INSTALLATION OF RAIN WATER HARVESTING STRUCTURE

at

GOVERNMENT V. Y. T. PG. AUTONOMOUS COLLEGE, DURG DISTRICT - DURG, CHHATTISGARH

Constructed By

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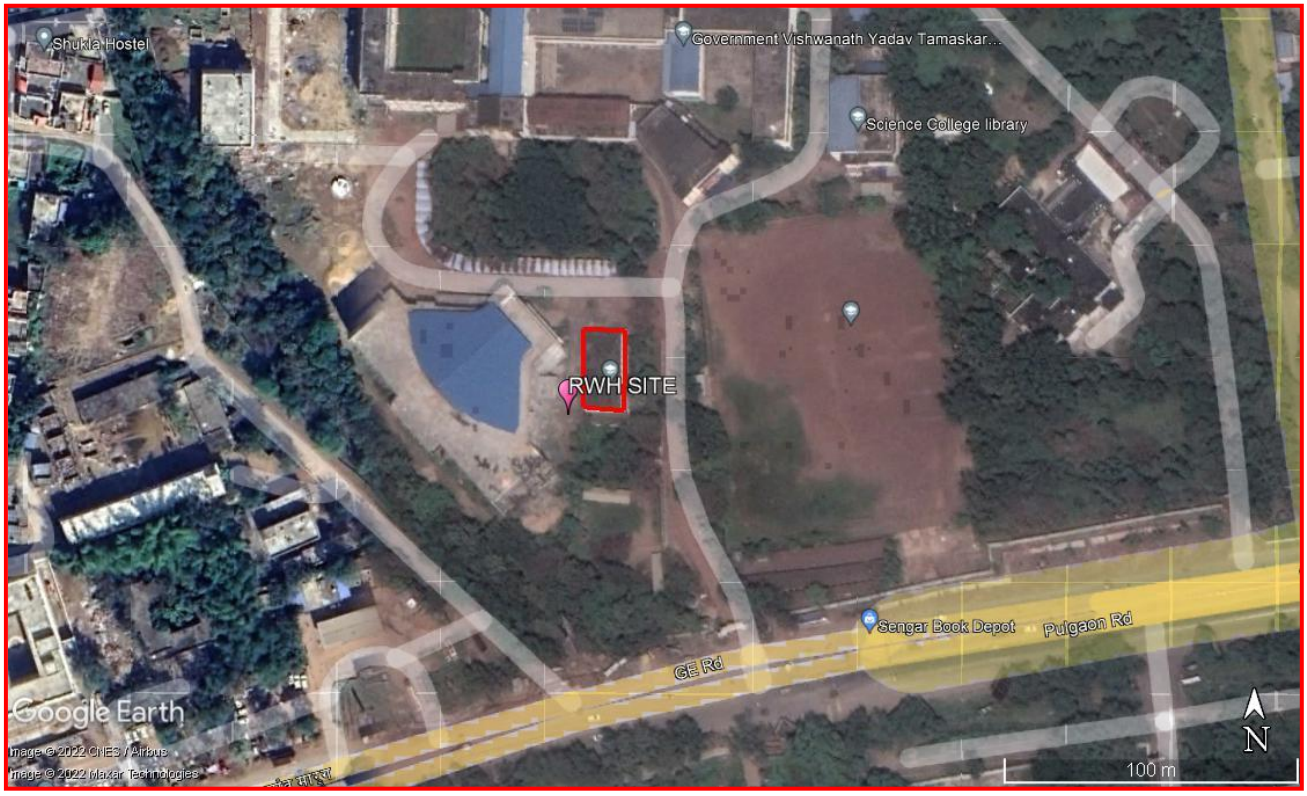
(Hydrogeologist)

Location of the Site for Rain Water Harvesting

Rain water harvesting Site is situated at Near Indoor Stadium at Government V Y T PG Autonomous College Durg, District – Durg (CG). Geographical location of the proposed school is 21°11'43.95" N, 81°17'48.65"E. Average elevation of the area 296 meters AMSL.

Building area – 15 m x 28 m = 420 sqm.



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About Rain Water Harvesting

Rain water harvesting is a technique of collection and storage of rainwater into natural reservoirs or tanks, or the infiltration of surface water into subsurface aquifers (before it is lost as surface runoff). Rain water harvesting is one of the most effective methods of water management and water conservation. It is the term used to indicate the collection and storage of rain water used for human, animals and plant needs. It involves collection and storage of rain water at surface or in sub-surface aquifer, before it is lost as surface run off. The augmented resource can be harvested in the time of need.

Artificial recharge to ground water is a process by which the ground water reservoir is augmented at a rate exceeding that under natural conditions of replenishment. The collected water is stored and pumped in a separate pipe distribution.

1. ADVANTAGES OF ARTIFICIAL RECHARGE (RWH STRUCTURE)

Advantages:

1. The cost of recharge to sub-surface reservoir is lower than surface reservoirs.

2. The aquifer serves as a distribution system also.

3. No land is wasted for storage purpose and no population displacement is involved.

4. Ground water is not directly exposed to evaporation and pollution.

5. Storing water under ground is environment friendly.

6. It increases the productivity of aquifer.

7. It reduces flood hazards.

8. Effects rise in ground water levels.

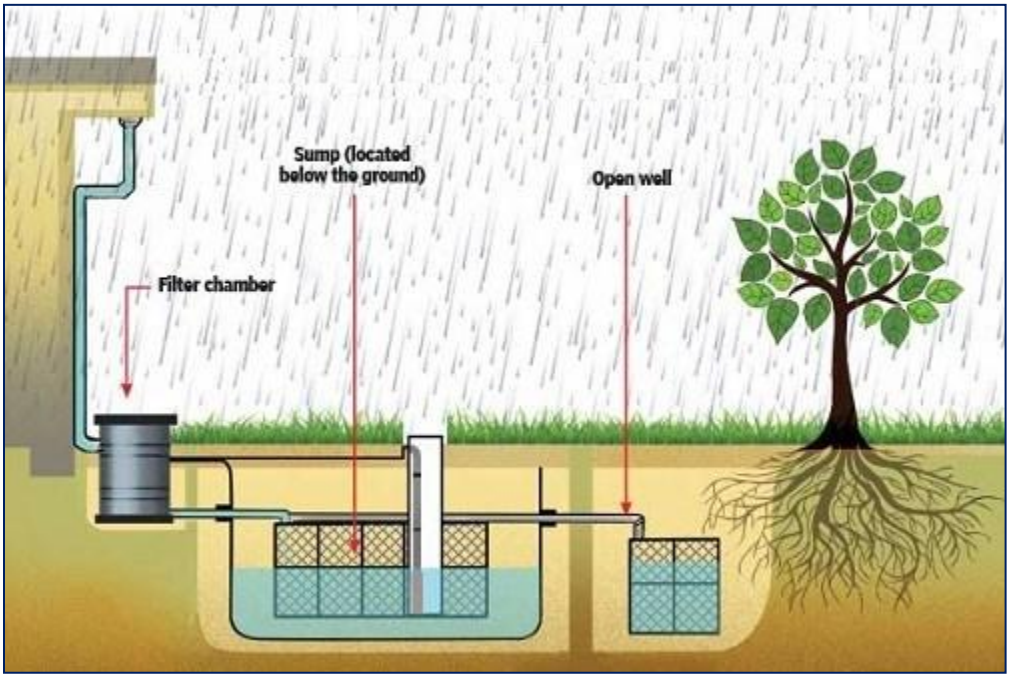
9. Mitigates effects of drought.

10. Reduces soil erosion.

2. Method of Rain Water Harvesting

Rainwater harvesting is the collection and storage of rainwater for reuse on-site, rather than allowing it to run off. These stored waters are used for various purposes such as gardening, irrigation etc. Various methods of rainwater harvesting are described in this section. Broadly there are two ways of harvesting rainwater -

1. **Surface runoff harvesting**
2. **Roof top rainwater harvesting**



1. Surface runoff harvesting

Surface water harvesting includes all systems that collect and conserve surface runoff after a rainstorm or in intermittent streams, rivers, or wetlands for storage in open ponds and reservoirs. This can provide water for direct household use (treatment is generally required), irrigation, livestock, and aquaculture. Storage can also be the goal of collecting surface water, whether through open reservoirs or direct infiltration to aquifers below ground. Storing water in an aquifer conserves water better as it prevents evaporation, unlike open reservoir systems. In urban area rainwater flows away as surface runoff. This runoff could be caught and used for recharging aquifers by adopting appropriate methods.

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Rainwater that is not captured directly, used by agriculture, or absorbed into the ground becomes surface water.

2. Rooftop rainwater harvesting

It is a system of catching rainwater where it falls. In rooftop harvesting, the roof becomes the catchments, and the rainwater is collected from the roof of the house/building. It can either be stored in a tank or diverted to artificial recharge system. This method is less expensive and very effective and if implemented properly helps in augmenting the groundwater level of the area.

Components of the Rainwater Harvesting:

The illustrative design of the basic components of roof top rainwater harvesting system is given in the typical schematic diagram.

The system mainly constitutes of following sub components:

i. Catchments
ii. Transportation
iii. First flush
iv. Filter

i. Catchments

The surface that receives rainfall directly is the catchment of rainwater harvesting system. It may be terrace, courtyard, or paved or unpaved open ground. The terrace may be flat RCC/stone roof or sloping roof. Therefore the catchment is the area, which actually contributes rainwater to the harvesting system.

ii. Transportation

Rainwater from rooftop should be carried through down take water pipes or drains to storage/harvesting system. Water from sloping roofs could be caught through gutters and down take pipe. At terraces, mouth of the each drain should have wire mesh to restrict floating material.

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iii. First Flush

First flush is a device used to flush off the water received in first shower. The first shower of rains needs to be flushed-off to avoid contaminating storable/rechargeable water by the probable contaminants of the atmosphere and the catchment roof. It will also help in cleaning of silt and other material deposited on roof during dry seasons Provisions of first rain separator should be made at outlet of each drainpipe.

iv. Filter

There is always some skepticism regarding Roof Top Rainwater Harvesting since doubts are raised that rainwater may contaminate groundwater. There is remote possibility of this fear coming true if proper filter mechanism is not adopted.

Secondly all care must be taken to see that underground sewer drains are not punctured and no leakage is taking place in close vicinity.

Gravel, sand and 'Netlon' mesh filter

Filters are used for treatment of water to effectively remove turbidity, colour and microorganisms. After first flushing of rainfall, water should pass through filters. A gravel, sand and 'Netlon' mesh filter is designed and placed on top of the storage tank. This filter is very important in keeping the rainwater in the storage tank clean. It removes silt, dust, leaves and other organic matter from entering the storage tank.

The filter media should be cleaned daily after every rainfall event. Clogged filters prevent rainwater from easily entering the storage tank and the filter may overflow. The sand or gravel media should be taken out and washed before it is replaced in the filter. Photograph of filter is shown below -

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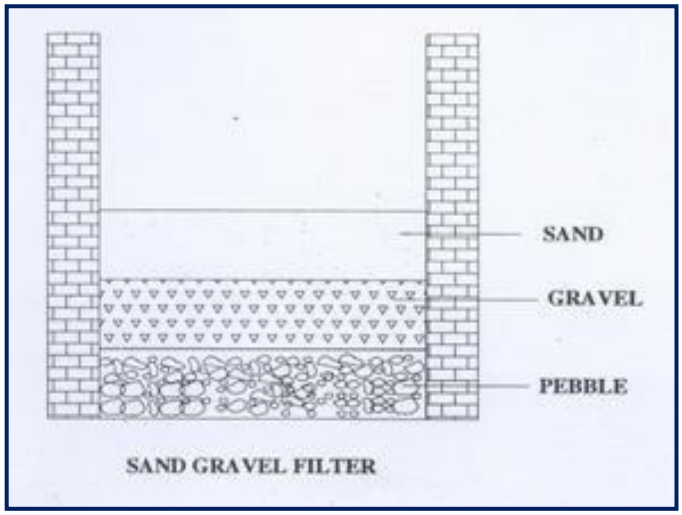
Gravel, sand and 'Netlon' mesh filter

Sand Gravel Filter

These are commonly used filters, constructed by brick masonry and filleted by pebbles, gravel, and sand as shown in the figure. Each layer should be separated by wire mesh. A typical figure of Sand Gravel Filter is shown in diagram.



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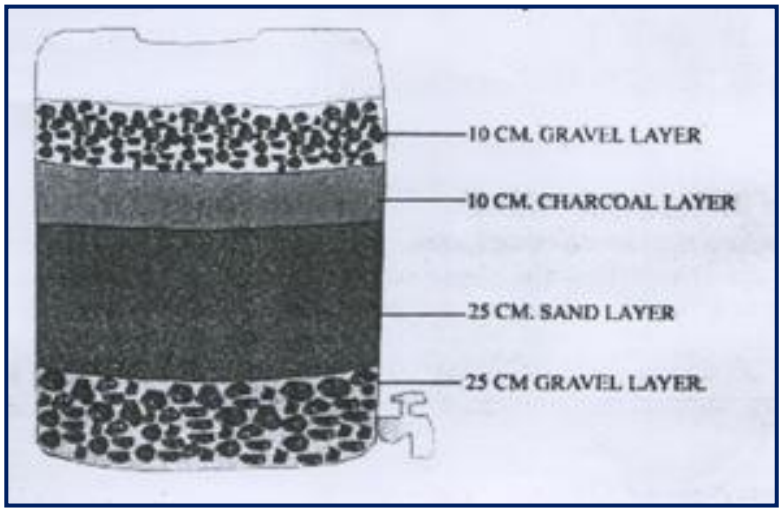
Charcoal Filter

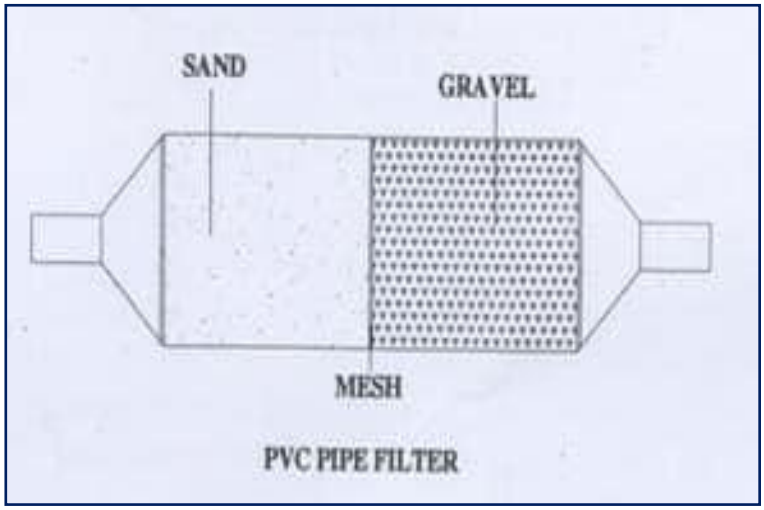
Charcoal filter can be made in-situ or in a drum. Pebbles, gravel, sand and charcoal as shown in the figure should fill the drum or chamber. Each layer should be separated by wire mesh. Thin layer of charcoal is used to absorb odor if any. A schematic diagram of Charcoal filter is indicated in diagram.



PVC –Pipe filter

This filter can be made by PVC pipe of 1 to 1.20 m length; Diameter of pipe depends on the area of roof. Six inches dia. pipe is enough for a 1500 Sq. Ft. roof and 8 inches dia. pipe should be used for roofs more than 1500 Sq. Ft. Pipe is divided into three compartments by wire mesh.

Each component should be filled with gravel and sand alternatively as shown in the figure. A layer of charcoal could also be inserted between two layers. Both ends of filter should have reduce of required size to connect inlet and outlet. This filter could be placed horizontally or vertically in the system. A schematic pipe filter is shown in diagram.



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Expected Volume of Rain Water to be Conserved at Site :

QUANTITY OF RECHARGE RAIN WATER FROM RWH STRUCTURE

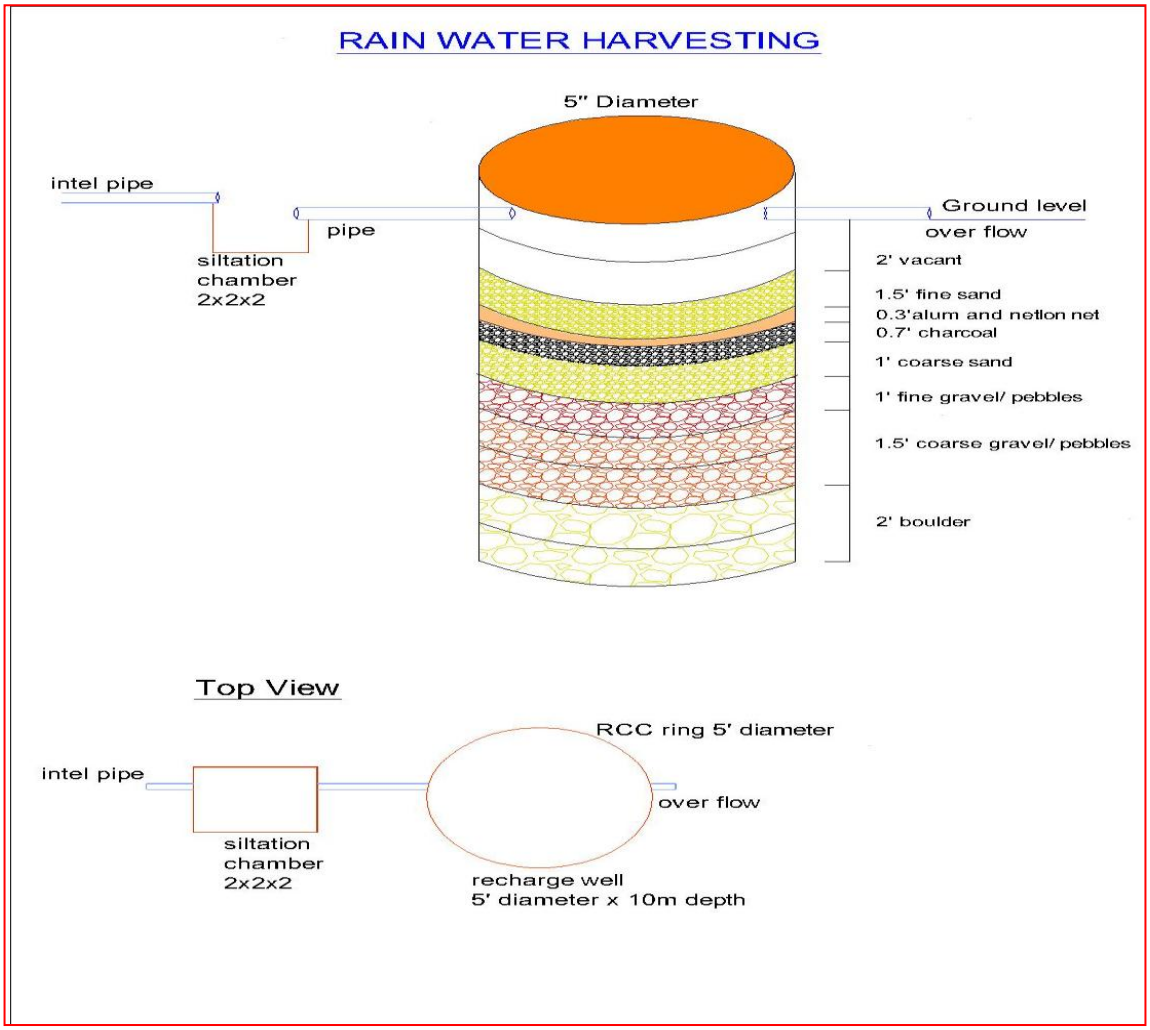
Average rainfall = 1178.90 mm

Runoff Available for Recharge:

Sl. No.	Land use type	Area (m^2)	Co-efficient of runoff	Rainfall (m)	Quantity of Rainwater (m^3)
1	Building/ sheds	420	0.80	1.11	**372.96**

From the above computation it has been estimated that a total of 372.96 m^3/year of rainfall runoff would be generated from various catchments that can be considered for harvesting/ recharge within the plant complex. Since the initial runoff from the various catchments would carry silt and other contaminations, it would be appropriate that the initial runoff generated need not be considered and would be diverted away from the harvesting/ recharge structures by means of provision of bypass arrangement. Hence, the effective volume of runoff available for harvesting/ recharge would be **90%** of the total annual runoff which works out to **335.65 m3/year**.

THE RAIN WATER HARVESTING STRUCTURE 5 FEET DIAMETERL:-



5 feet dia and 10 feet depth rain water harvesting recharge well

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POINTS TAKEN INTO CONSIDERATION FOR IMPLEMENTATION

OF

RECHARGE STRUCTURES

- All the storm water drains/ catchment area are to be cleaned prior to monsoon. Necessary repair/maintenance needs to be carried out wherever required.
- No contaminated water to be diverted into the recharge structures..
- Before the onset of the monsoon all the catchment area considered for recharge is to be cleaned. The recharge structures are to be in operation during the monsoon season only so as to avoid any contamination.
- Depth and location of the recharge wells may vary as per the prevailing site conditions. The exact depth of the recharge wells would be ensured during the construction phase.
- After the first rain the de-silting pit may be cleaned and subsequently on the onset of next monsoon.
- Depth of the retaining capacity of the recharge trenches (as per the enclosed designs) is below the existing inlet pipes.
- Necessary provision for not diverting the initial runoff to the recharge structures to avoid clogging of the recharge trench may be considered. The entire catchment area is to be maintained and necessary initiatives may be taken to keep the project area clean.
- The work may be undertaken by the specialized agencies so that the objective of rainwater harvesting is implemented in true spirit and due benefits are accrued.
- Prior to monsoon season the top most filter layer in the trench may be scrapped and replaced with the fresh & cleaned one, if necessary.
- On non-acceptance of water by the recharge well, the same may be cleaned using manual method/ compressor development.