



**BUSITEMA
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Pursuing Excellence

FACULTY OF ENGINEERING

**DEPARTMENT OF AGRICULTURAL MECHANIZATION AND IRRIGATION
ENGINEERING**

**DESIGN AND CONSTRUCTION OF A WATER WHEEL POWERED PUMP IN TENTE
VILLAGE.**

By

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ABSTRACT.

Today in Uganda some people do rain-water harvesting where by water is kept in surface, above ground or underground tanks to cater for the future use. Uganda has an abundance of surface water resources which include rivers, lakes and wetlands that cover about 20% of the total surface area on top of the underground water sources such as springs (WaterWiki.net, September 2012).

The case study was taken from Tente village located in Busia district in eastern Uganda. The farmers at this area grow a variety of crops which includes Maize, Groundnuts and vegetables such as Sukuma, Tomatoes, Onions and Cabbages. These farmers are not experienced in irrigation, but have experience in using watering cans, jerry-cans in irrigating their crops. Horticulture Irrigation Project (HIP) has assisted them in constructing water runoff collection ponds enabling them have water near their gardens though during dry seasons most of the ponds are affected. (Lab, 2014)

Reviews of the relevant literature related to the research study and a brief overview of Surface water existence, use of hydropower, existing hydropower technologies and the existing water wheel pumps was done. The main source of this information was from existing literatures written by other scholars that have been involved with design of water pumps of a similar nature.

When the design of the water wheel pump was accomplished, it was to Avail adequate water to the farmers for irrigation and domestic use, enable farmers have time for other farm operations and eliminate other negative effects associated with usage of other pumps.

The water wheel pump for pumping water to a desired Head was constructed. The Prototype operated by the running water (Hydropower) and continuously unless removed from the stream. The pump operated efficiently and for a long period of time.

DEDICATION.

This piece of work is dedicated to all those who have supported me on my journey to complete this level of my education especially my uncles, Mother and my dear sisters who have worked selfishly and tirelessly to provide all needs and ensure I attain education.

ACKNOWLEDGEMENT.

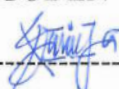
I thank the almighty God who has given me strength and protection. I extend sincere thanks to Busitema University especially AMI department, Administration, management and my fellow classmates for the support.

And lastly I thank the staff and management of all schools I went through before joining this University that is Kitura Catholic Primary School, Universal High School, Sheema High School, Bishop Stuart Core.PTC and Valley Collage Bushenyi. I am grateful to you for the knowledge, advice, and skills that I acquired from you. The Almighty God should bless you abundantly

DECLARATION.

I hereby declare that this piece of work is my own original work and has never been submitted wholly or partially to any University or institution of higher learning for any award.

NUWAMANYA GODEN

Signature: -----

Date: 02/06/2017-----



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CHAPTER ONE.

1.0 INTRODUCTION.

This chapter briefly gives the general information relevant to the research topic while clearly showing the problem of interest for the intended research. It shows how this device will help reduce the problem of limited access of water for irrigation through the fulfilment of a number of objectives and activities listed below.

1.1 Background of the study.

Today in Uganda some people do rain-water harvesting where by water is kept in surface, above ground or in underground tanks to cater for the future use. Uganda has an abundance of surface water resources which include rivers, lakes and wetlands that cover about 20% of the total surface area on top of the underground water sources such as springs (WaterWiki.net, September 2012).

Water usage for the different activities such as industrial, domestic, municipal, agricultural and recreation among others can be availed through different means. These means include gravity feed systems and pumping pressure systems. Pumping pressure systems include high or low reservoirs that hold non portable water for gravity feed, pumping station systems that use surface water from streams, rivers, canals, manmade or natural lakes and others special provisions for impound water. Also pumps at well sites that pump water to the treatment facilities and a combination of gravity flow and one or more pumping stations to transport the water from the source point to all the water demand points on the distribution systems. (William E, 2007)

Pumps that are used in these above systems are of different types such as centrifugal pumps, reciprocating pumps and rotary pumps. These have advantages like high water discharges, working with in varying heads among others and disadvantages like being expensive, pollutant and they require power sources like solar, electric and fuel. (Scout, 2002)

REFERENCES.

(n.d.).

Directorate of Water Development, M. o. (2016). *Directorate of Water Development, Ministry of Water & Environment, Republic of Uganda.*

Environment, N. R. (2016, 11 22). Water lifting devices. p. 45.

Ewbank, T. (1876). Hydraulics. *Hydraulics (16th edition)*.

FAO, N. R. (2016). *HYDRO POWER (Water lifting devices)*.

FAO.Org. (2011, 5 25). Pump classifications.

Habooloby. (2013). *Hydraulic Ram Pump*. Instructable.

Lab, H. I. (2014). *Vehetable Project*.

Research, B. (1984). *Spiral Tube Water wheel pump*. Harare, Zimbabwe: Ministry of Health.

Robert, F. (2007). *A Culture of improvement*. London,England: MIT Press, Cambridge, Massachusetts.

Robinson, M. (1969). Science and Technology in the Industrial Revolution. *University of Toronto Press*, 69.

Scout, P. (2002). *Pumps*.

SN, W. (2015). Spiral tube water wheel pump.

Vidali, C. F. (2016). Experimental and dimensional analysis of a breastshot water wheel. *Hydraulic Research*, 1-6.

(2011). *Water Supply Atlas*.

(n.d.). *Waterwheel* (<http://www.alternative-energy-tutorials.com/tag/waterwheel>).

William E, O. (2007). *Water and Development: Managing the relationship*. Paris: UNESCO.