The Quality of Agricultural Irrigation Water in Taiwan

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Country : Taiwan

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Abstract:

This study will go to the midstream of agricultural irrigation water near Luodong Senior High School from 5:20 to 5:50 pm every Monday to Friday from September 21, 2023 to January 21, 2024 to measure various water quality data, and cooperate with the Taiwanese A comparison of the irrigation water quality standards announced by the Ministry of Agriculture of the Taiwan shows that all measured items meet the specification limits. At the same time, samples were collected every Wednesday. After filtering impurities, it was found that the number of various types of cellulose was higher, while microorganisms and algae were less common.

Research Question and Hypothesis:

1. Measure the depth, pH value, conductivity, turbidity, dissolved oxygen, and total dissolved solids (TDS) of the agricultural irrigation ditch next to the school and analyze its changes over time.

2. Observe the correlation between each data.

3. Observe the differences in impurities in the upper, middle and lower reaches of the agricultural irrigation ditch next to the school.

4. Observe the filtered substances in the water and analyze their characteristics.

Research Methods and Materials **(Including GLOBE Data!):**

Measurement method

(1) Data definition description

1. This study considers impurities with a longest length greater than 2.5μm as observation objects, and observes impurities with a longest length greater than 12.5μm impurities and analyze their characteristics.

2. This study collected water samples from the upper, middle and lower reaches of agricultural irrigation ditches in Beichengzhen. Figures 4, 5 and 6 are define the positions of upstream, middle and downstream.

(2) Description of water sample testing equipment

1. TDS water quality testing pen is used to detect the amount of total dissolved solids (TDS) in water (including soluble salts, ionic organic matter, some heavy metal ions), the unit is mg/L.

2. Turbidity meter is used to detect the content of suspended substances in water (including soil, silt, fine organic matter, inorganic matter, plankton biology, etc.), the unit is NTU (1 NTU is equivalent to the turbidity of 1 milligram of silica in 1 liter of water).

3. The dissolved oxygen meter is used to detect the concentration of oxygen dissolved in water, the unit is mg/L.

4. The conductivity measuring instrument is used to detect the conductivity of the solution (the higher the ion concentration, the stronger the conductivity), and the unit is mg/L.

5. The pH value measuring instrument is used to detect the acidity and alkalinity of the solution.

(3) Sampling process

1. Connect the bucket to the Scout rope and tie it with the Scout rope railing.

2. Toss the bucket out from the center of the river.

3. After it is completely submerged in the water, pull it up and collect it.While taking the water sample, use a ruler to measure the water depth.

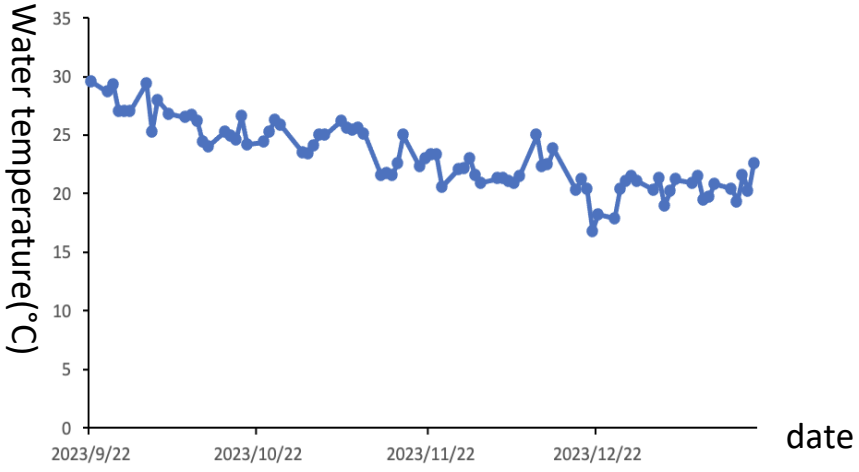
4. Use a beaker to collect water, measure it, and record the data.

5. Fill in the data into Excel.

Results:

Daily observation results of each data

(1) Use the water temperature measured every Monday to Friday from September 21, 2023 to January 19, 2024 as the vertical axis to make a line chart



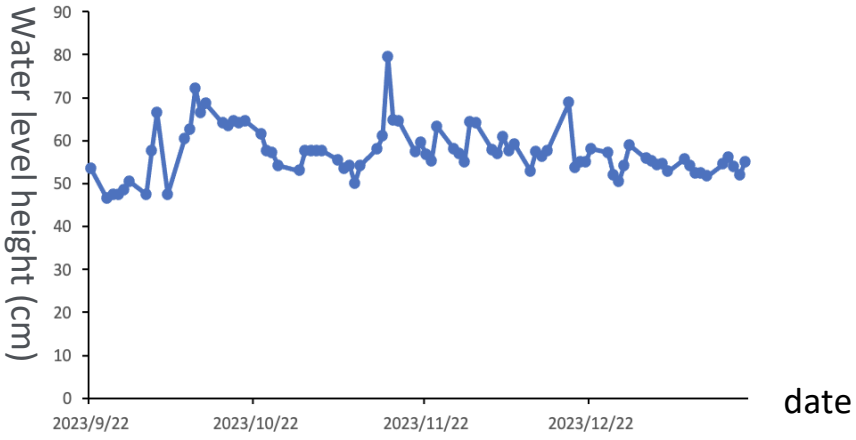
Canal water temperature changes day by day

Average: 23.18°C

Maximum value: 29.4°C (October 2, 2023)

Minimum value: 16.8°C

(2) Use the water level measured every Monday to Friday from September 21, 2023 to January 19, 2024 as the vertical axis to make a line chart.



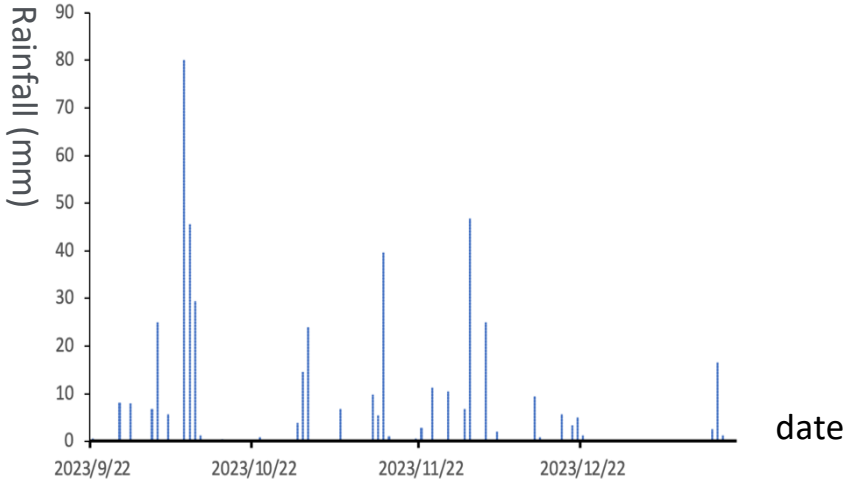
Canal water level changes day by day

Average: 57.27cm

Maximum value: 79.5cm (November 15, 2023)

Minimum value: 46.5cm (September 25, 2023)

(3) Use the rainfall measured every Monday to Friday from September 21, 2023 to January 19, 2024 as the vertical axis to make a bar chart

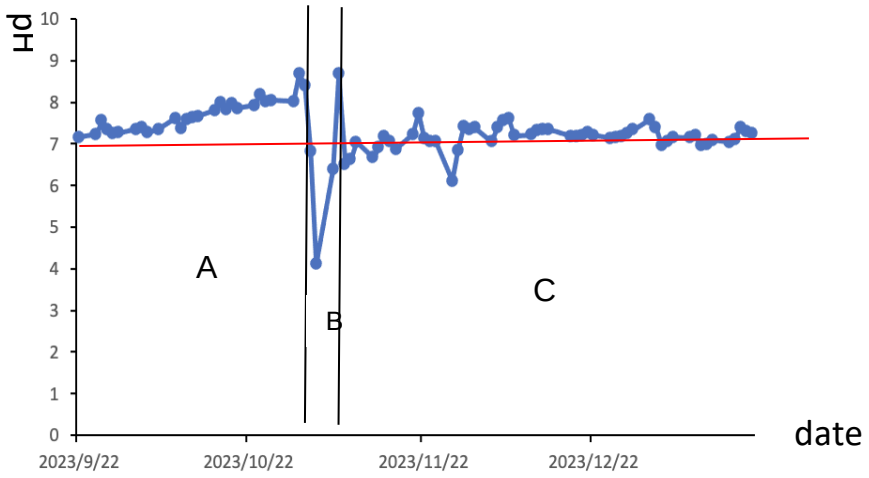


Rainfall changes day by day

Total rainfall: 471.41mm

Maximum value: 80mm (October 9, 2023)

(4) Use the pH value measured every Monday to Friday from September 21, 2023 to January 19, 2024 as the vertical axis to make a line chart. Due to the calibration failure of instrument A, the data increased, so it was replaced with instrument B. However, instrument B due to human negligence the error was too large, so it was replaced with the final instrument C.



pH changes day by day

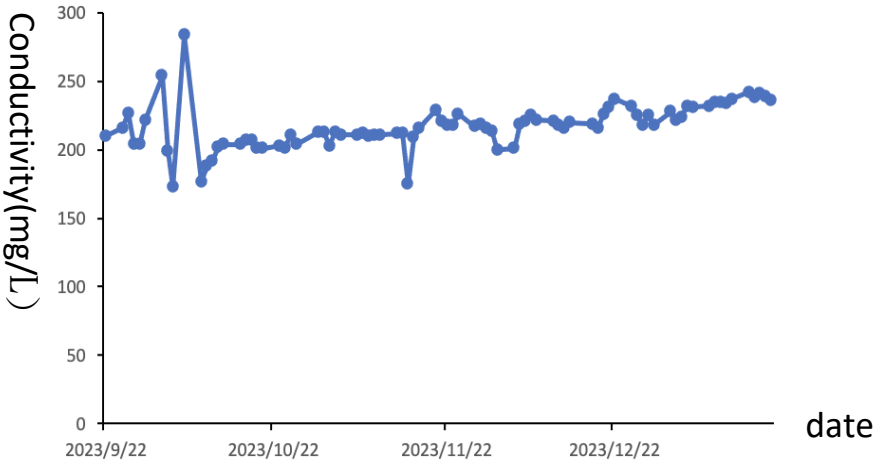
Average: 7.16

Maximum value: 7.52 (December 6, 2023)

Minimum value: 6.52 (November 8, 2023)

(The above are all instrument C data)

(5) Use the conductivity measured every Monday to Friday from September 21, 2023 to January 19, 2024 as the vertical axis to make a line chart.



Conductivity changes day by day

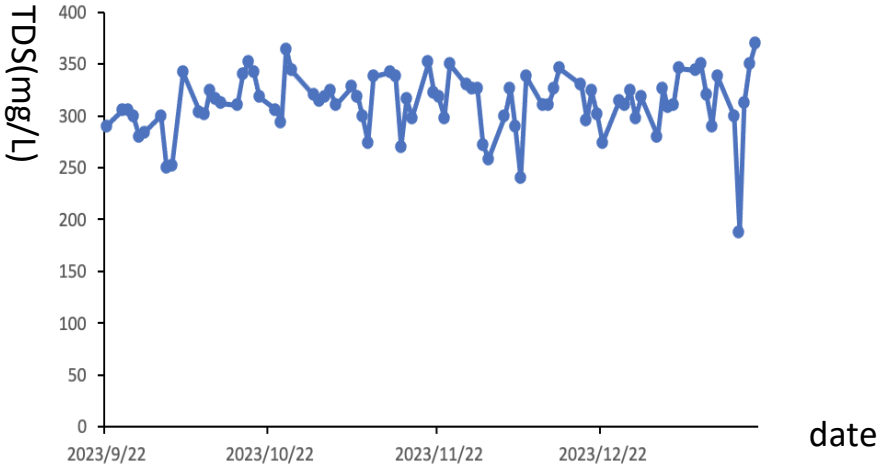
Average: 217.12 mg/L

Maximum value: 284mg/L (October 6, 2023)

Minimum value: 173mg/L (October 4, 2023)

Outlier: 284mg/L (October 6, 2023)

(6) Use the TDS measured every Monday to Friday from September 21, 2023 to January 19, 2024 as the vertical axis to make a line chart.



TDS changes day by day

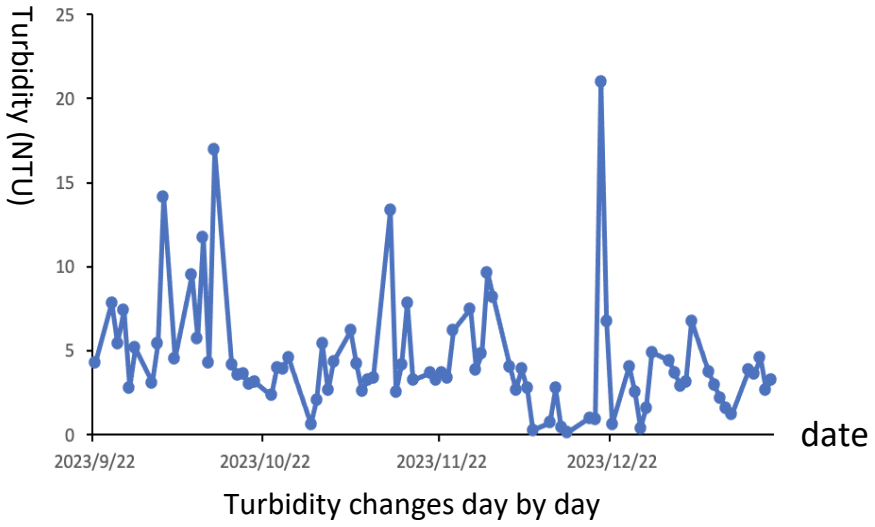
Average: 312.12 mg/L

Maximum value: 370mg/L (January 19, 2024)

Minimum value: 188mg/L (January 16, 2024)

Outlier: 188mg/L (January 16, 2024)

(7) Use the turbidity measured every Monday to Friday from September 21, 2023 to January 19, 2024 as the vertical axis to make a line chart



Turbidity changes day by day

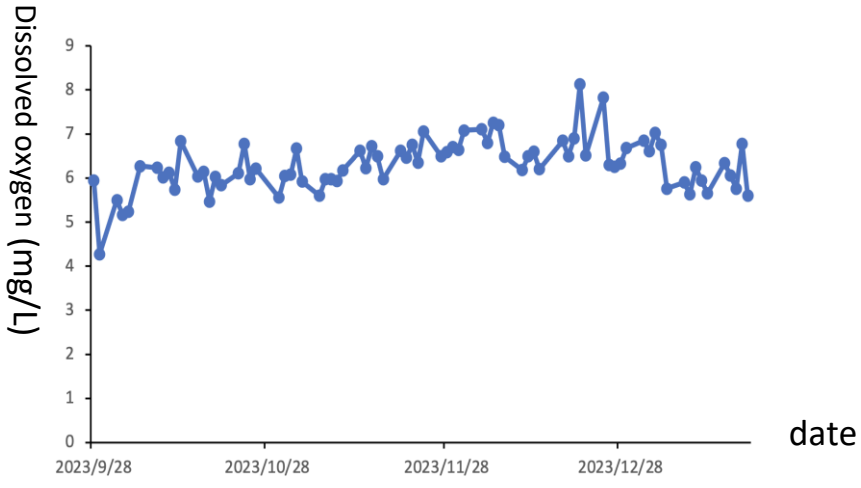
Average: 4.50NTU

Maximum: 20.97NTU (December 20, 2023)

Minimum value: 0.14NTU (December 14, 2023)

Outliers:
14.14 (October 4th)
16.95 (October 16)
13.34 (November 13)
20.97 (December 20)

(8) Use the dissolved oxygen measured every Monday to Friday from September 21, 2023 to January 19, 2024 as the vertical axis to make a line chart



Dissolved oxygen changes day by day

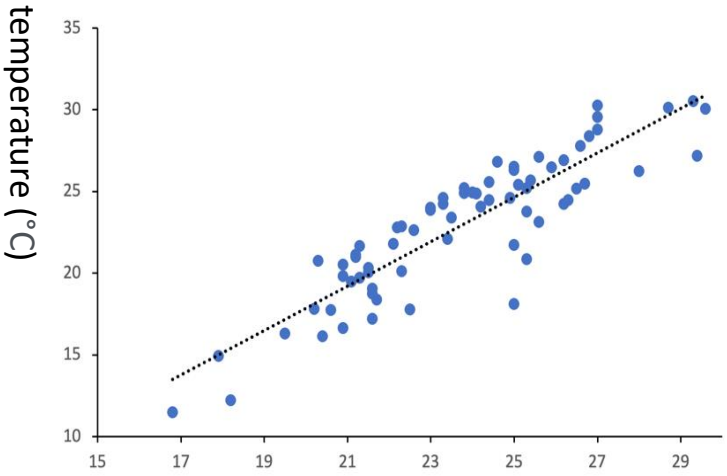
Average: 6.30mg/L

Maximum value: 8.13mg/L (December 21, 2023)

Minimum value: 4.27mg/L (December 29, 2023)

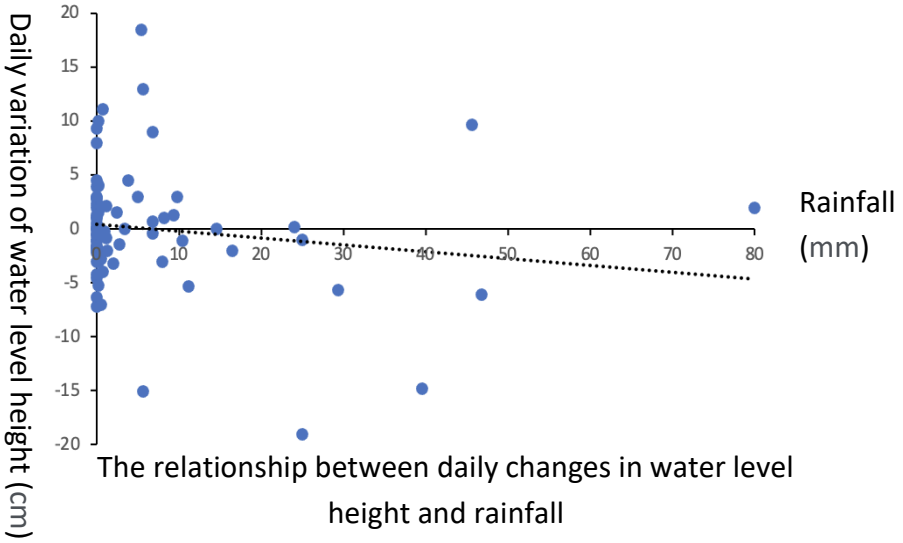
Discussion:

1. The main range of air temperature is from 11°C to 30°C, while the water temperature is from 16°C to 29°C. It can be observed that the change range of water temperature is smaller than that of air temperature. Since the specific heat of water is greater than that of air, the water temperature does not change as drastically as the air temperature.



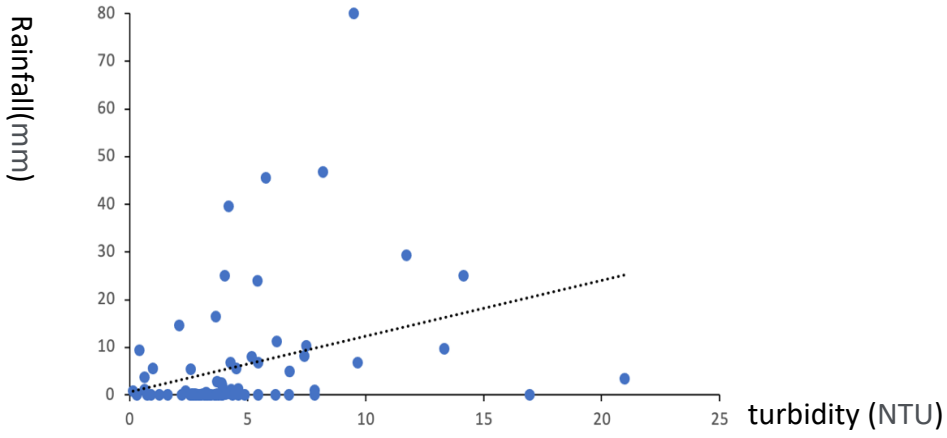
The relationship between air temperature and water temperature

2. It can be seen that the amount of rainfall has little impact on the water level, while the water level is closely related to the artificial control of the sluice.The switch is somewhat related.



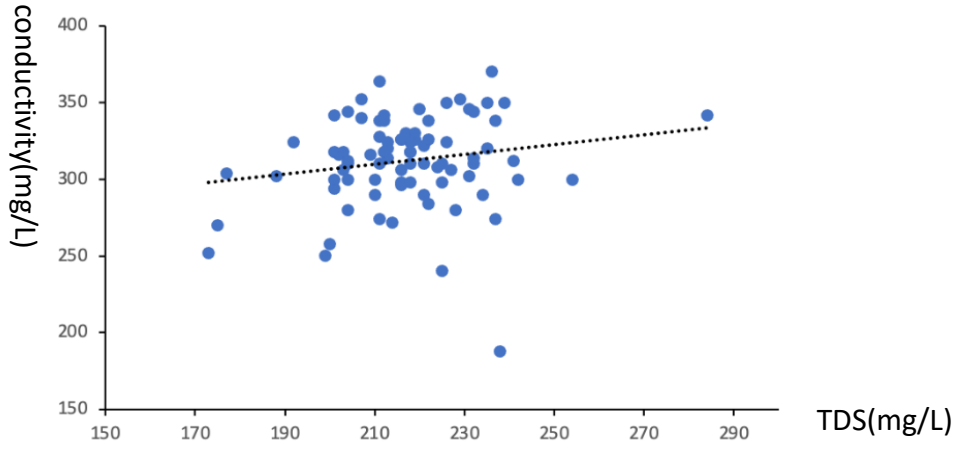
The relationship between daily changes in water level height and rainfall

3. It can be seen that there is a certain degree of interrelationship between rainfall and turbidity, but the specific impact needs to consider multiple factors. So there is little correlation.



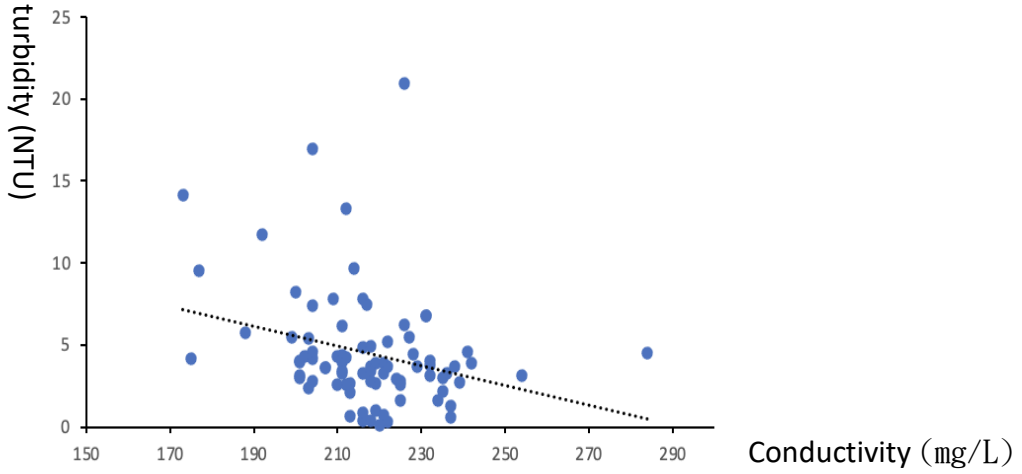
Relationship between rainfall and turbidity

4. Through calculation, it is known that R^2 is 0.0335, so the two sets of data do not have a linear relationship, and the conductivity is more focused on the ion concentration and conductivity of water, while the scope of TDS is more comprehensive, taking into account all dissolved in water of solid matter. Therefore, the TDS value is higher than the conductivity.



Relationship between Conductivity and TDS

5. Through calculation, it is found that R^2 is 0.0799. There is no linear relationship between these two sets of data, because turbidity is mainly measured.The content of suspended matter is mostly non-conductive substances. Conductivity measures the ion concentration and conductivity of water.Therefore, when the turbidity value increases, the conductivity does not necessarily increase.



The relationship between turbidity and conductivity

Conclusion:

1. Comparing the data collected by this institute with the agricultural irrigation water quality standards of the Ministry of Agriculture, we can know that the average of the measured data all are within the qualifying standards.

Item	Irrigation water quality standard limit	Value Research measured average
Water temperature	<35°C	23.18°C
Hydrogen ion concentration index (pH value)	6.0-9.0	7.16
Conductivity	<750mg/L	217.12mg/L
Dissolved oxygen	>3mg/L	6.25mg/L

2. The microfiber content observed in the downstream is higher than that in the upstream and midstream.

3. Conductivity and TDS Although the substances measured are particle concentrations in water, the concentration will also appear depending on whether the particles can conduct electricity difference.

4. There are too many variables that need to be considered in turbidity and rainfall, so the data directly comparing the two is not highly relevant.

5. The data of dissolved oxygen and pH value are relatively stable and do not change much.

Bibliography/Citations:

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https://reurl.cc/gMDLvz

(Search date: February 29, 2024)

2.Gregory A. Wetherbee (2019) It is raining plastic.

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3. NATIONAL TAIWAN UNIVERSITY CHEMISTRY DEPARTMENT TEACHING LABORATORY PH METERhttps://teaching.ch.ntu.edu.tw/gclab/doc/tech-basic/pH-meter.pdf

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4. National Taiwan University Climate Change and Sustainable Development Research Center Understanding Raw Water Turbidity

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6. Department of Biomechanical Engineering, Chiayi University Liquid Conductivity Measurement and Application

http://web.ncyu.edu.tw/~lanjc/lesson/C9/class/4-9703.pdf

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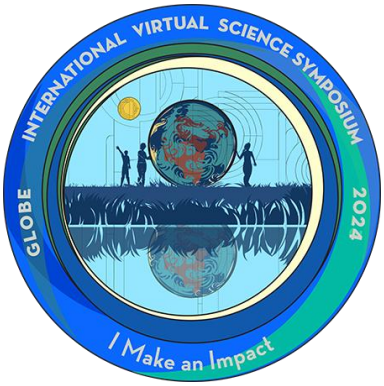
7. Central University Microplastics Workshop Lecture Notes

Badge Descriptions:

I MAKE AN IMPACT



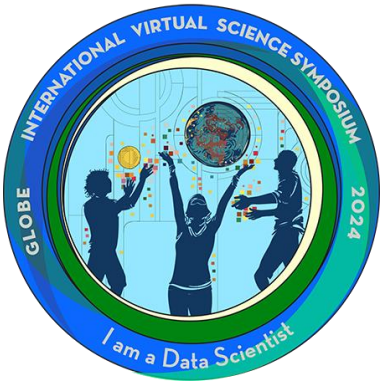
The report clearly describes how local issues give rise to research questions or how connections are made between local and global impacts. Students are required to clearly describe or demonstrate how the research will have a positive impact on their community by making recommendations or taking action based on the findings.

Justifications:

We used the data we collected and analyzed it.

Badge Descriptions:

I AM A DATA SCIENTIST



The report includes an in-depth analysis of students' own data as well as other data sources. Students discuss the limitations of these data, make inferences about past, present, or future events, or use the data to answer questions or solve problems in the represented system. Consider data from other schools or data available in other repositories.

Justifications:

The water samples in this study were agricultural irrigation water next to the school. The obtained data were compared with regulatory standards and it was found that all items were within regulatory standards. We will continue to observe whether plastic fibers and various data meet the standards. If they exceed the standards and cause water pollution, we will inform the Agriculture Bureau.