BUSITEMA UNIVERSITY
Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF MINING AND WATER RESOURCES ENGINEERING

WATER RESOURCES ENGINEERING PROGRAMME

FINAL YEAR PROJECT REPORT

DESIGN AND SIMULATION OF AN AQUIFER RECHARGE SYSTEM FOR RUBONGI SUB COUNTY, TORORO DISTRICT

BY

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ABSTRACT

The water supply for Rubongi sub county in Tororo district is highly reliant on groundwater. This project is aimed at coming with a technique that will be used in artificial groundwater recharge of the existing aquifer in the area. With an increasing population having a recent growth factor of 2.73%, groundwater demand is on the rise. For me to solve this problem I first of all needed to determine the groundwater supply and availability in the sub county and also other surface water sources including surface runoff from precipitation. This was done using the aquifer potential map of the sub county on a GIS platform, establishing the water demand of the area through population projection, hydrological analysis and water systems engineering and finally getting the specifications of the recharge system. The water balance for the area was obtained and this indicated the water supply would cater for the needs of the area.

It was observed that the area has high evaporation rates therefore the amount of recharge of the rainfall (108.88 MCM/year) and runoff (27.47MCM/year) was minimal but all the same due to the fissure characteristics in the area and the direction of flow recharge does occur. With the design of the structure, open trapezoidal channels were used due to their design and maintenance ease and these trapezoidal basins therefore serve a horizontal recharge purpose.

The main aim of recharging the aquifer is because as the population increases the water demand also increases also leading to increased demand. As demand increases most people turn to groundwater for sustenance which may lead to over abstraction. To prevent this, we have to recharge what is currently there and ensure continuous supply of water.

The simulation of the system was then done using MODFLOW, a groundwater modelling and simulation software that yielded the results for recharge rate based on the aquifer characteristics and recharge parameters of the study area in majorly six main steps leading to the performance of a steady-state flow simulation i.e. Create a new model, Assign model data, Perform the flow simulation, check simulation results, calculate sub regional water budget, Produce output

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DECLARATION

I **OYUKI GODFREY**, declare that all the material portrayed in this project proposal report is original and has never been submitted in for award of any Degree, certificate, or diploma to any university or institution of higher learning.

Signature .... Date 12/06/2018.

APPROVAL

This is to certify that the project proposal has been carried out under my supervision and this report is ready for submission to the Board of examiners and senate of Busitema University with my approval.

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MR. MUYINGO EMMANUEL

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ASTER – Advanced space borne Transmission Emission and Radiometer data

DEM – Digital Elevation Model

DGSM – Directorate of Geological Survey and Mines

DWD – Directorate of Water Development

DWRM – Directorate of Water Resources Management

ETM – Enhanced Thematic Mapper

GIS – Geographical Information System

MWE – Ministry of Water and Environment

NARO – National Agricultural Research Organization

NASA – National Aeronautics and Space Administration

NFA – National Forestry Authority

NRSA – National Remote Sensing Agency

RS – Remote Sensing

UNMA – Uganda National Meteorological Authority

USGS – United States Geological Survey

UTM – Universal Transverse Mercator

WGS – World Geodetic System

WIOA – Weighted Index Overlay Analysis

1 CHAPTER ONE: INTRODUCTION

This chapter briefly gives the general information relevant to the research while clearly showing the problem of interest for the intended design. It as well shows how this study will help reduce the problem through the fulfilment of a number of objectives listed therein.

1.1 Background of the study

Water is the most essential natural resource on the planet earth. It is categorized into saline water-which is ocean water and fresh water which is a finite resource essential for life development and the environment. According to the **UN annual report 2010**, saline water (oceans) cover about 97% of the earth's waters and fresh water is only a small proportion of the total water (3%) and mainly stored in ice and glacier form. Fresh water sources are mainly groundwater and surface water sources. According to the **UN annual report, 2010**, ice caps and glaciers contribute 68% of the fresh water, groundwater 30.1%, surface water 0.3% and others 0.9%.

According to **Banks, D., Robins, N., (2002)**. Groundwater is a form of water held under the ground in the saturated zone that fills all the pore space of soils and geologic formations. Its formed by rainwater or snow melt water that seeps down through the soil and into the underlying rocks (aquifers). It's the major resource of water supplies as provides more than half of humanity's freshwater for everyday uses such as cooking, hygiene as well as 30% of irrigated agriculture and industrial development.**(Pilla, Torrese and Bersan, 2010)** .

As of 2010, the world's aggregated groundwater abstraction was estimated at approximately 1000km^3 per year, approximately 67% of which is used for irrigation, 22% for domestic purpose and 11% for industrial purposes.**(Unesco and United, 2009).** The rate has at least tripled over the past 50years and continues to increase by 1-2% per year. The estimates suggest that the abstraction of groundwater accounts for approximately 26% of the total global water withdrawal and equals approximately 8% of the mean global groundwater recharge.**(UNESCO, 2012).**

Groundwater is crucial for the livelihoods and food security of 1.2 to 1.5billion rural households in poorer regions of Africa and Asia, but also for domestic supplies of a large part of the population elsewhere in the world. The global volume of stored groundwater is poorly known, estimated range 15.3 to 60million km^3 including 8 to 10 million of freshwater, while the remainder is the brackish and saline groundwater is predominantly at great depth**(Global and Usage, 2016).** Significantly groundwater storage depletion is taking place in many areas of intensive groundwater withdrawal.

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