**Does the Hummingbird Highway runoff affect the Sibun River?**

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**Introduction**

“When water from rain runs off roofs and roads into our rivers, it picks up toxic chemicals, dirt, trash and disease-carrying organisms” (Storm). Runoff can easily pick up anything left on surfaces such as concrete, as said in White Paper, "Total suspended solids and volatile suspended solids are the most common solids parameters measured because toxic organic contaminants and metals are often bound to fine particles". All bridges are going to have fine particles on their surface. I know that concrete can easily be covered by the emissions of motor vehicles. Oil, gasoline, and heavy metals can build up on the surface and then get washed away by rainfall. Some examples of common heavy metals are copper and zinc. Copper comes from bearing wear, engine parts, brake emissions, while zinc is released by tire wear, motor oil, grease. If these stray heavy metals and other contaminates make their way into the water supply, then there can be some adverse side effects. The overall health of a body of water can deteriorate if too much pollution is introduced. Organisms may be poisoned by high levels of metals as discussed by the National Cooperative Highway Research Program. "The toxic effect of a metal is elicited when the metal binds to an acceptor, and in most cases, the acceptor is the gill of an aquatic organism" (Dupuis). Because of this idea, I am interested in focusing my research on the Hummingbird Highway Bridge that runs over the river next to our lodge. Any rainfall would most likely pick up all of the pollution on the bridge and drain right into the nearby river. I believe that the runoff from the bridge could significantly affect the water quality of the river. I want to check for heavy metals that are suspended in the water. My alternate hypothesis is that the concentration downstream of the bridge will be greater than that of the upstream water. The null hypothesis is that the concentrations don’t vary from site to site.

**Materials**

1. One SenSafe Water Metals Kit

2. Ten water sample cups

**Method**

This experiment consists of 3 different trials.

* Test water upstream of bridge
* Gather ten 20 ml samples of river water
* Test each sample using one metal test strip per sample
* Gently stir strip back and forth for 30 seconds
* Wait 2 minutes
* Compare the resulting color with the test kit's color chart
* Test water downstream of bridge
* Gather ten 20ml samples of river water
* Test each sample using one metal test strip per sample
* Gently stir strip back and forth for 30 seconds
* Wait 2 minutes
* Compare the resulting color with the test kit's color chart
* Test water from a nearby tributary
* Gather ten 20 ml samples of river water
* Test the samples using one metal test strip per sample
* Gently stir strip back and forth for 30 seconds
* Wait 2 minutes
* Compare the resulting color with the test kit's color chart

**Results**

Upstream Average: 10.8ppm Downstream Average: 10.6ppm Tributary Average: 10.2ppm

|  |  |  |
| --- | --- | --- |
| **Sample** | **Site** | **Heavy Metals (ppm)** |
| 1 | Upstream | 10 |  |
| 2 | Upstream | 5 |  |
| 3 | Upstream | 17 |  |
| 4 | Upstream | 12 |  |
| 5 | Upstream | 14 |  |
| 6 | Upstream | 8 |  |
| 7 | Upstream | 9 |  |
| 8 | Upstream | 9 |  |
| 9 | Upstream | 11 |  |
| 10 | Upstream | 13 |  |
| 1 | Downstream | 15 |  |
| 2 | Downstream | 12 |  |
| 3 | Downstream | 11 |  |
| 4 | Downstream | 8 |  |
| 5 | Downstream | 13 |  |
| 6 | Downstream | 12 |  |
| 7 | Downstream | 10 |  |
| 8 | Downstream | 9 |  |
| 9 | Downstream | 9 |  |
| 10 | Downstream | 7 |  |
| 1 | Tributary | 15 |  |
| 2 | Tributary | 5 |  |
| 3 | Tributary | 10 |  |
| 4 | Tributary | 10 |  |
| 5 | Tributary | 7 |  |
| 6 | Tributary | 8 |  |
| 7 | Tributary | 12 |  |
| 8 | Tributary | 14 |  |
| 9 | Tributary | 9 |  |
| 10 | Tributary | 12 |  |

The data shows that the concentrations were not consistent with my hypothesis. The concentrations fluctuated no matter where the water came from. The averages turned out to be very similar as well.

**Conclusion**

 My data disproved my hypothesis. The averages of data were too similar in each trial to show any kind of drastic or significant change in heavy metal concentration. The downstream average was very close to the upstream average. This means that the bridge was contributing little to none of the heavy metals in the water.

There were definitely some sources of error in my project. First, my materials were not very accurate. The lowest reading for my testing kit was less than 10 ppm. That is a big gap from 0ppm-10ppm. The test was also color coded so there is human error involved, especially since I am somewhat colorblind. Some of my findings were difficult to determine where they lied on the color chart. It was very difficult to decide where the data fell, considering that the less that ten mark and less than 20 mark were similar shades of orange. Moreover, the readings depended on how you looked at the test strip. One time you may be under a shadow and the color looks darker than it really is. Another time I could have been at an angle that let more light through the filter, making the color appear brighter than it should. The test also recommended bending the test strip so that the filter had a white background to provide a better color. Sometimes it could bend too much, producing a shadow under the filter which darkened the color. Another error could have been that I didn't go far enough upstream. I wasn’t able to venture very far upstream, past the bridge, because the water became very deep. I couldn’t really swim across or hike through some jungle by myself, so I decided to go as far away from the bridge as I could. This upstream location was near some rocks about twenty feet away from the bridge. These upstream samples were collected somewhat close to the bridge, which could have actually contaminated on that side. The upstream results could have been much different if I had gone 100 feet away or more. The test also said to use 20 ml of sample fluid for each individual test. I had to estimate this sample size for every collection because I did not have any measuring tools. The data might have been more accurate if I had a graduated cylinder to provide consistent measurements of water samples. It is also possible that I tested after it hadn't rained for a while. This could have made the concentrations less than if it had just rained since the rain could have washed even more heavy metals from the bridge into the river. I also had to stir the test strip for 30 seconds and then wait 2 minutes to read the results. I did this by counting the seconds. The results could have been much different if I had used a stopwatch to record the testing times.

 If I were to expand on this project, I'd get a more accurate test kit. I think most of my error came from this factor. The test kit was too broad of a range with difficult to determine colors. A test kit that measured to 5 parts per million or lower would have been more ideal for this kind of project. Additionally, it could be helpful to find a test kit or a chemical experiment that gave you exact data instead of guessing what color it changed. I'd also try to get a guide to take me farther away from the bridge. I feel like my upstream test could have been too close to the bridge which messed up my data, making it look more concentrated than it should have been. There are many variations to improve on this project. Another way to test for the metal pollution is to check the soil. Some metals can be absorbed by the soil as well. These metals get deposited by the water, so testing the soil could show a connection to the health of the water. A different project could compare metal concentrations in the water and soil samples at different locations along the river. Another experiment could follow my procedure but compare a frequently used bridge’s water to the Hummingbird Highway’s water. The experiment could show the differences in pollution that Illinois rivers undergo, compared to the Sibun. The experiment could be fine tuned by focusing on a certain heavy metal to test for. This could cut down on accuracy loss since there’s only one thing being tested. My test kit revealed many different kinds of metals. One sample could have contained a lot of one metal, but no other metals. Another sample would have a mixture of metals, further varying the results. By cutting it down to a specific metal, much of the variance would be removed from the experiment.

**Works Cited**

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