Completed Projects
1997-1999

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Flood Hydrology Program

Program Leader: Prof Russell Mein

Project FL3: Hydraulic derivation of stream rating curves

Introduction

A major problem in flood estimation is that data on the largest observed floods, which should carry information relevant to the estimation of extreme floods, also has low levels of accuracy and reliability. A major source of such error is inaccurate rating curves, which are used to convert measured water levels to estimated flow rates.

Traditionally, the rating curve for a site is calculated using measurements taken during low flows and extrapolated for high flows, because of the hazards involved in measuring large floods. Rating curve reliability for high flows can be affected by factors such as changes in channel shape and vegetation spacing or 'roughness', sediment transport, and backwater effects caused by downstream flooding or dams. In this project, the CRC investigated the impact of these factors.

Researchers also developed a mathematical technique for determining more reliable rating curves based on the measurement of 'unsteadiness' in the surface slope of floodwater. As flood levels increase, the river's surface slope becomes steeper than the bed slope, driving more water downstream than would be estimated using a traditional rating curve. Conversely, as water level falls, the slope/discharge decreases. The technique has been developed into an expert system for practitioners to use in developing more accurate stream-rating curves for ungauged rivers.

Project's Intended Outcomes

- A critical review of available hydraulic open channel flow models
- Development of an expert system which would assist hydrographers to develop and extrapolate rating curves
- Design guidelines and procedures for practical application of the computer software

Key Project Achievements

- Completed development of mathematical technique for rating-curve estimation based on surface-slope 'unsteadiness', and completed computer coding for expert system development. The model was verified using data from the NSW Department of Land and Water Conservation.
- Completed preliminary research, including literature review and laboratory study, on effect of random spacing on vegetation 'roughness'.

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Project FL3:
Hydraulic derivation of stream rating curves

- Calibrated and verified two detailed mathematical models that describe the hydraulic interaction between main channel and floodplain flows, which creates additional roughness. The models were tested using data from a large flume in the UK.
- Tested a UK model for determining water surface elevation–flow rate in the cross-section of a vegetated floodplain. The model did not perform well under Australian conditions, and is being adapted for further testing here.

Staff Involved:

Project Leader

Assoc. Prof. Bob Keller (Monash University)

Senior Researchers

Janice Green (Department of Land and Water Conservation)

Liuchen Chen (Department of Land and Water Conservation)

Eric Lamb (Department of Land and Water Conservation)

Prof. Russell Mein (Monash University)

Prof. Tom McMahon (The University of Melbourne)

Research Fellows

Prof. John Fenton (Monash University)

Research Assistant

Mr Frank Winston (Monash University)

Participating Organisations

ACT Electricity and Water

Department of Land and Water Conservation, NSW

Department of Natural Resources and Mines, Qld

Melbourne Water

Monash University

The University of Melbourne

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