

Study of the Potential and Utilization of Springs for Clean Water Supply to Supporting Tourism Development in the North Badung Regency

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Abstract: Badung Regency is the main tourist destination in Bali with the distribution of tourist areas mostly in the southern area. Although most of them are located in the southern part, the northern area of Badung remains a concern for the Regional Government to be developed through several programs including the tourism village program based on community tourism development. To support this program, one of the supporting capacities that must be provided is the availability of sufficient water in terms of quantity, quality and continuity. From the preliminary research that has been carried out, it shows that the northern part of Badung has the potential for large springs that are spread almost throughout the region. Some of these springs have been used by the community as a source of clean water for daily needs, some have been used by as a source of raw water but some have not been utilized. With the significant impact caused by the tourism sector and to avoid excessive groundwater use by Badung Regency water company, it is very important to conduct a study on the availability of water from springs in the study area. Bali has 1287 springs spread throughout the province, 35% of which are in Badung Regency with significant potential. The potential of springs in this area is supported by water storage in Lake Batur which is right above Badung Regency in the North. The research method is carried out by studying literature and observing and measuring directly in the field. Activities are carried out by hearings with related institutions, communities and rural water user groups. The output of this research is in the form of a study on the potential of springs and their utilization as well as policies in the development of clean water supply in Badung Regency which are sourced from springs.

1 INTRODUCTION

The development of human life causes an increase in interest water resources seen from various angles such as social, economic culture, security and other needs (Romadhan, 2020) (Gupta and Kulkarni, 2018). The very important role of water as a source of life has made water have a high bargaining power at the economic level. This condition has an impact on conservation and protection of water sources but also has an impact on overexploitation which can reduce water quality (León and Domínguez-, 2021), (Rasul, 2016).

Badung Regency is the main tourist destination in Bali Province with the number of incoming tourists in 2019 amounting to 821,234 tourists both local and foreign (Patera et al., 2015). Most tourist destinations are still targeting the southern area such

as Kuta, Bena, Nusa Dua, Garuda Wisnu Kencana Cultural Park and others. However, the data also shows that Badung Regency as an agricultural area has begun to be glimpsed by tourists as an agricultural and cultural destination. In order to support the development of tourism in northern Badung, one of the much needed carrying capacities is the availability of clean water. The current conditions in North Badung are mostly using water from Badung Regency Water Company, partly from village water company and partly by self-drilling groundwater. With the geographical position of North Badung under Lake Batur, in this area there are more than 46 potential springs spread across several villages (Arntz et al., 2015). Several large springs have been used by Badung Regency water company as a source of raw water. In the framework of a reliable clean water supply system in

Northern Badung, it is very necessary to study the potential and use of springs accurately so that they can become a very important reference in the development of the tourism village. Research on the potential and conservation of springs is very important to know with certainty the amount of water and how to do the right conservation for the preservation of existing water resources. (Romadhan, 2020), (M.C. Baleseng, 2015), (E. Kreuzberg-Mukhina, N. Gorelkin, A. Kreuzberg V. Talskykh, E. Bykova and I. Mirabdullaev, 2004)

2 METHOD

The research was conducted in the form of information collection (secondary and primary data collection), field surveys and problem analysis. The surveys and data collection activities carried out included: data collection on potential springs, data collection for Badung Regency Water Company, spring development systems, measurement of deviant discharge in several potential springs and testing of water quality in several springs. More clearly the research methodology is carried out with the following steps:

- a. Inventory of water sources is based on secondary data and field checks are carried out. In the field, the topographic location, water discharge and conservation efforts that have been carried out by the community are recorded
- b. Coordinate with the community and local community leaders related to conservation and development efforts. The method used is in the form of group discussions and deep interviews
- c. Perform instantaneous discharge measurements at several potential springs with the instantaneous measurement method with the help of a current meter tool
- d. Conduct water quality testing using laboratory testing methods for physical, chemical, biological and bacteriological components
- e. Conducting an analysis of several villages that have developed a tourism village program
- f. Provide a reference for spring management policies related to development

3 DISCUSSION

3.1 Overview of Badung Regency

Badung Regency is located between 08°14'20" -

08°50'48" south latitude, and 115°05'00" - 115°26'16" east longitude, with the boundaries: north: Buleleng Regency; East: Bangli, Gianyar, and Denpasar City; South: Indonesian Ocean; West : Tabanan Regency. The area of Badung Regency is 418.52 km² administratively covering 6 sub-districts. The area of Badung Regency per District is as presented in Table 1 and the location map of Badung Regency is presented in Figure 1 below:

Table 1: Area of Badung Regency.

Sub District	Area (km ²)
Kuta Selatan	101,13
Kuta	17,52
Kuta Utara	33,86
Mengwi	82
Abiansemal	69,01
Petang	115
Total	418,52

Source: Badung Regency Government, 2021



Figure 1: Map of Badung Regency.

3.2 Topographical Overview

The highest altitude is in Petang District (2,075 m) above sea level, the lowest is in Kuta District (27 m) most of the urban areas are in the south. This indicates that physically development is progressing faster in the southern part, so it can be said that the further south Badung Regency is more urban and north it will be more rural. The slopes of Badung Regency can be grouped into 7 namely:

- a. slope 0 – 3%, is a flat area, generally an alluvial plain area of rivers, swamps and beaches. Its distribution includes Kuta, Legian and Benoa with

an area of 22.01 km² or 5.64% of the total area slope >3 – 5%, is a sloping area, generally an alluvial river plain area. Its distribution includes Jimbaran, Basangkasa and Petinggan with an area of 23.12 km² or 3.93% of the total area.

- b. slope >5 – 10%, is a undulating area generally is a undulating hilly area, the distribution covers the areas: Munggu, Dalung, Abianbase, Lukluk, Mengwi and Cemengan with an area of 109.9 km² or 28.19% of the total area.
- c. slope >10 – 15%, is a slightly sloping area. Its distribution includes Sembung, Batangnyuh, Sangeh, Allan, Getasan and Pangsang areas with an area of 59.53 km² or 15.27% of the total area.
- d. slope >15 – 30%, is a sloping area. Its distribution covers the areas of Unggasan, Pecatu, Kutuh, Petangan, Uluwatu and Sawangan with an area of 93.33 km² or 23.94% of the total area.
- e. slope > 30 – 70%, is a very sloping to steep area. Its distribution covers around Plaga, Kladan and Belok with an area of 75.49 km² or 19.36% of the mapping area.
- f. the slope of the slope > 70%, is an area that is up to steep. Its distribution covers the peak area of Mount Catur, with an area of 6.45 km² or 1.65% of the total area.

3.3 Springs Potential

In analyzing the springs in Badung Regency, it is carried out with secondary data from the Bali Penida River Council and direct observation to the field. The potential of existing springs in Badung Regency is shown in Table 2 below:

Table 2: Potential Springs In Badung Regency.

No	District	Springs
1	Petang	100
2	Abiansemal	106
3	Mengwi	67
4	Kuta Utara	6
	Total	379

Source: analysis, 2021

The results of the analysis and field observations show that there are 37 potential springs in Badung Regency with a total discharge of 1,439.54 litres/second. There are 10 springs that have been used as raw water sources with a water production of 116.3 litres/second or 8.08% of the total spring production. The springs that have been used for

Badung Regency Water Company can be seen in Table 3 below:

Table 3: Springs for Badung Regency Water Company Sources.

No.	Springs	Discharge (litres/second)
1	Ayunan	5
2	Batu Kurung	5
3	Kedewatan	4,5
4	Tanah wuk	35
5	Tuka	12
6	Dungun	15
7	Kerta	10
8	Sulangai	7
9	Sulangai Atas	2,8
10	Tangkup	25
	Total	116,30

Source: analysis, 2021

3.4 Fulfillment of Drinking Water by Village Water Company

The use of village water company in Badung Regency is very low, is within the value of 4.29%. There are many problems in the implementation of village water company, in this report all existing problems will be shown as evaluation material for agencies related to the fulfillment of drinking water for the community in Badung Regency. The use of water sourced from village water company is much smaller than that sourced from regency water company. This is due to the fact that most of them have been served by regency water company, while some areas with high or far topographical conditions have only used water from the village water company. The fulfillment of water by the community on a small scale is very good for the environment because it does not over-exploit, the community uses water wisely on a small scale. (Gupta and Kulkarni, 2018), (WCPA, 2012), (Barquín and Scarsbrook, 2008), (United

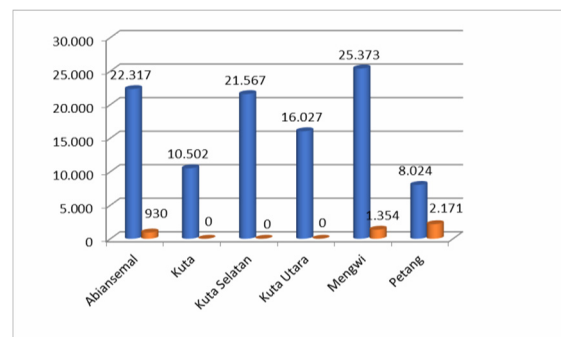


Figure 2: Comparison of the number of families using regency water company and village water company.

Nations, 2011), (Freeston *et al.*, 2017) Figure 2 shows a comparison of the number of families using water from Regency water company and village water company.

3.5 Fulfillment of Drinking Water with Non-Pipeline Network

Sources of water used in non-pipeline services include dug wells, boreholes and rivers. In calculating the percentage of non-pipeline network users, the only users who are counted are users of water sources in the form of drilled wells and dug wells. In Badung Regency there are quite a lot of users of dug wells and drilled wells. However, in the calculation, dug well users are only counted as 80% of the total existing users. This is because most of the owners of dug wells also use other water sources such as Badung Regency water company. Many of the dug wells are idle and no longer in use. So that the users of dug wells cannot be calculated optimally. The comparison between the total family and the family using dug wells and drilled wells can be seen in Figure 3

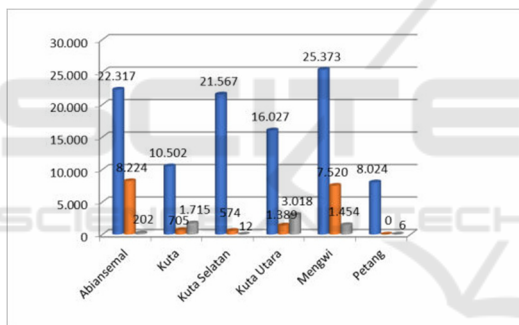


Figure 3: The comparison between the total family and the family using dug wells and drilled wells

3.6 Service of Badung Regency Clean Water

Sources of water used in clean water services in Badung regency is Badung regency water company, village water company, dug wells, drilled wells and rivers. The use of rivers as a source of drinking water is very little in Badung Regency, only 67 families. Clean water services in Badung Regency are very good. Overall, the service coverage of Badung Regency is 92.39%.

3.7 Water Quality

Spring quality testing was carried out on several potential springs by testing in the laboratory on

several parameters that were generally carried out regarding temperature, pH, BOD₅, COD, Nitrate and Nitrite. The test results show that there are almost no springs that have good quality to be drunk directly but must go through a processing process first. The results of a more complete water quality test can be seen in table 3

Table 3: Water Quality Test.

No.	Spring	Village	Parameter					
			Colour	pH	BOD ₅	COD	Nitrat(NO ₂ -N)	Nitrit(NO ₃ -N)
			UnitPtCo		mg/L	mg/L	mg/L	mg/l
1	Mumbul	Sangheh	No Detection	7,2	18,02	24,24	0,267	No Detection
2	Beji	Pangsan	0,442	7,44	24,02	40,4	0,924	No Detection
3	Purna	Mengwi	23,67	6,74	16,02	32,32	5,22	No Detection
4	B.Megoong	Bongksa Pertiwi	33,467	7,21	16,02	48,48	1,325	0,06
5	Jukut	Pelaga	33,12	7,2	8,56	11,45	1,27	No Detection
		Limit	15	6-9	2	10	10	

Source: laboratoriumanalysis

3.8 Tourism Village

Tourism Village is tourism based on the cultural excellence of the local community by carrying out the concept of sustainable conservation. This tour is managed by the local community ranging from accommodation, transportation attractions and other activities (Dewi *et al.*, 2018) (Permatasari, Widiati and Suryani, 2019) (Widnyana, Karunia and Sujana, 2020).

The Regency government has pioneered the development of five tourist villages in Badung Regency, namely Mengwi, Sangheh, Bongkasa Pertiwi, Pangsan and Pelaga. In these five villages, Sangheh is a village with a spring with a large discharge, namely the Mumbul spring, furthermore, Mengwi village has quite large springs, namely Purna springs, Bongkasa Pertiwi village has Batu Megoong springs, Pangsan village has Beji springs and Pelaga village has many springs but with a small discharge spread over almost the entire village area.

From the analysis of the instantaneous discharge and water needs for the purposes of the tourist village, it shows that the village has a sufficient amount of water.

4 CONCLUSION

Based on the results of field observations and analyzes that have been carried out related to springs in the North Badung area, it can be concluded several things as follows:

- a. The potential for springs in Badung Regency is 379 springs located in four sub-districts in the northern part of Badung, namely in Petang District as many as 200 units, in Abiansemal District as many as 106 units, Mengwi District as many as 67 units and in Kuta Utrara District as many as 6 units. Based from the discharge category, it can be classified into three groups, namely with 93 large potentials, 154 medium potentials and 132 small potentials. There are 37 potential springs developed
- b. The number of springs that have been utilized for the fulfillment of raw water currently amounts to 10 pieces
- c. Regarding sustainable spring management, it can be said that the local community and government have a high appreciation for water management because each spring has been protected by custom through local regulations/*awig-awig* which have implications for sustainable springs. The government, in this case the Regency Government and the Bali River Council has carried out several spring arrangements aimed at preserving the existing springs in the area.

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