

**INTEGRATION AND APPLICATION OF FLUVIAL-12 AND
ARCVIEW GIS FOR FLOOD RISK ANALYSIS**

By

EVANS JUISON

Report is submitted as
the requirement for the degree of
Bachelor Engineering (Hons) (Civil)

**UNIVERSITI TEKNOLOGI MARA
APRIL 2005**

TABLE OF CONTENTS

	<i>Pages</i>
DECLARATION	ii
ACKNOWLEDGEMENTS	vi
LIST of TABLES	vii
LIST of FIGURES	viii
ABBEVIATION	xiv
LIST of SYMBOLS	ix
ABSTRACT	xi
CHAPTER 1 INTRODUCTION	
1.1 Background	1
1.2 Objectives	2
1.3 Significant of the Research	3
1.4 Study Area	3
1.5 Structure of Thesis	4
CHAPTER 2 LITERATURE REVIEW	
2.1 Introduction	6
2.2 Flood Problem	6
2.2.1 Factor Causing Flood	8
2.2.2 Effect of Sediment Transport on Flood Level	10
2.3 Sediment Transport Modeling	11
2.3.1 HEC-6 model	13
2.3.2 FLUVIAL-12 model	15
2.3.2.1 Application of FLUVIAL-12	17
2.4 Geographic Information System (GIS)	22
2.4.1 Component of GIS	22
2.4.2 GIS Capabilities	24
2.4.3 GIS Data Structures	25
2.4.3.1 Raster Data Model	25
2.4.3.2 Vector Data Model	26
2.4.3.3 Triangular Irregular Network Model (TIN)	26
2.4.3.4 Regular Grids (Digital Elevation Model-DEM)	28
2.4.4 ArcView GIS	30
2.5 Hydraulic Modeling and GIS	31
2.5.1 Loose Coupling	32
2.5.2 Tight Coupling	34
2.6 Flood Risk Map Production	35
2.7 Conclusion	37
CHAPTER 3 RESEARCH METHODOLOGY	
3.1 Introduction	38
3.2 Staging of Research Process	38

ACKNOWLEDGEMENT

First I would like to thank my supervisor, Dr. Shanker Kumar Sinnakaudan, for his support and guidance in preparing this report by giving advice and previous reports about my research. Without his cooperation, I would not be able to complete this study.

Special thanks to the Library of University of Technology MARA for granting me permission to make use of the facilities in the library such as books, journals and using the internet to search some resourceful information for this report.

I would like to express my heartfelt appreciation to my parents and families for their patient, love prayers, support and also for understanding the sacrifices required in completing this study.

I would like to acknowledge to my beloved friends and classmates for being supportive and for their contribution and understanding. Special thanks to Ms. Anna Sapan for making all this possible through her strong support given to me.

Lastly but not least, thank you to all that have contributed either directly or indirectly in making this study a success.

I have made every effort to identify the original sources of information stated but, if there have been any accidental errors of omissions, I apologise to those concerned.

Evans Juison

APRIL, 2005

ABSTRACT

Geographic Information System (GIS) is an efficient and interactive spatial decision support tool for flood risk analysis. This research describes the ability of ArcView GIS tool to integrate the FLUVIAL-12 hydraulic model within GIS environment. Water surface profiles generated from FLUVIAL-12 are analysed in ArcView GIS to produce flood risk maps for Pari River. The users-friendly menu in the ArcView GIS to enable the users to create, analyse and visualise the flood risk maps, base on the output data from FLUVIAL-12 hydraulic model. The flood risk model is tested using the hydraulic and hydrological data from the Pari River catchment area. The required sediment input parameters spatial data were obtained from Sinnakaudan (2003). The results of this study prove that GIS provides an effective environment for flood risk analysis and mapping.

CHAPTER 1

INTRODUCTION

1.1 Background

In recent years, severe flooding has occurred in several parts of Malaysia, both as localized flash floods and as basin-wide floods on major river systems. Some of the badly affected areas are situated at the river basins in Penang (Juru River Basin), Pahang (Pahang River Basin), Terengganu (Setiu River Basin) and Perak (Kinta River Basin) (Sinnakaudan *et al.*, 2001). The flood prone areas are still under heavy development because there are no sustainable guidelines for the development on the flood plains (Sinnakaudan, 2003).

By their nature, floods are generated by the random coincidence of several meteorological factors but man's use of the river catchment also has an impact upon the severity and consequences of the events (Sinnakaudan, 2003).

There are few attempts in Malaysia to provide accurate flood risk maps taking into account of sediment movement along the river channel. Abu Hasan (1998) and Ab. Ghani *et. al* (1998; 1999) had attempted to quantify the effects of sediment movement and corresponding cross-sectional changes in producing the flood levels (Sinnakaudan, 2003). Successful applications of several sediment transport models such as HEC-6 and FLUVIAL-12 indicate the possibility of extending the obtained results in mapping the flood prone areas by incorporating sediment transport bearing, in mind the physical