CHAPTER I

INTRODUCTION

1.1 General

A septic tank is an underground chamber made of concrete, fiberglass or plastic through which domestic wastewater (sewage) flows for basic treatment.Settling and anaerobic processes reduce solids and organics, but the treatment efficiency is only moderate (referred to as "primary treatment"). Septic tank systems are a type of simple onsite sewage facility (OSSF). They can be used in areas that are not connected to a sewerage system, such as rural areas. The treated liquid effluent is commonly disposed in a septic drain field which provides further treatment. However, groundwater pollution may occur and can be a problem.

1.2 Background

The most common type of individual sewage disposal system consists of a septic tank and soakage pit. This is the most convenient and satisfactory method of sewage disposal within the confines of the individual. The safe disposal of sewage and household wastewater is necessary to protect the health of the public to prevent the occurance of nuisences and to protect the environment in general. Each household equipped with running water and modern plumbing is faced with the disposal of waterbone wastes. In areas without community sewerage this need has been met through the installation of individual sewage disposal systems.

In Bangladesh, sanitation programs are largely limited to on site options and exclude conventional sewerage technology, because of its high initial costs. Sewerage system exixts only in parts of Dhaka serving about 18% of 6.5 million city population. The primary on-site sanitation options include septic tanks and pit (water sealed) latrines. Septic tank system is considered as the most satisfactory method of waste disposal and is being installed in large numbers in the cities and other urban centers of the country. Of the total sanitation coverage of 73% in Dhaka about 40% population are served by individual septic tanks. About 31% of 2.0 million in Chittagong and about 22% of 8.5 million in the district towns are served by septic tanks disposal of the effluent. Although a large number of septic tanks are being used in urban areas of the country, most of them do not have proper effluent disposal facilities. Septic tanks, discharging directly into open water bodies, drains or ditches are common. On the other hand septic tank connected to soak pits have problems of soakage overflows. Soakpits receivingseptic tank effluents are either under designed or the pits face the problem of early clogging apparently related to the effluent quality.

1.3 Sanitation system in Bangladesh

Sanitation the science and practice of effecting healthful and hygienic conditions. Sanitation involves the study and use of hygienic measures to ensure safe and reliable water supply, proper drainage of wastewater, proper disposal of human wastes, and prompt removal of all refuse. The word sanitation actually refers to all conditions that affect health, and according to the World Health Organisation may include such things as food sanitation, rainwater drainage, solid waste disposal and atmospheric pollution.

The principal objectives of providing sanitation facilities are to maintain and improve public health and to minimise environmental pollution. Sanitation can contribute greatly to preventing spread of infectious diseases through transmission of disease causing agents into the body of a healthy person by different media such as contaminated foods and water, contact with contaminated soil and insect vectors.

A sanitation system involves arrangements necessary to store, collect, process and deliver human wastes or other forms of wastes back to nature in a safe manner. Sanitation systems with respect to human management may be considered to have these functions: excretion and storage; collection and transportation; process/treatment; and disposal or recycle. Sanitation systems may have varying combinations of these functions depending on local conditions. A sanitation system can, however, be classified as on-site sanitation and off-site sanitation. Again, sanitation is classified as wet and dry systems.

In Bangladesh, the main problem is proper management of human wastes. In the country, only 16% of the 90 million rural people use sanitary latrines; another 22% use the so-called home-made pit latrines. People are now becoming conscious of using latrines and about 60% of the total population has access to some form of latrines. Of about 30 million urban dwellers, sanitation coverage is available to about 42%. Conventional sewerage systems are used only in parts of dhaka and by only 18% of the city's 9 million people. The sanitation condition of the urban slums is deplorable. Most of the slum dwellers have literally no latrines; only a few have pit or surface latrines.

The major sanitation problem facing the rural people is the dearth of environmentally safe designs for installation of durable and low-cost pit-lined latrines in high water table or flood prone areas. Many latrines installed over the last decade leak and spread pathogens into the environment, particularly during flood conditions. Consumers will need to become aware of the advantages to the environment of certain sanitary latrine designs over others if this type of problem is to be resolved. If designs can be made flood-proof or more effective, the environmental pollution, which currently emanates from sanitary drainage, will be considerably reduced.

Sewerage is another important factor of sanitation. Conventional sewerage systems in Bangladesh exist only in parts of Dhaka city. The only sewage treatment plant at Pagla employswaste stabilisation methods of sewage treatment and discharges treated waste into the river buriganga. Storm water in Dhaka is collected by a separate drainage system. The dhaka water and sewerage authority (DWASA) is responsible for the construction as well as operation and maintenance of the waterborne sewerage system in Dhaka city. Dhaka's sewerage system is characterised by unauthorised connections, particularly by industries, resulting in huge revenue loss and adding unanticipated volumes to collect and treat.

In the absence of expensive conventional sewerage systems, septic tanks and pour-flush sanitation systems are largely used in the urban centres, including the major cities. However, the septic tank effluent disposal has generally been very poor. It is not uncommon to see, particularly in the country townships, septic tank effluents being discharged into open ditches without being aware of the effluent quality and their detrimental effects on the living environment.

Security of supplying pure drinking water is a major part of environmental sanitation. The Dhaka Water Supply and Sewerage Authority is responsible for water supply and sanitation within Dhaka city. Chittagong has a similar organisation, CWASA (Chittagong Water and Sewerage Authority). The current water supply capacity of DWASA is about 900 million litres/day (Ml/d). About 96% of it is obtained from 270 DTWs with the balance coming from two surface water treatment plants. Responsibility for water supply and sanitation outside the two major cities lies with the Department of Public Health Engineering (DPHE), which has been implementing a long-term programme. A total of 61 district towns and about 20 thana headquarters have piped water supplies, which serve, on average, about 25% of their populations. A further 55% of their populations have access to hand tubewells. Most of the piped systems obtain their water from DTWs, although four towns use

1.4 Objective of the Research

The research would give guidance in the design of septic tank system with emphasis on the effluent quality. This would also increase the awareness of the designers in the final disposal of effluent into the soakage pits or to use other means. The objectives of this research work are selected as follows:

(i) To suggest septic tank design considering effluent quality and soil absorption capacity on different location.

(ii) To assess the soil absorption capacity for different composition of domestic wastewater.

(iii) To assess the overall efficiencies of septic tanks for treating different composition of domestic wastewater.

1.5 Scope of the study

The main Scope of this investigation work are:

(i) To solution for waste water management.
(ii) To control water and air pollution.
(iii) To inprove waste disposal system.
(iv) To create recycling.
(v) To reduce public health risk.

1.6 Thesis layout

The thesis presents the analysis, result and finding the study in the following five chapters:

Chapter 1 represents the General, Background, Sanitation system in Bangladesh, Objective, Scope of the study and Thesis layout of the thesis.

Chapter 2 Review of Literature, Advantage and Disadvantage and Alternative waste management procedure.

Chapter 3 titled “Methodology” Site selection and Data collection.

Chapter 4 presents Data analysis and Result.

Chapter 5 presents Conclusion of the study and also provides Recommendation, Limitation for future study.

1.7 Summary

In this chapter we discuss about general, background of different area of Dhaka city and resources study of septic tank.

CHAPTER II

LITERATURE REVIEW

2.1 General

Throughout history major factors influencing the health and well being of a community have been the proper disposal of sewage and protection of water supplies from contamination. Safe disposal of sewage and household waste water is necessary to protect the health of the public and to prevent environmental pollution. In lieu of a high cost conventional sewerage system. The septic tank system is considered to be the most satisfactory method of household wastewater disposal.

A septic tank is a water tight chamber usually located just below ground level. That receives both excreta and flush water.Toilets and other household wastewater including sullage. Large populations in both rural and urban areas rely on septic tank soil absorption system as the principle means disposal of domestic waste materials. The main functions of the septic tank are; to separate solids from the liquid , to store solids and provide digestion of organic matters, and to discharge the partially clarified liquid for further treatment and disposal.

The effect of future climate on the sewer conveyance systems results in a greater prevalence of wet weather events resulting are less affected by infiltration and storm water increases. This leads to enhanced wastewater system vulnerabilities, such as increased hydraulic loadings to wastewater treatment plants and increased concentrations of pollutants removable sewage-based contaminants and nutrients during wet weather events released to the environment.

2.2 Review of Literature

The first reported use of the household septic tank was in France in 1860 when John Louis Mouras and Abbe Moigno discovered that a „box" placed between a house and its cesspool trapped excrement, reduced the amount of solids and produced a clarified liquid that more quickly entered the soil (Payne and Butler, 1995). It was acclaimed to be the first invent of a septic tank and was called the mouras pit or automatic scavenger; however it was not patented until 1881. Around the same period that mouras invented his septic tank, Dr. Tracey and Dr. Feathert of the lying-In hospital, Carlton, Melbourne had been operating what they described as an offensive system for disposal of sewage in 1861. In 1871, a Brisbane architect, Andrea Stombuco invented a new kind of closet which he tested in his royal oak hotel for two years. Even though stombuco was fined by the board of Health for keeping an unauthorized system, the same board later considered the invention in 1883. The term septic tank was not in use until 1885. It made its first appearance in the United States in 1883 when Philbrick introduced a two-chamber tank with an automatic siphon for intermittent effluent disposal to the residents of Boston.

Septic tanks were introduced to England by Cameron in 1895 and the type in use today"are of a form that would be instantly recognisable by those early sanitary engineers" (Payne and Butler, 1995). Modifications to septic tank designs have been incorporated to improve the STE quality, particularly with respect to reducing the suspended solids concentration and to a lesser extent the Biochemical Oxygen Demand (BOD), thereby preventing accelerated clogging of soil adsorption systems. From then onwards, the development community incorporated septic systems into building projects because they were economical to use and provided flexibility in planning growth outside urban areas. As the housing boom progressed, septic systems were installed with increased frequency and density and problems associated with septic systems became more apparent. Some housing developments in the 1950's and 1960 have had septic system failure rates as high as 30%. As a result, considerable research was initiated to determine the causes of failures and to develop technology to prevent them. Although much improvement has occurred, some problems still remain and continued research is necessary.

2.3 Septic Tank

A septic tank is an underwater sedimentation tank used for wastewater treatment through the process of biological decomposition and drainage. Septic tanks allow a safe disposal of wastewater and hence are widely popular in areas that have a poor drainage system or are off the mains sewage network. They work by collecting the excreta and wastewater in one big underground tank, they are predominantly used in rural areas. Septic tanks are not used much in urban areas as waste in cities and towns is dealt with and transported through the sewage system, these are maintained by the water company in your local area.

2.3.1 Advantages

Septic tanks are widely used by many people who do not have access to a public sewage system or prefer to use a septic tank because of its many advantages. Septic tanks can be a great solution when choosing an efficient water treatment solution. These are just some of the advantages of the septic system.

- The maintenance of the septic system is very economical.
- Need a small space compared to other water treatment systems.
- Water quality is obtained.
- People who use it do not have to be highly trained because their system is simple and easy to operate.
- It is an excellent option for rural communities, buildings, parks and motels.

2.3.2 Disadvantages

Septic tanks are a great option, but if proper maintenance is not given to the septic system, it can also bring many problems for its users. The most common disadvantages of septic systems are:

• In some cases, septic tanks may lead to contamination in water which may be used for human use and consumption.

• Foul odors caused by poor maintenance or clogged septic systems.

• A poorly maintained septic system can be a breeding ground for flies and insects that can transmit infectious diseases that can put in danger you and your family’s health.

• Soil contamination is also another problem that can manifest when poor maintenance is given to the septic system.

• There is a risk in rainy seasons that the septic system overflows bringing sewage to the surface.

• Clogged drains by oil, grease, fats, and other materials that may be thrown into toilets, sinks, and showers causing obstruction.

• Requires more responsibility and regular maintenance.

2.4 Alternative waste management procedure

The “waste management” reality in most places of the world equals no separation, no controlled collection. Dump your stuff next to the street outside the village, like your ancestors always did, and you’re fine. When all the efforts to burn fail (which they usually do), cover the remaining pile with a thin layer of earth and ignore the horrible smell. The method has been around for centuries and it worked very well until recently: Self-sufficient agricultural societies traditionally took all their goods from nature. Because those goods were 100% biodegradable, nothing happened when they were dumped – they simply returned to nature. This is the tried and tested waste management system of the developing world. The problems began when 20th century inventions were injected into this system, inhibiting the cycle from continuing to function the way it used to. Plastic packaging, oil containers, tires, batteries, electronics – they all interfere with nature’s absorption capacity. In the same way these products originate from an artificial production cycle, they require an artificial treatment at the end of their lifespans. However, even as fast as these “new” products conquer new markets, the awareness of the need for a change in waste management is inversely slow.

A typical solid waste management system in a developing country displays an array of problems, including low collection coverage and irregular collection services, crude open dumping and burning without air and water pollution control, the breeding of flies and vermin, and the handling and control of informal waste picking or scavenging activities. These public health, environmental, and management problems are caused by various factors which constrain the development of effective solid waste management systems.

The external support agencies have limitations in the amount of resources they can provide and the mandates and modes under which they can operate projects. Sometimes, projects are initiated with specific aims and expected outputs, but their scopes are not comprehensive enough to consider external factors influencing them. The external support agencies often do not fully understand socio-economic, cultural, and political factors influencing the selection of appropriate solid waste management systems. In other cases, very limited follow-up support, including human resource development activities necessary to sustain the project implementation, is provided by the external support agencies.

2.5 Waste management in Bangladesh

Waste management system and waste management problems in Bangladesh. Solid waste generation is in increasing trend with the growth of urban population. The country is generating about 8000 tons of solid waste each day from the six major cities (Dhaka, Chittagong, Khulna, Rajshahi, Barisal and Sylhet), of which Dhaka city alone is contributing about 70%. Waste management system is not well organized. Efforts are underway to improve the system of waste collection, transportation, recycling, incineration and land filling. Lack of regulations/standard for waste disposal, landfill & use, lack of awareness, improper choice of technology and inadequate financial support are the major constraints for waste management in Bangladesh.

To control and manage waste and with a view to exploring viable and proper guidelines for waste management in the right direction, we have to determine first the right approach towards waste management. However, choosing the correct approach in addressing the paramount problem of waste again depends absolutely on our attitude towards waste. To me, it is our typical, stereotyped attitude that stands as a stumbling block to the smooth and safe disposal of the wastes. Our prevalent attitude is that we will dump our wastes at our own sweet will at anywhere and at a convenient time and there is an authority that will either clean it or not. I think the very genome of the problem of waste management lies in the heart of this attitude.

In no way, waste management can be solely an authoritative responsibility. In the truest sense of the term waste management is obviously a shared or participatory responsibility. It is clearly a process in which both the individuals as well as the appointed authority must play their assigned or defined part from their respective levels. Waste management at the personal level may be called primary management. On the other hand, managing wastes at the authority or institution level can be defined as secondary management. When these two tiers merge into each other smoothly proper management then becomes easier.

In Bangladesh what we practically see at citizens' level concerning waste management is really horrifying. The grass root reality evidently tells us that the citizens on the whole contribute not the least to waste management. On the contrary, they add to the wounds of the waste management. Anatomising the mindset of the people we clearly spot the deep-going malaise of unburdening responsibility from the shoulder. What is more terrifying about the total process of waste management is that a huge bulk of educated and therefore conscious citizenry dump and dispose waste quite senselessly and irresponsibly.

In Bangladesh, the institutionalised authority carrying out the assigned job of safe disposal of waste happens to be the municipality, city corporation and in some cases voluntary NGO organisations. In most cases, we clearly notice a serious lapse and lack of coordination in their works. Even worse, these disposal units are helplessly ill-equipped, understaffed and poorly-budgeted in removing and cleaning the wastes instantly in a well-organised and smooth way.Many glaring instances can be cited here where we see mounting heaps of rotten, putrid wastes and garbage lying by the busy roads of the cities and towns. In fact, it has already become a regular phenomenon with our urbanites.

Now let us switch to the priority tasks to be done by the appointed authority. First, hygienic dustbin or dump corner has to be built at important points as per requirement. But it is a gigantic task and requires a huge monetary allocation. Second, treatment of the raw wastes must be done by installing waste treatment plant so as not to create any health or environmental hazards. At present, the appointed waste authority simply collect the scattered wastes and dump them at the earmarked dumping grounds. Third, from fast food shops to all shopping malls, arrangements have to be made to compel each and every outlet to mandatorily keep waste paper baskets. Fourth, new regulatory acts have to be enacted keeping provisions for monetary penalty for mindless dumping of wastes. Fifth, more and more facilities for recycling and refabricating of polythene, potentially most harmful entity to the environment, and bottles must be created. Above all, a mass awareness must be created about wastes and waste management through an organised and broad-based social campaign.

2.6 Waste management in other Countries

Proper management of solid wastes continues to be a serious problem world wide and especially in the economically developing countries. Growing population, rising standards of living and life-style, industrialization, and production and consumption of new products are acting in concert to generate increasingly greater quantities of solid wastes, and this in turn is creating serious problems of their management and proper disposal. Being aware of the implications of the problems of improper management and disposal, the developed countries have established their regulatory programmes. But the economically developing countries continue to manage solid wastes in what may be described as primitive ways such as throwing into open and unregulated dumps.

In this paper it is argued that as a matter of priority, the economically developing countries should establish appropriate solid waste management programmes, publish related regulations and by-laws and strictly enforce their compliance. Turkey, which is an economically developing country, currently has a total of 2020 open and unregulated dumps that have serious implications for both health and safety. Typically in istanbul — a densely populated Metropolitan City — there have been serious disasters in recent years such as the ‘Hekimbasi Open Dump accident’ due to the improper management of solid wastes. However, following the publication in 1991 of the Solid Waste Control Regulation in Turkey, the municipalities have now started to abandon or rehabilitate the existing open dumps and construct sanitary landfills according to the standards stipulated in the regulation mentioned above. Since 1995 the Municipality of the Metropolitan City of istanbul has built six transfer stations and two sanitary landfill sites.

It is argued, furthermore, that in the interests of environmental protection and quality of life, and for promoting sustainable development, it is essential for the economically developing countries to develop their national policies for solid waste management as a matter of priority, including recycling and/or recovery programmes and inventory studies on the quality and quantity of solid wastes.

2.7 Summary

Very little literature was found on certain topics related to on-site sanitation facilities. Septic systems are used in many urban and rural settings of developing countries, yet few studies on septic system performance and maintenance were retrieved from developing countries.

CHAPTER III

METHODOLOGY

3.1 General

The methodology adopted in this project is the physical count of houses (staff quarters), hostels, offices, etc. For septic tank rate of generation to be estimated, the population generating the waste water must be known. In this project, the location, age, size, the history of the system if records are available, the date the septic tank was last pumped, the distance from trees, if traffic occurs over the system, the amount of water entering the system, if trash and kitchen garbage are being disposed into the system, the condition of the absorption field and the flooding possibilities on the site where the septic system is located are the proper assessment bases for septic tank. Also, population of individual septic tanks were estimated, questionnaires were handed out to both students and workers, and pictures were also taken in other to gather a more accurate data. Prior to my project, the septic tank system was assumed to be under no form of maintenance. The choice for the material of the septic tank, for economic reasons, was assumed to be reinforced concrete (cast in situ) because of its relatively lower cost. The cast in situ septic tanks were used because they are subject to the different skills of different workers. The septic tank is a buried, water-tight container usually made of concrete, fiberglass, or polyethylene. Its job is to hold the wastewater long enough to allow solids to settle down to the bottom forming sludge, while the oil and grease floats to the top as scum. Compartments and a T-shaped outlet prevent the sludge and scum from leaving the tank and traveling into the drainfield area.

3.2 Flow Chart of Methodology

The study has been carried out following a systematic step of approaches. This is the mirror of this study. In fact, the chapter is a mirror of this study.

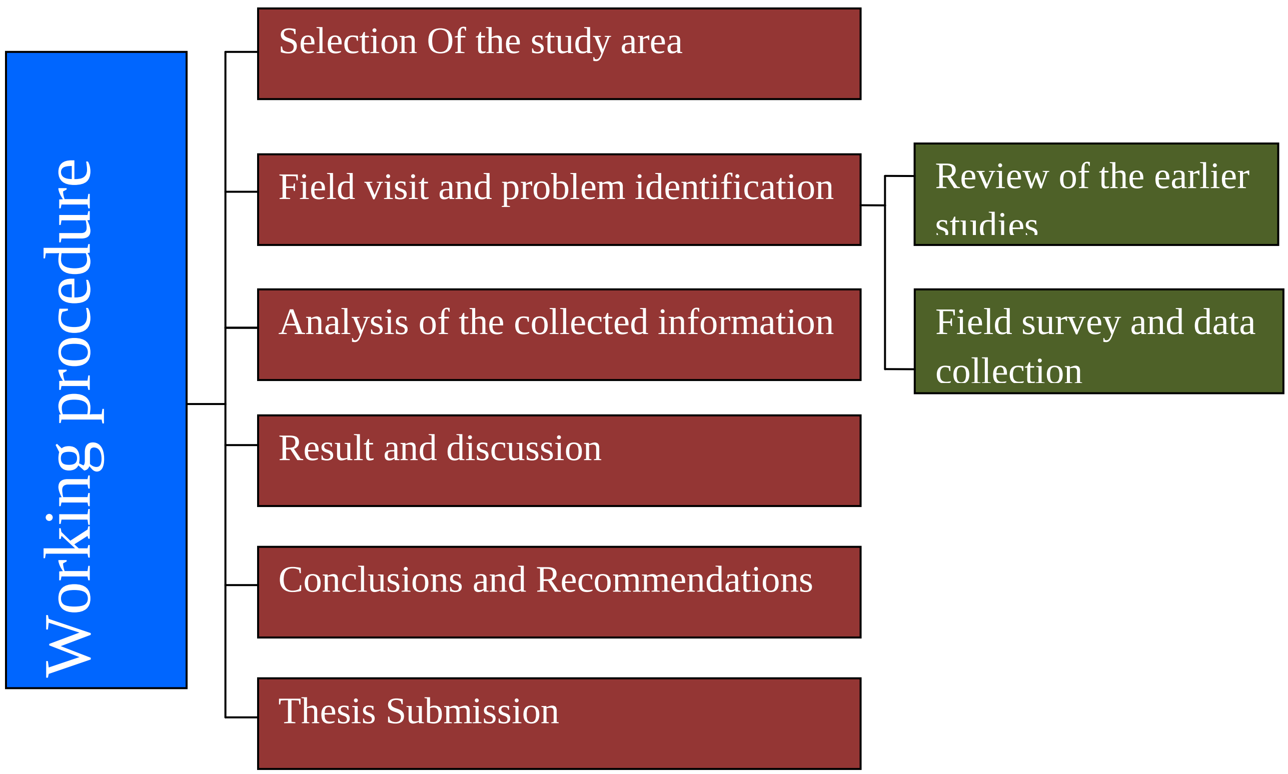

Figure 3.1: Working Procedure

3.3 Site Selection

Septic tanks go through several steps to filter all the waste that comes from home, before releasing it into environment. This even boosts the overall health of landscape. And during this final step in the process, the waste is released into a drain or drainage field.

There are a few things to think about when selecting where to place drain field, and tank. So before start installation, make sure keep these considerations in mind when it comes to drain field placement. This will ensure that septic tank system will function beautifully in the months and years to come.

3.4 Lay out of study area

Figure 3.2: Google map of the Study area

3.4 Data Collection

Gulshan:

Floor 6

1300 sft

2 unit each floor

60 people live this building.

Mirpur:

Floor 6

1500 sft

3 unit each floor

72 people live this building.

Savar:

Floor 6

1100 sft

2 unit each floor

50 people live this building.

Information are collected form Dhaka city corporation office Mohakhali:

(I) A person uses an average of 40 lpcd of water daily to clean.
(ii) A person uses 45 liters of water for bathing and oju.
(iii) 30 liters of water is used for cleaning clothes and cleaning the house.
(iv) 12 liters of water for a 6-member family is used for cooking.
(v) Everyday 10 liters of water is required on the tree planted in the beautification of the house.

Total 137 liters of water is used by a 6-member family.

3.5 Summary

We discusses about the site selection of septic tank, the working process and data collection of septic tank form Dhaka city corporation Mohakhali.

CHAPTER IV

DATA ANALYSIS

4.1 General

Data analysis and interpretation is the most important task of the thesis. The main objective of the thesis work totally depends on the accuracy of the data analysis and interpretation. In this thesis, to analyze the collected data, graphical representation are used.

4.2 Data Analysis

Savar:

**Design a septic tank to serve a building of 6th floor for 50 persons, who produce 40 lpcd of wastewater. The tank is to be desludged every three years.

Solution:

Sedimentation:

Minimum mean hydraulic retention time,

T_h= 1.5-0.3 log(Pq)

= 1.5-0.3 log(50*40)

= 0.51 days

The volume required for sedimentation is given by:

$V_h = 10^{-3}(Pq)\ t_h$

$= 10^{-3}(50*40)*0.51$

$= 1.02\ m^3$

Sludge Digestion:

Assuming a design temperature of 25^0C

$T_d= 30(1.035)^{35-T}$

$= 30(1.035)^{35-25}$

= 42.3 days

Volume required for sludge digestion

$V_d= 0.5*10^{-3}*Pt_d$

$= 0.5*10^{-3}*50*42.3$

$= 1.06\ m^3$

Sludge Storage:

Assuming sludge accumulation rate, C= 0.06 m^3 per person year

V_{sl}= CPN

= 0.06*50*3

$= 9\ m^3$

Overall effective tank volume:

$V= V_h+V_d+1.4\ V_{sl}$

= 1.02+1.06+1.4*9

$= 14.68\ m^3$

Tank effective depth:

Assume a cross-sectional area, A= $5m^2$

The maximum depth of sludge, $d_{sl}= V_{sl}/A$

= 9/5

= 1.8 m

Maximum submerged scum depth, d_{ss}= 0.4 V_{sl}/A

= 0.4*9/5

= 0.72 m

Scum clear depth= 0.075m (minimum)

Sludge clear depth= (0.82-0.26*5)

= -0.48 <0.3m (∴ 0.3mis adopted)

The total clear space depth= (0.075+0.3)

= 0.375 m

Depth required for sedimentation= V_h/A

= 1.02/5

= 0.20 <0.375

The total space depth is the controlling factor in the design.

The total effective depth is therefore, the sum of the sludge depth (1.8), the clear space depth (0.375) m and the maximum submerged scum depth (0.72)

The total effective depth= (1.8+0.375+0.72)

= 2.9 m

Surface area= (Volume/effective depth)

= 14.68/2.9

= 5.1 m^2

<u>Length:</u>

Area= L*B

∴L= (Area/B)

= 5.1/1.60

= 3.2 m

<u>Width:</u>

L/B= 2

∴L= 2B

Now, Area= L*B

=> Area= 2B*B

=> 5.1= $2B^2$

∴B= 1.60 m

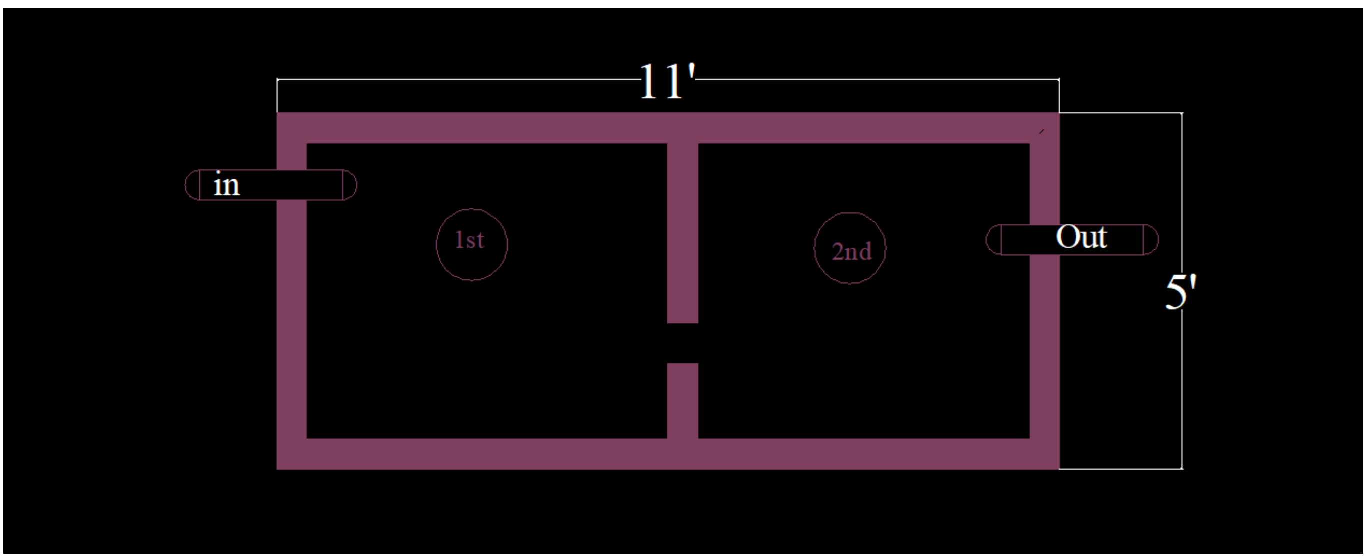

Figure 4.1: Lay out of septic tank at Savar

Mirpur:

**Design a septic tank to serve a building of 6th floor 72 persons who produce 40 lpcd per persons of waste water. The tank is to be desludged every three years.

Solution:

Sedimentation:

Minimum mean hydraulic retention time,

T_h = 1.5-03 log (Pq)

= 1.5-0.3 log (72*40)

= 0.46 days

The volume required for sedimentation is given by,

V_h = 10-3 (Pq)t_h

= 10-3 (72*40)*0.46

= 1.32 m^3

Sludge digestion:

Assuming a design temperature of 25^0C

T_d = 30 $(1.035)^{35-T}$

= 30 $(1.035)^{35-25}$

= 42.32 days

Volume required for sludge digestion

V_d = 0.5*10-3*Pt_d

= 0.5*10-3*72*42.32

= 1.52 m^3

Sludge Storage:

Assuming sludge accumulation rate, C = 0.06 m^3 per person year.

V_{sl} = CPN

= 0.06*72*3

= 12.96 m^3

Overall effective tank volume:

V = V_h+V_d+1.4 V_{sl}

= 1.32+1.52+1.4*12.96

= 20.98 m^3

Tank effective depth:

Assume a cross sectional area, A = 8.0 m^3

The maximum depth of sludge, d_{sl} = V_{sl} / A

= 12.96/8.0

= 1.62 m

The maximum submerged scum depth, d_{ss} = 0.4 V_{sl} / A

= 0.4*12.96 / 8.0

= 0.65 m

Scum clear depth, = 0.075 m (minimum)

Sludge clear depth = (0.82-0.26*8.0)

= -1.26 m <0.3 (0.3 m is adopted)

The total clear space depth

= (0.075+0.3)

= 0.375 m

Depth required for sedimentation = V_h /A

= 1.32/0.8

= 0.17 m < 0.375 m

The total clear space depth is the controlling factor in the design.

The total effective depth is therefore, the sum of the sludge depth 1.62 m, the clear space depth 0.375m, and the maximum submerged scum depth 0.65m.

The total effective depth = 1.62+0.375+0.65

= 2.65 m

Surface area= volume/effective depth

= 20.98/2.65

= 7.9

<u>Length:</u>

Area= L*B

∴L= (Area/B)

= 7.9/2

= 3.95 m

<u>Width:</u>

L/B= 2

∴L= 2B

Now, Area= L*B

=> Area= 2B*B

=> 7.9= $2B^2$

∴B= 2 m

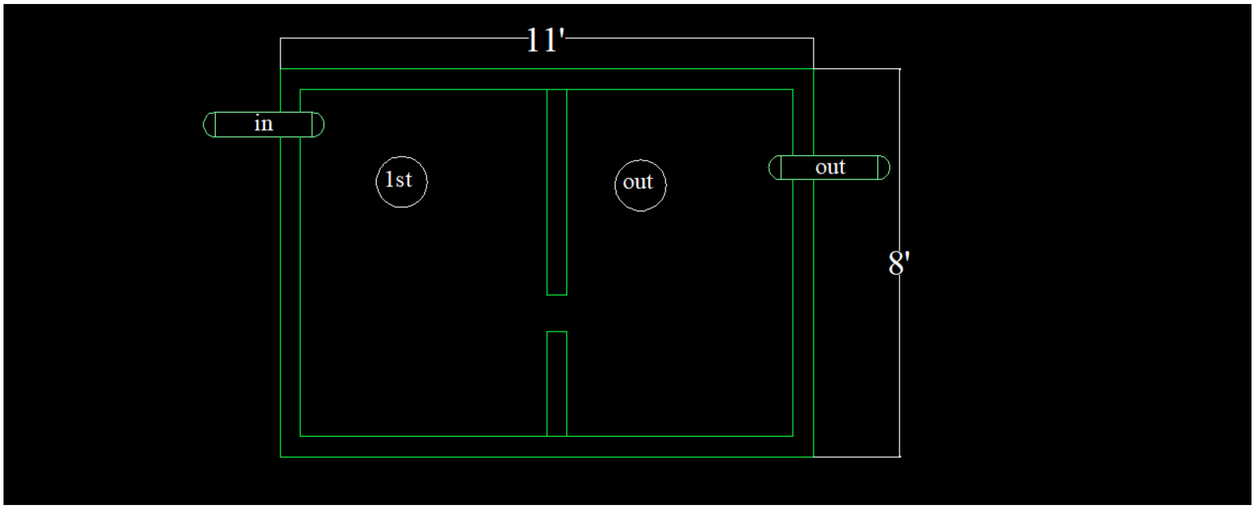

Figure 4.2: Lay out of septic tank at Mirpur

Gulshan:

**Design a septic tank to serve a building of 6th floor 60 persons who produce 40 lpcd per persons of waste water. The tank is to be desludged every three years.

Solution:

Sedimentation:

Minimum mean hydraulic retention time,

T_h = 1.5-0.3 log (Pq)

= 1.5-0.3 log (60*40)

= 0.49 days

The volume required for sedimentation is given by,

V_h = 10-3 (Pq)t_h

= 10-3 (60*40)*0.49

= 1.18 m^3

Sludge digestion:

Assuming a design temperature of 25^0C

$T_d = 30\ (1.035)^{35-T}$

$= 30\ (1.035)^{35-25}$

= 42.32 days

Volume required for sludge digestion

V_d = 0.5*10-3*Pt_d

= 0.5*10-3*60*42.32

= 1.27 m^3

Sludge storage:

Assuming sludge accumulation rate, C = 0.06 m^3 per person year.

V_{sl} = CPN

= 0.06*60*3

= 10.8 m3

<u>Overall effective tank volume:</u>

V = V_h+V_d+1.4 V_{sl}

= 1.18+1.27+1.4*10.8

= 17.58 m3

<u>Tank effective depth:</u>

Assume a cross sectional area, A = 5.0 m^3

The maximum depth of sludge d_{sl} = V_{sl} / A

= 10.8/5.0

= 2.16 m

The maximum submerged scum depth, d_{ss} = 0.4 V_{sl} / A

= 0.4*10.8 / 5.0

= 0.86 m

Scum clear depth= 0.075 m (minimum)

Sludge clear depth= (0.82-0.26*5.0)

= -0.46 m <0.3 (0.3 m is adopted)

The total clear space depth = (0.075+0.3)

= 0.375 m

Depth required for sedimentation = V_h /A

= 1.18/5.0

= 0.24 m < 0.375 m

The total clear space depth is the controlling factor in the design.

The total effective depth is therefore, the sum of the sludge depth 2.16 m, the clear space depth 0.375m, and the maximum submerged scum depth 0.86m.

The total effective depth = 2.16+0.375+0.86

= 3.39 m

Surface area= Volume/Effective depth

= 17.58/3.39

= 5.2 m^3

Length:

Area= L*B

∴L= (Area/B)

= 5.2/1.61

= 3.3 m

Width:

L/B= 2

∴L= 2B

Now, Area= L*B

=> Area= 2B*B

=> 5.2= $2B^2$

∴B= 1.61 m

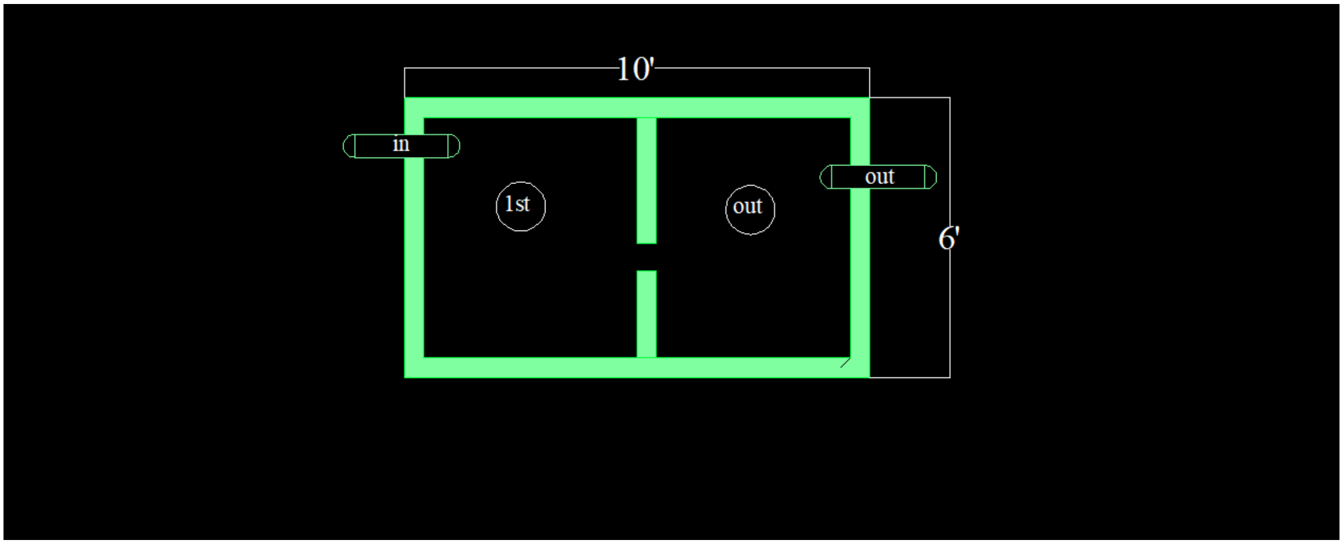

Figure 4.3: Lay out of septic tank at Gulshan.

4.3 Result

Location	Volume	Effective depth	Length	Width
Savar	14.48 m^3	2.9 m	3.2 m	1.60 m
Mirpur	20.98 m^3	2.65 m	3.95 m	2 m
Gulshan	17.58 m^3	3.39 m	3.3 m	1.61 m

CHAPTER V

CONCLUSION AND RECOMMENDATION

5.1 General

This final chapter summarizes existing sanitation and environmental problems in city communities and those on low-lying areas, enumerates the important considerations for the provision of sanitation systems in these communities, and identifies the feasible sanitation systems. It also provides general recommendations for future studies related to this research.

5.2 Conclusion

The provision of septic tank system proves its efficiency in the collection of waste water prior to the treatment as its capacity of storage of waste water is enough because of the immediate disposal of waste water to the next level of treatment plant since the septic tank system adopted conventionally which disposes the waste water to the land after certain period of detention time ad it serve the treatment process as it ends in the disposal whereas the septic tank system adopted has the additional feature for the enhancing the waste water to the treatment plant which can serve the society with the treated water to the possible extent.

The preliminary design of the septic tank system is slightly more economic. it reduces the storage capacity by 32% of the septic system which is normally adopted. On comparison of pretreatment it would be suggested that septic system proves it economic but it fails to satisfy the recycling/treatment of waste water as it drains it to the ground, whereas septic tank system which is adopted though fails to satisfy the economic criterion but it serves the reuse of treated waste water.

5.3 Recommendation

Size

The size of the septic tank will need depends mostly on the size of the house and the number of people who will reside there. Common residential septic tanks range in size from 750 gallons to 1,250 gallons. A septic tank is a self-contained unit designed to hold residential wastewater.

Maintenance

Inspect your system once each year. Generally, septic tanks should be pumped every three years.

Pump out septic tank when needed. Don't wait until have a problem.

Keep accurate records.

Practice water conservation.

Check with a certified septic technician for help with system problems.

5.4 Limitation

Septic tanks are a great option, but if proper maintenance is not given to the septic system, it can also bring many problems for its users.

In some cases, septic tanks may lead to contamination in water which may be used for human use and consumption.

Foul odors caused by poor maintenance or clogged septic systems.

A poorly maintained septic system can be a breeding ground for flies and insects that can transmit infectious diseases that can put in danger for health.

Soil contamination is also another problem that can manifest when poor maintenance is given to the septic system.

There is a risk in rainy seasons that the septic system overflows bringing sewage to the surface

Clogged drains by oil, grease, fats, and other materials that may be thrown into toilets, sinks, and showers causing obstructions.

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