RAINWATER HARVESTING IN RURAL AREAS

Center for Water and Sanitation (CWAS)
CRDF, CEPT University

In partnership with
HDFC Bank's Parivartan Program

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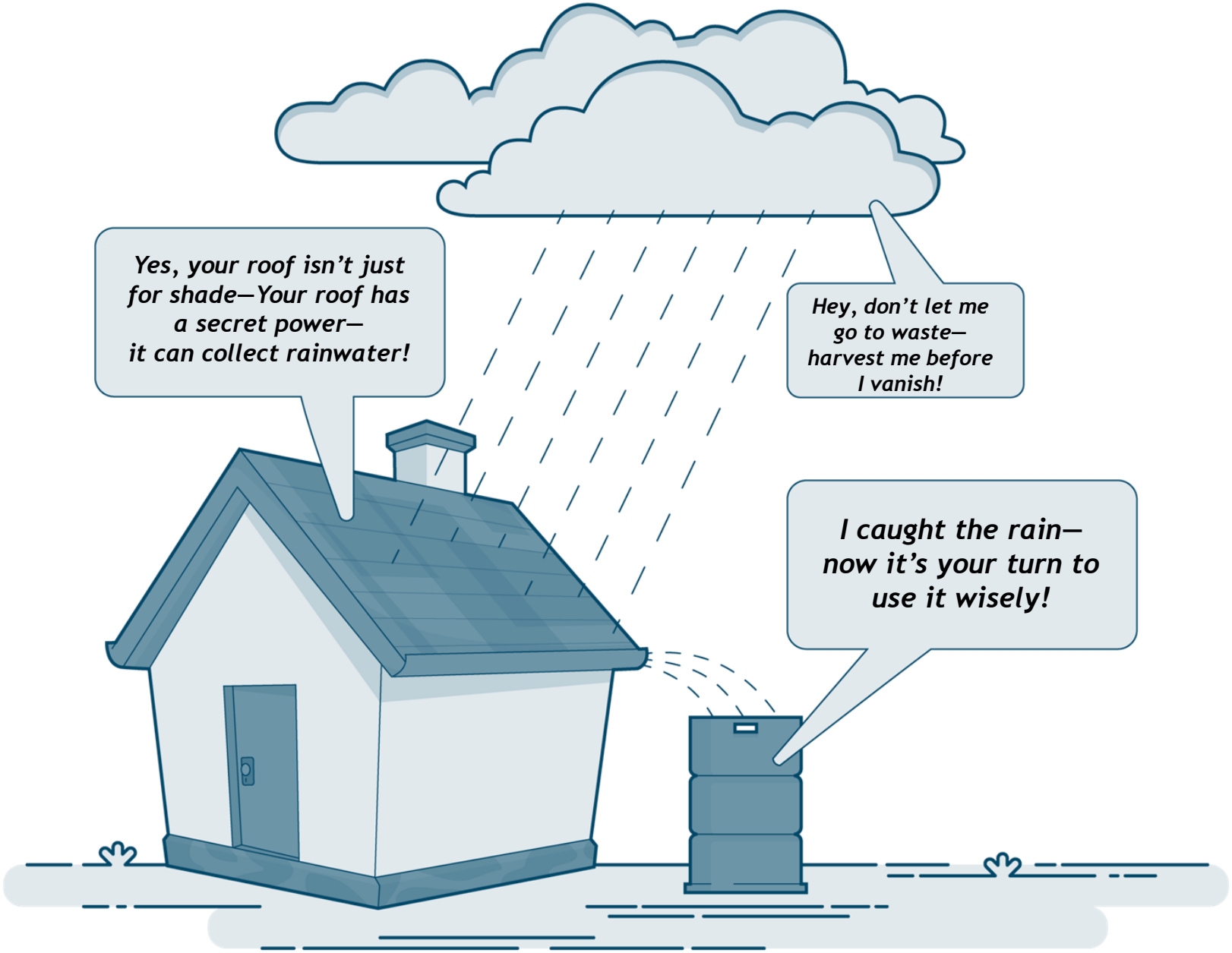

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Acknowledgement

Rural communities across India continue to face challenges in ensuring access to clean and safe drinking water. Many villages experience seasonal water shortages due to erratic rainfall, depleting groundwater levels, and inadequate water infrastructure. Additionally, improper waste management practices contribute to environmental degradation, further impacting water quality and public health. The Palghar District in Maharashtra, particularly the blocks of Mokhada, Dahanu, and Palghar, is no exception. Despite various interventions, these areas continue to grapple with water insecurity and waste management issues.

In this context, Center for Water and Sanitation (CWAS) of CRDF at CEPT University, in partnership with HDFC Bank's Parivartan Program, is supporting Palghar District in its journey towards water security. This initiative focuses on developing water security and waste management plans for 50 villages across the district, ensuring sustainable and community-led solutions. The project includes key activities such as rainwater harvesting, groundwater recharge, revival of defunct wells, mini piped water supply schemes, water quality surveillance, and decentralized waste treatment facilities. The project aims to provide a structured approach to water security planning by engaging with Gram Panchayats (GPs), local communities, and district officials to ensure that solutions are both technically sound and community-driven.

This "Rainwater Harvesting Booklet" has been developed as a practical guide for Gram Panchayat officials, local communities, and field teams working on improving water security in rural areas. The booklet outlines rainwater harvesting techniques that can be implemented at the household, community, and institutional levels. It provides step-by-step guidance on site selection, design considerations, implementation methods, and maintenance practices for rainwater harvesting systems. The objective of this resource is to help villages reduce their dependence on external water sources by harnessing rainwater for drinking and domestic use. The booklet can also be used for capacity-building activities to train various stakeholders for water conservation and water management.

The CWAS team acknowledges the valuable support of the Palghar District Administration, Gram Panchayat officials, and community members, whose active participation has helped shape this initiative, as well as the State Water and Sanitation Mission (SWSM) at the state level for sharing lessons beyond the Palghar district. We also express our gratitude to HDFC Bank's Parivartan Program for their partnership, commitment and support for improving rural water security. This effort aims to create a model that can be scaled up across other rural areas, ensuring sustainable and long-term water security for communities.

Meera Mehta and Dinesh Mehta
CWAS, CRDF, CEPT University
Ahmedabad, India

Secure the future drop by drop,
embrace rainwater harvesting.

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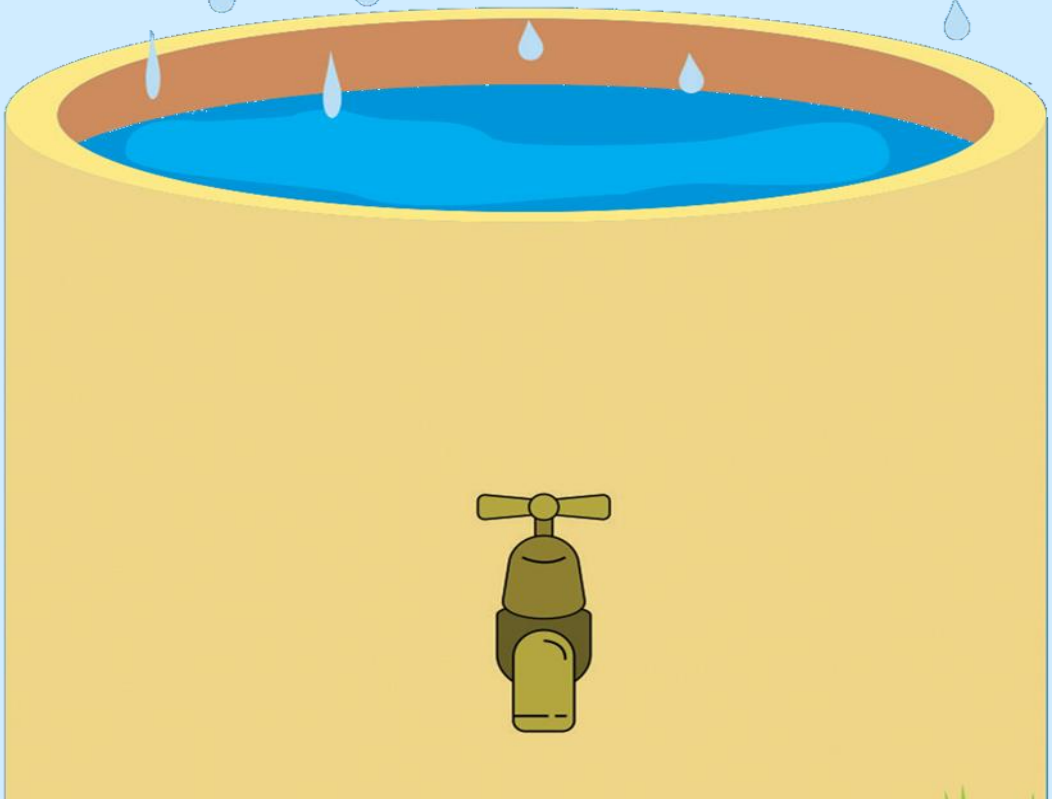
Catch The Rain

Where it falls, When it falls



How

WHERE?

Household level

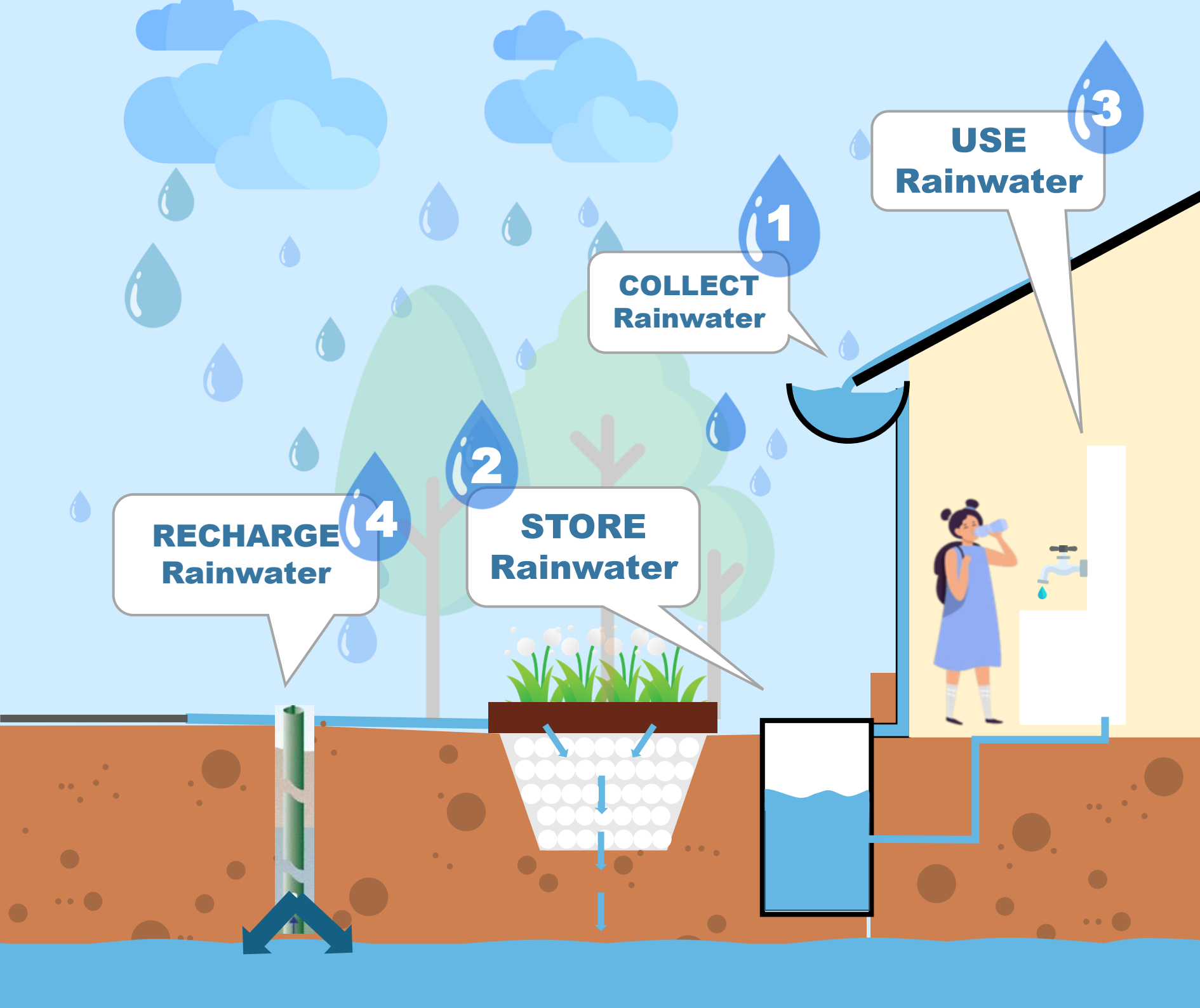
Institutional Buildings

Aanganwadi / Schools

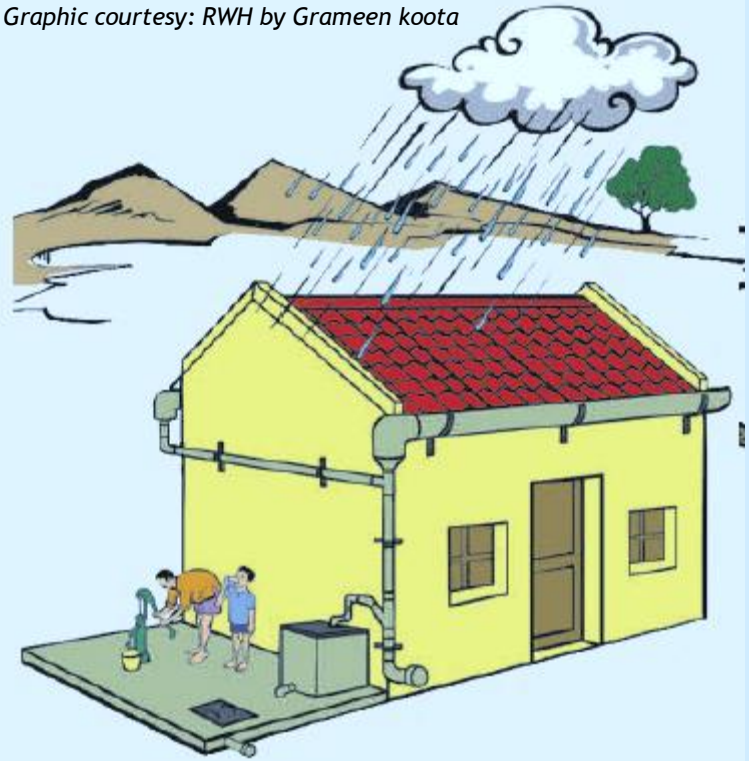
Farms

Hospital Buildings

Be the
"WATER CHAMPION"
of your city!


1
COLLECT
Rainwater
2
STORE
Rainwater
3
USE
Rainwater
4
RECHARGE
Rainwater

Graphic courtesy: RWH by Grameen koota



What is Rainwater Harvesting?

- Rainwater harvesting is a technology used for collecting and storing rainwater from rooftops, the land surface or rock catchments using simple techniques such as jars and pots as well as more complex techniques such as underground check dams.
- Rainwater tanks are above (surface) or under-ground (sub-surface) storage facilities.
- It is a simple low-cost technique that requires minimum specific expertise or knowledge.
- Local people can be easily trained to build rainwater harvesting systems thereby reducing the cost and encouraging participation and ownership.

Heavy rains and flood situation in rainy season

No water availability during summer months

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Need for Rainwater harvesting in Rural Areas

- Many rural areas often face seasonal water scarcity, which affects the daily lives of communities and limits their access to safe and reliable water sources due to various reasons.
- This not only impacts health and hygiene but also affects livelihoods, agriculture, and overall well-being.

Rainfall Pattern

Rural areas receive most of their rainfall during the monsoon but often face dry and drought-like conditions for the rest of the year.

Water scarcity

Many small areas face seasonal water shortages during dry months, often relying on tanker water supply to meet daily needs.

Cost effective

Compared to deep borewells or tanker water, rainwater harvesting provides a more sustainable and cost-effective solution for drinking water needs.

Jal Jeevan Mission

Water supply infrastructure and household tap connections to be provided under JJM. But ensuring source sustainability is the need of the hour.

Rainwater harvesting at household level and in schools/ institutional buildings

Rainwater harvesting at farmlands and for recharging wells

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Where it can be installed ?

Rainwater harvesting structures can be installed at anywhere including;

Household level

Institutional Buildings

Aanganwadi / Schools

Farms

Hospital Buildings

Slums

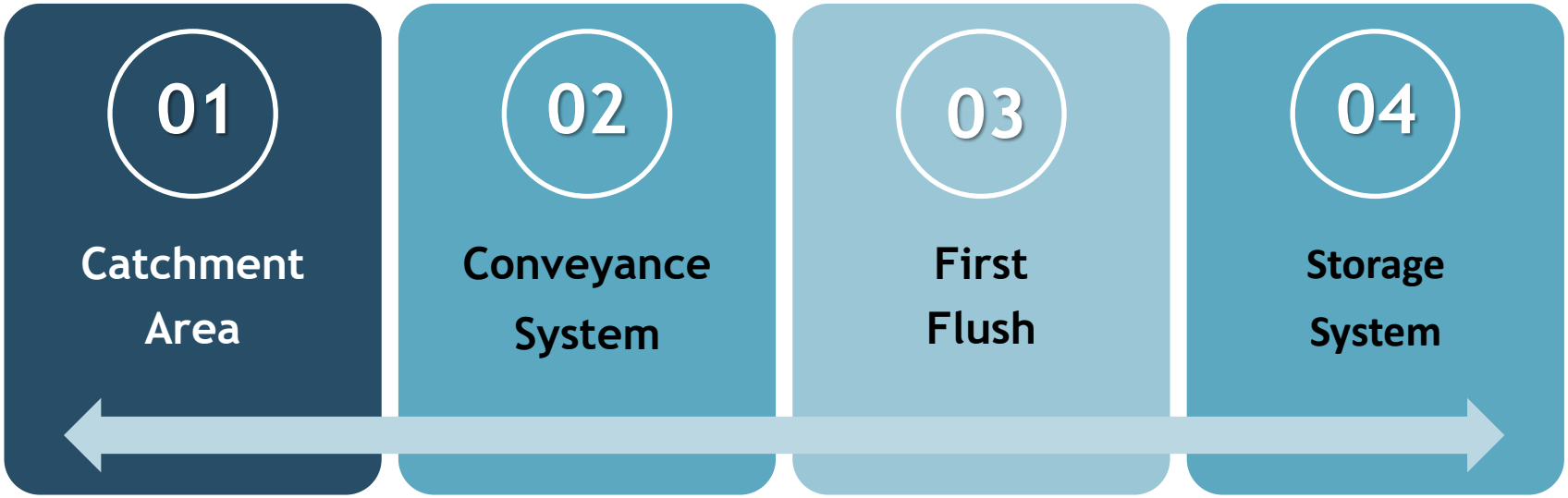
The potential for rainwater harvesting is huge…!!


Catchment area
Conveyance system
Storage tank
First flush/ Filter
Area can be utilized for Rain water harvesting system at common areas

Components of Roof Rainwater Harvesting?

In a domestic roof top rainwater harvesting system, rainwater from the roof is collected in a storage vessel or tank for use during periods of scarcity. Such systems are usually designed to support the drinking and cooking needs of the family.

It comprises of following components:



Types of roofs where Rain-Water Harvesting can be done?

Corrugated sheets roof

Galvanized iron Roof

RCC Roof

Types of open areas where Rain-Water Harvesting can be done?

Community common areas

Gardens and green areas

Water bunds in Farmlands

1. Catchment area

The surface that receives rainfall directly is the catchment of rainwater harvesting system. It may be terrace/roof and open ground/farmlands.

- Rainwater harvesting can be done on any type of rooftop - corrugated sheets, GI sheets, tiled or RCC roof.
- Cleaning of the roof before and during monsoon is mandatory; avoid storing materials on it.
- Roof surfaces should be smooth, easy to clean & durable to prevent material shedding into the water
- Rainwater harvesting can also be done on open grounds in villages or farmlands.
- *Calculate **potential rainwater harvest** using formula:*
  Roof area (sq.m) × Rainfall (mm) × 0.8 (runoff coefficient)

Bamboo betel trunk Gutter

PVC Material gutter

Plain galvanized iron gutter

Metal Material gutter

2. Conveyance system

To efficiently capture and transport rainwater, a well-designed conveyance system is essential. Channels along the edge of a sloping roof collect and direct rainwater to the storage tank. Gutters can be semi-circular or rectangular.

Gutter Installation for Rainwater Collection:

01 Gutter should be placed on the edge of the roof on both sides from where monsoon water will fall.

02 Use locally available materials like bamboo, PVC pipes, or metal sheet.

03 Use semi-circular or rectangular gutters for optimal flow.

04 Install with slight slope (1:100) toward collection point and ensure joints are properly sealed.

05 Ensure gutters are well-supported to prevent sagging or falling when filled with water.

06 Design the system for easy access and maintenance with removable sections for regular cleaning.

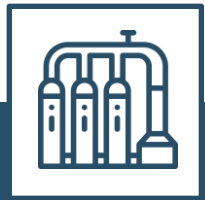
Rainwater filters or first flush filters to divert initial rains

3. Rainwater filters/ First flush

- First flush is a device used to flush off the water received in first rains.
- A first flush system diverts initial dirty runoff, and a filter unit removes debris and contaminants before water enters the storage tank. It will also help in cleaning of silt and other material deposited on roof during dry seasons.

Install the first flush device before the main storage tank and it should be easily accessible for regular maintenance.

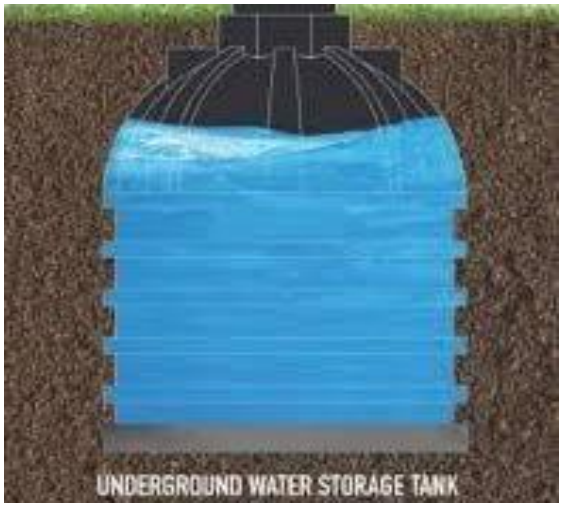
Install a basic PVC pipe diverter with a removable end cap to divert the first 3-4 rains before directing water or use rainwater filter to remove initial rainwater before storage.



Remove and clean rainwater filters before and after each rains to remove dirt, leaves and other debries. This will prevent clogging and ensure proper operations.

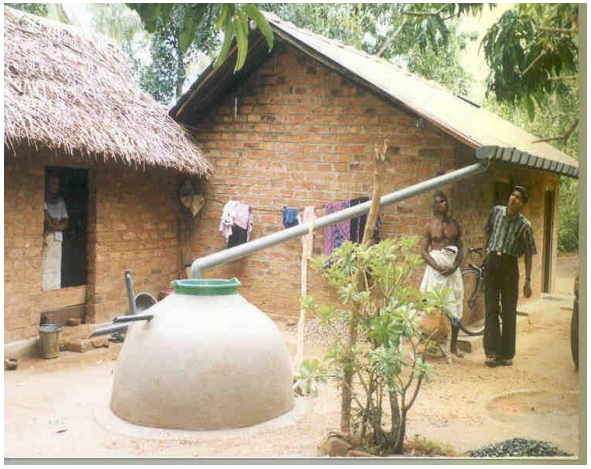
Ferrocement tank- underground

Brick masonary underground tank



PVC or plastic tank- underground

Concrete tank



Earthen or Ferrocement tank

Plastic tanks

4. Storage tank

- The rainwater storage tank collects all the filtered rainwater and keeps it for future use.
- The storage tank is made above the ground or underground.

Storage tanks come in various shapes and can be positioned either underground or above ground.

1. Construct storage tank- either underground or over the ground.
2. Storage tanks should have a tight-fitting roof to block sunlight and an inspection chamber.
3. Fill only with rainwater and install a handpump or tap for access.
4. Storage tanks vary in shape (cylindrical, rectangular, or square) and material (RCC, ferrocement, brick masonry, plastic, or galvanized iron).

Design of storage tank

The storage tank volume depends on several factors:

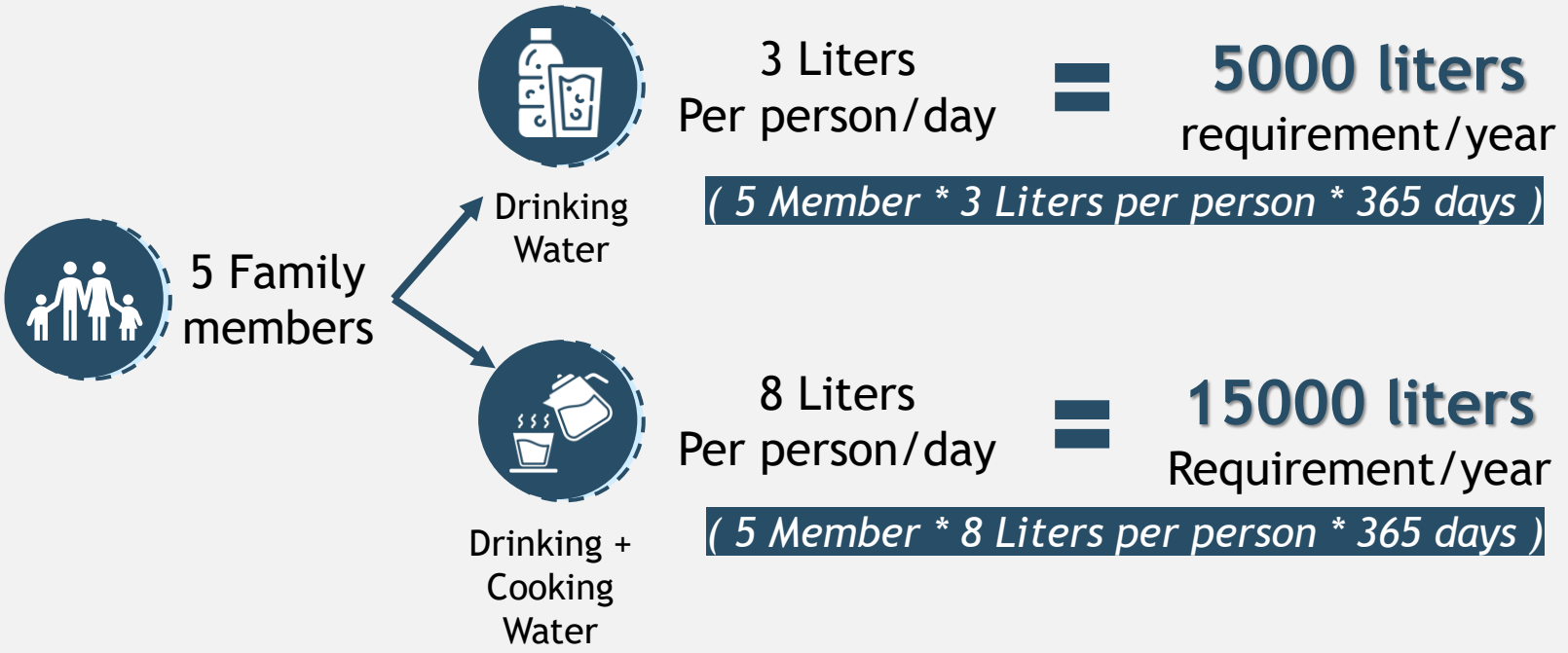
- Household Size
- Water Requirements
- Rainfall Availability
- Catchment Area
- Dry Spell Duration
- Tank Placement

X

=

Design of storage tank

Annual drinking and cooking water requirement for a family of five:



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Graphic courtesy: RWH by Grameen koota

Let's calculate rainwater harvesting potential for our villages !

Let's assume XY village:

- Annual average rainfall of XY village = 2500 mm/year
- Total households in XY village = 300 households
- Average roof area of households = 80 sq mt
- Runoff co-efficient = 0.8

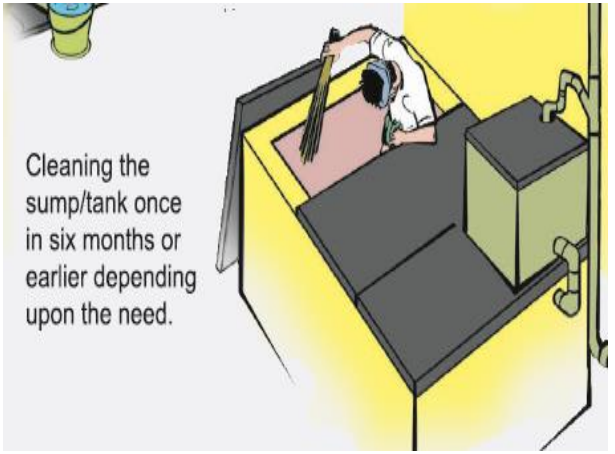
Total rainwater harvesting potential per households = 2500 * 80 * 0.8 = 1,60,000 liters/year

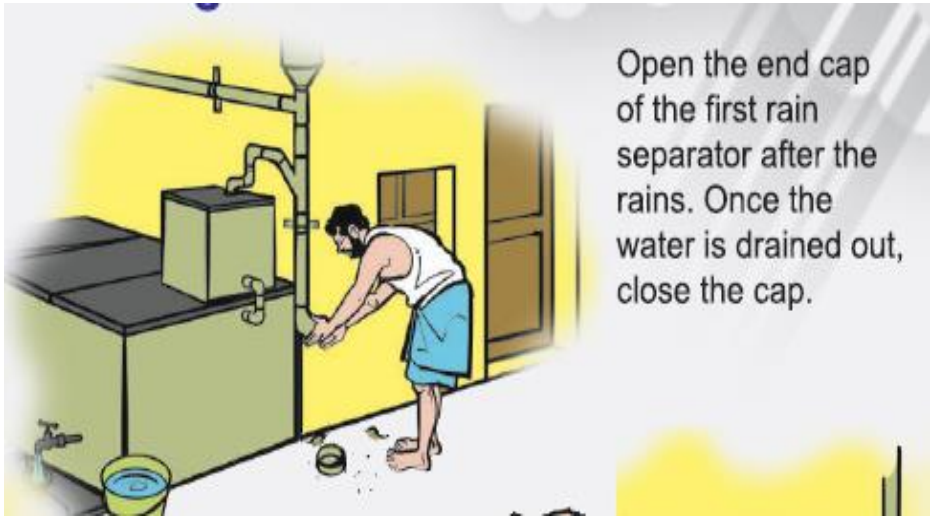
Total rainwater harvesting potential for entire XY village = 1,60,000 * 300 = 48,000,000 liters /year

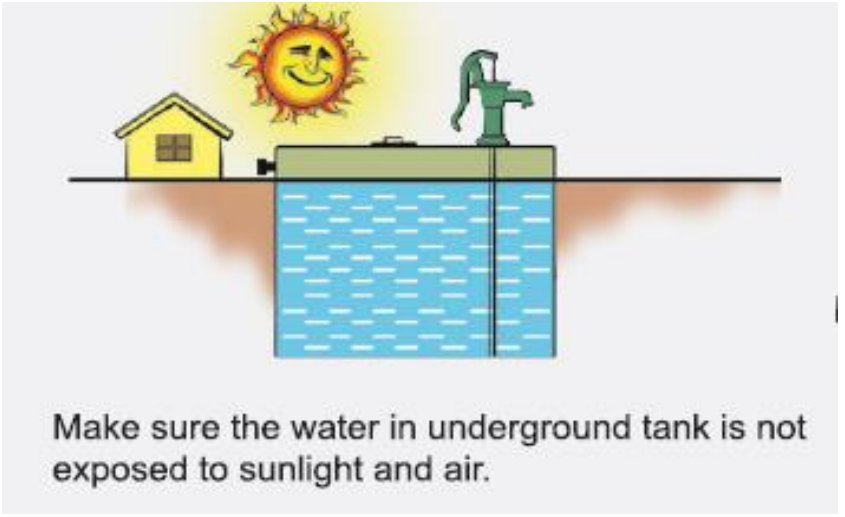
Let's assume,

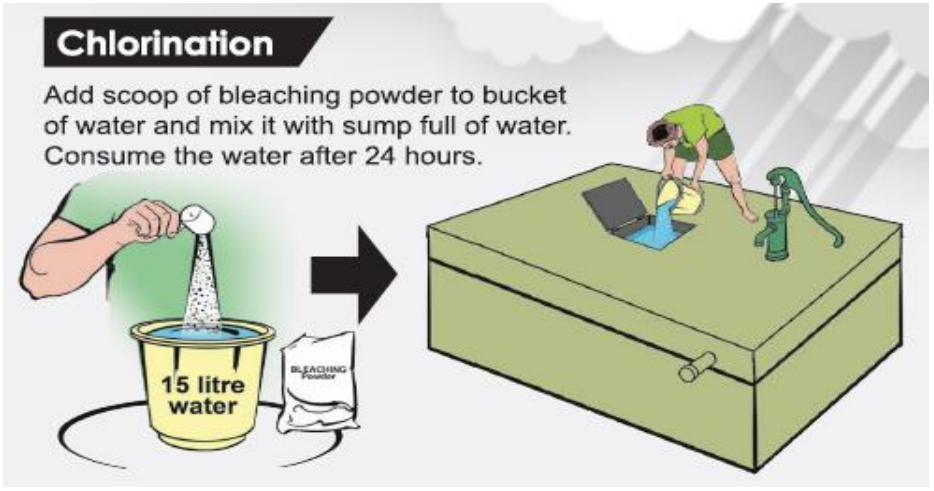
Annual water requirement for one household = 70 lpcd* 5 persons *365 days = 1,28,000 liters/year

> ***So, the harvested rainwater could meet 100% of a household's annual water needs.***









Methods to disinfect water

Graphic courtesy: RWH by Grameen koota

Dos and Don’ts of RWH

Proper rainwater harvesting ensures efficient water conservation and long-term sustainability.

Here are some key dos and don’ts to follow for effective implementation.

Do’s of RWH

- Divert initial rainwater before collecting it in the storage tank
- Clean the roof before monsoon and make sure there are no leaves on the roof
- Make sure the pipes are well maintained
- Ensure the rainwater tank has a tight lid to block sunlight and prevent algae growth.

Don’ts of RWH

- Do not store rainwater in tanks without proper covers.
- Don’t use paints, chemicals or hazardous substances on the roof
- Don’t leave the first rain separator valve open! Remember to close it

Graphic courtesy: Handbook on RWH by Uganda govt.

1. Marking the site

2. Excavating to required depth

3. Construction of tank foundation

4. Wall construction using brick masonry

5. Use of spirit level to ensure proper levelling

6. Plastering and waterproofing

6. Construction of concrete cover

7. Fixing piping from household roof

8. Installing handpump to use water

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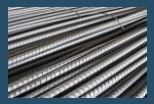
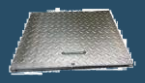
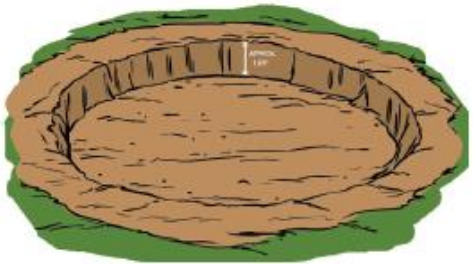
Tentative costing and material requirement (1/3)

For brick masonry tank (5000 liters)

	Items	Quantity
	Bricks	1600
	Sand	1.2 brass
	Rubble Stone	1 brass
	Cement	12 bags
	Steel (HYSD- 10mm)	80 kgs
	Water proofing solution	2 liters
	MS inspection chamber	1 number
	Handpump	1 number
	Rain filter	1 number
	PVC pipe – 75mm	15 meter

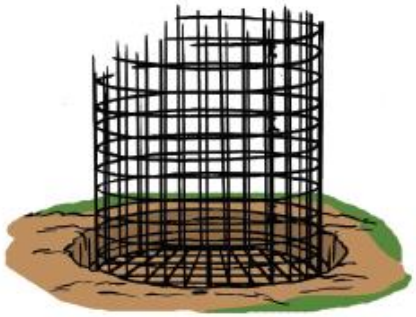
Graphic courtesy: Handbook on RWH by Uganda govt.

1. Marking the site



2. Excavating to required depth

3. Preparing floor mesh



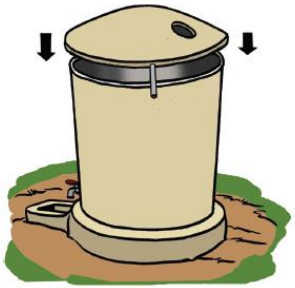
4. Erecting wall mesh and concreting foundation

5. Brickwork and installing washout pipes

6. Wrapping chicken wire mesh

6. Wrapping sack/mat

7. Plastering work and water proofing



8. Constructing tank cover//roof

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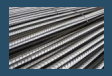
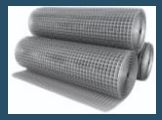
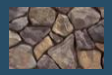
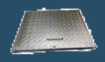
Tentative costing and material requirement (2/3)

For Ferrocement tank (10000 liters)

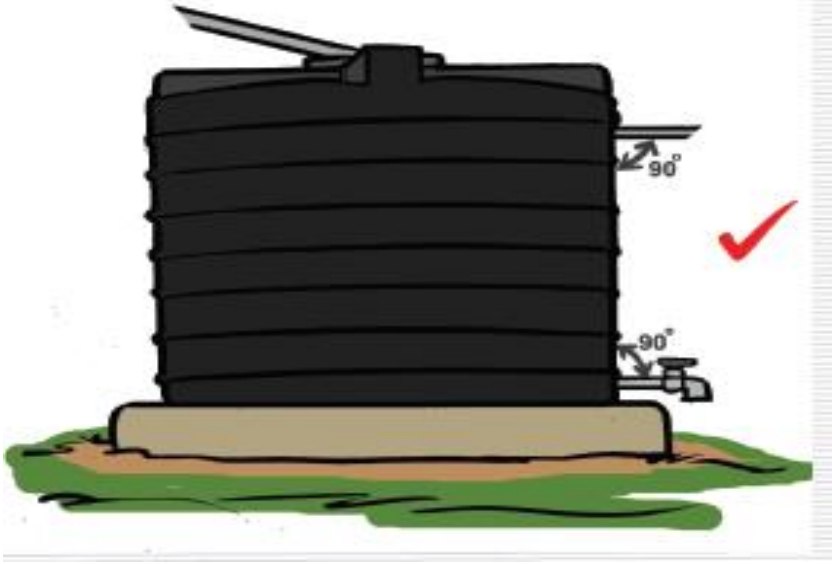
	Items	Quantity
	Cement	36 bags
	Steel (HYSD- 10mm)	230 kgs
	Weld mesh 5’0” x 5’0” 2”x2” opening- 12 gauge	1 roll
	Chicken Mesh 4'0" x 50'0" and 3'0" x 50’0”- 24 gauge	8 roll
	Sand for plaster	3.5 brass
	Metal no1 and 2 mix	1.2 brass
	Binding wire	7 kg
	Add mixture	4 liters
	Rubble Stone	4.5 brass
	MS inspection chamber	1 number
	Handpump	1 number
	Rain filter	1 number
	PVC pipe – 75mm	15 meter

Graphic courtesy: Handbook on RWH by Uganda govt.

1. Constructing raised platform using bricks and cement

2. Plastering the base platform and curing

3. Erecting Plastic tank on raised platform



4. Installing rainwater pipes from household roof

Tentative costing and material requirement (3/3)

For prefabricated plastic tank (5000 liters)- Food grade*

	Items	Quantity
	Food grain plastic tank	5000 liters
	MS inspection chamber	1 number
	Handpump	1 number
	Rain filter	1 number
	PVC pipe – 75mm	15 meter

**3 layer anti algae, anti bacteriological category tanks*

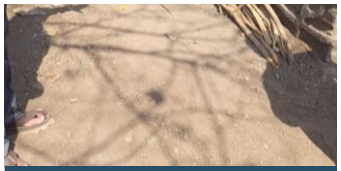
Case study 1- Household RWH - Mahagoan GP - Palghar block

Before Intervention

- Households relied on separate sources for drinking and other uses with women and children walking 200m daily to fetch water.
- Water collection took nearly an hour due to long waiting times.
- Summer shortages after February worsened the struggle.
- The lack of a reliable water source made daily life more challenging.

After Intervention

- A 5000L underground tank stores filtered rainwater for year-round drinking water.
- Provides 3L per person daily, meeting basic needs.
- Ensures water availability during shortages.
- Saves time and effort previously spent on water collection.



Space available in premises

Beneficiary Contribution

Digging work completion

Brick Masonry Underground Storage Tank

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Case study 2- School RWH - Z P School Palghar block

Before Intervention

- The school relied on a distant borewell with limited use, forcing students to carry water or use a community handpump.
- Water scarcity after January worsened access, and a single 500L tank was insufficient for daily needs.
- The unused handwashing facility affected hygiene practices.
- Meetings and school functions faced challenges due to water unavailability.

After Intervention

- A 35,000 RCC tank ensures year-round water supply for 33 students, providing 3L per student daily for drinking, cooking, and hygiene.
- Crucial during water-scarce periods, ensuring continuous availability when needed most.
- Intervention has reduced the efforts of teachers and students in managing water while improving hygiene practices.
- RCC tank serves as a platform for school functions and meetings.

Dilapidated structure removed

Z P School Wandivali

Underground Rectangular RCC Tank of capacity 30800 L.

Rainwater is a boon for nature,
Together we have to structure – save it !!

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Catch The Rain

Where it falls, When it falls

Booklet Reference - Jal Jeevan Mission, India

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