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GROUND WATER RECHARGING BY SEMI-FILTERED SEWAGE AND RUNOFF

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ABSTRACT

This study discusses the utilisation of everyday sewage from a small town that is not wasted and eventually ends up in the river. This also includes saving runoff from the monsoon to the summer by recharging the sewage with ground water, while runoff from the town is squandered by meeting the sewer and flowing onward. Both of these can be used for ground water recharge, storing water during dry seasons. The daily sewage is cleaned first by screening, then by a small sedimentation pond in which big particles settle, and finally by a root zone cleaning system that passes sewage through beds of soil containing tiny plants in a vertical orientation. The goal is simply to eliminate sewage and runoff waste.

Keywords: Semi-filtration, sewage, runoff, screening, sedimentation, and a root zone cleaning system are all available.

I. INTRODUCTION

Ground water is an essential source of water supply in India because of its ability to buffer short-term climate fluctuation, which is a major issue in the country. In India, one place might have very low temperatures in winter and high rainfall during the monsoon, while another location might have very high temperatures in summer and be impacted by drought. As a result, groundwater is critical for water delivery in such places. Runoff from that village's farmland and residential areas travels to the river, and from the river, the water rushes ahead and is squandered, causing this hamlet to suffer from drought. So redirecting this water to the ground rather than the river is the greatest approach to save water during a drought. The sewage from this residential neighbourhood likewise flows downstream to meet the river on a regular basis. This sewage water from a tiny town has no harmful elements. So the daily sewage is cleaned by screening initially, then by a tiny sedimentation pond where big particles settle, and finally by moving sewage water through various beds of soil containing various tiny size plants in a vertical manner. This semi-purified sewage water can be utilised for plants or, if not required, can be sent to the earth to raise the water table. Using this water in a drought situation is the greatest strategy to deal with the drought. During the monsoon season, agricultural runoff can be filtered and directly used for infiltration in the ground, saving it for future use.

A. Problem Statement

Climate change is a major issue in India. One little village in India receives a lot of rain during the monsoon season, yet in the summer, the same place runs out of water and suffers from drought. The rainwater accumulated in the region falls downward to meet the river and flows forward with it. Some of the river's water evaporates, while others flow and exit the settlement with no ground penetration. The same area's sewage flows to the river and flows with it. So this is the entire amount of runoff and sewage waste. Using our technology, we can remove this waste of sewage water and runoff and retain it for future use by recharging ground water.

Figure 1: Vadgaon Maval Map

B. Objective

The main goal of this strategy is to remove the waste of everyday sewage from the village's residential areas as well as farm runoff. The goal is to minimise waste while still avoiding the same area's drought state. Drought conditions can only be alleviated by storing monsoon season water and semi-purified sewage water on a regular basis. The sewage water is semi-purified utilising cost-effective processes such as screening, sedimentation, and a root zone cleaning system. The sewage water has been semi-purified since it contains no harmful chemicals, and it may now be utilised for ground recharge.

C. The project's scope of work

Many villages in India are currently suffering by drought; these are the same locations that receive greater or medium rainfall, but the water cannot be saved for future use owing to runoff. If this water is utilised for ground water recharge, it can be stored and used as needed. This water can be utilised in times of drought. Using this strategy, many communities' drought conditions can be alleviated.

II. LITERATURE REVIEW

For the technical words in this project, detailed review papers are necessary. Technical words such as root zone cleaning system, phytoremediation, filtration, sedimentation, and ground water recharge are given below; some are national and some are worldwide. These literature reviews provided in-depth understanding of all technical words.

'Root Zone technology: Reviewing its past and present' A. A. Raval and P. B. Desai

Increasing population, human activities, and urbanisation have an impact on the quality and quantity of water resources, resulting in contamination of water bodies owing to increased production of various forms of sewage. This research examines root zone cleaning systems (RZCS), which are soil-based planted filter beds. This is an efficient method of dealing with household garbage, and it is a natural technology. It is employed in high-temperature environments. It is simple to use, quick to instal, and requires little upkeep. It is a well-known technology in Europe and the United States. There is a need to popularise this technology in India for the sake of advantages and long-term growth.

Sewage/wastewater Treatment Technologies: A Review Niraj S. Topare, S. J. Attar, Mosleh M. Manfe

To guarantee compliance with regulatory criteria, users must concentrate their Sewage/Wastewater treatment process. The primary goal of the sewage treatment process is to eliminate the different parts of the polluting load, such as solids, organic carbon, nutrients, inorganic salts, metals, pathogens, and so on. Effective wastewater collection and treatment are critical for both environmental and public health reasons. Sewage/Wastewater treatment operations use a variety of technologies to lower its water and organic content, and the ultimate purpose of wastewater management is to safeguard the environment in a way appropriate with public health and socioeconomic considerations. Sewage/Wastewater treatment procedures, variables influencing selection, and design of Sewage/Wastewater systems are briefly reviewed in this article.

Efficiency of Root zone Technology for Treatment of Domestic Wastewater: Field Scale Study of a Pilot Project in Bhopal. (MP), India.Vinita Vipat, U R Singh and S K Billore

The author of this paper wishes to state that urban water bodies in tropical developing countries are the worst victims of domestic wastewater / sewage, owing to the growing gap between increasing waste water generation and the lack of compensating economic resources to address the issue through conventional technologies. As a result, biological machines might be a revolutionary instrument for the long-term management of water bodies. Because root zone technology is based on natural biological processes that run only on solar energy, it is minimal in cost and requires little to no operation and maintenance. As a result, the paper under consideration is an attempt to assess the performance efficiency of a field scale Horizontal Subsurface Flow constructed Wetland/Root zone demonstration unit built by Environmental Planning & Coordination Organization (EPCO) at Ekant Park, Bhopal as an economically and ecologically viable pilot project. The unit is meant to treat 70,000 litres per day of nalla wastewater flowing through the park. Pretreatment (settling tank – 35 m3) is followed by a Root zone bed (700 sq.m) with gravels, Reed plants (Phragmitis karka), and inlet-outlet systems for subsurface flow.

Root Zone technology for campus waste water treatment G. Baskar*, V.T. Deeptha and A. Abdul Rahaman

According to the author, contaminants are eliminated by a variety of physical, chemical, and biogeochemical processes such as sedimentation, absorption, and nitrification, as well as uptake by wetland plants. According to reports, root zone systems are most suited for schools, hospitals, hotels, and smaller towns. The purpose of this study was to determine the efficacy of the wetland plant Phragmites australis in the treatment of waste water generated on the SRM University campus. In the university grounds, a 1.5X0.6X0.3m prototype wetland unit was built. Fresh water was used to cultivate the Phragmites australis species in the field. 3X3 rows of plants were transplanted inside the pilot unit and exposed to waste water from the hostels and other campus buildings. The raw waste water and treated waste water were collected on a regular basis and checked for quality. On average, this pilot unit reduces TSS, TDS, TN, TP, BOD, and COD concentrations by 90 percent, 77 percent, 85 percent, 95 percent, 95 percent, and 69 percent, respectively. The Root Zone System meets tertiary treatment criteria with minimal running expenses, minimal maintenance costs, enriches the landscape, offers a natural habitat for birds, and has no smell problem.

Groundwater resource assessment in Africa Lei Wang, Brighid Ó Dochartaigh, David Macdonald

This paper does a literature analysis on groundwater recharge and groundwater resource assessment in Africa. The goal of this research is to find groundwater recharge estimations that have been conducted in Africa or outside of Africa but in similar habitats and climates to those found in Africa. The first section of the research emphasises the relevance of groundwater recharge modelling in studying the effects of climate change on groundwater resources in Africa. In the report's conclusion, we stress our key finding: there is a lack of knowledge on the scale, timing and geographic distribution of groundwater recharge over most of Africa. The majority of existing recharge estimates have been done on an ad hoc basis utilising widely disparate methodologies and data, resulting in little consistency between estimates in various locations. These estimates are likewise inconsistent and unequally distributed across Africa.

III. METHODOLOGY

First, we'll proceed to Vadgaon Maval, a tiny town with no industrial areas and a modest rainfall. Then we'll collect data on rainfall and water usage per capita so that we can compute the daily average sewage flow and runoff discharge, and by examining the region, we'll know which way the water is flowing and where it connects to the river.

Figure 2: Design location

We will use the data to create sedimentation tanks for daily sewage flow and a ground water recharging pond for runoff. We are going to create a filter and root zone cleaning system model (RZCS). Along with the runoff water, this semi-filtered sewage water will be discharged into a ground water recharging pond.

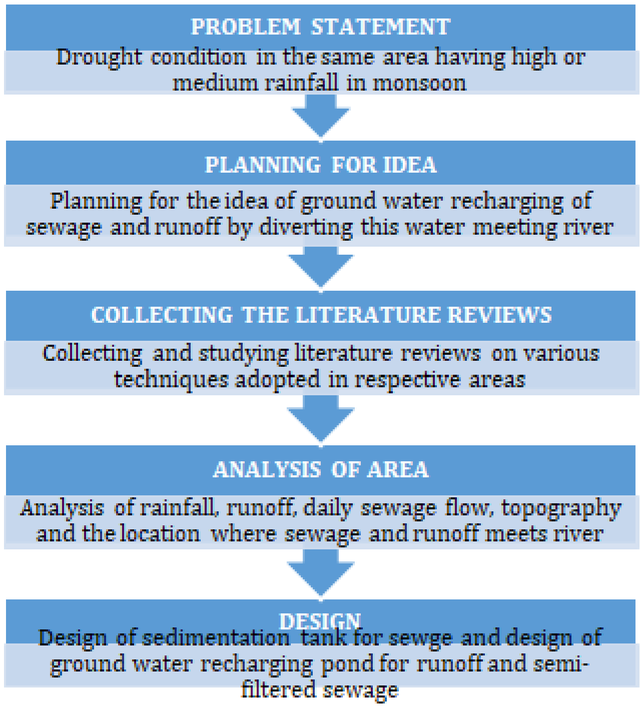

Figure 3: Flow chart of designed system

IV. RESULT AND DISCUSSION

A. Pond Recharge Design

Daily runoff discharge inflow =$1.92*10^6/365$ = 5260.274 m^3/day.

Maximum daily discharge inflow =5260.274*1.5 = 7890.41 m^3/day.

Provide 2 recharge ponds so,volume of one pond = 7890.41/2 = 3945.205 m^3

Assume depth of pond = 10 m.

Required area of pond = 16 m X 25 m.

By assuming the minimum constant rate of filtration rate of the soil at the recharge pond site which is assumed as = 16 mm/ hour.

So provide 2 extra ponds in case extra flood & minimization of infiltration rate.So, provide total 4 no. of ponds each having size (25 X 16 X 10) m. If there is any excess flood water from outlying regions, or if there is any way to reduce the infiltration rate of the recharge pond's bed, the excess water will be discharged into the river via the outlet.

B. Sedimentation tank design

Sewage Discharge from analysis = 1873368 ltr/day.

= 1873 m^3/day.

Retention period = 5 hrs.

Hourly sewage = 1873 / 24

= 78.04 m3/ hr.

Therefore, Total sewage at a time in sedimentation tank =(1873/24)*5.

= 390.208m^3

Therefore,

Dimensions of sedimentation tank are

Length (L) = 10 m.

Breadth (B) = 8 m.

Depth (D) = 5.5 m (0.5 m free board)

After reaching full depth of 5.5 m, the additional water, which is really runoff, will automatically be collected in the groundwater recharging pond supplied next to it via the channel given right after 5.5 m from the bottom of the tank and 1.5 m from the top of the tank.

C. Root zone cleaning rack design

A total of four vessels are given, one on top of the other. Each vessel is (3 X 1 X 0.3) m in size. To prevent dirt from seeping through the net holes, the bottom of each vessel should have net and be covered from the inside of the vessel with plastic material. Each vessel is filled with dirt after the bottom is covered with plastic. For the height of plant we are planting in the soil, there is a clearance of 30 cm from the ground level to the bottom of the lowest vessel and a clearance of 40 cm between the top of the soil of the bottom vessel and the bottom or bed of the vessel directly above it.

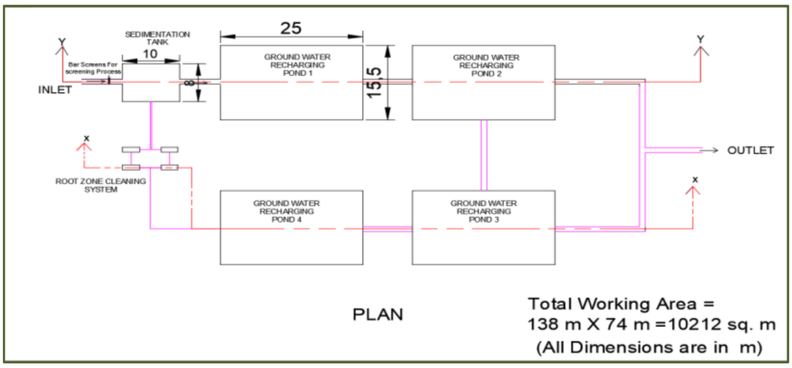

Figure 4: Layout Design

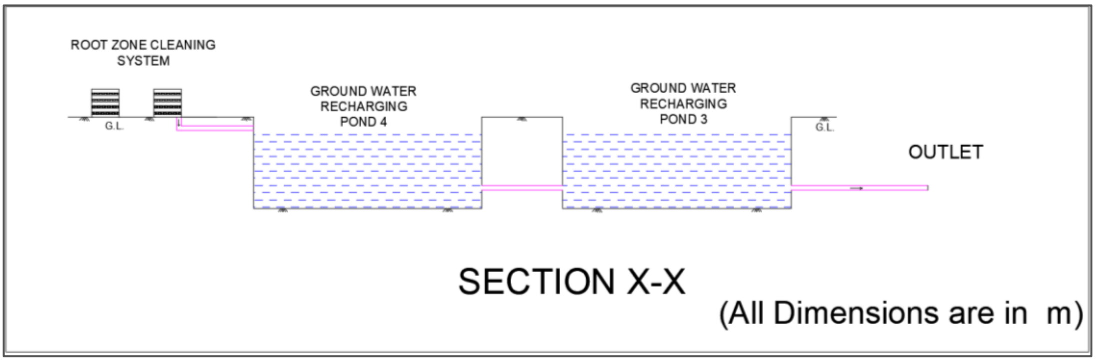

Figure 5: Sectional elevation along the X-X axis

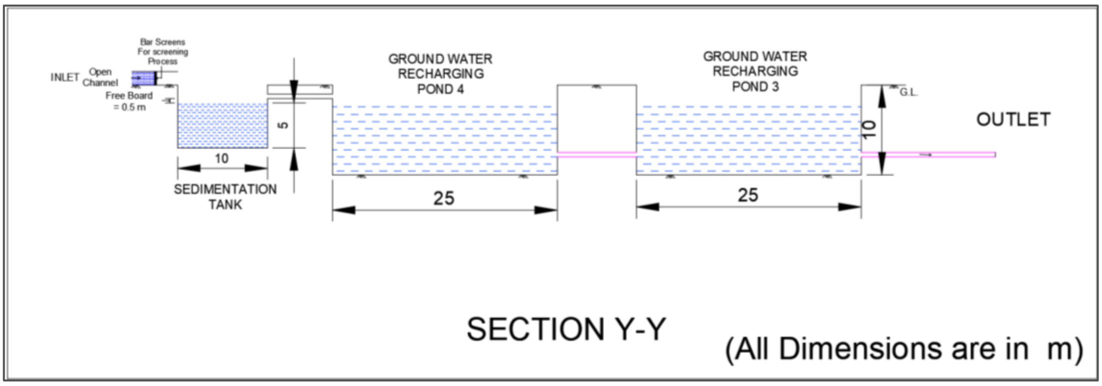

Figure 6: Elevation along the Y-Y axis

V. CONCLUSION

This project is providing us with a clear indication of the problem statement. Drought should not occur in areas with high or medium rainfall, yet drought does occur in certain areas due to runoff and daily sewage waste. We may infer from this experiment that runoff and everyday sewage should not be squandered by dumping it into the river. We can utilize it to recharge ground water and eliminate drought conditions. We can successfully work on difficulties caused by climate fluctuation using this way.

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