Participatory aquifer management and alternative approach to sustain urban water supply - Case studies from cities of Gujarat, India

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Context

- Urbanization is visible milestone for development increasing water demand
- Expansion and change in land use responsible for alteration of landforms and watersheds
- Concretization disturbed surface and subsurface hydrological interface
- Increasing dependency on distant sources

Aim

- Enhance the practical and action-oriented knowledge of city stakeholders on managing watersheds and aquifers in a scientific manner
- Demonstrate the use of water conservation and recharge techniques
  - To understand city's geohydrological characterization
  - Develop city specific water management planning strategies and technique
  - Create evidences for awareness, adaptation and scale up

Approach and Methodology

- City level – Participatory and Integrated
- State level – Partnership – documentations
- Country level – Action Research – Demonstration & Networking

Presentation focuses on city level approaches and interventions

Methodology

- Aquifer Mapping
- Groundwater Recharge DPR

Aquifer Mapping Process

Base Map Preparation

- Toposheet
- Town Planning Maps
- River and streams, Contour Landmarks
- Ward Boundaries and Roads

Base for Primary Data Collection

- Grid Layer on Base Map
- Consultation with Experts and mapping of lineaments and other geohydrological features

Primary Data

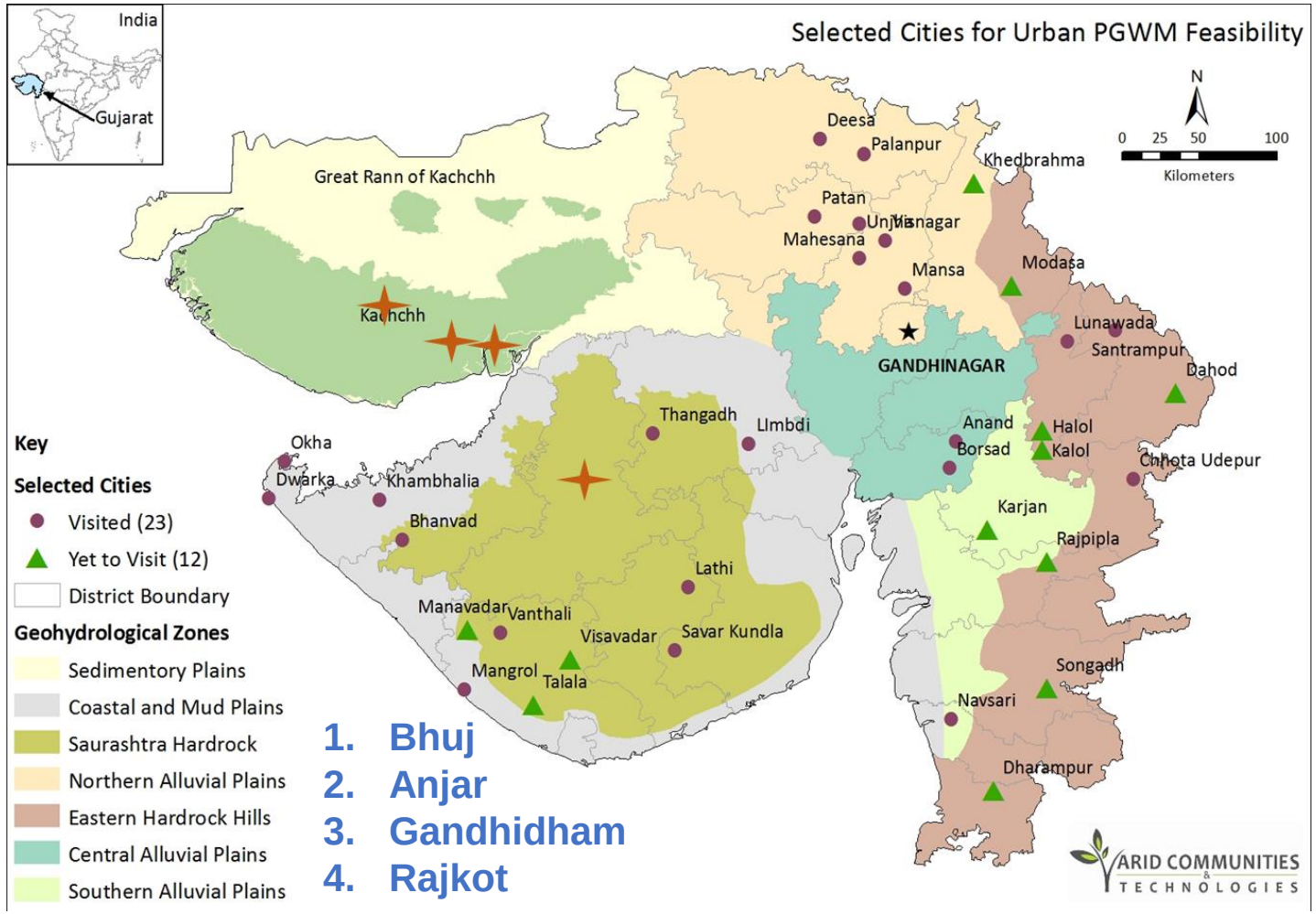
- Well Inventory, Litholog Mapping
- Water level and Discharge measurement
- Consultations with Drillers, Geo-hydrologist
- Secondary data from GWRDC

Thematic Mapping

- Lineament, Surface Geology, Landform, Drainage and Watershed
- Consultations with Drillers, Geo-hydrologist
- Secondary data from GWRDC

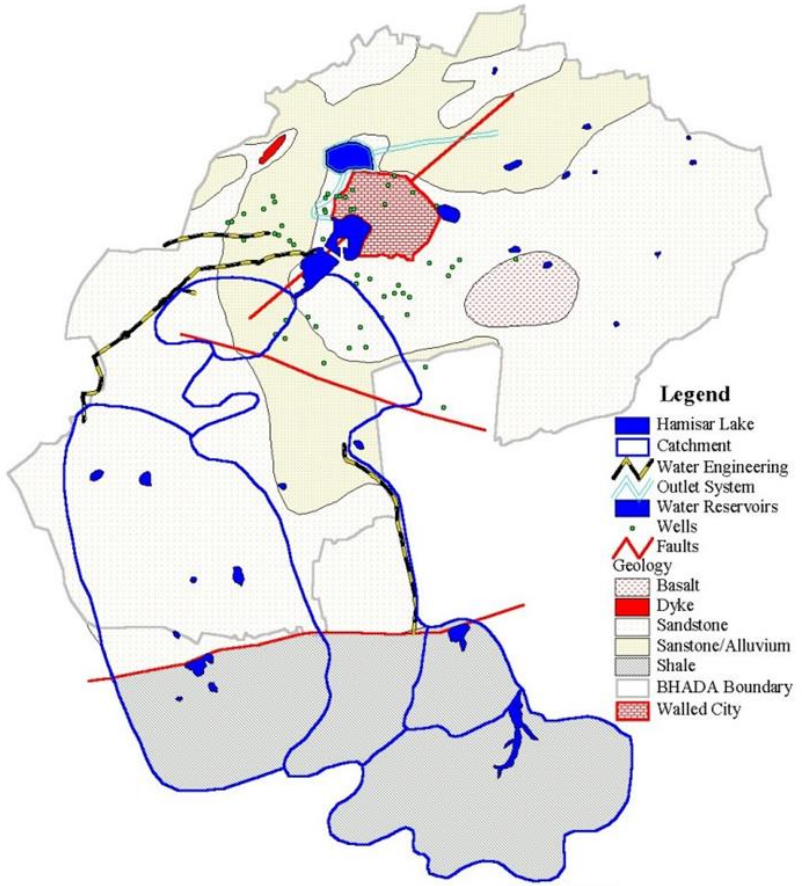
Groundwater Potential Zoning

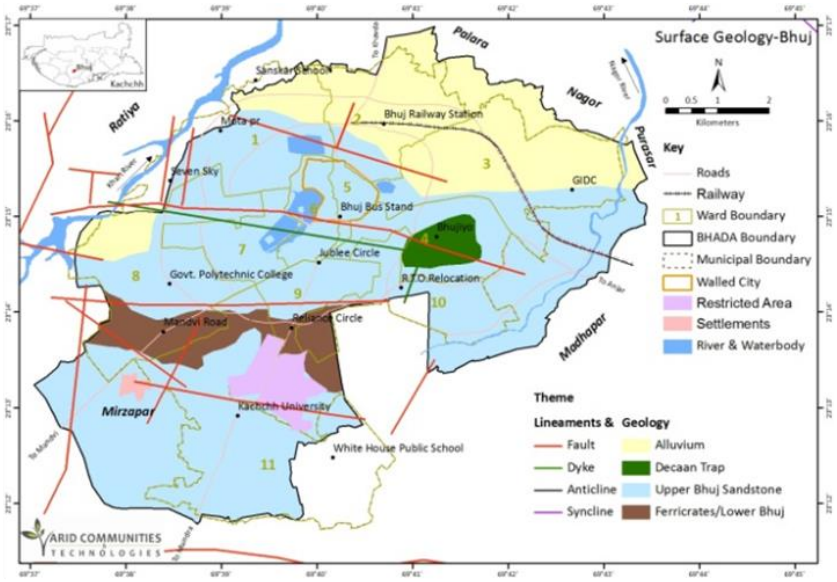
- Integration of all thematic layers, Rating based on groundwater recharge potentials
- Zone wise Strategies for GW Management

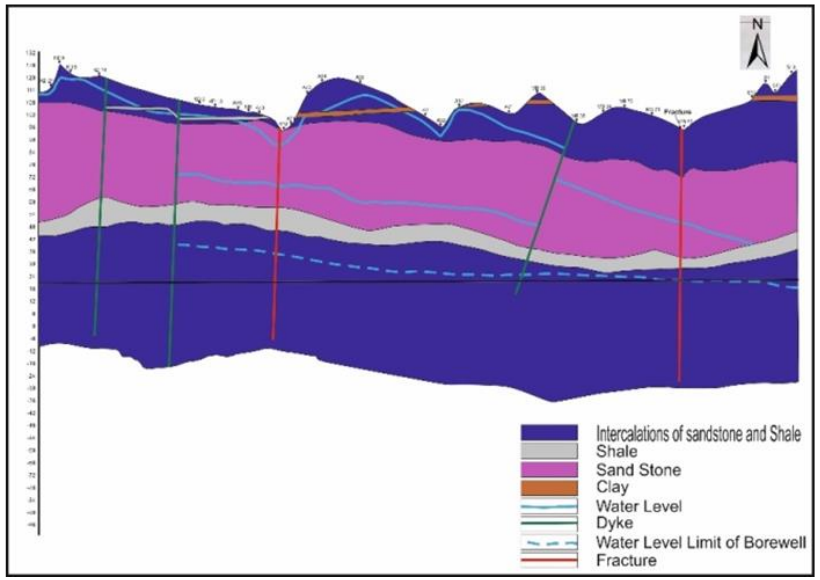


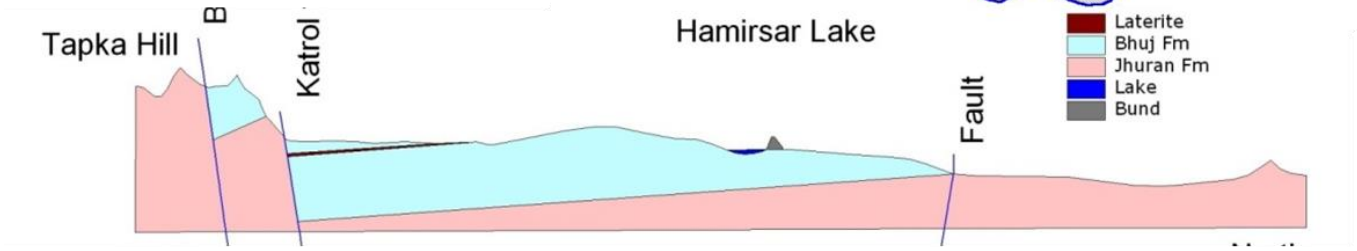
Bhuj – City Aquifer and Watershed Relation Ship

- Sedimentary Rocks – Regional Aquifer but compartmentalized due to Tectonics and Structures
- Permeable and Impermeable rocks have been used for surface and groundwater storage – knowledge used traditionally to manage groundwater to ensure water security during drought



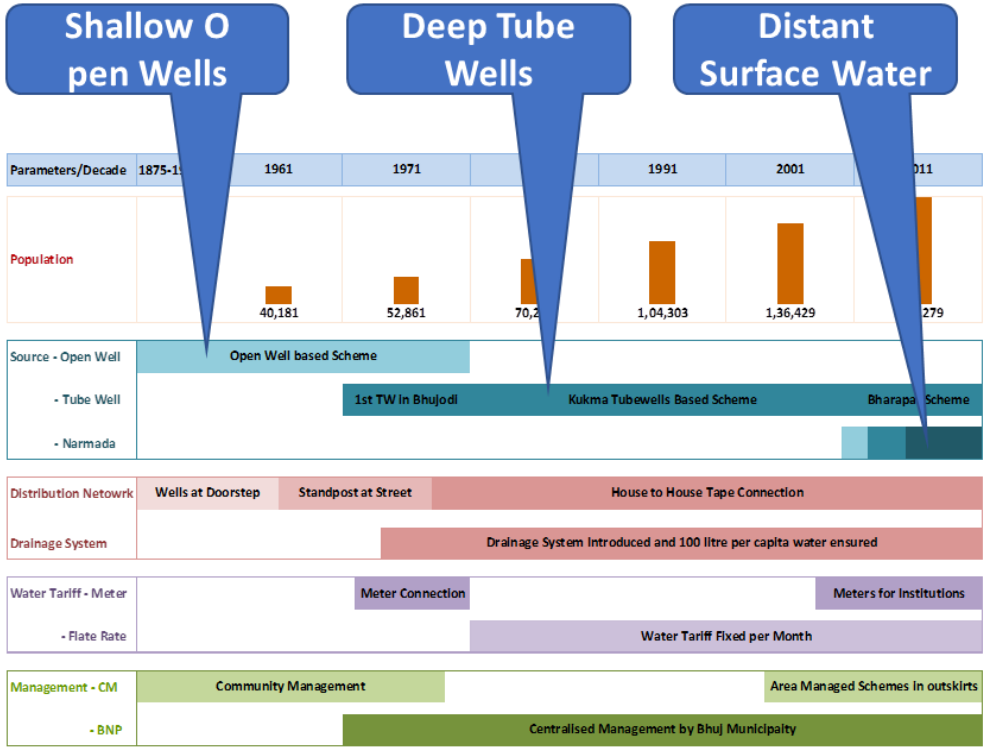


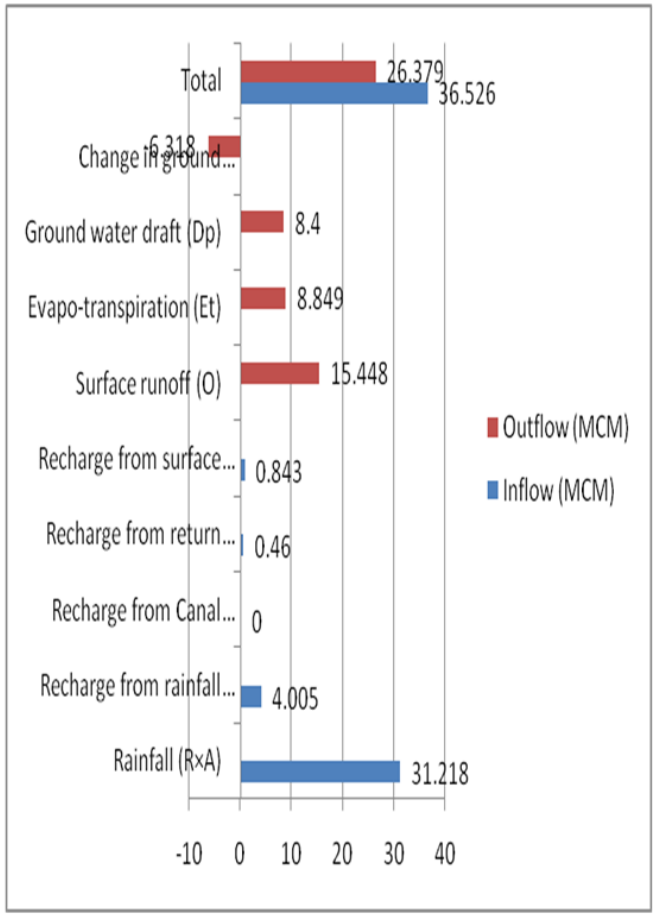




Bhuj City – Changes in Water Management and Dependency on source

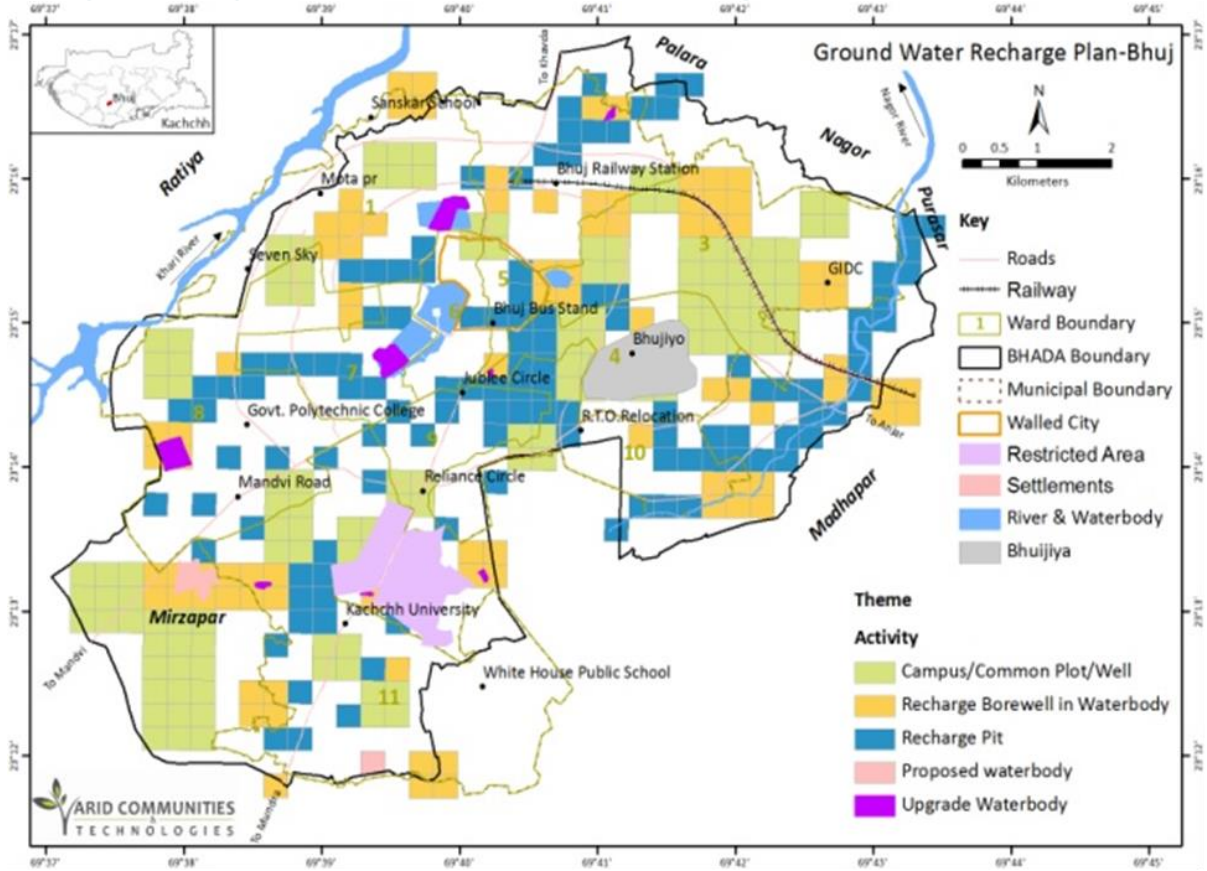
- The city expansion has taken through three phases modified
  - Landuse Pattern
  - Disturbed traditional integrated water management system
  - Increased dependency on external sources

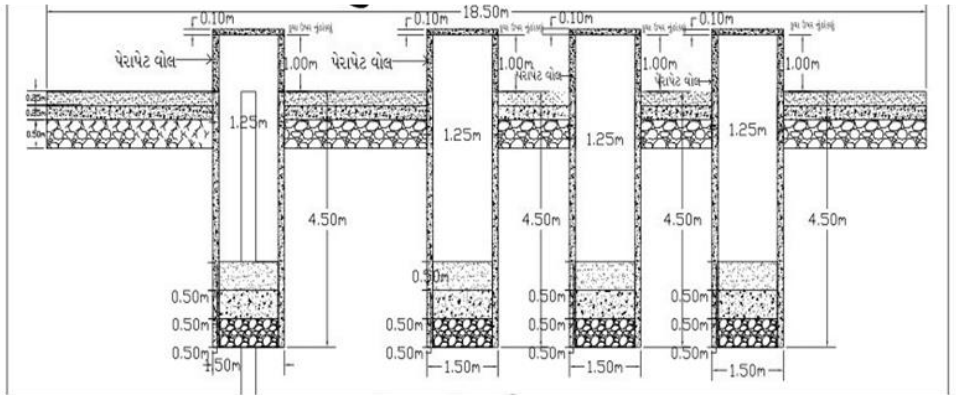




Even today Groundwater storage is more than demand
Quality is question – but can be solve with customized techniques interventions

Bhuj City MAR Planning and Intervention



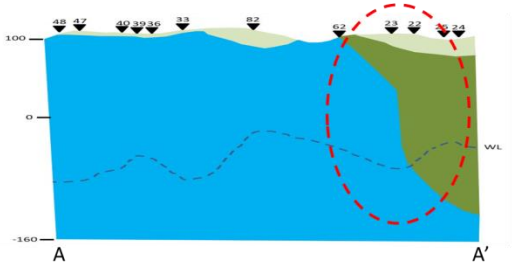


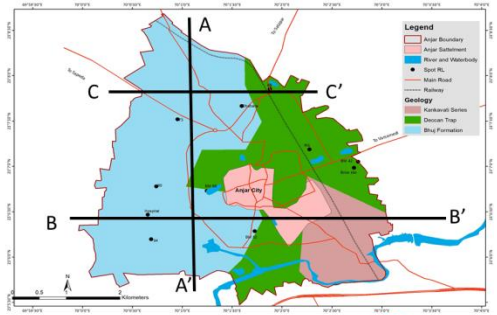
Due to customized MAR in Residential Area

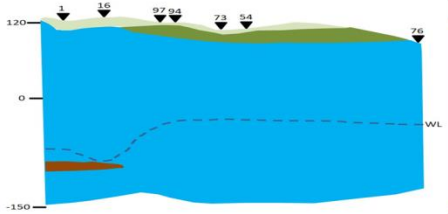
- WL raised and is at 15 m BGL (earlier it was 24 m BGL) and TDS decreased up to 600 ppm from 2100 ppm

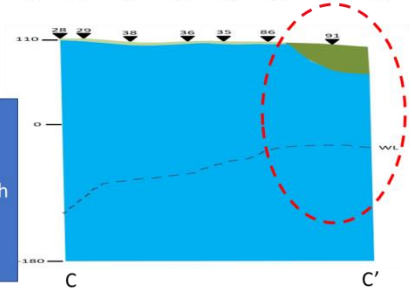
Anjar City – Aquifer, Water Level Behavior and Strategies

Geology and Aquifers

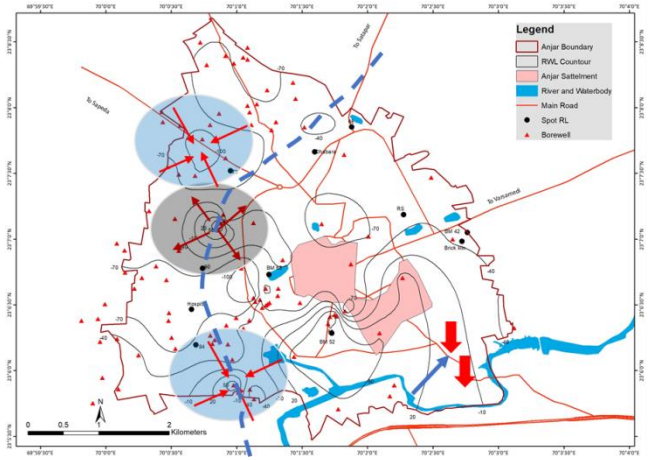


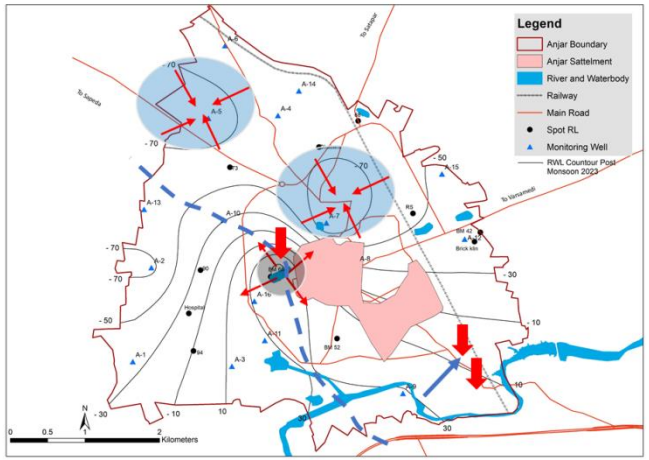






- Water level is higher near Contact zone
- Water levels depth increase as we move away from Contact zone



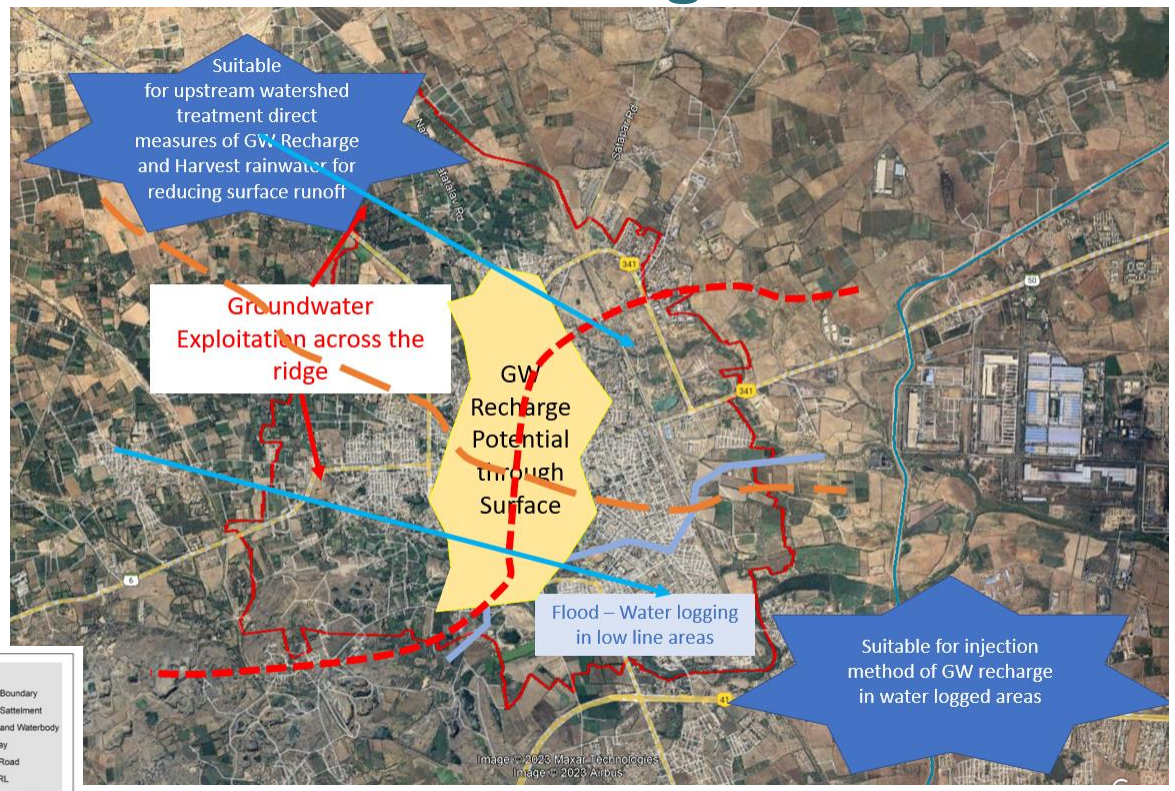


Subsurface Low

Subsurface High

Subsurface Ridge

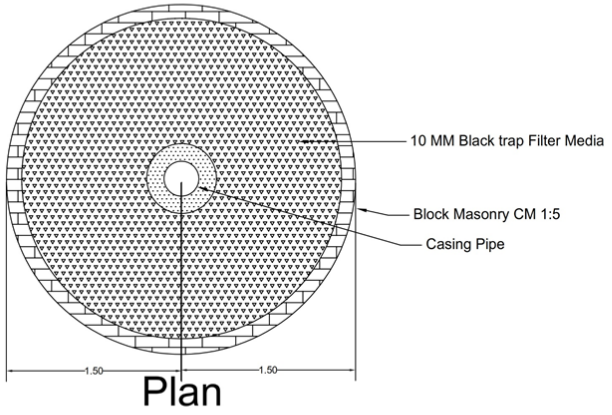
ARTW Sites



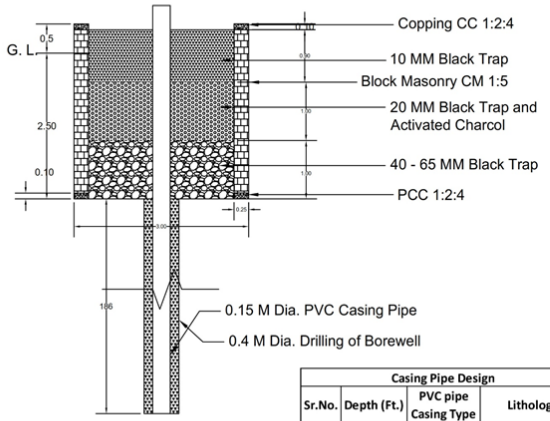
Seasonal GW Flow Direction and Selection of Artificial Recharge Demonstration

Anjar City – Artificial Recharge Demonstrations

ARTW at APMC



Plan

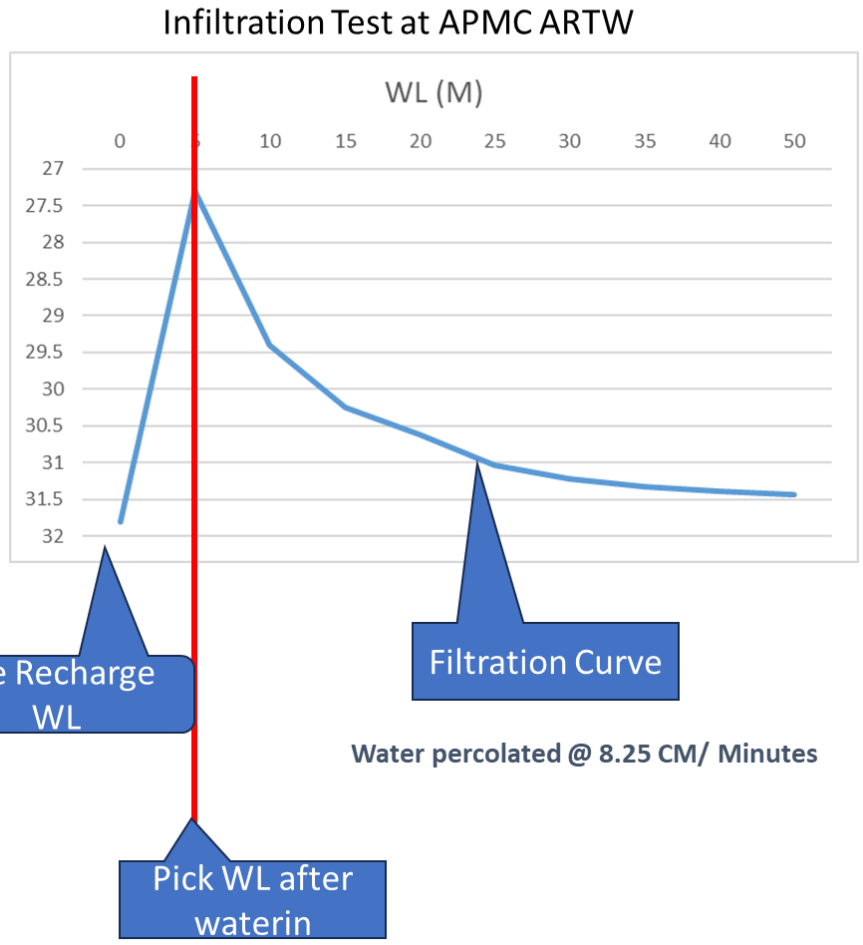


Cross Section

All Dimmension are in Meter

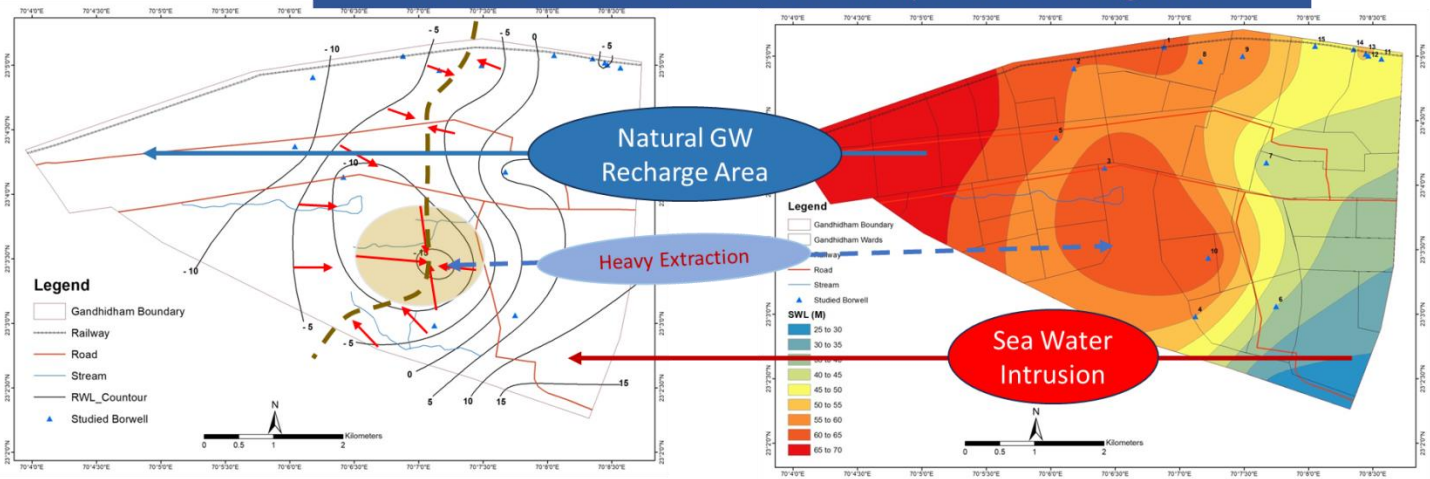
Casing Pipe Design			
Sr.No.	Depth (Ft.)	PVC pipe Casing Type	Lithology
1	0 to 40	Stainer Pipe	Weathered Basalt
2	40 to 120	Blind Pipe	Compact Basalt
3	120 to 340	Stainer Pipe	Sandstone
4	340 to 380	Blind Pipe	Sand with clay
5	380 to 610	Stainer Pipe	Sandstone

Time Minutes	WL (M)
0	31.8
5	27.3
10	29.4
15	30.25
20	30.62
25	31.03
30	31.22
35	31.33
40	31.39
50	31.43

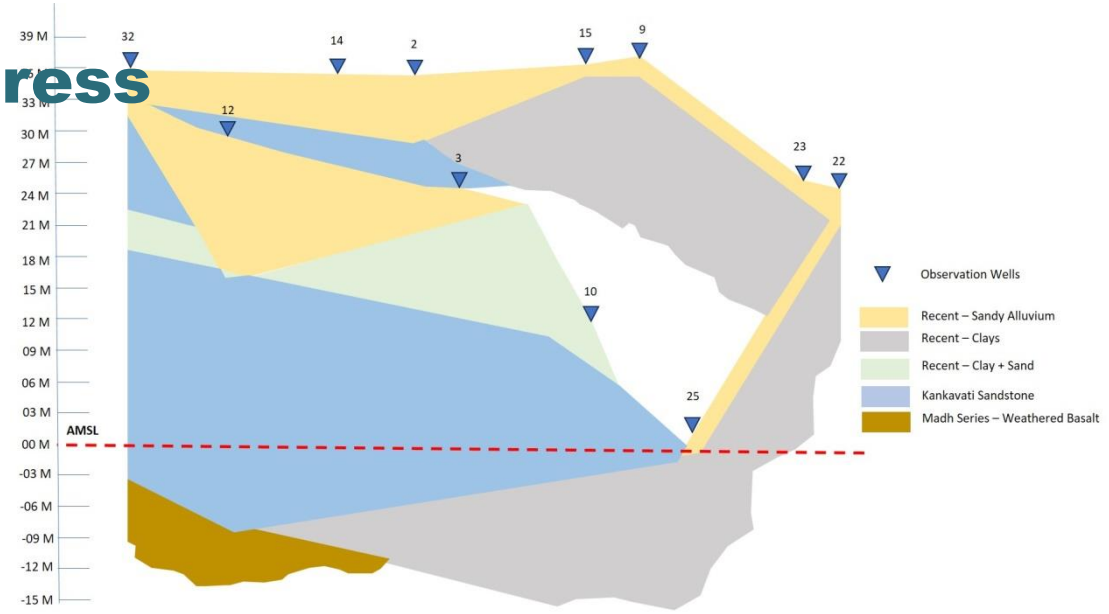


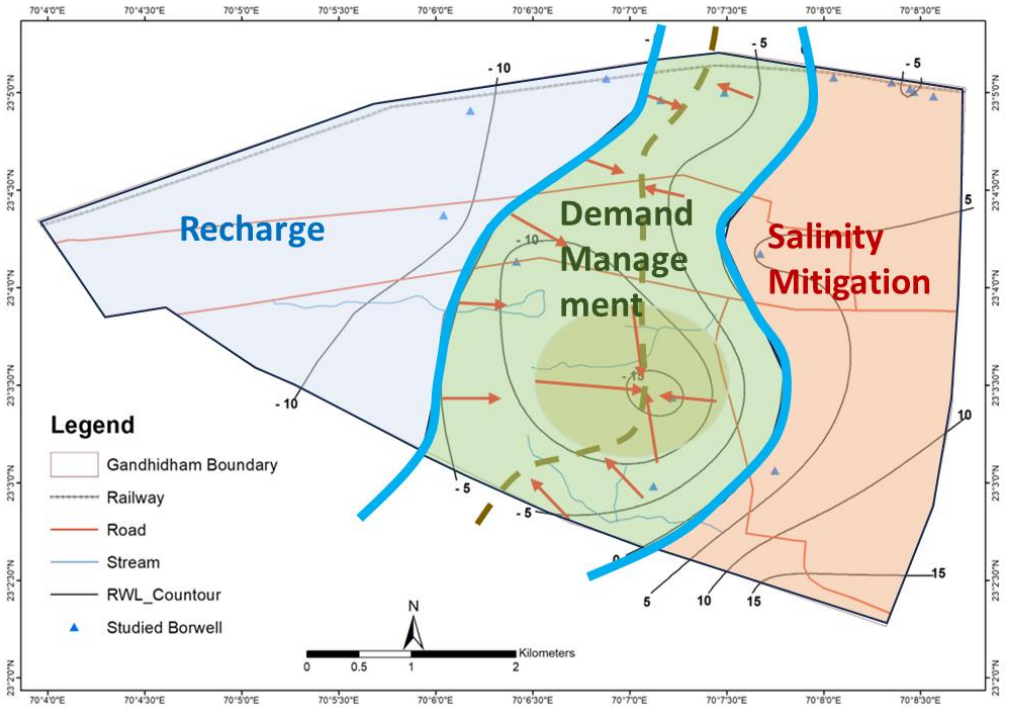
Gandhidham City – Aquifer- Salinity Ingress

Flat and Saline Mudflats – Only Water Level Behavior - Static Water Levels and Groundwater Flow Direction can help to define management

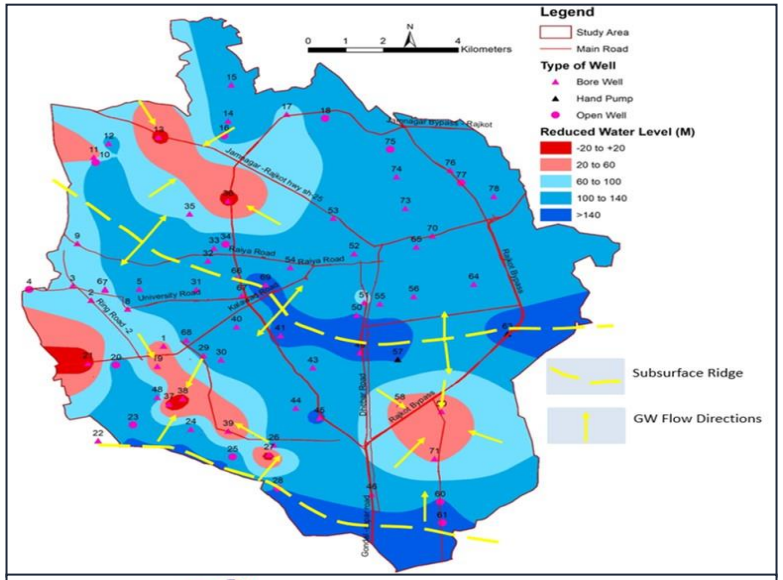


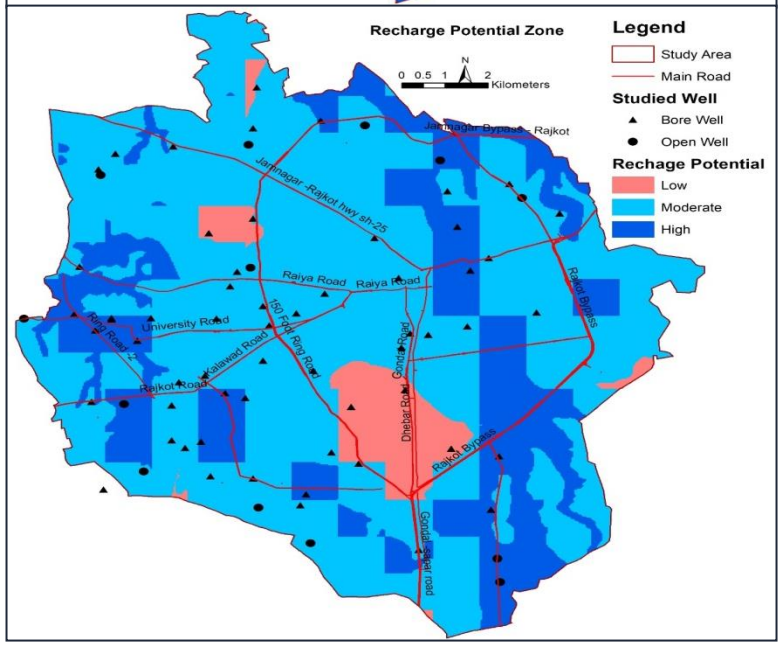
Water Level depth is shallow towards southeast and deep towards West



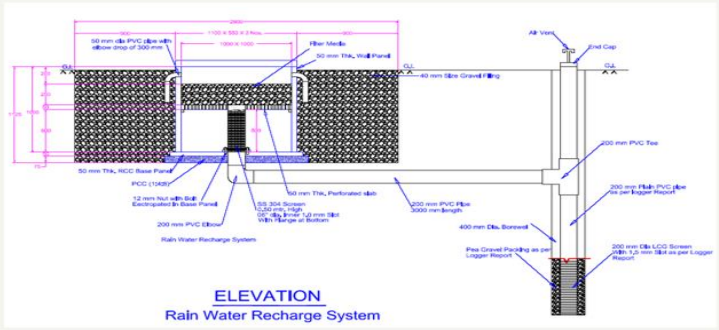


Rajkot City Objective to Input Policy

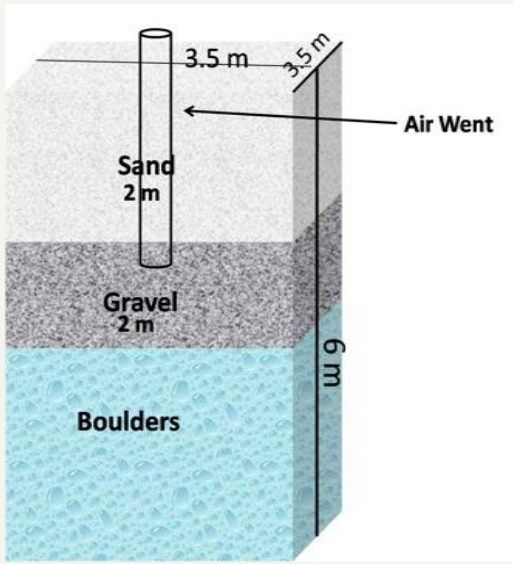




- Total 15 Borewells/Hand pumps out of 43



Precast Chamber



Recharge Pit

Implementation by RMC

Conclusion

- Each city should have Geohydrological zones for water management planning – delineated recharge and run off potential zones
- Groundwater monitoring network to be monitored on monthly bases – water level and water quality – By Bhujal Jankar
- Protocol for groundwater recharge techniques
- Use of defunct groundwater source for groundwater recharge through roof rain water diversion to maintain groundwater quality
- Each campus should have rainwater harvesting and recharge provision for at least 60 % of received rainfall
- Provision of groundwater recharge structure for shallow/deep aquifer should be planned for encroached old / traditional water body's land in cities
- Each tank of city should have tank management committee and for watershed a citizen council promoted by ULB and Civil Society
- Capacity building of ULB technical staff

Thank You

CWAS CENTER FOR WATER AND SANITATION
CRDF CEPT UNIVERSITY
BILL & MELINDA GATES foundation
FP FACULTY OF PLANNING

Global South Academic Conclave on WASH and Climate Linkages