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Drainage System in Humanist Open Space, Lunggi Park, Sambas City

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Abstract. A humanist open space area will not be implemented if it leaves some important segments in society such as parents, children, women and people with special needs. Integration of green infrastructure is needed to optimize open space area values. Public facilities and infrastructure especially for people with disabilities must meet four principles and criteria which include easiness, usefulness, safety and independence. Lunggi Park is one of the open space areas that are still not accessible for all people. Its drainage channel has a huge role in controlling water runoff in Lunggi Park. The research was concentrated in designing drainage system for Lunggi Park to construct a suited facilities and infrastructure for parents, children, women and people with special needs. This research also employed hydrological and hydraulic analysis in collecting prime and secondary data. The highest rainfall in 2008 was 192 mm. The processing of rainfall data using Gumbel Type I Method obtained a maximum discharge of a 2-year return period of 0,0445, a 5-year return period of 0,0569, a 10-year return period of 0,0649, a 20 year return period of 0,0728 and for a 25 year return period of 0,0744. Based on this result, the facilities and infrastructure of Lunggi Park should be arranged. The channels that do not function optimally is in spot one, two and four. Therefore, it is necessary to arrange new dimensions for these spots. Channel in 1st spot was designed to be square with 1,10 meters wide and 0,91 meters high. Channel in 2nd spot was designed to be square with 1,40 meters wide and 0,76 meters high. Channel in 3rd spot designed to be square with 1,55 meters wide and 0,68 meters high.

Keywords: Drainage System, Open Space Area, Humanist, Lunggi Park, Sambas City.

INTRODUCTION

Sambas City has a strategic location in the capital of Sambas Regency which borders directly with Malaysia. Sambas City does not yet have a proper open public space that are accessible to the community. Lunggi Park can contribute to the needs of public open space provision standards in Sambas City. Lunggi Park as an open space, has a condition that has not been managed and functioned optimally.

The image of a city is entirely determined by its citizens. Humanist city is a City that provides facilities and infrastructure that serves for women, children, the elderly and people with disabilities [1]. Open space area is a space that is planned to provide gathering areas, relaxing areas and other socio-cultural activities in the public. Public open space area has a function of gathering and communicative society, as a social binding to create interaction between groups of people [2].

Public facilities must be accessible. The obstacles in realizing the accessible public facilities include lack of knowledge from the users on diffable accessibility reference and lack of understanding towards people with disabilities has affected their needs [3]. Open space area must be democratic, friendly and responsive. Therefore, it can be enjoyed by all members of the community physically and visually [4]. Humanist design is applied by fostering the ability to empathize with users, enhancing concepts, imagining multisensory and facilitating the ability to think and design more holistically [5]. Moral and humanist accessibility criteria for guidelines and provision of access to facilities and infrastructure for parks include [6]:

1. Convenience means that everyone can reach all places that are common in a building.

2. Usability means that everyone must be able to use all the places or buildings that are common in an environment.
3. Safety means that every public place in a built environment must pay attention to the safety of all people.
4. Autonomy means that everyone must be able to reach, enter and use all the places or buildings that are common in an environment without the need for help from others.

Management in land use in these days is completed with a multifunctional infrastructure approach. The concept is being widely discussed as a personification of a livable city. Multifunctional infrastructure is realized by integrating green and blue elements. Therefore, it benefits the environment, economy, health, and society [7]. Humanist open spaces area that can be accessed by all groups are supported by good drainage planning. The key to this concept is managing rainwater run off by utilizing open spaces or parks that can provide hydraulic functions and improve all ecosystem services. Open space area is used for ecological and hydraulic connectivity that circulates surface water as naturally as possible. The humanist approach involves elements of the world as it is by shifting from passive towards active, participatory, democratic and inclusive condition. Humanist thought recognizes that humans are not only in certain groups, but more rational to other involved in it [8].

Urban physical development often ignores environmental sustainability. River and coastal flood in urban areas indicate the need for a good rainwater run-off system. One of the city's infrastructure closely related to the humanist element is the drainage channel. Drainage system is created to deal with the problem of excess water both above the surface of the land and below the surface of the ground [9]. Planning a sustainable drainage system with the principle of maintaining the natural flow mechanism needs to be applied to urban parks [10].

Poor drainage function in the park can cause the floor becoming slippery and muddy. As a consequence, it can interrupt visitor accessibility. The drainage functions are as follows [11]:

1. Freeing an area from water puddle, erosion and flooding.
2. Reducing environmental health risks due to water discharge flow.
3. The function of dense residential land will be better because it is protected from moisture.
4. Minimizing damage to soil structures for roads and other buildings.

The channel dimension is an important factor in the structure of drainage channels. The right dimension can optimize the function of drainage channels in open spaces so that multifunctional infrastructure can be realized with the integration of green and blue elements. The integration of green and blue elements will create a humanist open space that can be accessed safely and comfortably for all groups.

This research provides direction in structuring drainage of Lunggi Park as a Humanist Open Space. The design of humanist open space area will not be carried out if it leaves important segments in society such as parents, children, women and people with special needs. City parks and drainage canals become an important contribution to public services, especially in the social sector. The drainage channel plays a role in protecting the park from puddles and flooding in order to create a comfortable condition for visitors. In this context, standing water on the garden floor or other public facilities reflects the suboptimal drainage function as a channel for surface runoff. it is different in context from other fields of water conservation such as irrigation which functions the other way around.

METHODOLOGY

Lunggi Park is in 109o19’24,8”E 01o21’53,5”N beside Development Road and Sukaramai Road. Lunggipark contributes to the fulfillment of public open space provision standards in Sambas City. Lunggi Park has a strategic role in creating environmental harmony in the central area of the Sambas Regency Government. Lunggi Park, as an open space area, has a condition that has not been arranged and functions optimally. Lunggi Park is currently not becoming the main destination of the community as a place for gathering activities in Sambas City, because it does not have infrastructure that is friendly to children, the elderly, women and people with special needs yet. The existing drainage channels are not functioning optimally, some spots are still having puddles which results in uncomfortable conditions for visitors. The recreational needs of residents are carried out outside Lunggi Park due to minimal tourist attractions inside Sambas City.

Data collection techniques in this research consisted of primary and secondary data collection techniques. Primary data collection techniques included observation of rainfall data. Observations in this study were carried out at the inventory stage of infrastructure availability at Lunggi Park. The method of observation was structured non-participant observation. Observations were also conducted to identify the characteristics of existing drainage channels.

Rainfall data processing was performed to determine the intensity, duration, frequency and time series of rain so that affected maximum runoff. Maximum water runoff can affect the design of drainage channels and optimize by rational method. The rational method was the simplest approach to estimate the maximum runoff based on rainfall and land use characteristics of the catchment area [16]. Secondary data collection techniques included literature review from open space area regulation and agency observation. Broadly speaking the research method can be described in the chart below.

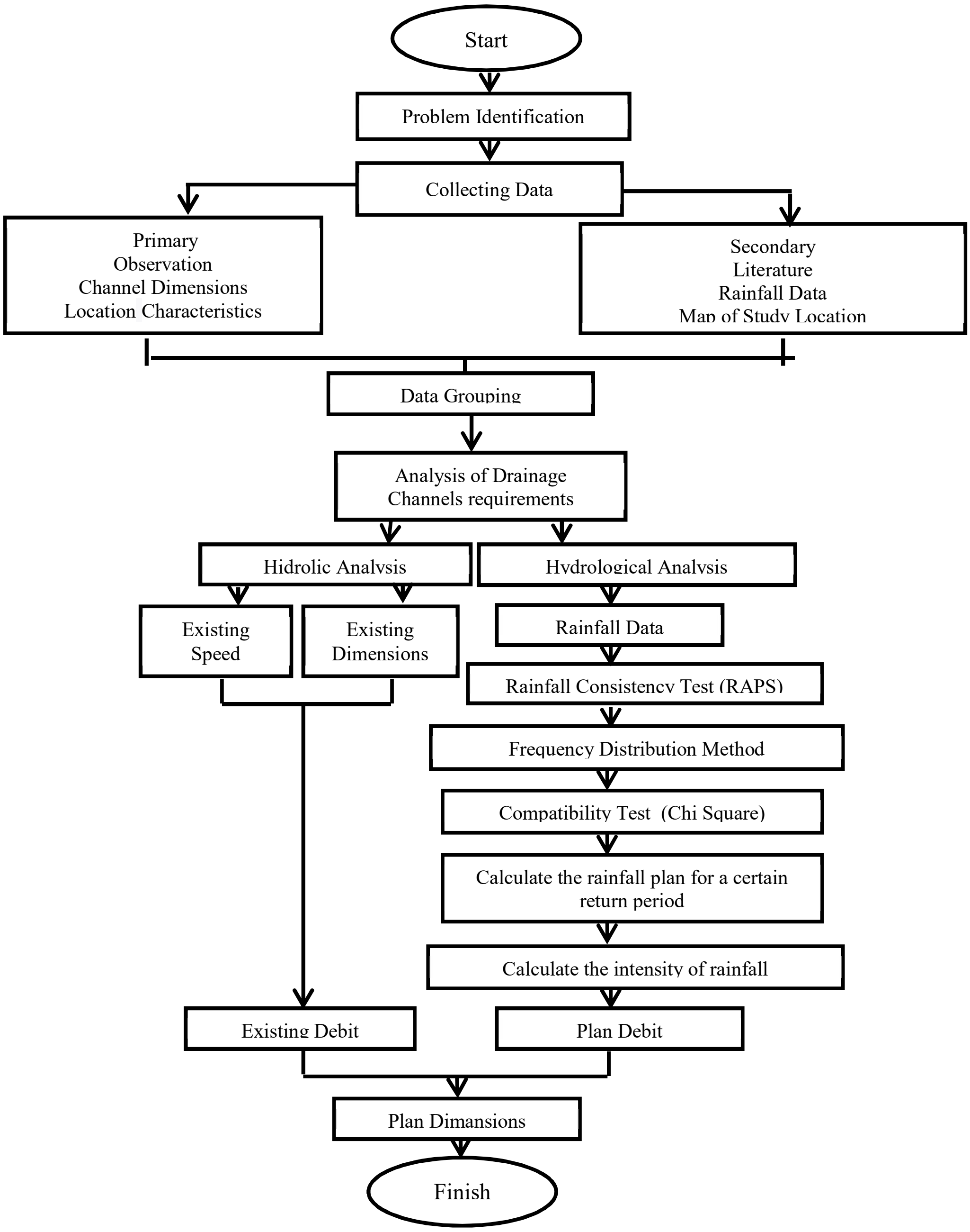

FIGURE 1. Research Methodology

Analysis of Lunggi Park drainage channel requirements consisted of hydrological and hydraulics calculations. In hydrological analysis, the first step was performed by collecting data on maximum daily rainfall. Estimation of planned rainfall was carried out by frequency analysis of annual maximum daily rainfall data, with 15 consecutive years of observation duration. then the rainfall consistency test was carried out to assess rainfall data that can be said to be consistent and appropriate. The next step in hydrological analysis was frequency analysis using several distribution methods to get the Standard Deviation (SD), Skewness Coefficient (Cs), Kurtosis Coefficient (Ck), and Variation Coefficient (Cv) accordingly. Standard deviation (SD) is the square root of the variance and shows the standard deviation of the data against its mean value. Standard deviation formula:

$$S_x = \sqrt{\frac{\sum(Xi-\bar{}}{n-1}} \quad \text{a)}$$

Information:
S = Standard Deviation
Xi =Variant value to i
X = Variant average value
n = The amount of data
Skewness Coefficient (Cs) is the degree of symmetry or distance symmetry of a distribution. Skewness Coefficient formula:

$$\text{Cs} = \frac{n.\sum(X-\bar{X})^3}{(n-1)(n-2).S^3} \quad \text{b)}$$

Information:
Cs = Skewness Coefficient
S = Standard Deviation
Xi =Variant value to i
X = Variant average value
n = The amount of data
Kurtosis Coefficient (Ck) is the degree or measure of the height and height of the peak of a data distribution against the normal distribution of data. The data distribution fluctuation is called kurtosis. Kurtosis Coefficient formula:

$$\text{Ck} = \frac{n^2 \sum(X-\bar{X})^2}{(n-1)(n-2)(n-3)S^4} \quad \text{c)}$$

Information:
Ck = Kurtosis Coefficient
S = Standard Deviation
Xi =Variant value to i
X = Variant average value
n = The amount of data
The coefficient of variation (Cv) is the ratio between the standard deviation and the average of a data. Variation Coefficient formula:

$$\text{Cv} = \frac{sd}{X} \quad \text{d)}$$

Information:
Cv = Kurtosis Coefficient
S = Standard Deviation
X = Variant average value

Chi square test was then performed to assess the suitability of several previous distribution methods. This test was performed so that the study did not only refer to one test result and to determine an acceptable method and the same as the results of the previous statistical test. The distribution method that has been discovered through chi square was used to calculate the rainfall period. Rainfall intensity is calculated at each repeat period to get the plan debit and design discharge. Rain intensity analysis was performed using the Monobone formula:

$$I = \frac{R24}{24}\left(\frac{24}{tc}\right)^{2/3} \quad \text{e)}$$

Information:
I = Intensity
R24 = annual maximum daily rainfall for certain period
tc = concentration time in hours

Plan debit or plan flood discharge is calculated using the rational method with the formula:

$$Q = 0{,}278\,.I.(C_1.A_1 + C_2.A_2 + C_3.A_3 \ldots C_n.A_n) \quad \text{f)}$$

Information:
Q = peak flood debit
I = Intensity
A = existing cross channel area
C = runoff coefficient

Hydraulic analysis was carried out to obtain the existing discharge value. This analysis processes existing flow velocity data and existing dimensions obtained from field observations. The maximum existing discharge was calculated using the formula:

$$Q = V.A \quad \text{g)}$$

Information:
V = velocity flow result in field observation

A = existing cross channel area

Existing discharges generated from hydraulics analysis and planned discharges resulting from hydrological analysis were juxtaposed to figure out which the spots are not safe for certain return periods. Unsafe canal spots was followed up with appropriate channel design plans so that runoff water and lunggi park drainage functions can run optimally.

RESULT AND DISCUSSION

Safety and comfort are the criteria for the public open spaces. The problem of puddle and muddy condition will cause discomfort and endanger the safety of visitors in Lunggi Park, especially for people with special needs. Analysis of drainage channel requirements is based on the presence of puddle problems in Lunggi Park. Analysis of drainage channel requirements is carried out with the hydrological and hydraulics analysis stages.

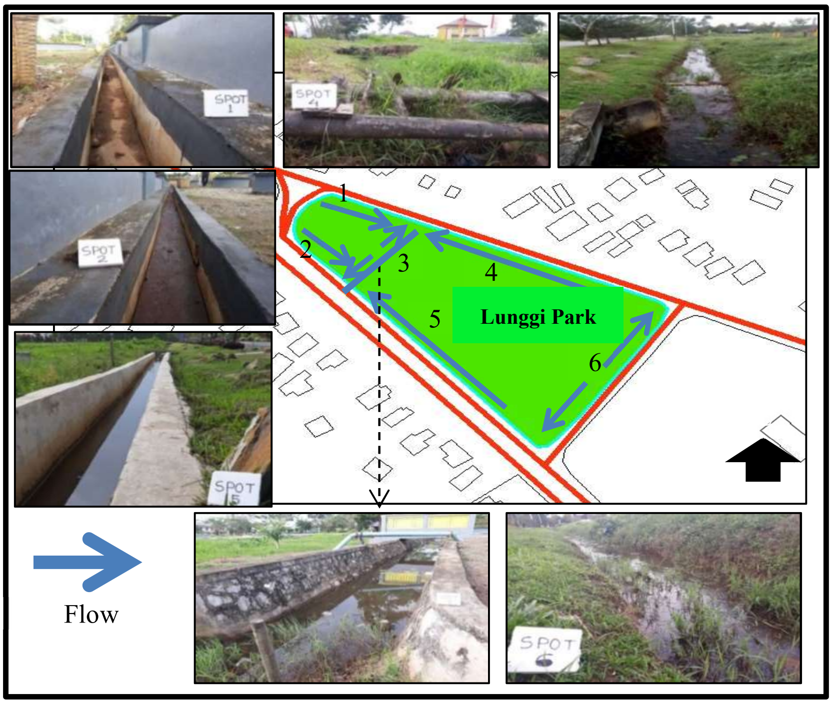

FIGURE 2. Map Of The Location Drainage Network

The picture above shows several spots of the Lunggi channel that are still natural and not well maintained. Untreated channel spots cannot flow optimally to channel surface runoff. As a consequence, there is a puddle on the floor of the Lunggi park which reduces the comfort and safety of visitors. Spot channels 1 and 2 have a small and disproportionate size. Spot channels 4 and 6 are still in the form of natural channels with poor condition. The condition of the drainage channels results in runoff not being able to be released optimally and causes a puddle on the floor of the Lunggi park. Spot channels 1 and 2 have a small and disproportionate size. Spot channels 4 and 6 are still in the form of natural channels with poor condition. The condition of the drainage channels results in runoff not being able to be released optimally and causes a puddle on the floor of the Lunggi park.

Based on the rainfall data of Sambas Regency in 2001 - 2015, the highest average rainfall occurred in January, which was 82,85 mm, and the lowest average rainfall occurred in February, which was 44,23 mm, while the annual average rainfall is at 57,57 mm.

TABLE 1. Sambas Regency Rainfall in 2001 - 2015 [16]

Year	Rainfall	Year	Rainfall
2001	104,00	2009	121,00
2002	90,00	2010	84,00
2003	126,00	2011	93,00
2004	111,00	2012	70,00
2005	98,00	2013	60,00

Year	Rainfall	Year	Rainfall
2006	136,00	2014	95,00
2007	133,00	2015	140,00
2008	192,00		

Based on the ranking results above, the highest rainfall occurred in 2008 with 192 mm and the lowest rainfall occurred in 2013.

Rainfall Consistency Test

This study used one rain station data so that consistency tests can be performed with statistical calculations such as Rescaled Adjusted Partial (RAPS). The result of Qcount is 3.760. The data were categorized as consistent if it satisfies the requirements of Qstatistics<Qcritical. Qtable value at 1% confidence level with the amount of 15 data (n) is 5,248. If the comparison of Qstatistics<Qcritical value in 3,760 < 5,248, in other words the rainfall data were categorized as consistent.

Analysis of Rainfall Frequency

Rainfall frequency analysis was performed to prove the data series that were suitable for the rainfall distribution. Frequency analysis is performed by processing rainfall data for statistical parameters and log parameters. The results of processing the rainfall frequency can produce Standard Deviation (SD), Skewness Coefficient (Cs), Kurtosis Coefficient (Ck), and Variation Coefficient (Cv) become instruments in terms of the choice of distribution method selection. Based on frequency analysis, the values of are obtained. Rainfall processing data results for statistical parameter values, SD: 32,816, Cs: 0,886, Ck: 1,548, Cv: 0,298. Rain data processing results for log values, SD:0,127, Cs: -0,021, Ck: 0,331, Cv: 0,063.

Analysis of Rain Distribution

Distribution analysis is calculated by processing rainfall data using several distribution methods. Distribution analysis conducted in this study is consisted of 5 (five) methods: Normal Method, Gumble Type I, Log Person Type III, Normal Log 2 Parameters, Normal Log 3 Parameters.

Based on the results of testing statistical descriptors on each method, three methods have met the requirements. Three methods that fulfill the requirements included Type I Gumbel Method, Normal Log 2 Parameters, and Normal Log 3 Parameters.

Furthermore, a compatibility test was performed on the five distribution methods using the Chi Square Test. This test is conducted so that the study does not only refer to one test result and determine an acceptable method.

The results of Chi Square (χ^2) Test for Type I Gumbel Type method resulted in a value of 0,67. Chi Square value (χ^2) on table with a degree of freedom 5% resulted in a value of 5,991. The terms of a distribution method were accepted if Chi Square (χ^2)Test< Chi Square value (χ^2) on table. The Type I Gumbel Distribution Method meets the requirements of 0.67 < 5.991, so it can be accepted.

The results of the Chi Square (χ^2) Test for Normal Log Method 2 Parameter resulted in a value of 13.33. The results of Chi Square (χ^2) Test for Normal Log Method 2 Parameter is greater than Chi Square value (χ^2) on table so the results are rejected because it does not match the terms of the Chi Square Test. The results of Chi Square (χ^2) Test for Normal Log Method 3 Parameter is unaccepted because it resulted in a greater value than Chi Square value (χ^2) on table which is 13,33 > 5,991. Based on the results of the two tests, it can be concluded that the distribution method that is suitable for use is the Gumbel Type I Method.

Rainfall Return Period

Based on the results of calculations using the Type I Gumbel Method, the rainfall return period can be seen in the table below:

TABLE 2. Sambas Regency Rainfall in 2001 – 2015

Return Period	R (mm)
R_2	104,803
R_5	134,064
R_{10}	152,991
R_{20}	171,407
R_{25}	175,371

Rainfall in the 2-year return period was 104.803 mm, and an increase in the 5-year return period was 134,064 mm. rainfall increase is not significant in the return period, 10 years, 20 years, and 25 years. The higher the rainfall, the greater the potential for flooding, so that the channel dimension engineering is required to regulate rainwater runoff.

Rainfall Intensity

Rain intensity analysis was performed using the Monobone formula. The table below shows the intensity of rain in the 2-year return period of 24,868 mm/hour, while in the 25-year return period it became 41,613 mm/hour.

TABLE 3. Rainfall Intensity of Sambas City in 25 Years

Return Period	I (mm/jam)
I_2	24,868
I_5	31,811
I_{10}	36,303
I_{20}	40,673
I_{25}	41,613

Maximum Plan Debit

The maximum runoff was calculated using the Rational Method. C value was adjusted to the runoff coefficient in the Lunggi park in the form of flat ground grass, garden and concrete. A value was obtained from the area of each existing cross channel area. The results of the maximum discharge calculation with return periods of 2, 5, 10, 20 and 25 years can be seen in the table below:

TABLE 4. Lunggi Park Drainage Water Discharge with a Maximum Period of 2, 5, 10, 20, and 25 years

Return Period	I	C.A	Q
Q_2	24,8683	0,00644	0,0445
Q_5	31,8115	0,00644	0,0569
Q_{10}	36,3027	0,00644	0,0649
Q_{20}	40,6725	0,00644	0,0728
Q_{25}	41,6132	0,00644	0,0744

Hydraulic Analysis

Channel dimension analysis identifies 6 (six) spot of channel location in Lunggi Park. Those spots have different shapes and dimensions. The channels that have been in the form of concrete hardening are located in spots 1, 2, 3 and 5, while for spots 4 and 6 the channel condition is still in the form of a soil overgrown with grass but has a fairly wide size. The position of these spots are shown in FIGURE 2.

Based on the results of the research location, the direction of water flow in Lunggi Park is centered on spot 3 which has a larger dimension than spot 1 and spot 2. Furthermore, water discharge in spot 3 is flowed partly to the secondary drainage channel of the Development Road and partly to the secondary drainage channel of the Sukaramai Road. The direction of water flow at spot 6 is directly connected to the Development Road drainage and the Sukaramai Road drainage.

Whole drainage channels in Lunggi Park have good and clean conditions. However, especially for channels in spot 6 and spot 4, attention needs to be paid to the condition of channels which are still in the form of natural channels covered with grass and sedimentation. These conditions if not repaired can hamper the flow of water then it can cause puddle in Lunggi Park.

TABLE 5. Calculation of Existing Water Discharge and Water Discharge for Lunggi Park Plan for a Period of 2 Years

Spot	Existing Cross Channel Area (m^2)	Flow Velocity (m/s)	Existing Discharge (m^3/s)	Water Discharge Plan (m^3/s)	Safe/ Not Safe
1	0,11	0,16	0,018	0,0445	Not Safe
2	0,09	0,15	0,014	0,0445	Not Safe
3	2,38	0,15	0,347	0,0445	Safe
4	0,39	0,16	0,063	0,0445	Safe
5	0,81	0,14	0,112	0,0445	Safe
6	1,06	0,17	0,178	0,0445	Safe

TABLE 6. Calculation of Existing Water Discharge and Water Discharge for Lunggi Park Plan for a Period of 5 Years

Spot	Existing Cross Channel Area (m^2)	Flow Velocity (m/s)	Existing Discharge (m^3/s)	Water Discharge Plan (m^3/s)	Safe/ Not Safe
1	0,11	0,16	0,018	0,0569	Not Safe
2	0,09	0,15	0,014	0,0569	Not Safe
3	2,38	0,15	0,347	0,0569	Safe
4	0,39	0,16	0,063	0,0569	Safe
5	0,81	0,14	0,112	0,0569	Safe
6	1,06	0,17	0,178	0,0569	Safe

Table 5 and **Table 6** shows that there are channels that are in unsafe conditions.The existing discharge values for spots 1 and 2 are smaller than the planned discharge value. Spot 3, 4, 5 and 6 are in a safe condition, because they have a comparison value of the existing water discharge greater than the planned discharge.

TABLE 7. Calculation of Existing Water Discharge and Water Discharge for Lunggi Park Plan for a Period of 10 Years

Spot	Existing Cross Channel Area (m^2)	Flow Velocity (m/s)	Existing Discharge (m^3/s)	Water Discharge Plan (m^3/s)	Safe/ Not Safe
1	0,11	0,16	0,018	0,0649	Not Safe
2	0,09	0,15	0,014	0,0649	Not Safe
3	2,38	0,15	0,347	0,0649	Safe
4	0,39	0,16	0,063	0,0649	Not Safe
5	0,81	0,14	0,112	0,0649	Safe
6	1,06	0,17	0,178	0,0649	Safe

TABLE 8. Calculation of Existing Water Discharge and Water Discharge for Lunggi Park Plan for a Period of 20 Years

Spot	Existing Cross Channel Area (m^2)	Flow Velocity (m/s)	Existing Discharge (m^3/s)	Water Discharge Plan (m^3/s)	Safe/ Not Safe
1	0,11	0,16	0,018	0,0728	Not Safe
2	0,09	0,15	0,014	0,0728	Not Safe
3	2,38	0,15	0,347	0,0728	Safe
4	0,39	0,16	0,063	0,0728	Not Safe
5	0,81	0,14	0,112	0,0728	Safe
6	1,06	0,17	0,178	0,0728	Safe

TABLE 9. Calculation of Existing Water Discharge and Water Discharge for Lunggi Park Plan for a Period of 25 Years

Spot	Existing Cross Channel Area (m^2)	Flow Velocity (m/s)	Existing Discharge (m^3/s)	Water Discharge Plan (m^3/s)	Safe/ Not Safe
1	0,11	0,16	0,018	0,0744	Not Safe
2	0,09	0,15	0,014	0,0744	Not Safe
3	2,38	0,15	0,347	0,0744	Safe
4	0,39	0,16	0,063	0,0744	Not Safe
5	0,81	0,14	0,112	0,0744	Safe
6	1,06	0,17	0,178	0,0744	Safe

Table 7, **Table 8** and **Table 9** show that starting in period 10 the channels which is in unsafe condition is on spots 1, 2 and 4. In a 10-year period, 20-year period, and 25-year period, the existing discharge values for spots 1, 2 and 4 are smaller than the planned discharge value. Spot 3, 5 and 6 are in a safe condition, because they have a comparison value of the existing water discharge greater than the planned discharge.

Based on the comparison of the existing discharge and the planned discharge periods of 2, 5, 10, 20, and 25 years above, it is known that the unsafe and potentially non-functioning drainage channels are spots 1, 2 and 4. The results of the comparison are channel dimension planning. Channel dimension planning is using square shape as the model design. Planning the channel dimensions for the 50 year period for spot 1 was calculated by stages:

a) Wet cross-sectional area (A)

$A = B \times h$

$= 0,50 \times 0,44$

= 0,528 m^2

b) Heigth extension

$W = \sqrt{0{,}5\,h}$

$= \sqrt{0{,}5 \; x \; 0{,}44}$

= 0,47m

c) Water discharge (Q) design

Q = 0,528 x 0,16

= 0,0840

When Qplans<Qdesigns or 0,0829< 0,0840, the condition can be categorized as safe. Q design is the discharge generated from the engineering dimensions of the channel, while the Q plan is the discharge generated from the calculation of the maximum rainfall flow plan. The same calculation was also performed in spots 2 and 4. The results of calculations and comparisons between Qexisting, Qplans and Qdesigns for 1, 2 and 4 spot channels over a 25-year period can be seen in the table below:

TABLE 10. Comparison of $Q_{existing}$, Q_{plans} and $Q_{designs}$in 25-year period

Spot	Existing Channel Dimension			Velocity (m/s)	$Q_{existing}$ (m^3/s)	Q_{plans} (m^3/s)	Safe/ Not Safe
	Width(m)	Height(m)	Area (m^2)				
1	0,25	0,44	0,110	0,16	0,018	0,0744	Not Safe
2	0,25	0,35	0,088	0,15	0,014	0,0744	Not Safe
4	1,30	0,30	0,390	0,16	0,063	0,0744	Not Safe
Spot	Existing Channel Dimension			Velocity (m/s)	Q_{design}(m^3/s)	Q_{plans} (m^3/s)	Safe/ Not Safe
	Width(m)	Height(m)	Area (m^2)				
1	1,10	0,44	0,484	0,16	0,0770	0,0744	Safe
2	1,40	0,35	0,490	0,15	0,0758	0,0744	Safe
4	1,55	0,30	0,465	0,16	0,0753	0,0744	Safe

Based on the table, it can be seen that the dimensions of the spot channels 1, 2 and 4 were planned wider than the existing dimensions. The planning is performed so that the flow of water at the three spots become smooth and safe. Channels design for each spot 1, 2 and 4 can be seen in Figure 3, 4, 5.

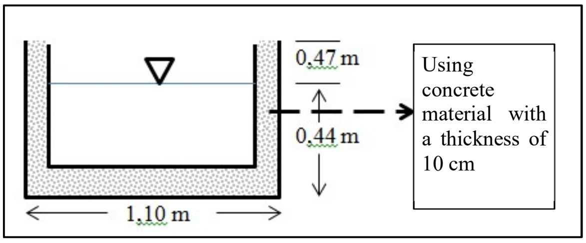

FIGURE 3. Channel Design on Spot 1

A sustainable drainage system is an integrated infrastructure solution for urban puddle problems. The philosophy of a sustainable urban drainage system is to get closer and reuse natural drainage and water catchment areas including open spaces [13]. The recommendation of drainage system management of Lunggi Park include Improving channel dimensions at spots 1, 2 and 4.

1. The dimensions of the drainage channel at spot 1 is planned to be 1,10 m wide and 0,91 m high with concrete material and a thickness of 10 cm.
2. The dimensions of the drainage channel at spot 2 is planned with 1,40 wide and 0,76 m height with concrete material and a thickness of 10 cm.
3. The dimensions of the drainage channel at spot 4 are planned to be 1,55 m wide and 0,68 m high with concrete material and a thickness of 10 cm .

CONCLUSION

Humans must be pleased and have the same rights whatever their circumstances to access public facilities. Proper accessibility for all important groups of people is provided in city parks as humane public facilities. Drainage channels in the park should be planned optimally.

The integration of green and blue elements creates multifunctional infrastructure so that public facilities, in this case the lunggi park, can be of human value. Humanist open space is a public facility that can be accessed by all groups with safe and comfortable conditions. Implementation of sustainable urban drainage systems in an appropriate and holistic manner is important.

Based on the comparison of the existing discharge and the planned discharge periods, it is known that the unsafe and potentially non-functioning drainage channels are spots 1, 2 and 4. The direction in structuring the drainage dimensions of Lunggi Park as a Humanis Open Space occurs at three spots. Drainage channel at spot 1 is planned to be 1,10 m wide and 0,91 m high with concrete material. Spot 2 drainage channel is planned with 1,40 width and 0,76 m height with concrete material. The dimensions of the drainage channel at spot 4 are planned to be 1,55 m wide and 0,68 m high with concrete material.

Recommendations or suggestions in the research of the drainage system in Lunggi Park are drainage maintenance action. Maintenance of drainage channels in Lunggi Park is required to optimize the function of the channel. Drainage serves to manage rainwater runoff to prevent puddle in the park.

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