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**DESIGN OF A LAWN SPRINKLER IRRIGATION
SYSTEM FOR TORORO GOLF COURSE**

BY

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of Bachelor of Science degree in water resources engineering*

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ABSTRACT

This report addresses the challenges faced by the Tororo Golf course due to the UN reliable rainfall patterns that are UN evenly distributed through the year affecting the normal growth of the grass on the golf course more especially on the Putting Greens since they rely on rainfall alone and this affects the consistency of the game.

Irrigation which is the artificial application of water to plants is the best insurance against such unpredictable weather changes hence design of a lawn sprinkler irrigation system with measures to apply correct amounts of water to the grass plant was considered and designed.

Climatic data, soil data, water data and other data collected were analyzed in order to get a well representative value to use during designing work. Results were adjusted to meet critical situations. Among the tools used during data analysis includes Microsoft EXCEL sheet, Microsoft office 2010 package and CROPWAT 8.0, CLIMWAT2.0 irrigation software, AutoCAD 2016 and Arc Gis software and this data was presented in form of tables, graphs etc.

From the determined infiltration rate of the soil i.e. 11.2mm/hr. and from Table 5000/5000 plus series nozzles performance from Rain bird, a rotor pop up sprinkler was selected and it was characterised with a working pressure of 3.5bars, a Nozzle size 3.0mm, Radius of throw 12,20m, flow rate of 0.74m³/hr. and a precipitation rate of 10mm/hr. for a triangular spacing based on a 62% diameter of throw. And this type of sprinkler could be employed satisfactory without any Runoff.

A rotor popup sprinkler irrigation was designed with measure to control the flow of water within the golf course, and also the fluctuating climate effect will be reduced by having water through the year. If the designed project is implemented, it will adequately supply water to the greens and keep the turf healthy on the course, also, it will not only eliminate wasteful over watering of the golf course but also lowering the ongoing repair and maintenance costs especially on the bare areas as a result of the lawn death within the course. Since modern irrigation practices have not been common in Uganda due to overreliance on rainfall yet not reliable any more in this century full off greenhouse effects like global warming.

DECLARATION

I, **Chelengati Andrew**, declare that the content of this report is my own original work and it has never been submitted wholly or partially to any University or institution of higher learning for any academic award.

Chelengati Andrew
.....

25th/05/2016
.....

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DATE



APPROVAL

This project report under the title "Design of a lawn sprinkler irrigation system for Tororo golf course" was under supervision and is hereby approved in partial fulfillment of the requirements for the award of a Bachelor's Degree of science in Water Resources Engineering.

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I do give a great gratitude to my supervisors who worked tirelessly to see that my final year project becomes successful, may God bless you abundantly as we continue to pursue excellence.

DEDICATION

I dedicate this report to more importantly my parents and all individuals who have in one way or the other helped me reach this academic level.

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LIST OF ACRONYMS/ABBREVIATION

DWRM	Directorate of Water Resources Management
UBOS	Uganda Bureau of Statistics
MWE	Ministry of Water and Environment
QGU	Queensland Golf Union
FAO	Food and Agricultural Organization
ASCE	American Society of Civil Engineers
ICID	International Commission for Irrigation and Drainage
GPS	Global Positioning Satellite
NWSC	National Water and Sewerage Corporation
PVC	Polyvinyl Chloride
TDH	Total Dynamic Head
USD	Unite States Dollars
UGX	Uganda Shillings
SAFR	Sub- Regional Office for East and Southern Africa
B/C	Benefit Cost Ratio
PVF	Present Value Factor
USDA	United States Department Of Agriculture
ETC	Crop Evapotranspiration
ETO	Reference Evapotranspiration
OM	Organic Matter Content

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CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND

A golf course is the ground with turf grass where the game of golf is played. It comprises a series of holes, a teeing ground, a fairway, the rough and other hazards, and a green with a hole. Some of the earliest golf courses to install irrigation systems were Long Island National Golf Links, the Merion Golf course, and Pinehurst found in the United States. When the game of golf spread to the other continents, golf course architects realized that without irrigation, building and maintaining golf course is impossible (Thompson et al., 1935).

In a global search it would be hard to find a better setting for the game of golf than here in Uganda because of the plenty of water once tapped can be used to keep the courses lush, green and gorgeous and that's why it's not surprising that there a number of golf courses through the country such as Uganda golf club, Jinja golf club, Kabale golf club, Entebbe golf club, Tororo golf club and others.

Based on experiences by the Government's DWRM (summarized for example in the Catchment Protection Guidelines) typical issues in catchment management have been identified such as the increasing climate variability with shifting seasonal patterns and frequent rainfall shortages. And there are many streams, swamps and ponds through the country where water can be tapped for irrigation and other purposes (Makowka, 2014)

The Tororo golf course with nine (9) holes, tee white (18 holes), par 72, 10 Greens, and of length 6352 yard is located in Tongue Avenue, Tororo town and the town is approximately 10 kilometers west of Malaba at the border between Uganda and Kenya. This is about 230 kilometers east of Kampala, Uganda's capita city. The coordinates of the town are 0° 41' 34.0" N and 34° 10' 54.0" E and the town was estimated to have a population of about 34,800 in 2002, 42,500 in 2010 and 41,906 in 2014 as depicted by the Uganda Bureau of Statistics (UBOS) during the national population census, this implies that the area is moderately populated.

Tororo area receives two rainfall seasons (March to May and August to November) plus a partial dry season between June and July and one dry season from December to February. Due to the UN reliable rainfall patterns that are UN evenly distributed in a given year, the grass plant on the golf course usually relies on rainfall alone; this affects the growth of grass and affects the consistency game. This area receives a maximum and minimum temperature of 29.7 & 16.9°C, and an average

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