RAIN Rainwater Harvesting Implementation Network

Acacia Water Solutions in Groundwater

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BGR

Fresh Groundwater Buffering in Coastal Bangladesh

Presented By: Sarmin Sultana

K M Ahmed

Albert Tuinhof, Jacob Oosterwijk, Koos Groen

Hans Spruijt, Lalit Patra

Sudhir K Ghosh

Department of Public Health Engineering

Department of Geology
University of Dhaka

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Acacia Water
Solutions in Groundwater

3R
MANAGING THE WATER BUFFER

Presentation Outline

Current Water Access in Bangladesh

Prospect of Managed Aquifer Recharge for Improving Water Access in Bangladesh

Action Research of groundwater buffering in Coastal area

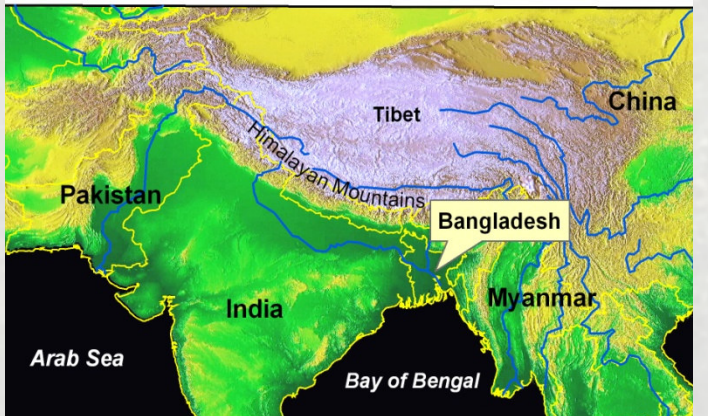
Investigation carried out so far

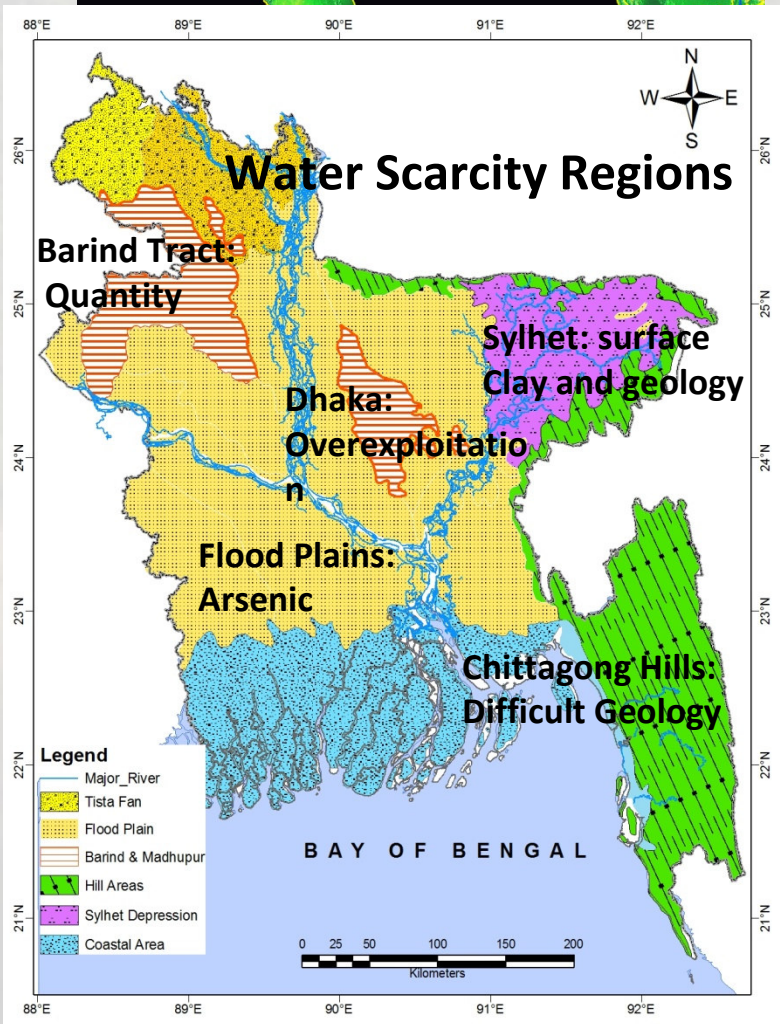
Results of Investigation

Way Forwards and scaling up

Water Supply Situation in Bangladesh

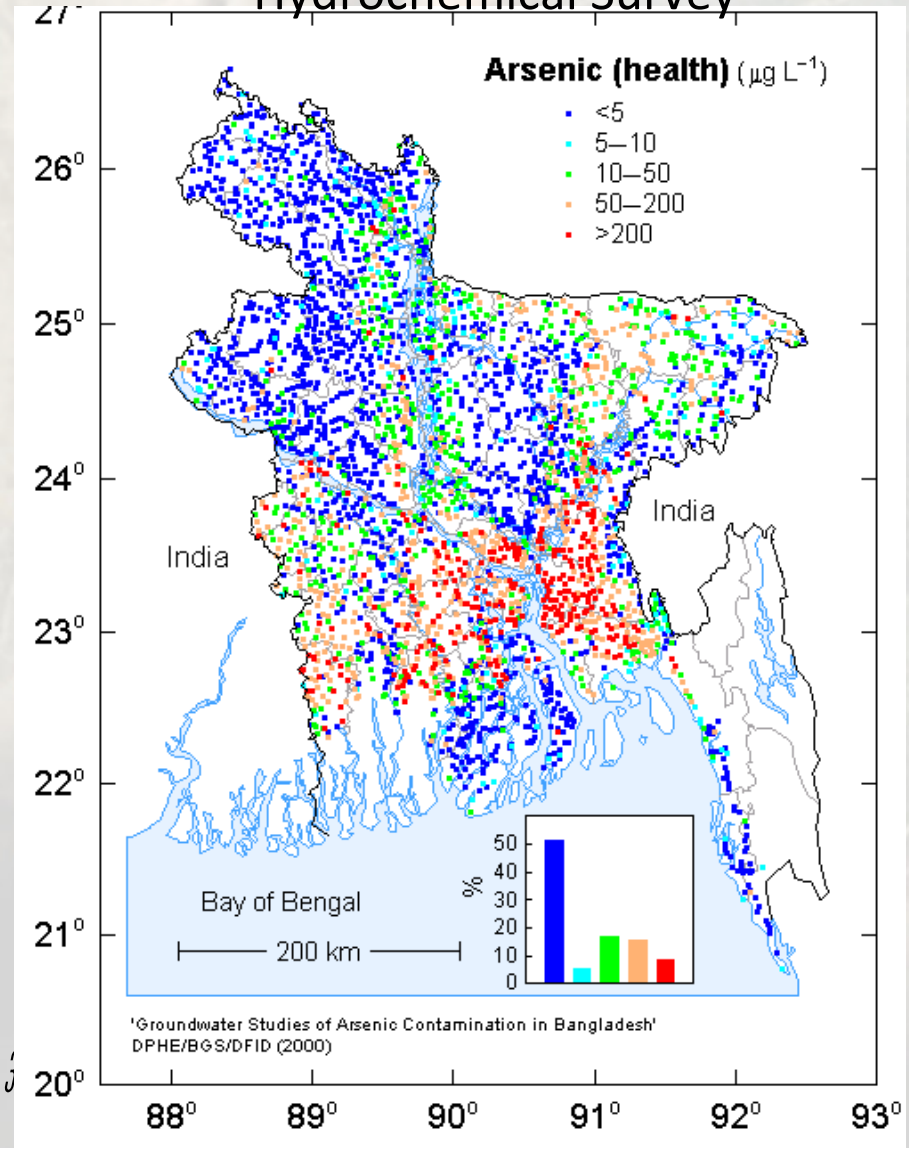
- Bangladesh achieved remarkabale success in providing access to safe water
- By and large there is no water scarcity
- There are seasonal shortages in certain areas
- But more importantly it faces (seasonal) water scarcity in terms of quality.
- Safe water in some areas is under threat due to climate change



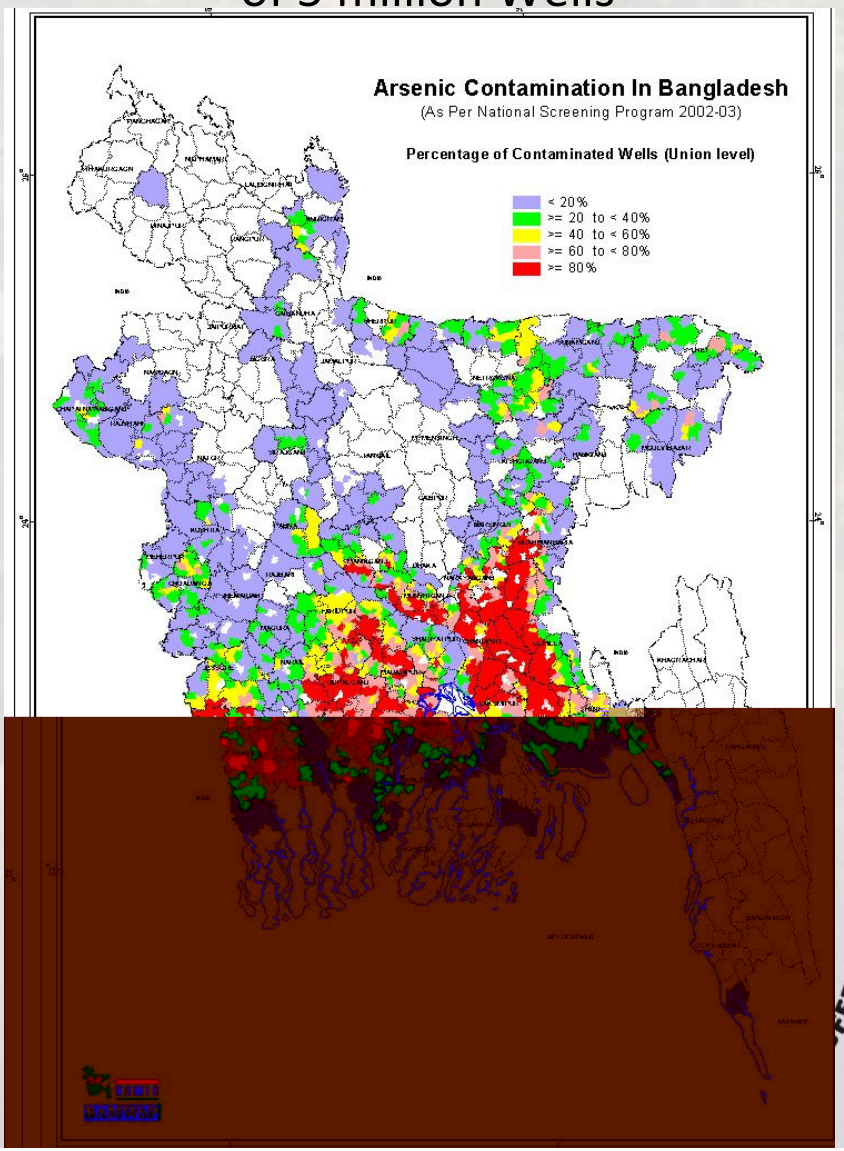


Arsenic in Shallow Groundwater: The Most Severe Quality Problem

DPHE & BGS (2000) National Hydrochemical Survey



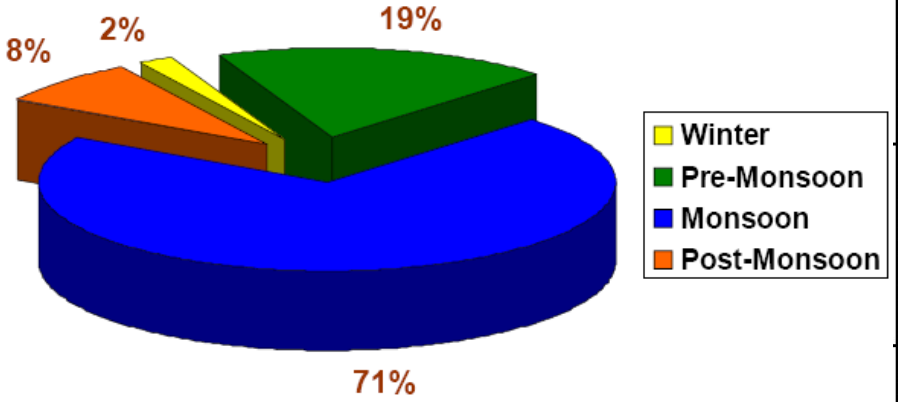
NAMIC (2004) Screening of 5 million Wells

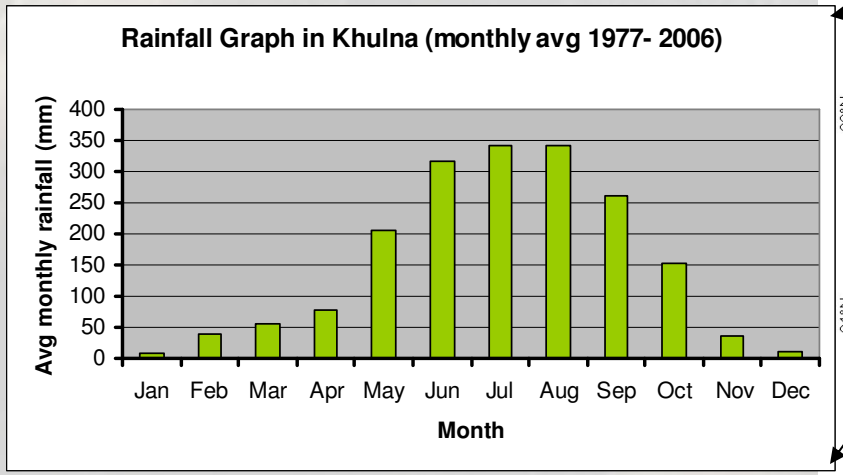


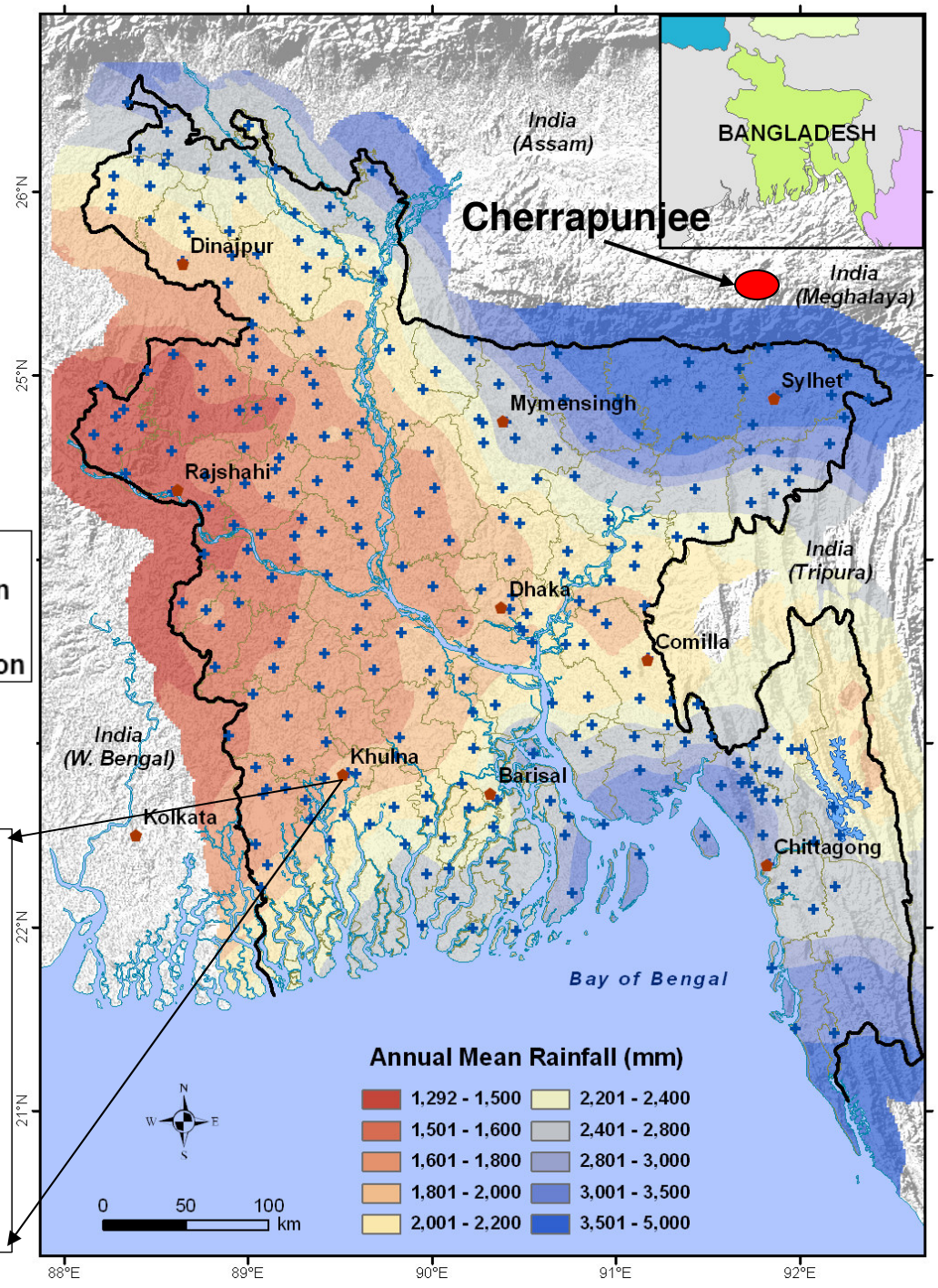
Scope of Applications of MAR in Bangladesh

- Bangladesh has high annual rainfall
- Rainwater harvesting is practiced in coastal and hilly areas
- MAR has not been adopted yet for water management here.
- To adapt with Climate Change MAR can be applied in:
    - ✓ Managing groundwater recharge
    - ✓ Enhancing groundwater storage
    - ✓ Improvement of groundwater quality

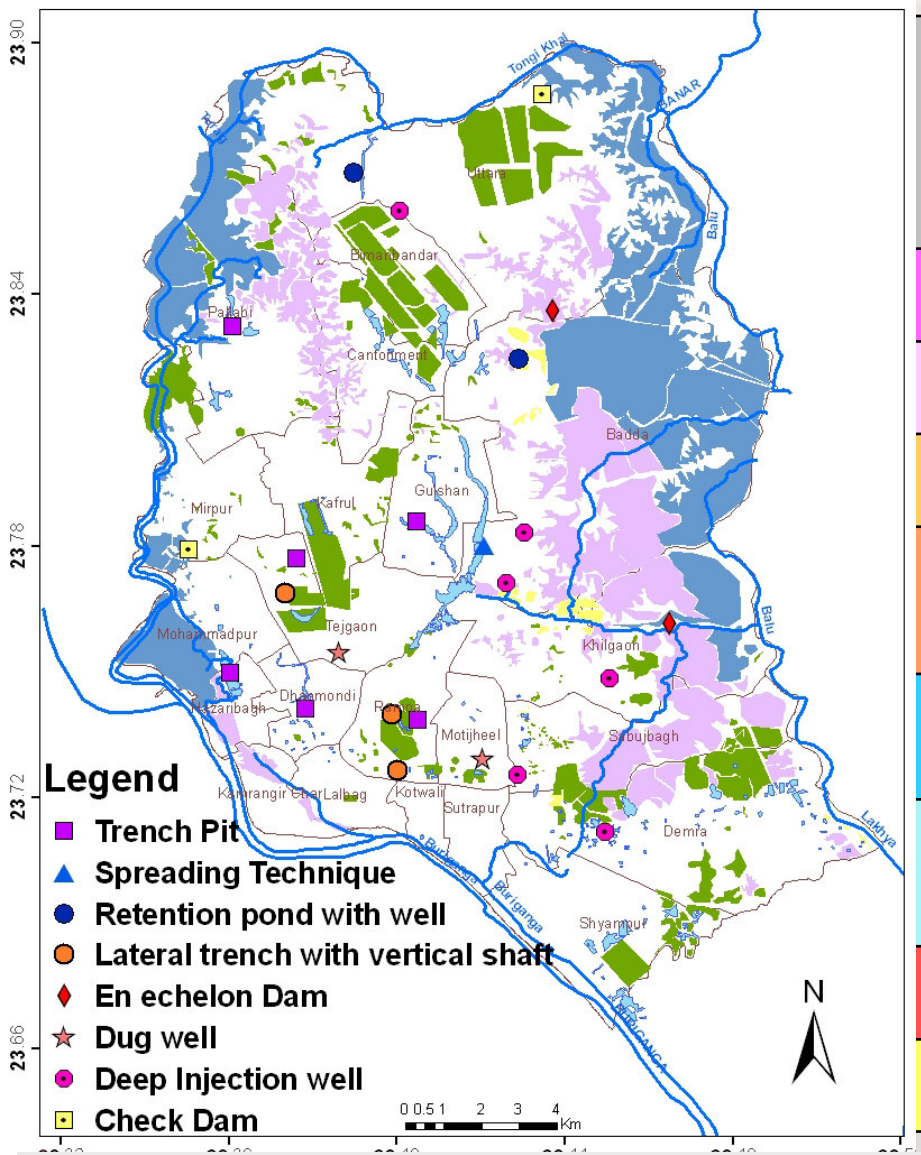
Characteristics of Rainfall in Bangladesh







Water Buffering Scopes: Map of Potential MAR Techniques, Dhaka

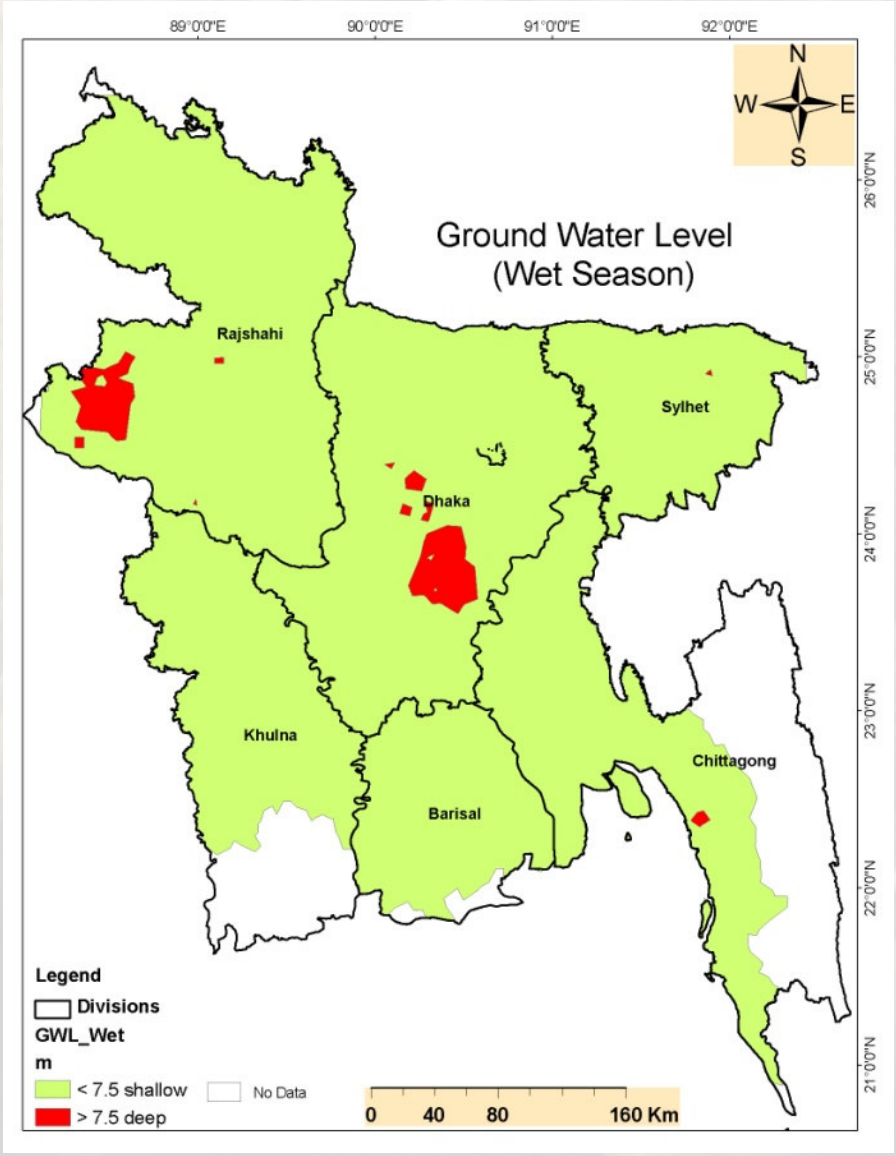


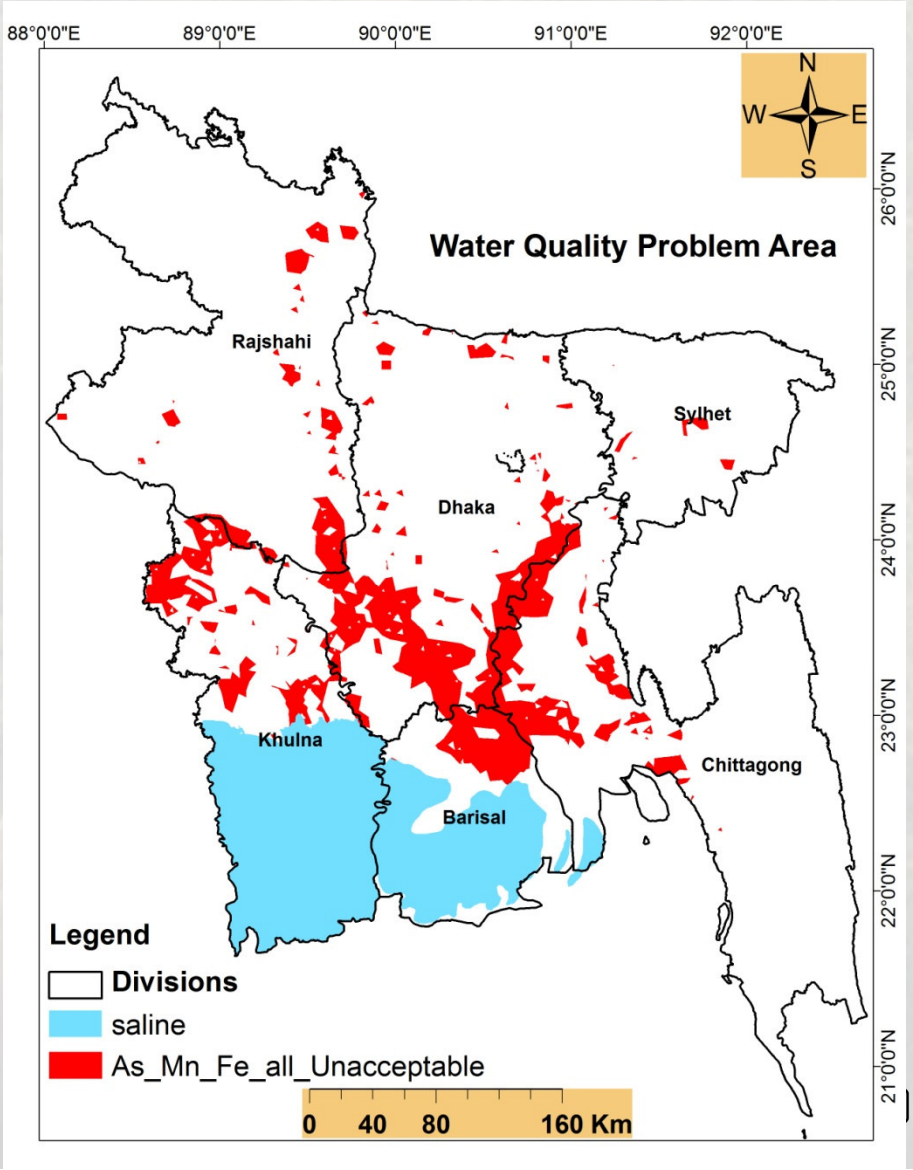
No of Locations	Clay thickness (m)	Method
6	10 - 15	Trench pit
6	40 - 50	Injection well
2	3 - 7	Dug well
3	5 – 15	Lateral trench with vertical shaft
1	0 - 10	Spreading Technique
2	20 - 25	Retention pond with well
2	25 - 35	En-echelon Dam
2	15 -30	Check dam

Sultana, Sarmin, 2009. Prospects of Artificial Recharge and Other Options for Augmentation of the Upper Dupi Tila Aquifer, Dhaka City, Bangladesh . MS Thesis, Department of Geology University of Dhaka

Action Research on groundwater Buffering in Bangladesh

GIS Mapping to Identify Potential 3R Applications Sites





Why focus on Coastal area? Climate Change is A Major issue

- Most scarse area for safe water
- Surface water mostly saline
- Deep and shallow groundwater saline/ brackish
- Impacts of inland deep groundwater abstraction
- Brackish water aquaculture
- Most vulnerable to climate change
  - ✓ Inundation due to Sea level Rise
  - ✓ Higher intensity and magnitude of Storm surges
  - ✓ Decreasing Dry season rainfall
  - ✓ Increase in monsoon rainfall
  - ✓ increasing evaporation

Limited Sources of Safe Water

Ponds Sand Filter

Rainwater Harvesting

Dried Ponds

Deep tube well

Water Logging
Brackish Water Aquaculture

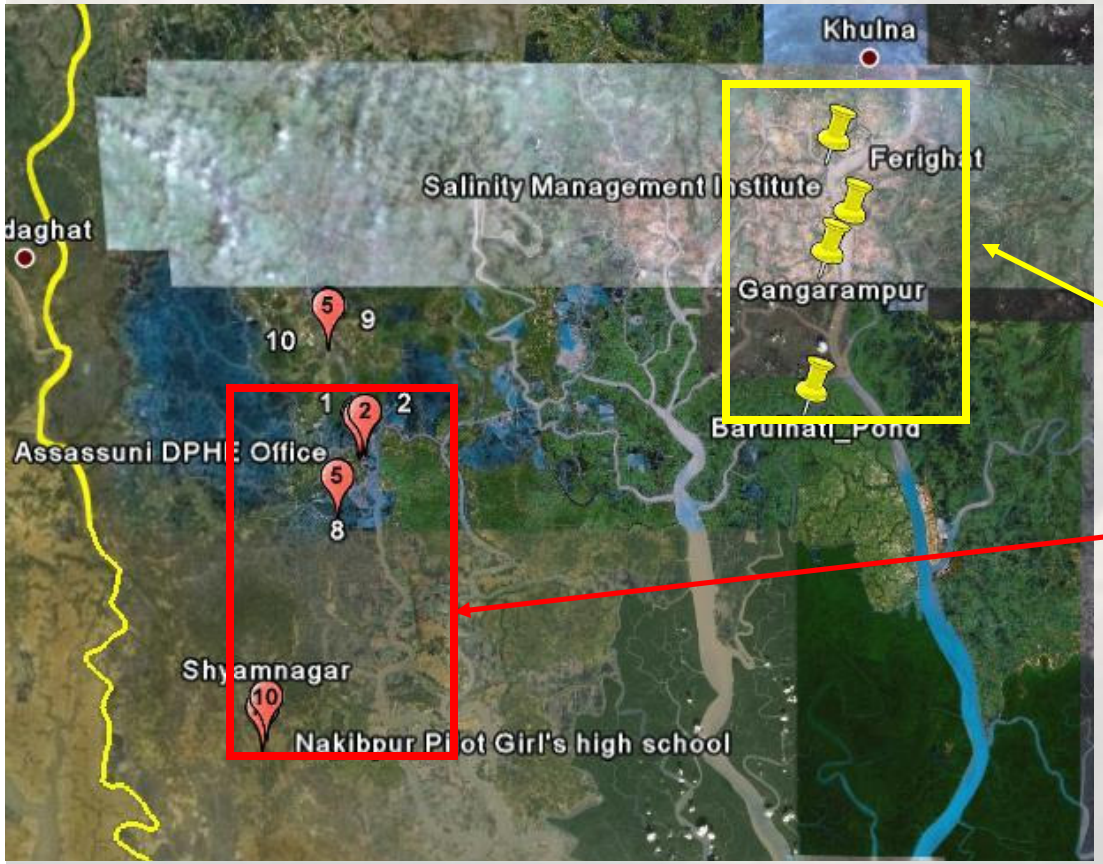
Water Transported
from Distant Sources

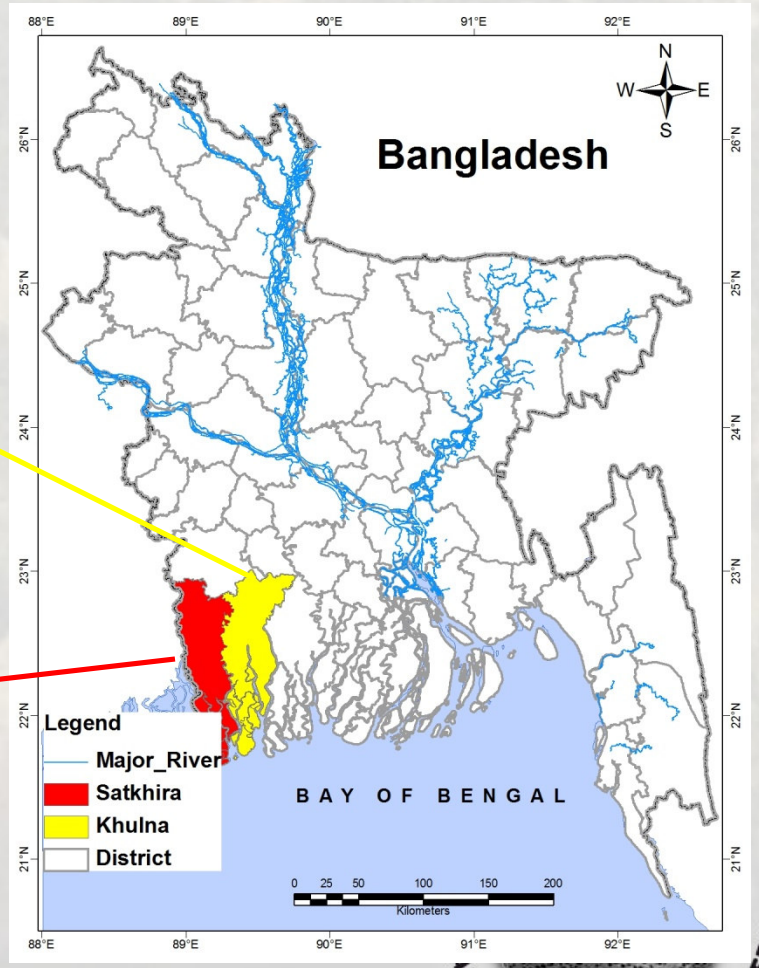
Location of Potential Sites for Technology Testing

Primary target areas are where

- shallow groundwater is brackish
- no deep fresh groundwater and
- clay layer at the surface

These areas are mapped by DPHE & population is 3 to 5 million



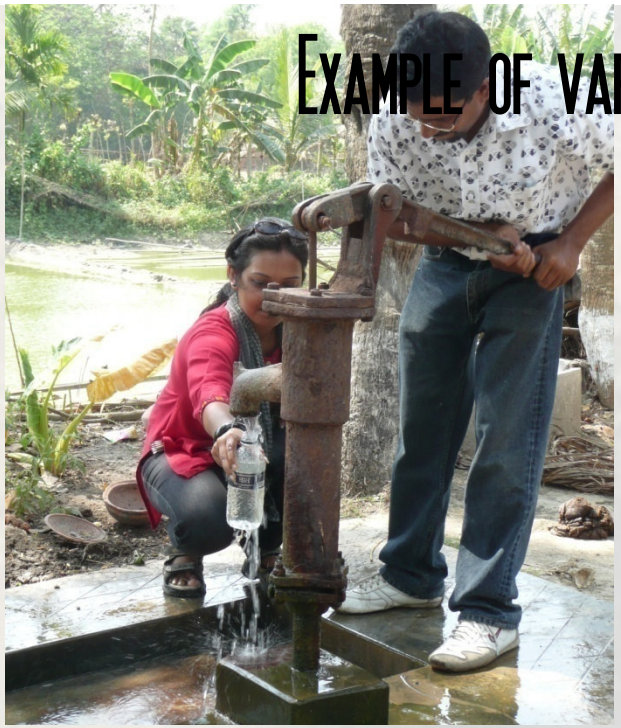


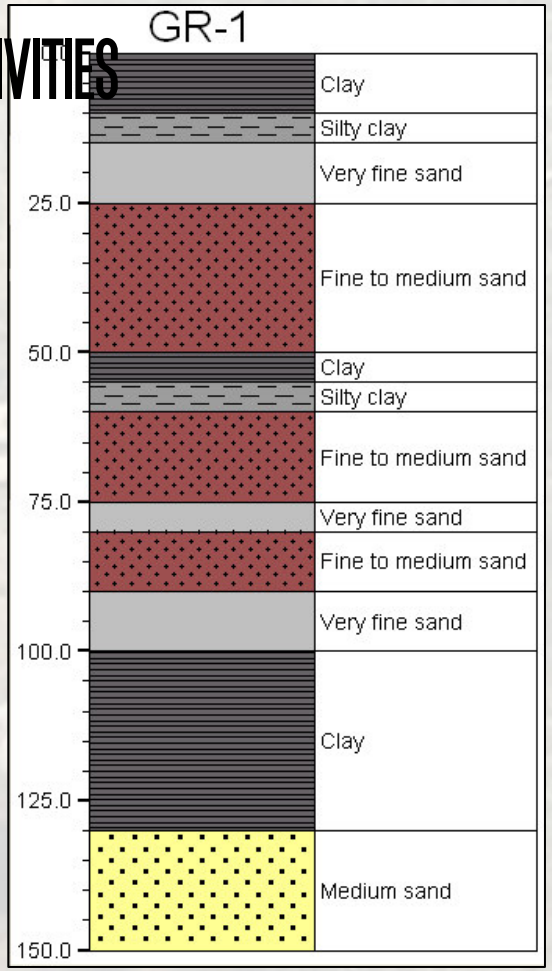
Study Areas

Investigations Carried out at Potential Infiltration Sites

Location and dimensions of pond/roof and accessibility	WQ of pond/shallow groundwater (As, EC, and Cl)	Borelog and grain size analysis data	Geophysical survey
Pond/roof ownership	Current conditions and use of the pond	Finding suitable local NGO Partner	Proximity to DPHE/NGO

Example of various field and laboratory activities

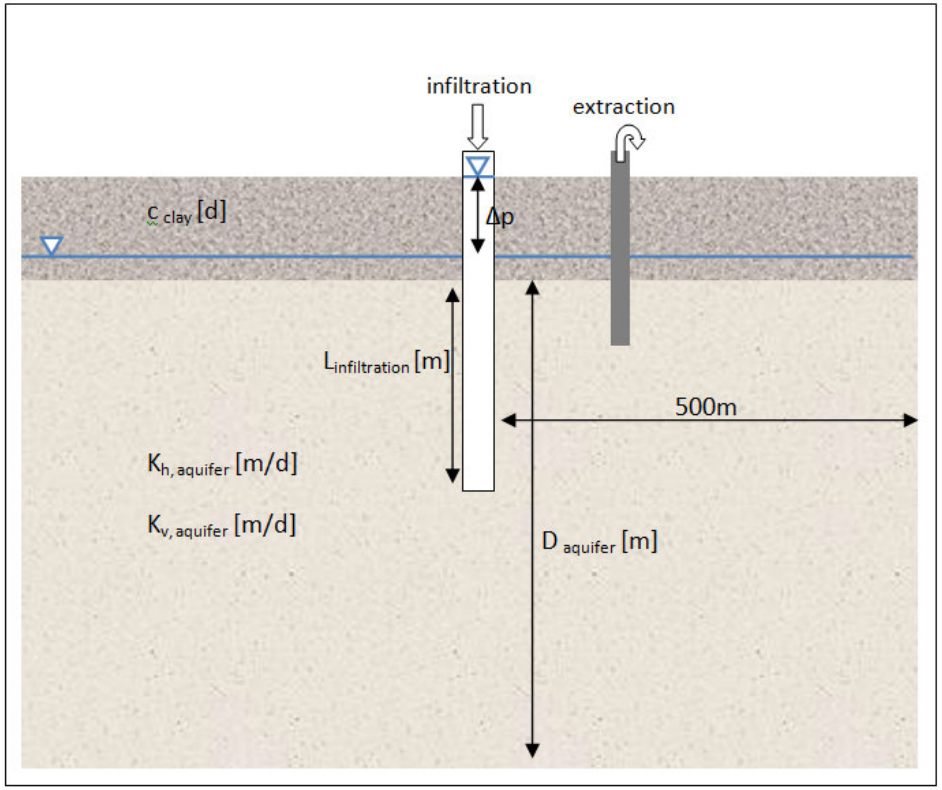




Features of Selected Sites

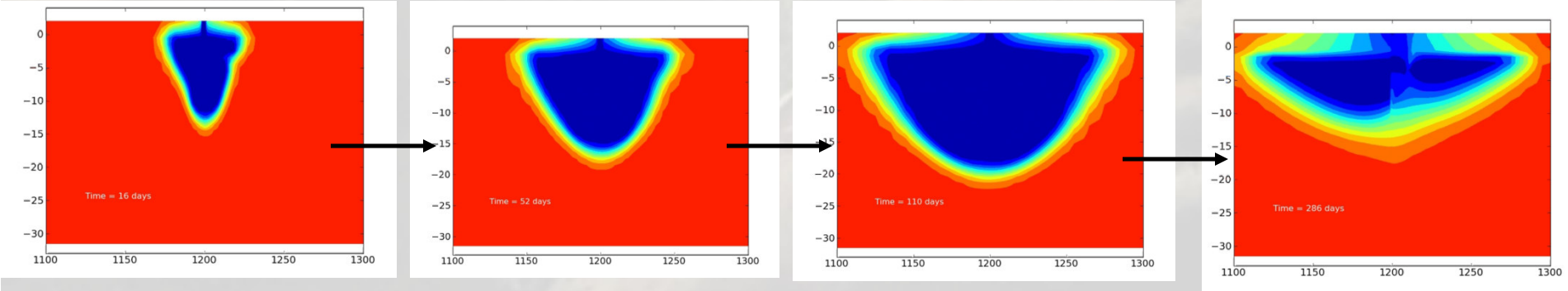
Location	DPHE office Asassuni	Sushilan Shyamnagar
Thickness clay (m)	13	6
Aquifer material	fine sand	fine sand
Groundwater quality (EC in uS/cm)	6440	Not sampled, have been reported high EC
Water source	pond	roof
Area (m^2)	5000	450
Infiltration device	drilled well	drilled well
Local partner	Sushilan	Sushilan
Pump capacity (l/s)	15	gravity

Conceptual Modeling of Infiltration System

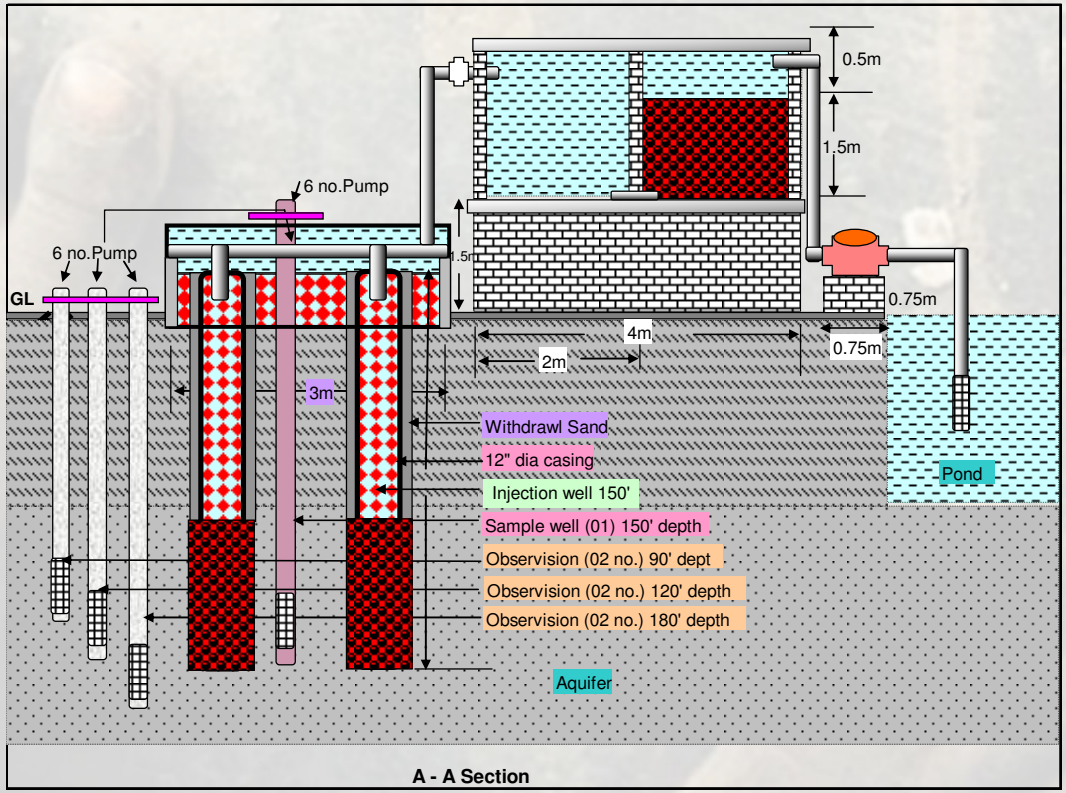


Significant amount of water can be injected during monsoon for abstraction during dry season

$K_{h,\ aquifer}$	horizontal permeability aquifer [m/d]
$K_{v,\ aquifer}$	vertical permeability aquifer [m/d]
$D_{\ aquifer}$	thickness aquifer [m]
$L_{infiltration}$	length infiltration well below clay layer [m]
$c_{\ clay}$	resistivity upper layer [d]
Δp	head infiltration well [m]



Example of Construction Design for Technology Testing



Pond Infiltration System

- Construction of infiltration scheme
- Monitoring:
  - Volume of water injected
  - Changes in water level
  - Water quality parameters (As, Fe, Cl, micro organisms)

Future Plan for scaling up

- Preliminary estimates show that hundreds of thousand people in 18 upazilas of 3 coastal districts will be benefited if water quality and quantity can be improved by MAR
- Socioeconomic survey
- Develop manual and guideline
- Pilot project in other areas including coastal zone where
  - ✓water table is declining
  - ✓water quality is poor (As, Fe, Mn, Cl)
  - ✓natural recharge is low and
  - ✓there is salinity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