THE CONTROLLING ACCELERATION OF WATERSHED DAMAGE AND WATER QUALITY IN CITARUM RIVER ON THE PERFORMANCE IR. H. DJUANDA DAM

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ABSTRACT

Citarum River is the largest river in West Java Province, Indonesia. With a length of ± 270 km and a watershed area of ± 562,958 ha, this river serves the Domestic Municipal Industry (DMI) needs in 12 Districts with nearly twenty million residents/communities and supplies 80% drinking water needs of DKI Jakarta. The Citarum River is nominated as a National Strategic of River Area. Along the Citarum River, there are three large dams namely, Saguling Dam, Cirata Dam, and Ir. H. Djuanda Dam with a total effective volume of 5.5 billion m^3 / year.

Over the past years, the Citarum watershed has experienced increasingly severe damage from the physical, environmental and social community aspects that lead to several problems like flooding, decreasing water quality, increasing waste, sedimentation, drought risk, and landslides. Due to those problems, the President of the Republic of Indonesia issued Presidential Decree No. 15 of 2018 about "Controlling Acceleration of Citarum Watershed Pollution and its Damage" which is implemented into several actions to carry out the watershed and river management by intersectoral and regional cooperation or known as Citarum Harum Program. The program has been carried out from 2018 and will be completed in 2025 with 6 priority controls, namely: handling critical land in the upstream of the Citarum Watershed, monitoring water quality systems, handling industrial and domestic waste, handling rubbish, management the floating net fisheries in the Citarum watershed, community education, and law enforcement.

For almost two years carrying out this program, based on the Pollution Index method the results of water quality status stated as mild to moderate polluted and based on the Storet method on the BCD category stated as heavily polluted. The methods are stated in the Decree. West Java Governor No. 39 of 2000 about "Water Quality Standards for the Designation of the Citarum River as a Source of Raw Water". The domino effect of poor water quality in the Citarum watershed brought effect to the management of Ir. H. Djuanda Dam that creates hydrogen sulfide gas and carbon dioxide gas, which caused a decrease in the quality of the concrete surface layer and the electrical-mechanical equipment corrosivity. The existence of the Citarum Harum program is expected to improve the water quality in the Jatiluhur Reservoir, with the result that in the future it will improve the performance of Ir. H. Djuanda Dam.

Keywords *: Citarum Harum, Watershed, Water Quality*

BAB I – PENDAHULUAN

I.1 Background of the Problem

Citarum River which is the largest river in West Java, based on the Minister of Public Works and Public Housing Regulation Number. 04 / PRT / M / 2015 concerning Criteria and Determination of River Areas, Citarum River Areas are designated as National Strategic River Areas. The length of the river channel reaches ± 269 km with a watershed area of ± 661,400 ha. This river serves the needs of DMI in 12 City Regencies, around 17.5 million residents in West Java and

serves the needs of 80% of DKI Jakarta drinking water. In this Citarum watershed, there are 3 cascade dams namely, Saguling Dam, Cirata Dam, and Ir. H. Djuanda Dam with a total effective volume of 5.5 billion m^3/year.

The Citarum River as one of the biggest water potentials in West Java holds a large potential for the community, both beneficial and adverse potential. Potential losses from the Citarum River include reduced land conservation areas, densely populated settlements, river pollution by domestic and industrial waste, and others. This causes disasters such as floods, droughts, and landslides. Potential losses from the Citarum River are problems that must be resolved jointly between the government and the community. Coordination, division of responsibilities, and harmonious communication between the two are believed to solve the complicated problems that occur in the Citarum River Basin. So that the President of the Republic of Indonesia issued Presidential Decree Number. 15 of 2018 "Controlling Acceleration of Citarum Watershed Pollution and its Damage".

The poor condition of water quality in the Citarum River also causes a domino effect on the performance of the Ir. H. Djuanda Dam that managed by Jasa Tirta II Public Corporation. The effects of poor water quality on the Citarum River Basin on the management of the Ir. H. Djuanda Dam including the emergence of aggressive H_2S and CO_2 gas, which results in a decrease in the quality of the concrete surface layer and corrosivity in electrical-mechanical equipment. It is hoped that the existence of the Citarum Harum program can improve the water quality of the Jatiluhur Reservoir, so that in the future it will improve the performance of the Ir. H. Djuanda Dam.

I.2 Problem Formulation

From the background of the problems mentioned above, the problem formulation can be described as follows:

– How is the role of Jasa Tirta II Public Corporation as Water Management in improving the performance of Ir. H. Djuanda Dam in the future?

– What is the effect of the Citarum Harum program on water quality in the Jatiluhur Reservoir?

I.3 The Purpose of Papers

From the formulation of the problem above, the purpose to be achieved from making this paper are as follows:

– To find out the extent of the participation of Jasa Tirta II Public Corporation as a Water Management in managing reservoir water quality with the Government through the Citarum Harum program.

– To find out how the effectiveness of the Citarum Harum program is when it is implemented in the Jatiluhur Reservoir.

I.4 Methodology

This research is a qualitative study. Data collection techniques in this paper are through the study of documents or library material. The data processing techniques are carried out through stages, namely:

– Data collection on Laws, Regulations and other related documents.

– Data compilation and analysis are written in a coherent and systematic way.

CHAPTER II – DISCUSSION

II.1 Citarum Harum Program

The Citarum watershed has been named by the World Bank as the world's dirtiest river in 2018. Some of the reasons that make the Citarum River be the dirtiest river in the world are: the Citarum River contains worrying chemicals, there are factory waste and household waste which have an impact on environmental damage and poor waste management. Besides that, other crucial problems that faced by the Citarum River are the behavior of local residents who do not care about the environment, the limited landfills as well as the mobilization of facilities and infrastructure for transporting waste due to the amount of waste per village of approximately 10-15 tons/day. For the downstream areas of the Citarum watershed, they also experience excessive groundwater exploitation and lack of conservation of coastal areas.

Of the many problems mentioned above finally, the Government of the Republic of Indonesia is committed to taking this issue seriously by issuing Presidential Regulation Number 15 of 2018 concerning " Controlling Acceleration of Citarum Watershed Pollution and its Damage ". The purpose of the establishment of this regulation is to save the Citarum watershed becomes a clean river in the next 7 years. Besides that, this regulation is expected to create synergy and build coordination between ministries/institutions, regional/provincial governments and districts/cities around the Citarum watershed and support from the Indonesian National Army which involves all elements of the community.

Several strategies implemented in controlling watershed pollution and damage are carried out by all stakeholders using 6 priority controls, namely: water quality monitoring systems and handling industrial waste, handling critical land in the upstream Citarum watershed, handling domestic waste, law enforcement, public education and the arrangement of floating net fisheries in the Citarum watershed.

Jasa Tirta II Public Corporation has implemented programs that are the priority of accelerating control in the Jatiluhur Reservoir, namely:

1. Arrangement of floating net fisheries in the Citarum watershed

   The legal basis for regulating the floating net fisheries in the Citarum watershed are:

   - President Jokowi's statement that the Citarum River is clean within 7 years.
   - Presidential Regulation Number 15 of 2018 concerning the Controlling Acceleration of Citarum Watershed Pollution and its Damage.
   - Maritime Coordinating Minister Regulation Number 8 of 2018 concerning Supervisory Work Procedures, Task Force for Citarum Watershed Damage Pollution Control Task Force.
   - Regional Regulation Number 7 of 2011 concerning Fisheries Management.
   - Governor's Decree Number 614.05 / Kep.79-Prodi / 2018 concerning the Preparatory Team for the Declaration of Citarum River Basin Ecosystem Restoration.
   - Governor's Decree Number 614 / Kep.1303-DLH / 2018 concerning the Secretariat for the task of controlling pollution and damage to watersheds (Citarum River Basin) in 2018 – 2023.
   - Purwakarta Regent Decree Number 660.05 / Kep.35-DLH / 2018 concerning the Establishment of the "Jatiluhur Jernih Lake" Operational Task Force in 2018.
   - Governor's Decree Number 41 of 2002 concerning Development and Utilization of Agricultural Land and Reservoir Areas.

   Table II.1 : The Number of Floating Net Fisheries's Data in Jatiluhur Reservoirs 2018 – 2019

No	Description	Number of floating net	Number of the floating net which is pulled out	Number of the floating net until November 2019	Explanation
1.	Floating net fisheries Data in 2014	25.951	-		(inside the zones)
2.	Floating net fisheries Data in 2015	-	1.536		
3.	Floating net fisheries Data in 2016	-	1.797		
4.	Floating net fisheries Data in 2017	-	5.386		
5.	Floating net fisheries Data in 2018	-	1.885		
6.	Floating net fisheries Data in 2019	-	-		
7.	Outside the Zones	8.523			Last data in 2010
	Total	34.474	10.586	23.888	

   For approximately 5 years, Jasa Tirta II Public Corporation has made efforts to control the floating net fisheries of approximately 10,586 plots. In 2019 there will be no control because it is a political year (the president and vice president's elections), where the situation is not conducive to curbing floating net fisheries. So that the total floating net fisheries that have not been disciplined is approximately 23,888 plots.

   In addition, the following activities have also been carried out:

   1. Socialization of the Citarum Harum program and curbing the floating net fisheries.
   2. Census of floating net fisheries ownership.
   3. Reducing the number of floating net cages in 3 Cirata, Saguling, and Jatiluhur reservoirs are preferred to dismantle non-operational floating net fisheries plots.
   4. Applying fish farming technology that is environmentally friendly with smart floating net fisheries and Culture Base Fisheries.

2. Domestic Waste Management

   The main target in handling domestic waste is landfill waste in villages located on the edge of the Citarum River 100% collected and processed according to the type of waste so there is no waste is discharged into the river.

   - Some of the efforts made by Jasa Tirta II Public Corporation in handling domestic waste include:
   - Biogas program based on community empowerment that aims to address pollution of livestock manure in the Cisangkuy River as one of the Citarum River tributaries through the application of biogas for waste management.

In addition to reducing pollution, the biogas program is also encouraged to increase the economic value added of farmers.

- Oxbow structuring activities including opening water access from the river to Oxbow (Dead River) which aims to be a long storage and reduce flood exposure during the rainy season. A total of 14 dead river segments (oxbows) in the Citarum River will be activated to reduce the load of Citarum during the rainy season.

3. Water Quality Monitoring and Industrial Waste Management System

   Activities undertaken in the water quality monitoring system are:

   - Determine monitoring points in the Citarum watershed and monitor at least 2 times a year.
   - Uniformity of frequency and water quality parameters of the Citarum watershed, at least there are 11 parameters tested, namely: pH, DO, BOD, COD, TSS, TDS, Fecal Coliform, NH_3-N, NO_3-N; T-P and Total Coli.
   - Reporting and analyzing Citarum watershed based on monitoring water quality data.
   - Optimization of information systems for monitoring water quality in the Citarum River Basin.

4. Management of Critical Land in the Upper Citarum River Basin

   The condition of critical land around the Citarum River Basin is quite alarming. Based on a map released by the Ministry of Environment and Forestry, the area of critical land around the Citarum watershed that spreads from Cisanti to Muara Gembong is 199,794.21 ha. The critical land is divided into two parts, namely state forest area of 52,426.04 ha and outside the area or managed by residents and other parties covering 147,486.71 ha. The purpose of handling critical land in the Upper Citarum watershed is to increase land productivity, provide clean water and air and increase the income of the people around the Upper Citarum watershed.

   To restore the function of land as before, several strategies are needed in handling critical land in the upstream Citarum watershed, as follows:

   - Agroforestry activities are planting outside the forest area, combining forest or timber tree management activities with the planting of short-term or annual crop commodities.
   - Application of soil and water conservation in agricultural activities to reduce the rate of erosion.
   - Distribution of productive seeds for free from the Ministry of Environment and Forestry (BPDASHL Citarum-Ciliwung) of 3 million mostly for handling the Upper Citarum Watershed.

   Jasa Tirta II Public Corporate cooperates with the Government in carrying out the conservation of the Citarum River Basin. The Governor of West Java has launched a program to support the conservation in the upstream Citarum under the name Citarum Bestari (Clean Healthy, Sustainable and Beautiful). The initial step action will be carried out at Km 0-20 namely from Mount Wayang to Majalaya Subdistrict which covers 5 Subdistricts and 56 villages with an area of 33,795.2 Ha by involving all stakeholders and communities.

5. Education Industry and Educational Institutions

   Various elements of society, ranging from the Central Government, Provincial Governments, City/Regency Governments and Non-Governmental Organizations (NGOs). Community to community, fully support the Citarum Harum program. The program will be carried out in the form of how to change the mindset of the people who previously did not care about the Citarum river, to become a form of ownership that must emerge from the community.

6. Law Enforcement

   The Citarum River continues to clean up the river through ecosystem restoration and law enforcement. The competent authority has also cracked down on a number of companies that dispose of factory waste not in accordance with standards. The Citarum Task Force launched two ammunition which includes the application of social sanctions and the involvement of non-civil apparatuses.

   Constraints that occur in law enforcement include:

   - Since the "Citarum Harum" was held in 2018, the police have revealed 58 cases of violations. These efforts are constrained by the lack of environmental regulatory officials (PPLH) required by law.
   - The law enforcement process downstream (Law 32/2009) by the Office of the Environment, Dansektor, Indonesian Republic Police and the Prosecutor's Office is quite good, but in the upstream, the process carried out by the Ministry of Industry has not seen any effort to encourage companies to improve their work.
   - The lack of accredited testing laboratory facilities is one of the bottlenecks in the case handling process.
   - Lack of competent personnel/expert witnesses detains the process of handling cases.
   - The use of sensor technology (iot) as a detector in the context of prevention and enforcement (Permen LHK P.93 / 2018 - Sparing).
   - There is no comprehensive information dissemination on LH Permen No. P.16 / 2019 from KLHK concerning BMAL so that in the field it uses a double standard.

II.2 The Condition of Jatiluhur Reservoir

Water quality monitoring in Jatiluhur Reservoir is implemented by referring to the following rules:

1. Law No.32 of 2009 concerning environmental protection and management.
2. Government Regulation Number. 82 of 2001 concerning Management of Water Quality and Pollution Control.
3. Minister of Public Works Regulation Number. 45 / PRT / 1990 concerning Water Quality Control at Water Sources.
4. Decree of the Governor of West Java No.39 of 2000 concerning the designation of raw water and water quality standards on the Citarum River and its tributaries in West Java.
5. Decree of the Minister of Environment Number 115 of 2003 concerning Guidelines for Determination of Water Quality Status.
6. Quality System Document in the environment of Perum Jasa Tirta II in the form of Procedure Number 29 concerning Monitoring of River / Canal / Reservoir Water Quality.

Monitoring water quality in the Jatiluhur Reservoir is carried out every month in 16 coordinate points of the reservoir waters. The location of the reservoir water sampling point is determined based on the Jasa Tirta II Public Corporation Board of Directors Number. 1 / 469 / KPTS / 2009. The analysis was conducted using water quality guidelines for Groups B, C, and D in accordance with the Decree of the Governor of West Java Number. 39 of 2000.

(a) The Physical Parameters

The brightness measured in the Jatiluhur Reservoir is classified as high with a range between 1.5 - 3.5 m. Just like other reservoirs in the Citarum watershed, the brightness value is quite high and highest in the Jatiluhur Reservoir. This relates to the very high water depth at the Jatiluhur Reservoir outlet (reaching 90 m), so that the suspended materials have a great opportunity to settle at the bottom of the waters. This is evidenced by the turbidity value which is also quite low in Jatiluhur Reservoir with a value of 2.88 - 31.2 NTU. In addition, this is also seen by the low value of TSS in the Jatilihur Reservoir, as well as in the Saguling Reservoir and Cirata Reservoir where TSS values are always low as a result of the opportunity for suspended material to settle in the reservoir. Thus there is a positive correlation between turbidity and TSS values. Meanwhile, the value of TSS or turbidity is negatively correlated with the value of water brightness. Vertically the turbidity value in the Jatiluhur Reservoir shows the increasing depth of turbidity decreases (Figure II.1). This shows that turbidity in reservoir waters is higher in the surface section and lowest in the water column section.

(b) The Chemical Parameters

DO values will decrease with increasing depth. This is caused by decreasing sunlight with increasing depth, so the photosynthesis process also decreases with increasing depth. The lowest DO measure in the Jatiluhur Reservoir is found at the floating net fisheries station. The low DO value is thought to be caused by the decomposition of organic matter in the waters due to high organic matter in the floating net fisheries region as a result of a large amount of leftover food that is not eaten by fish. In addition to this, it is suspected that at the bottom of the waters there are many leftover feeds that ultimately have to be decomposed aerobically, causing a low DO. Considering that the most leftover feed is at the bottom of the water, the higher of the depth water, the decomposition of organic matter is increasing, so the DO is lower.

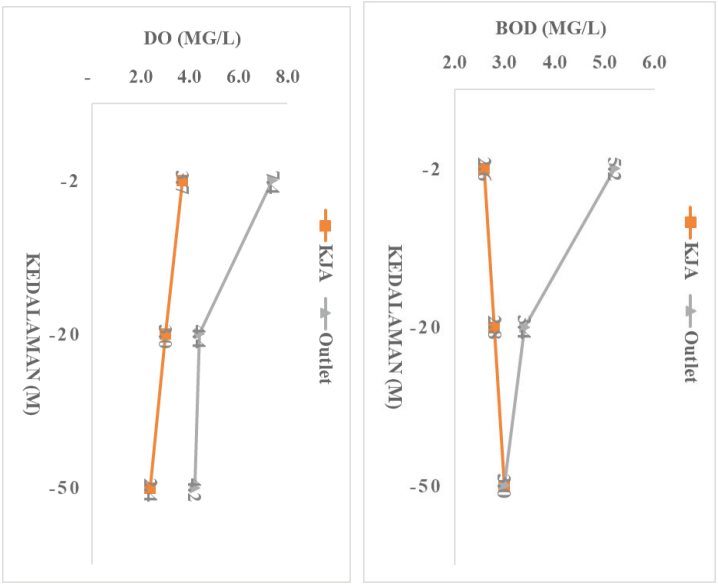

Figure II.1 : Dissolved Oxygen (DO) dan Biological Oxygen Demand (BOD) Vertically in Jatiluhur Reservoir)

Organic material in the Jatiluhur Reservoir is also the same height as other reservoirs in the Citarum River Basin. Likewise, the BOD and COD values which generally have passed the established quality standards of> 25 mg / L (COD) and> 3 mg / L (BOD). Thus the Jatiluhur reservoir has been contaminated by organic matter. The high level of organic material is thought to have originated mainly from fish farming activities in the floating net fisheries which generally feed the pump system. In addition to this, the organic material is also thought to originate from anthropogenic activities that exist around the Jatiluhur Reservoir, as well as the influence of anthropogenic activities along the Citarum watershed which is a hintherland area from urban to urban areas which has the potential to produce various kinds of waste such as domestic and industrial. The high value of COD indicates difficult organic matter to decompose (biological systems are no longer able to decipher) in the Citarum River in general and in the Jatiluhur Reservoir in particular is quite high.

(c) Water Quality Status

The results of calculations using water group, group BCD, CD, C and D in the Governor of West Java Province Decree Number. 39 of 2000, using the pollutant index method, obtained values respectively 3.90, 3.89, 3.89 and 3.89. This shows that the status of water quality in Jatiluhur Reservoir is based on water group, group BCD, CD, C and D in the Governor of West Java Province Decree Number. 39 of 2000 in the category of mildly polluted.

But the results of calculations using the storet method using water group, group BCD, CD, C and D in the Governor of West Java Province Decree No. 39 of 2000, obtained values successively -120, -68, -48. This implies that the Jatiluhur Reservoir is categorized as heavily polluted. Pollutant index values in the waters of the Jatiluhur Reservoir are highest compared to other scores in the Citarum watershed, whereas when viewed from the Storet index scores the Jatiluhur Reservoir waters have the second-lowest value after Cisanti Lake.

In calculating the water quality status of the Jatiluhur Reservoir using the Soret Method using D Water Group, the results obtained that the Jatiluhur Reservoir has a value of -24. This value indicates that the water quality status of the Jatiluhur Reservoir is in the medium polluted quality status. Therefore, the Jatiluhur Reservoir can breed fish and another aquatic biota. However, because the Jatiluhur Reservoir has been polluted, the cultivation carried out must be environmentally friendly. One example of environmentally friendly cultivation that can be done in the Jatiluhur reservoir is cultivation that does not provide feed. This can be done in this reservoir and in the Citarum Cascade Reservoir, given the deep green waters, which indicate that there is many planktons in this reservoir. On the other hand, plankton is an autotrophic body in which one of its roles is needed as food for plankton-eating heterotroph biota (plankton feeder). Therefore, fish that live in this reservoir will continue to grow and develop properly without having to be fed, because it will carry out the process of eating naturally, through each food chain, and subsequently the food chains will form webs food. If this condition can be carried out, the Jatiluhur reservoir which is a eutrophic reservoir will eventually return to its equilibrium environment, so it will become normal natural waters, like other natural waters which do not experience too much human intervention.

From tables II.2.1, II.2.2, II.2.3, II.2.4, II.2.5 and II.2.6 we can see that during the Citarum Harum program it has a positive impact on water quality in the Citarum watershed.

Table II.2.1 : Water Quality in Jatiluhur Reservoir 2018

NO.	Parameter	Unit	Inlet	KJA 2 m	KJA 20m	TKJA 40 m	Outlet 2 m	Outlet 20 m	Outlet 50 m	Quality standard
I	Physical									
1	Temperatur	°C	26.6	30.6	29.6	29.3	30.7	29.6	28.3	dev. 3
2	Turbidity	NTU	2.88	18.2	2.89	4.46	31.2	3.69	3.86	(-)
3	TDS	mg/L	124	98	114	114	108	106	124	1000
II	Chemical									
1	pH	-	6.11	7.55	6.71	6.08	7	6.65	6.3	6 - 9
2	DO	mg/L	4.1	3.7	3	2.4	7.4	4.4	4.2	3
3	BOD_5	mg/L	2.80	2.60	2.80	3.00	5.20	3.40	3.00	6
4	COD	mg/L	**58.31**	**51.02**	**62.61**	**51.02**	**71.62**	**65.61**	**67.76**	10

Table II.2.2 : Water Quality in Jatiluhur Reservoir 2019

NO.	Parameter	Unit	Inlet	KJA 2 m	KJA 20m	TKJA 40 m	Outlet 2 m	Outlet 20 m	Outlet 50 m	Quality standard
I	Physical									
1	Temperatur	°C	30	31.6	30.6	29.3	31.7	30.6	29.7	dev. 3
2	Turbidity	NTU	6.00	3.0	2.89	4.0	6.0	4.0	3.96	(-)
3	TDS	mg/L	295	255	220	195	110	106	90	1000
II	Chemical									
1	pH	-	7.11	5.65	5.71	5.98	7,5	6.85	6.2	6 - 9
2	DO	mg/L	**2.1**	3.9	3,8	**2.6**	5.2	4.3	3.9	3
3	BOD_5	mg/L	5	**6.4**	**7**	4	5.9	3.40	3.20	6
4	COD	mg/L	**14**	**19**	**21**	**14**	**17**	**12**	**10,4**	10

Table II.2.3 : The Quality Status of Citarum Watershed Waters Based on IP Index 2018

Location	Group				Explanation
	B,C,D	C,D	C	D	
Cisanti Lake	3.66	2.95	0.87	0.87	Good (<1); mild polluted (1.0 < PIj ≤ 5.0)
Citarum River	3.55	3.22	3.22	3.22	Mild polluted
Saguling Reservoir	3.88	3.68	3.68	3.68	
Cirata Reservoir	3.70	3.40	3.40	3.40	
Jatiluhur Reservoir	3.90	3.89	3.89	3.89	

Table II.2.4 : The Quality Status of Citarum Watershed Waters Based on IP Index 2019

Location	Group				Explanation
	B,C,D	C,D	C	D	
Cisanti Lake	0.7	0.5	0.4	0.4	Good (<1); mild polluted (1.0 < PIj ≤ 5.0)
Citarum River	5.672	4.32	2.92	2.92	Mild polluted
Saguling Reservoir	1.731	1.68	1.48	1.48	
Cirata Reservoir	2.276	1.92	1.40	1.40	
Jatiluhur Reservoir	3.497	2.89	2.19	2.19	

Table II.2.5 : The Quality Status of Citarum Watershed Waters Based on Storet Index 2018

Location	Group				Explanation
	B,C,D	C,D	C	D	
Cisanti Lake	-52	-44	-44	-20	Group of B,C,D; C,D; C is a heavy polluted (value > 31) Group of D is a moderately polluted (nilai 10-30)
Citarum River	-128	-124	-88	-28	
Saguling Reservoir	-108	-88	-64	-24	
Cirata Reservoir	-116	-96	-80	-20	
Jatiluhur Reservoir	-120	-68	-48	-24	

Table II.2.6 : The Quality Status of Citarum Watershed Waters Based on Storet Index 2019

Location	Group				Explanation
	B,C,D	C,D	C	D	
Cisanti Lake	-30	-14	-10	-10	Group of B,C,D; C,D; C is a heavy polluted (value > 31) Group of D is a moderately polluted (nilai 10-30)
Citarum River	-110	-104	-80	-20	
Saguling Reservoir	-80	-64	-44	-14	
Cirata Reservoir	-90	-76	-60	-10	
Jatiluhur Reservoir	-100	-58	-38	-14	

II.3 Water Quality and Water Characteristic Status in Cisanti Lake

Cisanti Lake is the upstream of the Citarum River. Cisanti lake is a lake that located in the middle of a natural forest, which is located at the bottom of Mount Wayang about 60 kilometers south of Bandung.

(a) The Physical Parameters

The measured brightness value in Cisanti Lake reaches 80%, even in Citarum Springs the brightness reaches 100%. The data is supported by low turbidity measurements, namely 13.3 NTU (2018) and 16.8 NTU (2019). This value is the lowest compared to other measurements in the Citarum River Basin (Table II.3.1).

The TDS value in Cisanti Lake is also quite low, ranging from 64 - 80 mg / L (2018) and has increased to 156.33 mg/L in 2019. Another physical parameter that is characteristic of the upstream area is the low temperature content of 21.3^0 C (in 2018) and in 2019 the temperature will reach 21.8^0 C. This temperature is the lowest compared to other temperatures in the Citarum River Basin. The low temperature in the Citarum spring that enters Cisanti Lake is due to the fact that around the spring is a dense forest area so the sun's penetration into the spring is very low.

The results of the three physics parameters above, prove that the Citarum Harum program has begun to be a significant benefit in the upper reaches of the Citarum River.

Table II.3.1 : Water Quality Measurement Results at Lake Cisanti

NO.	Parameter	Unit	Cisanti Lake 2018	Cisanti Lake 2019	Quality Standard **)
I	Physical				
1	Temperature *)	°C	21.3	21.8	dev. 3
2	Turbidity +	NTU	13.3	16.8	(-)
3	TDS +	mg/L	80	156,33	1000
II	Chemical				
1	pH *)	-	6.64	7.6	6 - 9
2	DO *)	mg/L	7.4	4,19	4
3	BOD_5	mg/L	3.60	4.76	6
4	COD +	mg/L	52.73	14.44	10

(b) The Chemical Parameters

The pH value in Cisanti Lake still in the normal range of 6.64 (2018) and in 2019 the pH reaches 7.6. According to other chemical parameters such as: sulfides (H_2S), oils and fats, detergents and phenols that measured in Cisanti Lake are low. This value is still far below the quality standards contained in the Decree of West Java Governor Number. 39 of 2000. This happened because, in Cisanti Lake and its surrounding areas, there were relatively no anthropogenic activities.

The dissolved oxygen content (DO) in the Cisanti spring is quite high at around 7.4 mg/L (2018) included in the uncontaminated criteria and has decreased in 2019 to 4.19 mg/L (including the moderately polluted criteria). The high dissolved oxygen content in the water is a clue or a characteristic that Cisanti spring is clean and clear water, and relatively undisturbed, especially from the disturbance of organic matter. These results are in line with the results of BOD_5 measurements. BOD_5 values in Cisanti springs with an average of 3.60 mg/l (2018) are included in the uncontaminated criteria and have increased in 2019 with an average of 4.76 mg/l. The low value of BOD_5 in springs occurs because the input of organic material especially those originating from anthropogenic activities is still very low. In addition to this, the Cisanti spring is also surrounded by natural forests that are relatively only producing little organic material.

COD value in the Cisanti spring reaches 10.66 mg/l. This COD value is still far below the specified quality standard, but for springs, the value is classified as high, even though in this region there is no industrial activity. This condition is thought to have an influence from the surrounding farming activities which currently still use artificial fertilizers and pesticides, so the use of these chemicals is suspected to affect the quality of springs that enter Cisanti Lake.

What is quite surprising in Cisanti Lake is the high COD value in Cisanti Lake which reaches 52.73 mg/l (2018) and has decreased in 2019 to 14.44 mg/l. According to Nollet (2007), COD value in uncontaminated waters will not reach more than 20 mg/L. These conditions indicate that in Cisanti Lake it is suspected that it has begun to be polluted, which is indicated from the presence of difficult to decompose organic materials whose numbers are quite high. The high value of COD is thought to originate from tourist activities that have not complied with throwing garbage into the Lake. In addition, it is also thought to originate from agricultural activities around the reservoir which ultimately affect the water quality in Cisanti Lake. Another thing that causes high organic matter can also come from weathering the remnants of plants or trees that enter the Lake waters which contain natural hazardous and toxic materials, such as natural PAH.

From the results of the four chemical parameters above, it proves that the Citarum Harum program is starting to show changes towards a better direction because only one parameter has still not improved, namely dissolved oxygen (DO).

(c) Water Quality Status

The results of the calculation of the status of water quality using Groups B, C, D in the Decree of the Governor of West Java Province Number 39 of 2000, the results obtained with the pollutant index method, obtained values respectively are 3.66 and 2.95. This implies that Cisanti Lake is the water that has a mildly polluted quality status.

However, the results of calculations using the storet method using Groups B, C, D in the Decree of the Governor of West Java Province Number 39 of 2000 obtained the results that Lake Cisanti is categorized as heavily polluted with successive values of -52, -44 and -44. This implies that Cisanti Lake is heavily polluted (Figure II.3.1). This is quite surprising as seen from the position of Lake Cisanti found in the upper reaches of the Citarum watershed. This pollution occurs seen from four main parameters namely the high value of BOD, COD and the value of Pb and Cr in Lake Cisanti. However, when compared to other locations the index value is the lowest where the lower (downstream) the value of the pollution status is higher.

When you look at the physical condition of the water in Cisanti Lake it can be seen is quite thick green and its overgrown by aquatic plants that live in the water column. This indicates that in Cisanti Lake there is a lot of organic matter and a lot of nutrients, thus triggering the growth of autotrophic bodies in it. Therefore, high phytoplankton growth causes water to be green, and high nutrients also trigger aquatic plants to grow very fertile.

The contamination of Cisanti by easily decomposed organic matter (BOD), difficult decomposed organic material (COD) and heavy metals Pb and Cr, is thought not to originate from the influence of the activities carried out at this time, but is thought to originate from previous activities. This is in accordance with the statement of Diana and Pasha (2015) which states that although the forest in Mount Wayang, which contains Cisanti Lake, has a protected forest status, but in the region in the 2000s, experienced the exploitation of natural resources that did not concern with the environmental sustainability, by being converted into community plantations, resulting in the removal of protected trees around the spring. Furthermore, it was said that in 2001, Cisanti Lake's condition changed, namely experiencing siltation due to erosion from around the spring. The author's observations in the field show that in the activities of community plantations around Mount Wayang, basically used various chemicals such as chemical fertilizers and pesticides. Therefore, it is suspected that the high COD and Pb and Cr heavy metals, all of which have exceeded this quality standard, are thought to originate from hazardous and toxic substances (B3) used in anthropogenic activities in protected forest areas that are used as community plantations, and subsequently, these B3 are carried by rainwater, and enter the spring and into Cisanti Lake.

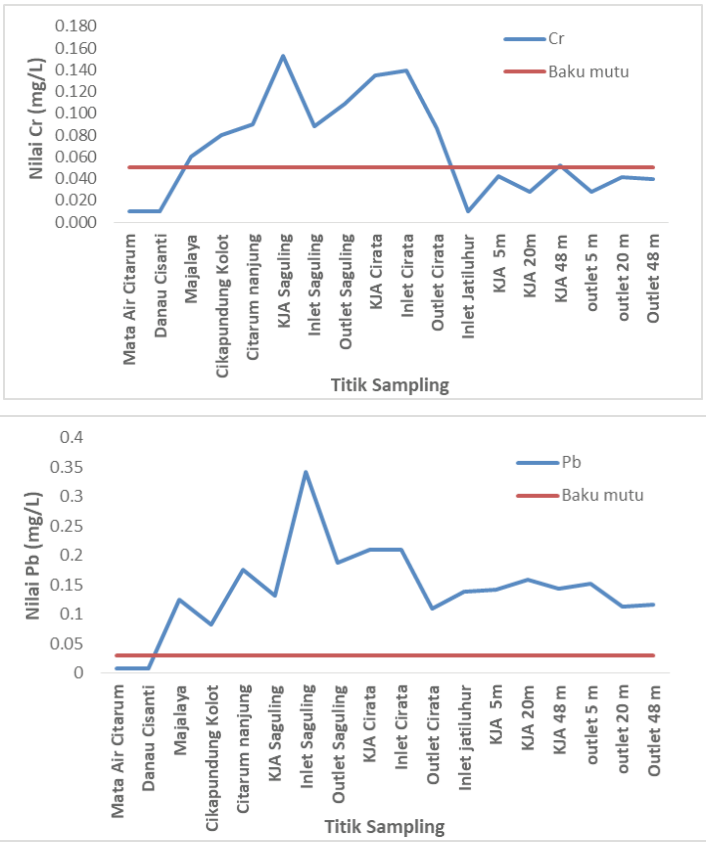

Figure II.3.1 : The Distribution of Heavy Metal As in the Citarum River Basin

II.4 The Effect of Water Quality on Performance Ir. H. Djuanda Dam

Poor water quality has the potential to disrupt the main functions of a reservoir and threaten the sustainability of water resource management. Disruption to the functions of the Jatiluhur Reservoir can cause large losses such as disruption of the irrigation system, disruption of raw water supply for DKI and surrounding residents and industry, damage to hydroelectric turbines (PLTA), dam floodgates cannot be operated automatically due to corrosion causing decreased economic life of the equipment (life cycle), flooding in Karawang and Bekasi regencies, damage to aquaculture and disruption of tourism activities. These disturbances can be in the form of internal problems in the Jatiluhur Reservoir (damage to systems and equipment and channels), the threat of natural disasters (floods, earthquakes and landslides), conflicts of interest, and sabotage. The situation, in addition to causing casualties, can also threaten environmental damage. Therefore, integrated and comprehensive management is needed so that the Ir. H. Djuanda can continue to perform its main functions.

The Citarum Harum program has been running for almost a year, some effects have begun to be felt for the performance of the Ir. H. Djuanda, although the results have not been significant. This can be seen from the comparison of water quality during 2018 - 2019, there were several improvements in water quality such as the physical parameters and chemical parameters in accordance with tables II.2.1, II.2.2, II.2.3, II.2.4, II.2.5 and II. 2.6 above. Going forward, Perum Jasa Tirta II hopes that the Harum Citarum Program will continue and work together with other stakeholders to continue working to improve the environment so that it has a positive impact on water quality in the Jatiluhur Reservoir and Citarum River Basin.

CHAPTER III - CONCLUSIONS AND SUGGESTIONS

III.1 Conclusions

1. A Presidential Decree is needed to deal with problems in the Citarum watershed by involving relevant agencies and stakeholders.
2. Citarum River starting from the upstream to the cascade reservoir has shown pollution, especially organic matter pollution which is seen from the value of BOD and COD and heavy metal pollution.
3. Water quality at the inlet, outlet and at Floating Net Fisheries in Saguling Reservoir, Cirata Reservoir DO, BOD, COD, total phosphate, ammonia, Cr, Pb have exceeded the quality standard, whereas at Jatiluhur Reservoir the parameters that do not comply with quality standards are DO, BOD, COD, total phosphate, and Pb. But based on its depth, Jatiluhur Reservoir water quality tends to get deeper and deeper.
4. The Water Quality Status of the Citarum Watershed is based on the IP Index of all designated classes, only Cisanti Lake is not polluted, while others are lightly polluted. But based on the Storet index, the designation classes I, II and III are classified as heavily polluted. Only class IV designation shows moderate contamination
5. The water quality of the Citarum Watershed and the Jatiluhur Reservoir when compared to the results of measurements in 2018 and 2019, better results are obtained. This indicates that the Citarum Harum program has a positive effect on the water quality of the Citarum River Basin.

III.2 Suggestions

1. It is necessary to manage pollution cases that occur in the waters of the Citarum River from upstream to downstream by analyzing the source of pollutants and monitoring the source of pollutants.
2. Institutional strengthening for the relevant agencies managing the Citarum River Basin and related stakeholders needs to be carried out to the Citarum Harum program is coordinated, synergistic and non-overlapping policies.