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**FACULTY OF ENGINEERING
DEPARTMENT OF MINING AND WATER RESOURCES ENGINEERING
WATER RESOURCES ENGINEERING PROGRAMME**

FINAL YEAR PROJECT REPORT

**DESIGN OF A CAR WASH WASTEWATER TREATMENT AND RECYCLING
SYSTEM.**

(Case study: Clock Tower Car Wash)

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A final year project report submitted to the Department of Mining and Water Resources Engineering as a partial fulfillment of the requirements for the award of a Bachelor of Science degree in Water Resources Engineering

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ABSTRACT


Uganda is a highly motorized society. Kampala as a city, has a high number of vehicles as the seat of power in Uganda. Most of the vehicle washing activities in Kampala city are carried out in streets. Cars that are washed in streets pollute streams, rivers, bays and estuaries (Huybrechts *et al.*, 2002). Wastewater from car washing stations contains a number of impurities that include; sand and dust, free oil, grease, detergents, phosphates, paint residues, rubber, volatile organic compounds (VOC's), and rubbish.

The main objective of this project was to design a car wash wastewater treatment and recycling system and the case study area being Clock Tower Car Wash- Kampala. The project involved a review of several literature pertaining to car wash effluent treatment and recycling systems, characterizing and quantifying the waste water composition, designing the various components of the car wash wastewater treatment and recycling system and finally economic analysis of the project was done.

Relevant equations were used in the design of various components of the Car wash wastewater treatment and recycling system. From the research carried out, wastewater generated from Clock Tower Car Wash was 16,800 litres per day and the highest number of vehicles that could be washed in a particular day being 100 vehicles, with 5 heavy vehicles and 95 light vehicles. The wastewater being discharged showed poor physical chemical characteristics and thus needs treatment before discharge or reuse. Conveyance pipes were sized, then treatment units; 2 Oil water separator tanks, 2 slow sand filters, clear water well plus water pump, and overhead tank were sized. An economic analysis of the system was done using benefit cost ratio approach and it was found to be 2.0. This means that the project is viable and thus should be implemented to curb down environmental degradation and reduce on the cost of fresh water from National Water and Sewerage Corporation (NWSC).

DECLARATION

I OBURA DENIS do declare that this project report on the design of a car wash wastewater treatment and recycling system is as a result of my own research and has never been presented in any academic institution for any award.

Signature:  Date: 27TH / 09 / 2016

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APPROVAL

This project report on the Design of a car wash wastewater treatment and Recycling System has been written under the supervision of;

Main supervisor

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Co-supervisor

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DEDICATION

This report is dedicated to my father Mr. Enabu Michael and my mother Mrs. Janet Enabu for their tireless efforts and sacrifices throughout my education.

ACKNOWLEDGEMENT

I thank the Almighty God for the great provision and guidance towards my final year project accomplishment.

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ACRONYMS

BOD ₅	Five day Biochemical Oxygen Demand
m	meter
ms/ cm	milliseconds per centimeter
m/ s	meters per second
mg/ l	milligrams per liter
ml	milliliter
mm	millimetres
gpd/ft	gallons per day per feet
APHA	American Public Health Association
NTUs:	Nephelometric Turbidity Units
TDS:	Total Dissolved Solids
NWSC	National Water and Sewerage Corporation
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
CVWF	Central Vehicle Washing Facilities
CPHEEO	Central Public Health and Environmental Engineering Organization
UEC	Upstream Engineering Centre
AS	Anionic Surfactant
μPVC	Un-plasticized Poly Vinyl Chloride
pH	Hydrogen Potential

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CHAPTER ONE

1.0 INTRODUCTION

This chapter outlines the relevant information and clearly shows the problem of interest for the intended research. It stipulates how this study will help reduce the problem through fulfillment of the objectives discussed below.

1.1 Background

Water is one of the most precious needs for life on earth. In developed countries, carwash industry is conscious of the need for wastewater treatment and water reclamation as a way of protecting the scarce fresh water resources from pollution. Worldwide, environmental legislation and guidelines concerning this specific issue have been released. Examples show that in Queensland, Australia, it is mandatory for the use of at most 70 L of fresh water in a single car wash, and in Europe some countries restrict the water consumption to 60–70 L per car and/or impose reclamation percentage (70–80%) (Boussu et al., 2007). However, developing countries are still behind to develop conscious for their wastewater produced by carwash industries.

Uganda is a highly motorized society. Kampala as a city, has a high number of vehicles as the seat of power in Uganda. It has a good urban environment being one of the most beautiful urbanities in East Africa. However, the climate is dusty despite the well planned road network. Therefore, like any other motorized society the vehicles are bound to get dirty more frequently thus, requiring frequent washing. Most of the vehicle washing activities in Kampala city are carried out in streets. Cars that are washed in streets pollute streams, rivers, bays and estuaries (Huybrechts *et al.*, 2002). Wastewater from car washing stations contains a number of impurities that include sand and dust, free oil, grease, detergents, phosphates, Volatile Organic Compounds (VOCs), heavy metals, and also rubbish. According to Uganda Revenue Authority in 2011, there were 635,656 motor vehicles plying Uganda's roads, an increase from 50,102 in 1991. According to statistics, the number of vehicles plying Uganda's roads increased by over 500,000 (100%). Assuming each of these cars was hand washed with 70 litres of water per week, the volume of untreated car wash effluent discharged to the environment per year would be approximately 2.3 billion litres. The predominant metal contaminants in diffuse urban runoff are copper (Cu), lead

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