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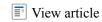
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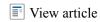
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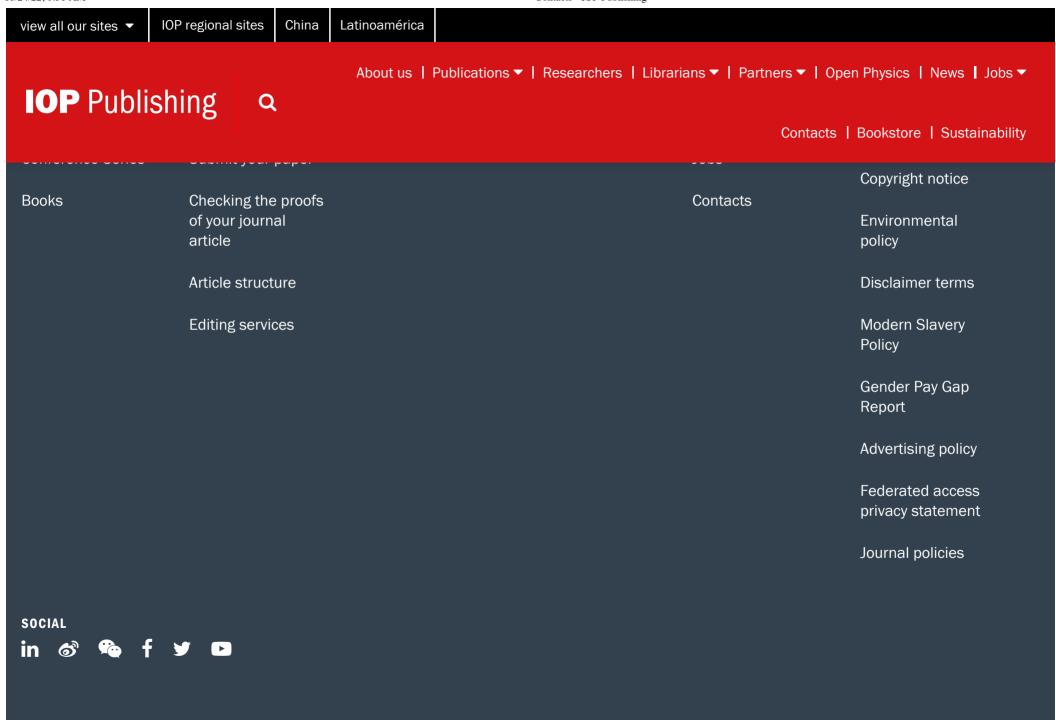
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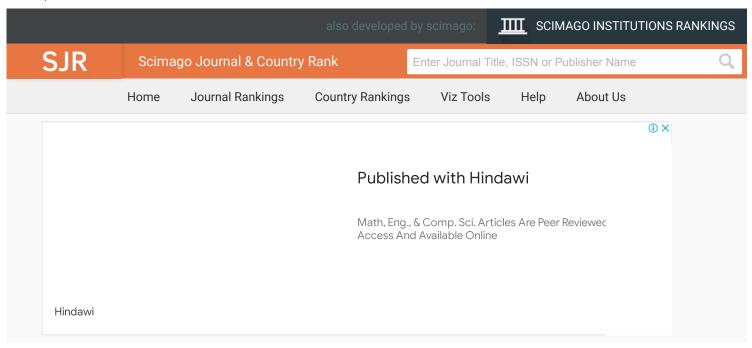
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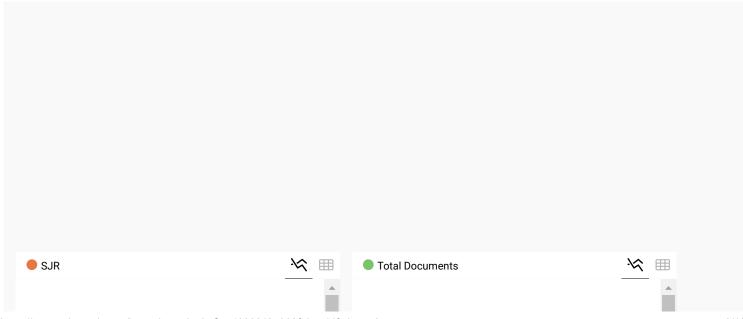
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A **Abdel Moktader Abdel Aziz El-Sayed** 3 weeks ago

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M **Melanie Ortiz** 3 weeks ago

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N **NAJI** 7 months ago

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kind regards

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M **Melanie Ortiz** 7 months ago

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A **Alharia Dinata** 2 years ago

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M **Melanie Ortiz** 2 years ago

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Best Regards, SCImago Team

V   **Vani**   2 years ago

good evening, whether this journal is Q4 or Q2 ?

↩ reply

SCImago Team

M   **Melanie Ortiz**   2 years ago

Dear Vani,
Thank you for contacting us.
As said below, we calculate the SJR data for all the publication's types, but the Quartile's
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F   **FEROSKHAN M**   2 years ago

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N   **Natt**   2 years ago

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N   **Nurgustaana**   3 years ago

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M   **Melanie Ortiz**   3 years ago

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M   **Mora**   3 years ago

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Thank you,

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Melanie Ortiz   3 years ago

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now it does not appear into Google Scholar and my account.

Please help me to resolve the issue. Thank you for your kindness. I am waiting for good news from
you.

Sincerelly,
Mursalin

↩ reply

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M   **Melanie Ortiz**   3 years ago

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S   **syaiful**   4 years ago

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best regards

syaiful

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E   **Elena Corera**   4 years ago

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Identification and Calculation of Pollutant Load in Ciwaringin Watershed, Indonesia: Domestic Sector

D S Wijaya[1*] and I Juwana[1]

[1]Faculty of civil engineering and planning, Insttitut Teknologi Nasional Bandung, Jl. PHH Mustopha No.23 Bandung 40124, West Java, Indonesia.

*dwitawijaya31@gmail.com

Abstract. Ciwaringin River is a major river in Ciwaringin watershed that is used as a source of water for daily activities, such as, agricultural and fishery, in Majalengka and Cirebon cities. Recently, population growth and its related activities in the watershed are feared to increase pollutant load in Ciwaringin River. The objectives of this study are to determine the water quality and to calculate pollutant load in Ciwaringin watershed, as an effort to control the river pollution.The water quality is obtaines from the sampling undertaken by DLH of West Java, which was then analysed by calculating its Pollution Index. The Pollution Index was calculated in accordance with Ministry of Environment Decree No.113/2003 on the Determination of Water Quality Status. Whilst, the pollutant load was analysed by identiying activities along the river that potentially contaminate the Ciwaringin River,namely the domestic, argicultural, and animal husbandry, and calculate the pollutant load of resepective activities. Results showed that selected segments in Ciwaringin watershed have a pollutant index value >5, which is classified as medium pollution level. As for the pollutant load from domestic sector, it was calculated that based on data in August 2016, the watershed is potentially polluted by 855.27 Kg/day of TSS, 2,448.65 kg/day of BOD, 410,245.82 kg/day of COD, 142,15 kg/day of N-Total, and 1.15 Kg/day of P-Total. These pollutant values were then compared with the standard quality of Goverment Decree No.82/ 2001 on Water Quality Management and Water Pollution Control which includes physical (TSS) and chemical parameters (BOD, COD, N and P).

1. Introduction

Major ecosystem services provided by rivers - both for life-sustaining and the hydrologic cycles. Currently in Indonesia river pollution has become serious problem. Based on the report issued by the Directorate General of Pollution Control and Environmental Degradation of the Ministry and Forestry, in 2015 almost 68% or the majority of river water quality in 33 provinces in Indonesia is in severe pollution due to domestic waste [1,2].

Basically, the river has the ability to "cleanse" contaminants through the natural chemical-physics-biological processes that take place naturally in water bodies (Self Purification). If the pollutant load in the water does not exceed the capacity of the river then self-purification will run optimally and there will be no pollution [3].

The Ciwaringin River originates flows from its headwaters in Mount Ciremai-Kuningan to Malengka and Cirebon. Based on interviews with DLH West Java Province, quality and capacity of the Ciwaringin watershed has begun to be monitoring since 2015. Meanwhile, in 2015 some segments in Ciwaringin

basin area have been in polluted condition. However, Ciwaringin River being one of the main sources of Majalengka and Cirebon's water supply for the necessities of life, irrigation and fisheries [4,5].

Based on the explanation above, this research is needed to conducting study and evaluating the calculation of the water pollution load capacity that can be received by the Ciwaringin River. Additionally, through this research, it is expected to determine appropriate pollution control solution, so that it can be used as the source of water supply in the future.

2. Methods

2.1. Data collection
In the data collection stage, the data used secondary data obtained from several instances, DLH West Java Province and Central Bureau of Statistics (BPS) of West Java Province. Data collected include : (1) base map scale 1:25.000, (2) water quality of the Ciwaringin river in June, August, and October 2016, (3) District spatial planning, and (4) Population data last 6 years (2010-2015).

2.2 Assessment of water quality status
Assessment of water quality status based on Ministry of Environment Decree No. 113/2003 on Guidelines for the Determination of the Water Quality status, where such values may be used to evaluate the condition of the river; whether it is polluted or not [6]. The status of water quality is the level of water quality condition that indicates the condition of pollutant or good condition at a water source within a certain time by comparing with the specified quality standard [3]. The provisions of the assessment of the status of water quality by using the pollutant index (PI) value are as follows: (1) $0 \leq PI \leq 1.0$ indicates that water quality is not polluted, (2) $1.0 < PI \leq 5.0$ indicates that water quality is lightly polluted, (3) $5.0 < PI \leq 10$ indicates that water quality is moderately polluted, and (4) $PI > 10$ indicate that water quality is severely polluted. Output at this step will be used in the next step (segment selection).

2.3 Segment selection
After obtaining the data, this research conducted on segments that have the most potential to contribute the pollution of the Ciwaringin River. Hence, it is necessary to select the segment from 4 segments that have been being monitored by DLH West Java. Segments selection have been done based on existing area, activities, land use, water quality and development plan according to District Spatial Planning (RTRW) in Ciwaringin River Basin area. To determine the selected segment will be done by scoring on all of segments. The greater the score then the more potential to pollute the Ciwaringin river water.

2.4 Calculation of maximum pollutant load domestic sector
Calculation of maximum pollutant load (MPL), obtained by multiplying the river flow with the concentration values of each parameter based on standard quality of the water to be studied. The water quality standard concentration has been obtained from the attachment of Government Regulation No. 82/2001 on the Management of Water Quality and Water Pollution Control. Generally, there are 5 key parameters to know pollutants such as BOD, COD and Nutrient (compound N and P). This key parameter is a water quality parameter that results in pollution with probability of occurrence $\geq 80\%$.

$$MPL\ 1 = Debit \times Concentration\ of\ Water\ Quality\ Standard\ x\ Conversion\ Factor \dots\dots\dots (1)$$
$$MPL\ domestic\ sector = MPL\ 1\ \times \%\ Pollution\ Load\ Domestic\ Sector \dots\dots (2)$$

2.5 Calculation of actual pollution load
Calculation of actual pollution load is the amount of polluted loads actually entering the river, from the results of water quality monitoring conducted by the DLH West Java. The actual pollutions load value obtained from the following formula

$$APL = Debit \times Concentration\ of\ measurement\ results\ x\ Conversion\ Factor \dots\dots\dots (3)$$

2.6 Calculation the projection of pollution load potential
The calculation of the polluted load projections are obtained by multiplying the projection population by the emission factor in Table 1. The projection calculation of population using arithmetic, geometric and least square method, then it will selected as the best method based on correlation value and variance of coefficient.

The calculation of potential pollution loads (PPL) that is obtained by multiplying the population by the emission factor, which has been listed in Table 1 also considering the sanitation pattern and equivalence ratio. Here is the formula used to calculate the pollutant load from the domestic sector: [4]

$$PPL = \alpha \times \Sigma Population \times Emission\ Factor\ x\ Rek \dots\dots\dots(4)$$

Table 1. Domestic Sector Emission Factor

No	Parameters	Emission Factor	Unit
1	TSS	38	g/person/day
2	BOD	40	g/person/day
3	COD	55	g/person/day
4	N-Total	1,95	g/person/day
5	P-Total	0,21	g/person/day

Note : Iskandar, 2007

The value of emission factor (FE) in Table 1 is obtained from the research results from Eko W. Irianto in Bandung, Yogyakarta and Makassar in Iskandar, 2007 as urban areas as, then for different region type (not urban area) calculation need multiplied by value rek [7]. Rek is the ratio of city equivalent that states the difference in domestic waste load generated between urban areas, peripheries and inland. According to Iskandar (2007) the value of the magnitude of the ratios are as follows: value 1 for urban areas, 0.8125 suburbs and 0.6250 for inland [7].

The value of α shows the sanitation pattern based on the distance of the pollutant source (house) to the river, with the provision of α value as follows: (1) distance 0-100 sanitary pattern is direct discharge to the river, has α value of 1, (2) distance 101-500 m then the sanitary pattern of open channels, has α value of 0.83 and (3) distance > 500 then sanitary pattern using septic tank, has α value of 0.3.

3. Results and discussion

3.1 Assessment of water quality status
The water quality status assessment is conducted in accordance with Decree of the Minister of Environment 115 of 2003. The data used is the water quality data of the river on June, August and October 2016 and designate the river for 2nd class. The result can be seen at Table 2. Calculation example :

1. Parameter that have no range, such as COD.
   [COD] results of sampling = Cij = 43 mg/l
   [COD] standard 2nd class = Lij = 25 mg/l
   Cij/Lij = (43 mg/l) ÷ (25 mg/l) = 1,72
   New Cij/Lij = $1,0 + P.log\ (C_i/L_{ij})$ ..... (3)
   $= 1 + 5\ (log)\ (1,72) = 2,17$

2. Parameter that if have low value then water quality descrease, only DO
   [DO] results of sampling = Cij = 4,3 mg/l
   [DO] standard 2nd class = Lij = 4 mg/l
   [DO] saturation = Cim = 10 mg/l
   Ci/Lij : $\frac{C_{im} - C_{i\ (hasil\ pengukuran)}}{C_{im} - L_{ij}} = \frac{(10-4,3.)}{(10-4)} = 0,95$

3. Parameter that have range, only pH

pH = Cij = 7,63

pH standard 2nd class = Lij = 6-9

$$\text{Ci/Lij} = \frac{\left[C_i - (L_{ij})_{average}\right]}{\left\{(L_{ij})_{max} - (L_{ij})_{average}\right\}}$$

$$= \frac{(7.63 - 7.5)}{(9 - 7.5)} = 0{,}09$$

4. Calculation of pollution index value

$$PI_j = \sqrt{\frac{\left(\frac{C_i}{L_{ij}}\right)_M^2 + \left(\frac{C_i}{L_{ij}}\right)_R^2}{2}}$$

$$= \sqrt{\frac{8{,}65_M^2 + (1{,}07)_R^2}{2}} = 6{,}17$$

(Moderately Polluted)

3.2 Segmen selection

Segments selection have been done based on existing area, activities, land use, water quality and development plan according to District Spatial Planning (RTRW) in Ciwaringin River Basin area. To determine the selected segment will be done by scoring on all of segments. The results of the scoring can be seen in Table 2. The scores are follows: score 4 is the largest area of activity value, score 3 is the second largest order of activity, score 2 is the third largest activity value, Score 1 is the fourth largest and Score 0 means no activity.

Table 2. Result of Scoring Segment Selection

No	Criteria	Segment 1		Segment 2		Segment 3		Segment 4	
		Value	Score	Value	Score	Value	Score	Value	Score
1	Area (Ha)	3,786.510	1	3,954.550	2	4,258.656	4	3,998.815	3
2	Activity								
	a. Domestic (Person)	38,347	3	1,609	1	4,260	4	3,580	2
	b. Agriculture (Ha)	2,203.79	2	1,608.88	1	4,259.87	4	3,579.85	3
	c. Farms (Livestock)	525,581	4	285,132	3	189,310		113,724	
	d. Mining (Ha)	-	0	64.751	1	-	0	-	0
3	Land Use								
	a. Urban solid (Ha)	386.77	2	589.16	3	1,010.47	4	199.32	1
	b. Garden (Ha)	736.71	3	981.93	4	13.18	2	79.73	1
	c. Forest (Ha)	-	0	1,178.32	4	30,75	3	-	0
	d. Rice field (Ha)	552.54	1	785.54	2	3,075.35	3	3,587.76	4
	e. Fields (Ha)	1,657.61	4	196.39	2	263.60	3	119.59	1
	f. Shrub (Ha)	349.94	4	196,39	3	-	0	-	0
4	Development plant	Optimization of water resources and utilization of reservoirs	2	Landfills, clean water network, conservation of springs and geothermal power plant	4	Clean water network, conservation of springs and oil & gas pipelined	3	Development of medical waste management	1
5	Water Quality Status								
	a. June 2015	Lightly Polluted (4)	2	Lightly Polluted (2)	2	Lightly Polluted (4)	2	Lightly Polluted (5)	2
	b. August 2015	Lightly Polluted (3)	2	Lightly Polluted (2)	2	Lightly Polluted (2)	2	Lightly Polluted (4)	2
	c. October 2015	Lightly Polluted (3)	2	Non Polluted (1)	1	Lightly Polluted (4)	2	Lightly Polluted (5)	2

Table 2. Continue

d. June 2016	Moderately Polluted (6)	3	Moderately Polluted (6)	3	Moderately Polluted (7)	3	Moderately Polluted (6)	3
e. August 2016	Non-Polluted (1)	1	Moderately Polluted (6)	3	Moderately Polluted (8)	3	Severely Polluted (10)	4
f. October 2016	Non Polluted (1)	1	Non Polluted (1)	1	Moderately Polluted (6)	3	Moderately Polluted (8)	3
Total Score		**37**		**42**		**45**		**32**

Note : Analysis results, 2017

Based on the Table 2 above, it was obtained selected segment, that is segment 3 with the biggest scores 45. The segment is considered to contribute the cause of river pollution, either various activities or land use. In order that, the segment will be the scope on this research.

3.3 Calculation of maximum pollution load domestic sector
Segment 3 with monitor point 3 is a 2nd class river for recreational, freshwater fish cultivation, livestock, irrigation, etc. Maximum pollutant values for BOD, COD, TSS N-Total and P-Total parameters in segment 3 of the multiplication of discharge and water quality standard can be seen in Table 3. The value of maximum pollution load (MPL) are divers, it is influenced by the debit a condition at the time of sampling by DLH West Java. DLH West Java sampled in June, August and October. The timing of the shipment is considered to represent the three seasons in Indonesia, namely the dry season, the transition season and the rainy season.

Table 3. Maximum Pollution Load

No	Parameters	Units	Water Quality Standard 2nd class	Jun-16		Agu-16		Okt-16	
				Debit (m^3/s)	MPL1 (Kg/day)	Debit (m^3/s)	MPL1 (Kg/day)	Debit (m^3/s)	MPL1 (Kg/day)
1	TSS	mg/liter	50	2.87	12,398.40	1.98	8,553.60	14.32	61,862.40
2	BOD	mg/liter	3	2.87	743.90	1.98	513.22	14.32	3,711.74
3	COD	mg/liter	25	2.87	6,119.20	1.98	4,276.80	14.32	30,931.20
4	Total – P	mg/liter	0.2	2.87	49.59	1.98	34.21	14.32	247.45
5	Nitrate (NO_3-N)	mg/liter	10	2.87	2,479.68	1.98	1,710.72	14.32	12,372.48
6	Ammonia (NH_3-N)	mg/liter	-	2.87	-	1.98	-	14.32	-
7	Nitrite (NO_2-N)	mg/liter	0,06	2.87	14.88	1.98	10.26	14.32	74.23

Note : Calculation Results, 2017

Calculation example :
$MPL\ (TSS\ June) = Debit \times Concentration\ of\ Water\ Quality\ Standard\ x\ Conversion\ Factor$

$$= 2{,}87\ \frac{m^3}{s}\ x\ 50\frac{mg}{lt}\ x\left(\frac{1\ kg}{1{,}000{,}000\ mg}\ x\ \frac{1\ m^3}{1000\ lt}\ x\frac{1\ day}{86{,}400\ s}\right) = \ 12{,}398{,}40\ kg/day$$

The maximum value of pollution loads in table 3 is the maximum contaminant load value for all sectors, namely domestic sector, agriculture, livestock and industry. To obtain the maximum pollutant load value of the domestic sector, it is necessary to know the percentage of pollutants from the domestic sector, as shown in Table 4. Using formula 2, the maximum domestic pollutant load value is presented in Table 5.

Table 4. Total Potential Pollution Load

Parameters	Pollution Loads (kg/day)				Total	Pollution Load Domestic Sector (%)
	Domestic	Agriculture	Farms	Industry		
TSS	2.825,79	0,20	-	-	2.825,99	**99,99**
BOD	2.915,84	49,03	618,10	980,00	4.562,97	**63,90**
COD	4.009,29	-	1.600,35	-	5.609,64	**71,47**
P-Total	15,31	27,24	9,92	-	52,47	**29,17**
N-Total	142,15	54,48	1,11	-	197,74	**71,89**

Note : Calculation Results,2017

Calculation load example :

$$\% \, pollution \, load \, domestic \, sector \, TSS \; = \left(\frac{Domestic \, Pollution \, loads}{Total \, pollution \, load}\right) \times 100\%$$
$$= \left(\frac{2,825.79 \, kg/day}{2.825,99 \, kg/day}\right) \times 100 \; = 99,99\%$$

Table 5. Maximum Pollutioan Load Domestic Sector

No	Parameters	Pollution Load Domestic Sector (%)	Jun-16		Agu-16		Okt-16	
			MPL1 (Kg/day)	MPL (Kg/day)	MPL1 (Kg/day)	MPL (Kg/day)	MPL1 (Kg/day)	MPL (Kg/day)
1	TSS	99,99	12,398.40	**12.386,00**	8,553.60	**8,553.00**	61,862.40	**61,858.06**
2	BOD	63,90	743.90	**475.35**	513.22	**327.96**	3,711.74	**2,371.89**
3	COD	71,47	6,119.20	**4,429.33**	4,276.80	**3,056.69**	30,931.20	**22,106.96**
4	P-Total	29,17	49,.9	**14.47**	34.21	**9.98**	247,45	**72.19**

Note : Calculation Results,2017

Calculation load example :

$$Maximum \, pollution \, load \, domestic \, sector \, (TSS) = \; MPL1 \, June \, 2016 \times \% \, pollution \, load$$
$$= 12.398,4 \frac{kg}{day} \; \times 99,9\% = 12.386,0 \, kg/day$$

For the parameter ammonia, nitrite and nitrate are not obtained maximum contaminant load value for the domestic sector. This is because in the calculation of the total pollutant load, the known parameter value is the N-total value.

3.4 Calculation of actual pollution load
The actual pollutant load value was obtained by multiplying the actual debit and actual concentration of the DLH of West Java sampling in 2016. The actual pollutant load value can be seen in Table 6.

Table 6. Actual Pollution Load 2016

No	Parameters	Jun-16			Agu-16			Okt-16		
		C	Q	APL$_1$	C	Q	APL$_1$	C	Q	APL$_1$
		(mg/L)	(m³/s)	(kg/day)	(mg/L)	(m³/s)	(kg/day)	(mg/L)	(m³/s)	(kg/day)
1	TSS	38	2,87	**9.422,78**	5	1,98	**855,36**	13	14,32	**16.084,20**
2	BOD	9,73	2,87	**2.412,73**	22,4	1,98	**3.832,01**	15,9	14,32	**19.672,20**
3	COD	36	2,87	**8.926,85**	83,8	1,98	**14.335,83**	34,6	14,32	**42.808,80**
4	P-Total	0,043	2,87	**10,66**	0,023	1,98	**3,93**	0,075	14,32	**92,8**

Note : Calculation Results,2017

Example :

$$APL\ (TSS\ june) = Debit \times Concentration\ of\ measurement\ results\ x\ Conversion\ Factor$$
$$= 2,87\ \frac{m^3}{s}\ x\ 50\ \frac{mg}{lt}\ x\ \left(\frac{1\ kg}{1,000,000\ mg}\ x\ \frac{1\ m^3}{1000\ lt}\ x\ \frac{1\ day}{86,400\ s}\right) =\ 12,398,40\ kg/day$$

　　To know the actual pollutant load from the domestic sector, Actual pollution loads multiplied by the percentage of polluters in the domestic sector. The calculation results can be seen in Table 7.

Table 7. Actual Pollutioan Load Domestic Sector

No	Parameters	Pollution Load Domestic Sector (%)	Jun-16		Agu-16		Okt-16	
			APL$_1$ (Kg/day)	APL (Kg/day)	APL$_1$ (Kg/day)	APL (Kg/day)	APL$_1$ (Kg/day)	APL (Kg/day)
1	TSS	99,99	9.422,78	**9.421,842**	855,36	**855,27**	16.084,20	**16.082,59**
2	BOD	63,9	2.412,73	**1.541,734**	3.832,01	**2.448,65**	19.672,20	**12.570,54**
3	COD	71,47	8.926,85	**6.380,018**	14.335,83	**10.245,82**	42.808,80	**30.595,45**
4	P-Total	29,17	10,66	**3,110**	3,93	**1,15**	92,80	**27,07**

Note : Calculation Results,2017

Example :

$$Actual\ pollution\ load\ domestic\ sector\ (TSS) =\ APL1\ June\ 2016 \times \%\ pollution\ load$$
$$= 9.422,78\frac{kg}{day}\ \times 99,9\% = 9.421.842\ kg/day$$

3.5 Calculation the projection of pollution load potential
Population projection is done to predict the number of polluters in the future. The population will be projected using the last 6 years population data (2010-2015) in Majalengka Regency and Cirebon Regency. Population projection calculation will be done with 3 methods namely arithmetic method, geometry method and least square method. The result of three methods then will be checked into the correlation factor, standard deviation and coefficient of variance. The method chosen must have correlation factor value near to 1, while the standard deviation must be the smallest among three methods. Besides, the coefficient of variance must be less than one (<1)). Moreover, the projected of each sub district population in the segment 3 area are presented in Figure 1.

　　From Figure 1, it can be concluded that each District where located in the segment 3 has a tendency of different population growth. Sub-districts with constant relative population are Sumberjaya Sub-

District, Gempol Sub-District, Susukan Sub-District and Arjawinangun Sub-district, while Ciwaringin Sub-district tends to increase significantly, and Arjawinangun sub-district tends to decrease.
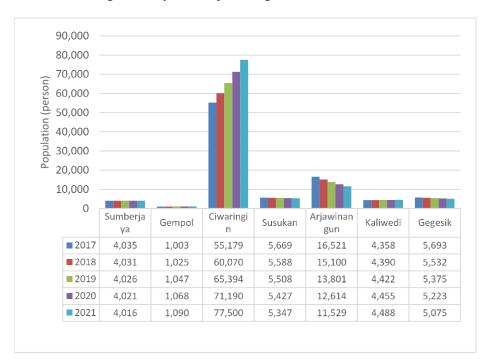

	Sumberja ya	Gempol	Ciwaringi n	Susukan	Arjawinan gun	Kaliwedi	Gegesik
■ 2017	4,035	1,003	55,179	5,669	16,521	4,358	5,693
■ 2018	4,031	1,025	60,070	5,588	15,100	4,390	5,532
■ 2019	4,026	1,047	65,394	5,508	13,801	4,422	5,375
■ 2020	4,021	1,068	71,190	5,427	12,614	4,455	5,223
■ 2021	4,016	1,090	77,500	5,347	11,529	4,488	5,075

Figure 1. Projected Result of Population in Segment 3

On the Calculation the projection of pollutant load potentials, there are several things are required: (1) data of population (2017-2021), (2) the distance of settlements to the river and (3) the type of area (urban, suburban, and inland). Besides, a map that used as a reference for the calculation of domestic contaminant loads can be seen in Figure 2. From figure 2 can be showed that the distance from source to the river less than 100 m and based on distric spatial planning document segmen 3 is a suburban area , so used α=1 and rek =0.8125 for calculating. Potential pollutant loads in detail can be seen in Table 8. Here is an example : $PPL\ BOD\ 2017 = \alpha \times \Sigma Population\ \times Emission\ Factor\ x\ Rek$
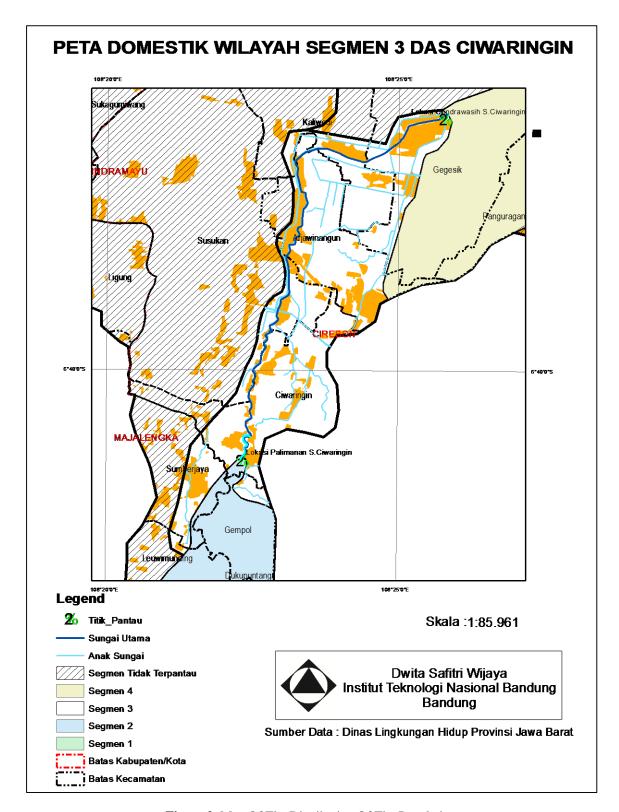$= 1 \times$ 92,459 persons x 0.04 kg/day x 0,8125 = 3,004.9 kg/day

Figure 2. Map Of The Distribution Of The Population

Table 8. Projection of Potential Pollutant Load

No	Parameters	Projection of Potential Pollutant Load (kg/day)				
		2017	2018	2019	2020	2021
1.	BOD	3,004.9	3,111.4	3.236.1	3,380.4	3,544.6
2.	COD	4,131.7	4,278.2	4.449.7	4,648.1	4,860.6
3.	TSS	2,854.7	2,955.8	3.074.3	3,211.4	3,367.4
4.	Total-N	146.5	151.7	157.7	164.8	172.8
5.	Total-P	15.8	16.4	16.9	17.8	18.6
	Population (Person)	92,459	95,736	99,573	103,999	109,046

Note : Calculation Results, 2017

Based on Table 8, it reveals that the pollution load increases in line with population growth. If there is no effort to control the pollutant load coming into the river, then the pollution load capacity of the river will be exceeded.

3.6 The recapitulation of maximum pollutant load, actual pollutant loads, and projection of pollution load potential

3.6.1 Comparison of maximum pollutant load and actual pollution load. Comparison of MPL and APL values is done to determine the pollution load capacity has been exceeded or not. The difference between MPL and APL values is presented in Table 9.

Table 9. Comparasion MPL and APL

No	Parameters	Maximum Pollutant Load (kg/day)			Actual Pollutant Load (kg/day)			The difference of polluted load (kg/day)		
		Jun-16	Agu-16	Okt-16	Jun-16	Agu-16	Okt-16	Jun-16	Agu-16	Okt-16
1	TSS	12.386,0	8.553,0	61.858,06	9.421,84	855,27	16.082,59	2.964,16	7.697,73	45.775,47
2	BOD	475,35	327,96	2.371,89	1.541,73	2.448,65	12.570,54	**-1.066,38**	**-2.120,69**	**-10.198,65**
3	COD	4.429,33	3.056,69	22.106,96	6.380,02	10245,82	30.595,45	**-1.950,69**	**-7.189,13**	**-8.488,49**
4	P-Total	14,47	9,98	72,19	3,110	1,15	27,07	11,36	8,83	45,12

Note : Calculation Results, 2017

The conclusions can be drawn from Table 9 is among the four parameters of the existing pollutant load value, there is a BOD and COD parameter that exceeds the maximum pollutant load during the dry season (june), the transition season (August) and The Rainy Season (October). Under those circumstances, BOD shows the amount of oxygen required by microorganisms to decompose organic substances under aerobic conditions. This parameter shows the level of pollution that has occurred in a certain period. BOD parameter closely related to the water body purification process itself (Effendi, 2003). This occurs if the BOD value is greater than the organic substance content (that must be described) will be greater. Then, it means the need for dissolved oxygen to decompose the BOD will be even greater. Thus, if the value of the oxygen content is not sufficient to carry out the decomposition, then the BOD pollutant value will continue to increase even beyond the load capacity of the BOD pollutant as occurs in the segment 3 of Ciwaringin river.

3.6.2 Comparison of maximum pollutant load and projection pollution load. The comparison of maximum and the projection of pollutant load has been done to predict the amount of pollution load in the future. The results of the comparison can be seen in Table 10.

Table 10. Comparasion MPL and APL

No	Parameters	MaximumPollutant Load (kg/day)			Projection of Pollutant Load (kg/day)				
		Jun-16	Agu-16	Okt-16	2017	2018	2019	2020	2021
1	BOD	475,35	327,96	2.371,89	3,004.9	3,111.4	3,236.1	3,380.4	3,544.6
2	COD	4.429,33	3.056,69	22.106,96	4,131.7	4,278.2	4,449.7	4,648.1	4,860.5
3	TSS	12.386,00	8.553,00	61.858,06	2,854.7	2,955.8	3,074.3	3,211.4	3,367.3
4	P-Total	14,47	9,98	72,19	15,8	16,3	16,9	17,7	18,6
5	N-Total	-	-	-	146,5	157,7	157,7	164,8	172,8

In addition, domestic pollutants are also derived from black water and gray watery from residents settlement activity. Approximately 60% - 80% of the total water used in households are disposed of as liquid waste. The waste directly or indirectly reaches water bodies (groundwater, rivers, lakes) thus affecting the quality of water bodies [8]. The content of gray waste water dominant contribute to add pollutants N and P [7], It causes the total P-value during the dry season and the transition exceeds the pollutant load capacity of the Ciwaringin river.

Based on table 10, the value of pollutant load on the projection result has increased every year. The existence of WWTP is expected to be one of the efforts to control water pollution from the domestic sector. Given the presence of WWTP services centered on settlement residents along the river flow is expected to decrease the level of pollution that occurs in river water. Forthwith, BOD content will be a reduction of removal efficiency about 84.7% and 79.6% of the COD content [9]. However, in this study, the sanitation pattern is calculated only based on the distance of the house to the water body, and have not seen the existing condition of the service IPAL on areas including Ciwaringin segment 3.

4. Conclusion

Obviously, based on the activities, land use, and water quality, segment 3 is a segment that needs to be further investigated. There is the highest activity and land use in that segment. Under those circumstances, the high activity causes the increasing pollutant load potential that will enter the river. It can be seen from the status of water quality in segment 3. The status of water quality in segment 3 is obtained based on the value of water quality pollution index in the year 2016, where the quality of water at that time is in medium polluted condition (IP Value 5.0> 10). Based on data August 2016, Ciwaringin watershed in segment 3 is potentially polluted by 855.27 Kg/day of TSS, 2,448.65 kg/day of BOD, 410,245.82 kg/day of COD, and 1.15 Kg/day of P-Total from domestic sector. Next, the value of polluted load was projected for 5 years (2017 - 2021) and the assumption of the value of polluted expenses for each year tend to increase has been obtained. In brief, the existing BOD and COD pollutant load value and the projection result have exceeded the maximum pollutant load allowed during the dry season and the transition, so that pollution control is required to prevent the river pollutant load from year to year does not tend to increase.

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Domestic Sector

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on **Annual Applied Science and Engineering Conference**
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