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FACULTY OF ENGINEERING

DEPARTMENT OF AGRICULTURAL MECHANIZATION AND IRRIGATION ENGINEERING

MITIGATING THE EFFECTS OF FLOODS ON AGRICULTURAL PRODUCTION IN AWOJA SUB CATCHMENT

BY

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ABSTRACT

Throughout the human history floods have been an integral part of the civilization. Still men have not quite coped well to live with floods. Flooding is the most frequent global natural disaster; rural areas are becoming more vulnerable to flooding due to effect of climate change. Flash flood is the common phenomena caused by heavy rains. Drainage channels is common strategy used for flood control. The failure of preventive measures has led to researchers to advocate a shift in thinking from preventive measures to flood risk and structural management measures. Recently, the advancement in computer-aided technology has been extensively used in formulating models used for flood calculation and hazard analysis. This study focuses on using a hydraulic model HEC-HMS and HEC-RAS in a GIS environment for the affected areas of Awoja, generates the flood area and the return period for the specified flood events. This project involved studying various literature and collecting ancillary data in form of journals and reports. This helped to formulate the methodology for the whole project.

It was followed by the modelling stage. This started with data collection from various sources i.e. from offices. Data collected included: - DEM, discharge flow data, land use/land cover data, rainfall data and soil data. These datasets were conditioned and processed in the GIS environment using the ArcGIS software. Land use and soil data was used to generate Curve number grid and later geo.hms was used to set up a project which involved basin characteristics and processing and exported into HMS to generate hydrograph (peak discharges) to be used in the HECRAS. The IDF curves were generated for a return period of 50 years that gave peak intensity of 119.5m/s. and therefore aided in calculating the design flood. The GeoRAS file was exported to the HEC-RAS program to compute for a steady flow simulation. The RAS mapper export from HEC-RAS program was then imported in to ArcMap to delineate a flood plain map which was overlaid to a Google image to determine flood prone areas. The drainage system was then designed with the design parameters already generated.

DECLARATION

I **ORIOKOT CHARLES, BU/UP/2015/151** declare that all the materials portrayed in this project proposal report is original and has never been submitted for the award of any degree, certificate or diploma to any university or institution of higher learning.

Signature

Date

APPROVAL

This project proposal has been submitted with the approval of my supervisor.

SUPERVISOR: Mr. Okirya martin

SIGNATURE

Date

DEDICATION

I would like to dedicate this report to my beloved family especially my mom and all my brothers and sisters not forgetting my classmates, all friends who have stood with me in this academic journey. After all everybody wants to succeed in life but it takes sacrifice, patience and endurance to be that person we all admire. To God be the glory.

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LIST OF ACRYNORMS AND ABBREVIATIONS

GIS ..... Geographical Information System

HEC-RAS..... Hydrological Engineering Centre-River Analysis System

HMS..... Hydrological Modelling System

DWRM..... Directorate of Water Resources Management

MWE.....Ministry of Water and Environment

DEM.....Digital Elevation Model

UNMA..... Uganda National Meteorological Authority

USGS.....US Geological Survey

TIN..... Triangular Irregular Network

CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND

Globally, flood risk accounts for about a third of all losses due to natural hazards. floods also cause hardship in rural areas due to their impacts on agricultural productivity. According to the FAO, crop production in the period 2003 to 2013 was the most affected agricultural sector by natural hazards in developing countries and about 60% of the damages are attributed to floods (Kaimal *et al.*, 2017)

Agriculture is a crucial sector for Uganda accounting for approximately 21.9 percent of Uganda's GDP, 85 percent of its export earnings, 68 percent of total employment and all food requirements. (Chude and Odunze, 2016). Uganda's climate is naturally variable and susceptible to flooding, and events which have had negative socio-economic impacts in the past. For example, parts of Western and Southern Uganda faced severe flooding conditions as a result of heavy rainfall that happened in FY2016/17. Similarly, in FY2013/14 the same disaster hit areas in western Uganda. In Kasese District, floods destroyed 700 acres of crop - mainly maize, coffee, cassava and groundnuts among others, and around 40 heads of cattle, 70 goats and 700 domestic birds were killed by the fast running water and boulders from River Nyamwamba and Mubuku. This contributed to disruption of people's livelihoods and increased their vulnerability(Ministry of Finance Planning and Economic Development, 2018).

The Awoja Catchment has seen little development of its water resources with the main water use sectors being water for domestic use, livestock watering, rainfed agriculture, and aquaculture. Environmental flows were assumed to be 15% of the natural stream flows in the sub-catchment. This was chosen as an illustrative measure for the preservation of river health and biodiversity that only becomes critical with high development and this was computed to be 185MCM/ yr. The 2013 water demand for domestic, livestock, rainfed agriculture, aquaculture, rural industry, and environmental water requirements expressed as a percentage of the total water demand in Awoja Catchment stood at 4.47%, 6.24%, 10.12%, 0.63%, 0.21%, and 78.34% respectively. Projections for 2040 indicate that, water demands for domestic use, aquaculture, and rural industry will increase to 19.22%, 1.43%, and 1.05% respectively while that of livestock, rainfed agriculture, and environmental flow requirements will drop to 4.97%,

REFERENCES

Aurecon and Ministry of Water and Environment (2013) 'Awoja Catchment Management Plan'.

Chude, V. O. and Odunze, A. C. (2016) 'Priorities for sustainable soil management in Nigeria.', *Nature & Faune*, 30(1), pp. 18–21. Available at: http://www.fao.org/3/a-i5292e.pdf.

Kaimal, A. *et al.* (2017) 'Smart Aquarium', *Smart Aquarium*, 03(06), pp. 18–21.

Ministry of Finance Planning and Economic Development (2018) 'BMAU BRIEF (17 / 18) Effects of changing weather patterns in the agricultural sector : How has production and livelihood been affected ?', *BMAU Briefing Paper 17/18*, (June), pp. 1–4.

KaatZ, J. A., 2014. Development of a HEC-HMS Model to Inform River Gauge Placement for a Flood Early Warning System in Uganda, MASSACHUSETTS INSTITUTE OF TECHNOLOGY