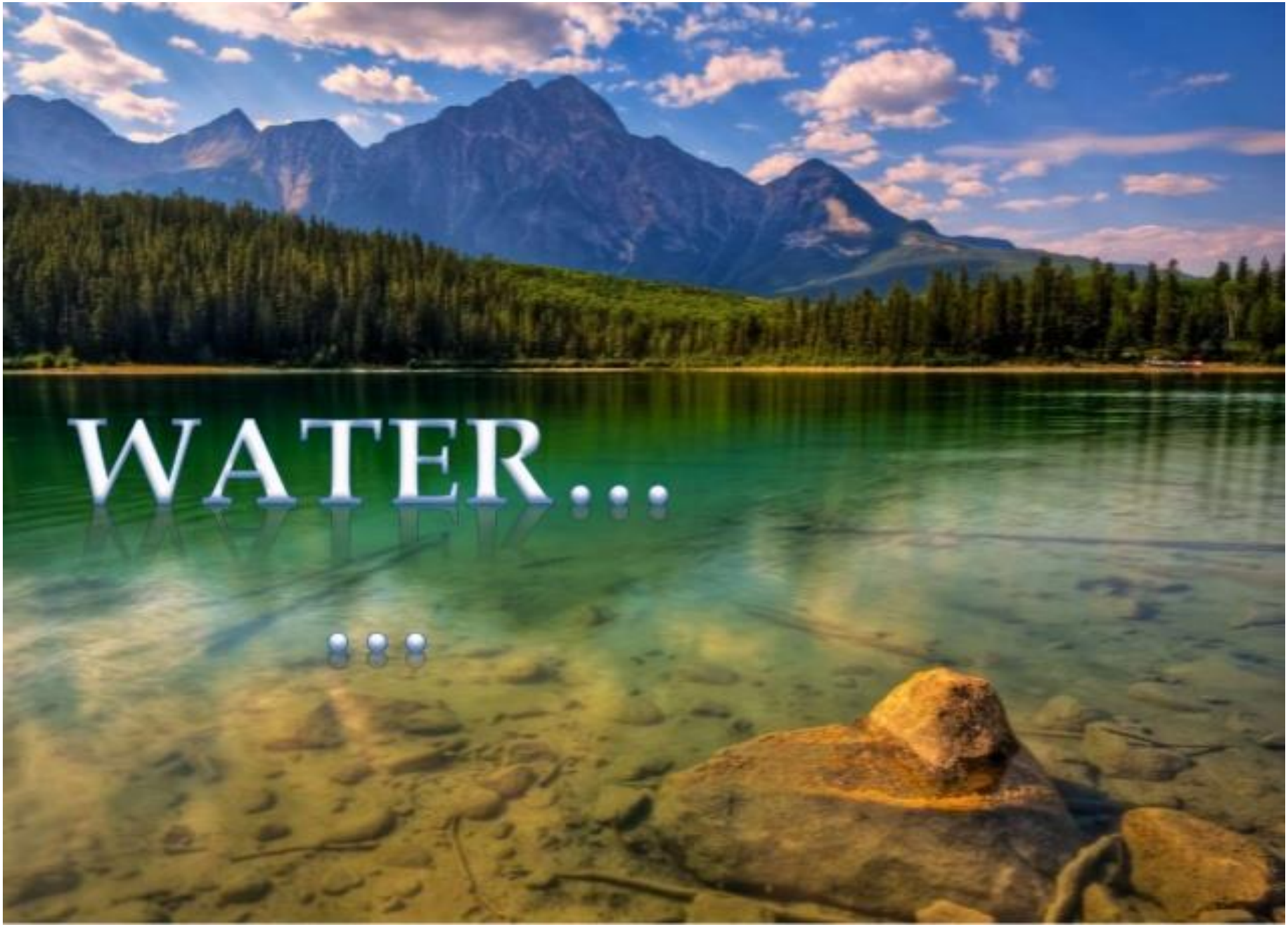

WATER…
…

RAINWATER HARVESTING

PRESENTED BY

GROUP 2

WISE

WISER

BE A RAIN WATER HARVESTER.

Some Facts about Water

- Only **2.5%** of the world's water is freshwater and most of this are in the form of polar ice-caps.
- Water use has increased by **70%** since 1970
- A recent report by Credit Suisse stated that by 2025 **18** countries will experience water demand beyond supply capabilities
- It takes up to **5000 lt** of water to produce 1kg of rice.
- Every square mile of developed land causes **16 million gallons** of rain water to directly enter the rivers on a rainy day!
- Each person uses about **150 litres** of water every day. About **60 litres** of this is for toilet flushing
- Toilet flushing is the single largest user of household water, **30-40%**, up to **90%** for offices.

What is Water harvesting??

- Water harvesting is the capture, diversion, and storage of water obtained from different freshwater sources for plant irrigation, domestic purposes, industrial purposes, groundwater recharge and other uses.

Rainwater harvesting [RWH]

- It is a type of water harvesting.
- It can be defined as the system of collection and concentration of rain water and its run off and its productive use for :-

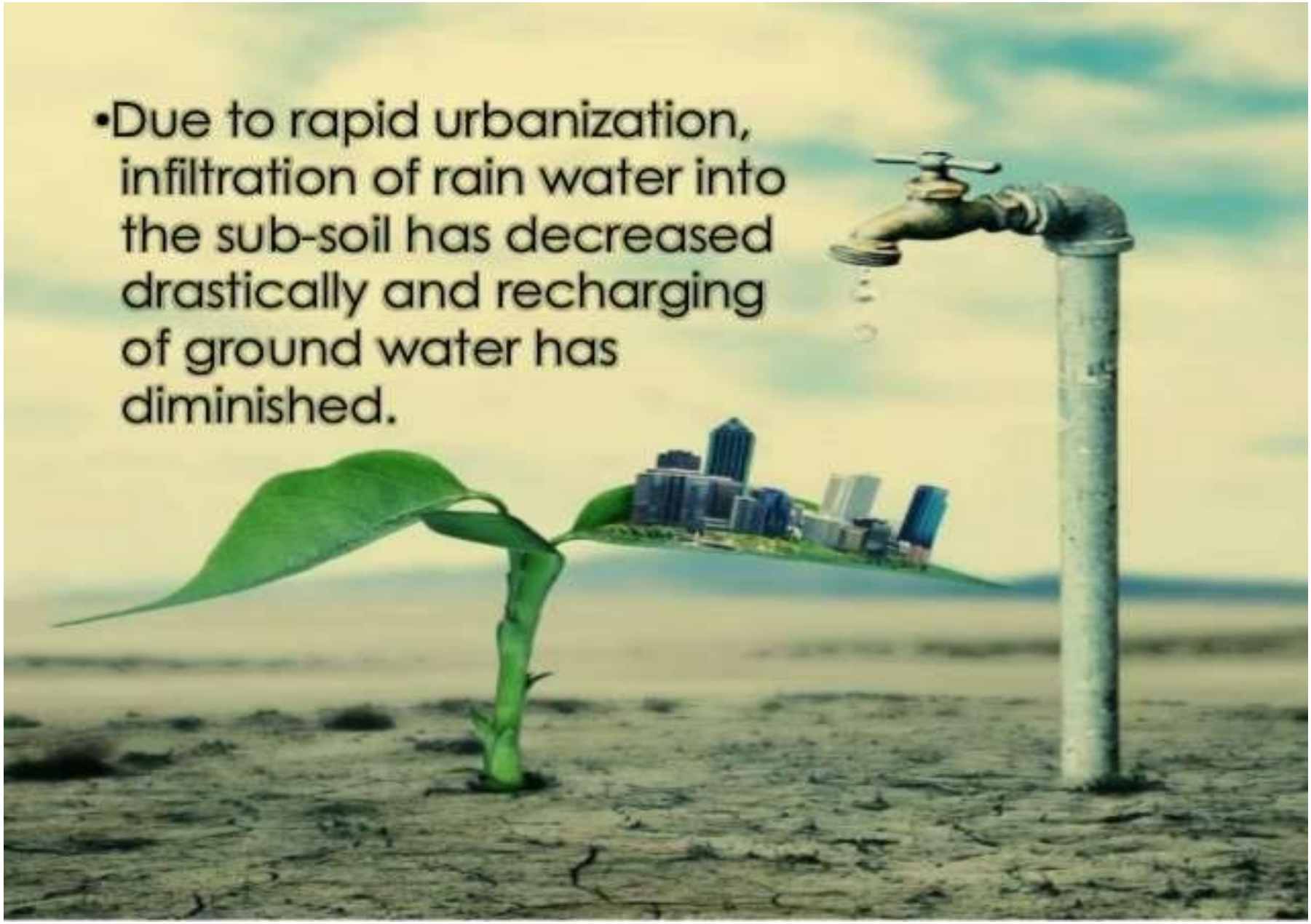
a) Irrigation of annual crops pastures and trees.

b) Domestic and livestock consumption.

c) Groundwater recharge.

Need For Rainwater Harvesting

- Major parts of our country have been facing continuous failure of monsoon and consequent deficit of rainfall over the last few years.
- Also, due to ever increasing population of India, the use of ground water has increased drastically leading to constant depletion of ground water level causing the wells and tube wells to dry up.
- In some places, excessive heat waves during summer create a situation similar to drought.
- It is imperative to take adequate measures to meet the drinking water needs of the people in the country besides irrigation and domestic needs.
- Out of 8760 hours in a year, most of the rain in India falls in just 100 hours.


•Due to rapid urbanization, infiltration of rain water into the sub-soil has decreased drastically and recharging of ground water has diminished.

SO WHAT IS THE SOLUTION?.....

WATER HARVESTING TECHNIQUES

Water Harvesting refers to collection and storage of rainwater and also other activity such as harvesting surface water extracting ground water , prevention of loss through evaporation and seepage.

Rainwater harvesting has been practiced for more than 4,000 years, it is also a good option in areas where good quality fresh surface water or ground water is lacking. In doing so, water harvesting assures a continuous and reliable access to water. The role of rainwater harvesting systems as sources of supplementary, back-up, or emergency water supply will become more important especially in view of increased climate variability and the possibility of greater frequencies of droughts and floods in many areas.

MULTIPLE BENEFITS

1. Improvement in the quality of ground water
2. Rise in the water levels in wells and bore wells that are drying up
3. Mitigation of the effects of drought.
4. Attainment of drought proofing
5. An ideal solution to water problems in areas having
6. inadequate water resources
7. Reduction in the soil erosion as the surface runoff is reduced
8. Decrease in the choking of storm water drains and flooding of roads
9. Saving of energy, to lift ground water. (One-meter rise in water level saves 0.40-kilowatt hour of electricity)


Improve living conditions.
Substitute ground-water.
Reduce flood risk.
Reduce soil erosion risk.
Recharge ground water.
Goals

Rainwater can be harvested in a variety of ways:

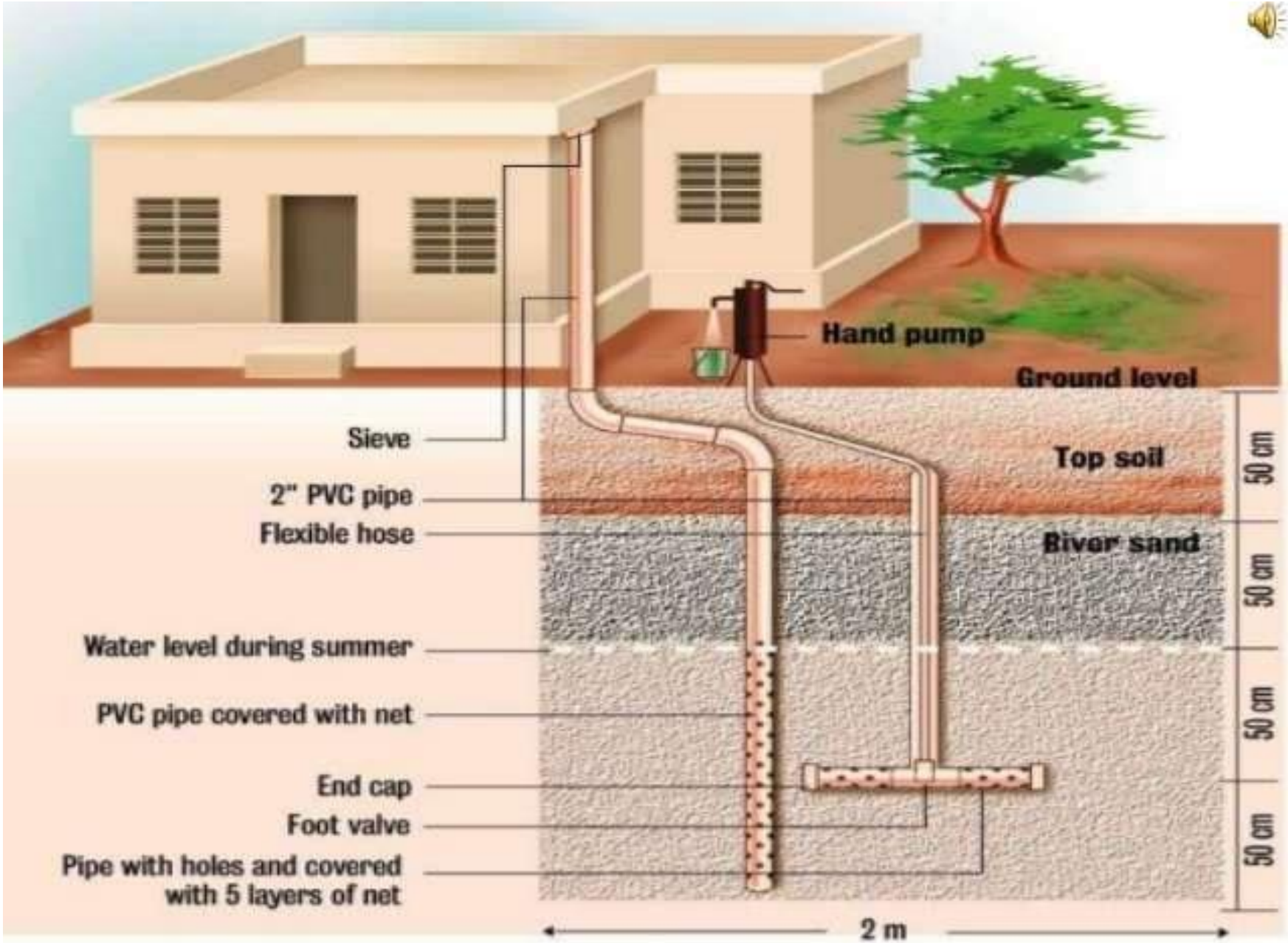
Rainwater can be harvested in a variety of ways:

- Directly from roof tops and stored in tanks.
- Monsoon run off and water in swollen streams during the monsoon and storing it in underground tanks.
- Water from flooded rivers can be stored in small ponds.
- Collection and transfer of rainwater into percolation tanks so as to facilitate discharge into ground.

RAINWATER HARVESTING TECHNIQUES

- ROOFTOP RAINWATER HARVESTING.
- SURFACE RUNOFF HARVESTING.

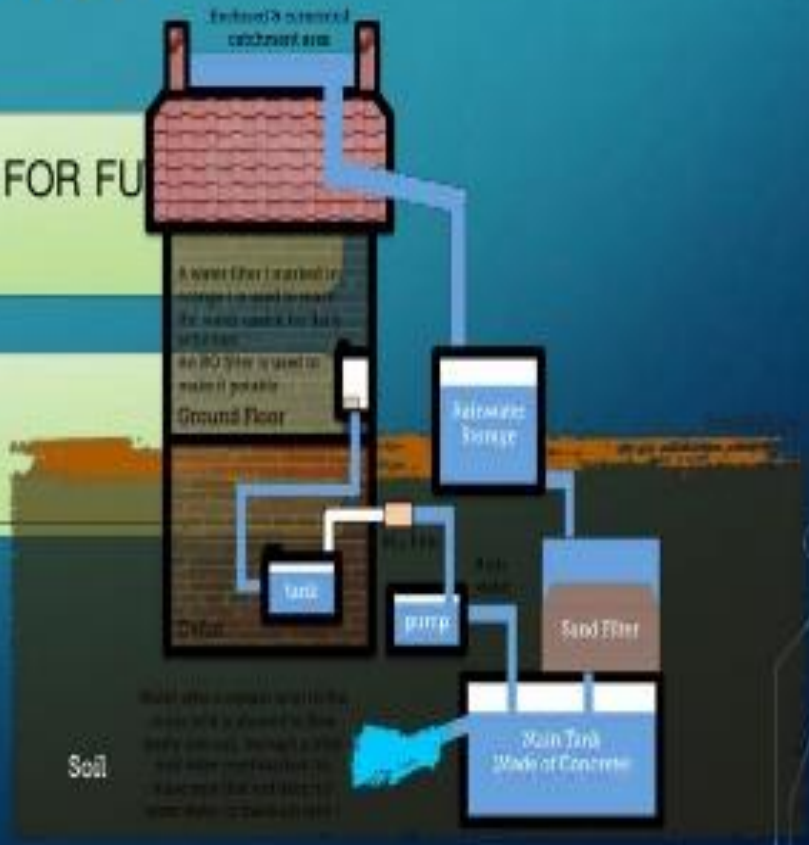

ROOFTOP RAIN HARVESTING
Rooftop rainwater harvesting is the technique through which rainwater is captured from the roof catchments and stored in reservoirs. Harvested rainwater can be stored in sub-surface groundwater reservoir by adopting artificial recharge techniques to meet the household needs through storage in tanks.

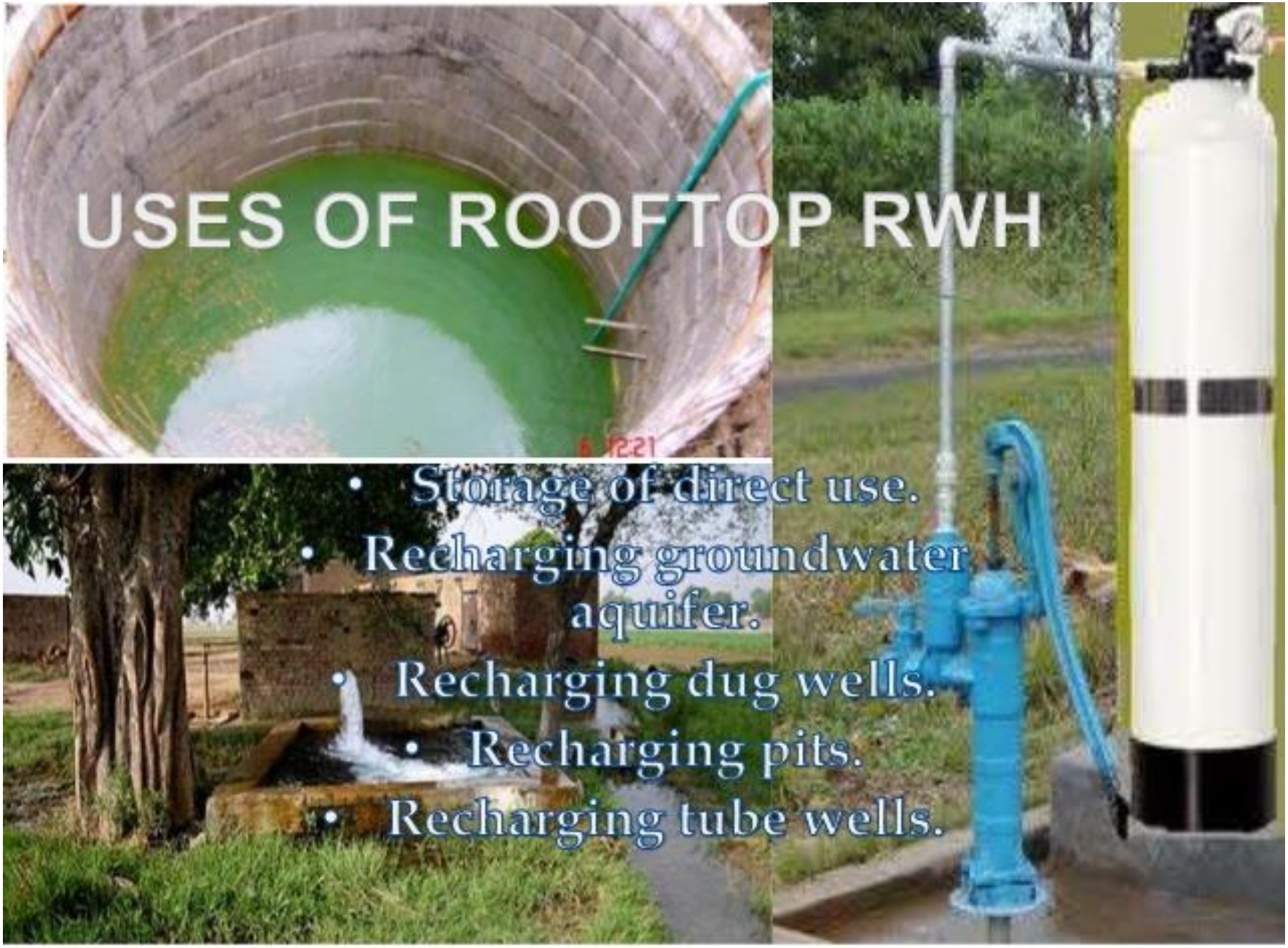

Hand pump
Ground level
Sieve
2" PVC pipe
Flexible hose
Top soil
River sand
Water level during summer
PVC pipe covered with net
End cap
Foot valve
Pipe with holes and covered with 5 layers of net
50 cm
50 cm
50 cm
50 cm
2 m

Techniques of Water Recharge

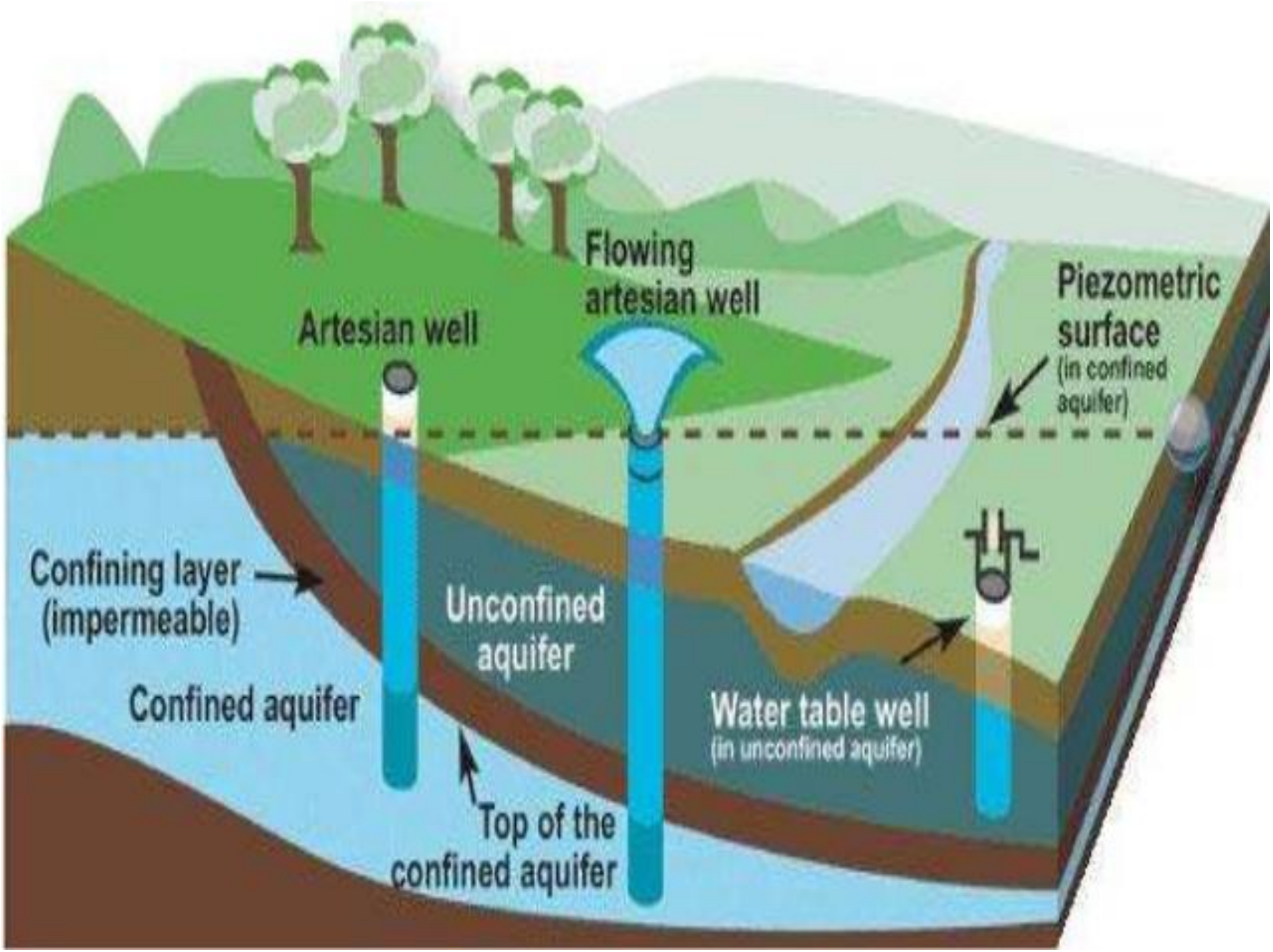
STORAGE OF RAINWATER ON SURFACE FOR FU
USE

RECHARGE TO GROUND WATER

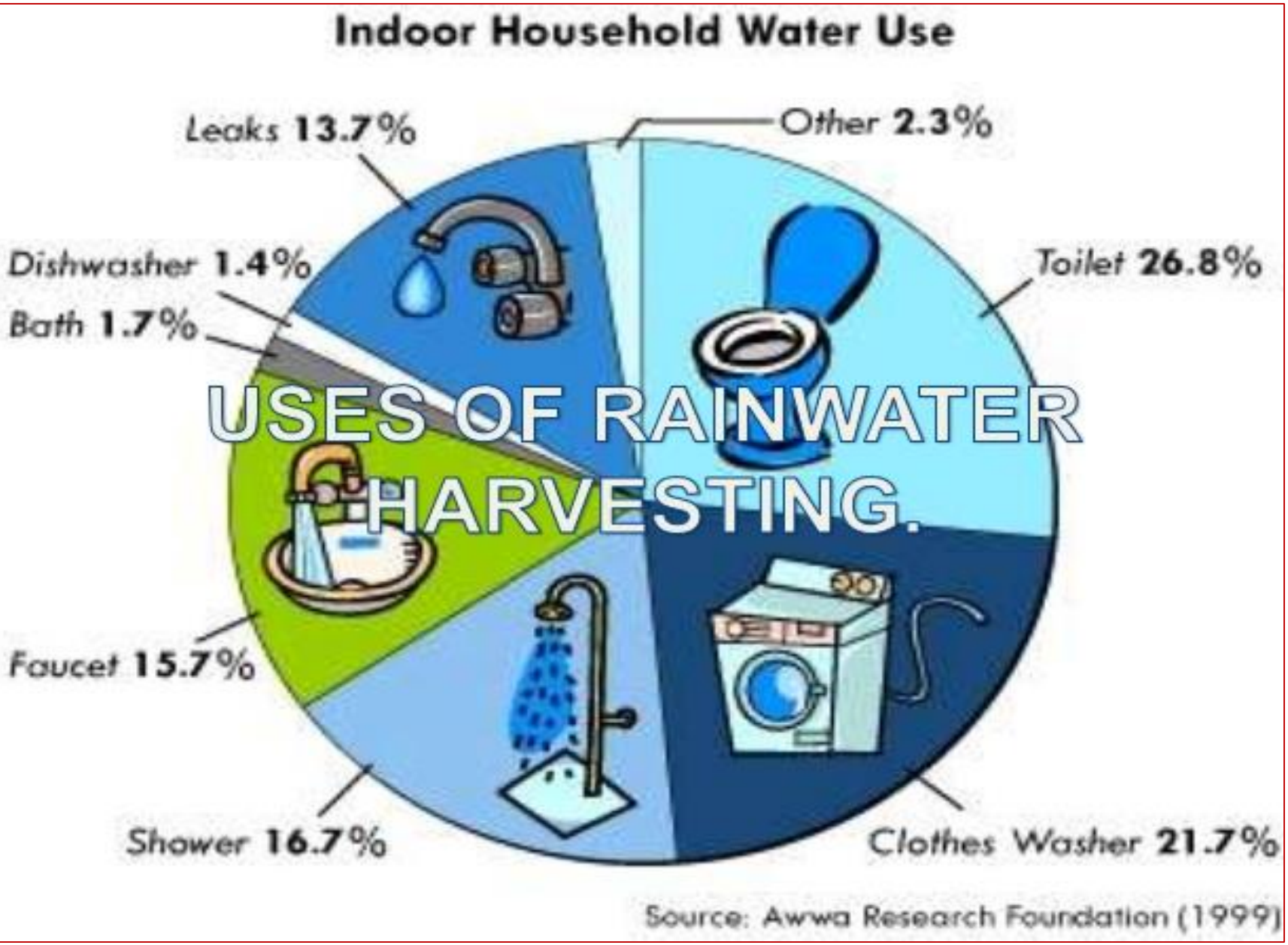


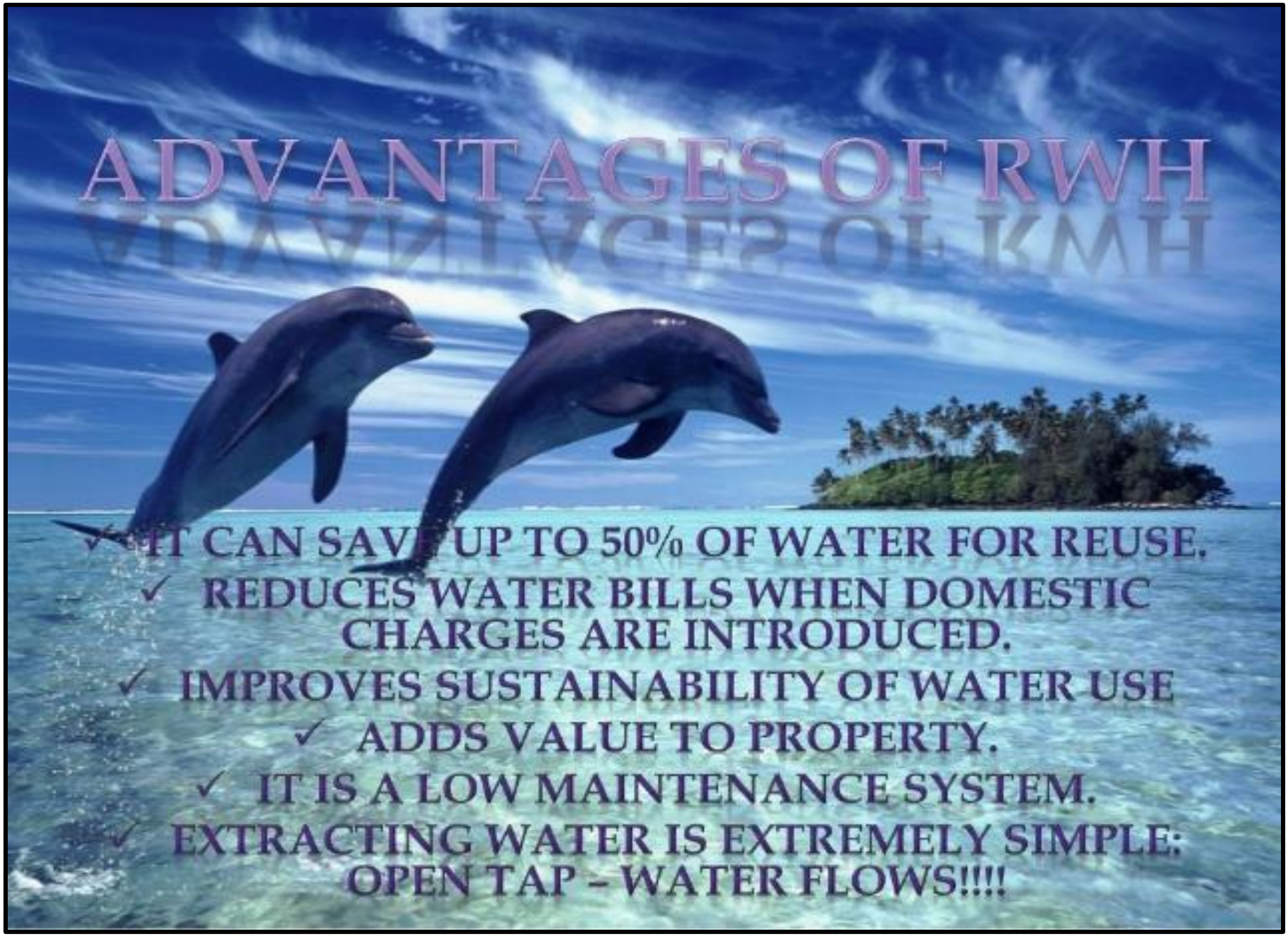

USES OF ROOFTOP RWH
• Storage of direct use.
• Recharging groundwater aquifer.
• Recharging dug wells.
• Recharging pits.
• Recharging tube wells.


Surface runoff harvesting
In this method of collecting rainwater for irrigation, water flowing along the ground during the rains will be collected to a tank below the surface if the ground
© J.V. Littell/www.bahiker.com


Flowing
artesian well
Artesian well
Piezometric
surface
(in confined
aquifer)
Confining layer
(impermeable)
Unconfined
aquifer
Confined aquifer
Water table well
(in unconfined aquifer)
Top of the
confined aquifer

EVEN USEFUL IN GARDENING


Indoor Household Water Use
Leaks 13.7%
Other 2.3%
Dishwasher 1.4%
Toilet 26.8%
Bath 1.7%
USES OF RAINWATER HARVESTING.
Faucet 15.7%
Shower 16.7%
Clothes Washer 21.7%
Source: Awwa Research Foundation (1999)

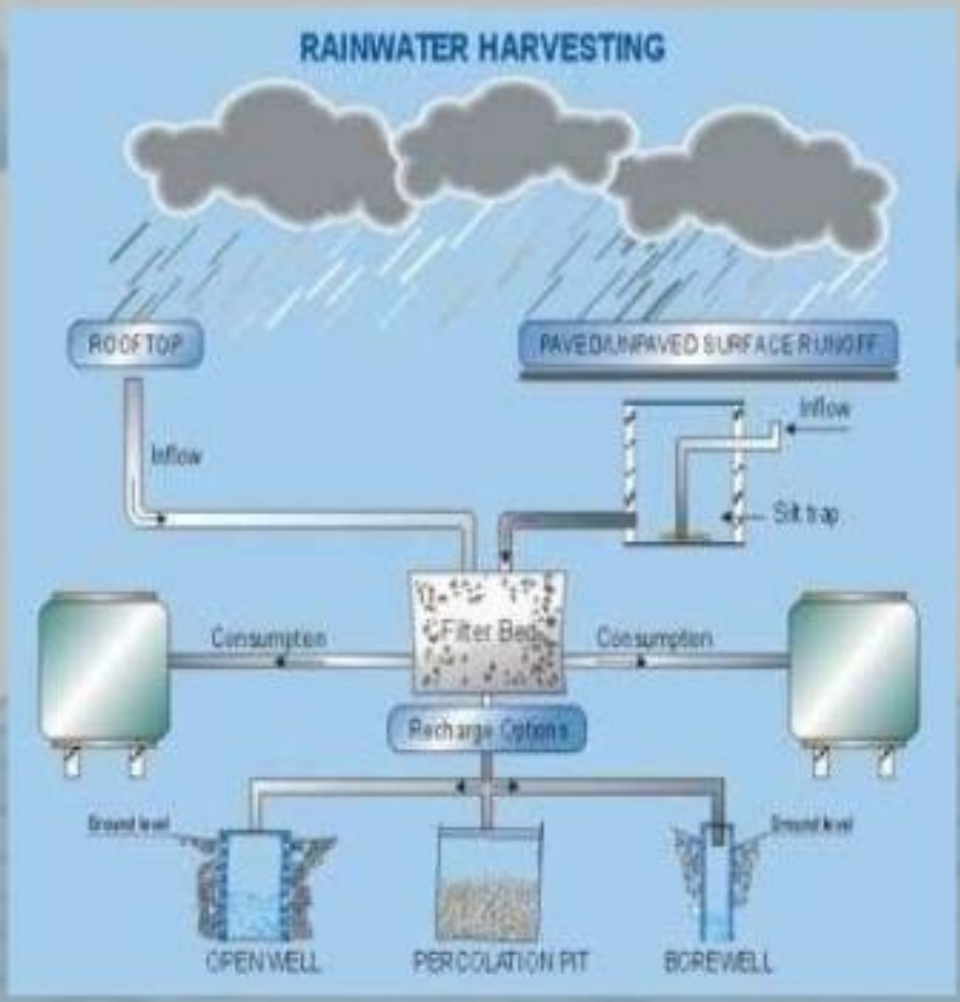

ADVANTAGES OF RWH
✓ IT CAN SAVE UP TO 50% OF WATER FOR REUSE.
✓ REDUCES WATER BILLS WHEN DOMESTIC CHARGES ARE INTRODUCED.
✓ IMPROVES SUSTAINABILITY OF WATER USE
✓ ADDS VALUE TO PROPERTY.
✓ IT IS A LOW MAINTENANCE SYSTEM.
✓ EXTRACTING WATER IS EXTREMELY SIMPLE: OPEN TAP – WATER FLOWS!!!!

Components of RWH

Catchment

Delivery

Storage



Models of RWH

There are two main models of rainwater harvesting done in India:-

- RURAL MODEL.
- URBAN MODEL.

Rural model of RWH

- Rural areas generally use traditional methods of rainwater harvesting.
- Main motive of rainwater harvesting in these areas is to facilitate irrigation for agriculture and use of water for domestic and drinking purposes.
- Nowadays practices are also been followed to as to recharge groundwater levels.
- Many of the traditional structures include Tankas, Nadis, Talabs, Bavdis, Rapats, Kuis, Virdas, Kunds, Khadins, Johads etc.

Bawodi

Traditional step wells are called *vavadi* in Gujarat, or *baoris* or *bavadis* in Rajasthan and northern India.

Kunds

Covered underground tank, developed primarily for tackling drinking water problems.


Rocky upland
Shallow dug well
Khadin bund
Khadin or cropped area
Spillway

Khadin Bund

Urban Model of RWH

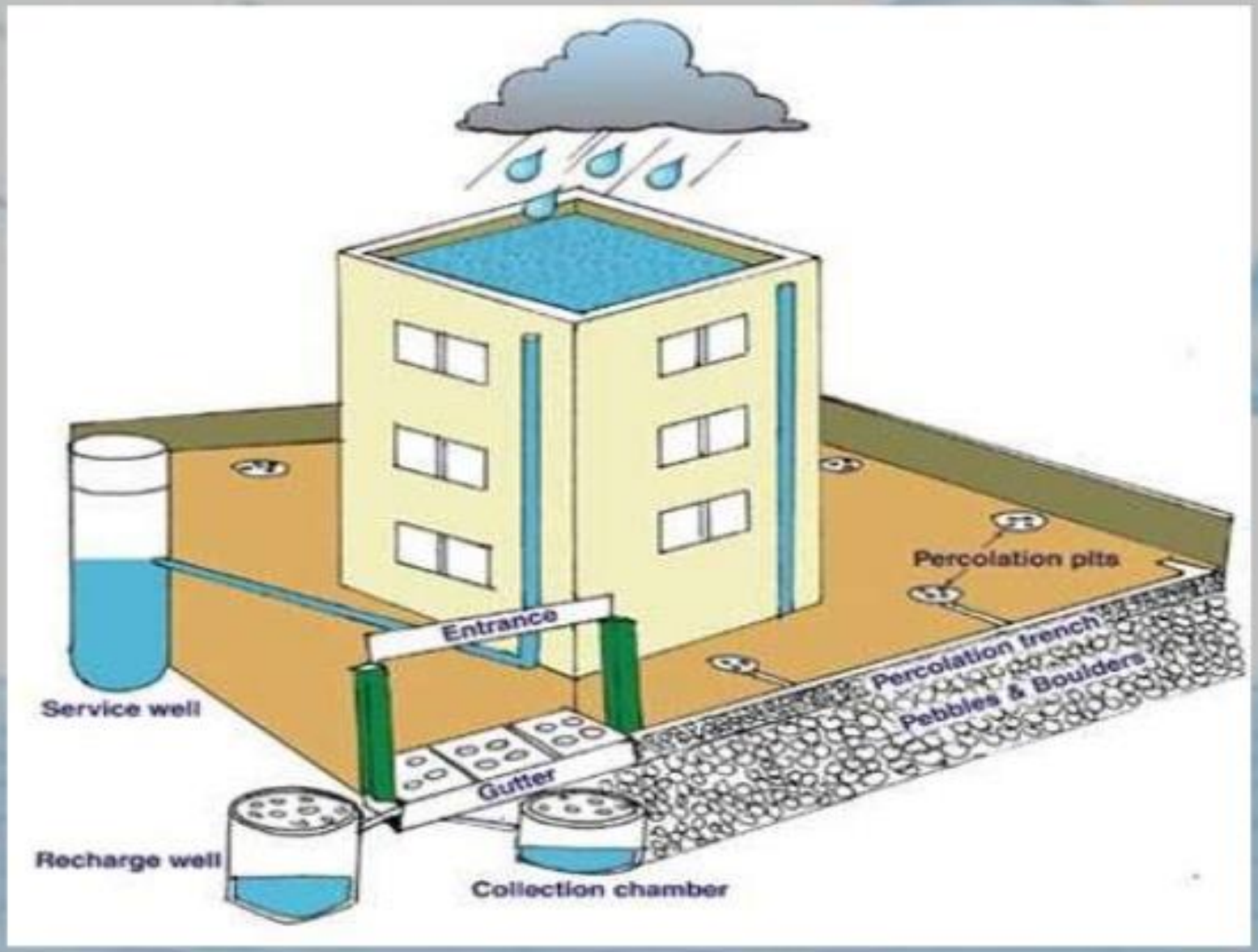
- More modernized system of rainwater harvesting.
- The main components of the urban model are:-

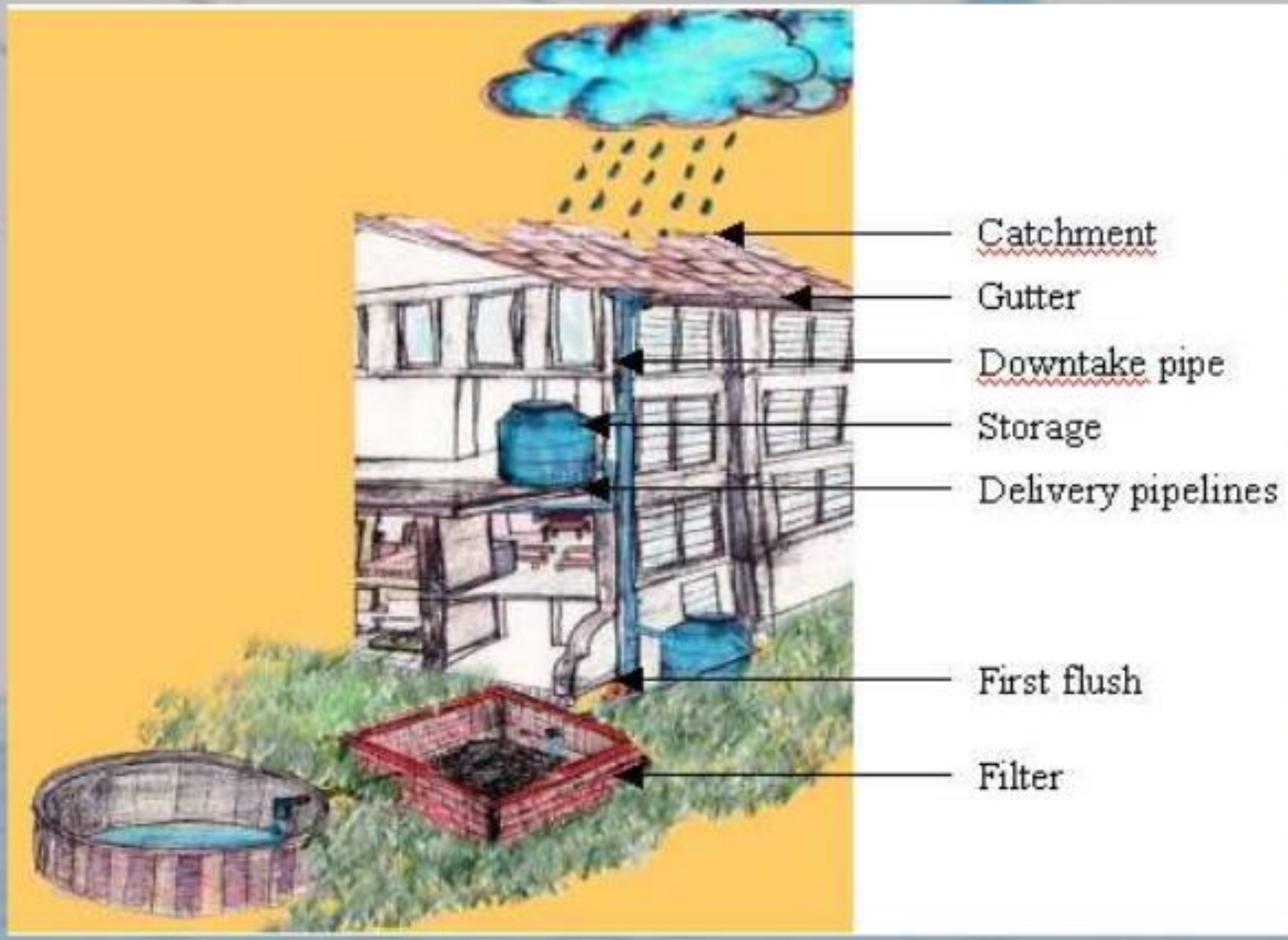
a) Roof catchment
b) Gutters
c) Down pipe
d) First flush pipe
e) Filter unit
f) Storage tank
g) Collection pit.

Components of Urban RWH models

Storage Tank

Pipe System


Percolation pits
Entrance
Percolation trench
Pebbles & Boulders
Service well
Gutter
Recharge well
Collection chamber


Catchment
Gutter
Downtake pipe
Storage
Delivery pipelines
First flush
Filter

Advantages

- RWH provides a good supplement to other water sources thus relieving pressure on other water sources.
- It can supply as a buffer and can be used in times of emergency or breakdown of public water supply systems.
- Helps reduce the storm drainage load and flooding in the cities.
- It is a flexible technology and can be built to require meets of any range. Also the construction, operation and maintenance is not very labour intensive in most systems.
- Prevents water wastage by arresting run off as well as prevents soil erosion and mitigates flood.
- Sustains and safeguards existing water table through recharge.
- Arrests sea-water intrusion and prevents salination of ground water.
- Rainwater harvesting can reduce salt accumulation in the soil which can be harmful to root growth. When rainwater percolates into the soil, it forces the salts down and away from the root zone area. This allows for greater root growth and water uptake, which increases the drought tolerance of plants.
- Rain-water is a clean and pure source of drinking water which requires minimal chemical treatment as the amount of pollutants are not much.

Disadvantages

- In terms of complex constructions, there is a requirement for high costs, trained professionals.
- Maintenance costs may add to the monetary burden.
- If not maintained properly then it can cause various problems in terms of algal or bacterial growth.
- Tanks if not constructed properly might result in leakages and metal tanks may also lead to problems such as corrosion harming the water quality.
- All these factors might prove harmful and result in various kinds of health issues.
- The system is very much rainfall dependent and hence if there are problems with the rainfall in the area, it may not be very effective.

Future of Rainwater Harvesting

- Rainwater harvesting systems serve as an alternative decentralized water source especially in the age when groundwater supplies are depleting and municipal water infrastructures are facing high replacement costs.
- The use of decentralized rainwater harvesting systems is growing nationally and internationally, especially in industrial countries like Asia, Europe and the US.

Watershed Management

- What is a watershed??
- Watersheds can be defined as a geo-hydrological unit draining to a common point by a system of drains. All lands on earth are part of one watershed or other. Watershed is thus the land and water area, which contributes runoff to a common point.
- For example, the watershed of a lake would include not only the streams entering that lake but also the land area that drains into those streams and eventually the lake.

Classifications of Watersheds

- Macro Watershed (> 50,000 Hect)
- Sub-Watershed (10,000 to 50,000 Hect)
- Milli-Watershed (1000 to10000 Hect)
- Micro-Watershed (100 to 1000 Hect)
- Mini-Watershed (1-100 Hect)

Watershed Mangement – Definition

- The process of creating and implementing plans, programs, and projects to sustain and enhance watershed functions that affect the plant, animal, and human communities within a watershed boundary.
- Watershed management is the integrated use of land, vegetation and water in a geographically discrete drainage area for the benefit of its residents, with the objective of protecting or conserving the hydrologic services that the watershed provides and of reducing or avoiding negative downstream or groundwater impacts. Fresh water, and freshwater ecosystems, is the most basic components of watershed management.

Need for Watershed Management.

- In spite of sufficient rainfall, people have to depend upon tankers for their domestic water supply in summers in most of the areas. This is mainly due to large runoff which is responsible for water loss as well as soil loss of the land.
- A raindrop, when flows along the slope, carries the loose soil along it. In this case the topmost layer of soil is lost rapidly. Due to high intensity rainfall, it is estimated that, more than 100 tons of soil is lost .

Objectives of Watershed management

- To control damaging runoff and degradation and thereby conservation of soil and water.
- To manage and utilize the runoff water for useful purpose.
- To protect, conserve and improve the land of watershed for more efficient and sustained production.
- To protect and enhance the water resource originating in the watershed.
- To check soil erosion and to reduce the effect of sediment yield on the watershed.
- To rehabilitate the deteriorating lands.
- To moderate the floods peaks at downstream areas.
- To increase infiltration of rainwater.
- To improve and increase the production of timbers, fodder and wild life resource.
- To enhance the ground water recharge, wherever applicable.

Parameters of Watershed Management

- **SIZE**: It helps in computing parameters like precipitation received, retained, drained off.
- **SHAPE**: Different shapes based on morphological parameters like geology and structure.
- **PHISIOGRAPHY**: Lands altitude and physical disposition. SLOPE: It controls the rainfall distribution and movement:
- **CLIMATE**: It decides the quantitative approach.
- **DRAINAGE**: It determines the flow characteristics and so the erosion behavior.
- **VEGETATION**: Information of species gives a sure ground for selection plants and crops.
- **GEOLOGY AND SOILS**: Their nature determines size, shape, physiographic, drainage and groundwater conditions. Soils, derivative of rocks are the basic to greenery
- **HYDROLOGY**: Basic to final goal of growing greenery in a watershed. It helps in quantification of water available.
- **HYDROGEOLOGY**: Availability of groundwater.
- **SOCIOECONOMICS**: Statistics on people and their health, hygiene, wants and wishes are important in managing water.

Watershed Mangement Practises

- Conserving soil and water.
- Improving the ability of land to hold water.
- Rainwater harvesting and recharging.
- Growing greenery – trees, crops and grasses.

Conserving Soil and Water

- Contour - Contour trenches trap rain water, enable it to percolate to underground aquifers and break the speed of fast moving water
- Gully control - Gully plugs help to control the flow of water, sedimentation and recharge ground water aquifers.
- Stone bunds - Building stone and nala bunds across the slope arrest the flow of water and control erosion in areas where soil work is not possible.

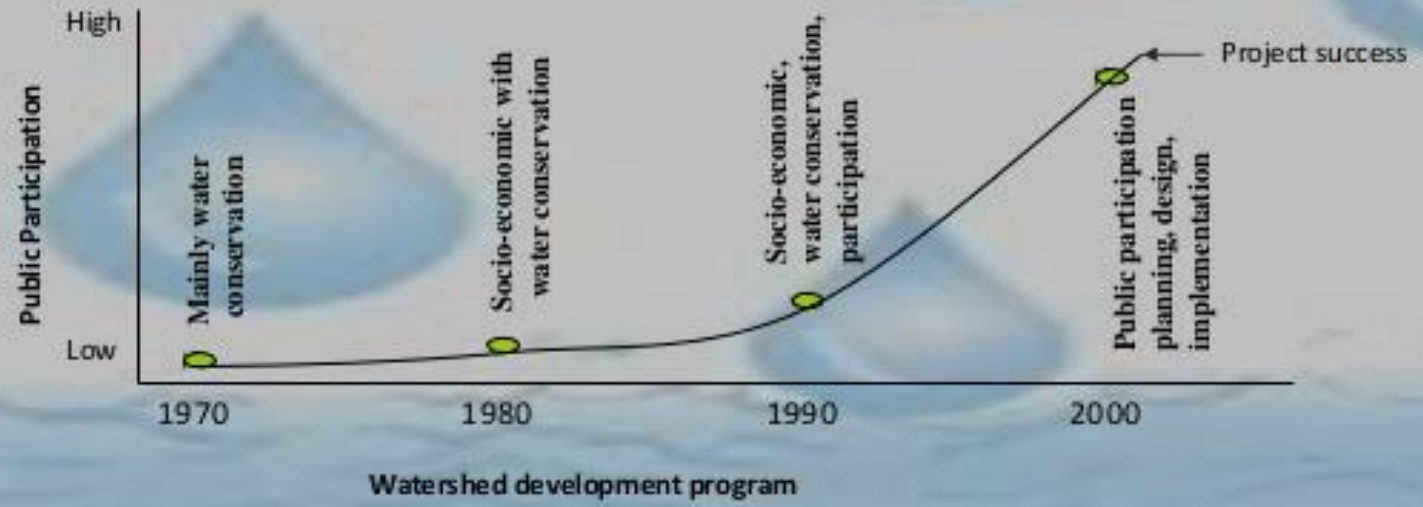
Growing Greenary

- Dry land agriculture.
- Irrigation.
- Forestry.
- Horticulture.
- Pastures.

Integrated Watershed Approach

•IWM is the process of planning and implementing water and natural resources.

•Emphasis is on integrating the bio-physical, socio-economic and institutional aspects.



Social issues are addressed through involvement of women and minority.

Community led water users groups have led the implementation efforts.

Advantages/Future Of WSM

- Watershed Development program is a revolutionary program aimed at fulfilling the water needs in the water scarce areas.
- In areas where there is inadequate water supply watershed management offers an ideal solution.
- It helps in utilizing the primary source of water and prevents the runoff from going into sewer or storm drains, thereby reducing the load on treatment plants.
- If we take steps to encourage each drop of rainfall to penetrate in the ground at the point where it strikes earth, it will result in addition of one drop to our useful water supply and subtraction of one drop from a potential flood.

Why do we need water harvesting?

"Earth provides enough to satisfy every man's needs, but not a single man's greed."

-Mahatma Gandhi

Water scarcity is the lack of sufficient available water resources to meet the demands of water usage within a region. According to United Nations Development Programme, this currently affects around 2.8 billion people around the world, on all continents, at least one month out of every year and more than 1.2 billion people lack the access to clean drinking water.

Over-consumption/excessive or unnecessary use of resources, Overpopulation, Slash and burn agricultural practices in developing countries, Technological and industrial development, Erosion, Habitat degradation leads to the loss of Biodiversity (i.e. species and ecosystems with its ecosystem services), Irrigation, Mining for oil and minerals, Aquifer depletion, Pollution or contamination of resources are the major factors responsible for the eminent water crisis.

BANDSARS

Bandar is composed of a small stream that conducts water from Ephemeral River toBandsar's inner part. This decreases water speed and supplies soil moisture. In the method, natural location of floodwater spreading is formed on alluvial fans. Bandsar is allot or pond formed by embankment construction in direction of water flow. So flood is taken, water is retained until infiltrated.Bandar has a very simple construction. It is made of the following parts:

- A shallow water drainage (ephemeral stream called Kale)
- A check-dam made of river sediment called Tarkehband Embankment (the main wall of the dam)
- Some parallel subsidiary walls for balancing water spreading called Mewband
- A waterway for overflow of water called Goushband

Bandsars covers different areas e.g. 1000 square meters in valleys to 30 ha in low slope

Rainwater Harvesting (Rural)

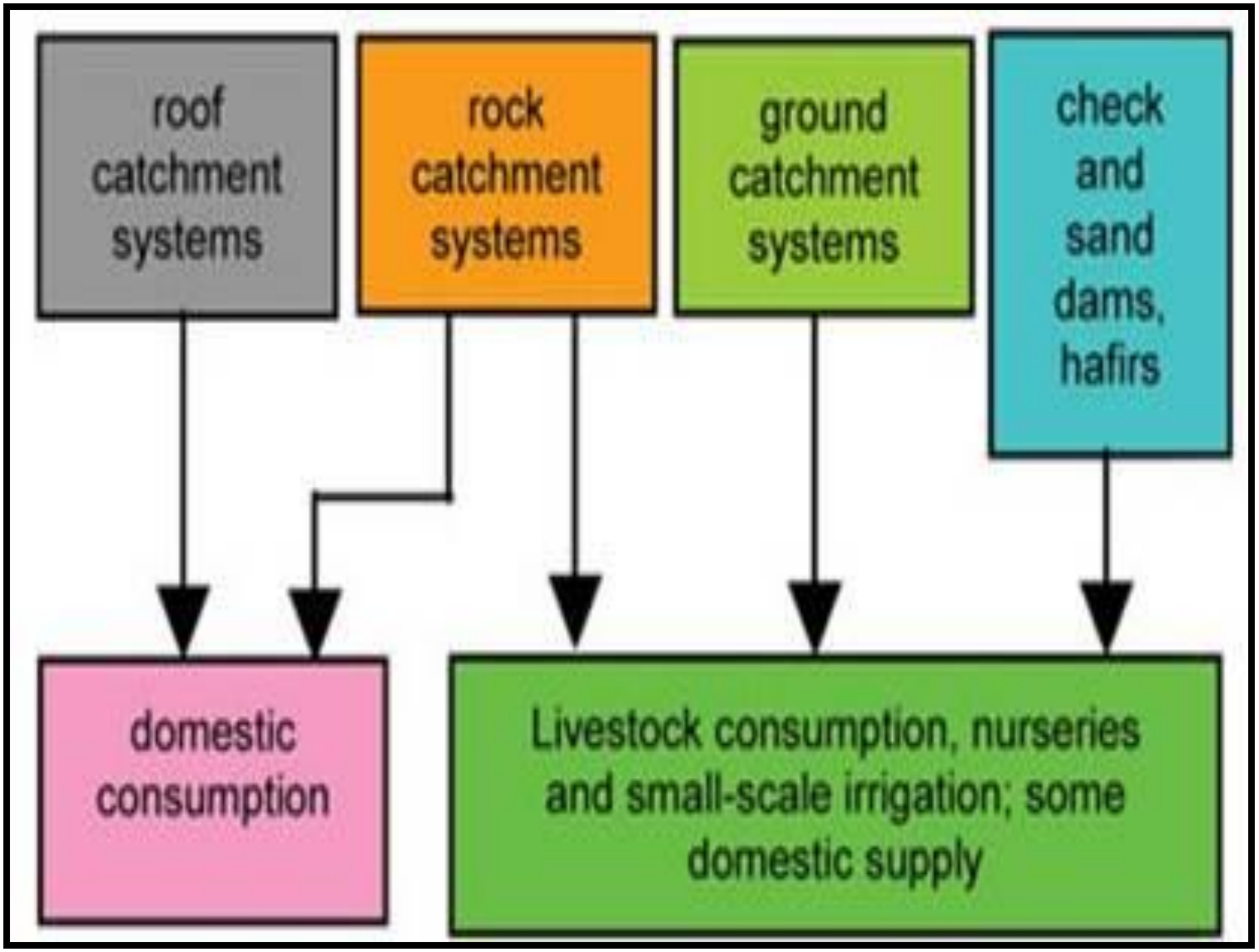
1. Concept
2. Roof catchment systems
3. Ground & rock catchment systems
4. Watershed management
5. Applicability
6. Advantages and disadvantages
7. References

Concept

Rainwater harvesting means capturing the rain where it falls or capturing the runoff and taking measures to store that water and keep it clean.

Rainwater harvesting can be undertaken through a variety of ways:

- **capturing run-off from roof tops**
- **capturing run-off from local catchments**
- **capturing seasonal floodwater from local streams**
- **conserving water through watershed management**


roof catchment systems
rock catchment systems
ground catchment systems
check and sand dams, hafirs
domestic consumption
Livestock consumption, nurseries and small-scale irrigation; some domestic supply

Functions of rainwater harvesting

Harvesting rainwater has several functions:

- **providing water to people and livestock**
- **providing water for food and cash crops**
- **increasing groundwater recharge**
- **reducing storm water discharges, urban floods and overloading of sewage treatment plants**
- **reducing seawater ingress in coastal areas**

Roof catchment systems

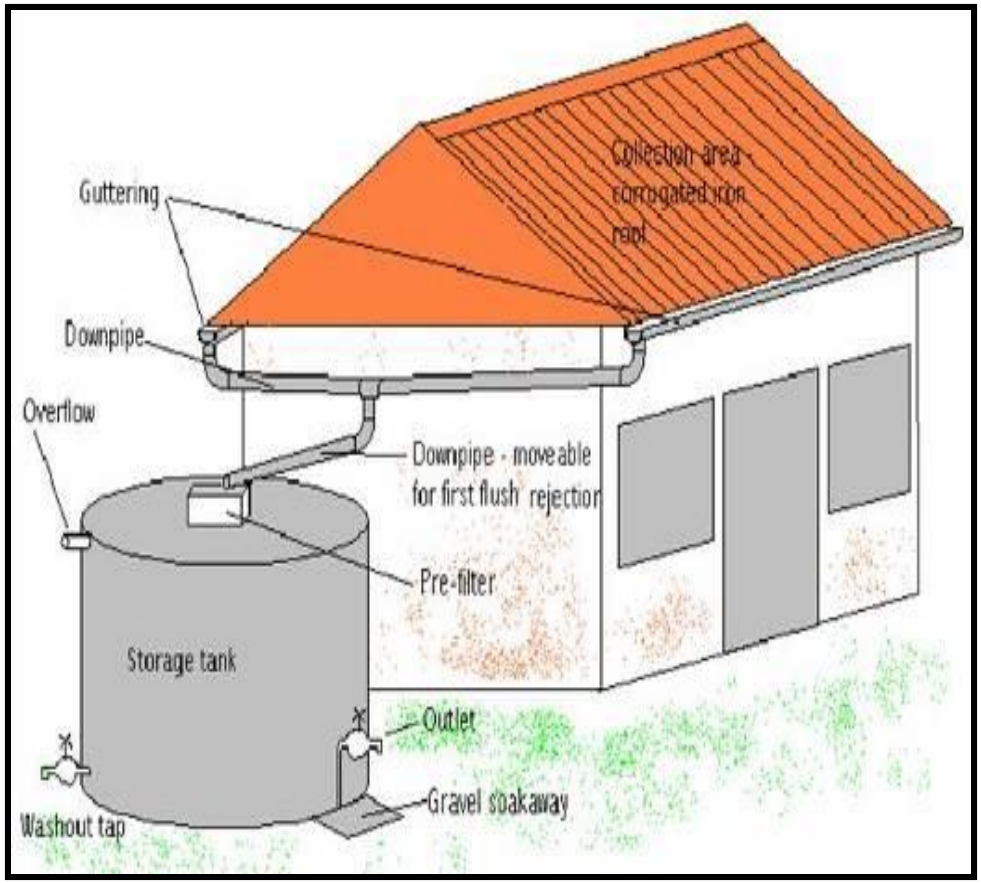
System components

Domestic rainwater harvesting system consist of:

- **a collection surface,**
- **a storage tank, and**
- **guttering or channels to transport the water from one to the other.**

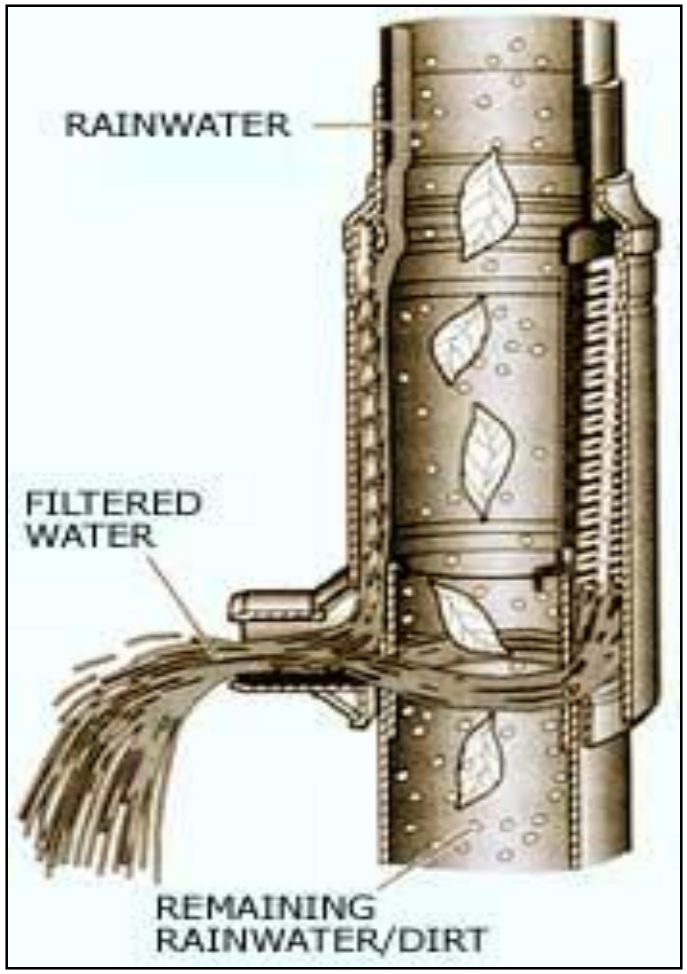
Peripheral equipment sometimes incorporated:

- **a first-flush system,**
- **a filtration equipment, and**
- **settling chambers**



Roof catchment systems

Filters



Roof catchment systems

Roof catchment systems

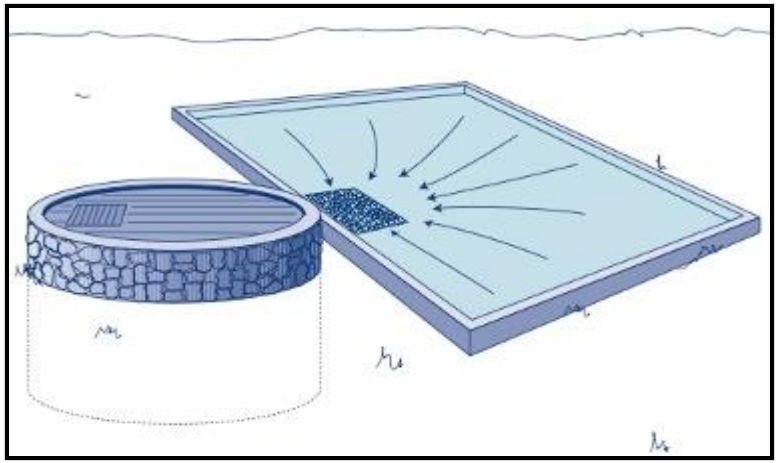
Surface harvesting

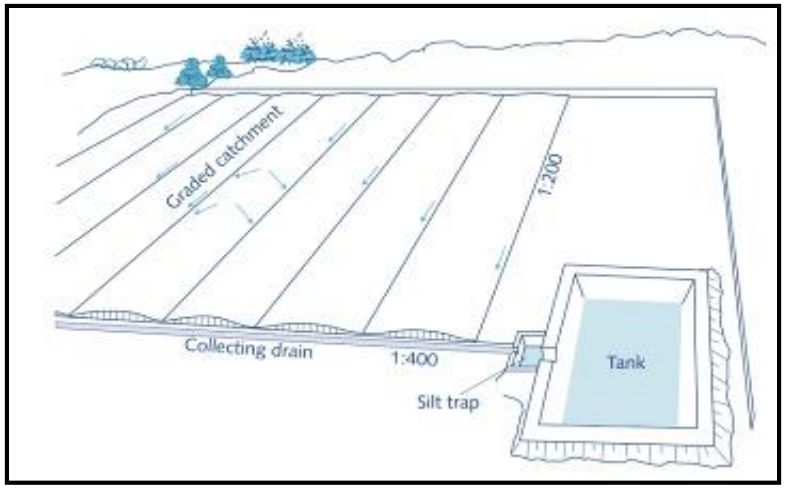
Ground & rock catchment systems

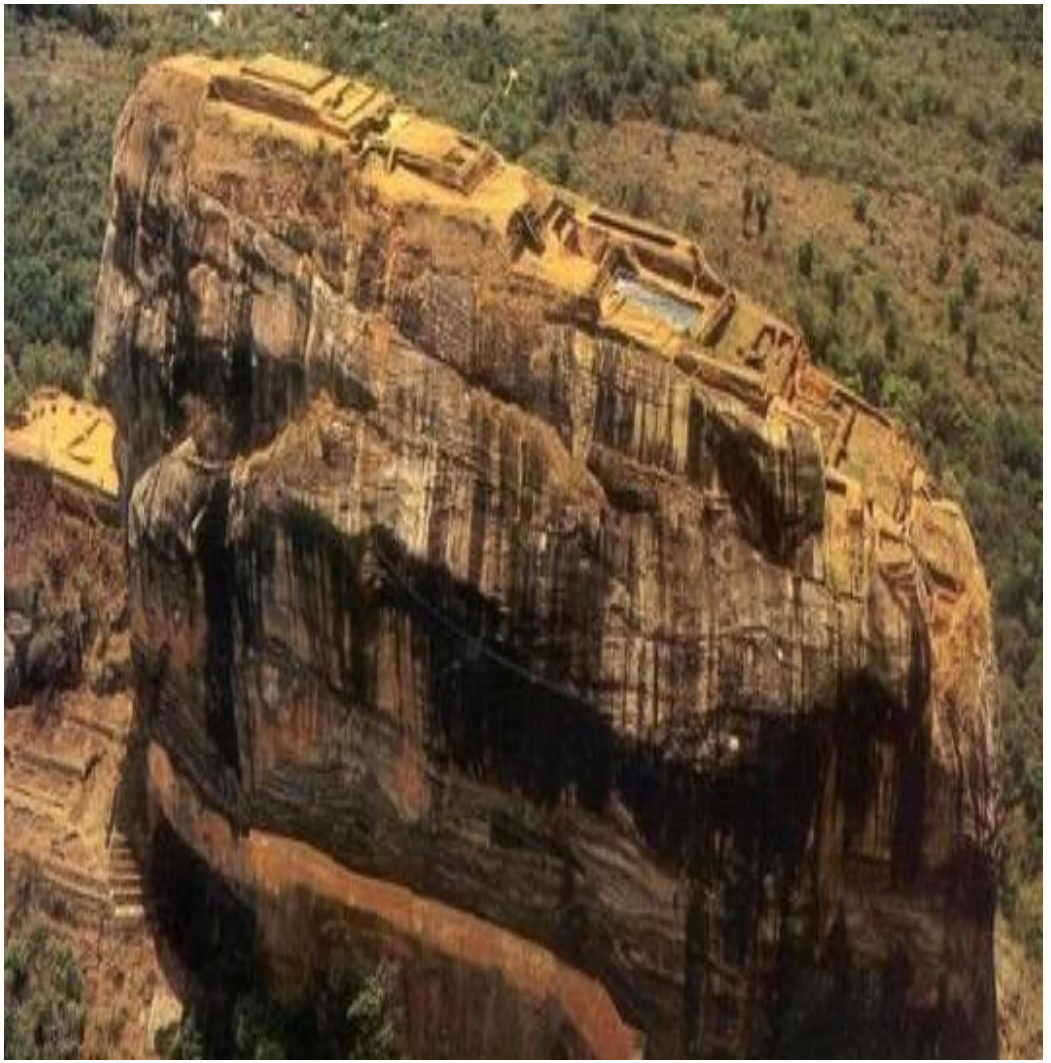
System components

Ground & rock catchment systems consist of:

- **a collection surface,**
- **a storage tank, and**
- **guttering or channels**







Watershed management

Contour trenches

Contour trenches trap rain water, enable it to percolate to underground aquifers and break the speed of fast moving water

Source: WOTR n.y.

Watershed management

Stone bunds across the slope to arrest the flow of water and control erosion in areas where soil work is not possible

Watershed management

Afforestation & field bunds

Afforestation and pasture development on barren wastelands (top) and field bunds (bottom)

Watershed management

Gully plugs and nala bunds

Gully plugs and nala bunds help to control the flow of water, sedimentation and recharge ground water aquifers

Watershed management

Check dams and percolation tanks

Check dams and percolation tanks at the lowest end of the drainage outlet

Applicability

- **water for domestic and agricultural purposes (e.g. drinking, irrigation, flushing toilet, etc.)**

Advantages and disadvantages

Advantages:
source of water where groundwater resources are unavailable or costly

Disadvantages:
Unreliable


Thank you