BUSITEMA UNIVERSITY

Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF MINING AND WATER RESOURCES

ENGINEERING

WATER RESOURCES ENGINEERING PROGRAMME

FINAL YEAR PROJECT REPORT

Design of an Aerobic lagoon for domestic waste water treatment

(Case study Busitema campus)

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ABSTRACT

As the population of the campus continues to increase, the demand on water resources will increase and as well as the increase in the domestic waste water production hence calling for need to have proper and safe disposal of the waste generated in environmentally friendly way. Men and women with knowledge of water resources and environmental management will be called upon to find the solution to this pending crisis. As long as Busitema University population is materially increasing, demand for efficient disposal of wastes will also increase. Unless the university devotes some of her resources and efforts to planning for the disposal of the increasing volumes of human wastes, the problem of environmental pollution and disease outbreaks is bound to arise.

Therefore the purpose of this design once implemented is to ensure improved sanitation situation at the campus, discharging effluent into the receiving environment of required National Standards since the tested quality parameters showed poor discharge requirements hence avoiding legal battles with environment protection agencies such as NEMA

The design is basically natural treatment plant depending on biological process feeding on the organic content of the waste water. The waste water is transported to treatment plant through gravity flow sewers from source points with clean chambers at specific points. The consists of four cells (units) in series.

The design is mainly for handling the peak daily domestic waste water generated from the campus for a period of thirty years

The total daily peak design flow by a population of 9781 people is515168.0288L/day requiring total area of 1611m^2 of land. The plant hydraulic detention period is 30 days for adequate treatment.

The design of the lagoon and sewer line was successful completed to perform to the standards

Recommended for environmental impact assessment of the project pending its implementation in the locality

DECLARATION

I Dickson Matua, Registration number BU/UG/2011/822 hereby declare that this report is my own, the first of its kind to be presented for any award of Bachelors Degree in this institution and has never been presented by any person in this institution, or any other university.

Sign.....

Date 25/06/2015

DICKSON MATUA

Project supervisors:

MARION ENGOLE

Sign.....

Date .....

BRIAN BAAGALA SEMPIJJA

Sign.....

Date.....

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In especial way would like to appreciate my lovely and only friend and wife in making Jacqueline E'DONIA for the love and prayers offered may you be blessed by Lord Jesus Christ.

Above all, I truly believe you do exist my almighty father lord thanks for your protection, guidance and the good health you offered to me my lord.

DEDICATION

This report is dedicated to none other than my family members especially my parents and siblings for the contributions of every kind received from them as a token towards my wellbeing and academic pursuit

LIST OF ACRONOMY

NEMA.....National Environmental Management Authority

BOD.....Biological oxygen demand, amount of oxygen required by Microorganisms to decompose the waste

DO.....Dissolved oxygen

COD.....Chemical Oxygen demand

TSS.....Total Suspended Solids, measures the suspended particle in the waste water

BOD loading rate.....measures the waste water organic content per the waste generated

mm.....millimeters

mg/L.....milligrams per liter

PH.....potential hydrogen ion

L.....length

W.....width

h.....plant depth

ft.....feet

m.....meters

L/day.....liters per day

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CHAPTER ONE: INTRODUCTION

1.1Background

Domestic wastewater accounts for 60% of pollutants that cause river pollution, and ranks as the major source of river pollution.

In general, domestic wastewater includes black water (fecal sewage) and gray water (wastewater from dishwashers, washing machines, sinks, and baths). Black water accounts for 32.5% of domestic wastewater, while gray water accounts for 67.5%. Domestic wastewater is categorized as organic pollutants.(Administration, 2010)

The majorly existing excreta disposal facility at Busitema Campus is Water Based. Waste water generated from this facility is channeled through sewer lines and disposed off to a nearby stream without adequate treatment. (Administration, 2010)

Every academic year the Campus experiences a rapid increase in student population, leading to increased generation of waste water beyond the design capacity of the existing facility. This is characterized by frequent sewage overflows at sewer lines from the student's Halls of residents and the restaurant.

The production of waste from human activities is unavoidable (HENZE, 2008). A significant part of this waste will end up as wastewater. The amount and type of waste produced in households is influenced by the behavior, lifestyle and standard of living of the inhabitants as well as the technical and juridical framework by which people are surrounded. Since early in history, people have dumped sewage into waterways, relying on natural purification by dilution and by natural bacterial breakdown. Population increases resulted in greater volume of domestic and industrial wastewater, requiring that we give nature a helping hand Water pollution is the contamination of water bodies (e.g. lakes, rivers, oceans, aquifers and groundwater)
(HENZE, 2008).

Demands on water resources for household, commercial, industrial, and agricultural purposes are increasing greatly. The world population will have grown 1.5 times over the second half of the twenty -first century, but the worldwide water usage has been growing at more than three times the population growth. In most countries human populations are growing while water availability is not. What is available for use, on a per capita basis, therefore, is falling. Out of 100 countries surveyed by the World Resources Institute in 1986, more than half of them were assessed to have

low to very low water availability, and quality of water has been the key issue for the low water availability.(S.Vigneswaran, 2004)

1.2 Problem statement

Water pollution occurs when pollutants are directly or indirectly discharged into water bodies without adequate treatment to remove harmful compounds. Wastewater can contain a range of contaminants at different levels in relation to the source.

The waste water generated from Busitema campus is not treated to the recommended discharge standards before disposing off to the nearby stream. This has led to increased stream pollution, water borne disease infection and destruction of aquatic life.

Water pollution affects plants and organisms living in these bodies of water. In almost all cases the effect is damaging not only to individual species and populations, but also to the natural biological communities.(Wikipedia, 2014)

Given the rapid spread of water pollution and the growing concern about water availability, the links between quantity and quality of water supplies have become more apparent. In many parts of the world, there is already a widespread scarcity, gradual destruction and increased pollution of freshwater resources. Large urban centers. However, untreated sewage poses acute water pollution problems that causes low water availability.

Development of human societies is heavily dependent upon availability of water with suitable quality and in adequate quantities, for a variety of uses ranging from domestic to industrial supplies.(S.Vigneswaran, 2004)

1.3 Significance of the project

The designed aerobic lagoon system will provide an adequate treatment and disposal of waste water generated from the campus for many years with relatively low maintenance costs.

The project will also be beneficial to the community relying the Namukombe stream for their domestic needs such water for washing, bathing, cooking due the discharging of fairly safe effluent from the plant, reduced water bone related disease infections such as cholera, bilharzia, dialiorrea, improved livelihood of surrounding community and environmental conservation thus protection of aquatic life of stream

1.4 objectives

1.4.1 Major objective

To design an aerobic lagoon for domestic waste water treatment

1.4.2 Specific objectives

I. To quantify the daily domestic waste water generated
II. To analyze the domestic waste water composition and quality
III. To design the various components of the aerobic lagoon system.

1.5 Justification:

Wastewater is treated to remove pollutants (contaminants). Wastewater treatment is a process to improve and purify the water, removing some or all of the contaminants, making it fit for reuse or discharge back to the environment. Discharge may be to surface water, such as rivers or the ocean, or to groundwater that lies beneath the land surface of the earth. Properly treating wastewater assures that acceptable overall water quality is maintained. In many parts of the world, including in the United States, health problems and diseases have often been caused by discharging untreated or inadequately treated wastewater. Such discharges are called water pollution, and result in the spreading of disease, fish kills, and destruction of other forms of aquatic life. The pollution of water has a serious impact on all living creatures, and can negatively affect the use of water for drinking, household needs, recreation, fishing, transportation, and commerce. Clean water is vital to the survival and growth of all life and all economic and environmental processes

1.6 Scope

The coverage of the project involved, the structural design of aerobic lagoon, sewer lines to transport waste water from the source points such as the halls of residence, restaurant, administration blocks and preferable the quarters to treatment plant in Busitema campus to minimize the pollution rate nearby stream used as discharging ground for the domestic waste generated from the campus.

CHAPTER TWO: LITERATURE REVIEW

2.1 Composition and Nature of Liquid Waste

It includes black waste water, grey and yellow waste water it is anticipated that the any residential will be producing domestic wastewater as a result of its activities. Domestic wastewater is the spent water originating from all aspects of human sanitary water usage

It typically institutes a combination of flows from the kitchen, bathroom and laundry, encompassing lavatories, toilets, baths, kitchen sinks, dishwashers, and washing machines.

Domestic wastewater as the name implies, principally originates in residences, commercial and institutional establishments and is also referred to as sanitary sewage,

In order to estimate the projected quantity of sewage waste, it is necessary to look at the nature of the sewage effluent

It is no wonder that one of the most popular methods for wastewater treatment around the world is also one of the simplest and least expensive. Lagoon systems use natural and energy-efficient processes to provide low-cost wastewater treatment. They are one of the most cost-effective wastewater treatment options for many homes and communities. (HOUSE, 1997)

There are several different types and names for lagoons and many possible system designs. Lagoon systems include one or more pond-like bodies of water or basins designed to receive, hold, and treat wastewater for a predetermined period of time. Lagoons are constructed and lined with material, such as clay or an artificial liner, which will prevent leaks to the groundwater below. (HOUSE, 1997)

While in the lagoon, wastewater receives treatment through a combination of physical, biological, and chemical processes. Much of the treatment occurs naturally, but some systems are designed to also use aeration devices that increase the amount of oxygen in the wastewater.

Dissolved oxygen is in aerobic lagoon present throughout much of the depth of aerobic lagoons. They tend to be much shallower than other lagoons, so sunlight and oxygen from air and wind can better penetrate the wastewater. In general, they are better suited for warm, sunny climates, where they are less likely to freeze. Wastewater usually must remain in aerobic lagoons from 3 to 50 days to receive adequate treatment. Wastewater treatment takes place naturally in aerobic lagoons with the aid of aerobic bacteria and algae. Because they are so shallow, their bottoms need to be either paved or lined with materials that will prevent weeds from growing in them. It is because of these concerns, the Agenda 21 adopted by the United Nations Conference on

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