STRATEGIES & POLICY FOR ARTIFICIAL RECHARGE OF GROUND WATER

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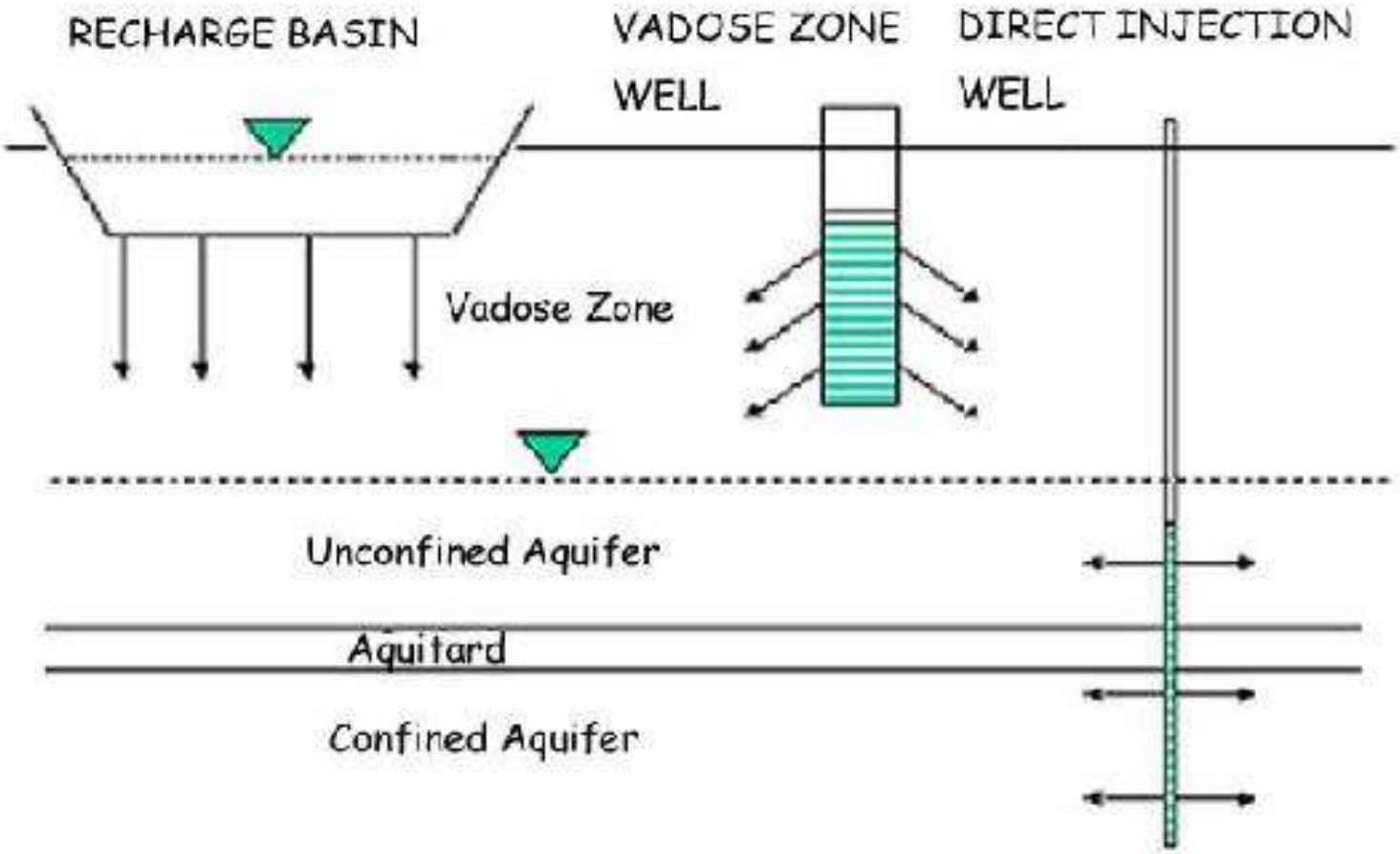
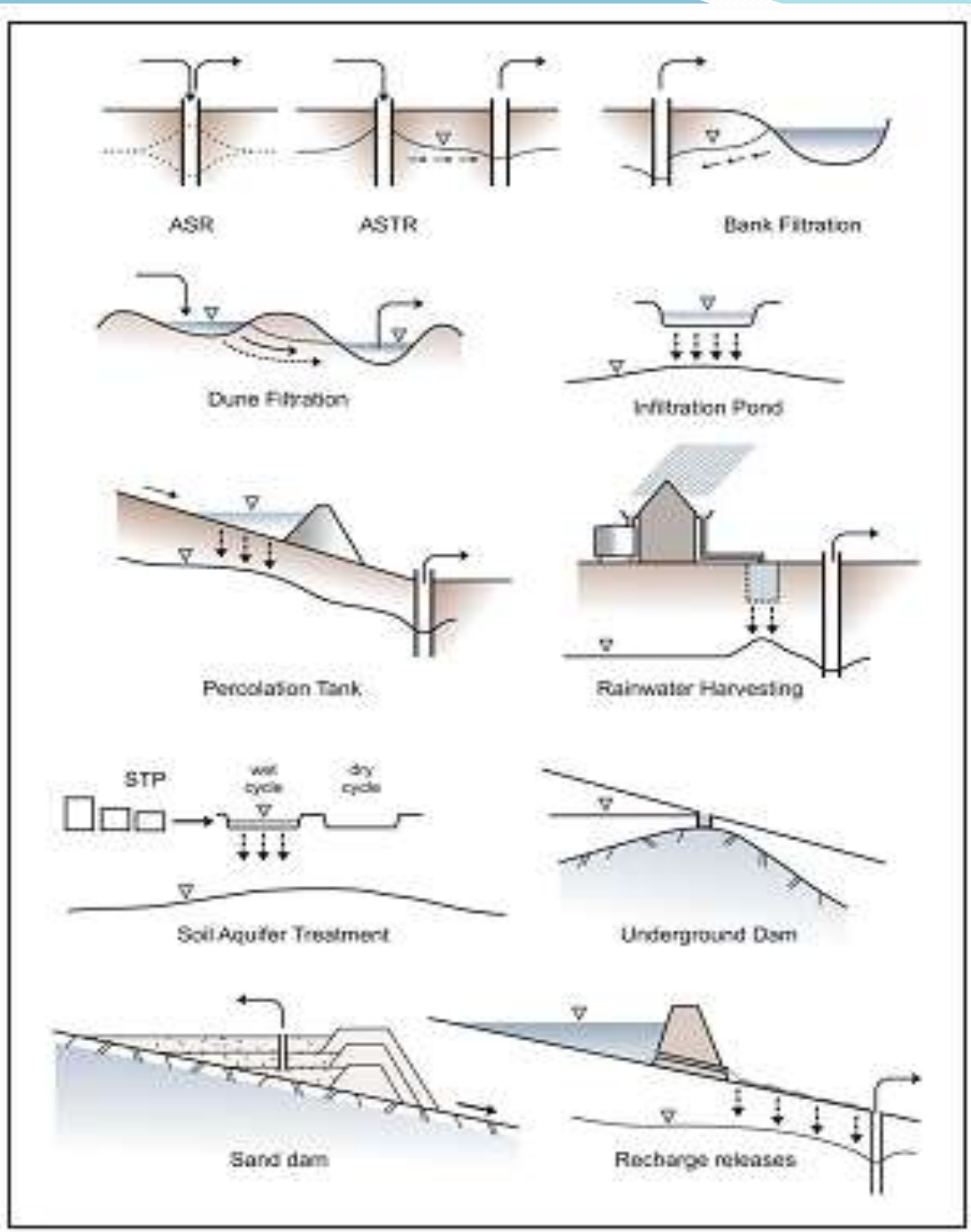
CONCEPT OF ARTIFICIAL RECHARGE

- Recharging practices began in 19th century in Europe.
- Traditional water harvesting in India dates back to Indus Valley Civilization and Mughal Period.
- The artificial recharge is the augmentation of underground aquifers by some methods of construction by artificially changing the natural conditions.

Method for aquifer recharge



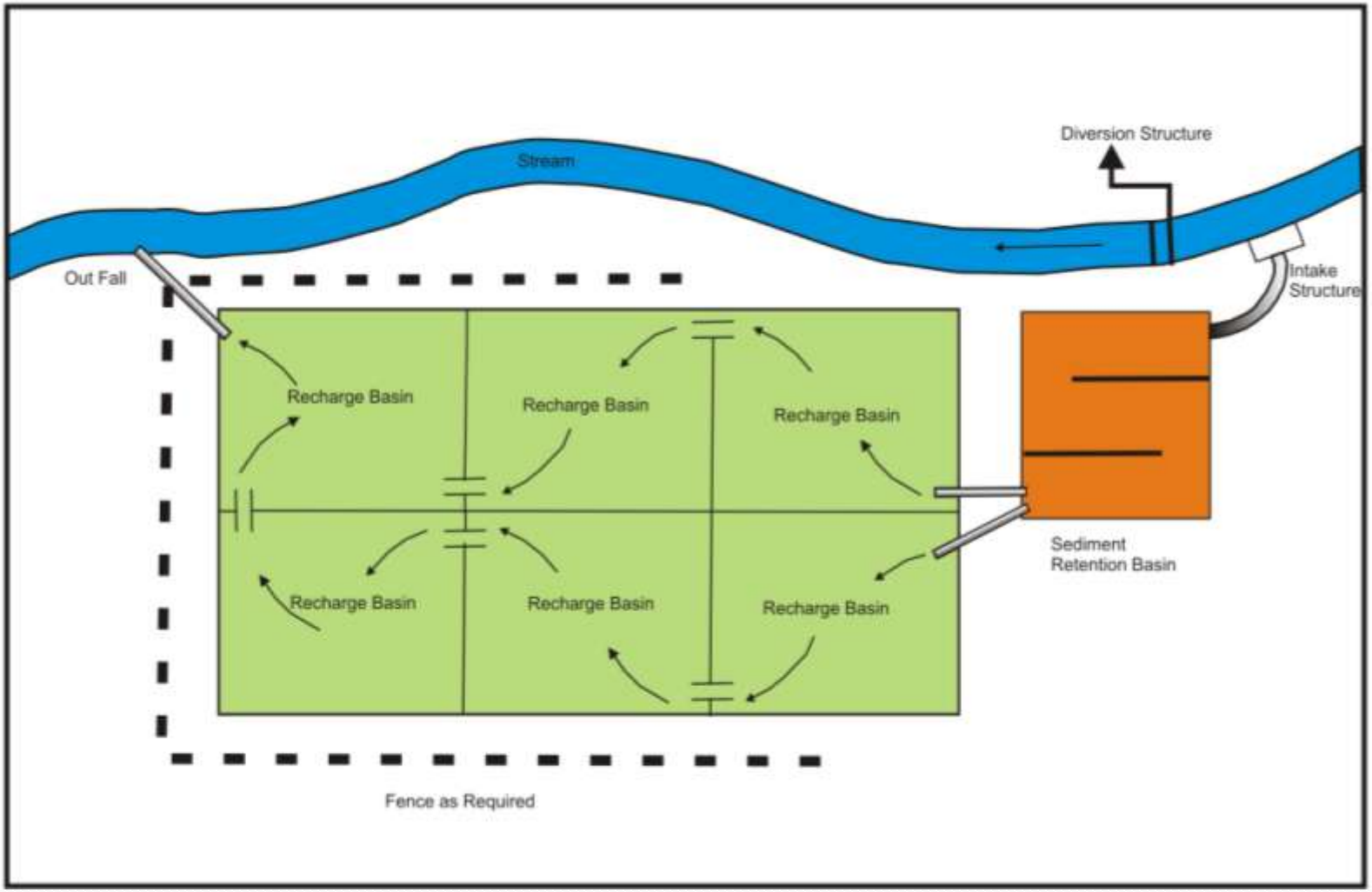


Schematic of types of management of aquifer recharge

Basin Spreading Recharge

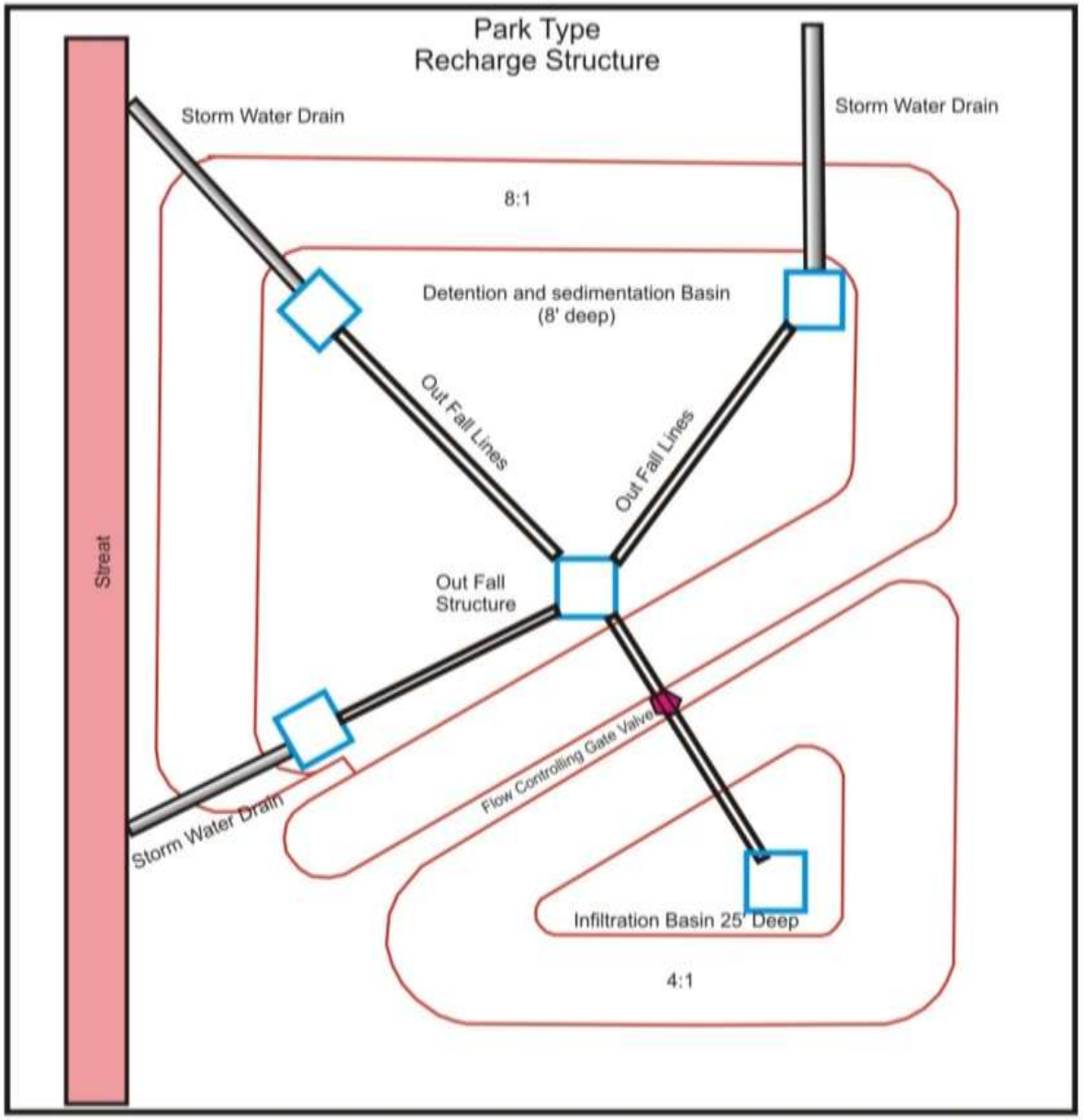
- Water is recharged by releasing it into basins formed by excavation or by the construction of containment dikes or small dams of dimensions varying from few meters to several hundred meters.
- The most common system consists of individual basins fed by pumped water from nearby surface water sources.
- Silt-free water avoids the problem of sealing basins during flooding.
- Basins require periodic scraping of the bottom surface when dry to preserve a percolation surface.
- Basins, because of their general feasibility and ease of maintenance, are the most favored method of artificial recharge from the surface.
- Gradients of major feeder ditches should be sufficient to carry suspended material through the system since deposition of fine-grained material clogs soil surface openings.
- The primary purpose of water spreading is to extend the time and the area over which water is recharged.

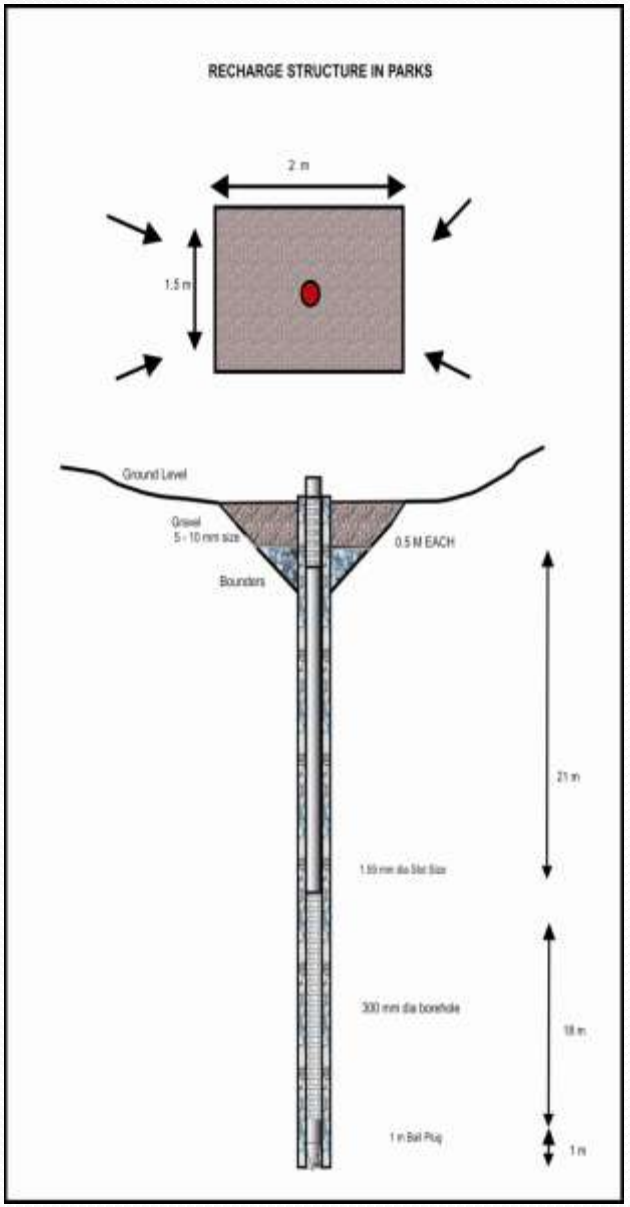
Basin Spreading Recharge



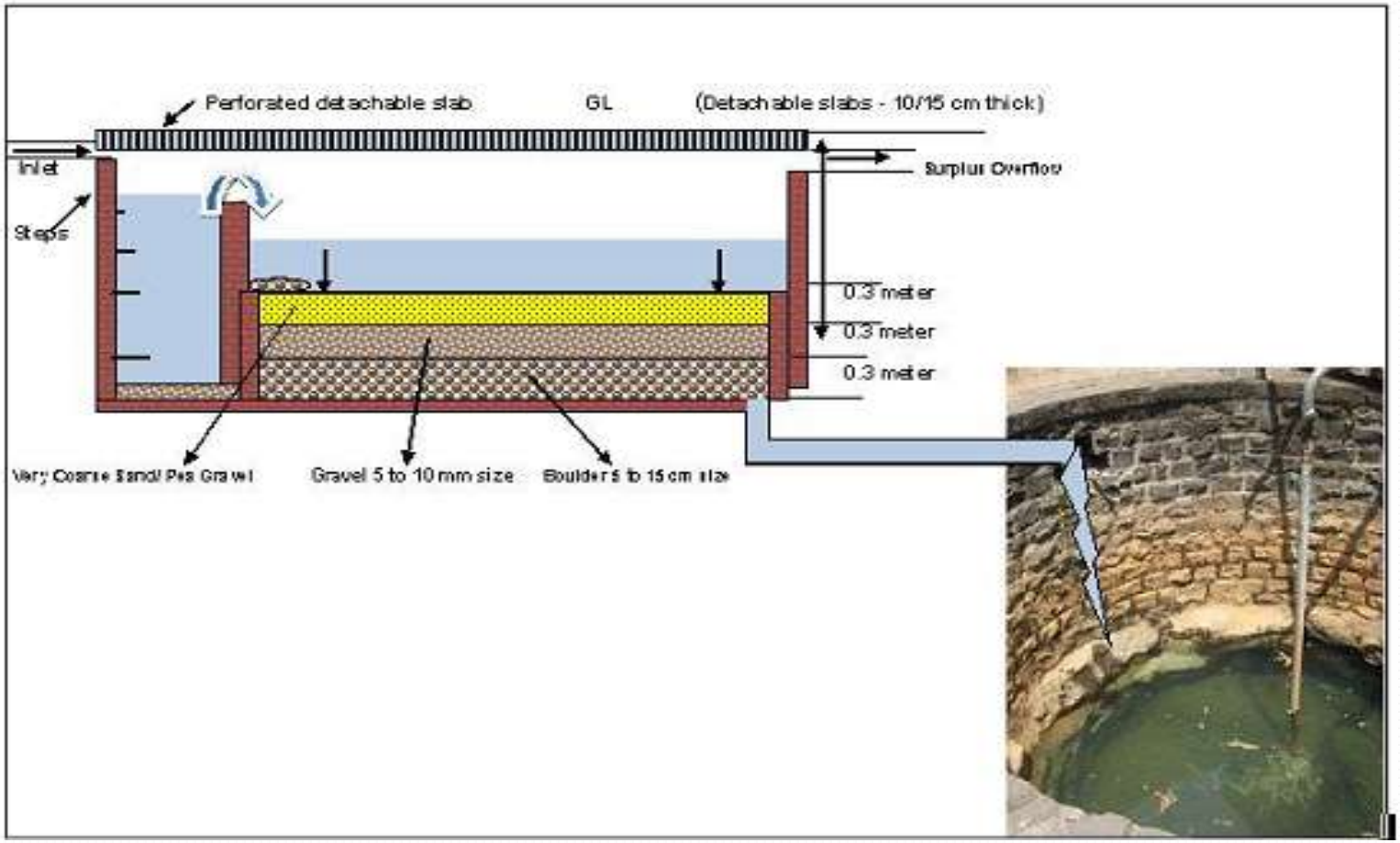
Park Type Structures

- Parks of residential colonies and institutional areas of urban agglomerate can be fruitfully utilized for recharge to ground water.
- Rainwater from the catchment of park as well as surrounding area is diverted towards the park which is excavated in a basin type depression to accommodate the rainwater from the elevated surrounding area.
- The water is recharged through recharge shaft/ recharge wells or recharge pit depending upon the hydrogeological conditions and depth of unconfined aquifer.
- Park type structure is used as rain water harvesting and recharge structure during monsoon and play ground in other seasons.
- Depth of excavation of park is such that the slope is in the ratio of 8:1 in the collector basin and 4:1 in the recharge basin.

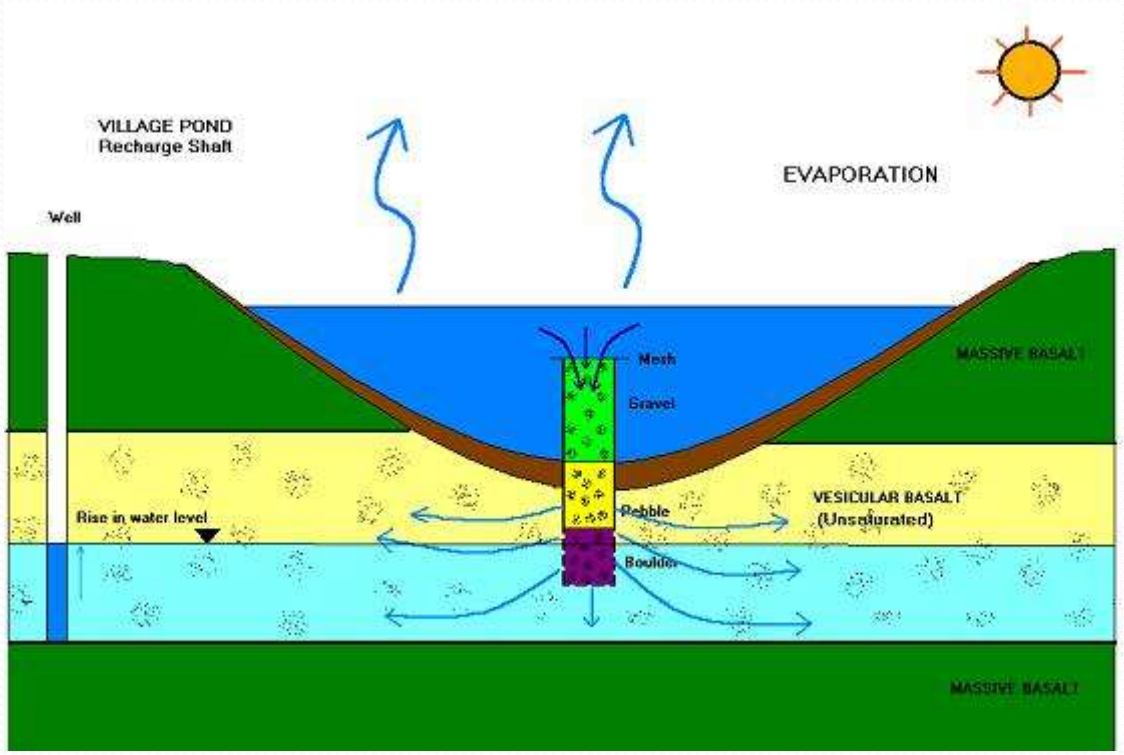

Park Type
Recharge Structure
Storm Water Drain
Storm Water Drain
8:1
Detention and sedimentation Basin
(8' deep)
Out Fall Lines
Out Fall Lines
Out Fall
Structure
Streat
Flow Controlling Gate Valve
Storm Water Drain
Infiltration Basin 25' Deep
4:1


RECHARGE STRUCTURE IN PARKS
2 m
1.5 m
Ground Level
Gravel
5 - 10 mm size
0.5 M EACH
Boulders
21 m
1.59 mm dia Slot Size
300 mm dia borehole
18 m
1 m Ball Plug
1 m

Dug Well Recharge



Pond Recharge shaft

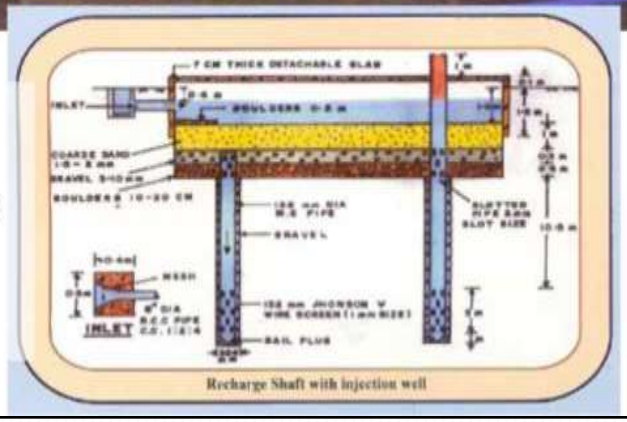


RTRWH in Shram Shakti Bhawan, New Delhi

Rainwater runoff: 3325 m^3

Recharge Structures
Trench & recharge wells: 3

Year of construction: 2001



Recharge Shaft with injection well

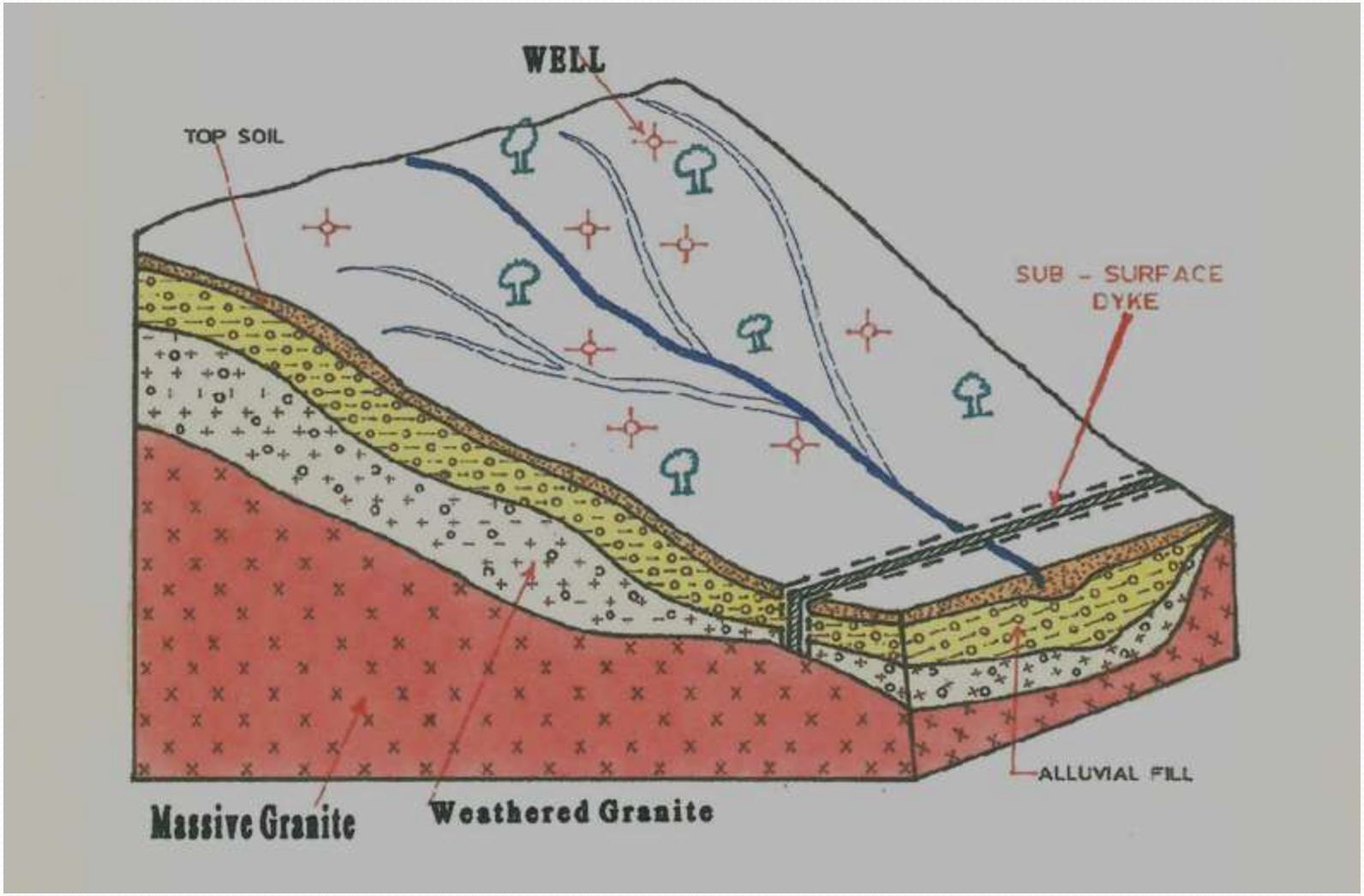
Average Recharge:
3000 m^3/Year

↑ (Rise) in water levels
Aug '07: 1.68 - 3.33 m

Cost : Rs 4.10 Lakh

Ground Water Dams or Sub Surface Dykes

- A ground water dam is a sub surface barrier across stream which retards the natural ground water flow of the system and stores water below ground surface to meet the demands during the period of need.
- The main purpose of ground water dam is to arrest the flow of ground water out of the sub-basin and increase the storage within the aquifer.
- Water levels in upstream of ground water dam rises and saturating the otherwise dry part of aquifer.
- The underground dam has following advantages: -
  - Since the water is stored within the aquifer, submergence of land can be avoided and land above reservoir can be utilised even after the construction of the dam.
  - No evaporation loss from the reservoir takes place.
  - No siltation in the reservoir takes place.
  - The potential disaster like collapse of dams can be avoided.


WELL
TOP SOIL
SUB - SURFACE
DYKE
ALLUVIAL FILL
Massive Granite
Weathered Granite

Approach to & basis for Artificial Recharge

- Basis should be water resource management philosophy of a state
- Factors that affect Technology choice
- Benefits and constraints of artificial recharge
- Ecological advantages
- Relatively rapid implementation
- Mitigating the effects of climatic variations
- Comparatively low capital cost

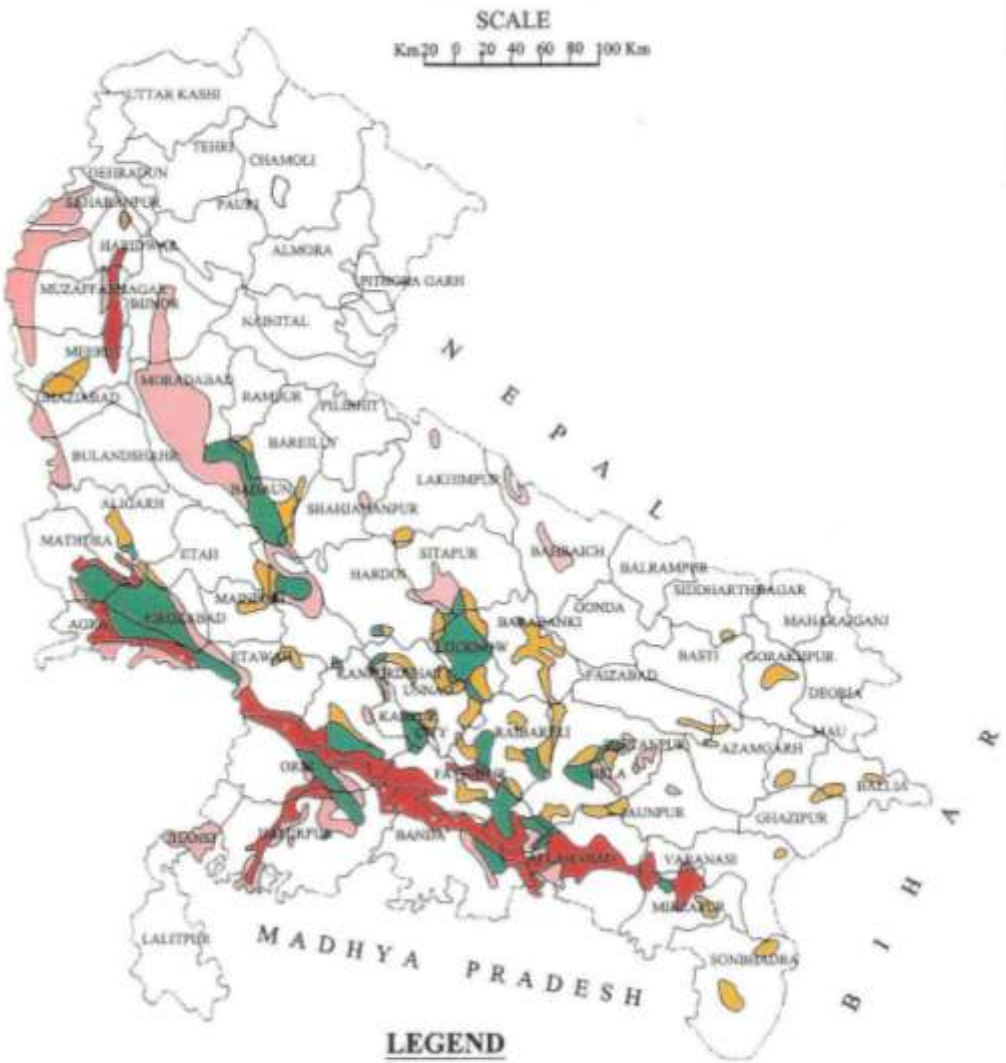
Aquifer storage vs Artificial Recharge Storage

- Aquifer with regard to its use allocations have two components
  - Dynamic groundwater
  - Static ground water
- Recharging is to viewed in relation to which portion of dynamic & static resource should be allocated to use as a policy imperative
- As of now NWP has laid down that use of only dynamic component limited to annual recharging availability in an area should be utilized
- The potential benefit in this case will be limited if only recharge of dynamic storage is considered in planning
- The potential storage will be maximum if part of static storage is also planned for use at least for drinking water needs notwithstanding its prohibitive cost.

Benefits of Artificial Recharge Schemes

- To maximize storage(long-term & seasonal)
- Water quality improvement through dilution
- Preventing saline-water intrusion & land subsidence
- Reducing reduction volumes from river flow
- Controlling effects of climate change
- Maintaining declining ground water levels

AREAS IDENTIFIED FOR ARTIFICIAL RECHARGE TO GROUNDWATER IN UTTAR PRADESH



LEGEND

AREA SUITABLE FOR RECHARGE WITH

- AREA SHOWING DECLINING TREND(>0.10m/Year) &WATER LEVEL 6-9 m b.g.l
- AREA SHOWING DECLINING TREND(>0.10m/Year) &WATER LEVEL BETWEEN 3 - 6 m b.g.l
- WATER LEVEL BETWEEN 6- 9 m b.g.l(<0.10m/Year)
- WATER LEVEL MORE THAN 9 m b.g.l

Constraints

Certain limitation as listed below need also to be kept in mind while planning for recharging.

Type of sources	User Scale	Limitations
Rain water storage tank	A family	Fails in periods of drought spell
Springs	Family/Village	Can also fail in dry season
Ground water	Village/Town	Needs sustainable aquifer yields
Artificial Recharge	Village/Town	Need aquifer with potential to accept recharge
Dams	Village/Town	Needs large area likely to be submerged

Strategic Policy Measures

- A strategic approach therefore presupposes a situation of assessment and knowledge base
- Making of recharge strategy acceptable and access able by community
- Broadening the awareness about the need for recharge
- Educating students and stakeholders
- Developing flag-ship projects to demonstrate value of AR-schemes
- Developing Recharging “information centres ” at block/municipality levels
- Producing TOTs for information centres and field demonstrations as Guides.

Legislation and Regulation

Existing legal provision in RWH & Recharging of Ground water

- 18 States and 4UTs have made Roof Top RWH mandatory
- 4 States namely Orissa, Meghalaya, Arunachal Pradesh, Jharkhand and 2 UTs of Lakshadweep & Andman & Nicobar Islands are in process of making such provision
- 6 States viz Chhattisgarh, Sikkim, Mizoram, Assam, Jammu & Kashmir and Manipur have yet to initiate action.
- An artificial recharge Advisory Council has be constituted in MOWR with its Minister in chair.
- The revised Ground Water Model Bill circulated by Union Govt. to States have a separate chapter as guideline on RWH & Recharging.
- Need for drafting a paper on legal requirements for implementing recharge for the use of planners, environmentalist and engineers.
- Training of regulatory staff in states in assessing planning and reviewing the effectiveness of artificial recharge scheme.

Strategic Planning Approach

AR-Schemes;

i. Should be made integral part of all IWRM projects and documents
ii. AR be considered to mitigate impacts of rain variability in rainfall
iii. Undertaking of detailed assessment of artificial recharge storage potential of aquifers under various agro-climatic regions of country.
iv. Detailed & refined quantification of surplus surface waters for recharging.
v. Developing economic models to compare AR-with other resources development options
vi. Identifying Aquifers with artificial recharge storage potential of 250-500 Mm^3 ; 500-750 Mm^3 and 75-1000 Mm^3 in every state/region.

Strategic Planning Approach……contd.

vii. making detailed analysis of country's skill and resources to the implementation of AR-Schemes.

viii. Need to upgrade and strengthen ground water level monitoring

ix. Need to provide guidance in technical aspects concerning viability of schemes

x. Need to develop specialized training courses on implementing operational artificial recharge schemes

xi. IIT's and other insstitutions…. should support artificial recharge initiatives

xii. Need to develop standards on operational management of AR-Schemes

Research Needs

- Implementing agencies & officials needs guidelines on water quality limits acceptable for recharge.
- The extent to which ground water quality & quantity can be improved
- Research of immediate concern are clogging in iron-rich ground water under artificial recharging.
- Quality-dilution research in arsenic and fluoride rich ground water areas.

Incorporating Artificial Recharge in Water Resources Planning

- AR–Schemes should be made integral part of IWRM projects and plan document
- Be part of water conservation Planning measures
- water use efficiency measures
- Conjunctive use measure
- AR-Strategy should target both Water resources level and water service levels

Policy Design & Issues

a. Mainstreaming of RWH & recharging for Aquifer storage Recovery & Transfer
b. Considering operational Recharge projects
c. Reviewing of State Water law on RWH & Recharging against Awareness arranging
d. Evolving Storm water policy
e. Developing convergence with NREGA / Watershed Development program based on common ground lines issued by Ministry of Water resource, Govt. of India.
f. Generating primary data through infiltration and percolation tests to produce areas percolation rates.

Policy Design & Issues……contd.

g. Modeling approach & simulation of recharge results in assessing recharge & ground water build up
h. Computing specific yield values of Aquifer through dug well / bore well recharging demonstration .
i. Setting up of groundwater demonstration recharge parks in each state for education & public awareness.
j. Consider Recharge though use of surplus flood water & using Flood-plan aquifer and Ephemeral river beds.
k. Evolve impacts and economic efficiency of Recharging Schemes.

Artificial Recharge Strategy Frame Work

Immediate :

- Priority(1):
  - Identifying knowledge constraints
  - Making knowledge & technologies accessible through awareness education and flagship projects and district/block level information centers
  - ground water monitoring at local and user levels
  - Priorities key research requirement
  - circulate information brochure on Recharge strategy

Artificial Recharge Strategy Frame Work……contd.

- Priority No(2):
- Broaden awareness
- Establish areas where ground water table has dropped due to higher extraction
- Develop procedure for recharge feasibility studies
- Develop institution and trained staff for operatinal recharge schemes
- Develop area specific standards and norms relating to artificial recharge
- Produce recharge guidlines in local language

Artificial Recharge Strategy Frame Work……contd.

Priority No(3) (2 to 3 years)

- Establish Information centers on Recharge programs and demonstrate value of recharge
- prepare documents to assist regulators, politicians and administrators in approving and reviewing recharge schemes
- Develop health risk assessment needs
- Review existing regulatory framework
- Ensure periodic review & updates of Recharge strategy evolved
- Incorporate element of artificial recharge in strategic planning documents
- Develop training course on Implementation of operational Recharge projects

Thank You