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Necessity and Design of Roof Top Rain Water Harvesting System

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Abstract: ***Rainwater harvesting involves collecting rainwater and recycling it for various potable and non-potable water uses. Currently, the water scarcity crisis is rapidly increasing, mainly due to lack of proper monitoring and control. This document was developed to assess the effectiveness of rainwater harvesting systems and the impact of their implementation. The article examines the feasibility in terms of rainwater harvesting and reducing pollutant emissions. Rainwater is collected on the roof and made drinkable after quality analysis. The case is a stormwater drainage project recharge wells were built to recharge groundwater. Also, for controlling water overflow from storage tanks are designed to provide water for horticulture and other non-potable uses. This allows the system to efficiently store rainwater and recycle it for various purposes. Helps reduce addiction groundwater supply, maintaining the groundwater level in the region and preventing overexploitation of groundwater requirements in growing population.***

I. INTRODUCTION

Saving water is essential as it is one of the most important factors for the survival of all species. According to the headquarters "The Ground Water Board" estimates that groundwater shortages will occur in 15 states in India by 2025. However, according to estimates from the "Bureau of Groundwater" According to Ministry of Environment and Forestry Report, only 10 to 20 percent of rainwater is collected. In urban areas, yes noted that nowadays concrete buildings are being built everywhere, so natural replenishment of the groundwater table is not possible. the process of falling rain. Rainwater, a source of fresh water, is wasted when discharged into the sewer system and becomes one of the sources of fresh water is one of the biggest problems today and will have even more serious consequences in the future. Hence rainwater To save water, an Indian family needs a collection system. Population growth around the world is causing similar phenomena. questions address the question of how high-water quality can be guaranteed for everyone. Currently, water is the world's main problem in the 21st century. defects, the best way to eliminate them and collect water wisely is to rain it and dispose of it responsibly. The means available for collecting rainwater are roofs and the ground.

II. LITERATURE REVIEW

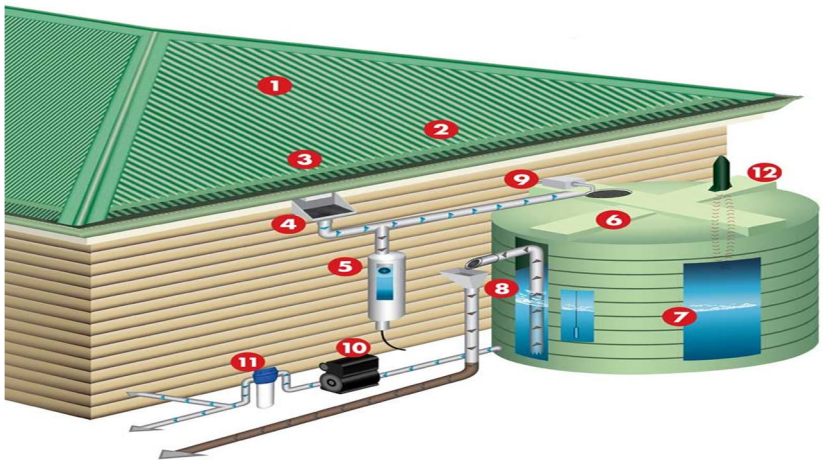
The rainwater harvesting methods adopted for this case are through collection of rooftop rainwater and surface runoff harvesting. A network of rainwater drains in the entire area is used for harvesting rooftop rainwater and surface runoff. The roofs of a building shall be so constructed or framed as to permit effectual drainage of the rainwater therefrom by means of a sufficient number of rainwater pipes of adequate size so arranged, jointed and fixed as to ensure that the rainwater is carried away from the building without causing dampness in any part of the walls or foundations of the building or those of an adjacent building. (NBC, 2016).

1) Recharge structures should be designed and constructed in favorable geological conditions i.e., permeable soils followed by murram etc. The structures should not be taken up in impervious clayey soils, rock and steep sloped areas.
2) Recharge structures should be preferred for recharging to depleted aquifers with deep water table. They should not be taken up in the shallow water table areas. The depth to water level should be not less than 5 to 6 meters in post-monsoon period.
3) Recharge structures should be taken up with unpolluted surface water only. Adequate precautions should be taken to prevent entry of polluted urban surface runoff water, sewerage water into recharge structures.
4) All existing kuntas and tanks in and around the urban agglomeration areas are to be protected against encroachments and should be converted as percolation ponds and tanks. The polluted drainage and other industrial pollutants should not be allowed to let into these tanks.

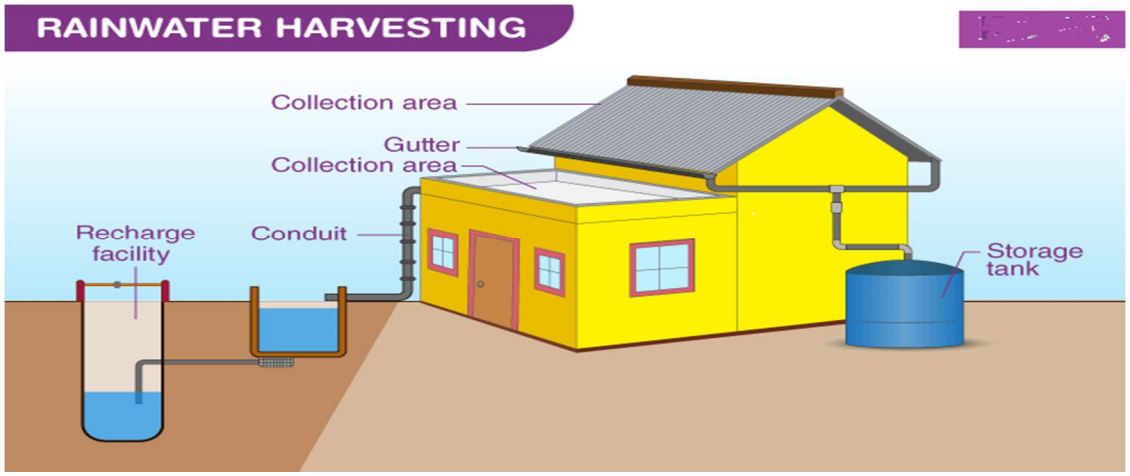
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III. METHODOLOGY



1) It all starts with ROOF SURFACE. Nearly all roof surfaces are fine for rainwater harvesting.
2) Gutters should have some sort of GUTTER PROTECTION SCREENING in order to keep large debris from entering the gutters.
3) We can collect rainwater from any type and shape of GUTTER. We do not need a special gutter for harvesting rainwater.
4) An additional filtration opportunity is with the installation of a RAIN HEAD (downspout filter) that allows for a bit of self-cleaning filtration options.
5) A FIRST-FLUSH DIVERTER helps to prevent the first flush of contaminated rainwater from entering the tank.
6) Another rainwater filtration opportunity is with a TANK SCREEN that is installed on the tank entry point. It also helps to keep mosquitoes and pests out.
7) RAINWATER TANKS come in all sorts of sizes and materials.
8) Install an INSECT PROOF FLAP VALVE on the end of the overflow pipe to keep mosquitoes and pests out.
9) An AUTO-FILL SYSTEM can be installed to keep a minimum amount of water in the tank at all times. This is very important for rainwater tanks that are connected to automatic irrigation systems in order to prevent the pump from running dry.
10) Select a PUMP SYSTEM to provide pressurized rainwater to distribute the rainwater easier or to connect to an inground irrigation system.
11) Install an IRRIGATION FILTER inline after the pump in order to catch any large debris that may have gotten through the pump.
12) A WATER LEVEL INDICATOR can be helpful with monitoring the water usage from the tank. Those are available in simple gauge tank options along with wireless digital options.



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Rainwater Percolation Tanks is an eco-friendly and sustainable method of collecting and storing rainwater for future use. With the increasing water scarcity in urban areas like Palwal, implementing a rainwater harvesting system has become crucial. Noida, a fast-developing city in Uttar Pradesh, faces water shortages due to overexploitation of groundwater and inadequate rainfall. Therefore, adopting can help alleviate the water crisis and ensure a sustainable water supply. Rainwater Percolation Tanks also aids in water conservation. By capturing Rainwater, it can be used for various non-potable purposes such as irrigation, washing cars, flushing toilets, and cleaning. This reduces the demand for freshwater and contributes to water conservation efforts.

a) Recharge structures should be designed and constructed in favorable geological conditions i.e., permeable soils followed by murram etc. The structures should not be taken up in impervious clayey soils, rock and steep sloped areas.

b) Recharge structures should be preferred for recharging to depleted aquifers with deep water table. They should not be taken up in the shallow water table areas. The depth to water level should be not less than 5 to 6 meters in post-monsoon period.

c) Recharge structures should be taken up with unpolluted surface water only. Adequate precautions should be taken to prevent entry of polluted urban surface runoff water, sewerage water into recharge structures.

d) Recharge structures should be planned and taken up in over exploited and critical areas experiencing intensive ground water development for various uses.

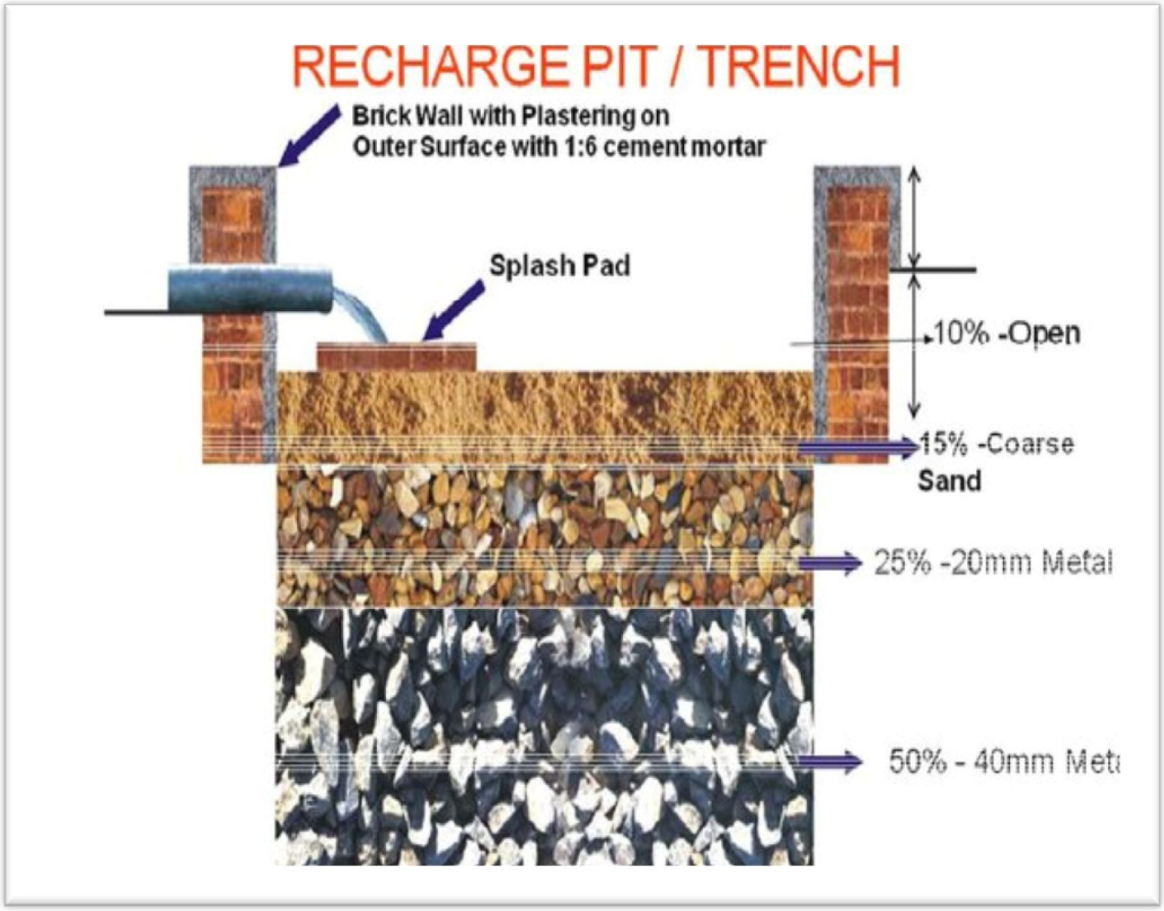
e) All existing kuntas and tanks in and around the urban agglomeration areas are to be protected against encroachments and should be converted as percolation ponds and tanks. The polluted drainage and other industrial pollutants should not be allowed to let into these tanks.

f) Ground water recharge through shafts is preferable in steep slope areas.

IV. RAIN BARRELS

This method is the most common and one that many people are familiar with. This involves installing a barrel at a gutter downspout to collect rainwater. The actual barrel may be a recycled barrel or a new commercially available rain barrel. Rain barrels capture water from a roof and hold it for later use such as on lawns, gardens or indoor plants. Collecting roof runoff in rain barrels reduces the amount of water that flows from your property. It's a great way to conserve water and it's free water for use in your landscape. They reduce runoff and pollution, reduce erosion, reduce flooding, reduce sewer backups, save money on water bills, help keep creeks and rivers healthy, and raise stormwater awareness.





This implies the surface upon which rain falls. The roof has to be appropriately sloped preferably towards the direction of storage and recharge.
The transport channels from catchment surface to storage. These have to be designed depending on site, rainfall characteristics and roof characteristics.
The systems that remove contaminants and debris. At first, a rain separator has to be put in place to divert and manage the first 2.5 mm of rain.
Sumps, tanks etc. where collected rain-water is safely stored or recharging the ground water through open wells, bore wells or percolation pits etc.

Three most important components, which need to be evaluated for designing the rainwater harvesting structure, are:

1) Hydrogeology of the area including nature and extent of aquifer, soil cover, topography, depth to water levels and chemical quality of ground water
2) Area contributing for runoff i.e. how much area and land use pattern, whether industrial, residential or green belts and general built-up pattern of the area
3) Hydro-meteorological characters like rainfall duration, general pattern and intensity of rainfall.

Rainwater Percolation Tanks is an eco-friendly and sustainable method of collecting and storing rainwater for future use. With the increasing water scarcity in urban areas like Palwal, implementing a rainwater harvesting system has become crucial. Noida, a fast-developing city in Uttar Pradesh, faces water shortages due to overexploitation of groundwater and inadequate rainfall. Therefore, adopting can help alleviate the water crisis and ensure a sustainable water supply. Rainwater Percolation Tanks also aids in water conservation. By capturing Rainwater, it can be used for various non-potable purposes such as irrigation, washing cars, flushing toilets, and cleaning. This reduces the demand for freshwater and contributes to water conservation efforts.

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V. RESULTS AND DISCUSSIONS

1) Less cost.
2) Helps in reducing the water bill.
3) Decreases the demand for water.
4) Reduces the need for imported water.
5) Promotes both water and energy conservation.
6) Improves the quality and quantity of groundwater.
7) Does not require a filtration system for landscape irrigation.
8) This technology is relatively simple, easy to install and operate.
9) It reduces soil erosion, stormwater runoff, flooding, and pollution of surface water with fertilizers, pesticides, metals and other sediments.
10) It is an excellent source of water for landscape irrigation with no chemicals, dissolved salts and free from all minerals.
11) We can essentially use rainwater anywhere we use tap water. The idea of using drinking water to flush our toilets and water our lawns is wasteful and irresponsible, especially in light of population growth and water shortages across the country. Rainwater collection is a technique to green your home and to lessen your environmental footprint.

There are basically three areas where rainwater can be used:

- Irrigation use
- Indoor, non-potable use
- Whole house, potable use

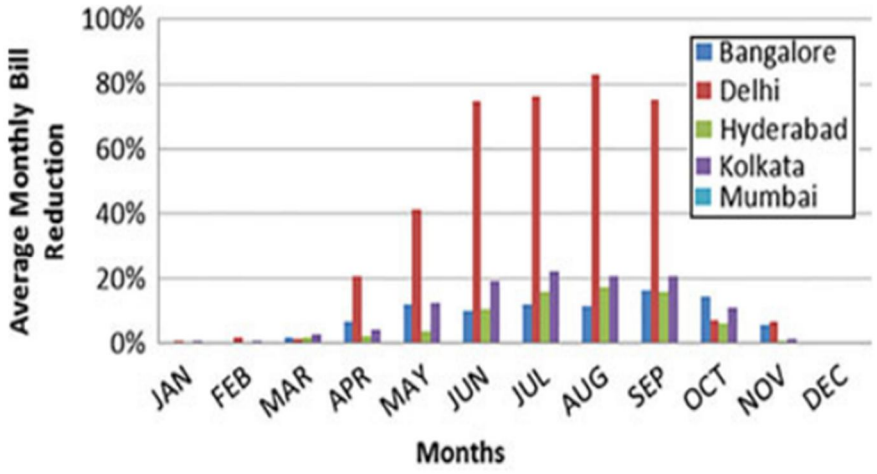


Figure 6. Average monthly water bill reductions with RWH.

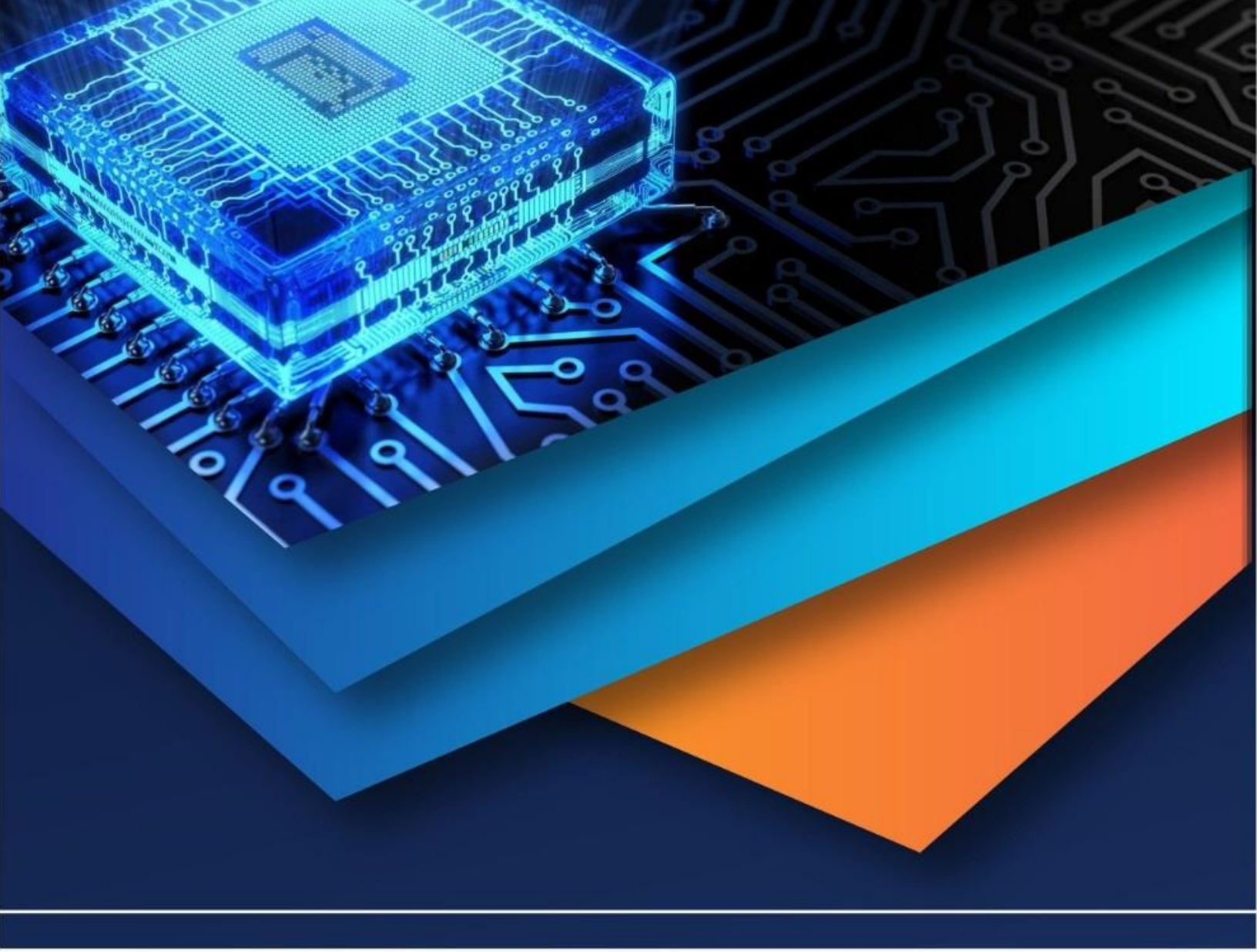
VI. CONCLUSION

The natural resources are under a significant deal of stress due to the expanding population and the increased demand for water. There will soon be a shortage of water worldwide due to the rapid depletion of underground reserves. This issue can be resolved if artificial methods are used. The necessity for and solution for rainwater harvesting are described in length in this study. In addition to helping with flood control, rainwater collection also helps with pollution control and continuous water supply. There is fast replenishing of ground water due to illegal boring is not being recharged by rainwater which results in the depletion of groundwater to alarming levels so the proposed design helps to retain the quality of precious rainwater and also to collect rainwater in buildings.

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