Willingness To Pay and Consumption Characteristics Of Drinking Water to the Households in Katulampa Village, City of Bogor

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Abstract. Katulampa Village has a variety of potential water resources with relatively good quality. The existence of a variety of water provides an alternative to the community to use clean water. With the increasing number of population and water needs on the one hand, while on the other hand the quantity and quality of water resources is relatively decreasing, the optimal management of water resources to meet various community needs is increasingly important. The objectives of this study are to identify the patterns of community water consumption in the Katulampa Village, to estimate household expenditure for water consumption, and to estimate the value of household willingness to pay (WTP) for water. This research uses descriptive analysis, expenditure analysis method, and contingent valuation method. The results indicated that households in the Katulampa Village consume on average 23.9 m³/month, which comes from various water sources, namely PDAM water, wells, rivers, springs, and seepage water. Bottled drinking water (bottled water) and refill water are consumed by communities specially to meet the needs of some drinking water. The proportion of expenditure for consumption of bottled water and refill water were relatively low compared to the average income of the people inside and outside Griya Katulampa Housing (GKH). Household expenditure for bottled water and refilled water is relatively high. The estimated average WTP for improved PDAM piped water is Rp 4,414/m³. Seepage water is still consumed by some people, although its use is limited to non-consumption activities.

Keywords: price of water, contingent valuation method, household income and expenditures, perception

1. Introduction
Water is a natural resource that is important for the survival of humans and other living things. In terms of quantity, supply of fresh water from the results of the hydrological process in Indonesia is actually relatively constant, around 690 billion m³/year (ADB 2016). Indonesia’s water resourcesupply is the sixth largest in the world¹. Indonesia’s water demands are constantly increasing over time, in line with the increase in population and their income and lifestyle. Current demand for clean water is estimated at 175 billion m³ (ADB 2016). Though water supply is larger than its demand, Indonesia faces serious water problems, since the availability of clean fresh water decreases due to

¹WEPA (Water Environment Partnership in Asia), http://www.wepa-db.net/policies/state/indonesia/indonesia.htm
environmental damage and pollution. This condition has resulted in the emergence of many problems in meeting the water needs of the community.

Currently, at least 80 percent of 260 million Indonesians have no access to piped water. Due to difficulties and limited access to clean water, large number of people using the alternative water sources for drinking water, bathing, and washing. Piped (tap) water is, actually, one important sources of clean water for the community consumption. In Indonesia, piped water is provided by the PDAM (Perusahaan Daerah Air Minum or regional state-owned water company). Besides piped water, there are still other water sources commonly used by the people of Indonesia, such as well water, springs, rainwater, and others. BPS data (2018) shows that the percentage of drinking water service coverage by piped water companies has decreased by 8.42% in 16 years, from 19.08% in 2000 to 10.66% in 2016 (Table 1). This condition illustrates that the growth of PDAM water services in Indonesia is not as fast as its population growth. Similar conditions also occurred in West Java, where percentage of drinking water service coverage has decreased from 12.38% to 7.04% in the same period. Data in Table 1, in general, shows that there have been massive changes in drinking water sources in Indonesia and West Java, from conventional drinking water sources (piped water, ground water, springs, etc.) to bottled water. Consumption of bottled water (air minum dalam kemasan or AMDK) has increased significantly during this period, so that in 2016 the proportion has reached more than 30% of the total drinking water consumption, both in Indonesia and West Java.

**Table 1.** Percentage of Drinking Water Consumption of the Households in Indonesia and West Java, 2000 and 2016 (in percent)

| Water Sources            | Indonesia 2000 | Indonesia 2016 | Change 2000 | Indonesia 2000 | Indonesia 2016 | Change 2000 |
|--------------------------|----------------|----------------|-------------|----------------|----------------|-------------|
| Tap water                | 19.08          | 10.66          | -8.42       | 12.38          | 7.04           | -5.34       |
| Pumped water             | 13.82          | 15.42          | 1.60        | 27.28          | 18.74          | -8.54       |
| Bottled water            | 0.86           | 31.3           | 30.44       | 0.79           | 36.60          | 35.81       |
| Protected well water     | 33.38          | 21             | -12.38      | 31.45          | 21.31          | -10.14      |
| Unprotected well water   | 14.12          | 6.04           | -8.08       | 13.41          | 4.68           | -8.73       |
| Protected spring water   | 7.50           | 8.48           | 0.98        | 7.52           | 7.43           | -0.09       |
| Unprotected spring water | 4.61           | 3.1            | -1.51       | 5.47           | 3.77           | -1.70       |
| Surface water            | 3.35           | 1.53           | -1.82       | 0.96           | 0.27           | -0.69       |
| Rain water               | 2.70           | 2.4            | -0.30       | 0.22           | 0.11           | -0.11       |
| Others                   | 0.57           | 0.06           | -0.51       | 0.52           | 0.06           | -0.46       |
| Total                    | 100.00         | 100.00         | 100.00      | 100.00         | 100.00         | 100.00      |

Source: BPS (2018): [https://www.bps.go.id/statictable/2014/09/10/1361/persentase-rumah-tangga-menurut-provinsi-dan-sumber-air-minum-2000-2016.html](https://www.bps.go.id/statictable/2014/09/10/1361/persentase-rumah-tangga-menurut-provinsi-dan-sumber-air-minum-2000-2016.html)

PDAM Tirta Pakuan of the Bogor City, is one of the best PDAMs nationally i.e., the second best of a total of 378 PDAMs in Indonesia (BPPSPAM 2017). In 2016, PDAM TirtaPakuan served around 147 thousand customers, of which the majority of the customers were households (BPS-Statistics of Bogor City, 2017). PDAM of the City of Bogor has served all Kecamatan (districts) i.e., five districts, in the City of Bogor, including the Kecamatan Bogor Timur (District of East Bogor). Most of the people of the District of East Bogor have been served by piped water from PDAM TirtaPakuan, with service levels reaching 82.94% of the total population density (PDAM Kota Bogor 2014).

2 BPPSPAM.2017. Buku Summary Kinerja PDAM. [http://sim.ciptakarya.pu.go.id/bppspam/download/173](http://sim.ciptakarya.pu.go.id/bppspam/download/173)
Village (Kelurahan) Katulampa is one of the areas of District of East Bogor (Kecamatan Bogor Timur) with good water resources, both in terms of quantity and quality. This village is an upstream of the Ciliwung River Basin and has other water sources in the form of spring water and also seepage water from the Kalibaru River. The community of Katulampa Village can use water from various sources, including ground water (wells and pumps), rivers, springs, seepage water, and PDAM spiped water to meet their daily needs. Griya Katulampa Housing (GKH) located in Katulampa Village is one of the housings that has a strategic position, since it has good quality and quantity of water, including the seepage water. Thus, the community in GKH has a variety of clean water alternatives. However, in the dry season groundwater discharge decreases, which resulting in a lack of water supply for daily community's needs. In such situation, community should make more efforts to obtain water, such as by buying water. In addition, seepage water in GKH is also not fully utilized, because the community considers that water quality is not good, so they prefer to use piped water from the PDAM compared to seepage water which is still free to use. In contrast, the community outside GKH has not been able to consume piped water from PDAM to meet their daily needs due to the unavailability of piping network systems, so they tend to use well water (ground water) and even river water as a source of water to meet their daily needs. This makes a difference in water management and utilization systems and costs (expenditure) for water consumption for the community inside and outside GKH.

The purpose of this study is to compare the patterns of water consumption and the willingness of the community to consume and pay for drinking water from PDAM among the people who are inside and outside GKH. The specific objectives of the research are: (1) Assessing the characteristics of water resources available in the Katulampa Village; (2) Comparing the patterns of clean water consumption between the community inside and outside GKH; (3) Comparing households’ expenditures for clean water consumption between the community inside and outside GKH; (4) Estimating the value of the willingness to pay (WTP) of the community to consume water when there is an improvement in PDAM piped water services; and (5) Analyzing community perceptions on seepage water flowing inside GKH.

2. Research Methods
The study was conducted in Katulampa Village, East Bogor District, Bogor City. Location is purposively selected with the consideration that the area has a variety of clean water and the people of the area also use water from various existing water sources, such as piped water of PDAM, ground water (wells/pumps), river water, springs, and seepage water in meeting their water needs. Data collection is carried out during May - June 2018.

This research uses both primary and secondary data. Primary data is obtained through community surveys, which include the aspects of respondents’ characteristics, information regarding water consumption and sources, as well as the willingness of the community to pay in consuming piped water from PDAM. Surveys are conducted both for the community and related stakeholders that are inside and outside GKH. Secondary data were obtained from the literature review, the results of previous studies, and information from relevant agencies such as the West Java Central Statistics Agency, Bogor City Bureau of Statistics, West Java in Figures, Bogor City in Figures, PDAM Tirta Pakuan of Bogor City, Profil Desa, and various internet sites. The respondents of this study were the households who lived in Katulampa Village. Communities are divided into two categories, namely households living inside and outside GKH. The number of households surveyed in this study were 80 respondents i.e., as many as 40 respondents for each category. Eligible samples in the study are 30 to 500, and if the sample is divided into categories, the number of sample members in each category is at least 30 (Sugiono, 2011). Sampling is done intentionally (purposive sampling).

Methods of data analysis used in this study can be divided into some categories:
1) **Descriptive Analysis.** Descriptive analysis is used so that research is not only limited to rigid statistical data, by providing explanations for what is happening in the community, so that research can produce more interesting conclusions. In this study, descriptive analysis was used to draw a systematic description of the characteristics of resources, quality, quantity, and continuity
of water in the Katulampa area. The pattern of utilization of clean water by the people who live inside and outside GKH, as well as the community’s perception of seepage water in GKH to obtain information regarding the future use of the water.

2) **Expenditure Analysis.** The amount of household expenditure for consumption of clean water is explained by using analysis multiplying the price of water with the volume of water consumed for each category. Then, the total water expenditure is divided by the average household income to estimate the proportion of the expenditure of clean water by each respondent's household. The data needed is the amount of income per household per month, volume of water use per household per month, and water prices. The percentage or proportion of total water expenditures to the total income can be calculated using the formula: \( p = \sum^n_{i=1} \frac{v_i}{I} \), where: \( p = \) proportion of water expenditure to the total income, \( v_i = \) price of water type \( i \), \( x_i = \) volume of water type \( i \) consumed, and \( I = \) total household income.

3) **Analysis of Willingness to Pay (WTP).** WTP is used to estimate the amount of households’ willingness to pay for clean water. The method used is the contingency valuation method (CVM). According to Fauzi (2006) and Syaukat et al. (2014), steps to conduct research to estimate WTPs are: (1) developing market hypotheses; (2) obtaining auction values (bids) or methods carried out by bidding game techniques; (3) calculating average WTP value using the following formula: \( \text{EWTP} = \frac{\sum_n WTP_i X_i}{n} \), where \( \text{EWTP} = \) expected value of WTP, \( WTP_i = \) value of WTP at category \( i \), \( X_i = \) number of households who want to pay at WTP at category \( i \), and \( n = \) number of WTP categories; (4) estimating the bid curve; and (5) Aggregating data (total WTP) using the formula: \( \text{TWTP} = P \cdot \text{EWTP} \), where \( \text{TWTP} = \) total WTP and \( P = \) number of households.

4) **Community Perception Analysis.** Community perceptions were analyzed using descriptive analysis. Descriptive analysis involves summarizing and organizing the data so they can be easily understood. Descriptive statistics will be used for this purpose. Unlike inferential statistics, it is as accurate as describing the data, but does not attempt to make inferences from the sample to the whole population. This description method is used to analyze how the perceptions (views and expectations) of the community (respondents) regarding the seepage water in the GKH at this time and in the future.

3. **Results and Discussion**

3.1. **Characteristics of water resources in the Katulampa area**
Katulampa Village has water sources from rivers, ground water, PDAM, springs, and seepage water. Community inside Griya Katulampa Housing (GKH) uses PDAM water, seepage water, and ground water as the main water sources; while those outside GKH use more ground water, river water, and also PDAM water. Some rukun warga (sub-groups of community) outside GKH have PDAM pipe network, but they have not used the piped water supplied by the PDAM, since ground water is still available and free. Data on respondents' clean water sources are presented in Table 1. Based on Table 1, majority of respondents inside GKH use only piped water from the PDAM (52.5%). It is because the wells available in some houses are not sufficient to function as the main water source and PDAM water is more practical. In the other side, majority of respondents outside GKH only use ground water as their main source of water needs (55%). The quality of existing wells is considered to have good quality. About 30% of both respondents inside and outside GKH use combination of water from PDAM and other sources (option d) or ground water and other sources (option e). In general, about 95% of household outside GKH uses groundwater, whether solely or conjunctively with other water.
Table 2. Sources of water to the respondents inside and outside GriyaKatulampa Housing

| Sources of water                          | Inside GKH | Outside GKH |
|------------------------------------------|------------|-------------|
|                                          | Number of Respondents | Percentage | Number of Respondents | Percentage |
| a. Piped water (PDAM)                    | 21         | 52.5        | 0                    | 0.0        |
| b. Ground water                          | 0          | 0.0         | 22                   | 55.0       |
| c. Other sources                         | 1          | 2.5         | 2                    | 5.0        |
| d. PDAM and other sources                | 11         | 27.5        | 0                    | 0.0        |
| e. Ground water and other sources        | 1          | 2.5         | 12                   | 30.0       |
| f. PDAM and ground water                 | 6          | 15.0        | 4                    | 10.0       |

Source: primary data (2018)

**PDAM water.** PDAM water is one of the main water sources inside GKH (95%), while outside GKH is only 10%, because PDAM water is considered as an alternative if well water experiences drought. The respondents (both from inside and outside GKH) claim that water services of PDAM flows continuously for 24 hours with good water quality. However, it sometimes has low water pressure, so that water can flow normally especially during the night. They also claim that the volume of water that is billed is according to what is printed on the meter and there is no pipe leak. Households in GKH consider that PDAM performance is good, while respondents outside GKH judge PDAM performance very well. Both groups consider that the price (tariff) of water charged by the PDAM is quite affordable.

**Other water sources.** Katulampa Village has potential natural water that is quite diverse, such as the Ciliwung River Basin, springs and seepage water from the Kalibaru River. About 32.5% of the respondents inside GKH utilize spring and seepage water sources, while people outside GKH (37.5%) utilize the Ciliwung River water.

**Gallon water and refill of gallon water.** Bottled water (air minum dalam kemasan or gallon water) and refill water are alternative clean water sources for the community, especially for drinking purpose. Community considers the quality of refill water is not as good as that of bottled water. About 10% of respondents inside GKH consume refill water, while outside GKH it reaches 65%. Refilled water is considered to have good quality and is available not far from where they live. The price of refill water is also considered not too high.

**Ground (well) water.** Katulampa Village is a region with good ground water conditions, so there are still many people who use well water to support their daily needs. At GKH, around 20% of the people own wells and consume ground water, while outside GKH it reaches 95%. The availability of well water inside GKH is generally obtainable at all times, except in the dry season, but has relatively poor quality (smelly, dirty, and colored), so the well water must be precipitated before it is used so that the dirt settles. Respondents outside the GKH considered that well water was always available in good quality. The cost of pumping water is considered not too expensive.

3.2. The pattern of utilizing clean water inside and outside GKH

Community’s water needs vary, so it will determine the volume of water used per month. The volume of water consumed is influenced by many factors such as the number of family members, availability of the resources, income, price (tariff) of water, distance of the house to water resources, and others. Data on the pattern and volume of water consumption of respondent inside and outside GKH for each type of water are presented in Table 2 and Table 3. From those two tables it can be seen that respondents inside GKH consume more water compared to those of outside GKH. Respondents inside GKH consume more piped water from PDAM, while those outside GKH consume more groundwater.
In general, the (weighted) average of water consumptions of the households inside and outside GKH are 23.90 m³/household/month and 20.75 m³/household/month, respectively.

Table 3. Sources and Volume of Water Consumption by Household inside GKH

| Sources of water          | Number of Respondents | Water consumption (m³/household/month) |
|--------------------------|-----------------------|----------------------------------------|
|                          |                       | PDAM water | Ground water | Other sources | Total    |
| a. Piped water (PDAM)    | 21                    | 21.13      | 0.00         | 0.00          | 21.13    |
| b. Ground water          | 0                     | 0.00       | 0.00         | 0.00          | 0.00     |
| c. Other sources         | 1                     | 0.00       | 0.00         | 27.35         | 27.35    |
| d. PDAM and other sources| 11                    | 18.53      | 0.00         | 6.47          | 25.00    |
| e. Ground water and other sources | 1 | 0.00 | 0.00 | 33.60 | 33.84 |
| f. PDAM and ground water | 6                     | 27.37      | 1.95         | 0.00          | 29.32    |
| Total                    | 40                    | 67.03      | 1.95         | 67.42         | 136.64   |

Table 4. Sources and Volume of Water Consumption by Household outside GKH

| Sources of water          | Number of Respondents | Water consumption (m³/household/month) |
|--------------------------|-----------------------|----------------------------------------|
|                          |                       | PDAM water | Ground water | Other sources | Total    |
| a. Piped water (PDAM)    | 0                     | 0.00       | 0.00         | 0.00          | 0.00     |
| b. Ground water          | 22                    | 0.00       | 20.57        | 0.00          | 20.57    |
| c. Other sources         | 2                     | 0.00       | 0.00         | 0.00          | 0.00     |
| d. PDAM and other sources| 0                     | 0.00       | 0.00         | 0.00          | 0.00     |
| e. Ground water and other sources | 12 | 0.00 | 25.77 | 0.00 | 25.77 |
| f. PDAM and ground water | 4                     | 9.50       | 7.55         | 0.00          | 17.05    |
| Total                    | 40                    | 9.50       | 53.89        | 0.00          | 63.39    |

Household consumption of bottled water (AMDK) and refilled water is relatively high. Respondents inside GKH consume about 8 gallons/household/month of bottled water (25 out of 40 respondents) and 10 gallons of refilled water (3 out of 40 respondents). For those outside GKH, the average water consumption is 4 gallons/household/month of bottled water (5 out of 40 respondents) and 12 gallons of refilled water (26 out of 40 respondents).

3.3. Households’ expenditures for water consumption

Household expenditures for water consumption vary depending on the sources of water and the volume of water consumption. Based on the above volumes of water consumption, expenditures for water consumptions are presented in Table 4 and Table 5. Since respondents inside GKH consume more piped water and AMDK water than those of outside GKH, they spend more money for water consumption. The average water expenditures for the respondents inside GKH vary from Rp 5,070 to Rp 140,223 per household per month, while those outside GKH range from Rp 7,738 to Rp 40,482 per household per month.
Table 5. Average Household Expenditures for water consumption for respondents inside GKH

| Sources of water          | Number of Respondents | Total Water Expenditures (Rp/month) | Average Expenditures |
|---------------------------|-----------------------|-------------------------------------|----------------------|
|                           |                       | PDAM water                          | Ground water         | Other sources | Expenditures   |
| a. Piped water (PDAM)     | 21                    | 1,862,000                           | -                    | -            | 88,667         |
| b. Ground water           | 0                     | -                                   | -                    | -            | -              |
| c. Other sources          | 1                     | -                                   | -                    | -            | -              |
| d. PDAM and other sources | 11                    | 905,000                             | -                    | -            | 82,273         |
| e. Ground water and other sources | 1 | - | 5,070 | - | 5,070 |
| f. PDAM and ground water | 6                     | 817,000                             | 24,336               | -            | 140,223        |
| Total                     | 40                    | 3,584,000                           | 29,427               | -            | 316,232        |

Table 6. Average Household Expenditures for water consumption for respondents outside GKH

| Sources of water          | Number of Respondents | Total Water Expenditures (Rp/month) | Average Expenditures |
|---------------------------|-----------------------|-------------------------------------|----------------------|
|                           |                       | PDAM water                          | Ground water         | Other sources | Expenditures   |
| a. Piped water (PDAM)     | 0                     | -                                   | -                    | -            | -              |
| b. Ground water           | 22                    | -                                   | 170,235              | -            | 7,738          |
| c. Other sources          | 2                     | -                                   | -                    | 30,000       | 15,000         |
| d. PDAM and other sources | 0                     | -                                   | -                    | -            | -              |
| e. Ground water and other sources | 12 | - | 118,644 | - | 9,887 |
| f. PDAM and ground water | 4                     | 147,000                             | 16,366               | -            | 40,842         |
| Total                     | 40                    | 147,000                             | 305,245              | 30,000       | 73,466         |

Household expenditure for AMDK water and refill water inside GKH is greater than related expenditure for those outside GKH. Consumption of bottled water and refill water for respondents inside GKH reaches Rp 204,840 per month (25 respondents) and Rp 56,667 per month (3 respondents); while for those stay outside GKH reaches Rp 57,400 per month (5 respondents) and Rp 55,000 per month (26 respondents). These indicate that consumption of bottled water for respondents inside and outside GKH have been relatively high, in line with the information in Table 1.

Total household income ranges from Rp 3.00 to Rp 9.50 million per month for those stay inside GKH, and from Rp 1.50 to Rp 6.14 million per month for those stay outside GKG. With these ranges of incomes, households’ expenditures for water range from 0.16 to 1.60 percent from the total their incomes. These indicate that water expenditures are relatively low compared to the total incomes. However, since many households inside and outside GKH (28 and 31 out of 40 households) have also consumed AMDK water and refilled water, household expenses for water consumption will be much higher than those percentages. Unfortunately, these water expenses are not captured in the six categories of water consumption patterns.

3.4. Household willingness to pay for piped water
The willingness to pay (WTP) analysis is used to estimate the maximum amount willing to be paid by the respondents when there is an improvement in the quality of services from PDAM, including the improvement on quantity, quality and continuity of services. Based on the questions and values offered in the questionnaire to the 42 respondents, 21 of them were not willing to pay for the improved piped water service, while the other 21 respondents were willing to pay that service. The average value of WTP is obtained by multiplying the value of WTP with the relative frequency of households who are
willing to pay at that value. Data on the distribution of average value of respondents' WTP can be seen in Table 6. It is shown that the estimated average value of WTP is Rp 4,414 per m³. The average WTP is slightly higher than the price (tariff) of PDAM piped water at the second and third blocks (20 m³ and 30 m³), where the average water consumption is located. With this level of WTP, the projected total WTP is about Rp 185,400 per household per month. This value is higher than the current (actual) expenditure for water.

Cumulative respondents’ willingness to pay for the water is presented at Figure 1. The WTP curve illustrates the relationship between the value of the WTP paid and the number of respondents who are willing to pay at the WTP level. It can be seen that the WTP curve has a negative slope which means that the higher the value of the WTP, the fewer respondents are willing to pay. The curve has an sloping shape, meaning that the demand for piped water is elastic to the price: when there is an increase in the price of one unit it will cause a decrease in the quantity demanded that is greater than one unit.

Table 7. Average Value and Total Value of Willingness to Pay for Piped Water

| WTP (Rp/m³) | No of Respondent | Frequency | Average WTP | Total WTP  |
|-------------|------------------|-----------|-------------|------------|
| 3,100       | 2                | 0.048     | 148         | 6,200      |
| 4,100       | 19               | 0.452     | 1,855       | 77,900     |
| 4,500       | 15               | 0.357     | 1,607       | 67,500     |
| 4,800       | 1                | 0.024     | 114         | 4,800      |
| 5,000       | 4                | 0.095     | 476         | 20,000     |
| 9,000       | 1                | 0.024     | 214         | 9,000      |
|             | 42               | 1.000     | 4,414       | 185,400    |

Figure 1. Willingness to pay of the households for piped water

3.5. Community perception on seepage water available at GriyaKatulampa Housing

About 47.5% of the community knows the principle management of the seepage (imbibition) water available at the GKH and has been managed by the community for a long time, while the other 40% does not know (Table 7). The water is consumable to support their continuous increased of water needs, except for drinking purpose. The community has developed a retention pool at the center of the water sources, closed to the mini park inside the GKH. From this pool the water is distributed to the community through private plastic-hose or PVC-pipe connection. However, the community (52.5%) believes that there is no special technical and system of management for the water. Thus, households
who want to consume it, they just make connection from the available sources to their homes. The pipes are not well managed by the owners, since there are many leakages along the pipes.

A half of the respondents believe that if PDAM water connection is available at a relatively close distance from their homes, they will not consume seepage water anymore. But, when the flow of PDAM water is stop or weak, seepage water is still needed (40%). In terms of community expectation towards the availability and function of seepage water, majority of the community (50%) expects that management of seepage water should be improved in the future to keep it continuously flows, to back up the continuously increased prices of piped water, bottled water and refill water. Majority of them (75%) believe that they have no long term plan in managing this water, but they agree to maintain, even improve, its availability and functions.

**Table 8.** Community perceptions of Griya Katulampa Housing water seepage

| No | Perception component                                                                 | Frequency | Percentage |
|----|-------------------------------------------------------------------------------------|-----------|------------|
| 1  | Principles of seepage water management                                              |           |            |
|    | a. Managed by residents                                                              | 19        | 47.5       |
|    | b. Don't know                                                                       | 16        | 40.0       |
|    | c. No one manages                                                                   | 5         | 12.5       |
| 2  | Seepage water management systems                                                     |           |            |
|    | a. There is no special system for residents who use seepage water                    | 21        | 52.5       |
|    | b. Don't know                                                                       | 17        | 42.5       |
|    | c. Pay monthly fees                                                                 | 2         | 5.0        |
| 3  | Every household needs seepage water                                                  |           |            |
|    | a. If there is already a PDAM, there is no need for seepage water                    | 20        | 50.0       |
|    | b. If the PDAM flow is small/stopped, it requires seepage water                      | 16        | 40.0       |
|    | c. Requires seepage water, but it is complicated in usage and maintenance so that choosing PDAM is more efficient | 4 | 10.0 |
| 4  | Expectations for the development of utilization of seepage water                    |           |            |
|    | a. Better managed                                                                   | 21        | 52.5       |
|    | b. There is no hope                                                                  | 10        | 25.0       |
|    | c. The amount of development above is necessary management in licensing issues and impacts on seepage water | 6 | 15.0 |
|    | d. Equity in the distribution of seepage water to each household                     | 3         | 7.5        |
| 5  | Plans for the development of utilization of seepage water                            |           |            |
|    | a. There are no plans                                                                | 30        | 75.0       |
|    | b. The seepage of seepage water area                                                | 7         | 17.5       |
|    | c. Making supporting facilities                                                     | 3         | 7.5        |

4. **Conclusion and Recommendation**

4.1. **Conclusion**

1) Katulampa Village has various sources of clean water, including PDAM piped water, wells, and other water sources in the form of rivers, springs, and seepage water. These water sources are conjunctively used in meeting community daily water needs, together with bottled water and refilled water. The largest use of water by respondents in Griya Katulampa Housing (GKH) is PDAM water and bottled water, while respondents outside GKH are well water and refill water. People use water from various sources to support their daily needs, such as cooking and drinking, bathing, washing clothes, washing vehicles, watering plants or flowing fish ponds, and other necessities.
2) The biggest average expenditure for water consumption per household is at GKH i.e., Rp 140,222 per month, while for people outside GKH it is Rp 40,834 per month. Both are for the users of PDAM water and well water. Nominally it appears that the water consumption expenditure for respondents in the GKH is greater than the expenditure of respondents outside the GKH. Expenditures for bottled and refilled water are also relatively high. However, in general, the proportion of water consumption relative to the average income is relatively low, both for the households inside and outside Griya Katulampa Housing.

3) The results of WTP analysis indicate that the estimated average value of WTP if there is an increase in PDAM water services is Rp 4,414 per m³, while the total value of WTP for piped water is Rp 185,400 per household per month.

4) The community considers that seepage water has an important function in meeting clean water needs, except for consumption. This water resource has been managed relatively well by the community together. This water can act as a substitute for PDAM water when the water flow of PDAM to the community experiences stopping flow or flowing weakly. The community does not have a plan in the development of the use of seepage water for the entire community, but they hope that the seepage water will be better managed to be sustainable.

4.2. Recommendation
1) Local government of Bogor City needs to increase its cooperation with the community to preserve the ecosystem of water resources and provide supporting facilities to support the fulfillment of water for all residents, such as bathing, washing and toilet facilities (mandi, cuci, kakus or MCK), especially outside the GKH.
2) Local government needs to raise public awareness to conserve and efficiently use the existing water resources by providing education and extension programs to the community.
3) PDAM and local government need to increase coverage and services of piped water more broadly considering that there are still many people who have not been served by piped water from PDAMs.
4) There needs to be involvement of all parties in managing and utilizing the seepage water available in GKH, so that its existence can be sustainable and its quality can be maintained, thus the community can use it more optimally.

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