Local Culture based Water Resources Conservation in the Village of *Sangeh*

I Gusti Lanang Made Parwita, Made Mudhina and I Nyoman Anom P. W.
Civil Department Polytechnic State of Bali, Jimbaran, Bali, Indonesia

Keywords: *Mumbul* Springs, *Sangeh* Village, Water Supply System, Water Conservation, Local Wisdom.

Abstract: Badung *Sangeh* Village has an area of 4.5 km^2, located in *Abiansemal* District, *Badung* Regency, with a population of 2,322 people with a density of 1,084 people / km^2 . The clean water supply system in this village uses water from the local drinking water company in *Badung* Regency with a 100% service percentage consisting of 967 customers. Based on the technical data of the local drinking water company in *Badung* Regency, there are 2 large water bodies with a discharge above 10 liters/second, namely *Gerana* springs (22 liters/second) which then become the source of water to the Regional Drinking Water Company in *Badung* Regency and springs *Mumbul* (± 125 liters/second) which is a source for irrigation, drinking water, holy water for religious purposes and a place for purification or self-cleaning. This research was conducted by collecting secondary data in the local drinking water company in *Badung* Regency as well as measuring the instantaneous discharge of the spring water and testing the quality of water directly. The analysis was carried out on water use patterns, raw water quality and the active participation of the community and government in carrying out water conservation in a sustainable manner. The results showed that the people of *Sangeh* Village with cool conditions, their monthly water usage for one customer is around 18.5 m^3. Water quality testing shows that the water quality meets the requirements as raw water. Even though all people have a water connection at their house, not a few of the people of *Sangeh* and its surroundings still take water from the *Mumbul* spring for drinking water consumption. There are several reasons that they convey related to taking water from the *Mumbul* spring, such as the taste of the water is better, it has been around since a long time ago, the place to get the water is clean and easy to reach and the fees for collecting the water are donations. Based on the very important function of the Mumbul spring related to culture and religion in the village of *Sangeh*, with the help of the *Badung* Regency Government, several facilities have been arranged and improved such as parking, cleaning/painting areas and the arrangement of the *Panca Tirta* Temple in the location of the spring. As a reinforcement of water conservation in *Sangeh* Village, it has also been supported by customary regulations */awig-awig* regarding the system and rules of taking water for various purposes. This integrated conservation model provides various benefits in addition to preserving the *Mumbul* spring as well as for the welfare of the surrounding community.

1 INTRODUCTION

Balinese who are predominantly Hindu have great respect for their surrounding environment. In Balinese Hinduism, the concept of *Tri Hita Karana* is known (three harmonious relationships that cause true happiness, namely relationships that are in harmony with God, relationships with people and relationships with the surrounding environment). With this concept, the respect of the Balinese people for forests, river, lakes and springs becomes very large because in their view, if they are well maintained, nature will provide prosperity for mankind (M. C. Baleseng 2015; Gusti and Agung 2020; Wijaya, Lantika, and Permadhi, 2021).

The *Mumbul* spring is in the *Banjar Brahmana* area of Sangeh Village, Abiansemal District, Badung Regency at the position of 8°30'39 " south latitude and 115°12'17" east longitude about 25 Km north of Denpasar City. The existence of *Sangeh* Village under Lake *Beratan* and Lake *Batur* and flanked by two river basins, namely the *Ayung* river in the east and the *Penet* River in the west, makes this area rich with several springs that are spread almost evenly in the village area. Some of the springs in the village area of *Sangeh* include *Brahmana 1*, *Brahmana 2*, *Mumbul*, *Pacung 1, Sangeh, Taman and Tanah Wuk.* The existing springs have been used by local community for various purposes. such as drinking water sources through the local drinking water

Parwita, I., Mudhina, M. and W., I.
Local Culture based Water Resources Conservation in the Village of Sangeh.
DOI: 10.5220/0010967500003260
In *Proceedings of the 4th International Conference on Applied Science and Technology on Engineering Science (iCAST-ES 2021)*, pages 1474-1478
ISBN: 978-989-758-615-6; ISSN: 2975-8246

company in *Badung* Regency, irrigation water sources, drinking water sources for the community as well as a means for cultural and religious activities. This has carried out conservation with the concept of local culture which is proven to be effective in maintaining the preservation of the spring. It is very necessary to conduct a deeper study so that the conservation pattern that has been successfully carried out in *Sangeh* Village can be carried out on springs in other places, of course with culture. the habits of the people are different.

The *Mumb*ul spring has a large pond on the north side of the road that connects *Taman* village with *Sangeh* village. The depth of the pool ranges from 1 to 3 m which is in a basin with low hills to the north. Dean Ananda (Gusti, Ni, and Ayu Agung. 2020), mentions that in the eastern area of Taman *Mumbul* Main Temple the vegetation is Tectona grandis and west of Taman Mumbul Main Temple the vegetation is Theobroma cacao. The spring pool of *Mumbul* becomes the main of a water source to be used for irrigation on the west side and for religious activities on the east side. Water from the *Mumbul* spring is used to irrigate 200 ha of rice fields in the south of *Sangeh* Village.

Figure 1: *Mumbul* spring.

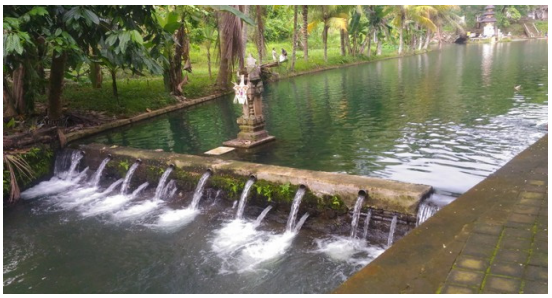

Figure 2: For irrigation.

The *Mumbul* spring has a very important role in relation to Balinese Hindu religious activities. It is recorded that 11 traditional villages in the vicinity use *Mumbul* spring as a holy spring/*Beji* for religious

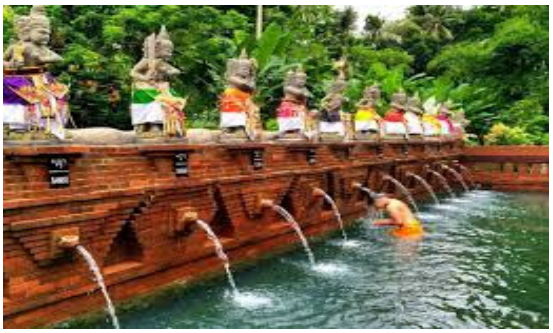

Figure 3: For purification ceremony.

activities in their respective areas. In *Mumbul* spring there are three temples, namely *Mumbul* temple. *Mumbul* templw which is built in the pool area as well as *Pancaka Tirta* temple to request drinking water.

a. *Mumbul* temple
This temple located in the north of the pool with a height of about 5 m from the water surface of the pool. This temple is a grand ceremony every 210 days.

b. *Mumbul* temple (pool area)
This temple is built in the form of a building/*Padmasana* which located in the middle of a pond. This temple is a big ceremony in conjunction with Mumbul Temple every 210 days.

c. *Pancaka Tirta* temple
This temple located in the south of the pond as a place to request drinking water for the surrounding population.

2 METHODOLOGY

The research was conducted by conducting field observations in the form of the location of the springs, the buildings around the springs, local community habits and policies, the participation of the surrounding community and the participation of the government in the conservation of the *Mumbul* spring. In addition, instantaneous discharge measurements were also carried out and water quality testing related to the quality of the *Mumbul* spring.

3 RESULT AND DISCUSSION

Inventory of springs is one of the important things to calculate water potential. (Gupta and Kulkarni 2018) (Barquín and Scarsbrook 2008). Based on the results

of interviews and observations with community leaders, youth and the general public, it is shown that the *Mumbul* spring area is managed by a traditional village (traditional village is a traditional Balinese community unit outside of the official village established by the Indonesian Government) which has power and authority. which is autonomous in the arrangement of the *Mumbul* spring. The existence of the Mumbul spring and all activities carried out in it must obtain permission from the *Sangeh* traditional village. Activities carried out in the springs by the *Sangeh* community and other surrounding villages must coordinate with the head of the customary village *(Bendesa*). *Bendesa* is assisted by several administrators. The customary village head performs his duties guided by the customary village regulations called *awig-awig.* In the management, all officers who work are given honoraria by the customary village.

Based on data from the Bali Penida River Council in 2015, the flow of *mumbul* springs is 112 liters/second divided into two outlets, namely the western outlet and the eastern outlet. From the results of direct measurements of the discharge of springs in the west with a current meter, it was found that the amount of discharge was 57.27 liters/second. Meanwhile, in the east, the flow rate is measured by instantaneous discharge of 62,7 liters/second. From the results of discharge measurements with several measurement experiments, it shows that the variation in the measurement results is consistent, in other words, the variation in discharge that occurs does not differ much. This shows that the *Mumbul* spring has a consistent discharge throughout its flow. Table 1 shows the measurement data of the spring outlet in the west and table 2 shows measurement data of the spring outlet in the east.

Table 1: West Outlet Instantaneous Discharge Measurement.

measurement	Channel shape	Wide (m)	water level (m)	Water velocity (m/second)	Discharge (liter/second)
1	Square	1,1	0,3	0,15	49,50
2		1,2	0,4	0,12	57,60
3		1,2	0,4	0,10	48,00
4		1,2	0,4	0,13	62,40
5		1,2	0,4	0,14	67,20
6		1,2	0,4	0,14	67,20
7		1,2	0,4	0,12	57,60
8		1,2	0,4	0,11	52,80
9		1,2	0,4	0,11	52,80
10		1,2	0,4	0,12	57,60
				Average	57,27

Source: analysis, 2020.

Table 2: East Outlet Instantaneous Discharge Measurement.

measurement	Channel shape	Diameter (m)	Water velocity (m/second)	Discharge (liter / second)
1	Round	0,08	1,20	6,03
2		0,08	1,40	7,03
3		0,08	1,03	5,17
4		0,08	1,21	6,08
5		0,08	1,02	5,12
6		0,08	1,30	6,53
7		0,08	1,02	5,12
8		0,08	1,03	5,17
9		0,08	1,03	5,17
10		0,08	1,21	6,08
11		0,08	1,03	5,17
			total	62,70

Source: analysis, 2020.

The results of the instantaneous discharge calculation show that there has been no significant change in discharge between the debit that was measured by the Bali River Council as measured in 2015 and the current measurements. It also shows that the condition, the springs are in good condition where there is no change in discharge at different time measurements. It is necessary to do a strategy in managing water carefully for various uses so that no party is harmed (E. Kreuzberg-Mukhina, N. Gorelkin, A. Kreuzberg V. Talskykh, E. Bykova and I. Mirabdullaev, 2004; Matt Yost et al., 2020).

Water quality testing is carried out to determine the actual water quality that is currently available. This water quality test is important as information material for people who use the *Mumbul* spring for drinking directly. Testing was carried out on 6 samples taken at different times and testing was carried out at the Analytical Laboratory of Udayana University. The parameters tested included color, temperature, pH, TDS, turbidity, BOD5, COD, Nitrate (NO3-N), Nitrite (NO2-N) and ammonia (NH3). The test results showed that the color was not detected, the air temperature was 27^{O}C, the pH was not detected, the turbidity was not detected, BOD5 18.02 mg / liter ,, COD 24.24 mg / liter, Nitrate 0.267 mg /liter, Nitrite was not detected and ammonia 0.076 mg / lt. The results of the analysis of the average water quality can then be seen in the following table 3.

Table 3: Water Quality Testing Results.

No.	Parameter	Metode	Unit	Hasil (average)	Quality standards of indonesia
1	Color	Spektrofotometri	Unit pt Co	no detection	15
2	Temperature	Termometri	^{o}C	27	Temperature ± 3
3	pH	Elektrometri	7,4	ttd	6,5-5,8
4	TDS	Gravimetri	mg/liter	0,267	500
5	Turbidity	Spektrofotometri	mgSiO_2/liter	no detection	5
6	BOD5	Titrimetri	mg/liter	18,024	-
7	COD	Titrimetri	mg/liter	24,24	-
8	Nitrat (NH3-N)	Spektrofotometri	mg/liter	0,267	50
9	Nitrit (NH2-N)	Spektrofotometri	mg/liter	no detection	3
10	Amoniak	Spektrofotometri	mg/liter	0,076	1,5

Source: Udayana University, 2020.

From the results of the above tests compared to the quality standard of Indonisea Government No. 492 /Menkes/Per/IV / 2015 (Matt Yost, et al., 2020), it shows that the Mumbul spring in Sangeh village is seen from its color, temperature, pH, TDS, turbidity, nitrite, nitrate and ammonila meet as water that can be drunk directly. However, for the nitrate and nitrite content, it is necessary to boil the water before consumption.

In accordance with the *Tri Hita Karana* concept for the Balinese Hindu Society and in accordance with the spirit of building the current Bali Province, namely *Nangun Sad Kerthi Loka Bali* (6 main aspects for the welfare of the Balinese people), it is very closely considered to protect the environment, especially the *Mumbul* spring. which is in *Sangeh* Village. The concept of conservation of the *Mumbul* spring spring seen from each of the elements can be conveyed as follows (Matt Yost, et al., 2020):

1. Farming Community (*Subak*)

For the people of *Subak Sangeh* and the surrounding *subak*, the existence of Mumbul spring is important because it is a source of irrigation water so that it provides welfare for the community who uses it. For this reason, the *Subak* community has made several kinds of regulations aimed at preserving springs. This rule is a local policy that is highly respected not only by members of the *Subak* community but also by other communities outside the *Subak* community. The existing regulations in *Subak* related to the preservation of the *Mumbul* spring include:

a. It is prohibited to throw garbage into springs and other drainage bodies
   Although this prohibition is not accompanied by sanctions, it has become a habit for the community to participate together in maintaining water sustainability
b. In ceremonial activities at *Mumbul* temple, all members will give dues as gratitude for God's grace that has given sufficient water.
c. The use of water for irrigation is allowed to be removed from the interests of water used for religious ceremonies
d. For serious violations, sanctions will be imposed in the form of sanctions from the traditional village

2. Traditional Village

The Traditional Village of *Sangeh* has a role in the conservation of the *Mumbul* spring because all regulations related to the management and preservation of the *Mumbul* spring are in the hands of the Traditional Village. The customary village has local regulations in the *Sangeh* Traditional Village which regulates the social life of the *Sangeh* community in several dimensions including preserving the *Mumbul* spring. Some of the local policies of the *Sangeh* Traditional Village which become reinforcement in the preservation of the *Mumbul* spring are as follows;

a. It is not allowed to throw garbage into the spring
b. Women who are menstruating are prohibited from entering the *Tirta Solas* area
c. Every other traditional village that will use the *mumbul* spring for religious activities must coordinate with the traditional *mumbul* village
d. It is not allowed to take water from the spring using a machine/pump
e. Each water withdrawal is expected to donate Rp. 2000 for cleaning fee
f. Every day the village employs 2 cleaners and 2 people as service personnel at *Tirta Solas*
g. To maintain the cleanliness of the *Mumbul* spring area, the traditional village of *Sangeh* has collaborated with the *Badung* Regency Sanitation Office in terms of transporting waste
h. Not allowed to park for cars/motorbikes outside the designated areas

3. Government

The subdistrict and regency and provincial governments of Bali actively provide support for the preservation of the *Mumbul* spring through repair and structuring programs such as repairing parking lots, repairing places for painting at *Tirta Solas,* structuring the *Pancaka Tirta* temple and other supporting facilities. This improvement is made through the budget of both the Provincial and District Government. Apart from that, the government also has the authority to regulate the community to conserve the forests around the springs. The government's role is very important to protect the springs through funding and infrastructure development. (Romadhan 2020), (United Nations 2011).

4. Visitors

For people outside *Sangeh* Village who visit, it is hoped that they will follow the rules conveyed by the officers and on the displayed announcement board. So that cleanliness and sustainability can still be maintained. There are many visitors to the springs in addition to domestic tourists as well as tourists from abroad. many tourists are interested in coming to the concept of a cultural village with the preservation of

the mumbul spring as the main tourist icon. In this condition, the concept of conservation and tourism provides community welfare (Amerta 2017; Maryati et al. 2021; Fatimah et al. 2021)

4 CONCLUSION

Based on what was stated in the introduction as well as the results and discussion, several things can be concluded as follows:

1. The discharge of the *Mumbul* spring is in a stable condition, as evidenced by the results of measurements by the Bali Penid River Council in 2015 of 112 liters/second, not much different: with the current conditions of 119.97 liters/second
2. From the aI quality test, it shows that the *mumbul* spring meets the requirements as raw water, whereas if it is used as drinking water it does not directly meet the requirements of the nitrate and nitrite content. However, for the nitrate and nitrite content, it is necessary to boil the water before consumption.
3. In terms of water conservation, preservation of the *mumbul* spring is fully supported by groups of irrigation water users (*subak*), the community, traditional villages and the government of both the regency and province of Bali.
4. The existence of *Mumbul* spring is still sustainable to this day due to the very large role of traditional villages in implementing local wisdom/*awig-awig* rules which have very high obscurity values from all levels of society.

ACKNOWLEDGMENTS

On this occasion the researchers would like to thank all those who have helped, especially friends from the Bali State Polytechnic research and service institute, the *Sangeh* village community, the local drinking water company in the *Badung* district and the Bali Penida river council.

REFERENCES

Amerta, I Made Suniastha. 2017. “Community Based Tourism Development.” *International journal of social sciences and humanities* 1(3): 97–107.

Barquín, José, and Mike Scarsbrook. 2008. “Management and Conservation Strategies for Coldwater Springs.” *Aquatic Conservation: Marine and Freshwater Ecosystems* 18(5): 580–91.

E. Kreuzberg-Mukhina, N. Gorelkin, A. Kreuzberg V. Talskykh, E. Bykova, V. Aparin, and and R. Toryannikova I. Mirabdullaev. 2004. “The Conservation and Sustainable Use of Freshwater Resources in West Asia, Central Asia and North Africa.” *Fresh water biodiversity conservation: The case of the Aral Sea*: 32–46.

Fatimah, Titin, Klara Puspa Indrawati, Nafiah Solikhah, and Theresia Budi Jayanti. 2021. “The Challenges of Rural Vernacular Lives in Facing the Global Tourism Influences.” *Proceedings of the International Conference on Economics, Business, Social, and Humanities (ICEBSH 2021)* 570(Icebsh): 1462–69.

Gupta, Akhilesh, and Himanshu Kulkarni. 2018. “Inventory and Revival of Springs in the Himalayas for Water Security.” *NITI Aayog*: 4. http://sdcuk.in/wp-content/uploads/2020/03/Inventory-and-revival-of-springs-in-the-Himalayas-for-water-security-Report-by-NITI-Aayog.pdf.

Gusti, Ni, and Ayu Agung. 2020. “Implementation of Tri Hita Karana Teachings in Subak Activities in Bali.” *Jurnal Penelitian Agama Hindu* 4(2): 133–40.

M.C. Baleseng. 2015. “Factors Affecting the Sustainability of Sme in The.” 9 (November): 2. https://dspace.nwu.ac.za/bitstream/handle/10394/17666/Baleseng_MC.pdf?sequence=1.

Maryati, Mari et al. 2021. “International Journa l of Education, Information Technology and Others (IJEIT) Application and Influence of Information Technology to Support the Tourism Village Marketing Strategy.” 4(1): 33–39.

Matt Yost, Niel Allen, Warren Peterson, and Jody Gale. 2020. Soil and Water Conservation Society *Water Optimization through Applied Irrigation Research*.

Romadhan, Ach Apriyanto. 2020. “Political Ecology Protection Spring Water in Batu.” *Journal of Local Government Issues* 3(1): 75–85.

United Nations. 2011. *The State of the World’s Land and Water Resources: Managing Systems at Risk*. http://www.fao.org/3/i1688e/i1688e.pdf.

Wijaya, Made Hendra, Putu Lantika, and Oka Permadhi. 2021. “Prinsip-Prinsip Tri Hita Karana Di Dalam Pengaturan Hukum Kepariwisataan Di Bali (Berdasarkan Pada Peraturan Daerah (Perda) Provinsi Bali Nomor 5 Tahun 2020 Tentang Standar Penyelenggaraan Kepariwisataan Budaya Bali).” : 27–45.