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Study of Raw Water Needs at Cibanten Reservoir Serang Regency, Banten Province

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Abstract

The rural communities of Sukadana and Sukabares in Serang Regency, Banten Province, require clean and quality water. Current water supply of 10 liters per second serves 4,120 people in Sukadana and 500 in Sukabares. Yet, many lack access due to a required flow rate of 21 liters per second for the combined population of 9,399. Additionally, the existing water network is aging and functioning suboptimally due to damage and insufficient volume capacity. Two main reasons, the damaged old network and insufficient water volume supply, necessitate the construction of a new water network by revamping the existing system and increasing the reservoir capacity. This network planning is designed to serve the community for the next 22 years, aiming toward Indonesia's golden age in 2045. To ensure the provision of clean water, a well-structured Raw Water Network Development is required. A sound network involves meticulous calculations of water demand and availability to formulate an appropriate Water Network System. The study utilizes measurements from a Current Meter at the Cibanten Reservoir and the FJ. Mock method for establishing reliable flow rates. Water demand calculations are based on population growth projections using arithmetic, geometric, and exponential methods, extended to the year 2045. The research indicates that by 2045, the new network will cater to 15,952 individuals, with a required flow rate of 36 liters per second. This will serve domestic households at 20.30 liters per second, social activities at 1.11 liters per second, and non-domestic purposes at 3.86 liters per second, resulting in a total demand of 35.38 liters per second, considering water loss due to evapotranspiration. The available drinking water flow is abundant at 272 liters per second. With the development and improvement of the Clean Water System, this water supply will be sufficient to meet the consumption needs of the communities in Sukadana and Sukabares in the Ciomas sub-district of Serang Regency, Banten Province. Furthermore, the Cibanten Reservoir serves an additional purpose by irrigating 159 hectares of rice fields in Sukadana Village at approximately 87 liters per second, as well as supporting tourism in Serang Regency and the broader Banten Province. The challenge of the Clean Water Network System is being addressed through the construction of this system by the Ministry of Public Works and Housing, Directorate General of Water Resources, SNVT Groundwater and Raw Water, and the Cidanau-Ciujung-Cidurian River Basin Agency, Banten province.

1. Introduction

Water plays a crucial role in the existence of living beings on this planet. Humans, as part of this realm, depend on water for various needs—direct, such as drinking, cooking, cleaning, and sanitation, as well as indirect, like irrigation, hydroelectric power generation, and tourism. Water sources include surface and groundwater. Growing populations and rapid development across sectors have escalated water demands, while the availability of water from sources remains relatively constant due to regional climates. In the Ciomas sub-district, there's the potential of Cibanten Reservoir, serving as a raw water source for clean water in Sukadana and Sukabares communities, Serang Regency, Banten Province. Geographically located between -7° 48' 2.84" to -7° 43' 30.9" latitude and 105° 58' 52.89" to 106° 4' 58.23" longitude, its boundaries are: 1) North: Pabuaran Sub-district, 2) South: Carita Sub-district, Pandeglang Regency, 3) West: Padarincang Sub-district, and 4) East: Baros Sub-district. The district's capital is situated in Panyaungan Jaya Village, approximately 26 KM away from the regency's capital. The hilly topography influences the district. Cibanten Reservoir is used by Sukadana and Sukabares for clean water, managed informally. This study aims to assess the potential water source utilized by the government to meet domestic and non-domestic water needs and provide solutions to related water supply issues.

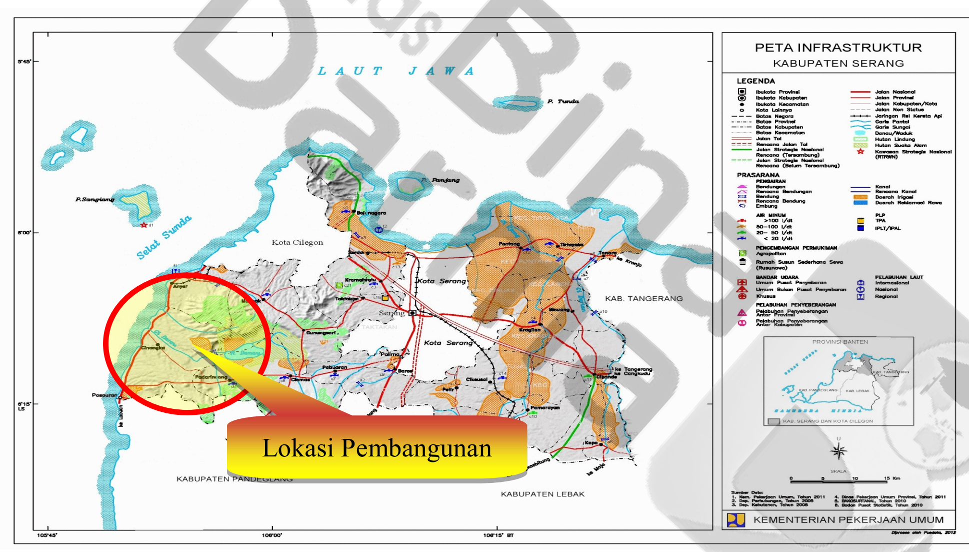

Figure 1.1 Cibanten Reservoir Research Location

2. Materials and Methods

A preliminary survey was conducted to gain an overview of the Cibanten Reservoir's condition, socio-economic status, population data, as well as existing facilities and infrastructure in the communities of Sukadana and Sukabares, Ciomas sub-district, Serang Regency, Banten Province. This study utilized both primary and secondary data. Primary data encompassed the flow rate of the Cibanten Reservoir, while secondary data included population statistics, facilities, infrastructure, rainfall and climatology data, and topographic data. Rainfall data, climatology data, and topographic maps were obtained from the Cibanten Rain Gauge Station and the BBWS C3 (Cidanau Ciujung Cidurian) Office, Banten Province. Rainfall data, climatology data, and topographic maps were used to analyze the reliable flow rate, which refers to the flow rate that can be truly relied upon in a river or reservoir, during both dry and rainy seasons. The Fj. Mock method was employed for analyzing the reliable flow rate. Additionally, flow rate measurements were taken using a Curenmeter.

A. Method of Fj. Mock

The parameters relevant to this study are as presented in the formulation by FJ. Mock in his paper "Land and Capability Appraisal and Water Availability Appraisal, Bogor, Indonesia, 1973." This introduced a method for simulating river flow based on rainfall, evapotranspiration, and the hydrological characteristics of the watershed. The model was derived from empirical research by incorporating monthly rainfall data and other monthly physical parameters, resulting in simulated monthly flow rates. The formula/equation of the FJ. Mock Model used in this study is:

Rain Data Processing

Rain value monthly (P) is obtained from recording of rain data monthly (mm) and quantity day rainfall in the month concerned (h). In principle, hydrological data got with method collect secondary data, with contact related agencies direct with problems encountered. Data bulk used rain in studies This taken from station imminent rain with area studies that is Rain Post Cibanten.Term trend long Rain monthly at the station used as rain data within the work area can seen in Table 2.1.

Table 2.1. Monthly Average Rainfall (mm) Study Area

No	Tahun	JUMLAH HUJAN (mm) / JUMLAH HARI HUJAN (hari)											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2014	522	537	229	97	153	141	325	397	76	146	260	457
	hari hujan	20	17	10	9	12	9	13	16	2	12	23	0
2	2015	547	266	306	317	157	299	144	71	25	158	327	697
	hari hujan	21	15	16	19	14	15	13	5	4	13	15	22
3	2016	481	961	569	340	196	333	196	180	181	534	113	606
	hari hujan	18	19	16	16	9	12	11	8	12	22	10	20
4	2017	495	336	196	184	408	169	201	48	169	100	200	359
	hari hujan	18	20	18	13	13	13	15	6	8	7	11	20
5	2018	358	245	286	296	191	168	18	23	179	77	314	457
	hari hujan	18	17	15	19	10	8	3	4	8	6	17	18
6	2019	874	380	385	658	766	46	121	24	32	89	42	168
	hari hujan	20	13	17	23	22	7	5	3	3	6	7	21
7	2020	393	292	290	414	489	403	140	128	226	134	332	670
	hari hujan	27	12	16	12	10	11	5	5	8	8	18	23
8	2021	392	413	222	353	252	272	47	410	482	277	516	284
	hari hujan	18	18	13	14	14	13	3	11	18	12	20	21
9	2022	244	419	509	192	280	272	124	179	129	208	145	320
	hari hujan	18	17	16	12	19	23	7	12	15	17	18	17

Source: Cibanten Rain Post

Climatological Data Processing

Description of conditions climate area studies can seen from results recording station existing climatology and rainfall. Climatological data For area studies This taken from Cibanten Rain Post

Hydrometric Data Processing

Hydrometric data got from implementation survey hydrometry carried out at the Cibanten Reservoir. Survey covers measurement of river discharge and water quality.

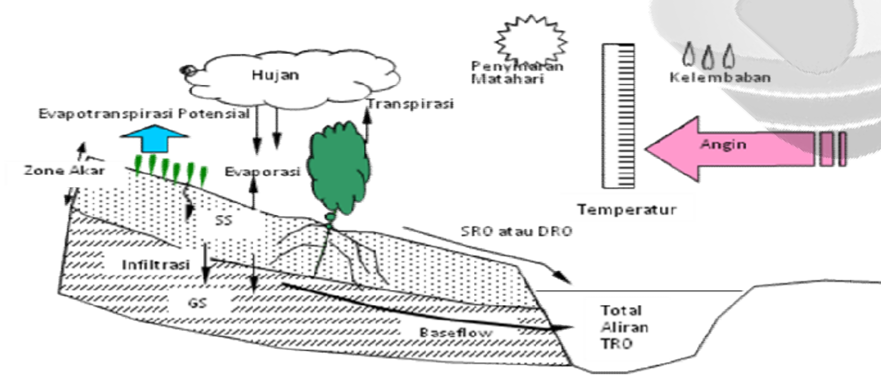

Figure 2.1. The Hydrological Cycle as the basis for the FJ water balance model. Mock and Influence Factors of Evapotranspiration

Formula of Perhitungan Debit Andalan

Evapotranspiration

Evapotranspiration limited is actual evapotranspiration with consider condition vegetation and surface land so that the similarities as following :

$$E = ETo^* \text{ x } \frac{d}{30}.m$$

Where:
E =Difference Between Evapotranspiration Potential And Evapotranspiration Limited (mm)
ETo* = Evapotranspiration Potential (mm)
d = Amount Day Dry or Day withoutRain In 1 Month
m = Percentage Land That is not Vegetation, Estimated From Use Map Land, Taken M = 0% For Land With Heavy Forest
m = 0 % at End RainSeason,and The Addition Of 10% Each Month Dry For Land With Forest Secondary
m = 10 % - 40 % for eroded land
m = 30 % - 50 % for land processed agriculture (rice field, lading,p)

Water balance at ground level

Water balance at ground level counted based on magnitude bulk Rain monthly reduced mark evapotranspiration limited monthly average so that obtained equation :

$\Delta S = P – ET$

Where:

ΔS = change soil water content (*soil storage*).

The value positive if P > ET, water enters to in land

The value negative if P < ET, part of the groundwater go out so that happen deficit.

Ground water storage

Runoff and *ground water values* magnitude depends from water balance and conditions the land. Required data are :

Coefficient *infiltration(I*) taken 0.2 - 0.5

Recession factor groundwater flow (k) is taken 0.4 - 0.7

Equation :

In = WS x I

Vn = k. Vn-1 + 0.5 (1 + k). in

ΔVn = Vn – Vn-1

Where:

In = infiltration, the volume of water entering to in land

Vn = volume of ground water

Vn-1 = volume of groundwater month to (n-1)

ΔVn = change in groundwater volume

I = coefficient *infiltration*

k = factor recession groundwater flow

Flow equalization

For even distribution incoming flowto deposition zone can used wall perforated walls.The surface area of the pit is calculated by the equation:

$$A_{Lubang} = \frac{1}{4}\pi . d^2 \text{ (dihitung per lubang) …. (12)}$$

The calculation of pressure loss in the hole is used equation:

$$h_f = k_1 \frac{V^2}{2g} + \frac{V_2}{2g}$$

B. Debit Measurement with Curenmeter

Location Water discharge measurement is carried out by Cibanten Dam, Sukabares Village, Ciomas District, Seranga Regency, Banten Province, at coordinates X = 615728.803, Y = 9312505.692. Water discharge measurements are carried out at 4 points, namely in the upstream of the weir, downstream of the Cibanten weir, the glory spring, and the bridal spring. An overview of the discharge measurement location can be seen in the following figure.

Figure 2.3. Activity Location Map

River and Open Canal Discharge Measurement Method (SNI 8066:2015)
Tools:

1. A Set of Current Meter Tools
2. Meter

Procedure measurement of water discharge in the river (Current Meter Method)

1. Assembly Tool *Current Meter*
2. Meter stretched throughout wide river and recorded results measurement.
3. River width shared to 3-7 areas based on wide river the.
4. After sharing 3-7 area, depth river be measured with use meter
5. After depth measured, parts a, b, c are measured return as point measurement *current meter.*
6. After obtaining three depth river with cut each part middle, the height of the current meter is determined by multiplying depth river with 0.6d.
7. Speed current be measured with three repetitions using a current meter with t = 60 seconds.
8. Calculate river water discharge

C. Raw Water Needs

Clean water needs ofHouseholds(domestic)

Clean water needs of Households is the water obtained in a manner individual from source of water made by each house ladder like well shallow, piping or hydrant general or can obtained from service System Drinking Water Supply (SPAM) PDAM. The source of raw water by PDAM consists from groundwater and surface water or combined from both. Use of water is influenced by:

- Type of water source (connection to House or fire hydrant general)
- Type of use (toilet, shower, etc.)
- Equipment per house ladder
- Use of water outside house (garden, wash car etc.)
- Income level

Domestic water demand refers to the water used for household purposes. The water requirement per person per day is estimated at a flow rate of 144 liters/person/day (Department of Public Works, Directorate General of Human Settlements, 2006).

The total water demand is calculated based on the projected number of water users for the next 5 to 10 years, and the requirement for each user is increased by 20% to account for water losses (leakage). This clean water demand is determined based on service provided through Public Hydrants (PH) using the following equations (Department of Public Works, Directorate General of Human Settlements, 2006):.

Qmd = Pnxqxfmd (3.2)

Qt = Qmd x 100/80 (factor water loss 20%) (3.3)

with :

Qmd = Need for clean water

Mr= Amount resident year n

q= Water requirement per person/ day

fmd= Day factor maximum (1.05-1.15)

Qt = total demand for clean water

Clean water needs House ladder, stated in unit liters / person / day (L/O/H), large need depends from category city based on amount residents, namely :

Table 2.2.. Clean Water Needs Population Per Person Per Day

No	City Category	Clean Water Needs (L/O/H)
1.	Semi-Rural	60
2.	Small town	90
3.	Medium City	110
4.	Big city	130
5.	Metropolis	150

Source : Directorate General Cipta Karya Ministry Public Works

a. Social water needs

Water requirement for social assumed 20% of amount residents in need need 30 liters/day. The more big and solid resident will tend more Lots own area commercial and social, so need the for water will more higher.

b. Non- Domestic Needs

Non-domestic water needs, namely water needs which include industrial needs, institutional needs, and commercial use. Institutional needs include water needs for schools, hospitals, places of worship, government buildings, and others. Commercial water needs for an area are in line with increasing population and land use changes.

D. Irrigation Water Needs

Water requirements for plant are shared into three needs, namely :

1) *Crop Water Requirement/CWR*
2) *Farm Water Requirement* / FWR
3) *Project Water Requirement/PWR*

Measurement speed use method *mean section* is performed with share cut channel to be measured into the later sectionsmeasurement done in each section. Location and amount measurement speed on each sexy customized with depth river/channel. Channel measured irrigationis channel relatively tertiary small and shallow, therefore That channel will shared into two sections and measurement speed Genre carried out at a depth of 0.6 parts from base channel (0.6 s).

3. Results and Discussions

3.1 Population Growth Projection

Population analysis is conducted to understand and formulate various aspects of population needed for water demand planning, including population count and trends in growth and distribution. Over time, a region will experience population growth. To project or predict future population, several formulas such as Arithmetic, Geometric, and Exponential can be used. In this study, data for formulating clean water demand in Sukabares, Sukarena, and Sukadana villages of Ciomas sub-district are utilized to calculate maximum daily and peak-hour water requirements, based on Exponential calculations.

Population registration data processed by the Central Statistics Agency (BPS) of Serang Regency, Banten Province, shows that the populations of Sukabares and Sukadana villages in the Ciomas sub-district have been consistently growing year by year. Population growth is influenced by natural factors such as births (natality) and deaths (mortality), as well as migration. Birth and death rates contribute to natural growth, while migration contributes to non-natural growth. Population growth data for Sukabares and Sukadana villages in the Ciomas sub-district can be observed in Table 3.1 below..

Table 3.1. Growth Population Sukabares and Sukadana Subdistrict Ciomas 2016–2022

No.	Village Name	Year						
		2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
1	Sukabares	2,664	2,799	2,935	3,070	3,209	3,419	3,610
3	Sukadana	4,921	5034	5.145	5,260	5,375	5,583	5,789
	Amount	**6,277**	**6,583**	**6,890**	**7,195**	**8,584**	**9,002**	**9,399**

The projected population results for upcoming years reflect the quantity of domestic water demand, as an increase in population is equivalent to an increase in domestic water needs. Social, cultural, and economic factors within the population determine the extent of domestic water usage. Three methods are employed to estimate future population: the Arithmetic Method, the Geometric Method, and the Exponential Method. These three methods, along with their mathematical formulas, are explained as follows:

a). *Arithmetic*method

Arithmetic Population Growth is population growth with an absolute number of *numbed* thatis considered equal each year. The equation used is:

Pn = Po (1 + r. n)

Where :

Pn = Amount resident "n" years who will come

Po = Amount Resident year previously

r = average percentage increase resident

n = Amount next year come

P2023 = Po (1 + r. n)

= 9,399 (1 + 2.3 % x 1)

= 9,615 souls.

P2024 = Po (1 + r. n)

= 9,399 (1 + 2.3 % x 2)

= 9,831 souls.

P2025 = Po (1 + r. n)

= 9,399 (1 + 2.3 % x 3)

= 10,048 souls.

b). *Geometric* Method

This method assumes that the development of the number of residents (consumers) is automatically multiplied by the equation:

$Pn = Po(1 + r)^{n}$

Where :

Pn = Number of "n" years to come come

Po = Amount Population by year previously

r = Average percentage of population growth

n = Amount next year come

$P2023 = Po(1 + r)^{n}$

$= 9{,}399\ (1 + 2.3\ \%)^1$
= 9,615 souls.
$P2024 = Po(1 + r)^n$
$= 9{,}399\ (1 + 2.3\ \%)^2$
= 9,838 souls.
$P2025 = Po(1 + r)^n$
$= 9{,}399\ (1 + 2.3\ \%)^3$
= 10,063 souls.

c). *Exponential* Method
This method follows the equation:
$Pn = Po\ (e)^{r.n}$
Where :
Pn = Number of "n" years to come come
Po = Amount Population by year previously
r = average percentage of population growth
n = Amount next year come
e= exponential
$P2023 = Po\ (e)^{r.n}$
$= 9.399\ (2.7182818)^{2.3 \times 1}$
= 9,618 souls.
$P2024 = Po\ (e)^{r.n}$
$= 9.399\ (2.7182818)^{2.3 \times 1}$
= 9,841 souls.
$P2025 = Po\ (e)^{r.n}$
$= 9.399\ (2.7182818)^{2.3 \times 1}$
= 10,070 souls.

1.1. Debit Measurement Results with Curenmeter

The cross-sectional shape of each water flow can be seen in the illustration below.

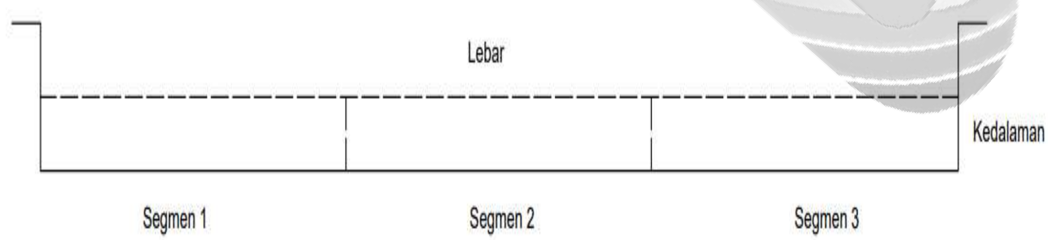

Figure 3.1.. Cross section Genre

The results of measurements carried out in the field, then data processing is carried out. So that a discharge is obtained that flows from each body of water. The results of data processing can be seen in the following table.

Table 3.3 Water Debit Measurement Results

Location Point	Segment	Depth (m)	Width (m)	Speed (m/s)	Average speed (m/s)	Cross Sectional Area Wet (m^2)	Discharge (m^3/sec)	Discharge (l/s)	Total Debit (l/s)
Cibanten Lake	1	0.09	2,13	0.3	0.43	0.19	0.08	83.07	274.77
				0.4					

Location Point	Segment	Depth (m)	Width (m)	Speed (m/s)	Average speed (m/s)	Cross Sectional Area Wet (m^2)	Discharge (m^3/sec)	Discharge (l/s)	Total Debit (l/s)
				0.6					
	2	0.09	2,13	0.4	0.5	0.19	0.10	95.85	
				0.5					
				0.6					
	3	0.09	2,13	0.4	0.5	0.19	0.10	95.85	
				0.5					
				0.6					

Location Point	Segment	Depth (m)	Width (m)	Speed (m/s)	Average speed (m/s)	Surface Area Wet (m^2)	Discharge (m^3/sec)	Discharge (l/s)	Total Debit (l/s)
Lower Cibanten Lake	1	0.35	0.45	0.6	0.475	0.16	0.07	67.85	234,65
	2	0.3	0.45	0.5		0.14	0.06	64,1	
	3	0.28	0.45	0.5		0.13	0.06	59,9	
	4	0.2	0.45	0.3		0.09	0.04	42.8	

1.2. Mainstay Debit Fj. Mock

Calculation of the average monthly discharge is conducted using monthly mid-rainfall data. This essential calculation of reliable flow rates can be achieved through various methods, with the commonly employed method being the F.J. Mock Method for estimating baseflow. The Directorate of Irrigation (1980) states that the estimation of available water in rivers is computed using the F.J. Mock Method. This method assumes that the rain falling within the River Irrigation Area (DPS) will partly be lost as evapotranspiration, determined based on climatological data. A portion will become direct runoff, and another portion will infiltrate into the soil as infiltrated water. When the soil moisture capacity is exceeded, water will flow downward due to gravity (percolation) into groundwater, eventually emerging in rivers as base flow.

The rainwater flow, modified by the DPS system in question, eventually reaches the rivers within the corresponding DPS. River flow is composed of the sum of surface runoff and base flow.

Table 3.4. Total Rain and Daily Amount of Rain

No	Tahun	JUMLAH HUJAN (mm) / JUMLAH HARI HUJAN (hari)											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2014	522	537	229	97	153	141	325	397	76	146	260	457
	hari hujan	20	17	10	9	12	9	13	16	2	12	23	0
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4	2017	495	336	196	184	408	169	201	48	169	100	200	359
	hari hujan	18	20	18	13	13	13	15	6	8	7	11	20
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	hari hujan	18	17	15	19	10	8	3	4	8	6	17	18
6	2019	874	380	385	658	766	46	121	24	32	89	42	168
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	hari hujan	18	18	13	14	14	13	3	11	18	12	20	21
9	2022	244	419	509	192	280	272	124	179	129	208	145	320
	hari hujan	18	17	16	12	19	23	7	12	15	17	18	17

The results of mainstay discharge analysis with the F.J Mock method in the Study area can be seen in Table 5.9. Calculation of Cibanten Embung Discharge with FJ Method. Mock with the calculation results of Debit experienced a surplus every month with the highest surplus in February of 63.79 liters / second and the lowest in August of 22.37 liters / second. Then the Cibanten Embung Water Balance Balance can be seen in Figure 5.10. Cibanten Embung Water Balance which shows that the discharge of water use is smaller than the availability of water, water use is 35.38 liters / second to 118.61 while water availability ranges from 254.07 liters / second to 292.83 liters / second. There is a water balance surplus between 133.91 liters / second to 189.42 liters / second.

1.3. Results of Raw Water Needs

Household, urban and industrial water needs are calculated using population statistics. The results of the calculation of clean water needs are as follows::

Clean water needs of Households (domestic)

Household clean water needs are water obtained individually from water sources made by each household such as shallow wells, piping or public water supply or can be obtained from the Drinking Water Supply System (SPAM) service.

Raw water sources consist of groundwater, surface water or a combination of the two. The use of water used is influenced by:

- Type of water source (connection to a house or public hydrant)
- Type of use (toilet, shower, etc.)
- Equipment per household
- Water use outside the home (park, car wash etc.)

For Sukabares and Sukadana villages, Ciomas sub-district, Serang Regency, Banten Province, the category of cities is medium so that the need for clean water per liter per person per day is 110 liters / person / day (see table). Formula calculates Clean Water Needs of Domestic Population = Number of Population x 110 x 1/(24x60x60) liter/second = 9,618 x 110 x 1/(24x60x60) liter/second = 12.24 liter/second.

Social water needs

Water needs for social are assumed to be 20% of the total population that requires the need of 30 liters / day. The larger and denser the population will tend to have more commercial and social areas, so the water needs will be higher. Social Water Needs Formula = 20% x Total Population x 30 x 0.00001157 liters/second = 20% x 9,618 x 30 x 1/(24x60x60) liters/second = 0.67 liters/second.

Non- Domestic Needs

Non-domestic water needs, namely water needs which include industrial needs, institutional needs, and commercial use. Institutional needs include water needs for schools, hospitals, places of worship, government buildings, and others. Commercial water needs for an area are in line with increasing population and changes in land use. The following are some of the water needs for non-domestic in 2023.

1). Water needs of school pupils

According to the Directorate General of Copyright, Department of Public Works, the need for clean water for school students is 5 liters / student / day. School Student Water Needs Formula = Number of Students x 5 liters/day = 1,820 x 5 liters/day = 9,100 liters/day.

2). Water needs of Puskesmas

According to the Directorate General of Copyright, Department of Public Works, water needs for hospitals are calculated based on the number of beds, which is 500 lt/bed/day and for puskesmas of 1200 liters/unit/day. Puskesmas Water Requirement Formula = Number of Puskesmas x 1,200 liters/day = 0 x 1,200 liters/day = 0 liters/day.

3). Water Needs for Places of Worship

According to the Directorate General of Copyrights of the Department of Public Works, the water requirement for mosques is 3000 liters / unit / day while churches / temples are 1000 liters / unit / day. Mosque/Mushola Water Requirement Formula = Number of Mosques/Mushola x 3000 liters/day = 44 x 3000 liters/day = 132,000 liters/day. Church/Temple Water Requirement Formula = Number of Churches/Temples x 1000 liters/day = 0 x 1000 liters/day = 0 liters/day.

4). Water needs for the Market

According to the Directorate General of Copyrights of the Department of Public Works, the water requirement for mosques is 12,000 liters / unit / day. Water Requirement Formula Number of Markets = Number of Markets x 1,200 liters/day = 1 x 1,200 liters/day = 1,200 liters/day.

5). Water needs for industry

According to the Directorate General of Cipta Karya DPU in 1996, the need for water for industry is 10 liters / unit / day. Water Requirement Formula for Industry = Number of Industries x 10 liters / day = 0 x 10 liters / day = 0 liters / day.

6). Water needs for stall employees

According to the Directorate General of Cipta Karya DPU in 1996, water needs for stall employees are liters / units / day. Water Requirement Formula for stall employees = Number of stall employees x 10 liters / day = 120 x 10 liters / day = 1,200 liters / day

Total non- domestic water demand = (1+2+3+4+5+6) x 0.00001157 liter/ second = 9,100 + 0 + 132,000 + 1,200 + 0 + 1,200 = 143,500 liter/ day x 1/(24x60x60) liter / second = 1.66 liters / second.

Total Water Needs in 2023 = Domestic Water Needs + Social Water Needs + Non- Domestic Water Needs = 12.24 +0.67 + 1.66 = 14.57 liters/ second.

Loss of Water

loss = 10% x Total Water Needs (liters/ second) = 10% x 14.57 liters/ second = 1.46 liters/ second.

Maximum Daily Needs

Maximum Daily Needs = 1.15 x Total Water Needs (liters/ second). = 1.15 x 14.57 liters/ second = 16.75 liters/ second.

Needs at Peak Hours

Demand for discharge at peak hours = 1.5 x total water demand (liters/ second) = 1.5 x 14.57 liters/ second = 21.85 liters/ second.

Total Water Needs = Debit Needs at Peak Hours – Water Losses (liters/ second) = 21.85 – 1.46 = 20.40 liters/ second.

Prediction of raw water needs in Sukabares and Sukadana Villages, Ciomas District, Serang Regency, Banten Province, in 2023 Domestic Water Needs of 12.24 liters/second, Social of 0.67 liters/second and Non-Domestic of 1.66 liters/second, water needs at peak hours of 21.85 liters/second, maximum daily needs of 16.75 liters/second, predictions of water loss of 1.46 liters/second, then the total water demand in 2023 is 20.40 liters/second. Then after that, in 2024, the total water demand is 20.96 liters / second and increases every year.

If reviewed until 2045, Domestic Water Demand is 20.30 liters/second, Social 1.11 liters/second, Non-Domestic is 3.86 liters/second, water needs at peak hours are 37.91 liters/second, maximum daily needs are 29.06 liters/second, predicted water loss is 2.53 liters/second, then Total Water Demand in 2045 is 35.38 liters/second (Table 3.4).

Table 3.5. Non- Domestic Water Needs in Sukadana and Sukabares Villages Subdistrict Ciomas Year 2023

No.	Kebutuhan Air Non Domestik	Rumuas Perhitungan	Volume	Satuan	Keb. Per Orang (liter)	Jumlah Kebutuhan Air Non Domestik (liter/hari)	Jumlah Kebutuhan Air Non Domestik (liter/detik)
1	Murid Sekolah	= Jumlah Murid x 5 liter /hari	1,820	orang	5	9,100	0.11
2	Puskesmas	= Jumlah Puskesmas x 1200 liter/hari	-	unit	1,200	-	-
3	Tempaat Ibadah						
	a). Masjid & Mushola	= Jumlah Masjid x 3000 liter/hari	44	unit	3,000	132,000	1.53
	b). Gereja/Pura	= Jumlah Gereja/Pura x 1000 liter/hari	-	unit	1,000	-	-
4	Pegawai Pasar	= Jumlah Pasar x 12.000 liter/hari	1	unit	1,200	1,200	0.01
5	Industri	= Jumlah Industri x 10 liter/hari	-	unit	10	-	-
6	Karyawan Warung	.= Jumlah Karyawan x 10 liter/hari	120	0rang	10	1,200	0.01
				Jumlah Kebutuhan Air		143,500	1.66

1.4. Water Balance

The results of mainstay discharge analysis with the F.J Mock method in the Study area can be seen in Table 5.9. Calculation of Cibanten Embung Discharge with FJ Method. Mock with the calculation results of Discharge experienced a surplus in each month with the highest surplus in February of 63.79 liters / second and the lowest in August of 22.37 liters / second. Then the Cibanten Embung Water Balance Balance can be seen in Figure 5.10. Cibanten Embung Water Balance which shows that the discharge of water use is smaller than the availability of water, water use is 35.38 liters / second to 118.61 while water availability ranges from 254.07 liters / second to 292.83 liters / second. There is a water balance surplus between 133.91 liters / second to 189.42 liters / second.

Table 3.7. Cibanten Reservoir Water Balance Balance

No.	URAIAN	DEBIT (LITER/DETIK)											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	**Ketersediaan Q**	**292.83**	**290.40**	**273.18**	**274.77**	**273.48**	**264.99**	**254.07**	**255.37**	**255.79**	**255.81**	**262.20**	**283.99**
1.1	Q Mata Air Embung Cibanten	234.65	234.65	234.65	236.31	234.65	234.65	234.65	234.65	234.65	234.65	234.65	234.65
1.2	Q Air Hujan	58.17	55.75	38.53	38.46	38.83	30.34	19.42	20.72	21.13	21.16	27.55	49.34
2	**Penggunaan Q**	**118.61**	**118.22**	**122.16**	**120.19**	**117.69**	**35.38**	**64.65**	**74.27**	**71.76**	**121.90**	**121.67**	**122.36**
2.1	Q Irigasi	83.23	82.84	86.78	84.81	82.31	-	29.27	38.89	36.38	86.52	86.29	86.98
2.2	Q Keb. Air aku Desa Sukadana & Sukabares	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38
2.3	Q95 Pemeliharaan (SE Dirjen No. 1 Th. 2016)	7.72	7.72	7.72	7.72	7.72	7.72	7.72	7.72	7.72	7.72	7.72	7.72
3	**Neraca Air (1-2)**	**174.21**	**172.18**	**151.02**	**154.58**	**155.78**	**229.61**	**189.42**	**181.10**	**184.02**	**133.91**	**140.53**	**161.63**
4	**Surplus/Defisit**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**

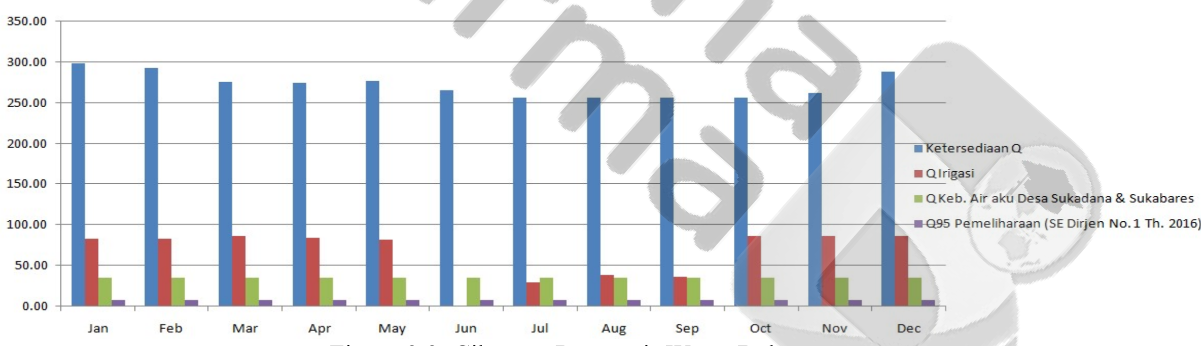

Figure 3.3. Cibanten Reservoir Water Balance

3.6. Water Quality Analysis (Laboratory Test)

In terms of health considerations, the quality of raw water must account for the possibility of pollution from potential sources of contamination in the river. In terms of its intended use, raw water should be capable of removing turbidity, color, iron, and manganese through a conventional filtration system without requiring special treatment. Regarding operational and maintenance aspects, the system should function and be maintained normally to produce potable water that meets health standards.

Sampling of this water is conducted at the planned intake site. These samples are collected for laboratory testing. Through these laboratory tests, the water quality intended for raw water purposes (Quality standard B) will be determined.

To assess water quality in the field, a "Water Quality Checker" measuring instrument is utilized.

For laboratory testing purposes, water samples are collected at the planned intake site. These samples are gathered for laboratory testing. Through these laboratory tests, the quality of the water intended for raw water purposes (Quality standard B) will be ascertained.

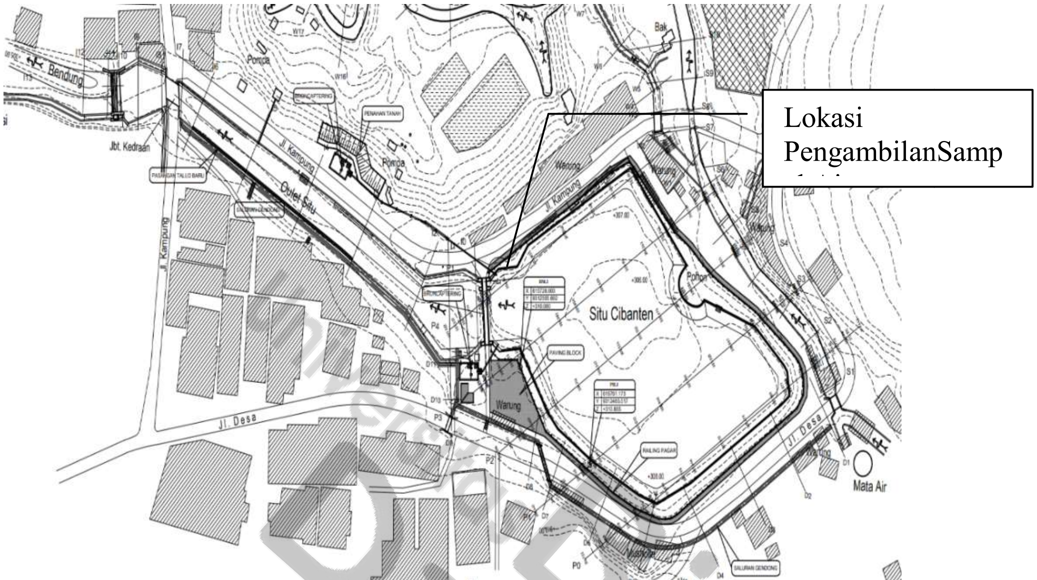

Figure 3.1. Water Sampling Locations

The water quality parameters studied refer to the standard parameters for drinking water quality according to Government Regulation No. 82 of 2001 as presented in Table 5.10 below

Table 3.1. Quality Standards for Raw Water Quality

Parameter	**Unit**	**Quality standards**	
		A	**B**
Nitrate	Mg/L	10	10
Nitrite	Mg/L	0.05	1
Substance organic	Mg/L	-	400
Fe	Mg/L	0.3	-
M N	Mg/L	0.1	-
Na	Mg/L	-	200
Hg	Mg/L	0.001	0.002
F	Mg/L	0.5	1.5
TDS	Mg/L	1000	1000
Sulfate (SO_4)	Mg/L	400	-
Cl^-	Mg/L	0.03	0.03
hardness	Mg/L	-	500

Source : Regulation Government No. 82 of 2001

The water samples were collected from Cibanten Reservoir. Each sample was collected in an amount of 2 liters. Based on the laboratory test results conducted at the Serang City laboratory, the tested samples are still suitable for use as raw water, as they still possess good physical and chemical properties for household/drinking water purposes. However, it should be noted that water quality during the rainy season, when the water at the location becomes turbid for a period, needs to be considered.

Water quality analysis is performed, taking into account the content of iron, magnesium, potassium, boron, chloride, sulfate, and nitrogen oxide that meet drinking water standards. Raw water to meet the needs of the community should contain as few toxins, heavy metals, and substances affecting health as possible, such as mercury, fluoride, and nitrate. The water content from the Cibanten Reservoir is suitable for consumption by the community after boiling. The results of the water quality analysis are presented in Table 5.11.

3.7. Cibanten Reservoir Capacity/Capacity

Reservoir volume Cibanten at the time This with Still there is aquatic plants and sedimentation is of 6,511.51 m3. Sediments and water plants Apu-apu of 1,416.87 m3. pond volume after done cleaning/normalization is 6,511.51 + 1,416.87 = 7,928.38 m3. Calculation of Reservoir Volume Cibanten can seen in table 5.13.

Table 5.13. Cibanten Reservoir Capacity/Capacity

	Sebelum			Sesudah		
Titik	Luas (m2)	Jarak (m)	Volume	Luas	Jarak	Volume
P0	45.6			102.82		
		17.8	1185.213		17.8	2017.719
P1	87.57			123.89		
		17.8	1883.774		17.8	2227.314
P2	124.09			126.37		
		15.8	1872.3		15.8	1840.463
P3	112.91			106.6		
		16.5	1570.223		16.5	1842.885
P4	77.42			116.78		
Total			**6511.51**			**7928.381**

Source : Analysis Researcher

Calculation Capacity / Capacity Reservoir Cibanten and Graphics Inundation Area Relationship and Volumes Reservoir can be seen in tables and figures below.

Table 5.14. Inundation Area Relationship with Reservoir Volume

Elevasi	Luas	Volume
m	m2	m3
306	569.23	0
307	2128.46	1,348.85
308	3607.05	4,216.60
309	4091.5	8,065.88

Source : Analysis Researcher

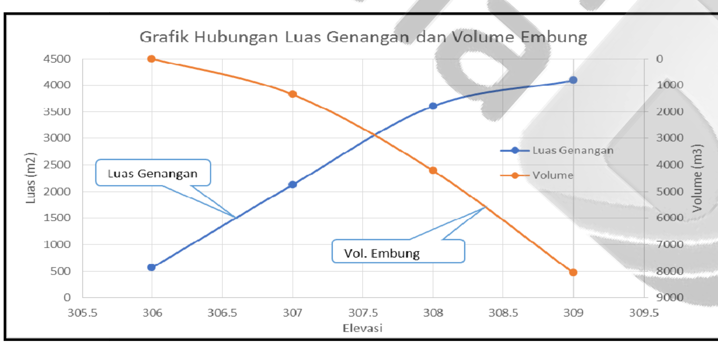

Figure 5.10. Relationship of Inundation Area and Reservoir Volume

On 40% of the surface of Cibanten Reservoir, there is a water plant known as "Apu-apu" (Pistia stratiotes). Despite reducing the reservoir's capacity and storage, this plant has numerous benefits. Also known as "kapu-kapu," this aquatic plant serves as an ornamental plant. The plant's size ranges from 2 to 10 cm in length and 2 to 6 cm in width, with leaves featuring notched edges and thick hair on the water's surface. Apu-apu produces spike-like flowers that emerge from the leaf axils. These white flowers are approximately 1 cm in size. Its fruit is round and red, measuring 5 to 8 cm, containing black, round seeds about 2 mm in size.With its broad leaves growing in clusters, Apu-apu serves well as shade for fish. Furthermore, Apu-apu functions as a cleaner of harmful radioactive pollutants in water. It effectively reduces iron (Fe) levels in water by more than 90% and enhances water quality over time. The plant also naturally removes excess algae and nutrients from the water. Additionally, Apu-apu can be used as feed material due to its dry weight composition of 37% BETN, 19.5% crude protein, 25.6% ash content, 1.3% crude fat, and 11.7% crude fiber (Yudhistira 2013).The volume of Apu-apu water plants in Cibanten Reservoir is calculated as 25% x 4,091.50 m² x 0.1 m = 102.29 m³. Recognizing the importance of Apu-apu, it is advisable not to completely remove this plant during the Cibanten Reservoir Rehabilitation activity. Instead, around 5-10% of the reservoir's surface area should be dedicated to preserving this plant.

Figure 5.11. Apu-apu Aquatic Plants on the surface of the Embung water Cibanten

4. Conclusion

From the results of the study can be concluded and suggested as follows: 1. The projected result of the discharge (liter / second) of clean water needs of Sukadana Village and SukabaresCiomas District until 2045 is 35.38 liters / second. 2. The availability of mainstay discharge (liter/second) of EmbungCibanten is 254.07 liters/second (minimum discharge in July) to 292.83 liters/second (maximum discharge in January), so that the people of Sukadana and Sukabares villages can enjoy the abundance of CibantenEmbung Water. 3. The result of the CibantenEmbung Water Balance Simulation is greater Availability than Usage (Surplus). Availability is 254.07 liters / second to 292.83 liters / second while Usage is 35.38 liters / second to 122.36 liters / second. Use in addition to raw water is also for agricultural irrigation. 4. After going through laboratory tests, the content of CibantenEmbung Water is included in the Class B category, so that it meets the standards for the procurement of raw water that is suitable for consumption by the community as clean water by first boiling it before being used as drinking water. 5.The volume of water in Cibanten Reservoir before cleaning/normalization of sediments and aquatic plants was 6,511.51 m3 and after cleaning/normalization of reservoirs from sediments and aquatic plants was 7,928.38 m3.Broncaptering 1 (3x3x2,5 m3) and Broncaptering 2 (3x8x3,5 m3).

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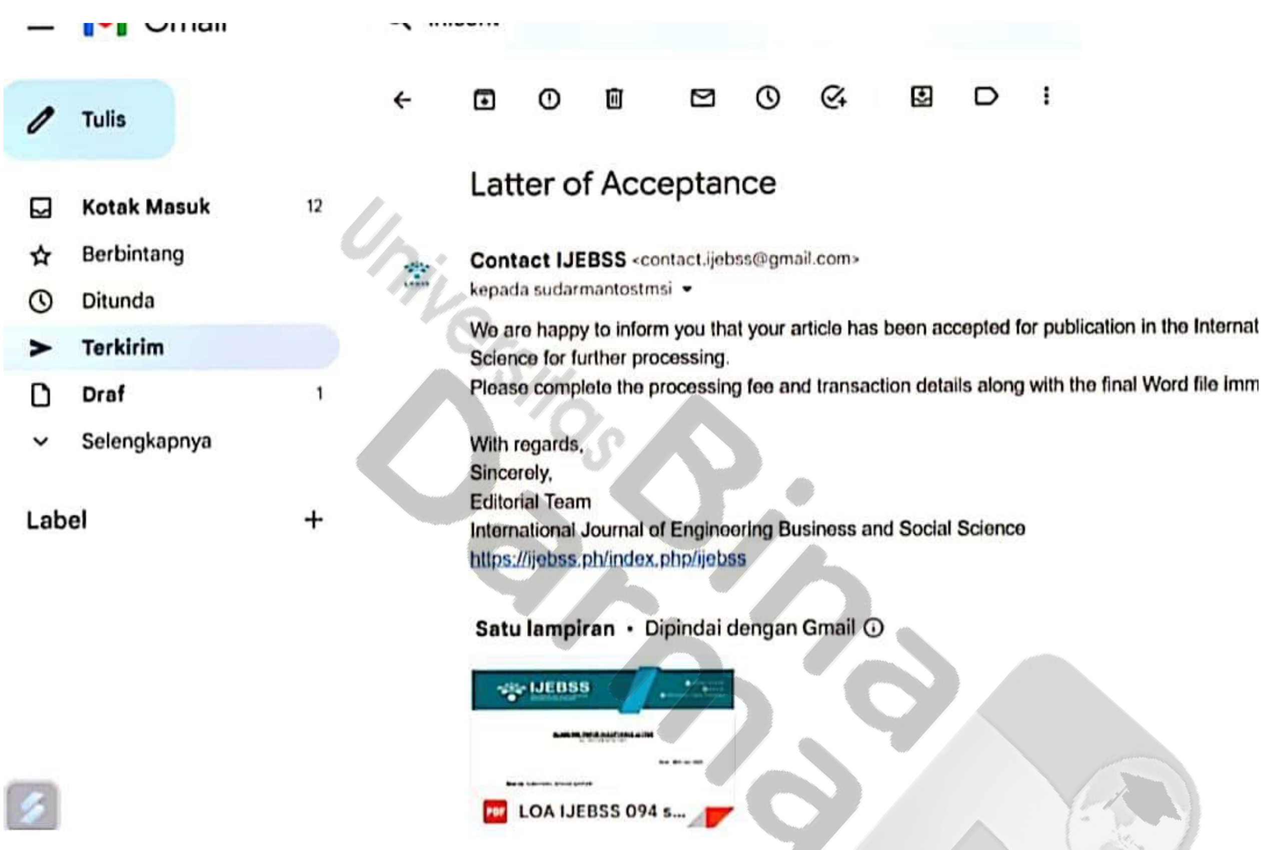

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