

بسم الله الرحمن الرحيم





شبكة المعلومات الجامعية التوثيق الالكتروني والميكروفيلم



جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

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لم ترد بالأصل





**Ain Shams University
Faculty of Engineering
Irrigation & Hydraulics Department**

**A MULTI-COMPONENT TECHNIQUE FOR RISK ANALYSIS
OF FLOOD PLAIN**

By

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Thesis in Partial Fulfillment of the Requirements for

The Degree Of

Master of Science in Irrigation and Hydraulics

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2020



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TO MY PARENTS AND THE REST OF MY FAMILY

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STATEMENT

This research is submitted to the Irrigation and Hydraulics Department, Faculty of Engineering, Ain Shams University in the partial fulfillment of the requirements for the Degree of Master in Civil Engineering.

The work in this thesis was carried out in the Irrigation and Hydraulics Department, Faculty of Engineering, Ain Shams University from 2014 to 2020.

No part of this thesis has been submitted for a degree or a qualification at any other university or institution.

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ACKNOWLEDGMENTS

At the beginning and end, thanks to Allah for everything.

First, I would like to thank my advisors, Dr. Mohamed Abdel Hamid Gad and Dr. Doaa Anas El-Molla, for their patience and persistent support throughout this study. Without them, this research would not have been possible.

The data for this study was provided by Dr. Ashraf El-Mustafa. This study would not have been possible without this data.

ABSTRACT

This research develops a general technique for performing flood plain and flood risk analysis in floodways. The general technique consists of two steps. The first step involves the hydraulic modeling of the floodway under consideration while the second step is the flood risk assessment. The hydraulic modeling (i.e., the first step) is done via the application of a hydraulic model. The chosen hydraulic model can vary from a 1D hydraulic model to a fully 2D hydrodynamic model depending on the complexity and the extent of river geometry. For that reason, the thesis applies different hydraulic models HEC-RAS-1D, FESWMS, and HEC-RAS-2D and provides a technical reference for setting up and running these models. HEC-RAS-1D represents the family of one-dimensional models, FESWMS represents the group of fully 2D hydrodynamic models, while HEC-RAS-2D represents the Semi-hydrodynamic 2D models. The thesis also provides a comparative analysis between the three models in terms of accuracy and engineering applicability. The results of the comparative analysis show that the choice of the hydraulic model must suit the case study under consideration. Each model has its advantages, disadvantages, and best applicable case. The 1D and semi-2D models proved to best suit the cases of long rivers (especially those with steep slopes) due to their numerical stability in performing the hydraulic simulation. The fully hydrodynamic group crashes and fails to model such long steep rivers due to the extreme difficulties to spin down the water surface elevation in such steep and long cases. However, the fully hydrodynamic group best simulates short reaches with complicated two-dimensional configurations (e.g., flow in the vicinity of bends or bridges) due to their high accuracy in representing the case without the need to spin down the model. The results also show that the semi-2D models outperform the 1D-models in representing long rivers due to the less effort encountered in representing river geometry and the more accuracy in representing the lateral flow components. The thesis finally presents a novel GIS-based methodology to assess the flooding risk. The methodology depends on using the specific energy of the flow (rather than the water depth or velocity alone) to estimate the Flood Risk Index Factor (FRI) taking also vulnerability into consideration. The analysis performed into this thesis is presented on a case study from the Nyamwambe River in Uganda to illustrate the findings.

KEYWORDS: Flood; Plains; Hydraulic; Hydrodynamic; Model; Risk; GIS

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