FLOOD MAPPING USING GEOGRAPHIC INFORMATION SYSTEM (GIS)

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To my beloved husband ***Mr Azlan Shah B Katiman,*** *my lovely children* ***Firash Fitri, Firash Fikri, Firash Fathi and Firash Fahmi.*** *To my friends and wonderful classmate* ***Pn Yuhani Bt Jamian, Pn Munirah Bt Dawi Saifudin, Cik Canarisa Nipi Ah Lian, Mr Lim Che Chien, Mr Tang Hing Kwong, Mr Chai Teck Jung, Mr Engku Shahrulerizal B Engku Ab. Rahman, Mr Norasman, Pn Mimi Sulastri Bt Jeman, Mr Tan Kheng Wee, Mr Loo Khee Hui.*** *Thank you for your support, motivation, love and friendship.*

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ABSTRACT

Naturally Malaysia facing with flood problem all over the country. This problem will make worst loses to property and life. Sarawak is one of the state in Malaysia which facing with this problem. In 1963,2004 and 2009, Sarawak experience the worst flood event all over the year. Hence the flood mitigation rush to built in order to control the flood. However before the flood mitigation plan is built, there are several information need to be develop in order to predict the flood area. Several research had been done in order to develop the flood hazard mapping. Certain use InfoWorks RS and other use Autocad 3D associate with Google Earth. In this study, the main aim is to provide flood hazard mapping and identify the rivers that contribute to flood. The flood map was evaluated based on areas and perimeter of the floodplain. The data was collected from Urban Section of DID Sarawak. The digitizing process was used in order to complete the flood mapping process. GIS application also used to achieve other objectives. The analysis show the flood prone area in Sarawak include the river that contribute to floodpain. It was 5163.6 km^2 and 9442.8 km of floodplain in Sarawak. Usually there were 550km^2 and 600km was cover with flood. For the conclusion Samarahan and Mukah was the division that always experience with the flood problem due to the number of river that contribute to flood and percentage of area that covered by flood. This research can help people to understand and get informed the frequent flood area and being prepared for the flood occurrences.

ABSTRAK

Malaysia merupakan sebuah negara yang sering berdepan dengan masalah banjir. Masalah ini membawa kepada kemusnahan harta benda dan juga nyawa. Sarawak merupakan salah satu negeri yang sering berdepan denga masalah banjir. Pada tahun 1963, 2004 dan 2009, Sarawak mengalami banjir yang teruk di dalam sejarah negeri Sarawak. Bertitik tolak daripada masalah tersebut, tebatan banjir telah di bina untuk mengawal masalah ini daripada berulang. Walau bagaimanapun, pembinaan tebatan banjir memerlukan beberapa informasi bagi menjangkakan kawasan yang kerap berlakunya banjir. Beberapa kajian telah dijalankan bagi membina peta banjir untuk membantu dalam pembinaan projek tebatan banjir. Terdapat beberapa kaedah yang digunakan untuk membina peta banjir antaranya dengan menggunakan 'InfoWorks RS' dan menggunakan 'Autocad 3D' bersama 'Google Earth'. Objektif bagi kajian ini adalah untuk mengenal pasti sungai-sungai yang merupakan penyumbang kepada masalah banjir. Keluasan dan perimeter kawasan banjir akan ditaksir melalui peta banjir yang dihasilkan. Menggunakan data yang diambil daripada Bahagian Urban, DID Sarawak, proses pendigitalan telah digunakan untuk menghasilkan peta banjir ini. Aplikasi GIS juga digunakan untuk mengetahui keluasan dan perimeter kawasan banjir. Analisis menunjukkan 5163.6 km^2 kawasan yang mengalami masalah banjir dengan perimeter 9442.8 km di seluruh Sarawak. Pada kebiasaannya keluasan dan perimeter kawasan yang terlibat dengan banjir adalah 550km^2 dan 600km. Kesimpulan daripada penilaian yang dilakukan mendapati bahagian Samarahan dan Mukah merupakan bahagian yang sering berdepan dengan masalah banjir. Ianya berpandukan jumlah sungai di bahagian tersebut dan juga peratusan kawasan yang dinaiki air. Kajian ini akan membantu penduduk di kawasan yang terlibat dengan banjir untuk memahami dan mendapatkan maklumat mengenai banjir. Selain itu mereka juga boleh membuat persiapan untuk menghadapi banjir.

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DID	-	Drainage and Irrigation Department
GIS	-	Geographic Information System
ARI	-	Annual Recurrence Interval
km^2	-	Kilometer square
km	-	Kilometer
%	-	Percentage

CHAPTER 1

INTRODUCTION

This chapter consist of introduction , research problem, research aim and objectives, research scope, significant of research and hypothesis.

1.1 Introduction

Some said " Flood is too much water in the 'wrong place' ". The fact is flood is one of the oldest natural disaster that happened in the world. Flood also the most frequent hazard in Malaysia. Flood can occur in any region in countryside or in cities. Due to data recorded by DID Malaysia in 2014, there are is over 30,000km^2 flooded area and 9% of the total area in Malaysia. Also 4.8 million (20%) people affected by the flood (Bibi Zarina,2014). Flood can cause by many reason. In Malaysia the flood occurrences always related to natural phenomenon and human activities. Natural phenomenon like heavy rainfall and high tides. Therefore the human activities related to change in land used, rapid uncontrolled development, effect of urbanization, inadequate drainage facilities, obstruction in rivers and solid waste debris (Keizrul,2004).

1.2 Problem Background

Sarawak is located on Borneo island which is the third largest island in the world. Also as the largest of Malaysia's thirteen states. Sarawak also known as a

state with longest river in Malaysia and having plenty of river basin. In each basin boundary, there are several main river. There are 22 major river basin all over the state. In each major river basin boundary there are plenty of main river. These rivers plays many roles to the environment and the main source for water supply. In other hand, the rivers also as one of the main source for the flood problem.

Sarawak always facing with flood problem when ever there is rainy season or during North East Monsoon in November to Februari. The worst flood event was in 1963, 2004 and 2009. But in previously 10 years, Sarawak experience almost flooded event every year whether it is worse or normal flood. Flood occurrence in Sarawak also related to the natural phenomenon and human activities.

Due to natural phenomenon, Sarawak which is located immediately north of the equator and it experiences two monsoons yearly. The North East Monsoon, which usually occurs between November to February, brings with it heavy rainstorms. The annual average rainfall is above 3,000 millimeters. During these rainstorms, flooding in the low-lying areas and natural floodplains along many rivers and even in some urban areas are common. Some said the high tides also cause for the flood occurrence in Sarawak River, but due to DID Sungai Sarawak tides is fully controlled by Kuching Barrage and Shiplock.

1.3 Research Problem

Sarawak facing with the worst flood event in Sarawak's history beginning in the year 1963. Then Sarawak facing with this natural disaster more often until year 2013. Even though there are many mitigation flood have been planned all over Sarawak, but the flood matter still not conquer. Every year we still heard about flood occurrence in every division in Sarawak.

In order to evaluate the floodplain, the flood prone map was develop by DID to shows the area that affected by flood. But the flood prone mapping is only a flood forecasting based on the previous flood data (Jones,2004). This flood prone area was used to develop an early warning of the flood occurrence. According to DID Sarawak (DID,2014), the flood

prone mapping that they develop is for 100 years ARI and updating the flood prone mapping whenever there is a flood event.

1.4 Research Aim and Objective

Research aim and objectives of this study can showed the importance of this study. It also related to the problem statement above. Hence the objectives of this study are :

i. To produce a flood mapping areas and identify the river that contribute to flood.
ii. To evaluate the flood mapping based on areas and perimeter.

1.5 Research Scope

This study was conducted at Sarawak as the biggest state in Malaysia. Consist of eleventh (11) division, Sarawak having the most river stream in Malaysia. There were thirty five (35) gazette river all over division. These river was the main contributed of flood occurrences.

Using GIS application to achieve all the objectives especially in order to produced floodplain area. The hardcopy data that obtained from DID was transferred into digital form with additional other hydrology data such as flood history.

Evaluate the data using GIS application like calculate the areas and perimeter of the floodplain from the flood map. The frequency of the flood area and perimeter also calculated and appear in histogram chart.

1.6 Significant of Research

The benefits and expectation from this study are :

i. The data analysis can give appropriate information to the villagers and concern bodies
ii. These analyse data can educate people about flood and preparation on facing flood problem.
iii. The Flood Hazard Mapping area will give the appropriate information on how far the flood can reach.

1.7 Hypothesis

The research will shows the affected area by flood due to the flood data that recorded by DID Sarawak. But the flood data only show the water level at several areas. So the flood prone mapping will be show the appropriate areas that affected by the flood.

The GIS tool can calculate the affected areas in kilometer square (km^2). Also it will gave a result on how far the flood can reach based on measurement in meter (km). The frequency areas and perimeter also calculated so that we can evaluate the most comment areas and perimeter that affected by flood.

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