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Regional Case Study

Analysis of Rainwater Harvesting (RWH) Capacity in Leuwigajah Urban-Village, South Cimahi

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Abstract

Leuwigajah Urban-Village is an area belonging to Citarum Watershed. Thus, it has a high potential to experience floods during the rainy season. Meanwhile, the area often experiences drought during the dry season due to high surface runoff and low infiltration. This paper discusses the capacity of RWH needed in N.A. of R.W. 19. It discusses hydrological conditions of the Cimahi watershed by presenting an analysis of rainfall data, land use data, and extreme discharge data, both maximum and minimum extreme discharges. Therefore, the Citarum Harum Community Service team decided to build Rainwater Harvesting (RWH) as a water supply source during the dry season. The RWH was built based on people's water needs 10 years later, from 2022-to 2032. Based on the calculations explained in the Rainwater Storage Module book issued by the Ministry of Public Works and Housing, the volume of RWH needed is 125 m3. However, due to limited land, it was decided to build an RWH with dimensions of 2 m x 2 m x 2 m which can accommodate 8 m3 of water. The water in this RWH can fulfil 6.4% of daily water needs, so it is recommended to be used for emergency purposes or secondary purposes such as agriculture and plantations.

Keywords: Drought; rainwater; rainwater harvesting (RWH); South Cimahi District

1. Introduction

Indonesia is located in a tropical region that has high annual rainfall. Rainfall in Indonesia has a very high diversity in time and space. Based on the average results of monthly rainfall, the rainy season will start from November to April because the average monthly rainfall in Indonesia is very high. The island areas of Java, Kalimantan, Papua, and Sumatra tend to enter the moderate and high rainfall groups ranging from 250 mm/month to 550 mm/month (Mulyono, 2014; Wahid and Usman, 2017; Setiawan, 2021). Rainwater that falls will seep into the soil, making the soil become saturated with water. After the soil is saturated with water, surface water runoff occurs. The value of significant surface runoff compared to soil absorption causes waterlogging and even flooding (Annisa et al., 2016; Bahunta et al., 2019).

On open land or with no vegetation, rainwater mostly becomes surface runoff that flows towards the river, so the river's flow increases rapidly. Increased surface flow volume will result in flooding problems in the downstream part of the watershed. Flooding occurs when the layout for the absorption of runoff water is reduced or absent. The river can no longer accommodate runoff water and inundates various areas such as settlements, roads, and various other places that are not where the water flows. Making rainwater reservoirs is one way to store water, which then the water can be used to meet daily needs during the dry season (Verrina et al., 2013; Qodriyatun, 2020; Muryani et al., 2016).

Sustainable water resource management uses the principle that water resources must be used (Kim et al., in Malik et al., 2016). This principle can identify alternative water sources that can be utilized as needed, not always meeting drinking water standards. Rainwater is an essential alternative water source, especially in areas with no clean water supply system, low surface water quality, and no groundwater (Abdulla et al., in Malik et al., 2016). As an alternative water resource, rainwater can be utilized for various needs as long as it is processed according to its purpose.

Rainwater Harvesting (RWH) systems are increasingly relied upon to reduce flooding and provide additional water supplies in urban environments. RWH is the process of intercepting, draining water and storing rainwater for future use. Rainwater harvesting (RWH) is a method or technology used to collect rainwater from building roofs, ground surfaces, roads, or rock hills and is utilized as a source of clean water supply. Rainwater Harvesting is a low-cost and straightforward project that provides water by accommodating rainwater from the roof and storing it so it can be used to meet domestic, agricultural, industrial, and environmental needs. In addition to domestic needs such as drinking and cooking, water from RWH can be used for irrigation, stormwater control, served urban water supply, helping water control in rural and urban areas, flush toilets, washing, landscape maintenance, and groundwater. According to Julius (2013), rainwater harvesting can be one of the best methods to restore the hydrological cycle and make it possible to build sustainable urban areas (Quinn et al., 2020; UNEP in Suprayogi et al., 2019; Abdulla et al., in Malik et al. 2016; Asnaning et al., 2018; Joleha et al., 2019).

The technique of collecting rainwater by capturing rainwater from rooftop catchment is called rooftop rain harvesting. Rainwater harvesting (RWH) by building roofs is generally an alternative to obtaining clean water sources that require a little processing before being used for human purposes. The best way to harvest rainwater is to replenish groundwater. If rainwater is accommodated in a natural pond or a new artificial tank, it can fill the natural aquifer to increase the surface of the groundwater. To meet the country's needs, harvested rainwater can be stored in a sub-surface groundwater reservoir using artificial recharging techniques in tanks (Mishra et al., 2020; Zang et al., in Suprayogi et al., 2019).

A rainwater harvesting system is recognized as an option for decentralized water supply, but there is still a debate about its benefits and costs. In developed countries, there are still doubts about its relevance, primarily since the way it supplies water in many countries is based on centralized infrastructure and single-use of water. However, in many regions of Southeast Asia, Central China, Africa, the Caribbean, and the Pacific Ocean, its people almost exclusively rely on rainwater harvesting systems (Huang et al., 2021; Joleha et al., 2019).

In numerous previous studies, Rainwater Harvesting (RWH) has centred on the system's ability to deliver water supplies. Rainwater will be harvested from the roof to produce drinking water (Zang et al., 2021). In their publication, Asnaning et al. (2018) mentioned that research on RWH conducted by Rosmin in 2015 used a rainwater harvesting system to collect rainwater and store it in a reservoir before being used to generate electricity. In addition, studies are looking at the potential for rainwater harvesting to provide an increasingly recognized water supply and stormwater management, which fosters interest in real-world application and considers designs based on stormwater management metrics (Quinn et al., 2021). This rainwater harvesting system can also be used to contribute to building a green campus, which is the goal of the University of Yalova, Turkey, where based on its publication, the university has developed a passive rainwater harvesting system with simple physical filtration, which is a novel in this field (Kucukkaya et al., 2020). To meet the needs of household-scale water on Merbau Island, which does not have a good source of clean water, research has been conducted on harvesting rainwater by looking at the area of each roof, the type of roof, and the number of family members in one household. The tank's volume was designed to hold water and estimate the required costs (Joleha et al., 2019). However, according to Islam et al. (2021), large-scale rainwater harvesting systems studies are minimal. Previous studies have focused heavily on various aspects of small-scale RWH systems, including risk analysis and economics. Based on its publication, the research that has been done shows the potential for high water supply in the community RWH in a water-scarce coastal area in Bangladesh and suggests conducting a reliability analysis to choose the right storage tank for a community before starting to implement its RWH system to avoid the high costs of building a water storage tank.

After we identified the importance of the need for RWH, this paper discusses hydrological conditions of the Cimahi watershed by presenting an analysis of rainfall data, land use data, and extreme discharge data, both maximum and minimum extreme discharges. This paper also discusses the analysis and calculation of the capacity of the RWH in the Community Hall of Neighbourhood Association (N.A.) of R.W. 19 as an effort to manage water resources in the Cimahi Watershed to reduce runoff and increase the supply of water needs in the Cimahi Watershed, especially in Leuwigajah Urban-village.

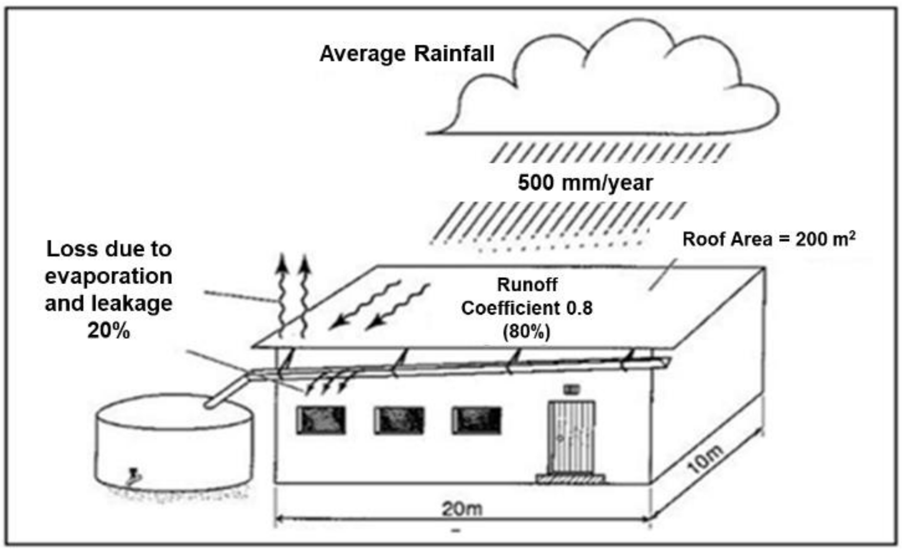

Figure 1. Illustration of rainwater harvesting building (Harsoyo in Silvia and Safriani, 2018)

2. Methodology

2.1 Location of Study

Concerning the Citarum Harum Community Service Program, Institut Teknologi Bandung contributed to its management by building RWH in the Citarum watershed area. The construction was done in South Cimahi District, Cimahi City, whose average rainfall is 294.75 mm, with an average number of rainy days of 13 days in 2018 (BPS, 2019). South Cimahi District has an area of 16.9 km2 or 1.690 ha, with a population density of 15,711 people/km2. The residents of South Cimahi District use water from various water sources, of which 44,717 households use pumps, 4,001 households use dug wells, 8,866 households use PDAM, and 124 households use springs. Therefore, it is expected that the construction of this RWH building can decrease the use of water resources from those sources.

Leuwigajah urban village, especially N.A. of R.W. 19, is part of the South Cimahi District, Citarum Watershed. Leuwigajah Urban-village is located at 6054'10" S and 107031'40" E. This area has an area of 393.473 ha or 3.93473 km2, located at an altitude of 726 meters above sea level. The population in

Leuwigajah urban village is 43,477 people, with a population density of 11049.63 people/km2 (BPS, 2020). As an illustration, the Leuwigajah urban village can be seen in Figure 2.

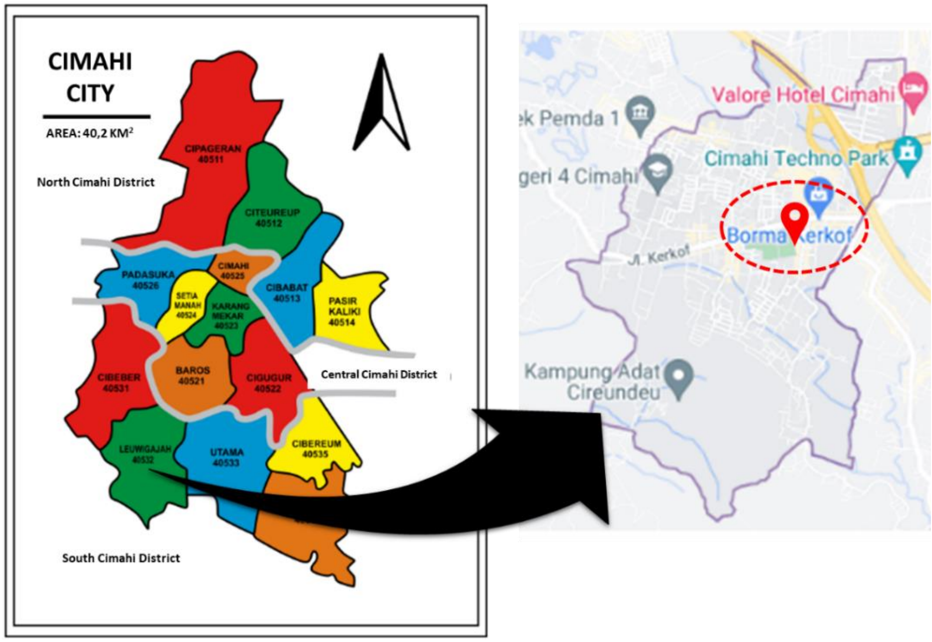

Figure 2. Leuwigajah urban-village, South Cimahi District, Cimahi City

2.2 Methods

Leuwigajah urban village is part of the Cimahi watershed area, where the watershed is located on Java Island, which has a monsoon rain type. Cimahi watershed climate type can be proven based on calculations of region rainfall calculated by the average algebraic method. This method is based on the assumption that all raincoaters have an equivalent influence. In addition, this method is the simplest and most suitable way for areas with a flat topography (Djafar et al., 2014; Suripin in Nurhayati, 2019). The calculation formula of this arithmetic method is shown in Equation 1 below.

$$P = \frac{P_1 + P_2 + \cdots + P_n}{n} = \frac{\sum_{i=1}^{n} P_i}{n} \tag{1}$$

with

P1, P2, ... Pn = rainfall recorded at the rain post

1, 2, .. n = the number of rain posts

Rainfall and discharge are closely related because the falling rain will be pumped and recorded at a discharge observation post. In addition, rainfall is needed to prepare a utilization and flood control design (Jatikusuma, 2016). To illustrate the relationship between rain and discharge, it can be done by simple regression analysis and moving average analysis. Changes in the hydrological regime can be analyzed with a simple linear regression approach that will produce a coefficient of runoff and basic flow that illustrates its tendency to move towards time. This simple linear regression approach can be seen in equation 2 (Pradiko et al., 2017). Moving average analysis is used to look for discharge extremity by looking at the tendency of daily maximum discharge values and daily minimums calculated successfully for 5 (five) years to eliminate the random nature of discharge (Jatikusuma, 2016; Marganingrum et al., 2013; Pradiko et al., 2017).

$$Q = C(P \times A) + b \tag{2}$$

wherewith

Q: river discharge (L^3/T)
C: runoff coefficient
P: regional rainfall (L/T)
A: watershed area (L^2)
b: base flow

2.3 Rainfall Data

The rainfall data involved in this study is secondary data obtained from the "Cimahi City in 2021" document issued by the Indonesia Statistics of Cimahi City. The data are presented in the following Table 1.

Table 1. Rainfalls data of Cimahi City in 2018

Month	Rainwater (mm)
January	174
February	215
March	192
April	221
May	53
June	45
July	12
August	22
September	28
October	66
November	76
December	56

Source: "Cimahi City in 2021", Indonesia Statistics (BPS) of Cimahi City

2.4 Projection of the Population of N.A. of R.W. 19

The population projection in N.A. of R.W. 19 was performed to determine the population from 2022 to 2032. According to the following equation, the method used is arithmetic growth (Widayani, 2016).

$$P_t = P_o\{1 + (r \times t)\} \quad (3)$$

in which
P_t = Population in the year of t
P_o = Population in the first year
r = Population Growth Rate
t = Projection Period

According to the data issued by the Indonesia Statistics of Cimahi City in 2021, the population growth rate in South Cimahi District in 2020 is 0.44%. Meanwhile, the population of N.A. of R.W. 19 in 2021 is presented in Table 2.

Table 2. The population of NA of RW 19 in 2021

Description	Number (People)
Male Population in NA of RW 19	730
Female Population in NA of RW 19	665
Total Population in NA of RW 19	1,350

Source: Data of N.A. of R.W. 19 of Leuwigajah Urban-Village

2.5 Projection of Water Needs of the Population of N.A. of R.W. 19

According to the Directorate General of Human Settlements Planning Criteria, Ministry of Public Works and Housing, Cimahi City, with a total population of 568,400 people, belongs to the Large City category with the daily clean water need is 120 litres per person per day.

Table 3. Clean water planning criteria

Description	City/Town Category Based on Number of Population (People)				
	> 1,000,000	**500,000 to 1,000,000**	**100,000 to 500,000**	**20,000 to 100,000**	**<20,000**
	Metropolis	**Large City**	**Medium City**	**Small City**	**Town**
House Connection Units (litters/person/day)	> 150	150 - 120	90 - 120	80 - 120	60 - 80
Hydrant Units (litters/person/day)	20 - 40	20 - 40	20 - 40	20 - 40	20 - 40
Non-Domestic Consumptions	600 – 900	600 – 900		600	
a. Small business (litters/unit/day)	1,000 – 5,000	1,000 – 5,000		1,500	
b. Large business (litters/unit/day)	0.2 – 0.8	0.2 – 0.8		0.2 – 0.8	
c. Large industry (litters/second/hectare)	0.1 – 0.3	0.1 – 0.3		0.1 – 0.3	
d. Tourism site (litters/second/hectare)					
Water Loss (%)	20 - 30	20 - 30	20 - 30	20 - 30	20 - 30

Source: Directorate General of Cipta Karya Planning Criteria in Tumanan et al., 2017

To determine the number of water needs, the following equation is used.

$$q = \frac{120\frac{litres}{person}}{day} \times The\ number\ of\ population \qquad (4)$$

3. Result and Discussion

3.1 Regional Rainfall and Climate Type

Leuwigajah urban village is part of the Cimahi watershed. Based on the calculation of regional rainfall, the climate type in the Cimahi watershed is a monsoonal type with two peaks of rain, namely in January-May and October-December. In this monsoon type, rainfall is concentrated in the rainy season, while the rainfall is relatively below 100 mm/month (Nurhayati et al., 2020; Sabar and Plamonia, 2012).

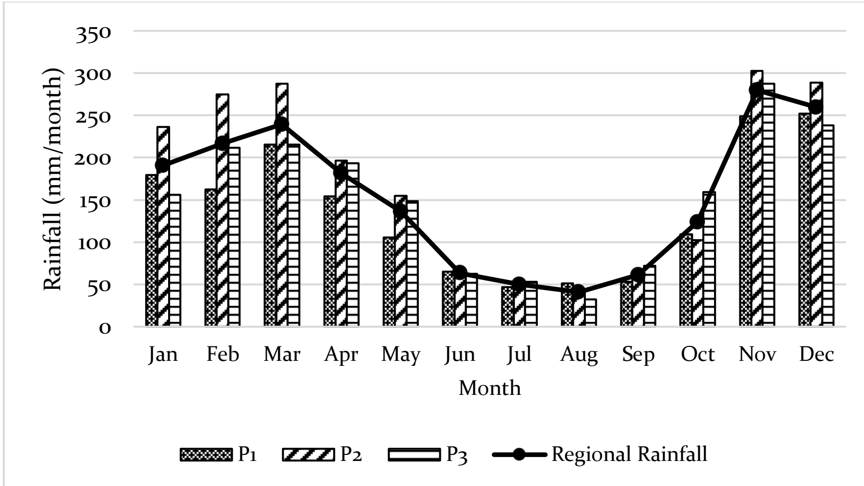

Figure 3. Regional rainfall in the Cimahi watershed area (Nurhayati et al., 2020)

3.2 Land Use in The Watershed Area

Leuwigajah urban village is downstream of the Cimahi watershed, whose land use is dominated by residential and industrial areas. The Cimahi watershed area has an area of 72.7 km2 with diverse land use, such as forests, agriculture/plantation, meadow/grassland, rice fields, and settlement/industry. However, built-up areas, namely settlements and industries, amounting to 62.45% or 45.402 km2, dominate the Cimahi watershed area in 2018. The table below shows the land use in the Cimahi watershed area from 2014 to 2018 (Nurhayati et al., 2021).

Table 4. Land-use change in the Cimahi Watershed area

Land use	Year (km²)			
	2014	**2015**	**2017**	**2018**
Forest	14.573	14.565	14.550	14.542
Agriculture/plantation	12.061	11.377	10.007	9.322
Meadow/grassland	3.686	2.555	2.294	1.163
Rice fields	6.294	5.164	2.905	1.775
Settlement/industrial zone	35.584	38.539	42.448	45.402
Total	72.7	72.7	72.7	72.7

Based on the table above, it can be seen that residential and industrial areas in the Cimahi watershed area have increased, while the agricultural/plantation areas have decreased. In this case, since the population experiences increase, the need for settlements will also increase.

3.3 Rain and Discharge Relationship

Rain and discharge are the main components of hydrology which are two random variables and become determinants and barriers in development. The falling rain will look for lower areas and pools and be recorded at a discharge observation post. The relationship between rain and discharge can be described by simple regression equations and moving average analysis. The trend of rain and discharge will describe the two components of hydrology separately (Marganingrum et al., 2013). Figure 4 shows the relationship between rain and discharge in the Cimahi watershed region (Nurhayati, 2019).

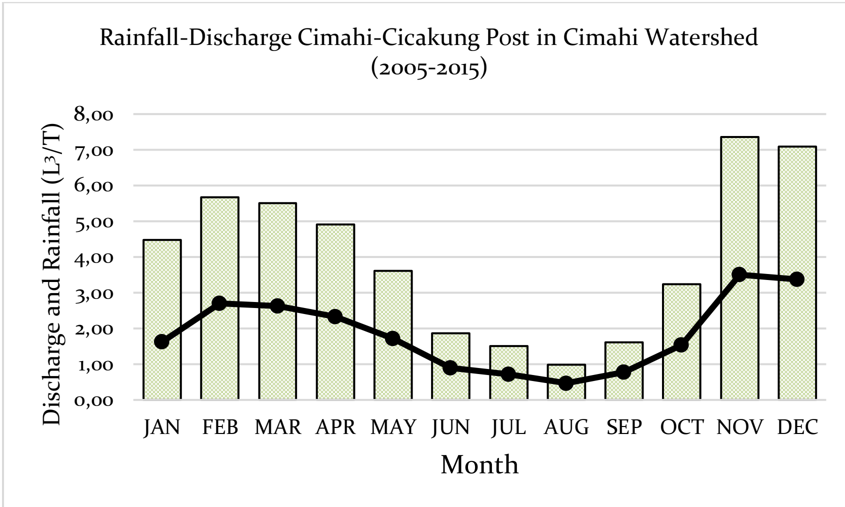

Figure 4. Rain and discharge relationship of Cimahi Watershed region

Based on the image of the relationship between rain and discharge above, it is shown that water that falls to ground level is not all pumping but becomes a base flow or baseflow that enters the ground through infiltration.

3.4 Degradation of Flow Regime and Discharge Extremities

The Citarum watershed area has decreased or degraded in terms of quantity and quality, and the Cimahi watershed is part of the Citarum watershed. Degradation can occur due to many things, including climate change and land change (Sabar in Nurhayati 2019). This change in the hydrological regime can be analyzed with a simple linear regression approach that will produce a runoff coefficient and a basic flow that describes its tendency to move towards time. Figure 5 shows the flow coefficient value that has increased each year. Figure 6 and Figure 7 below show the results of an analysis of discharge extremities in the Cimahi watershed region (Nurhayati et al., 2020).

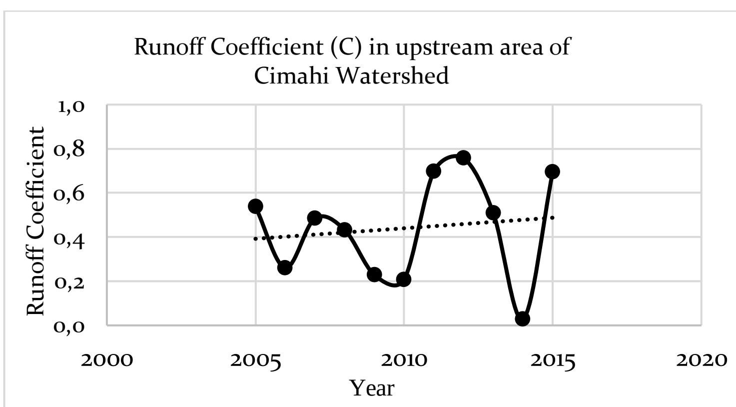

Figure 5. Runoff coefficient in the upstream area of the Cimahi Watershed (Nurhayati et al., 2020)

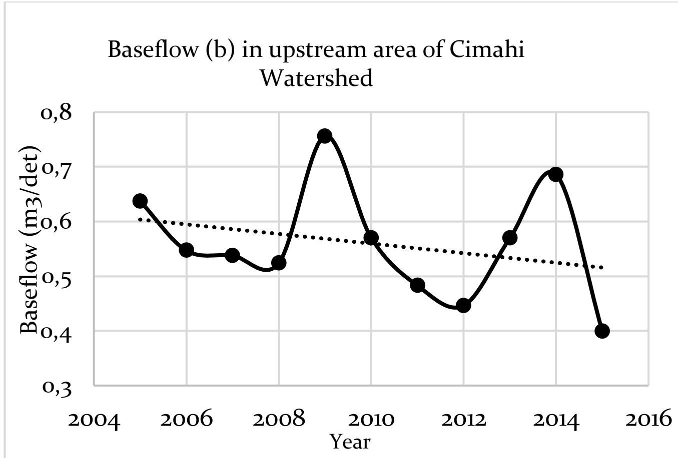

Figure 6. Baseflow in the upstream area of the Cimahi Watershed (Nurhayati et al., 2020)

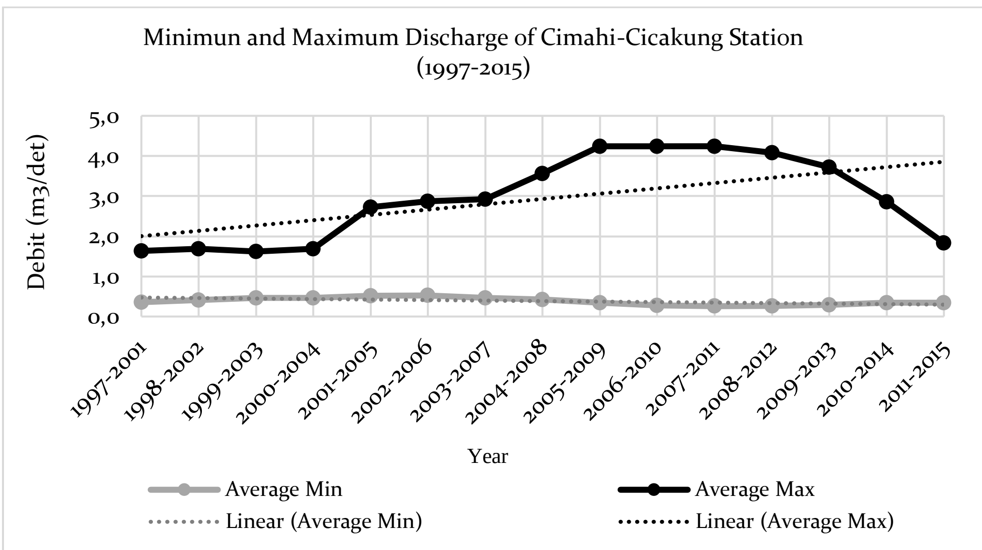

Figure 7. Cimahi Watershed discharge extremities (Nurhayati et al., 2020)

Based on the figure above, it can be seen that there is an increase in the coefficient of runoff (C) and a decrease in the number of base flows (b). These things occur because of urbanization that turns it into a built-up region. Successful conversion of land from forests, cultivation into settlements will affect the nature of river flow where water discharge will be more significant in the rainy season, and the discharge of runoff flow or baseflow will be smaller in the dry season, will pose a threat of drought (Pradiko et al., 2017; Sabar in Nurhayati 2019). In Figure 9, you can see the extremity of the discharge marked by the maximum discharge trend increasing and the minimum discharge trend decreasing. This indicates that there will be a drought in the dry season, and in the rainy season, there will be flooding.

3.5 Projection of the Population of N.A. of R.W. 19

According to the arithmetic method of population projection, as stated in point **2.4.**, the population of N.A. of R.W. is 19 from 2022 until 2032 in Table 5.

3.6 Projection of Water Needs of N.A. of R.W. 19 Population

According to the method of determining water needs based on the population, as stated in point 2.5., the projection of clean water needs in N.A. of R.W. 19 was determined and obtained in the following table.

Table 5. Results of projection of water needs of a population of N.A. of R.W. 19 until 2032

Year	Population (people)	Total Water Needs (liter/day)	Total Water Needs (m^3/day)
2022	1402	168240	168.24
2023	1409	169080	169.08
2024	1416	169920	169.92
2025	1423	170760	170.76
2026	1430	171600	171.6
2027	1437	172440	172.44
2028	1444	173280	173.28
2029	1451	174120	174.12
2030	1458	174960	174.96
2031	1465	175800	175.8
2032	1472	176640	176.64

The population in N.A. of R.W. 19 increased as much as 70 people. Therefore. the increment of water needs should be around 10,500 litres per day or 10.5 m^3 per day. The number of increments is by the number of water needs stated in the table above.

3,7 Calculation of RWH Dimension

RWH design was adjusted to the community's water needs and rainwater availability. Based on the standard of RWH design, to meet the water needs of every person in N.A. of R.W. 19, each house needs to build RWH with the capacity of 125 $m^{3,}$ as can be seen in Table 6.

Table 6. Calculation of RWH capacity for every house in NA of RW 19

Month	Number of days	Average rainfall (mm)	Roof area (m^2)	Amount of raw water (L)	Needs of clean water (L)	Lack of water (L)
January	31	174	40	6960	14880	7920
February	28	215	45	9675	13440	3765
March	31	192	45	8640	14880	6240
April	30	221	45	9945	14400	4455
May	31	53	45	2385	14880	12495
June	30	45	45	2025	14400	12375
July	31	12	45	540	14880	14340
August	31	22	45	990	14400	13890
September	30	28	45	1260	14880	13140
October	31	66	45	2970	14400	11910
November	30	76	45	3420	14880	10980
December	31	56	45	2520	14880	12360
The volume of rainwater harvesting						**123870**

The residents of N.A. of R.W. 19 can replace the water they usually use with rainwater if they build an RWH with 123870 litres or 123.87 cubic meters. This value was then rounded up to make the construction more accessible to 125 cubic meters.

3.8 Construction of RWH in N.A. of R.W. 19

The RWH, built-in N.A. of R.W. 19 for the Citarum Harum, is a communal RWH that everyone can use. RWH was built in the Community Hall of N.A. of R.W. 19. Although the construction was done for the community, the RWH built has not been able to fully meet every person's needs due to the limited land.

3.9 Purpose and Use of Rain Water Harvesting

The rainwater harvesting system is used mainly for collecting rainwater as an alternative source of water (Qomariyah et al., 2016). Aside from that, the rainwater harvesting system also plays a role in runoff control and groundwater conservation. By collecting and containing rainwater, less of it will become surface runoff that might harm the pavement of roads, accumulate into a flood, and disrupt rainwater infiltration. In addition to runoff control, collecting, containing, and using rainwater as a substitute for groundwater will conserve the quantity of groundwater inside the land surface. Moreover, it could enforce groundwater recharge. Rainwater harvesting is a series of activities to collect, use and/or refill groundwater. Among the various rainwater harvesting techniques, water harvesting from the roof is one of the right choices to increase groundwater replenishment or storage (Rofil and Maryono, 2017; Ali, 2015).

In 2021, there was research to plan rainwater harvesting in Universitas Negeri Jakarta to be used as an alternative source of water and reduce runoff rainwater. The method used to develop RWH is the water balance method, which compares the demand for water and water supply. This research shows that RWH of 200 m^3 will reduce groundwater use by up to 30% in building A FIO, B FMIPA, and C FIO. In addition, RWH of 80 m^3 will also reduce groundwater use by up to 13,9% in Ulul Albab mosque. The dimensions of RWH of 200 m^3 are 10 x 8 x 3 m, and RWH of 80 m3 is 6.4 x 5 x 3 m and the RWH is placed underground. This RWH system will improve the eco-drainage and reduce drain load by up to 18.9% from rainwater runoff.

Another research about RWH was conducted in 2018. The research's location is the village of Pandeyan, Umbulharjo, Yogyakarta. In this research, the RWH was designed to be applied at home. Because of that, the design was made by roof size and the number of occupants in one house. The research result shows that for a house with a roof size of 100 m^2 and five occupants, then the capacity of the RWH storage tank is 20 m^3. The required budget for the construction is about IDR19,259,197.66, and the RWH can replace other clean water providers by 58%. It is also shown in research conducted by Prihadi et al. (2019) in the Karst Region, Malang Regency, that a house of five people needs approximately 4.5 m^3 of drinking water throughout a dry season. The tank volume needed to cover for drinking purposes is 4 m^3 as rainwater provides 0.122 m^3/day of drinking water.

Rain Water Harvesting can also be used for communal non-consumption purposes such as hand-washing as a response to the COVID-19 pandemic. Research regarding RWH use for the hand-washing purpose was conducted by Lestari et al. (2021) in Susunan Baru District. It is shown that collected rainwater could replace the amount of water needed for the hand-washing purpose for 22 days, assuming that it rains three times a week. RWH construction in Leuwigajah Urban-Village was also carried out, as indicated by the studies above. RWH built has dimensions of 2×2×2 meters at Leuwigajah urban-village so that it can contain eight cubic meters of rainwater. This capacity is far from the total water needs of the residents of N.A. of R.W. 19, which reached 176.64 cubic meters in a day. The RWH capacity built at the community hall fulfilled 6.4% of what was supposed to be built. Even so, the construction of RWH in N.A. of R.W. 19 can replace the use of water from other sources for community needs. N.A. of R.W. 19 has a seedling and waste processing area not far from the Hall of N.A. of R.W. 19. In this case, the seedling and waste processing activities that require water can be taken from the RWH located in the community hall.

If the construction of the RWH building is needed to replace the use of water from other sources, then RWH with the exact dimensions as those built in the community hall is needed. The construction of RWH in the Community Hall NA of R.W. 19 is also expected to be the first step for residents to understand the potential use of rainwater better. In addition, the RWH in the community hall can be an example for residents who want to build their RWH.

3.10 Water Filtration in Rain Water Harvesting

NA of R.W. 19 is located near factories and industries and highways where large vehicles pass by. This results in a high possibility of air pollution and increases the number of contaminants in rainwater. That being the case, water filtration is needed for the rainwater to be used safely for daily activities. Depending on how contaminated the rainwater is, the water filtration method may vary from the simplest method to a more advanced one.

A simple water filter may consist of layers of porous mediums such as gravel, sand, coconut husk, and activated charcoal for adsorption. This filtration can only be used when the rainwater is not as polluted, especially by heavy metals that may be contained in the air due to various industrial activities. This water filter is arranged so that the least porous material is placed at the bottom. In this rainwater harvesting, the materials used are activated carbon with 1 – 2 millimetres in size, milled marble with 1 – 2 millimetres in size, sand with 0.4 - 1.2 millimetres in size, and gravel with 15 – 20 millimetres in size. However, these materials will only filter out the visible impurities such as fine sand, dust, and small insects that might get carried by rainwater that have not been settled yet. The process used in this water filter is slow sand filtration so that pumping is not needed to make the water pass through the mediums.

The target water quality from this rainwater harvesting is safe enough to be used for simple farming, the meaningless concentration of total suspended solids and turbidity. In contrast, it is best for drinking water to go through some appropriate process to remove bacteria and other contaminants on post-storage measures. Hence, the water quality follows Ministry of Health Regulation Number 492 of 2010 concerning Drinking Water Quality Requirements.

Abbasi and Abbasi in Campisano et al., (2017) recommended that filters in an RWH system should be easy to clean, not easily clog, and do not provide any entrance for more contamination (e.g., small insects and animals). In this case, the filter can be cleaned easily by running clean water through it until the tap's water runs clear.

3.11 Pictures During the Construction of Rain Water Harvesting

(a) (b) (c)

Figure 8 (a) Pre-construction of RWH in NA of RW 19 Leuwigajah, (b) Construction of RWH in NA of RW 19 Leuwigajah, (c) The finished form of RWH in NA of RW 19 Leuwigajah

The construction started with an excavation process and continued with the foundation installation process. It continued with columns construction and wall construction. Then, the filter was installed, and the building was coated in finishing cement to be continued with colour painting.

4. Conclusion

RWH building, constructed in Hall's N.A. of R.W. 19 for the Citarum Harum Community Service, has not met the community's needs to utilize rainwater fully. The capacity provided is still far from the total water needs of its community. The RWH built can at least become a water provider for community activities such as seedling and waste processing. In addition, the RWH that was built can also be an example for the community who want to build RWH in their houses.

After the construction of RWH in N.A. of R.W. 19, it is expected that the community will understand the potential of rainwater and how to use it. Therefore, all communities will want to use rainwater since it will feel much more if everyone builds their RWH in their house.

This paper discusses the capacity of RWH needed in N.A. of R.W. 19. It discusses hydrological conditions of the Cimahi watershed by presenting an analysis of rainfall data, land use data, and extreme discharge data, both maximum and minimum extreme discharges. The construction of RWH infrastructure is one of the real answers to the problem of water resources found in many locations, including dry locations and wet locations. Along with this study, the authors hope to increase efforts to develop communal scale infrastructure to control runoff and provide clean water.

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