



FACULTY OF ENGINEERING

**DEPARTMENT OF MINING AND WATER RESOURCES
ENGINEERING**

**EVALUATING THE PERFORMANCE OF LIRIMA GRAVITY FLOW
SCHEME AT BARAKI HILL, MANAFWA DISTRICT.**

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*A final year project Report submitted to the Department of Mining and Water Resources
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Science in Water Resources Engineering*

ABSTRACT

This project was evaluating the performance the Lirima Gravity flow scheme at Baraki Hill due to the Concerns raised by the locals of the community over shortage of water in the upstream area.

Therefore this project sought to understand the possible causes of the system underperformance and a way to overcome and create a more reliable system that will serve the needs of the people as planned. When this situation was related to the various millennium development goals concerning sustainable water development and Uganda's Vision 2040, it called for critical attention to water scarcity and other related problems.

This report consists of five chapters, chapter one contains the background which looks at the global, nationwide themes about water supply and generally looks at the Lirima Gravity Flow scheme specifications, Problem Statement, Significance of the study, Justification, objectives and scope of the study.

Chapter two contains the literature review of the project, Chapter three shows the various steps that I undertook to achieve my specific objectives, chapter four shows the Results and discussions and chapter five has the conclusion, Recommendations and appendices.

DECLARATION

I EMMANUEL OMUTOJO, BU/UP/2013/304 hereby declare and confirm that this report is original copy of my work and has never been presented or submitted by any other person for any other Academic awards at any institution of higher learning except me.

Signature: 

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APPROVAL

This piece of work has been approved by;

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DEDICATION

This piece of work is dedicated to all those who have supported, guided and financed me throughout this level of education especially my parents, Mr. Otimong Moses and family, Management and Staff of NWSC Tororo and Staff of Bubutu Water Office, Manafwa district and all my fellow course mates, especially to my fallen friend Mwesigye Jimreeves (RIP) who have always been there for me all time to support me on my academics and other fields.

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I appreciate my parents for their guidance and financial support they have rendered to me. May the Almighty God bless the works of their hands!

Finally I appreciate my friends who helped me to accomplish this project work especially Mwesigye Jimreeves (R.I.P), Lubanga Nicholas, Kadapawo Gerald. May the Good Lord bless and reward them with success in their endeavors.

LIST OF ABBREVIATIONS

WHO.....	World Health Organization
NWSC.....	National Water and Sewage Corporation.
OD.....	Outside Diameter
HDPE.....	High Density Polyethylene
uPVC.....	unplasticized Polyvinyl Chloride
nr.....	number
Km.....	Kilometer
MDPE.....	medium density polyethylene
GI.....	Galvanized Iron
GPS.....	Global Positioning System
HH.....	Household(s)
DC.....	Direct Current
AC.....	Alternating Current
AH.....	Amp Hours
Kwh.....	Kilo watt Hour
KW.....	Kilo Watt

LIST OF FIGURES

Figure 1 Layout of a Gravity Fed System.....	6
Figure 2 Standing-start-and-finish method for the gravimetric Calibration of Liquid Flow Meters	18
Figure 3 pressure Testing exercise at the booster Pump	21
Figure 4 A dead weight Tester	22
Figure 5 Mufutu Tank Line	23
Figure 6 Baraki Distribution,	23
Figure 7 Aerial View of Reservoir Tank at Musiye	28
Figure 8 Epanet2.0 Drawing of the system.....	39
Figure 9 Product Pump Curve for Mufutu Main	46
Figure 10 Solar Power Available in Different Parts of Uganda.....	47

LIST OF TABLES.

Table 1 Advantages and disadvantages of types of Various Pumps	11
Table 2 Velocity Variation	16
Table 3 Summary of Pipe Size	24
Table 4 Pump Details at Mufutu Tank	28
Table 5 Pressure Field Results	29
Table 6 Billing Receipts for January and February	30
Table 7 Average Survey Data	36
Table 8 Demand, Head and Pressure at node 3.	40
Table 9 Demand, Head and Pressure at node 16.	41
Table 10 Mufutu Pump Design	42
Table 11 System Flow Balance	44
Table 12 Baraki Pump Design	45
Table 13 Summary of Mufutu Pump Specifications	46
Table 14 Meru Pump Design	48
Table 15 Summary of the solar Pump Specifications	49
Table 16 Estimations of Project revenues	50
Table 17 Cost of the distribution Pipes and Fittings	51
Table 18 Costing of the masonry work for the Distribution and BPT at Butsebeni.	52
Table 19 Costing of the distribution system	52
Table 20 Costing of pumps	53
Table 21 Costing of the storage tanks	53
Table 22 Operation and maintenance costing of the system	55
Table 23 Summary of the total costs	56
Table 24 Summary of total costs and total benefits	56

TABLE OF CONTENTS

ABSTRACT	i
DECLARATION.....	ii
APPROVAL	iii
DEDICATION.....	iv
ACKNOWLEDGEMENT	v
LIST OF ABBREVIATIONS	vi
LIST OF FIGURES	vii
CHAPTER ONE.....	1
1.0 Introduction.....	1
1.1 Back Ground	1
1.2 Problem statement	2
1.3 Significance of the Study	3
1.4 Justification	3
1.5 Objectives of the project.....	3
1.5.1 Main objective	3
1.5.2 Specific objectives	3
1.6 Scope and limitation of the study.....	4
1.7 The research question	4
CHAPTER TWO.....	5
2.0 Literature review.....	5
2.1 Definitions and Terminologies	5
2.1.1 A water supply system or water supply network	5
2.1.2 Gravity Flow Supply system	5
2.2 Pump Boosters.....	9
2.2.1 Construction and function.....	9
2.2.2 Types of Pumps Installed in Water Supply Systems.....	10
2.3 Measurable Hydraulic Parameters in water supply systems	12
2.3.1 Measurement of Pressure in water Supply Lines.....	12
2.3.2 Measurement of Flow in water supply systems.....	14
2.3.3 Estimation of water velocity in distribution Lines	16
2.4 Calibration of Instruments.....	16
2.4.1 Gravimetric Calibration of Liquid Flow meters	17

2.5	Problems Faced With water Supply	18
CHAPTER THREE: METHODOLOGY		20
3.0	Introduction	20
3.1	The Study Area	20
3.2	Specific objective one (To analyze the distribution network under study and its hydraulics)	20
3.2.1	Data Collection Methods	20
3.3	Specific objective two (To determine Service delivery of the System)	24
3.3.1	Data Collection Methods	24
3.4	Specific objective three (To redesign the System to meet the required output)	25
3.4.1	Data Collection Methods	25
CHAPTER FOUR		27
4.0	Data Analysis	27
4.1	Analysis on the Hydraulics of the system	27
4.1.1	Pump Booster Station	27
4.1.2	The Specifications of the Pumps	28
4.1.3	Pressure Results from the Field test Carried out	29
4.1.4	Flow Measurements	29
4.2	Analysis on Service Delivery	31
4.2.1	The Results of the survey	33
4.3	Redesign of the system using EPANET 2.0 Software and AUTOCAD 2014	38
4.4	RESULTS AND DISCUSSIONS	39
4.4.1	EPANET2 drawing	39
4.4.2	Pressure Analysis on the new design	39
4.4.3	Design Flow Analysis	42
4.4.4	Economic Analysis of the Redesigned Water Supply system	50
CHAPTER FIVE: RECOMMENDATIONS AND CONCLUSION		58
5.0	Conclusion	58
5.1	Recommendations	58
Appendix A		59
APPENDIX B		60
References		61

CHAPTER ONE

1.0 Introduction

1.1 Back Ground

According to the Human Development Report 2006, It states that,water is life.

It continues to state that, adequate supply of water is central to life and civilization. The five basic human needs namely air, water, food, light, and heat. Water is common factor to other four. It is therefore not an understatement to say water is life, because it forms an appreciable proportion of all living things including man. In fact, water is very critical to human life. Water constitutes about 80% of animal cells. The human body by weight consists of about 70% water and several body functions depend on water ((Uzbekistan), 2006) .

According to the agenda 2030 for sustainable development, Goal 6 seeks to ensure availability and sustainable management of water and sanitation for all.

In section 6.1, “achieve universal and equitable access to safe and affordable drinking water for all”.

6.4, seeks to substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity and support strengthen the participation of local communities in improving water and sanitation management, thus this calls for great interventions from the relevant ministries and organizations in order to achieve this goals.

Focusing on the baseline status and targets of Uganda’s Vision 2040, the 2010 Water Consumption (m^3 per capita) was 26 and the target is 600 therefore there is serious need to double efforts to make sure the target is achieved.

According to WHO (Consultation, 2003), water distribution networks serve many purposes in addition to the provision of water for human consumption, which often accounts for less than 2% of the total volume supplied. This therefore calls for quick development and support of the water supply schemes to promote good health amongst people.

References

- (Uzbekistan), U. N. D. P., 2006. *Uzbekistan Human Development Report*. s.l.:s.n.
- Chaturvedi, K. P., 2014. PCR detection assay for sex determination in papaya using SCAR marker. *Acta Botanica Croatica*.
- CIA, C., 2014. CIA World Factbook. *Washington, DC: United States Central Intelligence Agency (CIA)*.
- Consultation, F. E., 2003. Diet, nutrition and the prevention of chronic diseases.
- De Corte, A., 2013. Optimisation of gravity-fed water distribution network design: A critical review.
- Dudley, R., 2005. Handbook of measuring system design: internet calibration. In: s.l.:s.n.
- Górecka-Drzazga, A., 2009. Miniature and MEMS-type vacuum sensors and pumps.
- Griggs, D., 2013. *Policy: Sustainable development goals for people and planet*. s.l.:s.n.
- HÁBITAT, O., 2006. Water and human settlements in an urbanizing world. In: s.l.:UNESCO.
- Loucks, D. P., 1979. Water resources systems.
- Murphy, M., 2012. State of the Water Industry Report-An Industry at the Crossroads. *Journal AWWA*.
- Stafford-Smith, M., 2013. *Policy: Sustainable development goals for people and planet*.
- Warner, N. & Gregg, T., 2002. *Lava flow field southwest of Arsia Mons, Mars: Estimates and comparisons of rheologic proper*. s.l., s.n.