

**ANALYSIS OF RAINFALL EVENT AND
BRIDGE ON GALING RIVER**

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ABSTRACT

The growth of development and not well planned drainage system is one of the factors causing flooding. The development activities will affect the properties of the soil. This phenomenon will result in serious flooding to the downstream area especially when the arrival of the monsoon season. Kuantan town is one of the examples that faces this problem. Therefore, this study is to predict the flood upon the arrival of the monsoon season at the Galing River as the selected catchment area based on historical rainfall data. The data for the study included, tidal water level and river cross section. Analysis were carried out using InfoWorks RS software. From the analysis, the hydrograph were plotted as the result to show the critical water level for the some of the section of the river.

ABSTRAK

Peningkatan terhadap pembangunan dan juga sistem perparitan yang tidak terancang adalah merupakan salah satu daripada factor-faktor penyebab kepada berlakunya kejadian banjir. Aktiviti-aktiviti pembangunan yang dijalankan akan menyebabkan kepada berlakunya perubahan sifat-sifat semulajadi tanah di kawasan tersebut. Fenomena seperti ini akan mengakibatkan kepada berlakunya banjir yang serius di kawasan hulu sungai terutamanya apabila tibanya musim hujan. Bandar Kuantan merupakan salah satu daripada contoh bandar yang menghadapi masalah ini. Oleh kerana itu, kajian ini dijalankan bertujuan untuk meramal kejadian banjir yang akan berlaku apabila tibanya musim hujan di Sungai Galing. Data data yang diperlukan untuk kajian ini termasuklah rekod data-data hujan, data pasang surut air laut dan juga data keratan rentas sungai. Analisis telah dilakukan dengan menggunakan perisian InfoWorks RS. Daripada analisis yang telah dilakukan, hidrograf telah dihasilkan untuk menunjukkan aras air kritikal bagi sesuatu bahagian pada sungai tersebut.

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LIST OF ABBREVIATION

NO	ABBREVIATION	
1	DID	Department of Irrigation and Drainage
2	MPK	Kuantan Municipal Council
3	JUPEM	Department of Survey and Mapping
4	GIS	Geographic Information System
5	CN	Curve Number
6	MSMA	Manual Saliran Mesra Alam
7	ARI	Average Reoccurrences Intensity
8	Q	Flow Rate of Water (m^3/s)
9	C	Dimensionless Runoff Coefficient
10	I	The Average Rainfall Intensity (in/hr, mm/hr)
11	A	Drainage Area (acres, ha)
12	t_c	Time of Concentration
13	F_c	Conversion Factor
14	L	Length of Flow Path from Catchment devided to outlet (km)
15	A	Area of the Catchment
16	S	Slope of Stream Flow
17	I	Rainfall Intensity (mm/hr)
18	P	Rainfall Depth (mm)
19	R_{I_t}	Average Rainfall Intensity for ARI
20	t	Duration, time (hr, min, sec)
21	a, b, c, d	Fitting Constant from IDF curve

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CHAPTER I

INTRODUCTION

1.1 Introduction

Flooding is the result of runoff that can not be absorbed into the ground. It occurs when rainfall exceeds the carrying capacity of drainage and changes in soil characteristics. This flood will immerse the affected area and leave a serious impact on the area. Floods are one of the most common hazards in the earth. Flood effects can be local, impacting a neighborhood or community, or very large, affecting entire river basins and multiple states.

However, all floods are not alike. Some floods develop slowly, sometimes over a period of days. But flash floods can develop quickly, sometimes in just a few minutes and without any visible sign of rain. Flash floods often have a dangerous wall of roaring water that carries rock, mud, and other debris and can sweep away most things in its path. Overland flooding occurs outside a defined river or stream, such as when a levee is breached, but still can be destructive. Flooding also can occur when a dam breaks, producing effects similar to flash floods. (Federal Emergency Management Agency, FEMA, June 2009).

Floods event at the selected area are in monsoon flood categories because this event normally occur when monsoon season at east cost of Peninsular Malaysia which is between November and February. Floods event at the selected area occur because of the meeting of two rivers and the backflow water from the sea when the water level rised.

Flood estimation at a catchment scale is important for many hydrological applications. A key factor for accurate flood estimates is accurate rainfall and accurate parameter of the model for input to the hydrological model.

This paper presents the results of an investigation into flood estimation on the Galing River, Kuantan as shown in Figure 1.1. The spatial and temporal characteristic of rainfall and flood behavior was analyzed by using InfoWorks RS software. By using a manual method, the problem cannot be totally observed. Because of that, a computer system is a best solution to solve this problem. It is because of the ability of this system that can analyze more data in a short time. This software was built to an extremely high level of details. The total stream length is needed to be calculated, but the model includes the surveyed river cross-sections within the length, as well as a modeled structure, that was hydraulically significant in the catchment. This was a somewhat higher level of details than would normally be applied, but it was warranted by the complexity of flooding problems in the catchment. This model is not only can help to estimate the flood event, but it also can solve the problems about the water organization system in this country.

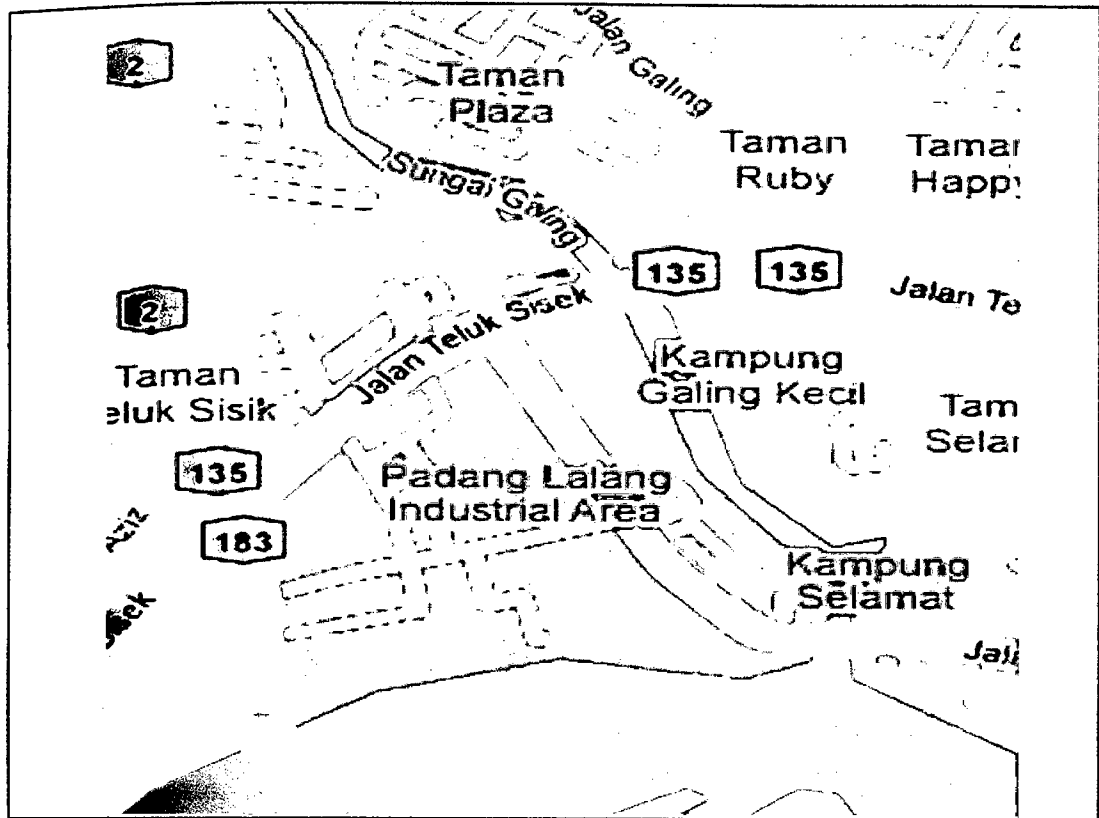


Figure 1.1: The Location of Galing River (Google Maps)

1.2 Problem Statement

Today, the local development had changed rapidly. It caused the unlimited growth of buildings in this country. As a result, there are some considerations that must be taken into an account. The flood may occur if the considerations such as the ground water table, the cross-section of the drainage system and the frequency of the flood are ignored.

Floods often occur in a developed area. This is because the rain would be absorbed in areas that are not developed compared to the developed area. As a result, if a large amount of rain in the developed area, only a little is absorbed into the ground and the rest will be water run-off and flow to the lower area. To prevent the occurrence of flooding, flood warning systems should be made to predict the flood that will occur in the future. River flooding in Galing River, Kuantan is caused by the occurrence of the reversal of water (backflow) from sea water to flow into the rivers and streams can not accommodate the excess water. This phenomenon will bring disaster to human life and damage to property. Consequently, this phenomenon can contribute bad effects to the social, economic, and environmental.

In order to prevent this disaster from occurring, the study should be carried out to predict the flood. In a life of highly developed, modern and filled with the system of science, there are a lot of software that were created in producing the flood warning system. One of the software is InfoWorks RS. This software is very accurate in analyzing the flood that will occur. It is able to analyze the data to be used for flood forecasting in a wide area. At the end of this study, a hydrograph will be generated as the data has been determined.

1.3 Objectives

The objectives of this study are:

- i. To determine the cross-section of Galing River.
- ii. To analyze the hydrological data for the critical month.
- iii. To propose the possible solution for the problem.

1.4 Scope of Study

This study had been using InfoWorks RS software. The location of study is in Kuantan area. In this study:

- i. The data obtained from the related department and reliable source.
- ii. The design analysis involved analyzing the change of water level heights, the excess of water, and the critical water level and the urbanization affect to the river.
- iii. The final results were analyzed by using unit hydrograph method.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

A flood can be divided into two categories which is monsoon flood and flash flood. Flood is a one of the example of natural disasters that can impact to the community and economy system at that place. There are many of factors that can affect the water level of the river, hence can cause the flood. The factors that can cause the flood are such as tidal water level, backflow of water, rainfall event, and urbanization. In this paper, the focus is on estimating the flood by using the Infoworks RS software to predict the rise of the water level when the backflow water from the sea is occurred. By using this software, the prediction on the rise of the water level can be attained. This information could be used to warn the public on the level of danger.

2.2 River

As shown in Figure 2.1, river is the natural flow of water flowing into oceans, lakes, rivers or to the other. Small rivers are usually known by several names such as creek, stream, brook and rill. River consists of several parts, starting from the springs that flow into streams. Then, the stream will encounter to form the main river. Flow of river water is limited on the basis of the river and on the left and right banks of rivers. River is one part of hydrological cycle. Water in the river is accumulated from natural processes such as rain, dew, and springs. River is important for all life on earth. Regardless of human, animals and plants need water to maintain their life. River system is vital to agriculture for plants and transportation systems for humans. Normally the river in Malaysia is the type of river water. River water is the sources of the river water comes from rainwater collected and produce a large flow. (<http://en.wikipedia.org/wiki/River>)



Figure 2.1: Example of River

2.3 Flow Rate

A fluid power variable that describes how much fluid is being moved and how much work is being performed. The flow of the water is directly proportional with the area of the river. If the area of the river is increase, the flow of the water is also increase. The flow rate is the quantity of fluid flowing per unit time across a given surface. The flow rate is usually represented by the symbol Q.

$$Q = AV$$

Where:

Q= volumetric flow rate (m^3/s)

A= cross sectional area (m^2)

V= velocity (m/s)

2.4 Hydrological Cycle

Hydrological cycle is nature process of water transfer cycle that occurs at the earth surface repeating and constantly. In this process, there are three main phases are involved in hydrological cycle which are evaporation and evapotranspiration, precipitation and runoff. (Ayob Katiman, Zulkifli Yusop, Kawi Bidin, 2007)

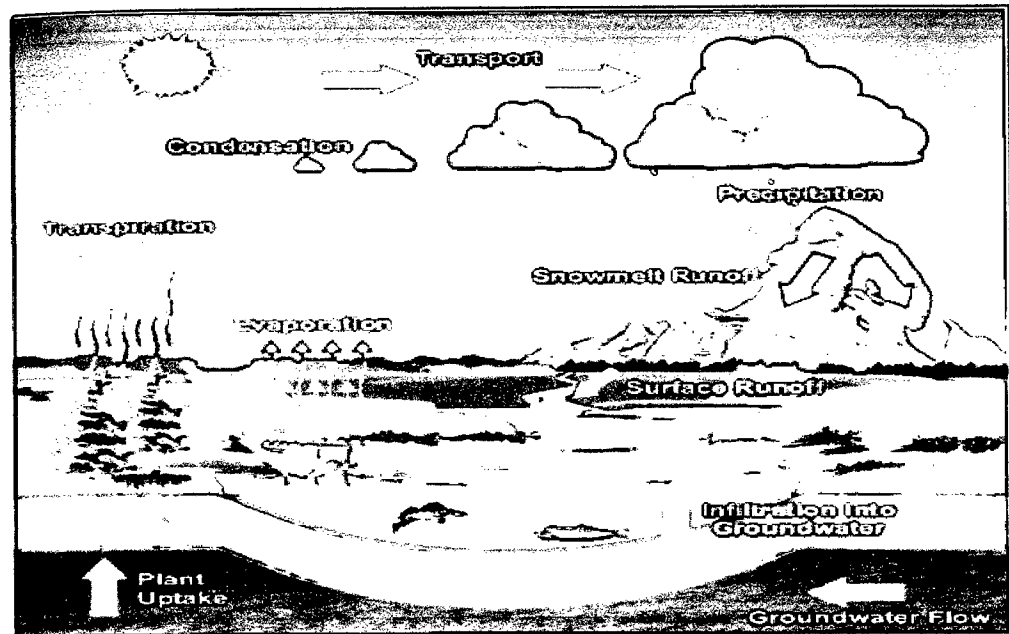


Figure 2.2: Hydrological Cycle Process (K Subramanya, 2005)

According to K Subramanya as shown in Figure 2.2, water is evaporating to the heat energy provided by solar radiation. The water vapour moves upwards and forms clouds. While much of the clouds condense and fall back to the ocean as rain, a part of the clouds is driven to the land areas by winds. They condense and precipitate onto the land mass as rain, snow, hail, and sleet. A portion of the water that reaches the ground enters the earth's surface through infiltration, enhance the moisture content of the soil and reach the groundwater body. Vegetation sends a portion of the water from under the ground surface back to the atmosphere through the process of transpiration. The portion of precipitation which by a variety of paths above and below the surface of the earth reaches the stream channel is called runoff. Once it enters a stream channel, runoff becomes streamflow.

2.5 Flood

Flooding is a natural disaster that resulted in an area is submerged in water. Floods may result in an area that suffered severe damage such as loss of property, lives, economic decline, and the homeless. Flooding is due to overflow of water from river to sea or land surface and sink area. Floods can be divided into two parts, namely flash floods and monsoon flood. Monsoon floods are caused by the backflow of water into the river when water levels rise. When the backflow of water into the river exceeds the capacity of the river, this will result in overflow of water to the nearest area. Flood can also be defined as the water has exceeded the normal limit. Floods are frequent natural disasters experienced in the world. Therefore, it is difficult or impossible to obtain insurance policies to protect goods and property damaged due to flooding. Flood is classified as disasters because of the effects of severe flooding left to the local community. Among them are physical damage, water pollution, and lack of food supplies. Physical damage is like structures such as buildings damaged and landslides resulting from the flood. Source of clean water can not be obtained as a result of water pollution. Food shortages are also caused destruction of crops and animal death. (<http://en.wikipedia.org/wiki/Flood>)

There are many factors that floods event can occur. The factors includes runoff, catchment area information, geographic location, land use, soil type, topography, vegetation, detention storage systems, flow diversions, channelization, and future conditions. (Hydraulic Design Manual, 2009)

2.6 Factors that Affecting Flood

2.6.1 Precipitation

The term precipitation means the formation of water that occurs in the atmosphere reach the ground. The three states that water occurs on earth are liquid, solids, and gaseous. Precipitation will normally form the rainfall, snowfall, hail, frost and dew. The magnitude of precipitation is closely related to time and area. According to K Subramanya, there are four conditions to form a precipitation which are the atmosphere must have moisture, there must be sufficient nuclei (salt particles or products of combustion) present to aid condensation, weather conditions must be good for condensation of water vapour to take place and the products of condensation of water must reach the earth. (K Subramanya, 2008. Sarka Blazkova, Keith Beven, 2003)