FACULTY OF ENGINEERING

DEPARTMENT OF MINING AND WATER RESOURCES ENGINEERING

FINAL YEAR PROJECT REPORT.

ASSESSING THE EFFECTS OF LAND USE CHANGES ON FLOW REGIME OF RIVER RWIZI USING SWAT MODEL.

BY

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BU/UG/2014/104

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A final year project report submitted to the Department of Mining and Water Resources Engineering as a partial fulfillment of the requirements for the award of a Bachelor of Science degree in Water Resources Engineering

ABSTRACT

The hydrology of most tropical catchments is largely influenced by variations in land use. Soil and Water Assessment Tool (SWAT) was used to assess the effect of land use changes on stream flow regime in the River Rwizi upper catchment covering a surface area of about 137900.5784 ha in western region of Uganda. River Rwizi has frequently featured in national news due to water resources problems especially low water levels as a result of prolonged dry seasons. Classified land use maps of 1983, 2003 and 2013 were evaluated to examine land use changes in the catchment. DWRM, DWD, NEMA and NARO provided hydro – meteorological data, soil data and historical aerial photographs for the study. The results of the study shows that in the period between 2003 and 2013, there has been a 2.42% decrease in forest cover, 0.28% decrease in wetlands, 11.33% decrease in Bush land and Cropland Agriculture had increased by 9.14% while Grass/ Pasture land had increased by 19.14%. The SWAT Model results showed that there is a substantial relationship between the observed and simulated average monthly stream flows in the river Rwizi upper Catchment. The Nash-Sutcliffe Efficiency (NSE) and coefficient of determination (R^2) during calibration period (1983-1991) were 0.8 and 0.86, respectively, while for the validation period (1997-2004) they were 0.81 and 0.94, respectively. The average monthly stream flows increased by 22.56 m3/s during the wet season and decreased by 1.75 m3/s during the dry season. The changes in stream flow were ascribed to the land cover change and rainfall variation. The high water demand in the dry months can be met by constructing water storage reservoirs to harvest the high runoff during the wet months. More research about the effect of climate change on catchment hydrology should also be conducted.

DECLARATION

I AYEBAZIBWE FRANCIS hereby declare that, this report is a true work of my hands and has never been presented by any person or institution for an academic award.

Signature…….

Date……

APPROVAL

This project report has been approved of my supervisors mentioned below;

MAIN SUPERVISOR**: MR. BAGAALA BRIAN SEMPIJJA**

Signature…….. **Date…….**

CO-SUPERVISOR: **Ms. NAKABUYE HOPE NJUKI**.

Signature…….. **Date…….**

DEDICATION

I dedicate this project report to my parents **Mr.Elidard Orumwenda** and **Mrs. Orumwenda Mable** and my brothers and sisters (Loyce Kembabazi, Johnson Nuwagaba, Atuhaire Marion, Tayebwa Moses, Tumwine Andrew, Natumanya Jacob, and Nuwaturinda Ritah) for the parental love, support and guidance. The almighty God richly bless you.

ACKNOWLEDGEMENT

First and foremost, I would like to thank Almighty God for his protection and guidance up to this stage in my life. I feel highly appreciative to the entire staffs in the department of Mining and Water Resources Engineering Busitema University for giving me knowledge in the field of Water resources. Specifically, I am very grateful to **Mr. Baagala Brian Sempijja** and **Ms. Nakabuye Hope Njuki** my final year project supervisors who gave me all the necessary guidance, advice and encouragement during preparation of this report, May the Almighty God bless you abundantly. In a special way, I acknowledge the staff of Ministry of Water and Environment especially DWRM (**Eng. Jackson Twinomujuni, Eng. Gaetano, Mr. Willington**) for technical advice. Last but not the least I highly appreciate all my relatives especially **Uncle Asaph Turinawe, Uncle Dithan Busesire, Mr. Hope Bahirayo, Mr. Kamugisha Fredrick, Mr. Muhangi Sam, sister Musime Jenifer and brother Danson)** who tirelessly supported me during times of financial need to accomplish this project. Finally I thank all my friends (Kunobere Abel, Tumushabe Abel, Twena Emmanuel, Turyahabwe Aron, Mucunguzi Abert …) and colleagues for the assistance they gave me up to final stage of this report.

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LIST OF ACRONYMS

DWRM	Directorate of Water Resources Management
MWE	Ministry of Water and Environment
SWATCUP	Soil and Water Assessment Tool Calibration and Uncertainty Program.
LH-OAT	Latin Hypercube One factor At a Time.
SWAT	Soil and Water Assessment Tool
NSE	Nash-Sutcliffe Efficiency
GIS	Geographical Information Systems
DWD	Directorate of Water Development
NFA	National Forestry Authority
NEMA	National Environmental Management Authority
NARO	National Agriculture Research Organization.
NWSC	National Water and Sewerage Cooperation
DEM	Digital Elevation Model

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CHAPTER ONE: INTRODUCTION

1.1 Back ground of the Study

The relationship between land use and hydrology was of great interest to hydrologists as it can provide crucial information for water resources management actions. This was important for avoiding or minimizing the negative effects of land use activities on the hydrology of tropical river systems. A change in land use from natural vegetation to agricultural crops often results in a drop in rainfall interception rates, a rapid delivery of storm flow to streams, and reduction in infiltration capacity of the soils due to compaction. Streamflow responses to changes in land use are accelerated by natural (e.g. channel degradation) or human-induced (e.g. agricultural management practices) factors that cause changes in the storage characteristics of catchments. The changes are also results of multiple factors including, macroeconomic activities, development policies and physical characteristics of the catchment(Sulivan, 2004). Therefore, carrying out an assessment of changes in land use can be a basis for improved water resources management and ecological restoration of most catchments**.**

It is important to note that the rate and extent of changes in land use may differ from one region to another. For instance, in many tropical regions, large scale changes in land use may involve the replacement of the natural vegetation cover with crops or pastures, which disrupts the hydrological cycle by altering the water yield**.** In the Comet catchment, Australia, during the period (1971–2007) immediately after forest clearing, the catchment showed an increase in the inter-annual streamflow that suggested a decrease in inter-annual evapotranspiration associated with land use changes mainly attributed to higher than average rainfall linked to the La Niña conditions in the 1970s(Sullivan, 2004)**.** In East Africa, land use changes in Weruweru-Kiladeda Sub-catchment – Tanzania significantly decreased the minimum flows by 0.5 m^3/s of river Pangani from 1999 to 2009(CHIWA, 2012)**.**

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