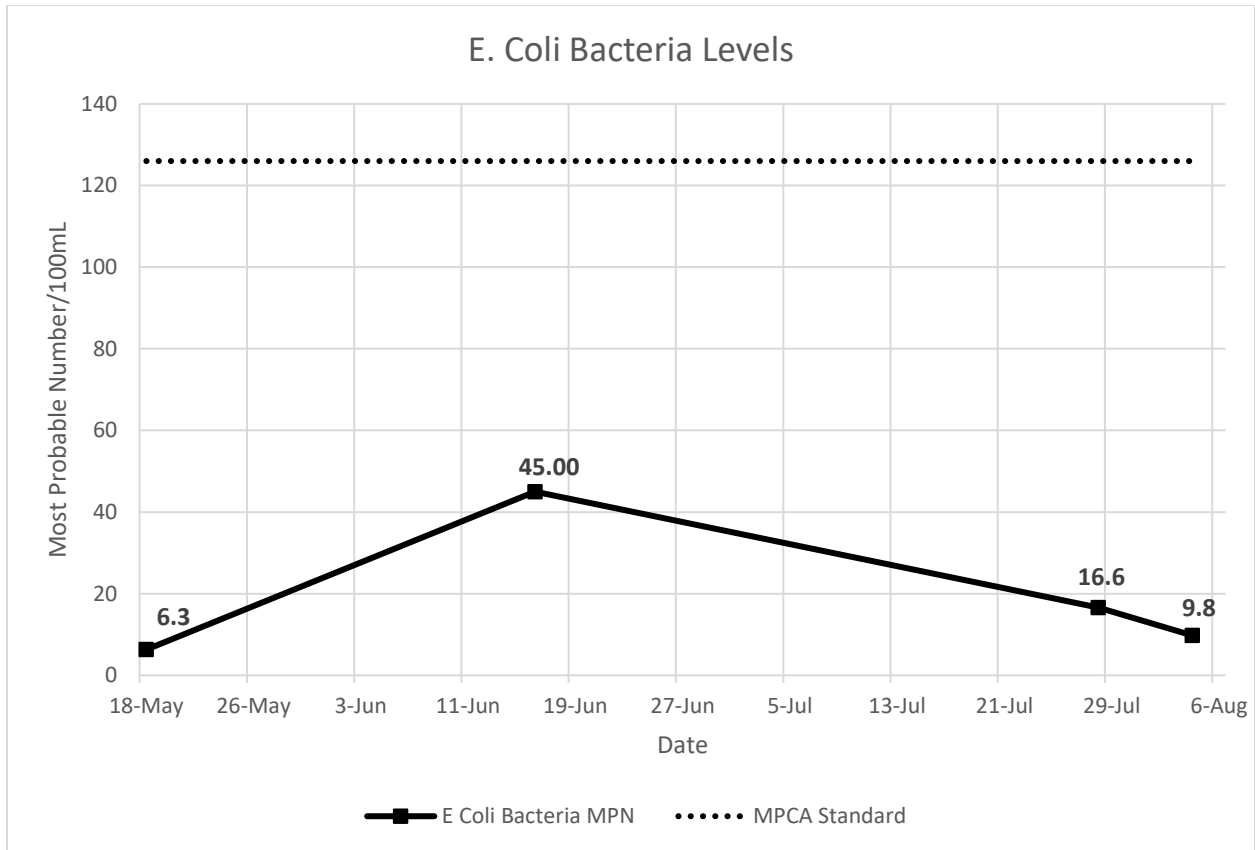


Figure 123. E. Coli Bacteria samples collected at S005-592.

12. Wilkin County Ditch No. 3

Wilkin County Ditch No. 3 is another multi-armed ditch that runs through three separate Townships in Wilkin County. Starting between Sections 15 and 16, Akron Township, water in the ditch flows mostly west/southwest through Akron, Nilsen, and Breckenridge Townships before it outlets into the Otter Tail River east of Breckenridge.

- a) S007-459: Located on the south side of State Highway 210 between Sections 1 and 2, Breckenridge Township in the Otter Tail planning region.

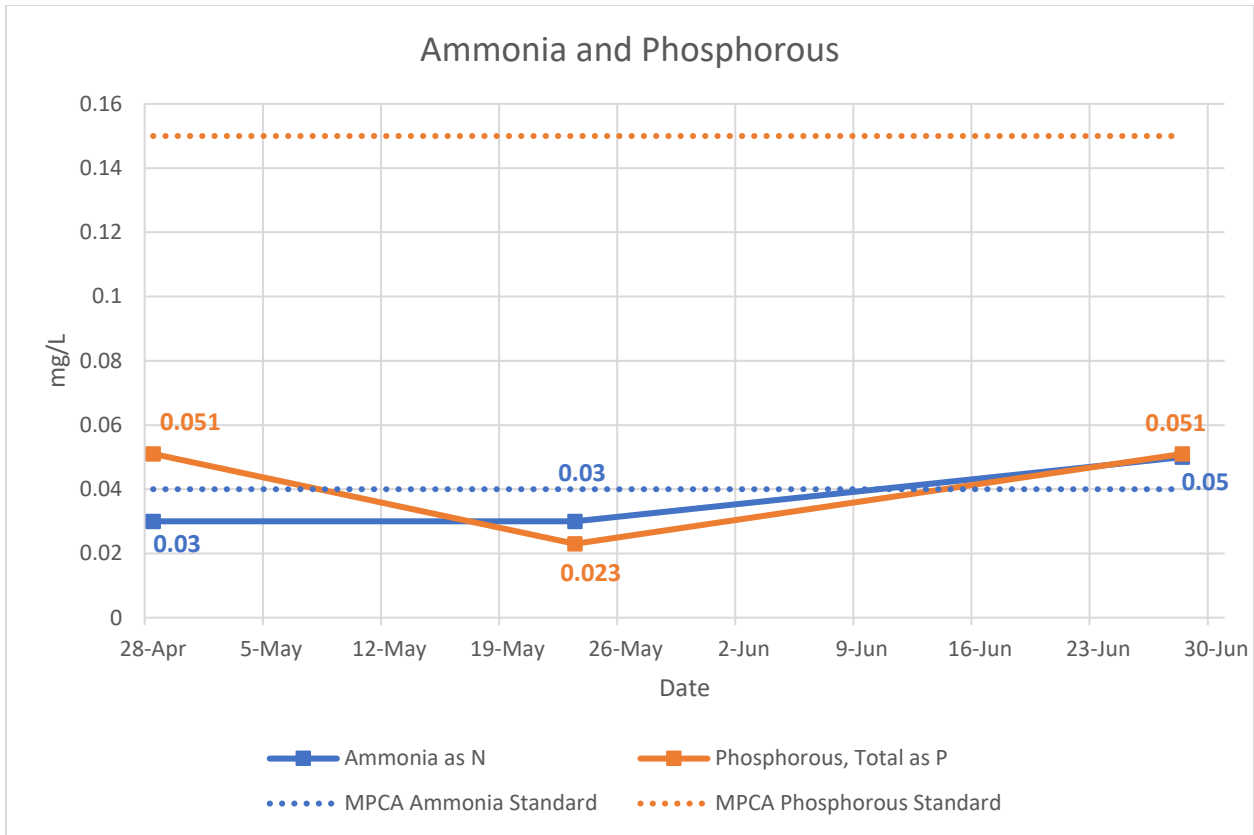


Figure 124. Ammonia and Phosphorous samples collected at S007-459.

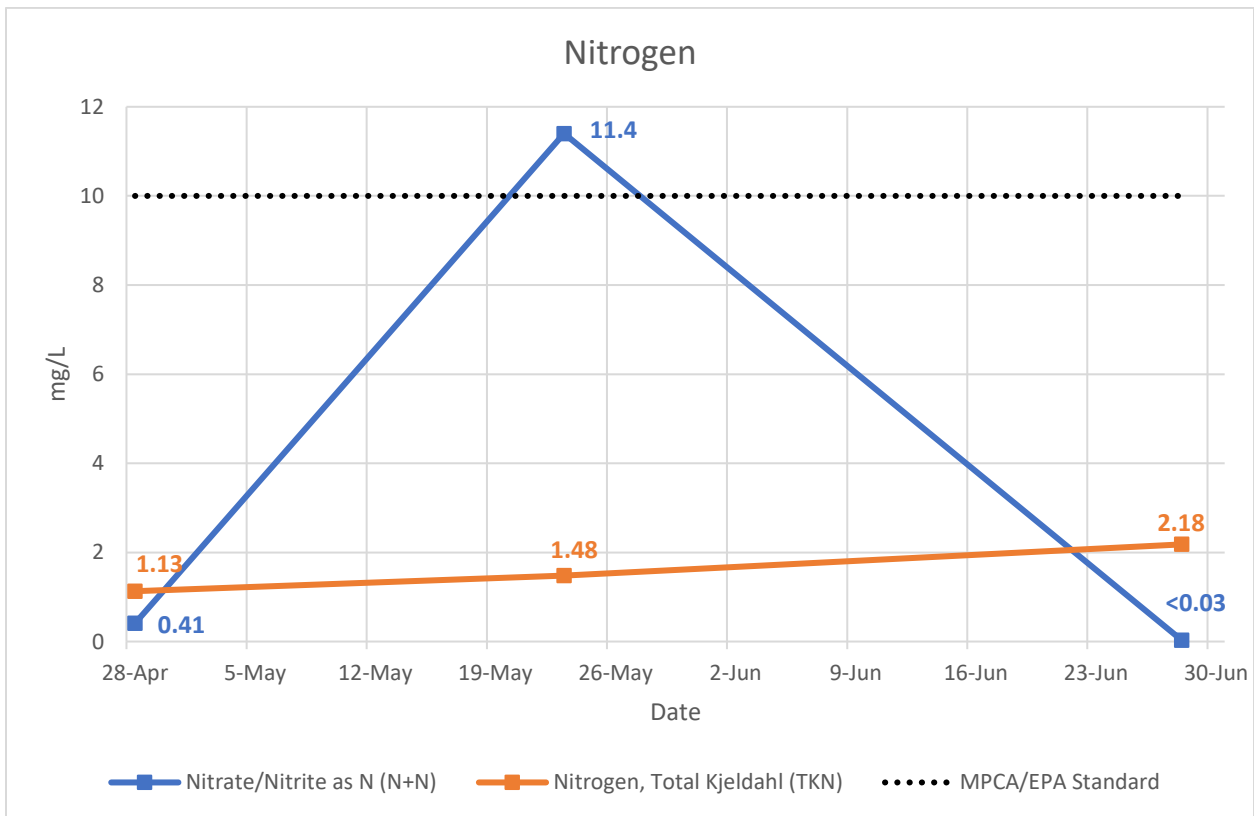


Figure 125. Nitrogen samples collected at S007-459.

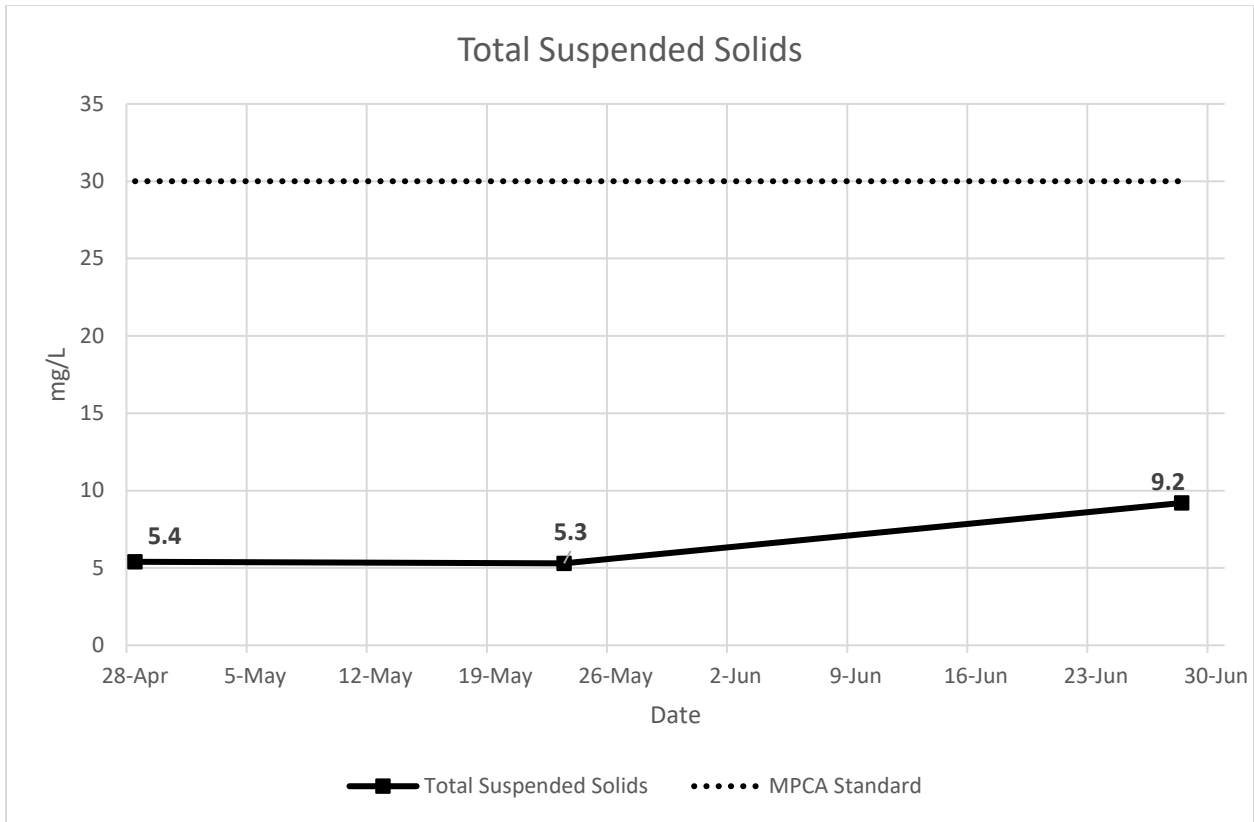


Figure 126. Total Suspended Solids samples collected at S007-459.

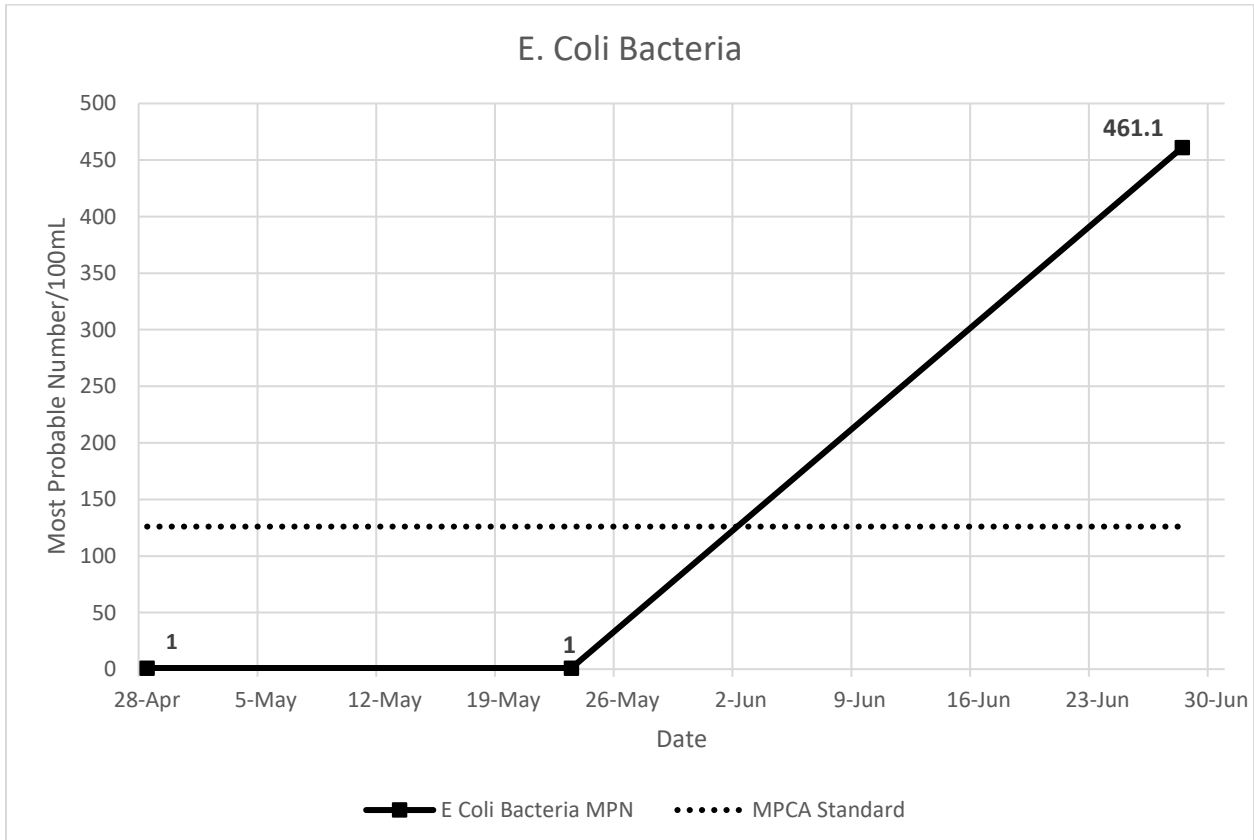


Figure 127. E. Coli samples collected at S007-459.

13. Wilkin-Otter Tail Judicial Ditch No. 2

Judicial Ditch No. 2 is a south flowing ditch, starting in Section 1, Andrea Township, Clay County and outlets into the Otter Tail River in Section 30, Orwell Township.

- a) S007-460: Located at approximately the halfway point of the ditch, as JD2 runs underneath State Highway 210, east of Foxhome. This station is within the Otter Tail planning region.

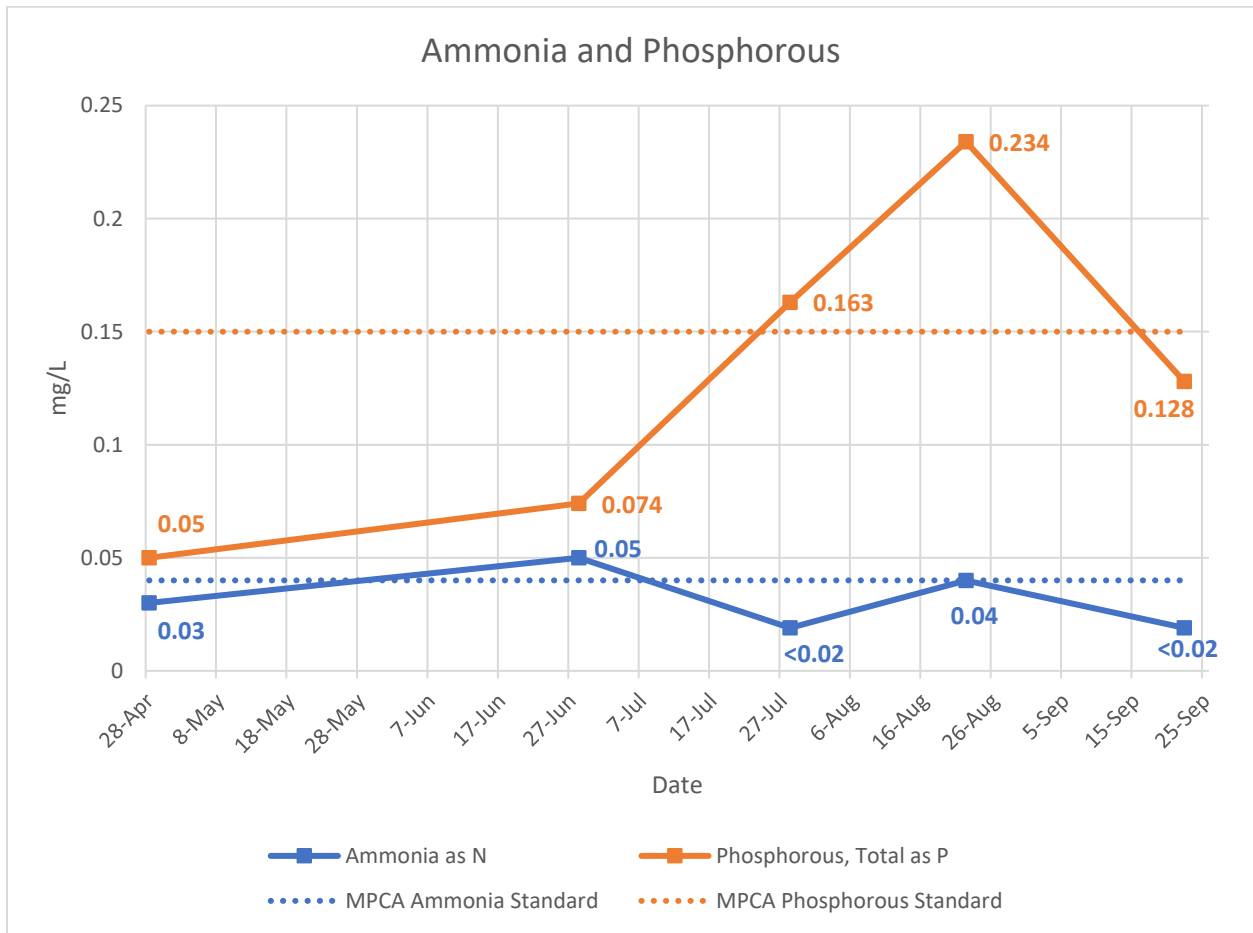


Figure 128. Ammonia and Phosphorous samples collected at S007-460.

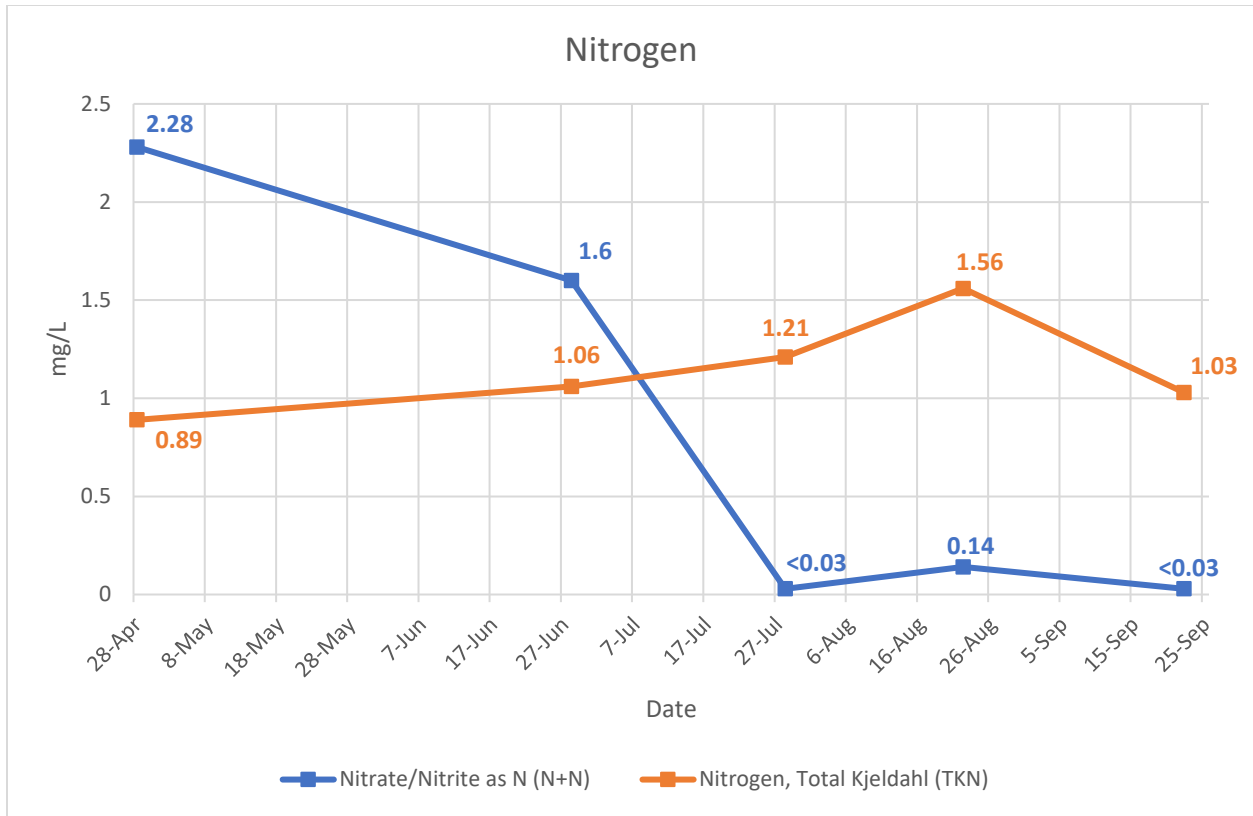


Figure 129. Nitrogen samples collected at S007-460 (MPCA and EPA standards are 10 mg/L).

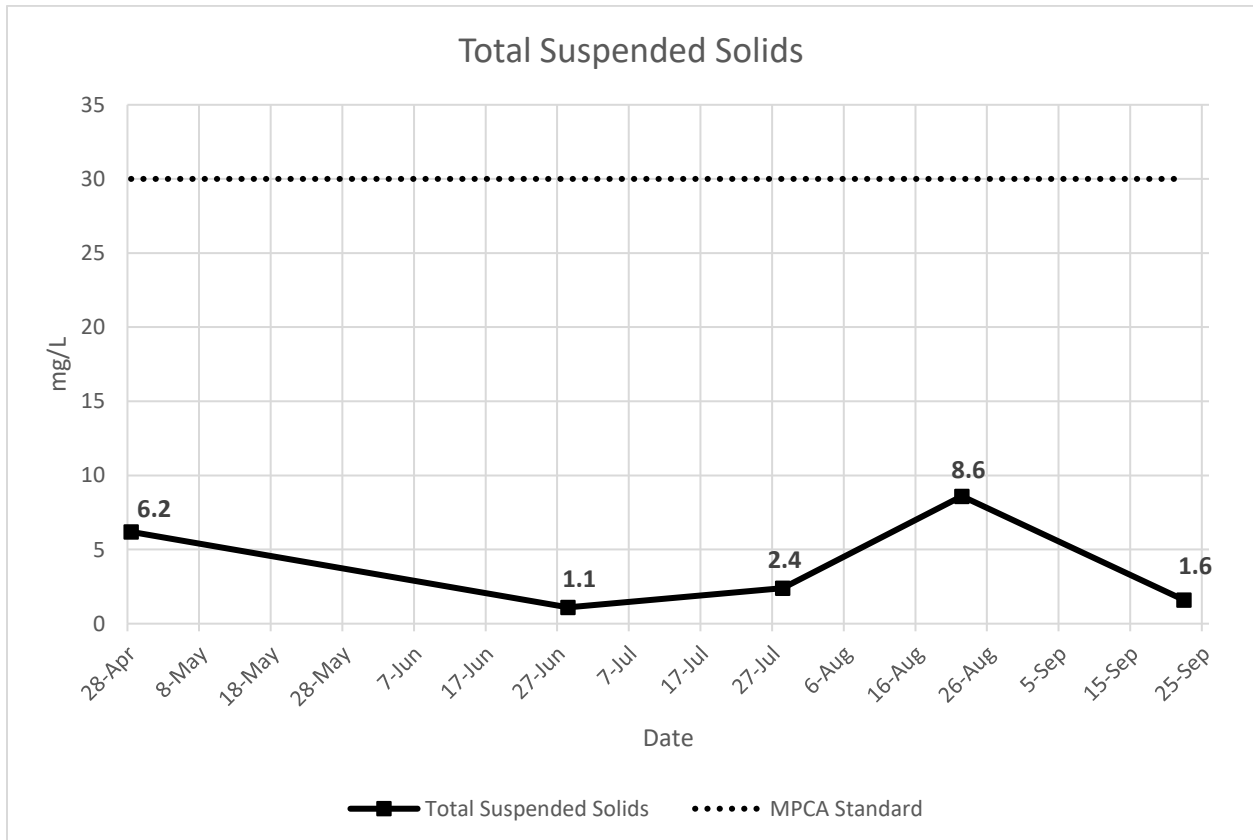


Figure 130. Total Suspended Solids samples collected at S007-460.

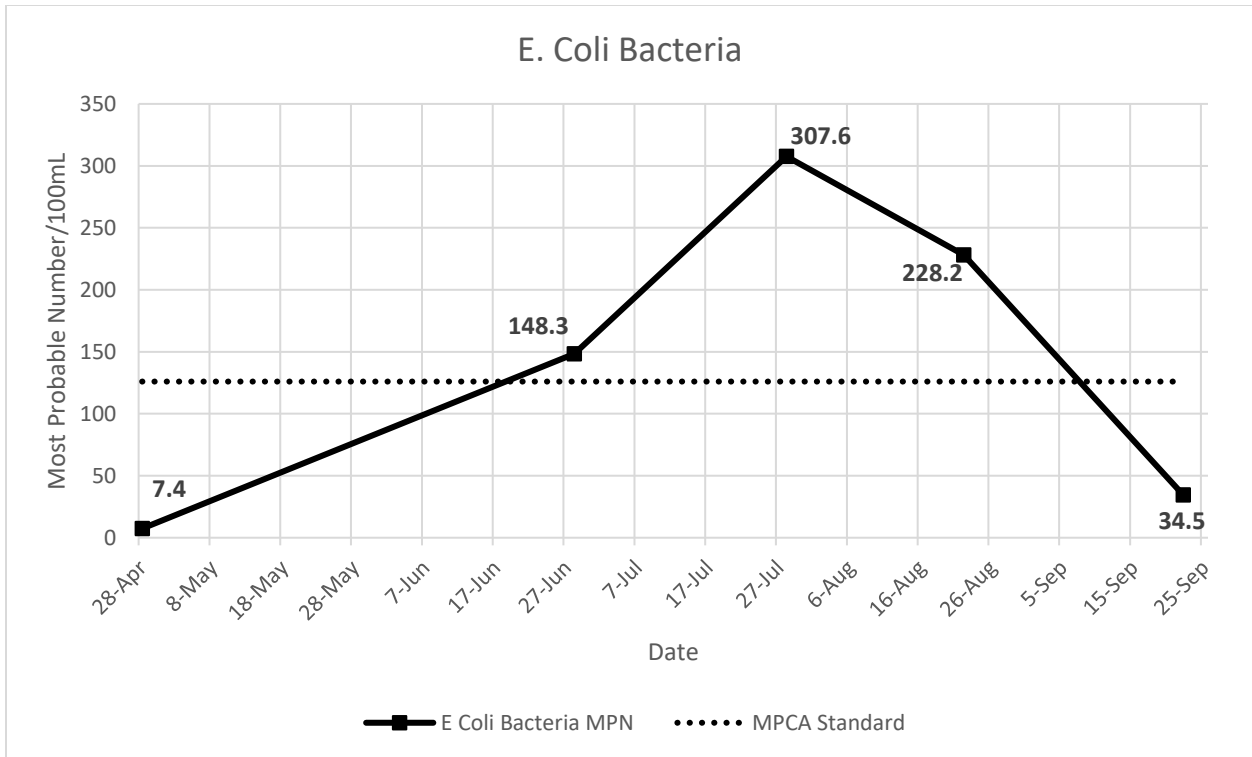


Figure 131. E. Coli Bacteria samples collected at S007-460.

14. Wilkin County Ditch No. 31

Wilkin County Ditch No. 31 is a mostly straight ditch starting in Andrea Township, moving west through Nilsen and Connelly Townships before outletting into the Red River.

- a) S007-461: Located along Highway 75 in Section 21, Connelly Township in the Upper Red planning region.

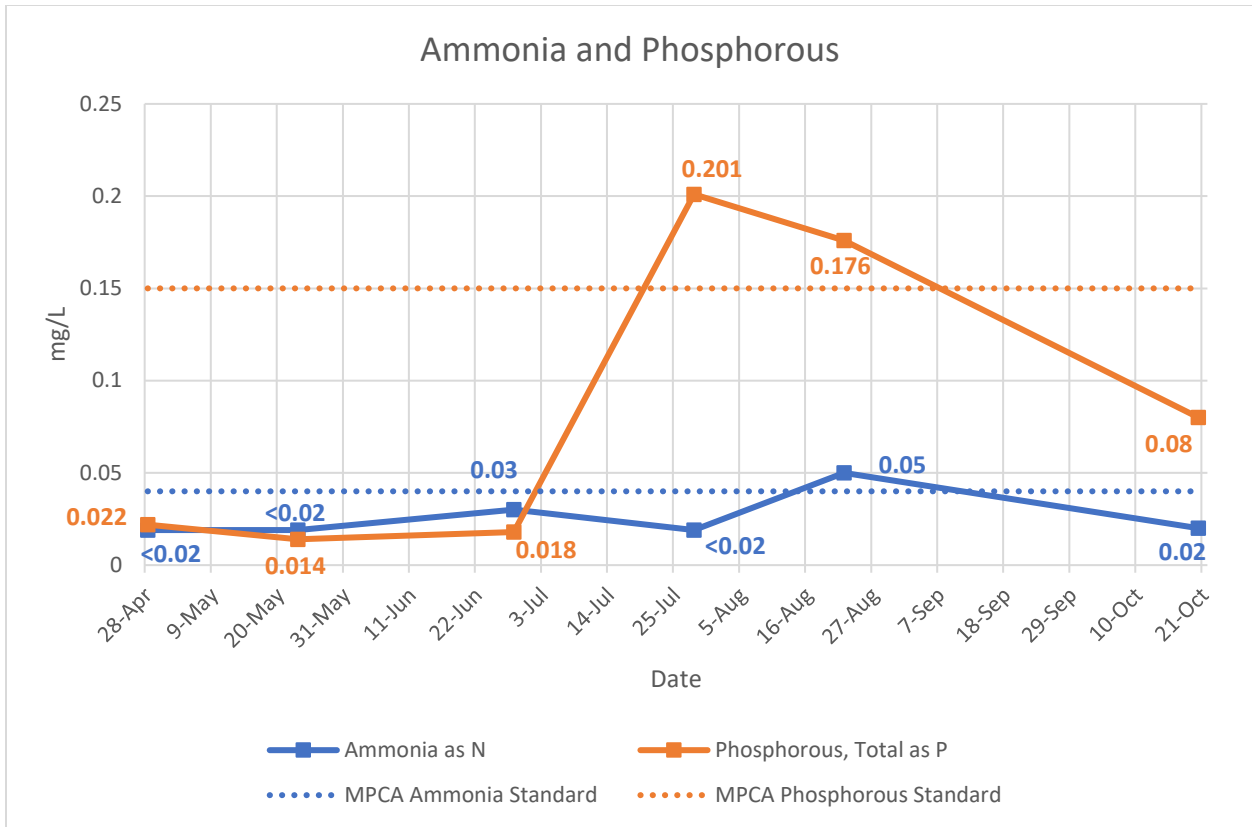


Figure 132. Ammonia and Phosphorous samples collected at S007-461.

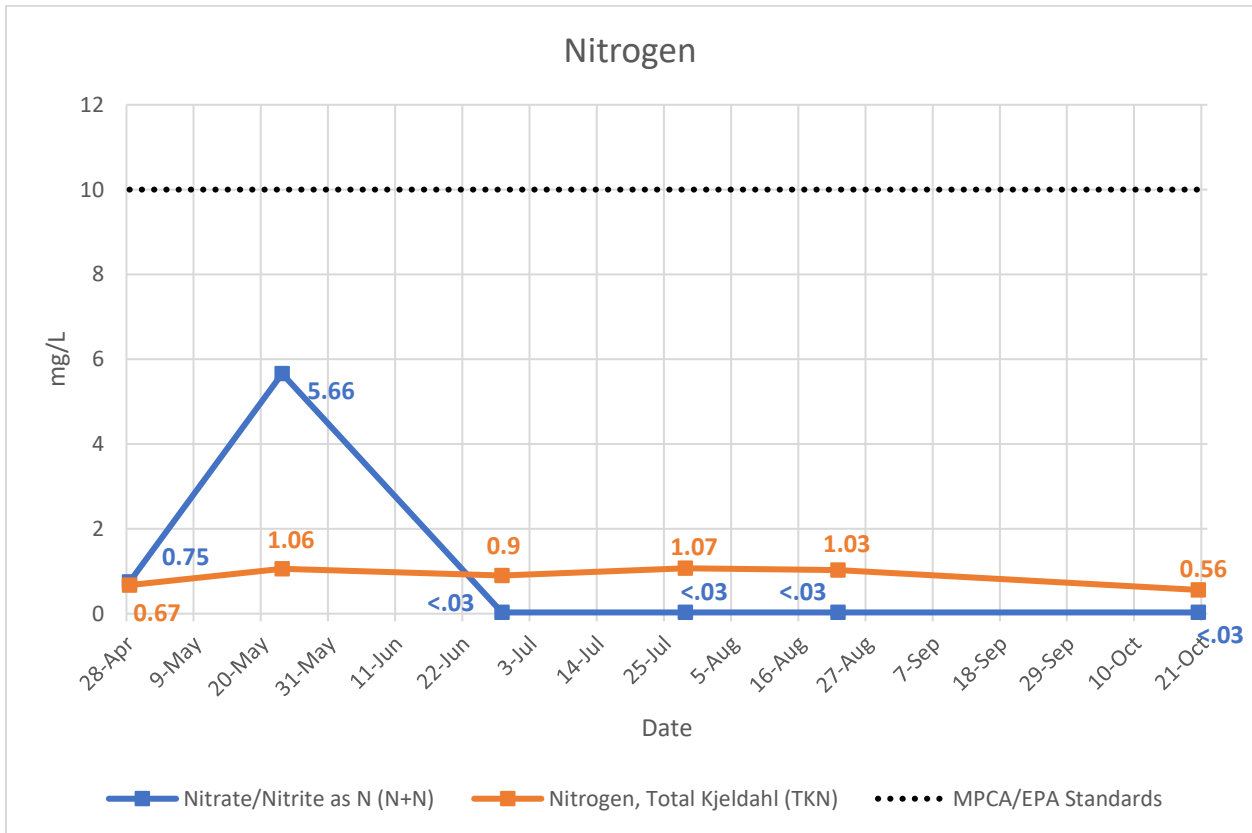


Figure 133. Nitrogen samples collected at S007-461.

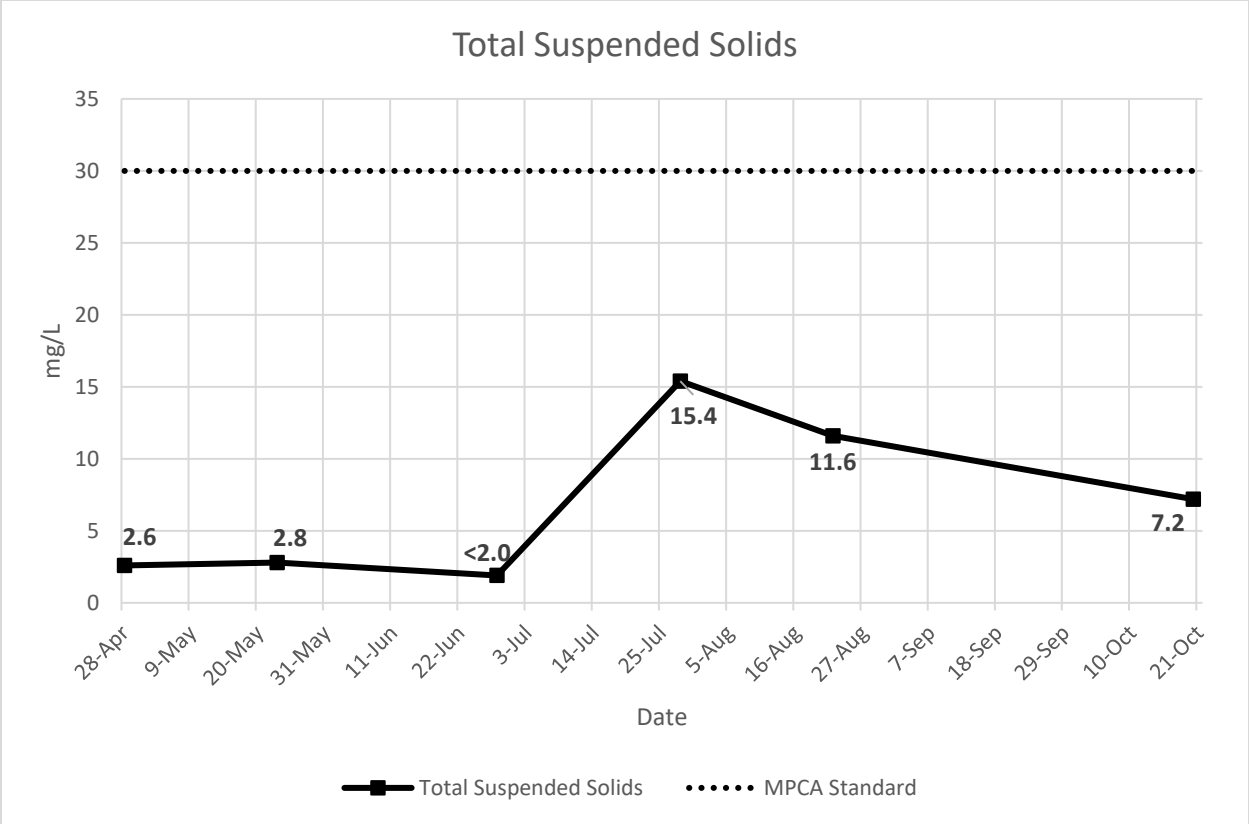


Figure 134. Total Suspended Solids samples collected at S007-461.

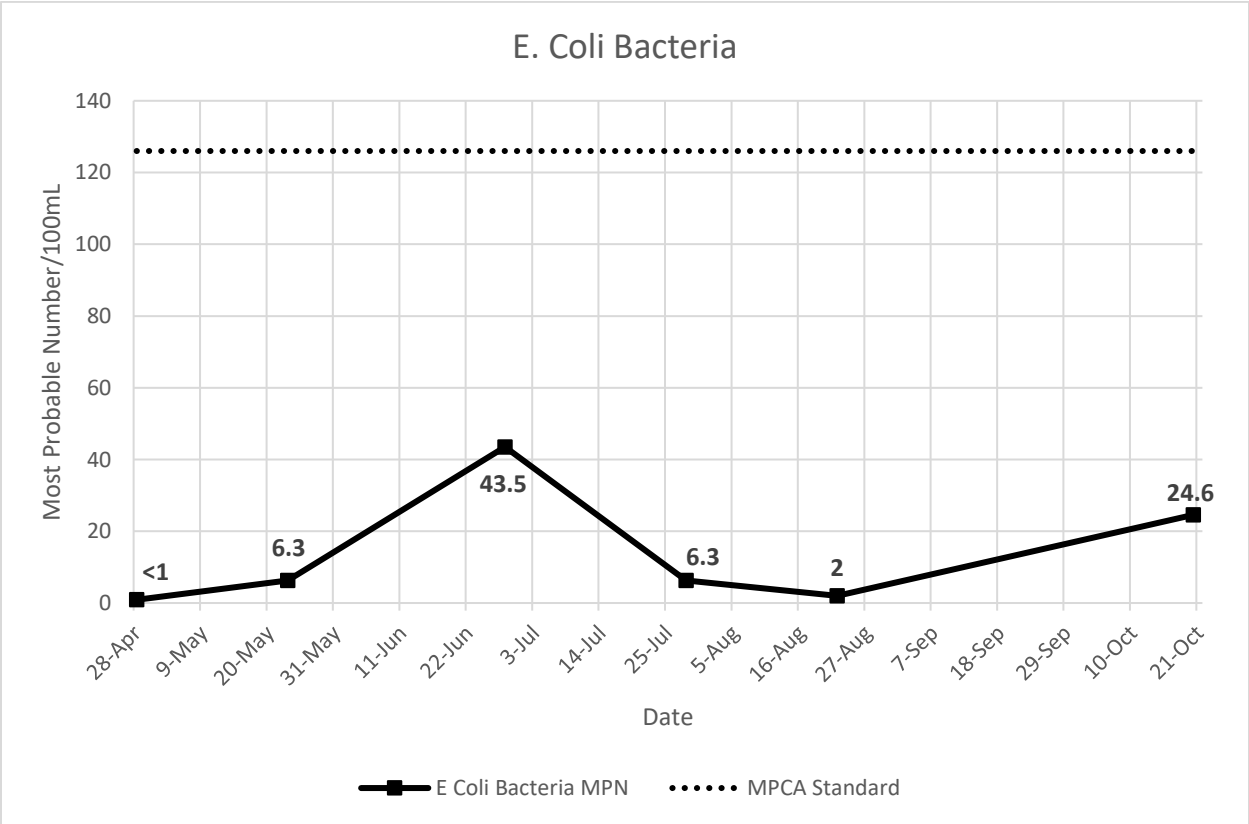


Figure 135. E. Coli Bacteria samples collected at S007-461.

15. Wolverton Creek

Wolverton Creek flows northwest starting in Wolverton Township, Wilkin County and outlets into the Red River in Holy Cross Township, Clay County. Wolverton Creek is a 23.5-mile-long stream that was highly sediment laden prior to the Wolverton Creek Restoration Project by BRRWD. Wolverton Creek was only sampled twice, on May 21 and June 27, 2022.

- a) S005-322: Located just downstream of where Clay County Ditch No. 36 outlets into Wolverton Creek. This station is within Section 5, Holy Cross Township in the Western planning region.

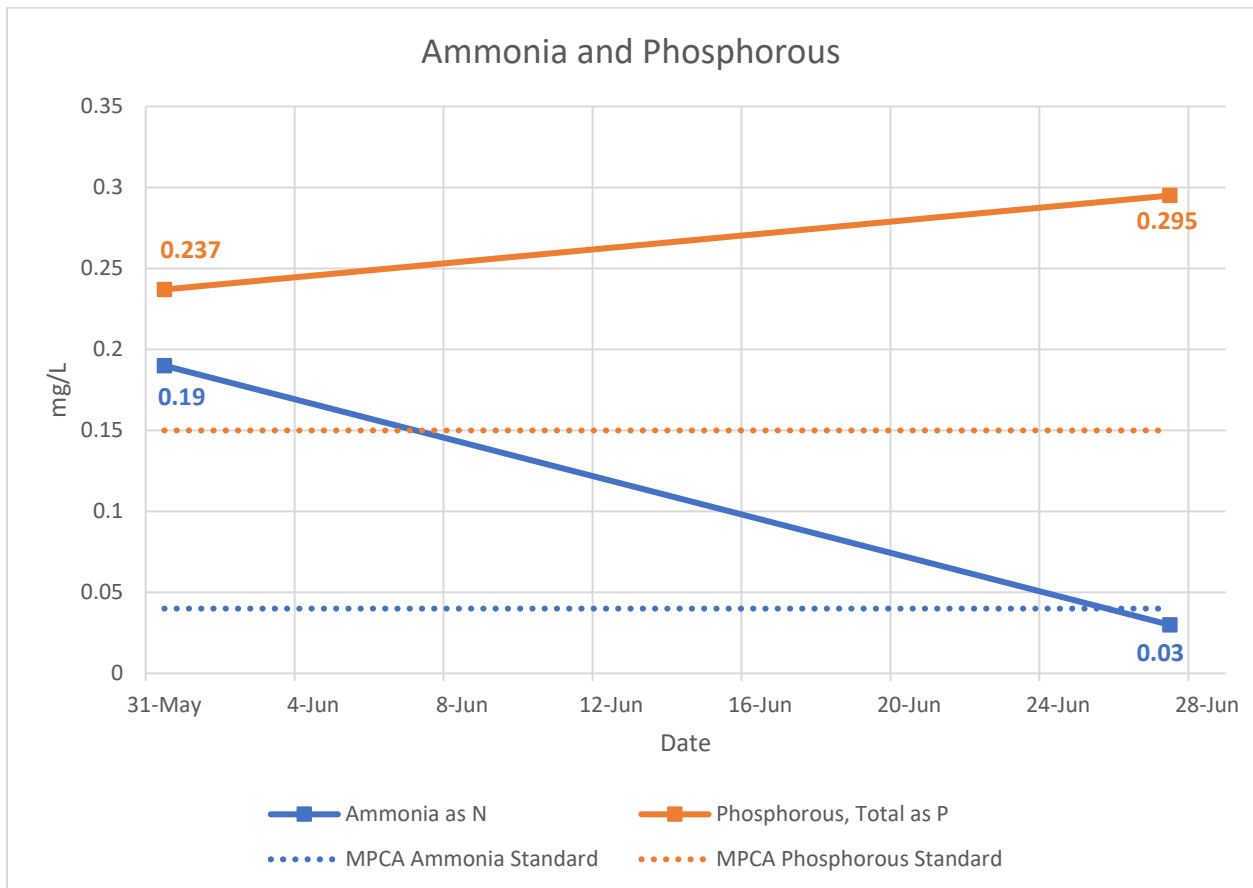


Figure 136. Ammonia and Phosphorous samples collected at S005-322.

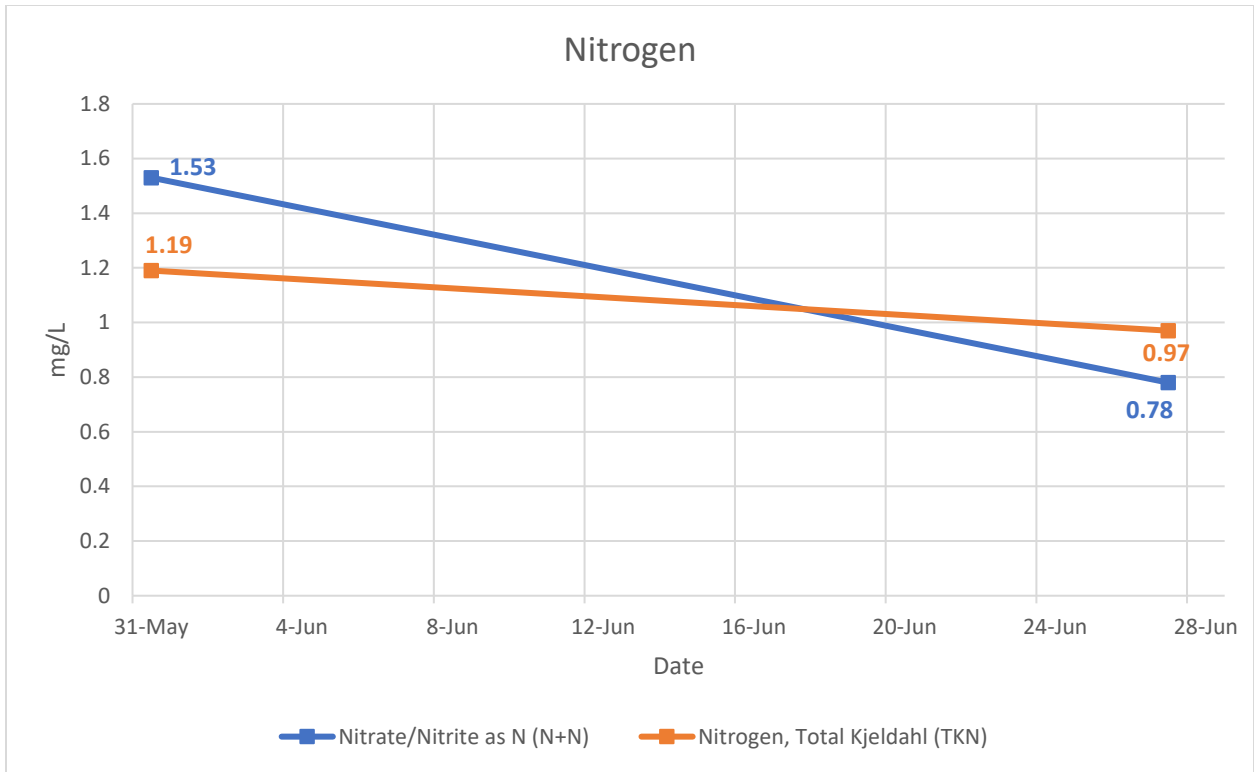


Figure 137. Nitrogen samples collected at S005-322 (MPCA and EPA standards are 10 mg/L).



Figure 138. Total Suspended Solids samples collected at S005-322.

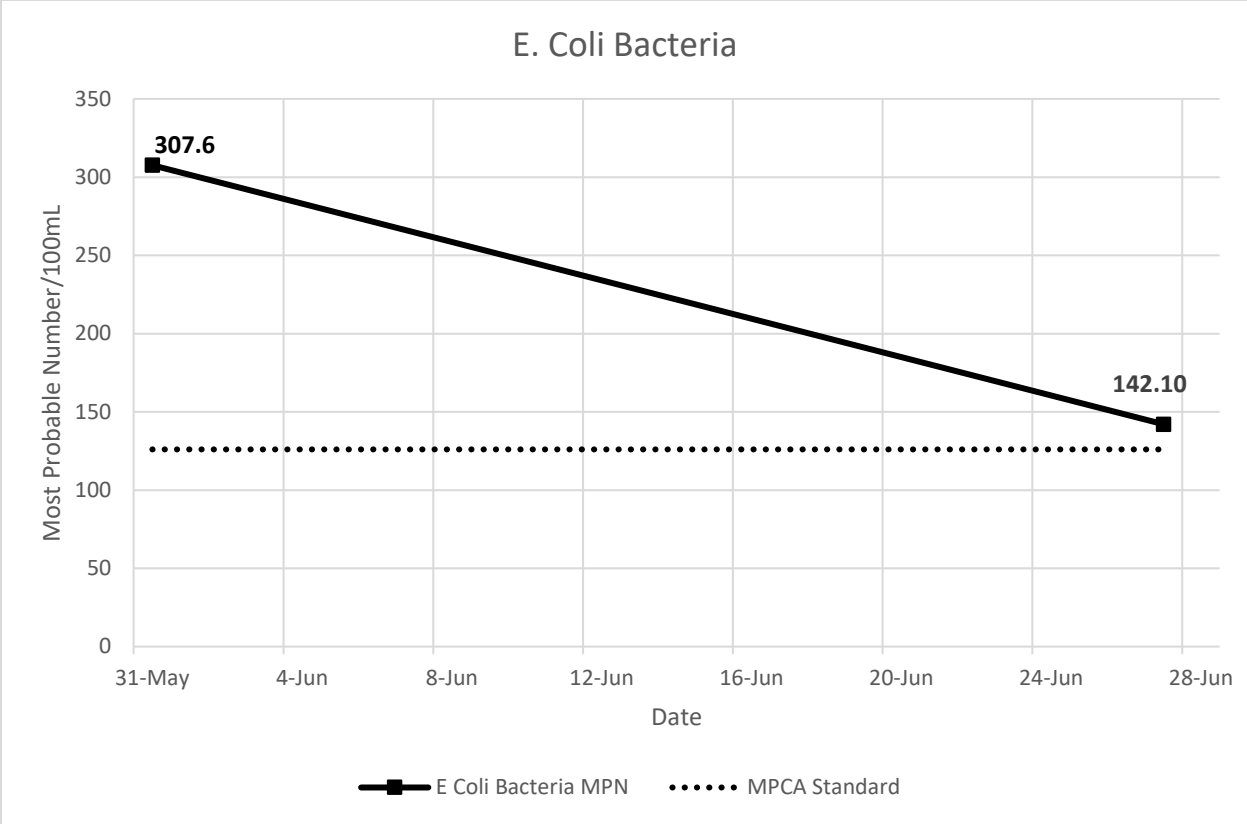


Figure 139. E. Coli Bacteria samples collected at S005-322.

Conclusions and Discussion

Most samples that were collected were close to or were within satisfaction with MPCA and EPA standards. Regarding ammonia, 119 samples (70%) collected were either at the MPCA standard of 0.4 mg/L or below, as opposed to 50 samples (30%) exceeding that threshold. 65% (110 samples) of the Phosphorous samples collected were at or below state standards, while 35% (60 samples) exceeded state standards (0.15 mg/L). Nitrate/Nitrite had only one (1) sample out of 171 over state standards (10 mg/L). TKN did not have a single sample (0/171) over the standard (10 mg/L). TSS also had 79% of samples (133) under state standards (30 mg/L), while 21% (35 samples) were above state standards. The analyte that varied the most was E. Coli, with 59% of the samples (100/169) in compliance with state standards (126 MPN/100mL). Chlorophyll-a samples were all in compliance, with all 9 samples below 40 ug/L.

The values of the analytes that were measured could be impacted by rainfall. Heavy precipitation events can lead to increased levels of these analytes entering these water bodies. This can be especially prominent when agricultural producers are planting, harvesting, or spraying fertilizers into their fields, or when a large construction project with bare soils is occurring near a water body. In 2022, there was a heavy rainfall event in the end of May that caused several washouts and significant erosion along waterways within BRRWD. Also, due to late snow melt and spring runoff, agricultural producers were planting their fields later than usual. This could have resulted in increased levels of some analytes observed in the June sampling.

BRRWD plans to continue monitoring these stations in the years to come. The Red River Basin River Watch Program has been a great opportunity that BRRWD has enjoyed supporting for the last 11 years. It is a great chance for professionals and Barnesville High School students to get a better understanding of the water quality of streams in our District. Continued monitoring of these stations can help us get a better understanding of the long-term health of our ecosystem, it can help determine locations of point source pollution, and it can be a great resource for landowners in the watershed. It also may help individuals along these bodies of water implement different land use practices in an attempt to decrease levels of specific analytes.

Resources Used

- <https://www.epa.gov/caddis-vol2/ammonia>
- <https://www.usgs.gov/special-topics/water-science-school/science/phosphorus-and-water>
- <https://nepis.epa.gov/Exe/ZyNET.exe/P100XQ8A.txt?ZyActionD=ZyDocument&Client=EP&Index=1991%20Thru%201994&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C91THRU94%5CTXT%5C00000035%5CP100XQ8A.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1>
- <https://www.usgs.gov/special-topics/water-science-school/science/bacteria-and-e-coli-water>
- <https://www.epa.gov/national-aquatic-resource-surveys/indicators-chlorophyll>
- https://www.brrwd.org/files/ugd/2e2831_16cb9cf735404345af535f515e5cae2e.pdf
- International Water Institute (2021). *Water Quality “Pre-Project” Data Summary Klondike Clean Water Retention Project.*
- International Water Institute (2023). *Water Quality Summary Buffalo Red River Watershed.*