THE NEEDS OF CLEAN WATER STUDY IN SOUTH BARITO REGENCY

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ABSTRACT

South Barito Regency is one of the regencies in province of Central Kalimantan. South Barito Regency is a regency whose developing quite rapid because in terms of its geographical location, South Barito Regency passed by national road and become a place of transit which also led to an increase in population and economic needs, especially the need for clean water. There are still areas experiencing water shortage problems because of the difficulty of distributing clean water. The purpose of this study was to determine the amount of water needs for 2017, 2021, 2026, 2031, and 2036 to serve the needs of community and also determine the water quality at the intake, and comparing water demand with intake capacity.

In this study, the calculation of population projections using statistical methods in which to pay attention to the rate of population growth of the past to estimate the number of people in the future. There are several methods that can be used to analyze the population growth in the future, namely arithmetic, geometric, linear regression, exponential, and logarithmic. For water quality check, field survey is needed to test parameters such as temperature, electrical conductivity, the amount of dissolved solids, pH, turbidity, salinity, and dissolved oxygen measurements.

Results of this research is needed clean water discharge Barito Selatan with consecutive results as follows in 2017; 2021; 2026; 2031; In 2036 amounted to 305.14 L / s, 429.55 L / s, 599.58 L / s, 755.02 L / s, 794.94 L / s .With intake capacity which is now only 184.5 L / s, it can be said that the need for clean water unfulfilled. In the aspect of water quality, source of raw water used by Water Supply Company of South Barito has not meet the standards in terms of pH and turbidity, so the use of water is not safe for the people of South Barito Regency.

Keywords: population projections, the need for clean water, water quality

I. PRELIMINARY

South Barito regency is one of the districts in the province of Central Kalimantan. The capital of the district is located in Buntok. South Barito district has an area of 8830 km² and a population of approximately 133 304 inhabitants. South Barito regency is a regency that development is quite rapid because in terms of geographical location in Central Kalimantan, South Barito regency become a transit point, because of the pattern of movement of people and goods also leads to an increase in population and economic needs, especially the needs of clean water.

Based on the results of the data Drinking Water Company (PDAM) South Barito regency taps subscribers in 2012 to 2016 has increased relatively rapidly. The percentage of water quality that meets the health requirements in South Barito regency is quite low at 57.8%. In the Book of PDAM Performance 2016, South Barito PDAM performance is still included in the category of less healthy with a value of 2.24. In the face of the risk of shortage of drinking water or clean water wastage possibility PDAM South Barito regency require predictions that can give you an idea how much the amount of water that will be distributed to customers in the future.

Research purposes

1. Knowing the percentage of the population growth of the data the population of South Barito regency for 5 years.
2. Projecting population growth for 5, 10, 15, and 20 years
3. Calculating the need for clean water in South Barito regency from now on up to 20 years into the future with an interval of 5 years.
4. Comparing the intake capacity of PDAM South Barito to the amount of water needs of up to 20 years.
5. Analyzing the quality of raw water in the South Barito regency intake.

II.   LITERATURE REVIEW

1.   Projected Population

There are several methods that can be used to analyze the population growth in the future, namely: arithmetic, goemetrik, linear regression, exponential, logarithmic

Arithmetic method

$$P_{n = P_0 + r \times (T_n - T_0)}$$ .... (Equation 2.1)

$$r = \sum_{i=1}^{N} \frac{P_i - P_{(i-1)}}{N}$$ .... (Equation 2.2)

Geometric method

$$P_n = P_0 (1 + r)^n$$ .... (Equation 2.3)

$$r = \sum_{i=1}^{N} \frac{P_i - P_{(i-1)}}{N}$$ .... (Equation 2.4)

Linear Regression Method

$$a = \frac{\sum y \, \sum x^2 - \sum x \, \sum(xy)}{N \sum x^2 - (\sum x)^2}$$ .... (Equation 2.5)

$$b = \frac{N \sum(xy) - \sum x \, \sum y}{N \sum x^2 - (\sum x)^2}$$ .... (Equation 2.6)

Exponential method

$$\ln a = \frac{1}{N}\left(\sum \ln y - b \sum x\right)$$ ....(Equation 2.7)

$$b = \frac{N \sum(x \ln y) - (\sum x \, \sum \ln y)}{N \sum x^2 - (\sum x)^2}$$ .... (Equation 2.8)

Logarithmic method

$$a = \frac{1}{N}\left(\Sigma y - b . \Sigma \ln x\right)$$ .... (Equation 2.9)

$$b = \frac{(N.\Sigma y.\ln x) - (\Sigma P.\Sigma \ln x)}{N.\Sigma(\ln x)^2 - (\Sigma \ln x^2)}$$ .... (Equation 2.10)

2. **Projected water needs**

a. **Factors Maximum Day**

The maximum day factor is factor comparison between the use of the maximum water usage per day with the daily average water used for a year.

     Q days maximum   =   FMD * Q day average

     Q days maximum   =   1.1 * Q day average

b. **Peak Hour Factor**

Peak hour factor is the ratio between the largest time water usage with average water use during maximum day.

     Q peak hours =   FJP * Q days max

     Q peak hours =   1.5 * Q days max

     Where:

     Q hour max   = Maximum water demand in one day

     Q peak hours = Maximum water demand at certain times of day

The daily requirement of maximum and peak hours is needed for calculating the amount of raw water needed, because it concerns the

requirement on certain days and at peak hours of service. So it is important to consider a coefficient for the purpose.

a. Terms of the quantity of water

Table 1 Domestic Water Needs

No.	City Category	Total of Population	Water Needs (liters/person/day)		Comparisson SR - HU
			SR	HU	
1	Metropolis	> 1,000,000	190	30	90-10
2	Big city	500.000-<1,000,000	170	30	80-20
3	Medium cities	100,000 <500,000	150	30	80-20
4	Small town	20,000-<100,000	130	30	70-30
5	City District/Village	3,000 to <20,000	100	30	70-30

(Source: Department of Public Works. 2007)

Each SR service criteria = 3-6 people / house

Each HU service criteria = 100 / HU

   non-domestic   : Criteria for water needs by type of facility

To calculate the water needs based facilities / domestic water requirements, water requirements standard tables required by the facilities (non-domestic) which will be presented in table 2 below.

Table 2 Standard Water Needs Based Facilities (non-domestic)

	Facility type	Unit	Standard Users	Clean Water Needs
EDUCATIONAL FACILITIES				
1	TK	liters / ppl / day	70	15-30
2	SD	liters / ppl / day	240	15-30
3	SMP	liters / ppl / day	360	15-30
4	SMU	liters / ppl / day	360	15-30
5	College	liters / ppl / day	750	15-30
WORSHIP PLACE				
1	mosques	lt / unit / day		800 - 2000
2	Musholla / langgar	lt / unit / day		300 - 1000
3	Church	lt / unit / day		200-600
4	Shrines / temple / monastery	lt / unit / day		100-500

	Facility type	Unit	Standard Users	Clean Water Needs
HEALTH FACILITY				
1	General Hospital	lt / bed / day		200-400
2	Maternity Hospital	lt / unit / day		600 - 1000
3	PHC	lt / unit / day		1000 - 1200
4	clinic / posyandu	lt / unit / day		800 - 1200
5	Pharmacy	lt / unit / day		100
Commerce & FACILITIES SERVICES				
1	Stalls / shops / stalls	lt / unit / day		6-12
2	Market	lt / unit / day		2500 - 5000
3	Supermarket	lt / unit / day		1500 - 2500
4	Restaurant / dining	lt / seat / day	100	40-140
5	Cooperative	lt / unit / day		500 - 1000
6	Bank	lt / unit / day		1100 - 1500
7	Insurance	lt / unit / day		1100
8	Terminal / station	lt / unit / day		2000-45000
UTILITIES, RECREATIONAL and SPORTS				
1	Government offices			
	a. village office	liters / ppl / day	15	10-50
	b. District office	liters / ppl / day	30	10-50
	c. district office	liters / ppl / day	50	10-50
	d. Autonom agencies	liters / ppl / day	30	10-50
	e. BUMN	liters / ppl / day	500	10-50
2	Cinema	lt / unit / day		1000 - 3000
3	Multipurpose building	lt / unit / day		1000 - 3000
4	meeting hall	lt / unit / day		1500 - 2000
5	Hotel / inn	lt / bed / day		75-150
6	Sports arena	lt / unit / day		1200 - 1600
7	Swimming pool	lt / unit / day		1000 - 1300
INDUSTRIAL ACTIVITY				
1	Big industry	liters / ppl / day	750	25
2	Average Industry	liters / ppl / day	300	25
3	Small industry	liters / ppl / day	50	25

(Source: Department of Public Works. 2007)

Raw water quality standards

According to the Drinking Water Quality Requirements Minister of Health of Republic of Indonesia No. 492 / Menkes / PER / IV / 2010, Terms of Drinking Water Quality can be seen in Table 3

Table 3 Requirements Drinking Water Quality

No.	Type Parameter Mandatory	Unit	content Maximum That Allowed
2. Parameters that are not directly related to health			
	a. physical parameters		
	1) Smell		Odorless
	2) Color	TCU	Colorless
	3) Substance Total Dissolved (TDS)	mg / liter	500
	4) Turbidity	NTU	5
	5) flavor		Tasteless
	6) Temperature	° C	Air temperature ± 3

3   METHODOLOGY

In this study, starting with literature that is collecting, reading and studying the books of literature related to the issue of raw water sources and matters related thereto. Then proceed to the formulation of the problem is to calculate the water needs required by the South Barito regency.

This was followed by the data collection phase. Data obtained in the form of primary data and secondary data. Primary data is data obtained directly from the source. The primary data in the form of interviews, a review of the field by using a Water Quality Checker, and water quality data (pH, TDS, EC, and temperature) taps South Barito regency. Secondary data is data collected by researchers indirectly or using other sources. This data is data and data taps for 5 years the total population of South Barito regency BPS.

Followed by analyzing primary and secondary data to obtain population projections over the next 20 years and the need for clean water for domestic and non-domestic in South Barito regency, and comparing the intake capacity and the need for clean water in South Barito regency.

4 RESULTS AND DISCUSSION

Table 4 Data BPS South Barito regency

No.	Year	Population
1	2012	126.300
2	2013	129.200
3	2014	130.609
4	2015	131.987
5	2016	133.304

(Source: South Barito regency in Figures 2016)

Table 5 Data PDAM South Barito

No.	Year	SR Customer	Capacity (Liters / sec)	Water Production (M3)	Water Distribution (M3)	Water Sold (M3)
1	2013	9.069	164,5	3.072.821	3.047.995	2.070.410
2	2014	9.321	184,5	3.252.405	3.226.154	2.188.553
3	2015	9.824	184,5	3.516.590	3.488.206	2.364.082
4	2016	9.897	184,5	3.348.781	3.238.285	2.361.558

(Source: South Barito Regency PDAM)

Table 6 Data Capacity Intake taps South Barito 2017

No.	locations	WTP amount (units)	Capacity (L / sec)
1.	Buntok	5	85
2.	Jenamas	2	7.5
3.	Baru	1	5
4.	Bangkuang	2	12.5
5.	Pendang	1	10
6.	Mengkatip	2	7.5
7.	Sababilah	1	10
8.	Tabak Kanilan	2	15
9.	Babai	2	10
10.	Patas	1	5
11.	Kalahien	1	10
12.	Tanjung Java	1	1
13.	Round	2	1
14.	Penda Asam	1	5
	amount	14	184.5

Table 7 Summary of Correlation Value and Standard Deviation

	arithmetical	geometric	Linear regression	exponential	logarithmic
R2	0,9833	0,9820	0,9833	0,9821	0,9672
STD	2768,57	2771,61	2655,52	2663,05	2612,02

Population Projection Method Linear Regression

The method that qualify the requirements of the criteria is the Linear Regression method, this method is the most qualified because it has a standard deviation (STD) most small and has a correlation coefficient (R2) closest to 1. Value Thus, the proper method of population projections are used to project the population of the District South Barito to 20 years is the Linear Regression method.

Table 8 Population Projection Methods Linear Regression

No.	Year	Projected Population (Pn)	Population Density (people / km2)	Population growth (%)
1	2017	135.319	15	1,51%
2	2018	136.998	16	1,24%
3	2019	138.678	16	1,23%
4	2020	140.357	16	1,21%
5	2021	142.037	16	1,20%
6	2022	143.716	16	1,18%
7	2023	145.396	16	1,17%
8	2024	147.075	17	1,16%
9	2025	148.755	17	1,14%
10	2026	150.434	17	1,13%
11	2027	152.114	17	1,12%
12	2028	153.793	17	1,10%
13	2029	155.473	18	1,09%
14	2030	157.152	18	1,08%
15	2031	158.832	18	1,07%
16	2032	160.511	18	1,06%
17	2033	162.191	18	1,05%
18	2034	163.870	19	1,04%
19	2035	165.550	19	1,02%
20	2036	167.229	19	1,01%

Projected water needs

Furthermore recapitulation domestic water requirement calculations Barito Selatan can be seen in Table 9. Calculation Results

Table 9 Domestic Water Supplies South Barito regency

No.	Description	Category	2017	2021	2026	2031	2036
1	Population projection	Total Population (people)	135.318	142.036	150.434	158.831	167.229
2	Target Services	% Of Population	34%	54%	80%	100%	100%
5	Population Served (soul)	a. Connection Home (SR)% Target (soul)	46.306	77.296	119.851	158.625	167.012
		b. Public Hydrant (HU) 100% -% Target (soul)	89.013	64.740	30.583	0	0
6	Σ Projected Domestic Connection	a. Connection Home (SR) = 6 org / SR	7.718	12.883	19.975	26.438	27.835
		Added Σ connection	-	1.334	1.475	280	280
		b. Public Hydrant (HU) = 100 org / HU	890	647	306	0	0
		Added Σ connection	-	-	-	-	-
7	Water needs	SR (L / org / h)	150	150	150	150	150
		a. Connection Home (SR)	6.945.898,61	11.594.439,5	17.977.615,17	23.793.752,86	25.051.740,35
		b. Public Hydrant (HU) = 30 L / org / h	2.670.375,28	1.942.207,1	917.496,97	0.00	0.00
8	Total domestic water needs	Number (L / day)	9.616.273,88	13.536.646,6	18.895.112,14	23.793.752,86	25.051.740,35
		Number (L / dt)	111,30	156,67	218,69	275,39	289,95

Furthermore recapitulation of the calculation of total water needs Barito Selatan can be seen in Table 10.

Table 10 Water Supply Needs Calculation Results Total Barito Selatan

No.	Description	Unit	Year				
			2017	2021	2026	2031	2036
1	Population projection	Soul	135.319	142.037	150.434	158.832	167.229
2	Total domestic demand	L / day	9616274	13.536.647	18.895.112	23.793.753	25.051.740
3	The percentage of non-domestic needs	%	52,31%	52,31%	52,31%	52,31%	52,31%
4	Total non-domestic needs	L / day	5.030.644,77	7.081.543,35	9.884.763,90	12.447.432,31	13.105.534,22
5	The total need for clean water	L / day	14.646.918,65	20.618.189,94	28.779.876,04	36.241.185,17	38.157.274,56
6	Percent Water Loss	%	27,07	20,00	20,00	20,00	20,00
7	losing Water (Leak rate of 20%)	L / day	2.929.383,73	4.123.637,99	5.755.975,21	7.248.237,03	7.631.454,91
		L / dt	33,90	47,73	66,62	83,89	88,33
8	Water production	L / day	17.576.302,38	24.741.827,93	34.535.851,25	43.489.422,20	45.788.729,47
		L / dt	203,43	286,36	399,72	503,35	529,96
9	Factors Day Maximum (110%)	L / day	19.333.932,62	27.216.010,72	37.989.436,37	47.838.364,42	50.367.602,42
		L / dt	223,77	315,00	439,69	553,68	582,96
10	Total Water Needs (Peak hours 150%)	L / day	26.364.453,57	37.112.741,90	51.803.776,87	65.234.133,30	68.683.094,21
		L / dt	305,14	429,55	599,58	755,02	794,94

Table 11 Water Needs in the Future

| No.	Year	Projected Needs Water		Target Services
		L / day	L / sec	
1	2017	26.364.453,57	305,14	34%
2	2018	28.967.814,01	335,28	39%
3	2019	31.626.982,22	366,05	44%
4	2020	34.341.958,18	397,48	49%
5	2021	37.112.741,90	429,55	54%
6	2022	39.939.333,37	462,26	59%
7	2023	42.821.732,61	495,62	65%
8	2024	45.759.939,60	529,63	70%
9	2025	48.753.954,36	564,28	75%
10	2026	51.803.776,87	599,58	80%
11	2027	54.909.407,14	635,53	85%
12	2028	56.776.812,00	657,14	90%
13	2029	60.625.696,71	701,69	95%
14	2030	64.544.341,12	747,04	100%
15	2031	65.234.133,30	755,02	100%
16	2032	65.923.925,49	763,01	100%
17	2033	66.613.717,67	770,99	100%
18	2034	67.303.509,85	778,98	100%
19	2035	67.993.302,03	786,96	100%
20	2036	68.683.094,21	794,94	100%
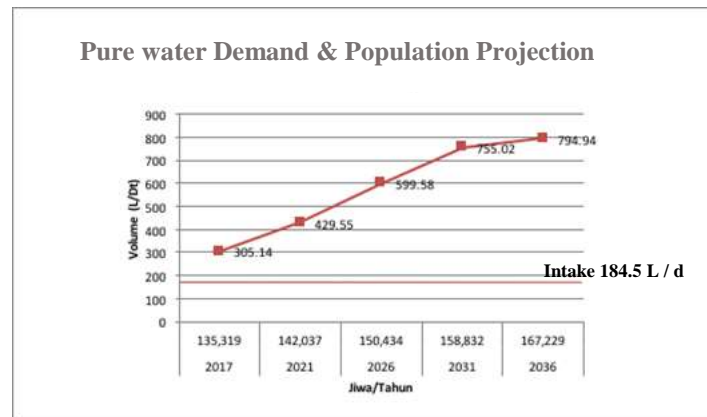
Figure 2 Graph Water Supplies Projected by Condition

Water quality testing

Water kualiatas data collected by testing in the laboratory using the tool to know the parameters contained in the water. In this study, the location of intakes at select housed in the river Barito, South Barito Regency, Central Kalimantan. It also conducted water sampling at one of the local residents who have been the installation of taps as a result of the comparison of water quality between water that has not been treated with water distributed

Table 12 Sample Test Results of South Barito Water Supply Company

No.	Parameter	Unit	Field Test Results		Require ment	Information
			Before Treatment	After Treatment		
1.	Temperature	^oC	26,44	26,37	25 oC (± 3)	Qualify
2.	Ph	pH	5,97	5,20	6,5 to 8,5	Does not qualify
3.	Electrical Conduction Power	mS / cm	0,082	0,048	-	-
4.	Turbidity	NTU	41,6	18,5	5	Does not qualify
5.	Dissolved Oxygen	mg / L DO	8,47	8,41	-	-
6.	Total Dissolved Solids	g / L TDS	0,054	0,032	0,5	Qualify
7.	Salinity	ppt	0	0	-	-

5. CONCLUSION

From the results of calculations and studies that have been done in the last chapter, it can be concluded as follows:

1. From calculations using linear regression method obtained amount
   South Barito regency population with the result row as follows in 2017; 2021; 2026; 2031; 2036 amounted to 135.319 inhabitants; 142.037 inhabitants; 150.434 inhabitants; 158.832 inhabitants; 167.229 inhabitants.

2. The calculation of water needs Barito Selatan with consecutive results as follows in 2017; 2021; 2026; 2031; In 2036 amounted to 305,14 L / dt, 429,55 L / dt, 599,58 L / dt, 755,02 L / dt, 794,94 L / dt.

3. PDAM South Barito regency in 2016 has amounted to 184.5 WTP L / dt obtained by calculating the projected water needs for South Barito regency in 2017 amounted to 305,14 L / dt, can be said for the year 2017 or the beginning of projections until the year the end of the projection in 2036 amounted to 794,94 L / dt needs clean water had not met

4. Water quality data obtained from the test results of the physical condition of tap water samples Barito Selatan yet eligible Class I water to the raw water needs

Suggestion

From the results of calculations and studies that have been done, then there are some suggestions that need to be done in order to maintain the water balance in South Barito regency, namely:

1. PDAM South Barito regency needs to increase the number or capacity of the WTP to meet the availability of water for South Barito regency provided no longer able to meet the water needs of South Barito regency in the next few years.

2. PDAM South Barito regency to review the drinking water supply system is in conformity with the standards based on the guidelines of the Regulation of the Minister of Public Works on the Implementation of SPAM No. 18 of 2007. In particular, in the process of setting the pH value.

3. South Barito regency taps need to conduct an examination of the means of distribution such as steel pipe when it is subject to corrosion in order to be replaced

with new ones, so that the pH of the water remains stable and does not decrease due to corrosion.

4. PDAM South Barito regency must improve service coverage to 44% by 2019 and reduce the number of water loss to 20%.

5. Keeping the existing water resources by way of preserving the environment and prevent deforestation.

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