



**BUSITEMA  
UNIVERSITY**  
*Pursuing Excellence*

**FACULTY OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF WATER RESOURCES**

**ENGINEERING**

**FINAL YEAR PROJECT REPORT**

**RE-DESIGN AND CONSTRUCTION OF A PRECAST PANEL**

**WATER TANK**

**CASE STUDY: BUSITEMA UNIVERSITY**

**By**

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**“This Final Year Project Report is submitted to the Department of Water Resources Engineering in partial fulfilment of the requirements for the Award of the Degree of Bachelor of Science in Water Resources Engineering of Busitema University”**

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## **ABSTRACT**

This research addresses the challenge of water quality deterioration in traditional water storage solutions, such as plastic and steel tanks, which promote the growth of microorganisms and pose significant health risks. The study focuses on the redesign, construction, and assembly of a precast panel water tank to provide a durable, low-maintenance, and safe alternative. The primary objective is to redesign and construct a precast slab water tank, with specific objectives including determining soil and concrete properties, redesigning the tank and its components, fabricating the tank, testing its performance, and conducting a financial analysis. The main objective of this research is to develop an efficient precast panel water tank, with specific objectives to determine soil and concrete properties, redesign the tank and its components, fabricate the tank, test its performance, and perform a financial analysis. The methodology involved extensive soil and concrete testing, redesign of tank components to enhance efficiency and reduce material wastage, and tank fabrication using precast concrete slabs. Performance testing and economic evaluations were conducted to ensure project viability. Key findings reveal that the redesigned tank serves multiple purposes and the soil foundation is suitable for light structures. The uniformly distributed aggregate sizes (6.3 to 28mm) enhance structural integrity. Population projections are crucial in determining the tank's storage capacity. Effective grouting minimizes leakages, and the economic analysis confirms the project's cost-effectiveness. The tank demonstrated a high efficiency rate of 95%. In conclusion, the study underscores the advantages of precast panel water tanks in maintaining water quality and cost efficiency. Recommendations for future research include examining water deterioration parameters, investigating the punching shear behaviour of composite slabs, and developing models to accurately predict punching shear capacity.

**Keywords:** water storage, precast panel concrete tanks, water quality, microorganism growth, structural integrity, economic analysis, punching shear behaviours, composite slabs

**DECLARATION**

I **KASULE BRIAN** and **AYEKO SCOVIA LYDIA** declare that, to the best of our knowledge, this report is the result of our original study and has never before been submitted for consideration for any academic award to any other university or higher education establishment. All of the material in this report is accountable to us.

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**APPROVAL**

This is to certify that the final year project report was written under the guidance our supervisor on the topic **“RE-DESIGN AND CONSTRUCTION OF A PRECAST PANEL WATER TANK”**

**SUPERVISOR: MR. TIGALANA DAN**

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## **ABBREVIATIONS /ACRONYMS**

ASTM	American Society for Testing and Materials
DFA	Design for assembly
DFM	Design for manufacture
DFMA	Design for manufacturing and assembly
HSC	High strength concrete
RC	Reinforced concrete
SDGS	Sustainable Development Goals
UHPRFC	ultra-high performance fibre reinforced concrete
WHO	World Health Organization
M25	concrete grade 25
mm	millimetre
kN	Kilonewton
MDD	Maximum Day Demand
ADD	Average Day Demand

# **1 CHAPTER ONE: INTRODUCTION**

## **1.1 Background of the Study**

Precast construction, or prefabricated construction, entails buildings where the majority of structural components are standardized and produced in off-site plants before being transported to the construction site for assembly (Precast, n.d.). This approach is particularly recommended in India due to its recent rapid economic growth and infrastructure development needs ( Khare et al., 2019). Precast construction allows for the creation of flat slabs with large spans, and even more slender slabs can be achieved using post-tensioned concrete (Precast, n.d.). However, slender slabs may encounter challenges related to stability, capacity, thermal and acoustical properties, and vibration resistance, all of which can be addressed with concrete, especially prestressed concrete (Milani & Kaviratne, 2022). Precast hollow core slabs, utilizing pre-tensioning, can achieve substantial spans. Incorporating hidden steel beams and a concrete topping further enhances the attractiveness of this slab type ( Satwika et al., 2020).

Access to safe and portable water is essential for human health and well-being. In developing countries like Tanzania, some areas have access to safe and clean water from sources such as manmade wells, natural springs, rivers, and Lake Victoria. However, there is still a significant reliance on limited piped water supply. For example, in Mwanza city, about 78% of the population receives piped water from the Mwanza Urban Water Supply and Sewerage Authority. The effectiveness of water supply in these areas depends largely on the availability of water reservoirs ( Mushi et al., 2021).

Water quality and quantity are crucial for human health. Despite global improvements in access to safe water, water quality is deteriorating due to contamination at various points in water supply systems, including distribution and storage ( Nnaji, Nnaji, and Ekwule, 2020). Water storage, a critical component of many water supply systems, presents challenges that can degrade water quality. Concrete tanks are a popular choice for water storage due to their strength, durability, resistance to corrosion, and ability to maintain water at an ideal temperature. Additionally, they are cost-effective compared to other materials ( Benko, Dobrý, and Cuhak, 2020).

The proportion of the world's population using safely managed drinking water services has been increasing, even before the adoption of the 2030 Sustainable Development Goals (World Bank, 2019). However, poor water quality remains a significant challenge, threatening human well-being (World Bank, 2019). Ensuring access to clean water is crucial for achieving various

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