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Cimarinjung River Water Quality Study in Ciwaru Village Ciletuh Geopark Area, Sukabumi Regency, West Java

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Abstract

This study aims to determine the water quality of the Cimarinjung River in the Ciletuh Geopark area, Ciwaru Village. The method used in the study was a survey method by taking samples at one location of Cimarinjung River water samples. The results of the study found that the water quality of the Cimarinjung River had some parameters that did not meet the standards required in the water quality standards in Government Regulation Number 22 of 2021 concerning the Implementation of Environmental Protection and Management (Appendix VI concerning Class 1 National Water Quality Standards). Shown by water quality in physical parameters, namely the total solids are sorted by 1369 mg/l which is not in accordance with the requirements (1000 mg/l). The water quality for chemical parmeter, chloride (Cl), was 9340 mg/l exceeding the required limit (300 mg/l). The quality of the biological parameter is APM Escherichia Coli 350 APM/100 ml which exceeds the required limit (100 APM/100 ml).

Keyword: Water quality, Cimarinjun River, Geopark Ciletuh

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1. Introduction

Rivers are a source of surface water that provides benefits to human life. River quality will experience changes in accordance with the development of the river environment which is influenced by various activities and human life (Yulis, 1970). The quality of the water supply entering a river depends on its catchment area, and human activity within the catchment region affects the quality of the water supply entering the river (Wiwoho, 2005).

Currently, the main problem faced is that the water on the surface is often polluted, reducing water quality. Water resource usability, yield, productivity, carrying capacity, and carrying capacity will all decline as water quality deteriorates, ultimately lowering the richness of natural resources. Currently, it costs a lot to obtain water that meets criteria since human activity has contaminated the water with numerous waste products, lowering the quality of available water (Kurnianto, 2017).

Pollution of a water by heavy metals has been developed a lot of chemical monitoring, by determining the level of each pollutant in water or sediment (Darmono, 2018). The causes of water pollution include the use of fossil fuels, industrial waste, domestic waste disposal, pesticide use and mining. Miners' lack of awareness of the importance of preserving the environment eventually has an impact on the community around the mine (Yulianti, Sukiyah, and Sulaksana, 2017).

The Ciletuh – Palabuhanratu Geopark area in Sukabumi Regency, West Java, there is mining in the upstream area which is characterized by turbid brown suspense river water in the dry season," said the Ciwaru village civil servant. Mining is an activity that can increase community income, however, mining can also be harmful if it is carried out without first adequately processing the waste from the processing of gold ore (Mardhia & Abdullah, 2018). A mining enterprise that uses all kinds of excavated materials and conducts its operations without adhering to the official mining laws of the Central or Regional Governments is known as unlicensed mining (PETI). Although the existence of mining withouta permit can increase the economic capacity of the community, the impact caused is also large. One of the things that can be found is that mining activities without permits also cause a decrease in water quality and environmental pollution in the activity area and upstream to downstream areas from unlicensed gold mining sites (Wantasen et al., 2021).

According to residents around the river, it also has animpact on health, namely many residents are affected by itching. Changes in this situation can occur due to the entry of other component substances into river water , so that the river water's quality drops to a certain extent which causes water cannot be utilized properly. Currently, water pollution, especially in open water (rivers) is a serious problem (Yulis et al., 2018).

Similar research was carried out in Bandar Alai Kari Village, Kuantan Tengah District, Kuantan Singingi Regency, which included the degree of acidity (pH) and levels of Hg or mercury metal, to measure the levels of accumulated heavy metal content (Hg) and pH using laboratory analysis. The results of the research showed that the pH value ranged above pH 6 between 6.46 - 6.50, this value still met the specified quality standard figures, then for the heavy metal content mercury it was 12.67 ppb - 13.60 ppb (µg/L). Very dangerous for the body, it is a waste product from amalgamation processing of gold (Yulis 1970).

The purpose of this study is to determine the quality of Cimarinjung waterin the Ciletuh Geopark area, Ciwaru Village. Water quality research on Cimarinjung is also to find out the truth of the statements of residents around the river that the Cimarinjung River is suspected to contain mercury sourced from the disposal of gold mining waste in the upstream area.

There are several studies that are relevant to the previous research, which are as follows Dedy Anwar Saleh Pohan research (2016) With the title "River Water Quality Analysis to Determine the Allocation Reviewed from the Environmental Aspect, From

the Environmental Science Journal, the purpose of this study is to analyze the water quality of the Kupang River based on river water quality standards according to Government Regulation Number 82 of 2001, calculate the pollutant load of the Kupang River and determine the Water Quality Status and recommend efforts to manage the water quality of the Kupang Pekalongan River The method used in this study is descriptive and survey methods. The difference between this study and the research to be carried out is that this study uses a descriptive method while the research to be carried out uses the grab sampling method.

2. Method

The method used in sampling points in this study is *Systematic Grid Sampling*, where the coordinate points are chosen randomly accordingly specified point distance. This method is often used for pattern studies spatial because it makes it easier to create pattern maps originating from a grid and this method considers the sampling location with the sampling area. The location of the water sampling of the downstream Cimarinjung River is in the Ciwaru Village area, Sukabumi Regency. The administrative map of the research location can be seen in Figure 1. Water samples carried out quality analysis at the Jakarta Health Laboratory Center based on testing using clean water parameters. Water quality analysis is based on references that include several parameters, namely physical parameters, chemical parameters, and microbiological parameters. This research is a descriptive research based on laboratory tests. The sampling method uses the grab sampling method, which is taking samples using prepared sample bottles. Furthermore, analysis was carried out with data obtained from field measurements and laboratory testing (Virginia et al., 2020).

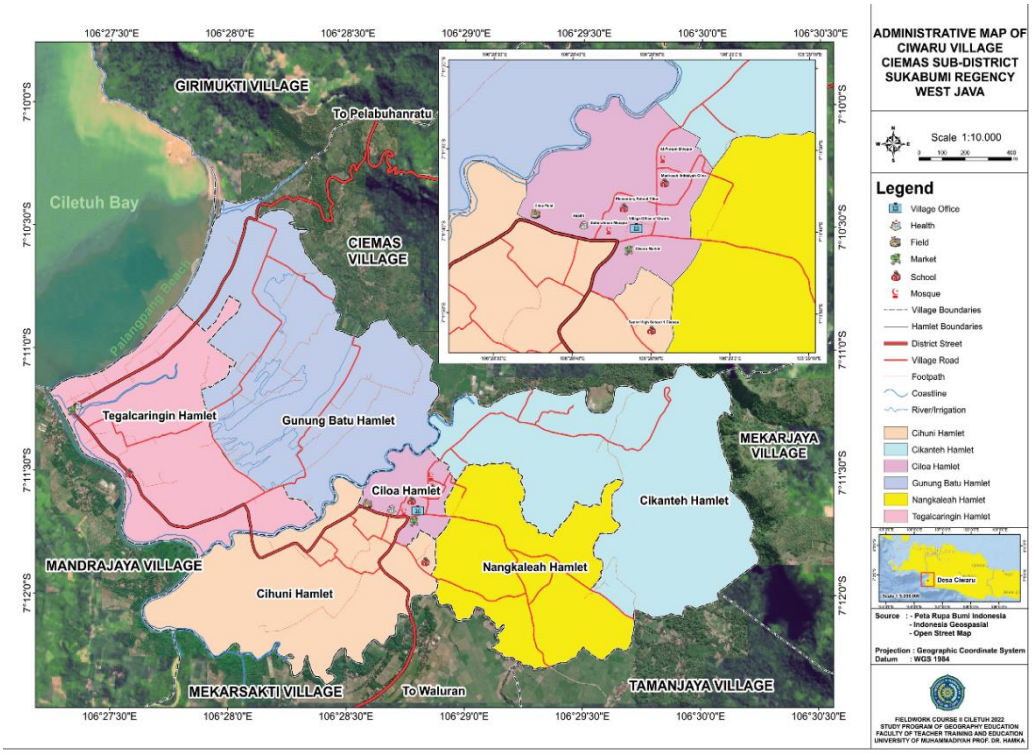

Figure 1. Ciwaru Village Administration Map of Sukabumi Regency

In this study, it was used to describe the condition of water quality of Sungai Cimarinjung originating from mining activities. The study was conducted in August 2022. Map The location of the river water point in Ciwaru Village can be seen in Figure 2.

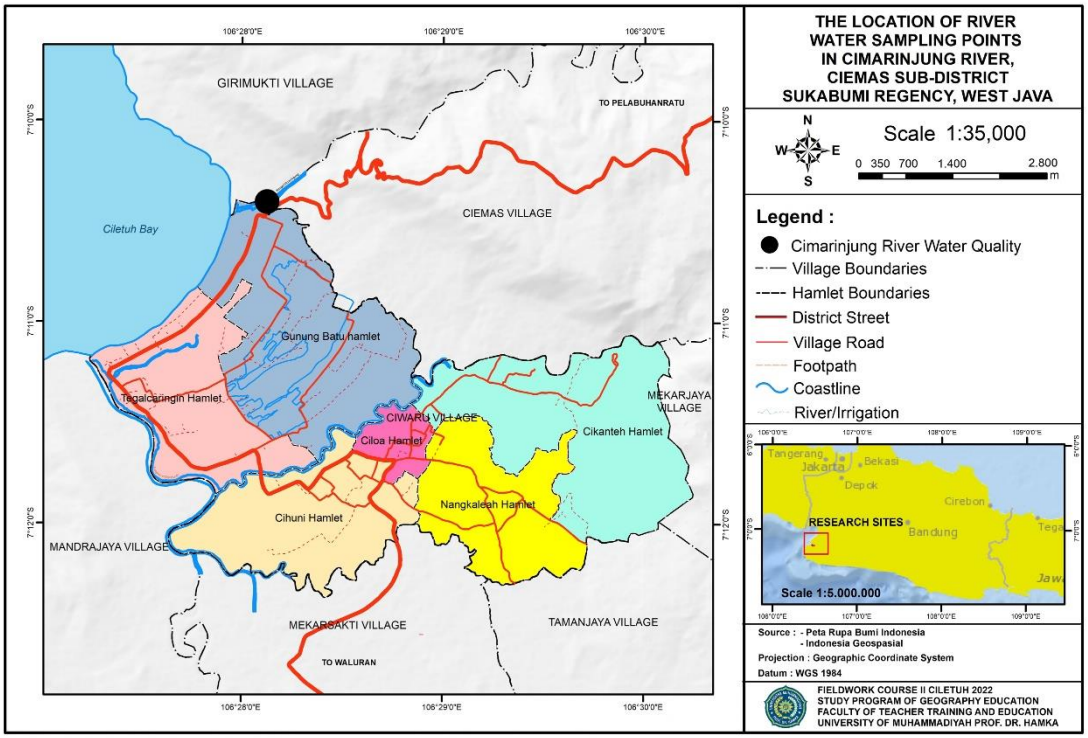

Figure 2. Location of Cimarinjung River Water Sampling Point in Ciwaru Village

3. Result and Discussion

Cimarinjung water is taken directly in the condition of the area where there is no rain in order to obtain river water quality that is not affected by rain. The waste released by mining activities can cause a decrease in the pH value which will have fatal consequences for aquatic organisms. However, in this research it can be seen that the pH value obtained still meets the established quality standards even though it is still in the acid category due to industrial activities such as gold mining, but it can be seen that there is still a balance between the processes of photosynthesis and respiration in these waters. This is in accordance with the opinion of (Safitri and Putri, 2013) that the amount of waste originating from households, chemical industries and fossil fuels into waters can affect the pH value in them and is in accordance with what Mahida (1981) stated. that changes in pH values can be influenced by industrial and household waste.

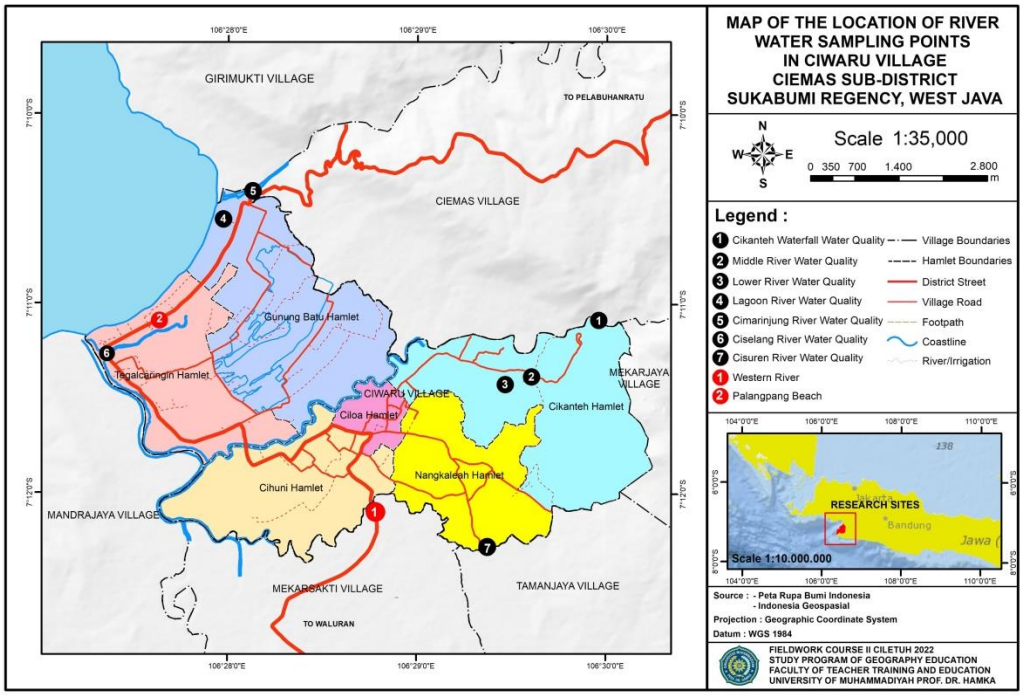

Figure 3. Location of River Water Sampling Point in Ciwaru Village

River water sampling was carried out at several sample points, while for laboratory testing, we only used 1 sample point due to time and cost limitations in research. For sample points that are not tested in the lab, we observe the physical quality of river water and the environment around the water sample point in which it is taken.

Here is an explanation of the physical quality of water

1. *Water Quality of Cikanteh Waterfall River*

This sampling was carried out on August 1, 2022, the researcher took water samples at a depth of 25 cm, The physical water in Cikanteh Waterfall is colorless, odorless, tasteless, water temperature 280 C, water turbidity (TDS) 26 ppm, water pH 28.0, water electrical conductivity 70 µs, water salinity 0.02 and the use of river water is used as tourism.

2. *Water Quality of The Central Cikanteh Curug River*

This sampling was carried out on August 2, 2022, the researcher took water samples at a depth of 45 cm, Pengambilan sampel ini dilakukan pada tanggal 02 Agustus 2022, peneliti mengambil sampel air pada kedalaman 45 cm, The physical water in the Central Cikanteh river water is gray, odorous, and tasteless, water pH 8.4, water temperature 270 C, turbidity TDS 27 pm, salinity 0.03, electrical conductivity 80µs. The use of river water as a domestic waste disposal and as irrigation for rice fields.

3. *Lower Cikanteh River Water*

This sampling was carried out on August 2, 2022, the researcher took water samples at a depth of 65 cm, Physical in the water of the Central Cikanteh River, the color of the river water is brownish, odorless, tasteless, water temperature 300 C, turbidity TDS 34 ppm, water pH 7.5, electrical conductivity 90µs, water salinity 0.03 and the use of Cikanteh water is used for rice field irrigation.

4. *Laguna River Water Quality*

This sampling was carried out on August 3, 2022, the researcher took samples on the surface of the lagoon water and did not measure the depth of the lagoon , Physically, the water of the Laguna River with a water temperature of 33ºC has a greenish water color, odorless, has a salty taste, water temperature of 33°C, turbidity (TDS) of 233 ppm, water pH 7.9, electrical conductivity of 1030µs, water salinity of 13.7 ppt, and the use of Laguna river water is used for tourist destinations.

5. Water Quality of The Cimarinjung River

This sampling was carried out on August 3, 2022, the researcher took water samples at a depth of 60 cm, the Physical in the water of the Cimarinjung River The water temperature is 32ºC with a brownish water color, the smell of water is odorless, tasteless, the PH of water is 7.4 and the conductivity of water electricity is 62µs, the salinity of water is 1.09 ppt, then the use of Cimarinjung River water is used for irrigation of rice fields.

6. Water Quality of Ciselang River

This sampling was carried out on August 3, 2022, the researcher took samples on the surface of the lagoon water and did not measure the depth of the lagoon, The physical quality of Ciselang river water is greenish, odorless, salty, water turbidity TDS 118 ppm, water temperature 30.5°C, water pH 7.5, electrical conductivity 690µs, water salinity 3.78 ppt, the use of Ciselang River water is used for rice field irrigation.

7. Water Quality of Cisuren River

This sampling was carried out on August 4, 2022, the researcher took water samples at a depth of 15 cm, The physical quality of Cisuren river water is colorless, odorless, tasteless, water turbidity TDS 98 ppm, water temperature 30°C, water pH 7.4, electrical conductivity 230µs, water salinity 0.12 ppt, the use of Cisuren River water is used for agricultural irrigation.

Apart from that, the existence of gold mining activities in the upstream areas of the river is a factor in the presence of the chemical element mercury in the water. This is in line with the opinion of (Buyang, 2013) that the heavy metal mercury can enter waters in the form of mining waste which is used to separate gold from rocks and soil in the form of sulfide. In table 3 you can see the results of measuring the mercury content (Hg) of the Kuantan river flow in Bandar Alai Kari village. The results of the river water test in the laboratory can be seen in Table 1:

Table 1. Water Quality Results of Cimarinjung River Water Sample Laboratory Test in Ciwaru Village (Jakarta Health Laboratory Center)

No.	Water Quality Parameters	Test Results	Unit	River Water Quality Standards. Class 1 Government Regulation No. 22 of 2021
	Physics			
1	Temperature	23,1	°C	Deviation 3
2	Total Solutes (*Total Dissolve Solid*)	1369	mg/l	1000
3	Total Suspended Solids *(Total Suspended Solid)*	<5	mg/l	40
	Chemistry			
1	Amonia-N	<0,06	mg/l	0,1

2	Arsenic(As)	0,001	mg/l	0,05
3	Barium(Ba)	<0,00628	mg/l	1
4	Iron (Fe)	<0,05	mg/l	0,3
5	BOD	<0,5	mg/l	2
6	Boron (B)	0,12	mg/l	1
7	COD	7,1	mg/l	10
8	DO	7	mg/l	≥6
9	Phenol	0,07	mg/l	0,02
10	Fluoride	0,84	mg/l	1
11	Hidrogen Sulfide (H2S)	0,01	mg/l	0,02
12	Cadmium(Cd)	<0,0005	mg/l	0,01
13	Chloride(Cl)	9340	mg/l	300
14	Khobalt(Co)	<0,0000957	mg/l	0,2
15	Cromium(Valense 6)	<0,009	mg/l	0,05
16	Manganese(Mn)	<0,01	mg/l	0,1
17	Mercury(Hg)	<0,000313	mg/l	0,002
18	Nitrate(as N)	0,38	mg/l	10
19	Nitrite(as N)	0,004	mg/l	0,05
20	Lab pH	7,33	mg/l	6,0-9,0
21	Phospat(PO4)	0,5	mg/l	0,2
22	Raksa(Hg)	<0,000313	mg/l	0,001
23	Selenium(Se)	0,00032	mg/l	0,01
24	Dissolved Zinc(Zn)	<0,005	mg/l	0,05
25	Methylene blue acrive (Surfectan)	-	mg/l	0,2
26	Cyanide	<0,007	mg/l	0,02
27	Sulfate	125	mg/l	300
28	Dissolved copper (Cu)	<0,02	mg/l	0,02
29	Lead (Pb)	<0,002	mg/l	0,03

	Microbiology			
1	APM *Coliform*	920	APM/100ml	1000
2	APM *Escherichia Coli*	350	APM/100ml	100

1. Physics

Cimarinjung River water samples were analyzed for physical parameters using standard analysis methods for each parameter obtained from laboratory test results. Analysis of water quality data based on water quality standards in Government Regulation Number 22 of 2021 concerning Implementation of Environmental Protection and Management (Attachment VI concerning National Water Quality Standards Class 1). Based on the results of laboratory tests on Cimarinjung River water samples for physical parameters, it is known that the water temperature is 23.1 °C. According to ATSDR (1999), the higher the temperature, the more mercury metal will evaporate to form mercury vapor which is colorless and odorless. Darmono (1995) stated that mercury metal will evaporate if the temperature of a body of water is high, this is because the basic nature of mercury is that it is a volatile substance so its presence in water will decrease. The rise and fall of the temperature of a body of water is influenced by the intensity of light entering the water and the presence of metal elements in the water (Ariawan in Rezki, 2017). The total dissolved solids (TDS) is 1369 mg/1 with the required standard being 1000. total dissolved solids, namely not in accordance with the required standards, and for total suspended solids (TSS) less than 5 (<5) it is in accordance with the required standard category, namely not exceeding 40. TSS and TDS are components of total solids, other than colloidal particles. The component that causes high TDS and TSS numbers comes from the diazonium salt compound which dissolves in water, which breaks down into particles of varying sizes. Particles that are larger in size and float in the water medium will be measured as TSS, while particles with a finer size will dissolve in water and be measured as TDS (Seni et al., 2011).

2. Chemistry

Analysis of the chemical quality of water Sungai Cimarinjung is carried out based on water quality data from laboratory tests that compare with river water quality standards in Government Regulation Number 22 of 2021 opposing the Implementation of Environmental Protection and Management (Annex VI on Class 1 National Water Quality Standards).

According to Fadil, et al (in Bunga & Padjadjaran, 2017) Amomnia (NH_3), N itrate (NO_3) and Nitrite (NO_2) are derivatives of organic nitrogen compounds that are toxic to living things found in waters. The level of toxicity of each compound varies where Ammonia and Nytrite are very toxic even in small levels while new nitrates are toxic in large levels. Based on the results of laboratory testing on chemical parameters in Sungai Cimarinjung water samples, it is known that the Nitrate compound is 0.38 mg / L, which means that it still meets river water quality standards according to Government Regulation Number 22 of 2021 the Implementation of Protection and Management of the Living Environment (Annex VI on Class 1 National Water Quality Standards). The low content of Nnitrate is likely caused by the environment around the sungau which is not much livestock activity and animals roaming around, where nitrates can be formed by the activity of microorganisms that cause decay of organic matter.

In solution, Kloride ions are in the compounds Kalium Klorida, Kalsium Kloride and Natrium Kloride. Kloride ions whose concentration exceeds the threshold, will have a negative impact, especially on human health, which can cause damage to the kidneys (Qomariyah, 2023). The results of the laboratory test on the K lorida parameter show that the Cimarinjung water sample has exceeded the threshold for river water quality standards in Government Regulation Number 22 of 2021 against the Implementation of Protection and Management of Hidup (Annex VI concerning Class 1 National Water Quality Standards) which is 300 mg / L While the results of the Klorida content in the Sungai C imarinjung water sample are 9340 mg / L. The amount of Klorida content is caused by water samples taken in the river channel close to the mouth of the Cimarinjung River which tastes waterit is rather salty which indicates the concentration of Klorida in river water is quite high.

Sulfate content can affect the change in taste in water to bitter taste and can cause side effects if sulfate levels in water have a high concentration. The danger of sulfate ions when consumed with a large enough sulfate content can cause laxative/diarrhea (Zelika Nur Jannah, 2021). The results of the Cimarinjung water ampel test show that the sulfate level of 125 mg / L, is still below the threshold of river water quality standards in Government Regulation Number 22 of 2021 against the Implementation of Protection and Management of the Living Environment (Appendix VI concerning Class 1 National Water Quality Standards). This condition is likely caused by the accumulation of organic waste on the banks of the river channel which results in a slight growth of anaerobic bacteria, and also no sulfate mineral dissolution rocks such as gypsum and fertilizer from sulfur compounds in rainwater due to industrial exhaust gases around the Cimarinjung S ungai water flow.

Iron content in surface water is very rarely found exceeding 1 mg / l. In water that does not contain oxygen such as groundwater, iron is as Fe^{2+} which is quite high, while in river water that flows and aeration occurs, Fe^{2+} oxidizes to Fe $(OH)_3$, where Fe (OH) 3 is difficult to dissolve at pH 6 to 8 (Henie Poerwandar Asmaningrum, 2016). The test results of the Cimarinjung water sample showed that the iron content is less than 0.05 mg / L (<0.05). This situation has not exceeded the maximum limit of Iron content in river water quality standards according to Government Regulation Number 22 of 2021 against the Implementation of Protection and Management of the Living Environment (Annex VI concerning National Water Quality Standards Class 1).

3. Microbiology

For the results of lab testing on biological parameters, namely obtaining results with APM Eshericia Coli in river water of 350 APM which exceeds the required standard of 100 APM / 100 ml which is guided by river water quality standards Government Regulation Number 22 of 2021 about the implementation of environmentalprotection and management. According to (Naillah et al., 2021) E.Coli bacteria come from large amounts of human feces and can transmit to others in river water, and E.Coli bacteria will die at a temperature of 60℃ for 30 minutes (Widyaningsih et al., 2016).

4. Conclusion

The Ciletuh-Palabuhanratu Geopark area in Sukabumi Regency, West Java, there are mining activities from one of the impacts of gold mining, namely water pollution in the Ciwaru Village C iletuh Geopark area. From the results of water quality tests in the

laboratory on physical, chemical, and microbiological parameters which show that water Sungai Cimarinjung has water quality below national water quality standards. It is suspected that the wastewater used for mining activities was discharged into the Cimarinjung River which allegedly contained mercury and cyanide. This can cause a decrease in Ciletuh Geopark tourist destinations, in addition to irrigation flows that can threaten to decrease crop yields, and according to residents around the health impact caused, many residents are affected by itching disease. The results of the study concluded that the results of water quality tests for 3 parameters, namely total dissolved solids, phenol, phosphate, chloride, hydrogen sulfide and APM Escherechia coli did not meet the required river water quality standards.

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