A Study to Find Solutions for Urban Floods in Citraland

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Introduction

Urban floods are no longer a stranger to Indonesia. Whether it is natural or manmade, urban floods damage the environment. It causes serious disruption to the life of urban citizens causing widespread loss of properties and human lives with the destruction of the environment. Flood mostly happens in coastal areas like in Surabaya, the second largest city in Indonesia. The entire region is composed of one major waterway called Surabaya Drainage Master Plane (SDMP). Surabaya's high rainfall rate of 1501-2001 mm during 2018 - 2019 (BMKG) has caused serious urban flooding in Surabaya. The drainage system that doesn't seem to be operating thoroughly is the cause of flooding in West Surabaya housing. Therefore, this research aims to observe the effectiveness of the drainage system and to find possible solution to flood generated problem in West Surabaya housing (Citraland). More specific objectives are:

1. To analyses the flood - prone areas in West Surabaya
2. To analyses flood risk in Surabaya

Methodology

The methodology used was research methodology where flood and drainage related information were gathered to provide a solution.

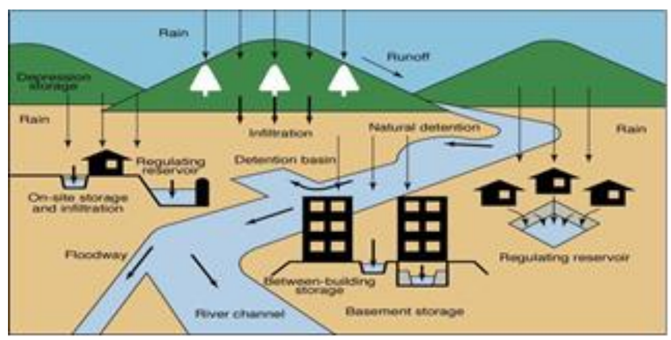
The formula of *mononobe* method and the rational method were used to figure out the drainage debit. The release flood prone areas were then observed and analyzed. Field work was also conducted to check the road relief and drainage in those mentioned areas notably in west Surabaya housing. Secondary data was also collected to analyses the drainage system. Giving an integrated alternative for drainage system that can be used in city

Result

The construction of roads relative to the elevation of intersecting creeks affects whether or not it will flood. Flood-prone areas are near to a river stream or creeks. Other than that, the area is topographic low like in BCA crossroad where the water assembles in the crescent shape road.

Box culvert analysis - The capacity of a culvert usually can't handle such big flood or high intensity rain that happen for more than an hour or more. The drainage is not effective since the pipe in the drainage is too small and pipe expansion is needed to carry out a large sum of water when it rains or flood. Most drainage in West Surabaya housing is a trapezium-based shape, with a dimension of width = 3.90 m, height = 3.30 m and also width = 3.50 m, height = 2.1 m. The most optimum open channel sections are the one with the smallest area of a particular debit and doesn't produce the smallest excavation. The best sections only apply to erosion resistant. The speed that won't cause sedimentation, 0.80 - 0.90 m/second.

Drainage system analysis - Integrated Drainage system or flood control map in a housing area, it will automatically minimize stagnant in an area. In every house there will be its own infiltration wells and in the housing area there will be detention basin as a temporary storage of surface runoff which will eventually end up in the nearest primary river/ channel. Area that is covered in asphalt and concrete can reduce soil permeability and soil infiltration capacity.



Picture 1- Illustration of Integrated Drainage System or Known as Comprehensive Flood Control Map

For the drainage in the street, elevation in the crescent road is needed and how much water can be stored.

Firstly, the *mononobe* method was used to find out the rate of rainfall (mm/hour). The formula is:

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

The following units are:

R24 = Maximum rainfall rates (24 hour/mm)
I = Rainfall intensity (mm/hour)
tc = Concentration time (hour)

Secondly using the Rational Method (30 ha), this method is used determine peak discharge from drainage basin runoff. The formula is:

$$Q_p = C\ I\ A$$

The following units are:

Q = Peak discharge, (0,002778)

c = Rational method runoff coefficient

I = Rainfall intensity, inch/hour

A = Drainage area, acre

UNESA, T10

Q = 0,00278. 0.42. 17. 102.25

= 1.99 m3/sec

(sources: *Evaluasi Kapasitas Saluran Drainase UNESA dengan adanya pengembangan kawasan Surabaya Barat*)

The waterways drainage will be derived and allocated into the sewer by a protected grid or a hole in the retaining surface acting similar to a side-groove overflow building

Strategy that can be applied - The strategy used by Singapore could be used to reduce floods. IWRM (Integrated Water Resources Management) it is a strategy to first allocate the water resources to a city and manage the water from the rain or river into a drinkable water.

Conclusion

In conclusion, the drainage system in West Surabaya housing doesn't seem to be operating well. The pipe in the housing area is too small or it can be said it's not optimum

By measuring the debit sections and using the integrated drainage system, it could help prevent flooding. Street floods in West Surabaya housing mostly happen in the low topographic road, using the tap building strategy or elevating the road is a solution that cost a lot. Implementing the IWRM plan is a two in one solution where people can drink tap water and flood percentage will decrease.

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