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Abstract
Basically some of the rain falling to the ground level will seep into the soil and the rest will flow to become surface runoff. Depending on the condition of the area when the water flows both the pervasive and flowing into the drainage. The characteristics of the regions that affect the rain water section are topography, soil type, and land use or land cover. The method of discussion uses quantitative and qualitative analysis. The quantitative analysis used in this research is a series of calculation process which ultimately aims to obtain the volume of water runoff and the volume of domestic wastewater produced by each catchment area and will enter to the collector drain. While for qualitative analysis is in form of effort to interpret data and result of calculation in order to reach a conclusion of research. Based on result of analysis done hence obtained by conclusion that high/low of water usage in study location also influenced by socioeconomic condition of resident and kind of land allotment in a region. The difference in the volume of clean water use further causes the difference in the volume of domestic wastewater. It is also known that the amount of domestic wastewater produced by each catchment area is 1% to 5% of the total water calculated will enter to the drain, while the rest comes from the rainwater runoff.
Keywords: surface flow, domestic wastewater, water runoff

1. INTRODUCTION

Hydrological cycle is one form of interaction between land, water and air. The sun causes the liquid to evaporate then the water vapor condenses and descends to become rain. Some rainwater will be absorbed into the soil (infiltration) and some that are not absorbed into the soil will be accommodated temporarily in the ground level basins and then flow over the ground level to the lower ground (Suripin, 2004). The water flow needs to be managed so as not to cause adverse effects on the life of living things on this earth. The immediate impacts of unplanned water flow management are floods, landslides, soil erosion and so on.

These disasters are common in several cities of Indonesia. Flood becomes an urban problem that needs attention from various parties. The flood disaster caused a lot of casualties and material. The causes may differ for each city and those with the same case. Reduced in water catchment area is one of the causes of flood disaster. Permanent buildings on land cannot absorb rain water that descends to the earth, consequently the volume of rain water will become the surface flow. Surface flow occurs when the amount of rainfall exceeds the water infiltration rate into the soil. After the infiltration rate is met, the water begins to fill the basins on the ground level. Enhancement of surface flow is caused by changing type of ground cover material.

Different regional characteristics will certainly also produce different volume of wastewater. Shopping areas that tend to close land with cement or paving will produce a volume of different wastewater from a residential area that still has open land for park allotment. In the urban village of Sawojajar, there are several areas with different physical characteristics. The difference of characteristic is the composition of the area of settlements/housing between built land and open land (KDB). Some housing units in residential areas, with the existence of the park will have open land as a water catchment area. In contrast, residential areas that use paving or other materials that cannot absorb water will certainly have a larger surface flow. Based on these conditions, it is necessary to calculate the volume of rain runoff by considering the existence of closed land and open land in the study area so that the volume of flow generated in accordance with the needs of water drainage that can be used as a drainage drain planning consideration.

The phenomenon in the study area shows that the drainage function is not only used as a mere rainwater drainage channel but also becomes a drain of domestic wastewater disposal by residents. The intensity of different water use activities by residents will also produce volumes of different domestic wastewater. This research aims to create the urban village of Sawojajar which is free from floods both at present and in the future through the calculation of the volume of rainwater runoff and domestic wastewater by considering the technical and socioeconomic aspects of the population.

2. LITERATURE REVIEW

2.1 Hydrologic Cycle

Hydrology is a science of water in all its forms (liquid, gas, solid) on, in and on the ground level. These include its dispersion, its cycle and behavior, its physical and chemical properties, and its relationship with the living

elements in the water itself (Asdak, 2004: 4).

The cycle of hydrology is the journey of water from sea level to the atmosphere then to the ground level and back again to the never-ending sea, the water will be retained temporarily in rivers, lakes or reservoirs, and in soil that can be utilized by humans or other living things (Asdak, 2004: 7).

2.2 Drainage System

Drainage from the word of English "Drainage" means flow, drain, waste, or divert water. Generally, it can be defined as a technical action to reduce excess water, either from rain water, seepage, or excess irrigation water from a region/land, so that the function of the region/land is not disturbed. Drainage can also be interpreted as an attempt to control groundwater quality in relation to salinity. So, the drainage concerns not only surface water but also groundwater [Suripin, 2004]. In general, the drainage system can be defined as a series of water structures that serve to reduce and/or waste excess water from a region or land, so that the land can be functioned optimally.

The building of the drainage system consists of an interceptor drain, collector drain, conveyor drain, main drain and receiving body. Along the system are often found other buildings, such as culverts, siphon, aqueduct, spills, water gates, waterfall buildings, tando ponds and pumping stations (Suripin, 2004)

2.3 Surface Water Appendix

Surface runoff occurs when the amount of rainfall exceeds the infiltration rate. After the infiltration rate is met, the water begins to fill the basin or depression at the ground level. After the filling is complete then the water will flow freely at the ground level.

Factors affecting surface runoff are divided into two groups, namely meteorological elements and elements of physical properties of the drainage area (Sosrodarsono & Takeda, 1978: 135). Meteorological elements include precipitation type, rain intensity, duration of rain, and distribution of rain in the drainage area, while the physical elements of the drainage area include land use, soil type, and condition of topography of the catchment area. Elements of physical properties can be categorized as static aspects while meteorological elements are dynamic aspects that can change with time.

3. RESEARCH METHODOLOGY

The method for estimating peak flow rates commonly used is the rational method of USSCS (1973). The mathematical equations of the rational methods are expressed in terms of:

$$Q = 0.002778CIA$$

Where: Q = flow discharge
C = surface flow coefficient
I = rain intensity in mm/hour
A = calculation of rainwater catchment area

The flow coefficient (C) is influenced by the rate of soil infiltration and the percentage of impervious land, the slope of land, the cover crop, and the rain intensity. The value of C for each land characteristic is as shown in the previous table above.

4. RESULT AND DISCUSSION

A. Calculation of domestic wastewater discharge at every catchment area

The calculation of domestic waste water discharge in each catchment area is based on the type of land allotment and the type of building located in the area. "The volume of water wasted to the drain is 70% of the total use of clean water"

The use of clean water for each type of housing and other allotment can be seen in table 3.98 above. The equation used to calculate the volume of wastewater from the amount of clean water used by residents is:

Qd = 0.7 x Q clean water

Where :

Qd = Discharge of domestic wastewater (liter/sec)
Q clean water = Use of residents' water supply (liter/sec)
0,7 = The percentage of clean water wasted to the drain.

The amount of water entering the drain is 70% of the total use of clean water for residents, facilities such as mosques, public health centers, and shop houses. For other facilities such as schools, plazas, and shops, as well as offices hence the amount of clean water usage contained in the above table, is largely a requirement for toilet, especially for the use of it. Therefore, the value of water entering the drain is 20% of the total use of clean water. The value of 20% is the use of water such as washing hands and other uses that do not enter the toilet.

For example the calculation in the Catchment Area 1, using the above equation, can be seen in the table

below:

Table 1 Example of Wastewater Volume Calculation in the Catchment Area1

Number	Type	Amount	Q clean water (liter/sec)	B x C = Amount Q clean water of each type (liter/sec)	0,7 x (BxC) = Qd, Volume of wastewater (liter/sec)
	A	B	C	D	E
	Mz 100/180	22	0,0412	0,906	0,634
	D 70/180	15	0,0391	0,586	0,411
	D 54/153	18	0,0360	0,648	0,454
	D 36/120	112	0,0257	2,878	2,015
	D 27/72	48	0,0206	0,989	0,692
	D 21/96	102	0,0206	2,101	1,471
	Mz 100/240	21	0,0412	0,865	0,606
	KTM 150/300	21	0,0412	0,865	0,606
	SD	1	0,4012	0,401	0,080
	TK	1	0,1372	0,137	0,027
Amount		-	-	10,372	6,996

Source : Analysis results

From the calculation above, it is known that the out domestic waste water of catchment 1 is 6.996 liter/sec or 0.006996 m^3/sec. The calculation results of waste water debit in all catchment areas in the study area can be seen in the table below:

Table 2 The Calculation's Result of Domestic Waste Water Debit In Each Catchment Area

Catchment Area	Q domestic waste water (m^3/sec)
1	0.007320
2a	0.000548
2b	0.006776
2c	0.001930
3	0.005922
4a	0.000294
4b	0.003952
5	0.005363
6a	0.000180
6b	0.001364
6c	0.004807
7a	0.000272
7b	0.006776
8	0.002520
9	0.001670
10	0.005233
11	0.004014
12	0.005134
13	0.002301
14	0.005153
15a	0.002237
15b	0.000594
16	0.000611
17	0.001772
18	0.002186
19a	0.000519
19b	0.002512
20	0.003530
21	0.000404
21b	0.004415

Catchment Area	Q domestic waste water (m^3/sec)
22a	0.001067
22b	0.002461
23	0.001211
24	0.001096
25	0.001038
26	0.000865
27	0.001759
28a	0.000288
28b	0.00026
29a	0.002648
29b	0.000622
30a	0.004934
30b	0.000811
31a	0.008295
31b	0.000757
33b	0.000270
34a	0.001162
34b	0.000405
35a	0.001648
35b	0.000648
36	0.001783
37a	0.004972
37b	0.000703
38	0.003404
39a	0.003891
39b	0.000621
40a	0.002297
40b	0.001124
41a	0.005242
41b	0.000946
42	0.011754
43a	0.007458
43b	0.000486
44	0.003245
45	0.005999

The volume of water usage in educational facilities is greater than the volume of water usage in other uses such as residence houses. It is because the number of water users are students, which is much larger than the number of each family member. Although the use of water in educational facilities is greater than the land use as a residence but the volume of waste water generated from the area with the dominance of educational facilities is smAlley in number than the catchment area destined for residentials. That is because, most of the water usage activities in the education area are for the toilet. For calculated water that wasted to the drain is about 20% of the total water usage. The water comes from activities such as hand washing or another activities that did not enter the toilet.

While for the allotment houses, the percentage of calculated water wasted to the drain is about 70% of the total water usage. Besides the education area, other allotment that calculated using the 20% number as the domestic waste water amount of the total usage of clean water is the office area.

B. The Calculation of Total Debit in Catchment Area

The calculation of total debit of each catchment area is the sum result between water debit plan and domestic waste water debit which out of the area. The sum will be used for calculating the volume of water that enter to the collector drain. For each drain that functioned as a collector drain from some catchment area then the volume of entering water to the drain is the sum result of the debit from the amount of areas that drain the water to one drainage drain. The debit amount from each catchment area are :

Table 3 Calculation Of Total Debit Of Each Catchment Area

Catchment Area	**Q Water plan (m3/sec)**	**Q domestic waste water (m3/ sec)**	Amount of Debit **(m3/ sec)**
1	0.264179	0.007320	0.271499
2a	0.032060	0.000548	0.032608
2b	0.219659	0.006776	0.226435
2c	0.069187	0.001930	0.071117
3	0.197338	0.005922	0.203260
4a	0.009480	0.000294	0.009774
4b	0.142936	0.003952	0.146888
5	0.142074	0.005363	0.147437
6a	0.006815	0.000180	0.006995
6b	0.039100	0.001364	0.040464
6c	0.200780	0.004807	0.205587
7a	0.043764	0.000272	0.044036
7b	0.190823	0.006776	0.197599
8	0.308541	0.002520	0.311061
9	0.133318	0.001670	0.134988
10	0.161852	0.005233	0.167085
11a	0.011674	0.000328	0.012002
11b	0.098158	0.000275	0.098433
12	0.099892	0.005134	0.105026
13	0.097944	0.002301	0.100245
14	0.146383	0.005153	0.151536
15a	0.068758	0.002237	0.070995
15b	0.030673	0.000594	0.031267
16	0.091477	0.000611	0.092088
17	0.086141	0.001772	0.087913
18	0.077514	0.002186	0.079700
19a	0.005416	0.000519	0.005935
19b	0.083428	0.002512	0.085940
20	0.130311	0.003530	0.133841
21a	0.021203	0.000404	0.021607
21b	0.146306	0.004415	0.150721
22a	0.062492	0.001067	0.063559
22b	0.121026	0.002461	0.123487
23	0.055000	0.001211	0.056211
24	0.044300	0.001096	0.045396
25	0.146834	0.001038	0.147872
26	0.035709	0.000865	0.036574
27	0.072000	0.001759	0.073759
28a	0.014641	0.000288	0.014929
28b	0.016494	0.000260	0.016754
29a	0.054181	0.002648	0.056829
29b	0.014039	0.000622	0.014661
30a	0.123405	0.004934	0.128339
30b	0.01082	0.000811	0.011631
31	0.14189	0.008295	0.150185
31b	0.021104	0.000757	0.021861
32a	0.047383	0.002243	0.049626
32b	0.01107	0.000486	0.011556
33a	0.030624	0.001255	0.031879
33b	0.005216	0.000270	0.005486
34a	0.021248	0.001162	0.02241
34b	0.005688	0.000405	0.00609
35a	0.031753	0.001648	0.0334
35b	0.009564	0.000648	0.01021
36	0.039974	0.001783	0.04176
37a	0.099455	0.004972	0.10443
37b	0.017361	0.000703	0.01806
38	0.062334	0.003404	0.06574
39a	0.074797	0.003891	0.07869
39b	0.022128	0.000621	0.02275
40a	0.03701	0.002297	0.03931
40b	0.018883	0.001124	0.02001
41a	0.110142	0.005242	0.11538
41b	0.01792	0.000946	0.01887
42a	0.206634	0.011754	0.21839
43a	0.131759	0.007458	0.13922
43b	0.009698	0.000486	0.01018
44	0.061963	0.003245	0.06521
45	0.119084	0.005999	0.12508
Total	**5.482807**	**0.177052**	**5.659866**

Source: Analysis Result

From the table above it is known that the volume out of water of each catchment area are the largest volume of water runoff and domestic waste water come from the catchment area 2. The catchment area 2 is the most widely catchment area with the land usage is for residence houses.

C. Total Volume of Domestic Rain runoff and Domestic waste Water from the Catchment Area of Each Collector Drain

In accordance with the analysis of the water flow's direction that adjusted to the existing conditions in the field so there are some drains that functioned as a collector drain of water runoff from several drain interceptors and drain it to drain conveyor.

Some of collector drains which has been set will receive rain runoff and domestic wastewater from some catchment areas. In accordance with the limitations of the material discussed in this study, the calculation's result of the runoff and domestic wastewater volume meant is total of out water debit of each catchment area but the calculation is not reach to the water's debit in the drain (drain capacity).

The following will describe the sum of the rain runoff and domestic waste water volume from some catchment areas which grouped by collector drains that functioned as a water flow container from some of the catchment areas. The grouping of catchment areas is based on the direction of water flow from each catchment area. Some catchment areas that drain the water to one collector drain will be grouped together with other catchment areas that drain water to the same collection drain.

- Drain On Sawojajar Highway

The drain on Sawojajar highway receives the flow of water from CA 1, CA 2a, CA 3, CA 4a, CA 6a, CA 7a, CA 23, CA 24, CA 25, CA 26, CA 27 and CA 28a. The amount of water debit from each CA can be seen in the table below:

No	Catchment Area	Water Debit (m^3)
1	CA 1	0.271499
2	CA 2a	0.032608
3	CA 3	0.203260
4	CA 4a	0.009774
5	CA 6a	0.006995
6	CA 7a	0.044036
7	CA 23	0.056211
8	CA 24	0.045396
9	CA 25	0.147872
10	CA 26	0.036574
11	CA 27	0.073759
12	CA 28a	0.014929
	Total	0.942913

- Drain On Maninjau Raya Street

The collector drain located on Maninjau Raya street consists of two drains both of them are the drain located on the west side of Maninjau Raya street or A Maninjau Raya Drain and the drain located on the east side of Maninjau Raya street or B Maninjau Raya drain. The volume of produced water by each region which will go to Maninjau Raya A and Maninjau Raya B drains, Can be seen in the table below :

A. Maninjau Raya Drain A

Table 5 The Entering Water Debit To The Collector Drain **Of Maninjau Raya A Drain**

No	Catchment Area	Water Debit (m^3)
1	CA 2b	0.226435
2	CA 4b	0.146888
3	CA 7b	0.197599
4	CA 10	0.167085
5	CA 14	0.151536
6	CA 18	0.079700
7	CA 21b	0.150721
	Total	1.119964

Source: Analysis Result

B. Maninjau Raya B Drain

Table 6 The Entering Water Debit To The Collector Drain **Of Maninjau Raya B Drain**

No	Catchment Area	Water Debit (m^3)
1	CA 2c	0.071117
2	CA 5	0.147437
3	CA 6b	0.040464
4	CA 8	0.311061
5	CA 11a	0.012002
6	CA 15b	0.031267
7	CA 19a	0.005935
	Total	0.6193

Source: Analysis Result

- Drain On **Danau Ranau** Street

The drain on the Danau Ranau street consists of two drains both of them are the drain on the west side of Danau Ranau or Danau Ranau A Drain and the drain on the east side of Danau Ranau or Danau Ranau B Drain. Volume of the entering water to the Danau Ranau Drain produced by some of the Catchment Areas which can be seen in the table below :

A. Danau Ranau A Drain

Table 7 The Entering Water Debit To The Collector Drain **Of** Danau Ranau A Drain

No	Catchment Area	Water Debit (m^3)
1	CA 11b	0.098433
2	CA 15a	0.070995
3	CA 12	0.105026
4	CA 16	0.092088
5	CA 19b	0.085940
	Total	0.452482

Source: Analysis Result

B. Danau Ranau B Drain

Table 8 The Entering Water Debit To The Collector Drain **Of** Danau Ranau B Drain

No	Catchment Area	Water Debit (m^3)
1	CA 13	0.100245
2	CA 20	0.133841
	Total	0.234086

Source: Analysis Result

- Drain on Simpang Danau Maninjau Street

In Simpang Danau Maninjau street there are two drains that hold the flow from some catchment area. The drain at Simpang Danau Maninjau A is a drain located on the west side of Simpang Danau Maninjau street and it is a collector drain that holds water from the street of Danau Maninjau Raya A and B, Danau Ranau A Street, as well as from the Catchment Areas 21a, 27b and the Catchment Area 28b. For the drain located on the east of Simpang Danau Maninjau Street or Drain of Simpang Danau Maninjau B receives a stream of Danau Ranau Drain B and CA 22a. The volume of entering water to the drain on Simpang Danau Maninjau Street is :

Table 9 The Entering Water Debit To The Collector Drain **Of** Simpang Danau Maninjau A

No	Catchment Area	Water Debit (m^3)
1	CA 21a	0.021607
3	CA 28b	0.016754
4	Danau Maninjau Raya Street A	1.119964
5	Danau Maninjau Raya Street B	0.6193
6	Danau Ranau Street A	0.452482
	Total	1.119964

Source: Analysis Result

Table 10 The Entering Water Debit To The Collector Drain **Of** Simpang Danau Maninjau A

No	Catchment Area	Water Debit (m^3)
1	CA 21a	0.021607
2	CA 28b	0.016754
3	Danau Maninjau Raya Street A	1.119964
4	Danau Maninjau Raya Street B	0.6193
5	Danau Ranau Street A	0.452482
	Total	**2.230107**

Source: Analysis Result

3.1.4.5. The Drain on Danau Kerinci Street

The drain on Danau Kerinci Street is a collector drain from several Catchment Areas. The drainage drain on Danau Kerinci Street consists of two drains both of them are the drains on the western and the eastern side of Danau Kerinci Street. The study area is Sawojajar village which is limited by Danau Kerinci Street with Madyopuro Village. Based on the study location limits the drain in the eastern side of Danau Kerinci Street which receive the water runoff from Madyopuro Village is not analyzed in the calculations. The water debit from the catchment area of Danau Kerinci Drain A.

Table 11 The Entering Water Debit To The Collector Drain **Of** Danau Kerinci A

No	Catchment Area	Water Debit (m^3)
1	CA 6c	0.205587
2	CA 9	0.134988
3	CA 17	0.087913
	Total	0.428488

Source: Analysis Result

- The Drain on Danau Toba Street

  The drain on Danau Toba Street is the collector drain that recieves the water from Danau Kerinci Street and Catchment Area 22 b. The entering water volume to Danau Toba Street is :

Table 12 The Entering Water Debit To The Collector Drain **Of** Danau Toba Street

No	Catchment Area	Water Debit (m^3)
1	CA 22a	0.063559
2	Danau Kerinci Street	0.428488
	Total	**0.492000**

Source: Analysis Result

- Drain on South **Simpang Ranugwati** Street

  The drain on South Simpang Ranugwati Street is the collector drain of the Catchment Area 45 which is located in a residential area. In accordance with the condition of the land slope at the location, the direction of water flow on South Simpang Ranugwati Street directly to Bango River located in the western side of the study area. The volume of out water from the Catchment Area 45 and flow into the South Ranugwati drain is 0.12508 m^3

- **Drain on Ranugwati Street**

  The drainage drain in the north of Ranugwati Street receives a water flow from the Catchment Area 44. Catchment Area 44 is a residential area in Sawojajar Village which the land use in addition to the s residentials, it is also designated as a means of trading and service such as shopping areas. Drainage drain on Ranugwati Street, the flow direction directly goes to Bango River which is located in the west of the Catchment Area 44. The volume of out water from the Catchment Area 44 is 0.06521m^3.

- **Drain on Sawojajar Highway - III Alley**

  The drain on Sawojajar Highway - III Alley is a runoff water catchment drain from the Catchment Areas 43a and 43b. The Catchment Area 43 is a residential area of the population which the land use is mostly for residential houses. The volume of out water from the Catchment Area 43a and flow into the drain at the north side street of Sawojajar Highway - III Alley is 0.13922 m^3. While the out water volume of the catchment 43b and flow into the drain on the south side of the street is 0.01018 m^3.

- **Drain on Sawojajar Highway - V Alley**

  The water flow direction on the drain at Sawojajar Highway - V Alley, directly goes to Bango River. The drain holds water from the Catchment Area 42 by the volume of its waste water is 0.221223 m^3. The drainage area 42 is a village area of the population which the land use is dominated by residentials.

- **Drain on Sawojajar Highway - Alley VII**
  The drain on Sawojajar Highway - VII Alley flows the water directly to Bango River. The drain holds water from the Catchment Areas 41a and 41b. Catchment Area 41 is a residential area of the population that mostly of the land use is for building houses. The out water volume of the Catchment Area 41a and which goes to the north side of the street is 0.11538 m3. For the drain on the south side of the street receives a flow from the catchment 41b for 0.01887 m3.
- **Drain on Sawojajar Highway - Alley IX**
  The drain on Sawojajar Highway – Alley IX is drain that holds water from the Catchment Area 40. The drain on the north side of the street receives a flow from the catchment area 40a for 0.03931 m^3 / sec. For the south side of Sawojajar Highway - IX Alley receives a flow from a catchment area 40b for 0.02001 m^3 / sec.
- **Drain on Sawojajar Highway - Alley XI**
  Drain on Sawojajar Highway - Alley XI receives the flow from flowing area 39. The drain on the north side of Sawojajar Highway - XI Alley receives a flow from the catchment area 39a for 0.07869 m^3. For the south side of the street receives a flow from the catchment area 39b for 0.02275 m^3. The water flow of both drains is flowed directly to Bango River.
- **Drain On Sawojajar Highway - XII Alley**
  On Sawojajar highway drain - XII Alley, the direction of the water flow goes directly to Bango River. The drain holds water flow from catchment area 38 that most of the land allotment for residential areas. The volume of water that comes out from catchment area 38 and enter the drain at Sawojajar highway - XII Alley is 0.06574m^3.
- **Drain On Sawojajar Highway - XIII Alley**
  Catchment area 37 hich is a residential area In the village of Sawojajar drainize the water into collector drain is the drain on Sawojajar highway XIII Alley. drain that located on the north side of the street receive water flow from catchment area 37a for 0.10443 m^3. For the drain on the south side of the street receive the water flow from catchment area 37b for 0.01806 m^3.
- **Drain On Sawojajar Highway - XV Alley**
  Drain on Sawojajar highway - XV Alley is drainage drain that hold water flow from catchment area 36. Based on land slope condition, then the direction of the water flow on the drain goes directly to Bango River. Located in the western side of the Catchment Area 36. The amount of water flow volume that out of the Catchment Area 36 and into the drain on Sawojajar highway - XV Alley is 0.04176 m^3.
- **Drain On Sawojajar Highway - XVI Alley**
  Drain on Sawojajar highway - XVI Alley, the water flow direction is drained directly to Bango River. The drain holds the water flow from catchment area 35a for drain on the north side of the street and 35b for the drain on the south side of the street. On sawojajar highway - XVI Alley is 0.0334 m^3 . while for drain 35b is 0.01021 m^3.
- **Drain on Sawojajar Highway - XVIIa Alley**
  Drain on Sawojajar highway - XVIIa Alley, is a drain located in the Sawojajar village area and directly distribute the water to Bango River. The drain holds the flow of water coming from catchment area 3a and 34b. The volume of water from catchment area 34a that enter water in into the drain on north side of the street is 0.02241 m^3. To the south side of Sawojajar highway XVIIa Alley received water flow from catchment area 34b for 0.00609 m^3 .
- **Drain on Sawojajar Highway - XVIIb Alley**
  Drain on Sawojajar highway - XVIIb Alley, is a drainage drain that collects airflow from catchment area 33. Catchment area 33 consist of two sub catchment area. Sub division of the catchment is based on the land slope and the direction of the drainage by the resident. On Sawojajar highway - XVIIb Alley there are two drains located on two sides of the street. The drain in the northern side of the street receives water from catchment area 33a with the volume of water flow is 0.031879 m^3. For drain on the south side of the street receives water from catchment area 33b for 0.005486 m^3.
- **Drain on Sawojajar Highway – XVIIIa Alley**
  The water flow that enter to the drain on Sawojajar highway – XVIIIa Alley is the water that coming from catchment area 32a and 32b. Based on exsisting conditions in the field of the catchment area 32a flow the water into the drain on the north side of Sawojajar highway – XVIIIa Alley. The water volume from catchment area 32a is 0.049626 m^3. While the drain on the south side of Sawojajar highway – XVIIIa holds the water flow from catchment area 32b for 0.011556 m^3.
- **Drain on Sawojajar highway – XVIIIb Alley**
  Drain on Sawojajar highway – XVIIIb Alley receives the water flow from catchment area 31a and 31b. The catchment area 31a distribute water to the drain on the north side of the street for 0.150185 m^3. For drain on the south side of the street receives flow from catchment area 31b with volume as much as 0.021861 m^3 .

- **Drain on Sawojajar highway – Alley XIX**
  Drain on Sawojajar highway – Alley XIX is drainage drain that the direction of the flow is directly to Bango River. The drain holds the water flow coming from catchment area 30a and catchment area 30b. Catchment area 30a flow the water into the drain on the north side of Sawojajar highway – Alley XIX. On the south side of the street holds the water flow from catchment area 30b. The volume of water that coming out of the catchment area 30a is 0.128339 m^3 . While the volume of water from area 30b is 0.011631 m^3.
- **Drain on Sawojajar highway – Alley XXI**
  Drain on Sawojajar highway – Alley XXI is a drain that holds the flow of water from catchment area 29a and 29b then flow them directly to Kali Bango. Catchment area 29a is a residential area located in the northernmost side of Sawojajar Village. The volume of water that coming out from catchment area 29a is 0.056829 m^3. For catchment area 29b that flow the water to the south side of the sreet is 0.014661 m^3 .

5. CONCLUSION

Conclusion

The conclusion drawn by the scope of the studies on the preparation of this thesis and also based on the results of the analysis in the field include, the condition of covered land and open land at the study area, as well as the volume of rainfall runoff and domestic wastewater produced by each catchment area in the study area.

Condition of Covered land and Open Land in Study Area

The land allotment in the study area is mostly for residential population with wider land built than open land. For residential areas, some of residents have plan to give paving pavement/ cement or expanding their home building on existing lots. This is increase the amount of covered land in the study area.

In the villager area is residential area that is not part of the Housing Sawojajar, the condition of the land is also dominated by the covered land of the building. From the analysis result known that average condition of Basic Building Coefficient (BBC) on residentials in Sawojajar villager area is 55% for house building and the rest is yard area. The analysis result is still being adjusted to the character of some residents as much as 48% head of household from the results of questionnaires with a sampling system plans to cement their yard. Based on the analysis with considering the resident characters who have plan to expanding the house building or cement their yard land then the wide ratio of covered land and the wide open land in the planning year can be predicted. The percentage of wide covered land and open land in the study location can be seen in table 4.1.

In table 4.1 below which is categorized as covered land is the area of street, The width of the building and the predicted area of the yard to be paving/cement or will be made an house bulidig expansion by the owner. For open land category is the home lot that predicted to not have cement / paving.

Table 13 The Percentage Comparison of Wide Covered land and Open Land in Study Area

Catchment Area	% Covered land	% Open Land
1	88	12
2	93	7
3	92	8
4	94	6
5	88	12
6	83	17
7	91	9
8	84	16
9	96	4
10	92	8
11	93	7
12	84	16
13	86	14
14	90	10
15	89	11
16	61	39
17	97	3
18	89	11
19	90	10
20	89	11
21	90	10
22a	94	6

Catchment Area	% Covered land	% Open Land
22b	96	4
23	87	13
24	88	12
25	87	13
26	87	13
27	87	13
28a	93	7
28b	90	10
29a	77	23
29b	97	3
30a	77	23
30b	77	23
31a	77	23
31b	77	23
32s	77	23
32b	76	24
33a	77	23
33b	77	23
34a	76	24
34b	76	24
35a	77	23
35b	76	24
36	76	24
37a	77	23
37b	76	24
38	77	23
39a	77	23
39b	76	24
40a	77	23
40b	77	23
41a	77	23
41b	76	24
42	76	24
43a	78	22
43b	76	24
44	76	24
45	77	23

From the table above it is known that the condition of covered land and open land in study location where the existance of the land is dominated by covered land. With such conditions, it means the runoff volume of water that flow on the surface because it is can not be absorbed into the land will be increase.

The Volume of Domestic Water that Generated by The Residents

The utilization of drainage in the study location is Mix drain, where the drainage in addition to hold rain runoff also hold the waste water from the result of residents activities. Based on the conditions, so in making of this thesis about drainage planning guidance in sawojajar village, in addition to consideration, rain runoff is also calculated as the volume of waste water from residents activities.

Factor that affecting the volume of waste water is the number of people, house wide, vehicle ownership and other properties that require water such as lawn mower, washing machine, fish pond, fountain, etc. As well as habit factor and land use type. The influence of the factor on the high and low volume of waste water is:

1. The higher the population the higher the usage of the water. Based on the results of analysis known that the addition of the head of household in the Sawojajar village area will increase the volume of domestic waste water as much as 0,0000270 m^3/sec. While for residential area of Sawojajar with shop development plan and the residence will increase the volume of domestic waste water as much as 0,000288 m^3/sec.
2. The more spacious the house of residents are, the higher their water needs. That is because water needs to clean the house (mopping, cleaning the yard, paving or watering the garden) will be higher. The

conclusion is based on the result of the questionnaire where the width of the lot is directly proportional to the clean water needs of each family. From the result of questionnaires in the study area it is known that the type of house residents can describe their income level. Residents with larger house types have higher incomes. The income level will affect their existing property. The higher the resident income the more property they owned, Thus the need of water for maintenance, and cleaning the property will be even higher.

3. The population habit is one of the factors that influence the high of low water usage. The habit factor in question is the intensity of cleaning the house (mopping floors and other furniture). From the result of the questionnaire it is known that residents outside of Sawojajar residence houses and residential houses with medium type of house such as 27, D 36, D 45, most of them do not have housekeeper so the house mopping activity is done on their own twice a week. For house with large type like Mz 100 most of their housekeepers are obliged to mop up the house every day.
4. Different types of land use also affect the volume of water usage. Commercial land for trade and service such as shopping complex, the water usage rate is lower than the education area and residential area. However, there are exceptions to shopping complex in the form of shop that are also functioned as residences. The volume of water is greater than other shopping complex that only functioned as a shop only.

The calculation result of domestic waste water volume then summed up with the debit of rain runoff. The sum result is the total of out water debit from each area and will go into collector drain. In the table below can be seen the comparison of rain water volume and dirty water in each Catchment Area.

Table 14 the comparison of rain water volume and dirty water in each Catchment Area.

Area	Rain Water Design V.	Dirty Water Volume	Debit Total	% Rain Water	% Dirty Water
1	0,251000	0,007520	0,258520	97	3
2	0,349000	0,008798	0,357798	98	2
3	0,196000	0,005922	0,201922	97	3
4	0,161000	0,005125	0,166363	97	3
5	0,147000	0,005363	0,155032	95	3
6	0,308000	0,008032	0,313542	98	3
7	0,201000	0,005542	0,203520	99	3
8	0,205000	0,002520	0,206670	99	1
9	0,134000	0,001670	0,135670	99	1
10	0,163000	0,005233	0,168233	97	3
11	0,118000	0,004014	0,122014	97	3
12	0,106000	0,005134	0,111134	95	5
13	0,107000	0,002301	0,109301	98	2
14	0,151000	0,005153	0,156153	97	3
15	0,149000	0,002847	0,151847	98	2
16	0,101000	0,000611	0,101611	99	1
17	0,086000	0,001772	0,087772	98	2
18	0,078000	0,002186	0,080186	97	3
19	0,082000	0,002725	0,084725	97	3
20	0,132000	0,003530	0,135530	97	3
21	0,184000	0,005214	0,189214	97	3
22a	0,062492	0,001067	0,063559	98	2
22b	0,121026	0,002461	0,123487	98	2
23	0,055000	0,001211	0,056211	98	2
24	0,044000	0,001096	0,045096	98	2
25	0,047000	0,001038	0,048038	98	2
26	0,036000	0,000865	0,036865	98	2
27	0,072000	0,001759	0,073759	98	2
28	0,014641	0,000288	0,014929	98	2
29	0,016494	0,000260	0,016754	98	2
30	0,056029	0,001945	0,057974	97	3
30b	0,014410	0,000595	0,015005	96	4
31	0,130219	0,004637	0,134856	97	3
31b	0,013500	0,000703	0,014203	95	5

Area	Rain Water Design V.	Dirty Water Volume	Debit Total	% Rain Water	% Dirty Water
32a	0,049764	0,001378	0,051142	97	3
32b	0,012564	0,000432	0,012996	97	3
33a	0,032480	0,001390	0,033870	96	4
33b	0,006335	0,000405	0,006740	94	6
34a	0,023193	0,000757	0,023950	97	3
34b	0,006652	0,000270	0,006922	96	4
35a	0,033998	0,001189	0,035187	97	3
35b	0,010910	0,000513	0,011423	96	4
36	0,042500	0,001658	0,044158	96	4
37a	0,109173	0,004188	0,113361	96	4
37b	0,019498	0,000676	0,020174	97	3
38	0,064863	0,001837	0,066700	97	3
39a	0,080162	0,002945	0,083107	96	4
39b	0,023791	0,000811	0,024602	97	3
40a	0,038538	0,001459	0,039997	96	4
40b	0,020518	0,000989	0,021507	95	5
41a	0,113608	0,003405	0,117013	97	3
41b	0,020342	0,000811	0,021153	96	4
42	0,215495	0,007566	0,223061	97	3
43a	0,140600	0,005728	0,146328	96	4
43b	0,011614	0,000486	0,012100	96	4
44	0,067327	0,002569	0,069896	96	4
45	0,127263	0,004853	0,132116	96	4
40a	0,038538	0,001459	0,039997	96	4
40b	0,020518	0,000989	0,021507	95	5
41a	0,113608	0,003405	0,117013	97	3
41b	0,020342	0,000811	0,021153	96	4
42	0,215495	0,007566	0,223061	97	3
43a	0,140600	0,005728	0,146328	96	4
43b	0,011614	0,000486	0,012100	96	4
44	0,067327	0,002569	0,069896	96	4
45	0,127263	0,004853	0,132116	96	4
Amount	**5,539288**	**0,161801**	**5,697634**	**97**	**3**

Source: Analysis Result

From the table above it is known that the average volume of dirty water that out from each catchment area is 3% of the total water debit. Thus the volume of water that most affect to the drainage planning is rain runoff.

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