

Structuring Disaster Threat Area in Tanjung Putus Hamlet at Langsa City

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Abstract— Disasters are events or series of events that threaten and disturb the lives of people caused by both natural and/or non-natural factors, resulting in human death, environmental damage, property loss, and psychological impact. Flooding is a natural disaster whose occurrence can be caused by several factors, such as high rainfall, geomorphology and human activity. The Tanjung Putus Hamlet area is located in Gampong Jawa Village, Langsa City. This area located along the Krueng Langsa river with a fairly densely populated settlement. This area is also a water catchment area. The area is vulnerable to catastrophic floods and landslides. Spatial arrangement of infrastructure, housing, and environment is not well-organized in the area. Research was done by field observation. This study aims to design the environment of disaster-prone areas into a cozy area of disaster. This Design will be done in the form of arrangement of regional infrastructure, land function, evacuation lane and early warning system. The arrangement is expected to improve the quality of life of the population in terms of comfort and security. The final result of this research is the formation of a river-friendly area, making the river a front side and environmentally friendly.

Keywords—component; disaster mitigation, environment design, flood, riverbank

I. INTRODUCTION

A natural disaster is a disaster caused by the event or series of events caused by nature, such as earthquakes, volcanoes, tsunamis, floods, droughts, hurricanes, and landslides. The flood is the event where the normally dry land (not the swamp area) became inundated by water, this is caused by high rainfall and topography the region form the lowlands to concave. In addition, the occurrence of floods can also be caused by the runoff of surface water which overflows and the volume exceeds the capacity of the drainage system or system stream flow of the river. The occurrence of flooding is also caused by the low ability of soil infiltration, thus causing the land no longer able to

absorb water. Flooding can occur due to rising water levels due to high rainfall, temperature changes, embankment/dam collapse, rapid melting of snow, obstruction of water flow (Ligal, 2008). The impact of floods is generally detrimental to the community because it can cause environmental damage, such as : the destruction of residential areas, the destruction of facilities and supporting infrastructure (including land transportation), the destruction of agricultural areas, the difficulty of getting clean water, and the emergence of various diseases (because the dirty environment when flood and after flood).

Riverbanks settlements are densely populated that located on the riverside. The settlement is located on the area that is prohibited to erect buildings based on laws and Government regulations. Tanjung Putus hamlet is an area located on the river Krueng Langsa. Tanjung Putus hamlet has a dense population and the layout of irregular house building. Based on Langsa City's Qanun, the borderline of the river is located 10 -12 m from the riverbank. And based on Permen PU, borderline of urban's river that has embankment is 3 m from the edge of the embankments. A safe area for buildings is the area next to river's borderline. Based on the regulations, residentials's area that located on Tanjung Putus hamlet is an area that prone to flood.

Every year, there are floods in the Tanjung Putus area. The floods caused by high rainfall in Tanjung Putus area or the river's water rises on the upstream and make the water overflows to the settlements. Floods that occur in Tanjung Putus is unavoidable. If flood happen, peoples will pick up their stuff to the city's street. Relocation or evacuation on Tanjung Putus area can not be done because some of the peoples has land certificates. So far, the activity here is running well eventhough they are on disaster-prone area. Therefore, it needs to be rearranged the environment on the Tanjung Putus area.

The purpose of this research is to arrange the disaster-prone area into disaster-friendly area. The arrangement is expected to improve the quality of life in terms of comfort and security.

II. RIVERBANKS

The river is a flow of water containers natural and artificial in the form of a network of drainage and water therein, from the headwaters to the estuary with the right and left is limited by a boundary line. Riverbanks is the space between the edge of the riverbed and the foot of the embankment next to the in which is located at the left and right the riverbed. The line of the border river is a virtual line on the left and right of the riverbed that is set as the limit of the protection of the river. The border of the river consists of a space on the left and right of the riverbed in between the border and the edge of the Riverbed to the river is not embankment, or between the lines of the border and the outer edge of the foot embankment to the river embankment. The line of the border river has embankment in urban areas, is determined at least a three (3) metres from the outer edges of the feet of the embankment along the river flow. (PUPR Regulation No. 28 / PRT / M.2015)

The disaster prone areas (KRB) is an area often or potentially high experienced a disaster. Characteristics of KRB outline is divided into 4 (four) types, namely:

- a. Coastal / beach area
- b. Floodplain area
- c. River border area
- d. Basin area

River border areas are flood-prone areas that are located about 100 m in the left - right of a large river, and 50 m in the left - right of the creek or small river. Floodplain area is a lowland area on the left and right of the river channel, whose ground elevation is very sloping and relatively flat, so that the flow of water into the river is very slow, resulting in the area vulnerable to flooding, either by the flooding of river water or the local rain in the area.

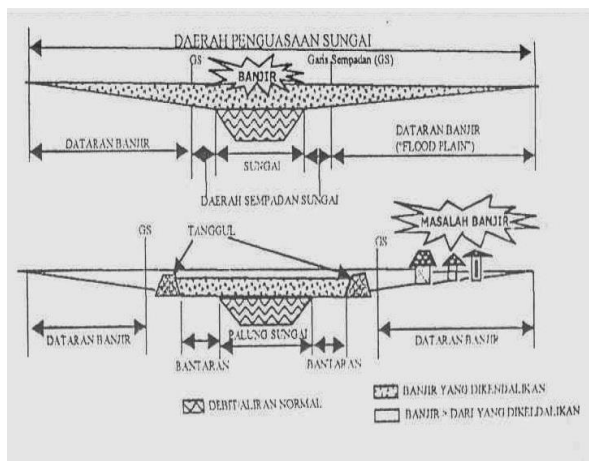


Figure 1. KRB border rivers and floodplain areas

The maintenance of the Bank of the river is part of the river which is helpful to accommodate and drain the some water from the flow of flood (Hening Anggani, 2005). In

areas where river benefits (between two border lines, including river banks) are forbidden to be settlements because it is part of the river that its function is to drain floods.

III. SETTLEMENTS REGION

Definition of settlement by Eko Budiharjo (1983: 49) which means "settlement is a container of human life not only about physical and technical aspects but also aspects of social, economic, cultural and its inhabitants. Not only about quantity but quality. Not only about home dwellings, but also workplaces, shopping and relaxing ".

According to UU no. 1 2011, Settlements are part of a residential environment consisting of more than one housing unit that has infrastructure, facilities, public utilities, and have support activities other functions in urban areas or rural areas. Slums are unfounded settlements habitable due to building irregularities, high building density, and quality of buildings and facilities and infrastructure that are not eligible.

Slum areas are the area where the conditions of settlements are below of standart. Houses and facilities and infrastructure are not in accordance with the standards that apply both the standard needs, building density, requirements of healthy homes, clean water needs, sanitation and completeness requirements of road infrastructure, open space and completeness of other social facilities.

The characteristics of slums, as expressed by Suparlan (1997) are:

- A. Public facilities that his condition is lacking or inadequate.
- B. The condition of the residential houses and settlements as well as the use of space reflects its inhabitants who are less able or poor.
- C. The existence of high frequency and volume density in the use of spaces in the slums to represent the existence of the chaos of spatial and the powerlessness of the economy of its inhabitants.
- D. Slums are community units that live in isolation with clear cultural and social boundaries, that is manifested as:
 - a. A single community, located on state-owned land, and therefore can be classified as a wild residence.
 - b. A single unit of community that is part of a RT (Rukun Tetangga) or a RW (Rukun Warga).
 - c. A single unit of community embodied as a RT or RW or even manifested as a Village, and not a wild residence.
- E. Social slum dwellers are socially and economically unsound, their citizens have livelihoods and varying degrees of density, as well as their origin. In slum communities are also known for social coatings based on their different economic capabilities.

- F. Most of the slum dwellers are those who work in the informal sector or have additional livelihoods in the informal sector.

IV. DISASTER MITIGATION

Disaster risk is the potential loss caused by a disaster in a region and a certain period of time that can be death, injury, illness, life threatened, loss of security, displacement, damage or loss of property, and disruption of community activities. Mitigation is an efforts to reduce disaster risk, both through physical development and awareness and capacity building the threat of disaster.

To reduce the loss, both material and life, due to flood disaster, community awareness action on the threat of disaster is required. Flood control techniques should be carried out comprehensively in areas prone to flooding and flood water supply areas. The basic principle of controlling flooded areas is technically done by increasing the dimension of the riverbed so that the flow of water that passes is not abundant out of the riverbed. Management that can be done is to make an adequate river embankment and create a reservoir or water reservoir to reduce flood peak. To meet the capacity of the river basin capacity, other efforts can be made such as adding drainage channels with floodways. In addition, tightening of land use restrictions on riverbanks for buildings, especially in river bodies is also needed, as well as forbidding waste disposal into rivers or drainage channels.

Flood control techniques in flooded areas are generally carried out by the Ministry of Public Works and its vertical institutions. While flood control techniques in water catchment areas rest on the principle of decreasing the runoff coefficient (C) through soil and water conservation techniques, namely:

- (1) efforts to increase the infiltration of rainwater into the soil,
- (2) and controls surface runoff on safe flow patterns. The applicable technique may be civil engineering, vegetative, chemical, or a combination of the three, according to the type of land use and site characteristics.

All these efforts are closely related to the ability of the soil / land in controlling rainwater to get into the earth, including vegetation / forest above it. The same type of forest plant where one grows on a thick layer of soil and the other on a thin layer of soil will have a different impact in controlling surface runoff or flooding.

Early warning of flood disaster can be done sequentially from upstream to downstream. If the warning have been done from the upstream then the downstream area will be better prepared so that the losses can be reduced. In the upstream area, early warning can be done by:

- a. Place the rain gauge upstream and prepare communications access to the downstream area, such as kentongan (slit drum). If in a day the rainfall has reached 100 mm and still looks rain down long enough and may be heavy (especially at night) then the people around flood prone areas should be ready to evacuate or move

to higher ground. This information should be sent to areas prone to flooding downstream.

- b. Identify the type of material carried by the flood. If a lot of non-soil material is transported by the flow, there is likely to be a big flood. The amount of non-soil material (branches and trunks) that are transported can indicate the magnitude of the strength of the water carrying it. Thus if the material is transported a lot, then the volume of water that brought it too much so that it can be predicted will be a big flood.
- c. See and observe the cloud conditions and the duration of rain. If there is a very thick cloud and continuous rain, especially if a few days there is a subsequent rainfall, then the flood disaster will be greater so that people living in flood prone areas are instructed to be more vigilant and prepare to move to higher ground.

The upstream early warning is sequentially downstream systematically. In more downstream areas, early warnings can be further enhanced with additional local technological developments.

V. RESEARCH METHODOLOGY

Structuring of Tanjung Putus hamlet is a process planning and the utilization of space in the Tanjung Putus hamlet. The planning and utilization of space done i.e. planning the layout of the infrastructure comprising roads and drainage, the functions of the land comprising the green line and housing, structuring evacuation and early warning systems. The research method used is the observation field. Data collection is done in this research are observation, interview and documentation. The observation is done is researchers observe directly into the location and conduct interviews to obtain the necessary data on this research. The research stages consist of:

1. Conducting a survey to the field to determine the condition of the cape area and make measurements.
2. The measurement and survey results are documented.
3. The analysis is to plan the layout of infrastructure, land functions, evacuation routes and EWS based on survey and measurement results.
4. The results of the analysis will be displayed in the form of drawings and explanations.
5. Summing up the results of the analysis to answer the purpose of this study.

VI. RESEARCH METHODOLOGY

A. Description of Tanjung Putus Hamlet

Tanjung Putus is one of the hamlets in Gampong Jawa Belakang. The area is a residential area located on the banks of the river Krueng Langsa so that the residential area is an area prone to flood disasters. Settlement is quite dense and can be seen from the condition of

irregular dwelling. The area has an area of ± 2.11 ha with total occupancy of 124 households. Research location can be seen on the map below.



Figure 2. Map Area of Tanjung Putus

B. Characteristic of settlement of Tanjung Putus hamlet

Settlement in Tanjung Putus area is the settlement that below of standart. Infrastructure and sanitation system is not feasible. The flood mitigation system does not exist yet. People use the river as a dump such as garbage and natural septic tank. Based on observations in the field of residential characteristics as follows:

1. Density of buildings and distances between buildings.

The density of buildings in the highlands of captivity is high. This can be seen from the density of the building. The distance between buildings is very close between one building with another building. There are even some buildings that do not have a building between buildings. Building distances are usually separated by environmental roads.



Figure 3. Density of buildings



Figure 4. Distance of building separated by environmental road

2. Quality of buildings

Most of the buildings in Tanjung Putus are made of wood. But there is a small portion made of concrete. The concrete house is not a stage house so it is not safe against flooding. Construction of buildings that use wood material, has a less feasible construction with foundations and walls slightly damaged. Improper building quality may also pose a risk to the occupants.



Figure 5. The condition of building quality

3. Infrastructure Conditions

Infrastructure currently available is the road and drainage. Most of the road is made of concrete rebates and partly from the ground. If rain or floods so streets from the ground it will be hard to follow. The existing drainage is just on the border between the Tanjung Putus hamlet and the Amalia hamlet. Most of the hamlet of Tanjung Putus has no drainage.



Figure 6. Concrete rebates road that is at the entrance of the Tanjung Putus hamlet



Figure 8. Garbage strewn at edge the river.



Figure 7. The ground road is located in the Tanjung Putus hamlet



Figure 9. The condition of the drainage into the border Tanjung Putus hamlet and Amalia hamlet

4. Sanitary Conditions

The sanitation system in the Tanjung Putus area is still not feasible. Clean water used by the community comes from PDAM, wells and rainwater. Water from wells used by the community is not good quality, this is due to water absorption from rivers and waste water communities that are directly discharged to the ground. Household wastes produced by people who do not have drainage are dumped to the ground and to the river. It is highly polluting the environment. Garbage strewn along the river. People living on the edge of the river do not have septic tank. They use the river as a toilet.



Figure 10. The condition of the drainage into the border Tanjung Putus hamlet and Amalia hamlet

C. Disaster risk management in the Tanjung Putus hamlet

The determination of the boundary line of the river can not be applied based on the Permen and the existing Qanun, because the whole building housing residents in the line of the border river. Flooding in the area cannot

be avoided, but can be minimized the impact of the risks posed. Flood disaster risk management includes all efforts to prevent hazards, reduce the likelihood of occurrence of hazards and reduce damage from unavoidable hazards. Mitigation is part of disaster risk management. Disaster mitigation include planning and implementing actions to reduce the risks against the harm caused due to human and natural hazards. Mitigation that can be done on Tanjung Putus is:

- Arrangement of land functions.
- Rewind the building from the river bank.
- Create a green line on the river's edge as water absorption and erosion prevention.
- Make retaining walls or sheet pile to hold the River Bank of the landslide and erosion so that the bottom of the river become shallow.
- Planning concept of the building and safe houses for flood district.
- Make a water level observation post and plan an early warning system

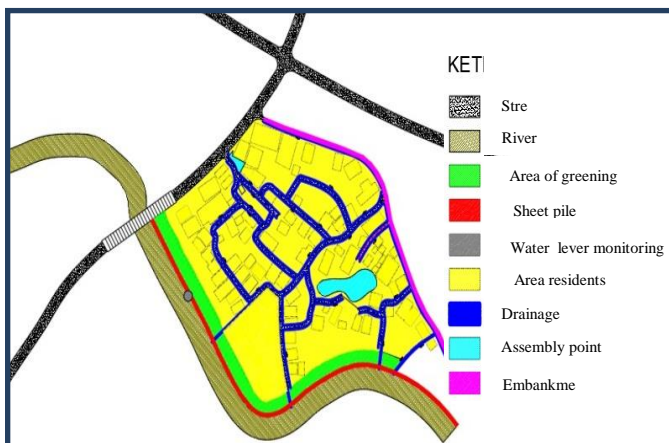


Figure 11. Zone structuring of land function of Tanjung Putus hamlet

The figure above is the result of structuring the existing land functions in the area of Tanjung Putus. On the map above, the available land is provided for green open spaces, residential areas, roads and drainage as well as areas of assembly points for disaster evacuation. Open green space that there is beneficial as rainwater catchment area and also as social space of society. In addition, green open space is made so that people no longer throw garbage to the river. On the river bank was built sheet pile to prevent landslides on river banks due to eroded water. Sheet pile also serves as a river safety. In the area of Tanjung Putus was also made an evacuation area or a gathering point so that when there is a warning of the threat of disaster then people do not need panic to should be running where.

The infrastructure of roads and drainage are also arranged in a regular basis. Map of the road network and drainage more clearly can be seen in the picture below.

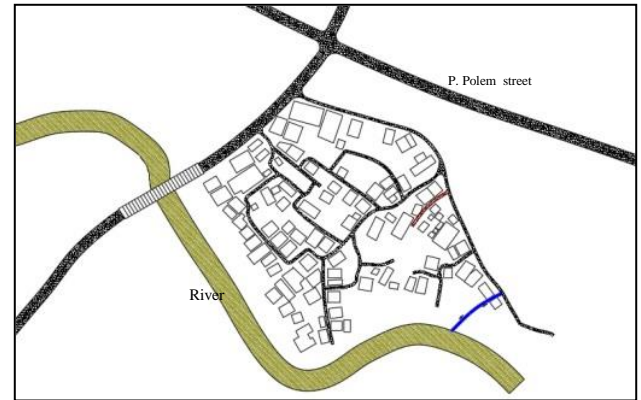


Figure 12. Road Network Plan

The road environment and the trail was built by construction concrete rebates or paving block, So when it rains or after the flood the roads then cannot be traversed. The road is also an pathway evacuation. On the pathway evacuation made signs disaster mitigation i.e. the evacuation line information boards, signs of danger and prohibition signs pointing the direction of the evacuation. In addition to the road were also built and furnished drainage.

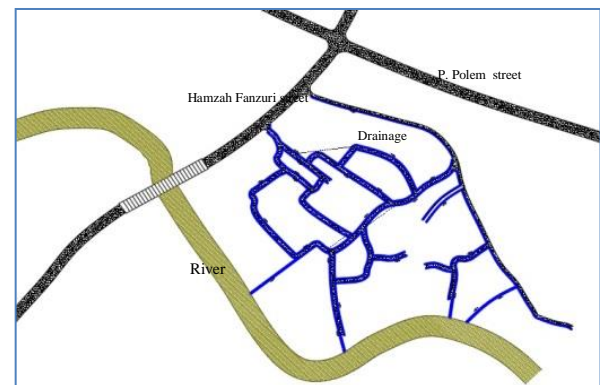


Figure 13. Drainage Network Plan

From the figure above, it can be seen that the drainage is planned to be on the left and right of the road. Drainage channel-shaped built covered. The drainage functions as a place of disposal of household waste water and rain water so that people do not throw directly into the ground.

Residential area made with the concept development of the House vertically so that the land can be used as open green space. The distance between the buildings can be used as open green space and do not covered with concrete. The existence of the distance between the buildings can control the population density.

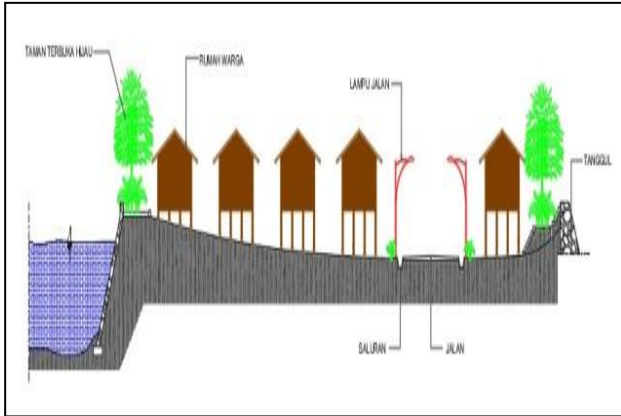


Figure 14. The form of house construction in the Tanjung Putus hamlet.



Figure 15. The concept of structuring building

The concept of building appropriate to this area is the stage home with of the strong foundation construction. House construction serves to anticipate and minimize the loss of life and property during floods. So when the flood occurred, the public can occupy his home. But for transportation facilities, the public can use canoes or rubber boats during floods. Therefore the need to distance between buildings to be traversed by canoes or rubber boats. The concept of the building can provide comfort during the flood.

Early warning system proposed for construction, namely in the form of higher water level observation post. At observation post installed a Board to measure the height of the water surface. Every resident will observe the height of water during the rainy season. The residents will observe the high water level from the observation post alternately during the rainy season. If the water height is increased then the citizens will do announcements. Announcements and notifications are

delivered through loudspeakers at mosques. The announcement was done so that the citizens preparing to standby facing floods.

VII. CONCLUSION

The conclusion that can be drawn from this study are as follows:

- 1) *The Tanjung Putus settlement area is in the line of the boundary rivers and declared as disaster-prone areas.*
- 2) *The concept structuring done has been adapted to the needs and desires of citizens without doing home eviction.*
- 3) *Structuring function of land and building concept can minimize the impact of disaster risk and can make the area comfortable against disaster.*

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