



HARVEST
CONSERVE
RECYCLE

W A T E R



ADHAAR

ADHAAR

ADHAAR

ADHAAR

WATER SAFE, SUSTAINABLE AND FOR ALL
DESIGN COMPETITION

ADHAAR

Team Member
Smriti Mehrotra
Shruti Mehrotra

SYMBIOSIS INSTITUTE OF DESIGN

Introduction

Innovate to Harvest, Conserve and Recycle water.

Introduction

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Research

Solutions-

1) Rainwater harvesting

2) Recycling water

Campaign

Design Brief : To design a potable Rainwater Harvesting System per five families in Mhada lower middle class colony (Pune).

Current situation per 1 family

water demand : 250ltrs per day

water supply : Depends on the seasons (water supply goes down during the summer months)

Water usage per family

25% washing clothes

5% washing dishes

16% Faucets

15% Drinking water

27% Flushing toilets

5% Bath



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Pune has a tropical wet and dry climate

Pune experiences three distinct seasons: summer, monsoon and winter.

The city receives an annual rainfall of 550 mm, mainly between June and September.

July is the wettest month of the year.

Rainfall data from (1992-2002)



Average rainfall for the past 30 years

Months	Avg rain
June	116.1mm
July	187.2mm
August	122.3mm
September	120.1mm

Total rainfall in a year is 550mm.



Site Plan (Mahdha colony, pune)

Introduction

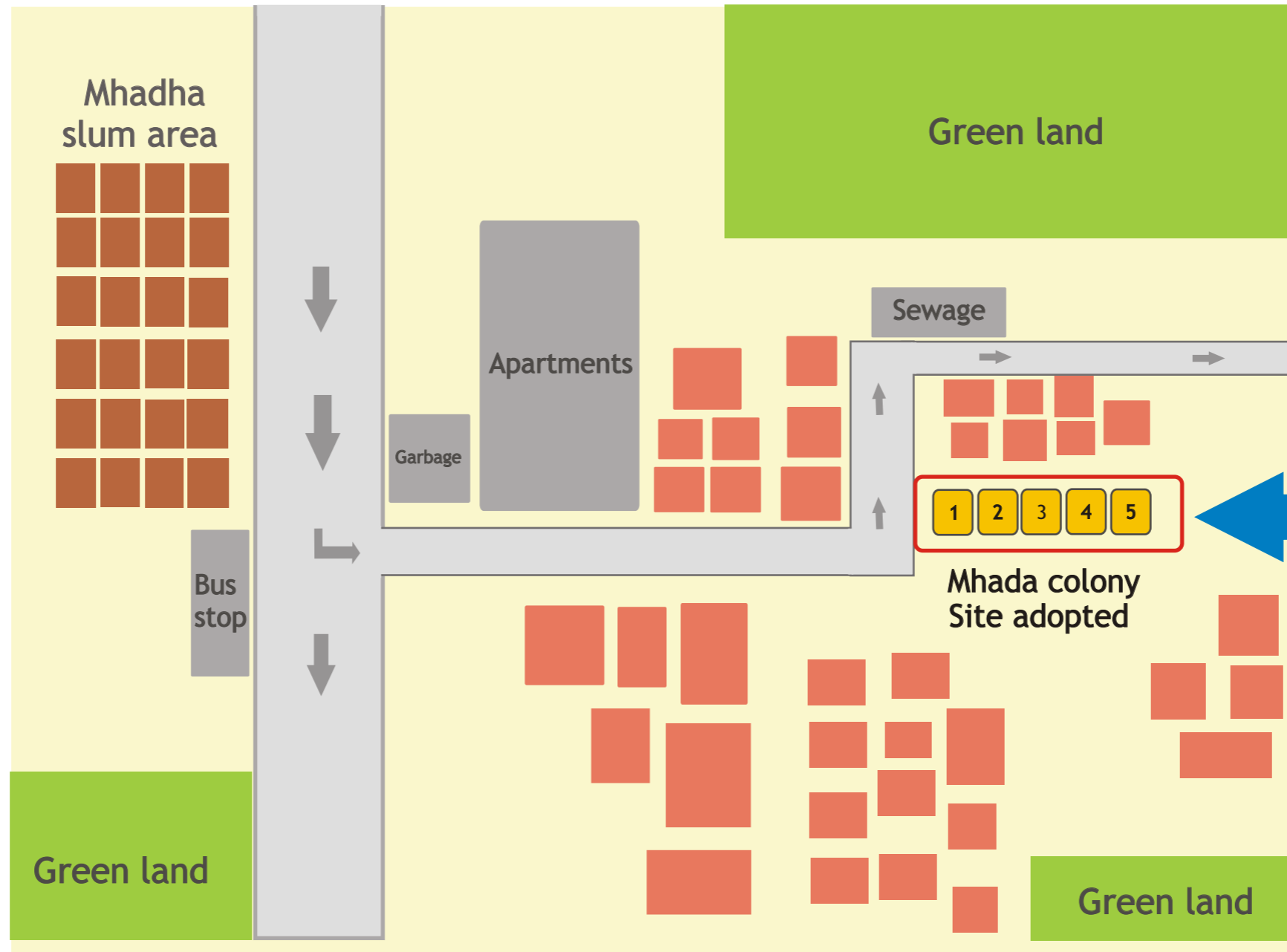
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- 2) Recycling water

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The five houses adopted



Site for rain water harvesting system to be build

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Research (existing systems)

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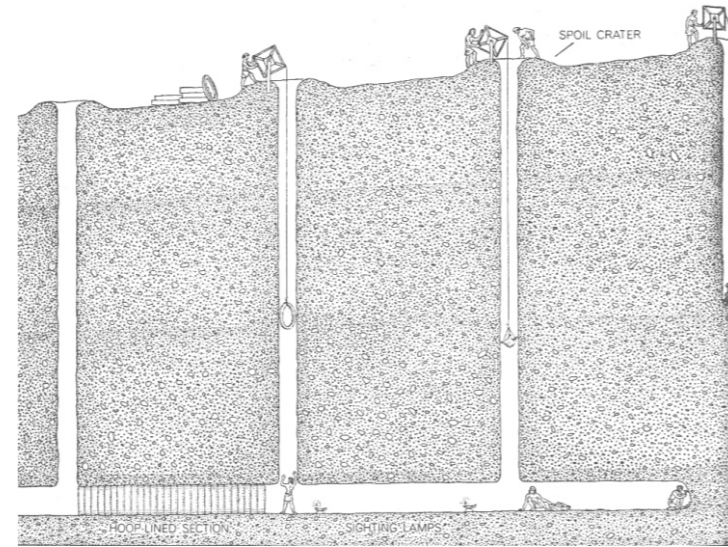
Solution for

1) Rainwater harvesting

2) Recycling water

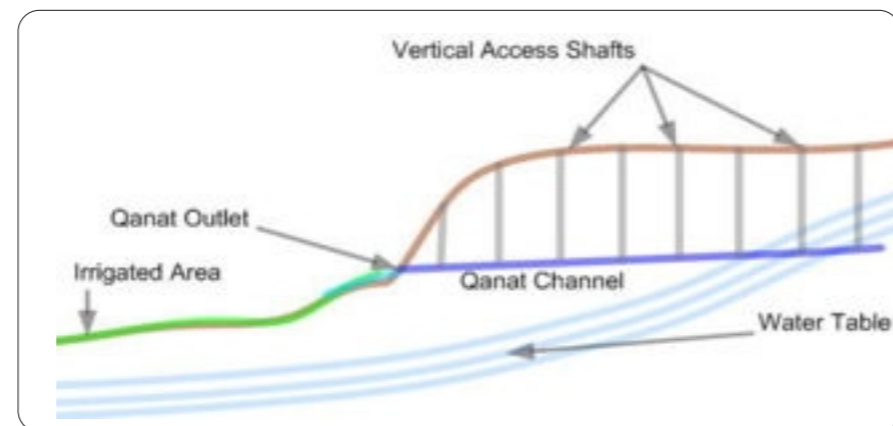
Campaign

Qanat system



In the early part of the first millennium B.C., Persians started constructing elaborate tunnel systems called **qanats** for extracting groundwater in the dry mountain basins of present-day Iran. Qanat tunnels were hand-dug

Along the length of a qanat, which can be several kilometers, vertical shafts were sunk at intervals of 20 to 30 meters to remove excavated material and to provide ventilation and access for repairs. The main qanat tunnel sloped gently down from mountains to an outlet at a village. From there, canals would distribute water to fields for irrigation.



Baoli system

Besides tanks, sultans and their nobles built and maintained many baolis (stepwells). These baolis were secular structures from which everyone could draw water. The water of this beautiful rock-hewn baoli is used for washing and bathing.



Research (existing systems)

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Grow rainwater harvesting system

Grow is essentially a tiered garden of low growing, flowering, native plants, whose roots can perform the same cleansing function as a reed bed.

Grey water (used wash water collected from showers, sinks and baths) is treated as it flows through the plants' root system. The treated water is safe to use for toilet flushing, cleansing public areas, and watering the garden.

Larger populations can be served by plumbing more than one GROW unit in parallel.

This system will require no extra land or valuable basement space

The system would also be able to provide thermal insulation to buildings in winter and act as a cooling layer in summer.

Other Advantages of the Green Roof Water Recycling System:

Visual amenity

Absorption of dust particles

Low maintenance

Lower water bills

Larger populations can be served by plumbing more than one



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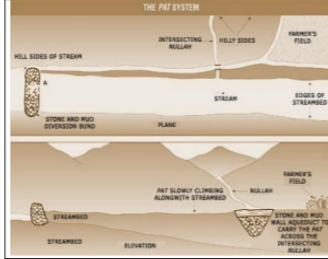

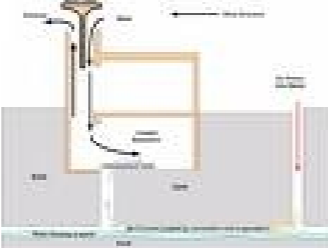

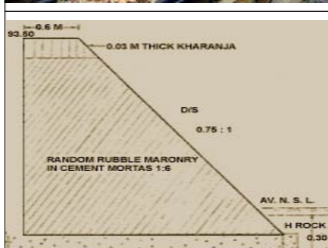

Solution for

1) Rainwater harvesting

2) Recycling water

Campaign



Existing systems		Functionality	Efficiency	Maintenance	Social acceptance	Cost effectiveness
	<p>Pats Divert water from hill streams into irrigation channels. made by piling up stones and then lining them with teak leaves and mud to make them leakproof.</p>	1				
		2		●		●
		3	●		●	
		4		●		
		5				
	<p>Baoli Secular structures Provide and store water and as a back-up during droughts Has a vertical shaft from which water is drawn</p>	1				
		2	●	●		
		3		●		●
		4			●	
		5				
	<p>Qanat Drains rely on gravity, destination lower than the source, which is typically an upland aquifer. constructed as a series of well-like vertical shafts</p>	1			●	
		2				
		3		●	●	●
		4	●			
		5				
	<p>Grow Tiered garden of low growing, flowering, native plants, whose roots can perform the same cleansing function as a reed bed.</p>	1				
		2				
		3		●	●	
		4	●	●		●
		5				
	<p>Rapat percolation tank, with a bund to impound rainwater flowing through a watershed and a waste weir to dispose of the surplus flow.</p>	1				
		2		●	●	
		3	●			●
		4		●		
		5				
	<p>Kuis /beris 10-12 m deep pits dug near tanks to collect the seepage. pit is usually made narrow. This prevents the collected water from evaporating.</p>	1				
		2	●			
		3		●	●	
		4			●	●
		5				

System "ADHAAR"

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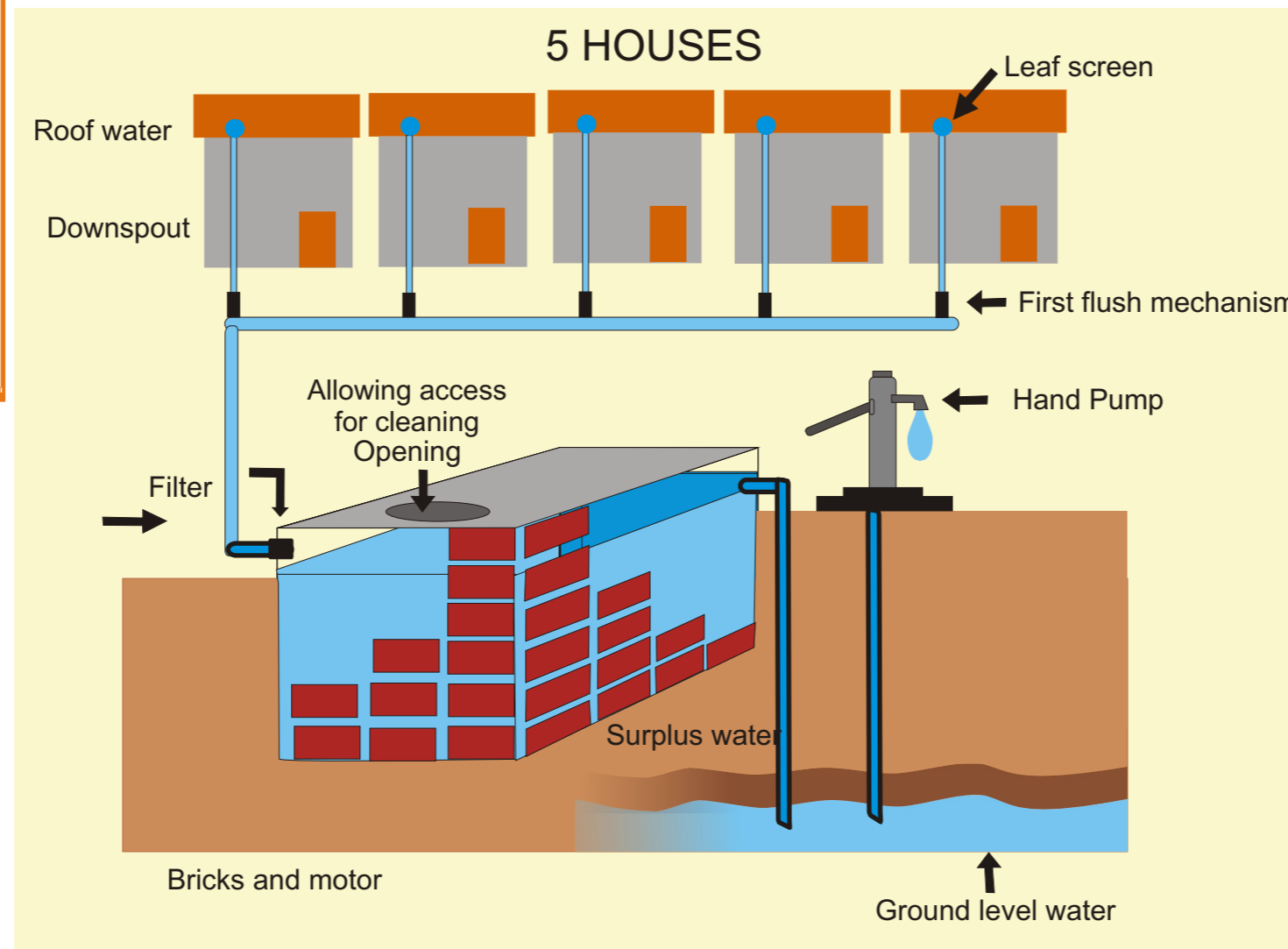
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Solution for

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Working of the system

In this system **five families** come together and build this system of an underground water storage tank, building of the system on their own helps them to understand the materials required for conserving water, **investment of the money** and finally the **sense of owning the system** will bring responsibility to maintain it.

The system works as follows-

The **total cost** will be born by the **5 families**

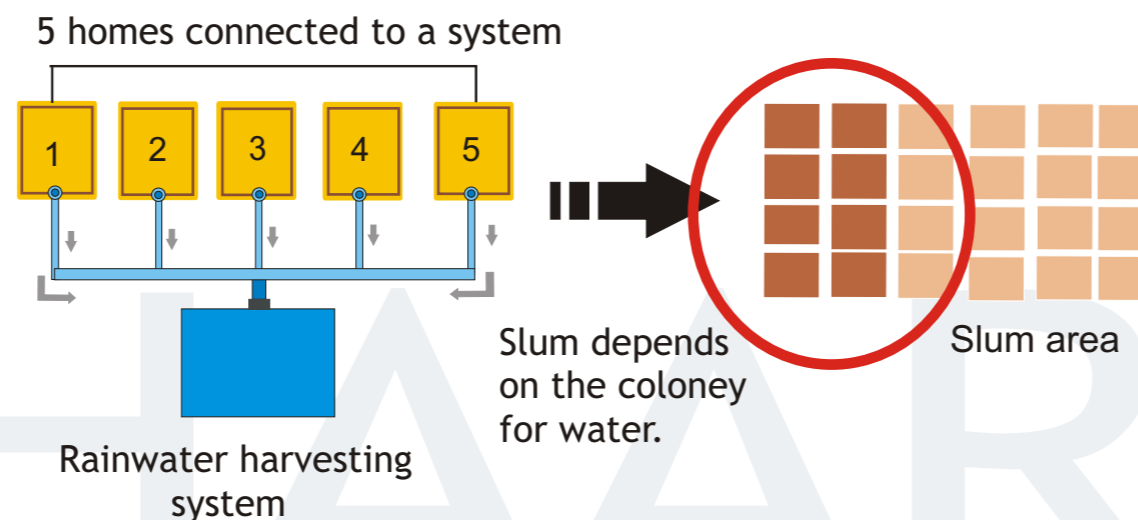
Tank is being constructed by the families so **no labour charges**
Made of easily available bricks and motor

If the tank overflows during **heavy rainfall** the water flows down to **underground natural water** so as to **increase the water level**

hand pump will be connected to the underground water.

Every month **each family** will be **responsible for routine maintenance**, including cleaning of the filter, leak repair and monitoring of water quality by adding alum

Benefits of the system shared by both the adopted houses and the slum area



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Harvesting

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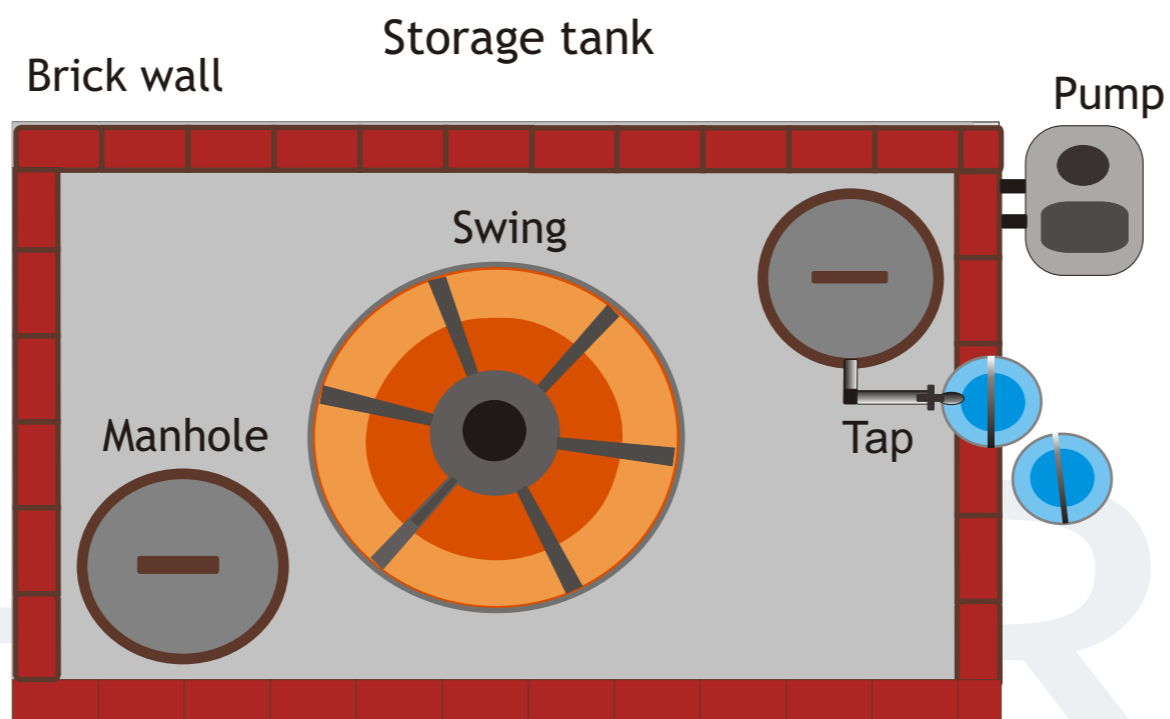
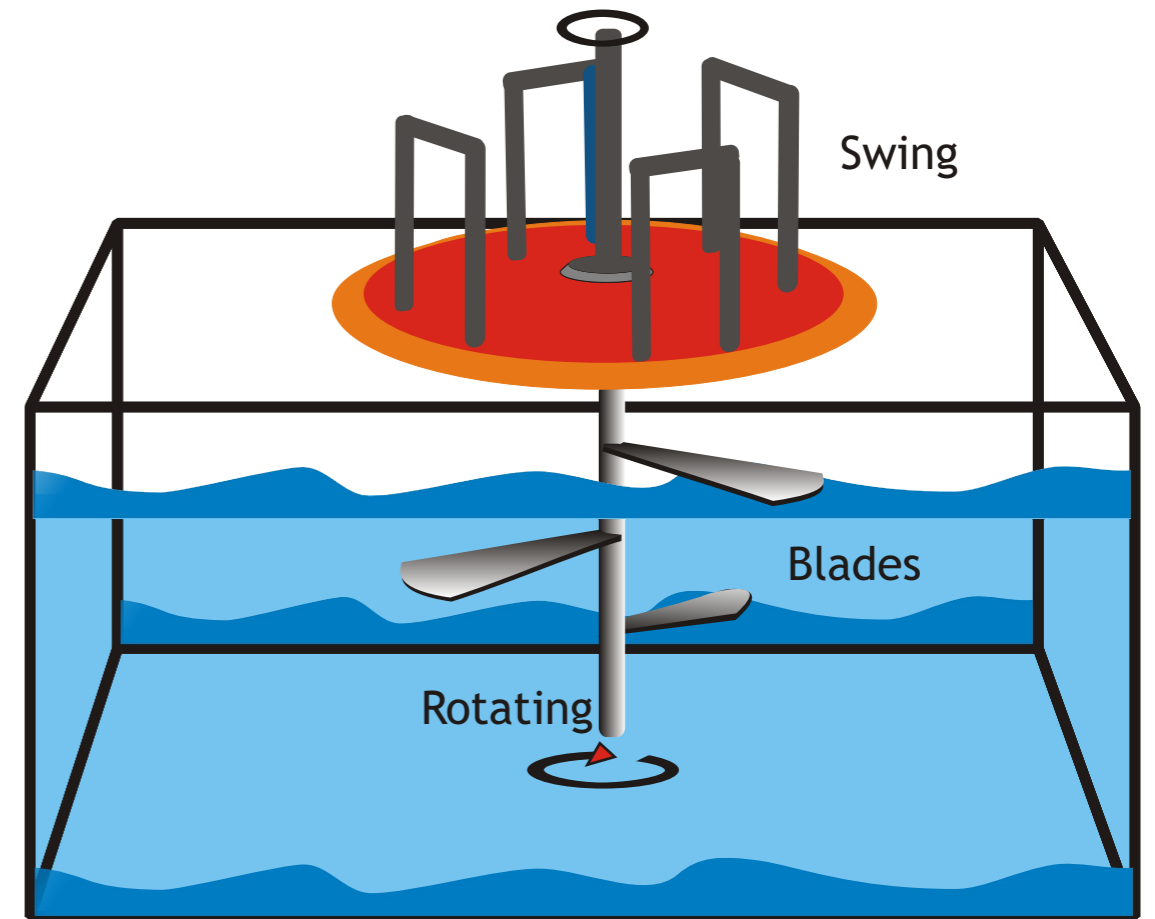
2) Recycling water

Campaign

Catchment area for each house 300sqft
Water collected from each house 3000litres
Total water collected from 5 teraces 15000litres

Dimension of the water storage tank
6ft by 8ft by 10ft
Holds upto 10,000 litres of rainwater
Remaining water flows down to the ground water
Increasing the water table level

A slight buffering using 1 tablespoon of alum to 100 gallons of water in the tank will neutralize the acid, if desired.
Also, the concrete storage tank will impart a slight alkalinity to the Water.
The tanks will be properly ventilated in order to let fresh air pass through.
Manhole- access for cleaning having inverted funnel hose without draining the tank annually



Keeping in consideration the population of enthusiastic children who do not have any playing ground in this area we have installed a mary go round. Which also eliminates the chances of contamination as the water wont be allowed to remain stagnant for long time. The blades attached to the swing will keep the water in motion.

Vanrai Bicycle water pump

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A lot of electricity is wasted while pumping the water from the tank to individuals homes. To cater to this problem we thought of implementing a pump mounted on a cycle which works mechanically when the cycle is peddled. This mechanically operated bicycle pump will be used to lift water from the tank and send it to individuals homes.

Innovator
CV pathak

Need
Difficultly to lift water unless an electric pump was used, which was not always available

Innovation
The bicycle is taken to the water source, parked and peddled on its stand to operate the pump.



bicycle frame



Suction hose



Centrifugal pump



Hose pipe inserted in water



removing air bubbles from the pipe



Air bubbles removed



Peddling to operate the pump



Water being lifted from the water source



Water running through the delivery pipe.

Harvesting

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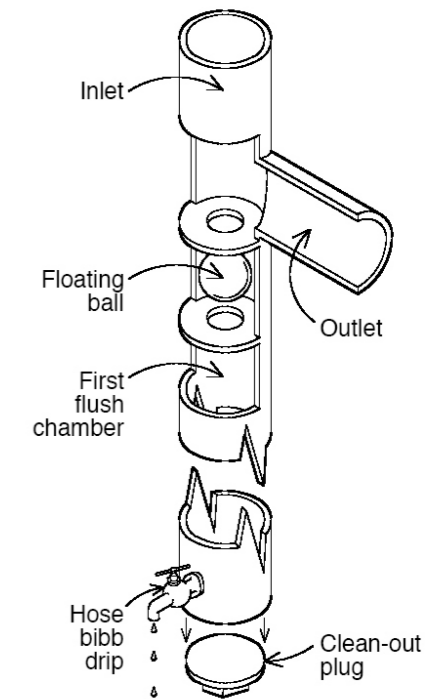
Solution for

1) Rainwater harvesting

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Campaign

Method	Location	Result
Screening	Roof with a slope and downspout	Prevent leaves and other debris from entering the tank
Settling (Sedimentation)	Within tank	Settles out particulate material
Filtering		
firsts flush	Before tank	To collect the first rain water, not usable for household work
roof washers	Before tank	Eliminates suspended material
Zero b	Attached to the main tap	Further filtering of water
Micro biological treatment		
Chemical treatment alum	Within tank(liquid, tablet, granular)	Kill microorganisms



First flush system

When the water comes from the roof, the diverter fills with water first, backs up, and then allows water to flow into the main collection piping.

As the chamber fills, the ball floats up and seals on the seat, trapping first-flush water and routing the balance of the water to the tank.

These stand pipes usually have a clean out fitting at the bottom, and must be emptied and cleaned out after each rainfall event.

The water from the



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Solutions (for recycling)

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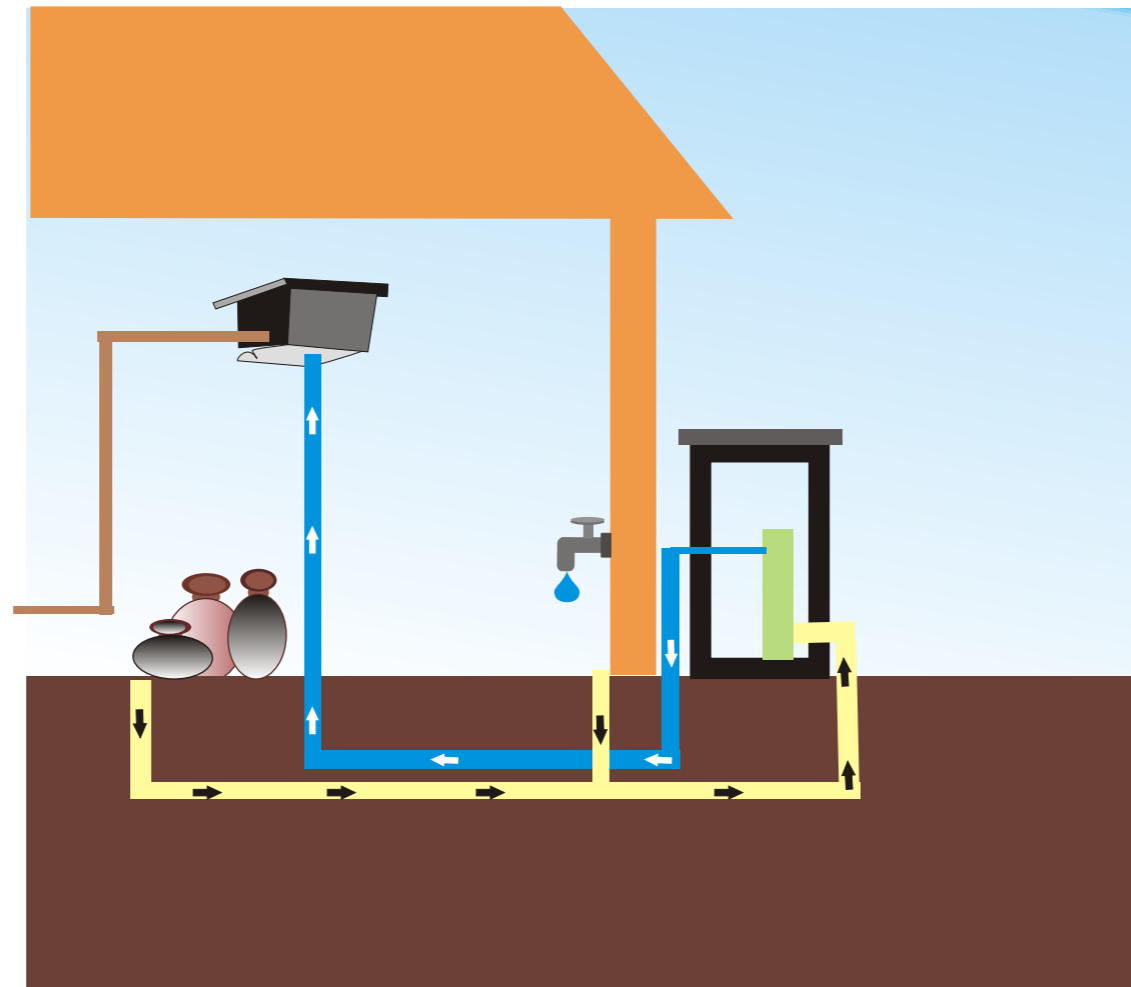
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Solution for

1) Rainwater harvesting

2) Recycling water

Campaign



- Yellow Grey water
- Blue Treated grey water
- Brown Black water to sewer

Greywater is the waste water produced from baths, showers, clothes washers, and wash-hand basins. It is fit for being recycled and reused.

Working of the grey water recycling system

The grey water from discharge pipes of roofs, sink and other sources is collected, goes to the cleaning tank

The cleaning tank is used to eliminate floating and sinking items.

Secondly a mechanism flushes the collected water if it has been stored long enough to be hazardous.

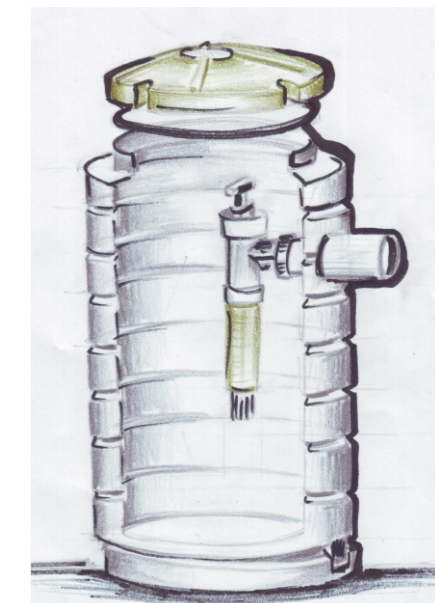
Recycled greywater of this kind is never clean enough to drink, but after filtration it is used to provide water for washing or flushing toilets

Relatively clean greywater may also be applied directly from the sink to the garden, as it receives high level treatment from soil and plant roots.



Black water contains fecal matter and urine. It is distinct from grey water (residue of washing processes, bathing etc.) it contains pathogens which need to decompose before they can be released safely into the environment

The water used after flushing is **black water** can be sent to the **sewage treatment plant or sold to the industry** from which they can **recover the maintenance cost of their system.**



The tanker filters the greywater coming from the household

ADHIAAR

Solutions (for recycling)

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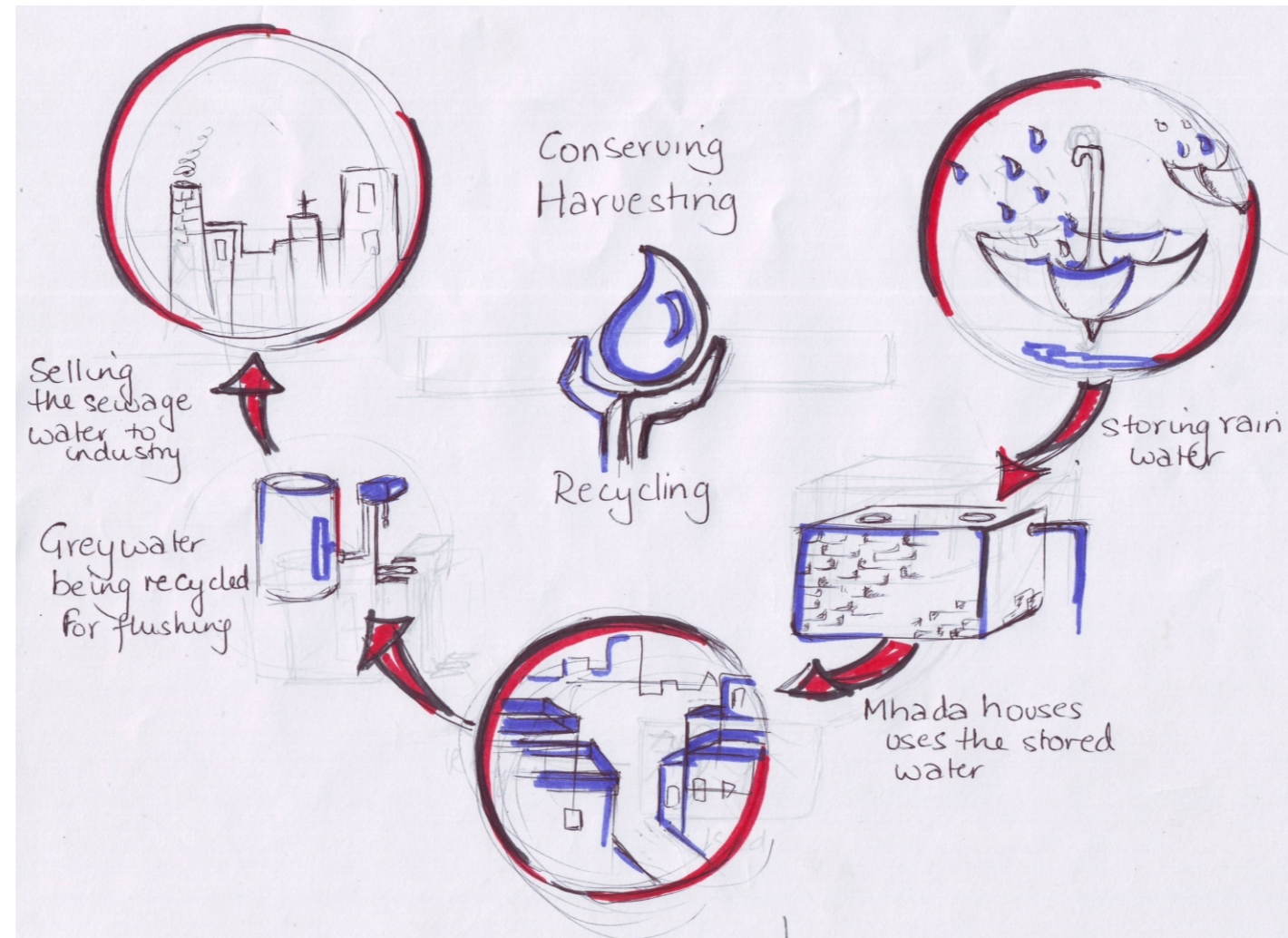
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1) Rainwater harvesting

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Industries using grey water in large quantity

When it comes to the socio - economic factor we came up with the solution of **selling the black water (sewage water)** of the Mhada houses to the industries which have water recycling plants.

There are multiple advantages in this arrangement. The people will **get rid of the waste and earn money** which can be used in the **maintainance** of the system. Secondly, the **industry gets a cheap source of water** and it is no longer competing for freshwater which can be spared to meet domestic requirements.

Talking about the future, the industries will be willing to invest in installation of such water recycling systems in places like Mhada as they will be getting a constant and a cheap source of water supply.

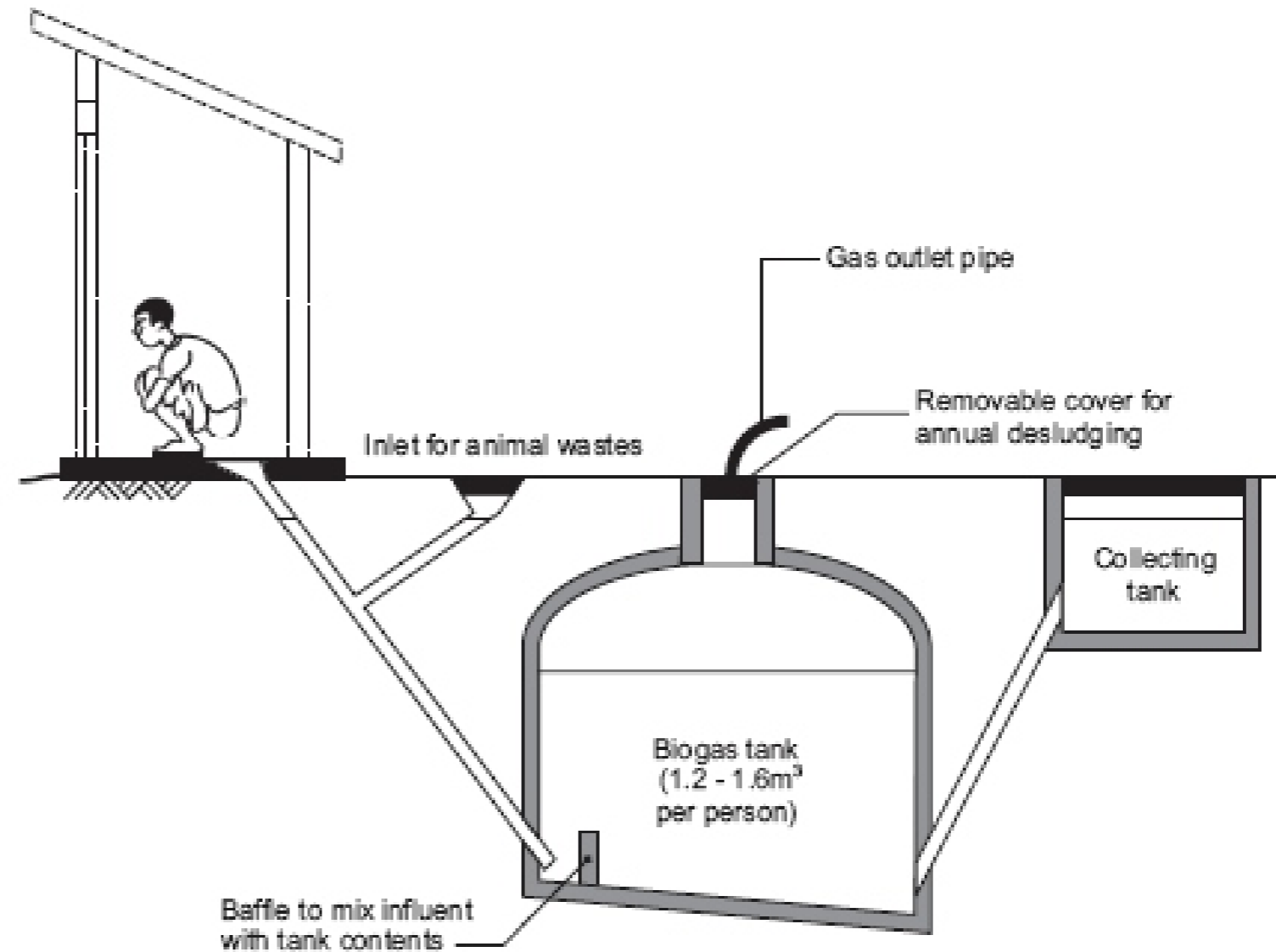


Grey water can be used to clean cattle and buffalo



Black water for biogas

The black water can either be sold to the industries or can be used to produce bio gas on a larger-scale. The gas can thus be effectively used for cooking and other purposes.



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If human excreta is combined with animal and agricultural wastes, and water, it will give off gas as it decomposes.

Given the right temperature and mix of wastes, much of the gas will be methane, which is flammable.

The mix of gases produced is called 'biogas'.

Biogas plants typically store the wastes for about 30 days.

This removes some of the pathogenic organisms but by no means all.

It is better to store the excreta for a period prior to or after putting them in the biogas tank.

Educational campaign

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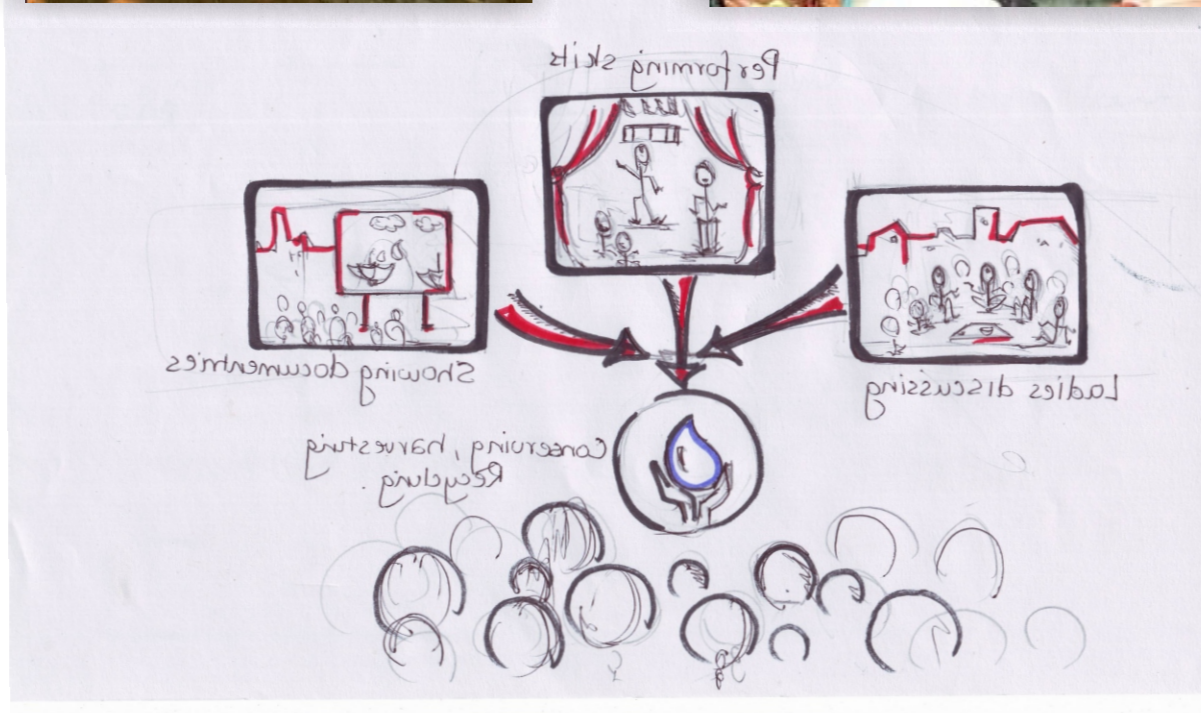
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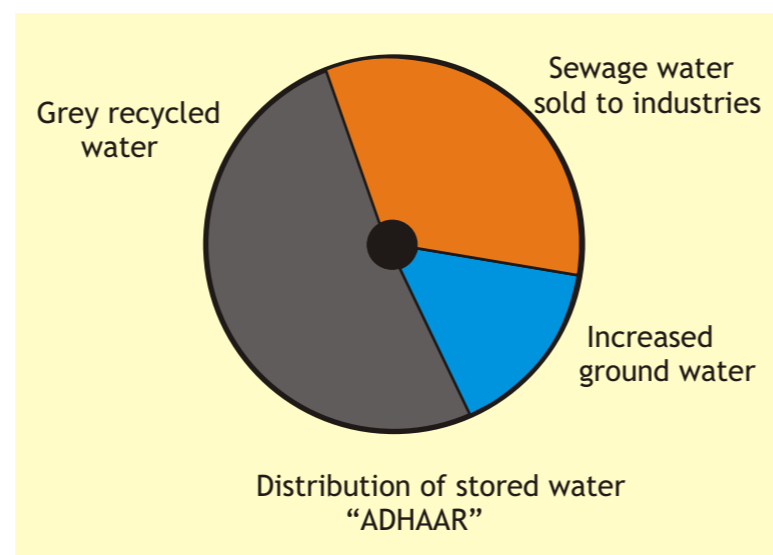


When it comes to conserving ,harvesting and recycling water the responsibility of a designer does not end with designing an effective system .It is also about how the system fits in that specific environment, how the native people adopt and accept it in their lives. For this we as designers need to make them understand the effectiveness and the importance of saving water.

At the beginning of our research we talked to the Mhada residents to know in depth the water problems they were facing and the answers were shocking. Out of 10 people ,we had a talk with, no one had any idea about rainwater harvesting.

So in order to integrate “ ADHAAR ” in Mhada ,the people have to understand the importance and the benefits of HARVESTING, CONSERVING AND RECYCLING rainwater we as students would like to organize a campaign which would be as follows-

- 1) **skits** will be performed by the locals in their **regional language** so that the message is easily understood.
- 2) short but entertaining **documentaries** on saving water which will be screened twice a month.
- 3) Once the system is adopted by the five families the ladies using that system can educate the other ignorant women in their area. since they all have meet during the evening for chit chat.



This poster is one in the series of posters which we plan to make for the campaign.

The campaign will have two parts -

In the start we would like to educate people on how water has become scarce and there is an urgent need to conserve it

In the second stage we will tell them small and cheap ways to conserve water for eg.hanging there umbrella upside down to collect water.

We have made a calendar out of the poster so that it is not only informative but useful also.this is how they will landup seeing it everyday and it may make an impact on them



2008



**Barish ke pani ko upyog mein laye
Aur
apne jivan ko surakshit banayen!**

Adhaar Adhaar

Features of our system

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Hygiene - sewage water being sold to the industry on a daily basis
easily accessible for cleaning

Economical - money received from industries helps in maintaining the system
The tank made of concrete and bricks

Portable drinking water for the site as well as the nearby slums

Excess rainfall increasing the ground level water - hand pumps installed
underground tank - saves space

low maintenance - tank doesn't need to be cleaned for a time period of 2-3 months

close to demand points so less distance covered hence **better water quality**

Saving the electricity for pumping up the water to individual houses by installing the
Vanrai pump

The system not only conserves and reuses rain water it also helps **create an awareness**
about it which is very important as far as the rural India goes and also because people are
still not aware of this concept

Also helps as a **playground for children**

Full reuse of water - water being used thrice once harvested then recycling grey water
for flushing toilet and finally black water being used in biogas plants or sold to industries.



Bibliography

Visited government offices

- 1)Municipal corporation
Viman nagar
- 2)Metrological department
Shivajinagar

Visited Industries

- 1)Jai mahalaxmi power coating
Kothrud
- 2)Narayan electroplating
Hadapsar

Net based research

[Http://www.greywater.com/](http://www.greywater.com/)

[Http://www.rainwaterharvesting.org/Urban/Components.htm](http://www.rainwaterharvesting.org/Urban/Components.htm)

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[Http://www.spate-irrigation.org/](http://www.spate-irrigation.org/)





Let us together conserve & harvest rainwater before it is too late!

Thank you!

ADHAR