

# Implementation Of Rainwater Harvesting in Rajgad Dnyanpeeth at Dhangawadi Village

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**Abstract**—Rainwater harvesting is an effective and sustainable method for conserving water and improving groundwater recharge. The present study focuses on the implementation of a rainwater harvesting system at Rajgad Dnyanpeeth. Increasing water demand and depletion of groundwater resources have created a need for efficient water management practices. Rainwater harvesting helps in collecting and storing rainwater for future use and also supports groundwater recharge through infiltration. The study aims to analyze the potential of rainwater harvesting by evaluating rainfall data, rooftop catchment area, runoff estimation, and storage capacity. The proposed system is designed to reduce water wastage and dependence on external water sources while ensuring better utilization of available rainfall. Proper collection and recharge of rainwater can improve groundwater levels and provide a reliable source of water for institutional use. The implementation of the rainwater harvesting system will contribute to sustainable water resource management and environmental conservation. It will also create awareness about the importance of water conservation and encourage the adoption of eco-friendly practices. The study highlights the practical benefits of rainwater harvesting in educational institutions and rural areas for long-term water sustainability.

**Index Terms**—Rainwater Harvesting, Groundwater Recharge, Water Conservation, Sustainable Water Management, Rooftop Catchment, Runoff Estimation, Water Resource Management.

## I. INTRODUCTION

One of the biggest challenges of the 21st century is to overcome the growing water shortage. Rainwater harvesting (RWH) has thus regained its importance as a valuable alternative or supplementary water resource, along with more conventional water supply technologies. Water shortages can be relieved if

rainwater harvesting is practiced more widely. People collect and store rainwater in buckets, tanks, ponds and wells. This is commonly referred to as rainwater harvesting and has been practiced for centuries. Rainwater can be used for multiple purposes ranging from irrigating crops to washing, cooking and drinking. Rainwater harvesting is a simple low-cost technique that requires minimum specific expertise or knowledge and offers many benefits. Rainwater harvesting is one of the alternative technologies for delivering drinking water. In fact, through the ages, this has been a traditional way of enhancing domestic water supply. Rainwater harvesting systems are viable options both for storing water for domestic use and for recharging groundwater aquifers. Nature has endowed India with huge water resources. We have perennial rivers like Ganga, Brahmaputra, Yamuna, Beas and other along with their tributaries and distributaries besides in North and Eastern India, we have spring and rain fed rivers in central and peninsular India.

The major rivers among these are Godavari, Krishna, Narmada, Tapti and Kaveri. These huge potential water resources notwithstanding, we are facing a water crisis across the country. Over the years, rising population, growing industrialization and expanding agriculture have pushed up the demand for water. Monsoon is still the main hope of our agriculture. Water conservation has become the need of the day. Rainwater harvesting is a way to capture the rainwater at the time of downpour, store that water above the ground or charge the underground water and use it later. This happens in open areas as well as in congested cities through the installation of required equipment. The collection and storage of rainwater from run-off areas such as roofs and other surfaces has

been practiced since ancient times in India. It is particularly useful where water supply is inadequate.

**A. Rainwater Harvesting System and Its Features**

Rainwater harvesting is an effective and sustainable technique used for collecting, storing, and utilizing rainwater at the place where it falls. The collected rainwater can either be stored in tanks for future use or used for groundwater recharge, depending on the site conditions and water requirements. This method helps in conserving water resources and reducing dependence on conventional water supply systems. Rainwater harvesting has become an important solution for addressing water scarcity, especially in urban and rural areas experiencing declining groundwater levels.

This study addresses this research gap by developing and evaluating a structurally reliable porous manhole cover capable of facilitating direct infiltration of rainwater into underground recharge systems.

**Components of Rainwater Harvesting System**

A rainwater harvesting system consists of various components used for collecting, conveying, filtering, storing, and recharging rainwater. The major components are:

- a) Catchment Area
- b) Mesh
- c) Gutters
- d) Conduits or Pipes
- e) First Flush Arrangement
- f) Filters
- g) Storage Facility
- h) Recharge Structure

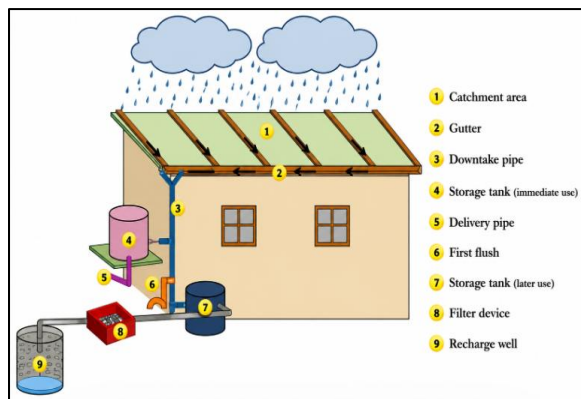


Fig 1 Element of typical rainwater harvesting (Reference: RWH in INDIA-An appraisal CPCBEVIS report)

**II. METHODOLOGY**

**A. Study Area**

The site is at Dhangawadi village Tal-Bhor, Dist-Pune. The site is lies a latitude of Bhor, Maharashtra, India is 18.143, and the longitude is 73.846 Bhor, Maharashtra, India is located at India country in the cities place category with the GPS co-ordinates of 18° 08' 34.8" N and 73° 50' 45.6" E. It is situated 42 km away from district headquarter Pune. It has an area of 4485.3944 sq.m. and shows map of RD's Campus.

As discuss the earlier the selection of introduction importance of rain water harvesting at Rajgad Dnyanpith Technical Campus, Pune.

We clearly came to know the all the advantages which we can draw out by implementing this small but highly efficient technique in the campus. Thus, to increase the potential, benefits of this system and draw maximum advantages from it, we need to have large roof top areas which will be going to act as catchment area more the catchment areas more will be surface runoff and thus more will be the amount of harvested water. Therefore, as much as possible we have included and considered all the measure buildings having large roof top areas. All the departments in buildings (Civil, Mechanical, Computer, E&TC). Given below a satellite pictures, showing majority of the buildings considered for rain water harvesting system at Rajgad Dnyanpith Technical Campus.

Table 1 Water consumption in Rajgad Dnyanpeeth Technical campus per person

Sr. No.	Description	Consumption (Liters/Day)
1	Drinking	3
2	Washing of laboratory utensils and machines	0.5
3	Flushing of water closets	5
4	For fire purpose	1.5
5	For planted trees (3700)	11,100
Total		11,110

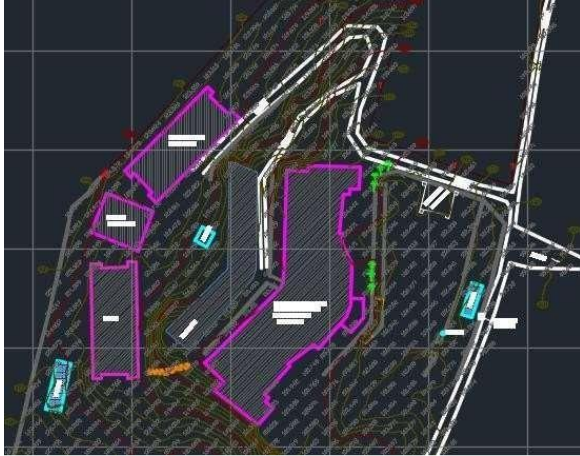


Fig 2 Layout of Rajgad Dnyanpith Technical Campus

**B. Ground water recharge through Bore well**

Average annual water resources in our river basins were estimated as 1,869 billion cubic meters (BCM) of which utilizable resources are of the order of 1,086 BCM. Out of this, 690 BCM is available as surface water and the remaining 396 BCM as ground water. The source of all this water is rain or snow. The huge ground water storage of 396 BCM is the result of rain and snowmelt water percolating through various layers of soil and rocks. However, the amount of percolation varies greatly from region to region and within the same region from place to place depending upon the amount and pattern of rainfall (i.e., number and duration of rainy days, rainfall amount and intensity), characteristics of soils and rocks (i.e., porosity, cracks and loose joints in rocks etc.), the nature of terrain (i.e., hills, plateaus, plains, valleys etc.) And other climatic factors like temperature and humidity. As a result, availability of water from sub-surface storages varies considerably from place to place.

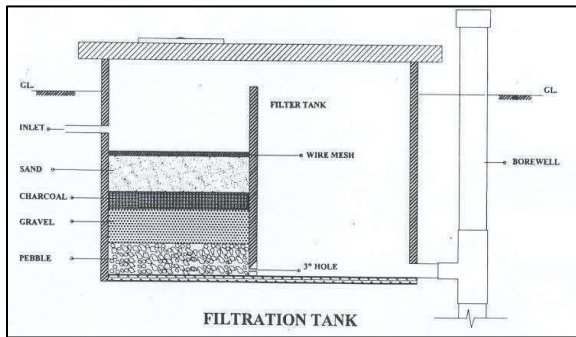


Fig 3: Schematic representation of ground water recharge through bore well  
(Reference: Rooftop rainwater harvesting recharge)

**III. OPTIMISTIC DETERMINATION OF SIZE AND TYPES OF TANKS**

**A. Volume of runoff per year.**

As we know the formula runoff discharge from

1. Volume of water receive (m<sup>3</sup>) = Area of catchment x Amount of rainfall
2. Total roof area of RD's campus was calculated = 2242.69 m<sup>2</sup>
3. Average annual rainfall at Pune = 997.67 mm/year = 0.997 m<sup>3</sup>/year
4. Total volume of surface runoff water supposed to be collected = 2242.69 x 0.83 = 1855.84 m<sup>3</sup>/year

Table 2 Showing rainfall and discharge of Rajgad Dnyanpeeth campus

Sr. No.	Month	Rainfall (mm)	Discharge (m <sup>3</sup> )
1	January	6.6	86.61
2	February	7.8	102.36
3	March	3	39.37
4	April	2.4	31.49
5	May	30.6	401.59
6	June	200.4	2630.04
7	July	296.4	3889.95
8	August	319.9	4198.36
9	September	111.5	1463.32
10	October	10.57	138.72
11	November	2.5	32.81
12	December	3	39.37
Total		997.67	13045.99

**B. Optimum dimension of the tank**

Total amount of water collected in one year = Size of tank = 2237.46 m<sup>3</sup>

- Taking height of tank = 4 m
- Area of the base 2237.46/4 = 559.36 m<sup>2</sup>
- We can take square base at each of side = 24 m
- So, tank will be dimension of 24 m x 24 m x 4 m. which is not economically
- Assume amount of water consume per month = 1100 x 0.1 x 30 = 3300 m<sup>3</sup>
- Amount of water collected during June, July and August = 818.35 m<sup>3</sup>
- Total amount of water to be stored = Size of tank = 10718.35 – 9900 = 818.35 m<sup>3</sup>
- Fixing the height of tank = 4 m.

- Area of base =  $818.35/4 = 204.58 \text{ m}^2$
- So as per suitability base can be taken square of size (14.3 X 14.3) m.

Hence, now tank will be of dimension (14.3 X 14.3 X 4) m which is economical and feasible. Thus, this is the optimum dimension of the tank, similarly the above procedure repeated to other all building inside the campus and rainwater harvesting capacities calculated.

#### IV. DETAIL ANALYSIS & DESIGNING OF RAINWATER HARVESTING SYSTEM

All the component of rain eater harvesting system is to be designed for building located inside the campus of RD. Hence to start off, a sample calculation was done on a main building, which will draw the steps which has to be followed by all other building for designing its system components. Hence given below the

complete design of all the components of rainwater harvesting of main building whose dimensions are mention in and tank size 14.3 m X 14.3 m X 4 m.

Finally cost of entire project play crucial role in any type of project. Before implementing the project, it is highly necessary for the engineering to check project, whether it is economical or not. Hence, the detail cost estimation should be done.

Tank floor shall be of 1:2:4 cement concrete. Inside of tank shall be finished with 12 mm

Implementation of Rainwater Harvesting in Rajgad Dnyanpeeth at Dhangawadi village. Cement plaster and floor shall be finished with 20 mm cement plaster with 1:3 mortar mixed with standard water proofing compound. Wall thickness is about 30 cm. Roof covering slabs shall be precast R.C.C. The length of the connecting pipe from latrine seat may be taken as 3 m. And suitable rates are assumed.

Table 3 Abstract Sheet

Sr. No.	Description of Items	Quantity	Unit	Rate (Rs.)	Per	Amount (Rs.)
1	Excavation for foundation in earth, soil of all types, sand, gravel and soft murum, including removing the excavated material up to a distance of 50 m (SSR No. 21.01, Ref. No. BDA1)	58.7	cu.m	143	cu.m	8,394.18
2	Providing and laying Cast in situ/Ready Mix cement concrete in M-20 of trap/granite/quartzite/gneiss metal for foundation (SSR No. 24.01, Ref. No. BDE1)	14.8	cu.m	4,257	cu.m	63,003.60
3	Providing first class burnt brick masonry with conventional/I.S. type bricks in cement mortar 1:6 (SSR No. 27.02, Ref. No. BDG2)	5.9	cu.m	5,267	cu.m	31,075.30
4	Providing internal cement plaster 12 mm thick in single coat in cement mortar 1:3 without neeru finish to concrete (SSR No. 32.05, Ref. No. BDL2B)	87.36	sq.m	219	sq.m	19,131.84
5	Providing internal cement plaster 12 mm thick in single coat in cement mortar 1:4 without neeru finish to concrete or brick surfaces, including scaffolding and curing complete (SSR No. 32.04, Ref. No. BDL2A)	57.4	sq.m	210	sq.m	12,054.00
6	Providing and laying Cast in situ/Ready Mix cement concrete in M20 for steps including centering, formwork, compacting, finishing and curing complete (SSR No. 24.06, Ref. No. BDE02)	35	sq.m	5,028	sq.m	1,75,980
Total						Rs. 3,09,638.92

Description	Amount (Rs.)
Cost for Degree Section = Cost of Water Tank + Pipe System + Rainy Filter	9,22,843.92
Cost for Diploma Section = Cost of Water Tank + Pipe System + Rainy Filter	9,22,843.92
Total Project Cost	Rs. 18,45,687.84

## V. CONCLUSION

The present study on the implementation of a rainwater harvesting system at Rajgad Dnyanpeeth demonstrates that rainwater harvesting is an effective and sustainable solution for water conservation and groundwater recharge. The study area receives sufficient annual rainfall of about 997.67 mm, which provides good potential for harvesting and storage of rainwater. The total rooftop catchment area of 2242.69 m<sup>2</sup> was found suitable for collecting a significant quantity of runoff water.

Based on the analysis, the estimated annual runoff that can be harvested is about 1855.84 m<sup>3</sup>. An economical and feasible storage tank of dimensions 14.3 m × 14.3 m × 4 m was designed to meet the campus water demand. The proposed system can effectively fulfill requirements such as drinking, washing, flushing, fire protection, and irrigation of planted trees within the campus.

The detailed design and cost estimation indicate that the project is technically feasible and economically practical. The total estimated project cost for both degree and diploma sections are approximately Rs. 18,45,687.84. The implementation of this system will reduce dependence on groundwater and external water sources, minimize runoff losses, and promote sustainable water management practices. Overall, the study highlights that rainwater harvesting can serve as an environmentally friendly and long-term solution for institutional campuses and rural areas facing water scarcity.

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