FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF WATER RESOURCES ENGINEERING

FINAL YEAR PROJECT

ASSESSING THE PERFORMANCE OF URBAN DRAINAGE SYSTEMS UNDER CLIMATE CHANGE IMPACT

CASE STUDY: NAMASUBA

By

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BU/UP/2021/0295

This final year project report is submitted to the Department of Water Resources Engineering as a partial fulfilment of the requirements of the award of a Bachelor of Science Degree in Water Resources Engineering.

MAY 2025

ABSTRACT

This study evaluates the resilience and effectiveness of urban drainage systems in mitigating flood risks under current and future climate conditions, using Namasuba, a densely populated suburb of Kampala, Uganda, as a case study. Employing the PCSWMM hydrologic-hydraulic modelling platform, the study first simulated baseline drainage system performance under storm events of 10, 25, and 50-year return periods, utilizing historical rainfall data (1995-2024) analysed through Intensity-Duration-Frequency (IDF) curves generated using Gumbel distribution.

To assess future impacts, precipitation projections were derived from the CMIP6 climate model (BCC-CSM2-MR) for two climate scenarios, SSP2-4.5 and SSP5-8.5. Bias correction of global model outputs to local conditions was achieved using Quantile Delta Mapping (QDM). Simulation results under future climate scenarios showed significant increases in runoff volume, flood duration, and the number of flooded nodes, with SSP5-8.5 presenting the most severe impacts.

To address these impacts, Low Impact Development (LID) measures, specifically infiltration trenches and rain barrels, were implemented within the PCSWMM simulations. These adaptations demonstrated substantial effectiveness, significantly reducing flood volumes and durations.

The findings underscore the vulnerability of existing urban drainage infrastructure in Namasuba to climate-induced flooding and highlight the importance of incorporating adaptive stormwater solutions into future urban planning strategies. This research contributes directly to achieving Sustainable Development Goals (SDGs) 11 (sustainable cities and communities) and 13 (climate action), providing actionable insights for policymakers and urban planners to enhance resilience and sustainability in urban areas.

Keywords: Urban drainage systems, Hydraulic Model, PCSWMM, Urban flooding, Climate Change, mitigation.

DECLARATION

I IRADUKUNDA ROBIN declare that this final year project report was originally written and compiled by me and has not been previously submitted for the award a bachelor’s degree I water resources engineering.

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APROVAL

I IRADUKUNDA ROBIN, submit this report for my final year research to the faculty of engineering and technology in the Department of Water Resources Engineering with the approval of my supervisor.

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ACKNOWLEDGEMENT

I thank the almighty God for granting me the strength and determination to undertake this project. I express my gratitude to my supervisor, Dr. Joseph Ddumba Lwanyaga for his much-needed guidance, supervision, and support throughout this work. I also thank my fellow students who offered necessary help to me during the learning of different software required for this work and during the preparation of this report.

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List of abbreviations

CMIP	-Coupled Model Intercomparison Project
GCM	- Global Climate Model
LID	- Low impact development
PCSWMM	-Personal computer storm water management model
RCM	-regional climate model
SWMM	- stormwater management model
SSP	- Shared socioeconomic pathway
UDS	- Urban Drainage Systems

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