Analysis of Clean Water Needs in Liliboy Village West Leihitu Sub-district, Central Maluku Regency

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***Abstract*- The clean water distribution system is the distribution or distribution of water through a piping system from the processing building (reservoir) to the service area (consumer). In planning a clean water distribution system, several factors must be considered, including the service area and population to be served, water demand, topography of the service area, type of system connection, distribution pipes, type of flow, network pattern, clean water distribution system equipment and leak detection. The water supply system must be able to provide sufficient water for the required needs. Government Regulation No. 16 of 2005 on drinking water development system states that the drinking water supply system states that the drinking water supply system Clean water is the main human need because it is related to sustainable life. Without water, humans cannot carry out activities, such as cooking, bathing, washing and fulfilling other needs. Liliboy Village, West Leihitu Subdistrict, Central Maluku Regency is the object of unmet water needs due to population growth factors every year and inadequate reservoirs, resulting in people experiencing clean water difficulties. This study aims The objectives achieved in this study are to analyse the availability, clean water needs in Liliboy Village for the next 10 years and the capacity of the Reservoir to meet the water needs of the village community.**

***Index Terms*- Clean Water, Discharge, Reservoir.**

I. INTRODUCTION

The clean water distribution system is the distribution or distribution of water through a piping system from the processing building (reservoir) to the service area (consumer). In planning a clean water distribution system, several factors must be considered, including the service area and population to be served, water demand, topography of the service area, type of system connection, distribution pipes, type of flow, network pattern, clean water distribution system equipment, leak detection.

The water supply system must be able to provide sufficient water for the required needs. Government Regulation No. 16 of 2005 on drinking water development system states that the drinking water supply system states that the drinking water supply system. Clean water is the main human need for sustainable survival. The use of clean water is very important for human activities including drinking, bathing, cooking washing and other purposes. In daily life, water is utilised not only for household purposes, but also for public, social and economic facilities. Therefore, it is natural that the clean water sector receives top priority handling because it involves the lives of many people. The fulfilment of clean water needs is highly dependent on the availability of water sourced from groundwater, surface water and rainwater.

Desa Liliboy merupakan salah satu desa yang terletak di Kecamatan Leihitu Barat Kabupaten Maluku Tengah Provinsi Maluku dengan luas 16,58 km² dengan jumlah penduduk enam tahun terakhir sebanyak 542 jiwa dengan jumlah kepala keluarga sebanyak 139 KK.

Liliboy Village is one of the villages located in West Leihitu Sub-district, Central Maluku Regency, Maluku Province with an area of 16.58 km² with a population in the last six years of 542 people with 139 family heads.

From the observations of researchers at the Reservoir location as a reservoir with a capacity of 46,000 litres / person / day is not adequate when viewed from a population of 542 people.

In addition to the population growth that is increasing every year, the construction of residences for the community, road construction and other facilities as well as the increasingly widespread logging of forests can affect the water discharge in water sources, especially during the turn of the summer, will result in the Liliboy Village community experiencing a lack of clean water due to decreased water discharge. Therefore, there are concerns that the availability of clean water cannot keep up with the clean water needs of the Liliboy Village community in the future.

Based on the description of the problem above, the researcher is interested in analysing the need for clean water in Liliboy Village, West Leihitu District, Central Maluku Regency.

II. METHODS

Research Location

This research is located in Liliboy Village, West Leihitu Sub-district, Central Maluku Regency.

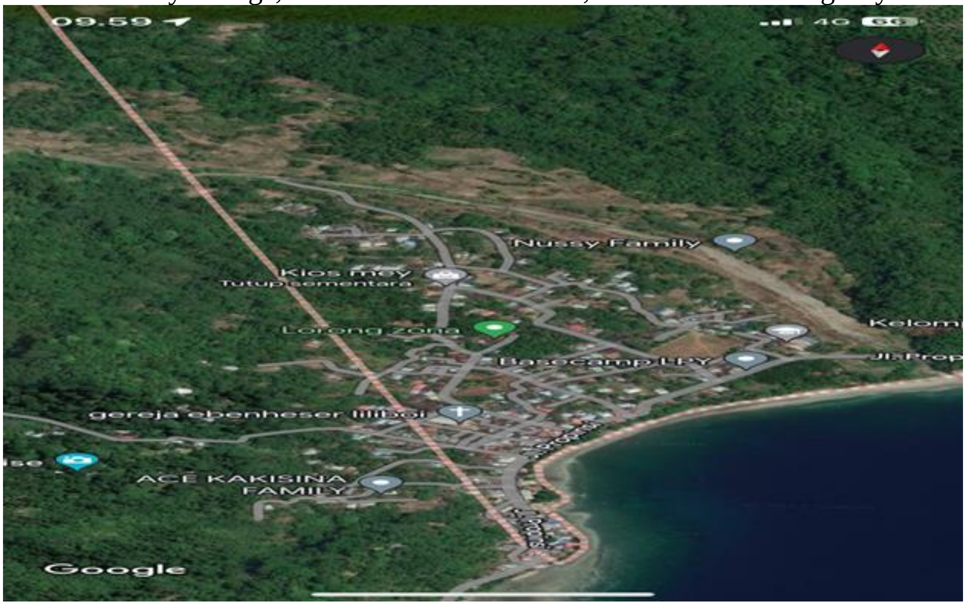

Figure 1 Research location

Data type

The types of data used in this study are:

a. Primary Data

Primary data is obtained by taking and measuring in the field in the form of observing and recording water conditions at water sources in Liliboy Village.

b. Secondary Data

Primary data obtained from Liliboy Village in the form of population data

Data Collection Technique

Data collection is done by means of:

The literature technique is a library approach that is carried out in order to obtain information through relevant books and observation techniques (observation) is direct observation in the field to obtain supporting data in this study.

Data source

As for the source of data sourced from : Liliboy Village in the form of population data

Research variables

A research variable is something that becomes the object of research observation, often also referred to as a factor that plays a role in research or symptoms to be studied. The variables used in this study include:

a. Clean Water Requirement
b. Population Growth
c. Water Discharge
d. Reservoir Design Kebutuhan Air Bersih

Analysis method

In the analysis stage, calculating existing data is done to find the rate of change of each element and determine the water demand. The data required in terms of quantity is the increase in population over the last 10 years, then the data is analysed using formulas to find the need for clean water for the next 10 years. The data processing is arranged as follows:

a. Population estimation

Geometric method

Arithmetic method

b. Water demand

Domestic demand

Non-domestic demand

Total water demand

c. Calculation of water discharge

Discharge plan

Gravity transmission system

Cross-sectional area of the pipe

Flow velocity in the pipe
Reynold's number
d. Reservoir Design
Total water demand
Calculating reservoir volume

Flow chart

From the research stages described above, the following is provided a research flow chart

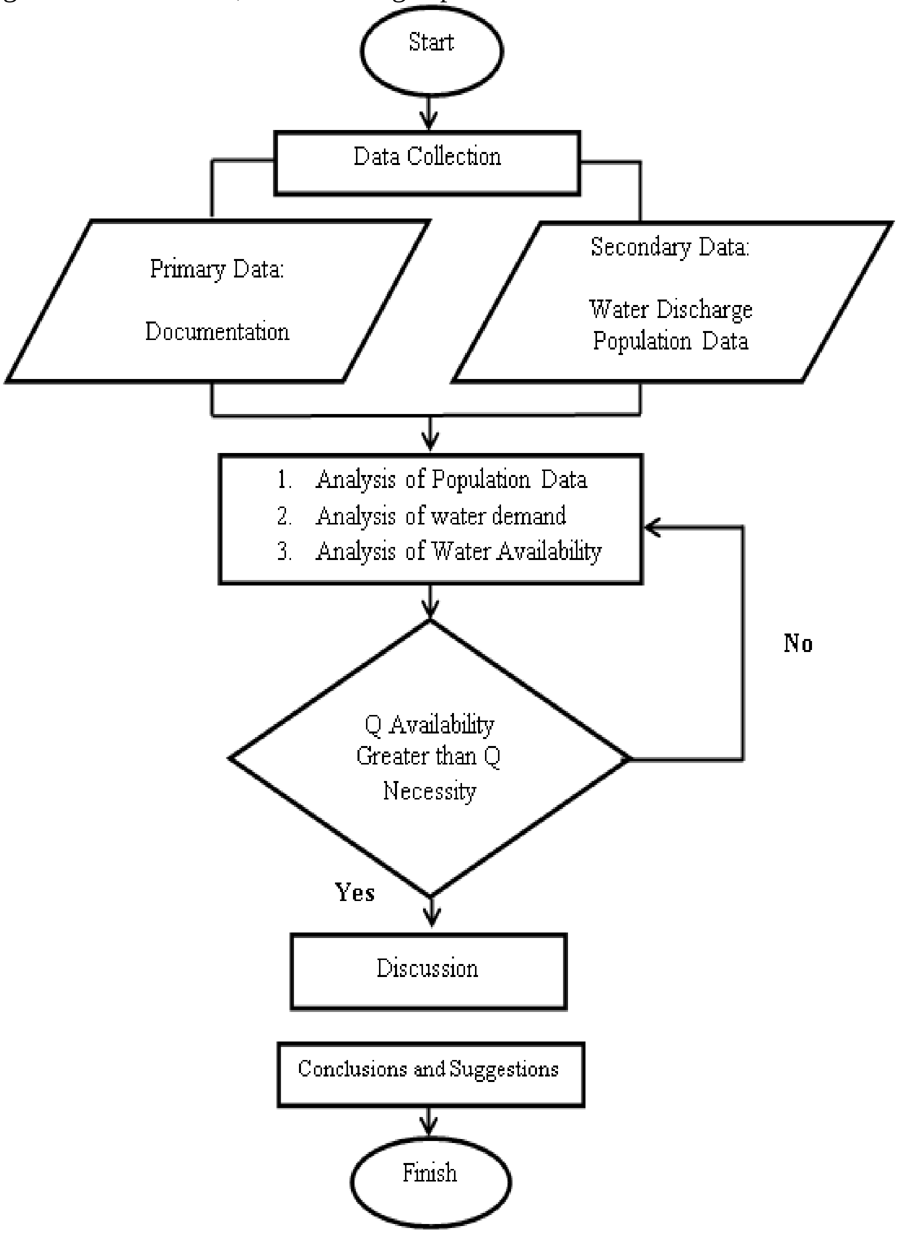

Figure 2 Research Flowchart

III. ANALYSIS AND DISCUSSION

Calculating Water Availability

a. Population Growth Analysis

Population data of Liliboy Village, West Leihitu Sub-District, Central Maluku Regency

Table 1 Population data

No	Year	Total Population (Soul)
1	2017	529
2	2018	236
3	2019	538
4	2020	532
5	2021	537
6	2022	542

Table 2 Calculation of Population Projections for 2022 to 2032 10-Year Projection

No	Year	N	Arithmetic	Geometrics
			Pn= 542+3*n	Pn=542 (1+0.005)^n
1	2022	0	542	542
2	2023	1	545	545
3	2024	2	547	547
4	2025	3	550	550
5	2026	4	552	553
6	2027	5	555	555
7	2028	6	558	558
8	2029	7	560	561
9	2030	8	563	564
10	2031	9	565	566
11	2032	10	568	569

b. Geometric Method Population Projection Calculation

- Pn (2023) = $542\ (1 + 0.005)^1$
  = 545
- Pn (2024) = $542\ (1 + 0.005)^2$
  = 547
- Pn (2025) = $542\ (1 + 0.005)^3$
  = 550
- Pn (2026) = $542\ (1 + 0.005)^4$
  = 553
- Pn (2027) = $542\ (1 + 0.005)^5$
  = 555
- Pn (2028) = $542\ (1 + 0.005)^6$
  = 558
- Pn (2029) = $542\ (1 + 0.005)^7$
  = 561
- Pn (2030) = $542\ (1 + 0.005)^8$
  = 564
- Pn (2031) = $542\ (1 + 0.005)^9$
  = 566
- Pn (2032) = $542\ (1 + 0.005)^{10}$
  = 569

c. Calculation of Population Projection by Arithmetic Method

- Pn (2023) = 542 + 3 x 1
  = 545
- Pn (2024) = 542 + 3 x 2
  = 547
- Pn (2025) = 542 + 3 x 3

= 550
- Pn (2026) = 542 + 3 x 4

= 552
- Pn (2027) = 542 + 3 x 5

= 555
- Pn (2028) = 542 + 3 x 6

= 558
- Pn (2029) = 542 + 3 x 7

= 560
- Pn (2030) = 542 + 3 x 8

= 563
- Pn (2031) = 542 + 3 x 9

= 565
- Pn (2032) = 542 + 3 x 10

= 568

d. Calculating the Total Water Needs in Liliboy Village, West Leihitu Sub-district

Calculation of population projections for 2022 - 2032 in Liliboy Village, West Leihitu District, Central Maluku Regency.

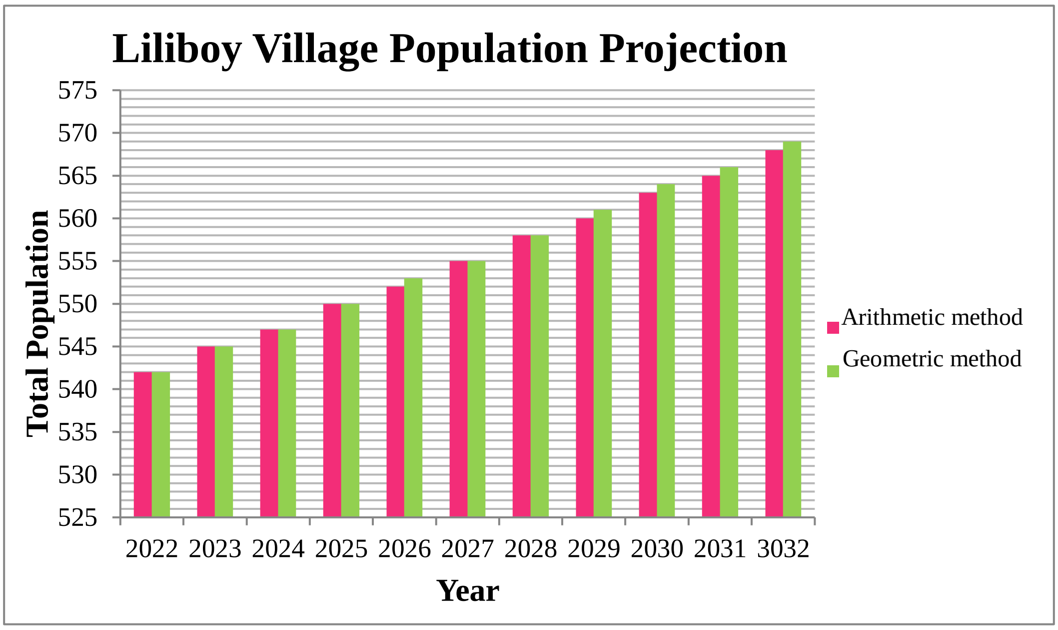

Figure 3 Liliboy Village Population Projection Chart

According to International Standards the water consumption for public hydrant connections is : 125 litres/person/day

e. Domestic Sector Analysis

The availability of clean water in Liliboy Village comes from a water source that is channeled through a reservoir measuring 3,40 m x 3,40 m x 4 m with a distance of 410 Km, then flowed to a distribution tub measuring 4,30 m x 4,30 m x 4,80 m litres with a distance of 870 Km, and flowed to settlements using distribution pipes with a distance of 670. Accompanied by a water distribution network system using public taps to residents' homes.

Table 3 Domestic Sector Analysis

No	Year	Total Population (Soul)	Average Water Consumption Litres/person/day	Total Usage Litres/day
1	2022	542	125	67750
2	2023	545	125	68082
3	2024	547	125	68416
4	2025	550	125	68752
5	2026	553	125	69089
6	2027	555	125	69428
7	2028	558	125	69768
8	2029	561	125	70110
9	2030	564	125	70454
10	2031	566	125	70800
11	2032	569	125	71147

Total clean water demand for the Liliboy Village community:

Total Population (2022) = 542 people

Standard Water Requirement/litre/person/day = 125 litres/person/day

- Clean water demand (2022) 125 x 542 = 67.750 litres/person/day
- Clean water demand (2023) = 125 x 545 = 68.082 litres/person/day
- Clean water demand (2024) = 125 x 547 = 68.416 litres/person/day
- Clean water demand (2025) = 125 x 550 = 68.752 litres/person/day
- Clean water demand (2026) = 125 x 553 = 69.089 litres/person/day
- Clean water demand (2027) = 125 x 555 = 69.428 litres/person/day
- Clean water demand (2028) = 125 x 558 = 69.768 litres/person/day
- Clean water demand (2029) = 125 x 561 = 70.110 litres/person/day
- Clean water demand (2030) = 125 x 564 = 70.454 litres/person/day
- Clean water demand (2031) = 125 x 566 = 70.800 litres/person/day
- Clean water demand (2032) = 125 x 569 = 71.147 litres/person/day

f. Non-Domestic Sector Analysis

1) Clean water requirement for the Church

Gereja Desa Liliboy = 542 people

Clean water requirement for the Church = 15 litres/person/day

So the water requirement for the Church = 15 x 542 = 8.130 litres/person/day

2) Clean water needs at the village office

Number of village staff = 12 people

Clean water needs in the office = 40 litres/person/day

So the water requirement for the office = 40 x 12 = 480 litres/person/day

3) Domestic water demand at school

Number of schools in Liliboy village = 3 schools

Water requirement for School = 30 litres/person/day

So the water requirement for the school = 30 x 3 = 90 litres/person/day

4) Total water demand

So the total clean water demand for the Liliboy Village community:

= 67750 + 8130 + 480 + 90

= 76450 litres/day

= 76,450 m^3/day

Because it is feared that there are leaks in the channel, it must be multiplied by a factor (x) according to Hazen William. So maximum water demand = 76,450 m^3/day x 1,12 = 85,624 m^3/day = 85,624 litres/day

Calculation of Water Discharge

Experiment using the tampin method using a 15 litre bucket

Table 4 Experimental water discharge

Experiment	**Time (seconds)**
P1	5,11
P2	5,27
P3	5,59
P4	4,86
P5	4,63
P6	5,29
P7	4,38
P8	4,52
P9	4,71
P10	5,07
Total	49,43
Average	4,94

Average = 49,43 / 10 = 4,94 litres

Volume = 150/10 = 15 liter = 0,015 m^3

Q = 0,015/4,94 = 0,003 m^3

a. Analysing Pipe Diameter

Clean water management in Liliboy Village, water is flowed by gravity from the spring to a reservoir with tub dimensions of 4,30 m x 4,30 m x 4 m with a distance of 400 m, then flowed to a distribution tub with a tub size of 4,30 m x 4,30 m x 4,80 m with a distance of 800 metres and flowed to settlements using distribution pipes to the 600 m Research location.

1) Determining the diameter of the pipe from the water source to the reservoir can be calculated using the following equation:

$D = 0{,}66\,[(214{,}75 \times v \times Q \times b)^{6,25} + 2^{1,25}(b \times Q^2)^{4,75} + v \times Q^{9,4}\, b^{5,2}]^{0,04}$

Where :

Q = Plan water discharge (m^3/ Second)

b = L/(g x hf)

hf = large height loss due to pressure by the pipe surface (m)

L = pipe length (m)

T = temperature in the pipe (O_c)

v = kinematic viscosity (m^2/second)

Z_0 = shelter elevation (m)

Z_1 = elevation of the review point (m)

Known :

Q = 0,003 m^3/second

L = 400 m

T = 25°C

Z_0 = 64 m

Z_1 = 56 m

g = 9,81

Asked : Pipe Diameter (D)……..?

Answer :

Kinematic Value (v)

V = $1{,}792 \times 10^{-6}\,(1[T/25]^{1,165})^1$

= $1{,}792 \times 10^{-6}\,(1[25/25]^{1,165})^1$

= 1,792 x 10^{-6} x 0,5
= 8,96 x 10^{-7} m^3/second
Large height Loss Value (b)
hf = Z_0 - Z_1 = 64 m - 56 m = 8 m
b = L/ g x hf
= 400/9,81 x 8
= 5,09
Pipe Diameter
D = $0,66\ [(214,75 \times v \times Q \times b)^{6,25} + 2^{1,25}(b \times Q^2)^{4,75} + v \times Q^{9,4} \times b^{5,2}]^{0,04}$
= $0,66\ [(214,75 \times 8,96 \times 10^{-7} \times 0,003 \times 5,09)^{6,25} + 2^{1,25}(5,09 \times 0,003^2)^{4,75} + 8,96 \times 10^{-7} \times 0,003^{9,4} \times 5,09^{5,2}]^{0,04}$
= $0,66\ [\ 2,83 \times 10^{-35} + 2^{1,25}(4,67 \times 10^{-5})^{4,75} + 8,97 \times 10^{-27}]^{0,04}$
= $0,66\ [\ 2,83 \times 10^{-35} + 2^{1,25}(2,68 \times 10^{-21}) + 8,97 \times 10^{-27}]^{0,04}$
= $0,66\ [\ 2,83 \times 10^{-35} + 6,37 \times 10^{-21} + 8,97 \times 10^{-27}]^{0,04}$
= 0,66 x 0,1556
= 0,10269 > 10,269 / 2,54 = 4,04 > 4 inches

2) Determining the diameter of the pipe from the reservoir to the distribution basin can be calculated using the following equation :
D = $0,66\ [(214,75 \times v \times Q \times b)^{6,25} + 2^{1,25}(b \times Q^{\wedge}2)^{4,75} + v \times Q^{9,4} \times b^{5,2}\ ]^{0,04}$
Where :
Q = Plan water discharge (m^3/second)
b = L/(g x hf)
hf = large height loss due to pressure by the pipe surface (m)
L = pipe length (m)
T = temperature in the pipe (O_c)
v = kinematic viscosity (m^2/second)
Z_0 = shelter elevation (m)
Z_1 = elevation of the review point (m)
Known :
Q = 0,003 m^3/second
L = 800 m
T = 25°C
Z0 = 56 m
Z1 = 34 m
g = 9,81
Asked: Pipe Diameter (D)……..?
Answer :
Kinematic Value (v)
V = 1,792 x 10-6 (1[T/25]1,165)1
= 1,792 x 10-6 (1[25/25]1,165)1
= 1,792 x 10-6 x 0,5
= 8,96 x 10-7 m3/second
Large height Loss Value (b)
hf = Z0 - Z1 = 56 m - 34 m = 22 m
b = L/ g x hf
= 800/9,81 x 22
= 3,70
Pipe Diameter
D = $0,66\ [(214,75 \times v \times Q \times b)^{6,25} + 2^{1,25}(b \times Q^2)^{4,75} + v \times Q^{9,4} \times b^{5,2}]^{0,04}$
= $0,66\ [(214,75 \times 8,96 \times 10^{-7} \times 0,003 \times 3,70)^{6,25} + 2^{1,25}(3,70 \times 0,003^2)^{4,75} + 8,96 \times 10^{-7} \times 0,003^{9,4} \times 3,57^{5,2}]^{0,04}$
= $0,66\ [\ 3,86 \times 10^{-36} + 2^{1,25}(3,39 \times 10^{-5})^{4,75} + 1,70 \times 10^{-27}]^{0,04}$
= $0,66\ [\ 3,86 \times 10^{-35} + 2^{1,25}(5,86 \times 10^{-22}) + 1,70 \times 10^{-27}]^{0,04}$
= $0,66\ [\ 3,86 \times 10^{-35} + 1,39 \times 10^{-21} + 1,70 \times 10^{-27}]^{0,04}$
= 0,66 x 0,1464
= 0,076 > 7,6 / 2,54 = 2,99 > 3 inches

3) Determining the diameter of the pipe from the reservoir to the distribution basin can be calculated using the following equation :

D = 0,66 [(214,75 ×v× Q×b)^{6,25} + 2^{1,25} (b×Q^2)^{4,75} + v ×Q^{9,4} b^{5,2}]^{0,04}
Where :
Q = Plan water discharge (m^3/second)
B = L/(g x hf)
Hf = large height loss due to pressure by the pipe surface (m)
L = pipe length (m)
T = temperature in the pipe (O$_c$)
v = kinematic viscosity (m^2/second)
Z_0 = shelter elevation (m)
Z_1 = elevation of the review point (m)
Known :
Q = 0,003 m^3/second
L = 600 m
T = 25°C
Z_0 = 34 m
Z_1 = 6 m
g = 9,81
Asked : Pipe Diameter (D)……..?
Answer :
Kinematic Value (v)
V = 1,792 x 10-6 (1[T/25]1,165)1
= 1,792 x 10-6 (1[25/25]1,165)1
= 1,792 x 10-6 x 0,5
= 8,96 x 10-7 m^3/second
Large height Loss Value (b)
hf = Z0 - Z1 = 34 m - 6 m = 28 m
b = L/ g x hf
= 400/9,81 x 28
= 2,18
Pipe Diameter
D = 0,66 [(214,75 x v x Q x b)^{6,25} + 2^{1,25} (b x Q^2)^{4,75} + v x Q^{9,4} x b^{5,2}]^{0,04}
= 0,66 [(214,75 x 8,96 x 10^{-7} x 0,003 x 2,18)^{6,25} + 2^{1,25} (2,18 x 0,003^2)^{4,75} + 8,96 x 10^{-7} x 0,003^{9,4} x 2,18^{5,2}]^{0,04}
= 0,66 [1,41 x 10^{-37} + 2^{1,25} (2,00 x 10^{-5})^{4,75} + 1,09 x 10^{-28}]^{0,04}
= 0,66 [1,41 x 10^{-37} + 2^{1,25} (4,78 x 10^{-23}) + 1,09 x 10^{-28}]^{0,04}
= 0,66 [1,41 x 10^{-37} + 1,13 x 10^{-23} + 1,09 x 10^{-28}]^{0,04}
= 0,66 x 0,120
= 0,526 > 5,26 / 2,54 = 2,07 > 2 inches
Reservoir Capacity :
3,4 m x 3,4 m x 4 m = 46 m^3
Reservoir Capacity
- Long = 4,30 m
- Width = 4,30 m
- High = 3,80 m
- Air chamber height = 1 m
- Volume = 88,00 m^3

b. Analysing Water Discharge by Gravitational Force
1) Calculating the Debit of Water Flowed from the Source to the Reservoir using a 4 inch diameter pipe
Known :
D =Ø4 = 10,16 / 100 = 0,1016
g = 9,81
L = 400 m
T = 25°C
Z_0 = 64 m
Z_1 = 56 m
* Kinematic value
V = 1,792 x $10^{-6}(1 + [\frac{T}{25}]^{1,165})^{-1}$

$= 1{,}792 \text{ x } 10^{-6}(1 + [\frac{25}{25}]^{1{,}165})^{-1}$
$= 1{,}792 \text{ x } 10^{-6} \text{x } 0.5$
$= 8{,}96 \text{ x } 10^{-7}$
∈ $= 0{,}05 = 5 \text{ x } 10^{-5}$
Asked : Water Discharge (Q)………?
Answer :
Greatest loss value :
Hf $= Z_0 - Z_1 = 64 \text{ m} – 56\text{m} = 8 \text{ m}$

$$Q = -0{,}956.D^2 \left[\frac{g.D.hf}{L}\right] ln\left(\frac{\epsilon}{3.7\,.D} + \frac{1{,}78 * v}{g.D.hf}\left[\frac{L}{g.D.hf}\right]^{0{,}5}\right)$$

$$Q = -0{,}956\text{x}0{,}1^2 \left[\frac{9{,}81\text{x}0{,}1\text{x}8}{400}\right] \ln\left(\frac{5\text{x}10^{-5}}{3{,}7\text{x } 0{,}1} + \frac{1{,}78\text{x } 8{,}96 \text{ x } 10^{-7}}{9{,}81\text{x}0{,}1\text{x}8}\left[\frac{400}{9{,}81\text{x}0{,}1\text{x}8}\right]^{0{,}5}\right)$$

= 0,001670
= 1,67 litres/second
Recheck the flow type:
Calculate the cross-sectional area of the pipe
A $= \frac{1}{4}\,.\pi.D^2$
A $= \frac{1}{4} \text{ x } 3{,}14 \text{ x}(0{,}1)^2 = 0{,}00785 \text{ m}^2$
Calculating the speed of water flow in a pipe
v $= Q/A$
v $= \frac{0{,}001670}{0{,}00785}$
v $= 0{,}21$ m/second
Reynolds number
R $= \frac{V.D}{v}$
R $= \frac{0{,}21 \text{ x } 0{,}1}{8{,}96 \text{ x } 10^{-7}}$
= 22, 44⟶ The flow type is Turbulent, as R > 4000

2) Calculating the Debit of Water Flowed from the Reservoir to the Distribution Tub using a 3 inch diameter pipe
Known :
D = Ø3 = 8 cm = 0,08
g = 9,81
L = 800 m
T = 25°C
Z_0 = 56 m
Z_1 = 34 m
* Kinematic value
V $= 1{,}792 \text{ x } 10^{-6}(1 + [\frac{T}{25}]^{1{,}165})^{-1}$
$= 1{,}792 \text{ x } 10^{-6}(1 + [\frac{25}{25}]^{1{,}165})^{-1}$
$= 1{,}792 \text{ x } 10^{-6} \text{x } 0.5$
$= 8{,}96 \text{ x } 10^{-7}$
∈ $= 0{,}05 = 5 \text{ x } 10^{-2}$
Asked: Water Discharge (Q)………?
Answer :
Greatest Loss Value :
Hf $= Z_0 - Z_1 = 56 \text{ m} – 34 \text{ m} = 22 \text{ m}$

$$Q = -0{,}956.D^2 \left[\frac{g.D.hf}{L}\right] ln\left(\frac{\epsilon}{3.7\,.D} + \frac{1{,}78 * v}{g.D.hf}\left[\frac{L}{g.D.hf}\right]^{0{,}5}\right)$$

$$Q = -0{,}956\text{x}0{,}08^2 \left[\frac{9{,}81\text{x}0{,}08\text{x}22}{800}\right] \ln\left(\frac{5\text{x}10^{-2}}{3{,}7\text{x}0{,}08} + \frac{1{,}78\text{x } 8{,}96 \text{ x } 10^{-7}}{9{,}81\text{x}0{,}08\text{x}22}\left[\frac{800}{9{,}81\text{x}0{,}08\text{x}22}\right]^{0{,}5}\right)$$

= 0,001146
= 1,14 litres/second

Recheck the flow type :
Calculating the cross-sectional area of a pipe

A $= \frac{1}{4} . \pi . D^2$

A $= \frac{1}{4}$ x 3,14 x$(0,08)^2$ = 0,0052 m^2

Calculating the speed of water flow in a pipe

v = Q/A

v $= \frac{0,001146}{0,0052}$

v = 0,22 m/det

Reynold's number

R $= \frac{V.D}{v}$

R $= \frac{0,22 \text{ x } 0,08}{8,96 \text{ x } 10^{-7}}$

= 19,64⟶ The flow type is Turbulent, as R > 4000

3) Calculating the Debit of Water Flowed from the Distribution Tub to Residents' Settlements using a 2 inch diameter pipe

D =Ø2 = 5 cm = 0,05
g = 9,81
L = 600 m
T = 25°C
Z_0 = 34 m
Z_1 = 6 m

* Kinematic value

V $= 1,792 \text{ x } 10^{-6}(1 + [\frac{T}{25}]^{1,165})^{-1}$

$= 1,792 \text{ x } 10^{-6}(1 + [\frac{25}{25}]^{1,165})^{-1}$

$= 1,792 \text{ x } 10^{-6}\text{x } 0.5$

$= 8,96 \text{ x } 10^{-7}$

$\in$ $= 0,05 = 5 \text{ x } 10^{-2}$

Asked: Water Discharge (Q)………?

Answer :

Greatest Loss Value :

Hf $= Z_0 - Z_1 = 34$ m – 6 m = 16 m

$$Q = -0,956 . D^2 \left[\frac{g.D.hf}{L}\right] ln\left(\frac{\epsilon}{3.7 . D} + \frac{1,78 * v}{g.D.hf}\left[\frac{L}{g.D.hf}\right]^{0,5}\right)$$

$$Q = -0,956x0,05^2\left[\frac{9,81x0,05x28}{600}\right] \ln\left(\frac{5x10^{-5}}{3,7x0,05} + \frac{1,78x\ 8,96 \text{ x } 10^{-7}}{9,81x0,05x28}\left[\frac{600}{9,81x0,05x28}\right]^{0,5}\right)$$

= 0,000449

= 0,44 litres/second

Recheck the flow type :

Calculating the cross-sectional area of a pipe

A $= \frac{1}{4} . \pi . D^2$

A $= \frac{1}{4}$ x 3,14 x$(0,5)^2$ = 0,001962 m^2

Calculating the speed of water flow in a pipe

v = Q/A

v $= \frac{0,000449}{0,001962}$

v = 0,23 m/second

Reynolds number

R $= \frac{V.D}{v}$

R $= \frac{0,23 \text{ x } 0,05}{8,96 \text{ x } 10^{-7}}$

= 12,83 ⟶ The flow type is Turbulent, as R > 4000

c. Calculating Liliboy Village Reservoir Capacity

The existing reservoir capacity in 2022 is 46 m³.

To meet the water demand until 2032, it is necessary to conduct the following analysis:

Based on the results of the analysis, the total clean water demand of the Liliboy Kara Village community is 76,450 litres/day, obtained from:

Total domestic sector water demand + total non-domestic sector water demand.

= 67750 + (8130+480+90)

= 76.450 litres/day

Then multiplied by the water loss (x) = 1,12

= 76.450 litres/day x 1,12

= 85624 litres/day

Then the maximum water demand = 85,45 m^3. So the dimensions of the reservoir capacity :

Long = 4,30 m

Width = 4,30 m

High = 3,80 m

Air chamber height = 1 m

Reservoir basin dimensions = Length x width x (height + airspace height)

= 4,30 m x 4,30 m x (3,80 m + 1 m)

= 88,00 m^3

Based on the results of the analysis, the total water demand is 76,450 litres/day. To get the maximum water demand, the total clean water demand is multiplied by 1,12 water loss value, obtained 85,624 litres/day. Then the reservoir capacity is designed according to the maximum water demand but plus a height of 1 m as air space. With dimensions of 4,30 m x 4,30 m x (3,80 m + 1 m) = 88,00 m^3.

IV. CLOSING

Conclusion

The conclusion obtained from this research is the availability of clean water needs with a discharge of 85,45 m³ / day and the capacity of the reservoir for clean water storage of 88,00 m^3 so that it can meet the needs of clean water in the village of Liliboy prediction for the next 10 years in 2032.

REFERENCES:

1. Darmayasa, I. K. A., Aryastana, P., & Rahadiani, A. A. S. D. (2018). Analysis of Clean Water Needs of the Petang Subdistrict Community. PADURAKSA: Journal of Civil Engineering, Warmadewa University, 7(1), 41-52.
2. Fadli, F. (2022). Analysis of Clean Water Availability and Needs in Komodo District, West Manggarai Regency. (Doctoral dissertation, Universitas_Muhammadiyah_Mataram).
3. Husain S,K Water Suplay And Sanitary Engginering 1978.
4. Kalensun, H. 2016. Planning of Water Distribution Network System. Yogyakarta, UGM Press.
5. Marasabessy, I., Maelissa, N., & Serang, R. (2023). Evaluation of the Availability of Clean Water Needs and Countermeasures in Lokki Hamlet, Lokki Village, Huamual Sub-district, West Seram Regency. Manumata: Journal of Engineering Science, 9(1), 47-56..
6. Maulida Pratama, D. (2017). Analysis of clean water demand and availability in sukamulia sub-district, east Lombok district (Doctoral dissertation, Mataram University).Review, 1(1), 18-24.
7. Rahayu S, et al.2009.Bogor Stream Debit PTP aradnya Paramita.
8. Raswari. 2007. Planning and Drawing of Plumbing Systems. Jakarta: Prenadamedia Group.
9. Salilama, A., Ahmad, D., & Madjowa, N. F. (2018). Analysis of Clean Water Needs (PDAM) in Gorontalo City Area. RADIAL: Journal of Science, Engineering and Technology Civilisation, 6(2), 102-114.
10. Triarmadja, R. (2019). Piped drinking water supply engineering. UGM PRESS.
11. Willyam, B. (2019). Review of Clean Water Needs and Distribution in Sri Meranti Village, Rumbai Subdistrict (Doctoral dissertation, Riau Islamic University).
12. Yuliani, Y., & Rahdriawan, M. (2014). Performance of community-based clean water services in Tugurejo, Semarang City. Journal of Urban & Regional Development, 10(3), 248-264.