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Projection of Clean Water Needs for Bandarmasih City Water Utility (PDAM) in Banjarmasin City, in the Banjarmasin Tengah Sub-district, for the Year 2031

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ABSTRACT

The geographical situation of Banjarmasin City, which partly supports the availability of clean water for the community, is crucial considering the primary needs of the people by utilizing natural resources that are expected to fulfil the community's demand for clean water. The need for clean water must be met for the entire population of Banjarmasin, including the Banjarmasin Tengah Sub-district, a district in Banjarmasin, South Kalimantan Province, with an area of 6.66 km² and a population of 91,780 people. The research method for preparing this report includes field surveys, collecting primary and secondary data, and conducting population projection calculations. A literature review was conducted by gathering, reading, and studying relevant sources such as journals and books necessary to conduct this research. Based on the analysis and discussion results, it can be concluded that the projected loss of clean water in the year 2031, assuming a standard rate of 36 L/s, is significant. The projected demand for clean water in the service area of the Central Banjarmasin branch of the PDAM in the projection year 2031 is approximately 215 L/s

INTRODUCTION

Indonesia is a developing country that is not exempt from challenges, including providing clean water. The need for clean water is of utmost importance. Thus, the clean water sector receives top priority for addressing because it concerns many people's lives. The geographical situation of Banjarmasin City, which partly supports the availability of clean water for the community, is crucial considering the primary needs of the people by utilizing natural resources that are expected to fulfil the community's demand for clean water.

The need for clean water must be fulfilled for the entire community of Banjarmasin, including the Banjarmasin Tengah Sub-district, a district in Banjarmasin, South Kalimantan Province, with an area of 6.66 km² and a population of 91,780 people. This location serves as the final study site for PDAM Bandarmasih in Banjarmasin City, precisely in the Banjarmasin Tengah Sub-district, to calculate the clean water needs in that district. Planning, design, and facilities for collection, transmission, and distribution are necessary for a proper clean water supply. With PDAM Bandarmasih in Banjarmasin City, it has become a company that manages and serves the clean water needs in Banjarmasin, including the Banjarmasin Tengah area, where my final research project is located. Through this final project study, the method used is based on the clean water requirements, involving data collection from PDAM Bandarmasih in Banjarmasin City and conducting direct interviews at the research location in the Banjarmasin Tengah Sub-district area. It's essential to know the current and future demand for clean water in the Banjarmasin Tengah Sub-district and assess how far the level of PDAM network service can be improved.

METHODS

Type of Research

The method is a process carried out in the calculation process. The steps taken in this calculation are field surveys, collecting primary and secondary data, and calculation analysis. A literature review is conducted by gathering, reading, and studying relevant sources such as journals and books necessary to conduct this research. Field survey involves direct observations to determine the location or place of data collection, capturing documentary photos, and conducting interviews with

relevant parties as additional data to complement this research.

Data Collection

The data for this research consists of gathering the necessary data for the calculations. The collected data includes:

- 1) Collection of primary data. Primary data is data obtained directly. The primary data obtained includes documentary photos, interviews, and observations.
- 2) Collection of secondary data. These data are obtained from the local government agencies in Banjarmasin City, which are necessary for the data calculation. The visited agency includes the office of PDAM Bandarmasih in Banjarmasin City.
- 3) Calculation of additional population for the past five (5) years. This calculation utilizes the primary and secondary data mentioned above. If the additional population calculation is correct (Yes), it will proceed to the projection calculation of the population for the next 12 years using the chosen method. If it is still incorrect (No), then the primary and secondary data mentioned above will be reexamined.
- 4) Projection calculation of the population for the next 12 years using the Geometric Method, as this method has the smallest Standard Deviation (SD) and the Correlation Coefficient (1) that closely approaches 1.
- 5) Projection calculation of clean water demand for the next 12 years. This projection calculation utilizes the chosen method, which is the Arithmetic method, by using the population figures from the years 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, and 2031. The projected water demand includes Domestic Water Demand, Non-Domestic Water Demand, and Water Loss.
- 6) Total water demand. To determine the total water demand from the above calculations for the next 12 years up to 2031. The magnitude of this water demand is based on the projected planning calculations.
- 7) Conclusion. Based on the calculated results and discussions that have been projected.

RESULTS AND DISCUSSION

Projection of Population Growth Rate

For estimating the future population in Banjarmasin Tengah Subdistrict, three methods are used: Arithmetic, Geometric, and Least Square.

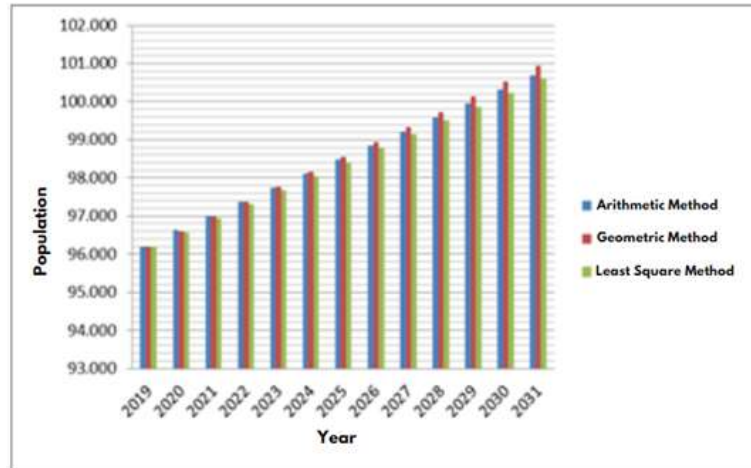


Figure 1. Combined Population Projection Diagram

With the values of (r) and standard deviation (Sd) from the three methods above, the choice among the three methods can be determined to calculate the population projection for the next ten years. The selection of the projection method is based on the coefficient of correlation (r), which should be close

to 1, and the standard deviation should be the smallest. The result of the correlation comparison of the selected method is with the Arithmetic method, as seen in Table 1, comparison of Correlation Coefficients and Standard Deviations.

Table 1. Comparison of Correlation Coefficient Values and Standard Deviations

No	Method	Correlation Coefficient	Standard Deviation
1	Arithmetic	0,994	88
2	Geometric	0,994	118
3	Least Square	0,994	91

Projection of Water Demand

The magnitude of water demand is influenced by several factors, which include Domestic Water Demand (consisting of Direct Connections and Public Hydrants), Non-Domestic Water Demand (including Education facilities, Commercial Facilities, Healthcare facilities, Religious facilities, Office facilities, and Industrial facilities), and Non-Revenue Water (Unaccounted for Water Usage).

Domestic Needs

The magnitude of clean water demand for domestic purposes is primarily determined by the population to be served, the type of connections, and the level of service provided. Clean water demand for facilities is divided into direct connections and public hydrants.

Table 2. Service Coverage for Domestic Needs

No	Year	Population	Services		SR		HU	
			%	People	%	People	%	People
1	2019	96.212	90%	86591	70%	60614	30%	25977
2	2021	96.578	90%	86920	70%	60844	30%	26076
3	2023	97.674	90%	87907	70%	61535	30%	26372
4	2025	98.405	90%	88565	70%	61995	30%	26569
5	2027	99.136	90%	89222	70%	62456	30%	26767
6	2029	99.867	90%	89880	70%	62916	30%	26964
7	2031	100.598	90%	90538	70%	63377	30%	27161

Non-Domestic Water Needs

Non-Domestic needs refer to water usage for purposes other than household consumption.

The amount of water needed to support educational facilities is determined by the number

of students and the size of the facility, as shown in Table 3—projections of Clean Water Needs for Educational Facilities.

Table 3. Projected Clean Water Requirements for Educational Facilities

No	Year	Requirement Standard L/People/Day	Types of Educational Facilities (People)				Water Needs L/day
			TK/RA	SDMI	SMP/MTs	SMA/SMK/MA	
1	2019	10	31576	116658	69700	67173	285106
2	2021	10	31696	117101	69965	67428	286191
3	2023	10	32056	118430	70759	68194	289439
4	2025	10	32296	119317	71288	68704	291605
5	2027	10	32536	120203	71818	69214	293771
6	2029	10	32776	121089	72348	69725	295937
7	2031	10	33015	121976	72877	70235	298103

The amount of clean water demand for religious facilities is based on assumptions, as seen in Table 4,

projected Clean Water Requirements for Religious Facilities.

Table 4. Projected Clean Water Requirements for Religious Facilities

No	Year	Requirement Standard L/People/Day	Types of Religious Facilities (People)			Water Needs L/day
			Small Mosque	Requirement Standard L/People/Day	Mosque	
1	2019	500	68000	2000	72000	140000
2	2021	500	68000	2000	72000	140000
3	2023	500	68000	2000	72000	140000
4	2025	500	68000	2000	72000	140000
5	2027	500	68000	2000	72000	140000
6	2029	500	68000	2000	72000	140000
7	2031	500	68000	2000	72000	140000

Based on assumption calculations, the amount of clean water requirement for healthcare facilities

can be seen in Table 5, projected Clean Water Requirements for Healthcare Facilities.

Table 5. Projected Clean Water Requirements for Healthcare Facilities

No	Year	Types of Healthcares Facilities (People)			Water Needs L/day	
		Requirement Standard L/People/Day	Hospital	Requirement Standard L/People/Day		Small Hospital / Clinic
1	2019	200	1000	2000	10000	11000
2	2021	200	1000	2000	10000	11000
3	2023	200	1000	2000	10000	11000
4	2025	200	1000	2000	10000	11000
5	2027	200	1000	2000	10000	11000
6	2029	200	1000	2000	10000	11000
7	2031	200	1000	2000	10000	11000

The amount of clean water demand for healthcare facilities can be seen in Table 6. Projected Clean Water Requirements for Office Facilities.

Table 6. Projection of Clean Water Demand for Office Facilities

No	Year	Requirement Standard L/People/Day	Number of Workers	Water Needs L/day
1	2019	10	87	870
2	2021	10	87	870
3	2023	10	87	870
4	2025	10	87	870
5	2027	10	87	870
6	2029	10	87	870
7	2031	10	87	870

Based on assumption calculations, the magnitude of clean water demand for commercial facilities can be seen in Table 7, projection of Clean Water Demand for Commercial Facilities.

Table 7. Projection of Clean Water Demand for Commercial Facilities

No	Year	Requirement Standard L/People/Day	Number of Workers	Water Needs L/day
1	2019	12.000	43	516000
2	2021	12.000	43	516000
3	2023	12.000	43	516000
4	2025	12.000	43	516000
5	2027	12.000	43	516000
6	2029	12.000	43	516000
7	2031	12.000	43	516000

Loss of Water

Water loss is the difference between the amount of water supplied and consumed. Water loss in a water distribution system is always present. This loss can be technical, such as losses due to the pipes themselves, while non-technical losses include water theft within the distribution pipes. We must consider

the magnitude of water loss in the system to determine the extent of water demand. Water loss is estimated to be around 20% of the total demand until the end of the planning year (Public Works Agency, 2004). The amount of water loss in 2031 is projected to be 36 L/s, as shown in Table 8—Water Loss.

Table 8. Water Loss

No	Year	Q L/Day	% Lost	Q L/Day	Q L/Second
1	2019	14807504	20%	2961501	34
2	2021	14861293	20%	2972259	34
3	2023	15022365	20%	3004473	35
4	2025	15129795	20%	3025959	35
5	2027	15237225	20%	3047445	35
6	2029	15344655	20%	3068931	36
7	2031	15452085	20%	3090417	36

Total Clean Water Demand

The conclusion from the above calculations for the total water demand over the next ten years in

2031, the obtained production rate is 215 L/s. The magnitude of water demand is based on the calculations in Table 9, Total Clean Water Demand.

Table 9. Total Clean Water Demand

No	Year	Q Domestic L/Day	Q Non Domestic L/Day	Q Lost L / Day	Q Total L/Day	Q Total L/Second
1	2019	13854528	952976	2961501	17769005	206
2	2021	13907232	954061	2972259	17833552	206
3	2023	14065056	957309	3004473	18026838	209
4	2025	14170320	959475	3025959	18155754	210
5	2027	14275584	961641	3047445	18284670	212
6	2029	14380848	963807	3068931	18413586	213
7	2031	14486112	965973	3090417	18542503	215

The projected demand for clean water in the service area of the PDAM branch in Banjarmasin Tengah in the year 2031 based on this prediction is approximately 215 L/dtk (litres per capita per day), where this flow rate is below the available production capacity of PDAM Bandarmasih, which is around 250 L/dtk (Uprating IPA II Pramuka for the service area of Banjarmasin Tengah). Therefore, for the year 2031, the capacity of the PDAM Bandarmasih's water treatment plant still meets or exceeds this prediction.

CONCLUSION

Based on the analysis and discussions that have been projected, it can be concluded that the estimated loss of clean water in the year 2031 with the assumed standard is around 36 L/dtk (litres per capita per day). The projected demand for clean water in the service area of the PDAM branch in Banjarmasin Tengah in the year 2031 based on this prediction is approximately 215 L/dtk, where this flow rate is below the available production capacity of PDAM Bandarmasih, which is around 250 L/dtk. Therefore, for the year 2031, the capacity of the PDAM Bandarmasih's water treatment plant still meets or exceeds this prediction.

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