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ANALYSIS OF PIPE NETWORK OPTIMIZATION FOR RAW WATER IN JABUNG SUB-DISTRICT, MALANG DISTRICT

Putut Subandriyo[1*], Laksono Djoko Nugroho[2], Haris Muhammadun[3]
[1-3]Civil Engineering Study Program, Faculty of Engineering, Universitas 17 Agustus Surabaya
E-mail: [1)] gentfu@gmail.com

Abstract

Jabung District is a sub-district located in the Malang Regency area of 135.89 km2 or around 4.56 percent of the total area of Malang Regency. This sub-district consists of 15 villages, including Argosari, Gadingkembar, Gunungjati, Jabung, Kemantren, Kemiri, Kenongo, Ngadirejo, Pandansari Lor, Sidomulyo, Sidorejo, Slamparejo, Sukolilo, Sukopuro, and Taji. With a population of 74,311 people in 2020, with a population density of 592 people/km2. In Jabung District, especially in 4 villages, including Pandansari Lor Village, Gading Kembar Village, Argosari Village, and Kemiri Village, there is currently a water shortage. Siuk Source Potential has water potential large enough to meet the standard needs in these 4 villages by gravity. From the results of instantaneous discharge measurements during the dry season in 2021, it can be seen that the discharge in Sumber Siuk is 65 l/sec, and the planned collection to fulfill these 4 villages is 20 l/sec. Construction of the broncaptering and raw water distribution network was built in 3 stages. Before the physical implementation of the installation of distribution pipes in stage 3, a trial run was carried out from stage 1 and stage 2.

Keywords: *Raw Water, Pipe Network, Optimization*

1. INTRODUCTION

Water is an extraordinary substance that is blessed by Allah SWT. Water can flow, change, pass through various obstacles to the flow through it. The existence of water in nature is very dependent on the surrounding natural environment and its channels, which continuously flow following the hydrological cycle or water cycle, namely moving from the ocean to the earth and back to the ocean, and so on.

Raw water sources used for drinking water needs can consist of springs, surface water (rivers, lakes, reservoirs, etc.), groundwater (dug wells, boreholes) and rainwater. In terms of water quality, the quality of spring water compared to surface water is generally relatively clear, so it is better to use spring water compared to surface water. However, the existence of springs is currently decreasing. Due to subsidence problems, groundwater, which usually has a higher iron and manganese content relative to other water sources, must be reduced or stopped. Rainwater, whose availability depends on the season, can still be used as a source of raw water by building large tanks or ponds.

Kecamatan Jabung is a kecamatan in Malang Regency with an area of 135.89 km2 or about 4.56 percent of the area of Malang Regency. The sub-district consists of 15 villages, including Argosari, Gadingkembar, Gunungjati, Jabung, Kemantren, Kemiri, Kenongo, Ngadirejo, Pandansari Lor, Sidomulyo, Sidorejo, Slamparejo, Sukolilo, Sukopuro and Taji. The population at the end of 2022 was 76,970 people and the population density was 566.41 people per square kilometer.

In Jabung Subdistrict, especially in 4 villages including Pandansari Lor Village, Gading Kembar Village, Argosari Village, and Kemiri Village, there is currently a shortage of water in meeting daily raw water needs. Based on the recording of BPS Malang Regency in 2023 in figures for each village, among others: Pandansari Lor Village 4,594 people, Gading Kembar Village 4,625 people, Argosari Village 4,234 people and Kemiri Village 6,139 people. Currently, these 4 villages rely on springs and surface water in the vicinity with decreasing discharge. The distribution network developed by the community is currently still makeshift and self-supporting by the village community. So that in 2019 the construction of a water catcher (broncaptering) and raw water distribution network was carried out which took from Sumber Siuk in Taji Village, Jabung District.

Siuk Source has a large enough water potential to meet raw water needs in the four villages by gravity (energy efficiency). From the results of instantaneous discharge measurements in the dry season in 2021, it can be seen that the existing discharge at Siuk Source is 51.30 l / d, and the withdrawal plan for the fulfillment of the 4 villages is 15 l /d.

The construction of water catchers (broncaptering) and raw water distribution pipelines built through 3 stages of development. In stage 1, 9,131.90 m of broncaptering, reservoirs, and distribution networks were built, stage 2 continued the installation of 10,254.90 meters of raw water distribution pipes, and stage 3 also continued the installation of 5,822.20 m of distribution pipes and the construction of reservoirs in Kemiri Village. Prior to the installation of stage 3 distribution pipes, stage 1 and stage 2 flow tests were carried out. The pipe material for stage 1 and stage 2 lines is PVC pipe Ø 6 "Type RRJ-S10 and some Galvanized Iron pipes on bridges / river crossings, while for stage 3 a distribution pipeline is planned that goes to Kemiri Village services with the same pipe specifications, namely PVC pipe Ø 6 "Type RRJ-S10 and HDPE PN 16 pipes totaling 5,822 m with a demand discharge of 7 l / d. The results of stage 1 and stage 2 flow tests are shown in Figure 1. The results of Phase 1 and Phase 2 flow testing on the distribution pipe show that there are several points where the pipe is broken and leaking. High pressure is a problem caused by intermittent water flow, bursts and leaks, and the communities in these four villages have high hopes for Sumber Siuk water to meet their raw water needs (PIPEFLOW.CO.UK. 2017).

To obtain results that are in accordance with expectations from both technical and non-technical aspects by making the right choice in the selection of components and materials, it is important to conduct research on the “ANALYSIS OF OPTIMIZATION OF PIPE NETWORKS FOR BAKU WATER” as well as rechecking the system from the source of Siuk to the last distribution pipe network, this is considering that there are still broken pipes at several points so that water cannot optimally serve residents in 4 villages(Sulistyarso 2015).

2. RESEARCH METHODS

The location of this research is located in Jabung District, which is a sub-district located in Malang Regency. Data collection instruments are tools selected and used by researchers in their activities to collect data so that these activities become systematic and

made easier by them (Sugiyono 2018). Furthermore, instruments defined as tools are means that can be realized in tools and materials.

In this study, the data collection methods used were observation, observation, and documentation. The type of data used in this study is primary data in the form of observation. Observations were made on:

a. The location of the raw water service area plan, namely pandansari lor village, gading kembar village, kemiri gede village and argosari village (Amin, Maricar, and Hatta 2021).
b. Location of coban siuk raw water source intake plan Location of existing distribution pipe network.

Secondary data is obtained from sources that can support research, including documentation and literature. The secondary data required in this study are as follows:

a. Geospatial Information Agency earth map Scale 1: 25.000.
b. Topogarfi measurement data from Coban Siuk to the service area.
c. Coban Siuk water source water discharge measurement data.
d. Satellite Image Recording.
e. BPS data 2023 in figures Jabung District Malang Regency.
f. According to Minister of Health Regulation No. 492/2010 on raw water quality guidelines.
g. Minister of Public Works and Public Housing Regulation No. 27/PRT/M/2016 of 2016 concerning guidelines for the implementation of raw water supply.
h. Indonesian National Standard (SNI) on pipe material and material specifications (Indonesia 2008)(Nasional 2002).

The data analysis carried out in this study is as follows:

a. Water Source Analysis

Conduct analysis and identification based on the data obtained on water sources that have sufficient water potential to meet raw needs in the service area by gravity and in accordance with the Regulation of the Minister of Health of the Republic of Indonesia Number 492 / MENKES / PER / IV / 2010 concerning Drinking Water Quality Requirements (Permenkes 2010).

b. Analysis of Existing Distribution Pipe Network

Identify and analyze based on the data obtained on the existing distribution pipe network from the water source to the service area(Natara 2018).

c. Population Growth Projection Analysis

Analyze the projected development of the population for the next few years based on the records of BPS Malang Regency Jabung District in numbers.

d. Evaluation of Pipe Hydraulics

In evaluating pipe hydraulics, the Clean Water Distribution Network System Components are modeled in the WaterCAD program, the components of the clean water distribution network system such as reservoir points, pipes, junctions, reservoirs are

modeled in such a way as to approach the performance of these components in the field(PUPR 2017).

e. Distribution Pipe Network Analysis

Analysis of the Clean Water Distribution Network System. after the network is drawn and all components are arranged as desired, then to analyze the network system, running (calculate) is carried out (Novianti, Salim, and Setyaningtias 2022).

3. RESULTS AND DISCUSSION

3.1. Projected Total Population Growth

As time goes by, the total population will also grow as well as what happens in the Jabung sub-district of Malang Regency, especially in several villages in the study to be carried out including Pandansari Lor Village, Gading Twin Village, Argosari Village and Kemiri Gede Village.

This method is often referred to as the population growth rates method. Projections based on population growth rates assume constant growth, either for arithmetic, geometric, or exponential models to estimate population numbers.

Table 1. Total Population

Desa	Jumlah Penduduk (jiwa)				
	2018	2019	2020	2021	2022
Kenongo	2.761	2.859	2.606	2.666	2.728
Ngadirejo	2.215	2.291	2.067	2.035	2.094
Taji	1.309	1.333	1.206	1.264	1.285
Pandansari Lor	4.588	4.913	4.411	4.530	4.594
Sukopuro	6.527	6.712	6.129	6.154	6.262
Sidorejo	4.193	4.314	4.019	4.081	4.153
Sukolilo	6.054	6.219	5.902	5.989	6.165
Sidomulyo	4.829	4.956	4.563	4.590	4.769
Gadingkembar	4.682	4.800	4.540	4.553	4.625
Kemantren	12.070	12.193	11.452	11.473	11.676
Argosari	4.267	4.373	3.985	4.137	4.234
Slamparejo	5.640	5.744	5.492	5.464	5.578
Kemiri	6.080	6.301	5.762	5.901	6.139
Jabung	9.445	9.541	8.583	8.692	8.932
Gunungjati	3.801	3.961	3.594	3.656	3.736
Total	**78.461**	**80.510**	**74.311**	**75.185**	**76.970**

Sumber : Kecamatan Jabung Dalam Angka 2019 - 2023

Desa	Jumlah Penduduk (jiwa)				
	2018	2019	2020	2021	2022
Pandansari Lor	4.588	4.913	4.411	4.530	4.594
Gadingkembar	4.682	4.800	4.540	4.553	4.625
Argosari	4.267	4.373	3.985	4.137	4.234
Kemiri	6.080	6.301	5.762	5.901	6.139
Jumlah	19.617	20.387	18.698	19.121	19.592

Sumber : Kecamatan Jabung Dalam Angka 2019 - 2023

Source: Jabung Sub-district in 2019-2023

r = (4.594/4.588) x (1 / 5) – 1
r = 0.000
Pn = 4.594 x (1 + 0.000)^2
Pn = 4.595

The projected population growth until 2041 can be seen in the following table:

Table 2. Projected Population of Pandansari Lor Village

Tahun	Proyeksi Jumlah Penduduk			
	Aritmatika (Jiwa)	Geometrik (Jiwa)	Eksponensial (Jiwa)	*Least Square* (Jiwa)
2019	4.594	4.594	4.594	4594
2020	4.595	4.595	4595	33406
2021	4.596	4.596	4596	33968
2022	4.598	4.598	4598	34530
2023	4.599	4.599	4599	35092
2024	4.600	4.600	4600	35654
2025	4.601	4.601	4601	36217
2026	4.602	4.602	4602	36779
2027	4.604	4.604	4604	37341
2028	4.605	4.605	4605	37903
2029	4.606	4.606	4606	38465
2030	4.607	4.607	4607	39027
2031	4.608	4.608	4608	39589
2032	4.610	4.610	4610	40151
2033	4.611	4.611	4611	40713
2034	4.612	4.612	4612	41275
2035	4.613	4.613	4613	41838
2036	4.614	4.614	4614	42400
2037	4.616	4.616	4616	42962
2038	4.617	4.617	4617	43524
2039	4.618	4.618	4618	44086
2040	4.619	4.619	4619	44648
2041	4.620	4.620	4620	45210
2042	4.622	4.622	4622	45772
2043	4.623	4.623	4623	46334
Stdev	**8,84**	**8,87**	**8,86**	**8057,04**
Korelasi	**1,00**	**1,00**	**1,00**	**0,98**

Uji Kesesuaian Metode Proyeksi Pertumbuhan Jumlah Penduduk
Sungai Sisir

Nomor	Metode	Rekapitulasi	
		Standar Deviasi	Koefisien Korelasi
1	Aritmatik	8,843	1,000
2	**Geometrik**	**8,865**	**1,000**
3	Eksponensial	8,864	1,000
4	*Least Square*	8057,037	0,980

Sumber: Hasil Perhitungan

Source: Calculation results

Table 3. Projected Raw Water Needs of Pandansari Lor Village

No	Uraian	Satuan	Tahun		
			2021	2022	2041
1	Jumlah Penduduk	Jiwa	4.596	4.598	4620
2	Kebutuhan Air				
	- Sambungan Rumah (SR)	lt/org/hr	100	100	100
3	Pelayanan				
	- Sambungan Rumah (SR)	jiwa/Samb	5	5	5
4	Faktor Pemakaian				
	- Kebutuhan Harian Maksimum		1,1	1,1	1,1
	- Kebutuhan Jam Puncak		1,50	1,75	1,50
5	Prosentase Pelayanan Penduduk				
	- Sambungan Rumah (SR)	%	100	100	100
6	Jumlah Penduduk Terlayani				
	- Sambungan Rumah (SR)	Jiwa	4.597	4.598	4.621
7	Jumlah Sambungan				
	- Sambungan Rumah (SR)	Unit	920	920	925
8	Kebutuhan Domestik				
	- Sambungan Rumah (SR)	lt/hr	459.640,22	459.760,38	462.049,34
		lt/dt	5,32	5,32	5,35
9	Kebutuhan Non Domestik	%	20%	20%	20%
		lt/hr	91.928,04	91.952,08	**92.409,87**
		lt/dt	1,06	1,06	1,07
10	Faktor Kehilangan	%	20%	20%	20%
11	Total kehilangan	lt/hr	110.313,65	110.342,49	110.891,84
		lt/dt	1,28	1,28	1,28
12	Total Kebutuhan Harian Rerata	lt/hr	661.881,92	662.054,94	**665.351,04**
		lt/dt	**7,66**	**7,66**	**7,70**
13	Total Kebutuhan Harian Maksimal	lt/hr	728.070,11	728.260,44	731.886,15
		lt/dt	***8,43***	***8,43***	***8,47***
14	Total Kebutuhan Pada Jam Puncak	lt/dt	***11,49***	***13,41***	***11,55***

Sesuai Kebutuhan Proyeksi :

Kapasitas Tandon (15% dari Kebutuhan Air)	:	109782,92	liter
	:	109,78	m^3
Dimensi Tandon Pandansari Lor (P x L x T)	:	**8 x 7.75 x 2.75**	m^3
	:	**170,50**	m^3

Source: Analysis results

Table 4. Projected Population of Argosari Village

Tahun	Proyeksi Jumlah Penduduk			
	Aritmatika (Jiwa)	Geometrik (Jiwa)	Eksponensial (Jiwa)	*Least Square* (Jiwa)
2019	3.985	3.985	3.985	3985
2020	3.932	3.931	3931	33406
2021	3.880	3.877	3878	33968
2022	3.827	3.825	3825	34530
2023	3.774	3.773	3773	35092
2024	3.722	3.722	3722	35654
2025	3.669	3.671	3671	36217
2026	3.616	3.621	3621	36779
2027	3.564	3.572	3572	37341
2028	3.511	3.524	3524	37903
2029	3.458	3.476	3476	38465
2030	3.406	3.428	3429	39027
2031	3.353	3.382	3382	39589
2032	3.300	3.336	3336	40151
2033	3.248	3.291	3291	40713
2034	3.195	3.246	3246	41275
2035	3.142	3.202	3202	41838
2036	3.090	3.158	3158	42400
2037	3.037	3.116	3116	42962
2038	2.984	3.073	3073	43524
2039	2.932	3.031	3032	44086
2040	2.879	2.990	2990	44648
2041	2.826	2.950	2950	45210
Stdev	**387,66**	**341,69**	**341,66**	**8163,90**
Korelasi	**-1,00**	**-1,00**	**-1,00**	**0,98**

Uji Kesesuaian Metode Proyeksi Pertumbuhan Jumlah Penduduk
Sungai Sisir

Nomor	Metode	Rekapitulasi	
		Standar Deviasi	Koefisien Korelasi
1	**Aritmatik**	**387,660**	**-1,000**
2	Geometrik	341,688	-1,000
3	Eksponensial	341,659	-1,000
4	*Least Square*	8163,905	0,980

Sumber: Hasil Perhitungan

Source: Calculation result

Table 5. Projected Raw Water Needs of Argosari Village

No	Uraian	Satuan	Tahun		
			2022	2023	2041
1	Jumlah Penduduk	Jiwa	3.825	3773	2950
2	Kebutuhan Air				
	- Sambungan Rumah (SR)	lt/org/hr	100	100	100
3	Pelayanan				
	- Sambungan Rumah (SR)	jiwa/Samb	5	5	5
4	Faktor Pemakaian				
	- Kebutuhan Harian Maksimum		1,1	1,1	1,1
	- Kebutuhan Jam Puncak		1,75	1,75	1,50
5	Prosentase Pelayanan Penduduk				
	- Sambungan Rumah (SR)	%	100	100	100
6	Jumlah Penduduk Terlayani				
	- Sambungan Rumah (SR)	Jiwa	3.825	3.773	2.950
7	Jumlah Sambungan				
	- Sambungan Rumah (SR)	Unit	765	755	590
8	Kebutuhan Domestik				
	- Sambungan Rumah (SR)	lt/hr	382.482,65	377.287,90	294.966,93
		lt/dt	4,43	4,37	3,41
9	Kebutuhan Non Domestik	%	20%	20%	20%
		lt/hr	76.496,53	75.457,58	**58.993,39**
		lt/dt	0,89	0,87	0,68
10	Faktor Kehilangan	%	20%	20%	20%
11	Total kehilangan	lt/hr	91.795,84	90.549,09	70.792,06
		lt/dt	1,06	1,05	0,82
12	Total Kebutuhan Harian Rerata	lt/hr	550.775,01	543.294,57	**424.752,38**
		lt/dt	**6,37**	**6,29**	**4,92**
13	Total Kebutuhan Harian Maksimal	lt/hr	605.852,51	597.624,03	467.227,62
		lt/dt	***7,01***	***6,92***	***5,41***
14	Total Kebutuhan Pada Jam Puncak	lt/dt	***11,16***	***11,00***	***7,37***

Sesuai Kebutuhan Proyeksi :

Kapasitas Tandon (15% dari Kebutuhan Air)	:	70084,14	liter
	:	70,08	m^3
Dimensi Tandon Argosari (P x L x T)	:	**7.2 x 7.0 x 2.5**	m^3
	:	**126.00**	m^3

Source: Analysis result (2022)

Table 6. Projected Population of Gading Kembar Village

Tahun	Proyeksi Jumlah Penduduk			
	Aritmatika (Jiwa)	Geometrik (Jiwa)	Eksponensial (Jiwa)	*Least Square* (Jiwa)
2019	4.540	4.540	4.540	4540
2020	4.512	4.512	4512	33406
2021	4.485	4.484	4484	33968
2022	4.457	4.457	4457	34530
2023	4.430	4.430	4430	35092
2024	4.402	4.402	4402	35654
2025	4.375	4.375	4375	36217
2026	4.347	4.348	4348	36779
2027	4.320	4.322	4322	37341
2028	4.292	4.295	4295	37903
2029	4.265	4.269	4269	38465
2030	4.237	4.243	4243	39027
2031	4.210	4.217	4217	39589
2032	4.182	4.191	4191	40151
2033	4.154	4.165	4165	40713
2034	4.127	4.139	4139	41275
2035	4.099	4.114	4114	41838
2036	4.072	4.089	4089	42400
2037	4.044	4.064	4064	42962
2038	4.017	4.039	4039	43524
2039	3.989	4.014	4014	44086
2040	3.962	3.989	3989	44648
2041	3.934	3.965	3965	45210
Stdev	**202,68**	**191,30**	**191,28**	**8066,50**
Korelasi	**-1,00**	**-1,00**	**-1,00**	**0,98**

Uji Kesesuaian Metode Proyeksi Pertumbuhan Jumlah Penduduk
Sungai Sisir

Nomor	Metode	Rekapitulasi	
		Standar Deviasi	Koefisien Korelasi
1	**Aritmatik**	**202,679**	**-1,000**
2	Geometrik	191,302	-1,000
3	Eksponensial	191,284	-1,000
4	*Least Square*	8066,496	0,980

Sumber: Hasil Perhitungan

Source: Calculation result

Table 7. Projected Raw Water Demand of Gading Kembar Village

No	Uraian	Satuan	Tahun		
			2022	2023	2041
1	Jumlah Penduduk	Jiwa	4.457	4430	3965
2	Kebutuhan Air				
	- Sambungan Rumah (SR)	lt/org/hr	100	100	100
3	Pelayanan				
	- Sambungan Rumah (SR)	jiwa/Samb	5	5	5
4	Faktor Pemakaian				
	- Kebutuhan Harian Maksimum		1,1	1,1	1,1
	- Kebutuhan Jam Puncak		1,75	1,75	1,50
5	Prosentase Pelayanan Penduduk				
	- Sambungan Rumah (SR)	%	100	100	100
6	Jumlah Penduduk Terlayani				
	- Sambungan Rumah (SR)	Jiwa	4.457	4.430	3.965
7	Jumlah Sambungan				
	- Sambungan Rumah (SR)	Unit	892	886	793
8	Kebutuhan Domestik				
	- Sambungan Rumah (SR)	lt/hr	445.687,57	442.950,72	396.463,68
		lt/dt	5,16	5,13	4,59
9	Kebutuhan Non Domestik	%	20%	20%	20%
		lt/hr	89.137,51	88.590,14	**79.292,74**
		lt/dt	1,03	1,03	0,92
10	Faktor Kehilangan	%	20%	20%	20%
11	Total kehilangan	lt/hr	106.965,02	106.308,17	95.151,28
		lt/dt	1,24	1,23	1,10
12	Total Kebutuhan Harian Rerata	lt/hr	641.790,10	637.849,03	**570.907,69**
		lt/dt	**7,43**	**7,38**	**6,61**
13	Total Kebutuhan Harian Maksimal	lt/hr	705.969,11	701.633,93	627.998,46
		lt/dt	***8,17***	***8,12***	***7,27***
14	Total Kebutuhan Pada Jam Puncak	lt/dt	***13,00***	***12,92***	***9,91***

Sesuai Kebutuhan Proyeksi :

Kapasitas Tandon (15% dari Kebutuhan Air)	:	94199,77	liter
	:	94,20	m^3
Dimensi Tandon Gading Kembar (P x L x T)	:	**8 x 7 x 3.0**	m^3
	:	**168.00**	m^3

Source: Analysis result (2023)

Table 8. Projected Population of Kemiri Gede Village

Tahun	Proyeksi Jumlah Penduduk			
	Aritmatika (Jiwa)	Geometrik (Jiwa)	Eksponensial (Jiwa)	*Least Square* (Jiwa)
2019	5.762	5.762	5.762	5762
2020	5.702	5.700	5700	33406
2021	5.641	5.640	5640	33968
2022	5.581	5.579	5579	34530
2023	5.521	5.520	5520	35092
2024	5.461	5.461	5461	35654
2025	5.400	5.402	5402	36217
2026	5.340	5.345	5345	36779
2027	5.280	5.287	5287	37341
2028	5.220	5.231	5231	37903
2029	5.159	5.175	5175	38465
2030	5.099	5.120	5120	39027
2031	5.039	5.065	5065	39589
2032	4.978	5.011	5011	40151
2033	4.918	4.957	4957	40713
2034	4.858	4.904	4904	41275
2035	4.798	4.852	4852	41838
2036	4.737	4.800	4800	42400
2037	4.677	4.749	4749	42962
2038	4.617	4.698	4698	43524
2039	4.557	4.648	4648	44086
2040	4.496	4.598	4598	44648
2041	4.436	4.549	4549	45210
Stdev	**443,60**	**401,47**	**401,43**	**7853,29**
Korelasi	**-1,00**	**-1,00**	**-1,00**	**0,98**

Uji Kesesuaian Metode Proyeksi Pertumbuhan Jumlah Penduduk
Sungai Sisir

Nomor	Metode	Rekapitulasi	
		Standar Deviasi	Koefisien Korelasi
1	**Aritmatik**	**443,601**	**-1,000**
2	Geometrik	401,469	-1,000
3	Eksponensial	401,433	-1,000
4	*Least Square*	7853,293	0,980

Sumber: Hasil Perhitungan

Source: Calculation results

Table 9. Projected Raw Water Demand of Kemiri Gede Village

No	Uraian	Satuan	Tahun		
			2022	2023	2041
1	Jumlah Penduduk	Jiwa	5.579	5520	4549
2	Kebutuhan Air				
	- Sambungan Rumah (SR)	lt/org/hr	100	100	100
3	Pelayanan				
	- Sambungan Rumah (SR)	jiwa/Samb	5	5	5
4	Faktor Pemakaian				
	- Kebutuhan Harian Maksimum		1,1	1,1	1,1
	- Kebutuhan Jam Puncak		1,75	1,75	1,50
5	Prosentase Pelayanan Penduduk				
	- Sambungan Rumah (SR)	%	100	100	100
6	Jumlah Penduduk Terlayani				
	- Sambungan Rumah (SR)	Jiwa	5.580	5.520	4.550
7	Jumlah Sambungan				
	- Sambungan Rumah (SR)	Unit	1.116	1.104	910
8	Kebutuhan Domestik				
	- Sambungan Rumah (SR)	lt/hr	557.924,02	551.961,76	454.904,07
		lt/dt	6,46	6,39	5,27
9	Kebutuhan Non Domestik	%	20%	20%	20%
		lt/hr	111.584,80	110.392,35	**90.980,81**
		lt/dt	1,29	1,28	1,05
10	Faktor Kehilangan	%	20%	20%	20%
11	Total kehilangan	lt/hr	133.901,76	132.470,82	109.176,98
		lt/dt	1,55	1,53	1,26
12	Total Kebutuhan Harian Rerata	lt/hr	803.410,59	794.824,94	**655.061,86**
		lt/dt	**9,30**	**9,20**	**7,58**
13	Total Kebutuhan Harian Maksimal	lt/hr	883.751,65	874.307,43	720.568,05
		lt/dt	***10,23***	***10,12***	***8,34***
14	Total Kebutuhan Pada Jam Puncak	lt/dt	***16,27***	***16,10***	***11,37***

sumber : hasil analisis, 2023

Sesuai Kebutuhan Proyeksi :

Kapasitas Tandon (15% dari Kebutuhan Air)	:	108085,21	liter
	:	108,09	m^3
Dimensi Tandon Kemiri (P x L x T)	:	**8.0 x 6.7 x 3.0**	m^3
	:	**160,80**	m^3

Source: Analysis result (2023)

3.2. Identification of Distribution Pipe Network

The distribution pipeline network from Coban Siuk to the service area is currently installed using a combination of materials(Risdiyanto and Harliansyah 2022). Currently, the main network that has been installed from the Reservoir to the Kemiri Tandon has not been able to flow water optimally, this is because there are many leaks and broken pipes when water is flowed as needed. The distribution pipe network is divided into 3 stages as in the following table:

Table 10. Distribution Pipes

No	Distribution Pipe	Pipe Diameter	Pipe Type	Length (m)	Information
	Jalur Distribusi Utama				
	a. Reservoir – Taji reservoir	6"	Galvanis (GI)	75,31	Stage 1 2019
	b. Taji reservoir - BPT 1 Pipa Kanan	4"	Galvanis (GI)	488,95	Stage 1 2019
	c. Taji Reservoir - BPT 1 Left Pipe	4"	Galvanis (GI)	210,08	Stage 1 2019
	d. BPT 1 - BPT 2	6"	Galvanis (GI)	1074,87	Stage 1 2019
	e. BPT.2 - End of Stage 1 (P 255)	6"	PVC □ 6" Type RRJ-S10	7282,64	Stage 1 2019
	f. End of Stage 1 (P-255) - End of Stage 2 (P-597)	6"	PVC □ 6" Type RRJ-S10	10255,5	Stage 1 2020
	g. End of Stage 2 (P-597) - Kemiri reservoir	6"	Combination of PVC □ 6" Type RRJ-S10,S8, and HDPE PN16	5842,4	Stage 2 2021
	Tapping				
	a. P.102 - To Pandansari Lor Village Services	4"	HDPE PN 12.5 SDR 13.6	1130,55	Plan
	b. P.142 - To Gading Kembar Village Services	3"	HDPE PN 12.5 SDR 13.6	1594,74	Plan
	c. P.268 - To Argosari Village Services	2"	HDPE PN 12.5 SDR 13.6	814,07	Plan

Source: Processed data (2023)

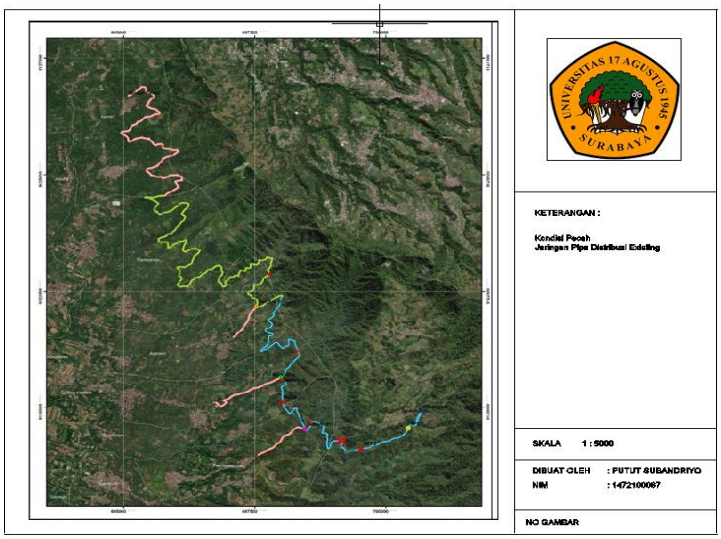
Table 11. Condition of Distribution Pipe Problems

Tahun Pemasangan	Koordinat x	Koordinat y	Dokumentasi	Keterangan
2019 (Tahap 1)	7°57'51.83"S	112°48'24.15"E		1. Pipa PVC ∅6" Type RRJ-S10 2. Area menurun curam 3. Sering terjadi pipa pecah
2019 (Tahap 1)	7°57'49.67"S	112°48'25.41"E		1. Pipa PVC ∅6" Type RRJ-S10 2. Area perlintasan sungai 3. Pipa melengkung pada perlintasan sungai 4. Sambungan flange Socket kurang kuat menahan tekanan air
2019 (Tahap 1)	7°57'48.75"S	112°48'23.41"E		1. Pipa PVC ∅6" Type RRJ-S10 2. Pipa tertanam dalam tanah 3. Posisi pipa pada belokan tajam 4. Sering terjadi pipa pecah

Tahun Pemasangan	Koordinat		Dokumentasi	Keterangan
	x	y		
2019 (Tahap 1)	7°57'23"S	112°47'47"E		1. Pipa PVC ∅6" Type RRJ-S10 2. Sebagian pipa diluar tanah karena batuan, tidak dapat digali 3. Area menurun curam 4. Sering terjadi pipa pecah

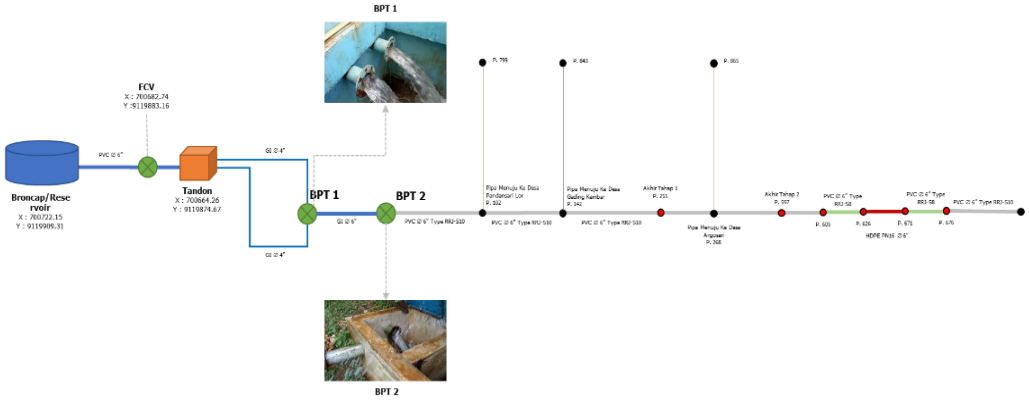
Source: Processed data (2023)

Figure 1. Location of Existing Distribution Pipe Leaks and Ruptures



Source: Processed data (2023)

Figure 2. Schematic of Distribution Pipe Network



Source: Processed data (2023)

3.3. Evaluation of Distribution Pipe Network

This chapter will analyze and evaluate the existing conditions of the current distribution pipe network(Rembulan et al. 2020). To get good analysis and evaluation results in conducting the analysis, WaterCAD v.8i software is used(Nuryani and Santosa 2020). While the data used are technical data on distribution pipe networks and primary data from measurements taken in 2022(Rada and Triatmadja 2021).

3.4. Existing Distribution Pipe Network

The current distribution pipeline network from the Reservoir to the Tandon in Kemiri Village is 25,209.70 m long with a planned discharge of 9 l/dt, while the tapping line with a planned discharge of 2 l/dt to the service areas of Pandansari Lor Village, Gading Kembar Village, and Argosari Village has not been installed. The service to the Kemiri reservoir is not optimal because the upstream part of the network often has leaking and pipe bursting problems. Table 4.9 is the result of analyzing the existing hydraulic conditions of the distribution network from the Reservoir to Kemiri Tandon. Pipe specifications installed in the distribution pipeline network include:

1) S-8 class pipe, which is a 6 "PVC pipe that can withstand water pressure from inside up to 16 bar.
2) S-10 class pipe, which is a PVC pipe that can withstand water pressure from the inside up to 12.5 bar.
3) Galvanized Iron Schedule 40 pipe is a pipe that has a standardized thickness set by ANSI (American Nation Standart Institute). SCH is a parameter for measuring wall thickness with ID. While the code 40 refers to the strength of the pipe resistance that can reach 40 bar.
4) HDPE PN 16 pipe which is able to withstand water pressure from inside up to 16 bar.

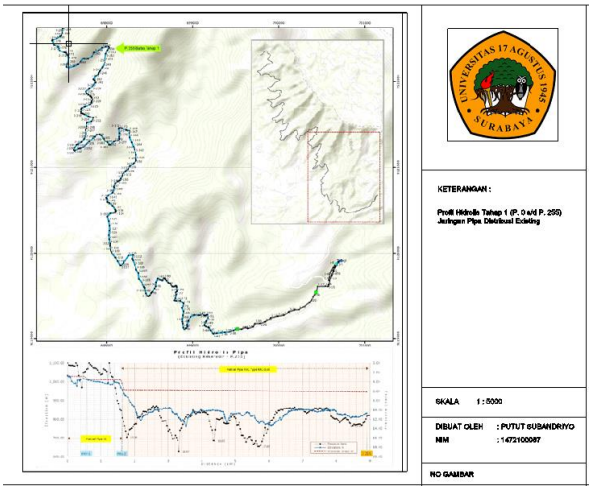
3.5. Pipeline Hydraulics

Based on the existing conditions installed, it can be seen the ability to withstand pressure, flow velocity in the pipe, and hydraulic grade in each section of the pipe the complete analysis results are presented on the attachment page, the following is a recapitulation of the analysis results with the help of Watercad v8.i software:

1) In Section Reservoir - Press Release Tub 2 (Tandon Taji) using galvanized iron pipe matrial, the maximum pressure that occurs is 5.22 bar and the minimum pressure is 0.00 bar, the maximum flow velocity in the pipe that occurs is 0.82 m/s and the minimum pressure is 0.49 m/s, while the maximum hydraulic grade that occurs is 4.50 m/s and the minimum pressure is 1.54 m/s(Haestad Methods 1999).
2) In Section 2 - P. 255/J.255 (end of stage 1) using PVC pipe material Type RRJ-S10, the maximum pressure that occurs is 18.97 bar and the minimum pressure is 2.01 bar, the maximum flow velocity in the pipe that occurs is 0.49 m/s and the minimum pressure is 0.49 m/s, while the maximum hydraulic grade that occurs is 1.55 m/s and the minimum pressure is 1.54 m/s.
3) In Section P. 255/J.255 (end of stage 1) - P. 597/J.597 (end of stage 2) using PVC pipe material Type RRJ-S10, the maximum pressure that occurs is 16.43 bar and the minimum pressure is 6.07 bar, the maximum flow velocity in the pipe that occurs is

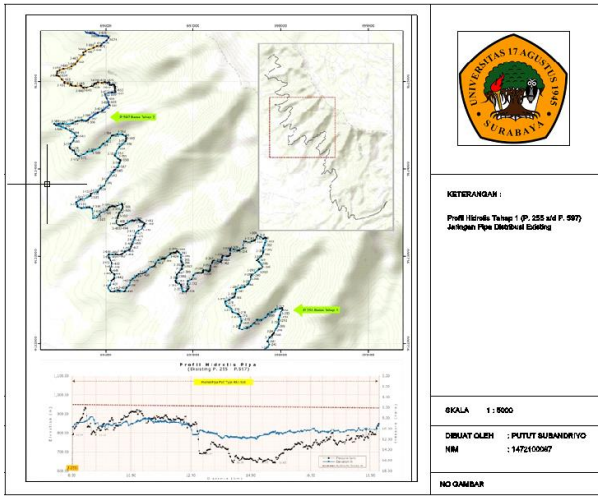
0.49 m/s and the minimum pressure is 0.49 m/s, while the maximum hydraulic grade that occurs is 1.56 m/s and the minimum pressure is 1.53 m/s.

4) In Section P. 597/J.597 (end of stage 2) - P. 601/J.601 (stage 3) using PVC pipe material Type RRJ-S10, the maximum pressure that occurs is 9.42 bar and the minimum pressure is 8.13 bar, the maximum flow velocity in the pipe that occurs is 0.49 m/s and the minimum pressure is 0.49 m/s, while the maximum hydraulic grade that occurs is 1.55 m/s and the minimum pressure is 1.54 m/s.
5) In Section P. 601/J.601 (stage 3) - P. 626/J.626 (stage 3) - using PVC pipe material Type RRJ-S8, the maximum pressure was 13.11 bar and the minimum pressure was 11.17 bar, the maximum flow velocity in the pipe was 0.49 m/s and the minimum pressure was 0.49 m/s, while the maximum hydraulic grade was 2.01 m/s and the minimum pressure was 1.54 m/s.
6) In Section P. 626/J.626 (stage 3) - P. 671/J.671 (stage 3) - using HDPE PN16 pipe material, the maximum pressure is 16.41 bar and the minimum pressure is 13.23 bar, the maximum flow velocity in the pipe is 0.49 m/s and the minimum pressure is 0.49 m/s, while the maximum hydraulic grade is 2.02 m/s and the minimum pressure is 1.55 m/s.
7) In Section P. 671/J.671 (stage 3) - P. 676/J.676 (stage 3) - using PVC pipe material Type RRJ-S8, the maximum pressure that occurs is 13.56 bar and the minimum pressure is 11.22 bar, the maximum flow velocity in the pipe that occurs is 0.49 m/s and the minimum pressure is 0.49 m/s, while the maximum hydraulic grade that occurs is 1.55 m/s and the minimum pressure is 1.54 m/s.
8) In Section P. 676/J.676 (stage 3) - Kemiri Tandon (stage 3) - using PVC pipe matrial Type RRJ-S10, the maximum pressure that occurs is 10.39 bar and the minimum pressure is 3.31 bar, the maximum flow velocity in the pipe that occurs is 0.57 m/s and the minimum pressure is 0.49 m/s, while the maximum hydraulic grade that occurs is 4.83 m/s and the minimum pressure is 1.54 m/s.



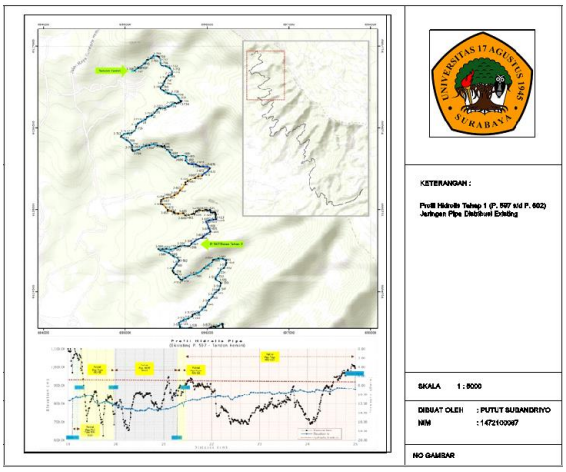
Source: Processed data (2023)

Figure 3. Existing Hydraulic Distribution Pipe Network Phase I (P. 0 to P.255)



Source: Processed data (2023)

Figure 4. Existing hydraulic distribution pipe network Phase I (P. 255 to P.597)



Source: Processed data (2023)

Figure 5. Existing hydraulic distribution pipe network Phase I (P. 255 to P.597)

3.6. Material Specifications

Based on the results of the analysis, transmission pipe criteria, and pipe material specifications that:

1. Review of the flow velocity in the pipe, the flow velocity is in accordance with the minimum velocity criteria of 0.3 m/s for all types of pipe material, and the maximum velocity of 4.5 m/s for PVC pipe material and 6 m/s for DCIP pipe material. From the results of the analysis on all sections of the pipe network, it still meets the criteria for both PVC pipe material and DCIP pipe material(Pahude 2022).
2. The pressure review can be seen that the pressure that occurs is different, on steep and steep topography there is great pressure. The ability to withstand the existing

pressure depends on the type of material installed. The following are the results of the analysis based on the hydraulic pressure review that occurred:

a) In Section Reservoir - Press Release Tub 2 using galvanized iron pipe material, the maximum pressure that occurs is 5.22 bar and the minimum pressure is 0.00 bar, based on the specifications of galvanized iron pipe material with sch 40, the pressure that occurs is still far below the ability of the pipe to withstand pressures up to 40 bar.
b) At Section 2 - P. 255 (end of stage 1) the pressure that occurs in this section is very large if compared with the specifications of the pipe material installed. With RRJ-S10 PVC pipes that can only withstand a maximum pressure of 12.5 bar, while the pressure that occurs at some points exceeds the ability of the pipe which causes the pipe to burst. This is also supported by the absence of air valves and trashblocks at vulnerable points. In this section there are many vulnerable points with hydraulic that occurs more than 12 bar. The following is the location of the vulnerable points in this section:

Table 12. Vulnerable Points of Press Release Basin Section - 2 (P. 255/J.255) - Phase I

Section	Panjang Pipa (m)
J-47 - J-59	354.64
J-80 - J-98	479.74
J-120 - J-128	309.73
J-132 - J-137	91.08
J. 143 - J-172	1,023.49
J-229 - J-251	618.17
Total	**2,876.85**

Source: Processed data (2023)

c) In Section P. 255 (end of stage 1) - P. 601 using PVC pipe matrial Type RRJ-S10, the pressure that occurs exceeds 12.5 bar. With RRJ-S10 PVC pipes that are only able to withstand a maximum pressure of 12.5 bar, while the pressure that occurs at some points exceeds the ability of the pipe which causes the pipe to burst. The following is the location of the vulnerable points in this section:

Table 13. Vulnerable Points of Press Release Basin Section - 2 (P.255/J.255 P.601/J.601) - Phase II

Section	Panjang Pipa (m)
J-397 - J-542	3,905.21
J-547 - J-571	1,030.46
Total	**4,935.67**

Source: Processed data (2023)

d) Table 7. 2 Vulnerable Points of Press Release Tank Section 2 - P. 255 (end of stage 1).
e) In Section P. 601 (stage 3) - P. 626 (stage 3) - using PVC pipe material Type RRJ-S8, the maximum pressure that occurs is 13.11 bar. Based on the specifications of PVC pipe material Type RRJ-S8, the pressure that occurs is still below the ability of the pipe to withstand pressures up to 16 bar.
f) In Section P. 626 (stage 3) - P. 671 (stage 3) - using HDPE PN16 pipe material, at some points the pressure exceeds 16 bar on the P. 646 - P. 653 network or 150.60 m long. The pressure that occurs is between 16.01 bar - 16.41 bar.
g) In Section P. 671 (stage 3) - P. 676 (stage 3) - using PVC pipe matrial Type RRJ-S8, the pressure that occurs is still below the ability of the pipe to withstand pressures up to 16 bar.
h) In Section P. 676 (stage 3) - Tandon Kemiri (stage 3) using PVC pipe matrial Type RRJ-S10, the pressure that occurs is still below the ability of the pipe to withstand pressures up to 12.5 bar.

3.7. Analysis and Interpretation of Results

Based on the analysis of the existing distribution pipe network carried out, and based on the criteria and specifications of the pipe material in the following table:

Table 14. Analysis Results of Existing Replacement Material Specifications

Patok	Elevasi	STA	Panjang Pipa (m)	Pressure (bar)	Matrial Pipa		Rencana Tambahan Aksesoris
					Eksisting	Rencana	
Section J. 47 - J. 59							
J-47	829.61	2,076	354.64	12.47	PVC RRJ-S10	HDPE PN 16	-
J-48	819.66	2,084		13.45			-
J-49	808.23	2,130		14.56			-
J-50	794.89	2,175		15.86			-
J-51	800.93	2,214		15.26			*Trushblock*
J-52	810.79	2,230		14.29			-
J-53	812.08	2,239		14.17			-
J-54	813.98	2,249		13.98			-
J-55	818.21	2,280		13.56			-
J-56	822.67	2,315		13.12			-
J-57	824.45	2,331		12.94			-
J-58	823.84	2,385		12.99			-
J-59	837.60	2,431		11.64			
Section J. 80 - J. 98							
J-80	828.54	3,200	156.41	12.41	PVC RRJ-S10	HDPE PN 16	-
J-81	828.99	3,217		12.36			-
J-82	829.45	3,243		12.31			-
J-83	829.22	3,258		12.33			-
J-84	818.59	3,284		13.37			-
J-85	806.56	3,306		14.54			-
J-86	809.98	3,328		14.21			-
J-87	802.43	3,357		14.94			-
J-88	797.45	3,373	180.02	15.43	PVC RRJ-S10	HDPE PN20	-
J-89	789.27	3,388		16.22			-
J-90	790.36	3,401		16.12			-
J-91	796.82	3,433		15.48			-
J-92	791.96	3,460		15.95			-
J-93	785.82	3,492		16.55			-
J-94	761.00	3,537		18.97			-
J-95	807.67	3,584	143.31	14.39	PVC RRJ-S10	HDPE PN16	-
J-96	812.19	3,613		13.95			-
J-97	820.88	3,663		13.09			-
J-98	827.04	3,680		12.48			-
Section J. 120 - J. 128							
J-120	826.44	4,663	25.88	12.39	PVC RRJ-S10	HDPE PN16	-
J-121	813.68	4,677		13.64			-
J-122	806.43	4,689		14.35		HDPE PN20	-
J-123	783.53	4,740	70.32	16.58	PVC RRJ-S10		-
J-124	782.83	4,759		16.65			-
J-125	806.83	4,817	213.53	14.29	PVC RRJ-S10	HDPE PN16	-
J-126	831.15	4,867		11.90			-
J-127	830.01	4,916		12.01			-
J-128	829.19	4,973		12.08			-
Section J. 132 - J. 137							
J-132	821.57	5,187	91.08	12.79	PVC RRJ-S10	HDPE PN16	-
J-133	820.36	5,195		12.91			-
J-134	819.91	5,202		12.95			-
J-135	820.04	5,216		12.94			-
J-136	820.43	5,225		12.90			-
J-137	826.63	5,278		12.28			-
Section J. 143 - J. 172							
J-143	816.85	5,451	129.84	13.21	PVC RRJ-S10	HDPE PN16	-
J-144	817.13	5,507		13.18			-
J-145	821.47	5,564		12.74			-
J-146	807.61	5,581		14.10			-

Patok	Elevasi	STA	Panjang Pipa (m)	Pressure (bar)	Matrial Pipa		Rencana Tambahan Aksesoris
					Eksisting	Rencana	
J-147	793.50	5,624	692.86	15.47	PVC RRJ-S10	HDPE PN20	-
J-148	793.45	5,632		15.48			-
J-149	787.42	5,664		16.06			-
J-150	788.31	5,685		15.97			-
J-151	778.93	5,709		16.89			-
J-152	786.39	5,757		16.15			-
J-153	789.97	5,775		15.80			-
J-154	790.56	5,812		15.73			-
J-155	783.03	5,832		16.47			-
J-156	782.02	5,854		16.56			-
J-157	773.54	5,897		17.38			-
J-158	775.51	5,947		17.18			-
J-159	780.76	5,990		16.66			-
J-160	774.99	6,000		17.23			-
J-161	768.70	6,057		17.83			-
J-162	768.51	6,085		17.85			-
J-163	771.53	6,122		17.55			-
J-164	779.41	6,158		16.77			-
J-165	785.27	6,210		16.19			-
J-166	792.17	6,274		15.50			-
J-167	809.12	6,325	200.79	13.84	PVC RRJ-S10	HDPE PN16	-
J-168	797.29	6,352		14.99			-
J-169	805.54	6,387		14.18			-
J-170	816.40	6,435		13.11			-
J-171	820.53	6,450		12.70			-
J-172	824.98	6,474		12.26			-
Section J. 229 - J. 251							
J-229	822.31	8,157	618.17	12.27	PVC RRJ-S10	HDPE PN16	-
J-230	818.47	8,186		12.64			-
J-231	821.25	8,195		12.37			-
J-232	823.20	8,207		12.18			-
J-233	824.84	8,232		12.01			-
J-234	826.80	8,257		11.82			-
J-235	828.24	8,265		11.67			-
J-236	824.48	8,283		12.04			-
J-237	823.85	8,289		12.10			-
J-238	818.08	8,337		12.66			-
J-239	815.81	8,385		12.87			-
J-240	809.04	8,438		13.53			-
J-241	810.86	8,468		13.34			-
J-242	813.55	8,486		13.08			-
J-243	811.69	8,534		13.25			-
J-244	812.36	8,567		13.18			-
J-245	813.05	8,577		13.11			-
J-246	813.74	8,582		13.04			-
J-247	813.83	8,595		13.03			-
J-248	811.79	8,612		13.23			-
J-249	811.58	8,665		13.24			-
J-250	816.47	8,723		12.76			-
J-251	817.96	8,776		12.60			-

Patok	Elevasi	STA	Panjang Pipa (m)	Pressure (bar)	Matrial Pipa		Rencana Tambahan Aksesoris
					Eksisting	Rencana	
J-454	779.02	14,431		15.56			-
J-455	778.24	14,445		15.63			-
J-456	777.27	14,453		15.73			-
J-457	774.11	14,497		16.03			-
J-458	774.56	14,527		15.98			-
J-459	774.49	14,547		15.98			-
J-460	772.99	14,559		16.13			-
J-461	771.21	14,579		16.30			-
J-462	770.69	14,598		16.35			-
J-463	775.22	14,613		15.90			-
J-464	778.82	14,646		15.55			-
J-465	776.69	14,653		15.75			-
J-466	775.92	14,697		15.82			-
J-467	774.66	14,714		15.94			-
J-468	771.08	14,753		16.29			-
J-469	772.18	14,774		16.18			-
J-470	772.88	14,807	765.22	16.10	PVC RRJ-S10	HDPE PN20	-
J-471	773.96	14,857		15.99			-
J-472	774.56	14,869		15.93			-
J-473	776.40	14,907		15.74			-
J-474	776.53	14,915		15.73			-
J-475	775.24	14,958		15.85			-
J-476	774.00	15,007		15.96			-
J-477	774.07	15,046		15.95			-
J-478	772.52	15,056		16.10			-
J-479	769.56	15,064		16.39			-
J-480	769.51	15,071		16.39			-
J-481	769.89	15,078		16.35			-
J-482	769.04	15,107		16.43			-
J-483	779.14	15,135		15.44			-
J-484	775.28	15,145		15.82			-
J-485	778.29	15,154		15.52			-
J-486	782.20	15,189		15.13			-
J-487	784.55	15,208		14.90			-
J-488	786.51	15,228		14.70			-
J-489	785.52	15,261		14.80			-
J-490	787.67	15,311		14.58			-
J-491	787.59	15,332		14.58			-
J-492	793.38	15,358		14.01			-
J-493	793.61	15,382		13.99			-
J-494	794.05	15,389		13.94			-
J-495	792.88	15,415		14.05			-
J-496	793.65	15,438		13.97			-
J-497	793.79	15,456		13.96			-
J-498	793.76	15,466		13.96			-
J-499	793.35	15,490	573.45	14.00	PVC RRJ-S10	HDPE PN16	-
J-500	794.88	15,516		13.84			-
J-501	797.90	15,527		13.54			-
J-502	798.29	15,544		13.50			-
J-503	800.19	15,568		13.31			-
J-504	804.23	15,598		12.91			-
J-505	803.46	15,619		12.99			-
J-506	803.92	15,630		12.94			-
J-507	806.27	15,647		12.71			-
J-508	805.28	15,657		12.80			-
J-509	803.85	15,665		12.94			-
J-510	803.57	15,673		12.97			-
J-511	808.88	15,722		12.44			-

Patok	Elevasi	STA	Panjang Pipa (m)	Pressure (bar)	Matrial Pipa		Rencana Tambahan Aksesoris
					Eksisting	Rencana	
J-512	806.52	15,732	1,099.27	12.67	PVC RRJ-S10	HDPE PN16	-
J-513	797.49	15,762		13.55			-
J-514	798.86	15,774		13.41			-
J-515	799.15	15,787		13.38			-
J-516	801.67	15,796		13.14			-
J-517	800.31	15,822		13.26			-
J-518	794.31	15,840		13.85			-
J-519	800.51	15,870		13.24			-
J-520	800.44	15,921		13.24			-
J-521	798.49	15,941		13.42			-
J-522	796.03	15,979		13.66			-
J-523	800.62	16,027		13.20			-
J-524	801.93	16,072		13.07			-
J-525	805.58	16,127		12.70			-
J-526	807.63	16,187		12.49			-
J-527	811.48	16,219		12.11			-
J-528	805.63	16,247		12.68			-
J-529	802.19	16,307		13.01			-
J-530	803.19	16,360		12.90			-
J-531	800.79	16,369		13.13			-
J-532	803.27	16,416		12.88			-
J-533	807.66	16,477		12.45			-
J-534	805.85	16,536		12.61			-
J-535	809.87	16,591		12.21			-
J-536	810.62	16,601		12.14			-
J-537	807.10	16,618		12.48			-
J-538	807.61	16,644		12.43			-
J-539	815.07	16,700		11.69			-
J-540	810.29	16,756		12.15			-
J-541	812.34	16,809		11.94			-
J-542	811.97	16,862		11.97			-

Patok	Elevasi	STA	Panjang Pipa (m)	Pressure (bar)	Matrial Pipa		Rencana Tambahan Aksesoris
					Eksisting	Rencana	
J-646	763.17	20,405	150.57	16.19	HDPE PN16	-	*Trushblock*
J-647	761.02	20,414		16.39			*Trushblock*
J-648	762.88	20,424		16.21			*Trushblock*
J-649	760.82	20,456		16.41			*Trushblock*
J-650	761.26	20,497		16.35			*Trushblock*
J-651	763.54	20,505		16.13			*Trushblock*
J-652	764.71	20,512		16.01			*Trushblock*
J-653	762.88	20,555		16.19			*Trushblock*

Source: Processed data (2023)

4. CONCLUSION

The conclusions obtained from the analysis of the Optimization of the Raw Water Distribution Pipe Network for Jabung Subdistrict are as follows:

1. The condition of the water discharge from the source to the service village shows that the available discharge at the coban siuk water source is 51.30 l / dt, while the water needs of the population in the four villages that must be served are as follows:
   a. maximum daily demand in 2041 (20-year projection) pandansari lor village of 8.47 l/dt, argosari village of 5.41 l/dt, gading kembar village of 7.27 l/dt, and kemiri gede of 8.34 l/dt.
   b. clean water demand at peak hours in 2041 (20-year projection) pandansari lor village amounted to 11.55 l/dt, argosari village 7.37 l/dt, gading kembar village 9.91 l/dt, and kemiri gede village 11.37 l/dt.

2. The existing condition of the distribution pipeline from the source to the service village is in very extreme topographic conditions (slopes, cliffs and a little steep) with a height difference from taking water sources to the service area of ± 300 m, where the elevation of the Coban Siuk Taji tendon is + 1003.03 m, the elevation of pandansari lor village is + 700.81 m, the elevation of twin ivory village is + 654.77 m, the elevation of argosari village is + 686.38 m, and the elevation of kemiri gede village is + 852.05m.

3. The installed distribution pipe material is not in accordance with the existing hydraulic conditions, this is based on the results of the hydraulic analysis of existing conditions using the help of the WATERCAD V8.i program, it can be seen that the PVC RRJ S-10 pipe matrial with a maximum pipe strength of only up to 12.5 bar is not able to withstand the hydraulic pressure that occurs as evidenced by the results of the flow test that occurred rupture(Wulandari and Santosa 2021).

ADVICE

Based on the results of the existing hydraulic analysis, it is necessary to do:

1. The accuracy of water demand calculation data is very helpful so that exploitation of existing water sources will not occur in the future.
2. The availability of topographic data is needed in analyzing the raw water distribution pipe network(Yuris Permana, n.d.).
3. It is necessary to repair the pipe at a critical point by replacing the PVC pipe with HDPE pipe (PN 16 and PN 20) from the siuk reservoir to the kemiri gede reservoir and the construction of taping to Gading Kembar Village and Argosari Village, while for Pandansari Lor village services, it continues to use the old route by replacing the pipe with appropriate specifications at several critical points.

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