



Faculty of Engineering

**DETERMINATION OF SPILLWAY CAPACITY OF PROPOSED  
BENGOH DAM**

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Bachelor of Engineering with Honours  
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Judul: DETERMINATION OF SPILLWAY CAPACITY OF PROPOSED BENGHOH DAM

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**DETERMINATION OF SPILLWAY CAPACITY OF PROPOSED BENGHOH DAM**

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This project is submitted in partial fulfillment of  
the requirements for the degree of Bachelor of Engineering with Honours  
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Dedicated to my family and friends

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## **ABSTRACT**

The aim of the study is to determine the spillway capacity of proposed Bengoh dam. The proposed Bengoh dam is located 43 km away from Kuching city. The purpose of the construction of Bengoh dam is to supply more raw water supply to Batu Kitang Water Treatment Plant due to increase in water demand in Kuching area. The geography and hydrology location of Sg. Bengoh make it suitable to construct a dam in that location. The Bengoh dam's spillway should be able to pass the peak outflow during the design flood in Sg. Bengoh. In this study, the determination of spillway capacity of proposed Bengoh dam is conducted by analyzing the design flood to produce the outflow hydrograph for the spillway. The determination of spillway capacity is very important in designing spillway structure. Sufficient design of spillway can avoid dam overtopping which may lead to destruction of the dam that can affect the environment and injury to human downstream of the dam.

## **ABSTRAK**

Matlamat kajian ialah untuk menentukan kapasiti alur limpah Cadangan Empangan Bengoh. Cadangan Empangan Bengoh terletak 43 km jauh dari bandaraya Kuching. Tujuan pembinaan empangan Bengoh ialah untuk membekal lebih banyak bekalan air mentah ke Pelan Rawatan Air Batu Kitang berturutan peningkatan permintaan air di kawasan Kuching. Kedudukan geografi dan hidrologi Sg. Bengoh membuatnya sesuai untuk pembinaan empangan di lokasi tersebut. Alur limpah empangan Bengoh seharusnya mampu untuk melepasi kadar alir keluar puncak semasa reka bentuk banjir berlaku di Sg. Bengoh. Di dalam kajian ini, penentuan kapasiti alur limpah untuk cadangan empangan Bengoh dijalankan untuk menganalisa reka bentuk banjir untuk menghasilkan hidrograf kadar alir keluar untuk alur limpah. Penentuan kapasiti alur limpah adalah penting untuk mereka bentuk struktur alur limpah. Rekaan alur limpah yang mencukupi dapat mengelak air melepasi ketinggian empangan yang mampu menyebabkan kerosakkan empangan yang boleh membahayakan alam sekitar dan mendatangkan kecederaan kepada manusia di hilir empangan.



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## **LIST OF ABBREVIATIONS**

C	-	Discharge coefficient
DID	-	Department of Irrigation and Drainage
Eq.	-	Equation
etc.	-	et cetera
FSL	-	Full Supply Level
Hr	-	Hour
H	-	Head on crest
I	-	Inflow rate
JKR	-	Jabatan Kerja Raya
km	-	kilometer
Kpg.	-	Kampung
KWB	-	Kuching Water Board
L	-	Crest length
LSD	-	Land and Survey Datum
m	-	meter

mm	-	milimeter
MLD	-	Megaliter per day
N	-	Number of piers
O	-	Outflow rate
PMF	-	Probable Maximum Flood
PMP	-	Probable Maximum Precipitation
Q	-	Discharge rate
RL	-	Reduced Level (to LSD)
S	-	Storage
Sg.	-	Sungai
SSRS	-	Sungai Sarawak Regulation Scheme
t	-	time
WMO	-	World Meteorological Organisation
WTP	-	Water Treatment Plant
$\Delta t$	-	Time interval
$C_o$	-	Ogee crest coefficient
$H_e$	-	Actual head on crest

- $H_o$  - Design head
- $K_a$  - Abutment contraction coefficient
- $K_p$  - Pier contraction coefficient
- $m^3/s$  - Meter cube per second
- $Mm^3$  - Million mater cube

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# CHAPTER 1

## INTRODUCTION

### 1.1 BACKGROUND

The proposed Bengoh dam site is located about 43 km away from Kuching city center on Sg. Bengoh, about 1.2 km upstream from the confluence of Sg. Semadang and Sg. Bengoh near Kpg. Bengoh. The river flows in a deep, steep-sided valley or gorge. The dam site is located on a double bend in the river where it is simplify the arrangement of the tunnel and the spillway. The dam is 63 m high and 267 m long and once completed will able to store 144 m<sup>3</sup> of water with the lake surface area of 10 km<sup>2</sup>.

Spillway is a part of the dam where its function is to channel the flood water safely downstream when the reservoir is full to prevent the dam from overtopping. In other words, a spillway is some kind of protection for the dam against the floods that might occur during the service period of the dam. The design of the spillway must considering the most extreme flood that ever occurred at the site so that the spillway is able to accommodate such flood.

## **1.2 STATEMENT OF PROBLEM**

During maximum precipitation, the water capacity will increase due to the water that flowing into the reservoir and can cause overtopping at the dam. Overtopping at the dam should be avoided because it can cause the dam to breach, leak or burst. To prevent the dam from overtopping, a spillway must be design to allow the excessive water to flow downstream. Designing a spillway will require us to consider the ability of the spillway to accommodate excessive water capacity during the greatest flood ever occur at the reservoir area. A spillway can prevent lost of lives and destroying the nature because it protecting the dam from breaching.

## **1.3 OBJECTIVE OF STUDY**

To determine the spillway capacity for Bengoh dam so that the spillway can accommodate excessive water capacity during the Probable Maximum Flood (PMF) occurrence. The spillway will able to protect the dam from overtopping to keep the structure safe from damages. When the capacity is obtained, the checking for spillway structure can be done to see whether the spillway can cater the peak water capacity during PMF.

## **1.4 SCOPE OF STUDY**

To examine and analyze the problems, in relation to:

- Obtain design flood
- Spillway characteristic
- Flood routing of probable maximum flood through reservoir
- Determination of spillway capacity to accommodate PMF

# **CHAPTER 2**

## **LITERATURE REVIEW**

### **2.1 DEVELOPMENT AT SUNGAI SARAWAK**

Sg. Sarawak is very important to the people resided within Sg. Sarawak system. Its roles for water supply, agriculture and aquaculture, industries, navigation, recreation, biodiversity etc. are vital for them. The activities and developments that taken place in the Sg. Sarawak basin are:

#### **2.1.1 Urban and Industrial Development**

Kuching is an urban center at Sg. Sarawak river system with population of 450000. The towns and villages within Sg. Sarawak system are Batu Kawa, Batu Kitang, Siniawan, Bau, Petra Jaya etc. The developments include the hotel and tourism industries, shop houses, business center, administration center, housing center, factories etc. The main industrial zones are the Sama Jaya Free Industrial Zone in Muara Tabuan and Small Industrial Zone in Demak Laut.

### 2.1.2 Agriculture Activities

The agriculture activities constitute about 70% of catchment area of Sg. Sarawak. The various types of these activities are shifting cultivation, horticulture and mixed farming, pig rearing, palm oil development etc.

### 2.1.3 Fisheries and Fishing Ground

The location for fisheries and fishing ground is between the confluence of Sg. Sarawak Kiri and Sg. Sarawak Kanan to Pending area at Kuching.

### 2.1.4 Mining and Sand Extraction

There are some sand extraction activities upstream of barrage. The mining activities only in Bau but the activity was stop in 1997 because of arsenic pollution to Sg. Sarawak.

### 2.1.5 Water Extraction

Sg. Sarawak Kiri supplies 95% of water supply for Kuching City and the water intake is at Batu Kitang. Sg. Sarawak Kiri was gazette as a water catchment area to protect it as water resources.