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Study and Design Analysis of Wastewater Soak Pit and Soak Pit Technique

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ABSTRACT

The trends of the last century have been urbanization and industrialization, which are consuming every industry. The negative impacts of technology's rapid growth are becoming more apparent. Pollution and waste production increase in tandem with population growth and urbanization. Waste is made up of degradable and biodegradable materials, plastic, and wastewater. A portion of the garbage can be recycled, while other waste can be discarded or repurposed. Since water now makes up 75% of the world, waste water follows suit. The ability to recycle and reuse waste water is the primary source of decrease. Sewage treatment facilities are installed by the government wherever feasible, but in certain rural locations, installation is not feasible since soak pits provide an alternative solution to this issue. The objective of this research is to conduct a thorough analysis and study of the soaks pit design and technique in order to express its significance. The study concludes that the magic soak pit method of disposing of wastewater used of Chemistry Laboratory at Govindrao Wanjari College of Engineering & Technology, Nagpur. The technique raises the ground water level in addition to disposing of the wastewater.

Keyword -Soak Pit, urbanization and industrialization, Wastewater, Ground water

INTRODUCTION

Wastewater is water generated after the use of freshwater, raw water, drinking water or saline water in a variety of deliberate applications or processes. In other term Waste water is a general term used to represent the water with poor quality that contains more amounts of pollutants and microbes. If wastewater is discharged into the nearby water bodies, it can cause serious environmental and health problems to human beings.It originates from paper mills, commercial, industrial, chemical, and agricultural processes (heavy metals, solvents, and hazardous sludge), as well as from our sinks, showers, and toilets sewage, dish washing, and laundry. The release of waste water into naturally occurring bodies of water may cause pollution, endanger aquatic life, and render the water unfit for human consumption. It also hastens the spread of illness and deteriorates the environment. Poor sanitation and chemically tainted waste water are associated with the spread of illnesses including cholera, dysentery, diarrhea, hepatitis A, typhoid, and polio.

The removal of impurities and pollutants from waste water, subsurface discharge of water, reuse of water, and release to ground water are some of the waste water disposal techniques, such as waste water treatment systems, soak pit systems, etc. An underground structure used in soak pit systems that is intended to collect and distribute trash or impurities from wastewater that has been partly or fully treated. In order to assist filter and cleanse the water before it recharges the groundwater, it permits the wastewater to seep into the nearby soil. In places lacking access to centralized sewer systems, soak pits are often utilized for on-site sewage disposal and storm water management. A soak pit is a covered space with permeable walls that lets water seep into the earth gradually. It's a construction similar to a dry well. Gravity causes the water to flow through it. Water enters a dry well by one or more entrance pipes or channels at the top and exits through several tiny exit apertures spaced over a wider area found in the dry well's side and bottom The magic soak pit is a cheap, effective, and secure waste water treatment method that guarantees sustainability, lessens the negative impacts of pollution, and breaks down the pollutants and toxins found in waste water. For this reason, we planned, created, and built a magic soak pit. In present work, addressing the issue of waste water and reduce the effects of pollutants and contaminants present in waste water to protect groundwater sources and ensure sustainability. The present work also revels the planning, designing and construction of a magic soak pit which is an economical, efficient and safe solution for treatment of waste water.

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LITERATURE REVIEW

Pooja Hireholi et. al, 2023) waste and waste water creates unhygienic condition in areas. Also villages have lack of drainage system. Such disposal creates nuisance of mosquito to the people and also various diseases rises. The study is about disposal of domestic wastewater without creating unhygienic condition at domestic level. A greater quantity of water is found in the earth's interior. Safe drinking water is essential to humans and other life forms even though it provides no calories or organic nutrients. The study uses the method of magic soak pit for disposal of wastewater. The study identifies that the magic soak pit method is safe to dispose the wastewater. The method used is not only disposes the wastewater but also increases the ground water level.

(Krishna and Shivendra et. al. 2017) The current study examines the consolidation behavior of three zones of soil collected from neat soak pit regions in Kanakapura, Hoskote, and Dodaballapur, Karnataka, India, at a depth of 0.5 meters from natural ground level and a radial distance of 2.5 meters from the pit area using auger boring. In the aforementioned areas, human excreta and sewage are released straight into these pits. Contaminants from the hole may traverse a maximum distance of 10 meters and may also migrate vertically downwards, polluting subsurface water and affecting soil engineering behavior. As a result, we are curious in the consolidation qualities of this region's soil. An effort was also made to conduct a consolidation comparison research of three above-specified zone soils owing to pollutant intrusion. According to the one-dimensional fixed-ring consolidation test, Hoskote soil requires a higher pre-consolidation pressure and thus has a lower rate of permeability than other soils; however, Dodballapur soil requires a lower pre-consolidation pressure for soil consolidation. This represents soil softening caused by pollutant penetration near the soak pit location.

Objectives of the Study

- To enhance the use of wastewater.
- Determine the source of waste water formation and investigate its physical qualities.
- Design the magic pit depending on wastewater outflow.
- Conduct several tests to determine qualities such as BOD, COD, and TSS.
- Analyze physical and chemical contaminants in the treated waste water from the Soak Pit .
- To assess the possibility of using waste water.

METHODOLOGY

The methodology for this investigation comprises of the following phases.
1. Finding an appropriate place for this project. Identify the most accessible waste water location first.
2. Laboratory test to determine the qualities of water.
3. The soak pit will be developed and erected based on the test findings.
4. After that, it will be operated for some time before water is collected to investigate its features.
5. The results and conclusion will be based on testing.

Planning and Design of Magic Soak pit

For the efficient waste water disposal, we will plan to construct rectangular soak pit. The soak pit having the depth 1.5m, length 1.82m and width 1.21m along with specific size of cover. For the designing of soak pit, we will use civil related Software i.e. Auto Cad by the proposed graphical design of rectangular soak pit as mention in Figure 1.

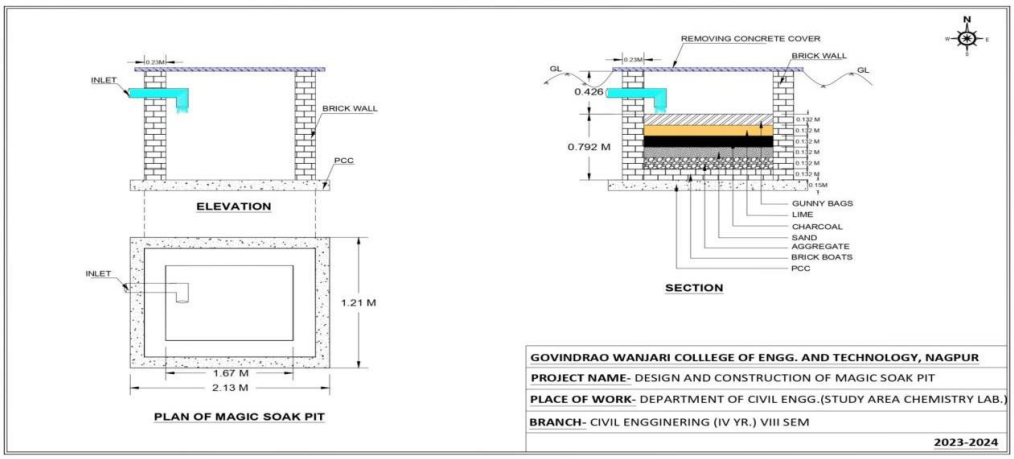

Figure 1: Proposed Graphical Design of Magic Soak pit

Dimension of Soak pit: Length outer 2.13 m, Length inner 1.37 m, Width 1.21 m, Height 1.25 m, have an capacity 120 liters per day. We are constructing Magic Soak Pit at selected location with available materials and commercial design. A soak pit is an underground structure that disposes of chemical content water, most commonly storm water runoff, by disposing it into the ground, where it merges with the local groundwater. A septic tank is designed to carry out the liquid waste. It has to be constructed based on the instruction given in the Indian Standard code IS 2470. Soak pit with 1.5 m depth, 1.82 m length, 1.21 m width, and specific cover size. We will use civil software, such as Auto Cad, to design a rectangular soak pit, as stated in the proposed work's graphical abstract. Consider drainage patterns, soil conditions, building proximity, and local regulations when placing the soak pit. We chose a 2.13 x 1.21 x 1.25 m3 soak pit trench for the Chemistry Lab's 120-liter-per-day disposal capacity. Depending on pit size, excavation can be done manually or mechanically, but manually is more cost-effective. Design consideration of septic tank design as per-

1. Surface and subsoil water should not enter the tank.
2. Avoid flushing solid waste and paper into the septic tank to prevent blockages.

Construction of Magic Soak Pit
After selecting a suitable location for the construction of magic Soak Pit, we followed below procedure are to complete the construction of magic soak pit:

Taking Proper Measurements: Accurately measure the dimensions of the soak pit area to ensure it meets the required capacity for wastewater treatment and drainage.

Marking All Lining Measurements: Mark the boundaries and depth of the soak pit on the ground to guide excavation and construction.

Excavating Land: Dig a pit with a depth of 4 feet within the marked boundaries, ensuring uniform depth across the area. We required one day completing the excavating of land.

Flooring the Base with Mortar: Use mortar to create a strong and stable base for the soak pit, providing a solid foundation for subsequent construction.

Constructing Walls with Bricks and Mortar: Build 9 inch walls around the perimeter of the soak pit using bricks and mortar, ensuring they are sturdy and capable of containing waste water. For the constructing walls with bricks and mortar we required three days.

Watering for 15 Days: Keep the soak pit moist for 15 days after construction to allow the mortar to cure properly and enhance its strength.

Checking Measurement and Construction: Conduct a thorough inspection of the soak pit to verify that all measurements and construction meet the required standards and specifications.

Connecting Chemical Lab Basins: Installed pipes to connect chemical lab basins to the inlet of the soak pit, ensuring proper drainage of wastewater.

Applying Layers of following Materials:
Brick Boats: Use brick boats to create channels for water flow within the soak pit.
Stones: Place a layer of stones at the bottom of the pit to facilitate drainage and filtration.
Aggregate: Add aggregate material to further promote drainage and provide structural support.
Sand: Apply a layer of sand to enhance filtration and remove finer particles from wastewater.
Charcoal Powder: Use charcoal powder to remove impurities and odors from the water.
Gunny Bags: Layer gunny bags to act as a barrier for trapping solid particles and preventing clogging.

Covering All Upper Layers: Cover the top layer of the soak pit with a permeable material to prevent debris from entering while allowing water to infiltrate.

Final Inspection and Testing: Inspect the completed soak pit for any defects or issues and conduct tests to ensure proper drainage and functionality.

Monitoring and Maintenance: Regularly monitor the soak pit's performance and conduct routine maintenance to prevent clogging and ensure continued operation.

Training and Awareness: Provide training to users and maintenance personnel on the proper use and maintenance of

the soak pit, including identifying potential problems and performing basic troubleshooting.

Figure 2: Constructed Magic Soak pit

RESULT AND DISCUSSION

Discussing the results and findings of a soak pit study and analysis. General outline for discussing the results are:

Result

As find result the soak pit had an immediate water release. The findings make it abundantly obvious that the layers of brick boats, aggregates, sand, charcoal, lime, and gunny bags among other materials were responsible for the soak pit's improved capacity for absorption. A water sample taken from the top of the soak hole was likewise found to have the same quality as previous water samples. Therefore, it's believed that the chemical leaves no harmful compounds in the water it passes through, and the water is safe to drink from the ground. When it came to upkeep, the findings showed that the effluent needed to be well-filtered or clarified to avoid an excessive build-up of solids, the soak pit needed to be built away from busy places, the biomass and particles needed to be moved or cleaned to avoid clogging, and the pit could be sealed with a removable lid for future access. From the current work's results, we have identified a few benefits: health risks are negligible as long as the soak pit is not used for raw sewage and storage/treatment technology is operating properly; the constructed area needed is relatively small; the soak pit can be maintained and repaired using materials that are readily available locally; and the power consumption is conservative. Because the equipment is subterranean, no people nor animals come into touch with the wastewater.

Discussion

- **Effectiveness:** This could involve analyzing data on water infiltration rates, reduction in surface runoff, and groundwater recharge. Quantitative measurements were compared against initial goals to determine effectiveness.
- **Efficiency:** Assess the efficiency of the soak pit system in terms of cost-effectiveness, resource utilization, and maintenance requirements. Compare the cost of installation and maintenance with the benefits gained, such as reduced flooding or improved water quality. Environmental Impact: Discuss the environmental implications of the soak pit project. Evaluate whether the study helped mitigate issues like soil erosion, groundwater depletion, or pollution. Consider any unintended consequences or negative impacts on the environment.
- **Community Engagement:** Discuss the level of community involvement and acceptance of the soak pit project. Assess whether stakeholders were engaged in the planning and implementation process, and whether there was community support for the project.
- **Challenges and Lessons Learned:** Identify any challenges faced during the study implementation and discuss how they were addressed. Reflect on lessons learned that could inform future projects or improvements to the current system

CONCLUSIONS

In this study find the importance in addressing waste water management issues while summarizing its main conclusions. 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 work, 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.

Future Recommendations:
This includes suggestions for expanding the soak pit study to other areas, optimizing design and maintenance practices, or addressing any remaining issues or concerns.

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