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CAPACITY OF ADHYAKSA RESERVOIR IN NORTH JAKARTA

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ABSTRACT

Adhyaksa reservoir is located within the Adhyaksa Public Hospital on Mabes Hankam street number 60, Ceger, Cipayung district, in the area of East Jakarta, which is one of the areas prone to flooding. Adhyaksa reservoir has a pump house available that is used to pump the excess water in the reservoir but there are still puddles in several places around the residential area. The problems occurs due to sedimentation in the canal, inadequate size of the canal, and narrowing of the canal. These causes the canal that is supposed to drain water into a reservoir to not work optimally. By conducting canal analysis using Log Pearson III method, using data obtained from 3 Rainfall Station namely, Bekasi Rainfall Station, Halim Rainfall Station, and Bogor Rainfall Station, it was found that the rainfall intensity that occured in the last 10 years cycle is 162,29 mm. Then, the Mononobe equation was used to find the intensity of rain per hour that occours. The planned rain discharge was then found using a rational method. From these calculations, it was discovered that there are 9 canals namely (5, 11, 12, 13, 17, 18, 19, 20 and 23) that are unable to accommodate the rainfall that occurs.

Keywords: *Flood, Drainage, Canal, Puddle, Reservoir*

1. PRELIMINARY

Ceger Pump House is one of the pumps that is located at 6°18’44,58” south latitude and 106°53’23,02” east longitude. To the northeast is Tb. Simatupang and to the southeast is Gempol street. This reservoir holds water from drainage canals originating from Cipayung’s Subdistrict, namely Raya Gempol Ceger street, connecting canal for Mabes Hankam street and Bambu Apus street, which comes from home residents that are quite dense. Although there’s already Ceger Pump House that was prepared to deal with puddles and floods, puddles still occur when rain falls with high intensity. However, this condition doesn’t last long. When the rain stops, the puddles will slowly recede. Another problem is natural factor in the form of sedimentation from leaves, twigs, sand and household waste, such as detergent water along residential canals which inhibit the flow of water to Ceger Pump House. Then there is the problem of canal size. In Makmur Alley and Tepu Alley the canal size is inadequate to accommodate rainwater, so water overflows out of the canal and create puddles around the settlement. Canals that are located around Rawa Segaran street, 222 Junior High School street, Ceger Raya street, and Gempol street have closed canals that makes it difficult to clean the sedimentation and rubbish from the canal. has Apart from having a deep and thick sedimentation, the canal also has bad odor because the canal water doesn't flow to Ceger Pump House. Based on these conditions, the writer wants to analyze the problems of the canal around Ceger Pump House area which can be used as an evaluation for the citizen and the government so that they can carefully handle the problems of frequent puddles or floods.

Research Purposes

The purpose of this research are:

1. To know the amount of rain discharge that enters the canal.
2. To know the canal's ability to accommodate rain discharge.

2. THEORETICAL BASIS

Frequency and Probability Analysis

In statistic, there are several parameters related to data analysis which include average ($\bar{X}$), standard deviation (S), variant coefficient (Cv), skewness (Cs), and sharpness coefficient (Ck). Here are some formula:

$$\bar{X} = \sum_{i=1}^{n} Xi/n \quad (1)$$

$$S = \sqrt{\frac{\sum_{i=1}^{n}(Xi-\bar{X})^2}{n-1}} \quad (2)$$

$$Cv = \frac{S}{\bar{X}} \quad (3)$$

$$Cs = \frac{n \times \sum_{i=1}^{n}(Xi-\bar{X})^3}{(n-1) \times (n-2) \times S^3} \quad (4)$$

$$Ck = \frac{n^2 \times \sum_{i=1}^{n}(Xi-\bar{X})^4}{(n-1) \times (n-2) \times (n-3) \times S^4} \quad (5)$$

Information:

$\bar{X}$: Average score
Xi : Variant score
n : Amount of data
S : Standard deviation
Cv : Variant coefficient
Cs : Skewness
Ck : Sharpness coefficient

Normal Distribution

Normal distribution is also called Gauss distribution, here is the formula of normal distribution:

$$X_t = X + K_t \,.\, S_x \quad (6)$$

information:

X_t : Rainfall plan return period T years (mm)
X : Rainfall average score (mm)
K_t : Frequency factor (score of the Gauss Variable)
S_x : Standard deviation

Gumbel's Distribution

Here is the formula of Gumbel's distribution:

$$X = \bar{X} + \frac{(Y_t - Y_n)}{S_n} . S_x \quad (7)$$

Information:

X_t : Rainfall plan return period T years (mm)
$\bar{X}$: Rainfall average score (mm)
Y_t : Reduced variate of Gumbel's parameter for period T years
Y_n : Reduced mean is a function of the amount of data
S_n : *Reduced* standard deviation
S_x : Standard deviation

Normal Log Distribution

Normal Log Distribution is the result of the transformation of normal distribution, by changing variate X into logarithmic score of variate X. Here is the formula of Normal Log Distribution:

$$Y = \bar{Y} + K \,.\, S_d \quad (8)$$

Information:

Y : Logarithmic score of X score or InS
$\bar{Y}$: Average score of the data count
K : Characteristic of Log normal probability distribution
S_d : Standard deviation of score Y

Log Pearson III Distribution

Karl Pearson developed several kinds of empirical equations from a distribution, one of them is Log Pearson III Distribution.

Here is the formula of Log Pearson III Distribution:

$$\text{Log}\, X_T = Log\ X + G\ .\ S_x \qquad (9)$$

Information:

Log X_t : Rainfall plan return period T years (mm)
Log X : Rainfall average score (mm)
G : Variable standard for X_t
S_x : Standard deviation

Rainfall Intensity

If there's only daily rainfall, then dr. Mononobe formulates its rainfall intensity as follows:

$$I = \frac{R_{24}}{24}\left[\frac{24}{t}\right]^{2/3} \qquad (10)$$

information:

R_{24} : Maximum rainfall in 24 hours (mm)
t : Rainfall duration (hour)
I : Rainfall intensity (mm/hour)

Water Discharge

To calculate the top discharge at a drainage, the Rational Method calculation is used as follows:

$$Q = 0{,}278.\,C.\,I.\,A \qquad (11)$$

Information:

Q : Surface runoff peak discharge (m^3/s)
C : Coefficient *run off*
I : Rainfall intensity (mm/hour)
A : Large of drainage area (km^2)

Time of Rain Intensity Concentration (Tc)

To find the concentration time (Tc), it can be calculated using Kirpich formula as follows:

$$T_c = \frac{0{,}0195\ x\ L^{0{,}77}}{S^{0{,}385}} \qquad (12)$$

Information:

T_c : Concentration time (minute)
L : The length of the water from farthest point to the point under review (m)
S : River slope

Average Flow Speed (V)

To find the average flow velocity (V) use the following formula:

$$V = \frac{1}{n}\,.R^{2/3}.S^{1/2} \qquad (13)$$

Information:

V : Average flow velocity (m/s)
n : Manning's roughness coefficient
R : Radius of the hydraulic (m)
S : Canal slope

Calculating Existing Canal Discharge

The purpose of examining existing canal is to find out the amount of water flow that can be accommodated by the canal in its current state. Capacity analysis of drainage canal is carried out to determine the ability of existing drainage canal to accommodate the planned discharge resulted from the calculation.

Discharge Canal

Here is the formula of discharge canal:

$$Q = A\,.\,V \qquad (14)$$

Information:

Q : Discharge canal (m^3/s)
A : Large of wet cross-sectional area (m)
V : Average flow velocity (m/s)

Canal Slope

Slope of the canal is obtained from the slope of contour map in Google Earth. Here is the formula of canal slope:

$$S = \frac{\Delta H}{L} \qquad (15)$$

Information:

S : Canal slope
ΔH : The different between the height of the farthest point and the area drift
L : Canal length (m)

Wet Cross-Sectional Area

Here is the formula of wet cross-sectional area:

$$A = b.\,h \qquad (16)$$

Information:

A : Large of wet cross-sectional area (m^2)
b : Wide canal (m)
h : Water level (m)

Hydraulic Radius

Here is the formula of hydraulic radius of the canal:

$$R = \frac{A}{P} \qquad (17)$$

Information:
R : Hydraulic Radius (m)
A : Large of wet cross-sectional area (m^2)
P : Wet circumference (m)

3. RESEARCH METHODOLOGY

Data Collection

Data collection technique in this research is primary data collection,where data is obtained from direct observation in the field. The data collected was the dimension data of drainage canal around pump house area. Secondary data is also collected from other parties related to this research. Secondary data includes rainfall data and maps from Google Earth. This data was obtained from STA Bekasi, STA Halim, and STA Bogor as well as agencies related to research.

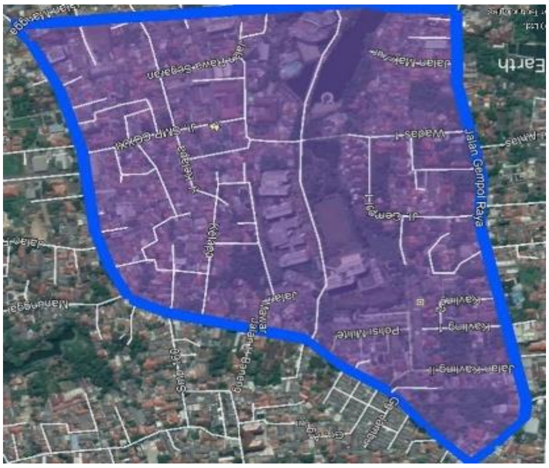

Figure 1. Research Site

Analysis of Rainfall Data Frequency

The calculation of rainfall data frequency analysis is carried out in order to obtain the score of the planned rainfall. It was calculated using several analysis probability distribution, including Gumbel, Normal, Normal Log, and Log Pearson III, using a 10 years rainfall cycle.

Canal Capacity Analysis

The Calculation of canal drainage capacity analysis at the research location was carried out using the equations contained in bibliography, which is the one related to canal drainage capacity calculation.

4. RESULT AND DISCUSSION

Rainfall Data Analysis

Maximum daily rainfall data is obtained from Perum Jasa Tirta II and the Meteorology, Climatology and Geophysics Agency (BMKG). The observation location are in Bekasi Station, Halim Perdana Kusuma Station, and Bogor Climatology Station for 20 years.

Table 1. Maximum Rainfall Data

Year	Maximum Rainfall Data		
	Bekasi	**Halim**	**Bogor**
1998	58	42	127,1
1999	53	42	149,6
2000	106	54,3	93,8
2001	72	92,8	107,5
2002	74	107,6	127
2003	0	71,7	123,3
2004	0	39,8	141,6
2005	0	96,6	126,5
2006	87	88,5	136,4
2007	80	217,6	155,5
2008	70	136,1	104,5
2009	72	95	115,1
2010	72	96,8	144,5
2011	75	305	97,6
2012	68	94,4	116
2013	0	161	97,4
2014	0	120,8	169,1
2015	25	124,6	155,8
2016	105	111,6	108,6
2017	75	136,3	117,6
2018	0	101,2	134,5

Table 2. Calculation of Distribution for Rainfall

No	Xi	$(Xi - \bar{X})$	$(Xi - \bar{X})^2$	$(Xi - \bar{X})^3$	$(Xi - \bar{X})^4$
1	61,26	-50,33	2533,27	-127503,19	6417433,99
2	65,48	-46,11	2126,49	-98060,65	4521956,51
3	67,44	-44,15	1949,55	-86079,68	3800734,42
4	93,89	-17,70	313,43	-5549,03	98240,34
5	108,46	-3,14	9,85	-30,91	97,01
6	83,59	-28,01	784,43	-21969,95	615326,07
7	63,25	-48,34	2336,92	-112970,98	5461214,20
8	103,49	-8,11	65,73	-532,86	4320,05
9	98,35	-13,25	175,55	-2325,93	30817,37
10	191,59	80,00	6399,77	511972,94	40957114,10
11	123,24	11,64	135,55	1578,21	18374,70
12	97,01	-14,59	212,77	-3103,62	45271,57
13	104,39	-7,20	51,87	-373,54	2690,15
14	239,93	128,33	16468,97	2113487,79	271227044,17
15	96,40	-15,20	230,93	-3509,35	53329,74
16	146,35	34,75	1207,61	41965,47	1458331,25
17	131,93	20,33	413,39	8405,13	170893,66
18	121,66	10,06	101,21	1018,24	10243,88
19	110,35	-1,25	1,56	-1,94	2,42
20	126,58	14,99	224,65	3367,09	50466,88
21	108,87	-2,72	7,42	-20,21	55,05
Σ	2343,52		35750,93	2219763,02	334943957,53

Based on the table above, it can be seen that the scores include average ($\bar{X}$), standard deviation (S), variant coefficient (Cv), slope coefficient (Cs), and coefficient of sharpness (Ck):

1. Average score ($\bar{X}$) = 111,60
2. Standard deviation (S_d) = 42,28
3. Coefficient of variation (C_v) = 0,38
4. Slope coefficient (C_s) = 1,91
5. coefficient of sharpness (C_k) = 9,54

Table 3. Result Calculation of Distribution Method and Requirements of Distribution Method

No	Distribution	Requirements	Calculation	Information
1	Gumbel	Cs < 1,14	Cs = 1,91	Not qualify
		Ck < 5,4	Ck = 9,54	Qualify
2	Normal	Cs = 0	Cs = 1,91	Not qualify
		Ck = 3	Ck = 9,54	Not qualify
3	Log Normal	Cs = 0,00	Cs = 1,19	Not qualify
		Ck = 3,00	Ck = 5,62	Not qualify
4	Log Pearson III	No requirement	-	Qualify

Rainfall Plan Log Pearson III Method

After calculating rainfall, standard deviation, slope coefficient, and sharpness coefficient, then calculate the return period according to the method that meets the requirements of Log-Pearson III method.

Table 4. Rainfall Plan Log Pearson III Method

No	Year	Xi	Log Xi	$(\text{Log Xi} - \log \bar{X})^2$	$(\text{Log Xi} - \log \bar{X})^3$
1	1998	61,26	1,79	0,0552	-0,0130
2	1999	65,48	1,82	0,0425	-0,0088
3	2000	67,44	1,83	0,0374	-0,0072
4	2001	93,89	1,97	0,0025	-0,0001
5	2002	108,46	2,04	0,0002	0,0000
6	2003	83,59	1,92	0,0100	-0,0010
7	2004	63,25	1,80	0,0489	-0,0108
8	2005	103,49	2,01	0,0001	0,0000
9	2006	98,35	1,99	0,0009	0,0000
10	2007	191,59	2,28	0,0677	0,0176
11	2008	123,24	2,09	0,0047	0,0003
12	2009	97,01	1,99	0,0013	0,0000
13	2010	104,39	2,02	0,0000	0,0000
14	2011	239,93	2,38	0,1281	0,0458
15	2012	96,40	1,98	0,0015	-0,0001
16	2013	146,35	2,17	0,0205	0,0029
17	2014	131,93	2,12	0,0096	0,0009
18	2015	121,66	2,09	0,0040	0,00002
19	2016	110,35	2,04	0,0004	0,0000
20	2017	126,58	2,10	0,0064	0,0005
21	2018	108,87	2,04	0,0002	0,0000
Σ		2343,52	42,47		
$\text{Log}\,\bar{X}$		2,02223	0,14863		

Based on the table above, it can be seen that the scores includes average Log score ($\bar{X}$), standard deviation Log x (Sd) and slope coefficient Log x (Cs):

1. Average score ($\bar{x}$) Log x = 2,02
2. Standard deviation (S_d) log x = 0,15
3. Slope coefficient (Cs) log x = 0,54

Table 5. Return Period Maximum Rainfall

Period (T)	(Average Log X)	Coefficient (G)	Sd log X	Log X Year	Rainfall Plan (mm)
2	2,02	-0,089	0,15	2,01	102,09
5	2,02	0,805	0,15	2,14	138,63
10	2,02	1,325	0,15	2,22	165,62
25	2,02	1,921	0,15	2,31	203,14
50	2,02	2,330	0,15	2,37	233,61
100	2,02	2,713	0,15	2,43	266,36
200	2,02	3,077	0,15	2,48	301,71

Calculate the Run off Coefficient

Based on the existing condition of the canal which has different dimensions, and considering that the location of the canal is between residents' houses and main road, the catchment area is divided into 24 parts.

Table 6. Run Off Coefficient Calculation Results

Location	Large (Km^2)	Coeff. Run Off
1	0,000324	0,0003078
2	0,00042	0,000399
3	0,0003	0,000285
4	0,00076	0,000722
5	0,00044	0,000418
6	0,00026	0,000247
7	0,000855	0,00081225
8	0,000493	0,00046835
9	0,000462	0,0004389
10	0,000442	0,0004199
11	0,00264	0,002508
12	0,000812	0,0007714
13	0,000962	0,0009139
14	0,001813	0,00172235
15	0,000495	0,00047025
16	0,001935	0,00183825
17	0,000528	0,0005016
18	0,00017	0,0001615
19	0,001024	0,0009728
20	0,001395	0,00132525
21	0,000493	0,00046835
22	0,000665	0,00063175
23	0,000406	0,0003857
24	0,00024	0,000228

Calculating Rainfall Intensity

Before looking for canal rainfall intensity, first calculate the time of rain intensity concentration that occurs using the Kirpich formula.

Table 7. Canal Concentration Time (Tc) Calculation

Location	L	S	TC	
			Minute	Hour
1	0,53	0,9434	0,0122	0,0002038
2	0,40	0,8750	0,0101	0,0001689
3	0,59	0,8475	0,0138	0,0002307
4	0,21	0,7143	0,0067	0,0001112
5	0,18	0,8333	0,0056	0,0000931
6	0,70	0,9286	0,0152	0,0002540
7	0,46	0,8696	0,0113	0,0001886
8	0,29	0,8621	0,0080	0,0001326
9	0,38	0,7895	0,0101	0,0001689
10	0,31	0,6452	0,0094	0,0001561
11	0,20	0,1000	0,0137	0,0002283
12	0,26	0,7692	0,0076	0,0001274
13	0,60	0,7500	0,0147	0,0002449
14	0,61	0,8197	0,0144	0,0002397
15	0,63	0,6349	0,0163	0,0002712
16	1,36	0,0956	0,0610	0,0010168
17	0,32	0,0312	0,0308	0,0005132
18	0,25	0,2000	0,0125	0,0002076
19	0,32	0,1562	0,0166	0,0002762

20	0,62	0,0323	0,0506	0,0008437
21	0,56	0,8929	0,0130	0,0002172
22	0,67	0,9701	0,0145	0,0002416
23	0,22	0,0909	0,0153	0,0002549
24	0,27	0,1852	0,0136	0,0002269

Table 8. Rainfall Intensity

Location	Return Period (T)	Rainfall Plan		Rainfall Intensity (I)
		Tc (hour)	Log person III (mm)	Log person III (mm/hour)
1	10	165,62	0,001	5741,725
2	10	165,62	0,001	5741,725
3	10	165,62	0,001	5741,725
4	10	165,62	0,001	5741,725
5	10	165,62	0,001	5741,725
6	10	165,62	0,001	5741,725
7	10	165,62	0,001	5741,725
8	10	165,62	0,001	5741,725
9	10	165,62	0,001	5741,725
10	10	165,62	0,001	5741,725
11	10	165,62	0,001	5741,725
12	10	165,62	0,001	5741,725
13	10	165,62	0,001	5741,725
14	10	165,62	0,001	5741,725
15	10	165,62	0,001	5741,725
16	10	165,62	0,001	5741,725
17	10	165,62	0,001	5741,725
18	10	165,62	0,001	5741,725
19	10	165,62	0,001	5741,725
20	10	165,62	0,001	5741,725
21	10	165,62	0,001	5741,725
22	10	165,62	0,001	5741,725
23	10	165,62	0,001	5741,725
24	10	165,62	0,001	5741,725

Rain Discharge Plan (Qt)

Calculation of rain discharge plan uses a rational method.

Table 9. Rain Discharge Plan (Q_t)

Location	Return Period	Coef. Run off (C)	Rainfall Intensity (I)	Catchment Area (A)	Rain Discharge Plan (Q_t)
	(T)		mm/jam	(Km^2)	(m^3/det)
1	10	0,781	5741,725	0,0003	0,404
2	10	0,781	5741,725	0,0004	0,524
3	10	0,781	5741,725	0,0003	0,374
4	10	0,781	5741,725	0,0008	0,948
5	10	0,781	5741,725	0,0004	0,549
6	10	0,781	5741,725	0,0003	0,324
7	10	0,781	5741,725	0,0009	1,067
8	10	0,781	5741,725	0,0005	0,615
9	10	0,781	5741,725	0,0005	0,577
10	10	0,781	5741,725	0,0004	0,552
11	10	0,781	5741,725	0,0026	3,297
12	10	0,781	5741,725	0,0008	1,014
13	10	0,781	5741,725	0,1010	126,125
14	10	0,781	5741,725	0,0018	2,265
15	10	0,781	5741,725	0,0005	0,619
16	10	0,781	5741,725	0,0019	2,419
17	10	0,781	5741,725	0,0005	0,660
18	10	0,781	5741,725	0,0002	0,213
19	10	0,781	5741,725	0,0010	1,281
20	10	0,781	5741,725	0,0014	1,745
21	10	0,781	5741,725	0,0005	0,617
22	10	0,781	5741,725	0,0007	0,832
23	10	0,781	5741,725	0,0004	0,508
24	10	0,781	5741,725	0,0002	0,300

Table 10. Existing Drain Discharge

Location	L	S	b	h	A	P	R	n	V	Qs
	(m)		(m)	(m)	(m)	(m)	(m)		m/s	m^3/s
1	0,53	0,9434	0,53	0,50	0,27	1,53	0,173	0,013	23,215	6,152
2	0,40	0,8750	0,40	0,30	0,12	1,00	0,120	0,013	17,506	2,101
3	0,59	0,8475	0,59	0,50	0,30	1,59	0,186	0,013	23,036	6,796
4	0,21	0,7143	0,21	0,69	0,14	1,59	0,091	0,013	13,166	1,908
5	0,18	0,8333	0,18	0,23	0,04	0,64	0,065	0,013	11,315	0,468
6	0,70	0,9286	0,70	0,80	0,56	2,30	0,243	0,013	28,903	16,186
7	0,46	0,8696	0,46	0,54	0,25	1,54	0,161	0,013	21,255	5,280
8	0,29	0,8621	0,29	0,37	0,11	1,03	0,104	0,013	15,813	1,697
9	0,38	0,7895	0,38	0,36	0,14	1,10	0,124	0,013	17,029	2,330
10	0,31	0,6452	0,31	0,30	0,09	0,91	0,102	0,013	13,506	1,256
11	0,20	0,1000	0,20	0,08	0,02	0,36	0,044	0,013	3,052	1,256
12	0,26	0,7692	0,26	0,11	0,03	0,48	0,060	0,013	10,292	0,049
13	0,60	0,7500	0,60	0,55	0,33	1,70	0,194	0,013	22,334	0,294
14	0,61	0,8197	0,61	0,57	0,35	1,75	0,199	0,013	23,713	7,370
15	0,63	0,6349	0,63	0,64	0,40	1,91	0,211	0,013	21,730	8,245
16	1,36	0,0956	1,36	0,90	1,22	3,16	0,387	0,013	20,095	8,762
17	0,32	0,0312	0,32	0,41	0,13	1,14	0,115	0,013	3,215	12,357
18	0,25	0,2000	0,25	0,09	0,02	0,43	0,052	0,013	4,813	0,422
19	0,32	0,1562	0,32	0,26	0,08	0,84	0,099	0,013	6,508	0,108
20	0,62	0,0323	0,62	0,12	0,07	0,86	0,087	0,013	2,704	0,541
21	0,56	0,8929	0,56	0,57	0,32	1,70	0,188	0,013	23,834	7,608
22	0,67	0,9701	0,67	0,89	0,60	2,45	0,243	0,013	29,535	17,611
23	0,22	0,0909	0,22	0,31	0,07	0,84	0,081	0,013	4,349	0,297
24	0,27	0,1852	0,27	0,22	0,06	0,71	0,084	0,013	6,332	0,376

Based on rain discharge data and existing canal capacity, it can be compared to know whether the canal capacity is able to accommodate the rain discharge.

Table 11. Comparison of Canal Discharge Capacity with Rainfall Discharge

Area	Discharge		Information	Discharge	Information
	Rain Plan (Qt)	Existing Canal (Qs)		Ideal Canal (Qi)	
1	0,404	6,152	ABLE	6,152	ACCOMMODATE
2	0,524	2,101	ABLE	2,101	ACCOMMODATE
3	0,374	6,796	ABLE	6,796	ACCOMMODATE
4	0,948	1,908	ABLE	1,908	ACCOMMODATE
5	0,549	0,468	NOT ABLE	2,496	ACCOMMODATE
6	0,324	16,186	ABLE	16,186	ACCOMMODATE
7	1,067	5,280	ABLE	5,280	ACCOMMODATE
8	0,615	1,697	ABLE	1,697	ACCOMMODATE
9	0,577	2,330	ABLE	2,330	ACCOMMODATE
10	0,552	1,256	ABLE	1,256	ACCOMMODATE
11	3,297	0,049	NOT ABLE	4,827	ACCOMMODATE
12	1,014	0,294	NOT ABLE U	1,559	ACCOMMODATE
13	126,125	7,370	NOT ABLE	131,837	ACCOMMODATE
14	2,265	8,245	ABLE	8,245	ACCOMMODATE
15	0,619	8,762	ABLE	8,762	ACCOMMODATE
16	2,419	12,357	ABLE	48,915	ACCOMMODATE
17	0,660	0,422	NOT ABLE	0,743	ACCOMMODATE
18	0,213	0,108	NOT ABLE	0,226	ACCOMMODATE
19	1,281	0,541	NOT ABLE	1,474	ACCOMMODATE
20	1,745	0,201	NOT ABLE	1,919	ACCOMMODATE
21	0,617	7,608	ABLE	7,608	ACCOMMODATE
22	0,832	17,611	ABLE	17,611	ACCOMMODATE
23	0,508	0,297	NOT ABLE	0,542	ACCOMMODATE
24	0,300	0,376	ABLE	0,376	ACCOMMODATE

5. CONCLUSION

Based on the analysis of planned flood in Ceger Pump House area using daily rainfall data from STA Bekasi, STA Halim, and STA Bogor, it was found that planned rainfall discharge for the 10 years return period with Log Pearson III analysis was 165.62 mm. Then, it was found that canal 5 has the ability to accommodate rain discharge of 0.468 m3 / s < 0.549 m^3/s ; Canal 11 has the ability to accommodate rain discharge of 0,049 m^3/s < 3,297 m^3/s ; canal 12 has the ability of0,294 m^3/s < 1,014 m^3/s ; canal 13 has the ability of 7,370 m^3/s < 126,125 m^3/s ; canal 17 has the ability of 0,422 m^3/s < 0,660 m^3/s ; canal 18 has the ability of 0,108 m^3/s < 0,213 m^3/s ; canal 19 has the ability of 0,541 m^3/s < 1,281 m^3/s ; canal 20 has the ability of 0,201 m^3/s < 1,745 m^3/s ; canal 23 has the ability of 0,297 m^3/s < 0,508 m^3/s. The calculation shows that these cannales can't accommodate rainfall discharge that happened. By making changes to the dimensions of the canal, the ideal canal discharge for canals 5, 11, 12, 13, 17, 18, 19, 20, 23 should be respectively 2,496 m^3/s ; 4,827 m^3/s ; 1,559 m^3/s ; 131,837 m^3/s ; 0,743 m^3/s ; 0,226 m^3/s ; 1,474 m^3/s ; 1,919 m^3/s ; 0,542 m^3/s.

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