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Flood Control System Management In The Pampang River Sub-Watershed Apt Pranoto Samarinda Airport Area

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ABSTRACT
The purpose of the research is to analyze the flood control system, and provides information about flood control system with various planned scenarios.
The research was conducted for about four months at the Upstream Karang Mumus sub-watershed in Sei Siring Urban-village of North Samarinda Sub District, Samarinda Municipality, East Kalimantan.
Generally, the scope of the research includes (1) conducting a field survey in detail, (2) identifying the factors that cause flooding, and (3) formulating a recommendation for making a significant contribution to the development program of environmentally sound to minimize the environmental and social impacts that could occur.
The research results showed that: (1) the most dominant cause of the flooding problems naturally is the topographical conditions of flood-prone areas, which is relatively low and flat, and it is an area of concentration of surface runoff from the catchment area of the Karang Mumus river and Pampang river; (2) the drainage system is still facing problems either in the system, physical facilities/ structures and non-structure constraints; (3) based on the study of potential flood control, flood control systems at Upper zone of Karang Mumus River could be applied both structural and non-structural mechanisms; and (4) there are five scenarios of existing flood control system. In such scenarios, the flood control system applied a combination of existing conditions with some bendali and diversion. Apart from that, the flood control system also applied the scenario, only normalizing the Pampang river.
Keywords: *Flood Control, Sungai Pampang, Port APT Pranoto Samarinda City.*

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I. INTRODUCTION

Samarinda City, the capital of East Kalimantan Province, is being hit by a severe problem, namely the flood problem. Recently, floods have occurred very often, so they have significantly disrupted the activities of their residents. Various efforts that have been made have not been optimal in overcoming the flood problem.

Efforts have been made in the form of maintenance of drainage channels and rivers that cross the Samarinda City area, various studies and construction of flood control facilities, and several regulations for flood control. Still, these efforts are not fast enough to develop the city. Therefore, an integrated arrangement of flood control is needed by compiling priorities and financing following actual conditions and predictions of its development.

Most areas of Samarinda city that are troubled by flooding are located in the Karang Mumus watershed (320 km^2). In addition, two other sub-systems also have flooding problems, namely the Karang Asam Besar watershed (9.65 km^2) and the Karang Asam Kecil watershed (16.25 km^2). As for the Samarinda Seberang region, flood-prone areas are located around Loa Janan, Rapak Dalam, and Palaran.

Flood-prone areas of the Karang Mumus watershed are spread from the upstream, central areas to the downstream areas. The flood-prone area of the upstream Karang Mumus watershed is located in APT Pranoto, Sei Siring Village, precisely in the Pampang Sub-Watershed area.

II. RESEARCH METHODS

The study was carried out for 4 months in the Karang Mumus Hulu Sub-Watershed in the APT Pranoto Area, Sei Siring Village, North Samarinda District, Samarinda City, East Kalimantan Province.

The scope of the study regarding the implementation of research to analyze the flood control system of the Karang Mumus Atas River (Lempake) includes a detailed field survey as a basis for specific and detailed design planning regarding the initial condition of the Karang Mumus Atas (Lempake) River, identification of

factors that cause floods, and making a tangible contribution from environmentally sound development programs to minimize environmental impacts and social happening.

III. RESULT AND DISCUSSION

A. Flood Control System

To deal with flood inundation in Pampang and surrounding areas, information is needed regarding the amount of inundation, including area, depth/height, duration and frequency and level of losses caused by flood inundation. For the implementation of this handling to be maximized, it is necessary to develop a flood control system by referring to specific parameters to determine a type of flood control building.

Following the results of surveys and investigations, efforts are needed to control it using an engineering aspect approach to deal with flood problems in the Pampang area and its surroundings. The survey results specifically provide alternatives to the flood control system or pattern according to the conditions of the technical and non-technical characteristics of the watershed.

B. Flood Control Analysis

For flood control analysis, various stages are carried out in planning flood control buildings, namely planning flood control buildings through flood analysis and routing using the HEC RAS program. The Hydraulics model is prepared to determine the process of flood entry into the river body and determine the water level's elevation in the river and its surroundings at the time of the flood. A Hec-RAS program package from the Hydrologic Engineering Center (HEC) of the US Army Corps of Engineers was used to analyze the river hydraulics model. This program package can analyze river flow at Unsteady Flow conditions and allows hydrolysis calculations of river water level profiles by paying attention to lateral flow and stage hydrographs of the Lempake reservoir as boundary conditions.

1. Flood Control Simulation

A flood search is carried out through the river to determine the flooding condition along the river channel. Flood tracing is carried out for current conditions based on data on the characteristics of the river channel and its flood banks. Based on the search results, it is known that the capacity of the existing channel or river can no longer accommodate discharge runoff from the existing catchment area. Observing these conditions requires an ideal design to accommodate discharge entering the channel to reduce runoff and lower flood water levels.

a. Flood Control Modeling Scenarios

Hydraulic analysis was carried out on the Pampang river with a total river length of nearly 6.5 km carried out using an average flood discharge (Q5) year with several scenarios as follows :

Plan 00 : The current existing conditions without system changes within the watershed.

Plan 01 : The existing condition of the Pampang River with the addition of Bendali on the Karang Mumus Atas River

Plan 02 : The existing condition of the Pampang River with the addition of Bendali Karang Mumus Atas and Bendali Sei Siring.

The Pampang River scheme is presented according to some of the scenarios outlined above.

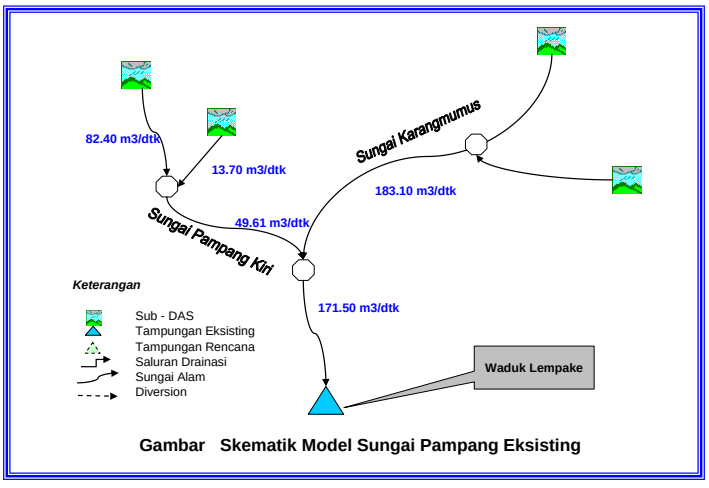


Figure 1. Existing Pampang River Model Scheme

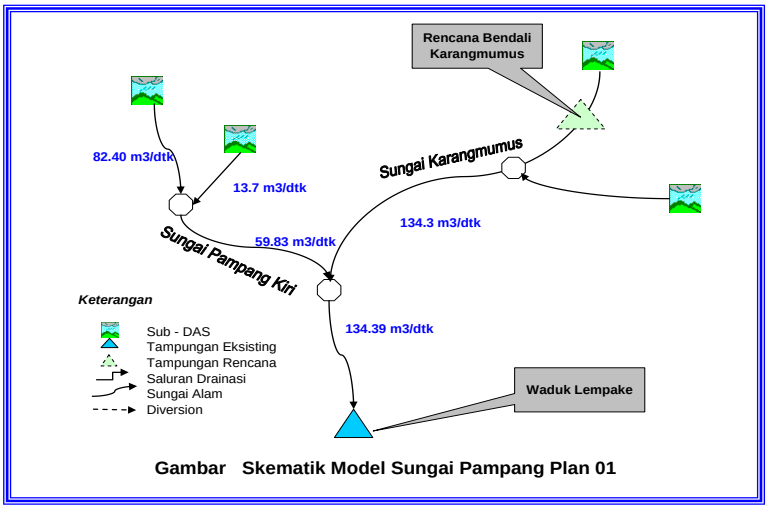


Figure 2. The schema in Scenario 01

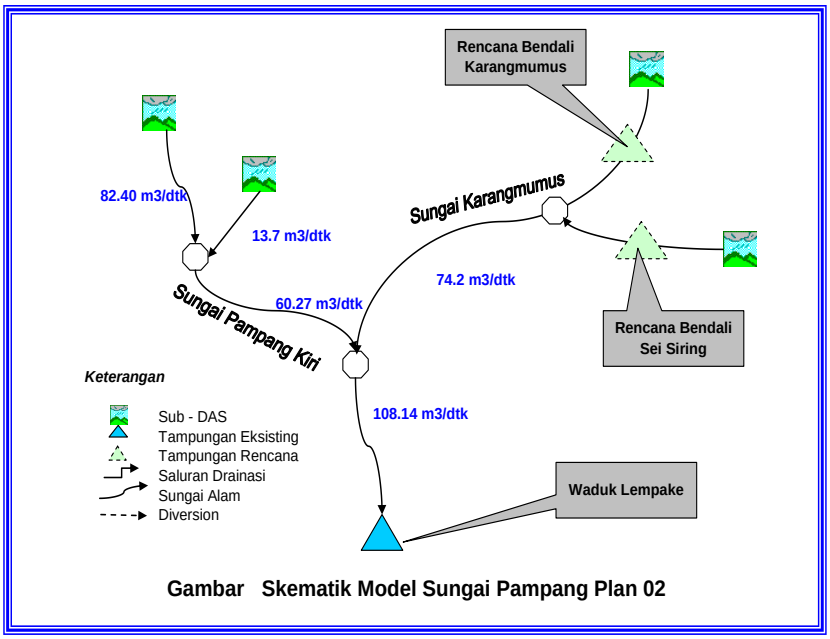


Figure 3. The schema in Scenario 02

Modeling the hydraulics of the Pampang river with the HEC-RAS program is presented in Figure 4.

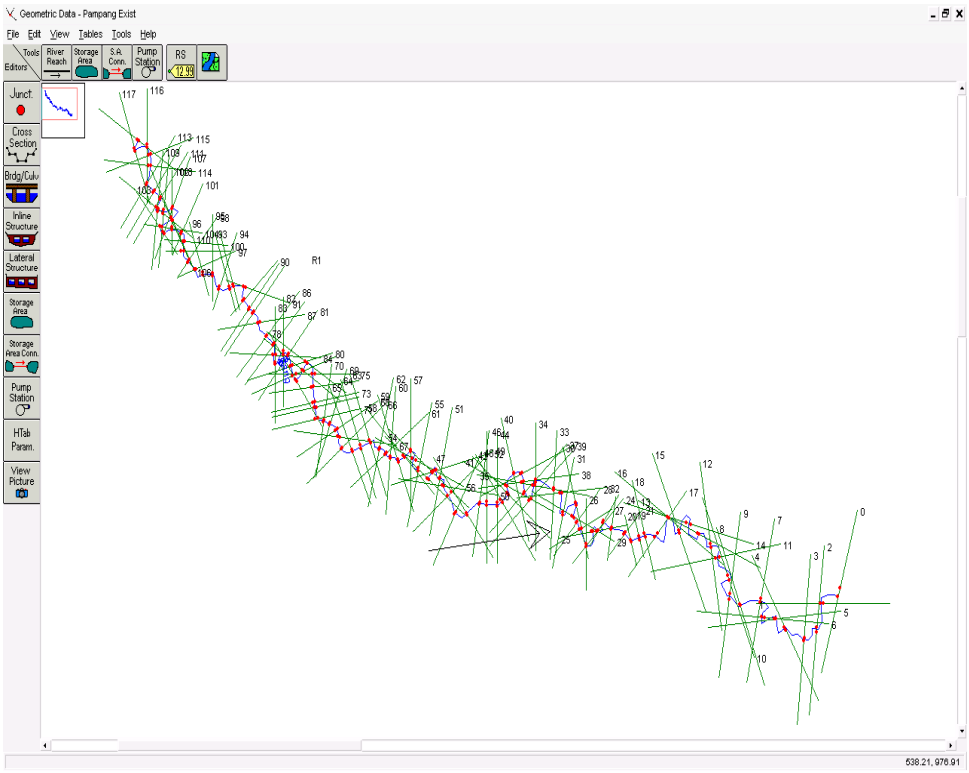


Figure 4. Geometric Model of Pampang river data on the HEC RAS program

The Pampang River will be studied and evaluated against several conditions that adapt to the conditions in the hydrological model coupled with river normalization conditions. As a condition of the upstream boundary is the water output from the Upper Pampang River and the upper Karang Mumus River in the middle part entering several tributaries so that the input in the model in the middle is the hydrograph inflow of some of the tributaries while in the downstream part, the downstream boundary is in the form of a stage hydrograph of the Lempake reservoir. Here is a picture of the boundary of the Pampang river flood hydrograph (Figure 5).

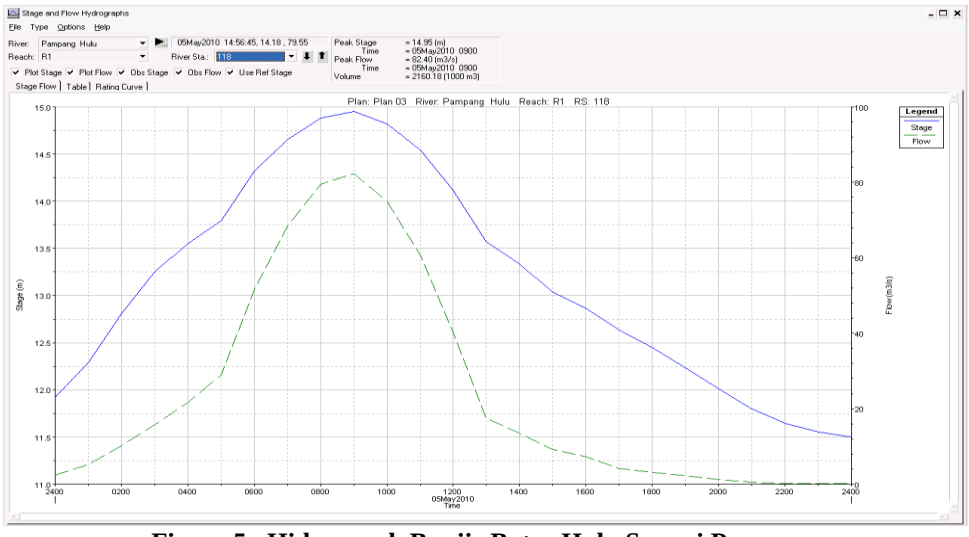


Figure 5. Hidrograph Banjir Batas Hulu Sungai Pampang

b. Output Model

Based on the flood control system simulation with the help of the Hec – RAS Program package, a flood water level profile was obtained along the river channel under review. To compare current and planned conditions (planned flood control system) graphically displayed water level profiles along the river's channel under review.

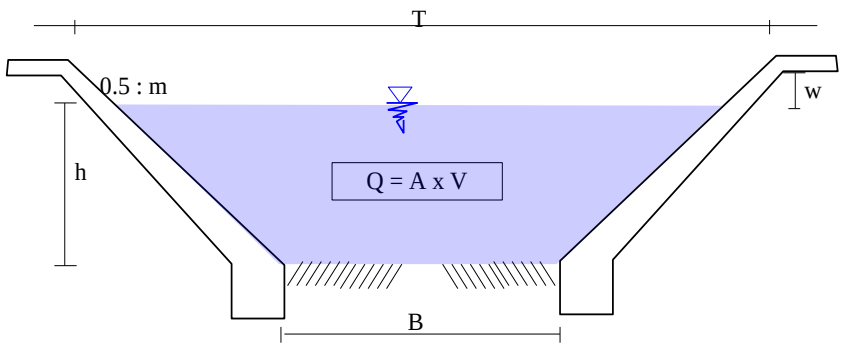
Figure 6. Pampang River Water Level Profile Plan 02 Condition

C. Normalization of Pampang River

Pampang River is a tributary of Karang Mumus. The lower reach of the river is Karang Mumus River. From the results of field investigations and calculation analysis in flood tracing, it was found that the flow capacity of the Pampang river was no longer qualified to accommodate water discharge. For this reason, an ideal design is needed to accommodate water discharge from upstream to meet the required flow capacity and reduce flood water levels/water runoff from rivers. In addition, it is necessary to arrange the river border area, which is required to be free from settlements, so that the water flow rate is not disturbed.

In this case, a river normalization design was put forward, which has been analyzed hydraulically to obtain the ideal design of a river cross-section needed to lower the flood water level. The following is the technical data on the normalization of the Pampang river from calculations and simulations.

PERHITUNGAN KAPASITAS DESAIN SUNGAI PAMPANG (DOWN STREAM)



SKETSA DIMENSI SUNGAI

Channel Cross-sectional Area Calculation

Channel Base Width (B) = 12 m
Talud slope (m) = 0.50 m
Guard Height (w) = 0.50 m
Water Depth (h) = 4,000 m
Channel Depth (H) = 4,500 m = w + h
Channel Top Width (T) = 16,000 m = B + 2 x m x H

Calculation of Channel Discharge Capacity (Hydraulics)

Planned Flood Discharge (Q_5) = **110.00** m^3/s
Plan Base Slope (S) = 0.00089
Manning roughness (n) = 0.025
Wet Cross Section Area (A) = B x h + 2 x 0.5 x (1 + m) x h
= **56,000** m^2
Wet Circumference of Channel (P) = B + 2 x h $(1 + m^2)^{0.5}$
= **20,994** m
Hydraulic Radius (R) = A/P
= **2,674** m
Flow Rate = 1/n x $R^{2/3}$ x $S^{0.5}$
= **2,299** m/s
Channel Flow Capacity (Q) = A x V
= **128,756** m^3/s

The following is a profile of the water level resulting from the Pampang river's routing in existing conditions after normalization.

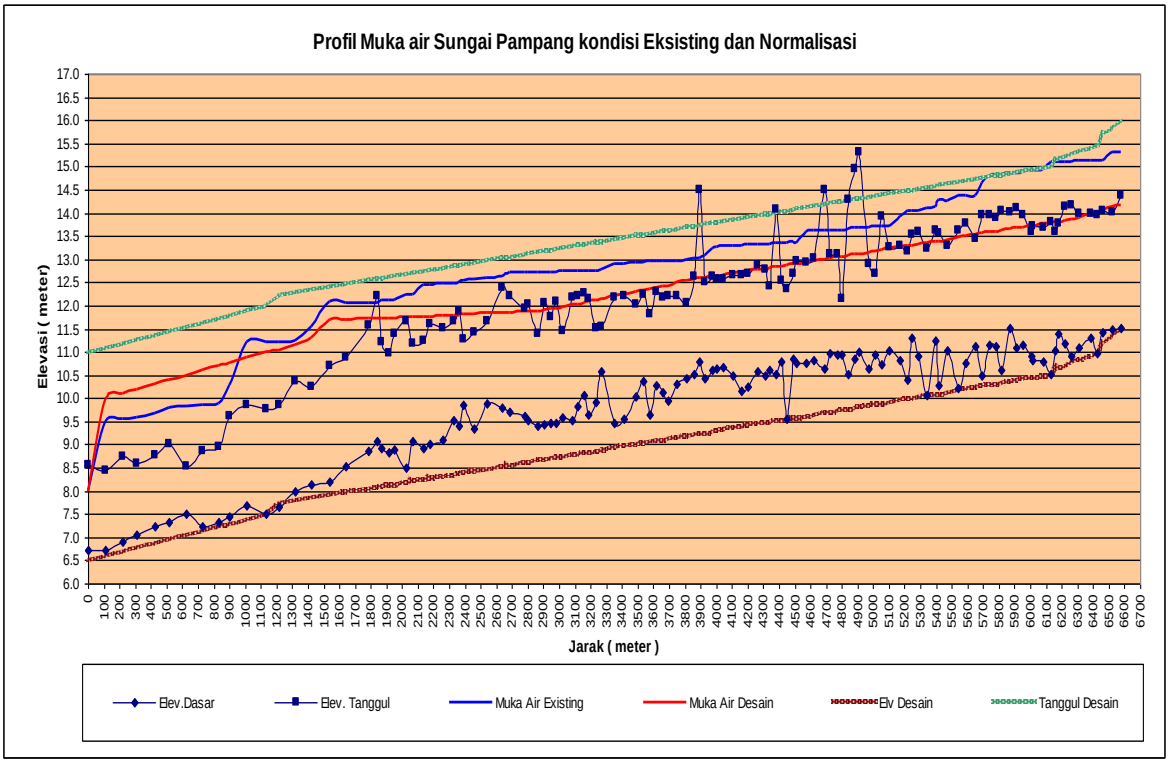


Figure 7. Water level profile of Pampang river's existing condition and normalization

By analyzing the results of the hydraulics model, several statements can be put forward, namely as follows:

1. From the results of the execution of flood tracing through the river channel, it can be observed that to accommodate flood discharge from the upstream area, it is necessary to normalize it, so that surface water runoff can be accommodated in the river channel.
2. To help reduce surface runoff in parts of the river where there is a meander, editing or making shortcuts or bypasses is carried out so that there is no flow queue that results in runoff.

3. To help reduce surface runoff from upstream areas, where many new settlements are currently being developed, small-scale reservoirs in settlements are needed, such as infiltration wells. Creating infiltration wells will significantly help reduce runoff at the local level of residential areas before runoff enters the drainage channel.

IV. CONCLUSIONS AND SUGGESTIONS

A. Conclusions

Based on the results of the analysis and discussion, conclusions can be drawn, namely as follows:

1. The most dominant cause of natural flooding problems is the topographical condition of flood-prone areas that are relatively low and flat and are areas of surface runoff concentration from the catchment areas of the Karang Mumus and Pampang Rivers.
2. The drainage system still faces problems, physical facilities/structures and non-structural constraints.
3. Based on the study of flood control potential, the flood control system of the Karang Mumus Atas River can be carried out structurally and non-structural.

B. Suggestions

Based on the results of the study, several things can be stated, namely:

1. Based on these conditions, to reduce the impact of flooding in Lempake Atas flood control program, wherever possible, is immediately implemented.
2. Flood control programs that have been prepared must be socialized, both to the community and related agencies. Furthermore, the government, through relevant agencies, must commit and be consistent in implementing the planned program.
3. From the various scenarios of the flood control system model that have been studied, Pampang river normalization activities are priority activities. To increase the level of flood reduction, it needs to be combined with control buildings (Bendali Pampang and Bendali Karang Mumus). Specifically, it is necessary to improve the environmental drainage system to reduce the burden of flooding due to local runoff in residential areas.

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