

**Protocol for Activities:
Data compilation, Data gap analysis,
Data Acquisition and Preparation of
Aquifer map**

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Central Ground Water Board**

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Aquifer Mapping

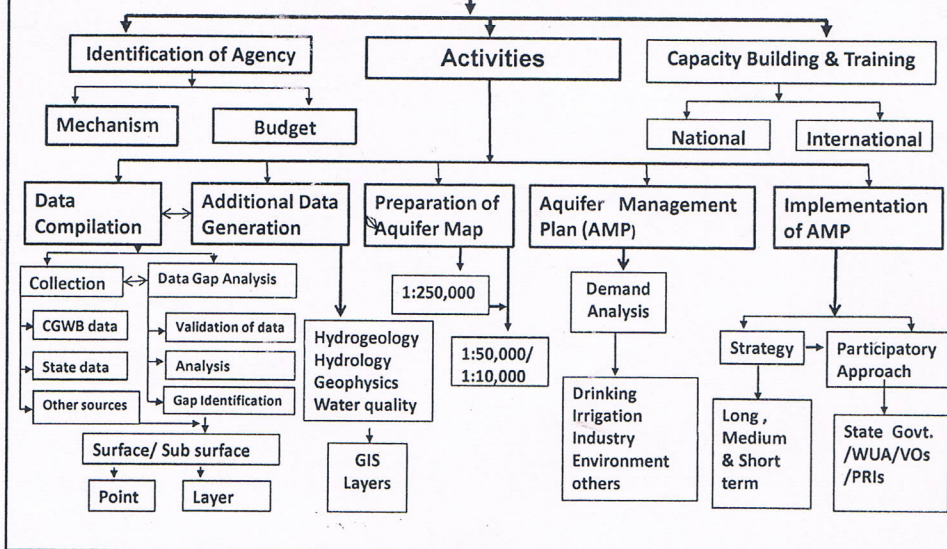
- **Aquifer mapping is a scientific process - a combination of geologic, geophysical, hydrologic, & chemical field and laboratory analyses are applied to characterize the quantity, quality, and sustainability of ground water.**
- **Deliverables to meet the requirement of farmers, community and other end users.**

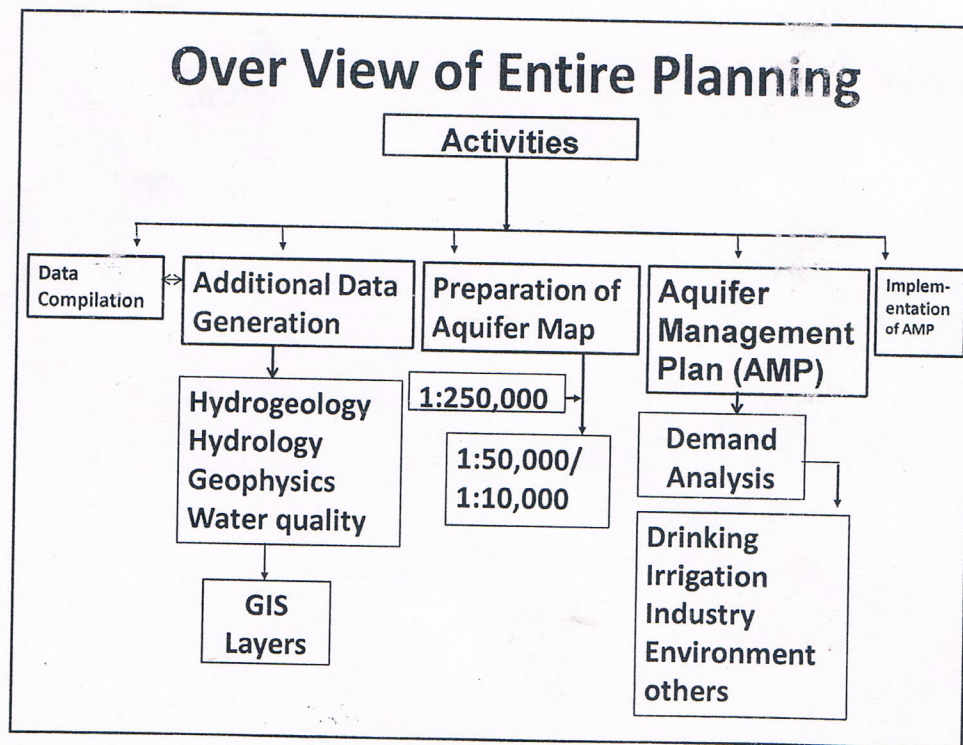
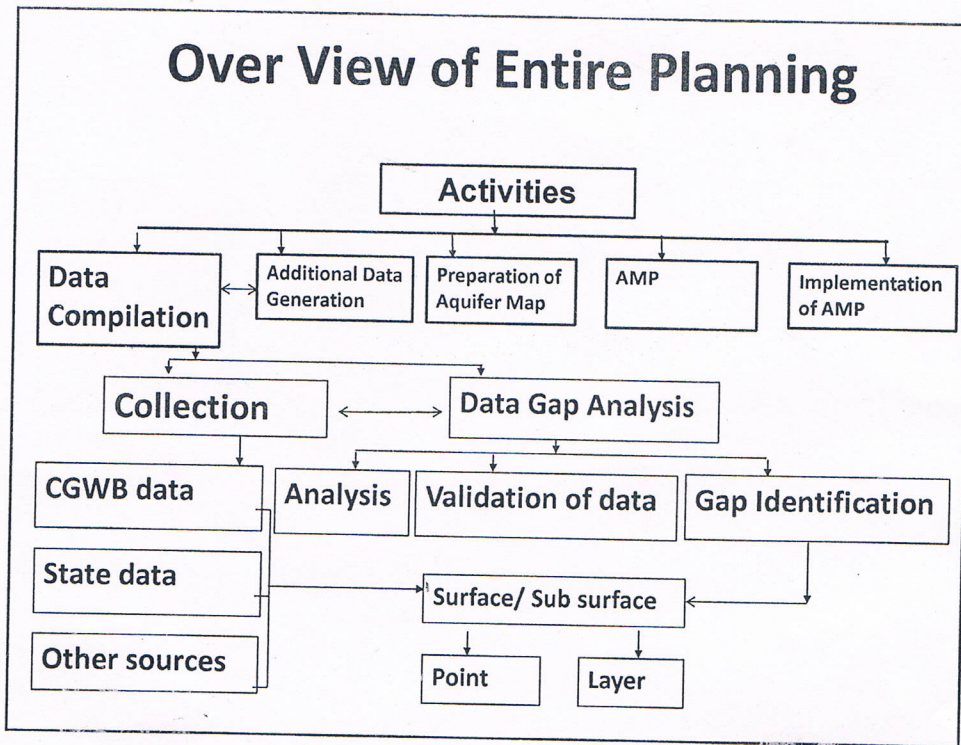
Objective of Aquifer mapping

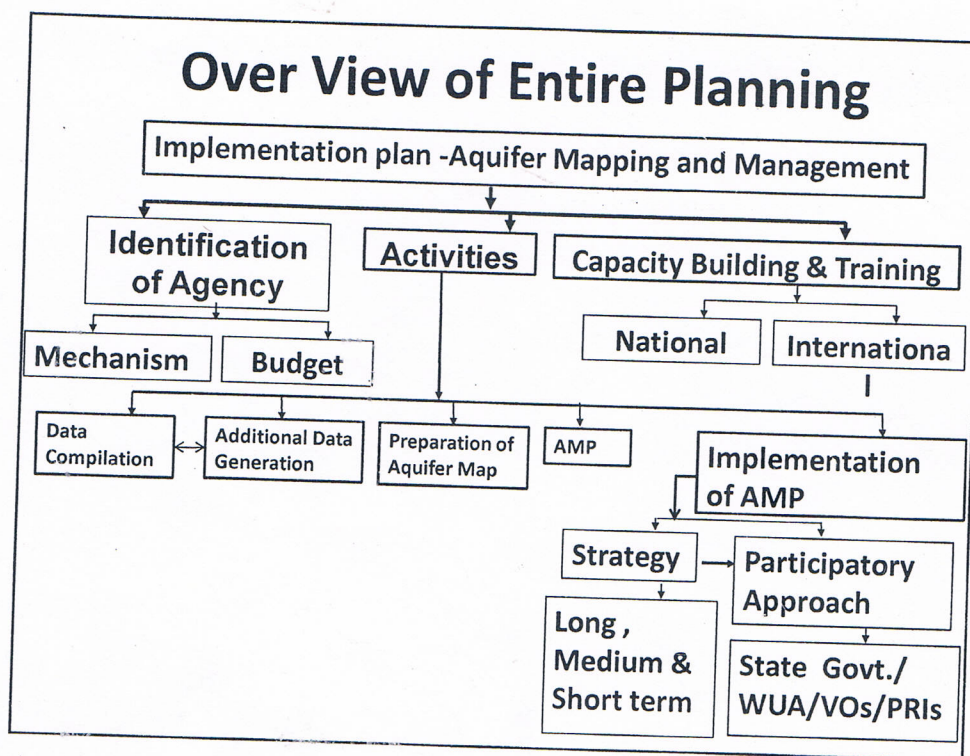
- Define aquifer geometry at 1: 50,000 to 1:10,000 scale in identified areas, type of aquifers, ground water regime behavior, hydraulic characteristics, and geochemistry of aquifer systems.
- Assessment recharge and discharge areas and ground water resources (dynamic and In storage).
- Develop a dynamic system for sustainable management of ground water resources (in conjunction with surface water) for an aquifer as a unit.

Over View of Entire Planning

Implementation plan -Aquifer Mapping and Management





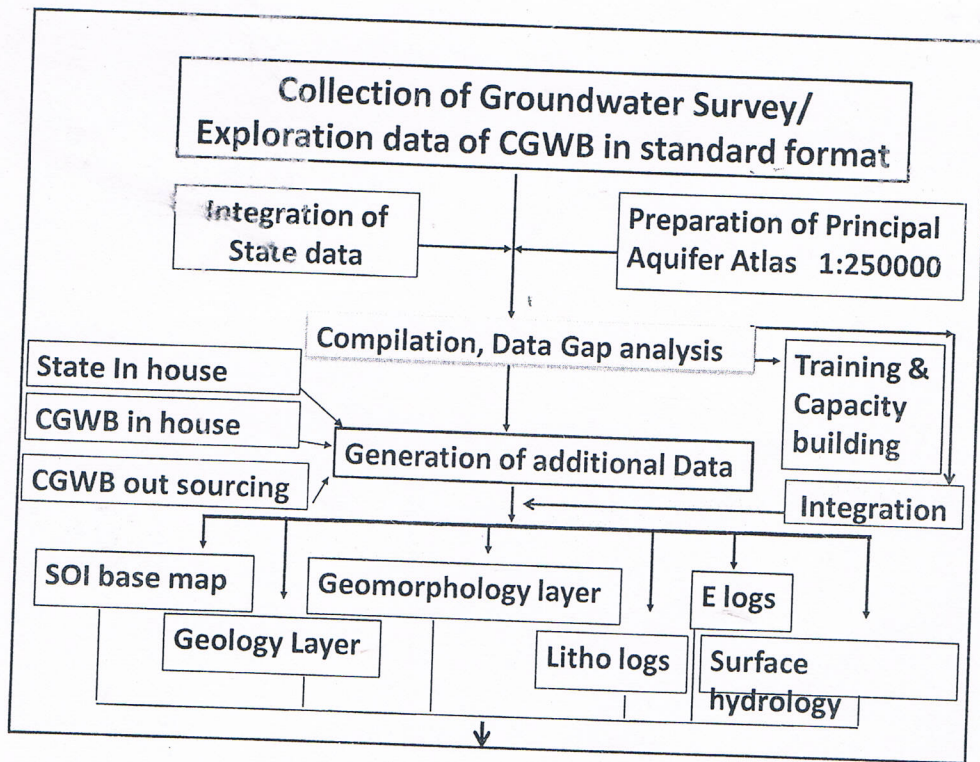
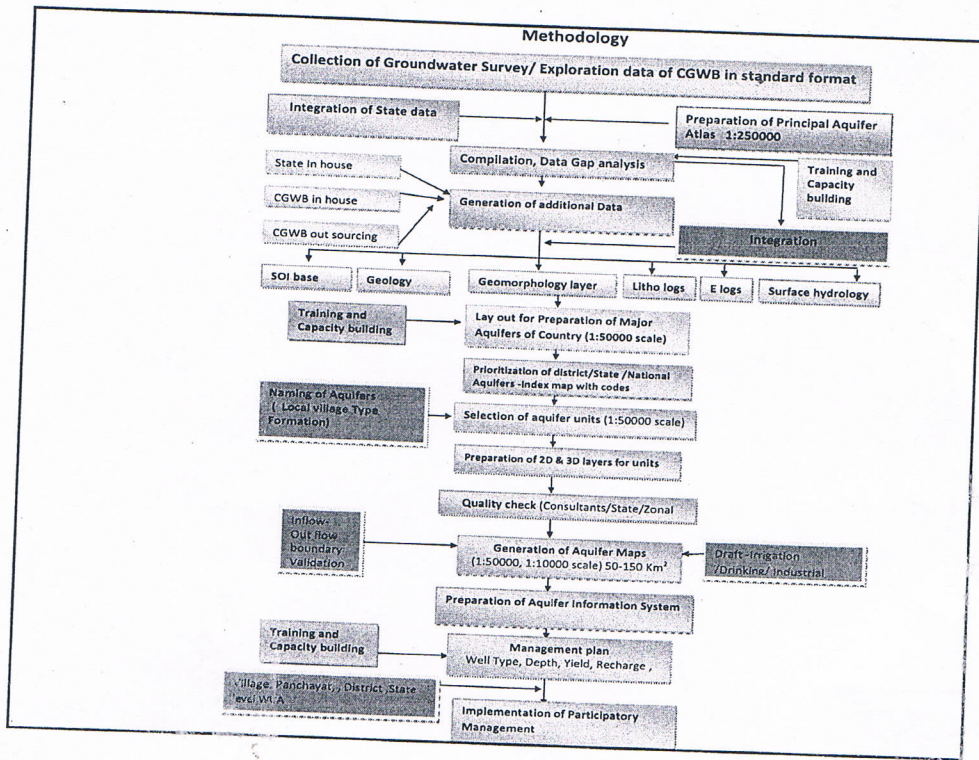


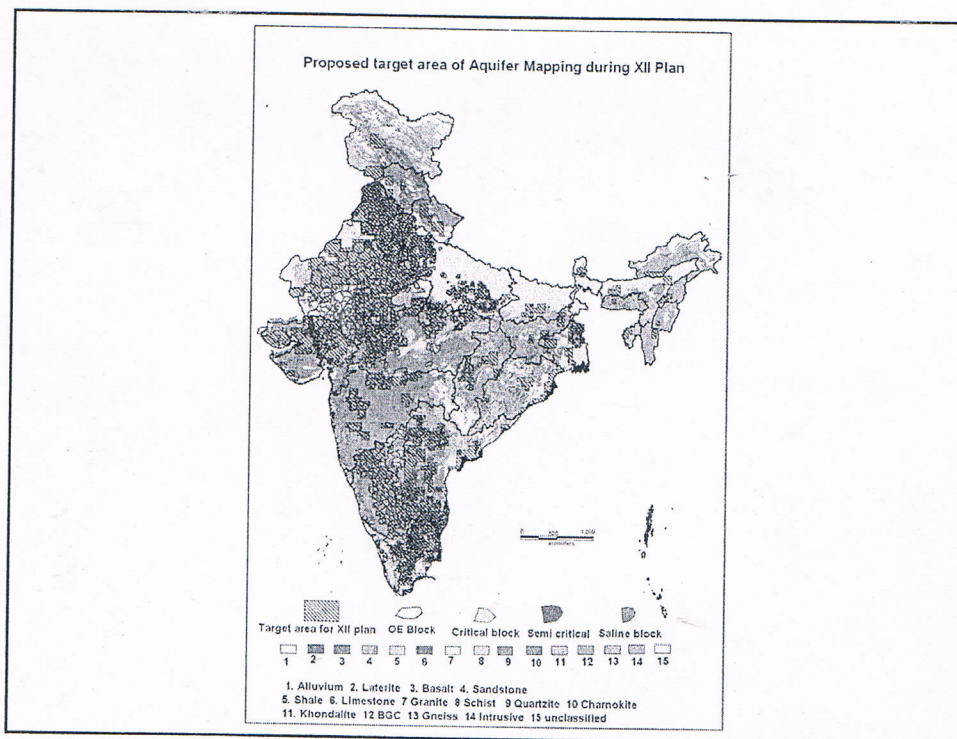
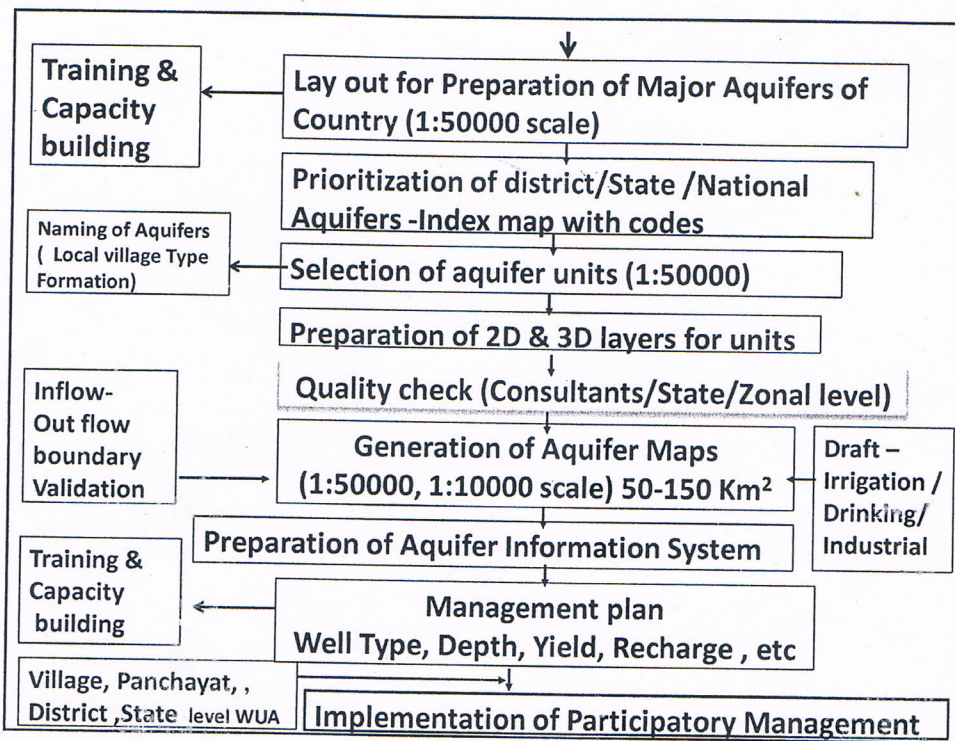
Approach

1. Literature survey on Hydrogeological mapping and use of Geophysical techniques in aquifer characterization
2. Delineation of extent of Aquifer Units, their Definition and Evaluation
3. Prioritisation for work programme
4. Data Compilation, Identification of Data gaps & Generation of data
5. Preparation of Aquifer map to develop sustainable Management Plan
6. Development of Aquifer Information and Management System
7. Capacity Building & Outreach Programme
8. Risk Analysis

| Major Activities & Sub Activities | | |
|--|---|---|
| I | Compilation of Existing Data/ Identification of Principal Aquifer Units & Data Gap | <ul style="list-style-type: none"> • Compilation of Existing ground water Data • Identification of Data Gap |
| II | Generation of Data | <ul style="list-style-type: none"> • Generation of Geological layers in 1: 50,000 scale • Surface and sub-surface geo-electrical and gravity data generation • Hydrological information • Parameters on Ground water recharge • Preparation Hydrogeological maps in 1: 50,000 scale • Generation of additional water quality parameters |

| Major Activities & Sub Activities | | |
|--|---|--|
| III | Aquifer Map Preparation(1: 50,000 scale and for identified areas in 1:10,000 scale) | <ul style="list-style-type: none"> • Analysis of data base and preparation of GIS layers • Preparation of Aquifer Maps |
| IV | Aquifer Response Model/Aquifer Management Plan | <ul style="list-style-type: none"> • Model Conceptualisation • Model Simulation • Preparation of Aquifer Management Plan |
| V | IEC Activity & Implementation of Aquifer Management Plan | <ul style="list-style-type: none"> • Capacity building • Participatory Groundwater Management |





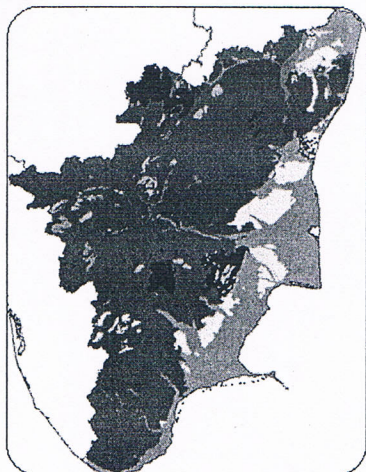
**Compilation of Existing Data/
Identification of Principal Aquifer
Units & Data Gap**

- **Preparation of Base map and thematic layers**

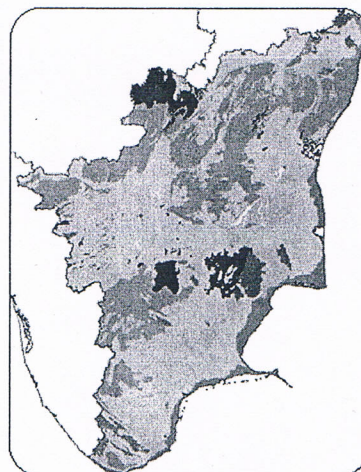
Data Source: CGWB/SOI/NRSC/State Agency

- **Database of Exploration wells**

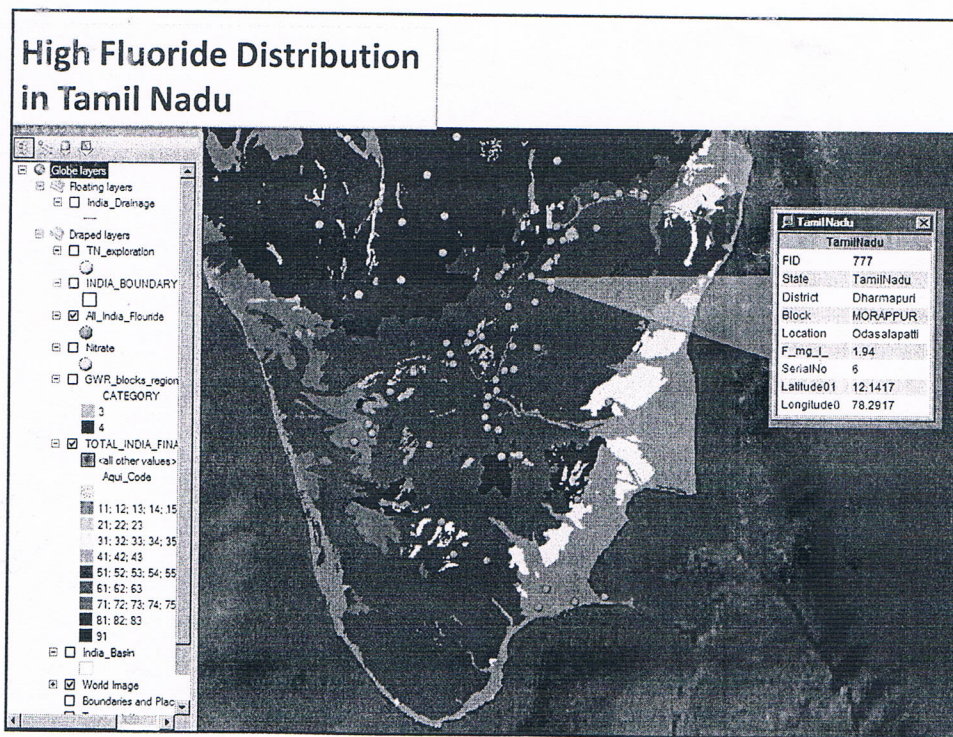
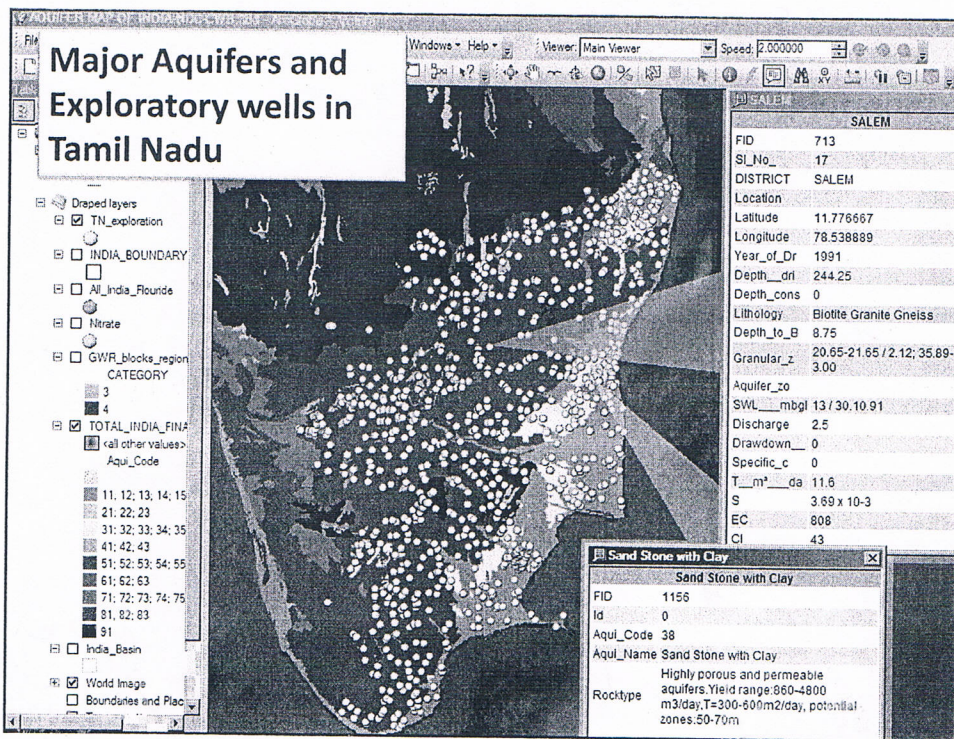
Data Source: CGWB/State Agency

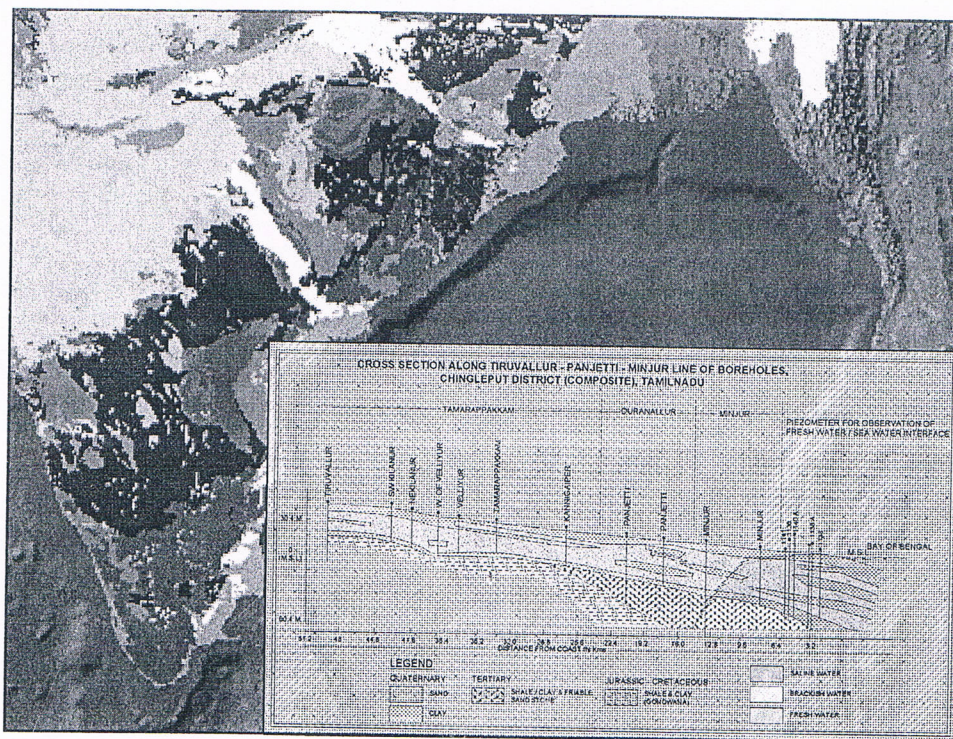


Major aquifer systems



Aquifer systems

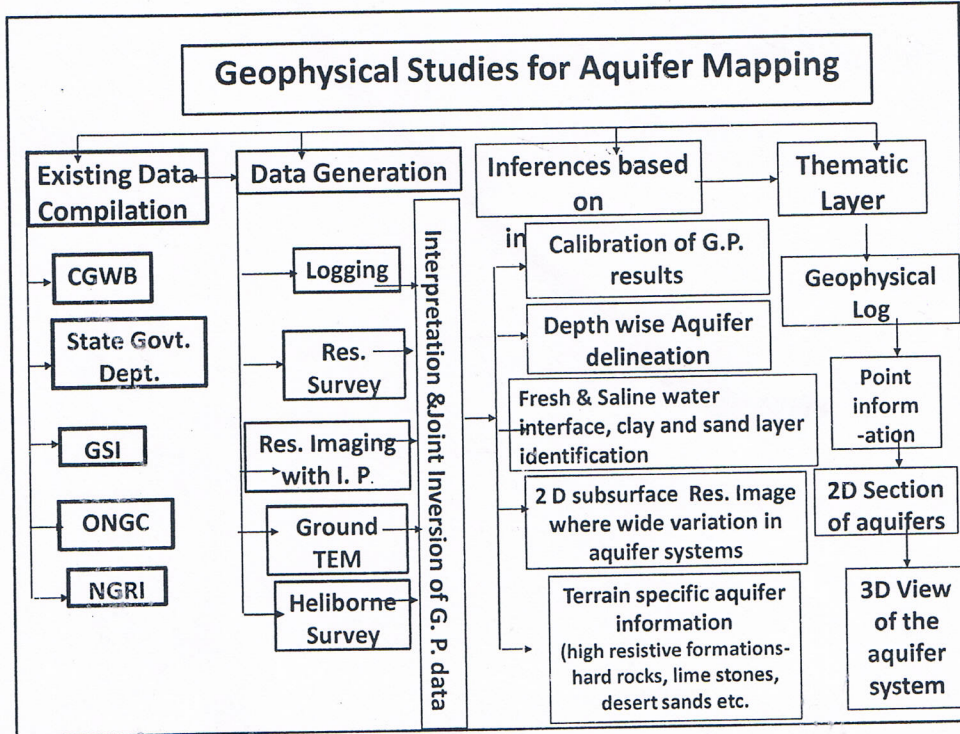




**Compilation of Existing Data/
Identification of Principal Aquifer
Units & Data Gap**

- **Compilation of Geology, Geophysics, Hydrogeology, Geochemical, Hydrology**

**Data Source: GSI/NRSC/CGWB/CWC/
NGRI/State Agency**



Compilation of Existing Data/ Identification of Principal Aquifer Units & Data Gap

- Delineation of principal aquifers (Vertical & Lateral)

Data Source: CGWB/State Agency

- Compilation of Aquifer wise Water Level data

Data Source: CGWB, State Agency

**Compilation of Existing Data/
Identification of Principal Aquifer
Units & Data Gap**

- **Compilation of Aquifer wise Draft Data**

Data Source: CGWB, State Agency

**Compilation of Existing Data/
Identification of Principal Aquifer
Units & Data Gap**

Identification of Data Gap

- **Sub-surface Information**
- **Aquifers geometry (Vertical & Lateral)**
- **Aquifer parameters**
- **Aquifer wise Draft**
- **Aquifer wise Water Level**
- **Aquifer wise Water quality**

Generation of Data

**Preparation Hydrogeological maps
(1: 50,000)**

- Exploratory drilling
- Pumping tests
- Sub-surface lithological data generation from existing wells

Data Source: Field Studies

Generation of Data

Generation of additional water quality parameters

- Analysis of Groundwater for pesticide, Bacteriological contamination
- Analysis of Groundwater for As , F and other parameters in groundwater

Data Source: Field Studies

Aquifer Map Preparation

(1: 50,000 and for identified areas in 1:10,000)

**Analysis of data base, Preparation of GIS layers &
Preparation of Aquifer Maps**

Integration of Hydrogeological, Geophysical, Geological, Hydro-chemical data

- **Integration of hydrogeological, Geophysical, geological data into delineation of principal aquifers.**
- **Delineation of Principal Aquifer extent (vertical & Horizontal). Horizontal in 1:50000 scale with suitable Vertical scale (1:2000)**
- **Demarcation of variation of quality within each principal aquifer.**
- **Outputs in the form 3-D.**
- **Outputs as shape files on GIS platform with UTM Coordinate system.**

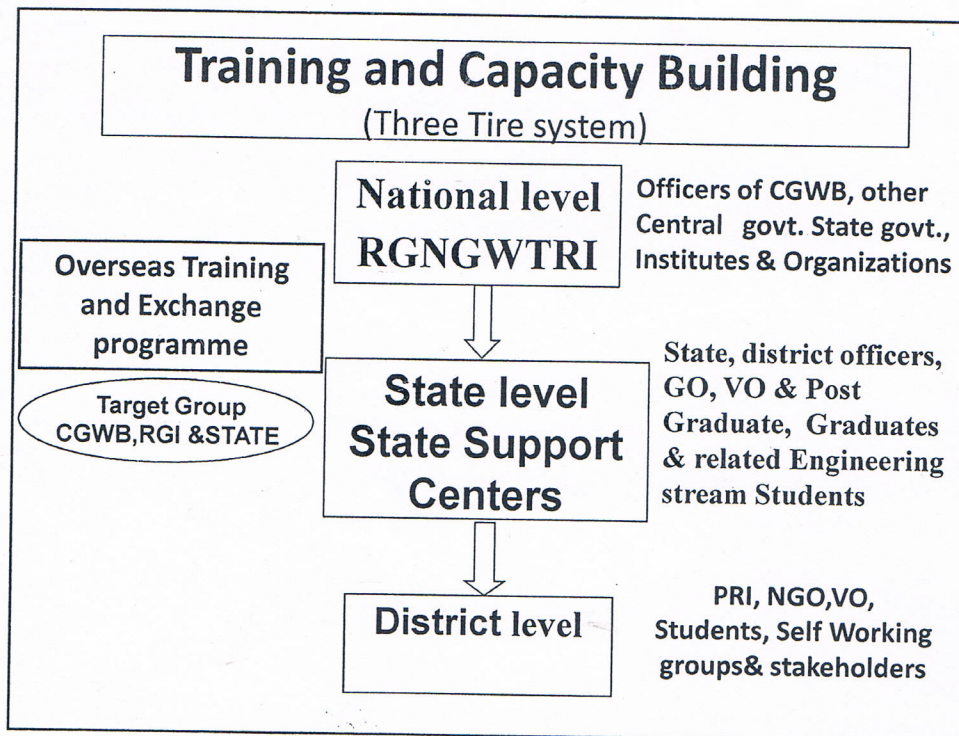
Aquifer Response Model/ Aquifer Management Plan

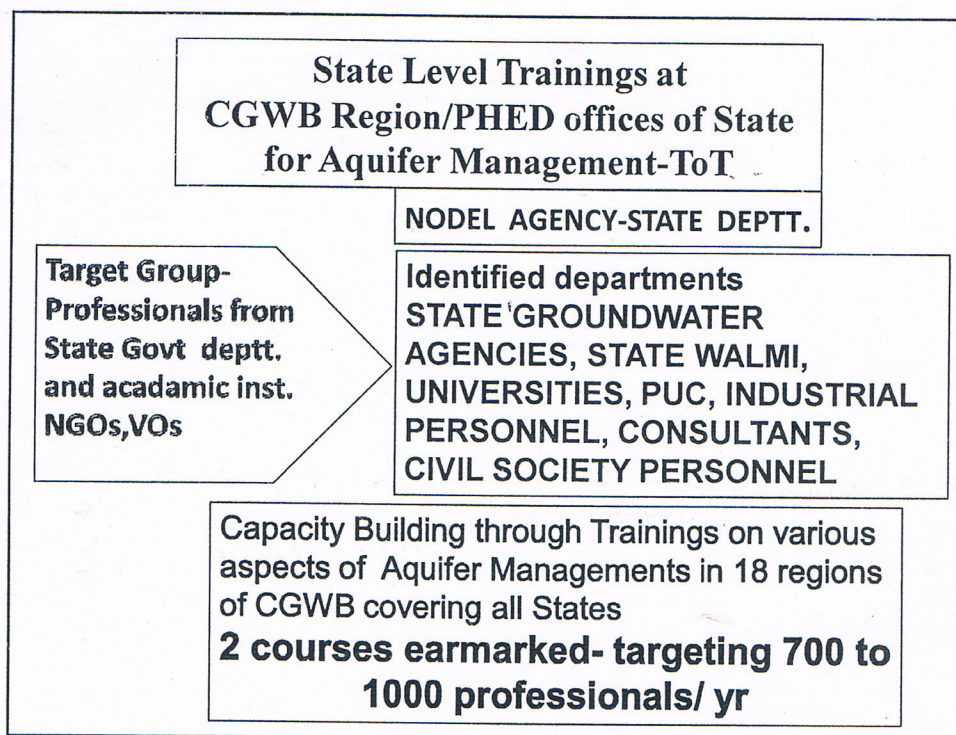
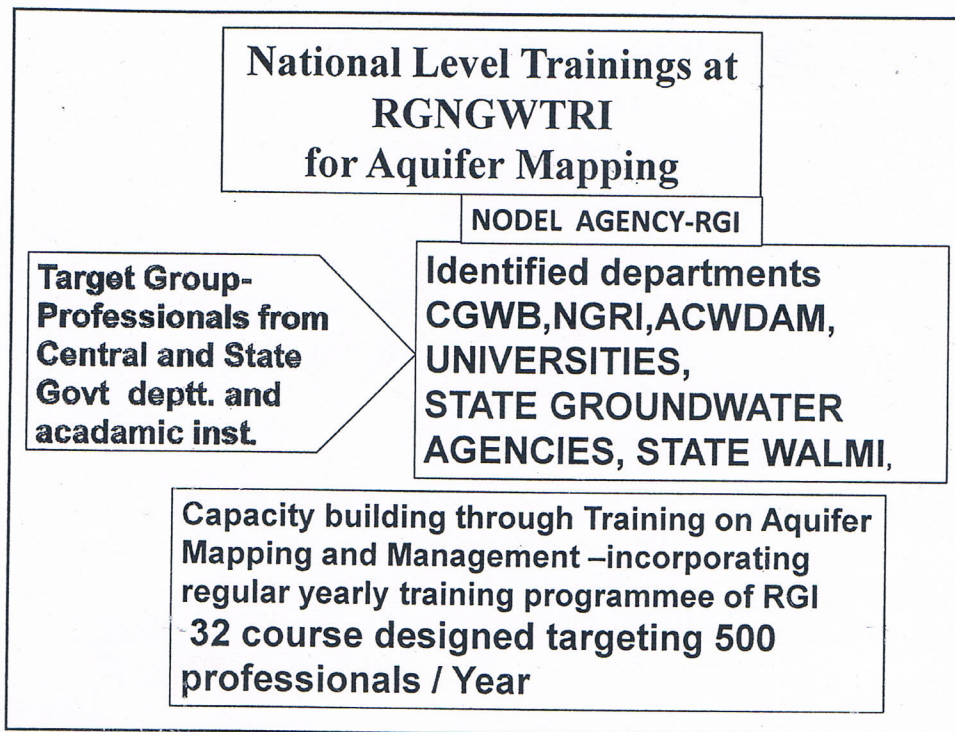
- **Integration of data and conceptualisation**
 - **Aquifer Geometry**
 - **Aquifer units**
 - **Aquifer parameters**
 - **Groundwater Draft & Recharge**
- **Model Conceptualisation**
- **DSS for AMP**

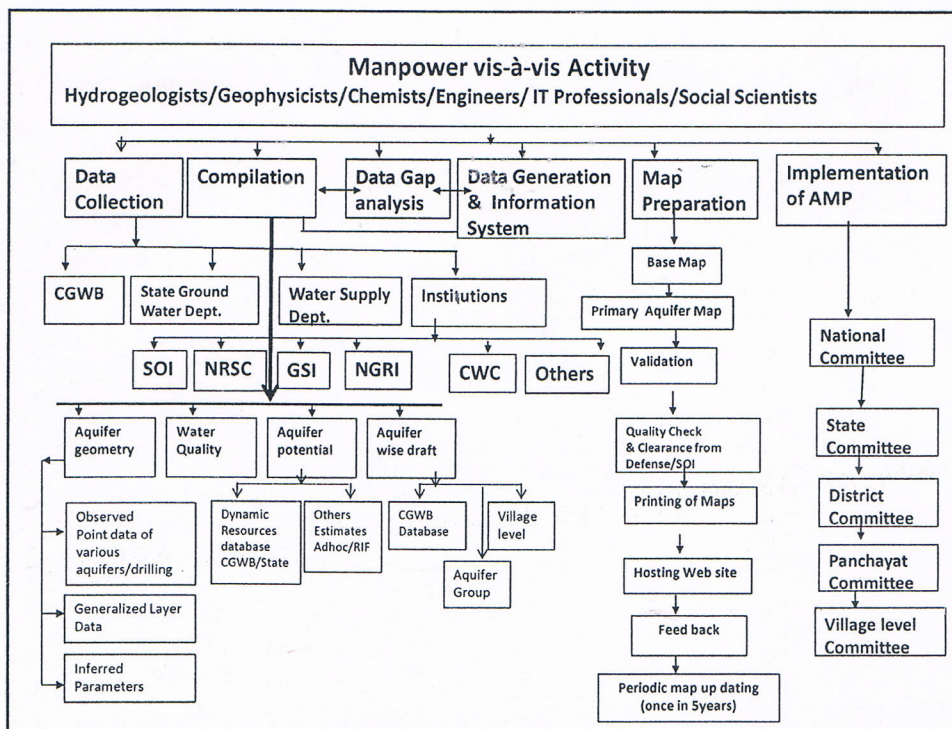
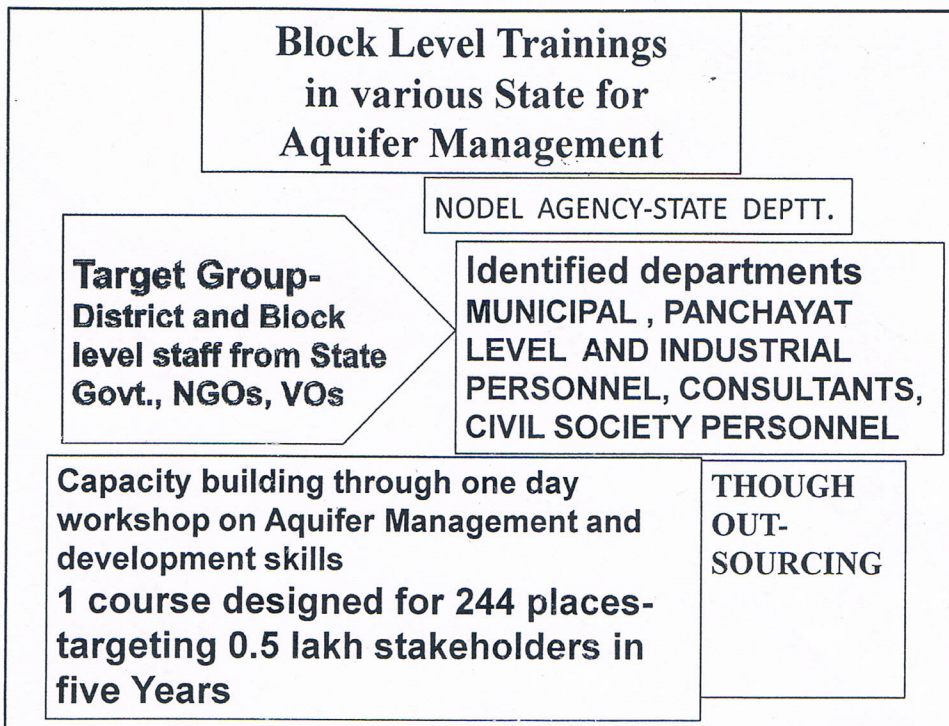
Aquifer Response Model/ Aquifer Management Plan

Dissemination of Information of aquifer to public and end users

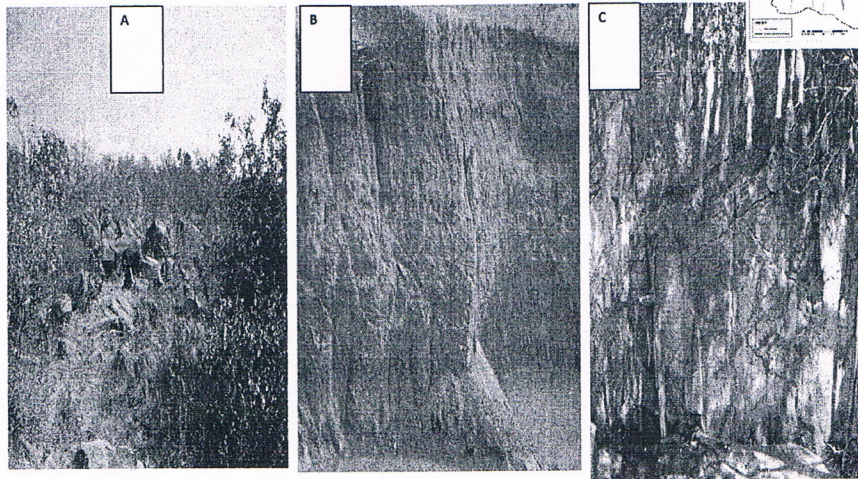
- Translation of formulated Aquifer Management Plan into Implementation plan for end users
- Making the plan available on the website for public access.
- Involve NGOs, PRI, Water Users Association etc in the translation of scientific data into useful information for effective implementation



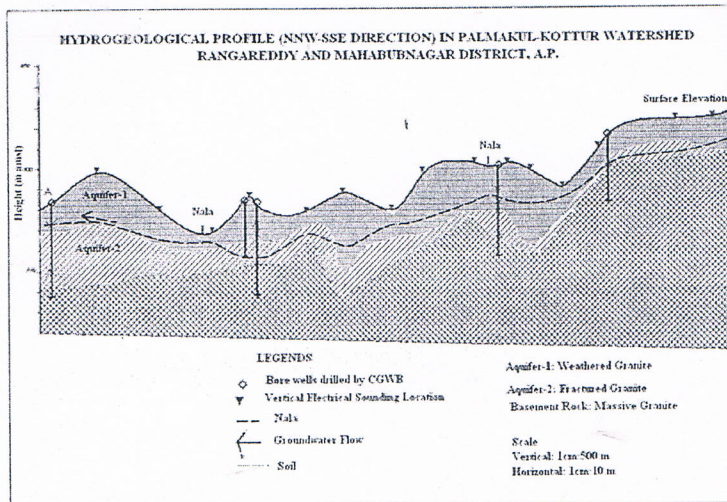




A-Basic dykes (dolerite), B-Highly weathered granite
Fractured granite in well section



Aquifer geometry in (SSE-NNW direction)

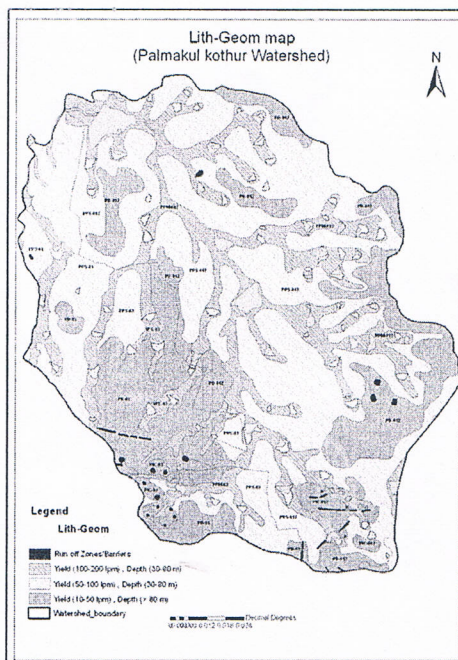


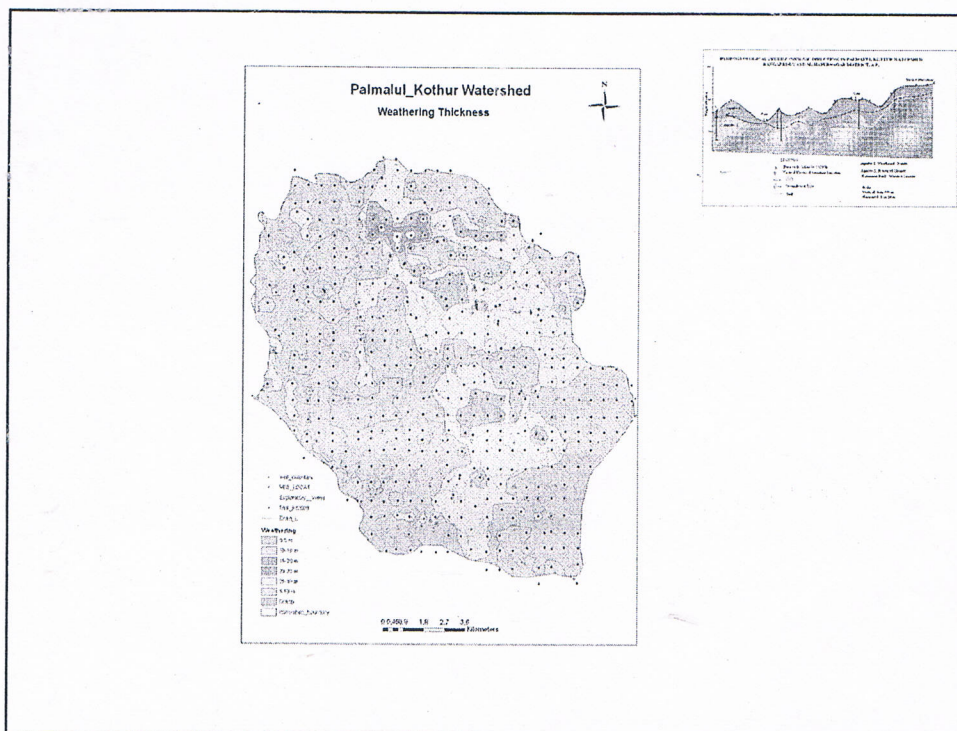
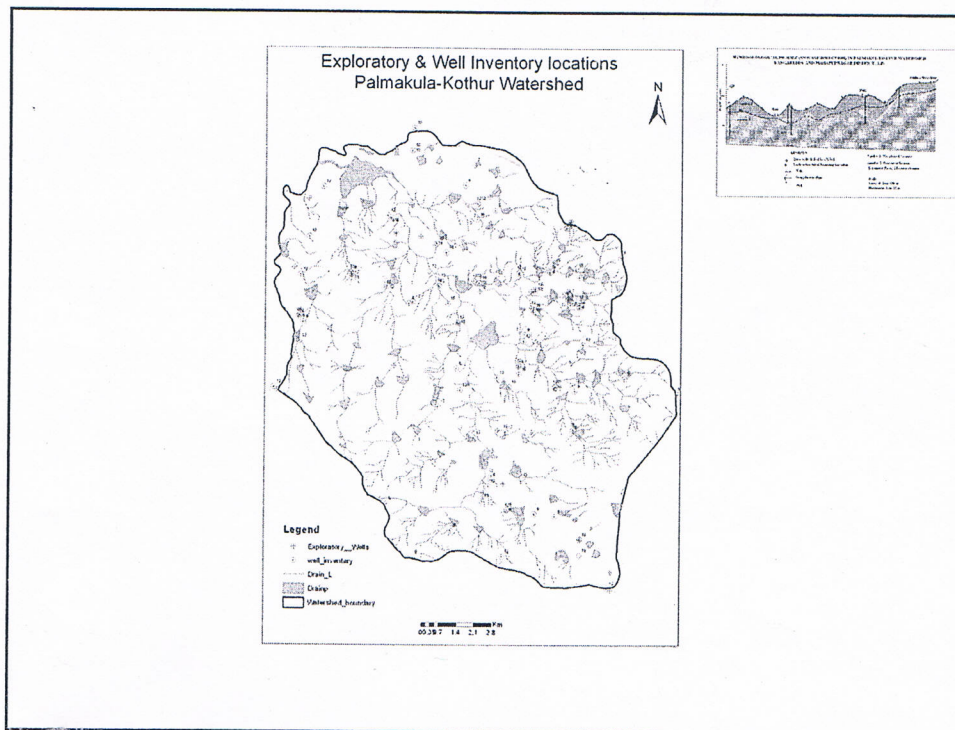
Aquifer geometry in (SSE-NNW direction)

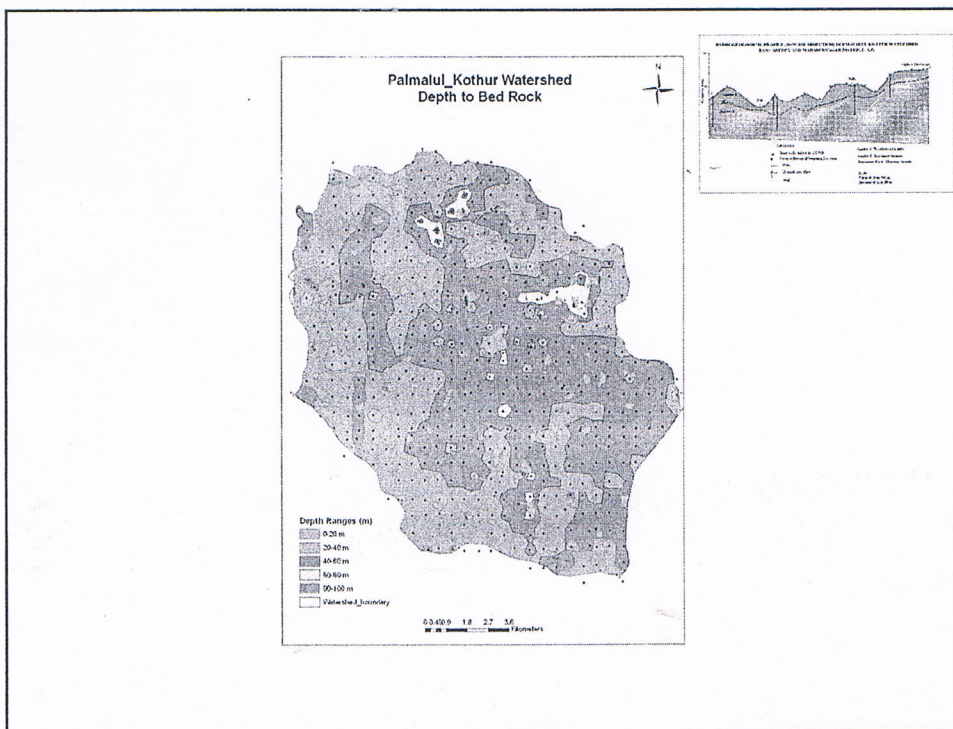
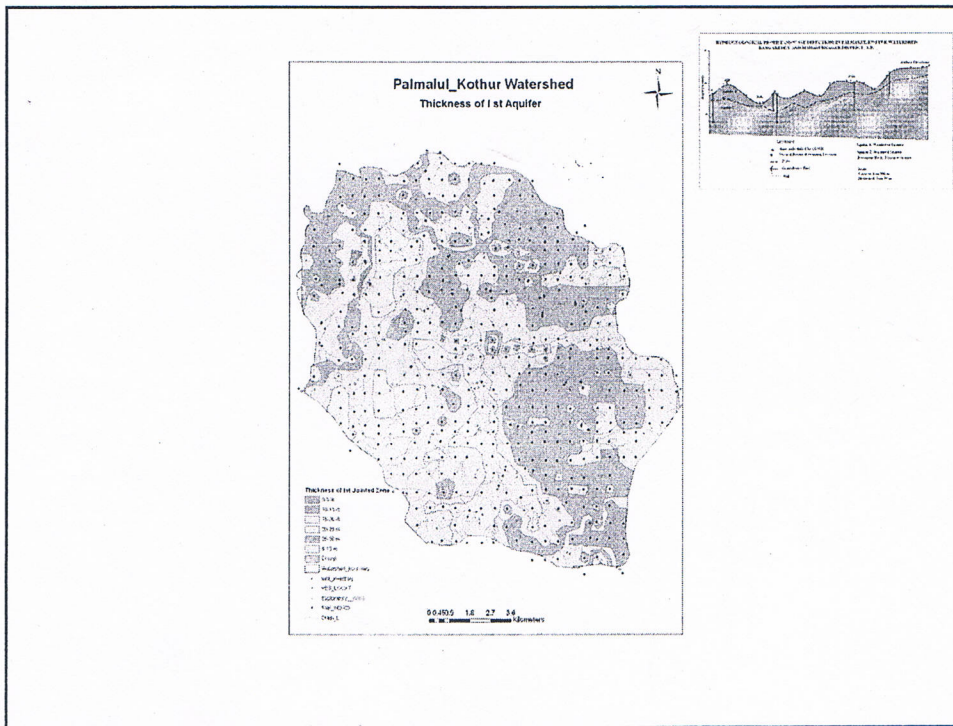


| S. No. | Lithology | Depth (m) | Layer | Aquifer |
|--------|-------------------|-----------|-------|---|
| 1 | Top soil | 1-3 | 1 | Un-confined Aquifer Or shallow aquifer |
| 2 | Weathered Granite | 2-30 | | |
| 3 | Fractured granite | 10-50 | 2 | Leaky to Confined Aquifer |
| 4 | Massive granite | >10-50 | 3 | Aquitard |

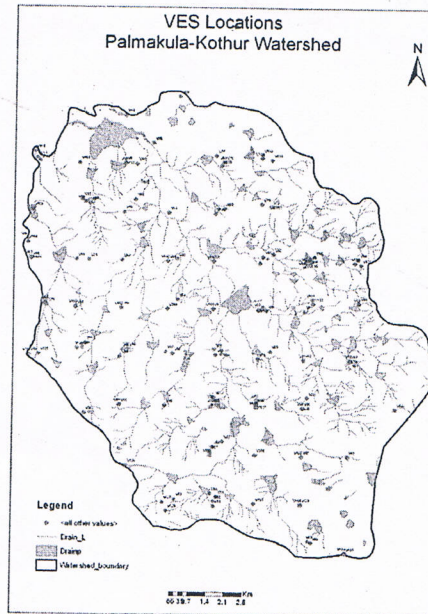
Prospective yield map



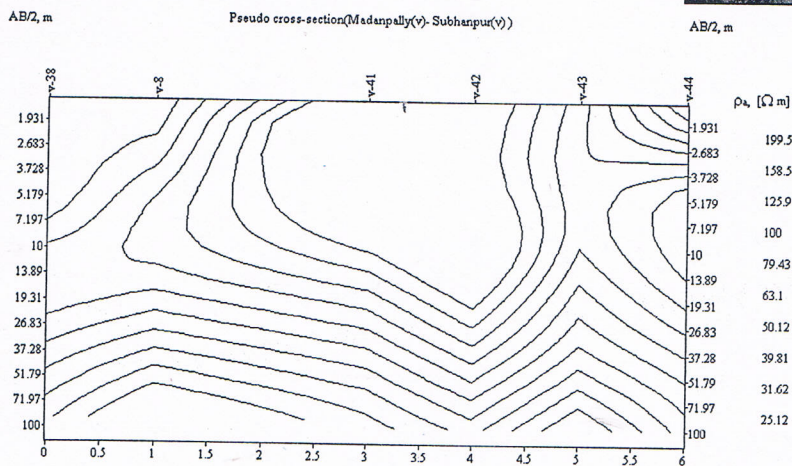




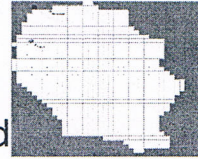
VES LOCATIONS



Pseudo Cross-section(Madanpally(v)- Subhanpur(v))



CONCEPTUAL MODEL



Model is conceived as a pseudo 3-D model with 3 layers viz.,

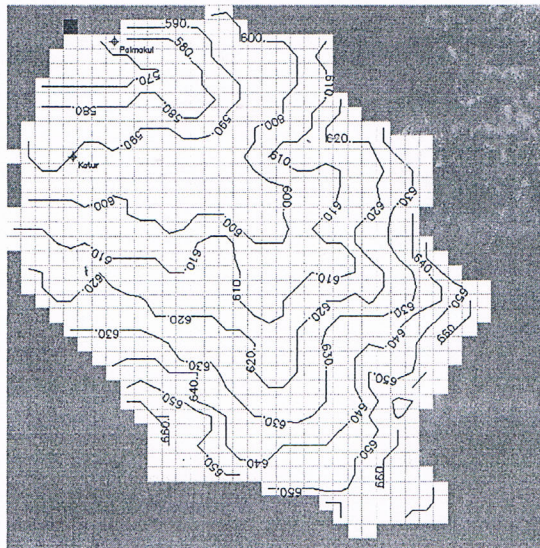
Layer-1: weathered zone ~ 15 m bgl (Un-confined)

Layer-2: Shallow fracture zone ~ 15 m in continuation with weathered zone (Un-confined)

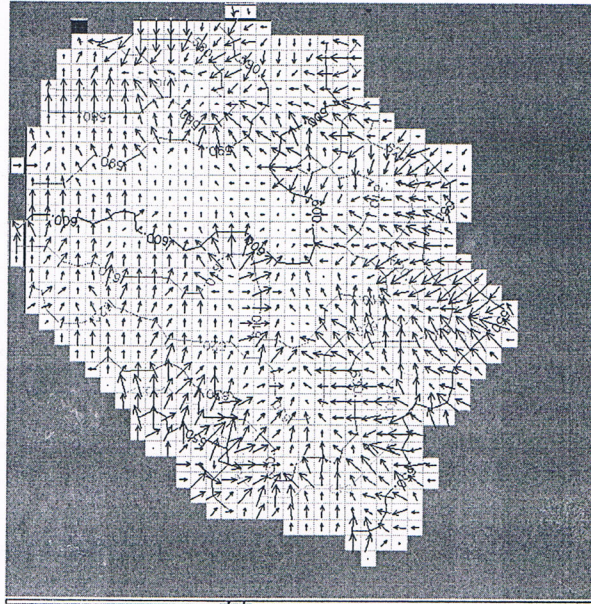
Pseudo Layer : 30-45 m (Aquitard).

Layer-3 : Deep fractured zone 45 to 100 (Semi-confined/Confined Aquifer.)

Initial Heads- Layer-I



Head Observation Contours, Vectors & Cross section (PMPATH)



TRANSIENT STATE CALIBRATION

| Parameter | Value | | | Source of value & Remarks |
|------------------------------------|-------------------------|-------------------------|-------------------------|--|
| | Layer-1 | Layer-2 | Layer-3 | |
| <i>Transient State calibration</i> | | | | |
| Hydraulic Head | 458-663 | 459-664 | 459-664 | Read from average WT data |
| Horizontal Hydraulic conductivity | 1 m/day | 1 m/day | 0.2 m/day | Long Duration Pumping tests |
| Vertical Hydraulic conductivity | 0.000065 | 0.000065 | 0.000065 | Computed from the horizontal and aquifer thicknesses |
| Transmissivity m ² /day | 10 | 10 | 8 | Historical data base |
| Storage Co-efficient | 0.0008 | 0.0008 | 0.0008 | Historical data base |
| Effective porosity | 0.05 | 0.05 | 0.05 | Historical data base |
| Specific Yield | 0.02 | 0.015 | 0.01 | Historical data base |
| Recharge Flux m/day | 0.000003 | Nil | Nil | Field experience |
| Wetting capability | 1 | 1 | 1 | Field experience |
| Evapotranspiration | 0.007 | Nil | Nil | Commonly used in India |
| Recharge | 0.00003 | Nil | Nil | Historical data base |
| Wells (cell) | -50 m ³ /day | -50 m ³ /day | -50 m ³ /day | Field experience |

Thanks