ANALYSIS AND MONITORING OF RIVER WATER QUALITY IN TASIKMALAYA CITY

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Abstract

The rivers passing through the City of Tasikmalaya include the Citanduy River, the Ciloseh River, the Ciwulan River and the Cibanjaran River. While the tributaries are the Cibanjaran River which include the Cihideung/ Dalem Suba River, the Cipedes River, the Ciromban River, the Cidukuh River, the Cicacaban River, the Cibadodon River, the Cikalang River, the Tonggong Londok River, the Cibeureum River and the Cimulu River. These rivers flow and empty into the Citanduy River. The aims and objectives of this study are environmental quality monitoring activities, especially the quality of river water in the Tasikmalaya City. To find out in more detail and carefully the level of pollution that occurs, this study aims to conduct water quality monitoring so that the resulting data can determine the source of pollutants that cause deterioration of river water quality. Monitoring was conducted during the rainy season and the dry season. Based on the monitoring, it appears that the river being monitored does not meet the quality standards as a class II water body with varying status ranging from lightly polluted to heavily polluted. Parameters that do not meet quality standards include TSS, BOD, COD, nitrite, $Cr6^{+}$, Zn, free chlorine, Total Phosphate, oil and fat, E. Coli and Total Coliform.

Keywords: *Tasikmalaya City, river water pollution, Water Pollution Index*

Introduction

One of the RPJN's sustainable development goals is the maintenance of environmental quality that can be used to measure the success of environmental management programs. It is an important task of a local government besides having a role in determining the formulation of policies and materials for public communication. The quality of the environment needs to be monitored to know changes from time to time (Yustiani et.al, 2016).

Part of environmental management which is the obligation of the Central, Provincial, Regency and City governments as well as companies is environmental monitoring activities. Environmental monitoring is the periodical environmental parameter tests at predetermined locations and sampling points for a certain period (Liu et.al, 2012). This means that when environmental samples taken can represent actual conditions for the same parameters in a certain period, the monitoring data can be compared. Environmental quality data can also be used as a basis for planning, evaluation, and supervision which is very useful for decision makers, planners, program compilers, both at the central and regional levels in determining environmental policies. This is in accordance with the philosophy which states that: "*No Measurement – No Data; No Data – No Information; No Information – No Management; No Management – No Policy".*

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Water is an environmental component that is important for human life and other living things. Water can be disastrous when it is not available in the right conditions, both in quality and quantity. One of the water bodies which is a wealth of water resources is a river. The river functions as a reservoir, storage for irrigation and raw material for drinking water for the community along its flow (Yustiani, et.al, 2017).

The river is also an easy and practical place for disposal of waste, both solid and liquid, as a result of household activities, home industry, garment, livestock, workshop, and other businesses (Roman et.al, 2016). With the disposal of various types of waste and rubbish containing various types of pollutants to water bodies, both biodegradable and non-biodegradable, it will cause heavier loads to be received by the river. If the load received by the river exceeds the threshold set based on quality standards in Government Regulation Number 82 of 2001 concerning Management of Water Quality and Control of Water Pollution, then the river is said to be polluted, physically, chemically and biologically.

Tasikmalaya City is one of the cities in the southeastern part of West Java Province, Indonesia. The rivers flowing through the Tasikmalaya City include the Citanduy River, the Ciloseh River, the Ciwulan River and the Cibanjaran River. While the tributaries are the Cibanjaran River which include the Cihideung/ Dalem Suba River, the Cipedes River, the Ciromban River, the Cidukuh River, the Cicacaban River, the Cibadodon River, the Cikalang River, the Tonggong Londok River, the Cibeureum River and the Cimulu River. These rivers flow and empty into the Citanduy River, except for the Ciwulan River.

The aims and objectives of this study are to investigate the river water quality by means of monitoring activities. Water quality monitoring serves to provide factual information about the condition (status) of water quality in the present, past trends and predictions of future environmental changes. The basic information generated from monitoring activities can be used as a reference for preparing environmental planning, evaluation, control and supervision, spatial planning, and location permits for businesses or activities. Monitoring data can be used as a basis for consideration, formulating policies or making decisions and evaluating environmental management policies, especially controlling water pollution.

Methodology

Water Sampling

There are several equipments used in the sampling activity:

1. Water sampler container/ bucket with a weight and equipped with a rope
2. Sample preparation tool: 6 bottles of Polyethylene Terephthalate (PET) 1.5 L.
3. Field testing equipment: pH meter, 2 pipette bottles, and a thermometer.

The chemical used in the sampling processes are HNO_3 p.a MERCK and H_2SO_4 p.a MERCK for sample preparation of chromium and COD parameters.

Sampling Points

There were 24 sampling points from rivers and tributaries passing through Tasikmalaya City. The sampling location were display in Table 1.

Table 1. River Water Monitoring Locations

No.	River / Monitored Surface Water	Sampling Location
1.	Ciwulan Hulu	Jl. Leuwi Budah Kp. Tanjung Loka (Sasak Gantung) RT 03/03 Kec. Kawalu
2.	Ciwulan Hilir	Jl. KH. Syeh Abdul Muhyi Jembatan Sukaraja (Perbatasan Kota Tasik dengan Kabupaten Tasik) Kel. Urug Kec. Kawalu
3.	Cibangbay	Kp. Peundeuy Kel. Urug

No.	River / Monitored Surface Water	Sampling Location
	Hulu	Kec. Kawalu
4.	Cibangbay Hilir	Kel. Leuwiliang-Kawalu
5.	Cimulu Hulu	Kp. Gn. Kokosan (Gd. Air PDAM) Kel. Cibunigeulis Kec. Bungur sari
6.	Cimulu Hilir	Jl. Anyar RT 02/03 Nyangga Hurip Kel. Marga Bakti, Kec. Cibeureum
7.	Cikalang Hulu	Bantarsari- Bungursari
8.	Cikalang Hilir	Kp. Tarikolot 06/02 Kel. Margabakti Kec. Cibeureum
9.	Cihideung Hulu	Jl. Bebedilan (Depan Cuci Mobil Pusaka Jaya Motor)
10.	Cihideung Hilir	Jembatan Singkup, Purbaratu
11.	Citanduy Hulu	Kp. Nangoh RT. 02/11 Kel. Sukamaju Kaler Kec. Indihiang
12.	Citanduy Hilir	Kp. Gobang Kel. Singkup Kec. Purbaratu
13.	Ciloseh Hulu	Bendung Bengkok Kp. Bengkok Bungursari
14.	Ciloseh Hilir	Kp. Ganoang Sukaasih (Sukamenak) Kec. Purbaratu
15.	Cilamajang Hulu	Bendung Cilamajang Kp. Gn. Lingga-Kel. Cibeuti Kec. Kawalu
16.	Cilamajang Hilir	Kp. Tanjung Loka Kec. Salawu
17.	Ciromban Hulu	Kp. Cibeureum Kel. Sukalaksana Kec. Purbaratu
18.	Ciromban Hilir	Jl. Bebedahan I No. 108 – Purbaratu
19.	Cibadodon Hulu	Jl. Paseh - Kel. Tuguraja Kec. Cihideung
20.	Cibadodon Hilir	Leuwi Munding (Belakang Perum Grand Laswi Residence)
21.	Cidukuh Hulu	Jl. Galunggung (Gg. Mesjid Baitul Mulya)
22.	Cidukuh Hilir	Jl. Golempang Kel. Sukaasih Kec.Purbaratu
23.	Cinutut Hulu	Jl. Lukmanul Hakim (depan ruko A9) Kel. Tugu Jaya Kec. Cihideung
24.	Cinutut Hilir	Jl. Taman Harapan (Jembatan Cibadodon)

Referring to the Decree of the State Minister for the Environment Number 115 of 2003 concerning Guidelines for Determining the Status of Water Quality, one of the methods used to determine the quality status of river water is the pollution indexing method. The pollution index is an index related to pollution compounds used to determine the level of pollution relative to the permissible water quality parameters (Nemerow 1974 in Kepmen-LH Number 115 of 2003). Management of water quality on the basis of the Pollution Index (IP) can provide input in decision making in order to assess the quality of the waters for a designation and take action to improve the quality if there is a decrease in quality due to the presence of pollutants. Water quality designation (j) (Appendix 3) and Ci states the concentration of water quality parameters (i) obtained from the analysis results, then Pij is the Pollution Index for the allocation (j) which is a function of Ci / Lij. Pij is determined by:

1. Choosing parameters if the parameter price is low, the water quality will improve.
2. Select a quality standard parameter concentration that does not have a range.
3. Calculating the Ci / Lij price for each parameter at each sampling location.
4. If a decreasing concentration value indicates an increased level of pollution (for example DO), then the maximum value of Cim is determined (for example for DO, then Cim is the saturated DO value). In this case the measured Ci / Lij value is replaced by the calculated Ci / Lij value, namely:

$$(Ci/Lij)\ new = \frac{Cim - Ci\ (measurement)}{Cim - Lij} \quad (1)$$

If the Lij quality standard value has a range,

- for $C_i \leq L_{ij}$ average

$$(Ci/Lij)\ baru = \frac{[Ci - (Lij)average]}{[(Lij)min - (Lij)average]} \quad (2)$$

- for $C_i > L_{ij}$ average

$$(Ci/Lij)\ baru = \frac{[Ci - (Lij)average]}{[(Lij)max - (Lij)average]} \quad (3)$$

If two values (Ci/Lij) are adjacent to the reference value 1.0. Suppose (C1 / L1j) = 0.9 and (C2/L2j) = 1.1 or a very large difference, for example (C3/L3j) = 5.0 and (C4/L4j) = 10.0.

In this example the extent of damage to water bodies is difficult to determine. The way to overcome this is:

- Use of the value (Ci/Lij) of the results measurement if this value <1.0, then the value

$$(C_i/L_{ij})_{new} = (C_i/L_{ij})_{measurement} \quad (4)$$

- If the result of (Ci/Lij) measurement> 1.0 then the new (Ci/Lij) value can be obtained from:

$$(Ci/Lij)new = 1{,}0 + P.\log(Ci/Lij)measurement$$

P is a constant and its value is determined independently and adjusted to the results of environmental observations and or the desired requirements for a designation (usually the value 5).

Determine the average and maximum values of the overall Ci/Lij ((C /Lij) R and (Ci/Lij) M). So that the value of the Pollution Index can be known from the equation:

$$Pij = \sqrt{\frac{(Ci/Lij)M^2 + (Ci/Lij)R^2}{2}} \quad (5)$$

From the results of the calculation of the Pollution Index value, the value or score describes the condition of the water quality according to the criteria in the following table.

Table 2. Determination of water quality status based on the Pollution Index

Score	Criteria
$0.0 \leq P_{Ij} \leq 1.0$	Good
$1.0 < P_{Ij} \leq 5.0$	Lightly polluted
$5.0 < P_{Ij} \leq 10$	Moderately polluted
$P_{Ij} > 10$	Heavily polluted

The result of sampling and laboratory analysis of river water quality in Tasikmalaya City is as in Table 3. Based on the results of monitoring conducted at several monitoring locations during two monitoring periods, assuming the rainy season and dry season, it appears that the river being monitored does not meet the quality standards as a class II water body with varying status starting from lightly polluted, moderately polluted to heavily polluted (Table 4). Parameters that do not meet quality standards include TSS, BOD, COD, nitrite, $Cr6^+$ metal, Zn metal, free chloride, Total Phosphate, oil and grease, E. Coli and Total Coliform.

The river in Tasikmalaya City is generally used by residents for agricultural irrigation. On the other hand, water resources are also used as water bodies that receive waste from industrial or domestic activities that have the potential to reduce the quality of these water bodies. Water body pollution can occur due to industrial waste, household/ domestic waste and agricultural waste.

Based on the source, pollution can be grouped into 3 (three) namely pollution that comes from households (domestic), industrial waste from companies, and agricultural / plantation waste. Various kinds of pollutant sources indicate that the concentration of pollutants varies widely; this is because the sources of wastewater also vary so that the time factor and the sampling method greatly affect the concentration.

Table 3 Results of River Monitoring in the City of Tasikmalaya

No	River Name	Monitoring Point	Date (mm/dd/yyyy)	Temp (°C)	pH	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	NO_2 (mg/L)	NO_3 (mg/L)	Free Chloride (mg/L)	TP (mg/L)	Oil & Grease (mg/L)	Fecal Coliform (/100 ml)	Total Coliform (/100 ml)
1	Ciwulan Hulu	Jl. Leuwi Budah Kec. Kawalu	2/24/2019	27.0	7.9	112	38	3	22	0.01	0.4	0.12	0.3	6	3,200	14,000
			8/14/2019	26.5	7.5	102	24	3	20	0.01	0.3	0.1	0.2	4	2,400	10,000
2	Ciwulan Hilir	Jl Syekh Abdul Muhyi (Jembatan Sukaraja	2/24/2019	27.1	8.3	102	38	3	22	0.01	0.1	0.1	0.25	8	1,600	12,100
			8/14/2019	27.0	8.1	96	26	3	18	0.01	0.1	0.1	0.2	6	1,200	10,000
3	Cibangbay Hulu	Kp. Peundeuy Kel. Urug Kec. Kawalu	2/20/2019	25.1	8.5	169	14	1	9	0.02	0.7	0.08	0.11	48	300	1,900
			8/22/2019	25.0	8.1	148	12	1	8	0.002	0.5	0.05	0.11	24	200	1,400
4	Cibangbay Hilir	Kel. Leuwiliang Kec. Kawalu	2/20/2019	25.5	8.2	236	4	1	9	0.012	0.3	0.06	0.42	4	1,700	10,800
			8/22/2019	25.6	8.1	212	4	1	5	0.012	0.2	0.06	0.42	3	1,200	9,600
5	Cimulu Hulu	Kp. Gn. Kokosan Kec. Bungursari	5/8/2019	28.3	8.3	773	8	1.6	4	0.011	0.8	0.01	1.4	11	2,300	18,800
			10/30/2019	28.3	8.1	680	6	2	4	0.011	0.8	0.01	1.2	9	2,000	16,000
6	Cimulu Hilir	Nyangga Hurip Kel. Margabakti Kec. Cibeureum	5/8/2019	37.9	7.4	111	10	2	5	0.016	0.6	0.16	0.19	76	55,100	60,500
			10/30/2019	27.0	7.5	96	8	2	4	0.014	0.4	0.1	0.1	56	35,100	55,100
7	Cikalang Hulu	Kel. Bantarsari - Kec. Bungursari	2/10/2019	26.5	8.3	28	4	4	15	0.001	0.3	0.05	1.07	42	1000	5000
			9/8/2019	27.0	8.1	24	4	4	12	0.001	0.2	0.05	0.6	32	600	$1{,}25x10^4$
8	Cikalang Hilir	Kel. Margabakti Kec. Cibeureum	2/10/2019	27.6	8.1	32	2	10	16.5	0.008	0.7	0.08	0.19	20	1000	5000
			9/8/2019	28.0	7.9	32	28	8	15	0.008	0.6	0.05	0.8	16	4,200	8000
9	Cihideung Hulu	Jl. Bebedilan	5/10/2019	26.8	7.6	196	20	9	23	0.001	0.1	0.01	1.54	103	62,100	430,000
			11/1/2019	27.0	7.8	182	14	7	18	0.001	0.1	0.01	1.24	84	46,200	240,000
10	Cihideung Hilir	Jembatan Singkup Kec. Purbaratu	5/10/2019	28.2	7.4	117	48	2.18	4	0.24	1.2	0.05	0.78	31	7,100	38,500
			11/1/2019	28.4	7.5	102	34	2	4	0.12	0.8	0.05	0.56	22	4,600	24,500
11	Citanduy Hulu	Jl. Letjen Ibrahim Adjie Kec. Indihiang	2/28/2019	25.0	8.5	92	14	3.5	26	0.013	0.4	0.05	0.22	7	1,100	7,700
			8/18/2019	26	8.1	76	8	3	20	0.013	0.5	0.03	0.18	5	900	6,200
12	Citanduy Hilir	Kp. Gobang Kel. Singkup Kec. Purbaratu	2/28/2019	27.4	8.2	101	42	2	6	0.007	0.2	0.04	0.33	12	200	1,100
			8/18/2019	28.0	7.9	98	36	2	5	0.006	0.2	0.03	0.2	8	100	900
13	Ciloseh Hulu	Bendung Bengkok Kp. Bengkok Kec.	2/27/2019	27.7	8.6	102	2	17	7	0.005	0.6	0.09	0.48	6	700	32,000
			9/7/2019	28.1	7.8	96	2	6	15	0.003	0.5	0.07	0.32	4	600	28,000

No	River Name	Monitoring Point	Date (mm/dd/yyyy)	Temp (°C)	pH	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	NO_2 (mg/L)	NO_3 (mg/L)	Free Chloride (mg/L)	TP (mg/L)	Oil & Grease (mg/L)	Fecal Coliform (/100 ml)	Total Coliform (/100 ml)
		Bungursari														
14	Ciloseh Hilir	Kp. Ganoang Sukaasih (Sukamenak) Kec. Purbaratu	2/27/2019	28.1	8.2	56	6	18.5	22	0.026	0.8	0.01	1.07	14	1,300	21,800
			9/7/2019	28.5	7.6	48	4	14	20	0.001	0.6	0.01	0.8	12	1,100	18,000
15	Cilamajang Hulu	Kp. Gn. Lingga Kel. Cibeuti Kec. Kawalu	2/6/2019	24.0	8.0	146	76	5	7	0.034	0.2	0.04	1.25	6	1,200	5,600
			8/15/2019	25.0	7.6	128	62	4	6	0.03	0.2	0.03	0.8	5	1,100	4,800
16	Cilamajang Hilir	Kp. Tanjung Loka Kec. Kawalu	2/6/2019	25.2	6.8	138	76	4	23	0.038	0.7	0.09	1.49	10	900	3,600
			8/15/2019	25.0	6.5	124	56	3	22	0.04	0.6	0.06	1.2	8	700	2,800
17	Ciromban Hulu	Kp. Cibeureum Kel. Sukalaksana Kec. Purbaratu	5/15/2019	27.1	7.7	144	202	15	38	0.005	0.9	0.03	0.39	31	500	2,900
			11/3/2019	28.0	7.4	124	186	12	28	0.005	0.8	0.03	0.33	24	400	2,400
18	Ciromban Hilir	Jl. Bebedahan I No. 108 Kec. Purbaratu	5/15/2019	27.6	7.3	180	4	6	15	0.018	0.3	0.02	1.73	10	1000	12,700
			11/3/2019	27.0	7.5	140	4	4	10	0.016	0.3	0.01	1.56	8	600	10,000
19	Cibadodon Hulu	Jl. Paseh - Kel. Tuguraja Kec. Cihideung	2/3/2019	29.1	8.1	452	66	77.5	122	0.021	1.2	0.07	3.75	120	30,000	330,000
			9/14/2019	28	7.7	348	56	64.2	112	0.01	0.8	0.06	2.76	82	10,000	220,000
20	Cibadodon Hilir	Leuwi Munding (Belakang Perum Grand Laswi Residence)	2/3/2019	28.8	7.8	160	30	12	30	0.012	0.7	0.1	12	83	10,000	90,000
			9/14/2019	28	7.6	140	24	10	26	0.01	0.5	0.05	8	64	7,000	60,000
21	Cidukuh Hulu	Jl. Galungggung (Gg. Mesjid Baitul Mulya)	5/9/2019	26.4	7.4	103	92	29	73	0.025	0.3	0.02	0.91	8	8,400	9,000
			10/31/2019	26.0	7.5	84	64	18	36	0.01	0.2	0.02	0.4	6	5,400	7,000
22	Cidukuh Hilir	Jl. Gelompang Kel. Sukaasih Kec. Purbaratu	5/9/2019	28.0	7.7	106	202	5.6	14	0.038	0.7	0.02	0.41	25	6,400	43,500
			10/31/2019	27.5	7.4	92	124	5	12	0.02	0.6	0.02	0.3	18	1,800	38,100
23	Cinutut Hulu	Jl. Lukmanul Hakim Kel. Tugujaya Kec. Cihideung	5/15/2019	26.8	8.4	140	38	2.8	7	0.08	0.08	0.02	0.88	0.88	2,600	20,400
			11/2/2019	26.5	8.1	128	26	2.4	6	0.06	0.6	0.02	0.6	0.6	2,000	18,200
24	Cinutut Hilir	Jl. Taman Harapan (Jembatan Cibadodon)	5/15/2019	28.4	7.5	149	36	6	16	0.051	0.4	0.02	1.53	1.53	31,700	54,700
			11/2/2019	27.5	7.6	132	28	6	16	0.051	0.4	0.02	1.24	1.24	29,100	48,200

Table 4 Status of River Water Quality in Tasik Malaya City

No	River Name	Period I Water Quality Status	Period II Water Quality Status	Parameters that Exceed Quality Standards
1	Ciwulan Hulu	Heavily polluted	Heavily polluted	Free Chlorine, Fecal Coliform, Total Coliform
2	Ciwulan Hilir	Moderately polluted	Moderately polluted	Free Chlorine, Total Coliform
3	Cibangbay Hulu	Lightly polluted	Lightly polluted	Free Chlorine
4	Cibangbay Hilir	Moderately polluted	Moderately polluted	Free Chlorine, Total Coliform
5	Cimulu Hulu	Heavily polluted	Heavily polluted	Total Phospat, Fecal Coliform, Total Coliform
6	Cimulu Hilir	Heavily polluted	Heavily polluted	Free Chlorine, Fecal Coliform, Total Coliform
7	Cikalang Hulu	Moderately polluted	Moderately polluted	Free Chlorine, Total Phosphate
8	Cikalang Hilir	Moderately polluted	Moderately polluted	BOD, Free Chlorine, Fecal Coliform
9	Cihideung Hulu	Heavily polluted	Heavily polluted	BOD, Total Phosphate, Fecal Coliform, Total Coliform
10	Cihideung Hilir	Heavily polluted	Heavily polluted	Free Chlorine, Fecal Coliform, Total Coliform
11	Citanduy Hulu	Lightly polluted	Lightly polluted	Free Chlorine
12	Citanduy Hilir	Lightly polluted	Lightly polluted	Free Chlorine
13	Ciloseh Hulu	Heavily polluted	Heavily polluted	BOD, Free Chlorine, Total Coliform
14	Ciloseh Hilir	Moderately polluted	Moderately polluted	BOD, Total Phosphate, Total Coliform
15	Cilamajang Hulu	Moderately polluted	Moderately polluted	Free Chlorine, Total Phosphate
16	Cilamajang Hilir	Moderately polluted	Moderately polluted	Free Chlorine, Total Phosphate
17	Ciromban Hulu	Lightly polluted	Lightly polluted	BOD
18	Ciromban Hilir	Moderately polluted	Moderately polluted	Total Phosphate, Total Coliform
19	Cibadodon Hulu	Heavily polluted	Heavily polluted	BOD, COD, Free Chlorine, Total Phosphate, Fecal Coliform, Total Coliform
20	Cibadodon Hilir	Heavily polluted	Heavily polluted	BOD, Free Chlorine, Total Phosphate, Fecal Coliform, Total Coliform
21	Cidukuh Hulu	Heavily polluted	Heavily polluted	BOD, COD, Fecal Coliform
22	Cidukuh Hilir	Moderately polluted	Moderately polluted	Fecal Coliform, Total Coliform
23	Cinutut Hulu	Moderately polluted	Moderately polluted	Fecal Coliform, Total Coliform
24	Cinutut Hilir	Heavily polluted	Heavily polluted	Total Phosphate, Fecal Coliform, Total Coliform

Visually the condition several water samples were seen turbid. Based on the results of the calculation of the water quality status of several rivers, there are rivers that have TSS values above the required Class II water quality standards. This is because the condition of the river water has begun to change its function due to the many activities that occur along the river so that it will affect the physical condition of the water which is formerly clearly visible from the total amount of suspended solids in the river.

Other river water parameters that exceed Class II Water Quality standards are COD levels at several monitoring points. This COD parameter is a very important parameter because this parameter is also an indicator of water pollution. COD is the amount of oxygen needed to oxidize organic substances in rivers by utilizing potassium dichromate oxidizer as a source of oxygen. The COD figure is a measure of water pollution by organic substances which can naturally be oxidized through biological processes and can reduce dissolved oxygen in rivers. The high COD parameter can be caused by industrial waste or domestic waste (Ramawati et.al, 2013). On the other hand, water that is not polluted has a low COD value.

Another river water parameter that also exceeds Class II Water Quality standards is free chloride found in several rivers. The presence of free chloride can be caused by natural conditions. Naturally, the presence of chloride in rivers is very large. Excessive concentrations of free chloride will certainly be harmful to health if the water is used as a source of drinking water.

Conclusion

Based on the monitoring, laboratory analysis and data processing, it can be concluded as follows:

- River status are varied from lightly polluted, moderately polluted to heavily polluted
- The index shows that river water status was similar between two periods of monitoring.
- Parameters that do not meet quality standards include TSS, BOD, COD, nitrite, $Cr6^{+}$, Zn, free chlorine, Total Phosphate, oil and fat, E. Coli and Total Coliform.

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