Strategy Analysis of Sustainable Water Supply System in Buleleng Regency

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Abstract: The Provincial Government of Bali prepares development in a comprehensive and sustainable manner by taking into account the carrying capacity of Bali's nature which is guided by the planned universal development program contained in the Nangun Sat Kerthi Loka Bali program. With this program, it is hoped that the welfare of the community will be achieved while preserving the natural surroundings as a support for human life in various sectors of life. One of the main obstacles in the development of sustainable water resources is the lack of water resource development planning based on the concept of sustainability, with challenges faced covering aspects of geography, institutions, regulations, human resources, funding sources, awareness and community participation. In line with the description above, while still paying attention to the linkages and sustainability of water resources development programs in the Bali region, as well as the efforts that have been implemented, it is important to make more sustainable planning, especially in the Buleleng Regency area. The increasing demand for water causes several problems in the process of providing water in sufficient quantity and quality. The availability of water on the earth's surface is naturally limited, and is determined by time and space. The rapid development of tourism and industry has resulted in increased water demand, while water reserves are decreasing. Population growth in Buleleng Regency is increasing, so that the fulfillment of the basic needs of the community for clean water is increasing. Buleleng Regency is a regency with the largest area in Bali Province, namely 1,365,880 km2, about 24.232% of the total area of Bali Province. Buleleng Regency has a population of 664,000 people in 2020 The population distribution in 9 sub-districts includes Gerokgak District 85,730 people, Seririt District 73,600 people, Busungbiu District 41,210 people, Banjar District 73,450 people, Sukasada District 78,880 people, Buleleng District 139,570 people, Sawan District 61,140 people, KubuAddan District 56,150 people, Tejakula District 54,270 people. Buleleng sub-district is the most populous sub-district in this district. The percentage of the total population in Bali Province in 2020 is 15.225%. In terms of quantity, the current population growth rate of Buleleng Regency is 0.58%. Clean water services in Buleleng Regency are carried out by the Regional Drinking Water Company (PDAM) of Buleleng Regency and community groups. PDAM Buleleng Regency is able to serve 19 urban villages with the percentage of services reaching 90.08%, and services at the rural level reaching 24.01%. The level of clean water services managed by PDAM has reached an average of 27.12% of the total population of Buleleng Regency. The current availability of clean water in Bulelelng Regency until 2040 is 887.43 l/sec, and water demand in Bulelelng Regency until 2040 is 1,707.87 l/sec, there is a water deficit in 2040 in Bulelelng Regency of 820, 44 l/sec. To overcome the clean water deficit in Bulelelng district, the Titab Reservoir SPAM development was carried out at 300 liters/sec, and Tamblang Reservoir SPAM at 400 liters/sec, Tamblingan Lake at 100 liters/sec, and Sanih Spring development at 50 liters/sec. The development of a clean water supply system in Buleleng Regency will be able to meet clean water needs until 2040, resulting in a clean water surplus of 29.56 liters/sec.

1 INTRODUCTION

1.1 Background

Population growth in Buleleng Regency is increasing, so that the fulfillment of the basic needs of the community for clean water is increasing. Buleleng Regency is a regency with the largest area in Bali Province, namely 1,365,880 km2, about 24.232% of the total area of Bali Province. Buleleng Regency has a population of 664,000 people in 2020 The population distribution in 9 sub-districts includes Gerokgak District 85,730 people, Seririt District 73,600 people, Busungbiu District 41,210 people,

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Banjar District 73,450 people, Sukasada District 78,880 people, Buleleng District 139,570 people, Sawan District 61,140 people, KubuAddan District 56,150 people, Tejakula District 54,270 people. Buleleng sub-district is the most populous sub-district in this district. The percentage of the total population in Bali Province in 2020 is 15.225%. In terms of quantity, the current population growth rate of Buleleng Regency is 0.58%. (Central Bureau of Statistics of Buleleng Regency, 2020)

Clean water services in Buleleng Regency are carried out by the Regional Drinking Water Company (PDAM) of Buleleng Regency and community groups. PDAM Buleleng Regency is able to serve 19 urban villages with the percentage of services reaching 90.08%, and services at the rural level reaching 24.01%. The level of clean water services managed by PDAM has reached an average of 27.12% of the total population of Buleleng Regency.

1.2 Problem Formulation

The formulation of the problem from the Strategic Analysis of the Sustainable Water Supply System in Buleleng Regency is;

1. How much is the availability and need of clean water in Buleleng Regency
2. What is the strategy for a sustainable clean water supply system in Buleleng Regency

1.3 Purpose

The purpose of this study was to obtain answers to the problems presented, is:

1. Calculate the current and projected water supply and demand in the future
2. Develop a clean water supply system strategy in Bulelelng Regency

2 LITERATURE REVIEW

2.1 Sustainable Water Resources Management

Sustainable urban development is development in an effort to improve long-term social and ecological health. Efforts to realize sustainable urban development, namely to achieve livability for all city residents. One of the embodiments is done through the provision of piped water. Clean water service through pipes is a basic need of the community which greatly affects the smooth running of urban activities. Water is an integral part of human life. The unavailability of public infrastructure, namely the provision of water through pipes is one of the poor categories. Poor access to clean water as the main infrastructure is a representation of the state's failure to manage the public service sector (Erwin Nugraha, 2009).

2.2 Strategy Management

Strategic management is defined as a way to guide companies to achieve a number of goals, including corporate responsibilities, managerial capabilities, to administrative systems related to strategic decision making, and operations.Strategic management is a series of fundamental decisions and actions from the highest management, which are applied by all members of an organization, for the realization of organizational goals (Agrifa Masir. 2017).

2.3 Population

The calculation of the population is important, because knowing the population of an area will be the basis for making population policies at a certain time. The province of Bali, which includes nine regencies and cities, has a relatively varied population. Population development in the province of Bali has not been evenly distributed. As a result of the uneven development of the region, especially related to the development of the tourism industry sector, community social centers, and government, which are still in the district capital.

Calculation of the population using arithmetic, geometric and least square formulas. To determine the method used in each sub-district, the smallest standard deviation value of the three approaches will be determined. (Minister of Public Works Regulation 2007).

2.4 Clean Water Development System

Part of a clean water distribution network system, are the components that exist in a series of clean water distribution network systems. These parts consist of pipes and their connections, valves, pumps, reservoirs, all of which must work properly.

Based on the instructions of the Integrated City Infrastructure Development Program regarding Guidelines for Planning and Technical Design for the drinking water sector, it is stated that the raw water sources that can be treated are springs, namely water sources that are above the ground surface, shallow wells, namely water sources resulting from

excavations or drilling depths. less than 40 meters deep, deep wells, namely water sources from excavation or drilling with a depth of more than 40 meters, rivers, namely water drainage channels formed from upstream to empties into the sea or lakes, lakes and water reservoirs, namely deep water storage units a certain amount of which the water comes from streams or rainwater reservoirs.

3 METHODOLOGY

3.1 Scope of Research

The scope of research on the Strategy of Sustainable Water Supply System in Buleleng Regency, is:

1. Study of literature or review of relevant studies related to the clean water supply system in Bulelelng Regency
2. Survey of the current condition of the clean water supply system
3. Analyzing the current availability and demand for clean water and future projections
4. Determine the strategy for providing clean water for Buleleng Regency

3.2 Data Source

The data source is a very important part related to the validity of the data. With regard to the data to be retrieved, the data that will be needed are as follows:

1. Demographic data of the population, socio-cultural facilities and infrastructure, tourism, industry.
2. Clean water supply system data in Bulelelng Regency
3. Data on current sources of clean water in Bulelelng Regency
4. Clean water quality and quantity data

3.3 Survey Method

1. Field survey to determine the state of the existing network/system of drinking water facilities, identify and inventory problems.
2. Survey of Clean water Supply System and development plan.
3. Survey of clean water supply infrastructure, Sanih Water system, Grokgak Dam system, Titab Dam and Titab Dam clean water system development, Tamblang Dam system
4. Measurement of water source discharge as a Clean Water Supply System Development Plan in Sanih Springs, Bulelelng Regency

3.4 Analysis of Clean Water Availability

In calculating the mainstay discharge using the basic year planning method. The planning base year is a reliable debit pattern where the debit pattern has actually happened in previous years. The mainstay discharge calculation is intended to find the quantitative value of the available discharge throughout the year, in the dry season and in the rainy season.

3.5 Population Analysis

Calculation of the population using arithmetic, geometric and least square formulas. To determine the method used in each sub-district, the smallest standard deviation value of the three approaches will be determined.(Minister of Public Works Regulation 2007).

3.6 Clean Water Needs Analysis

The Directorate General of Human Settlements has set the water usage standard for metropolitan cities of 190 liters/person/day, standard waterrequirements for large cities at 170 liters/person/day, medium cities at 150 liters/person/day, and small cities at 130 liters people. /day.

3.7 Water Balance

The water balance is intended to determine how much potential is available each month, as well as how much water is needed. The Water Balance will know the months of surfing as well as the months that are in deficit. Mathematically, the calculation method for obtaining the residual water discharge in this water balance analysis is the mainstay discharge minus the demand discharge.

3.8 Clean Water Supply System Strategy

The clean water supply system strategy is carried out by means of a literature study, with the development of the concept of sustainable water source management, based on the condition of the current system that has been running, taking into account the

sustainability of clean water supply in the future. Inventory of existing clean water sources and clean water sources that are in the process of being built.

4 DISCUSSION RESULT

4.1 Population

The backward calculation of the population projections of the nine sub-districts above shows that the standard deviation of the geometric method has the smallest standard deviation value. Population projections for the nine sub-districts in 2020, 2025, 2030, 2035, and 2040 in Buleleng Regency using the geometric method produce the population as shown in the following table.

Table 1: Projected Population of Buleleng Regency 2020-2040.

Districts	Projected population (person)				
	2020	2025	2030	2035	2040
Gerokgak	85.730	89.239	92.892	96.695	100.653
Seririt	73.600	75.582	77.618	79.709	81.855
Busungbiu	41.210	41.902	42.606	43.321	44.049
Banjar	73.450	75.688	77.995	80.372	82.821
Sukasada	78.880	82.386	86.047	89.871	93.865
Buleleng	139.570	144.957	150.551	156.361	162.396
Sawan	61.140	62.371	63.627	64.909	66.216
Kubutambahan	56.150	57.294	58.461	59.653	60.868
Tejakula	54.270	54.466	54.663	54.860	55.058
Buleleng Regency	**664.000**	**683.885**	**704.460**	**725.750**	**747.781**

4.2 Water Potential

Buleleng Regency has potential water sources, including:

1. Pangkung Dalem Spring with a capacity of 100 liters/sec,
2. Lamaman Springs with a capacity of 50 lt/sec,
3. Welding Springs with a capacity of 10 lt/sec,
4. Camplung Springs with a capacity of 10 lt/sec
5. Banjar Ancar Spring with a capacity of 4 lt/sec
6. Subuk Springs with additional discharge of 4.5 lt/sec
7. Ambengan Spring SPAM with a capacity of 3 lt/sec
8. Sanih Springs with a capacity of 50 lt/sec

Utilization of raw water sources is constrained by :

1. limited funds,
2. conflict of use with the interests of agricultural irrigation
3. construction that is still in the process of completion.

4.3 Clean Water Balance

The provision of clean water is planned to meet the clean water needs of the population (domestic) and public facilities, thus it is calculated by considering factors that can support or cause an increase in the need for clean water.

The drinking water needs of an urban area are analyzed based on several considerations, namely, the number of residents during planning until the end of the planning year, and service targets. From the considerations above, population is an important factor in determining the policy for providing urban infrastructure, including the need for drinking water. Population parameters that must be observed include the number, density, rate of increase and distribution.

Table 2: Current Clean Water Balance in Buleleng Regency.

Description	Unit	Year				
		2020	2025	2030	2035	2040
Population	Person	664.000	683.885	704.460	725.750	747.781
Water requirement	l/s	1.188,15	1.530,07	1.576,51	1.624,58	1.707,87
Production capacity Local water company	l/s	761,00	761,00	761,00	761,.00	761,.00
Production capacity Non Local Water Company	l/s	126,43	126,43	126,43	126,43	126,43
Current Total Availability	l/s	887,43	887,43	887,43	887,43	887,43
Water Balance	l/s	-300,72	-642,64	-689,08	-737,14	-820,44

Provision of drinking water infrastructure, to meet domestic needs or household needs for community members, is also needed to meet water needs in various urban facilities such as public facilities, business or trade facilities as well as industrial needs and special needs.

4.4 Development Strategy

Buleleng Regency experiences a shortage of clean water in 2040 of 820.44 liters/second, assuming the production capacity of PDAMs and Non-PDAMs until 2040 is 887.43 liters/second, while the projected water demand in that year is 1,707.87 liters/second. second. To be able to meet these deficiencies, there are several plans for a Clean Water Supply System that can be developed in Buleleng Regency until 2040, including:

1. Titab reservoir with a capacity of 300 liters/second to meet the needs of Western Buleleng
2. Tamblang reservoir with a capacity of 400 liters/second to meet the needs of Eastern Buleleng

3. Tamblingan Lake with a capacity of 100 liters/second
4. Sanih Springs with a capacity of 50 liters/second

Table 3: Neraca Air Bersih Setelah Pengembangan.

Description	Unit	Year				
		2020	2025	2030	2035	2040
Total population	person	664.000	683.885	704.460	725.750	747.781
Total water requirement	l/s	**1.188,15**	**1.530,07**	**1.576,51**	**1.624,58**	**1.707,87**
Production capacity Local water company	l/s	761	761	761	761	761
Production capacity Non Local water company	l/s	126,43	126,43	126,43	126,43	126,43
Current Capacity		**887,43**	**887,43**	**887,43**	**887,43**	**887,43**
Development Capacity						
System Titab	l/s	150	300	300	300	300
System Tamblang	l/s	-	400	400	400	400
Tamblingan Lake	l/s	-	100	100	100	100
Air Sanih Spring	l/s	25	50	50	50	50
Total Development	l/s	175	850	850	850	850
Total Capacity	l/s	**1.062,43**	**1.737,43**	**1.737,43**	**1.737,43**	**1.737,43**
Water Balance	l/s	-125,72	207,36	160,92	112,85	29,56

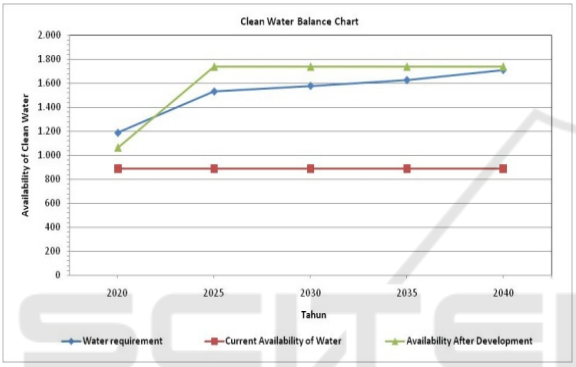

Figure 1: Clean Water Balance Chart.

4.5 Clean Water Service Targets

The distribution of clean water service targets in Bulelelng Regency is carried out by considering the differences in character between each target. Clean water service targets are grouped into five, namely:

1. Strategic Area
2. Super Commercial Area
3. Commercial/Urban Area
4. Rural Area
5. Remote Areas Vulnerable to Water

Villages with sustainability in social, financial, environmental, institutional and technical aspects have a very good level of sustainability, while villages with sustainability in just one aspect have a low level of sustainability. (Kamulyan, P.2017). The sustainability of the Village Drinking Water Company is influenced by the social capital and human capital it has. The influencing social capital factors are a network of strong social relationships, trust, and regulatory norms, while the influential human capital factors are motivation, commitment, work team effectiveness and leadership (Andito Sidiq Swastomo. 2020).

5 CONCLUSION

The conclusions of the research on Strategy Analysis of Sustainable Water Supply System in Buleleng Regency can be presented as follows:

1. The current availability of clean water in Bulelelng Regency until 2040 is 887.43 l/sec, and the water demand in Bulelelng Regency until 2040 is 1,707.87 l/sec, there is a water deficit in 2040 in Bulelelng Regency of 820.44 l/sec.
2. To overcome the clean water deficit in Bulelelng district, the strategies that need to be carried out are, the development of the Titab Reservoir SPAM of 300 l/s and the Tamblang Reservoir SPAM of 400 l/s, Tamblingan Lake of 100 l/s, Development of the Sanih Springs of 50 lt/sec.
3. The development of a clean water supply system in Buleleng Regency will be able to meet the needs of clean water until 2040, resulting in a clean water surplus of 29.56 l/sec.

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