



## Analysis of Domestic Water Availability and Demand As Well As The Economic Value Of Laabhalano Spring Pola Village, Pasir Putih District, Muna Regency

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### ABSTRACT

Laabhalano Spring in Pola Village, Pasir Putih Subdistrict, Muna Regency, serves as the local community's primary source of clean water. However, the sustainability of this water source is under threat due to environmental degradation, such as deforestation and land-use changes, which could impact both the quality and quantity of the water. This study aims to analyze water availability, and domestic water demand, and assess the economic value of the environmental services provided by Laabhalano Spring. The methods used in this research include measuring the water flow and surveying domestic water needs in 82 households in Pola Village. The findings show that the water flow from Laabhalano Spring is 110,376 m<sup>3</sup> per year, sufficient to meet the community's domestic water needs. Total domestic water consumption is 330 m<sup>3</sup> per month, primarily for bathing, washing, and daily consumption. Additionally, the economic value of this clean water service is estimated to be IDR 137,700,000 per year, highlighting the critical role of this spring for the local community's livelihood. While the current water flow is adequate, the threat to the sustainability of the spring remains, especially if the surrounding ecosystem is not properly managed. Therefore, sustainable environmental management is essential to ensure a continuous clean water supply for the residents of Pola Village. Strengthening conservation efforts and monitoring the surrounding environment are key to preserving both the quality and availability of water in the future.

## **INTRODUCTION**

Environmental services are the products derived from biological natural resources and their ecosystems, offering both direct (tangible) and indirect (intangible) benefits. According to Mustofa (2020), these services are naturally provided and encompass a flow of goods and services that benefit humans and the environment, generated through ecosystem processes. Key benefits include natural tourism (recreation), air quality protection (hydrology), soil fertility, erosion and flood control, aesthetic value, unique ecosystems, biodiversity conservation, and carbon sequestration and storage.

One of the most vital environmental services is the provision of clean water, which plays a fundamental role in sustaining human life and ecosystem stability. Water availability impacts various sectors, not only in terms of quantity but also in terms of quality and distribution across regions (Lopis et al., 2017). Rapid population growth, coupled with water-intensive lifestyles, places additional strain on water resources, often leading to water scarcity during critical periods (Kustanto, 2020).

Communities obtain clean water from multiple sources, including groundwater, springs, and surface water (Suryani, 2016). Springs and surface water are particularly crucial for rural communities due to their relatively low utilization costs (Warih and Fajarwati, 2013). One such critical water resource is the Laabhalano Spring in Pola Village, Muna Regency, which supplies raw water for domestic needs. However, the sustainability of this spring is intrinsically linked to the surrounding forest ecosystem in Pasir Putih District. The forest's hydrological functions are increasingly under threat due to deforestation, land conversion for agriculture, and illegal logging.

The forest surrounding Laabhalano Spring plays a vital role in maintaining hydrological balance and water quality. Forest ecosystems act as natural catchments, facilitating water infiltration, absorbing excess rainfall, and preventing soil erosion (Santoso, 2024). However, environmental degradation, characterized by increased sedimentation in watershed areas, has compromised the forest's capacity to regulate hydrological functions, adversely affecting the spring's water quality (Suryanti and Wijayanti, 2023).

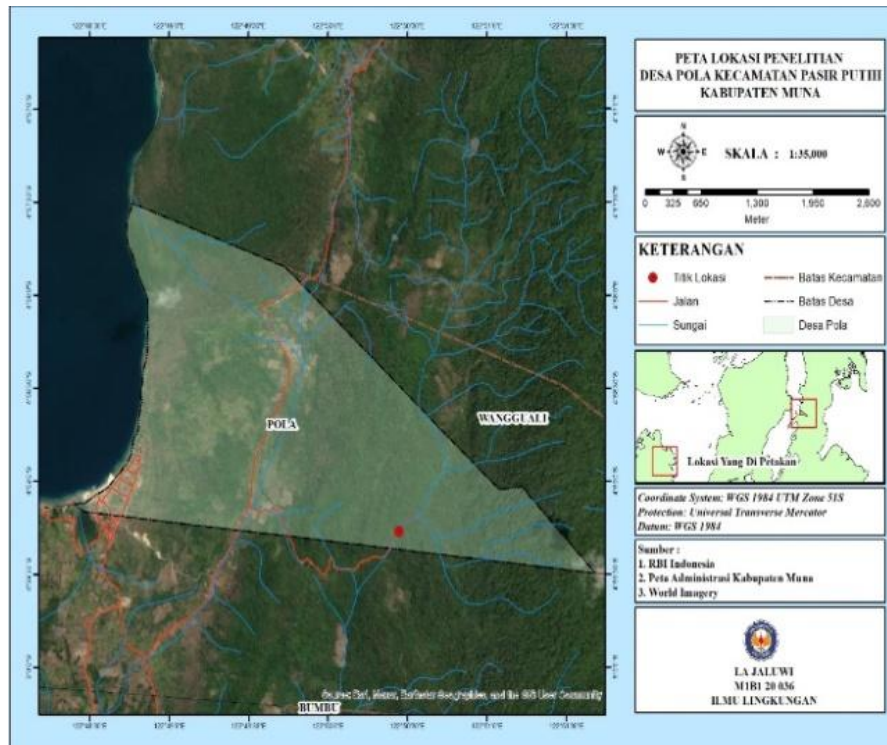
Visible symptoms of environmental degradation include reduced water discharge during the dry season and heightened turbidity levels and discharge during the rainy season. To address these challenges, conservation efforts must integrate data on water availability and domestic demand, along with an economic valuation of water resources. As emphasized by Hidayat (2016), economic assessments are critical for resource sustainability, as low resource valuations often lead to inefficient allocation, over extraction, and unsustainable practices. This study focuses on evaluating the availability and demand for domestic water and determining the economic value of environmental services provided by Laabhalano Spring in Pola Village, Pasir Putih District, Muna Regency.

## **METHODS**

### **Location and Time**

This research was carried out in Pola Village, Pasir Putih District, Muna Regency, the research location was located at coordinates between - 4°59'35.28"S and 122° 48'39.666"E,

which lasted for 3 months, from May to July 2024. The research location map is shown in Fig 1.



**Fig 1.** Map of the Research Location in Pola Village, Pasir Putih District, Muna Regency

## Method of Collecting Data

The analysis carried out in this research is as follows:

### 1. Water Availability Analysis

Analysis of water availability is calculated based on spring flow discharge using the following equation (Said and Sudarmadji, 2013):

$$Q = V \times t \dots\dots\dots(1)$$

Where :

- Q : Spring discharge (m<sup>3</sup>/s)
- V : Volume of measuring vessel (m<sup>3</sup>)
- t : Time (s)

### 2. Analysis of Domestic Water Needs

Domestic water needs or water needs household clean water is the water required for households that is obtained individually from the Laabhalano spring created by each household. Water needs are calculated by multiplying the population by the need for clean water (SNI 19-6728.1-2002 concerning the preparation of resource balances).

$$Q_{md} = P_n \times q \dots\dots\dots(2)$$

Where :

- $Q_{md}$  : The need for clean water
- $P_n$  : Number of rural residents
- $Q$  : Water usage requirements  
liters/person/day

### 3. Economic Valuation of Environmental Services

The price approach method applies as follows (Kasim et al., 2015) :

$$NE = TPA \times HB \dots\dots\dots (3)$$

$$TPA = \frac{PA \times 30 \text{ day}}{n} \times \text{Population} \times 1 \dots\dots\dots (4)$$

Where:

- $NE$  : Economic value of water (Rp)
- $TPA$  : Total Water Users ( $m^3/\text{year}$ )  $HB$  = Current price ( $\text{Rp}/m^3$ )
- $PA$  : Water Use (cooking, drinking, bath, washing, toilet and vehicles washing)  
( $m^3/\text{HH}/\text{day}$ )
- $N$  : Number of respondents (HH).

## RESULT AND DISCUSSION

### 1. Water Availability

Discharge measurements of Laabhalano Spring aimed to quantitatively evaluate the potential for water flow. Discharge was calculated based on measurements of the dimensions of the reservoir and the time taken to fill it. The basin used had dimensions of 8 meters long, 6 meters wide and 0.10 meters high, with a total volume of  $4.8 \text{ m}^3$ . The average time required to fill these tanks was 1,355.36 seconds. The measurement results showed that the spring discharge was  $0.0035 \text{ m}^3/\text{second}$ , which when converted is equivalent to  $302.4 \text{ m}^3/\text{day}$  or  $110,376 \text{ m}^3/\text{year}$ . This indicates that Mata Air Laabhalano has a large enough and consistent flow capacity to meet the clean water needs of the Pola Village community, Pasir Putih Sub-district.

However, the sustainability of water resources, particularly Laabhalano Spring, is strongly influenced by ecological factors that affect its sustainability, such as forest sustainability, sustainable land management, and control of human activities around the water source. Environmental degradation, such as deforestation and land conversion, can reduce forest vegetation diversity (Kahirun et al., 2019), which in turn can threaten the sustainability of clean water supply for the community. Deforestation activities around watersheds that lead to decreased water infiltration and degradation of water quality can cause a significant decrease in spring discharge, as well as increase the potential risk of natural disasters such as floods and landslides (Santoso, 2024). Therefore, effective and sustainable environmental conservation efforts, involving collaboration between the government and the community, are needed to preserve Laabhalano Spring and ensure the availability of clean water for the Pola Village community in the future.

## 2. Domestic Water Demand

The volume of water used by the Pola Village community to meet their daily needs from Laabhalano Spring was calculated using a sample of 82 households (HH). Daily water use data collected from the 82 respondent households, representing household water consumption in Pola Village, can be seen in Table 1.

**Table 1.** Water usage volume of 82 households

Number.	Type of use	Volume Water Usage		
		Discharge m <sup>3</sup> /day	Discharge m <sup>3</sup> /month	Discharge m <sup>3</sup> /year
1.	Bath	4.04	121.2	1,454.4
2.	Washing	2.93	87.9	1,054.8
3.	Toilet	1.74	52.5	626.4
4.	Vehicle Washing	0.93	27.9	334.8
5.	Cooking	0.82	24.6	295.2
6.	Drinking	0.53	15.9	190.8
<b>Total</b>		<b>11</b>	<b>330</b>	<b>3,956.4</b>

**Source:** Primary data processed, 2024

**Table 2.** Respondents' volume of water use in Pola Village

Number.	Type of use	Number of respondents (HH)	Respondent's total water use (m <sup>3</sup> /day)	Average (m <sup>3</sup> /day/HH)
1.	Bath	82	4.04	0.049
2.	Washing	82	2.93	0.035
3.	Toilet	82	1.74	0.021
4.	Vehicle Washing	82	0.93	0.011
5.	Cooking	82	0.82	0.01
6.	Drinking	82	0.53	0.006
<b>Total</b>			<b>11</b>	<b>0.132</b>

**Source:** Primary data processed, 2024

Table 1 shows that Laabhalano Spring plays an important role in meeting the domestic needs of the Pola Village community, such as bathing, washing, toileting, washing vehicles, cooking, and drinking. Total water use by 82 households was recorded at 11 m<sup>3</sup> per day, which is equivalent to 330 m<sup>3</sup> per month and 3,956.4 m<sup>3</sup> per year. Based on this data, the average daily water usage per HH is 0.132 m<sup>3</sup>, as described in Table 2. This amount of usage illustrates a fairly high level of water demand to support the various daily activities of the Pola Village community. Laabhalano Spring, with its consistent capacity, is a vital resource in meeting these needs.

**Table 3.** Volume of water use in Pola Village for a population of 459 households

Number	Type of use	Average (m <sup>3</sup> /day/HH)	Total (HH)	Total m <sup>3</sup> /day	Total m <sup>3</sup> /month	Total m <sup>3</sup> /year
1.	Bath	0.049	459	22.491	674.73	8,096.76
2.	Washing	0.035	459	16.065	481,95	5,779.8
3.	Toilet	0.021	459	9.639	289,17	3,470.4
4.	Vehicle Washing	0.011	459	5.049	151.47	1,817.64
5.	Cooking	0.01	459	4.59	137.7	1,652.4
6.	Drinking	0,006	459	2.754	82.62	991.44
<b>Total</b>				<b>60.588</b>	<b>1,817.64</b>	<b>21,808.44</b>

*Source: Primary data processed, 2024*

Based on calculations, the average daily water use per household in Pola Village is 0.132 m<sup>3</sup>. With 459 households, the total daily water use reached 60,588 m<sup>3</sup>. On a monthly scale, the total water use by the community reached 1,817.64 m<sup>3</sup>, while in a year the amount reached 21,808.44 m<sup>3</sup>. This data shows the high demand for domestic water in the community to support daily activities, such as bathing, washing, cooking and other needs.

The availability of water from Laabhalano Spring, which reaches 110,376 m<sup>3</sup> per year, shows that the current water needs of the Pola Village community can still be met. However, the sustainability of this water resource faces various threats, including an increase in population, changes in water consumption patterns, and ecosystem degradation due to human activities. Environmental damage such as deforestation, changes in land use change, and non-optimal resource management can reduce water discharge and reduce its quality, thus threatening the sustainability of the Laabhalano Spring function.

In this context, sustainable management of water resources is very important. Conservation approaches such as reforestation, land use change control, and community education on the importance of preserving ecosystems around springs need to be implemented systematically (Pravitasari and Nugraheni, 2024). In addition, institutional strengthening in water resources management, including supervision and empowerment of local communities (Suryawan, 2021), can play a role in ensuring adequate water supply for domestic needs while maintaining the socio-economic sustainability of the Pola Village community.

### 3. Economic Valuation of Environmental Services

As part of the analysis related to water resources management, the willingness of the community to contribute to the cost of water utilization also needs to be considered. The willingness to pay by the Pola Village community for the utilization of Laabhalano Spring water environmental services based on prevailing prices can be seen in Table 4. This data illustrates the extent to which the community is prepared to support the sustainability of water utilization through financial contributions, which will be very important for the sustainable management and maintenance of water resources in the future.

**Table 4.** Pola Village Community Retribution to BUMDES Pola

Number.	Tariff (Rp/Month)	Total HH	Total Monthly Payment	Total Payment per year
1.	Rp.25.000,00	459	Rp. 11,475.000	Rp137,700,000.00

*Source: Primary data processed, 2024*

Based on Table 4, payments made by the Pola Village community, with a total population of 459 households, show significant results. The total financial contribution received by BUMDES Pola from the community reached Rp11,475,000.00 per month, which is equivalent to Rp137,700,000.00 per year. This contribution reflects the level of willingness of the Pola Village community to support the management and maintenance of the Laabhalano Spring water resources.

This income not only reflects the economic value of the environmental services provided by Laabhalano Spring but also indicates the level of community awareness of the importance of the sustainability of these water resources. The funds received by BUMDES Pola are used for various purposes, such as infrastructure maintenance, water quality management, and environmental conservation efforts around the water source. This community's financial contribution plays an important role in ensuring the sustainability of clean water supply for domestic needs. In addition, this step is also a tangible manifestation of community participation in preserving water resources which are vital assets for their daily lives.

## CONCLUSIONS

Based on the results of the research conducted, it can be concluded that the Laabhalano spring has significant potential as a water resource for the Pola Village community. The water availability of Laabhalano spring was recorded at 302,4 m<sup>3</sup>/day or equivalent to 110.376 m<sup>3</sup>/year, while the domestic water needs of the Pola Village community only reached 21.808,44 m<sup>3</sup>/year. This indicates a water surplus of 88.567,56 m<sup>3</sup>/year that can be further utilised for various other purposes. In addition, based on the economic value analysis, Laabhalano spring has a significant economic contribution with a value of Rp 137.700.000,00 per year. The existing water surplus, coupled with the economic value obtained, indicates that the management and utilisation of this spring has the potential to support the sustainability of the local economy, as well as improve the welfare of the Pola Village community.

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