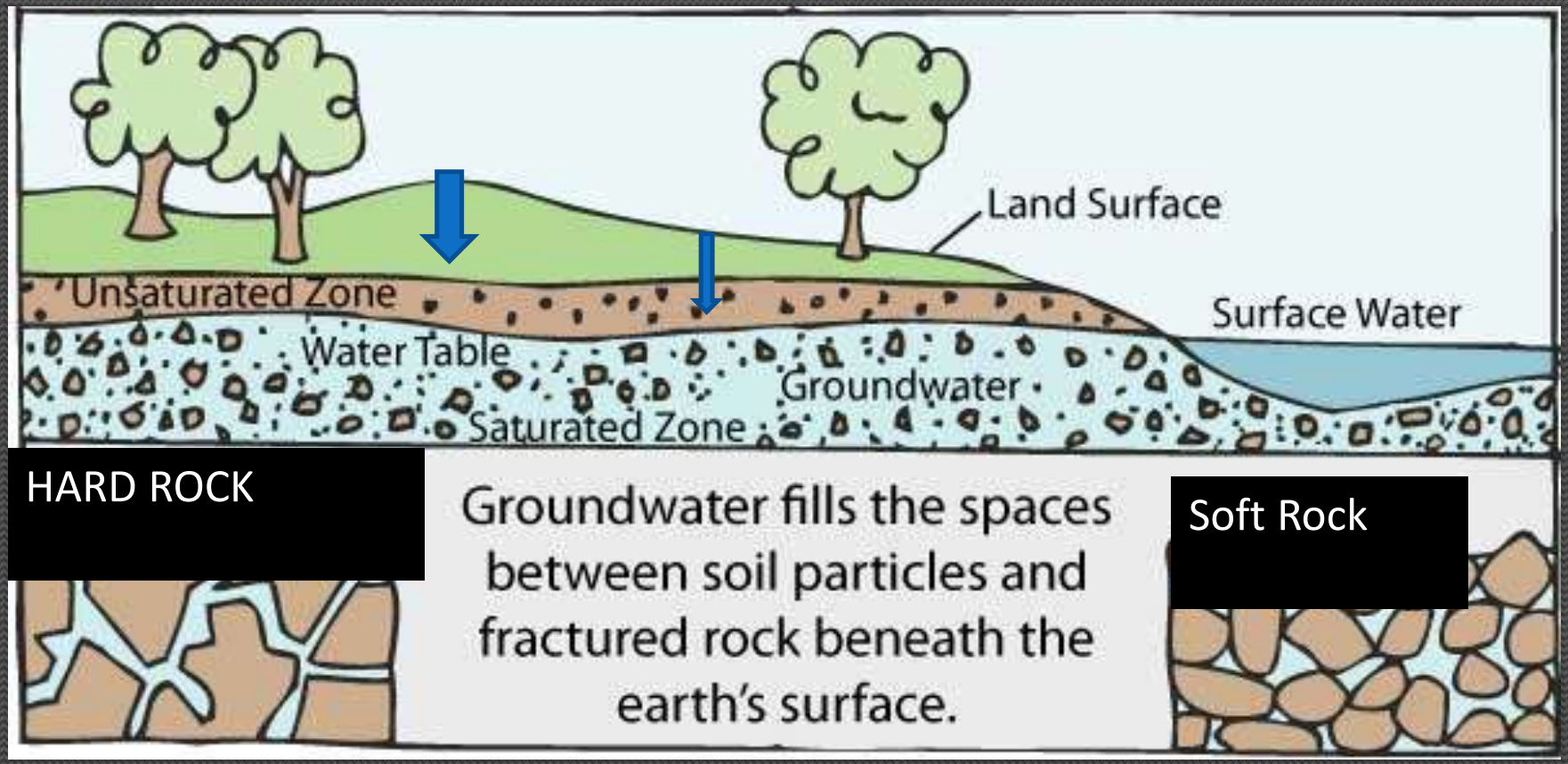
CATCH THE RAIN-THROUGH RAIN WATER HARVESTING

M.K.Garg
Scientist 'D'
CENTRAL GROUND WATER BOARD
Faridabad

Mission- Catch the Rain

- To create awareness to save water.
- Catch the Rain, where it falls, when it falls.
- To nudge all the stake-holders to create awareness for Rain Water Harvesting structures suitable to the climatic and lithological conditions to store rain water.

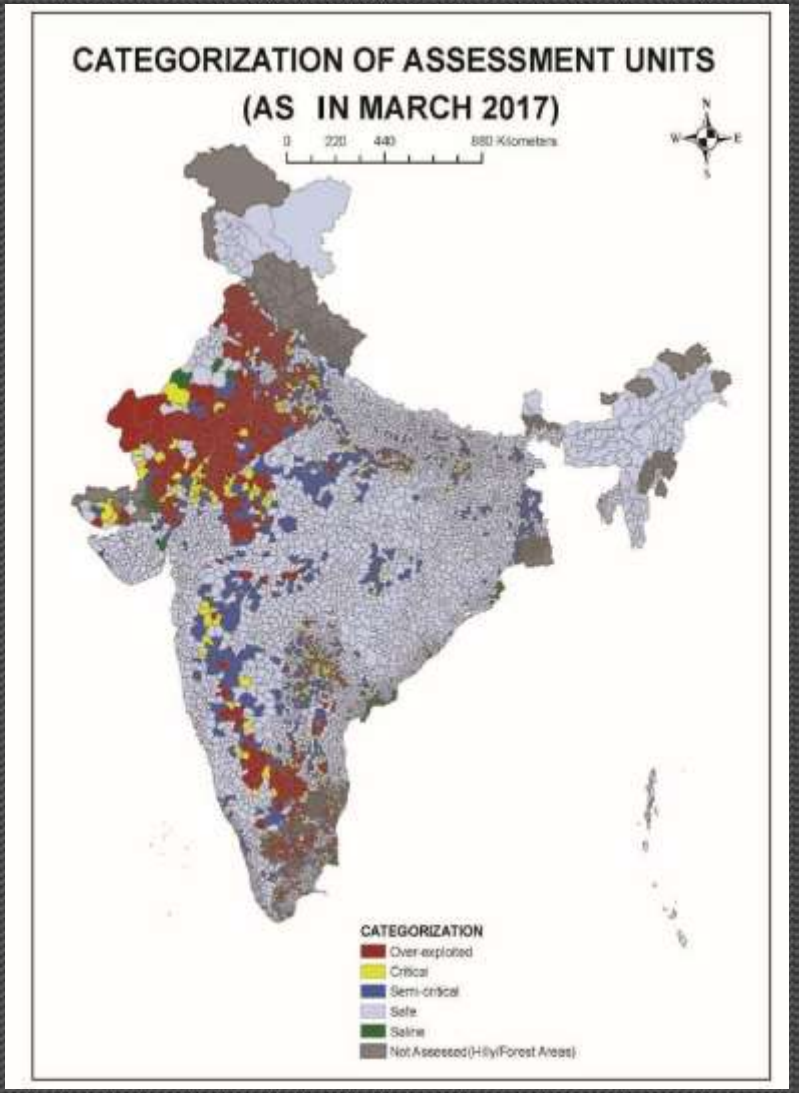
- Ground Water – invisible resource



India is the largest user of groundwater in the world and uses - over a quarter of the global total.

GROUND WATER AVAILABILITY

Annual Ground water Recharge (B.Cu.m)	**431.86**
Annual Extractable GW Resources (B.Cu.m)	392.70
GW Extraction for all uses (B.Cu.m)	248.69
Stage of GW Extraction	63%
Total Assessment Units	6881
Safe	4310
Semi Critical	972
Critical	313
Over Exploited	1186
Saline	100



Rain Water Harvesting

- Rain Water Harvesting is the technique of collection and storage of Rain water at surface or in sub-surface aquifer, before it is lost as surface runoff.
- It is an effective tool to utilize a large quantity of good quality water which otherwise goes as waste creating several problems on the way.
- RWH
  - Storage & Direct Use
  - Recharge
  - Combination of Storage & Recharge

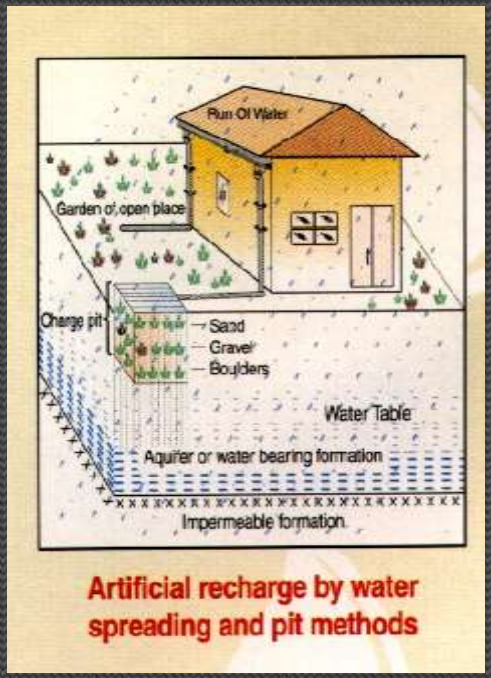
Need of RWH

- To supplement water supply to meet the demand
  - Surface water is not adequate to meet our ever increasing water demand and we have to supplement with ground water.
- To augment water availability through harvesting of Rain water
  - Due to rapid urbanization, infiltration of rain water into the sub-soil has decreased drastically and recharging of ground water has been reduced.
- To arrest decline in ground water level
  - Over-exploitation of ground water resource has resulted in decline in water levels in most part of the country.

Benefits of RWH

- Enhanced availability of ground water at specific place and time
- Improvement in the water quality of groundwater by dilution
- Raise the water level & increase in yield of wells.
- Reduction in power consumption.
- Sustainable agriculture production.
- Sustainable ecology by increase in the vegetation cover
- Arresting of sea water ingress in vulnerable coastal aquifers.

- RWH-Harvesting
  - Storage & Direct Use
  - Recharge
  - Combination of Storage & Recharge
- Different Methods for Rural & Urban Environs
- Different types of Structures for different hydrogeological terrain



Artificial recharge by water spreading and pit methods

RWH Techniques

Typically, a rainwater harvesting system consists of three basic elements:

- Collection system
- Conveyance system
- Storage system.

RWH Techniques

- Collection systems can vary from simple types within a household to bigger systems where a large catchment area contributes to an impounding reservoir from which water flows by gravity or pumped.
- The categorisation of rainwater harvesting systems depends on factors like the size and nature of the catchment areas and whether the systems are in urban or rural settings.

Storage of Rainwater on surface for future use

The Storage of rainwater on surface is a traditional technique and structures used are underground tanks, Ponds etc

Storage Tank

- Conservation of Rainwater by collecting in storage tanks is generally done in areas with poor aquifer systems, eg., hilly areas & poor quality areas, deeper aquifer, because these area are either not favorable for recharge or abstraction of ground water is difficult & expensive.

Storage of Rainwater on surface for future use(contd)

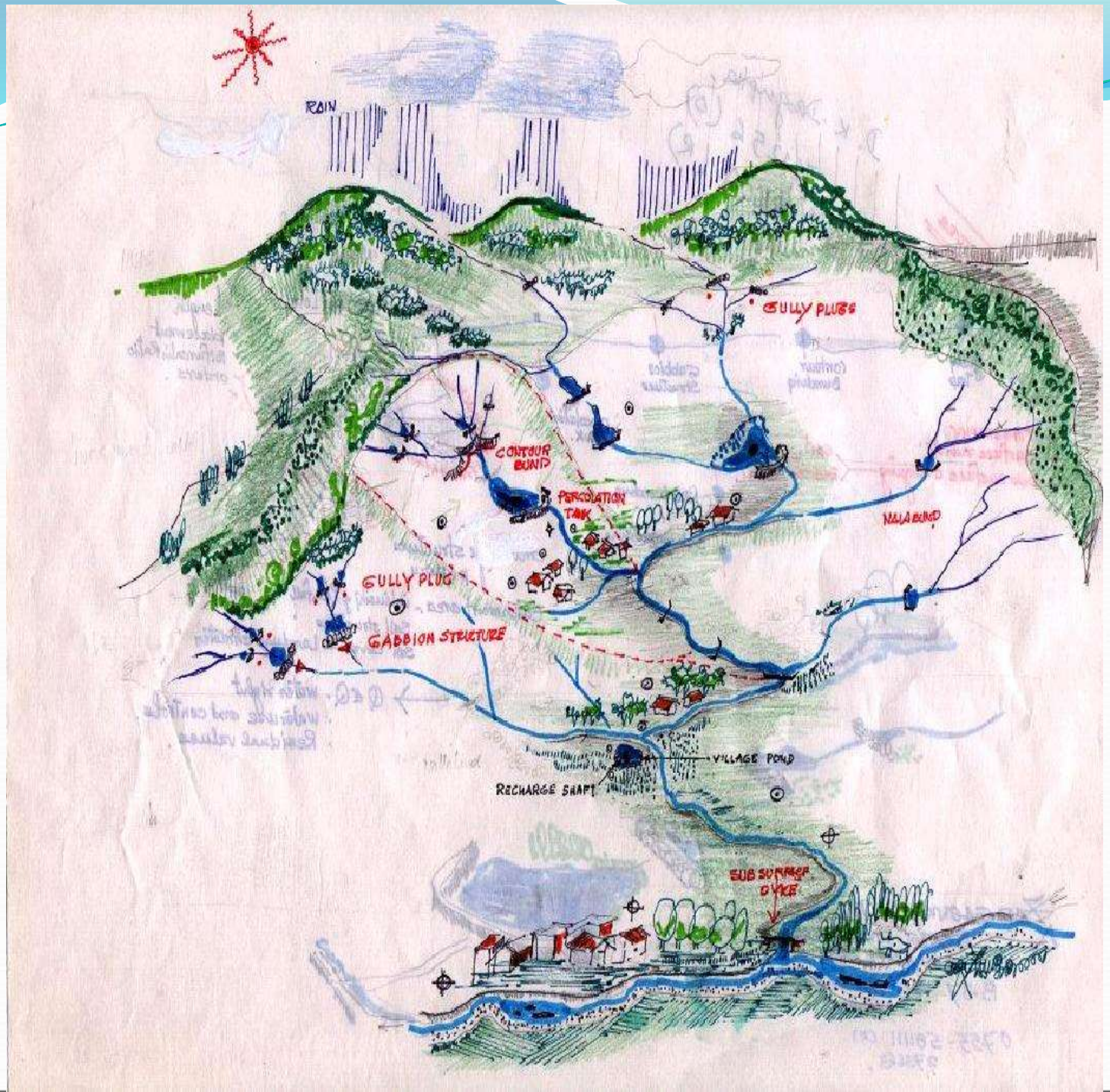
- The rooftop runoff is stored in a tank which may be a syntax tank, RCC tank or Masonry tank and may be constructed on surface or below the ground surface
- The runoff of the first shower is drained out.
- The stored water of tank is used for domestic purposes after chlorination & filter.

Urban Recharge Structures

- **Aquifer extends from surface**
  - Recharge Pit
  - Recharge Trench
- **Aquifer separated by non permeating horizon (Clay etc)**
  - Recharge Shaft
  - Trench with Recharge well
  - Shaft with recharge well.
- **Recharge through Existing Structures (Abandoned)**
  - Recharge through dugwell
  - Recharge through abandoned tubewell/handpump.

Rural Recharge Structures

- **Aquifer extends from surface**
  - Check Dam/ Nala Bund/ Gully Plug/Gabbion
  - Contour Trench/Contour Bund
  - Percolation tank/village ponds
  - Springshed/watershed development
- **Aquifer separated by non permeating horizon (Clay etc)**
  - All the structures mentioned above with
    - recharge wells/shafts/Injection wells
- **Groundwater conservation**
  - Subsurface Dyke


RAIN
GULLY PLUGS
CONTOUR BUND
PERCOLATION TANK
NALA BUND
GULLY PLUG
GABBION STRUCTURE
VILLAGE POND
RECHARGE SHAFT
SUB SURFACE DYKE

Present practices of RWH

- **Roof Top Rain Water Harvesting-**

➢ **What is Roof Top Rain Water Harvesting ?**

- Roof Top Rain Water Harvesting is a technique of collection and storage of rain water from the roof of the building in surface or in sub-surface aquifer before it is lost as surface run-off.

➢ **Where and why it is required ?**

- Practiced generally in urban areas. The augmented resource is used in the time of need. This system is useful mainly for drinking / domestic purposes.

RUN OFF CO-EFFICIENT

The entire volume of the rain falling on the roof cannot be harvested. A part of it is lost due to evaporation, seepage etc.

Available Run off = Rainfall * Area * Runoff-Coefficient

Run off coefficient is defined as the actual percentage of rainwater that can be harvested.

Catchments	Runoff Coefficient
Roof top	0.75 - 0.95
Paved area	0.50 - 0.85
Bare ground	0.10 - 0.20
Green area	0.05 - 0.10

RTRWH

AVAILABILITY OF HARVESTED WATER THROUGH ROOF TOP RAINWATER HARVESTING

Rainfall (mm)	600	700	800	1000	1200	1400	1600
Roof area (sq m)	Harvested water from roof top (cu m)						
20	9.6	11.2	12.8	16	19.2	22.4	25.6
30	14.4	16.8	19.2	24	28.8	33.6	38.4
40	19.2	22.4	25.6	32	38.4	44.8	51.2
50	24	28	32	40	48	56	64
60	28.8	33.6	38.4	48	57.6	67.2	76.8
70	33.6	39.2	44.8	56	67.2	78.4	89.6
80	38.4	44.8	51.2	64	76.8	89.6	102.4
90	43.2	50.4	57.6	72	86.4	100.8	115.2
100	48	56	64	80	96	112	128
150	72	84	96	120	144	168	192
200	96	112	128	160	192	224	256
250	120	140	160	200	240	280	320
300	144	168	192	240	288	336	384
400	192	224	256	320	384	448	512
500	240	280	320	400	480	560	640
1000	480	560	640	800	960	1120	1280
2000	960	1120	1280	1600	1920	2240	2560
3000	1440	1680	1920	2400	2880	3360	3840

RTRWH

Calculations involved in Rooftop Rainwater Harvesting

Area of the roof top(Length x Width)	100 sq.m
Average annual Rainfall	1200 mm or 1.2 m
Precipitation on 100 sq. m. roof	100 x1.2 or 120 m^3
Maximum annual collection of water (@ 80% efficiency)	96m^3
Average annual consumption per head	0.12 x 365 = 43.8 m^3
Average annual draft per family (Taking 5 members per family)	43.8 x 5 = 219 m^3

Therefore saving by recharge (96m^3) is about 44 % of annual draft of per abstraction structure.

- **Water requirement for about 160 days for a family of 5 members.**

Note: Design to be made based on Max Daily RF (Intensity)

RTRWH

TYPES OF RECHARGE STRUCTURES USED IN RTRWH

RTRWH through Recharge pits (Lodhi Garden)

- Areas where permeable rocks are exposed at shallow depth.
- For building having roof area of 100sq.m , for recharging shallow aquifers
- 1-2m wide,2-3 m deep and 2-3m long pit ,back filled with boulders (5-20cm),gravel(5-10mm.size)and Coarse sand(1.5-2mm.size) .

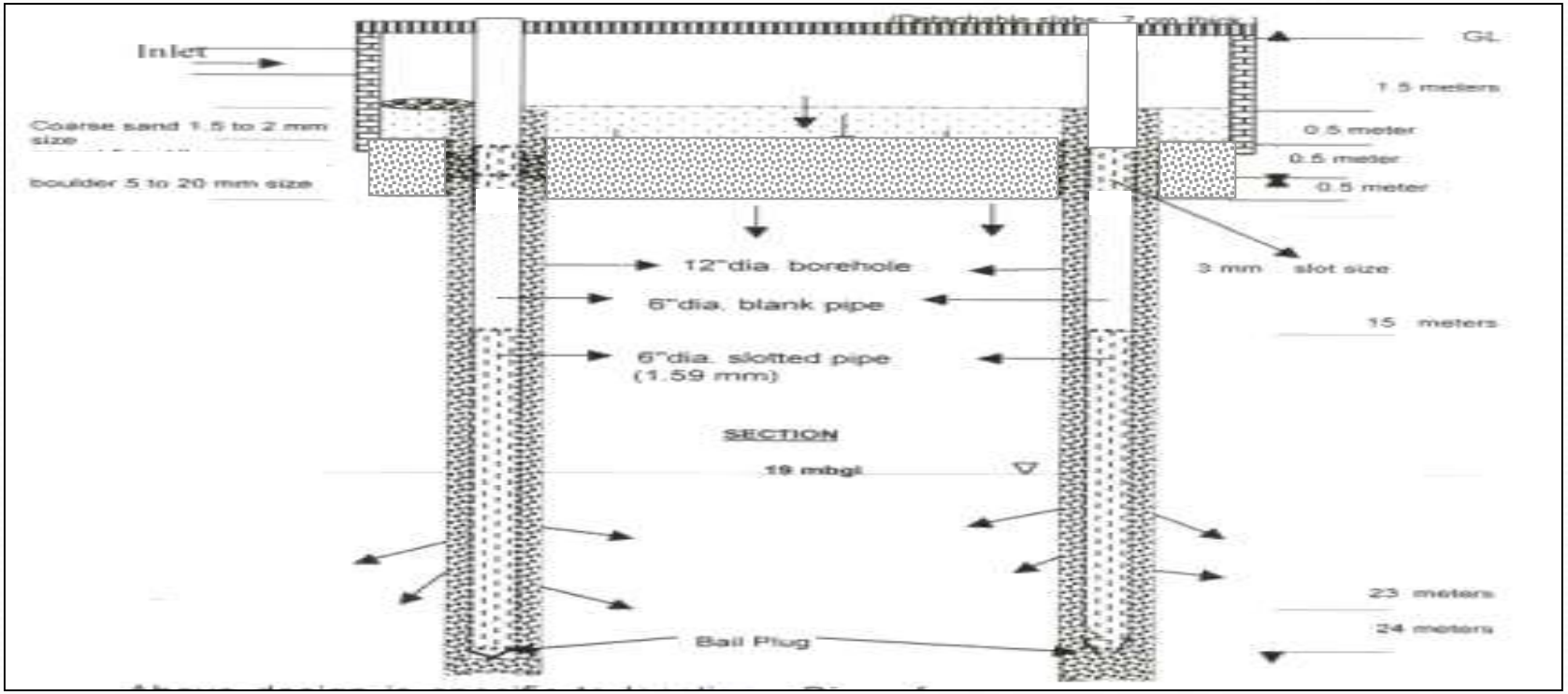
  A mesh should be provided at roof to prevent entry of solid waste /leaf debris into recharge pit.
- Settling pit or desilting chamber should be provided to prevent the entry of finer particles into the recharge pit.
- Clogging of filter media reduces the rate of filtration.Top layer of filter media should be cleaned periodically.
- By pass arrangements for diverting the flow of first 2-3 shower should be provided.

Recharge through trenches

- Suitable for building having roof area of 200 – 300 sq.m and where permeable rocks are at shallow depth.
- Trench may be 0.5 - 1m.wide ,1 - 1.5m deep and 10 - 20m long depending upon the roof area.
- Trench is backfilled with filter media of recommended size, in the order of increasing grain size.
- Settling pit or desilting chamber should be provided to arrest the flow of finer particles before it enters into the trench.
- Clogging of filter media reduces the rate of filtration.Top layer of filter media should be cleaned periodically.

RTRWH

Trench with Recharge wells

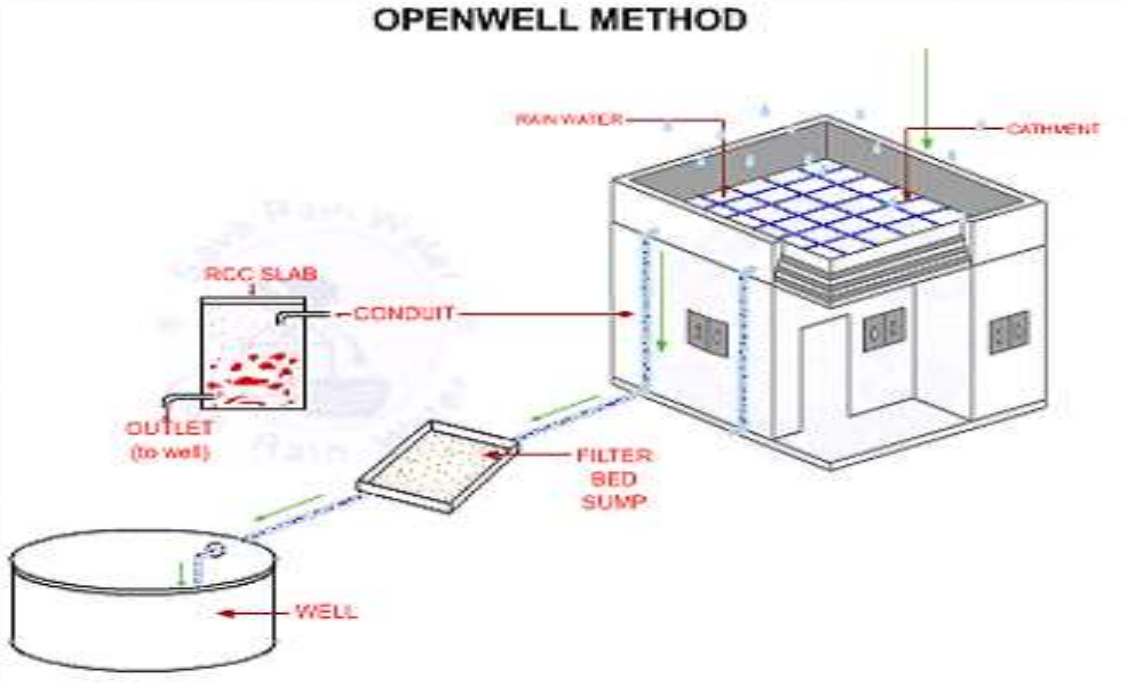


- Suitable where top layer is impervious and permeable strata lies at shallow depth(within 20 m).
- Where roof area is big and large quantity of roof water is available within a short period of heavy rain fall.
- Lateral trench of 1.5 to 3m. in width and 10-30m length is constructed with the shallow recharge well in the centre.

RTRWH

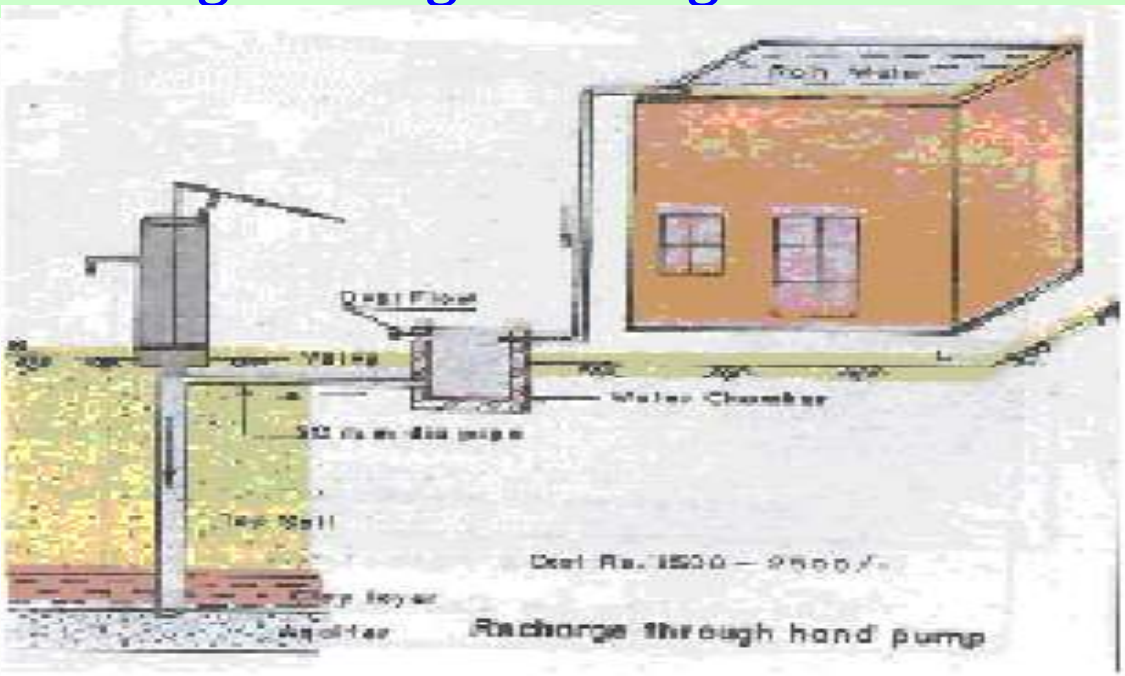
Trench with recharge well (Lodhi Garden)

Recharge through existing Dugwell



- This method is used where Shallow dug well exists.
- Water collected on roof top is brought down through PVC pipes.
- Water is passed through the settling tanks and filter media .
- Filtered water is allowed to flow in to the dug well.

Recharge through existing tubewell



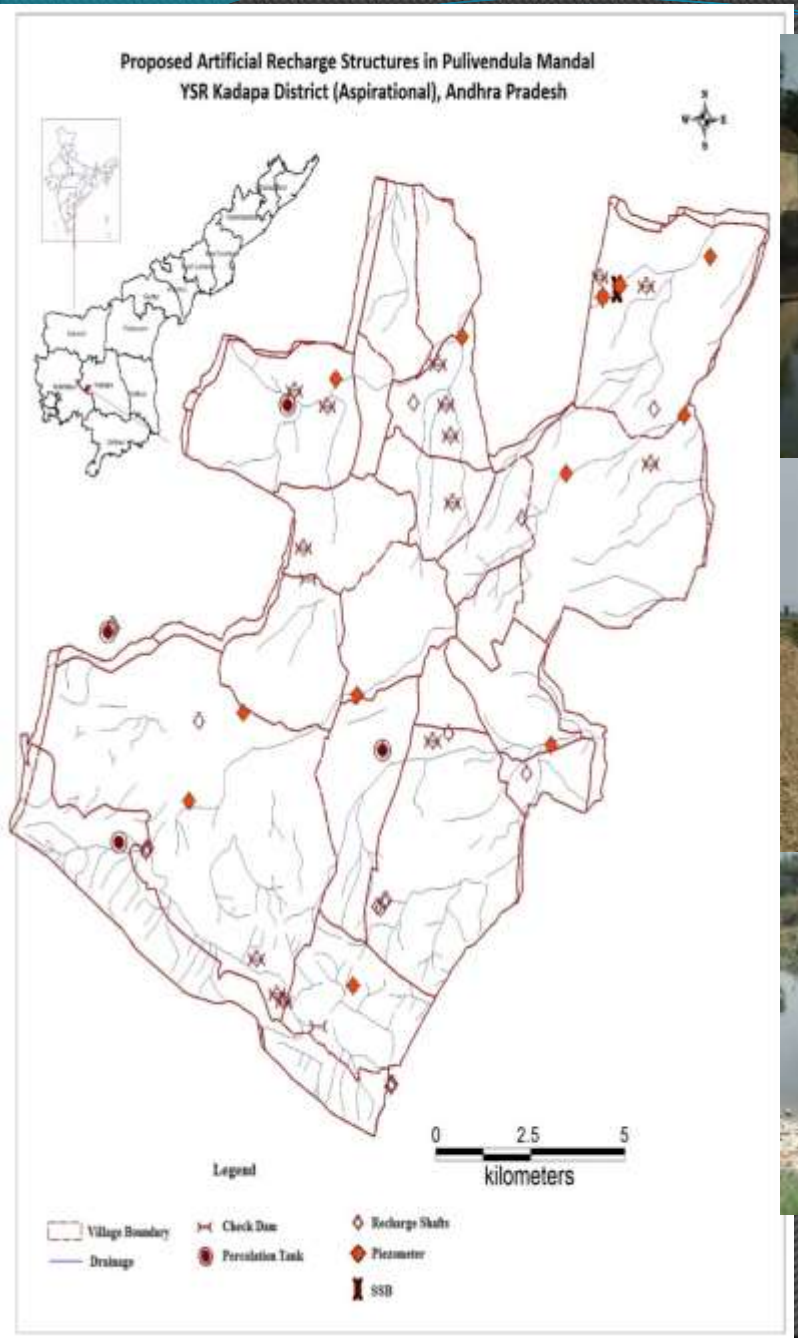
- Recharging deeper aquifers through the existing tube wells.
- Roof water is brought down at G.L by using pvc fittings.
- Water is passed through PVC filter before entering into recharge structure.
- Desilting tank is constructed before Filter.
- Water from tube well should be used after chlorination.

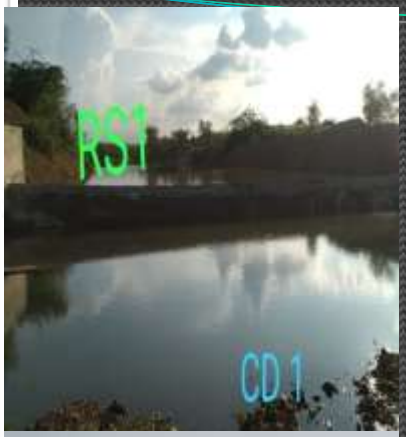
On Going Work:
Artificial Recharge in Aspirational Districts

- **Objective**
  - Harvesting of the runoff water in stream to store at suitable locations for augmenting recharge to the ground water

  - **Work taken up**
  - Maharashtra, Andhra Pradesh & Telangana

Andhra Pradesh

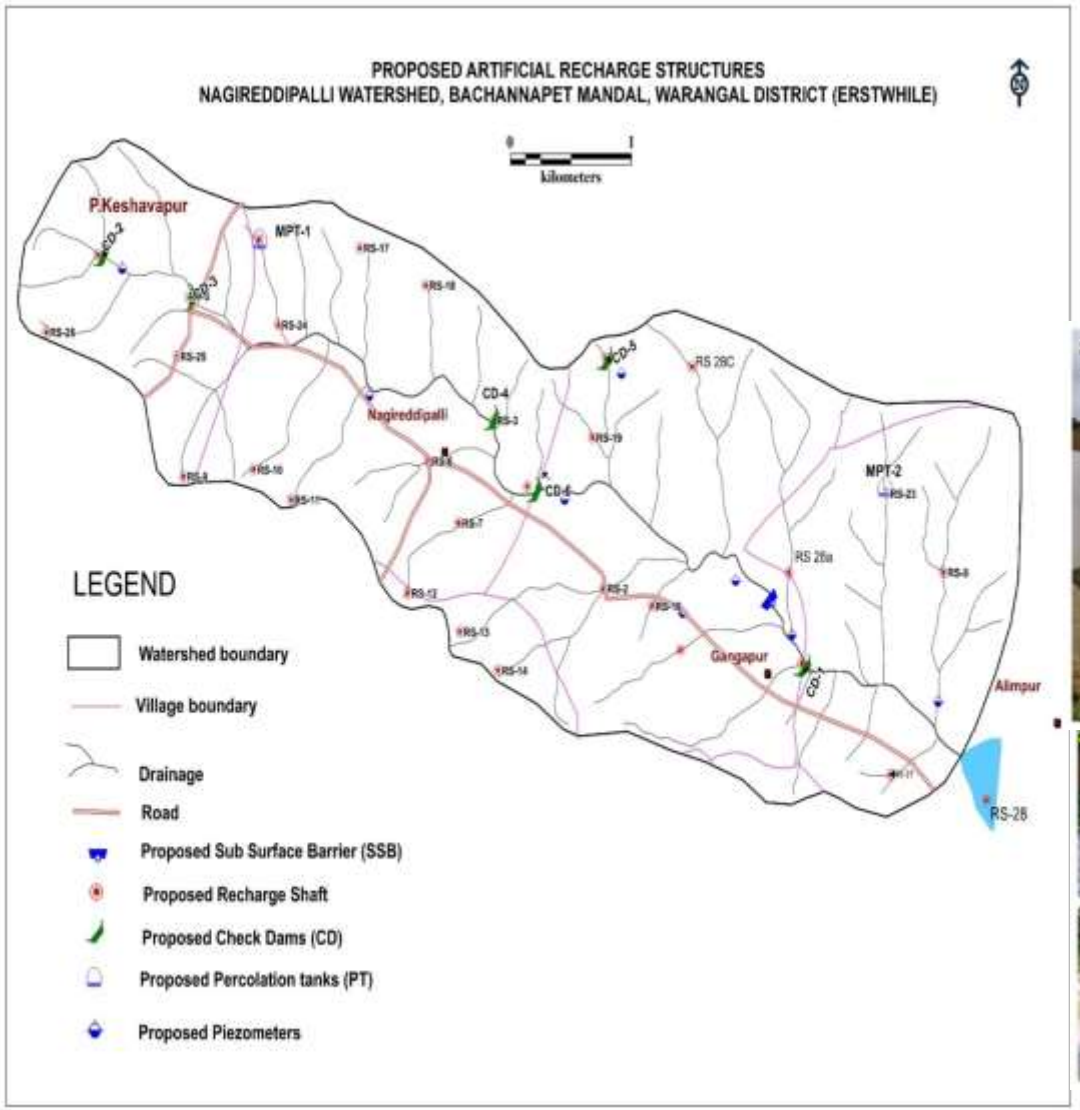




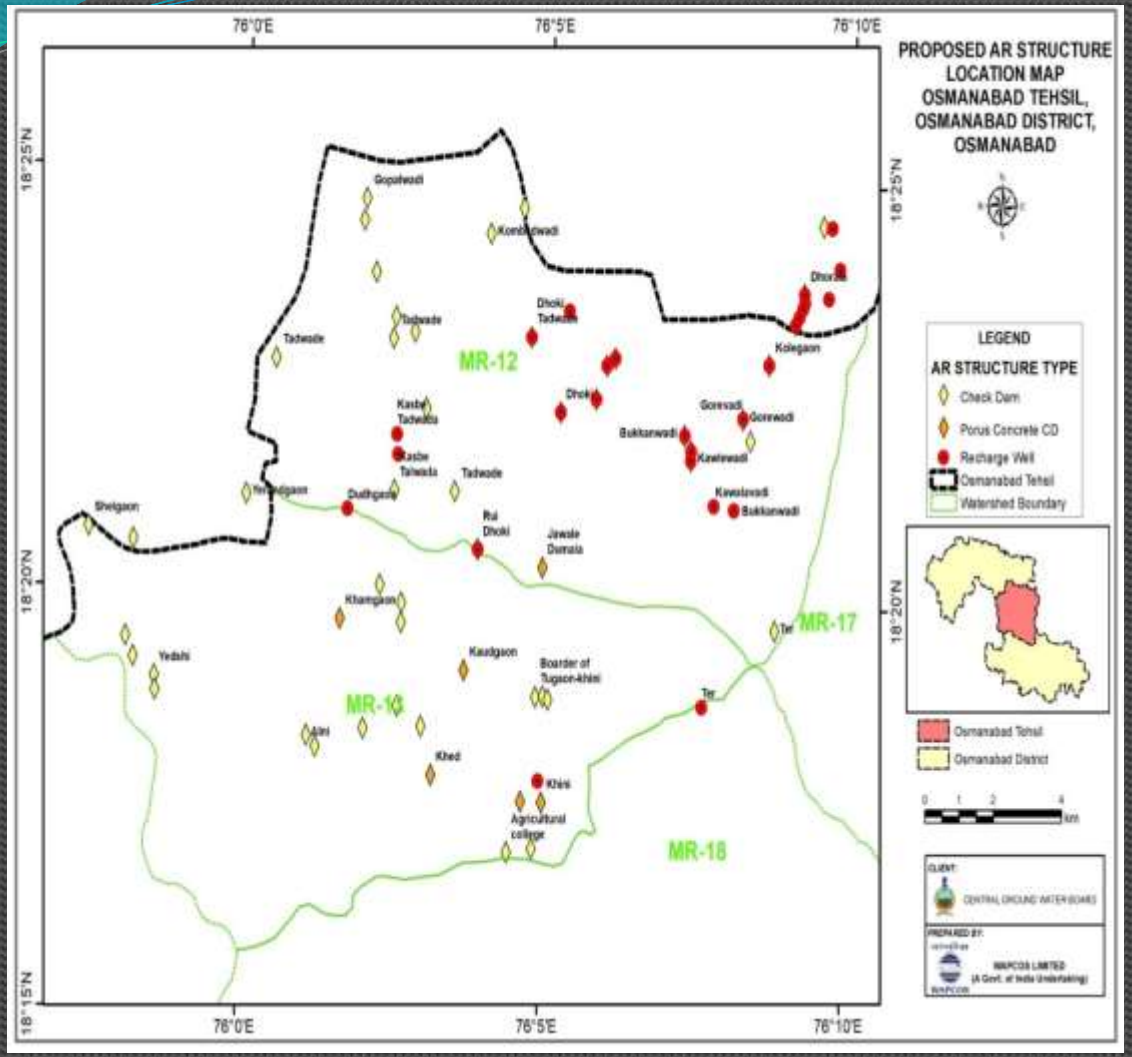
- Status: **Completed**
- Structures:
  - CD 16, PT- 04, SSB- 01,
    RS- 35, PZ-13

Telangana

- Status: **Completed**
- Structures:
  - CD 06, SSB-01, RS-31, PZ-08



Maharashtra



- Status: **Completed**
- Structures:

Check Dam: 55

Piezometer: 20
Installation of AWLR also completed.

Recharge well: 46

On Going Work: Association with MNREGA Work

- Objective
  - To provide technical guidance in selection of sites & design of artificial recharge structures in priority areas
  - Conduct trainings to MNREGA Officials for Capacity Building
- 9 Blocks selected in the State of Haryana Rajasthan, MP, Maharashtra, AP, Telangana, Karnataka & TN
- Sites selected through Joint site visits by CGWB & State Govt. officials
- Work is executed by State Government through MNREGA Fund

On Going Work:
Association with MNREGA Work


Trench, Devarajgattu


Checkdam, Thokapalli


MI Tank,
Boyadgumpala


Multi Arch Check Da
Doddamallekere


Borewell Recharge Structure,
Thokapalli


Farm Pond, Gundamch


Multi Arch Check Dam, Allpura


Multi Arch Check Da
Kerekeliganahalli

Win- Win Solution for water scarcity

- Cath the rain where it falls
- Good quality
- Can provide water at the place of requirement
- Can supplement the existing water supply
- No requirement of large investments/people displacement
- Environment friendly

Thanks