



STATE-LEVEL ORIENTATION WORKSHOP

SOURCE SUSTAINABILITY AND GREYWATER MANAGEMENT IN RURAL AREAS OF UTTAR PRADESH



Date:
February 19, 2026



Venue: Auditorium, Water and Land
Management Institute, Telibagh, Lucknow

PARTICIPATION ONLY BY INVITATION

For more information visit: www.cseindia.org



जल शक्ति मंत्रालय
जल संसाधन, नदी विकास और गंगा संरक्षण विभाग
MINISTRY OF JAL SHAKTI
DEPARTMENT OF WATER RESOURCES,
RIVER DEVELOPMENT & GANGA REJUVENATION



***Groundwater Resource Assessment and
Implementation of National Aquifer Mapping and
Management Plan
Uttar Pradesh***

**Central Groundwater Board, Northern Region,
Lucknow**

Date: 19.02.2026

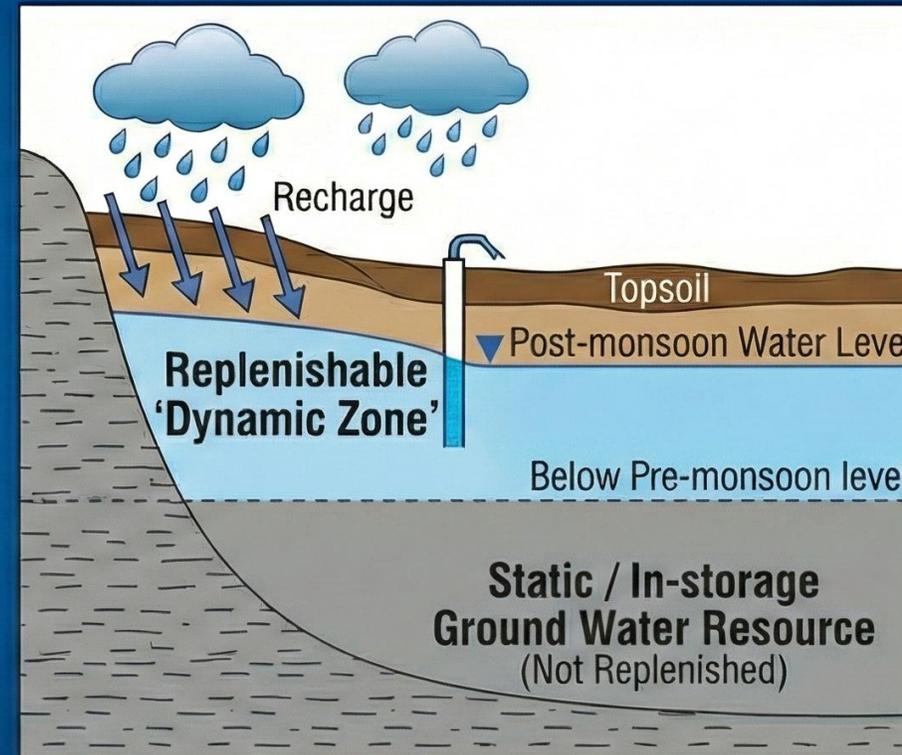


Total Availability of Ground Water in an Aquifer

$$\text{Total Availability} = \text{Dynamic Ground Water Resource} + \text{Static / In-storage Ground Water Resource}$$

Dynamic Ground Water Resource

- The Ground Water Resource which replenishes every year.



Static / In-storage Ground Water Resource

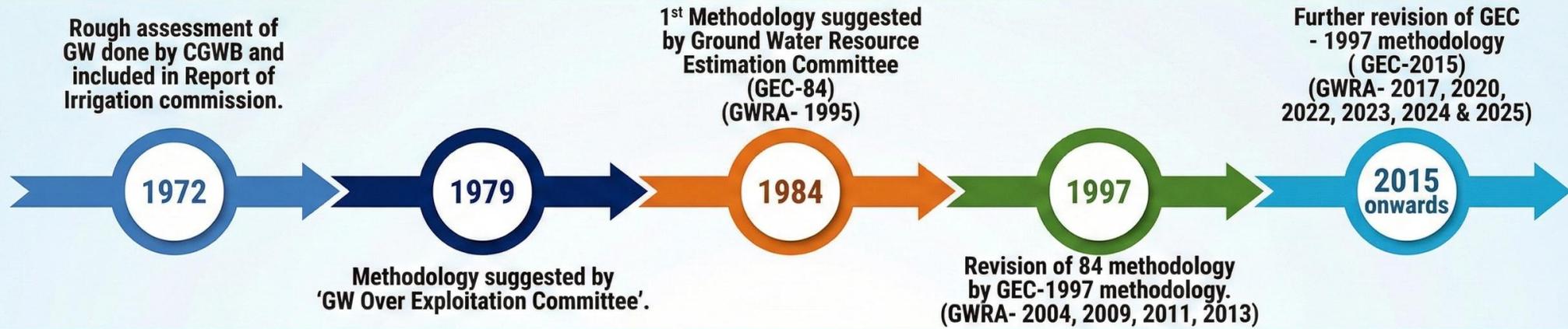
- The Ground Water Resource that is not replenished every year.
- The Ground Water that is available below the Dynamic Zone.
- That is available Below pre monsoon water level.
- One Time Resource.

Estimation of Ground Water Resources

- Based on Ground Water Estimation Committee – 2015
- Recommendations of R&D Advisory Committee From Time to Time if any



GROUND WATER RESOURCE ESTIMATION IN INDIA: EVOLUTION & METHODOLOGY



INFLOW COMPONENTS

- Rainfall Recharge
- Recharge From canals
- Recharge From Surface Water Irrigation
- Recharge From Ground Water irrigation
- Recharge From Tanks & Ponds
- Recharge From Water Conservation Structures
- Lateral Inflow across Boundaries
- Sub surface inflow from hydraulically connected streams
- Vertical inter aquifer inflow

OUTFLOW COMPONENTS

- Gross Ground Water Extraction
- Lateral Outflow across Boundaries
- Sub surface Outflow from hydraulically connected streams
- Vertical inter aquifer Outflow
- Evaporation
- Transpiration

SOGE and Categorization

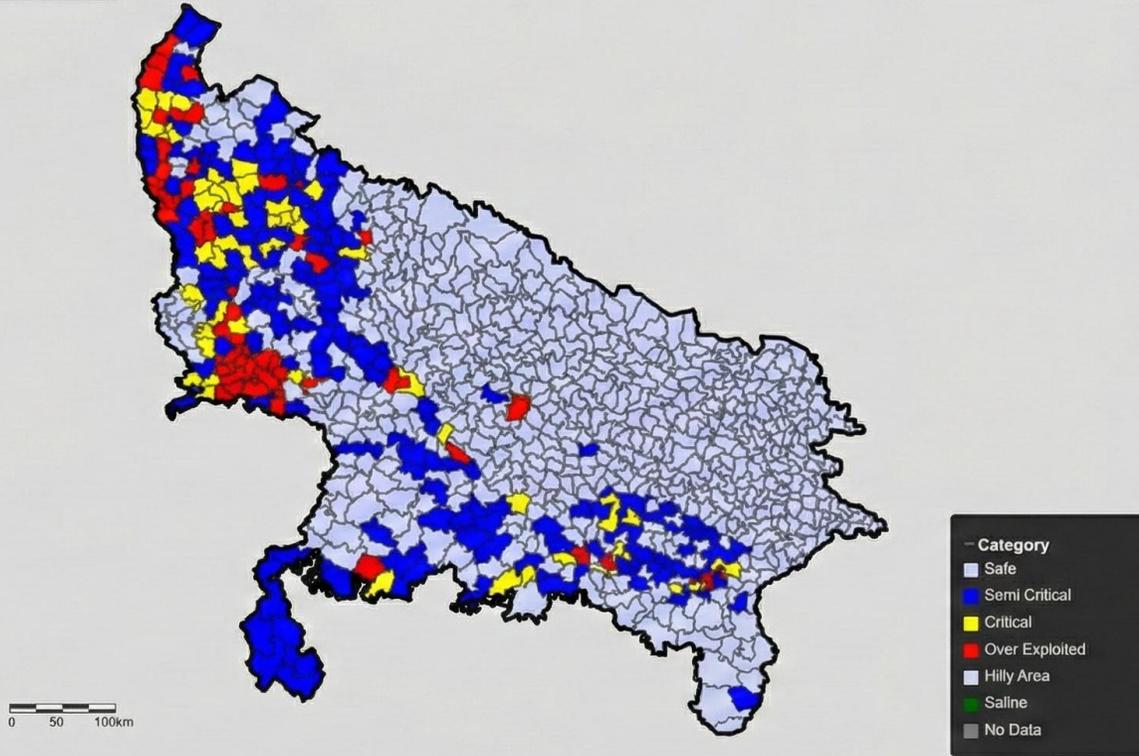
- **Annual Extractable Ground Water Resources**= Total Annual Ground Water Recharge - Natural Discharge
- **Stage of Ground Water Extraction**= (GW Extraction for all uses*100)/ Annual Extractable Ground Water Resources

Stage of Ground Water Extraction	Category
≤70%	Safe
>70%and ≤90%	Semi-Critical
>90%and ≤100%	Critical
> 100%	Over Exploited



DYNAMIC GROUND WATER RESOURCE ESTIMATION 2025: UTTAR PRADESH

Assessment year: 2024-2025



LEGEND



KEY STATISTICS & CATEGORIZATION

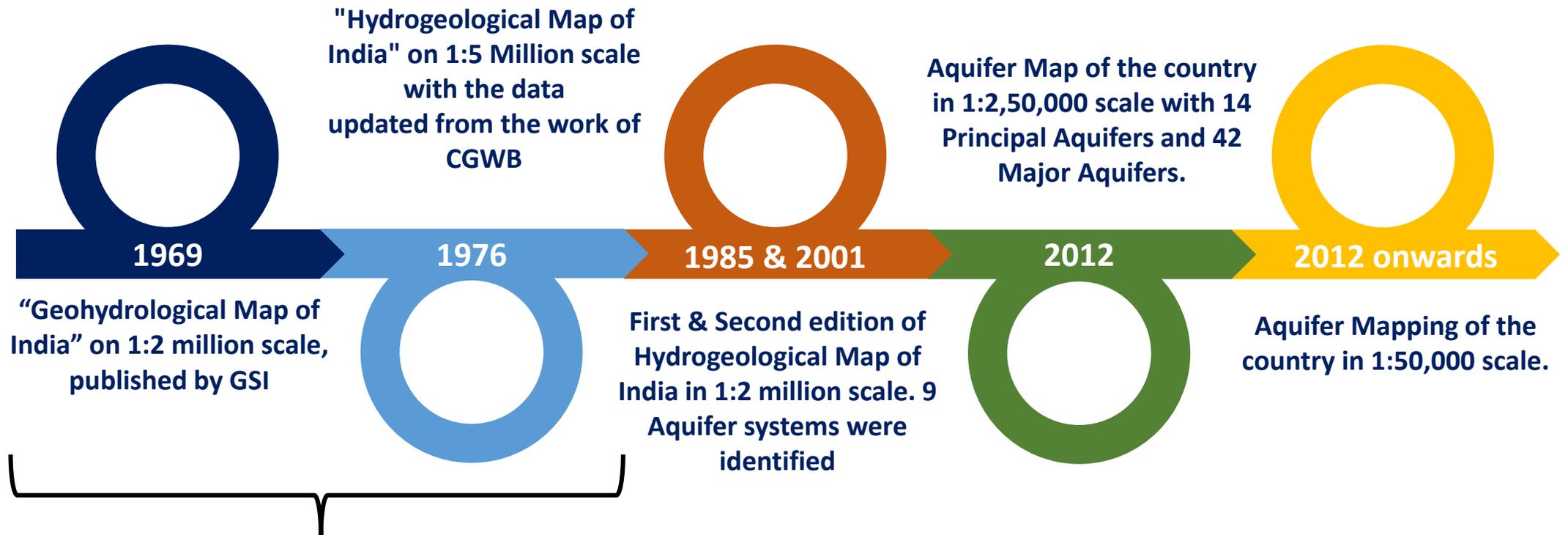
- Annual Extractable Ground Water Resources: 66.98 BCM
- Total Extraction: 46.89 BCM
- Average Stage of Ground Water Extraction of the State: 70%
- All the 10 Cities fall within the Over Exploited Category.

Stage of Ground Water Extraction Norms

Stage	Category
<70%	Safe
70-90%	Semi Critical
90-100%	Critical
>100%	Over Exploited



Hydrogeological Studies in India



Aquifers of the Nation was divided in Porous (Unconsolidated & Consolidated) and Fissured (consolidated) Formation



Objective of NAQUIM

1

Aquifer Geometry

To Establish 3-Dimensional
Extension of Aquifers in
1:50,000 scale

2

Aquifer Characteristics

To determine aquifer-specific
ground water level, quality,
and hydraulic characteristics.



3

GW Resource

Estimation of Aquifer
Resource and total Ground
Water Availability in all
aquifers

4

Management

Formulation of Aquifer
Specific implementable
management plans



Approach

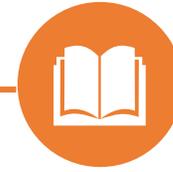
Exploration

~ 2000 exploratory wells & observation wells were constructed tapping different aquifer systems for its delineation and properties.



Hydrogeological Survey

Monitoring of ground water regime, development, assessment and potential for conservation.



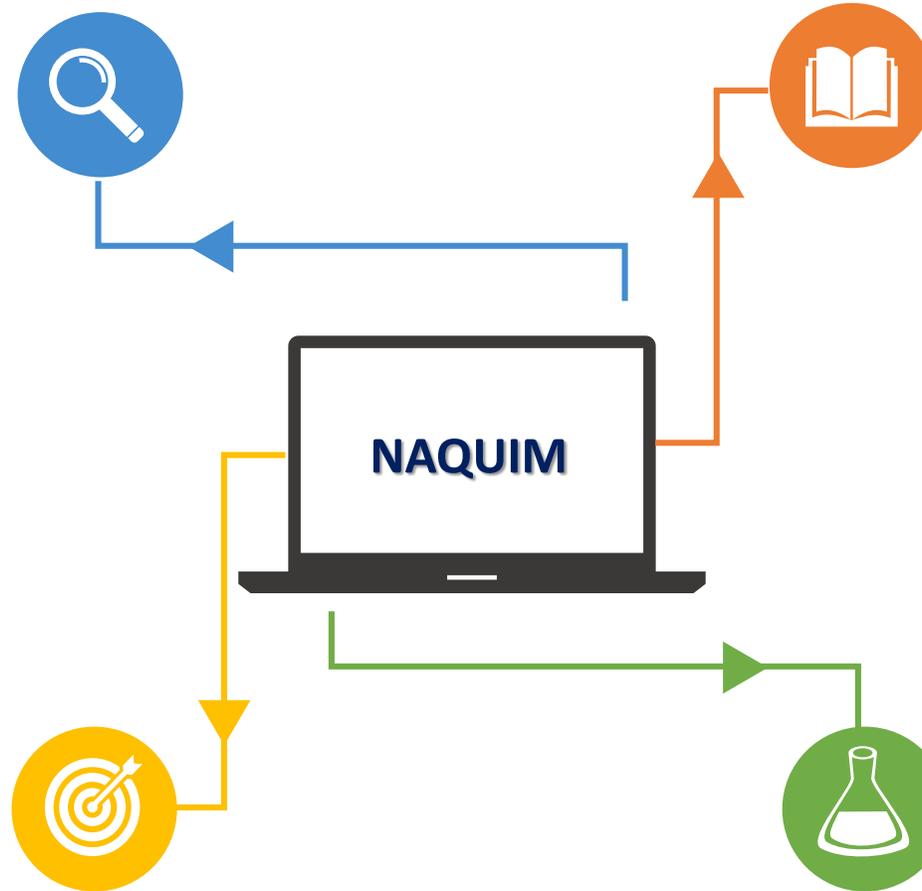
Geophysical Studies

Geophysical Logging, Vertical Electrical Sounding (VES), Transient Electro Magnetic Survey (TeM) and 2D Imaging Survey for 3D Aquifer Geometry determination.



Ground Water Quality

To ascertain aquifer-wise ground water quality, analysis of Basic and Heavy Metal parameters of different aquifers



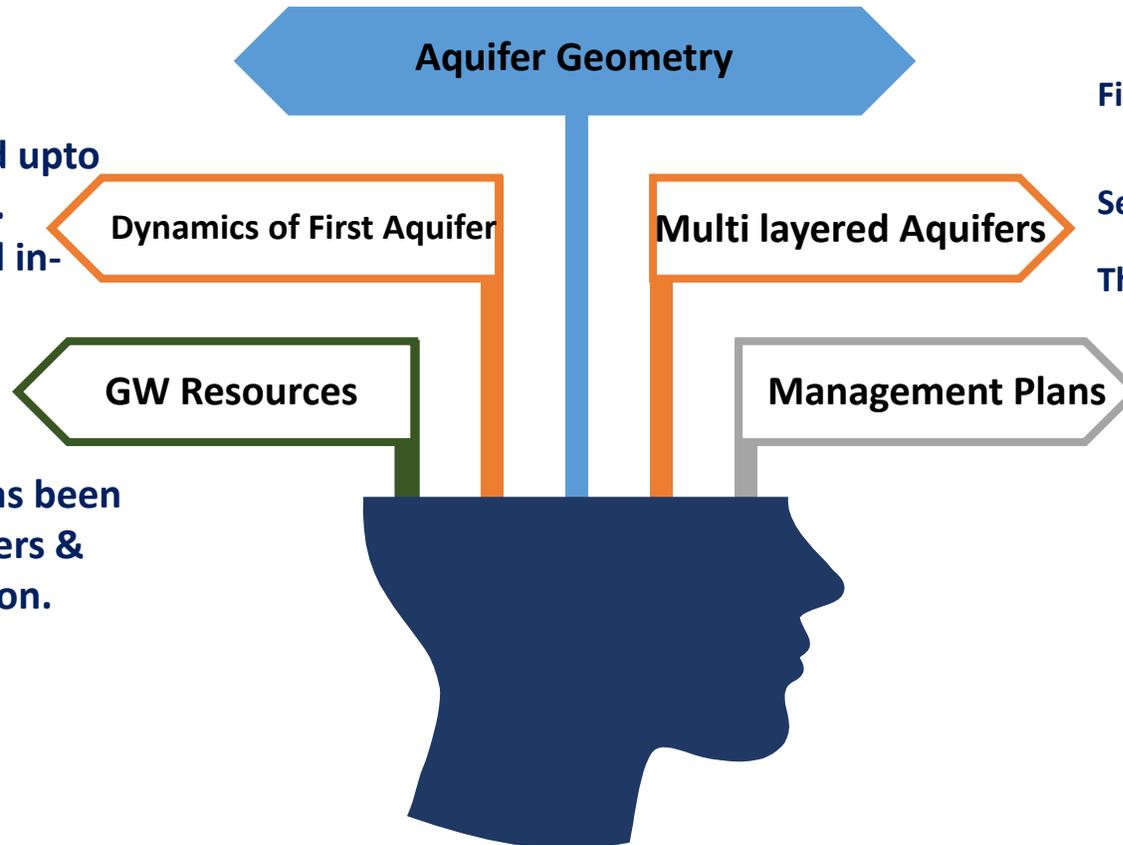


Outcome of NAQUIM

Deciphered multi layered aquifer geometry of UP.
Three tier aquifers in alluvium. In Bundelkhand
Granites and Vindyan Sandstone, weathered &
fractured aquifers established.

First Aquifer comprises unconfined upto
50 mbgl, and semi confined below.
Facilitated estimating dynamic and in-
storage resource in First Aquifer.

Aquifer wise available resource has been
estimated, using Aquifer Parameters &
Aquifer Dimension from Exploration.



First aquifer 0.0 – 150 mbgl

Second aquifer 100 – 210 mbgl

Third aquifer 225 ~ 360 mbgl

Unconfined to
Semi confined

Confined

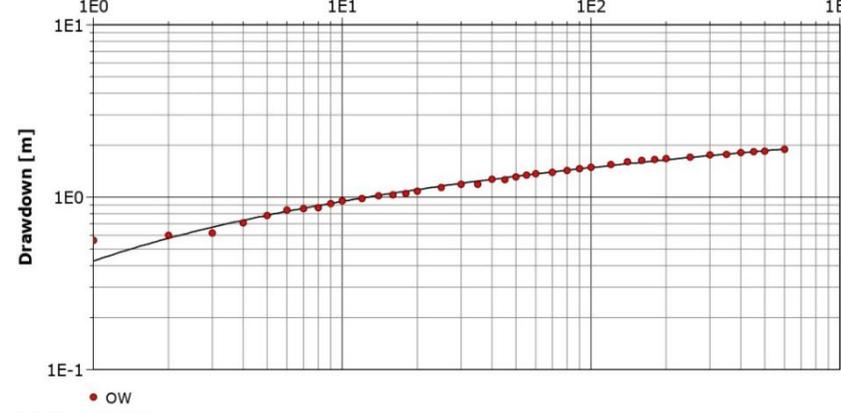
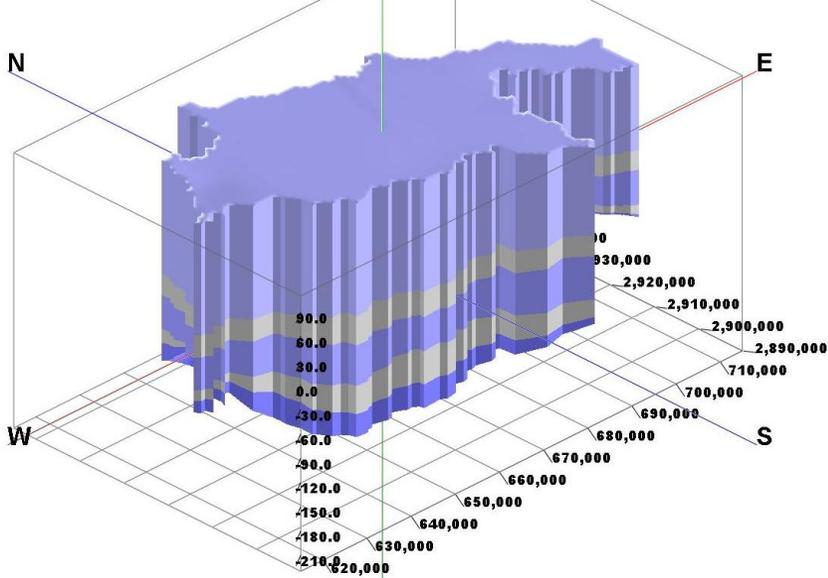
Confined

- OCS areas
- Water Quality Infested areas
- Water logged areas
- Flood Prone areas
- Aquifers with issues of Sustainability (Bundelkhand)



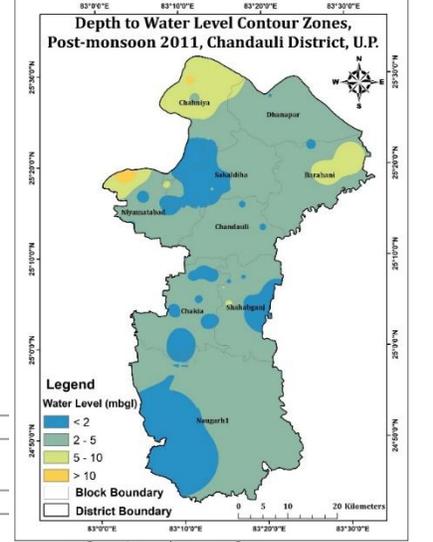
NAQIM Activities

- Stratigraphy**
- Aquifer Group I
 - Clay Horizon I
 - Aquifer Group II
 - Clay Horizon II
 - Aquifer Group III

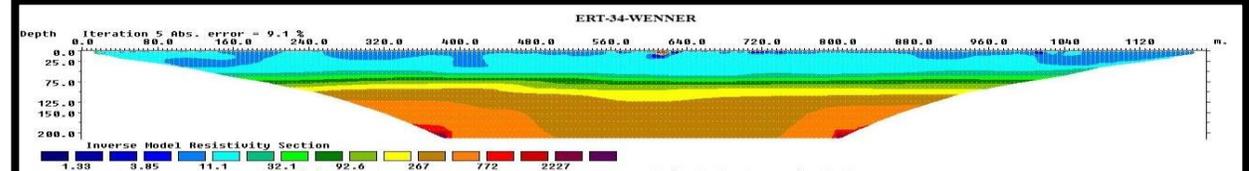
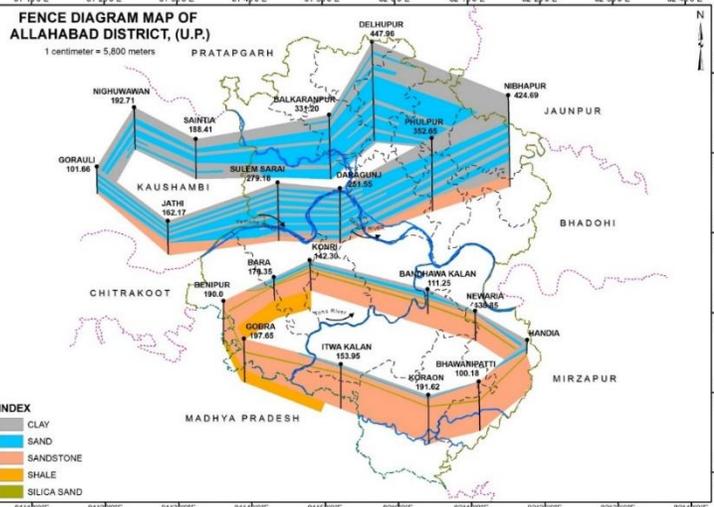
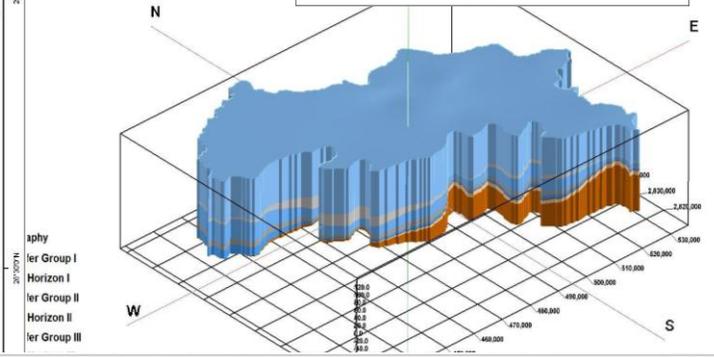
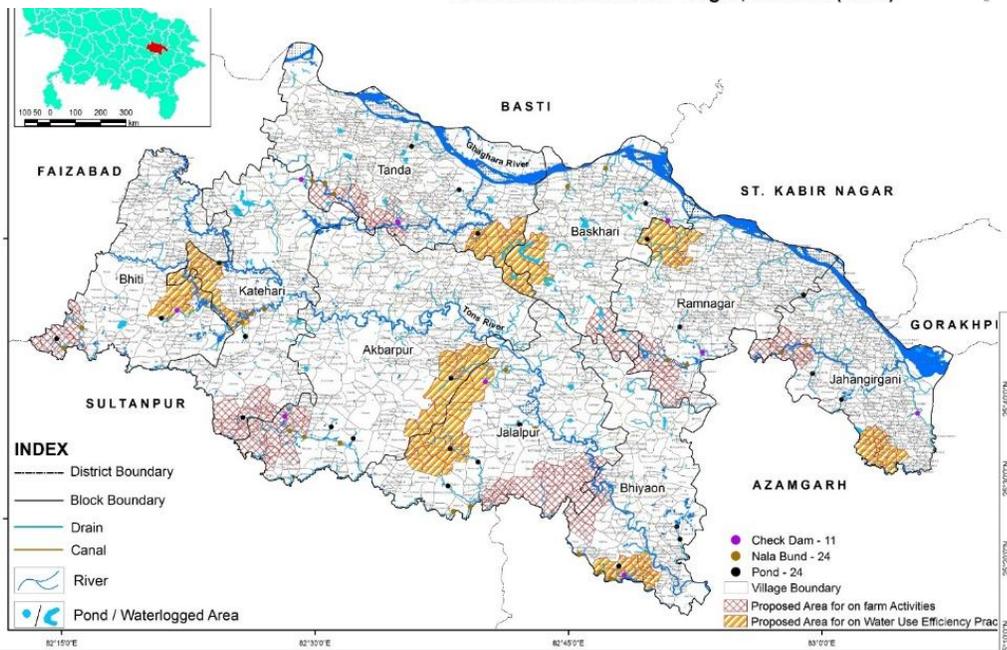
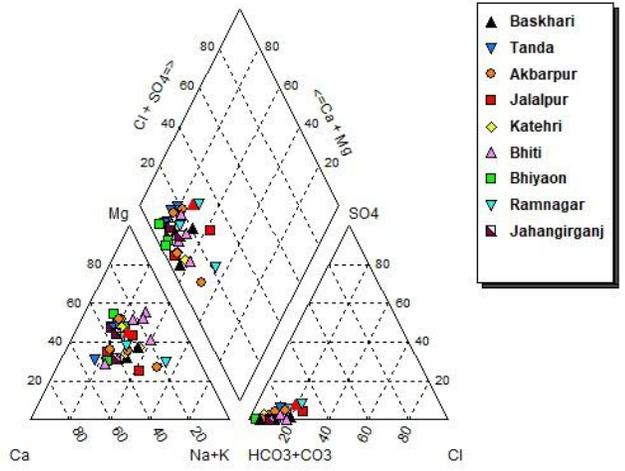


Calculation using Theis

Observation Well	Transmissivity [m ² /d]	Hydraulic Conductivity [m/d]	Storage coefficient	Radial Distances to PW [m]
OW				25.0

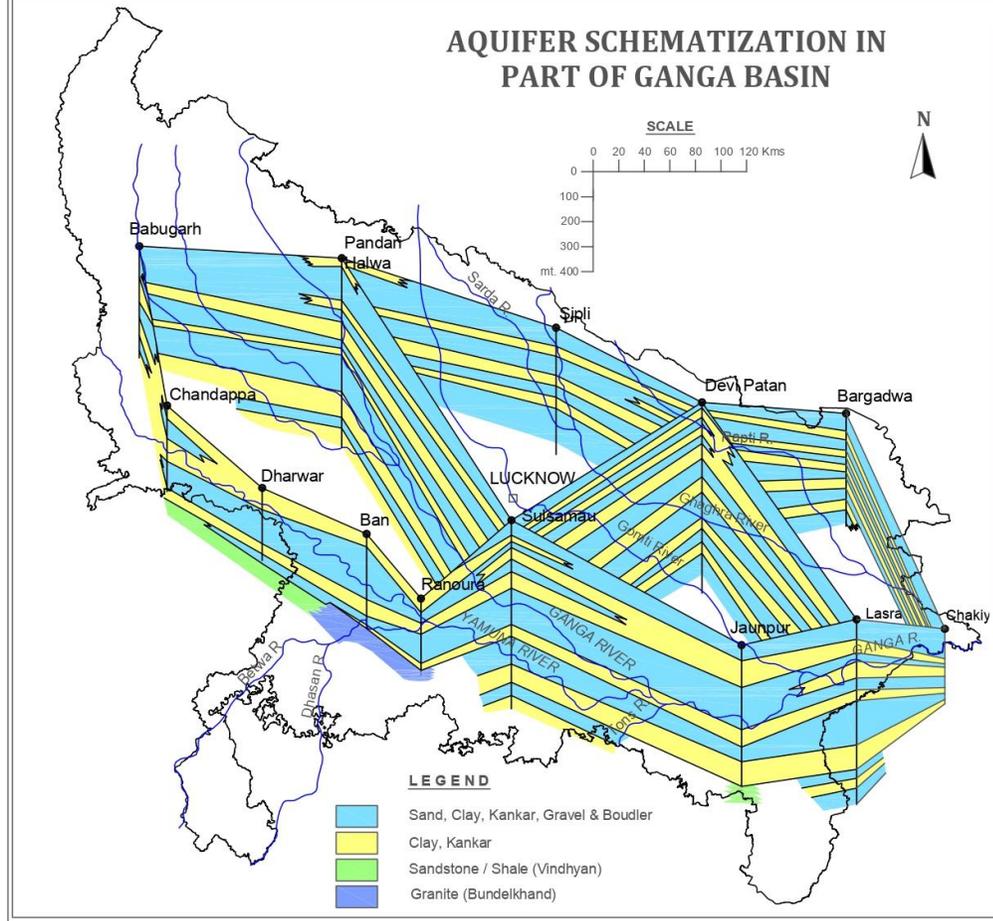


Piper Diagram, Ambedkar Nagar District

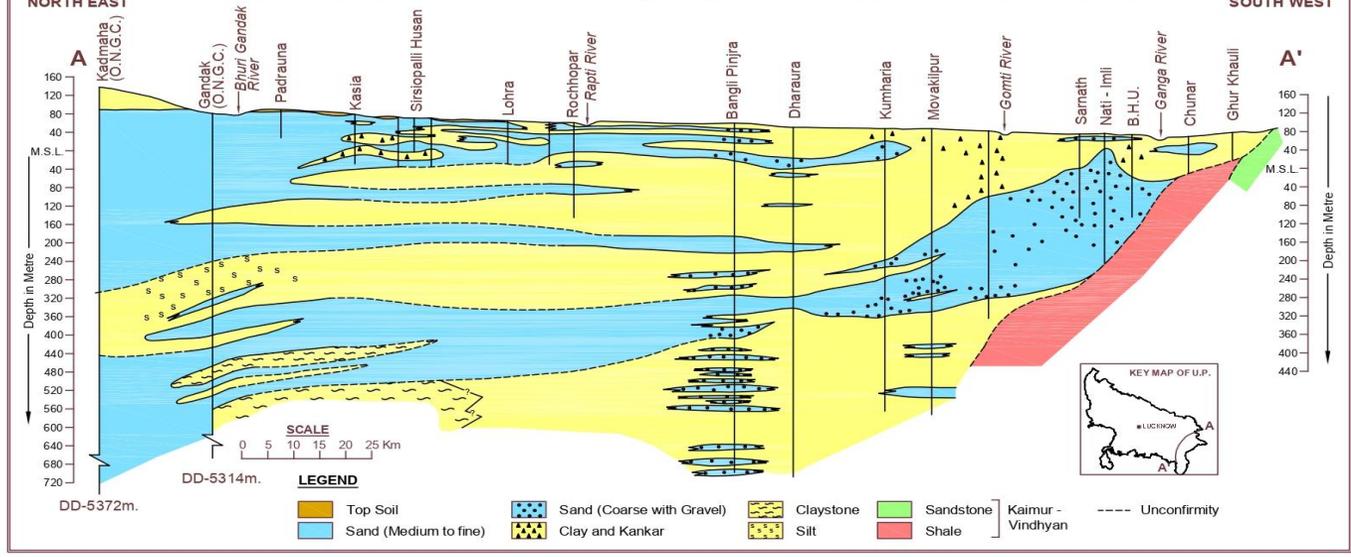




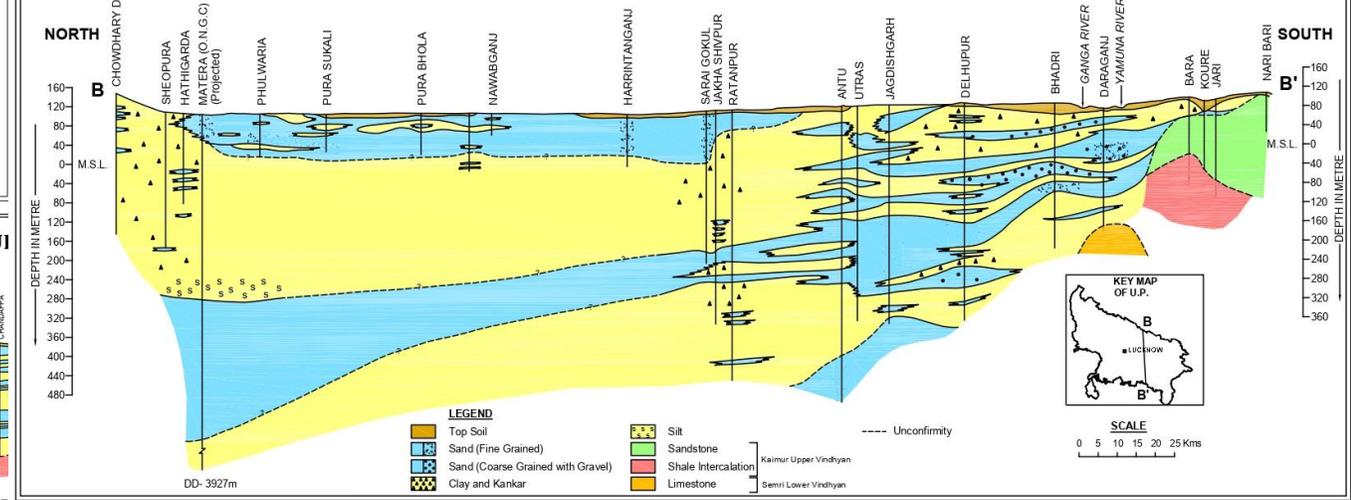
AQUIFER SCHEMATIZATION IN PART OF GANGA BASIN



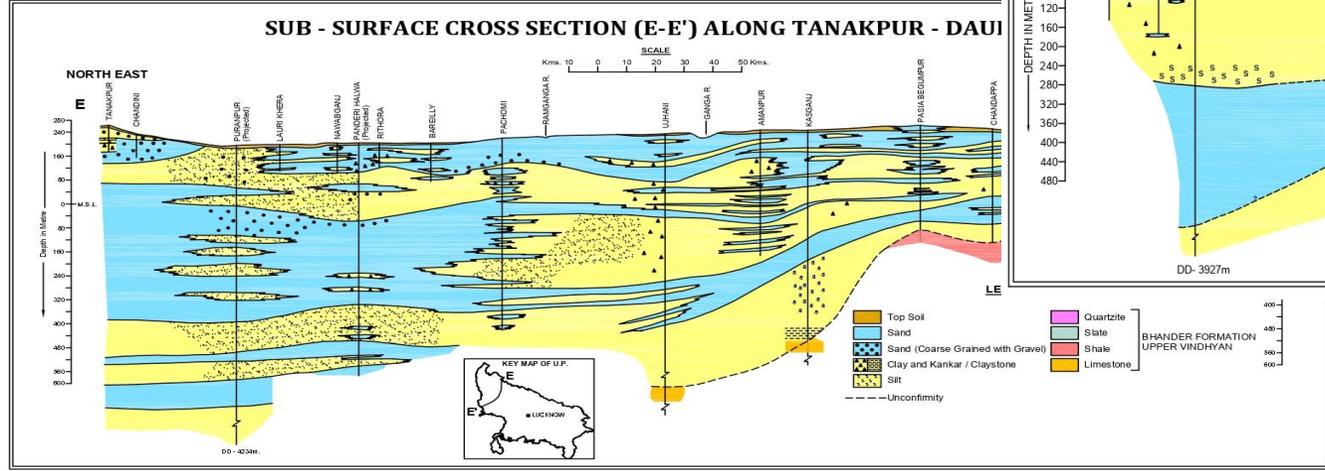
SUB - SURFACE CROSS SECTION (A-A') ALONG KADMAHA - GHUR KHAULI



SUB - SURFACE CROSS SECTION (B-B') ALONG CHOWDHARY DIH - NARIBARI



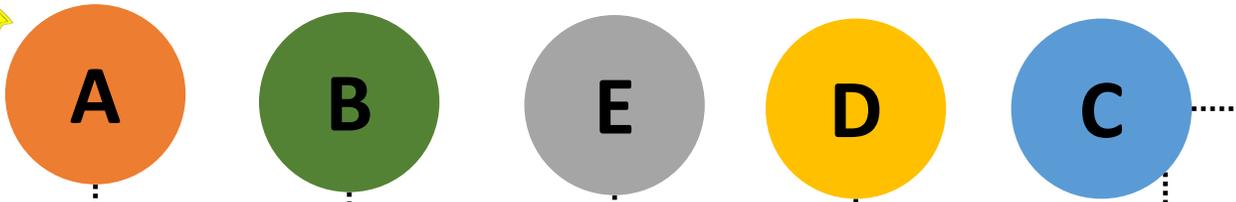
SUB - SURFACE CROSS SECTION (E-E') ALONG TANAKPUR - DAU



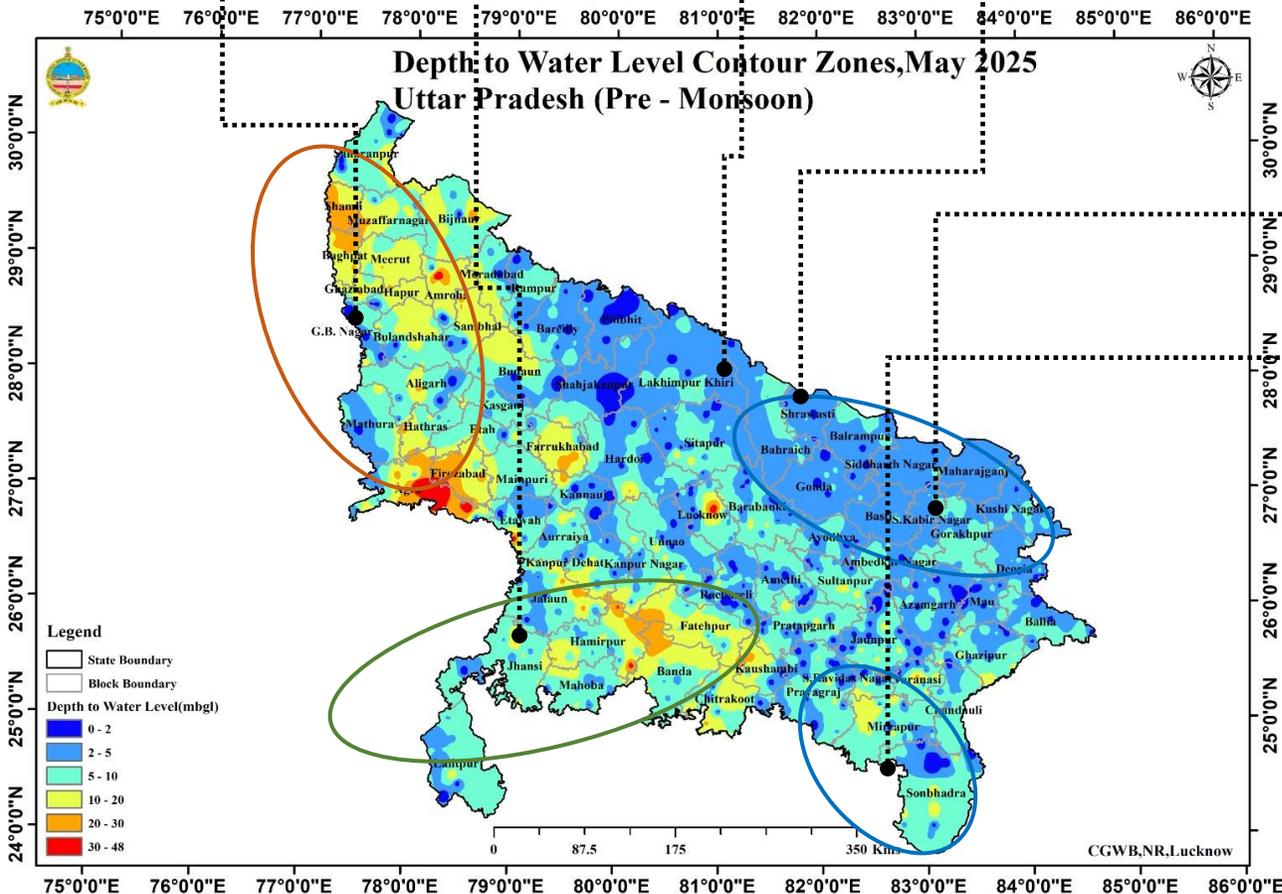
Outcome

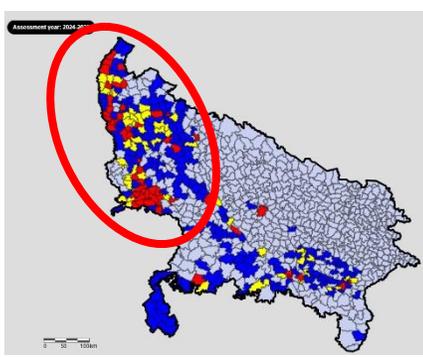


Area Specific Management Strategies



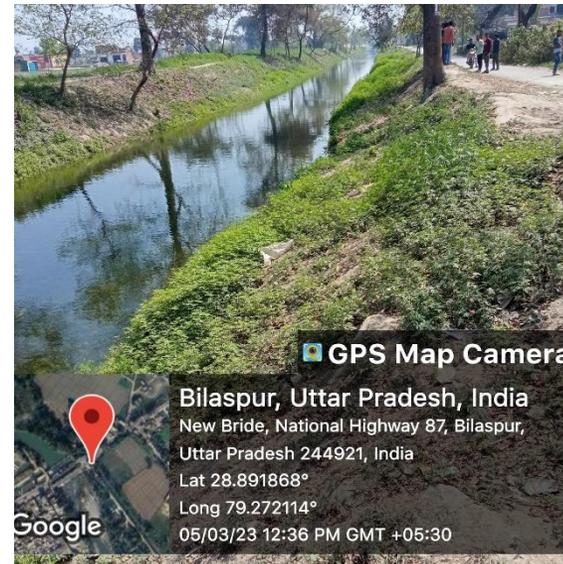
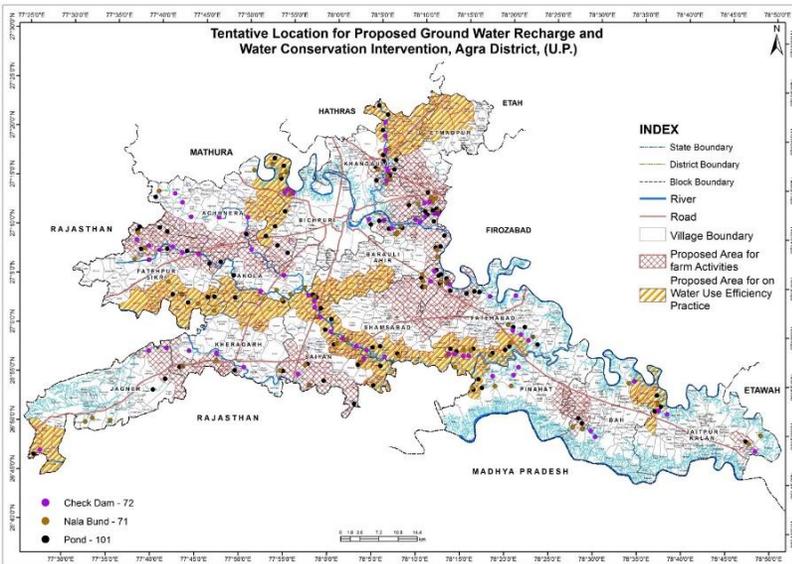
A	Over-Exploited, Critical and Semi Critical Areas.	Artificial Recharge and WUE, On farm Interventions.
B	Bundelkhand Areas.	Artificial Recharge.
C	Arsenic Infested Areas.	Use of Cement Sealing Technology.
C	Fluoride Infested Areas.	Proposal for Conjunctive Use and artificial recharge .
D	Shallow Water Level Areas.	Proposal of Ground Water Developmental Schemes like PMKSY-GW.
E	Waterlogged & Flood Affected Areas.	Proposal for Conjunctive Use & extraction of additional GW.





A. OCS Areas

Issue: Deeper Ground Water Level and huge extraction for irrigation purposes



➤ **Supply-side interventions for Artificial Recharge**

Proposal for

1. Check Dams
2. Rooftop Rain Water Harvestings
3. Conservation of water bodies
4. De-siltation of ponds
5. Recharge Shafts
6. Recharge Trench

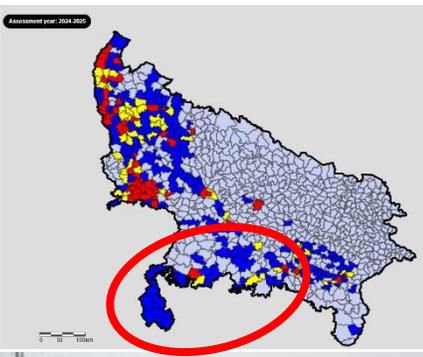
➤ **Demand-side interventions for saving groundwater for irrigation purposes**

Proposal for

1. Water use efficiency (use of drip and sprinkler irrigation)
2. On farm activities



B. Bundelkhand Areas



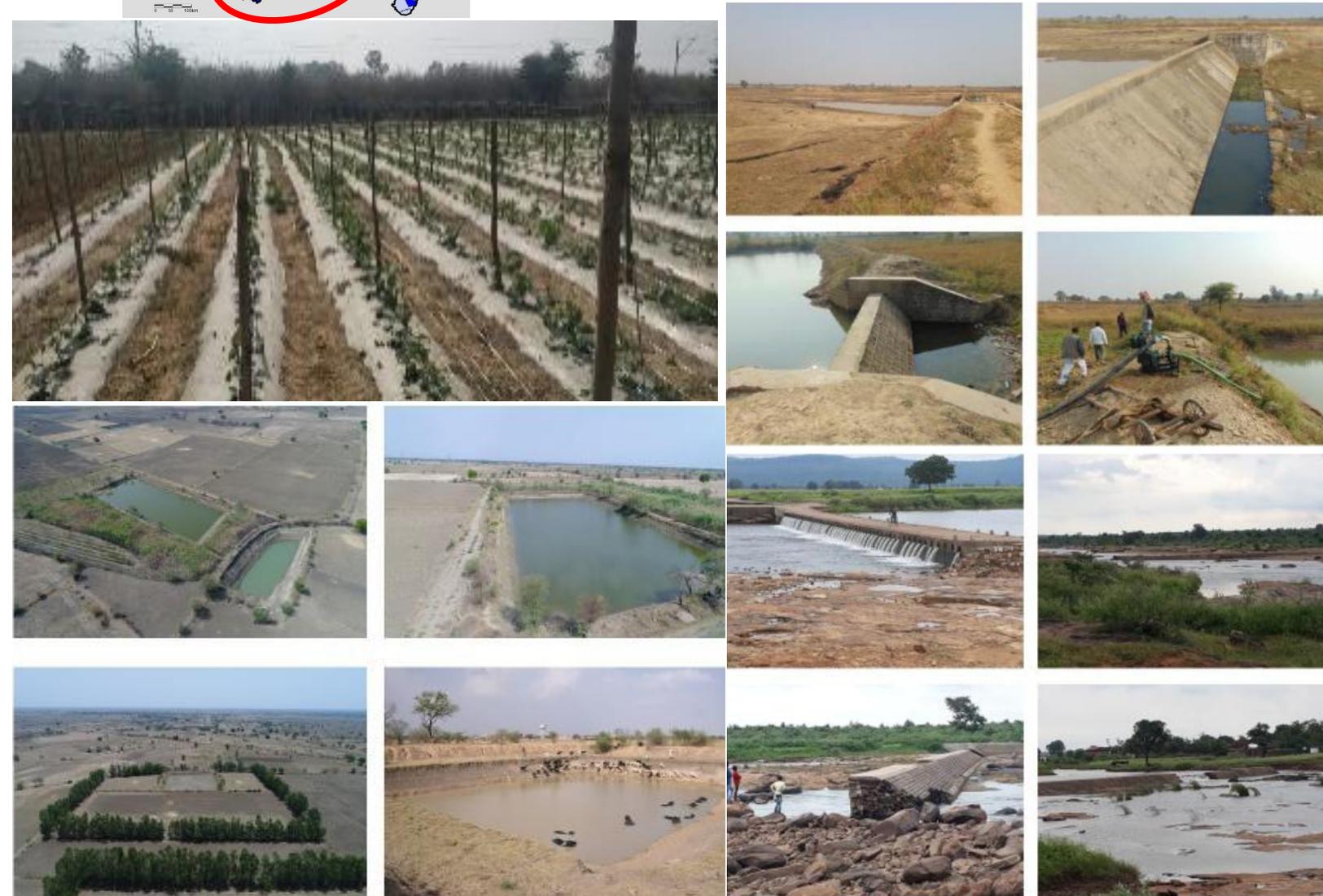
Issue: Ground Water Sustainability

- Management plans mainly focused on Artificial Recharge and water conservation

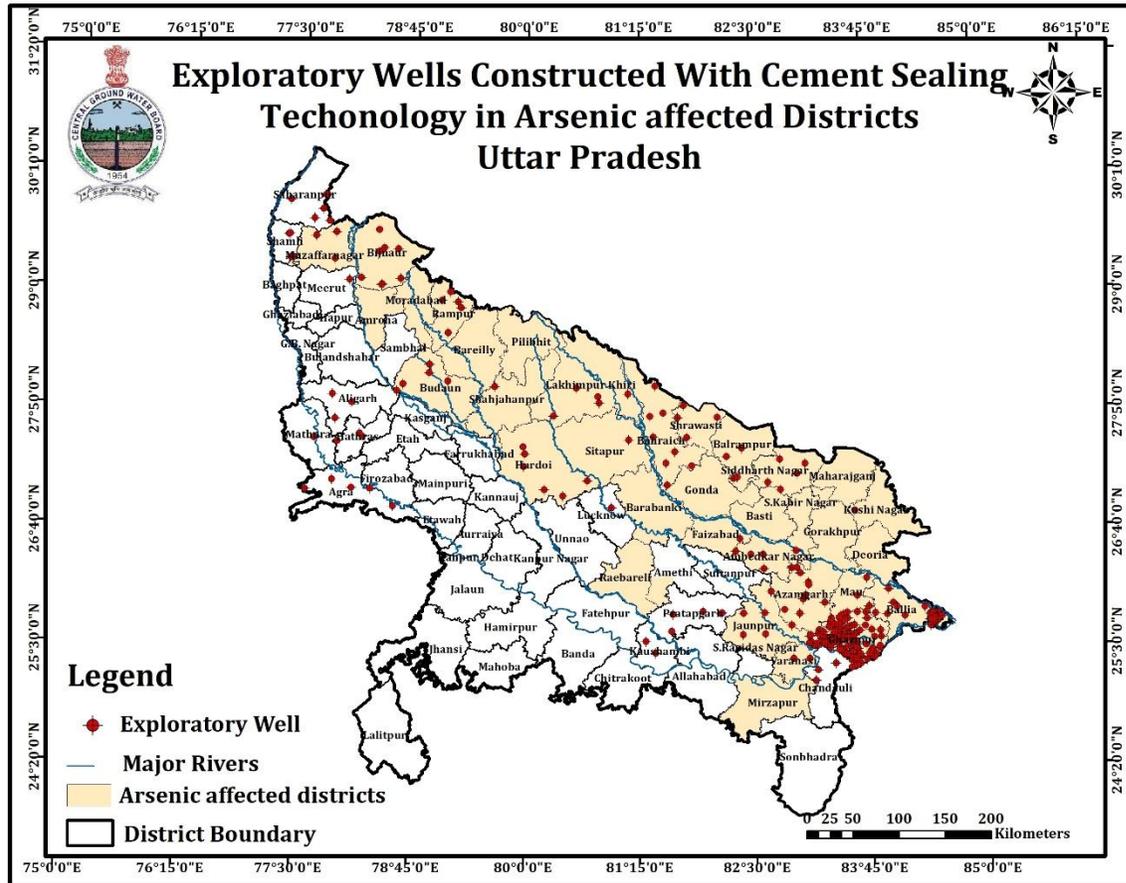
Proposal for

1. Check Dams/ Percolation Tank
2. Rooftop Rain Water Harvestings
3. Conservation of traditional water bodies.
4. Recharge Shafts
5. Staggered trenches
6. Gully Plug
7. Nala Development

- Demand side interventions for saving in irrigation draft also proposed



C. Arsenic affected areas



Pilot Drilling

Drilling of pilot hole followed by Geophysical logging & Litholog preparation.



Determination of Zones



Well Construction

reaming and a suitable well assembly lowering is taken up.



Depth identification for Cement Sealing

Prominent clay layer immediately below Arsenic infested aquifer to be demarcated for cement sealing.



Gravel Packing

Pea sized Gravel packed in annular space up to 2 metres above the identified clay layer through 2" feeder pipe.



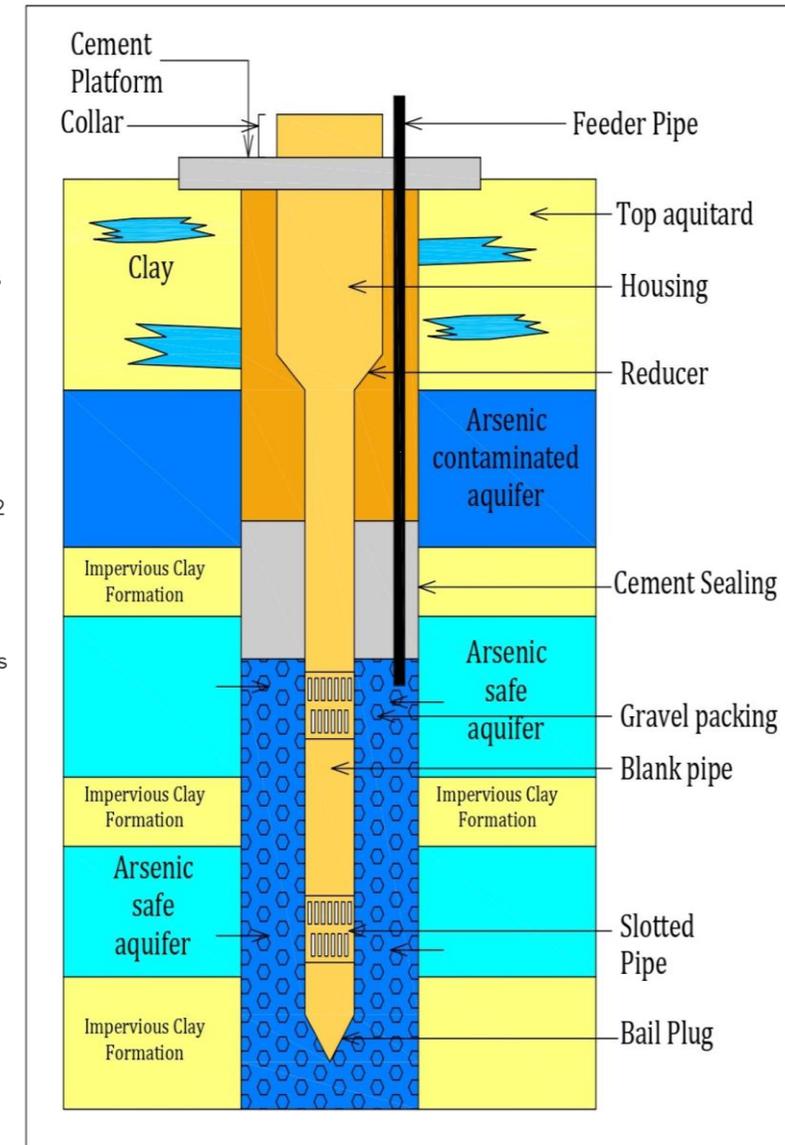
Cement Sealing

The gravel packed identified clay layer is grouted through cement slurry for 5 metres thickness. This will be left for hardening for 24 hours for compaction.



Installation of Feeder Pipe

feeder pipe for gravel packing is kept below the cement sealing zone to accommodate the settlement of gravel during the compressor development.



•As per BIS 10500:2012, the maximum permissible limit of Arsenic in drinking water is 0.01 mg/l (ppm) or 10µg/l (ppb).

•Of the 75 districts in the state, several districts have been identified to be affected by Arsenic, generally present in the shallow aquifer (up to 100 mbgl).

•A total of 294 wells (since 2012) have been constructed in the state with the cement sealing technology to get As free water from the deeper aquifers.

C. Fluoride Affected Areas

Constructed Fluoride Free Bore well
 Site- Hathwani (EW)
 Discharge- 48 LPM
 GWL- 22.60 mbgl

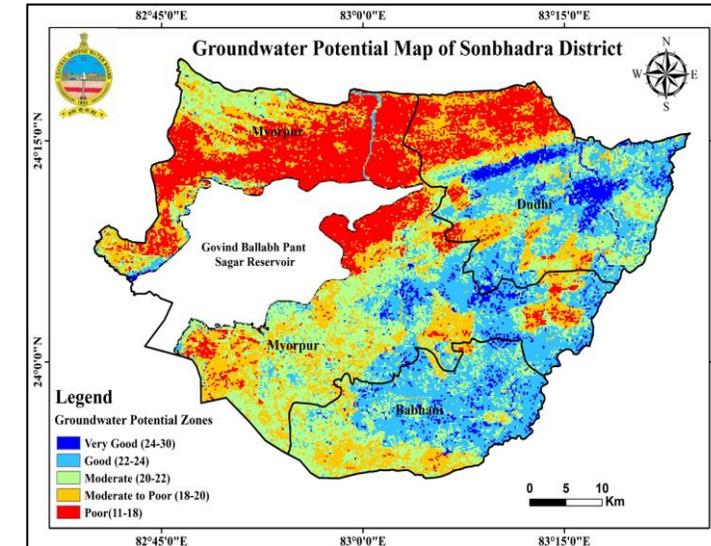
1. Zones with marginal fluoride (1.5 to 1.7 mg/L) area,
 Desilting of existing Check dam -20 no.
 New Check dam proposed- 7 no.

Conservation Structure(Existing):
 Desilting of Ponds (> 0.5) - 18 no.
 Desilting of Ponds (0.5 to 1.0) - 19 no.
 Desilting of Ponds(1.0 to 3.0) - 44 no.
Proposed Ponds with Recharge shaft (<3ha.)-22 no.

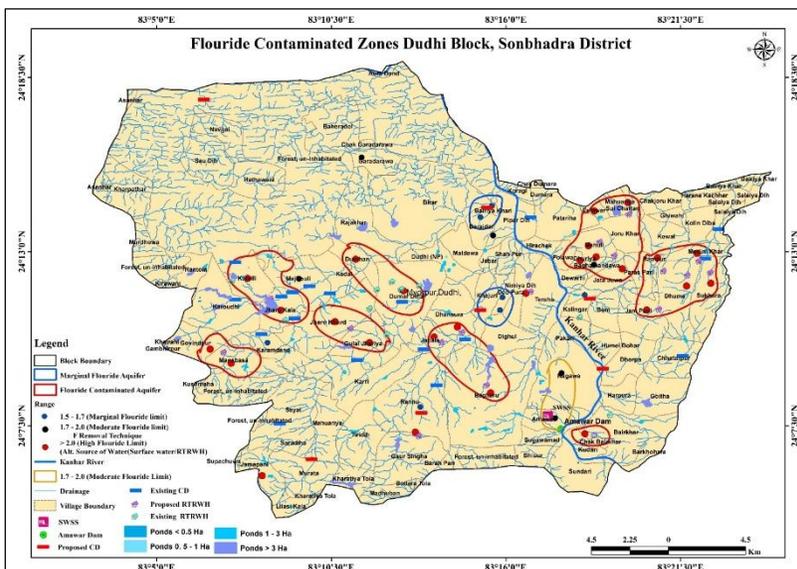
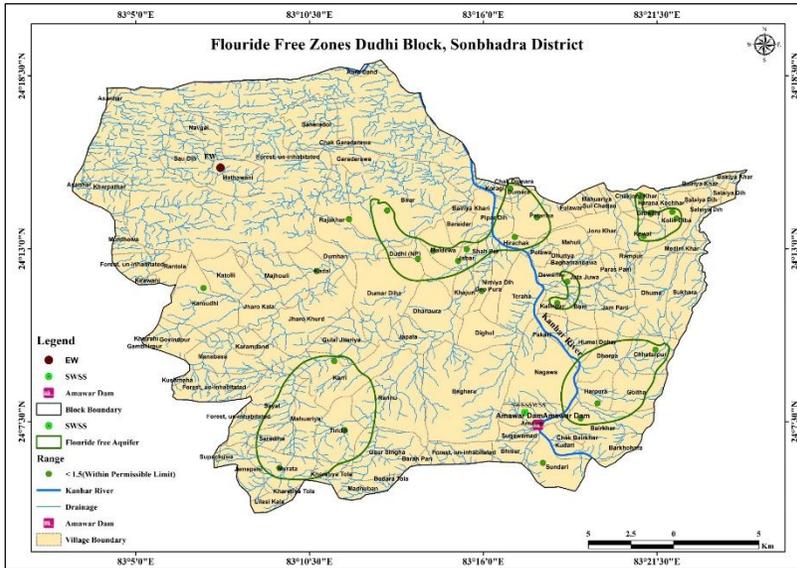
Proposed RTRWH Structure: -17 no.

2. Zones with moderate fluoride (1.7 to 2.0 mg/L)
 Fluoride removal plants with different capacities

3. Zones with high fluoride (>2.0 mg/L) area,
 Alternate sources of water supply like surface water, rainwater, Filter Water etc.

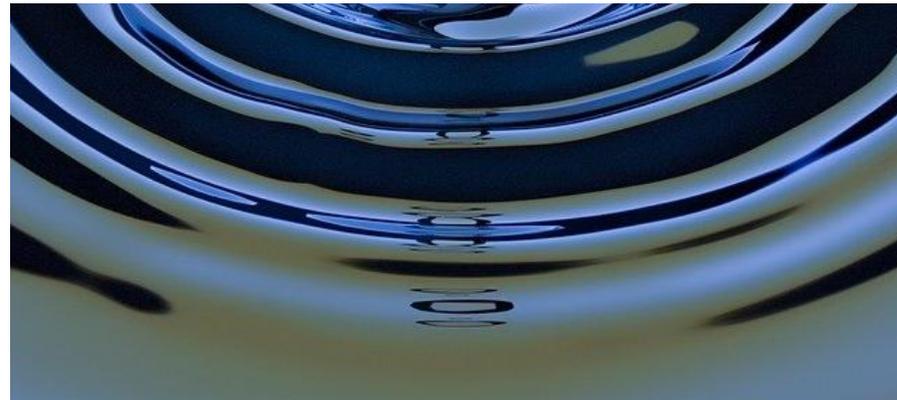
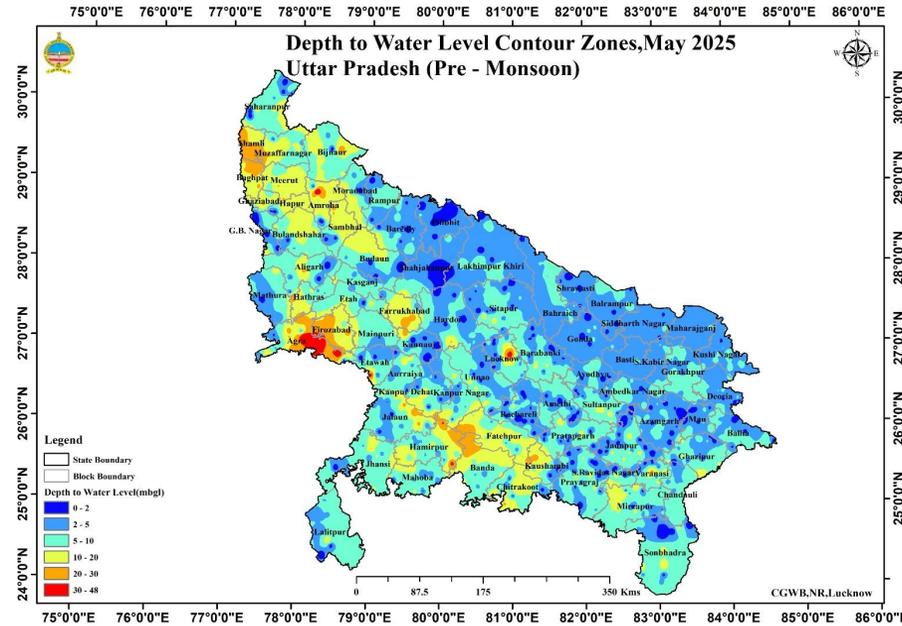


Groundwater Potential Zone	Area Sq Km
1 Very Good	100.96
2 Good	519.44
3 Moderate	580.6
4 Moderate to Poor	493.2
5 Poor	428.16
Total	2122.36



D. Shallow Water Level Areas

- Proposed for taking up schemes like PMKSY-HKGP-GW for development of irrigation in Northern Terai Areas including Siddharthnagar, Bahraich, Maharajganj, Gorakhpur, Pilibhit, Lakhimpur, Sitapur, Gonda, Basti etc.
- District-wise potential for additional irrigation estimated.
- Adoption of schemes like PMKSY-HKGP-GW can uplift the socio-economic status of small and marginal farmers
- Proposals for development of GW shall restrict number of wells, to not to exceed stage of GW extraction beyond 70%.



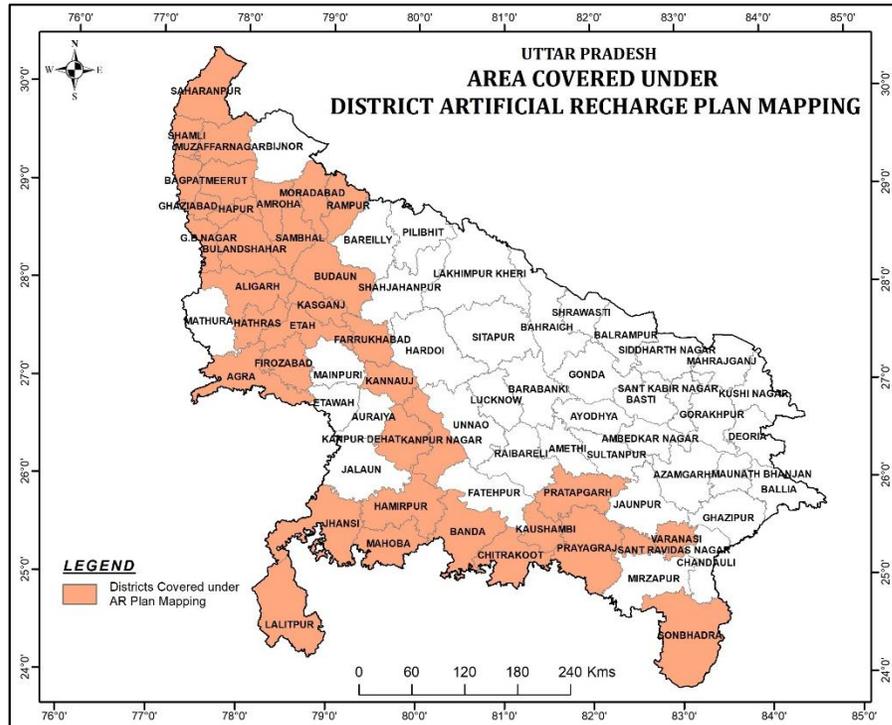
E. Water Logged & Flood Affected Areas

- Proposal for conjunctive use of surface and ground water in Canal Command areas.
- Augmentation of canal water by ground water to facilitate irrigation upto tail end of canal command area.
- Flood plains and inundated areas can be used for Managed Aquifer Recharge (MAR) by developing GW and creating space in aquifers for recharge during monsoon.
- This will also help in flood control.

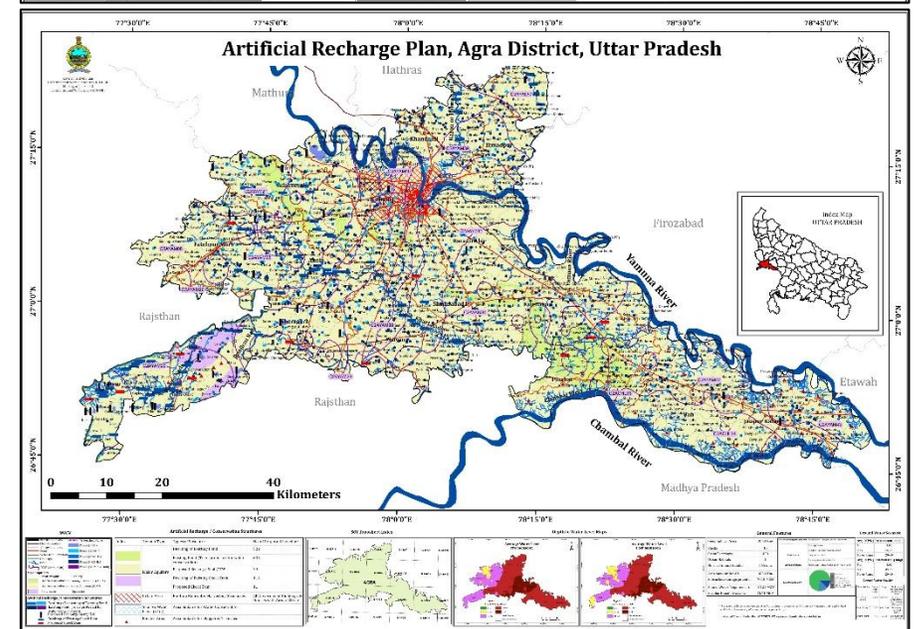
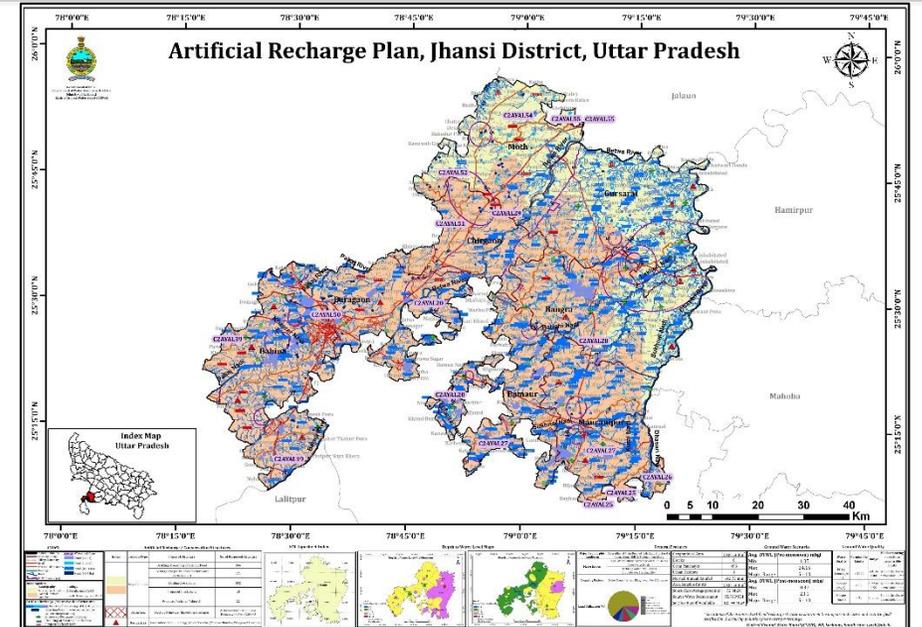
DISTRICT RECHARGE PLAN

- Total no. of districts = 42
- Type- JSA and OCS districts

Agra	Hathras
Aligarh	Kasganj
Amroha	Kaushambhi
Baghpat	Lalitpur
Bulandsahar	Mahoba
Budaun	Moradabad
Banda	Sonbhadra
Chitrakoot	Muzaffarnagar
Kanpur Dehat	G.B.Nagar
Kanpur Nagar	Pratapgarh
Kannauj	Rampur
Etah	S. Ravidas Nagar
Farrukhabad	Meerut
Jhansi	Saharanpur
Firozabad	Shamli
Ghaziabad	Varanasi
Hamirpur	Prayagraj
Hapur	Sambhal



Bijnor	Mainpuri
Fatehpur	Mathura
Jaunpur	Mirzapur





THANK YOU