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Drainage Capacity Analysis in The Area of Angke Jaya Tambora West Jakarta

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Abstract

Drainage is used to reduce and remove excess water in an area so that the area can be optimally enabled. This research aims to analyze and examine the drainage problems in the Angke Jaya Tambora West Jakarta Housing area, the drain channels are poorly maintained and often flooding. The data used in this study are primary and secondary, in the planning of flood debt calculations used 2nd anniversary. For the calculation of flood discharge plan to use rational method and coupled with the discharge of flood household, and the result will be compared with existing conditions of drainage channels in the residential area Angke Jaya Tambora West Jakarta. Obtained flood discharge plan of 13.225 m3/sec, for the existing condition of drainage channels 5 channels enter the category is not safe because the condition of existing capacity of channels is less than flood discharge plan, namely channels A4, D5, D6, D8, and D9. The planning of the wells to accommodate the excess discharge flooding, and it takes 19 pieces of replacement wells on the A4 channel, 1 on the D5, D, D8, and D9 channels.

Keywords
Drainage, Hydrological Analysis, Flood Discharge Plans, Absorption Wells.

1. Introduction

Population growth in Indonesia is increasing every year and requires a lot of land to be used as dwellings, especially in urban areas. The narrowness of the land and the large number of residential developments and supporting facilities make many unnecessary land uses. The impact of a large number of human activities and lack of attention to the environment gives rise to many natural disasters, such as floods that most often occur in urban areas. During high rainfall it is not uncommon for water to flood in the streets and until flooding can occur, this is due to a lack of community attention to land use and drainage channels. Stagnant water or flooding that can also occur due to lack of functioning drainage channels or channels that are inadequate in accommodating water discharge. If no action is taken to overcome this problem it will disrupt community activities and hamper economic, socialandcultural development.

Planning and maintenance of drainage channels is needed to maintain and regulate the flow of water to create a healthy and comfortable environment. Drainage system in general can be interpreted as a prsarana that functions to drain excess water from an area to receiving water bodies such as rivers. Drainage can also be interpreted as a system of drainage of clean water and wastewater from residential areas, industries, agriculture, road bodies and other pavement surfaces, as well as channeling excess water in general, whether in the form of rainwater, wastewater or other dirty water that comes out of the area concerned to water bodies or artificial recharge buildings.

In this study, researchers will conduct research on the Angke Jaya Housing area, Angke Village, Tambora District, West Jakarta, which is a residential area that pays little attention to the drainage system and not infrequently the streets in the housing area are flooded during high rainfall.

1.1 Identification Problems

1. Full channel condition (10 cm height only)
2. The drainage on the channel is not smooth.
3. Sedimentation builds up in drainage channels.
4. There are a number of residential houses that have advanced to the street,
covering the existing drainage, and making it difficult to clean the debris.

1.2. Problem Solving

1. What is the condition of the drainage channels in the Angke Jaya Housing area, Angke Village, Tambora District, West Jakarta?
2. What is the flood discharge in the Angke Jaya Housing area, Angke Village, Tambora District, West Jakarta?
3. Do you need to plan for a new dimension of drainage in the Angke Jaya Housing area, Kelurahan Angke, Tambora District, West Jakarta?

1.3. Purpose and Objectives

1. Knowing the condition of drainage channels in the area of Angke Jaya Housing, Angke Village, Tambora District, West Jakarta.
2. Knowing the magnitude of flood discharge in the Angke Jaya Housing area, Angke Village, Tambora District, West Jakarta.
3. Knowing whether or not the new dimension of drainage channel planning is Needed in the Angke Jaya Housing area, Angke Village, Tambora District, West Jakarta.

1.4 Benefits of Research

At this writing the benefit gained is knowing whether the design of drainage channels in the Angke Jaya Housing area, Angke Village, Tambora District, West Jakarta is sufficient to accommodate flood plans that have been analyzed later, and concludes whether it is necessary to plan a new drainage channel in the Housing area Angke Jaya, Angke Village, Tambora District, West Jakarta.

1.5 Scope and Limitation of Problems

1. The location of the study was conducted in the area of Angke Jaya Housing, Angke Village, Tambora District, West Jakarta.
2. It only calculates the discharge of water from rainwater and household waste water.
3. Not calculating a budget plan.
4. Only calculates dimensions.

1.6 Library Review

Drainage which is derived from English drainage means to drain, drain, dispose, or drain water. In the field of civil engineering, drainage in general can be defined as a technical measure to reduce excess water, whether coming from rain water, seepage, or excess irrigation water from an area / land, so that the function of the area / land is not disrupted. Drainage can also be interpreted as an effort to control groundwater quality in relation to salinity (Suripin,2004:7) According to Bambang Triatmodjo (2015: 1), hydrology is the science related to water on earth, both regarding its occurrence, distribution and distribution, its properties and its relationship with its environment, especially with living things. Hydrological planning can be found in several activities such as planning and operating water buildings, water supply for various purposes (clean water, irrigation, fisheries, animal husbandry), hydroelectric power, flood control, erosion and sedimentation control, water transportation, drainage, controlling pollution, waste water, etc.

2. Methodology

1. Study of literature

At this stage what is done in this study is to identify problems in the drinase system that occur in the Angke Jaya Housing Area, Kel. Angke, Kec. Tambora, West Jakarta and literature study on the Drinase system as reference material and knowledge in the process of data collection, data processing, research results, to get conclusions in this study.

2. Data collection

The data needed in this study are primary data and secondary data, which will be explained as follows :

1) Primary Data

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Primary data is population data to determine household wastewater discharge for the purpose of calculating flood discharge plans, and existing conditions of drainage channels including channel length, channel width, depth, channel elevation, channel type and channel catchment area to determine channel capacity requirements to accommodate incoming water discharge.

2) Second Data

Secondary data is data of minimum daily maximum rainfall for the last 10 years obtained from relevant agencies for the purposes of calculating flood discharge plans, and maps of the Angke Jaya Housing Area, Kel. Angke, Kec. Tambora, West Jakarta.

3. Data Processing

At this stage after all the necessary data has been collected, data processing will be carried out with the stages of the calculation of the flood discharge plan and the calculation of the capacity of the existing drainage channels.

4. Data Processing Results

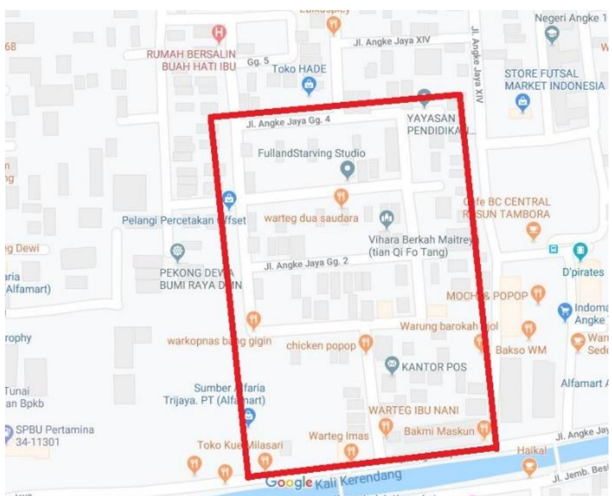
After the results of data processing will be obtained the results of planned discharge and channel discharge, and if the channel discharge is greater than the planned flood discharge then the calculation of the dimensions of the new drainage channel is not carried out, and vice versa if the planned flood discharge is greater than the channel discharge it will be taken into account dimensions of new drainage channels.

2.1 Research Methods

The research methodology used in this thesis is an evaluative descriptive analysis, a method that evaluates objective conditions in a situation that is the object of research, and the object of the study is the drainage channel in the Angke Jaya Housing Area, Kel. Angke, Kec. Tambora, West Jakarta.

2.2 Research Location and Time

In this final project, the research will be conducted in August 2019 until September 2019. The research location is in the Angke Jaya Housing Area, Kel. Angke, Kec. Tambora, West Jakarta. The location map of the study can be seen in Picture 2.1.



(Source: Google Earth)

Figure 2.1. Research Location Map

3. Hydrological Analysis

Hydrological analysis calculations are used to get flood discharge into the drainage channel being evaluated. The stages of the hydrological analysis calculation are as follows :

1. Calculate regional rainfall

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2. Analysis of the frequency of rainfall plans
3. Selection of distribution type
4. Test data compatibility

3.1 Rainfall Area Analysis

Rainfall data used is rainfall data for 10 years, namely from 2009 to 2018, rainfall data obtained from the Climatology and Geophysics Meteorological Agency.

Table 3.1. Daily / Month Maximum Rainfall Data (mm / day)

Tahun	Jan	Feb	Mar	Apr	Mei	Jun	Jul	Agt	Sept	Okt	Nov	Des
2009	148,9	87,1	35,4	26,9	73,4	22,4	15,7	6	15	16	39	48,5
2010	82,4	88,3	52,9	13,7	85,2	44	28,5	18,6	56,1	52	29,8	69,3
2011	31,1	58,1	30,6	6,5	62	58	51,3	10	2,8	34,3	78,5	66,4
2012	48,9	60,9	60,3	50,1	43,6	21,9	25	0	24,6	0,1	75,1	59,4
2013	117,8	53,7	52,7	34	47	46,4	37,7	71,8	0,8	41,8	37,2	81,5
2014	154,1	284	165,3	10,9	165,3	43	33,7	71,8	53,7	0	46,4	34,1
2015	133,4	247	54	30,7	25,1	25,2	2,5	0	16	0	0	87,4
2016	34,3	108	38,8	112,7	16,4	75,5	43,4	42,3	39,5	49,3	29,1	6,6
2017	82,9	148,6	26,5	41,5	44,3	53,4	19,8	1,9	43,2	23,3	39,1	48,1
2018	66,3	100,5	129,6	69,3	14,7	12,2	0	46	15	54,1	39,8	11,9

Source: Climatology and Geophysics Meteorological Agency

Table 3.2 Daily / Year Maximum Rainfall Data (mm / day)
References

Tahun	Curah Hujan Maksimum
2009	148,9
2010	88,3
2011	78,5
2012	75,1
2013	117,8
2014	284
2015	247
2016	112,7
2017	148,6
2018	129,6

Source: Climatology and Geophysics Meteorological Agency

3.2. Analysis of Frequency of Rainfall Plans

Rainfall analysis of this plan is carried out to find out the maximum daily rainfall that will be used to calculate the flood discharge plan. The following calculations use the Normal Distribution, Normal Log Distribution, Log-Person III Distribution, and Gumbel Distribution.

3.2.1. Normal Distribution

The following calculation is the probability of rainfall for a 10 year return period with a Normal distribution.

Calculate the average value of variat ($\overline{X}$)

$$\overline{X} = \frac{\Sigma\, Xi}{n}$$

$$\overline{X} = \frac{1430{,}5}{10} = 143{,}05 \text{ mm/hari}$$

Table 3.3 Normal Distribution Calculation

No.	Tahun	Curah Hujan Kawasan (Xi)	$\overline{X}$	$(Xi-\overline{X})$	$(Xi-\overline{X})^2$	$(Xi-\overline{X})^3$	$(Xi-\overline{X})^4$
1	2009	148,9	143,05	5,85	34,22	200,20	1171,18
2	2010	88,3	143,05	-54,75	2997,56	-164116,55	8985380,94
3	2011	78,5	143,05	-64,55	4166,70	-268960,65	17361409,72
4	2012	75,1	143,05	-67,95	4617,20	-313738,91	21318558,93
5	2013	117,8	143,05	-25,25	637,56	-16098,45	406485,94
6	2014	284	143,05	140,95	19866,90	2800239,91	394693814,94
7	2015	247	143,05	103,95	10805,60	1123242,38	116761045,39
8	2016	112,7	143,05	-30,35	921,12	-27956,07	848466,66
9	2017	148,6	143,05	5,55	30,80	170,95	948,79
10	2018	129,6	143,05	-13,45	180,90	-2433,14	32725,71
Σ		**1430,50**		**0,00**	**44258,59**	**3130549,68**	**560410008,21**

Source: Calculation Analysis Results

Frequency factor (KT) values for the 10 year return period are obtained from the Gauss Reduction Variable Value table, so the calculation of the probability of rainfall returns for the 10 year return period with the Normal distribution is as follows :

$$X_T = \overline{X} + K_T . S$$
$$X_{10} = 143{,}05 + (1{,}28).(70{,}126)$$
$$X_{10} = 232{,}81 \text{ mm/day}$$

Calculation of rainfall with a return period with the Normal distribution can be seen in table 4.4

Table 3.4 Calculation of Rainfall for Birthday of T Year with Normal Distribution

Periode Ulang T (tahun)	$\overline{X}$	S	K_T	X_T
2	143,05	70,126	0	143,05
5	143,05	70,126	0,84	201,9558
10	143,05	70,126	1,28	232,8113
20	143,05	70,126	1,64	258,0566
50	143,05	70,126	2,05	286,8083
100	143,05	70,126	2,33	306,4436

Source: Calculation Analysis Results

3.2.2. Log Normal Distribution

Following is the calculation of the rainfall probability re-distribution period of the Normal Log. Calculate the average value of variat (log X)

$$\text{Log } \overline{X} = \frac{\Sigma \text{ Log X}}{n}$$
$$\text{Log } \overline{X} = \frac{21{,}14}{10} = 2{,}114 \text{ mm/day}$$

Table 3.5 Calculation of Normal Log Distribution

No	Tahun	X	Log X	Log $\overline{X}$	Log X - Log $\overline{X}$	(Log X - Log $\overline{X}$)^2	(Log X – Log $\overline{X}$)^3	(Log X - Log $\overline{X}$)^4
1	2009	148,90	2,17	2,16	0,02	0,0003030	0,00000527	0,000000092
2	2010	88,30	1,95	2,16	-0,21	0,0439016	-0,00919858	0,001927353
3	2011	78,50	1,89	2,16	-0,26	0,0679218	-0,01770167	0,004613378
4	2012	75,10	1,88	2,16	-0,28	0,0783149	-0,02191625	0,006133217
5	2013	117,80	2,07	2,16	-0,08	0,0071137	-0,00059999	0,000050604
6	2014	284,00	2,45	2,16	0,30	0,0887030	0,02641845	0,007868221
7	2015	247,00	2,39	2,16	0,24	0,0562682	0,01334732	0,003166105
8	2016	112,70	2,05	2,16	-0,10	0,0107255	-0,00111077	0,000115036
9	2017	148,60	2,17	2,16	0,02	0,0002733	0,00000452	0,000000075
10	2018	129,60	2,11	2,16	-0,04	0,0018389	-0,00007886	0,000003382
	Σ	**1430,50**	**21,14**	**21,55**	**-0,41**	**0,36**	**-0,01**	**0,023877463**

Source: Calculation Analysis Results

Table 3.6 Calculation of Rainfall for Birthday of T Year with Normal Log Distribution

Periode Ulang T (tahun)	Log $\overline{X}$	S	K_T	Y_T
2	2,114	0,199	0	2,114
5	2,114	0,199	0,84	2,28116
10	2,114	0,199	1,28	2,36872
20	2,114	0,199	1,64	2,44036
50	2,114	0,199	2,05	2,52195
100	2,114	0,199	2,33	2,57767

Source: Calculation Analysis Results

3.2.3. Log Person III Distribution

Following is the calculation of the probability of rainfall with the Log Pearson III distribution.

Table 3.7 Calculation Log Pearson III Distribution

No	Tahun	X	Log X	Log $\overline{X}$	Log X - Log $\overline{X}$	(Log X - Log $\overline{X}$)²	(Log X – Log $\overline{X}$)³	(Log X - Log $\overline{X}$)⁴
1	2009	148,90	2,17	2,16	0,02	0,0003030	0,00000527	0,000000092
2	2010	88,30	1,95	2,16	-0,21	0,0439016	-0,00919858	0,001927353
3	2011	78,50	1,89	2,16	-0,26	0,0679218	-0,01770167	0,004613378
4	2012	75,10	1,88	2,16	-0,28	0,0783149	-0,02191625	0,006133217
5	2013	117,80	2,07	2,16	-0,08	0,0071137	-0,00059999	0,000050604
6	2014	284,00	2,45	2,16	0,30	0,0887030	0,02641845	0,007868221
7	2015	247,00	2,39	2,16	0,24	0,0562682	0,01334732	0,003166105
8	2016	112,70	2,05	2,16	-0,10	0,0107255	-0,00111077	0,000115036
9	2017	148,60	2,17	2,16	0,02	0,0002733	0,00000452	0,000000075
10	2018	129,60	2,11	2,16	-0,04	0,0018389	-0,00007886	0,000003382
	Σ	**1430,50**	**21,14**		**-0,41**	**0,36**	**-0,01**	**0,023877463**

Source: Calculation Analysis Results

The steps in using the Log Person III distribution are as follows :

Calculate the average price (log X)

$$\text{Log}\,\overline{\text{X}} = \frac{\Sigma\,\text{Log X}}{\text{n}}$$

$$\text{Log}\,\overline{\text{X}} = \frac{21{,}14}{10} = 2{,}114\ \text{mm/day}$$

Calculating Standard Deviation Price (S)

$$\text{S} = \left[\frac{\sum_{n=1}^{n}(\text{LogX}_i - \text{Log}\overline{\text{X}})^2}{n-1}\right]^{0,5}$$

$$= \left[\frac{0{,}36^2}{9}\right]^{0,5}$$

$$= 0{,}199$$

Calculate the coefficient of skewness

$$\text{G} = \frac{\sum_{n=1}^{n}(\text{LogX}_i - \overline{\text{LogX}})^3}{(n-1)(n-2)s^3}$$

$$\text{G} = \frac{10\ \times\ -0{,}01^3}{9 \times 8 \times (0{,}199)^3} = -0{,}0000176$$

Calculates the rain or flood logarithm with a return period T

The K value (Interpolation) is a standardized variable for X, the magnitude of which depends on the coefficient of G, can be seen in the table K Value for the Distribution of Person Log III.

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Table 3.8 K value (interpolation)

Periode Ulang	G		
	-0,1	-0.0000176	0,0
	K		
2	0,0165	0,00825	0,000
5	0,846	0,844	0,842
10	1,27	1,276	1,282
25	1,7155	1,73325	1,751
50	1,998	2,0245	2,051

Source: Calculation Analysis Results

$$\text{Log } X_T = \text{Log}\overline{X} + K.s$$
$$\text{Log } X_T = 2{,}114 + 0{,}00825 \times 0{,}199$$
$$\text{Log } X_T = 2{,}116$$
$$X_T = 130{,}617 \text{ mm/day}$$

Table 3.9 XT Calculation

Periode Ulang	Kemencengan	K	Log X_T	X_T
2		0,00825	2.116	130,617
5		0,844	2,281956	191,406
10	-0,0000176	1,276	2,367924	233,305
25		1,73325	2,45891675	287,685
50		2,0245	2,5168755	328,757

Source: Calculation Analysis Results

3.2.4. Gumbel Distribution

Calculate the average value of variat (log X)

$$\overline{X} = \frac{\Sigma \text{ Xi}}{n}$$
$$\overline{X} = \frac{1430{,}5}{10} = 143{,}05 \text{ mm/hari}$$

Table 3.10. Gumbel Distribution Calculation

No.	Tahun	Curah Hujan Kawasan (Xi)	$\overline{X}$	$(Xi - \overline{X})$	$(Xi - \overline{X})^2$	$(Xi - \overline{X})^3$	$(Xi - \overline{X})^4$
1	2009	148,90	143,05	5,85	34,22	200,20	1171,18
2	2010	88,30	143,05	-54,75	2997,56	-164116,55	8985380,94
3	2011	78,50	143,05	-64,55	4166,70	-268960,65	17361409,72
4	2012	75,10	143,05	-67,95	4617,20	-313738,91	21318558,93
5	2013	117,80	143,05	-25,25	637,56	-16098,45	406485,94
6	2014	284,00	143,05	140,95	19866,90	2800239,91	394693814,94
7	2015	247,00	143,05	103,95	10805,60	1123242,38	116761045,39
8	2016	112,70	143,05	-30,35	921,12	-27956,07	848466,66
9	2017	148,60	143,05	5,55	30,80	170,95	948,79
10	2018	129,60	143,05	-13,45	180,90	-2433,14	32725,71
Σ		**1430,50**		**0,00**	**44258,59**	**3130549,68**	**560410008,21**

Source: Calculation Analysis Results

Yn, Sn, and Ytr values are obtained from the Reduce Mean (Yn), Reduced Standard Deviation (Sn), and Reduced Variate (YTr) tables. Calculation of the probability value of rainfall for a 10 year return period with the Gumbel distribution is as follows :

$$X_{Tr} = \overline{X} + \frac{Y_{Tr} - Y_n}{S_n} S$$

$$X_{10} = 143{,}05 + \frac{2{,}2510 - 0{,}4952}{0{,}9496} \times 70{,}126$$

$$= 272{,}712 \text{ mm/day}$$

3.2.5. Selection of Distribution Type

Statistical parameters in the selection of this type of distribution needed are Standard Deviation (S), Skewness Coefficient (Cs), Kurtosis Measurement (Ck) and Variation Coefficient (Cv). Here are the results of the calculation :

Table 3.11. Distribution Type Selection Parameters

Jenis Distribusi	Syarat	Hasil
Normal	$C_s \approx 0$ $C_k \approx 3$	$C_s = -0{,}206$ $C_k = 0{,}341$
Log Normal	$C_s = C_v^3 + 3C_v$ $C_k = C_v^8 + 6C_v^6 + 15C_v^4 + 16C_v^2 + 3$	$C_s = -0{,}575$ $C_k = 0{,}335$
Gumbel	$C_s = 1{,}14$ $C_k = 5{,}40$	$C_s = -0{,}206$ $C_k = 0{,}341$
Log Person III	$C_s \neq 0$ Atau selain nilai diatas	$C_s = -0{,}575$ $C_k = 0{,}335$

Source: Calculation Analysis Results

From the calculation results presented in table 4.11, it can be concluded that the type of distribution that can be taken is the Log Person III distribution.

3.3. Data Match Test

3.3.1. Chi Square Test

Before carrying out the calculation of the data suitability test, first carry out data processing, which is to sort data from the largest to the smallest as presented in table 4.12.

Table 3.12. Daily / Year Maximum Rainfall Data (mm / day)

Tahun	Curah Hujan Maksimum
2009	148,9
2010	88,3
2011	78,5
2012	75,1
2013	117,8
2014	284
2015	247
2016	112,7
2017	148,6
2018	129,6

Source: Calculation Analysis Results

The next stage is to calculate the distribution class (G), which is as follows :

G = 1 + 3,33 Log (n)

G = 1 + 3,33 Log (10)

G = 1 + 3.33 (1) = 4.33 ≈ 5

The distribution class used 10 pieces of data is 5. As an interval class that is used every 20%. Data intervals are taken from the reset period as follows :

The results of the calculation of the distribution class above are then included as class interval classes in each probability distribution.

From the calculation of the distribution of Log Person III are as follows:
S = 0.199
G = -0.0000176
From table 2.2 the interpolation is done so that the K value for each interval is as follows:
K5 = 0.842001
K2,5 = 0.140336
K1,67 = -0,37048
K1.25 = -0.842
Following is the calculation of the class interval for the distribution of Log Person III
Log X5 = + K5. S.
= 2.114 + (0.842001. 0.199)
= 2,282
X5 = 191,426
Log X2,5 = + K5. S.
= 2.114 + (0.140336. 0.199)
= 2,142
X2,5 = 138.68
Log X1,67 = + K5. S.
= 2.114 + (-0.37048. 0.199)
= 2,041
X1,67 = 109,901
Log X1.25 = + K5. S.
= 2,114 + (-0,842. 0,199)
= 1,947
X1.25 = 88,512

Table 3.13. Chi Square Test

No	Sub Kelas	Jumlah Data		Oi-Ei	$\chi^2 = \frac{(O_i - E_i)^2}{E_i}$
		Oi	Ei		
1	P < 88,512	3	2	1	0.5
2	88,512 < P < 109,901	0	2	-2	2
3	109,901 < P < 138,68	3	2	1	0.5
4	138,68 < P < 191,426	2	2	0	0
5	P > 191,426	2	2	0	0
Jumlah		10	10		3

Source: Calculation Analysis Results

$$Ei = \frac{n}{k} = \frac{10}{5} = 2$$
$$(DK) = 5 - (2 + 1) = 2$$

From Table 4.13 it is known, based on Table 2.7 the critical value for the Chi-squared distribution at the degree of confidence (α) = 0.05 or 5% obtained value Because the Pearson III log distribution equation can be accepted.

3.3.2. Smirnov Kolmogorov Test

The results of calculations can be seen in table 4.14, an example of calculation using data in 2008, which is as follows:

a. Sorting rain data from large to small can be seen in table 4.12, and look for opportunities with the opportunity formula as follows :

$$P(\text{LogX}) = \frac{m}{(n+1)}$$

$$P(\text{LogX}) = \frac{1}{(10+1)} = 0{,}091$$

b. Look for the value of P (X <) :

$$P(\text{LogX} <) = 1 - P(\text{LogX})$$
$$= 1 - 0{,}091 = 0{,}909$$

c. Look for the value f (t) :

$$f(t) = \frac{\text{LogX} - \text{Log}\overline{X}}{S} = \frac{2{,}113 - 2{,}114}{0{,}199} = -0{,}007$$

d. the value of P '(Log X) is searched using the area table under the normal curve of f (t) with the value :

$$P(\text{LogX}) = \frac{m}{(n-1)}$$

$$P(\text{LogX}) = \frac{1}{(10-1)} = 0{,}111$$

Up to value $'(LogX)$:

$$P'(\text{LogX} <) = 1 - P'(\text{LogX})$$
$$= 1 - 0{,}111 = 0{,}889$$

Find the D value using the formula:

$$D = P(\text{LogX} <) - P'(\text{LogX} <) = 0{,}909 - 0{,}889 = 0{,}020$$

Table 3.14. Calculation Results of the Smirnov Kolmogorov Test Distribution Person Log III

Tahun	M	X	Log X	P(LogX)	P'(LogX<)	$f(t) = (LogX - Log\overline{X})/s$	P'(LogX)	P'(LogX<)	D
1	2	3	4	5	6 = 1- Kolom 5	7	8	9 = 1- Kolom 8	10 = 6 - 9
	1	148,90	2,173	0,091	0,909	0,296	0,111	0,889	0,020
	2	88,30	1,946	0,182	0,818	-0,844	0,222	0,778	0,040
	3	78,50	1,895	0,273	0,727	-1,101	0,333	0,667	0,060
	4	75,10	1,876	0,364	0,636	-1,198	0,444	0,556	0,080
	5	117,80	2,071	0,455	0,545	-0,215	0,556	0,444	0,101
	6	284,00	2,453	0,545	0,455	1,705	0,667	0,333	0,122
	7	247,00	2,393	0,636	0,364	1,400	0,778	0,222	0,142
	8	112,70	2,052	0,727	0,273	-0,312	0,889	0,111	0,162
	9	148,60	2,172	0,818	0,182	0,292	1,000	0,000	0,182
	10	129,60	2,113	0,909	0,091	-0,007	1,111	-0,111	0,202

Source: Calculation Analysis Results

From Table 4.14. above it can be concluded that Dmax = 0.202 on the 9th sequence data. By using Table 2.8. Critical value of D0 for Smirnov-Kolmogorov test with a degree of confidence of 5% and n = 10, then obtained D0 = 0.41. Because the value of Dmax <D0 then Pearson log distribution distribution III can be accepted.

3.4 Calculation of Flood Discharge Plan

The design of flood discharge calculation is carried out to get the flood discharge entering the drainage.

3.4.1 Flow Coefficient

Flow coefficient (C) is a constant price, a ratio between the rain that flows on the surface and the rain water that falls. In the Angke Jaya Tambora Housing Area of West Jakarta, the study was included in the character of multiunit housing (combined), so that the value obtained in accordance with table 2.9 was 0.60 to 0.75 and the highest value was taken, 0.75.

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3.4.2 Calculation of Time of Concentration of Channels

The results of the calculation of the complete concentration time are presented in table 4.16

Tabel 3.15. Channel Concentration Time (tc)

No.	L	S	n	to	Asal	A	P	R	V	td	tc
Saluran	m			menit	m2	m2	m	m	m/dt	menit	menit
A1	102,50	0,02	0,01	22,46	0,60	0,60	2,60	0,23	3,75	0,46	22,92
A2	69,33	0,01	0,01	17,67	0,25	0,25	1,40	0,18	2,68	0,43	18,10
A3	125,70	0,01	0,01	43,14	0,48	0,48	2,00	0,24	2,46	0,85	43,99
A4	240,05	0,00	0,01	113,86	0,40	0,40	1,80	0,22	1,69	2,37	116,22
B1	125,70	0,01	0,01	43,14	0,48	0,48	2,00	0,24	2,46	0,85	43,99
B2	69,33	0,01	0,01	17,67	0,25	0,25	1,40	0,18	2,68	0,43	18,10
B3	128,50	0,01	0,01	44,59	0,48	0,48	2,00	0,24	2,43	0,88	45,47
B4	52,60	0,02	0,01	11,68	0,40	0,40	1,80	0,22	3,61	0,24	11,92
C1	128,50	0,01	0,01	44,59	0,48	0,48	2,00	0,24	2,43	0,88	45,47
C2	69,33	0,01	0,01	17,67	0,30	0,30	1,70	0,18	2,70	0,43	18,10
C3	125,00	0,01	0,01	42,78	0,48	0,48	2,00	0,24	2,47	0,84	43,63
C4	52,60	0,02	0,01	11,68	0,40	0,40	1,80	0,22	3,61	0,24	11,92
D1	306,13	0,00	0,01	163,97	0,56	0,56	2,30	0,24	1,59	3,21	167,17
D2	306,13	0,00	0,01	163,97	0,36	0,36	1,80	0,20	1,40	3,65	167,62
D3	31,20	0,03	0,01	5,34	0,20	0,20	1,40	0,14	3,49	0,15	5,48
D4	52,60	0,02	0,01	11,68	0,48	0,48	2,00	0,24	3,80	0,23	11,91
D5	31,00	0,03	0,01	5,28	0,16	0,16	1,20	0,13	3,35	0,15	5,44
D6	31,00	0,03	0,01	5,28	0,16	0,16	1,20	0,13	3,35	0,15	5,44
D7	52,60	0,02	0,01	11,68	0,48	0,48	2,00	0,24	3,80	0,23	11,91
D8	25,00	0,04	0,01	3,83	0,12	0,12	1,10	0,11	3,26	0,13	3,95
D9	25,00	0,04	0,01	3,83	0,12	0,12	1,10	0,11	3,26	0,13	3,95
D10	52,60	0,02	0,01	11,68	0,48	0,48	2,00	0,24	3,80	0,23	11,91
D11	51,25	0,02	0,01	11,23	0,56	0,56	2,20	0,25	4,01	0,21	11,44
D12	51,25	0,02	0,01	11,23	0,56	0,56	2,20	0,25	4,01	0,21	11,44
D13	208,00	0,00	0,01	91,83	0,36	0,36	1,80	0,20	1,69	2,05	93,88
D14	101,50	0,01	0,01	31,30	0,56	0,56	2,30	0,24	2,76	0,61	31,92
D15	101,50	0,01	0,01	31,30	0,56	0,56	2,30	0,24	2,76	0,61	31,92

Source: Calculation Analysis Results

3.4.3 Calculation of Intensity of Rainfall Area

The return period that will be used in the calculation of rainfall intensity is a return period of 2 years. Rainfall intensity is calculated using the mononobe formula with the concentration time value (tc). Calculation of rainfall intensity on channel A1 is as follows:

XT = 130,617 mm day

TC = 22.92 minutes

$$I = \left(\frac{X_2}{24}\right).\left(\frac{24}{tc}\right)^{\frac{2}{3}}$$

$$I = \left(\frac{130{,}617}{24}\right).\left(\frac{24}{22{,}92/60}\right)^{\frac{2}{3}} = 86{,}011 \text{ mm/hour}$$

The results of a complete rainfall intensity calculation are presented in table 4.16.

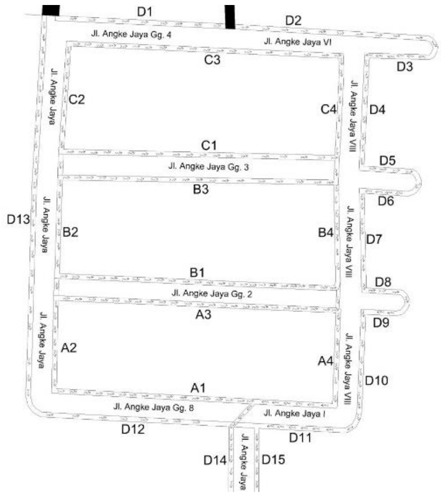
Table 3.16. Rainfall Intensity (I)

No	X_T	t_c	t_c	I
Saluran	mm/hari	menit	jam	mm/jam
A1	130,617	22,920	0,382	86,011
A2	130,617	18,100	0,302	100,673
A3	130,617	43,990	0,733	55,692
A4	130,617	116,220	1,937	29,141
B1	130,617	43,990	0,733	55,692
B2	130,617	18,100	0,302	100,673
B3	130,617	45,470	0,758	54,477
B4	130,617	11,920	0,199	132,998
C1	130,617	45,470	0,758	54,477
C2	130,617	18,100	0,302	100,673
C3	130,617	43,630	0,727	55,998
C4	130,617	11,920	0,199	132,998
D1	130,617	167,170	2,786	22,870
D2	130,617	167,620	2,794	22,829
D3	130,617	5,480	0,091	223,277
D4	130,617	11,910	0,199	133,073
D5	130,617	5,440	0,091	224,370
D6	130,617	5,440	0,091	224,370
D7	130,617	11,910	0,199	133,073
D8	130,617	3,950	0,066	277,736
D9	130,617	3,950	0,066	277,736
D10	130,617	11,910	0,199	133,073
D11	130,617	11,440	0,191	136,693
D12	130,617	11,440	0,191	136,693
D13	130,617	93,880	1,565	33,598
D14	130,617	31,920	0,532	68,969
D15	130,617	31,920	0,532	68,969

Source: Calculation Analysis Results

3.4.4 Distribution of Catchment Areas

Catchment area calculations are done using the help of Autocad software. The catchment area can be seen in Figure 4.1, and the area of drainage catchment area can be seen in table 4.15.



(Source: Personal Image)
Figure 3.1. Catchment Area

Table 3.17. Capture Area of Drainage

No. Saluran	Jalan		Pemukiman		Jumlah	
	m^2	km^2	m^2	km^2	m^2	km^2
A1	245,2375	0,00025	2268	0,0023	2513,238	0,002513
A2	226,5083	0,00023	536	0,0005	762,5083	0,000763
A3	277,49	0,00028	2866	0,0029	3143,49	0,003143
A4	120,025	0,00012	705	0,0007	825,025	0,000825
B1	277,49	0,00028	1969	0,0020	2246,49	0,002246
B2	226,5083	0,00023	630	0,0006	856,5083	0,000857
B3	367,0625	0,00037	2091	0,0021	2458,063	0,002458
B4	120,025	0,00012	576	0,0006	696,025	0,000696
C1	367,0625	0,00037	1962	0,0020	2329,063	0,002329
C2	226,5083	0,00023	596	0,0006	822,5083	0,000823
C3	306,125	0,00031	1825	0,0018	2131,125	0,002131
C4	120,025	0,00012	519	0,0005	639,025	0,000639
D1	153,0625	0,00015	987	0,0010	1140,063	0,00114
D2	153,0625	0,00015	852	0,0009	1005,063	0,001005
D3	96,2325	0,00010	339	0,0003	435,2325	0,000435
D4	120,025	0,00012	537	0,0005	657,025	0,000657
D5	116,25	0,00012	379	0,0004	495,25	0,000495
D6	116,25	0,00012	314	0,0003	430,25	0,00043
D7	120,025	0,00012	441	0,0004	561,025	0,000561
D8	62,715	0,00006	154	0,0002	216,715	0,000217
D9	62,715	0,00006	277	0,0003	339,715	0,00034
D10	120,025	0,00012	405	0,0004	525,025	0,000525
D11	357,975	0,00036	353	0,0004	710,975	0,000711
D12	66,25	0,00007	618	0,0006	684,25	0,000684
D13	679,525	0,00068	3066	0,0031	3745,525	0,003746
D14	274,1875	0,00027	919	0,0009	1193,188	0,001193
D15	274,1875	0,00027	891	0,0009	1165,188	0,001165

Source: Calculation Analysis Results

3.4.5 Calculation of Rain Water Flow Discharge

Tabel 3.18. Rainwater Flow Discharge

No Saluran	C	I	A	Qp	Qp total
		mm/jam	km^2	m3/det	m3/det
A1	0,75	86,011	0,00251	0,04507	0,06108
A2	0,75	100,673	0,00076	0,01602	0,09635
A3	0,75	55,692	0,00314	0,03650	0,07176
A4	0,75	29,141	0,00083	0,00501	0,19424
B1	0,75	55,692	0,00225	0,02608	0,06134
B2	0,75	100,673	0,00086	0,01799	0,03526
B3	0,75	54,477	0,00246	0,02792	0,04519
B4	0,75	132,998	0,0007	0,01930	0,09139
C1	0,75	54,477	0,00233	0,02645	0,04373
C2	0,75	100,673	0,00082	0,01728	0,01728
C3	0,75	55,998	0,00213	0,02488	0,02488
C4	0,75	132,998	0,00064	0,01772	0,04260
D1	0,75	22,87	0,00114	0,00544	0,00544
D2	0,75	22,829	0,00101	0,00478	0,01022
D3	0,75	223,277	0,00044	0,02025	0,03047
D4	0,75	133,073	0,00066	0,01823	0,04870
D5	0,75	224,37	0,0005	0,02316	0,07186
D6	0,75	224,37	0,00043	0,02012	0,09197
D7	0,75	133,073	0,00056	0,01557	0,10754
D8	0,75	277,736	0,00022	0,01257	0,12010
D9	0,75	277,736	0,00034	0,01969	0,13979
D10	0,75	133,073	0,00053	0,01457	0,15436
D11	0,75	136,693	0,00071	0,02026	0,17462
D12	0,75	136,693	0,00068	0,01949	0,04574
D13	0,75	33,598	0,00375	0,02624	0,02624
D14	0,75	68,969	0,00119	0,01716	0,06289
D15	0,75	68,969	0,00117	0,01675	0,19137

Source: Calculation Analysis Results

Calculation of rainwater flowrate using the rational method formula, the following is the calculation of rainwater flowrate for channel D2, which is as follows:

Qp = 0.278 C.I.A

Qp = 0.278. (0.75). (22.829). (0.00101)
Qp = 0.01022 m3 / sec
For channel D2, an additional water discharge from D1 flow is added,
Qp D1 + Q_p D2 = 0.00544 + 0.00478
Qtotal D2 = 0.01022 m3 / sec
The full calculation will be presented in table 4.18.

3.4.6 Calculation of Dirty Water Discharge

The calculated dirty water discharge is the water debit that comes from household waste, and other buildings. The amount is affected by the large number of residents and the average water needs of the population. Estimates for the average disposal of liquid waste per person per day are presented in table 2.10, and it is concluded that the amount of waste water per person per day is 400 liters. Following are the calculations for channel D2.

Q_ak = Pn x 400 liters / person / day
Q_ak = Pn x 0.00463 liter / person / sec
Q_ak = 45 x 0.00463 liter / person / sec
Q_ak = 0.2083 m3 / sec
The complete calculation for dirty water discharge has been presented in table 3.19.

Tabel 3.19. Debit Air Kotor

No. Saluran	Jumlah Rumah	Jumlah Orang	Air Buangan	Air Buangan	Qak	Qak Total
			lt/org/hari	lt/org/dtk	m^3/dt	m^3/dt
A1	17	68	400	0,00463	0,3148	0,356
A2	2	9	400	0,00463	0,0417	0,435
A3	17	66	400	0,00463	0,3056	0,384
A4	2	10	400	0,00463	0,0463	1,398
B1	18	70	400	0,00463	0,3241	0,403
B2	2	9	400	0,00463	0,0417	0,079
B3	18	61	400	0,00463	0,2824	0,319
B4	2	10	400	0,00463	0,0463	0,644
C1	18	59	400	0,00463	0,2731	0,310
C2	2	8	400	0,00463	0,0370	0,037
C3	17	58	400	0,00463	0,2685	0,269
C4	2	9	400	0,00463	0,0417	0,310
D1	10	48	400	0,00463	0,2222	0,222
D2	9	45	400	0,00463	0,2083	0,431
D3	2	8	400	0,00463	0,0370	0,468
D4	2	7	400	0,00463	0,0324	0,500
D5	3	9	400	0,00463	0,0417	0,542
D6	3	8	400	0,00463	0,0370	0,579
D7	3	7	400	0,00463	0,0324	0,611
D8	3	9	400	0,00463	0,0417	0,653
D9	3	9	400	0,00463	0,0417	0,694
D10	5	20	400	0,00463	0,0926	0,787
D11	4	18	400	0,00463	0,0833	0,870
D12	12	48	400	0,00463	0,2222	0,481
D13	18	56	400	0,00463	0,2593	0,259
D14	13	52	400	0,00463	0,2407	0,722
D15	11	44	400	0,00463	0,2037	1,074

Source: Calculation Analysis Results

3.4.7. Calculation of Flood Discharge Plan

In the calculation of flood discharges in the Angke Jaya Tambora Housing Area of West Jakarta, namely rainwater flow discharges added with dirty water discharge.
The following is a calculation on channel A1.

$Q_r = Q_{P\ total} + Q_{ak\ total}$
$Q_r = 0{,}00053 + 0.042$
$Q_r = 0.043$ m3/dt
Complete calculations for flood discharge are presented in table 3.20.

Table 3.20. Flood Discharge Plan

No	Qp total	Qak total	Qr
Saluran	m^3/dt	m^3/dt	m^3/dt
A1	0,06108	0,356	0,418
A2	0,09635	0,435	0,532
A3	0,07176	0,384	0,456
A4	0,19424	1,398	1,592
B1	0,06134	0,403	0,464
B2	0,03526	0,079	0,114
B3	0,04519	0,319	0,365
B4	0,09139	0,644	0,735
C1	0,04373	0,310	0,354
C2	0,01728	0,037	0,054
C3	0,02488	0,269	0,293
C4	0,04260	0,310	0,353
D1	0,00544	0,222	0,228
D2	0,01022	0,431	0,441
D3	0,03047	0,468	0,498
D4	0,04870	0,500	0,549
D5	0,07186	0,542	0,614
D6	0,09197	0,579	0,671
D7	0,10754	0,611	0,719
D8	0,12010	0,653	0,773
D9	0,13979	0,694	0,834
D10	0,15436	0,787	0,941
D11	0,17462	0,870	1,045
D12	0,04574	0,481	0,527
D13	0,02624	0,259	0,286
D14	0,06289	0,722	0,785
D15	0,19137	1,074	1,265

Source: Calculation Analysis Results

3.5 Calculation of Drainage Channel Dimensions

After knowing the planned flood discharge in the West Jakarta Angora Jaya Tambora Housing Area, the dimensions of the existing drainage channel will be calculated to determine whether or not the channel is sufficient to accommodate the planned flood discharge. Furthermore, if there are unsafe channels, a new drainage channel calculation will be performed to determine the dimensions of the safe channel.

3.5.1 Calculation of Existing Drainage Channel Dimensions.

Berikut merupakan perhitungan untuk saluran A1 :

b = 0,6

h = 1

S = 0,02

$$A = b \text{ x } h$$

$$A = 0{,}6 \text{ x } 1 = 0{,}6 \text{ m2}$$

$$P = b + 2\,h$$

$$P = 0{,}6 + (2 \text{ x } 1) = 2{,}60$$

$$R = \frac{A}{P}$$

$$R = \frac{0{,}60}{2{,}60} = 0{,}23 \text{ m}$$

$$V = \frac{1}{n} R^{\frac{2}{3}} S^{\frac{1}{2}}$$

$$V = \frac{1}{0{,}01} 0{,}23^{\frac{2}{3}} \,.\, 0{,}02^{\frac{1}{2}}$$

$$V = 3{,}75 \text{ m/sec}$$

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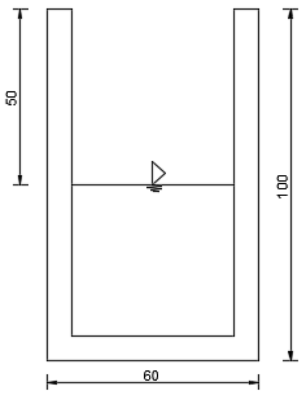
$Q_{sal} = A \times V = 0,6 \times 3,75 = 2,25 \text{ m}^3/\text{dt}$



(Source: Personal Image)
Figure 3.2. Drainage Channel Cut

If Qsaluran > Qrencana, the drainage channel is able to accommodate the flow of flood discharge, and declared safe. If the Channel <Qrage drainage plan is able to accommodate the flow of flood discharge, and declare dunsafe. The full calculation is presented in table 3.21.

Table 3.21. Calculation of Existing Drainage Channel Dimensions

No Saluran	b (m)	h (m)	A (m^2)	V (m/dt)	Qsal (m^3/dt)	Qrencana (m^3/det)	Keterangan	Keterangan
A1	0,60	1,00	0,60	3,75	2,25	0,42	Qsal > Qrencana	Aman
A2	0,70	0,35	0,25	2,68	0,66	0,53	Qsal > Qrencana	Aman
A3	0,80	0,50	0,40	2,46	0,98	0,46	Qsal > Qrencana	Aman
A4	0,80	0,50	0,40	1,69	0,68	1,59	Qsal < Qrencana	Tidak Aman
B1	0,80	0,50	0,40	2,46	0,98	0,46	Qsal > Qrencana	Aman
B2	0,70	0,35	0,25	2,68	0,66	0,11	Qsal > Qrencana	Aman
B3	0,80	0,60	0,48	2,43	1,17	0,36	Qsal > Qrencana	Aman
B4	0,80	0,60	0,48	3,61	1,73	0,73	Qsal > Qrencana	Aman
C1	0,80	0,60	0,48	2,43	1,17	0,35	Qsal > Qrencana	Aman
C2	0,50	0,60	0,30	2,70	0,81	0,05	Qsal > Qrencana	Aman
C3	0,80	0,60	0,48	2,47	1,18	0,29	Qsal > Qrencana	Aman
C4	0,80	0,60	0,48	3,61	1,73	0,35	Qsal > Qrencana	Aman
D1	0,70	0,80	0,56	1,59	0,89	0,23	Qsal > Qrencana	Aman
D2	0,60	0,60	0,36	1,40	0,50	0,44	Qsal > Qrencana	Aman
D3	0,40	0,50	0,20	3,49	0,70	0,50	Qsal > Qrencana	Aman
D4	0,80	0,60	0,48	3,80	1,83	0,55	Qsal > Qrencana	Aman
D5	0,40	0,40	0,16	3,35	0,54	0,61	Qsal < Qrencana	Tidak Aman
D6	0,40	0,40	0,16	3,35	0,54	0,67	Qsal < Qrencana	Tidak Aman
D7	0,80	0,60	0,48	3,80	1,83	0,72	Qsal > Qrencana	Aman
D8	0,30	0,40	0,12	3,26	0,39	0,77	Qsal < Qrencana	Tidak Aman
D9	0,30	0,40	0,12	3,26	0,39	0,83	Qsal < Qrencana	Tidak Aman
D10	0,80	0,60	0,48	3,80	1,83	0,94	Qsal > Qrencana	Aman
D11	0,80	0,70	0,56	4,01	2,24	1,04	Qsal > Qrencana	Aman
D12	0,80	0,70	0,56	4,01	2,24	0,53	Qsal > Qrencana	Aman
D13	0,60	0,60	0,36	1,69	0,61	0,29	Qsal > Qrencana	Aman
D14	0,70	0,80	0,56	2,76	1,55	0,79	Qsal > Qrencana	Aman
D15	0,70	0,80	0,56	2,76	1,55	1,27	Qsal > Qrencana	Aman

Source: Calculation Analysis Results

Berdasarkan perhitungan dimensi saluran drainase eksisting pada tabel 3.21, ditemukan saluran yang masuk dalam kategori "tidak aman", karena kapasitas saluran tidak cukup untuk menampung debit banjir rencana, yaitu pada saluran A4, D5, D6, D8, dan D9. Dalam mengatasi hal ini akan direncanakan sumur resapan.

3.6 Infiltration Wells Plan

The infiltration well planning is used in draining excess water discharge in several "unsafe" channels, by draining rainwater that falls from the roofs of residents' homes to seep into the ground by storing the water in the infiltration well. Channels that fall into the "unsafe" category will be presented in table 3.22, as follows :

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Table 3.22 Channels By Unsafe Categories (Q drainage channels <Q plan)

No Saluran	Qsal	Qrencana	Kelebihan Debit	Kategori
	m^3/dt	m^3/det	m^3/det	
A4	0,68	1,59	0,92	Tidak Aman
D5	0,54	0,61	0,08	Tidak Aman
D6	0,54	0,67	0,13	Tidak Aman
D8	0,39	0,77	0,38	Tidak Aman
D9	0,39	0,83	0,44	Tidak Aman

Source: Calculation Analysis Results

Based on table 3.22, there are channels that fall into the "unsafe" category, so that an infiltration well will be planned.

3.6.1. Infiltration Wells Construction

1. Channels of income / expenditure using pralon pipes.
2. The well wall can use masonry without plastering
3. The bottom of the well and the gaps between the soil excavation and the wall where the water is absorbed are filled with fibers / gravel.

3.6.2 Discharge of Rainfall Plans on the Roof Surface

To find out the flow of rain that enters the infiltration well, it is necessary to know in advance the flow of rain falling through the roof of the residents' houses. Example calculation using No. A4 channels as follows:
Q masuk = 0.278. C.I.A

Is known :
Catap = 0.75 (based on Table 2.9. Runoff Coefficient Standard)
IA4 = 29.14 mm / hour
Aatap = 80 m2 = 0.0080 km2

So, Q masuk is:
Qmasuk = 0.278. 0.75. 29.14. 0.008
= 0.048607 m3 / sec
Calculation of rain discharges that fall to the roof surface will be presented in full in table 3.23, as follows :

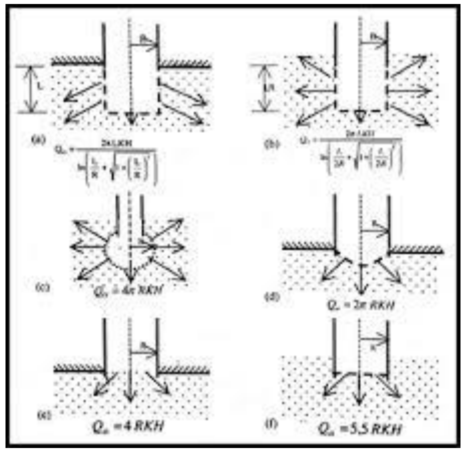
Table 3.23 Rainwater Discharge Falls on the Roof

No Saluran	C	I	Aatap	Aatap	Qmasuk
		mm/jam	m^2	km^2	m^3/det
A4	0,75	29,14	80,00	0,008	0,048607
D5	0,75	224,37	80,00	0,008	0,374249
D6	0,75	224,37	80,00	0,008	0,374249
D8	0,75	277,736	80,00	0,008	0,463264
D9	0,75	277,736	80,00	0,008	0,463264

Source: Calculation Analysis Results

4.6.3 Discharge of Absorption Well Absorption

Furthermore, it is necessary to know the discharge of rainwater that enters the absorption well (Qresapan). The calculation refers to No. Channel A4, as follows :



(Source: Sistem Drainase Perkotaan yang Berkelanjutan, 2004:300)
Figure 3.3 Geometric Factors of Infiltration Wells

Qresapan = F. K. H
Infiltration Wells Design Plan:
Is known :
- Qresapan = Discharge that can be absorbed by infiltration wells (m3 / sec)
- Type of blank wells with circular appearance
- The planned well diameter is 2 m = R = 1 m
- F = geometric / circumference factor = = 2 x 3.14 x 1 = 3.14 m
- K = For the soil permeability value, it is assumed that the value of K = 10-2 cm / s = 10-4 m / s for the shaft soil.

JENIS TANAH	k (cm/det)	NAMA
Kerikil	> 10^{-1}	*High permeability*
kerikil halus/pasir	10^{-1} – 10^{-3}	*Medium permeability*
pasir sangat halus pasir lanau lanau tidak padat	10^{-3} – 10^{-5}	*Low permeability*
lanau padat lanau lempung lanau tidak murni	10^{-5} – 10^{-7}	*Very low permeability*
Lempung	< 10^{-7}	*Impervious (rapat air)*

(Source: www.google.co.id)
Figure 3.4 Soil Permeability Coefficient

- H = Assumption of infiltration well depth = 2 m

Infiltration Wells Calculation:
Qresapan = F. K. H
= 3.14. 10-4. 2
= 0,000628 m3 / sec
For complete Qresapan calculation will be presented in table 4.24, as follows :

Table 3.24 Qresapan Rainwater in Infiltration Wells

No Saluran	Qresapan Air Hujan dalam Sumur Resapan			
	F (m)	K (cm/dtk)	H (m)	Qresapan (m^3/dtk)
A4	3,14	0,0001	2,00	0,000628
D5	3,14	0,0001	2,00	0,000628
D6	3,14	0,0001	2,00	0,000628
D8	3,14	0,0001	2,00	0,000628
D9	3,14	0,0001	2,00	0,000628

Source : Calculation Analysis Results

3.6.4 Residual Water Discharge Flowing into Drainage Channels

Furthermore, it will be found the difference in the remaining discharge from the rain discharge that has been accommodated into the infiltration well, by way of Qmasuk (Table 4.23) reduced by Qresapan (Table 4.24). The following is an example of a calculation that refers to No. A4 channel:

Is known :

Q in = 0.048607 m3 / sec (table 4.23)

Q infiltration = 0,000628 (table 4.24)

Settlement:

Qtampung = Qmasuk - Qresapan

= 0.048607– 0.000628

= 0.047979 m3 / sec

For the calculation of the complete infiltration wells collected discharge will be presented in table 4.25 as follows :

Table 3.25 Discharge accommodated in infiltration wells

No Saluran	Qmasuk atap (m^3/dtk) (4)	Qresapan (m^3/dtk) (5)	Qtampung (m^3/dtk) (6) = (5) - (4)
A4	0,048607	0,000628	0,047979
D5	0,374249	0,000628	0,373621
D6	0,374249	0,000628	0,373621
D8	0,463264	0,000628	0,462636
D9	0,463264	0,000628	0,462636

Source : Calculation Analysis Results

4.6.5 Total Infiltration Wells Needs

After knowing the difference in the remaining discharge from the rain discharge that has been accommodated into the infiltration well, it can be seen the amount of infiltration well needs in the area of the house in each Channel Number. Example calculation refers to No. A4 channel:

Is known :

Discharge Excess A4 = 0.92 m3 / sec (Table 4.22)

Qtampung = 0.047979 m3 / sec

Settlement :

$$\text{Jumlah Sumur Resapan} = \frac{\text{Kelebihan Debit}}{\text{Qtampung}}$$

The calculation of the number of recharge well requirements in full is presented in table 4.26 as follows :

Table 3.26 Amount of Infiltration Wells Needs

No Saluran	Qlebih (m^3/dtk) (3) = (2) - (1)	Qtampung (m^3/dtk) (6) = (5) - (4)	Jumlah Sumur Resapan (7) = (2) : (6)
A4	0,92	0,047979	19
D5	0,08	0,373621	1
D6	0,13	0,373621	1
D8	0,38	0,462636	1
D9	0,44	0,462636	1

Source : Calculation Analysis Results

From table 4.26, it is known that the number of infiltration wells needed in A4 Channel is 19 units, Channel D5, D6, D8, and D9 are 1 piece.

4. Conclussion

From the results of the analysis and discussion in the previous chapter and answer from the formulation of the problem, the following conclusions can be drawn:
1. The condition of the drainage canal in Angke Jaya Tambora Housing Area West Jakarta is poorly maintained, there are many houses that progress to cover the existing channels, making the channel difficult to clean, so there is a lot of garbage in the channel and accumulation of sedimentation. There are 5 channels that are concluded to be "unsafe", because the planned flood discharge is greater than the drainage capacity, namely on channels A4, D5, D6, D8,andD9.
2. The need for flood drainage capacity in the Angke Jaya Tambora Housing Area of West Jakarta is 13,225 m3 / second.5.2 Suggestions
Suggestions that can be delivered at the writing of this thesis after getting the results and solutions provided, the advice that will be given are as follows:
1. Regular cleaning of drainage channels, on sedimentation and rubbish in the drainage channel.
2. Construction of infiltration wells on channels A4, D5, D6, D8, D9 can be carried out, so that in the rainy season stagnant water can be diverted to infiltration wells.

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