

MUDDY RIVER
ANALYSIS
FINAL PROJECT

— ENVIRO SEC. 04 —
JUNE 2016

THE MUDDY RIVER ANALYSIS PROJECT

WHY IS THE MUDDY RIVER SO MUDDY?

ENVIRO SEC. 04 - JUNE 2016

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ABSTRACT

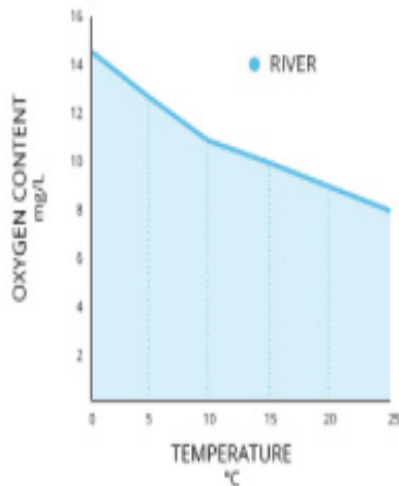
The Purpose for doing this experiment was to investigate the health of the Muddy River. The problems we were investigating were the effects of the various invasive species and changing the natural flow of the river. Each group was assigned a specific working location where we would take our water samples. The procedure we followed was taking water samples from the river by using small plastic bottle containers once every two days. We also would record the air temperature and the humidity of the day using our cellular devices. We also recorded the water temperature using a thermometer. After each group collected their samples, we all stored them in the classroom until the next day, where we would then measure the pH, dissolved oxygen, and nitrogen levels of our water samples of the day before. We repeated this process multiple times, to ensure that there was sufficient data to base our results off of. Before collecting the samples and their data, our class's general consensus agreed with the hypothesis that the Muddy River was not healthy. While collecting data at the river, we observed that the water was slick and grimey. We also noticed high amounts of litter, including candy bar wrappers, empty bottles, needles, etc. There were also rotting animal carcasses near the shores of the river which could also contribute to its pollution. The amount of surrounding the Muddy River was evident enough for us to hypothesize that its health is at critical condition.

INTRODUCTION

History of the Muddy River (BC-FLO)-The Muddy River was first officially recognized in the year 1639 when John Winthrop wrote about the Muddy River in his famous "Journal of John Winthrop". In his journal, he described the Muddy River as the sight of the first unidentified flying object, as seen by James Everell when he and two others saw lights speeding back and forth across the Charles River from the Back Bay Fens area to Charlestown. Frederick Law Olmsted designed the emerald necklace, a chain of public parks extending from Boston through Brookline, covering over one-thousand acres. Several parks create the 'jewels' of the necklace, including both the Boston Common and the Back Bay Fens. Olmsted created the Emerald Necklace to increase tourism and improve life within and around greater Boston, as the Fens became an issue throughout the Industrial Revolution. By the time of the Civil War the Back Bay Saltwater Marsh became foul smelling and needed restoration desperately. Olmsted created and designed many public parks throughout Boston and included various non-native species of trees and shrubs around the Muddy River.

After the damming of the river in 1910, the marsh became fresh-water, and the heightened level of the river caused more species to grow around the parks. Additionally, as years went on by the 1920's many areas throughout the Emerald Necklace were covered in public ballparks and rose gardens. As decades wore on the Muddy River began to fall into disrepair, revealing the effects of time. Within the last twenty-five years there have been many movements to restore the area back to Olmsted's vision more than a century before.

1990s flooding- In October of 1996, it rained almost 10 inches in 3 days causing the Muddy River to overflow its banks and flood the nearby MBTA stations such as the Riverway and Kenmore Station. There was about \$60 million in damage and for a week people were bused from station to station as the mess was being cleaned up. This incident led to the idea of the Restoration Project. In order for a river to be considered "healthy" the pH of the river must fall between 6.5 and 8.5 on the 0-14 scale. The ideal pH for river water is around 7.4. Dissolved oxygen concentration for healthy rivers is based off of the temperature. The ideal temperature for a healthy river is around 55 F as seen in the Cuyahoga river that created a climate ideal for plants and animals to live in. A healthy river's nitrate concentration should be within 0.1 to 3 milligrams per liter with the ideal being less than 0.1.



“Since October of 1996, the Muddy River has flooded three times, causing damage to residences, businesses, academic, medical and cultural institutions and the public transit system in Boston and Brookline.”

Outlined on the Muddy River website, are the goals for improvement. Priorities of the restoration project are improving flood control, water quantity, aquatic life, and rehabilitation of landscape.

Flood control was specifically implemented in order to prevent major floods, like one in 1996, specifically to stop damaging nearby properties and business. For example, in March 2010, the muddy river had flooded so much, it rose over the landscape. Major restrictions existed, such as the growth of invasive vegetation, like Phragmites, “the build-up of

sediments in the riverbed, and limiting water movement by forcing the river through undersized pipes.” After a previous construction, the entire Fens was no longer subject to immense flooding. Urban stormwater runoff, which carries sand and sediment, causes destruction to the river as well. Some runoff from streets, and trash, is included in this. The Boston Water & Sewer Commission (BWSC) has been investigating the river, in order to add onto the benefits already instilled. “The Muddy River Restoration Project includes the rehabilitation of elements of the historic landscape, within four sections of the Emerald Necklace: Charlesgate, the Back Bay Fens, the Riverway, and Leverett, Willow, and Wards Pond in Olmsted Park.” Frederick Law Olmsted created a project proceeding this to influence the bettering of the river. The Emerald necklace project, which was projected to be completed between the 1800s and the 1900's, was created by Frederick Law Olmsted. The project began around 1878 with the agenda to clean up and control invasive species in the marshy area that we now know as The Fenway and Back Bay. In 1880, Olmsted suggested that the Muddy River be included in the park plan. The linear park, Clemente, enclosing the river still exists today. Olmsted's vision was to have a park where you could walk alone.

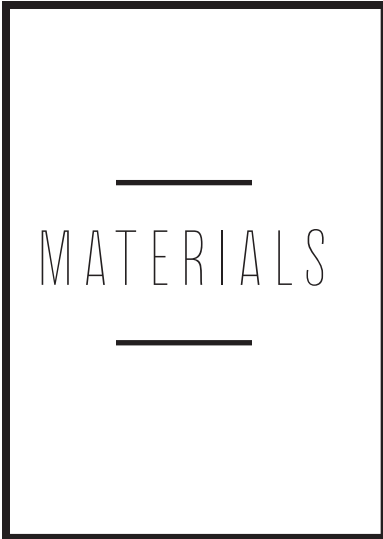


Muddy River from the Longwood Bridge c. 1920.



Emerald Necklace view from Boston University





MATERIALS (INDOORS):

iPads
 PasPort AirLink
 LaMatte Nitrite Nitrogen
 River Water

MATERIALS (OUTDOORS):

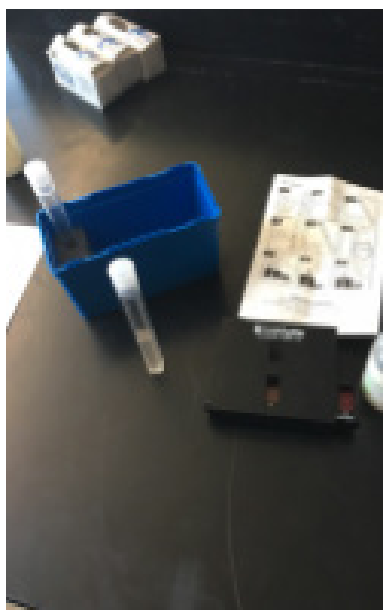
Thermometer
 Sample container
 Rain boots
 Camers



PROCEDURES

Collecting the Sample:

1. Walk to lobby from room 316.
2. Proceed to Muddy River meeting spot.
3. Each group proceed to designated areas.
4. Place thermometer into the water (to test for temperature) and record data.
5. Collect water samples by inserting the tube into the river.
6. Record location's atmosphere (smells, etc).
7. Meet at Muddy River meeting spot at designated time.
8. Walk back to classroom.
9. Store water samples in fridge for future analysis of quantitative data.
10. Repeated steps 1-9 on various dates.



PROCEDURES

Nitrogen Analysis:

1. Put on a pair of gloves and goggles.
2. Pour water sample 5mL in test tube.
3. Insert Nitrogen 1 tablet from kit.
4. Shake test tube until tablet dissolves completely.
5. Insert Nitrogen 2 tablet from kit.
6. Shake test tube until tablet dissolves completely.
7. Let the test tube sit for five minutes.
8. Insert tube into nitrogen color scale.
9. Compare the water sample's color with the color scale.
10. Record the nitrogen level onto data sheet.
11. Repeat steps 1-10 with other samples on later dates.



PROCEDURES

Dissolved O₂ :

1. Gather the the sensors, iPad, and samples into one place.
2. Plug the Bluetooth module into the measurement module.
3. Turn on the module.
4. Plug the two sensors into the main unit.
5. Go to the Bluetooth settings on the iPad.
6. Pair the two through Bluetooth.
7. Open up the app on the iPad.
8. Twist off the cap for the sample and the sensor's alcohol vial.
9. Put one of the sensors into the sample.
10. Wait for a while so that measurements stabilize.
11. Record measurements' best samples
12. Repeat all steps for remaining water samples.



MUDDY RIVER

- MAP -

The map shows the Muddy River winding through a green park area. Six circular callouts are placed along the river, each containing a photograph of a specific spot. The callouts are labeled with names and phone numbers. The map also shows several streets: Park Dr, Fenway, Emerald Necklace, and Kilimarnock St. Landmarks like Simmons College, New American Cafe, and Museum Arts, B are also visible.

- GEESLAND**
42.34034 -71.099085
- STICKS**
42.339560 -71.098339
- 50 SHADES OF GEESE**
42.341169 -71.099085
- THE BROOM**
42.340267 -71.099262
- GAY'S RESORT**
42.339379 -71.0982007
- IN THE CUT**
42.340303 -71.096194

Group 1- Brooms

Date	Temperature	pH Levels	Nitrogen Levels	Dissolved Oxygen (mg/L)
June 1	24° C	7.81	<1 ppm	4.2
June 3	17° C	7.42	<1 ppm	9.22
June 7	25° C	7.55	2 ppm	2.89

Group 2 -Gay's Resort (Victor, Eddie, Tom, Andrew)

Date	Temperature	pH Levels	Nitrogen Levels	Dissolved Oxygen (mg/L)
June 1	23° C	8.7	0.1 ppm	12.4
June 3	22° C	7.9	<0.1 ppm	4.1
June 7	23° C	8.3	<0.1 ppm	5

Group 3- In the Cut

Date	Temperature	pH Levels	Nitrogen Levels	Dissolved Oxygen (mg/L)
June 1	18° C	8.37	1.5 ppm	9.74
June 3	18° C	7.52	3 ppm	9.8
June 7	22° C	8.62	2 ppm	12.27

Group 4- 50 Shades of Geese

Date	Temperature	pH Levels	Nitrogen Levels	Dissolved Oxygen (mg/L)
June 1	24° C	8.31	1 ppm	13.4
June 3	20° C	7.93	1 ppm	13.32
June 7	25° C	7.94	1 ppm	9.11

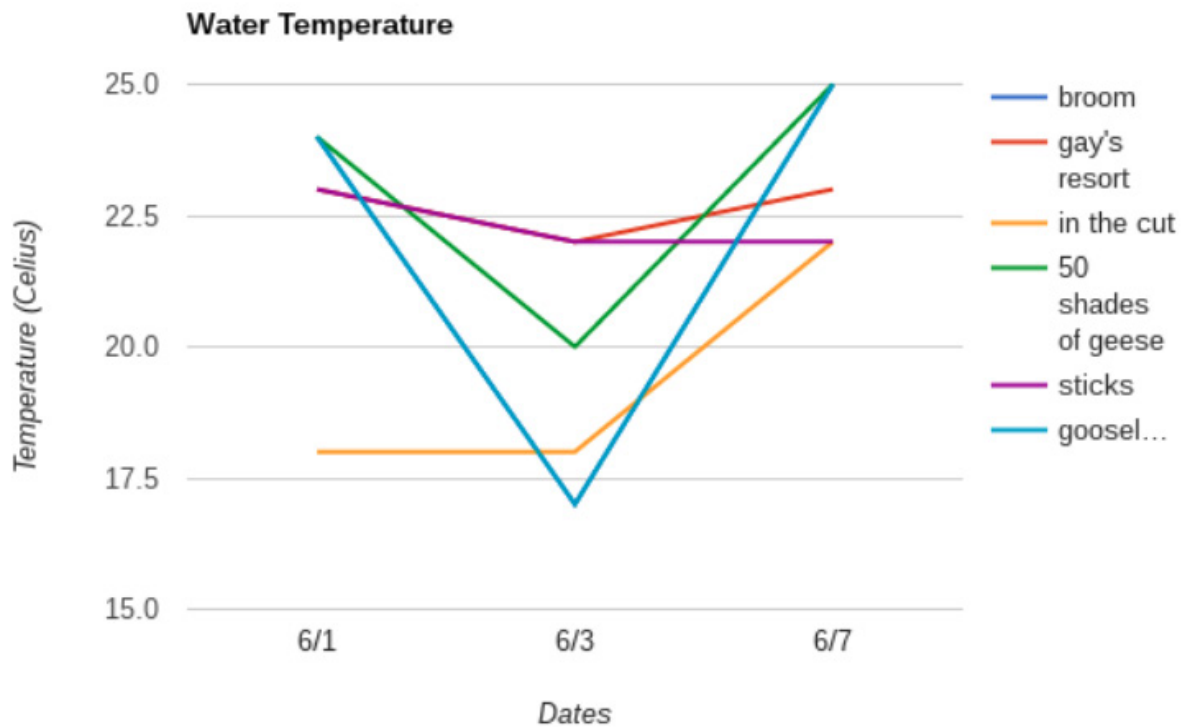
Group 5- Sticks

Date	Temperature	pH Levels	Nitrogen Levels	Dissolved Oxygen (mg/L)
June 1	23° C	8.20	> .1 ppm	11.2
June 3	22° C	7.53	> .1 ppm	11.25
June 7	22° C	8.7	> .1 ppm	13.5

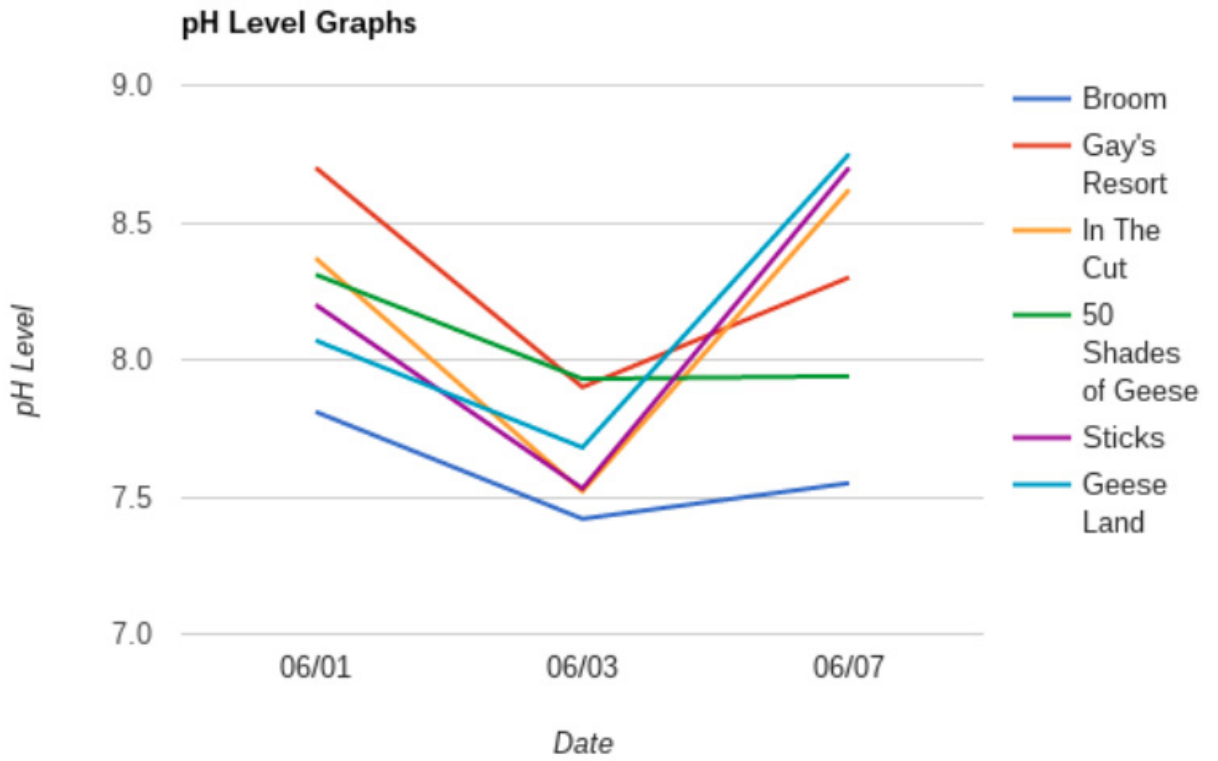
Group 6 - Gooseland

Date	Temperature	pH Levels	Nitrogen Levels	Dissolved Oxygen (mg/L)
June 1	24° C	8.07	0.1 ppm	6.3
June 3	17° C	7.68	< 1 ppm	4.52
June 7	25° C	8.75	< 1 ppm	11.32

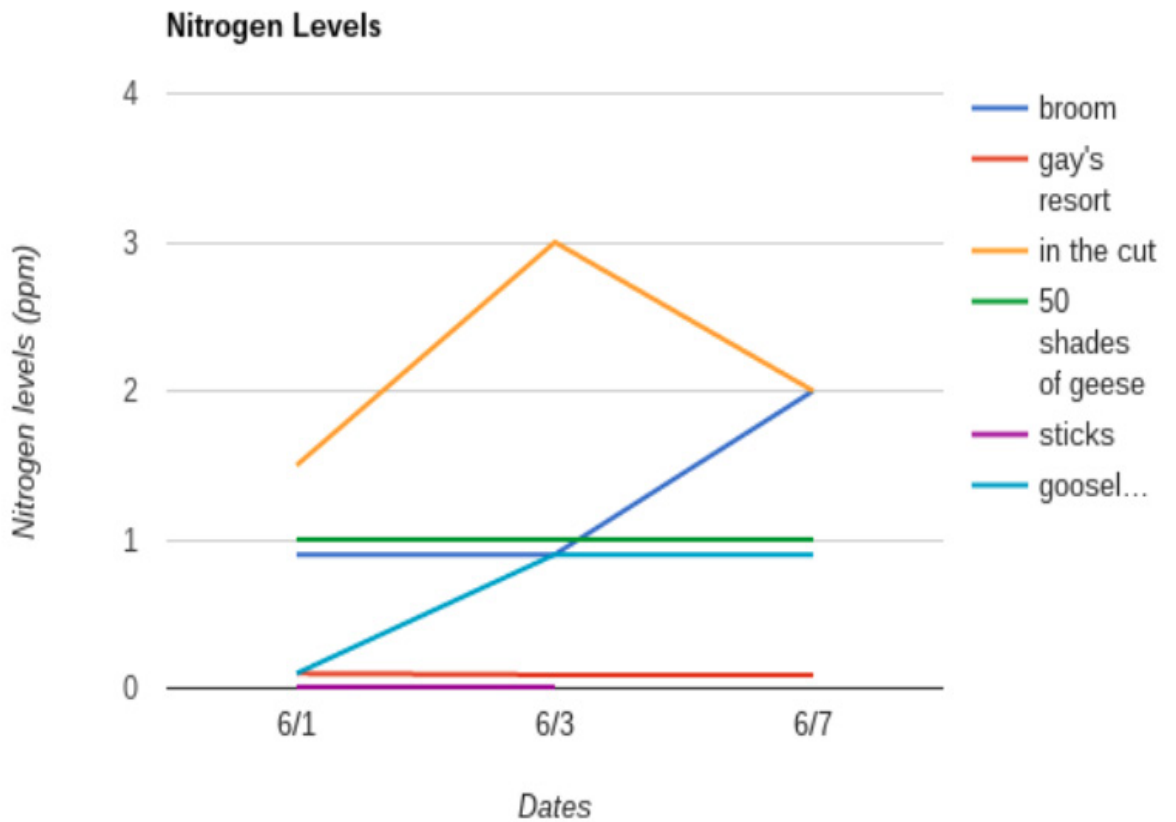
TEMPERATURE



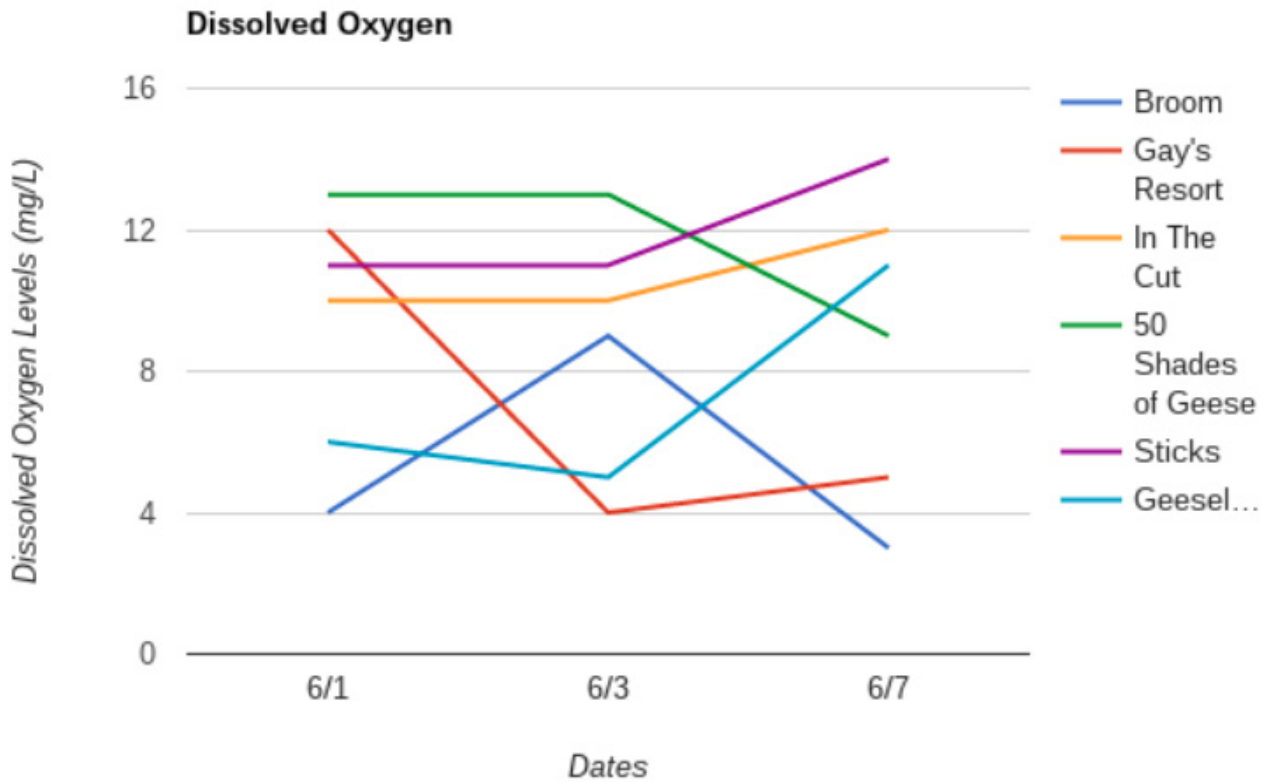
PH LEVEL



NITROGEN LEVELS



DISSOLVED OXYGEN



DISCUSSION

When analyzing data taken from studies done on the Muddy River, it is important to look further into four different areas focused on in the study - pH levels, nitrate levels, temperature, and dissolved oxygen levels. All of these measurements point to the health of the river, organisms within it, and any outside activity that may affect the river.

In terms of pH levels, the ideal pH for US Natural water is around 7.4, with 7.0 being neutral. pH levels are almost essential to aquatic life as extremes in pH can make a river inhospitable. Low pH is especially harmful to immature fish and insects, the main inhabitants of a river. Acidic water also speeds the leaching of heavy metals harmful to fish. On June 7, many groups recorded PH levels that were higher than the suggested level, which is between 7.5 and 8.5. This day, the air temperature was 86 degrees fahrenheit, which was the hottest day that we experienced while collecting our data. It was also a day on which the water temperature was consistently above 22° C. High temperatures can result in high turbidity, referring to the amount of suspended solids in a body of water. This includes silt, clay, plankton, and sewage, but most importantly, industrial waste. This suggests that on June 7, as there was a higher turbidity and a higher temperature, which makes it easier for metals harmful to fish to spread, that there may have been either an illegal dumping of waste into the river, or runoff from construction going on nearby.

This was probably also the case on June 3, because one group experienced unusually high levels of nitrate in the water. This was probably because they were near the construction that has been going on. Nitrates, although they do not directly affect aquatic life, are generally harmful to an aquatic environment. When nitrates are present in high levels in a body of water, it can trigger processes such as Eutrophication or Anoxia, two processes that are link with algae blooms and low oxygen content.

Luckily, there were no irregularities in the dissolved oxygen concentration, which means that the muddy river is not a dead zone and can host many forms of aquatic life. The amount of dissolved oxygen in a body of water determines what can live and grow there. If the area has less than 1 mg/L it is considered hypoxic, or a “dead zone” which means that nothing can live or grow there. Only one group, group 1, experienced a lower level of dissolved oxygen (2.89 mg/L) which could suggest the beginnings of a hypoxic environment.

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