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Feasibility Study of Drainage System Outline Plan in Curup District, Rejang lebong Regency

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ABSTRACT

The purpose of this study is to determine the feasibility of the *drainage system outline plan* based on the Regulation of the Minister of Public Works and Public Housing (PUPR) number 14 of 2018 in Rejang Lebong Regency, especially in Curup District. Based on the results of the feasibility test analysis of the *drainage system outline plan* in Curup District, it was found that the condition of the drainage system was categorized as feasible. Waterlogging that often occurs due to closed drainage channels and buried in soil. Then, in the category of infrastructure and wastewater treatment facilities are declared infeasible because based on the outline conditions the capacity of drainage channels amounting to 0.0417186 m^3/s cannot accommodate dirty / waste discharge originating from population activities, which is 56,442,2006 m^3/sec.

Introduction

The development of a residential area must be followed by the arrangement of a drainage system. According to the regulation of the Minister of Public Works No. 12 of 2014 article 1 paragraphs 3-5 states that the definition of a drainage system is a unity of technical and non-technical systems of drainage facilities and infrastructure in an area. Drainage infrastructure is a water channel, both above the surface and below the ground surface, and drainage facilities are complementary buildings, namely all buildings that participate in regulating and controlling the water flow system [1].

The arrangement of a good drainage system is one that can accommodate water disposal as much as possible, so that if the water discharge is more than expected, the drainage system can still accommodate and drain water. In addition, drainage also serves to reduce soil erosion and distribution by increasing infiltration into the soil. This has also been stated in the Regulation of the Minister of Public Works and Public Housing (PUPR) Number 14 of 2018 concerning the Prevention and Improvement of the Quality of Slum Housing and Slum Settlements. Indicators that have been determined in the assessment of a good settlement, including: environmental roads, environmental drainage, provision of clean / drinking water, clean water and wastewater management, fire security, and public open spaces [2].

One of the residential areas with complete buildings but poor drainage systems is located in Curup District, Rejang Lebong Regency, so. Based on field observations, several roads in Curup District experience inundation every rainy season arrives. Although there is only inundation and there is no flooding like in other areas, the puddle also disturbs motorists and can damage the road. According to Ramdani *et al.*, (2022) Puddles can cause road damage because water can loosen the bond between aggregate and asphalt. In addition, almost all household wastewater is discharged directly into micro-drainage channels as well as into other open channels. This condition results in reduced capacity so that inundation and groundwater pollution become very large.

To overcome this, planning is needed in the form of drafting a drainage system concept with a detailed survey such as data and working drawings of the drainage system on *outline plan* So that the concept planning is in accordance with the needs of the field. Thus, an effort to improve drainage system services in Rejang Lebong Regency, especially in Curup District, is to make a comprehensive and integrated drainage system plan. As research has been conducted by Merlindo *et al.*, (2022) in designing the form of technical construction and

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closed drainage system in Kelurahan Pelabuhan Baru, Rejang Lebong Regency. The results of the design have not yet been tested for the feasibility of planning a drainage system. This study aims to conduct due diligence *outline plan* drainage system in Curup District, Rejang Lebong Regency which is adapted to regional spatial planning, urban development and population growth.

Literature Review

Understanding Drainage

Drainage is a system intended to deal with the problem of excess water that is not needed in the form of water flowing above the ground surface or below the ground surface. According to Suripin (2004) in the journal Saidah *et al.*, (2021) Drainage comes from the word *drainage* which means to dry or throw away. Excess water can be sourced from rain runoff (*excess rainfall*) or comes from wastewater from settlements.

The function of drainage is as a means of sanitation to prevent stagnant water that interferes with the comfort and health of the environment and as a means of preventing flooding. Residential areas often experience flooding due to the failure of drainage channels to remove excess water. In addition, high rainfall is not offset by adequate channel capacity or even covered by garbage.

Types of Drainage

Drainage by its construction is divided into [5] :

1. Open channel, is a drainage channel that drains waste water or rainwater built without a channel cover. This channel can be used in areas that are not very densely populated. The advantage is that it is easy to maintain the channel. But there are also disadvantages, namely the ease of solid overflow or garbage polluting the channel
2. The channel is not open, the purpose of the channel is to drain dirty water that interferes with environmental health. Such channels are usually found in the downtown area, trade and main roads of the city. Channel closures also serve for the safety of road users and the aesthetics of the city.

Drainage System Maintenance

Maintenance of drainage systems can be categorized into:

1. Regular maintenance, in the form of continuous maintenance activities throughout the year of the building's useful life.
2. Maintenance is carried out periodically covering the sequence.
3. Emergency maintenance is limited to revision, while channels or building accessories to be handled physically have the potential to cause the system to not function optimally and is dangerous for humans, goods, property, and other infrastructure [6].

Research Methods

Place and time of study

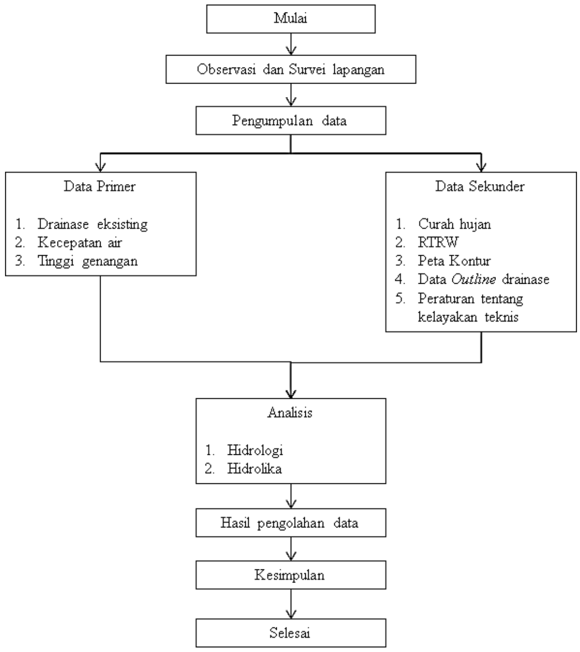

Figure 1. Research Flow Chart

The picture above is the stage of the process that will be carried out in this study. This research was conducted in Curup District, precisely on Jalan Ahmad Marzuki, Jalan Santoso, and Jalan Basuki Rahmat, Rejang Lebong Regency, Bengkulu Province.

Hydrological Analysis

This analysis is used to obtain the characteristics of rain. The rainfall data for the last 10 years was obtained from rainfall stations around Rejang Lebong Regency, namely BMKG Kepahiang Station, BMKG Mojorejo Station, and BMKG Musikejalo Station from 2012 to 2021.

1. Frequency Distribution Analysis

Frequency distribution analysis is carried out to obtain the amount of design rainfall determined based on certain design benchmarks. To obtain design rainfall with a certain recurrence period, several distribution methods can be used, namely:

a. Normal Method Frequency Distribution

$$P(t) = \frac{1}{\sigma\sqrt{2\pi}} . e^{\frac{-1}{2}t^2} \quad \text{...... (1)}$$

$$t = \frac{X - \mu}{\sigma} \quad \text{...... (2)}$$

Information:

P(t) = Normal probability density function (normal curve ordinate)

π = 3,14156

e = 2,71828

X = continuous random variables

t = average of X values

σ = standard deviation from the value of X

b. Normal Log Method Frequency Distribution

The Normal Log distribution is the result of the transformation of the normal distribution by converting the variance value X into a logarithmic value. The equation used is:

$$\text{Log X} = \overline{\text{log X}} + k.S\overline{\text{log X}} \quad \text{......... (3)}$$

Information:

Log X = the expected variate value X occurs at a given recurrence opportunity or period

$\overline{\text{Log X}}$ = average X value of observations

S $\overline{\text{Log X}}$ = standard deviation from logarithmic variate value X

k = characteristic of a normal log distribution. The value of k can be obtained in a table that is a function of cumulative odds and repeat periods.

c. Frequency Distribution of E.J Gumbel Method

The equation of E.J Gumbel's method is as follows:

XT = X + K . Sd ....(4)

Information:

XT = The extrapolated variate is the amount of design rainfall for a given recurrence period.

X = Average price of rainfall

$$\overline{X} = \frac{\sum_{i=1}^{n} X_i}{n} \quad \text{...... (5)}$$

Where Sd is the Standard Deviation

$$Sd = \sqrt{\frac{\sum_{i=1}^{n}(X_i - \overline{X})^2}{n-1}} \quad \text{...... (6)}$$

Information:

X = Average rating

Xi = variate value to i

n = amount of data

K = Frequency factor which is a function of the return period and the type of frequency distribution [7].

d. Frequency Distribution of Pearson Type III Log Method

The recommended method in using the Pearson Type III Log distribution is to convert data series into logarithmic form.

$$\overline{LogX} = \frac{\sum \log X}{n} \quad \text{......... (7)}$$

Standard Deviation:

$$Sd = \sqrt{\frac{\sum_{i=1}^{n}\left(\text{Log } X_i - \overline{\text{Log X}}\right)^2}{n-1}} \quad \text{........ (8)}$$

Information:

X = precipitation (mm)

$\overline{LogX}$ = Log X mean

K = frequency factor

Rainfall data that has been analyzed using the four methods above then the rainfall that occurs is checked again using the following conditions:

Table 1. Terms of Distribution Type

Types of Distribution	Condition
Usual	Cs = 0 Ck = 0
Gumbel	Cs 1.1396≤ Ck 5.4002≤
Log Pearson	Cs 0≠
Log Normal	Cs = 3Cv + Cv2 = 0.3

[8]

2. Fit Test

To determine the distribution pattern and average discharge that best matches the statistical distribution that has been carried out, a fit test is carried out. The fit test is used to test and select the best method for subsequent calculations. This test is carried out on rainfall data by taking into account the frequency of rainfall. The parameter test used is the Chi-Squared test.

a. Chi Square Test

The Chi-Squared test is used to test the observation distribution, whether the sample meets the conditions of the distribution being tested or not. Here are the steps for calculating the Chi-Squared Test:

Counting the number of classes:

K = 1+3,322 log n ....(9)

Information:

K = number of classes

n = Amount of data

Finding the amount of rainfall that falls within the class limit can be calculated by the equation below:

$$X2 = \Sigma 2 \frac{(Oj-Ej)^2}{Ej} \quad ...... (10)$$

Information:

X2 = Chi-Squared parameter calculated
K = number of classes
Oj = frequency of class observations
Ej = theoretical frequency of class [9].

3. Rainfall Intensity Analysis

Rain intensity is the amount of rain expressed in terms of the height of rain or the volume of rain per unit of time. Rainfall intensity can be calculated using Mononobe's equation:

$$I = \frac{R_{24}}{24}\left(\frac{24}{t}\right)^{2/3} \quad .... (11)$$

Information:
I = rain intensity (mm/hour)
t = lamamya rain (hours)
R24 = maximum daily precipitation (for 24 hours)(mm) [10].

4. Plan Discharge Coefficient

Before the cross-sectional dimension design of the drainage channel, a discharge (Q) of the runoff water plan is needed to be flowed later. With the hope that the planned drainage channel will be able to accommodate the amount of runoff water discharge (Q) that burdens the channel. The method used to calculate the discharge (Q) derived from rainwater runoff in this study is a rational method because the drainage area has an area smaller than 0.80 km2. The formula for finding the planned discharge is:

$$Q = \frac{1}{3,6} C.I.A \quad ...... (12)$$

Information:
Q = Discharge (m^3/sec)
C = Drainage coefficient (the value of the drainage coefficient is taken in the table of values based on ground surface conditions)
I = Rain intensity for a certain repeat period (mm/hour)
A = Area to be irrigated (km^2)[11]

Hydraulics Analysis

This analysis is carried out to determine the capacity of a drainage channel that is used as a comparison of modeling discharge that overloads the drainage channel.

1. Channel Cross-section

To plan the dimensions of the drainage channel, the following formula is used:

a. Square cross-sectional shape

Area (A): A = b.h .... (13)

Wet circumference (P): P = b+2.h ..... (14)

Hydraulic radius (R): $R = \frac{b.h}{b+2.h}$...... (15)

Peak width (T): T = b ..... (16)

Hydraulic (D): D = h ...... (17)

Cross-sectional factor (Z): $Z = b.h^{1,5}$ .. ... (18)

b. Trapezoidal cross-sectional shape

Area (A): A = (b+z.h)h ...... (19)

Wetcircumference(P): $P = b + 2.h\sqrt{1+z^2}$ (20)

Hydraulic radius (R): $R = \frac{(b+z.h)h}{b+2.h\sqrt{1+z^2}}$... (21)

Peak width (H): $T = b + 2.z.h$ (22)

Hydraulic Depth (D): $D = \frac{(b+z.h)h}{b+2h.z}$ (23)

Cross-sectional factor (Z): $Z = \frac{(b+z.h)h)^{1,5}}{\sqrt{b+2z.h}}$ (24)

2. Flow Speed

The flow speed must be taken into account so that it is not too high and not too slow. When the flow speed is too high, water can shorten the cross-sectional life of the channel. Meanwhile, if the flow is too low, it will result in sediment deposited carried by water and the growth of nuisance plants. The calculation of the flow velocity on the open flow uses the formula below:

Manning's formula:

$V = R1/n^{2/3}$. S1/2 ...... (25)

Information:
V = Average flow speed in line (m/sec)
n = Manning roughness coefficient
R = Hydraulic radius of the channel (m)
S = channel base slope [12].

3. Drainage Channel Capacity

The capacity of the drainage drainage can be determined by the following formula:

Q = V.A ... (26)

Information:
Q = in-line flow discharge (m^3/sec)
V = in-line flow velocity (m/sec)
A = wet cross section of channel (m^2) [13]

Technical Due Diligence

After the analysis of hydrological and hydraulics data, the next stage is a technical feasibility test using the Regulation of the Minister of Public Works and Public Housing (PUPR) of the Republic of Indonesia number 14 / PRT / M / 2018 with the following assessment criteria:

Table 2. Assessment Criteria Technical Feasibility Test Outline *Plan* Drainage System [14]

No	Aspects	Criterion
1.	Building Condition	a. Building irregularity b. Building density c. Non-compliance with the technical requirements of the building
2.	Building (environmental road conditions)	a. Coverage of environmental road services b. Environmental road surface quality
3.	Environmental roads (drinking water supply conditions)	a. Availability of safe access to drinking water b. Unmet drinking water needs
4.	Drinking water supply (environmental drainage conditions)	a. Inability to drain water runoff b. Unavailability of drainage c. Quality of drainage construction
5.	Environmental drainage (wastewater management conditions)	a. Wastewater management system does not comply with technical standards b. Wastewater management infrastructure and advice not in accordance with technical requirements
6.	Wastewater management (waste management conditions)	a. Waste infrastructure and facilities are not in accordance with technical requirements b. Waste management systems that do not comply with technical standards
7.	Waste management (waste protection conditions)	a. Unavailability of fire protection infrastructure b. Unavailability of fire protection facilities

[14]

Results and Discussions

Hydrological Analysis

Hydrological analysis is carried out to determine the maximum rainfall that occurs at the study site and the amount of planned discharge that affects the dimensions and construction built.

1. Rainfall Data

Rainfall data was obtained at 3 rainfall stations around Rejang Lebong Regency, namely BMKG Kepahiang Station, BMKG Musi Kejalo Station, and Mojorejo Station. The rainfall data used in this study is rainfall data for the last 10 years, namely 2012-2021 which can be seen in Table 3.

Table 3. Rainfall Data of Rejang Lebong District

No	Year	Maximum Daily Rain			Average Daily Max Rain
		Kepahiang	Musikejalo	Mojorejo	
1	2012	112	90,5	7	209,5
2	2013	160	64,5	69,8	294,3
3	2014	86	104,9	415	605,9
4	2015	65	71	374	510
5	2016	90,5	27	38,8	156,3
6	2017	92	79,5	31	202,5
7	2018	79,5	40,05	347	466,55
8	2019	120,5	44,7	124	289,2
9	2020	98,5	24	93,6	216,1
10	2021	94,2	17	72,3	183,5
Sum		**998,2**	**563,15**	**1572,5**	**3.133,85**
Average		**99,82**	**56,315**	**157,25**	**313,385**

2. Distribution Frequency Analysis

The calculation of the maximum daily rain data frequency analysis in this study used the distribution methods of Normal, Log Normal, Gumbel, and Log-Pearson Type III. This is because Curup District is included in the category of small cities with a catchment area of more than 359 Ha. To calculate the discharge with a certain repeat period, a maximum rain with a certain repeat period is also required. Maximum rain is also called planned rain.

Table 4. Rainfall Analysis

Birthday	Rainfall Frequency Analysis			
	Usual	Log Normal	Gumbel	Log Pearson III
2	3313,385	0,397	334,692	0,4020
5	33.265,59	0,426	3498,641	0,4274
10	33.334,78	0,441	3876,89	0,4378
25	33.391,39	0,453	8883,51	0,4471
50	33.455,9325	0,466	11.113,315	0,4522
100	33.499,9625	0,474	13.327,395	0,4563
$\bar{X}$	**313,385**	**313,385**	**313,385**	**313,385**
Sd	157,25	0,21	157,25	0,21

a. Normal Distribution Calculation

From the analysis of the data above, it was obtained $\bar{X}$ = 313.385

Standard Deviation is calculated using equation 6 which yields = 157.25

Rainfall analysis of normal distribution plan:

For T = 2 Years

KT = 0.00

XT = 3313.385 mm

b. Normal Log Distribution Calculation

From the data above, obtained the value X = 24.960 / 10 = 2.496
Standard deviation = 0.21

Precipitation analysis of Normal Log Distribution plan:
For T = 2 Years
KT = 0.00
XT logs = 2.496 mm
X2 = antilogue 2.496 = 0.397
X5 = antilogue 2.6724 = 0.426
X10 = antilogue 2.7648 = 0.441
X25 = antilogue 2.8404 = 0.453
X50 = antilogue 2.9265 = 0.466
X100 = antilogue 2.9853 = 0.474

c. E.J Gumbel Distribution Calculation

Analysis of the rain plan of the Gumbel Distribution using equation 4.
K = -0.1355
X2 = 334.692 mm
X5 = 3498.641 mm
X10 = 3876.89 mm
X25 = 8883.51 mm
X50 = 11,113.315 mm
X100 = 13,327,395 mm

d. Pearson III Log Distribution Calculation

From the data above, obtained X = 2.496 and standard deviation = 0.21. Coefficient of astonishment (G) = -0.286

Bulk analysis of the Pearson III Log Distribution plan:
For T = 2 Years
KT = 0.132
Log XT = 2.52372 mm
X2 = antilogue 2.52372 = 0.4020
X5 = antilogue 2.67576 = 0.4274
X10 = antilogue 2.74086 = 0.4378
X25 = antilogue 2.80008 = 0.4471
X50 = antilogue 2.83326 = 0.4522
X100 = antilogue 2.85993 = 0.4563

The results of the analysis of the four methods are:

Table 5. Recapitulation of Maximum Rainfall Value

Reset Period	Usual	Log Normal	Gumbel	Log Pearson III
2	157,25	87,58	135,96	87,58
5	289,17	256,83	323,41	256,83
10	358,28	451,20	447,50	451,20
25	432,09	823,74	604,34	823,74
50	479,21	1209,63	720,67	1209,63
100	523,18	1731,37	836,15	1731,37

3. Rainfall Intensity Analysis

Analysis of rainfall intensity is used to determine the height of rainfall that occurs at a time when the water is concentrated to give a picture of the heavy rain per hour. The existing rainfall data is in the form of point rain, so the analysis method used in this study is the Mononobe method. The results of the analysis of rainfall intensity in duration t = 24 using equation 11 are as follows.

R2 = 3.65
R5 = 10.70
R10 = 18.80
R25 = 34.32
R50 = 50.40
R100 = 72.14

4. Conformity Test with Chi Squared

The fit test with the Chi Squared method is used to test the vertical deviation whether the observation frequency distribution is acceptable to the theoretical distribution or whether the sample qualifies the tested distribution or not. This test is carried out on rainfall data that has been analyzed by taking into account the frequency of rainfall.

Table 6. Chi Square Test Calculation Results

No	Group intervals	Amount of data (Oi)	Ei	$(Oi-Ei)^2$	$(Oi-Ei)^2/Ei$
1	X <188.0234	2	2,5	0,25	0,1
2	188.0234 < X< 313.385	5	2,5	2,25	0,9
3	313,385<X<438.7466	0	2,5	0,25	0,1
4	X > 438.7466	3	2,5	0,25	0,1
	Sum	**10**	**10**	**3**	**1,2**

From the table above, it can be seen that the distribution equation obtained X_T = 1.2 with degrees of freedom:
dk = 2

Based on the critical values for the Chi-Squared test in table appendix 7, it is known that if the probability is >5%, then the distribution equation used is acceptable. So it is known = 0.05 with R = 3, obtained $X\alpha^2$ = 7.815. From the results of these calculations, X2 > XT = 7.815 > 1.2. So that the maximum daily rainfall with the Gumbel method is acceptable.

Table 7. Chi Square Test Calculation Results of Log Pearson III Method

No	Group intervals	Amount of data (Oi)	Ei	$(Oi-Ei)^2$	$(Oi-Ei)^2/Ei$
1	X <256.83	5	2,5	6,25	2,5
2	256.83< X<	3	2,5	0,25	0,1

3	451.20 451.20< X<823.74	2	2,5	0,25	0,1
4	X > 1209.63	0	2,5	-0,25	-0,1
	Sum	**10**	**10**	**3**	**2,6**

From the results of the analysis above, it was obtained = 2.6 with degrees of freedom (dk) = 2. Based on the table = 5%, the value $\lambda_h^2 \alpha \lambda$ 2 = 7.815.from the calculation results obtained 2 > = 7.815 > 2.6, so that the Pearson Log III distribution equation can be used.λ λ_h^2

5. Plan Discharge Coefficient

The intensity of rainwater and the intensity of dirty or waste water that has been calculated are then analyzed again to obtain the capacity of the drainage channel. Plan discharge or design discharge is rainwater discharge plus dirty water discharge.

a. Discharge Due to Rainfall

The drainage coefficient is based on physical factors, so for flat areas the smallest value of the drainage coefficient (C) is taken and for slope areas the largest value is taken. Because the condition of the ground surface at the study site is flat and paved, the smallest value of drainage coefficient is taken. The results can be seen in the table below.

Table 8. Flow Coefficient

Types of Land Use	C	A	C.A
Public	0,70	0,4	0,28
	0,70	0,049	0,0343
	0,70	0,021	0,0147
Total		**0,47**	**0,329**

CDAS = 0.70
Q2 = 0.289 m^3/sec
Q5 = 0.849 m^3/sec
Q10 = 1.491 m^3/sec
Q25 = 2.722 m^3/sec
Q50 = 3.999 m^3/sec
Q100 = 5.909 m^3/sec

Table 9. Results of Rational Method Calculation

Birthday	R (mm)	T (Hours)	I (mm/h)	A (m2)	Q (m3/sec)
2	87,58		30,40		0,289
5	256,83		89,13		0,849
10	451,20		156,59		1,491
25	823,74	0,167	285,74	0,049	2,722
50	1209,63		419,80		3,999
100	1731,37		620,27		5,909

b. Discharge Due to Resident Waste

1) Population Growth Calculation

According to data from the Central Statistics Agency (BPS) of Rejang Lebong Regency, the population in Curup District in 2021 when planning began was 27017 people. Population growth must also be taken into account to calculate the water needs of each resident, from the water needs of each resident, it can be known the amount of wastewater caused by households.

a) Growth Geometry

Based on geometric growth calculations, the geometric population growth rate in Curup District per year is 0.0017 or 0.17 percent.

b) Exponential Growth

Based on exponential growth calculations, the estimated population of Curup District in 2021 is 45.9289 people.

2) Calculation of Gross Discharge/Resident Discharge

The discharge of dirty water or wastewater comes from the activities of residents in Curup District. In this area, especially at the research locations, namely Jalan Ahmad Marzuki, Jalan Santoso, and Jalan Basuki Rahmat, there are no factories or public buildings that cause an increase in wastewater discharge other than from the household itself.

To estimate the amount of water should be known in advance the average water requirements and the number of inhabitants of the city. In this study, dirty water discharge came from the calculation of dirty water per inhabitant, which was 56,442,2006 m^3 / sec.

Hydraulics Analysis

This stage is also the basis for determining the *outline plan for the* drainage system of Curup District, Rejang Lebong Regency.

1. Channel Cross-section

Based on observations of several roads that became research locations in Curup District, there is one research area that often experiences problems in drainage channels, namely on Ahmad Marzuki road as shown in Figure 2.

Figure 2. Cross-section of the right channel of Ahmad Marzuki street

Figure 3. Cross-section of the left channel of Ahmad Marzuki street

This area is inundated due to the large discharge from the north which has a higher contours. This area does not yet have a proper drainage channel because there is a left channel that is buried in soil and a closed right channel that causes channel blockage and causes abundant water to the road body.

2. Water Flow Speed

After analyzing the cross-section of the channel in the drainage system *outline plan*, the next stage is to analyze the flow velocity that must be calculated so that it is not too high and not too slow and so that the cross-section of the drainage system channel can be designed properly sediment carried by water and the growth of disturbing plants.

The calculation of the flow velocity on open flow is used the formula below:
Cross-sectional area (A) = 0.049 m^2
Wet circumference (P) = 0.84 m
Hydrolysis radius (R) = 0.058 m
The flow velocity is calculated using equation (25) obtained V = 0.8514 m/s

3. Drainage Channel Capacity

After obtaining the flow speed in the designed channel cross-section, the next stage is to calculate the channel capacity using equation 26 with the result = 0.0417186 m^3/s

Technical Due Diligence

After obtaining the results of hydrolysis and hydraulics analysis, the next is a technical feasibility test to find out whether the design of the *drainage system outline plan in* Curup District, Rejang Lebong Regency is in accordance with the Regulation of the Minister of Public Works and Public Housing (PUPR) of the Republic of Indonesia number 14 / PRT / M / 2018. The results of the technical feasibility test analysis can be seen in the table below.

Table 10. Technical Feasibility Test *System Outline* PlanCurup District, Rejang Lebong Regency

Province	= Bengkulu	Area SK	= 6.21 Ha
Kab./City	= Rejang Lebong/Curup	Verification Area	= 6.21 Ha
District	= Curup	Population	=26,971inhabitants
Area	= Ahmad Marzuki Street		

Aspects of criteria	Criterion	Parameters	Existing Conditions	Outline Conditions	Feasibility	
					Proper	Not worth it
Environmental road conditions	Coverage of environmental road services	25%-50% of the area is not served by the neighborhood road network	Neighborhood roads with dense areas of settlements are often passed by freight transport	Densely populated residential areas served by the neighborhood road network	√	
	Environmental road surface quality	51-75% of areas have poor road surface quality	Some areas have poor road surface quality with potholes and uneven road surfaces resulting in puddles	The area has a road surface that meets the criteria of a good road surface	√	
Environmental drainage conditions	Inability to drain water runoff	25%-50% of the area is inundation > 30 cm,> 2 hours >2x a year	Closed drainage channels and buried soil resulted in waterlogging on neighborhood roads with a height of ± 20 cm	Able to drain water runoff with a drainage channel capacity of 0.0417186 m3/s	√	
	Unavailability of drainage	25%-50% of the area is not available environmental drainage	The right area of the road has a closed drainage channel and the left area of the road has a drainage channel that is buried in the soil	There are drainage channels on the left and right sides of the road that meet the standard criteria	√	

Province	= Bengkulu	Area SK	= 6.21 Ha
Kab./City	= Rejang Lebong/Curup	Verification Area	= 6.21 Ha
District	= Curup	Population	=26,971inhabitants
Area	= Ahmad Marzuki Street		

Aspects of criteria	Criterion	Parameters	Existing Conditions	Outline Conditions	Feasibility	
					Prope r	Not worth it
	Quality of drainage construction	25%-50% of areas have poor environmental drainage construction quality	A1 = 75.5030 m2 A2 = 60.753 m2 P = 1582 m	A = 0.4 m2 P = 1.8 m	√	
Wastewater management conditions	Wastewater management system does not comply with technical standards	25%-50% wastewater system area that does not comply with technical standards	The wastewater system is drained through pipes connected to drainage channels	Wastewater per resident as much as 56,442,2006 m^3/sec		√
	Wastewater management infrastructure and facilities are not in accordance with technical requirements	25%-50% of areas have wastewater sarpras not in accordance with technical requirements	Wastewater from residents' homes is channeled centrally into drainage channels	Wastewater per resident as much as 56,442,2006 m^3/sec		√
Waste management conditions	Waste infrastructure and facilities are not in accordance with technical requirements	51%-75% of areas have waste management sarpras that do not meet technical requirements	There is no garbage collection point in the surrounding environment because residents collect directly to the garbage collector	Have a waste management sarpras that meets the requirements technical	√	
	Waste management systems that do not comply with technical standards	51%-75% of areas have non-compliant waste systems	Residents dispose of garbage by collecting it directly to the garbage collector and transported to the landfill	Have a waste management sarpras that meets the standards technical	√	

Conclusion

Based on the results of the analysis that has been carried out on the feasibility research *of the drainage system outline plan* in Curup District, it can be concluded that:

1. The condition of the drainage system is zoned feasible. Ahmad Marzuki Street, Santoso Street, and Basuki Rahmat Street are not in areas prone to floods and landslides. Waterlogging that often occurs due to closed drainage channels and buried in soil.
2. Wastewater treatment infrastructure and facilities are declared inadequate because based on the outline conditions the capacity of drainage channels amounting to 0.0417186 m^3/s cannot accommodate dirty discharge / waste originating from population activities which is 56,442,2006 m^3/sec.

Suggestion

Based on the conclusions above, some suggestions are recommended as follows:

1. It is necessary to carry out sediment dredging and maintenance periodically to minimize the occurrence of blockages in drainage channels.
2. Replanning can be done by changing the dimensions of flooded channels.
3. The government can create infiltration wells in residential areas to reduce the occurrence of water runoff into the channel. Making inlets is also needed to accommodate and channel rainwater runoff along the road so that it can flow into drainage channels.

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