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A Study of the Ablution Wastewater Conservation at Al Baythar Mosque in the Banjarbaru City, Indonesia

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ABSTRACT

The City of Banjarbaru, based on the attachment of existing RAKH, the current conditions, the area of Banjarbaru City Green Open Space is + 2,638.83 Ha or 8.213% of the Banjarbaru City area, which consists of public green open space and private green open space. In contrast, the minimum green open space (RTH) is 30% of the city area. It is the trigger for flooding in Banjarbaru City. The aim of this research is to the evaluation of the infiltration well for ablution wastewater in a public building. This monitoring includes water table monitoring from the pump wells around the infiltration well. The future impact will reduce the volume of floods that occur in Banjarbaru City. This study used a mosque as a pilot site to apply infiltration well design built-in 2014. The mosque, in this case, is not only burdened by rainwater but also from water used for ablution, which has been released into road drainage channels. After five years of infiltration well was build the condition of the water table around can be maintained. It is evidenced by the absence of additional depth of pump wells around the infiltration well.

Keywords: ablution wastewater, infiltration well, mosque, and Banjarbaru city

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1. Introduction

The land cover increase is one of the causes of flooding due to lack of water infiltration into the ground other than rainfall (Wesli et al., 2013). Implementation of Undang-undang Republik Indonesia No. 26 of 2007 concerning Spatial Planning (UU RI No. 26, 2007). In this law, the minimum green open space (RTH) is 30% of the city area. The minimum of public city green open space is 20% of the city area, and the rest is private green open space, which depends on the population in a city.

The City of Banjarbaru, based on the attachment of existing RAKH, the current conditions, the area of Banjarbaru City Green Open Space is + 2,638.83 Ha or 8.213% of the Banjarbaru City area, which consists of public green open space and private green open space. Public green open space is 2,350.40 hectares or 7,315% of the total area of Banjarbaru City (Bappeda, 2016). It means that the city/public and private green open space does not reach the minimum value stipulated in the law. The construction of private and public buildings without supervision will give the community the freedom to cover all the land they own with the pavement. It does not support the drainage of rainwater to infiltration into the ground. When there is high-intensity rainfall, water will accumulate on the ground surface without entering the land. It is the trigger for flooding in Banjarbaru City at this time.

One of the best ways to store groundwater in the rainy season is to build an infiltration wells system (Bahunta and Waspodo, 2019). This system can be applied in Banjarbaru City because the water table level is adequate for constructing infiltration wells. This solution has also been stated in one of the regional regulations owned by the City of Banjarbaru, namely the Regional Regulation of the City of Banjarbaru, number 05 of 2000, concerning the Implementation and Tax Utilization of Groundwater and Surface Water in chapter IV control, section 19 subsection three. The content of the regulation is that for every 5 (five) drilled wells in one location owned or for every underground water extraction with a water discharge of more than 50 (fifty) liters per second or in certain places where the water condition is considered vulnerable; the permit holder is required to provide 1 (one) special drilled well to monitor environmental changes as a result of groundwater extraction in the vicinity and construct 5 (five) rainwater infiltration wells to help restore water resources (Peraturan Daerah No 5, 2000).

The infiltration well technology is one of the rainwater harvests in urban and rural areas (Tamelan and Kapa, 2020). One of the constructions of infiltration wells in urban and public facilities is carried out in the ITB Bandung campus to reduce surface runoff with an impermeable surface balance (Mardiah *et al*., 2018). The other academic's community service with assistance and development of the infiltration wells in Tlogomas Village, Lowokwaru District, Malang City to subtract the flood (Hirijanto, Mundra and Wedyantadji, 2021; Prayitno *et al*., 2021). In the same study area, there are many research development in infiltration technic to reduce floods or inundation. Research on

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infiltration wells in the Banjarbaru City area, especially in the ULM Campus, is being implemented because the existing groundwater level ranges from 7 to 18 m (Fachrurazie, Firman Arifin and Sri Susanti, 2002). Maulana also developed a similar study by calculating the required budget for wells in the ULM (Isramaulana, 2016).

This research aims to evaluate the infiltration well for ablution wastewater in a public building. This monitoring includes water table monitoring from pump wells around the infiltration well. In this case, the public facility that will be used as a model in this service is the mosque (Suratkon, Chan and Tuan Ab Rahman, 2014). The mosque is one of the public facilities which is the center of religious and social activities, which is very appropriate to be used as a pilot facility for the implementation of the infiltration well system for the community. The mosque was chosen as a pilot site because the mosque received a load from rainwater and received a load from the water used for ablution, which had been released into the drainage channel.

The Al Baythar Mosque was chosen, which is located in the Lambung Mangkurat University area. It is a public facility used by the community around the campus. Banjarbaru City, in general, has a fairly deep groundwater table (≥5 meters). In this mosque was built an infiltration well in 2014. So it can be used as one evaluation monitoring of the performance of infiltration well after five years.

2. Literature Review

2.1. Infiltration Well System

Water resources management and protection are critical given the increased water use, one of which is preserving groundwater with infiltration wells (IKA, 2007). A recharged system or infiltration system is a technical building that is planned to absorb rainwater (surface runoff) into the ground, which consists of three types, namely infiltration well, infiltration trench, and infiltration yard (Sunjoto, 2016b). Infiltration wells are water conservation that is commonly made as an individual (Kimpraswil, 2000). Infiltration well is also effective in reducing the local excess runoff (Mardiah *et al*., 2018).

The primary purpose of infiltration wells is to increase water entry into the soil aquifer as infiltration water. Infiltration Well Design Theoretically, according to (Sunjoto Sunjoto. 1994), the volume and efficiency of infiltration wells can be calculated based on the water balance of entering the water to the well and infiltration into the ground. They can be written as follows (Sunjoto, 2016b):

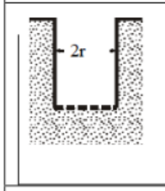
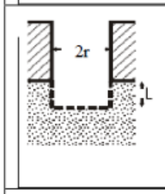
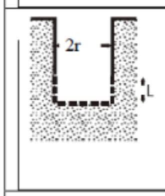
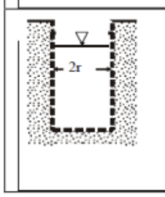
$$H = \frac{Q}{FK}\left\{1 - \exp^{\left(\frac{-FKT}{\pi R^2}\right)}\right\}$$

with,

H = water depth in the well (m)
Q = inlet water discharge (m^3/s)
F = the shape factor (m)
K = hydraulic conductivity (m/s)
T = flow duration (s)
R = well radius (m)

The shape factor is a quantity that represents the circumference and cross-sectional area of the well, the hydraulic gradient, the state of the soil layer and the position of the well against the layer, and the porosity of the suitable wall, which is expressed in terms of the radius of the well (Sunjoto, 2016a). It is shown in Table 1.

Table 1. Shape Factor for Flat Bottom

Condition	Shape Factor
	$F = 2\pi R$
	$F = \dfrac{2\pi(L + R\ln 2)}{\ln\left[\dfrac{L+2R}{R} + \sqrt{\left\{\left(\dfrac{L}{R}\right)^2 + 1\right\}}\right]}$
	$F = \dfrac{2\pi(L + R\ln 2)}{\ln\left[\dfrac{L+2R}{R} + \sqrt{\left\{\left(\dfrac{L}{2R}\right)^2 + 1\right\}}\right]}$
	$F = \dfrac{2\pi(H + R\ln 2)}{\ln\left[\dfrac{(H+2R)}{2R} + \sqrt{\left\{\left(\dfrac{H}{2R}\right)^2 + 1\right\}}\right]}$

The methods concepts are fitted to probability concepts. SNI T-02-02-2006 states that the local drainage system design is based on a five years return period (PU, 2006).

2.2. Infiltration and Soil Permeability

Permeability is the ability of the soil to release water. Soil with high permeability can increase the infiltration rate, thereby reducing the water flow rate. Soil permeability can be tested with a constant head (Sunjoto, 2016a). Permeability is affected by void ratio, grain size, temperature and

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structure, and stratification. Lower permeability correlated with the size of grain and void ratio.

2.3. Hydrology Analysis

The maximum rainfall frequency analysis is intended to predict the maximum amount of rainfall with a specific return period, which will later be used for calculating the design discharge using the empirical method. The equation for the calculation of the frequency analysis method used is the Normal distribution method, the Log-normal distribution method, the Gumbel Frequency distribution method, and the Log-Pearson Type III distribution method (Chow, Maidment, and Mays, 1988; Suripin, 2004; Bambang Triadmodjo, 2008). The hydrology analysis was conducted based on the maximum daily precipitation with the rainfall-runoff method (Suripin, 2004).

1. Determination of data series for analysis with annual maximum series.
2. Determination of statistical parameters, such as mean, standard deviation, variation coefficient, skewness coefficient, and kurtosis coefficient (Bambang Triadmodjo, 2008).
   a. Mean
   $$\overline{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$$
   b. Standard deviation
   $$S = \sqrt{\frac{\sum_{i=1}^{n}(X_i - \overline{X})^2}{(n-1)}}$$
   c. Variation coefficient
   $$C_v = \frac{S}{\overline{X}}$$
   d. Skewness coefficient
   $$C_s = \frac{n}{(n-1)(n-2).S^3}.\sum_{i=1}^{n}(X_i - \overline{X})^3$$
   e. kurtosis coefficient
   $$C_k = \frac{n^2}{(n-1)(n-2)(n-3).S^4}.\sum_{i=1}^{n}(X_i - \overline{X})^4$$
   with:
   n = number of data
   X_i = rainfall data
3. To estimated distribution type as Normal distribution, Log-normal distribution, Gumbel distribution, and Log Pearson III distribution.
4. The analysis of the suitability test used two statistical methods, namely the Chi-Square test and the Smirnov-Kolmogorov test.
5. Rainfall Intensity
   The empirical formula is used to convert the daily rainfall intensity to the rainfall intensity with a shorter duration, which can be written in the following equation:
   $$I = \frac{R_{24}}{24}\left(\frac{24}{tc}\right)^{2/3}$$
   with,
   I = rainfall intensity (mm/hour)
   R_{24} = daily maximum rainfall in 24 hours (mm/hour)
   Tc = time of concentration (hour)
6. Design discharge
   The method to calculate the amount of design discharge is the rational method. Mathematical equations are expressed in the form:
   $$Q = 0.278 \cdot C \cdot I \cdot A$$ \
   with,
   Q = design discharge (m^3/s)
   C = runoff coefficient of the roof or pavement
   I = rainfall intensity (mm/hour)
   A = area of the roof or pavement (km^2)
7. Ablution waste water discharge
   Ablution wastewater is water used after the cleaning process in Muslim worship (Suratkon, Chan and Tuan Ab Rahman, 2014). At certain times, such as during worship hours, water entering through the inlet pipe is certain to be very abundant, especially during mass worship times such as Maghrib, Friday, and Taraweeh prayers. Also, in the seasons of Islamic holidays, such as Maulid and others, the mosque is always filled with worshipers who are sure to consume a lot of water for ablution.

3. Research Methodology

3.1. Data

The data collected in this research are from primary and secondary data. Rainfall data were collected as secondary collected data from bmkg online from the year 1993 to 2012 for infiltration well design (BMKG, 2012). The data was collected for redesign using rainfall data from 1993 to 2020. The rainfall accumulated as input for infiltration is well influenced by the C coefficient (runoff coefficient). C coefficient for roof cover is about 0.75 to 0.95 (Suripin, 2004).

The land use and the capacity of wastewater from ablution as primarily collected data. Permeability coefficient is held out by laboratory tests using the constant head method and direct measurements using a Double Ring Infiltrometer in the field to be used to infiltration well analysis.

The amount of wastewater from ablution was collected by direct observation in Al Baythar Mosque for one month. Especially during mass worship times such as Maghrib, Friday, and Taraweeh prayers. Based on observation, wastewater ablution is 0.004 m^3 (Q_{oW}) per congregant.

$Q_{RW} = Q_{oW} * max$.congregants/tw

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3.2. Study Area

This research is located in the Banjarbaru City, South Kalimantan, Indonesia. Geographically, the Banjarbaru City is located between 3º 25' 40"- 3º28'37" South Latitude and 114º4'22"- 114º54'25" East Longitude. The geographical position of Banjarbaru City is 35 km at 296°30' southeast of Banjarmasin City, which is the capital city of South Kalimantan Province.

The Banjarbaru City area is located at an altitude of 500 m above sea level, with an altitude of 0 – 7 m (33.49%), 7 – 25 m (48.46%), 25 – 100 m (15.15%), 100 – 250 m (2.55%) and 250 – 500 m (0.35%). The slope classification of the Banjarbaru City is a slope of 0 – 2% covering 59.35% of the area, a slope of 2 – 8% covering 25.78% of the area, a slope of 8 – 15% covering 12.08% of the area. The rocks classification in the Banjarbaru City consists of Alluvium 48.44%. In the city of Banjarbaru, there are 3 (three) groups of soil types, namely Podzol soil (63.82%), Lathosol (6.36%), and Organosol (29.82%) (RPIJM, 2015).

The Banjarbaru land-use patterns are generally divided into two, namely developed areas and undeveloped areas. The developed area in Banjarbaru consists of settlements, trade and services, education, health, worship, offices, tourism, and special area as security areas. The undeveloped area as rainfed rice fields, shrubs, and abandoned land, which are also areas prone to inundation (RPIJM, 2015).

The Banjarbaru city as one of an urban area that is the central of government in the province of South Kalimantan. As the central of the government, the Banjarbaru is equipped with public facilities that support the government facilities and community activities.

In the developed area in Banjarbaru accompanied by green open spaces, neighborhood association park (area 0.22 Ha), citizens Association park (5.31 Ha), urban village park (area 6.62 ha), sub-district park (9.36ha area), city park (area 46.82 Ha), urban forest (an area of 1,725.11 Ha), road island and road median (395.81 ha), pedestrian path (2.17 Ha), high-voltage power grid green line (129.87Ha), green open spaces in bordering the river (0.19 Ha), and cemetery (area 28.92 Ha). Meanwhile, private green open space in Banjarbaru City is + 288.44 Ha, which includes: the yard of the house with an area of 1.70 ha and office yard, shops, and business premises covering an area of 286.73 hectares. These green open spaces only covered 8.213% of the Banjarbaru city area (Bappeda, 2016).

The growth of worship places in the city of Banjarbaru is substantial. More than 100 mosques in the last ten years built-in Banjarbaru City. From the results of research conducted for two months, some data on mosques in Banjarbaru City were obtained, which will then be analyzed to get one large mosque that will be used in the planning and construction of infiltration wells.

Tabel 2. Data on the Area of Mosques in Banjarbaru City

No	Building	Location	Area (m^2)
1	Agung Al-Munawaroh mosque	Jl. Trikora	4600
2	Jami Hidayatul Muhajirin mosque	Jl. Manggis	1410
3	Al-Baythar mosque	Jl. A.Yani km.36	657
4	Masjid Jami Sulaiman mosque	Jl. A. Yani km 21	625
5	Nurul Muhajirin mosque	Jl. A. Yani km 30,4	580
6	Istiqomah mosque	Jl. A. Yani km 33,7	540
7	Nur Jariyah mosque	Jl. A. Yani km 30.5	529
8	Nurul Fallah mosque	Jl. A.Yani km.36.5	456
9	Darul Yaqin mosque	Jl. A.Yani km. 20	440
10	Al-Ikhlas mosque	Jl. Panglima Batur	400
11	Kanzul Khairat mosque	Jl. Panglima Batur Timur	324
12	Darul Muttaqien mosque	Jl. Kamboja	324
13	Jami Al-Mukarramah mosque	Jl. A. Yani km 25	309
14	Miftahul Khairat mosque	Jl. A. Yani km 31.5	289
15	Ishlah mosque	Jl. RO Ulin	260
16	Nurul Iman mosque	Jl. A. Yani km 33.5	225
17	Baitul Azhim mosque	Jl. Bhayangkara	196

Al-Baythar Mosque was chosen as a pilot mosque because the mosque is located on the ULM Banjarbaru campus. The mosque is also used by the community around the campus for worship facilities.

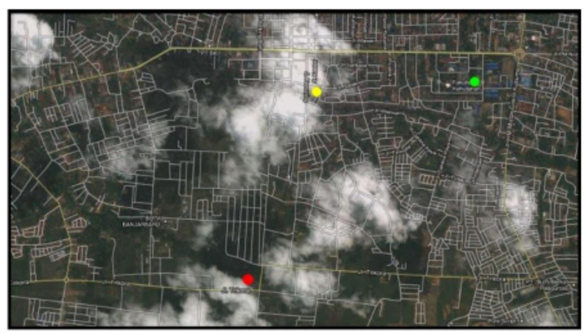

Figure 1. Al-Baythar Mosque Location (Isramaulana, 2016)

Al-Baythar Mosque coordinate: 3º 26'45" LS - 114º 50'39" BT as shown in Figure 1. The roof plan is shown in Figure 2.

From the results of a review of the settlements around the location of the Al-Baythar Mosque, it is known that the depth of the groundwater table (MAT) is around 5.4 m. For the use of ablution wastewater, it can be analyzed from the number of mosque congregations with an estimated four litters of ablution per person. From the results of the interview, it is known that the maximum congregation of the mosque occurs

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at the time of Friday prayer, which is as many as 1,360 congregations.

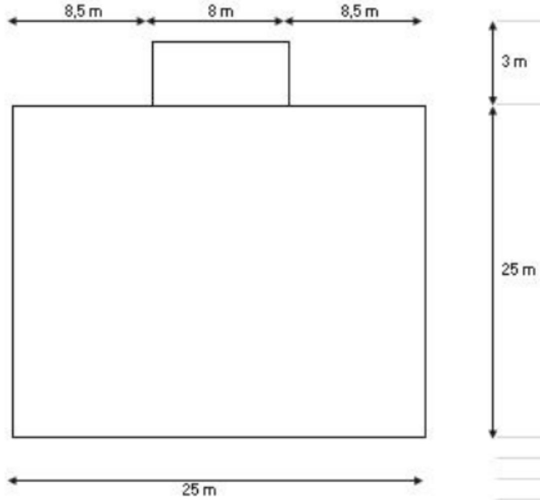

Figure 2. The roof plan for Al-Baythar Mosque

The method used in this academic community service is to evaluation to the design of infiltration well system construction from a pilot infiltration well building on public facilities.

4. Result

4.1. The Rainfall Frequency

Infiltration wells with relatively short concentration times needed the largest (maximum) rainfall data. Rainfall data is sourced from the Banjarbaru Meteorology, Climatology and Geophysics Agency (BMKG) for 20 years, 1993-2012 (BMKG, 2012). Calculation of Statistical Parameters Calculation of 5 statistical parameters includes the calculation of the mean, standard deviation, coefficient of variation, coefficient of skewness, and coefficient of kurtosis. Mean value as 107.7 mm, standard deviation as 34.19 mm, coefficient of variation as 0.32, skewness coefficient as 0.91, and coefficient of kurtosis as 3.03.

The chi-squared test was carried out for the four rainfall analysis methods, so the ones that are below the limit value are the Log-normal Method and the Gumbel Method. The results of the chi-squared test can be concluded that the acceptable distribution is the Log-Normal distribution with a Chi^2 value of 2.5 and Gumbel with a Chi^2 value of 3.0 smaller than the 5% Chi^2 table of 5.991. The Smirnov-Kolmogorov suitability test was carried out for the four rainfall analysis methods. None of them was an approach to the limit value. Dmax ranged from 0.854 – 1.185 higher than the 5% Do Table of 0.36. The conclusion from the analysis of the frequency of rainfall data used is the Log-Normal distribution. Rainfall frequency from the calculation of the statistical parameters above, then the estimate is included in the Log-normal distribution. Then the rainfall frequency is taken as listed in Table 3.

Table 3. The rainfall frequency distribution using the Log-Normal method

Return Period	Log-normal distribution
T (year)	(mm)
2	103.08
5	132.39
10	150.94

The infiltration well built-in 2014. In the year 2020, the rainfall frequency analysis was a redesign. It is conducted to find out whether we need the dimensions of the new infiltration well or not. The rainfall frequency redesign used data from 1993 to 2020 (BMKG, 2012). Mean value as 109.9 mm and standard deviation as 35.91 mm. It is suitable for the Gumbel method distribution after being tested with the chi-squared test and the Smirnov-Kolmogorov test.

The conclusion from the analysis of the frequency of rainfall data used is the Gumbel distribution. Rainfall frequency from the calculation of the statistical parameters above, then the calculation is included in the Gumbel distribution. Then the rainfall frequency is taken as listed in Table 7.

Table 7. The Rainfall Frequency Distribution Using the Gumbel Method

Return Period	Gumbel Distribution
T (year)	(mm)
2	104.45
5	141.30
10	165.70

4.2. Rainfall Intensity Design

The intensity of the rainfall frequency is used as the input discharges at the infiltration well, using hourly rainfall data. Assuming that the rainfall is uniformly distributed within a certain duration, the intensity of the rainfall frequency is determined as the intensity of the rainfall with a return period of 5 years and the duration of rainfall for 1 hour, then the amount of the intensity of the rainfall frequency is:

$$I_R = \frac{R_{24}}{24} * \left(\frac{24}{T}\right)^{\frac{2}{3}}$$

where:

T = tc

$$tc = 0.0195 \left[\frac{L}{\sqrt{S}}\right]^{0,77}$$

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tc = 2.1208
So:

$$I_R = \frac{132.39}{24} * \left(\frac{24}{2.1208}\right)^{\frac{2}{3}}$$
= 27.8 mm/hour

4.3. Design Discharge

If the value of C is taken as 0.95, then the design discharge is obtained as a function of the roof area, namely:
$Q_{RH} = 0.278 \ x \ C \ x \ I \ x \ A$ (km^2)
Q_{RH} = 0.278 x 0.95 x 27.8 x A (km^2)
Q_{RH}= 7.07*A (m^3/s)
Furthermore, the Q_{RH} value for each roof area on the mosque building can be seen in Table 4.

Table 4. Roof Area for Each Building and Design Discharge Value

Roof area (A)	design discharge (Q_{RH})	
km²	m³/s	m³/jam
0.000649	0.004998	17.99448

4.4. Ablution wastewater discharge

Ablution waste water discharge can be calculated by
$QRW = 0.004^*$ x *max*.congregants/*4800*
QRW = 8.33333 x 10^{-7} x max.congregants (m3/s)
Furthermore, the Q_{RW} value for each roof area on the mosque building in 2014 can be seen in Table 5.

Table 5. The Use of Ablution Water in Each Time

Discharge per Congregation	(m³)	0.004
Congregation	Fajr	15
	Dzuhur	70
	Asr	30
	Maghrib	25
	Isha	20
	Friday	1,360
Duration	(s)	4,800
Discharge	(m³/s)	0.001133

Permeability coefficient is held out by laboratory tests and direct measurements in the field. Testing by the constant head method in the laboratory resulted in the permeability coefficient (K) of 4,585 x 10-5 cm/s for the Al-Baythar Mosque. Direct measurement of the infiltration rate with a Double Ring Infiltrometer from the field obtained results of 1,667 x 10-6 m/s. The research location is silty soil, fine-grained with small permeability, so the infiltrated rate is slow. Calculation of Infiltration Wells with H = 5 m and =1.4 m.

K = 4.585 x 10^{-5} cm/s = 1.651 x 10^{-3} m/hour
T = 1 hour
I = 27.8 mm/hour
A = 649m^2 = 0.000649 km^2
Q = 0.278 * C * I* A
= 0.278 * 0.95 * 27.8 * 0.000649
= 0.00477 m^3/s
= 17.157 m^3/hour
R = 0.7 m
Geometry factor:
$F = 2\pi R$
$F = 2\pi * 0{,}7$
$= 4.4$m
So it can be substituted into the formula:

$$H = \frac{Q}{FK}\left\{1 - exp\left(\frac{-FKT}{\pi R^2}\right)\right\}$$

Table 6. Depth (H) and Number of Wells

K	Roof (m)	Ablution (m)	Σ Wells
6.00 x 10^{-5}	12	3	5
1.651 x 10^{-3}	12	3	5

The total depth of infiltration wells required for Al Baythar Mosque is 12 m for water from the roof and 3 meters for ablution wastewater. The infiltration well depth (H) is 3 m. For implementation, one well was built for wastewater used for ablution.

The loss of water into the soil in the infiltration wells are calculated as water seeping through all parts, both the bottom and the channel cliffs on the original soil or with a porous coating, with the following data:

H_w = 5 m
W_b = 1.4 m
W_s = 1.4 m
λ = 1
K = 4.58497 x 10^{-5}cm/s = 4.58497 x 10^{-7} m/s
$\sum$wells = 5
So,

$$q = \frac{4KH_W\sqrt{\lambda(W_b + W_S)}}{ln\left\{\frac{H_W + 2\sqrt{\lambda(W_b + W_S}}{2\sqrt{\lambda(W_b + W_S)}} + \sqrt{\left(\frac{2H_W}{2\sqrt{\lambda(W_b + W_S)}}\right)^2 + 1}\right\}}$$

q = 3.908 x 10^{-5}m^3/s/m

Design of Infiltration Wells and Examples of Its Application in Al. Baythar Mosque in the year 2014 as part of academic community service of Faculty of Engineering, Universitas Lambung Mangkurat. This community service

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had an evaluation in 2020 as a form of wastewater ablution conservation to surrounding wells.

5. Discussion

5.1. Rainfall Intensity

The rainfall intensity used in this research took place in Banjarbaru Station, from years 1993 to the year 2012, as the rainfall design for infiltration well. Rainfall intensity to the year 2020 for rainfall redesign. Based on rainfall frequency redesign in 2020, the distribution used is Gumbel methods distribution. The rainfall pattern after 25 years has no significant difference. The difference in the value of the rainfall pattern only took no more than 10% from the design in 2014. It means that the design of the infiltration well in 2014 is still reasonable for further use. It did not have to be redesign or rebuilt the infiltration well in the Al Baythar mosque in this case. Based on rainfall frequency analysis in this rainfall station in the Banjarbaru city has a rainfall data that has been well recorded since 1993 to support hydrology analysis.

5.2. Wastewater Ablution Discharge Design

In 2020, the total of wastewater ablution still used the data from 2014, as 0.001133 m^3/s, with duration 4800 s. It caused of in 2020 there still be a pandemic that people did not allow to go to the mosque frequently due to activity restrictions on all public facilities in Indonesia. The activity in the Al Baythar Mosque will be restricted too, so there is not much wastewater from ablution activities. There is no need for a new wastewater ablution infiltration well building. In an academic community in the year 2020, we only need to observe the infiltration well building in the year 2014 and to monitoring the pump well around the infiltration well after five years. The infiltration well can be one solution for wastewater management in public facilities in an urban area like in the Banjarbaru city.

5.3. Infiltration Well Design and Monitoring

Infiltration well in Al Baythar as a pilot project of the academic community service to apply their knowledge in society. The infiltration wells construction is one solution for handling wastewater ablution in public facilities, especially the mosques that are widely spread in Banjarbaru city as an alternative to wastewater conservation in Banjarbaru City with sufficient groundwater levels.

The infiltration well monitoring implemented in the year 2020. The method used to monitor the effectiveness of the infiltration well in Al Baythar Mosque is by observing the water level in the pump wells around the infiltration well as evidence of water conservation with the construction of infiltration wells. As far as five years, the pump well in the location near the infiltration well never deepened. At the same time, almost all the wells as far as radius more than 1 km^2 from the infiltration well have been additional depth. The infiltration wells are proven to be effective in increasing the water level in pump wells as substantiation of the applicability of wastewater conservation in urban public facilities.

5.4. Water Conservation

Water conservation refers to protection, development and efficient management of water resources for beneficial purposes. There are many examples of water conservation. The infiltration wells are one of the most widely used as water conservation methods in Indonesia. Infiltration wells are usually built on soils with shallow groundwater levels, for example, in the study area where the groundwater level is around 5 meters. The infiltration well design is lower than 5 meters, with the walls that are left without a waterproof layer so that all water that enters the well can be absorbed to the ground and increase the groundwater level. In this case, the infiltration wells not only have to function as a reduction of flood but also has a function as an infiltration area that is able to maintain the groundwater level around the infiltration well.

Water conservation in this study includes wastewater conservation, such as from wastewater ablution. Water conservation with infiltration well, where wastewater ablution is put into the ground, is effective for maintaining groundwater level in the research field, and it can maintain the quantity of pump well water. The infiltration well built-in Al Baythar mosque is an example of water conservation in public facilities in the Banjarbaru city. It can be built in other public facilities around Banjarbaru for water conservation and to prevent flood disasters.

6. Conclusion and Future Research

6.1. Conclusion

In many studies, wastewater management and water conservation are two separate activities, but not in this case. In this research, wastewater ablution management can be implemented as water conservation practice with the infiltration well design. The conclusion of the construction of infiltration well in 2014 and monitoring in 2020 in Al Baythar mosque after five years divided as 3 point as 1. Infiltration well is effective for wastewater from wastewater ablution in public facilities in the urban areas, 2. Based on groundwater monitoring, the results show that the wastewater ablution stored in the infiltration wells can increase the quantity of pump well water in the area with a fairly short observation time. The infiltration well in Al Baythar can be used to maintain the water level in the pump well around the infiltration well, and 3. The infiltration well not only effective as a prevention method for flood disaster, but also as wastewater conservation method in public facilities in an urban area like Banjarbaru city.

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6.2. Future Research

This research had a small scope of the area caused is only based on academic community service in public facilities in Lambung Mangkurat University, which must be observed continuously. As the first academic community service based on research in the water resources civil engineering field, this service has quite a good impact and can continue to be developed by other academic staff. The implementation of infiltration well can be applied in other public facilities with different cases, such as in-office areas, tourist areas, or other public facilities in urban areas.

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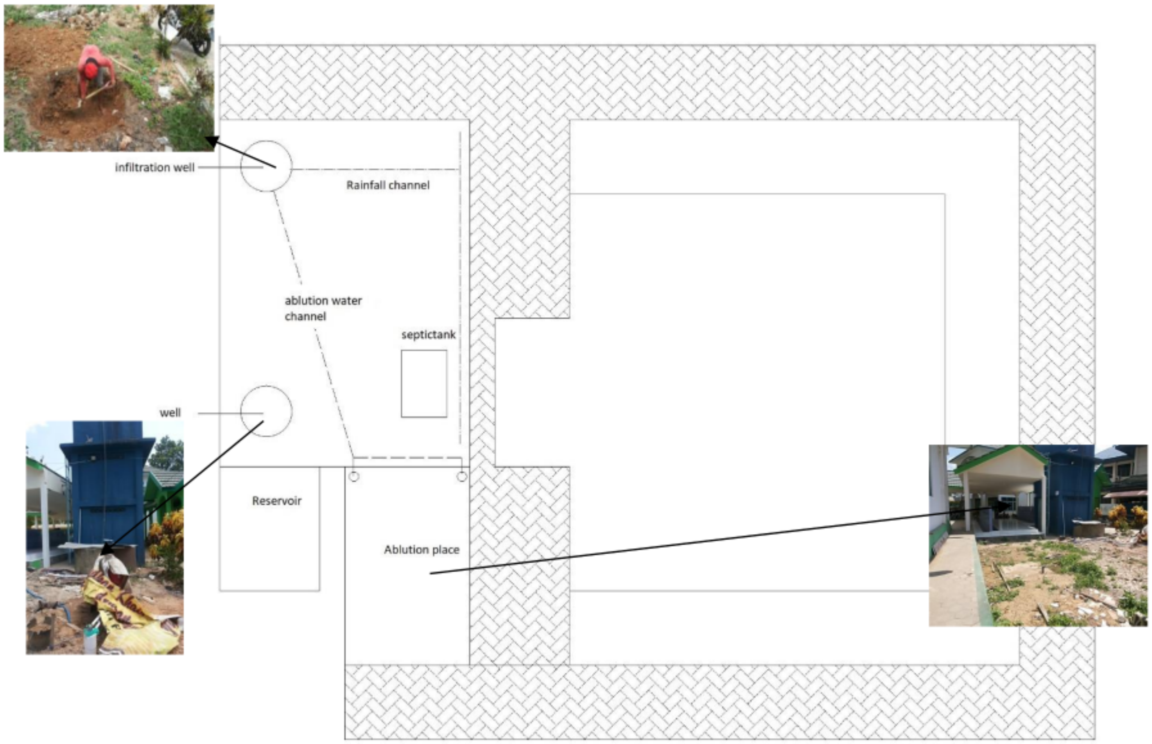

Figure 2. Site project of infiltration well

Figure 3. Infiltration well detail

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References:

Bahunta, L. and Waspodo, R. S. B. (2019) "Rancangan Sumur Resapan Air Hujan sebagai Upaya Pengurangan Limpasan di Kampung Babakan, Cibinong, Kabupaten Bogor (The Design of Infiltration Wells to Reduce Runoff in Babakan Village, Cibinong, Bogor Regency)," *Jurnal Teknik Sipil dan Lingkungan*, 04(01), pp. 37–48.

Bambang Triadmodjo (2008) *Hidrologi Terapan*. Yogyakarta, Indonesia: Beta Offset.

Bappeda (2016) *Rencana Aksi Kota Hijau (RAKH) Kota Banjarbaru Tahun 2016*.

BMKG (2012) *Data Hujan Online*. Jakarta. Available at: http://dataonline.bmkg.go.id (Accessed: January 30, 2016).

Chow, V. Te, Maidment, D. R. and Mays, L. W. (1988) *Applied Hydrology*, *McGraw-Hill Book Company*. McGraw-Hill Book Company. doi: 10.1061/(ASCE)1090-025X(1999)3:3(132).

Fachrurazie, C., Firman Arifin, Y. and Sri Susanti, D. (2002) "Analisa Drainase Sumur Resapan Pada Kampus UNLAM Banjarbaru," *Info-Teknik*, 3(1), pp. 24–34.

Hirijanto, Mundra, I. W. and Wedyantadji, B. (2021) "Infiltration Wells Alternatives to Reduce Water Puddle in Lowokwaru District , Malang City," 2(1), pp. 1–8.

IKA, S. (2007) *Pedoman Umum Pembangunan Sumur Resapan dalam Rangka Antisipasi Kekeringan tahun*. Jakarta, Indonesia.

Isramaulana, A. (2016) "Rencana Anggaran Biaya Untuk Sumur Resapan Masjid Besar Kota Banjarbaru," *Info Teknik*, 15(2). Available at: https:// ppjp. ulm.ac. id/journal/ index.php/ infoteknik/ article/view/ 226.

Kimpraswil (2000) *Petunjuk Teknis. Tata-Cara-Perencanaan-Sumur-Resapan-Air-Hujan-untuk-Lahan-Pekarangan.pdf*. Bandung, Indonesia.

Mardiah, A. M. *et al*. (2018) "Study on the Effectiveness of Infiltration Wells to Reduce Excess Surface Run off in ITB," *MATEC Web of Conferences*, 147, pp. 1–5. doi: 10.1051 /matecconf/201814703008.

Peraturan Daerah No 5 (2000) *Peraturan Daerah KOta Banjarbaru No 05 Tahun 2000*. Available at: https://repository.up.ac.za /bitstream/handle/2263/64096/LaPlacaHow2018.pdf?sequence=1

Prayitno, G. *et al*. (2021) "Planning and Assistance the Making of Infiltration Institusi Pendidikan Islam berupa Pondok Pesantren berperan penting," 4(1), pp. 212–220.

PU (2006) "Perencanaan Sistem Drainase Jalan," p. 99.

RPIJM (2015) *RPIJM Kota Banjarbaru 2016-2021*.

Sunjoto, S. (2016a) *Groundwater Engineering*. Department of Civil and Environmental Engineering UGM.

Sunjoto, S. (2016b) *Teknik Drainase PRO-AIR dan Konservasi Berkelanjutan*.

Sunjoto Sunjoto. (1994) "Infiltration well and urban drainage concept," *Future groundwater resources at risk*, (222), pp. 527–532.

Suratkon, A., Chan, C. M. and Tuan Ab Rahman, T. S. (2014) "SmartWUDHU': Recycling ablution water for sustainable living in Malaysia," *Journal of Sustainable Development*, 7(6), pp. 150–157. doi: 10.5539/jsd.v7n6p150.

Suripin (2004) *Sistem Drainase Perkotaan yang berkelanjutan*. Yogyakarta, Indonesia: Andi Offset.

Tamelan, P. G. and Kapa, M. M. J. (2020) "Rainwater harvest using well infiltration technology in the dry land rural areas with semi arid climate," 6587(December), pp. 6577–6587.

UU RI No. 26 (2007) *Undang-undang No 26 Tahun 2007 tentang Penataan Ruang*.

Wesli *et al*. (2013) "the Effect of Land Use and Community Participation on Flood Control At North Aceh District," *Indonesian Journal of Geography*, 45(2), pp. 171–186. doi: 10.22146/ijg.4874.

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