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Design and Construction of Magic Soak Pit

Abhishek Gajbhiye[1], Purvesh Dhande[2], Sanket Meshram[3], Janvi Patil[4], Mrunali Patil[5], Sonali Shendre[6], Pravin Gaidhane*[7], Sandeep Hanuwate[8], Ravindra Wakodikar[9]

[1-6, 8-9]Department of Civil Engineering, Govindrao Wanjari College of Engineering & Technology, Nagpur, Maharashtra, India.

[7]Department of Chemistry, Govindrao Wanjari College of Engineering & Technology, Nagpur, Maharashtra, India.

[7*]**Corresponding Author:**

Dr. Pravin Gaidhane:

Abstract:-

The present project work addressing the issue of chemical contaminated water coming from Chemistry Laboratory at Govindrao Wanjari College of Engineering & Technology, Nagpur. The waste water containing chemical contents is directly discharged without treatment into the underground causing environmental problems and also affecting the health of human beings due to the contamination of soil. Therefore, the chemical contaminated water needs to be treated to reduce the effects of pollution or chemical contaminants present in waste water to protect groundwater sources and ensure sustainability. In view of effect of waste water on environment and to protect groundwater sources, we planned, designed and constructed a magic soak pit. The present work revels that the magic soak pit is an economical, efficient and safe solution for treatment of waste water. In this project materials used are brickbats, aggregates, charcoal, sand and lime.

Keywords:- *Waste water, Groundwater, Designing, Construction Materials, Magic Soak Pit*

Introduction

Waste water is the polluted form of water generated from rainwater runoff and human activities. It is also called sewage. In short used water is wastewater. It comes from our sinks, showers, and toilets (think sewage) dishwashing, laundry, and from paper mills, commercial, industrial, chemical and agricultural activities (thick metals, solvents, and toxic sludge). When waste water discharge into natural water bodies can lead to water pollution, harming aquatic life and making water unsafe for human use. It also contributes to the spread of diseases and environmental degradation. The chemical contaminated waste water and poor sanitation are linked to transmission of diseases such as cholera, diarrhea, dysentery, hepatitis A, typhoid and polio. Waste water disposal methods like waste water treatment system, water reuses system, soak Pit system etc., include removal of contaminants and pollutants from waste water, water subsurface discharge, water reuse and discharge to ground water [1-4].

In soak Pit system, an underground structure designed to receive and disperse waste or contaminants from treated or partially treated wastewater. It allows the wastewater to percolate into the surrounding soil, where natural processes help filter and purify the water before it recharges the groundwater. Soak

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pits are commonly used for on-site sewage disposal and storm water management in areas without access to centralized sewer systems [5-6].

A soak pit is a covered, porous-walled chamber that allows water to slowly soak into the ground. It is a dry well type of a structure. Water flows through it under the influence of gravity. A dry well receives water from one or more entry pipes or channels at its top and discharges the same water through a number of small exit openings distributed over a larger surface present in the side and bottom of the dry well [7-8]. The literature study [9-10] reveals the advantages of magic soak pit as mentioned below are:-

a. It can be constructed using locally available materials.

b. It is very cost effective as it can be afforded everyone.

c. It also helps in ground water recharging.

d. It does not require large areas; it can be made in small areas as well.

e. It is used where municipal drainage system is not available.

The magic soak pit is an economical, efficient and safe solution for treatment of waste water which reduces the effects of pollution, destruct the pollutants and contaminants present in waste water, protect groundwater sources and ensure sustainability. Hence in present work, we planned, designed and constructed a magic soak pit.

Research Methodology: The study aims at studying chemical contaminants present in waste water coming from chemistry laboratories and creates a cost effective and efficient mechanism for magic soak pit for water disposal at Govindrao Wanjari College of Engineering & Technology, Salai, Godhani, Nagpur, Maharashtra. The methodology of present study (project work) completed in multiple steps.

In first step, we find the suitable location to carry out present project work. Herewith we select the study area i.e., location: Chemistry Laboratory, Department of First Year B. Tech., Govindrao Wanjari College of Engineering & Technology, Nagpur. In present study area "Chemistry Laboratory" a wide spectrum of experiments are conducted to support the field of engineering. The experiments like determination of Hardness & alkalinity of water sample, detection of free chlorides, Nickels ions, Ferrous ion in water, study of COD, BOD, determination of acidic value and saponification value of oil etc., were performed The study involves a comprehensive examination of pollutants, contaminants, byproducts and chemicals present in wastewater as a result of various experiments performed in the chemistry laboratory. On the investigation, it was found that the result waste water contains various constituents of salts, acids, bases, EDTA, indicators, Nickel ions, Ferrous ions, free chlorides, unwanted oil sample etc.

At study area such chemical contaminated water directly discharged without treatment into the underground which causing environmental problems and also affecting the health of human beings due to the contamination of soil. Hence the mentioned result and study help us to select suitable location for project [**figure 01**].

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In second step, According to lab results, we continued our work on Planning and Design of Magic Soak Pit. For the efficient waste water disposal, we were planning to construct rectangular soak pit. The soak pit having the **depth 1.46 M, length 2.13 M and width 1.21 M** along with specific size of cover. For the designing of soak pit, we were using civil related Software i.e. **AutoCAD** by which finalized the graphical design of rectangular soak pit as mention in graphical abstract of present work [**Figure 02**].

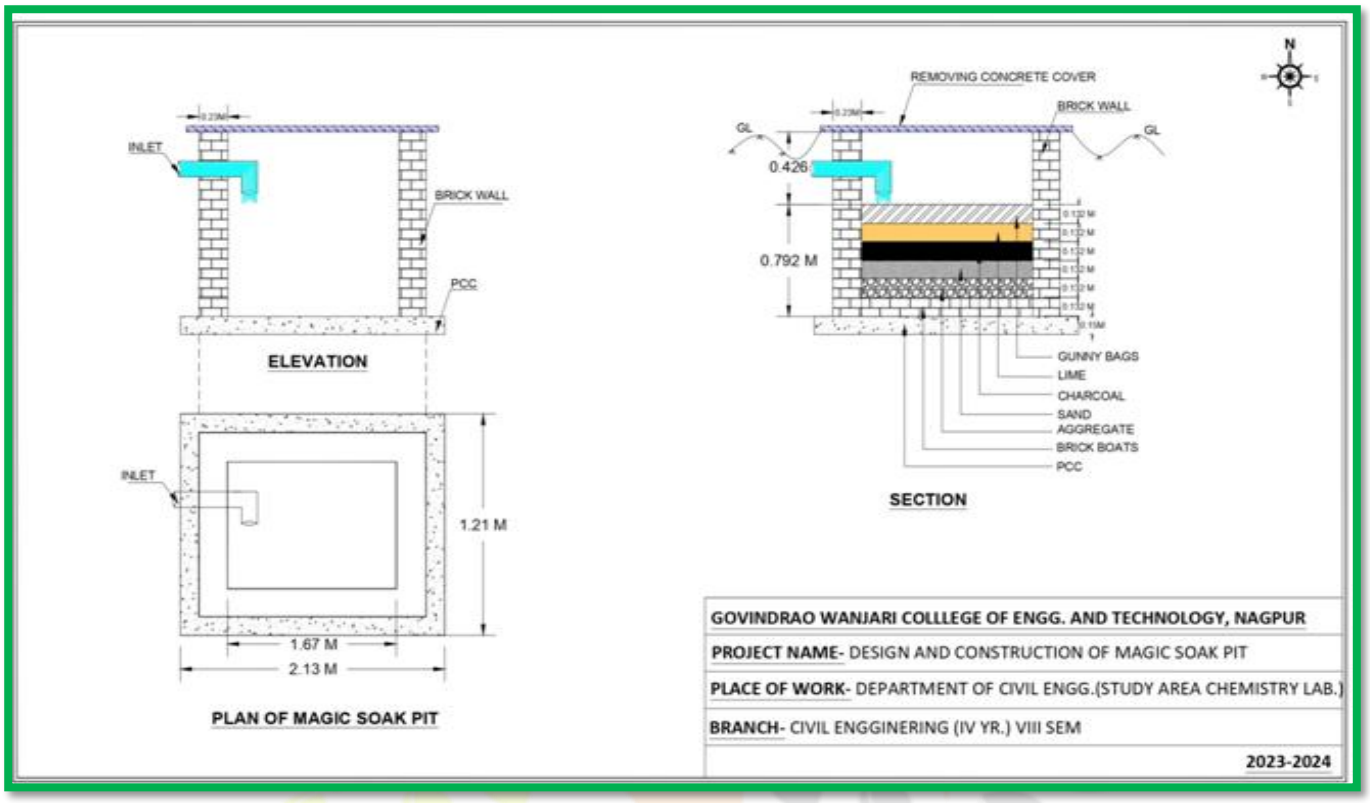

Figure 02: Graphical Abstract: Drawing and Designing of Magic Soak Pit by AutoCAD

In the final steps means material selection and construction of magic soak pit, we finalized material for construction of Magic Soak Pit. For the construction of magic soak pit, various types of materials like Gunny Bags, Lime, Charcoal powder, Sand, gravels and Bricks- bats were used. A soak pit is an underground structure which is a covered, porous-walled chamber that allows water to slowly soak into the ground. In this step we were follow the following procedure for the construction of Magic soak pit

1. The excecution of project work was continued with marking as considering the finalized dimensions for the soak pit . During excavation, the process of digging, removing and relocating earth or soil was carried out to create a void or cavity for construction or other purposes. Nearby 03 feet deep soil was excavated with the help of excavationg tools. The process of PCC flooring was carried out to provide strength and durability for magic soak pit and built a 09-inch brick wall on the PCC flooring and making 1.46 x 2.13 x 1.21 M^3 trench or pit which is suitable for waste water of selected location, having capacity to takes 120 liter waste water to discharge in a day and it sufficient for disposing through it.

2. The constructed pit filled by the alternate layers of selected material having thickness 0.132 M. A layer of brick boats was laid at the bottom of the magic soak pit to provides robust support, facilitating efficient water drainage into the soil, effective wastewater management and promoting environmental sustainability practices. The layer of aggregate was placed as the second bottom layer in

the soak pit to enhances drainage by providing space for water flow, prevents clogging, distributes pressure evenly, and promotes sustainability through natural filtration and local sourcing.

The layer of sand was added as the third bottom layer in soak pit to facilitating efficient water percolation, enhancing filtration, and ensuring stable drainage. The charcoal layer was added as the fourth bottom layer of magic soak pit. The charcoal used as an additional filtration layer, effectively absorbing impurities and odors from the water, improving its quality before it infiltrates into the surrounding soil. The layer of lime powder used as fifth layer in a magic soak pit to controls odors, reducing pathogens, adjusts pH and aids in solidification. It enhancing wastewater treatment and ensuring environmental safety and efficiency in drainage. A gunny bags used as a top layer having 0.132 m thick is placed as a top layer in the magic soak pit .Gunny bags was used as a protective barrier to prevent soil and debris ingress. This allows filtered water to percolate through, ensuring the effectiveness of the filtration process and the longevity of the soak pit system.

In plumbing work, a PVC 03 inch pipe was utilized for plumbing objectives , connecting all the sinks to the pipeline, which was subsequently link to the constructed magic soak pit. Cover the pit and make sure that pit will not damage from any external activity. Process of covering of pit use like that we can open that anytime for its maintenance purpose [**Figure 03**] .

Figure 01: Location of Study area: GWCET, Nagpur

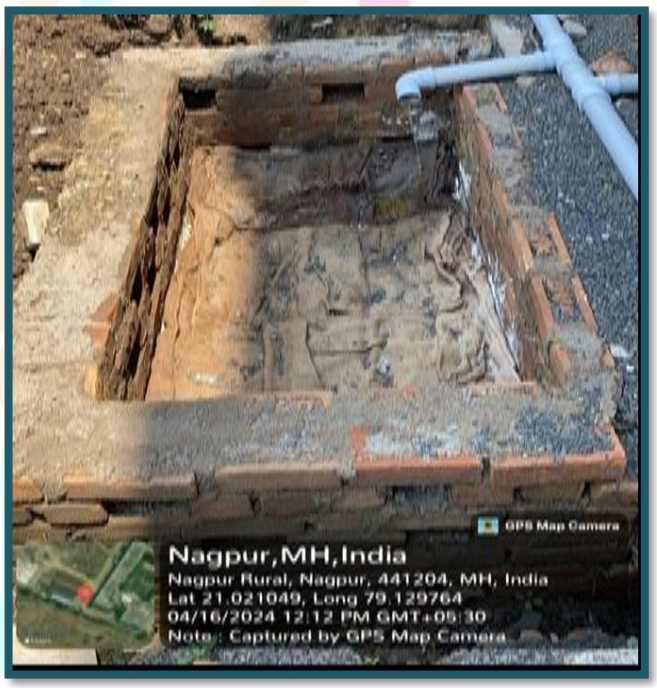

Figure 03: Constructed Magic soak Pit

Result and Discussion:

It is observed that there was instant discharge of water in soak pit. It is clearly evident from the results that, the absorption capacity of the soak pit increased due to various layers used in soak pit like brick boats, aggregates, sand, charcoal, lime and gunny bags. It was also observed that the quality of water sample collected from top of soak pit containing same contents similar to that of other water samples. Hence, it is said that the chemical does not leave any harm full substances to the water that is passing through it and the water is safe to reach the ground water.

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Regarding the maintenance, the results were found like the effluent was clarified or filtered well to prevent excessive buildup of solids, the constructed soak pit must be kept away from high-traffic areas, the particles and biomass need to be cleaned or moved to prevent the clogging, a removable lid may be used to seal the pit for future access.

From the results of present work, we finding some advantages such as the soak pit can be built and repaired with locally available materials, the constructed area required is comparatively less, the power conservative and as long as the soak pit is not used for raw sewage, and storage/treatment technology is functioning well, health concerns are minimal. The technology is located underground and thus, humans and animals have no contact with the effluent.

Conclusion:

Summarize the key findings of the project and reiterate its significance in addressing waste water management challenges. Highlight any successes achieved and areas for further research or development. By following this structure, we can provide a comprehensive discussion of the results and findings of the soak pit project, addressing both technical aspects and broader implications for water management and community development. It is found that, in the areas where severe draughts exist, no any general watershed development intervention suits. This certainly will contribute for ground water storage and will help to solve the water scarcity problem of the selected location in near future. Overall, soak pit projects offer numerous advantages for managing waste-water and making them a valuable tool for sustainable water management in diverse contexts. By using this method, we can improve groundwater considerably; this method was really helpful in the study area where the facility of drainages is not provided.

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References:

[01] E. D. Enger, B. F. Smith, A study of interrelationships. Environmental Science. Edward E. Bartell. California, USA, 2004.

[02] Krishnaswamy Kanagamani, P. Geethamani and M. Narmatha Department of Chemistry,

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Hazardous Waste Management, Pg No. 1-11, SNS College of Technology, Coimbatore-641035, India.

[03] Online source- https://en.wikipedia.org/wiki/Chemical_waste

[04] Pawel Lochnyski et al., Research on neutralization of wastewater from pickling and electro polishing processes, Archives Of Environmental Protection, Volume 47, Issue 4, PG 18-29, Sept 2021.

[05] Prasenjit Mondal, et al., Impact Of Soak Pit On Groundwater Table, Environmental Pollution Control Journal, Volume 18, Issue 1, 12-17, Dec 2014. Pradeep V. Kulkarni., et al, Soak Pit the Best Solution For Water Conversation In Draught Prone Villages Journal Of Water Resource Engineering & Pollution Studies, Volume 5, Issue 2 ,11-18, 2020.

[06] Kamble Nisha., et al, Futuristic Waste Water Soak Pit, Journal Of Emerging Technologies And Innovative Research (JETIR) , c738-c740, Volume 10 , Issue 6 , June 2023.

[07] Atharva Jadhav., et al, To study the soak pit and bring new view for future modification, International Journal Of Engineering Applied Science and Technology, Volume 6, Issue 12, 323- 325 April 2022.

[08] Pradeep V. Kulkarni., et al, Soak Pit The Best Solution For Water Conversation In Draught Prone Villages, Journal Of Water Resource Engineering & Pollution Studies, Volume 5, Issue 2 ,11- 18, 2020.

[09] Siddhesh Wagh., et al, Construction Of Magic Soak Pit With Locally Available Materials And Economical Design, Internal Journal Of Innovative Science And Research Technology, 364-367, Volume 4, Issue 1, January 2019.

[10] Akshay Matwadkar., et al, A Study On Disposal Of Domestic Waste Water By Magic Soak Pit Method In Rural Areas, International Research Journal Of Engineering And Technology (IRJET) , Volume 6, Issue 3 , 4125-4127, March 2019.

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