Waste Water Treatment

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Abstract— The dirty water that comes homes and businesses as a result of laundry, using the bathroom and all the soapy water that comes from washing dishes, is what we called sewage or waste water. It is treated by a variety of methods to make it suitable for its intended use .water treatment is done in two main stages, Primary and Secondary treatment. In arid areas, where there is not enough water, sewage also undergoes tertiary treatment to meet the demand of drinking water supply. During primary treatment, the suspended particles area separated from the water and the BOD of the water is reduced, preparing it for the next stage in waste water treatment .Secondary treatment can be done by the variety of means .the most common methods are the Trickling filters and activated sludge. The activated sludge method uses air and a biological floc that is comprised of bacteria and protozoans. This aeration continues for 4 to 6 hours, after which it is stopped and the contents moved to a settling tank. In this tank, the floc settles out and removes much of the organic materials with it. This process removes 75 to 95 % of the BOD. In the tricking filters, sewage is passed over a bed of rocks or molded plastics .over which a bio film of aerobic micro-organisms grow. This method removes 80 to 85 % or BOD. The water is then disinfected, mostly by the chlorination, and released into flowing streams or oceans. The statistical analyses show that there were significant relationship among percent land cover, source water quality, and drinking water treatment cost. The data exhibited high variability and indicating possible uncounted constraining factor – such as in the diffrenceses in water treatment plant processes and hydrological, geological, and regional diffrenceses, which remain as future consideration.
Key words: Waste Water

I. INTRODUCTION

On behalf of Peconic Green Growth, Inc., Natural Systems Utilities (NSU) has prepared this technical feasibility report which identifies and compares options for deployment of a decentralized wastewater utility solution as a means of mitigating nitrogen loadings that are affecting the quality of the Long Island Sound Watershed. This report was prepared in accordance with a grant funded by the Long Island Sound Study and the National Fish and Wildlife Foundation .This report provides an evaluation of a decentralized system that would serve the existing residential community referred to herein as “Brower Woods”. Brower Woods is located on the eastern banks of Mattituck Creek in the Town of Southhold, Suffolk County, NY. A map defining the project boundary is provided in Figure 1 of Appendix A. This community was selected by Peconic Green Growth, Inc. (PGG) after careful analysis of existing comminutes located within the Towns of Riverhead and Southold. Brower Woods was determined to be suitable for a decentralized sewer system as it meets the following criteria:

- Environmental need is defined. Nitrogen present in marine environments serves as a food source for algal blooms. When these algal blooms thrive, they can severely reduce oxygen which is essential to the survival of most marine life. In addition, in certain cases, algal blooms can lead to the formation of toxins (i.e. saxitoxin) that can be harmful to humans. As in the case of Mattituck Creek, there has been recent shellfish bed closures due to toxic algal blooms caused by Alexandrium. Alexandrium synthesizes saxitoxin that leads to the human illness known as paralytic shellfish poisoning. In 2009, Mattituck Creek had higher densities of Alexandrium than any other system monitored on Long Island (Gobler 2011; Final report to the Long Island Sound Study). In August of 2013, Stony Brook University surveyed oxygen levels in bottom waters of tributaries across Nassau and Suffolk County. Mattituck Creek had the lowest oxygen levels at 0.04 mg per liter, a level that is practically anoxic (severely oxygen deficient).
- Existing disposal systems are comprised of either cesspools or septic systems. In the case of Brower Woods, all existing properties are served by cesspools or septics, which is contributing to excessive nitrogen levels found in the Mattituck Creek.
- Groundwater beneath the project is located within a 2 year time of travel to adjacent surface water bodies. According to the Influence Map prepared by the Town of Southold. approximately 90% of the homes located within the proposed Brower Woods sewer service area are located within the 2 year zone of influence.
- Project septic density exceeds that of current conventional treatment standards.
- There is no feasible alternative for connection to a centralized sewer facility. The nearest town sewer system is in Riverhead, which is located approximately 9 miles from Brower Woods.
- Projected wastewater flows shall be greater than or equal to 30,000 gpd. The 30,000 gpd threshold was selected as a requirement for this study as it is the limit of alternative intermediate systems approved by Suffolk County.

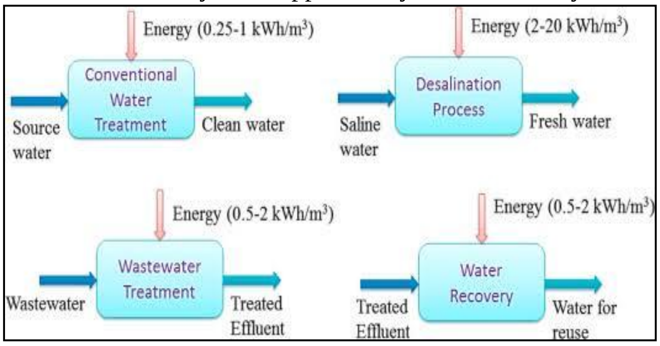

Fig. 1: ways of water treatement

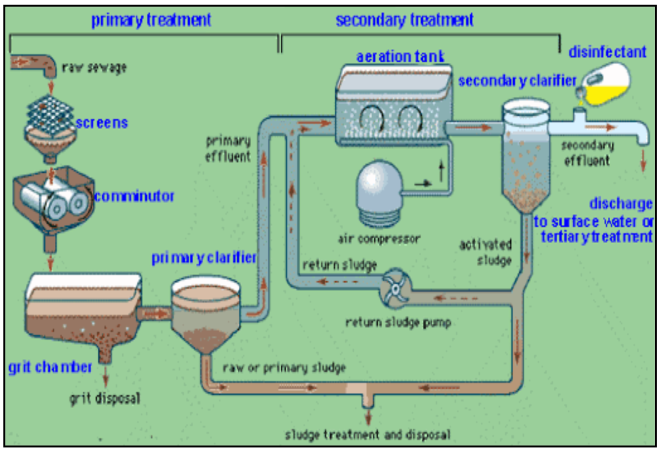

Fig. 2: primary and secondary treatment layout

II. Disposal or Reuse

Although disposal or reuse occurs after treatment, it must be considered first. Since disposal or reuse are the objectives of wastewater treatment, Disposal or reuse disposal or reuse options are the basis for treatment decisions. Acceptable impurity concentrations may vary with the type of use or location of disposal. Transportation costs often make acceptable impurity concentrations dependent upon location of disposal, but expensive treatment requirements may encourage selection of a disposal location on the basis of impurity concentrations. Ocean disposal is subject to international treaty requirements. International treaties may also regulate disposal into rivers crossing international borders. Water bodies entirely within the jurisdiction of a single nation may be subject to regulations of multiple local governments. Acceptable impurity concentrations may vary widely among different jurisdictions for disposal of wastewater to evaporation ponds, infiltration basins, or injection wells.

III. Present Situation

Waste water in the Nantes metropolitan area (575,000 h) is treated in twelve purification plants, with capacities that vary from 1,200 inhabitant equivalent (Vertou – Pégers Reigners) to 600,000 inhabitant equivalent (Vallée de Tougas - Nord Loire). Together, they have a total capacity of 780,000 inhabitant equivalent, which will increase to 840,000 population equivalent when the updated biological treatment process at the Petite Californie (Sud Loire) purification plant comes into service (at the end of 2010).This capacity means that expansion of the metropolitan area presents no fears and industrial waste-water discharges containing biodegradable effl uent can be treated (102 agreements signed in 2009, 477 authorisations, 2,094 fi les opened). There is systematic and regular monitoring of industrial discharges. In addition, waste water from villages far removed from the transfer networks is treated by nine semi-public treatment plants.

IV. Environmental Need

The primary purpose of a decentralized wastewater collection and treatment system is to eliminate existing, inadequate septic systems and cesspools and reduce the quantity of nitrogen and other nutrients entering the groundwater and surrounding water bodies. Reducing these nutrient loads will improve the water quality for aquatic and terrestrial wildlife species and for human use and recreation. A more detailed analysis of the need for the types of systems proposed in this report can be found in the Water Quality section of the report titled "Plan for Decentralized Wastewater Treatment, North Fork in the Long Island Sound Watershed" prepared by Peconic Green Growth, Inc., a not-for-profit organization, to be published in March 2014.

V. Levels of Wastewater Treatment

Wastewater treatment options may be classified into groups of processes according to the function they perform and their complexity:

A. Preliminary Treatment –

includes simple processes that deal with debris and solid material.The purpose of preliminary treatment is to remove those easily separable components. Thisis usually performed by screening (usually by bar screens) and grit removal. Their removal is important in order to increase the effectiveness of the later treatment processes and prevent damages to the pipes, pumps and fittings.

B. Primary Treatment –

is mainly the removal of solids by settlement. Simple settlement of the solid material in sewage can reduce the polluting load by significant amounts. It can reduce BOD by up to 40%. Some examples of primary treatment is septic tanks, septic tanks with upflow filters, Imhoff tanks.

C. Secondary Treatment –

In secondary treatment the organic material that remains in the wastewater is reduced biologically. Secondary treatment actually involves harnessing and accelerating the natural process of waste disposal whereby bacteria convert organic matter to stable forms. Both aerobic and anaerobic processes are employed in secondary treatment. Some examples of secondary treatment are UASB, reed bed systems, trickling filters and stabilization ponds.

D. Tertiary treatment –

is the polishing process whereby treated effluent is further purified to acceptable levels for discharge. It is usually for the removal of specific pollutants e.g. nitrogen or phosphorus or specific industrial pollutants. Tertiary treatment processes are generally specialised processes. Some examples of tertiary treatment are bank's clarifiers, grass plots, etc.
Advanced or quartiairy treatment are applicable only to industrial wastes to remove specific contaminants.

VI. Separation of Solids

Wastewater treatment also relies on the separation of solids, both before and after stabilisation. The choice of method of solid removal will depend on the size and specific weight of pieces and particles of suspended solids.

VII. Screening

For the larger pieces of solids for e.g. diapers, cloth, etc. in wastewater treatment. Screens require cleaning at very short intervals. Materials captured through screening require a safe place to be disposed of. Below is a diagram of waste stabilisation ponds showing screening as the first stage.

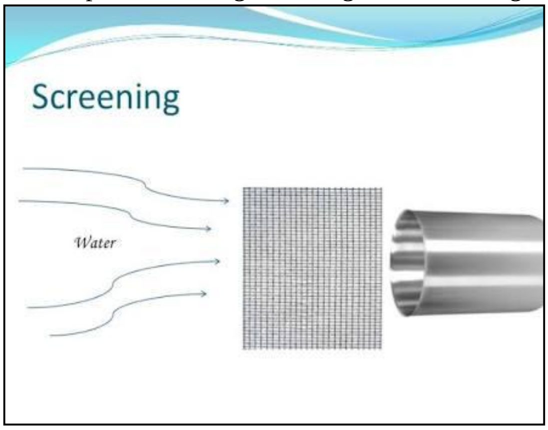

Fig. 3: screening process

VIII. SEDIMENTATION

Separation of solids happens primarily by gravity, predominantly through sedimentation. Coarse and heavy particles settle within a few hours or minutes while smaller and lighter particles may need days and weeks to sink to the bottom.

IX. FLOTATION

Flotation is the predominant method to remove fat, grease and oil. Unwanted flotation occurs inseptic tanks and other anaerobic systems where floating layers of scum are easily formed.Accumulated scum could be removed manually or left purposedly to seal the surface of anaerobic ponds to prevent bad odour. Below is a diagram of a septic tank showing scum floating on the surface.

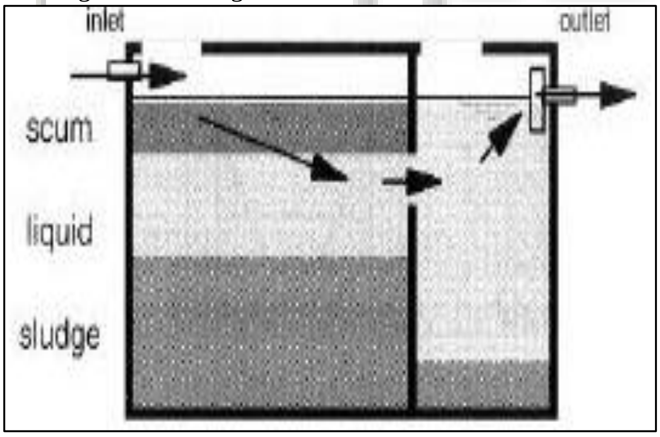

Fig 4- Wastewater separation in a septic tank.

X. FILTRATION

Filtration becomes necessary when suspended solid particles are to be removed that cannot be forced to settle or float within a reasonable time. Most filters have a double function, they provide a fixed surface for treatment of bacteria and they form a physical obstacle for the smaller solid particles by creating adhesion of particles to their surfaces. Filtration can be both on the upstream and the downstream. E.g. Upstream Anaerobic Sludge Blanket. Anaerobic filters direct flow upwards through the filter material. Trickling filters allow the wastewater to descend in a downward direction through the filter material. The speed at which filtration occurs depends on the type of filter material used. Smaller grain sizes and fine mesh sizes would cause filtration to be slower than larger, wider-spaced material, but would cause the retention of many more solids and clog faster.

XI. A NEW INNOVATIVE ADVANC WASTEWATER TREATMENT TECHNOLOGY

APOP is a new concept for advanced photo oxidation processes at wastewater treatment plants. By using the APOP-concept a non-hazardous effluent from wastewater treatment plant can be achieved. APOP-characteristics

- Simple system for disinfection of wastewater
- Simple system for removalof endocrine disruptors and other hazardous compounds
- Flexible system
- Easily installation
- Advanced process control technology

XII. ADVANTAGES

- UV-lamps with high energy intensity
- Low capital cost
- Low operation cost

XIII. ENVIRONMENT AND HEALTH

- Excellent bathing quality
- No risks for recipient water bodies and eco-systems. Endocrine disruptors can be found in birth-control pills, cosmetics, washing powder and many other products used in normal households.
- The consequence of discharge of endocrine disruptors into to the nature e.g. by wastewater is that intersex among fish, roach and snails has been found in recipients water bodies.
- The APOP-system is able to eliminate pathogenic microorganisms and endocrine disruptors from wastewater. The principle in the system is that light from ultraviolet lamps is able to destroy mechanisms inside bacteria and remove chemical substances from wastewater with use of oxidants, e.g. ozone or chloride dioxide.
- The ultraviolet lamp used in this project is developed and patented by a Danish company Scan Research A/S.

XIV. CONCLUSION

The wastewater generated by the Brower Woods community in Mattituck, NY can be treated cost effectively via a decentralized collection system and wastewater treatment plant located near the community. Assuming an average daily flow of 30,000 gpd, a STEP collection system with a Natural Wetlands Treatment System would result in a drastic reduction in the total amount of pollutants discharged each year. Such a system would reduce the discharge of BOD to local waterways by 23,892 lbs, TN by 5,016 lbs, and TSS by 25,990 lbs annually and provide immense environmental benefit to the community, Mattituck Inlet, and the Long Island Sound.

"Land where you live is not gifted from your parents, but is borrowed from your grandchildren"

ACKNOWLEDGMENT

We wish to express our deep sense of gratitude and indebtedness to Er. Ashutosh Mishra , Head Of the Department, Chemical Engineering, Dr. A.I.T.H. , Kanpur for introducing the present topic and for his inspiring guidance, constructive and valuable suggestion throughout this work. His able knowledge and expert suggestion throughout this work at every stage, for without his warm affection and encouragement, the fulfillment of the task would have been very difficult.

I owe my sincere gratitude and thankfulness to faculty member of Department Of Chemical, Dr. A.I.T.H. Kanpur for showing sustained interest and providing help throughout the period of my work.

Last, but not the least ,I would like to thank Almighty GOD and my parents, whose dedicated and untiring efforts towards me has bought me at this stage of life.

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