BUSITEMA UNIVERSITY
Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF MINNING AND WATER RESOURCES ENGINEERING

WATER RESOURCES ENGINEERING PROGRAMME

FINAL YEAR PROJECT REPORT

Design of an Embankment/Levee on River Malaba Bank

OPIRA ALFRED

BU/UP/2011/793

EMAIL: - salfredopira@gmail.com;+256 775-112-568

SUPERVISOR(S)

MAIN SUPERVISOR: Eng. OKELLO GEATANO

CO-SUPERVISOR: Mr. OTIM DANIEL

A final year project report submitted to the department of mining and water resources engineering as a requirement for partial fulfillment of the ward of a Bachelor of Science degree in Water Resources Engineering

May 2015

ABSTRACT

A levee or dyke is defined as an earthen embankment extending generally parallel to the river channel and designed to protect the area behind it from overflow of flood waters.

Embankments are the oldest known forms of flood protection works and have been used extensively for this purpose. These serve to prevent inundation, when the stream spills over its natural section, and safeguard lands, villages and other properties against damages.

Amoni village experiences tropical climate with both wet and dry seasons, the village experiences a problem of water spilling over the natural section damaging lands, villages and other properties.

The main research objective was to design an embankment/Levee on the River Malaba bank in Amoni village and specific objectives were to determine the topography of the project site, determine the type and physico – mechanical characteristics of the soil at the project site, determine the key climate factors contributing to floods and determine the cost-benefit analysis of the project.

The historical background, types, components and classification of Levee, the reasons which justify the need for Levee, water resources and evolution of irrigation in Uganda, design requirements for an embankment for flood control have been discussed in the literature review. Stability analysis of the embankment, dimensions of the channel by partial filling and partial cutting, design and determination of the runoff flow rate are also discussed in the literature review.

The methods used in data collection during the research included; desk study, oral interviews, consultations and discussions, carrying out topographic surveys, laboratory soil sample tests, and infiltration tests. Climatic data for 13 years for Tororo discharge and water level data for 50 years from the current year of River Malaba were obtained and Software's like MS Excel were used in analyzing the collected data.

The embankment parts; berm width, crest width, top width and drainage blanket filters were designed using the analyzed data and appropriated materials were selected. Detailed drawings were generated using AutoCAD in two dimensions.

Challenges like delay of design data, difficulty in obtaining soil sampling equipment like a core were encountered during the research. Flood control in Amoni village is possible if the project is implemented. However, Environment Impact Assessment (EIA) must be conducted before commencement of the project, a bye law to prevent all forms of human activities that can cause the degradation of the river within the project area and the levee should be fenced off with lockable fence to restrict animal traffic.

DEDICATION

I dedicate this report to almighty God and my parents who tirelessly supported and guided me up to this stage in my life.

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 indebted to the entire staffs in the department of Water Resources engineering for giving me knowledge in the fields of Water and Water resources.

Specifically, I am very grateful to Eng. Okello Geatano and Mr. Otim Daniel 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.

Last but not least, I appreciate my parents, Mr. and Ms. Okello, for the support they have continued to offer me in order to attain quality education. May the Almighty God bless the work of your hands and may He make you live long enough to enjoy the fruits of your labors.

Finally I thank all my friends and colleagues for the assistance they have given me in endeavors to see me through with my research.

DECLARATION

I **OPIRA ALFRED** hereby declare to the best of my knowledge that this is my true and original piece of work and has never been submitted to any university or institution of higher learning by anybody for any academic award.

Signature…….. Date …….

APPROVAL

This piece of work has been approved by;

Main Supervisor

ENG. OKELLO GEATANO

Signature……

Date……..

Co-supervisor

MR. OTIM DANIEL

Signature……

Date……..

Table of Contents

ACRONYMS AND SYMBOLS

NSL	:	Natural Surface Level
HFL	:	High Flood Level
SPF	:	Standard Project Flood
PMF	:	Probable Maximum Flood
Cumecs	:	Cubic meter per second
C/S Slope	:	Country side slope
B.C. Ratio	:	Benefit-Cost Ratio
BIS		Bureau of Indian Standard
USBR	:	United States Bureau of Reclamation.
IDF	:	Intensity Duration Frequency Curve
AFD	:	Annual Flood Damages
RA	:	Residential Area
CIA	:	Commercial/Industrial Area
AA	:	Agricultural Area
AVRA	:	Assessed Value of damageable property within Residential Area
AVCIA	:	Assessed Value of damageable property within Commercial Industrial Area.
AVAA	:	Assessed Value of damageable property within Agricultural Area
ABED	:	Annual Bank Erosion Damages.
TAVP	:	Total Assessed Value of Property within the threatened area.
PL	:	Project Life.

LIST OF FIGURES

LIST OF TABLES

LIST OF EQUATIONS

LIST OF APPENDICES

CHAPTER ONE: INTRODUCTION

1.1 Background

Floods are recurrent phenomena in world from time immemorial. Floods of varying magnitudes, affect parts of the world, almost every year due to different climate and rainfall patterns. With the increase in population and developmental activities in the world, there has been a tendency to occupy the floodplains, often resulting in serious flood damages to properties and loss of lives over the years. Of late, some areas, which were not traditionally prone to floods, also experienced severe inundation.

Floods cause severe bank erosion if the river banks are fragile and not protected against the heavy flood discharges. It may therefore become very essential for an embankment to be constructed along a river or stream.

Embankments are the oldest known forms of flood protection works and have been used extensively for this purpose or confine the course of a river to provide higher and faster water flow. These serve to prevent inundation, when the stream spills over its natural section, and safeguard lands, villages and other properties against damages, (Puram, 2012)

The River Malaba catchment is part of a broader division referred to as the Lake Kyoga basin, which is one of the eight major surface water basin delineations for Uganda.

The Lake Kyoga basin covers an area of 26,796 square km; the area considered in the study as the River Malaba catchment covers about 6,455 square km.

The main river reach modeled in the study has its origins on the slopes of Mount Elgon, from where it forms the border between Uganda and Kenya for several kilometers before turning into Uganda. There it flows through the districts of Mbale, Tororo, Butaleja, and Pallisa before finally discharging into Lake Kyoga (Kizito *et al.*, 2006).

Amoni village at the bank of river Malaba experiences tropical climate with both wet and dry seasons in a year, it has a total annual rainfall estimated to be 1,494 mm, bimodal rainfall with peaks from March – May and August – November, and the dry season runs from December to February although some seasonal variations have occurred in recent years in form of torrential rains. The village has a mean annual minimum and maximum temperatures of 16.2^0C and 28.6^0C respectively, mean annual humidity of 68% and mean annual sunshine duration of 6.9 hours per day (CLIMWAT 2.0 & CROPWAT 8.0).

REFERENCES

Arora, 2002. Irrigation, Water Power and Water Resource Engineering

Arthur J. Rocque, et al., 2001. Guidelines for Inspection and Maintenance of Dams

Cause, D.S., 2001, Aswan High Dam: Construction, effects on Egyptian Life and Agriculture, and environmental impacts.

David A. Chin, 2006, "Water Resources Engineering Second Edition," ISBN 0-13-148192-4

FAO, 1995.Irrigation in Africa in figures, Water Report 7

Featherstone, R.E. & Naluri C., 1995. Civil Engineering Hydraulics: essential theory with worked examples. 3rd ed. Blackwell science.

Garg S. K., 1995, Irrigation Engineering and Hydraulic structures

GIBB, 1989. Sub-Saharan Hydrological Assessment, Uganda, Final Report October 1989, Sir Alexander Gibb & partners.

Japan International Cooperation Agency (JICA), 2002.Technical Standards and Guidelines for Planning and Design, Volume I : flood control

Kamal, E.B. *et al.*, 2003. Assessment of Existing Micro Dams in Ethiopia, Sudan and Uganda.

Narita, *et al.*, 2000. Design and Construction of Embankment Dam.

Puram.A.K, 1989. River Behavior Management and Training Volume-I (Central Irrigation and Power (CBIP)

Richard G. Allen., Pereira Luis S., Raes Dirk., Smith Marti, 1998, Crop Evapotranspiration, FAO Irrigation and Drainage Paper No. 56: FAO, water Information Network-Uganda-Irrigation sub–sector Review

Smith, N., 1971. "A History of Dams." The Chaucer Press, Peter Davies, London, UK.

U.S. Army Corps of Engineers, 1970. "Engineering and Design Stability of Earth and Rock-Fill Dams," EM 1110-2-1902