INDONESIAN JOURNAL OF MULTIDISCIPLINARY SCIENCE

P-ISSN: 2808-5957
E-ISSN: 2808-6724
ijoms.internationaljournallabs.com

Studies Analysis Management Wastewater Treatment Plant Rinjani South Housing Complex Cirebon City

Mochamad Varel[1], Fikky Sabillah Ases[2], Rifqi Khaerifo [3], Tira Roesdiana [4]
Universitas Swadaya Gunung Jati, Indonesia
Email: tira.roesdiana@gmail.com

ARTICLE INFO

Published:

Keywords: *Wastewater treatment; Domestic wastewater; System efficiency*

This work is licensed under CC BY-SA 4.0

ABSTRACT

Wastewater refers to water generated from human or business activities and is categorized into domestic and non-domestic wastewater. Domestic wastewater originates from residential or business activities and is often discharged directly into water bodies without proper treatment, even if it does not meet established quality standards. Wastewater quality standards define acceptable pollutant levels before discharge into water or soil media. Untreated wastewater can pollute the environment, causing water discoloration, foul odors, fish mortality, and the spread of disease. This study examines the centralized domestic wastewater treatment system at the National Housing City (Perumnas) in Cirebon. The research focuses on analyzing the treatment process, evaluating system efficiency, and comparing results to applicable standards and regulations. Data for this thesis were obtained from the Perumnas *Wastewater Treatment Plant (IPAL)* of Cirebon City, including both primary and secondary data. The main issues studied involve pump capacity and available land for plant expansion. The Perumnas *IPAL* is designed to treat domestic wastewater with a capacity of 6,000 SL. Assuming one SL serves four people and daily water consumption is 180 L/person/day, the estimated wastewater flow is 3,456 m^3/day. The wastewater is processed in three types of ponds: an anaerobic pond (1 unit), a facultative pond (1 unit), and two maturation ponds, with the treated output intended for PDAM water use.

INTRODUCTION

Wastewater is water that is discharged from human activities or business operations. It is divided into two categories: domestic and non-domestic wastewater (Avasarala & Janardhana, 2020; Gao & Li, 2020). Domestic wastewater originates from settlements, restaurants, offices, commercial areas, apartments, and dormitories (Fang & Wang, 2017; Sarı & Koyuncu, 2018). It can be further divided into two types: toilet wastewater from septic tanks and non-toilet wastewater from household activities (Avasarala & Janardhana, 2020; Gao & Li, 2020; Wang & Liang, 2018).

Domestic wastewater is often discharged directly into water bodies without proper treatment, even though it does not meet established wastewater quality standards

(David K.AU3 - Usman D. K., 2019; Nasoetion D. A.AU3 - Saputra M.AU4 - Ergantara R. I., 2017; Said D. R. K., 2017; Said M. R., 2018; Sali A.AU3 - Purwanto Y., 2018)

. These quality standards set allowable limits for pollutant levels or concentrations that wastewater must meet before being discharged into water or soil environments from any business or activity. Wastewater that exceeds these standards can pollute the environment, causing water bodies to turn brown, emit foul odors, lead to fish mortality, and spread disease (Zhou & Liu, 2019; Zhang & Chen, 2020).

Therefore, treatment is required to ensure domestic wastewater can be safely released into the environment and reused efficiently—for example, for watering plants or washing vehicles. A domestic wastewater management system involves a series of activities and infrastructure designed to handle domestic wastewater management within one integrated unit.

Before selecting an appropriate treatment technology for domestic wastewater, it is necessary to analyze the wastewater characteristics. This analysis helps to determine the suitable treatment technology needed to ensure that the wastewater complies with quality standards and can be safely discharged into water bodies. Factors such as land availability, operational and maintenance costs, and investment expenses must also be considered when choosing the treatment technology

(Dear Sir, 2020; Judo N. I., 2017; Sulistia A. C., 2019; Suoth, 2016; Zaneti R.AU3 - Rubio J., 2013)

.

Accordingly, this study examines the centralized domestic wastewater treatment system at *Perumnas* in *Cirebon City*.

Table 1. Baku Quality Water Waste

Parameter	Baku Quality
pH	6- 9
BOD	30 mg/L
COD	100 mg/L
TSS	30 mg/L
Oil And Fat	5 mg/L
Ammonia	10 mg/L
Total coliform	3000/100 mL
Detergent (MBAS)	200 µg /liter

The *IPAL Perumnas* system in *Cirebon City* currently operates with a pump capacity of 2 x 40 liters/second, which remains in good condition. However, significant issues have been identified including leakage in some embankments, particularly in the downstream section of the facultative pond. Additionally, the existing land area is insufficient for the planned expansion of the *IPAL*, especially in the *Perumnas* residential area. These operational and infrastructure challenges threaten the system's effectiveness in managing domestic wastewater.

Previous studies underscore these challenges. Widyarani et al. (2022) demonstrated that grey water volume is 1–4 times higher than black water, and untreated wastewater is 3–6 times more common. Their review highlighted serious environmental risks posed by pollutants such as TSS, BOD, COD, oils, and coliform bacteria if untreated. They also pointed out the insufficiency of on-site septic tank treatment and poor infrastructure quality control. Moersidik et al. (2013) assessed centralized wastewater treatment plants (WWTP) in Indonesian cities, including *Cirebon*. They reported an average pollutant reduction efficiency of about 80%, but system coverage served less than 20% of the population. Untreated grey water was a major pollution source, contributing nearly 60% of the contaminants in receiving water bodies. The study also emphasized community

demand for more accessible communal wastewater treatment facilities (Asmadi S. K. M., 2012; Ayu F. S. P., 2021).

The aim of this research is to evaluate the current pond-based treatment method used by the *IPAL Perumnas* system in *Cirebon City* and analyze the domestic wastewater management strategy of the city through the stages of infrastructure development implementation. The study also seeks to assess the results and effectiveness of wastewater disposal facilities in *Cirebon*. Based on these findings, technical and policy-oriented recommendations will be provided to improve treatment efficiency and enhance water reuse for non-potable purposes. Additionally, the research aims to encourage and strengthen community involvement in domestic wastewater management. Furthermore, this study contributes to academic literature on urban domestic wastewater management in medium-sized Indonesian cities and serves as a practical reference for local governments and stakeholders.

METHOD

This research was conducted through a theoretical review and empirical evaluation of the performance of the wastewater treatment system at the Perumnas Kota Cirebon *IPAL* network facilities. The study focused on reviewing the treatment process and assessing the system's efficiency, comparing the results with applicable standards and regulations.

Data required for this research were obtained from the Cirebon City Perumnas *IPAL* Wastewater Treatment Plant and comprised both primary and secondary sources. Primary data were collected through direct observation and field measurements of physical wastewater parameters, such as temperature and pH, using a thermometer and pH meter in each processing tank. Chemical parameters, including BOD, COD, nitrite, and ammonium levels, were measured across various tanks—namely RSPS tanks, equalization tanks, aeration tanks, sedimentation tanks, and treated effluent tanks. Wastewater samples from each stage were analyzed in laboratories such as PDAM Cirebon City, UPT Laboratory, and Radiology Cirebon City.

Secondary data were obtained from government agencies, private companies, and prior field studies to support the thesis. These included literature, graphs, tables, and land maps. Specifically, secondary data comprised monthly water quality reports (BOD, COD, nitrite, and ammonium) from the UPT wastewater treatment plant, technical specifications of aerators and pumps, tank dimensions (equalization, aeration, sedimentation, and chlorination tanks), treatment plant flow diagrams, population data of Margasari Ward from 2013 to 2018, and projections of wastewater discharge entering the Perumnas treatment plant.

Scheme Study

Channel Water Waste

From inhabitant Which distributed through pipe And in capacity to wastewater treatment plant through tub collector which is then managed through sedimentation methods in several ponds, namely

- Pool Anaerobic

- Pool Optional
- Pool Maturation I and II

After through process the new waste Which Already in process will in flow to river.

Management Installation Domestic Water Waste

Screening

Screening is usually the initial stage in the wastewater treatment process. This process aims to separate pieces of wood, plastic, and so on. The screen consists of straight or curved iron bars and is usually installed at an angle of 60 °. to horizontal. Effectiveness process depends on distance between bar (iron bars). On a fine screen the distance between the bars ranges between 5 mm - 15 mm, on a medium screen between 15 mm - 50 mm, and on a coarse screen more than 50 mm.

Equalization

Equalization actually reduces the various discharge variations during treatment to achieve a constant or nearly constant discharge and can be applied in several different situations, depending on the characteristics of the system. The best location for placing the equalization tank must be determined first for each selected system such as this Margasari WWTP which uses the Extended Aeration system. Because the optimal location will vary with the characteristics of the collection system and the wastewater to be handled, land requirements and availability, and the type of treatment required.

The conclusion is that the equalization tank is generally rectangular and circular in shape. Reactor flow mixture and plug complete is two type reactor Which most often used in the field of wastewater treatment. Hydraulic flow characteristics of mixed flow and plug flow complete can depicted as variation from flow ideal and non-ideal, depends in relation to on current enter and current go out. Time current with term “t” equal to the theoretical hydraulic detention time defined as follows:

t = V/Q

Where

T = time Wait For tub equalization is 4 until 8 hour (hour)

V = Volume reactor (m3)

Q = Debit water waste (m 3 /day)

Equality following This can used For estimate with Meaning dimensioning the Equalization pool

$Tw = D\ .\ T\ i + f\ .\ t\ .\ T\ a$

$f\ 1 + D$

Where :

T = time detention (day)

D = depth pool (m)

T i = temperature influential water waste (0 F)
T a = temperature air average (0 F)
T w = temperature in the pool (0 F)
f = factor number adjustment Because influence wind humidity And use aerator about 0.5
Coefficient elimination BOD And COD can counted use equality following This :
Kw = K 20 θ Tw- 20
Where :
Kw = coefficient elimination BOD orI COD on temperature Tw
K 20 = coefficient reaction on temperature 20 0 C
E = coefficient temperature For season hot is 1,035 Whereas mark BOD or COD effluent after reaction (tub aerobics) can counted with equality to 4
S= S 0(1+ b . t)
a . Kwt
Where
Kw = coefficient elimination BOD or COD on temperature S = concentration of BOD or COD coming out (mg/l) So = Concentration of BOD or COD coming in (mg/l)
A = coefficient constant with mark 0.5
B = coefficient constant with mark 0.2
Need oxygen Which required For to unravel material organic can calculated by equation 5
Rr = a'. Sr + b' Xv1 Where :

Rr = need oxygen (kg oxygen/day)
a' = 1 – a (coefficient need oxygen For oxidation material organic until results end)
b' = level auto oxidation mud
= 0.28 For pressure air 1 ATM
Xv = concentration biological solid (VSS) (mg/l) = a. Sr/(1+bt)
Sr = Mark influential COD highest
T = time detention (day)
Influence temperature to concentration fed up oxygen dissolved on pressure 1 ATM

Table 2. Influence Temperature

Water Temperature (^{0}C)	Cw (mg/L)	Water Temperature (^{0}C)	Cw (mg/L)
0	14.62	16	
2	13.84	18	9.54
4	13.13	20	9.17
6	12.48	22	8.83
8	11.87	24	8.53
10	11.33	26	8.22
12	10.83	28	7.92

14	10.37	30	7.63

Aeration

The removal of pollutants contained in wastewater is the aim of wastewater treatment. water waste. Additions oxygen is Wrong One business from taking the pollutant, so that the concentration of the pollutant will be reduced or can even be eliminated completely. Hydraulic residence time (HRT) is the average time required for the influent in the aeration tank to undergo the activated sludge process. The HRT value is inversely proportional to the dilution rate. Biological treatment in the aeration tank ranges from 5 to 14 hours. Calculation for HRT value can be done using the following equation:

$$HRT = \frac{V}{Q}$$

Where :

HRT = Hydraulic Retention Time (O'clock)
V = volume reactor or tub aeration (m 3)
Q = Debit water waste that enter tub aeration (m 3 /hour)

The more tall debit Influenza so the more fast flow influential going to outlet Which means the lower the residence time or hydraulic retention time .
In planning an aeration tank, the aerator capacity also determines the ideal dimensions of the tank used. The relationship between the aerator capacity and the ideal dimensions of the tank can be seen in the table. 3 following:

Table 3. Influence Aeration

High Capacity		*Wide Tank*		*Tank*	
Mobile phone	**Kw**	**Ft**	**M**	**Ft**	**M**
10	7.5	10- 12	3- 3.6	30- 40	9- 12
20	15	12- 14	3.6- 4.2	35- 50	10.5- 15
30	22.5	13- 15	3.9- 4.5	40-60	12-18
40	30	12-17	3.6- 5.1	45- 65	13.5- 20
50	37.5	15-18	4.5- 5.5	45- 75	13.5- 23
75	56	15- 20	4.5- 6	50- 85	15- 26
100	75	15- 20	4.5- 6	60-90	18- 27

RESULT AND DISCUSSION

The Perumnas IPAL is designed to treat domestic wastewater at 6,000 SL. Assuming 1 SL serves 4 people, and the drinking water requirement is 180 l/person/day, the incoming wastewater discharge is approximately 3456 m3 / day (pump capacity per day). This wastewater is then

processed on 3 pool processing Which consists of on pool anaerob (1 units), pool optional (1 units) And pool maturation (2 units). Evaluation on fourth pool the explained as follows.

A. Pool Anaerobic

1. Volume Pyramid Tied up = 1/3 x (L at + (L at x L al)^0.5 + L al) x H
   = 2784.7 m 3
2. Time detention (td) = V/Q
   = 2784.7 m 3 /3456 m3 / day = 0.81 day (< 1 day)

Time detention pool No in accordance criteria design Which set. This can resulting in the process degradation Which expected happen No ongoing. For overcome matter This Upgrading can be done by increasing the depth, adding a divider, or reducing the flow rate into the pond. Based on the current dimensions, the maximum flow rate that can be processed is as follows:

Q max total (td = 1 day) = 2784.7 m3 / day

B. Pool Optional

- Volume Pyramid Tied up = 1/3 x (L at + (L at x L al)^0.5 + L al) x H
  = 5,295.7 m 3
- Time detention (td) = V/Q
  = 5,295.7 m 3 /3456 m3 / day = 1.53 day (< 11 day)

Time detention pool No in accordance criteria design Which set. This can resulting in the process degradation Which expected happen No ongoing. For overcome matter This Uprating can be done (increasing depth or adding bulkheads) or reducing the discharge. entered into pool. If refers to dimensions that there is now then The maximum debit that can be processed is as follows:

Q max total (td = 11 day) = 481.42 m3 / day

C. Pool Maturation I

- Volume Pyramid Tied up = 1/3 x (L at + (L at x L al)^0.5 + L al) x H
  = 5989.9 m 3
- Time detention (td) = V/Q
  = 5989.9 m 3 /3456 m3 / day) = 1.73 day

D. Pool Maturation II

- Volume Pyramid Tied up = 1/3 x (L at + (L at x L al)^0.5 + L al) x H
  = 8506.7 m 3
- Time detention (td) = V/Q
  = 8506.7 m 3 /3456 m3 / day = 2.46 day

The total detention time of the maturation pond was 4.19 days. This value does not meet the established design criteria. This may result in the expected degradation process not taking place. For overcome matter This can done uprating (add depth and aerator or add partition) or lower debit Which enter to pool. If Referring to the current dimensions, the maximum discharge that can be processed is as follows:

• Q max total (td = 5 day) = 2899.32 m3 / day

Based on the evaluation results above, it can be concluded that uprating in the processing ponds wastewater treatment plant Java Sparrow very required. Pool optional wastewater treatment plant Mount Rinjani is a pool that become priority main uprating . Matter This happen remember results evaluation on Facultative ponds are quite concerning. Uprating steps that need to be taken include adding depth or partitions. Furthermore, anaerobic ponds can be uprated in the same way. Maturation ponds are uprated by adding partitions or aerators.

Table 4. Basics Projection Need Water Waste

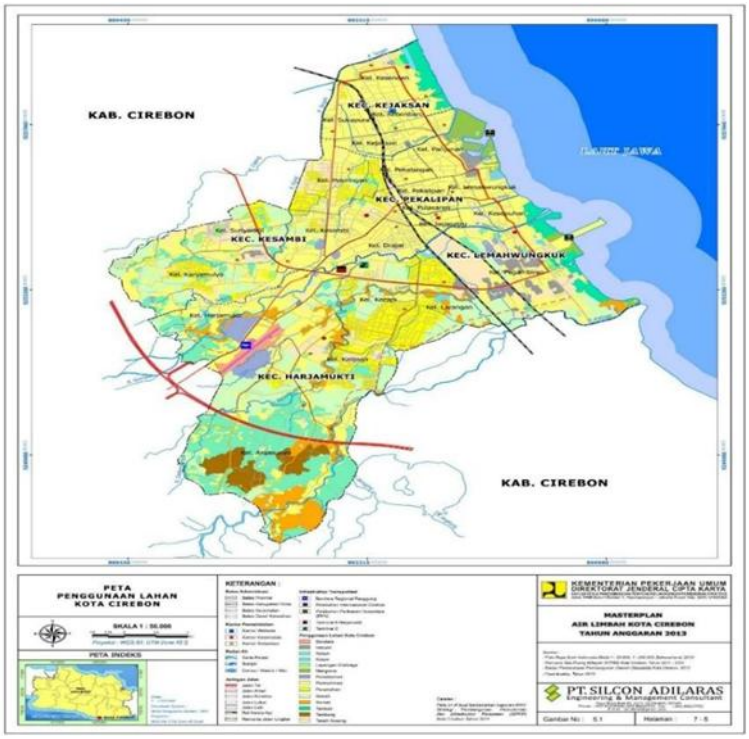
No	Stages Population Planning and Criteria	House hold (M/O/H)	Urban	House Urban Ladder (RK) Netto	Households (RK) with Loss	Population Assumption k (%)	AP, Air per Worker (L/O/H)	Need Air Industry = %PxAPxRL (L/O/H)	ıter eds lustry Loss
		(1)=R	*(2)=35% x R*	*(3)=(1)+(2)*	*(4)=(RK)/(1-KP)/(1- KT)*	*(5)=P*	*(6)=AP*	*(7)=RI*	*(8)=(RI)/(1-KP)/(1-KT)*
I	**Year 2013, with resident:**								
1	20,000 - 100,000 soul	100	35	135	191	6%	500	21	30
2	100,000 - 500,000 soul	120	42	162	230	6%	500	21	30
3	>1,000,000 soul	150	53	203	287	6%	500	21	30
II	**Year 2018, with Resident**								
1	20,000 - 100,000 soul	104	36	141	199	6.31%	526	23	33
2	100,000 - 500,000 soul	125	44	169	239	6.31%	526	23	33
3	>1,000,000 soul	156	55	211	299	6.31%	526	23	33
III	**Year 2023, with Resident**								
1	20,000 - 100,000 soul	108	38	146	207	6.97%	580	28	40
2	100,000 - 500,000 soul	130	46	176	249	6.97%	580	28	40
3	>1,000,000 soul	163	57	219	311	6.97%	580	28	40
IV	**Year 2033, with Resident**								
1	20,000 - 100,000	113	39	152	215	7.62%	635	34	48

	soul								
2	100,000 - 500,000 soul	135	47	182	259	7.62%	635	34	48
3	>1,000,000 soul	169	59	228	323	7.62%	635	34	48

Table 5. Year 2033 with resident 20,000 – 100,000 soul Capacity Subdistrict The Great Wall reach wastewater treatment plant 452 m3

No.	Subdistrict	Capacity Water Waste (L)			
		2013	2018	2023	2033
1	The Great Wall	245.08	288.67	345.33	452.90

Location Study



Fgure 1. Map Network City Cirebon

Specification And Condition wastewater treatment plant National Housing

The location of the Perumnas IPAL is in Harjamukti Village, Harjamukti District, City Cirebon, West Java Province. This wastewater treatment plant (WWTP) is capable of serving and accommodating household waste for the Margasari sub-district. The wastewater treatment plant's capacity is 1.5 m. Wastewater This is a maximum of 2 x 75 liters/second or around 648m3/day.

Table 6. Condition wastewater treatment plant National Housing

No	wastewater treatment plant	System	Waste Water Pump	Supporting Buildings g	Treatment Pond	Land Availability	Alternative Repair
1.	North Housing Complex	Operate	Functionin g	Poorly maintained	Maturation pool is overgrown water hyacinth goiter	There isn't any	Technology Development
2.	South Housing Estate	Operate	Functionin g	Poorly maintained	Good	No There is	Technology Development

Management Water Waste wastewater treatment plant National Housing

The Perumnas wastewater treatment plant (IPAL) is designed to treat 6,000 SL of domestic wastewater. Assuming 1 SL serves 4 people and the drinking water requirement is 180 l/person/day, the incoming wastewater discharge is approximately 3,456 m3 / day. This wastewater is then processed in 3 treatment ponds consisting of an anaerobic pond (1 unit), a facultative pond (1 unit), and a maturation pond (2 units). The evaluation of the four ponds is explained as follows:

E. Pool Anaerobic

• Volume Pyramid Tied up = 1/3 x (L at + (L at x L al)^0.5 + L al) x H
= 2784.7 m 3

• Time detention (td) = V/Q
= 2784.7 m 3 /3456 m3 / day = 0.81 day (< 1 day)

Time detention pool No in accordance criteria design Which set. This can resulting in the process degradation Which expected happen No ongoing. For overcome matter This Upgrading can be done by increasing the depth, adding a divider, or reducing the flow rate into the pond. Based on the current dimensions, the maximum flow rate that can be processed is as follows:

• Q max total (td = 1 day) = 2784.7 m3 / day

F. Pool Optional

• Volume Pyramid Tied up = 1/3 x (L at + (L at x L al)^0.5 + L al) x H
= 5,295.7 m 3

• Time detention (td) = V/Q
= 5,295.7 m 3 /3456 m3 / day = 1.53 day (< 11 day)

Time detention pool No in accordance criteria design Which set. This can resulting in the process degradation Which expected happen No ongoing. For overcome matter This uprating can be done (increasing depth or adding bulkheads) or reducing the discharge. entered into pool. If refers to dimensions that there is now then The maximum debit that can be processed is as follows:

• Q max total (td = 11 day) = 481.42 m3 / day

G. Pool Maturation I

• Volume Pyramid Tied up = 1/3 x (L at + (L at x L al)^0.5 + L al) x H
= 5989.9 m 3

• Time detention (td) = V/Q
= 5989.9 m 3 /3456 m3 / day) = 1.73 day

H. Pool Maturation II

• Volume Pyramid Tied up = 1/3 x (L at + (L at x L al)^0.5 + L al) x H
= 8506.7 m 3

• Time detention (td) = V/Q
= 8506.7 m 3 /3456 m3 / day = 2.46 day

The total detention time of the maturation pond was 4.19 days. This value does not meet the established design criteria. This may result in the expected degradation process not taking place. For overcome matter This can done uprating (add depth and aerator or add partition) or lower debit Which enter to pool. If Referring to the current dimensions, the maximum discharge that can be processed is as follows:

- Q max total (td = 5 day) = 2899.32 m3 / day

Based on the evaluation results above, it can be concluded that uprating in the processing ponds wastewater treatment plant Java Sparrow very required. Optional pond of wastewater treatment plant Rinjani is a pool that become priority main uprating . Matter This happen remember results evaluation on The facultative pool is quite worrying. The uprating step that needs to be taken is to increase the depth or bulkheads. Furthermore, anaerobic ponds can be upgraded in the same way. Maturation ponds can be upgraded by adding bulkheads or aerators.

Table 7. Recapitulation Evaluation wastewater treatment plant in National Housing City Cirebon

1	**National Housing North Java Sparrow**					
	Debit (m3/day)	3.456	-	3.456	3.456	3.456
	Depth (m)	2	-	1.75	1.50	1.50
	Volume (m3)	2,784.69	-	5,295.65	5,989.85	8,506.74
	Time Stay (day)	0.81	-	1.53	1.73	2.46

	Maximum Debit (m3/day)	**2,784.69**	**-**	**481.42**	**2,899.32**	
2	**National Housing South Mount Rinjani**					
	Debit (m3/day)	3.456	-	3.456	3.456	3.456
	Depth (m)	2	-	1.75	1.50	1.50
	Volume (m3)	6,401.25	-	17,311.7	9,666.53	9,440.52
	Time Stay (day)	1.85	-	5.01	2.80	2.73
	Maximum Debit (m3/day)	**6,401.25**	**-**	**1,573.79**	**3,821.41**	

Table 8. Development system On- Site

NO	WARD	AMOUNT KK					NON-SYSTEM		DEVELOPMENT SYSTEM ON-SITE															
							2013		2018			2023				2028				2033				
		2013	2018	2023	2028	2033	TOTAL H	%	KK	%	NS	%	KK	%	NS	%	KK	%	NS	%	KK	%	NS	%
	1Argasunya	4,523	4.724	4,933	5.151	5,379	3.777	83.5	969	20.5	2,809	59.5	884	17.9	1.925	39.0	746	14.5	1,179	22.9	559	10.4	620	11.5
	2Kalijaga	7,763	8.107	8,466	8,841	9.232	1,996	25.7	512	6.3	1,484	18.3	0	0.0	1,484	17.5	575	6.5	909	10.3	431	4.7	478	5.2
	3The Great Wall	4,790	5.002	5.223	5,454	5.695	335	7.0	0	0.0	335	6.7	0	0.0	335	6.4	0	0.0	335	6.1	0	0.0	335	5.9
	4Lute	5,671	5.922	6.184	6,457	6,743	818	14.4	0	0.0	818	13.8	0	0.0	818	13.2	0	0.0	818	12.7	388	5.8	430	6.4
	5Prohibition	4.109	3,754	3,921	4,094	4.275	127	3.1	0	0.0	127	3.4	0	0.0	127	3.2	0	0.0	127	3.1	0	0.0	127	3.0
KEC	**HARJAMUKTI**	**26,342**	**27,508**	**28,726**	**29,997**	**31,325**	**7,053**	**26.8**	**1,480**	**5.4**	**5,572**	**20.3**	**884**	**3.1**	**4.689**	**16.3**	**1,322**	**4.4**	**3.367**	**11.2**	**1,378**	**4.4**	**1,989**	**6.3**
	6The Gambiran	5.358	5,595	5,843	6.102	6,372	1,874	35.0	481	8.6	1,394	24.9	438	7.5	955	16.3	370	6.1	585	9.6	0	0.0	585	9.2
	7The Elderly	3.676	3,839	4.009	4.186	4.371	862	23.4	0	0.0	862	22.5	271	6.8	591	14.7	0	0.0	591	14.1	280	6.4	311	7.1
	8Lemahwungkuk	1.975	2,063	2.154	2.249	2,349	349	17.7	0	0.0	349	16.9	0	0.0	349	16.2	135	6.0	214	9.5	0	0.0	214	9.1
	9Panjunan	2,607	2,722	2,843	2,968	3.100	427	16.4	0	0.0	427	15.7	0	0.0	427	15.0	165	5.6	261	8.8	0	0.0	261	8.4
KEC	**LEMAHWUNGKUK**	**13,616**	**14,219**	**14,848**	**15,505**	**16,192**	**3,512**	**25.8**	**481**	**3.4**	**3,032**	**21.3**	**710**	**4.8**	**2.322**	**15.6**	**671**	**4.3**	**1,651**	**10.6**	**280**	**1.7**	**1,371**	**8.5**
	10 Multiplication	1,816	1,659	1,733	1,810	1,890	222	12.2	0	0.0	222	13.4	0	0.0	222	12.8	0	0.0	222	12.3	105	5.6	117	6.2
	11 Pulasaren	1,881	1,964	2,051	2,141	2,236	61	3.2	0	0.0	61	3.1	0	0.0	61	3.0	0	0.0	61	2.8	0	0.0	61	2.7
	12 The Universe	2,526	2,638	2,754	2,876	3.004	81	3.2	0	0.0	81	3.1	0	0.0	81	2.9	0	0.0	81	2.8	0	0.0	81	2.7
	13 Pekalangan	1,463	1,528	1,595	1,666	1,740	118	8.1	0	0.0	118	7.7	0	0.0	118	7.4	0	0.0	118	7.1	0	0.0	118	6.8
KEC	**MULTIPLICATION**	**7,458**	**7,788**	**8,133**	**8,493**	**8,869**	**481**	**6.5**	**0**	**0.0**	**481**	**6.2**	**0**	**0.0**	**481**	**5.9**	**0**	**0.0**	**481**	**5.7**	**105**	**1.2**	**376**	**4.2**
	14 The Great Work	6,371	6,653	6,948	7.255	7,576	1,444	22.7	0	0.0	1,444	21.7	454	6.5	990	14.2	0	0.0	990	13.6	469	6.2	520	6.9
	15 Sunrise	2,745	2,866	2.993	3.125	3.264	256	9.3	0	0.0	256	8.9	0	0.0	256	8.5	0	0.0	256	8.2	0	0.0	256	7.8
	16 Degree	3.835	4.005	4.182	4.367	4,561	197	5.1	0	0.0	197	4.9	0	0.0	197	4.7	0	0.0	197	4.5	0	0.0	197	4.3
	17 Kesambi	2.354	2,458	2,567	2,680	2,799	245	10.4	0	0.0	245	10.0	0	0.0	245	9.5	0	0.0	245	9.1	0	0.0	245	8.7
	18 The Mind	2,793	2,91	3,04	3,18	3.32	69	2.5	0	0.0	69	2.4	0	0.0	69	2.3	0	0.0	69	2.2	0	0.0	69	2.

NO	WARD	AMOUNT KK					NON-SYSTEM		DEVELOPMENT SYSTEM ON-SITE															
							2013		2018			2023			2028			2033						
		2013	2018	2023	2028	2033	TOTAL H	%	KK	%	NS	%	KK	% NS	%	KK	% NS	%	KK	%	NS	%
			7	6	1	2																		1
KEC	**KESAMBI**	**18,098**	**18,899**	**19,735**	**20,609**	**21,521**	**2.211**	**12.2**	**0**	**0.0**	**2.211**	**11.7**	**454**	**2.3**	**1,756**	**8.9**	**0**	**0.0**	**1,756**	**8.5**	**469**	**2.2**	**1,287**	**6.0**
19	Prosecutor's Office	2.280	2.381	2.486	2,596	2,711	376	16.5	0	0.0	376	15.8	0	0.0	376	15.1	146	5.6	230	8.9	0	0.0	230	8.5
20	Sukapura	3,504	3,659	3,821	3,990	4.167	351	10.0	0	0.0	351	9.6	0	0.0	351	9.2	0	0.0	351	8.8	0	0.0	351	8.4
21	Kebonbaru	2,087	2.180	2.276	2.377	2.482	220	10.6	0	0.0	220	10.1	0	0.0	220	9.7	0	0.0	220	9.3	0	0.0	220	8.9
22	Sensation	3.035	3.169	3.310	3.456	3.609	142	4.7	0	0.0	142	4.5	0	0.0	142	4.3	0	0.0	142	4.1	0	0.0	142	3.9
KEC	**PROSECUTOR'S OFFICE**	**10,906**	**11,389**	**11,893**	**12,420**	**12,969**	**1,089**	**10.0**	**0**	**0.0**	**1,089**	**9.6**	**0**	**0.0**	**1,089**	**9.2**	**146**	**1.2**	**944**	**7.6**	**0**	**0.0**	**944**	**7.3**
AMOUNT	**TOTAL**	**76,421**	**79,803**	**83,336**	**87,025**	**90,877**	**13,606**	**17.8**	**1,961**	**2.5**	**11,645**	**14.6**	**2,048**	**2.5**	**9,597**	**11.5**	**2.138**	**2.5**	**7,459**	**8.6**	**2.233**	**2.5**	**5,226**	**5.8**

Development Installation Water Waste National Housing City Cirebon

Plan development of wastewater treatment plant based on on study repeat on capacity and dimensions The four existing wastewater treatment plants (WWTPs) accommodate the incoming wastewater discharge and volumetric load. Testing was conducted to align existing conditions with the planned design criteria. A summary of the existing conditions of the four WWTPs in Cirebon City is presented in the following table:

Table 9. Recapitulation Condition Existing wastewater treatment plant in City Cirebon

No	Type Data	wastewater treatment plant Java Sparrow	wastewater treatment plant Mount Rinjani
1	Service Area (Sub-district)	The Great Wall (Ex. Prohibition And Kel Kecapi)	
2	Population (Year 2033)	4.314	15,474
3	SL Amount	863	3.095
4	Capacity SL	6,000	6,000
5	SR Connect	1,419	4,738
6	BOD in (mg/L)	180	200
7	BOD out (mg/L)	170	30
9	Burden BOD IPAL max (kg/day)	951	951
10	Burden BOD Service Area (kg/day)	137	491

From the table above, it can be concluded that the expansion of the service area at the Gelatik IPAL and Rinjani IPAL is still possible. The sub-districts that are currently served by wastewater have not been able to maximize the processing capacity of the two IPALs. From the population projections that have been carried out, it is known that the Gelatik IPAL and Rinjani IPAL can process 50% of the population of Harjamukti District.

On the other hand, with the conditions that There is moment This wastewater treatment plant Sensation And wastewater treatment plant Ade Irma only capable accommodate 20% potential waste connections in the service area plan.

Table 10. wastewater treatment

1	**National Housing North Java Sparrow**	**Anaerobic 1**	**Anaerobic 2**	**Optional**	**Maturation 1**	**Maturation 2**
	Debit (m3/day)	3.456	-	3.456	3.456	3.456
	Depth (m)	2	-	1.75	1.50	1.50
	Volume (m3)	2,784.69	-	5,295.65	5,989.85	8,506.74
	Time Stay (day)	0.81	-	1.53	1.73	2.46
	Maximum Debit (m3/day)	**2,784.69**	**-**	**481.42**	**2,899.32**	
2	**National Housing South Mount Rinjani**					
	Debit (m3/day)	3.456	-	3.456	3.456	3.456
	Depth (m)	2	-	1.75	1.50	1.50
	Volume (m3)	6,401.25	-	17,311.7	9,666.53	9,440.52
	Time Stay (day)	1.85	-	5.01	2.80	2.73
	Maximum Debit (m3/day)	**6,401.25**	**-**	**1,573.79**	**3,821.41**	

Table 11. Development system On- Site

NO	WARD	AMOUNT KK					NON-SYSTEM		DEVELOPMENT SYSTEM ON-SITE															
							2013		2018				2023				2028				2033			
		2013	2018	2023	2028	2033	TOTAL	%	KK	%	NS	%	KK	%	NS	%	KK	%	NS	%	KK	%	NS	%
1	Argasunya	4,523	4.724	4,933	5.151	5,379	3.777	83.5	969	20.5	2,809	59.5	884	17.9	1.925	39.0	746	14.5	1,179	22.9	559	10.4	620	11.5
2	Kalijaga	7,763	8.107	8,466	8,841	9.232	1,996	25.7	512	6.3	1,484	18.3	0	0.0	1,484	17.5	575	6.5	909	10.3	431	4.7	478	5.2
3	The Great Wall	4,790	5.002	5.223	5,454	5.695	335	7.0	0	0.0	335	6.7	0	0.0	335	6.4	0	0.0	335	6.1	0	0.0	335	5.9
4	Lute	5,671	5.922	6.184	6,457	6,743	818	14.4	0	0.0	818	13.8	0	0.0	818	13.2	0	0.0	818	12.7	388	5.8	430	6.4
5	Prohibition	4.109	3,754	3,921	4,094	4.275	127	3.1	0	0.0	127	3.4	0	0.0	127	3.2	0	0.0	127	3.1	0	0.0	127	3.0
KEC	**HARJAMUKTI**	**26,342**	**27,508**	**28,726**	**29,997**	**31,325**	**7,053**	**26.8**	**1,480**	**5.4**	**5,572**	**20.3**	**884**	**3.1**	**4.689**	**16.3**	**1,322**	**4.4**	**3.367**	**11.2**	**1,378**	**4.4**	**1,989**	**6.3**
6	The Gambiran	5.358	5,595	5,843	6.102	6,372	1,874	35.0	481	8.6	1,394	24.9	438	7.5	955	16.3	370	6.1	585	9.6	0	0.0	585	9.2
7	The Elderly	3.676	3,839	4.009	4.186	4.371	862	23.4	0	0.0	862	22.5	271	6.8	591	14.7	0	0.0	591	14.1	280	6.4	311	7.1
8	Lemahwungkuk	1.975	2,063	2.154	2.249	2,349	349	17.7	0	0.0	349	16.9	0	0.0	349	16.2	135	6.0	214	9.5	0	0.0	214	9.1
9	Panjunan	2,607	2,722	2,843	2,968	3.100	427	16.4	0	0.0	427	15.7	0	0.0	427	15.0	165	5.6	261	8.8	0	0.0	261	8.4
KEC	**LEMAHWUNGKUK**	**13,616**	**14,219**	**14,848**	**15,505**	**16,192**	**3,512**	**25.8**	**481**	**3.4**	**3,032**	**21.3**	**710**	**4.8**	**2.322**	**15.6**	**671**	**4.3**	**1,651**	**10.6**	**280**	**1.7**	**1,371**	**8.5**
10	Multiplication	1,816	1,659	1,733	1,810	1,890	222	12.2	0	0.0	222	13.4	0	0.0	222	12.8	0	0.0	222	12.3	105	5.6	117	6.2
11	Pulasaren	1,881	1,964	2,051	2,141	2,236	61	3.2	0	0.0	61	3.1	0	0.0	61	3.0	0	0.0	61	2.8	0	0.0	61	2.7
12	The Universe	2,526	2,638	2,754	2,876	3.004	81	3.2	0	0.0	81	3.1	0	0.0	81	2.9	0	0.0	81	2.8	0	0.0	81	2.7

NO	WARD	AMOUNT KK					NON-SYSTEM		DEVELOPMENT SYSTEM ON-SITE															
							2013		2018				2023				2028				2033			
		2013	2018	2023	2028	2033	TOTAL H	%	KK	%	NS	%	KK	%	NS	%	KK	%	NS	%	KK	%	NS	%
13	Pekalangan	1,463	1,528	1,595	1,666	1,740	118	8.1	0	0.0	118	7.7	0	0.0	118	7.4	0	0.0	118	7.1	0	0.0	118	6.8
KEC MULTIPLICATION		**7,458**	**7,788**	**8,133**	**8,493**	**8,869**	**481**	**6.5**	**0**	**0.0**	**481**	**6.2**	**0**	**0.0**	**481**	**5.9**	**0**	**0.0**	**481**	**5.7**	**105**	**1.2**	**376**	**4.2**
14	The Great Work	6,371	6,653	6,948	7.255	7,576	1,444	22.7	0	0.0	1,444	21.7	454	6.5	990	14.2	0	0.0	990	13.6	469	6.2	520	6.9
15	Sunrise	2,745	2,866	2.993	3.125	3.264	256	9.3	0	0.0	256	8.9	0	0.0	256	8.5	0	0.0	256	8.2	0	0.0	256	7.8
16	Degree	3.835	4.005	4.182	4.367	4,561	197	5.1	0	0.0	197	4.9	0	0.0	197	4.7	0	0.0	197	4.5	0	0.0	197	4.3
17	Kesambi	2.354	2,458	2,567	2,680	2,799	245	10.4	0	0.0	245	10.0	0	0.0	245	9.5	0	0.0	245	9.1	0	0.0	245	8.7
18	The Mind	2,793	2,917	3,046	3,181	3.322	69	2.5	0	0.0	69	2.4	0	0.0	69	2.3	0	0.0	69	2.2	0	0.0	69	2.1
KEC KESAMBI		**18,098**	**18,899**	**19,735**	**20,609**	**21,521**	**2.211**	**12.2**	**0**	**0.0**	**2.211**	**11.7**	**454**	**2.3**	**1,756**	**8.9**	**0**	**0.0**	**1,756**	**8.5**	**469**	**2.2**	**1,287**	**6.0**
19	Prosecutor's Office	2.280	2.381	2.486	2,596	2,711	376	16.5	0	0.0	376	15.8	0	0.0	376	15.1	146	5.6	230	8.9	0	0.0	230	8.5
20	Sukapura	3,504	3,659	3,821	3,990	4.167	351	10.0	0	0.0	351	9.6	0	0.0	351	9.2	0	0.0	351	8.8	0	0.0	351	8.4
21	Kebonbaru	2,087	2.180	2.276	2.377	2.482	220	10.6	0	0.0	220	10.1	0	0.0	220	9.7	0	0.0	220	9.3	0	0.0	220	8.9
22	Sensation	3.035	3.169	3.310	3.456	3.609	142	4.7	0	0.0	142	4.5	0	0.0	142	4.3	0	0.0	142	4.1	0	0.0	142	3.9
KEC PROSECUTOR'S OFFICE		**10,906**	**11,389**	**11,893**	**12,420**	**12,969**	**1,089**	**10.0**	**0**	**0.0**	**1,089**	**9.6**	**0**	**0.0**	**1,089**	**9.2**	**146**	**1.2**	**944**	**7.6**	**0**	**0.0**	**944**	**7.3**
AMOUNT TOTAL		**76,421**	**79,803**	**83,336**	**87,025**	**90,887**	**13,606**	**17.8**	**1,961**	**2.5**	**11,645**	**14.6**	**2,048**	**2.5**	**9,597**	**11.5**	**2.138**	**2.5**	**7,459**	**8.6**	**2.233**	**2.5**	**5,226**	**5.8**

Development Installation Water Waste National Housing City Cirebon

Plan development of wastewater treatment plant based on on study repeat on capacity and dimensions The four existing wastewater treatment plants (WWTPs) accommodate the incoming wastewater discharge and volumetric load. Testing was conducted to align existing conditions with the planned design criteria. A summary of the existing conditions of the four WWTPs in Cirebon City is presented in the following table:

Table 13. Recapitulation Condition Existing wastewater treatment plant in City Cirebon

No	Type Data	wastewater treatment plant Java Sparrow	wastewater treatment plant Mount Rinjani
1	Service Area (Sub-district)	The Great Wall (Ex. Prohibition And Kel Kecapi)	
2	Population (Year 2033)	4.314	15,474
3	SL Amount	863	3.095
4	Capacity SL	6,000	6,000
5	SR Connect	1,419	4,738
6	BOD in (mg/L)	180	200

7	BOD out (mg/L)	170	30
9	Burden BOD IPAL max (kg/day)	951	951
10	Burden BOD Service Area (kg/day)	137	491

From the table above, it can be concluded that the expansion of the service area at the Gelatik IPAL and Rinjani IPAL is still possible. The sub-districts that are currently served by wastewater have not been able to maximize the processing capacity of the two IPALs. From the population projections that have been carried out, it is known that the Gelatik IPAL and Rinjani IPAL can process 50% of the population of Harjamukti District. On the other hand, with the conditions that There is moment This wastewater treatment plant Sensation And wastewater treatment plant Ade Irma only capable accommodate 20% potential waste connections in the service area plan.

Table 14. wastewater treatment

1	**National Housing North Java Sparrow**	**Anaerobic 1**	**Anaerobic 2**	**Optional**	**Maturation 1**	**Maturation 2**
	Debit (m3/day)	3.456	-	3.456	3.456	3.456
	Depth (m)	2	-	1.75	1.50	1.50
	Volume (m3)	2,784.69	-	5,295.65	5,989.85	8,506.74
	Time Stay (day)	0.81	-	1.53	1.73	2.46
	Maximum Debit (m3/day)	**2,784.69**	**-**	**481.42**	**2,899.32**	
2	**National Housing South Mount Rinjani**					
	Debit (m3/day)	3.456	-	3.456	3.456	3.456
	Depth (m)	2	-	1.75	1.50	1.50
	Volume (m3)	6,401.25	-	17,311.7	9,666.53	9,440.52
	Time Stay (day)	1.85	-	5.01	2.80	2.73
	Maximum Debit (m3/day)	**6,401.25**	**-**	**1,573.79**	**3,821.41**	

Table 15. Target Service Management Water Waste City Cirebon

No	Management System	Condition Existing (2013)		Target Period Achievements 2014-2033	
		SL	**%**	**SL**	**%**
1	**System Off- Site**	8.136	11%	13.136	16%
2	**System On-Site**	54,680	72%	55,024	69%
	Target Service			68,160	85%
3	**Non- System**	13,605	18%	11,644	15%
	Amount	76,421	100%	79,803	100%

CONCLUSION

The Perumnas IPAL is designed to treat domestic wastewater with a capacity of 6,000 standard liters (SL), where each SL serves approximately four people consuming 180 liters of water per person per day, resulting in a maximum wastewater discharge of about 3,456 m³ per day. The treatment process involves three types of ponds: one anaerobic pond, one facultative pond, and two maturation ponds, with the treated effluent discharged into the river. From 2013 to 2033, the National Housing City Cirebon wastewater treatment plant is expected to sufficiently

accommodate the wastewater load within its design capacity. For future research, it is recommended to investigate the long-term environmental impact of discharging treated wastewater into the river, explore advanced treatment options to improve effluent quality, and assess the feasibility of expanding capacity or integrating water reuse systems in anticipation of population growth and increased water demand.

REFERENCES

Asmadi S. K. M., S. A.-S. (2012). *The Basics Technology Processing Water Waste*. Goshen Publishing.

Ayu F. S. P., W. F. G. A.-P. (2021). Planning of Domestic Wastewater Treatment Plant (WWTP) Using Constructed Wetland Method in Bumi Ciruas Permai 1 Housing, Kabupaten Attack. *Journal Environment And Resource Natural (JOURNALIST)*, *4*(2), 130–141.

Avasarala, S. R., & Janardhana, B. (2020). Optimization of domestic wastewater treatment using bio-filtration techniques: A sustainable approach. Environmental Technology & Innovation, 19, 100884. https://doi.org/10.1016/j.eti.2020.100884

David K. AU3 - Usman D. K., V. V. A.-P. (2019). Implementation of water conservation concept in Apartment Building X. *Jurnal Serambi Engineering*, *4*(2).

Dear Sir, B. A. (2020). *Use Grease Trap Model Zig Zag To Decrease Thickness of Oil and Fat Layers*.

Gao, W., & Li, Z. (2020). Sustainable domestic wastewater treatment: A review of innovative technologies. Science of the Total Environment, 738, 139691. https://doi.org/10.1016/j.scitotenv.2020.139691

Fang, L., & Wang, L. (2017). Comparison of various domestic wastewater treatment technologies: A comprehensive review. Desalination, 423, 42-58. https://doi.org/10.1016/j.desal.2017.07.030

Judo N. I., S. A.-S. (2017). Policy And Strategy Management Water Waste Domestic in Indonesia. *Journal of Environmental Engineering*, *10*(2).

Nasoetion D. A. AU3 - Saputra M. AU4 - Ergantara R. I., P. A.-W. (2017). Evaluation and Redesign of the Wastewater Treatment Plant (WWTP) of Pertamina Bintang Amin Hospital, Bandar Lampung. *Journal of Engineering, Technology, and Science*, *1*(2).

Said D. R. K., N. I. A.-T. (2017). Processing water leachate with anaerobic-aerobic biofilter process and denitrification. *Indonesian Water Journal*, *8*(1).

Said M. R., N. I. A.-S. (2018). Ammonia Removal in Domestic Wastewater Using the Moving Bed Biofilm Reactor (MBBR) Process. *Indonesian Water Journal*, *7*(1).

Sali A. AU3 - Purwanto Y., G. P. A.-S. (2018). Effectiveness of Biofiltration Technique Using Wasp Nest Media on Reducing Total Nitrogen Levels in Liquid Waste. *Journal Precipitation: Media Communication And Development Technique Environment*, *15*(1), 1–6.

Sarı, H., & Koyuncu, I. (2018). The effect of treatment technologies on the quality of domestic wastewater: A comparative study. Environmental Monitoring and Assessment, 190, 364. https://doi.org/10.1007/s10661-018-6699-5

Sulistia A. C., S. A.-S. (2019). Analysis Quality Water Waste Domestic Office. *Journal of Environmental Engineering*, *12*(1).

Suoth, A. E. (2016). Characteristics Water Waste House Ladder On Wrong One Upper Middle Class Housing Complex in South Tangerang. *Ecolab*, *10*(2), 80–88.

Wang, Y., & Liang, Y. (2018). Cost-effectiveness analysis of decentralized wastewater treatment systems: Case study in China. Environmental Impact Assessment Review, 70, 32-42. https://doi.org/10.1016/j.eiar.2018.01.002

Zaneti R. AU3 - Rubio J., R. N. A.-E. (2013). Car wash wastewater treatment and water reuse– a case study. *Water Science and Technology*, *67*(1), 82–88.

Zhang, X., & Chen, L. (2020). Assessment of wastewater characteristics and treatment performance in urban areas: A review of recent advances. Science of the Total Environment, 711, 134576. https://doi.org/10.1016/j.scitotenv.2019.134576

Zhou, J., & Liu, Y. (2019). Domestic wastewater management in urban areas: Challenges and solutions. Journal of Environmental Management, 240, 39-49. https://doi.org/10.1016/j.jenvman.2019.02.037