

Special Issues Rivers'07: River Modelling and Flood Mitigation; Malaysian Perspectives

Malaysia is fortunate in that historically it has not experienced natural disasters in the form of earthquakes, volcanoes, and typhoons. The most common natural disaster frequently encountered in Malaysia is flooding. Two major types of floods occur in Malaysia, including monsoon floods and flash floods. The Department of Irrigation and Drainage in Malaysia has estimated that about 29 000 sq. km, or 9%, of the total land area and more than 4.82 million people (i.e. 22% of the population) are affected by flooding annually. The damage caused by flooding is estimated to be about RM 915 million (£160 million).

While monsoon floods are governed by heavy and long durations of rainfall, more localized flooding, which occurs especially in newly developed town areas, has been reported more frequently in recent years. In October 2003 major flooding affected a large area in northwestern part of the Peninsular, including the state of Kedah, Penang and northern Perak. The December 2007 floods, on the other hand, occurred in the state of Pahang, after more than 30 years since the last similar floods of 1971. Flash floods have occurred more frequently in the country since the 1980s, with these types of floods often having a drastic impact on parts of the country.

Two common approaches adopted in reducing the impact of flood problems have been increasingly adopted in Malaysia and these include structural and non structural measures. Structural measures include such measures as river widening, deepening and straightening, with the aim being to reduce the magnitude of the flood, but at the same time this approach often transfers the flooding problem further downstream. For non structural measures, tools such as computer models can be used to quantify the effects of human interference on the river system. Such tools are already available widely used in many countries worldwide, but the application of sophisticated models is still relatively new in Malaysia. One reason for this limited use of such models in Malaysia is that the tools often do not properly model the more extreme flood events, where the river flows are often supercritical.

In Malaysia it is regarded as increasingly important to carry out a thorough analysis of flood events with the help of available river models to understand the flood behaviour before any structural measures are undertaken. Therefore, before any amendments are implemented within a catchment and the flood plain, river engineers must evaluate the potential extent and impact of flood events and advise the implementing agencies as to what steps need to be undertaken to provide further preventative measures to avoid the anticipated flood problems that might occur.



This special issues of the ICE Water Management Journal contains four technical papers that were presented at the Second International Conference on Managing Rivers in the 21st Century or Rivers'07, held in Kuching, Sarawak, Malaysia, June 2007:

1. **Modelling effects of mangroves on tsunamis** - F. Y. Teo MSc, PEng (Malaysia), MIE (Malaysia), R. A. Falconer DSc, FEng, FICE, FCIWEM and B. Lin PhD, CEng, MCIWEM
2. **Two-dimensional flood modelling of the Damansara River** - S. P. Lim MEng and H. S. Cheok MEng
3. **Modelling urban river catchment: a case study in Malaysia** - C. S. Leow BEng, R. Abdullah PhD, N. A. Zakaria PhD, A. Ab. Ghani PhD and C. K. Chang MSc
4. **Water quality monitoring of Maong River, Malaysia** - S. Said PhD, D. Y. S. Mah MEng, P. Sumok MSc and S. H. Lai PhD

Source: Vol 162, Issue WM1, 2009 Water Management Journal, <http://www.editorialmanager.com/water>



CONTENTS

- 3** | **Bangkok Visit -
Chao Phraya River**
- 4 - 5** | **International Visitor**
- Prof. Joseph HW Lee
(University of Hong Kong)
- 6** | **Visit to BIOECODS**
- National Service
(PLKN Jiwa Murni Semanggol
Camp)
- 7** | **Postgraduate Research**
- 8 - 9** | **MSc Sustainable River
Management**
- 10** | **Research and Innovation**
- ESC Project
- 11** | **Research and Innovation**
- RIMP (Sarawak)
- 12 - 13** | **ESC Seminar**
- 14 - 15** | **MSMA Short Course**
- 16** | **Rivers'07 - WM Special
Issue: Paper Abstract**

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FOREWORD

Prof. Dr. Nor Azazi Zakaria
REDAC Director



The Universiti Sains Malaysia (USM) has chosen **sustainability** as a platform to create a new future. The term denotes an over-arching concept of meeting "the needs of the present without compromising the ability of future generations to meet their needs." The submission for the **APEX (Accelerated Programme for Excellence)** university status aptly entitled "**Transforming Higher Education for a Sustainable Tomorrow**" summarily represents our collective views of what and who we are, and why as well as how we have nurtured ourselves to remain distinctively different from others, at least in the Malaysian context. These are recommendations of USM's Vice Chancellor, Professor Tan Sri Dato' Dzulkifli Abdul Razak submitted in USM's document to be accorded the APEX university status in April 2008. Later, USM has been granted APEX status to transform USM into Malaysia's first world-class university by the Malaysian Cabinet on 27th August 2008 as announced by the Higher Education Minister Datuk Seri Mohamed Khaled Nordin.

REDAC has been very proactive in promoting sustainability even before its formal inception in 2001. REDAC has been on the forefront of river conservation and rehabilitation since 1994. Starting with the river sediment transport study, **sustainable river management** or **SURIM** has been given strong emphasis due to rapid and unregulated development of river basins in Malaysia. River responses in terms of erosion and sedimentation along the river have been studied involving river sediment data collection and river modeling using hydraulic models such as HEC-RAS and FLUVIAL-12. Recent research and consultancy projects on sustainable river management include appraisal of the design of a flood mitigation project of the Sungai Muda and the effects of sand mining in three rivers (Muda, Langat, and Kurau). A sustainable river management course leading to an MSc degree was started in the 2008/2009 Academic Year.

Sustainable urban drainage system or **SUDS** is another niche research area very actively promoted by REDAC since 1998. Flash flood, water availability, and water-quality degradation has become major national issues in recent times. With the smart partnership with the Department of Irrigation and Drainage (DID) Malaysia, REDAC has been involved in several national level research and consultancy projects to solve the three major issues, starting with the peak flow attenuation study using infiltration storage tanks in 1998. Later, with the construction of a new USM Engineering Campus at Nibong Tebal, Penang, an opportunity was taken to design and construct the Bio-Ecological Drainage System (BIOECODS) promoting infiltration, storage, and water-quality improvement. BIOECODS, completed in 2002, has become a pilot project in promoting SUDS not only in Malaysia, but also in other countries in Southeast Asia. REDAC has received many visitors from Malaysia and also international visitors such as from the UK, USA, Japan, Australia, Thailand, Indonesia, Vietnam, Hong Kong, and Iran. Other SUDS projects that REDAC has been involved with include the rehabilitation of old mining ponds as storm-water management facilities in Ipoh, Perak as well as a new BIOECODS facility for the new campus of Universiti Malaysia Kelantan (UMK) at Bachok, Kelantan. REDAC is also preparing the guide for Erosion and Sediment Control (ESC) for DID Malaysia.

Postgraduate research in both **SURIM** and **SUDS** are the backbone of the active programs being carried out at REDAC. Also, REDAC has been active in promoting SURIM and SUDS by conducting several short courses, seminars, and workshops in cooperation with DID Malaysia. Information on the postgraduate studies and short courses are available via REDAC website: <http://redac.eng.usm.my/> or email: redac@eng.usm.my.

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Bangkok, Thailand Visit: Chao Phraya River



Profile of Chao Phraya River



River Cruise Jetty



A technical visit to Bangkok was made on 30th May 2008. The visit included a tour of Chao Phraya River in the vicinity of Bangkok.



Flap Gate and Pumping Station



Suspended Bridge





International Visitor



Prof. Joseph Lee made a one day visit to REDAC on the 29th July 2008. He made a presentation on his current project research works mainly Hong Kong urban flooding. Afterwards, Prof. Aminuddin accompanied Prof. Lee to visit components of BIOECODS around the USM Engineering Campus. Several programmes have been proposed between REDAC and HKU in the near future.



Innovative Urban Flood Control for Metropolitan Environment

By
Joseph Hun-wei Lee
Department of Civil Engineering
The University of Hong Kong

Croucher Laboratory of Environmental Hydraulics

Tai Hang Tung Storage Scheme

Urban flood control Mong Kok West Kowloon

Stormwater drainage system for Mong Kok, West Kowloon

Guinness Book of Records: Mong Kok is the most densely populated place on earth, cramming in 130,000 humans per sq. km (78,000 persons per sq.km – 1996-2001)

VISFLOOD – VR simulation of urban flooding

Tai Hung Tung (No Weir)

Data Point #66
Depth: 0.8658 m
Velocity: 0.4115 m/s
Flow: 2.6900 m³/s

Yuen Long Bypass Floodway – final design

The Yuen Long Bypass Floodway design needs to divert the required flow, convey maximum flood within acceptable flood levels, and optimize flow behaviour within extremely tight space constraints.

"Hydraulic jet control for river junction design of Yuen Long Bypass Floodway, Hong Kong". Arega, Lee and Tang, ASCE Journal of Hydraulic Engineering, Jan 2008



GPT Model, Hydraulic Lab



Swale



Engineered Waterway



Recreational Pond



Visit to BIOECODS

REDAC has had a pleasure of receiving participants from Malaysian National Service or officially known as PLKN (Program Latihan Khidmat Negara). A total of 480 trainees PLKN Jiwa Murni Semanggol Camp, Perak visited USM Engineering Campus on the 1st March 2008. The visit is part of the trainee's community service module that inculcates the importance of environment.

Two talks were delivered in the programme. The first talk on the topic 'USM student admission' was given by Pn. Faridah Bharum, from registry office, USM. Second talk was delivered by Mr. Chang Chun Kiat, from REDAC on environmental issues, threat and solutions. Also, REDAC arranged a guided campus tour for the participants. On the tour, participants were shown around the Bio-Ecological Drainage System (BIOECODS) located surrounding the campus. Briefing on the BIOECODS component was given at recreational pond at the end of the campus tour.

The trainees were able to see themselves the application of several options of Best Management Practices (BMPs) in urban storm water management to reduce flash flood, water scarcity and water pollution. The visit is expected to have major impact on participants awareness and understanding of the environmental issues.



Environmental Awareness Briefing



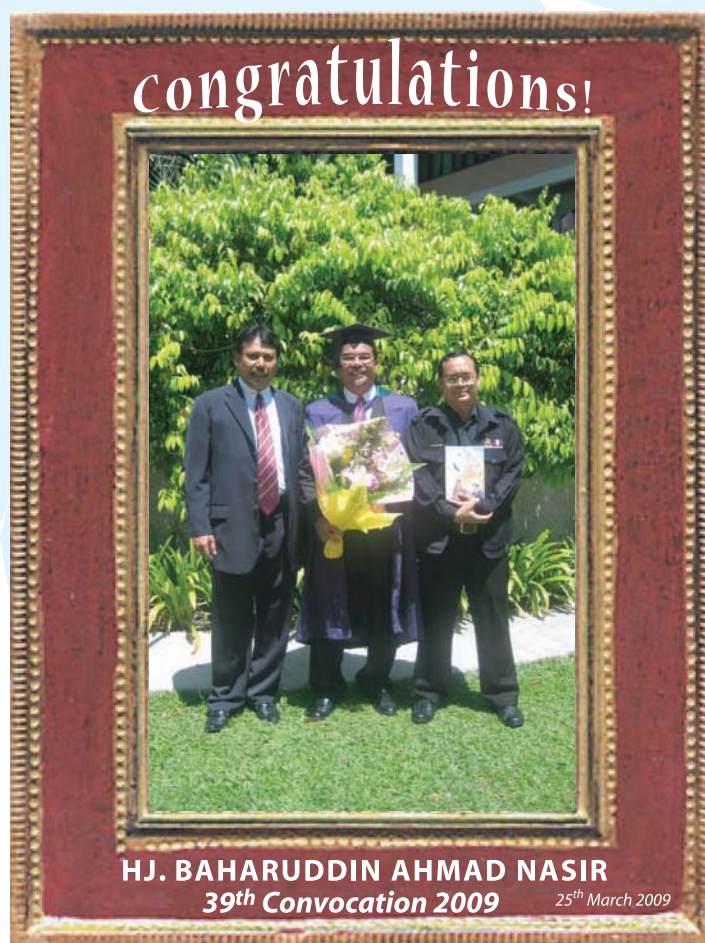
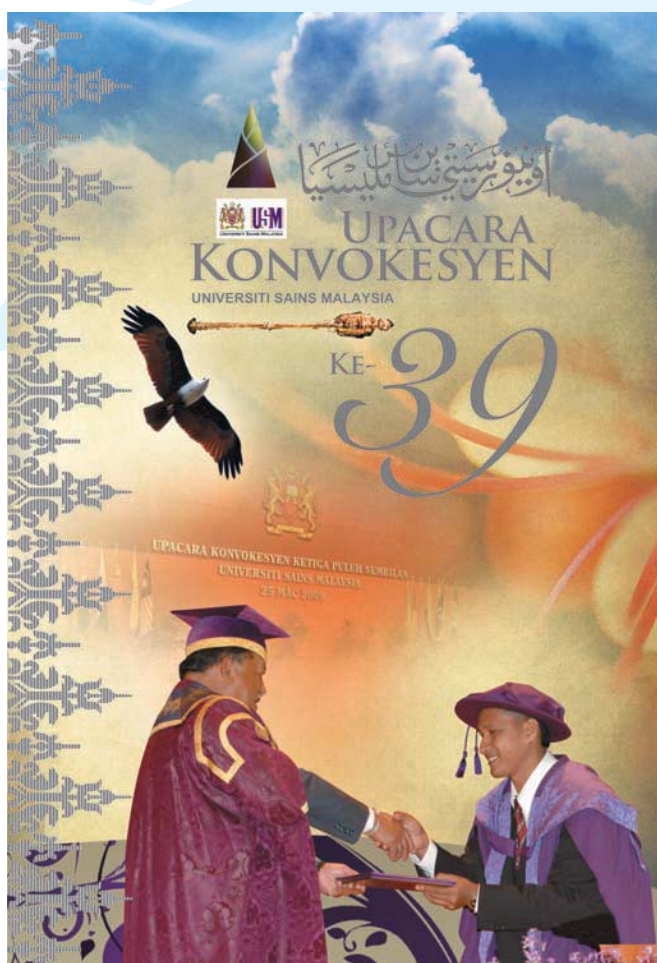
Recreational Pond



Postgraduate Research

Recently Completed MSc Theses

No.	Name	Thesis Title	Supervisors
1.	Baharuddin Ahmad Nasir	Peak Flow Attenuation Using Dry Pond for Existing Housing Schemes.	Prof. Dr. Aminuddin Ab. Ghani Assoc. Prof. Dr. Rozi Abdullah
2.	Liew Yuk San	Stormwater Management for An Urban Housing Scheme: Kota Damansara, Selangor.	Prof. Dr. Aminuddin Ab. Ghani Prof. Dr. Nor Azazi Zakaria
3.	Khairul Rahmah Ayub	SWAT Application for Hydrologic and Water Quality Modeling for Suspended Sediments: A Case Study of Sungai Langat's Catchment in Selangor.	Prof. Dr Hamidi Abd Aziz Dr. Lai Sai Hin
4.	Asnol Adzhan Abd Manap	Efficiency of Swale and Dry Pond for Stormwater Management.	Prof. Dr. Aminuddin Ab. Ghani Prof. Dr. Nor Azazi Zakaria
5.	Nur Asmaliza Mohd Noor	Water Quality Modeling of Constructed Wetlands in Malaysia: Case Study BIOECODS, USM	Assoc. Prof. Dr. Rozi Abdullah Prof. Dr. Aminuddin Ab. Ghani
6.	Joseph Dinor	The Effect of Deforestation on Catchment Response: Case Study for Sungai Padas Catchment.	Prof. Dr. Nor Azazi Zakaria Assoc. Prof. Dr. Rozi Abdullah



MSc Sustainable River Management

Programme Objectives

Rapid economic growth towards achieving Vision 2020 has left negative impact on river basins across the country. Natural catchment areas have been developed that has caused significant negative impact such as depleting of storage in dams, river pollution and the destruction of habitat for numerous species of valuable floras and faunas. This programme emphasizes the importance of sustainable development within the river basins.

Programme Structure

Course Code	Course Subject	Synopsis	Credit Hours
EAD 511	River Management	Open Channel Hydraulics, River Morphology, Sediment Transport, River Rehabilitation, Integrated River Basin Management (IRBM)	4
EAD 512	Urban Drainage Management	Flooding Impacts, Policies and Institutional Frameworks, Urban Hydrology, Ecological Approach, Non-Structural Flood Mitigation Strategies	4
EAD 513	Hydroinformatics	Urban Drainage and River Designs using Available Software	4
EAD 514	River Ecosystem	River Ecosystem Functions, Flora and Fauna Management, Wetland Management	4
EAD 515	Hydraulic Structure	Dam outlet works, Energy Dissipator, Gates, Barrages, Cross Drainage, Pumping Stations	4
EAA 605	Dissertation	Research Projects	20

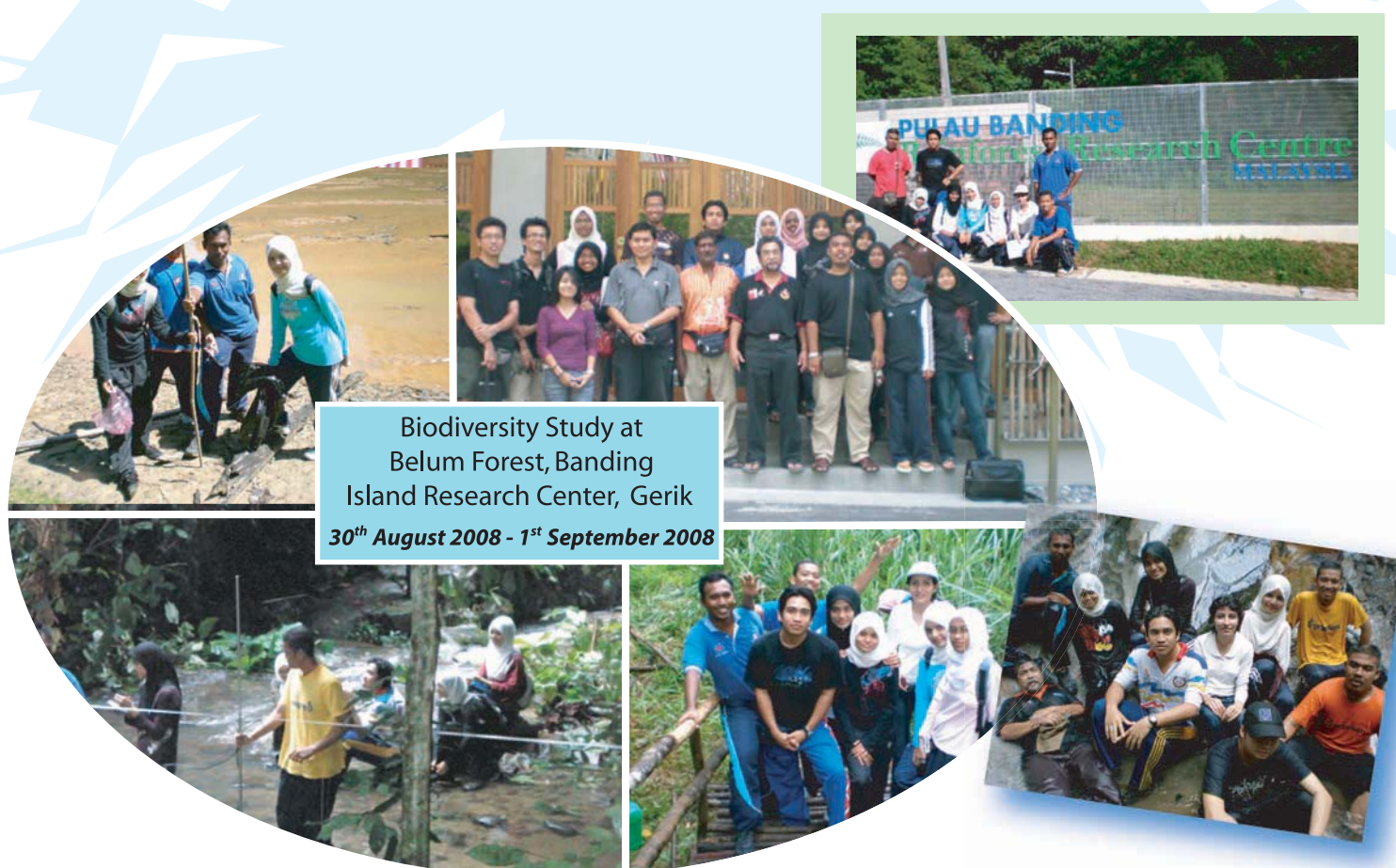
The course is offered on a full time basis in 2 semesters. The students are required to take 5 subjects during the first semester and complete a research project in the second semester. The student may choose to complete the course in 2 years. The course is offered through School of Civil Engineering.



River Morphology Study at Sungai Kulim, Kedah

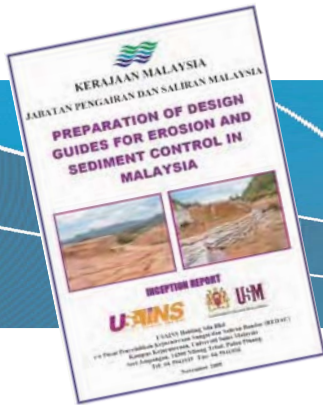
Dissertation Projects

No.	Name	Supervisor	Title
1.	Noor Azma Lui (P-WM0028/08)	Dr. Lai Sai Hin	Performance of Sustainable Urban Drainage System (SUDS) In Storm Water Management : A Case Study
2.	Mohd Azlan Mohd Yusoff (P-WM0026/08)	Assoc. Prof. Dr. Rozi Abdullah	Peak Flow Attenuation using Detention Pond
3.	Rosma Aina Roslan (P-WM0030/08)	Dr. Lai Sai Hin	Discharge Estimation for Overbank Flow of Flooding River Using Artificial Neural Networks (ANN) and Genetic Algorithm
4.	Mohd Hanif Ismail (P-WM0027/08)	Mr. Zorkeflee Abu Hasan	Hydrologic Modelling for Sungai Maka, Tanah Merah, Kelantan
5.	Nusaibah Mohamed Yusof (P-WM0029/08)	Mr. Zorkeflee Abu Hasan	Modelling of Sedimentation Pattern in Bukit Merah Reservoir
6.	Rozaini Ramli (P-WM0032/08)	Dr. Lai Sai Hin	Determination of Soil Erodibility, K Factor for Malaysian Soil Series
7.	Shahnisfanizam Yaacob (P-WM0033/08)	Assoc. Prof. Dr. Rozi Abdullah	Stormwater Quality Modelling Using EPA SWMM (BIOECODS)
8.	Mohd Aminur Rashid (P-WM0025/08)	Mr. Zorkeflee Abu Hasan	Developing a Probabilistic Flood Plain Boundary and Evaluating System Sustainability Option of Maka River, Kelantan using HEC-RAS and CCHE2D
9.	Zahra Zangeneh Sirdari (P-WM0034/08)	Prof. Dr. Aminuddin Ab. Ghani	Effect of Channelization on the Stability of Kulim River



Biodiversity Study at
Belum Forest, Banding
Island Research Center, Gerik
30th August 2008 - 1st September 2008





Title : **PREPARATION OF DESIGN GUIDES FOR EROSION AND SEDIMENT CONTROL IN MALAYSIA**

Client : Department of Irrigation and Drainage (DID)

Period : 30th September 2008 - 31st August 2009

Objectives

The objectives of this study are as follows:

- to enable engineers and planners to have access to a single standard procedure to calculate erosion and sedimentation rates at any site in the country, primarily for the purpose of controlling erosion and sedimentation during the earthworks stage of construction.
- to enable engineers to have expertise in designing control structures like sediment traps and basins using available historical records of rainfall for Peninsular Malaysia and soil series/type data.

Scope of Works

- Review existing US methodology as laid out in the CPESC (Certified Professional in Erosion and Sediment Control) manual.
- Rainfall, soil and landuse data collection and collation.
- Production of isoerodent, ie. Erosivity map for Malaysia.
- Production of slope length, erodibility, P factor (management practice), and C factor (crop cover) tables.
- Production of hydrologic soil group tables, runoff curve number tables for various categories of landuse, and runoff curve number graph.
- Production of soil erodibility tables for various soil textures and layers, and soil erodibility nomograph.
- Incorporation of work examples and photographs to illustrate estimates.
- Incorporation of the use of BMPs to control earthworks in typical Erosion and Sediment Plans (ESCP).
- Producing relevant isopleths using GIS for further modeling application.
- Hands-on training for DID staff.

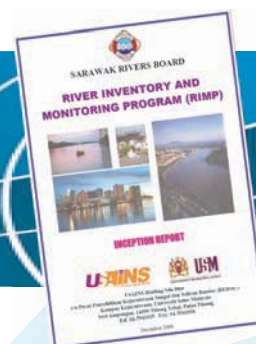


Soil Erosion at Construction Sites



Research and Innovation

Title : **RIVER INVENTORY AND MONITORING PROGRAM (RIMP)**
 Client : Sarawak Rivers Board (SRB)
 Period : 15th November 2008 - 15th October 2009



Objectives

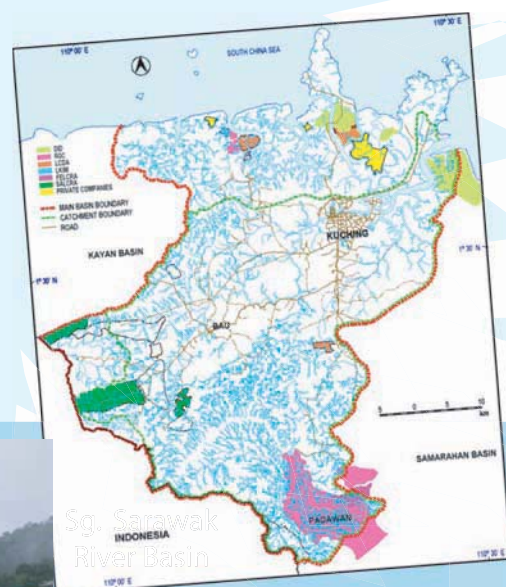
The objectives of this project are as follows:

- To provide information on waterways traffic for passengers, cargo and cruising vessels.
- To monitor and utilize facilities as accident prevention of river traffic and to provide information on waterway traffic accidents.
- To prevent and reduce river polluting activities along Sg. Sarawak such as illegal dumping and other river related offences as provided in the Sarawak Rivers Ordinance, 1993.
- To create a river profile for Sg. Sarawak for navigational and sediment control and connects it with a digital network to Sarawak River Board, Headquarter in Kuching.
- To develop a network for advance warning in event of an emergency such as information on water level and including flood warning.



Scope of Works

- To formulate conceptual design and components need for the implementation/build-up of River Information Center at the Sarawak Rivers Board HQ in Kuching that shall be linked by digital lines to the regional offices of Sarawak Rivers Board. The center will be provided with computers, display boards, brochures, pamphlets and other interactive displays and to the computer software application. The proposal must be expandable and modifiable characteristic.
- To be utilize as one of the input component to formulate plans for the implementation River Monitoring Program.
- To formulate plan for the set-up of river profiling and inventory program for Kemena River and Sarawak River in a short-term period.
- To propose computer networking required with the SRB regional offices via W.A.N of computer in between SRB Regional Offices with sufficient physical unit and peripherals and best platform program and application.



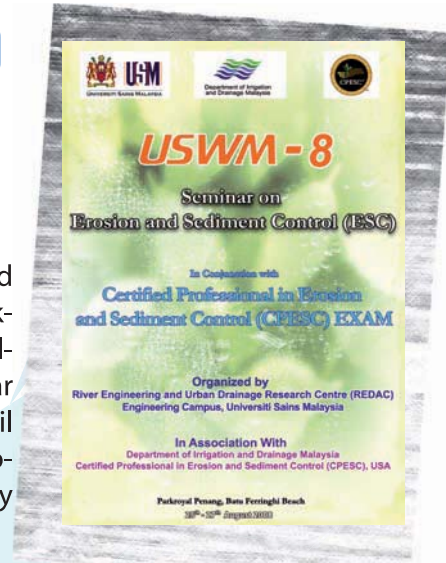
**January 2009 -
Sg. Sarawak
Flooding**



Urban Storm Water Management (USWM-8) Seminar on Erosion and Sediment Control (ESC)

25th - 27th August, 2008
Parkroyal Penang, Batu Ferringhi Beach, Penang, Malaysia

A seminar on Soil Erosion and Sediment Control was co-organized by REDAC and Department of Irrigation and Drainage Malaysia from 25th -27th August 2008 at Parkroyal Hotel, Penang. The event was a continuation from a series of seminars initialized by REDAC known as the Urban Storm Water Management (USWM) Seminar Series. The objective of the current series (USWM-8) is to expose participants on soil erosion and sediment control in urban stormwater management. There were altogether 120 participants taking part in this event, which include government agency representatives, consultants and researchers.



On the first day, participants were briefed on the theories of soil erosion and sediment control. Among the invited speakers were former DID Deputy Director (operation) Datuk Ir. Ahmad Fuad Embi, and Mr. Eric Berntsen (technical vice chair for the Certified Professionals in Erosion and Sediment Control, CPESC, United States of America).

The participants were taught on technical aspects of erosion and sediment control including calculation exercise and construction site management with various erosion and sediment control facilities. On the final day, a majority of the participants took the CPESC exam, which upon passing, would certify them as a technically competent personnel to examine, and design soil erosion and sediment control plans (ESCP).



Registration



Opening Ceremony



Presentation



Participants



Urban Storm Water Management (USWM) on MSMA

USWM-7 and USWM-7(b) were jointly organized with Urban Drainage Division of Department of and Irrigation Drainage (DID, Malaysia). The short courses were organized on 27th - 28th May 2008 at The Grand BlueWave Hotel, Johor Bharu, Johor and on 30th - 31st July 2008 at The Grand BlueWave Hotel, Shah Alam, Selangor. Participants from the consultants and government agencies of the south and central regions attended these short courses with 46 participants in USWM-7 and 77 participants in USWM-7(b).



Johor Bharu / 27th - 28th May 2008



This short course was a part of the initiatives from the DID in introducing Submission Checklist on the requirement for the developer or designer in fulfilling the quantity and quality control as required in Stormwater Management Manual for Malaysia (MSMA). The checklist will be used as the reference document for any new proposed land development at the One Stop Center (OSC) that was established in 14th April 2007 by the Prime Minister.

In submitting the new proposed land development area, the developer or designer should comply with the MSMA requirement upon submitting the following documents to the relevant authorities:

- Submission of Plan for Planning Permission
- Submission of Plan for Drainage and Stormwater Management
- Submission of Plan for Erosion and Sediment Control Plan
- Inspection and Maintenance of BMPs

It is hope that through these short courses, the entire participants such as engineers, planner, developer or any individuals that are involved in approval the submission will have clear understanding on the needs of MSMA.

Registration



Participants



Speakers





Shah Alam, Selangor

30th - 31st July 2008



Participants



Speakers



Rivers'07 - WM SPECIAL ISSUE: PAPER ABSTRACTS

Modelling Effects of Mangroves on Tsunamis

F. Y. Teo MSc, PEng (Malaysia), MIE (Malaysia), R. A. Falconer DSc, FEng, FICE, FCIWEM and B. Lin PhD, CEng, MCIWEM

The hydrodynamic effects of estuarine mangrove trees on tsunami currents have been studied in this paper. An existing two-dimensional depth-integrated numerical model, with both the effects of drag force induced by mangrove trees and the blockage effects on the water flow through mangrove swamps, have been included. To investigate how these trees affect the attenuation of the tsunami current at the head of the estuary, one idealised case has been considered with mangrove trees distributed along the whole channel. This model has been used to simulate the water level variations and velocities induced by tsunami currents at three locations along the centre of the channel. Recorded data of tide elevation during a historical tsunami have been used to set up the open seaward boundary condition in this model. Three cases of different diameters and densities of idealised mangrove trees have been studied to examine the significance of the vegetation on the current attenuation. It was found that mangrove trees have a significant impact on the hydrodynamic processes of tsunami waves. The model has also been set to simulate these tsunami currents in a real estuary, namely the Merbok estuary, Kedah, Malaysia. Simulations have been undertaken for the swamp area and main river, for both conditions of with and without mangrove trees, with the aim of studying the effects of mangrove trees on the hydrodynamic processes during a tsunami. Comparisons of velocity profiles and water elevations for both cases have been undertaken. These results show that the mangroves help in reducing the effects of a tsunami in the main river and swamp areas.

Two-dimensional Flood Modelling of the Damansara River

S. P. Lim MEng and H. S. Cheok MEng

The various methodologies used in Malaysia for studying flood range from the traditional flood mapping through visual observations to one-dimensional river modelling. Although shown to be practicable, these conventional methods are still far from being able accurately to model the magnitude, direction, extent and rate of flood wave propagation over the flood plain. With the advent of geographic information system (GIS), light detection and ranging (Lidar) survey and advancement in hydraulic modelling software, this study utilises the advanced engineering technologies for the two-dimensional hydraulic modelling of the Damansara River. Results of the simulations show that the model is capable of providing crucial information such as direction and rate of flood propagation, flood inundation extent, flood depths and flood duration for the studied areas.

Modelling urban river catchment: a case study in Malaysia

C. S. Leow BEng, R. Abdullah PhD, N. A. Zakaria PhD, A. Ab. Ghani PhD and C. K. Chang MSc

Generally, many rivers within urban catchments in Malaysia are being altered from their natural states to meet the demand of developments. Most of these rivers have also become the receiving water body for urban drainage systems. Therefore, it has become extremely difficult to separate river from the rest of the drainage system. Study of interaction between such river and urban drainage is necessary for urban drainage planning and design. Present study showcases how urban river modelling using InfoWorks Collection System (CS) on Berop River, Perak (Malaysia), can assist stormwater system design. Calibrated using historical flood event, the developed model was used for evaluation of various design storms, possible scenarios as well as existing and future land use condition. The study found that within a data scarcity condition, InfoWorks CS played a significant role in providing good platform for stormwater system modelling as well as satisfactory simulations and analyses for complex combination of river and urban drainage stormwater system. This is the much needed advantage for practising engineers in time saving stormwater system design.

Water Quality Monitoring of Maong River, Malaysia

S. Said PhD, D. Y. S. Mah MEng, P. Sumok MSc and S. H. Lai PhD

A water quality simulation model for Maong River, which flows through Kuching City, in Malaysia was explored with a focus on predicting the dissolved oxygen (DO) parameter. The model simulated the DO levels using the hourly data collected in December 2006. The water quality model was developed to simulate the inflow water conditions and estimate the DO levels at various locations along the river reaches as it flows through the highly populated Maong River catchments. The model adopted a hydrodynamic flow simulation to capture advection and diffusion due to different flow conditions. From the results, it is clear that DO concentrations are clearly affected as the river flows downstream. The correlation of the observed and simulated DO concentration was 0.82.



Source: Vol. 162, Issue WM1, 2009, Water Management Journal
<http://www.editorialmanager.com/water>