BUSITEMA UNIVERSITY
Pursuing Excellence

FACULTY OF ENGINEERING.

DEPARTMENT OF WATER RESOURCES ENGINEERING.

FINAL YEAR RESEARCH RPORT.

Alleviating Water Scarcity in Semi-Arid Catchments Using Trench-Recharged Subsurface Dams.

A case of Lokok catchment.

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ABSTRACT.

Water scarcity is a pressing global challenge, particularly in semi-arid catchments where the availability of water resources is limited. This research focuses on addressing water scarcity in the semi-arid catchment of Lokok through the innovative approach of trench-recharged subsurface dams. The proposed solution draws inspiration from Zekai Sen's (2023) design aiding the recharge of these dams by use of trenches. This design is viewed as potential to enhance higher yield from subsurface dams while reducing the impact of flood waters downstream. The primary objective of the study is to assess the spatial extent of water scarcity alleviation in Lokok Catchment through the approach of trench-recharged subsurface dams.

This report begins the first chapter by presenting the background of water scarcity in semi-arid regions, emphasizing the need for sustainable and effective solutions such as subsurface dams. The problem statement further explains this challenge in the Lokok Catchment. The chapter then proceeds to the main and specific objectives of the study, justification, and scope which covers the conceptual, geographical, and time scope of the study.

The study employs a comprehensive methodology encompassing details, methods, and recommendations from the literature reviewed, research questions, and practical activities to achieve the specified objectives. The research explores the intricacies of trench-recharged subsurface dam design in the Lokok Catchment.

Results include insights into the effectiveness of trench-recharged subsurface dams in the Lokok catchment, validated through the assessment of specific objectives. The research is anticipated to contribute valuable knowledge to the field of water resource management by offering a sustainable solution to alleviate water scarcity in semi-arid catchments and providing a roadmap for the design of trench-recharged subsurface dams as an innovative strategy for water resource management in similar regions.

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DEDICATION.

This work is dedicated to my family and friends, whose support has been a constant source of strength and inspiration throughout this academic endeavor. It is also dedicated to those living in drylands, may the findings of this study contribute, in even the smallest measure, to the collective efforts aimed at alleviating water scarcity in semi-arid regions.

DECLARATION

I **NGOLOBE KENNETH**, hereby declare that this report was written by me. I affirm that the research conducted for this report was carried out diligently, employing reliable sources and appropriate methodologies. Any external sources used have been appropriately cited, referenced, and credited.

This report has not been utilized in the acquisition of an academic award by any individual in any learning institution.

Date ....

Signature ....

APPROVAL.

I hereby certify that this report was written and completed by NGOLOBE. KENNETH. And is ready for submission to the Department of Water Resources Engineering, Faculty of Engineering and Technology Busitema University.

Mr Baagala Brian Ssempijja Supervisor:

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Date: ....

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List of Acronyms.
UN: United Nations.

UNICEF: United Nations Children’s Fund.

WHO: World Health Organization.

UNECA: United Nations Economic Commission for Africa.

CMP: Catchment Management Plan.

SDG: Sustainable Development Goals.

NDP3: National Development Plan 3.

MADM: Multi-Attribute Decision Making.

MWE: Ministry of Water and Environment.

GIS: Geographic Information System.

LULC: Land Use and Land Cover.

AHP: Analytic Hierarchy Process.

SCS-CN: Soil Conservation Service Curve Number.

NRCS: Natural Resources Conservation Service.

USDA: United States Department of Agriculture.

1.0 CHAPTER ONE.

1.1 INTRODUCTION.

This chapter is comprised of the background of the study, the problem statement, objectives of the study, justification, and the scope of this study which includes the conceptual scope, geographical scope, and the time scope for the project.

1.2 Background.

Water scarcity is a serious challenge for many regions of the world, especially in semi-arid areas, where limited water resources compound the impacts of erratic rainfall and frequent droughts. The United Nations (UN) 2020, approximates that 2.1 billion people live in the world's deserts and drylands, which include arid, semi-arid, and dry sub-humid areas.

In the African region, one in three people suffer from water scarcity, and the problem is getting worse due to population growth and climate change (WHO, 2022). While Sub-Saharan Africa has primarily economic water scarcity, the continent's dry regions, primarily found in North Africa, frequently face physical water scarcity. Nonetheless, climate change has an impact on both areas, leading to more frequent and severe droughts that decrease the amount of water available (UNECA, 2011). In arid and semi-arid regions of Africa, a shortage of water has a major influence on livelihood, increasing the risk of diseases spread by inadequate sanitation and hygiene, killing livestock, and drying crops, which leaves people without food (UNICEF, 2022).

Deriving from the Paris Agreement of 2015, a global average temperature rise of about 1.5 to 2.0°C is expected by 2050. Evaporation rates from reservoirs and bodies of surface water will inevitably rise as a result. Subsurface dam construction projects are the leading developments in many arid and semi-arid locations, particularly in the Middle East, and even in subtropical climate regions, to mitigate these losses (Sen. Z, 2023). Conventional subsurface dams have been implemented in the Horn of Africa, particularly in Ethiopia and Somalia, and in North Africa, particularly in Algeria (Zoran Stevanovic, 2016). Subsurface storage is also gaining acceptance in the Southern parts of Africa (EC Murray and G. Tredoux, 2004). This has resulted in several benefits, including increased use of stored alluvial groundwater, recharge of unconfined aquifers, and dilution of groundwater salinity (Stevanovic et al., 2016).

Uganda, especially in its dry catchments is also faced with water scarcity. According to the Climate Change Knowledge Portal (CCKP), Uganda has encountered 9 extreme drought events from 1900

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