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Analysis of Clean Water Production Capacity Regional Drinking Water Company City Tidore Islands

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Abstract

The need for clean water is an unlimited and sustainable need, while the need for clean water supply and services is increasing from time to time which is sometimes not matched by service capabilities. This is a challenge that must be faced by the local government and a solution is immediately sought so that the majority of people who depend on PDAMs in the city of Tidore Islands do not lack clean water. The purpose of this study was to determine the prediction of the clean water needs of the population of the city of Tidore Islands in the next 20 years, starting from 2016 to 2036. This research was carried out in the service area of the PDAM, Tidore Islands district, especially on Tidore Island. Prediction of population growth and increasing facilities Social activities are carried out using Arithmetic and Geometric methods. The results of this study indicate that the need for clean water for the people of the city of Tidore Islands in 2036 is for normal use of 488.20 liters/second, for maximum day use is 572.90 liters/second. for use at peak hours of 871.8 liters / second

Keywords: *Production capacity, clean water*

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INTRODUCTION

Water is a basic need that is very basic for human survival, so there is an expression "Where there is water there is life". People can live without food for three weeks, but without drinking water, humans can only survive for 4-7 days. The availability of clean water is very important for household and industrial consumption. Thus, clean water gets the main handling priority because it involves the livelihood of many people. Meeting the need for clean water can be done in various ways, adapted to existing resources. For urban areas, in general, the provision of clean water is piped and non-piped. Regional drinking water company (PDAM) as the manager of drinking water with a piped system, while the non-pipeline system is managed by the community. The need for clean water is an unlimited and sustainable need. Meanwhile, the need for clean water supply and service is increasing from time to time, which is sometimes not matched by service capability. This increase in demand is caused by an increase in the population, an increase in the standard of living of the residents as well as the development of the city/service area or other matters related to the improvement of the socio-economic conditions of the residents.

The population of the island city of Tidore has increased every year where in 2015 it reached 96,979 people, in 2016 it reached 98,206 people, in 2017 it reached 99,337 people, in 2018 it reached 100,415 people, in 2019 it reached 101,414 people and in 2020 it reached 114,480. This is a challenge that must be faced by the local government and a solution must be found immediately so that the majority of people who depend on PDAMs in the city of Tidore Islands do not lack clean water. If this condition is not immediately addressed, the water demand will continue to increase along with the increase in population each year.

Several previous research results revealed that by calculating the clean water capacity analysis, it will produce a projection of service coverage so that clean water services can be achieved, Meanwhile, the results of research conducted by show that the influence of community intervention factors (eg the use of water-saving equipment and rainwater tanks) on water needs is among the most significant. The results also confirm that community intervention programs and water pricing policies together can play a significant role in reducing overall water demand. On the other hand, the effect of rainfall on water demand was found to be very limited, while temperature showed some degree of correlation with water demand.

Other researchers reveal that the influence of society and government, will cause the proposed multi-criteria model decision-making approach to be appropriate for carrying out strong and well-structured decision-making. In balancing the water supply-demand strategy in the water supply system and the research results of highlight the need for water resource planners and decision makers to better consider the importance of effective public awareness and education, encouraged internal and external, in the behavior and management of water demand.

In general, the source of raw water on Tidore Island is ground water, where for the PDAM's raw water source, drilled wells are used, the depth varies between 5 - 100 meters. The obstacle faced in the future is the limited discharge produced by each well while the increase in the amount of clean water demand cannot be avoided. Lack of water at certain hours, especially at peak hours of use, can disrupt the water demand for the needs of the population, thus requiring alternative regulators and an effective increase in water production capacity that meets minimum needs at peak hours.

Based on this, the problem in this study is how much water production capacity is needed to meet the use of clean water for the community in the city of Tidore Islands?

The purpose of this study was to analyze the clean water production capacity of PDAM Tidore Kepulauan City.

METHODS

This research was conducted in the service area of PDAM Tidore Kepulauan City with a duration of six months. The research design uses quantitative descriptive research to predict the need for clean water in the next 20 years. The type of data used is secondary data in the form of time series of customers' clean water usage in the City of Tidore Islands for 12 years, starting from 2004 until 2016.

The data processing technique is to analyze the clean water production capacity of PDAM Tidore Islands using the Geometrical Increase method and the Arithmetical Increase method [7].

Geometrical Increase method

$$Pn=Po(1+r)n \quad (1)$$

with :

Pn = Total population in the nth year (people)
Po = Total population at the beginning of the year (people)
r = Percentage of population geometrical growth per year (%)
n = Period of time under review (years)
Arithmetical Increase method.

$$Pn = Po + n.r \quad (2)$$

$$r = Po – Pt/ t \quad (3)$$

with :
Pn = Total population in the nth year (people)
Po = Total population at the beginning of the projection year (people)
r = Population growth rate per year (%)

n = Period of time under review (years)
t = Number of years before the year of analysis

RESULTS AND DISCUSSION

Geographical Circumstances

Tidore Islands City as an autonomous region which was divided from the Central Halmahera district based on Law no. 1 of 2003 concerning regional expansion which was inaugurated on May 31, 2003. As for the map of the city of Tidore, the islands are [1]:

Figure 1. Map of the City of Tidore Islands

Geographically, the location of the Tidore Archipelago City area is at the astronomical limit of 00 - 20 north latitude at north latitude to 00-500 south latitude and at 127010'-127045' east longitude. Tidore Archipelago City has a land area of 1,550.37 km2. The entire area in this area is surrounded by the sea and has the following boundaries:

- North side with West Halmahera Regency
- South side with South Halmahera Regency
- East side with East Halmahera Regency and Central Halmahera Regency
- West side with the City of Ternate

Area and Topography

The administrative area of Tidore Kepulauan City is divided into 89 villages/kelurahan, with an area of 1,883.33 square kilometers or equal to 3.01% of the North Maluku Province. Furthermore, the following table is a breakdown of the area of the administrative area of the Region by District in the City of Tidore, Islands:

Table 1. Area by District in the City of Tidore, Islands

Name of District	Area (Km)²	Percentage (%)
South Tidore	42.4	2.73
North Tidore	37.64	2.43
Tidore	36.08	2.33
East Tidore	34	2.19
Oba	403.67	26.04
South Oba	196.58	12.68
North Oba	376	24.25
Central Oba	424	27.35

Source: BPS City of Tidore Islands

From the total area owned by Tidore Kepulauan City, most of them are highlands, which is 72.5% of the total area and the rest is lowlands as much as 27.74%. There are 5 sub-districts whose topography is highland and hilly, namely South Oba, Tidore, South Tidore, Central Oba, East Tidore, while the other sub-districts are in the lowlands.

Table 2. Area Height Above Sea Level (ASL) According to Observations in the City of Tidore, Islands

Name of District	High ASL
South Tidore	22
North Tidore	18
Tidore	31
East Tidore	14
Oba	26
South Oba	28
North Oba	48
Central Oba	20

Source: BPS City of Tidore Islands

1.1. Climate

The climate in the Tidore Archipelago City area is like a tropical island area, where the climate is strongly influenced by sea breezes. The dry season occurs from December to March, while the rainy season occurs from May to October caused by the southeast wind. The transition season occurs in April and December.

Table 3. Average Monthly Rainfall and Rainfall in the City of Tidore Islands

Month	Rainy Day (Day)	Dry Days (Days)	Rainfall (mm^3)
January	11	20	106
February	1	28	38
March	8	23	204
April	16	14	111
May	13	18	238
June	20	10	344
July	19	12	224
August	7	24	139
September	11	19	248
October	21	10	339
November	17	13	179
December	18	13	280
Total	162	204	2 450

Source : Soasio Plant Protection Brigade

1.2. Hydrological Conditions

In general, the availability of clean water on the island of Tidore is experiencing difficulties, especially during the dry season. In coastal areas that are not served by PDAM, clean water is obtained from residents' dug wells. In the dry season, this well experiences a decrease in water flow

and feels a bit brackish. This dug well can serve 30 families. In the rainy season, in general, the people of the city of Tidore Islands use water by collecting rainwater in a reservoir.

Surface water sources in the Tidore Islands city area are on the island of Halmahera, which include the Kayasa river, Akelamo river, Neweri river, Sinofa river, Tafaga river, and Lifofa river. Meanwhile, the rivers in the Tidore island area do not have a continuous water discharge.

1.3. Demographics

The population of the city of Tidore Islands in 2016 was 98,206 people, consisting of 49,552 men and 48,695 women. Judging from the population distribution in each sub-district, Tidore sub-district has the most population with a population of 18,801 people and the sub-district with the least population is Oba Selatan sub-district, which is 5,476 people. For the population density of each sub-district, Tidore sub-district has the highest density with a total of 521 people per square kilometer, then North Tidore sub-district with a total of 393 people per square kilometer and the lowest is Oba Tengah sub-district with a total of 22 people per square kilometer.

Table 4. Area and Total Population by District in Tidore Islands City

Name of District	Area (Km)²	Total Population (Persons)	Population density
South Tidore	42.4	13 338	315
North Tidore	37.64	14 809	393
Tidore	36.08	18 801	521
East Tidore	34	8 367	246
Oba	403.67	11 431	28
South Oba	196.58	5476	28
North Oba	376	16473	44
Central Oba	424	9511	22
	1.550,37	98.206	63

Source: BPS City of Tidore Islands

1.4. Production Capacity and Existing Service Level of PDAM Tidore Kepulauan City

The production capacity of PDAM Tidore Islands is 39.2 L/sec. With details on the table:

Table 5. Production Capacity of PDAM Tidore Islands

No	**SPAM UNITS**	**WATER SOURCES**	**IMPLEMENTATION**		**Installed capacity**	**Production capacity**	**Household Connections (UNIT)**	**DESCRIPTION**
			Year of Development	Source of funds				
1	Indonesiana	Deep Well	1985 s/d 2014	APBN	35,538 Ltr/s	24.2 Ltr/s	2938	6 Units of Wells and 1 Unit of Bron captering
2	Gurabati	Deep Well	2017	APBD	4,7 Ltr/s	4 Ltr/s	1124	1 Well Unit
3	Mareku	Deep Well	2012	APBD	4,7 Ltr/s	4 Ltr/s	529	1 Well Unit
4	Fobaharu	Deep Well	2014	APBN	4,7 Ltr/s	4 Ltr/s	135	2 Units of Wells (1 unit in use)
5	Rum	Deep Well	2013	APBN	3,8 Ltr/s	3 Ltr/s	310	1 Well Unit
Total Production Capacity						39,2 Ltr/s		

Source: PDAM Tidore Islands

Currently, there are three sub-districts in the Tidore Islands City district that have been served with clean water from PDAM, namely, Tidore sub-district, South Tidore sub-district, and North Tidore sub-district. The sub-districts of East Tidore, Oba, South Oba, North Oba, Central Oba have not been served. From data on clean water services in North Maluku Province in 2016, the level of

service from PDAM Tidore Islands is 4,383, public hydrants 9 units of non-domestic commercial connections, population served 21,915 people, service percentage 22, 31% of the total population of the city of Tidore Islands.

1.5. Population Growth Analysis

For the accuracy of the calculation of the estimated population in the next few years, a rather large sample of the population is needed, the more sample years that are calculated, the more accurate the calculation results and closer to the predictions set. This study uses a sample of population growth from 2004 to 2016. Using the Geometric and Arithmetic method, the population growth ratio is calculated which is then averaged to project population growth in the next 10 years.

Table 6. Population Growth Data for Tidore Islands City

No	Year	Number of Souls	Arithmetic Growth (Soul)	Geometric Growth (%)
1	2004	49474		
			726	1.45
2	2005	50200		
			500	1
3	2006	51300		
			600	1.16
4	2007	51900		
			600	1.14
5	2008	52655		
			755	1.4
6	2009	53836		
			1181	2.14
7	2010	55133		
			1297	2.25
8	2011	57651		
			2518	4.3
9	2012	58804		
			1153	1.7
10	2013	68654		
			9850	12.55
11	2014	78504		
			9850	11.15
12	2015	88354		
			9852	10
13	2016	98206		

Source: Data Processing Results

1.5.1. Population Projection Calculation

Geometrical Increase method

The basic formula for the geometric method:

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

From the data in table (6), Po = 98206 souls

r = 4.44% or = 0.044

so the forward projection equation is:

Pn = 98206(1+0.044)n (3)

Arithmetical Increase method

The formula for the Arithmetic method is:

Pn = Po+nr (4)

r = Po-Pt/t

t = To-Tt

Pt = Total Population in 2004 = 49474 people

Po = Total Population in 2016 = 98206 people

To = 2016

Tt = 2004

r = (98206-49474)/2016-2004

r = 48732/11 = 4430

So the arithmetic equation is:

Pn =Po+nr

Pn = 98206 + 4430n (5)

Table 7. Population Projection of Tidore Islands City 2016-2036

No	Year	n	Arithmetic Method Pn = 98206 + 4430n	Geometric Method Pn = 98206(1+0,044)n	Average projection
1	2016	0	98206	98206	98206
2	2017	1	102636	102527	102582
3	2018	2	107066	107038	107052
4	2019	3	111496	111748	111622
5	2020	4	115926	116665	116295
6	2021	5	120356	121798	121077
7	2022	6	124786	127157	125972
8	2023	7	129216	132752	130984
9	2024	8	133646	138593	136120
10	2025	9	138076	144691	141384
11	2026	10	142506	151058	146782
12	2027	11	146936	157704	152320
13	2028	12	146936	164643	155790
14	2029	13	146936	171888	159412
15	2030	14	146936	179451	163193
16	2031	15	146936	187346	167141
17	2032	16	146936	195590	171263
18	2033	17	146936	231829	189383
19	2034	18	146936	242576	194756
20	2035	19	146936	253250	200093
21	2036	20	146936	295240	221088

Source: Data Processing Results

From the analysis of the data above, the population of Tidore Islands City in 2016-2036 is 221,088 people (20 years projection).

1.5.2. Standards of Analysis

According to the planning criteria for the 2017 Directorate General of Human Settlements, the Public Works Department, the standards for clean water requirements are as follows:

1. Consumption of household connections: 120 liters/person/day
2. Consumption of general hydrants is: 60 liters/person/day
3. The comparison between household connections and public hydrants is: SR = HU = 80: 20

3.8. Clean Water Needs Analysis

3.8.1. Domestic Sector

Household Connection

Table 8. Household Water Needs

No	Year	Number of Population (people)	Service Level (%)	Number of Serviced (lives)	Average water consumption (liters/person/day)	Total Usage (liters/day)	Amount of Water Needs (Liters/second)
a	b	c	d	e	f	g	h
1	2016	98206	80	78565	120	9427776	109.1
2	2017	102582	80	82065	120	9847827	114.0
3	2018	107052	80	85642	120	10277004	118.9
4	2019	111622	80	89298	120	10715709	124.0
5	2020	116295	80	93036	120	11164361	129.2
6	2021	121077	80	96862	120	11623397	134.5
7	2022	125972	80	100777	120	12093274	140.0
8	2023	130984	80	104787	120	12574470	145.5
9	2024	136120	80	108896	120	13067483	151.2
10	2025	141384	80	113107	120	13572832	157.1
11	2026	146782	80	117425	120	14091060	163.1
12	2027	150754	80	120603	120	14472344	167.5
13	2028	155605	80	124484	120	14938110	172.9
14	2029	160457	80	128366	120	15403877	178.3
15	2030	165309	80	132247	120	15869643	183.7
16	2031	170161	80	136128	120	16335410	189.1
17	2032	175012	80	140010	120	16801176	194.5
18	2033	179864	80	143891	120	17266943	199.8
19	2034	184716	80	147773	120	17732709	205.2
20	2035	189567	80	151654	120	18198475	210.6
21	2036	194419	80	155535	120	18664242	216.0

Source: Data Processing Results

[a] = serial number
[b] = Projection Year (Planning Year)
[c] = Result of calculation of population projection (table 7)
[d] = Criteria for the Directorate General of Human Settlements = 80%
[e] = [c] x [d]
[f] = Planning criteria for the Directorate General of PU
[g] = [e] x [f]
[h] = [g]/(24x60x60)

General Hydrant

Table 9. General Hydrant Water Needs

No	Year	Number of Population (people)	Service Level (%)	Number of Serviced (lives)	Average water consumption (liters/person/day)	Total Usage (liters/day)	Amount of Water Needs (Liters/second)
a	b	c	d	e	f	g	h
1	2016	98206	20	19641	60	1178472	13.6
2	2017	102582	20	20516	60	1230978	14.2
3	2018	107052	20	21410	60	1284626	14.9

4	2019	111622	20	22324	60	1339464	15.5
5	2020	116295	20	23259	60	1395545	16.2
6	2021	121077	20	24215	60	1452925	16.8
7	2022	125972	20	25194	60	1511659	17.5
8	2023	130984	20	26197	60	1571809	18.2
9	2024	136120	20	27224	60	1633435	18.9
10	2025	141384	20	28277	60	1696604	19.6
11	2026	146782	20	29356	60	1761382	20.4
12	2027	150754	20	30151	60	1809043	20.9
13	2028	155605	20	31121	60	1867264	21.6
14	2029	160457	20	32091	60	1925485	22.3
15	2030	165309	20	33062	60	1983705	23.0
16	2031	170161	20	34032	60	2041926	23.6
17	2032	175012	20	35002	60	2100147	24.3
18	2033	179864	20	35973	60	2158368	25.0
19	2034	184716	20	36943	60	2216589	25.7
20	2035	189567	20	37913	60	2274809	26.3
21	2036	194419	20	38884	60	2333030	27.0

Source: Data Processing Results

[a] = serial number

[b] = Projection Year (Planning Year)

[c] = Result of calculation of population projection (table 7)

[d] = Criteria for the Directorate General of Human Settlements = 80%

[e] = [c] x [d]

[f] = Planning criteria for the Directorate General of PU

[g] = [e] x [f]

[h] = [g]/(24x60x60)

3.8.2. Non-Domestic Sector

Educational Facilities

Educational facilities function to serve the community so that student growth is assumed to be the same as the population growth of the city of Tidore Islands. Based on the regulations of the Directorate General of Creative Works, the need for educational facilities includes public facilities with water needs of 10-15% of domestic needs

Table 10. Water Needs for Educational Facilities

No	**Year**	**Number of students (people)**	**Average water consumption(SR) (Liters/second)**	**Average consumption(HU) (Liters/second)**	**Total Domestic Water (Liters/second)**	**15%= 0,15 Domestic water needs**
a	b	c	d	e	f	g
1	2016	50083	109.12	13.6	122.8	18.4
2	2017	52287	113.98	14.2	128.2	19.2
3	2018	54587	118.95	14.9	133.8	20.1
4	2019	56989	124.02	15.5	139.5	20.9
5	2020	59497	129.22	16.2	145.4	21.8
6	2021	62114	134.53	16.8	151.3	22.7
7	2022	64848	139.97	17.5	157.5	23.6
8	2023	67701	145.54	18.2	163.7	24.6
9	2024	70680	151.24	18.9	170.1	25.5
10	2025	73790	157.09	19.6	176.7	26.5
11	2026	77036	163.09	20.4	183.5	27.5
12	2027	78828	167.50	20.9	188.4	28.3
13	2028	81517	172.89	21.6	194.5	29.2

14	2029	84207	178.29	22.3	200.6	30.1
15	2030	86896	183.68	23.0	206.6	31.0
16	2031	89585	189.07	23.6	212.7	31.9
17	2032	92275	194.46	24.3	218.8	32.8
18	2033	94964	199.85	25.0	224.8	33.7
19	2034	97654	205.24	25.7	230.9	34.6
20	2035	100343	210.63	26.3	237.0	35.5
21	2036	103032	216.02	27.0	243.0	36.5

Source: Data Processing Results

[a] = Sequence Number

[b] = Projection Year (planning year)

[c] = The number of students in 2016 is 50083 people obtained from the BPS City of Tidore Islands in 2017. The calculation of the projected number of students is calculated using the geometric method with the formula Pn=

Po (1+r)n

[d] = Total (SR)

[e] = Total (HU)

[f] = [d]+[e]

[g] = [f] x 15 %

Worship Facilities

The growth of worship facilities is assumed to be equal to population growth. In the regulations set by the Directorate General of Human Settlements Dep. PU, water needs for mosques are 3000 liters/unit/day while for Musallah 2000 liters/unit/day. The projected number is *assumed for the mosque every 5 years to increase by 1 unit*, while the Mushollah increases by 1 unit every 2 year

Table 11. Water Needs for Mosques

No	Year	Number of Mosques (Unit)	15%= 0.15 Domestic water demand
a	b	c	d
1	2016	148	18.4
2	2017	148	19.2
3	2018	148	20.1
4	2019	148	20.9
5	2020	148	21.8
6	2021	149	22.7
7	2022	149	23.6
8	2023	149	24.6
9	2024	149	25.5
10	2025	149	26.5
11	2026	150	27.5
12	2027	150	28.3
13	2028	150	29.2
14	2029	150	30.1
15	2030	150	31.0
16	2031	151	31.9
17	2032	151	32.8
18	2033	151	33.7
19	2034	151	34.6
20	2035	151	35.5
21	2036	152	36.5

Source: Data Processing Result

[a] = Sequence Number

[b] = Projection Year (planning year)

[c] = Number of mosques in 2016 which is 148 people obtained from BPS City of Tidore Islands in 2017. The calculation of the projected number of mosques is calculated with the assumption that in 5 years there will be an increase of 1 mosque.

[d] = 15% of the total domestic water demand.

Table 12. Water Needs for Mushola Worship Facilities

No	Year	Number of Mosques (Unit)	15%= 0.15 Domestic water demand
a	b	c	d
1	2016	124	18.4
2	2017	124	19.2
3	2018	125	20.1
4	2019	125	20.9
5	2020	126	21.8
6	2021	126	22.7
7	2022	127	23.6
8	2023	127	24.6
9	2024	128	25.5
10	2025	128	26.5
11	2026	129	27.5
12	2027	129	28.3
13	2028	130	29.2
14	2029	130	30.1
15	2030	131	31.0
16	2031	131	31.9
17	2032	132	32.8
18	2033	132	33.7
19	2034	133	34.6
20	2035	133	35.5
21	2036	134	36.5

Source: Data Processing Result

Market Facilities

Market facilities in the Tidore Islands City area along with the market area can be seen in the following table 12

Table 14. Market Area in Tidore City, Islands

No	Market	Market Area (ha)
1	Sarimalaha	4
2	Pasar baru	3
3	PPI Goto	3
4	Rum	2
5	Galala	2
6	Ake Tobololo	2
7	Lola	1
8	Wama	1

To fulfill the need for clean water at market facilities based on the criteria of the Directorate General of Human Settlements, the amount is 1200 liters/ha/day. Meanwhile, the market area is assumed to increase by 2ha every 5 years. The results of the analysis for the need for clean water can be seen in table 15 the following :

Table 15. Water Needs for Market facilities

No	Year	Number of Mosques (Unit)	15%= 0.15 Domestic water demand
a	b	c	d
1	2016	124	18.4
2	2017	124	19.2
3	2018	125	20.1
4	2019	125	20.9
5	2020	126	21.8
6	2021	126	22.7
7	2022	127	23.6
8	2023	127	24.6
9	2024	128	25.5
10	2025	128	26.5
11	2026	129	27.5
12	2027	129	28.3
13	2028	130	29.2
14	2029	130	30.1
15	2030	131	31.0
16	2031	131	31.9
17	2032	132	32.8
18	2033	132	33.7
19	2034	133	34.6
20	2035	133	35.5
21	2036	134	36.5

Source: Data Processing Result

[a] = Sequence Number

[b] = Projection Year (planning year)

[c] = area of market land (ha).

[d] = 15% of the total domestic water demand

Office Facilities

Projection of the number of office employees is calculated using the geometric method. Office employees in 2016 were 3893 people (BPS Tidore Islands in Figures 2017). Table 16. Water Needs for Office Facilities

Table 16. Water Needs for Office Facilities

No	Year	Number of users (life)	15%= 0.15 Domestic water demand
a	b	c	d
1	2016	124	18.4
2	2017	124	19.2
3	2018	125	20.1
4	2019	125	20.9
5	2020	126	21.8
6	2021	126	22.7
7	2022	127	23.6
8	2023	127	24.6
9	2024	128	25.5
10	2025	128	26.5
11	2026	129	27.5
12	2027	129	28.3

13	2028	130	29.2
14	2029	130	30.1
15	2030	131	31.0
16	2031	131	31.9
17	2032	132	32.8
18	2033	132	33.7
19	2034	133	34.6
20	2035	133	35.5
21	2036	134	36.5

Source: Data Processing Result

Hospital Facilities

The development of health facilities until 2016 the number of beds (bed) as many as 250 beds (BPS City of Tidore Islands in Figures 2017). It is assumed that 10 beds are added every 2 years. According to the standard planning criteria from the Directorate General of Human Settlements, the need for public facilities is 10%-15% of the total domestic water demand.

Table 17. Water Needs for Hospital Facilities

No	**Year**	**Number of beds (units)**	**15%= 0.15 Domestic water demand**
a	b	c	d
1	2016	124	18.4
2	2017	124	19.2
3	2018	125	20.1
4	2019	125	20.9
5	2020	126	21.8
6	2021	126	22.7
7	2022	127	23.6
8	2023	127	24.6
9	2024	128	25.5
10	2025	128	26.5
11	2026	129	27.5
12	2027	129	28.3
13	2028	130	29.2
14	2029	130	30.1
15	2030	131	31.0
16	2031	131	31.9
17	2032	132	32.8
18	2033	132	33.7
19	2034	133	34.6
20	2035	133	35.5
21	2036	134	36.5

Source: Data Processing Result

Health Center Facilities

There are 10 Puskesmas facilities in the Tidore Islands city area (BPS, Tidore Islands in Figures 2017). Water needs for health centers according to the Directorate General of Human Settlements Dep. PU. the need for public facilities is 10%-15% of the total domestic water demand. It is assumed that in the next ten years there will be an increase of 4 Puskesmas units

Table 18. Water Needs for Health Center Facilities

No	Year	Number of beds (units)	15%= 0.15 Domestic water demand
a	b	c	d
1	2016	124	18.4
2	2017	124	19.2
3	2018	125	20.1
4	2019	125	20.9
5	2020	126	21.8
6	2021	126	22.7
7	2022	127	23.6
8	2023	127	24.6
9	2024	128	25.5
10	2025	128	26.5
11	2026	129	27.5
12	2027	129	28.3
13	2028	130	29.2
14	2029	130	30.1
15	2030	131	31.0
16	2031	131	31.9
17	2032	132	32.8
18	2033	132	33.7
19	2034	133	34.6
20	2035	133	35.5
21	2036	134	36.5

3.9. Recapitulation of Clean Water Needs for Tidore Islands City

From the results of calculating the need for clean water in the Tidore Islands City area, the recapitulation results are obtained in table 19.

Table 19. Recapitulation of Clean Water Needs for Tidore Islands City

No	Year	SR	HU	Education facility	Mosque	Musholla h	Market	Office	Hospital	Public health center	Amount
		(L/s)	**(L/s)**	**(L/s)**	**(L/s)**	**(L/s)**	**(L/s)**	**(L/s)**	**(L/s)**	**(L/s)**	**(L/s)**
1	2016	109.1	13.6	18.4	18.4	18.4	18.4	18.4	18.4	18.4	251.7
2	2017	114.0	14.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	262.9
3	2018	118.9	14.9	20.1	20.1	20.1	20.1	20.1	20.1	20.1	274.3
4	2019	124.0	15.5	20.9	20.9	20.9	20.9	20.9	20.9	20.9	286.0
5	2020	129.2	16.2	21.8	21.8	21.8	21.8	21.8	21.8	21.8	298.0

6	2021	134.5	16.8	22.7	22.7	22.7	22.7	22.7	22.7	22.7	310.3
7	2022	140.0	17.5	23.6	23.6	23.6	23.6	23.6	23.6	23.6	322.8
8	2023	145.5	18.2	24.6	24.6	24.6	24.6	24.6	24.6	24.6	335.6
9	2024	151.2	18.9	25.5	25.5	25.5	25.5	25.5	25.5	25.5	348.8
10	2025	157.1	19.6	26.5	26.5	26.5	26.5	26.5	26.5	26.5	362.3
11	2026	163.1	20.4	27.5	27.5	27.5	27.5	27.5	27.5	27.5	376.1
12	2027	167.5	20.9	28.3	28.3	28.3	28.3	28.3	28.3	28.3	386.3
13	2028	172.9	21.6	29.2	29.2	29.2	29.2	29.2	29.2	29.2	398.7
14	2029	178.3	22.3	30.1	30.1	30.1	30.1	30.1	30.1	30.1	411.2
15	2030	183.7	23.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	423.6
16	2031	189.1	23.6	31.9	31.9	31.9	31.9	31.9	31.9	31.9	436.0
17	2032	194.5	24.3	32.8	32.8	32.8	32.8	32.8	32.8	32.8	448.5
18	2033	199.8	25.0	33.7	33.7	33.7	33.7	33.7	33.7	33.7	460.9
19	2034	205.2	25.7	34.6	34.6	34.6	34.6	34.6	34.6	34.6	473.3
20	2035	210.6	26.3	35.5	35.5	35.5	35.5	35.5	35.5	35.5	485.8
21	2036	216.0	27	36.5	36.5	36.5	36.5	36.5	36.5	36.5	498.2

Source: Data Processing Result

Furthermore, the results of the number of clean water needs in table 4.19 above are multiplied by water needs at normal hours, namely 1 hour, the water demand factor at maximum hours is 1.15 and at peak hours is 1.75 (Criteria Dijend. Ciptakarya 2017) [8]

Tabel 20. Water demand fluctuation

		TAHUN PROYEKSI 2016-2036																				
	Factor	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Normal (L/det)		252	262,9	274,32	286	298	310,3	322,802	335,6	348,8	362,3	376,13	386,31	398,74	411,17	423,60	436,04	448,47	460,90	473,33	485,77	498,20
FHM (L/det)	1,15	289,4	302,3	315,5	328,9	342,7	356,8	371,2	386,0	401,1	416,6	432,5	444,3	458,5	472,8	487,1	501,4	515,7	530,0	544,3	558,6	572,9
FJP (L/det)	1,75	440,4	460,0	480,1	500,6	521,5	543,0	564,9	587,4	610,4	634,0	658,2	676,0	697,8	719,5	741,3	763,1	784,8	806,6	828,3	850,1	871,8

FHM = Water usage factor on maximum day
FJP factor = Water consumption factor at peak hours

CONCLUSION

The results of data analysis show that the production capacity of the PDAM is 39.2 liters/second with details from the calculation results of the projected water demand for the city of Tidore Islands for the next 20 years, for normal use it is 488.20 liters/second, for a maximum of 572 days. .90 liters/second and for peak hours of 871.8 liters/second

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