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Study of water quality and water quality status using pollutant index in Sebenaq River, Mahakam Ulu Regency, East Kalimantan

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Abstract: Mahakam Ulu Regency is a regency located in the upper reaches of the Mahakam River. The Mahakam River in Mahakam Ulu Regency consists of several tributaries, one of which is the Sebenaq River, located in the capital city of Mahakam Ulu Regency. The Sebenaq River is used by the local community to meet the need for clean water because PDAM is not yet available and is also used as a means of transportation. The Sebenaq River flows through the central office area of the Mahakam Ulu Regency Government, main roads, and residential areas. Along with the development of Ujoh Bilang Village as the center of the capital city of Mahakam Ulu Regency and the use of Sebenaq River water by the surrounding community, it is deemed necessary to conduct research related to the water quality and quality status of the Sebenaq River. This study aims to provide data on water quality and quality status of the Sebenaq River to be used by related parties in the management and utilization of the Sebenaq River in the future. The locations for water sampling, river cross-section profile data collection, and in-situ parameter testing are Station I (Upstream of Sebenaq River), Station II (Tributary of Sebenaq River), Station III (Sebenaq River Crossing Road 1), Station IV (Sebenaq River Crossing Road 2), and Station V (Downstream of Sebenaq River). Based on the results of the calculation of the determination of water quality status using the Pollutant Index method with class I quality standards according to Government Regulation No. 22 of 2021, the water quality status of the Sebenaq River is classified as lightly polluted, with details of Station I (Upstream of the Sebenaq River) having a score of 3.795 indicating lightly polluted conditions, Station II (Sebenaq River Tributary) with a score of 2.781 indicating lightly polluted conditions, Station III (Sebenaq River Crossing Road 1) with a score of 2.361 indicating lightly polluted conditions, Station IV (Sebenaq River Crossing Road 2) with a score of 2.878 indicating lightly polluted conditions, and Station V (Downstream of the Sebenaq River) with a score of 2.327 indicating lightly polluted conditions.

Keywords: *Pollutant Index, River quality status, Utilization of river water.*

1. Introduction

Water is an important compound that supports all forms of life on earth. Household, agricultural, livestock, business and commercial activities require clean water. Along with the development of construction and population growth, the need for clean water also increases, while the amount of clean water available is increasingly limited, as well as the quality of water which is decreasing. Clean water sources are obtained from river or lake water, groundwater, seawater, or rainwater.

Kalimantan is an island that has many rivers which are the main source of clean water and support daily activities for the local community. Before the existence of a modern water distribution system and urban planning, people tended to live around rivers to meet their need for clean water. River water with good quality contributes to supporting the lives of living things around it, conversely polluted river water has a negative impact on aquatic organisms, humans, and the ecosystem as a whole.

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The Mahakam River functions as a center for many businesses, ranging from industry, agriculture, forestry, mining, to the community economy. In addition, the Mahakam River functions as the heart of life for most of the people of East Kalimantan, especially those who live and work in the area. For a long time, the Mahakam River has played an important role in the lives of the surrounding community as a water source, fishery source, and means of transportation.

Mahakam Ulu Regency is a regency located in the upstream area of the Mahakam River. The Mahakam River in Mahakam Ulu Regency consists of several tributaries, one of which is the Sebenaq River which is located in the capital city of Mahakam Ulu Regency. The Sebenaq River is used by the local community to meet the need for clean water because there is no PDAM and is also used as a means of transportation. The Sebenaq River flows through the central office area of the Mahakam Ulu Regency Government, main roads and residential areas.

Research on the status of river water quality in Kalimantan has been conducted by Christiana, et al. [1] concerning the Analysis of Water Quality and Quality Status and Pollution Load of the Mahap River in Sekadau Regency, West Kalimantan and Cahyanto, et al. [2] concerning the Study of Water Quality and Water Quality Status of the Kahala River, Kenohan District, Kukar Regency. The methods commonly used to determine water quality status are the STORET method and the Pollution Index method. The water quality testing parameters used are The parameters used in this study are pH, DO, BOD, COD, TSS, NO3-N, T-Phosphate, Fecal Coli, these parameters represent the condition of river water in general, and are used to determine the water quality status in the Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number 27 of 2021 concerning the Environmental Quality Index. Along with the development of Ujoh Bilang Village as the center of the capital of Mahakam Ulu Regency and the utilization of Sebenaq River water by the surrounding community, it is deemed necessary to conduct research related to water quality and quality status of the Sebenaq River. This study intends to provide data on water quality and quality status of the Sebenaq River so that it can be used by related parties in the management and utilization of the Sebenaq River in the future.

2. Materials and Methods

2.1. Study area

This research was conducted in the Sebenaq River with the following locations for water sampling, river cross-section profile data collection and in-situ parameter testing:

1. Station I (Sebenaq River Headwaters) with coordinates: 0° 28' 10.042" N, 115° 11' 16.594" E;
2. Station II (Sebenaq River Tributary) with coordinates: 0° 29' 3.642" N, 115° 11' 57.587" E;
3. Station III (Sebenaq River Road Crossing 1) with coordinates: 0° 28' 11.461" N, 115° 13' 12.699" E;
4. Station IV (Sebenaq River Crossing Road 2) with coordinates: 0° 28' 25.810" N, 115° 14' 33.206" E;
5. Station V (Sebenaq River Downstream) with coordinates: 0° 28' 12.398" N, 115° 16' 4.659" E;

The laboratories for water quality testing are the Laboratory of the Environmental and Natural Resources Research Center (P2LH-SDA) of Mulawarman University and the Laboratory of the Samarinda Industrial Standardization and Service Center.

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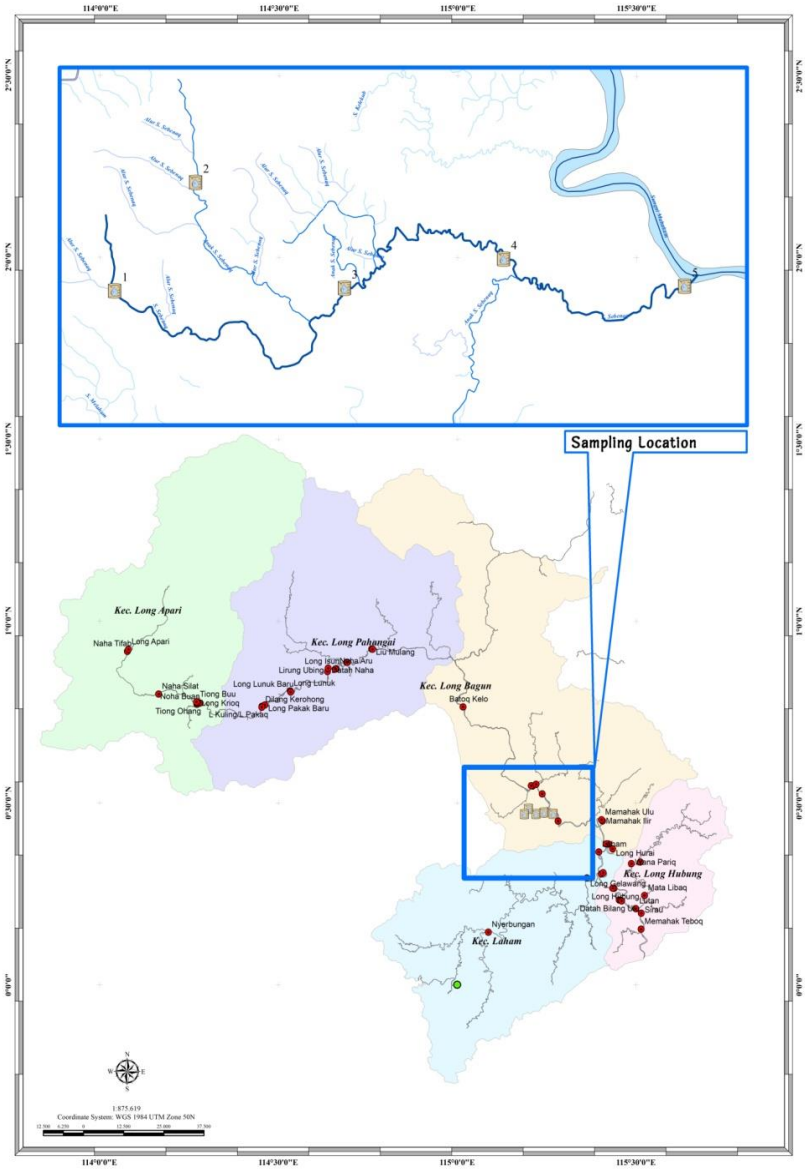

Figure 1.
Map of the Sebenaq river.

Table 1.
Research parameters.

Sampel	Parameters	Baku Mutu	Acuan
water	Suspended Residue (TSS)	50 mg/L	SNI 6989.3 [3]
	Acidity (pH)	6 – 9	SNI 6989.11 [4]
	Dissolved Oxygen (DO)	6 mg/L	Environment Federation (WEF) [5]
	Total Phosphate	0,2 mg/L	SNI 6989.31 [6]
	Nitrate	10 mg/L	SNI 06-2480 [7]
	Biochemical Oxygen Demand (BOD5)	2 mg/L	SNI 6989.72 [8]
	Chemical Oxygen Demand (COD)	10 mg/L	SNI 6989.2 [9] (Spektrofotometri)
	Fecal Coliform	100 mg/L	APHA 23rd 9221 Fischer, et al. [10]

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2.2. Water Discharge

The method used in determining river discharge is the river profile method (Cross Section). In this method, discharge is the result of multiplying the vertical cross-sectional area of the river by its flow rate.

$$Q = A \times V$$

Where:
Q = Flow rate (m/s);
A = Vertical cross-sectional area (m);
V = River flow velocity (m/s).

2.3. Making a River Profile

To find out the cross-sectional area of a river, namely by determining the river profile. The area of the river cross-section (A) is the sum of all parts of the river cross-section by multiplying the distance interval in the horizontal position by the water depth, the formula is written as follows Bosiers, et al. [11].

$$A\ (m^2) = L_1D_1 + L_2D_2 + \ldots\ldots\ldots L_nD_n$$

where:
L = Horizontal cross-sectional width (m)
D = Depth (m)

Water Quality Status Pollution Index Method (IP)
This method has been regulated in accordance with the Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number 27 of 2021 concerning the Environmental Quality Index.
The formula used in determining the Pollution Index is as follows:

$$Pij = \sqrt{\frac{(Ci/Lij)_M^2 + (Ci/Lij)_R^2}{2}}$$

Description:
Lij: Concentration of water quality parameters listed in the water quality standards (J)
Ci: Concentration of water quality parameters in the field
Pij: Pollution index for the designation (J)
(Ci/Lij) M: Value, maximum Ci/Lij
(Ci/Lij) R: Value, average Ci/Lij
This method can directly link the level of pollution with whether or not the waters can be used for certain uses and with the values of certain parameters.
Evaluation of the IPj value is:

Table 2.
Classification of pollutant index (IP) status.

IPj value	Water quality
0-1.0	Good condition
1.1-5.0	Light contamination
5.0-10.0	Moderate contamination
>10.0	Heavy contamination

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3. Results and Discussion

3.1. River Water Discharge

The range of Sebenaq River water discharge at each sampling station, obtained quite varied results, as shown below.

Table 3.
Current speed, cross-sectional area and river water discharge.

No.	River name	Dry season period			Rainy season period		
		Current velocity (m/s)	Cross-sectional area (m^2)	Debit (m^3/dtk)	Current velocity (m/s)	Cross-sectional area (m^2)	Discharge (m^3/sec)
1.	Stasiun-I	0.38	4.54	1.72	0.29	10.41	2.98
2.	Stasiun-II	0.47	2.33	1.09	0.55	2.93	1.61
3.	Stasiun-III	1.25	2.66	3.33	0.55	13.39	7.40
4.	Stasiun-IV	1.24	2.78	3.45	0.54	28	14.98
5.	Stasiun-V	0.42	17.87	7.5	0.23	75.91	17.46

3.2. River Cross-section Profile

3.2.1. Cross-section Profile of Station I (Upstream of Sebenaq River)

In general, the river cross-section profile at Station I, namely the Upstream of Sebenaq River, shows a curved river bank on the left side and a slight fracture, while the right river bank is also curved, where the riverbed tends to be flat. The cross-sectional area of the river filled with water at station I in the dry season is 4.54 m2, while in the rainy season it is 10.41 m2.

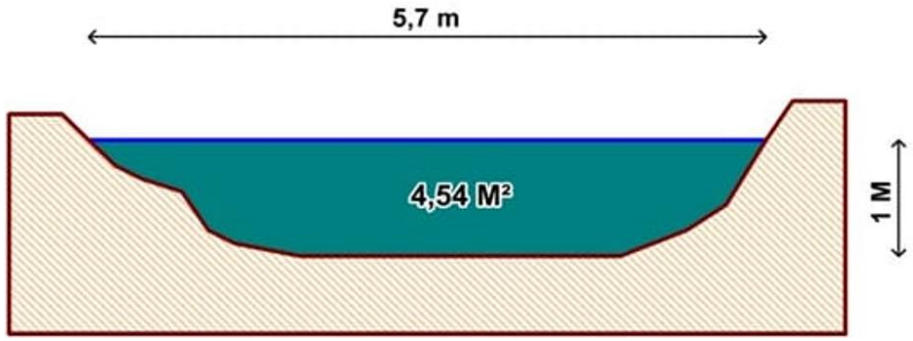

Figure 2.
River profile at station I (Upstream of Sebenaq River).

3.2.2. Cross-sectional Profile of Station II (Sebenaq River Tributary)

The river cross-sectional profile at the location of Station II, namely the Sebenaq River Tributary, shows a concave shape and a slight fracture at the bottom of the river, as well as a curved shape of the river cliffs on the left and right sides. River cross-sectional area. The cross-sectional area of the river filled with water at station II in the dry season is 2.33 m2, while in the rainy season it is 2.93 m2.

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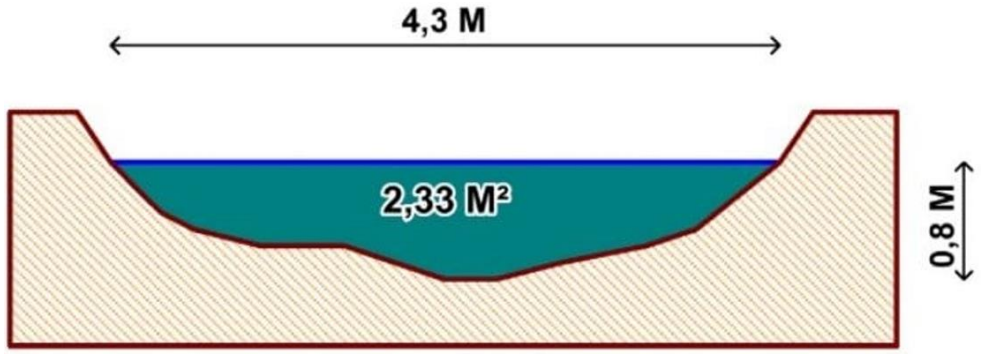

Figure 3.
River profile at station II (Sebenaq River Tributary).

3.2.3. Cross-Sectional Profile of Station III (Sebenaq River Road Crossing 1)

At Station III, namely Sebenaq River Crossing Road 1, the river cross-section profile has a wide shape with a base that is not too deep. The right and left sides form cliffs/jering that are almost the same depth with a sloping shape and form a fairly flat riverbed. The cross-sectional area of the river filled with water at station III in the dry season is 2.86 m2, while in the rainy season it is 13.39 m2. The cross-sectional area of the river in the rainy season which increases quite drastically can be caused by the level of rainfall, topographic conditions and areas around the river where there are settlements and roads with less land cover, so that rainwater will be directly carried into the river affecting the increase in the cross-sectional area of the river.

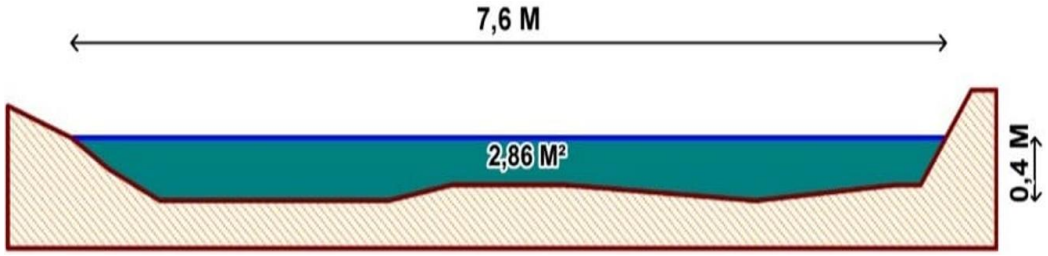

Figure 4.
River Profile at Station III (Sebenaq River Road Crossing 1).

3.2.4. Cross-Sectional Profile of Station IV (Sebenaq River, Road Crossing 2)

At Station IV, the cross-sectional profile of the Sebenaq River, Road Crossing 2 shows a widening shape with sloping left and right river banks, and a fairly flat riverbed with few waves. The cross-sectional area of the river filled with water at station IV in the dry season is 2.78 m2, while in the rainy season it is 28 m2. As at station II, the cross-sectional area of the river at station IV in the rainy season which increases quite drastically can be caused by the level of rainfall, topographic conditions and areas around the river where there are settlements and roads with less land cover, so that rainwater will be carried directly into the river, affecting the increase in the cross-sectional area of the river.

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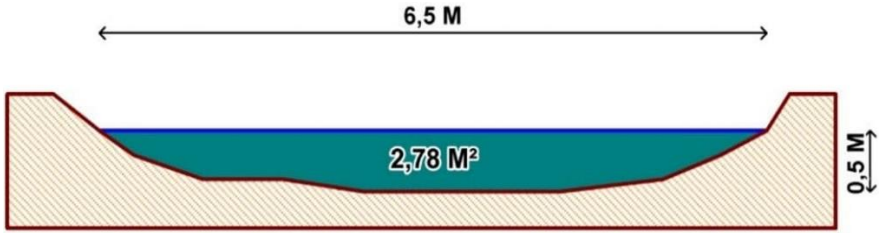

Figure 5.
River Profile at Station IV (Sebenaq River Crossing Road 2).

3.2.5. Cross-Sectional Profile of Station V (Sebenaq River Downstream)

At station V, the cross-sectional profile of the Sebenaq River Downstream shows a fairly flat basin and riverbed shape, as well as a curved river cliff shape on the left and right sides. The cross-sectional area of the river filled with water at station V in the dry season is 17.87 m2, while in the rainy season it is 75.91 m2. As at stations III and IV, the cross-sectional area of the river at station V in the rainy season increases quite drastically due to the level of rainfall, topographic conditions and areas around the river where there are settlements and roads with less land cover, so that rainwater will be carried directly into the river, affecting the increase in the cross-sectional area of the river.

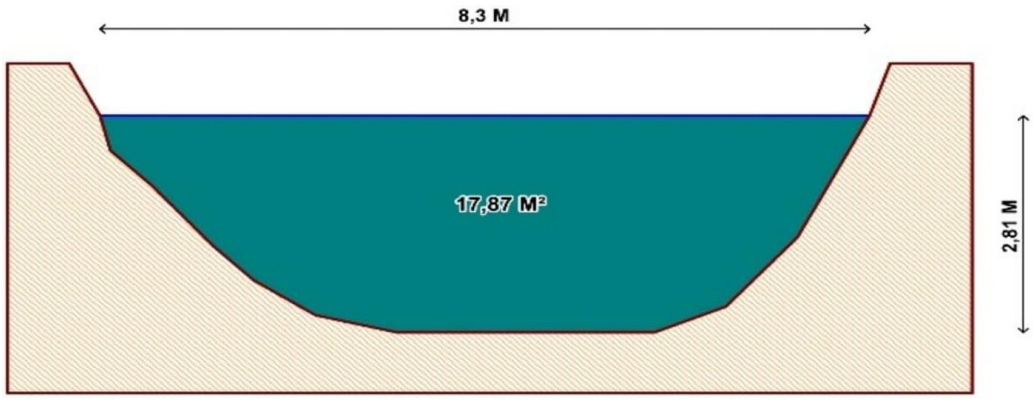

Figure 6.
River profile at station V (Downstream of Sebenaq River).

3.3. Water Quality

Overall, of the 8 water quality parameters analyzed, most are still within the permitted range based on the quality standards in Government Regulation Number 22 of 2021 Appendix V forclass I. The analysis of the Sebenaq River water quality is presented in the following table.

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Table 4.
Results of the Sebenaq river water quality analysis during the dry season period.

No.	Parameter	Unit	Water quality standards	Station				
				I	II	III	IV	V
A	Physics							
1	TSS	mg/L	50	10	4	8	8	12
B	Chemistry							
2	pH		6-9	6.5	6.55	6.43	6.43	7.01
3	Dissolved Oxygen (DO)	mg/L	6	7.01	7.08	7,04	7.03	7.03
4	BOD	mg/L	2	1.4	1.26	1,39	1.7	1.7
5	COD	mg/L	10	10.91	17.7	15,97	19.08	19.08
6	Nitrate (NO_3-N)	mg/L	10	0.585	0.725	0,571	0.55	0.676
7	Total Phosphate (PO_4)	mg/L	0,2	ttd	ttd	ttd	ttd	ttd
C	Biology							
8	Fecal Coli	Jumlah/100L	100	>1100	20	150	75	43

Description:
I : Sebenaq River Headwaters
II : Sebenaq River Tributaries
III : Sebenaq River Road Crossing 1
IV : Sebenaq River Road Crossing 2
V : Sebenaq River Downstream
BML : Government Regulation No. 22 of 2021 Class I

Table 5.
Results of sebenaq river water quality analysis during the rainy season period.

No.	Parameter	unit	Water quality standards	Stasiun				
				I	II	III	IV	V
A	Physics							
1	TSS	mg/L	50	19	4	27	22	20
B	Chemistry							
2	pH		6-9	6.26	6.35	6.37	6.64	6.8
3	Dissolved Oxygen (DO)	mg/L	6	6.41	6.71	6.58	6.22	6.81
4	BOD	mg/L	2	1.74	1.64	1.24	1.64	1.5
5	COD	mg/L	10	44,52	40.15	47.8	78.74	39.06
6	Nitrate (NO_3-N)	mg/L	10	<0.058	0.093	0.533	0.227	0.155
7	Total Phosphate (PO_4)	mg/L	0.2	<0.006	<0.006	<0.006	<0.006	<0.006
C	Biology							
8	Fecal Coli	Jumlah/ 100L	100	230	750	150	230	230

Description:
I : Sebenaq River Headwaters
II : Sebenaq River Tributaries
III : Sebenaq River Road Crossing 1
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3.4. pH Parameters

Measurement of pH values in the Sebenaq River found that at all stations, both during the rainy season and the dry season, the results still met the class I quality standards according to PP No. 22 of 2021. The pH value in the dry season ranged from 6.43 - 7.01, while in the rainy season it ranged from 6.26 - 6.8. According to Yuliastuti [12] the pH value is influenced by the input of organic and inorganic waste into the river body. As seen in Figure 7, the pH value in the rainy season decreased slightly compared to the dry season except at station IV, it is possible that in the rainy season the rainwater runoff that enters the river body carries organic and inorganic materials from around the river which affects the decrease in the pH value. So that the increase in the cross-sectional area and water discharge of the Sebenaq River is inversely proportional to the pH value.

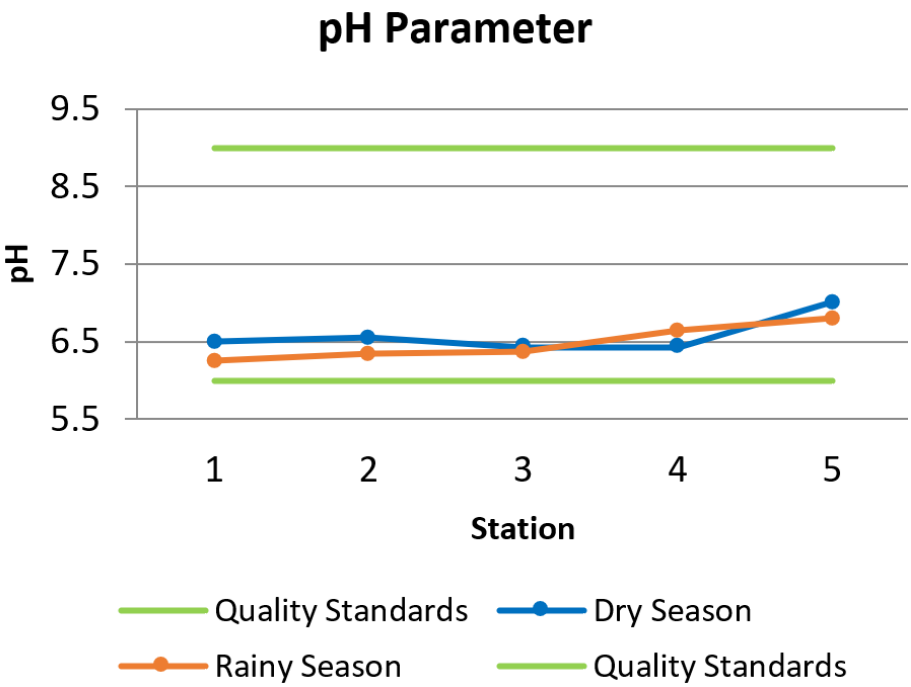

Figure 7.
pH parameter curve.

3.5. TSS Parameters

TSS concentrations at all Sebenaq River stations, both in the dry and rainy seasons, still meet the class I quality standards according to PP No. 22 of 2021 with a maximum value of 50 mg/L. According to Dewa, et al. [13] the thing that influences the increase in TSS concentration is thought to be due to the input of material into the river body, while the thing that influences the decrease in TSS concentration is the small water flow rate so that some TSS is deposited. The results of the TSS value test show that the smallest concentration is at station II with a value of 4 mg/L both in the rainy and dry seasons, this is because station II is a tributary of the Sebenaq River which is located in the upstream area, with a small river water flow rate of 0.47 m/s in the dry season and 0.55 m/s in the rainy season. As seen in Figure 8, the increase in TSS values at all stations in the rainy season except at station II, is possible due to the entry of material such as mud and others from around the river carried by rainwater runoff. So that the increase in cross-sectional area and water discharge of the Sebenaq River is directly proportional to the increase in TSS concentration.

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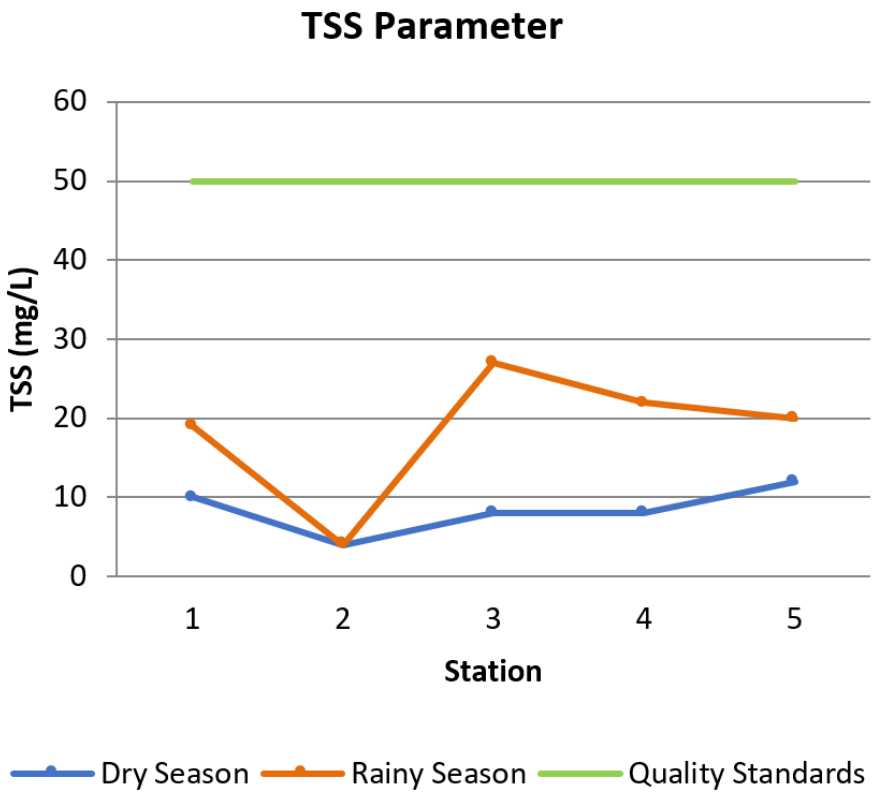

Figure 8.
TSS parameter curve.

3.6. DO Parameter

DO concentration at all stations, both in the dry season and the rainy season, still meets the quality standards of class I PP No. 22 of 2021 with a minimum value of 6 mg/L. In the dry season, the DO concentration is in the range of 7.01 - 7.08 mg/L, while in the rainy season it is between 6.26 - 6.8 mg/L. According to Maghfiroh [14] high dissolved oxygen (DO) concentrations can support the self-purification process. As seen in Figure 9, the decrease in DO concentration in the rainy season is influenced by the increase in organic material carried by rainwater runoff into the river body, the increase in organic material results in a decrease in DO concentration, where more oxygen is used for the decomposition of organic compounds by microorganisms. so that the increase in the cross-sectional area and water discharge of the Sebenaq River is inversely proportional to the DO concentration.

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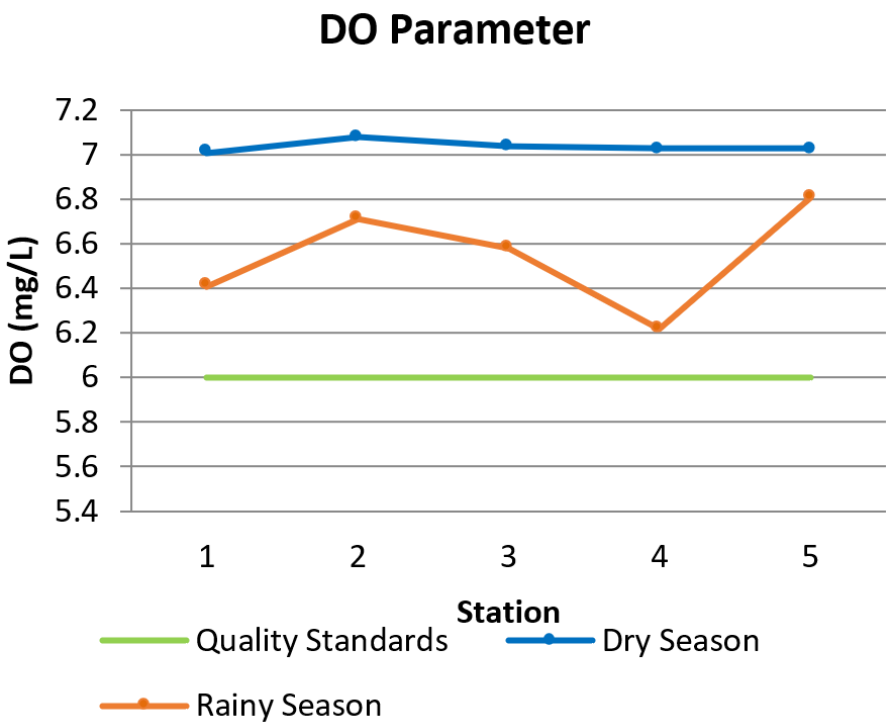

Figure 9.
DO parameter curve.

3.7. BOD Parameter

BOD concentration is a value measured in 5 days, where the BOD concentration at all Sebenaq River stations in the dry season and rainy season still meets the quality standards of class I PP No. 22 of 2021 with a maximum value of 2 mg/L. BOD concentration in the dry season ranges from 1.26 - 1.7 mg/L while in the rainy season between 1.24 - 1.74 mg/L. According to Brontowiyono, et al. [15] the BOD parameter is related to the natural ability of water to clean itself (self-purification). BOD concentration that meets the quality standards indicates that there is sufficient dissolved oxygen (DO) availability for the self-purification process. As seen in Figure 10, there is no significant difference in BOD concentration either in the dry season or in the rainy season, this shows that the Sebenaq River has good natural ability to clean itself (self-purification).

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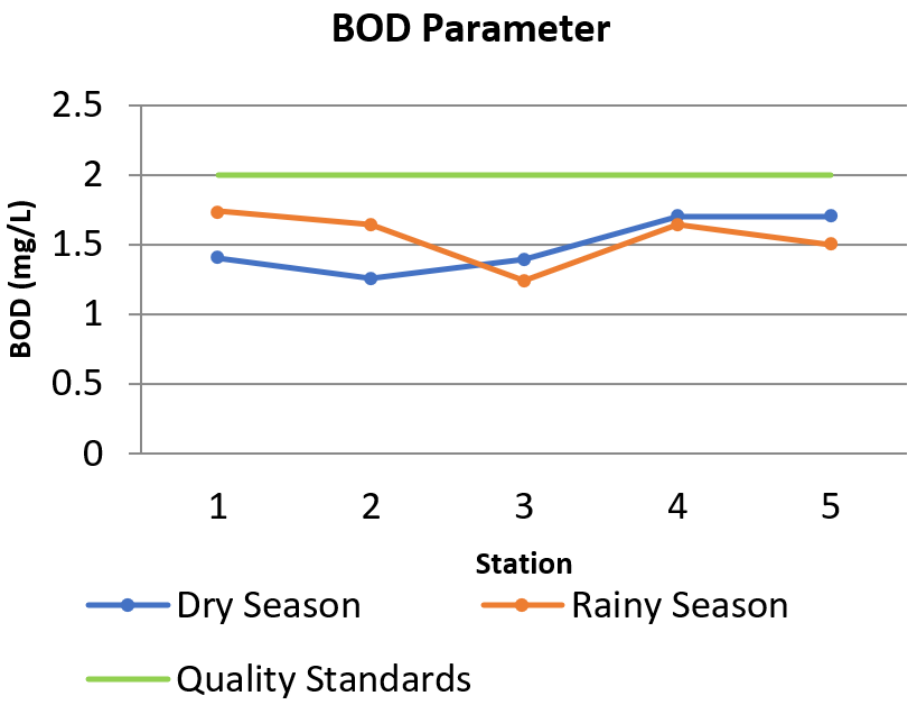

Figure 10.
BOD parameter curve.

3.8. COD Parameter

The COD concentration at all Sebenaq River stations in the dry season and the rainy season has exceeded the quality standard class I PP No. 22 of 2021 with a maximum value of 10 mg/L. The COD concentration in the dry season ranges from 10.91 - 19.08 mg/L, while in the rainy season between 39.06 - 78.74 mg/L. According to Yudo [16] high COD values indicate the pollution isband that occurs. According to Duhupo, et al. [17] organic materials measured in COD are organic materials that are easily decomposed or those that are difficult to decompose biologically. COD concentrations exceeding the quality standards indicate the entry of pollutants into the Sebenaq River water body which is quite high, the source of these pollutants can come from construction activities of office buildings located upstream of the Sebenaq River, then from residential activities of the community around the Sebenaq River, as well as land and river transportation activities that could have fuel spills entering the water body, where several road points cross the Sebenaq River. As seen in Figure 11, the increase in COD concentration in the rainy season compared to the dry season, is possible due to the entry of organic materials from around the Sebenaq River carried by rainwater runoff, this is comparable to the increase in the cross-sectional area / discharge of the Sebenaq River.

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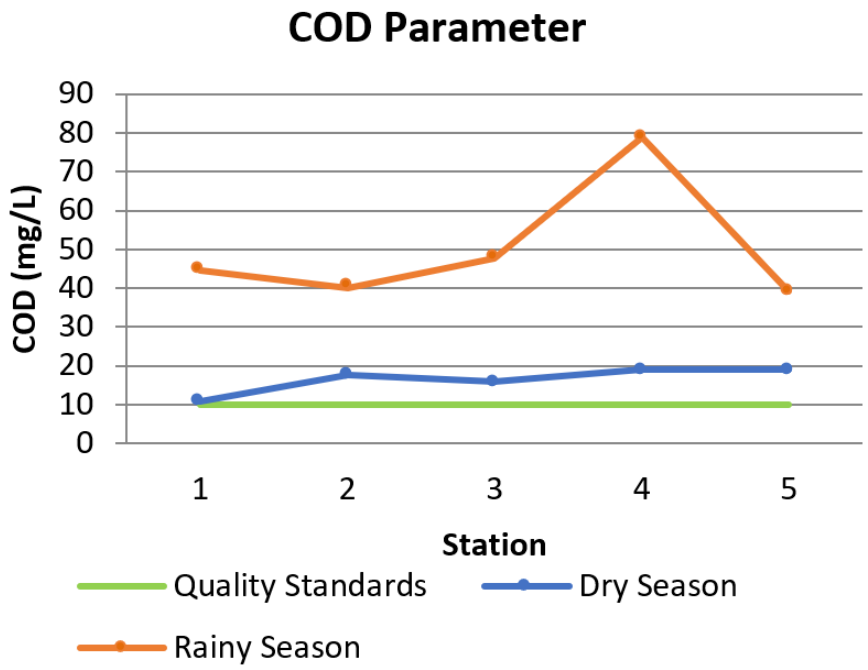

Figure 11.
COD Parameter Curve.

The significant difference between BOD and COD values indicates that in the Sebenaq River there are more organic materials that are difficult to decompose biologically than chemicals that are easily decomposed biologically. For COD values that exceed the quality standard, the actual pollution load can be calculated by multiplying the measured COD concentration by the water discharge. The actual pollution load of the COD parameter in the Sebenaq River is shown in Table 6 below:

Table 6.
Actual COD load.

No.	River name	COD pollutant load (g/sec)	
		Dry season	Rainy season
1.	Station I (Upstream Sebenaq River)	18.77	132.67
2.	Station II (Tributary Sebenaq River)	19.29	64.64
3.	Station III (Sebenaq River Road Crossing 1)	53.18	353.72
4.	Station IV (Sebenaq River Road Crossing 2)	65.83	1179.53
5.	Station V (Downstream Sebenaq River)	143.10	681.99

3.9. Nitrate Parameters (NO3-N)

The concentration of nitrate at all Sebenaq River stations, both in the dry and rainy seasons, still meets the quality standards of class I PP No. 22 of 2021 with a maximum value of 10 mg/L. The concentration of nitrate in the dry season ranges from 0.55 - 0.725 mg/L, while in the rainy season the lowest value is <0.058 and the highest value is 0.533 mg/L. According to Casali, et al. [18] agricultural activities will produce nitrate and phosphate runoff. The concentration of nitrate that meets the quality standards can be understood that around the Sebenaq River there is not much agricultural activity, where most of the existing agricultural activities are still managed traditionally. As seen in Figure 12, the decrease in nitrate concentration in the rainy season is possible due to the dilution of the Sebenaq River water, this is inversely proportional to the cross-sectional area and river discharge which increases in the rainy season.

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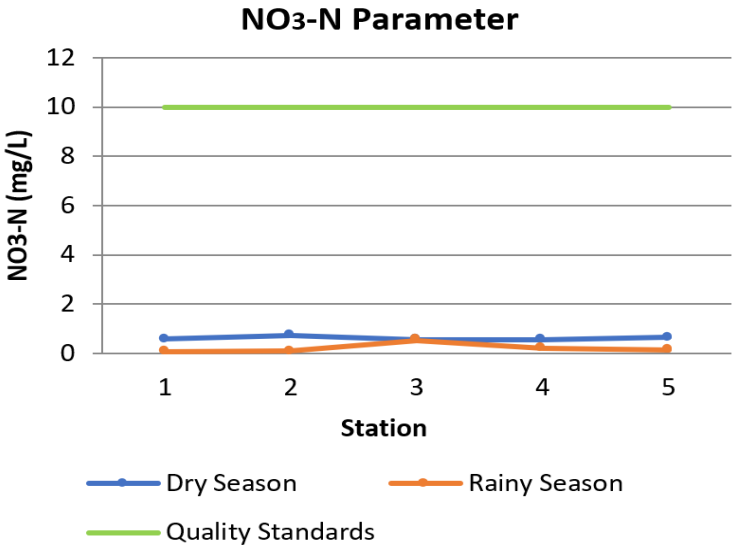

Figure 12.
Nitrate parameter curve.

3.10. Total Phosphate Parameters (T-Phosphate)

The total phosphate concentration at all Sebenaq River stations, both in the dry and rainy seasons, still meets the class I quality standards of PP No. 22 of 2021 with a maximum value of 0.2 mg/L. The total phosphate concentration in the dry season is below the detection limit of laboratory testing. The total phosphate concentration that meets the quality standards can be understood that there is not much agricultural activity around the Sebenaq River, where most of the existing agricultural activities are still managed traditionally. As seen in Figure 13, the total phosphate concentration in both the dry and rainy seasons is equally below the detection limit, this shows that in the rainy season, the runoff water that enters the Sebenaq River body does not contain phosphate pollutants, so there is no effect of increasing the cross-sectional area and water discharge of the Sebenaq River on the total phosphate concentration.

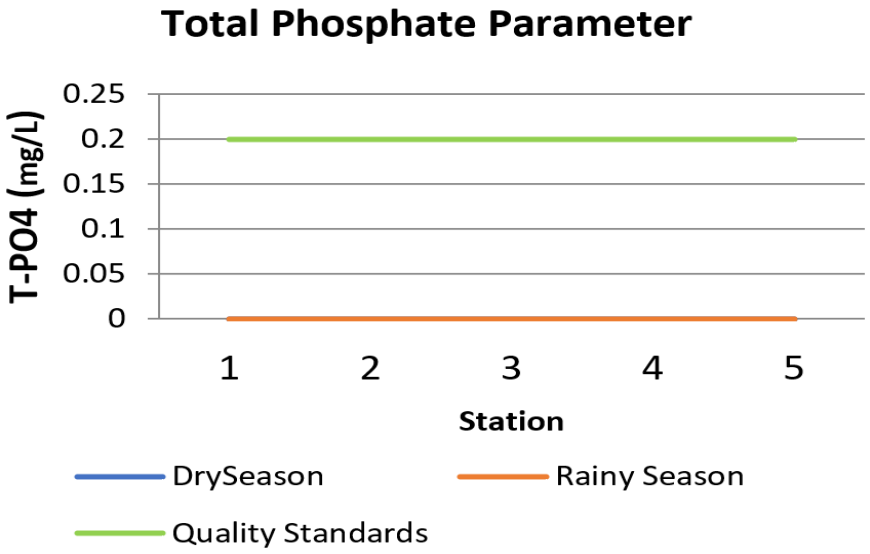

Figure 13.
Total phosphate parameter curve.

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3.11. Fecal Coli Parameters

The Fecal Coli value for the dry season that exceeds the quality standard is at stations I and III, while for the rainy season at all stations the value is above the quality standard class I PP No. 22 of 2021 with a maximum value of 100 counts/100 L. Fecal Coli is a bacteria that comes from human or animal feces, as well as domestic waste and agricultural waste. So the presence of Fecal Coli content in river water indicates the presence of MCK activities, agriculture or the presence of animals around the river.

In the dry season at stations I and III, the Fecal Coli value exceeds the quality standard, which can be caused by incidental conditions, namely MCK activities. The Fecal Coli value at station I is >1000 counts/100L, this is because around station I there are construction activities for Mahakam Ulu district government office buildings, where workers carry out MCK activities at station I. Meanwhile, the Fecal Coli value exceeds the quality standard at station III because the station is often used by local residents for MCK activities. Unlike stations I and III, at stations II, IV and V the Fecal Coli value still meets the quality standard, this is likely because at these stations there are still few sources of contamination that can increase the Fecal Coli value, and the fairly high DO value also helps the decomposition of organic materials contaminated by feces. As seen in Figure 14, during the rainy season at all Sebenaq River stations the Fecal Coli value exceeds the quality standard, this is possible because of the presence of rainwater runoff that carries material from around the River, which could contain feces from animals around the River. As is known, people who live near the Sebenaq River have pets such as chickens, cats, dogs, etc. So that the increase in the cross-sectional area and water discharge of the Sebenaq River is directly proportional to the increase in the Fecal Coli value.

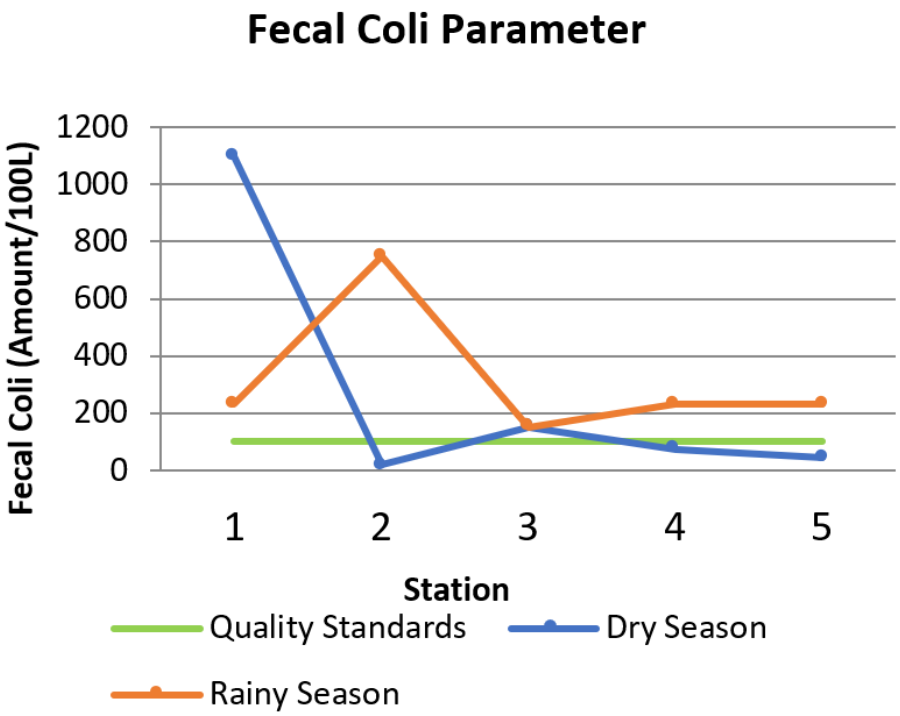

Figure 14.
Fecal coli parameter curve.

3.12. Water Quality Status Pollutant Index Method

The results of the calculation of the quality status according to the Pollutant Index method are presented in the following table.

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Table 7.
Water quality status of the sebenaq river with the pollutant index method.

No.	River name	Average PIj value	Status
1.	Station I (Upstream Sebenaq River)	3,795	Light Pollution
2.	Station II (Tributary Sebenaq River)	2,781	Light Polltion
3.	Station III (Sebenaq River Road Crossing 1)	2,361	Light Pollution
4.	Station IV (Sebenaq River Road Crossing 2)	2,878	Light Pollution
5.	Station V (Downstream Sebenaq River)	2,327	Light Pollution

The results of the calculation of the Sebenaq River water quality status using the Pollutant Index method obtained results at all stations, the status is lightly polluted. The Sebenaq River water quality status is influenced by parameter values that exceed the quality standards, namely Fecal Coli and COD. Efforts to control the Fecal Coli parameters that exceed the quality standards in the Sebenaq River can be carried out with a policy of improving sanitation facilities and clean water for the community so that people no longer carry out MCK activities in the Sebenaq River. Meanwhile, efforts to control the COD parameter value that exceeds the quality standards are by carrying out spatial planning, where the Sebenaq River boundary with a radius of 50 M is designated as a green belt, as well as the residential area of the community and other activities to meet the provisions of the river boundary. Arrangement of the Sebenaq River boundary can also be useful for preventing erosion and increasing the rate of sedimentation of the Sebenaq River bed.

4. Conclusion

The results of the study on water quality and water quality status of the Sebenaq River are as follows:

1. The cross-sectional profile of the Sebenaq River from Station I (Upstream of the Sebenaq River) to Station V (Downstream of the Sebenaq River) shows quite varied conditions, with the influencing factors being the density of riparian vegetation and topographic conditions around the river.
2. The water quality of the Sebenaq River with class I quality standards according to Government Regulation No. 22 of 2021 in the dry season for all stations the parameters that exceed the quality standards are COD, while at stations I and III the parameters that exceed the quality standards are Fecal Coli. While in the rainy season for all stations the parameters that exceed the quality standards are COD and Fecal Coli.
3. The results of the study of the water status of the Sebenaq River show that the water quality status according to the Pollutant Index method is lightly polluted.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

Copyright:

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