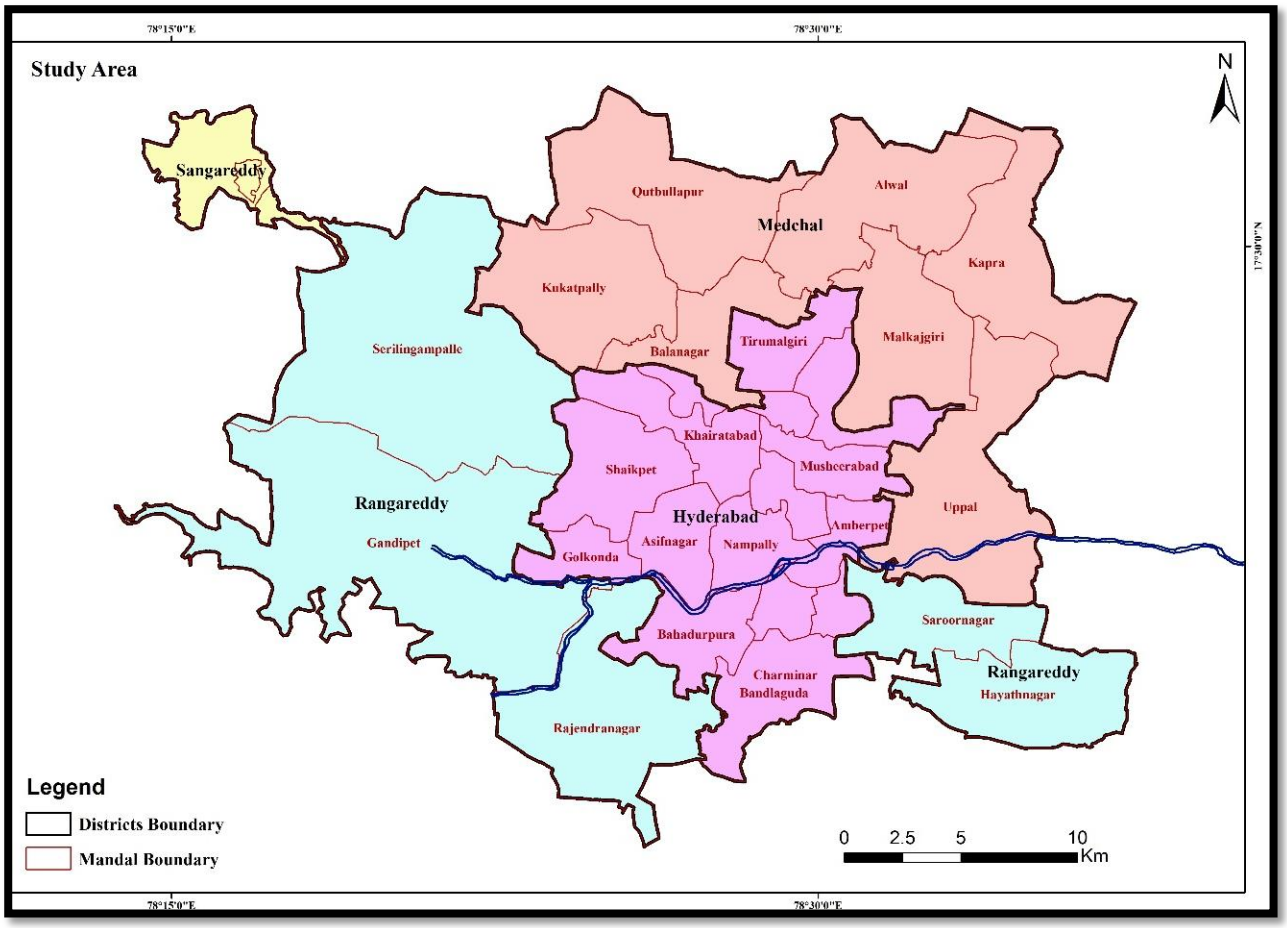
GOVERNMENT OF INDIA
MINISTRY OF JAL SHAKTI
DEPARTMENT OF WATER RESOURCES
RIVER DEVELOPMENT & GANGA REJUVENATION
CENTRAL GROUND WATER BOARD

Inception Report: NAQUIM 2.0 Studies

Detailed study on Urban Agglomerates in Hyderabad District and parts of Rangareddy, Sangareddy and Medhchal Malkajgiri Districts of Telangana State

AAP 2023-24



CGWB, SR

HYDERABAD

April 2023

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Contents

1.0 Introduction

The National Aquifer Mapping and Management programme (NAQUIM) launched by CGWB in the year 2012 with the objectives of delineating and characterizing aquifers and preparing aquifer management plans on 1:50,000 scale. In this programme, mapping the Aquifers in 1: 50,000 scale was considered sufficient for planning requirements up to mandal level. The findings of NAQUIM studies are being utilized by many agencies, especially the State government agencies involved in ground water management and water supply but large scale implementation at ground level by the user agencies has been lacking. As per the feedback received from the agencies using the NAQUIM outputs, major limitations include non-availability of printed maps at usable scales and lack of site specific recommendations for implementation at village level. Keeping the above limitations in mind and considering the future requirements, now NAQUIM 2.0 has been taken up with broad objectives.

2.0 About Study Area:

In the commencement year (2023-2024) of NAQUIM 2.0, 16 mandals of Hyderabad district, seven mandals of Medhchal Malkajgiri District, five mandals of Rangareddy district and two wards of Sangareddy districts (Table-1) have been taken for the study under urban agglomerates. The total geographical area of study area is 772.05 sq.km. The latitudinal extension of the study area is from 17°10´29"N to 17°45´9N and the longitudinal extension of the study area is 78°15´.0 E to 78°45´17 E. The study area is falling under the toposheets No. 56 K/2, 56 K/3, 56 K/6, 56 K/7, 56 K/10 and 56 K/11 (Fig 1). Hyderabad experiences the semi-arid tropical climatic conditions. The temperatures reaches 45º C during the summer season and with the onset of monsoons during June the temperature drop and varies between 26º C to 38º C. The average annual rainfall is 884 mm. The south west monsoon contributes 74% of annual rainfall and north east monsoon contributes 14%.

Table 1: Summary of Administrative Divisions of Study area

District	**No: of mandals**	**Area (sq.km)**
Hyderabad	16	183
Medchal Malkajigiri	7	267
Rangareddy	5	304
Sangareddy	2	17.1
Total	**30**	**772**

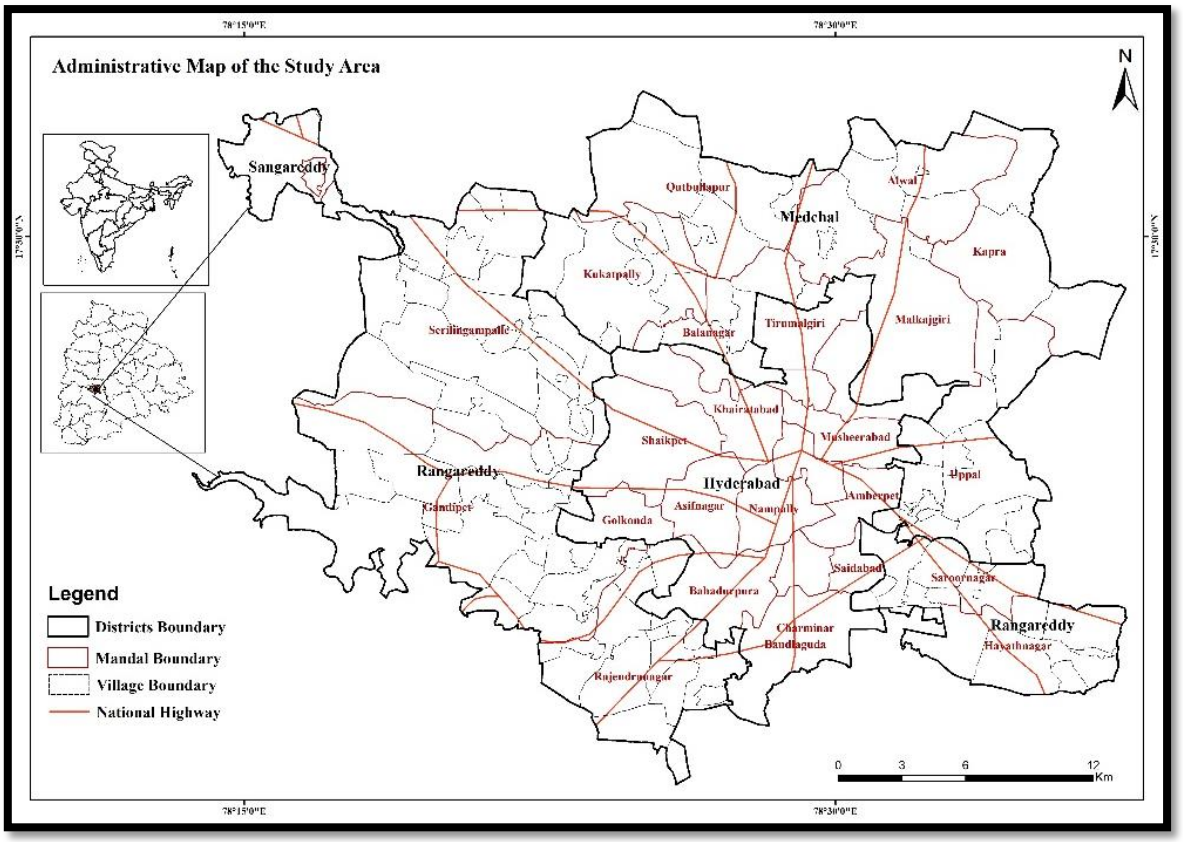

Fig. 1 Index map of Study Area

The area has undulating topography with elevation ranging from 460 to 560 m amsl. The main geomorphic units are residual hills, pediment, inselbergs, pediplains and valley fills. The study area is drained by Musi River, a tributary of Krishna River (Figure 2). The River Musi originates from Anantagiri hills in Vikarabad district and flows 70 kilometers before entering into the reservoirs of Osman Sagar and Himayat Sagar in nearby Rangareddy district. Apart from the River Musi, Hyderabad was endowed with a number of natural and artificial lakes, which includes Hussain, an artificial lake that was built across a tributary of the Musi River by Ibrahim Quli Qutub Shah in the year 1563. Hussain Sagar was originally constructed to supply drinking water supply to Hyderabad before Himayat Sagar and Osman Sagar. The lake also protected the low lying areas around the lake from floods.

The study area forms part of the Pre-Cambrian peninsular shield and is underlain by the Archaean crystalline complex, comprising pink and grey granites and granite gneisses (Figure 3). A thin veneer of alluvium of Recent age occurs along the Musi River. This undulating terrain is punctuated by granite hillocks and mounds. Several dykes intrude the granite, and some of these dykes form linear ridges. Many of these hills and ridges (for example in Banjara Hills, Shaikpet, Malkajgiri and Addagutta areas) are intervened by low-lying areas

and drained by minor streams. The granites exhibit structural features such as fractures, joints, faults and fissures. WNW - ESE and ENE-WSW, NE-SW trending structures are tensional in nature while NW-SW& NW-SE structures are shears in type.

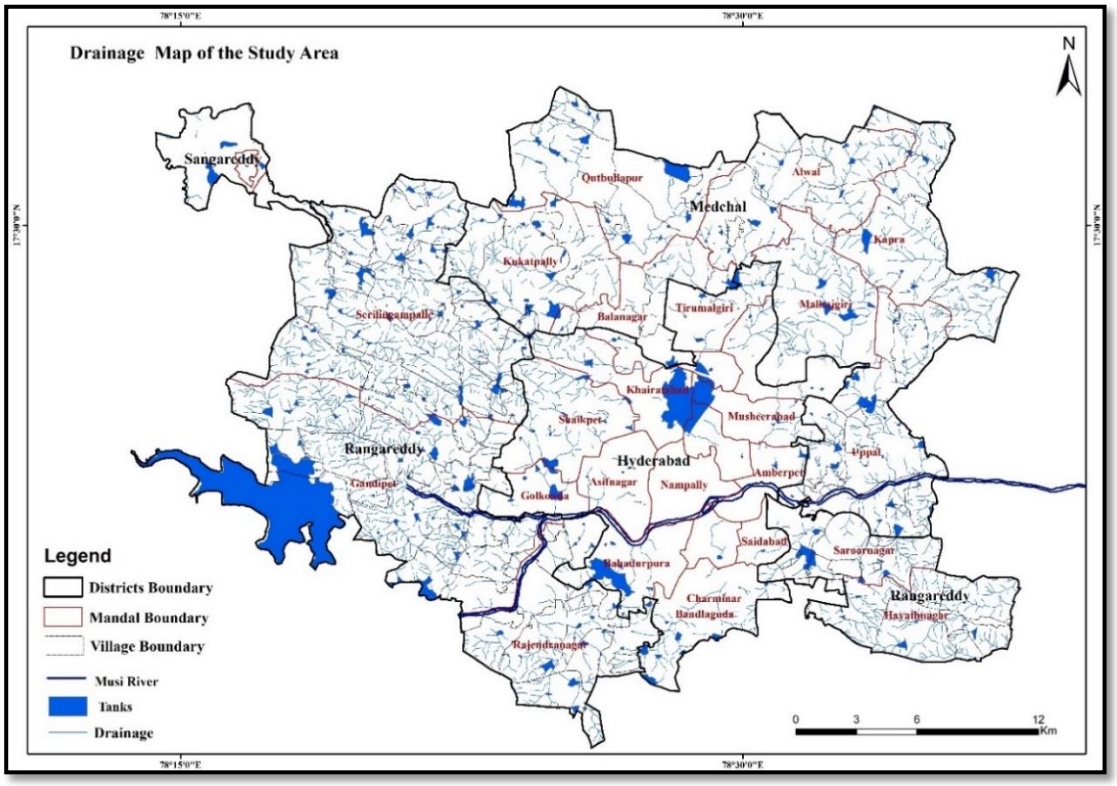

Fig. 2 Drainage map

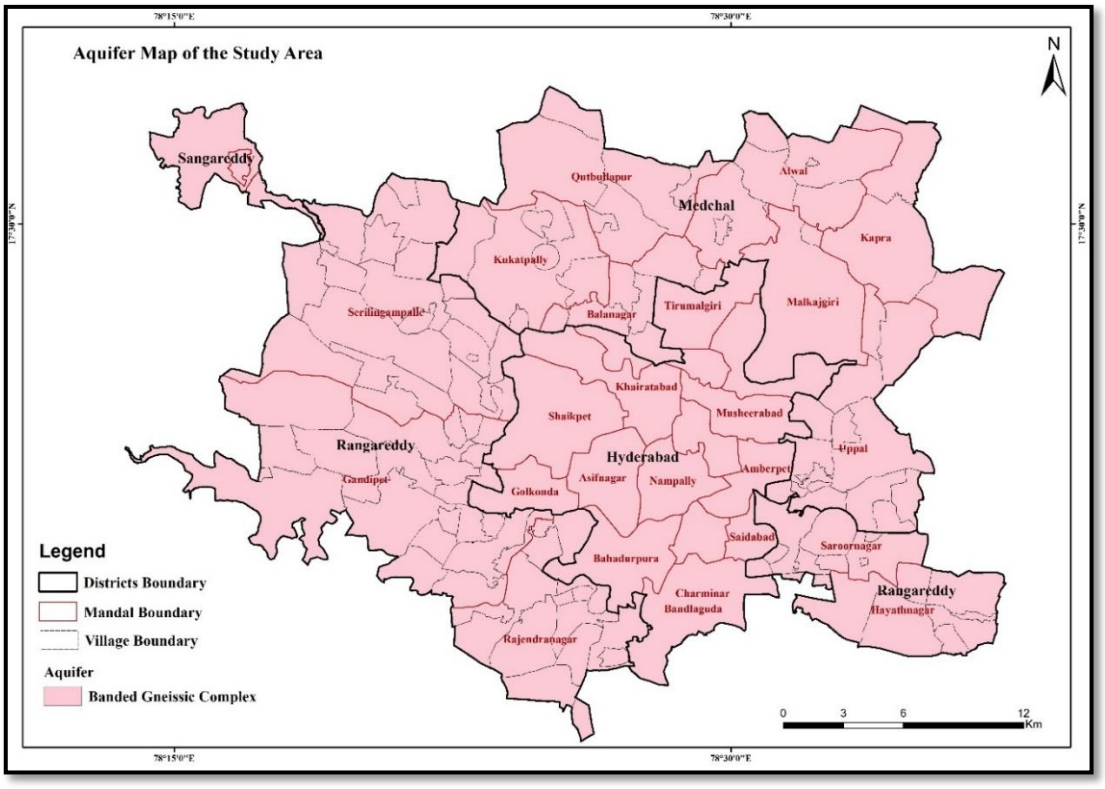

Fig 3. Principal Aquifers

3.0 Priority types

NAQUIM 2.0 is designed to provide detailed information to support groundwater management decisions at ground level. Since the issues are different in different areas, the studies under NAQUIM 2.0 are proposed as issue specific and will be undertaken in prioritized focus areas. Broadly 11 Priority areas are identified based on ground water related issues and the present study deals with specific priority area i.e. under "Urban agglomerate" and Industrial Clusters where emphasis is to be placed on the effects of urbanization and industrialization on ground water system in the study area.

The detailed study is planned to cover following topics,

1. Aquifer Dispositions in the area
2. Aquifer-wise Ground water levels
3. Delineation of Recharge Areas
4. Estimation/Refinement of parameters used for resource assessment
5. Assessment of ground water resources
6. Ground Water Quality
7. Ground Water Quality Management Interventions including demarcation of safer aquifers
8. Artificial Recharge Plan
9. Identification of potential aquifers for drinking water supply
10. A plan for drinking water source sustainability
11. Plan for Conjunctive use of surface water and ground water
12. Recommendations for tackling water logging
13. Demand driven studies like- Source Finding, Development of new cities, Waste disposal sites.

4.0 Previous Studies:

A number of hydrogeological studies has been taken up earlier in the area and the details of referred reports are listed below.

- NAQUIM studies: 2017-18
- District Brochure: 2017-18
- Resource Assessment Report as on March 2022
- State Ground Water Report-2019-20
- District Report: Hydrogeological Framework and Development Prospects in Hyderabad District: 2006.
- Micro-level Surveys on Ground Water Pollution in Saroornagar Sub-Basin: 2001-02
- Hydrogeology and Ground Water Quality: 1999
- Ground Water Quality Study in Jidimetla Industrial Area: 2002-03

- Artificial Recharge to Ground water through Rooftop Rainwater Harvesting in Osmania University: 2007

Major Issues identified from Previous Studies

Various studies carried out by CGWB - Ground Water Management Studies, Ground Water Quality Studies, District Reports, Brochures, Basic Data Reports - gives a clear picture about the aquifer disposition of the area, fracture depth & identified the areas with poor sustainability and quality issues. Also identified the chemical quality issues of a particular site. But a several research papers are available, which identified and quantified the extent of pollution especially along the Musi River and near to the industrial areas. The main issues identified in the stusy area are:

- **Urbanisation**: With the progressive urbanization, it has intensively affected the hydrological systems in different forms such as flooding in low lying areas, shrinkage or disappearance of many of the tanks (Masab tank, Nallakunta etc) or due to unabated human encroachments or affected by pollution (Kukatpalli Nala, Hussain Sagar etc). Hussain Sagar Lake has shrunk from about 550 hectares to about 349 hectares (nearly 40%) due to encroachments. Subsequent to urbanisation, the no: of point and non-point sources of pollution increased and disturbed the ground water recharge component by increasing impermeabilization and ground sealing.
- **Industrial Pollution**: Discharge of untreated industrial and domestic effluents has led to the total degradation of the water quality in many water bodies. About 15 mld (million litres a day) of industrial effluents from the industrial estate, in addition to 55 mld domestic sewage, are released into Kukatpally Nallah, which flows into Hussain sagar lake in the centre of the city. Most of the untreated sewage finds its way into water bodies resulting in poor water quality, high pollution, loss of habitat and environmental degradation.
- **Geogenic Pollution:** As the country rock, granite gneiss hosts the fluoride bearing minerals, fluoride has been reported from ground water.
- **Anthropogenic Pollution:** High generation of waste in response to rapid increase in population and absence of sewage network resulted in discharge of treated or untreated water to Musi River**.**
- **Change in Cropping Pattern:** Reduction in paddy cultivation

5.0 Objective of the Study:

- Providing information in higher granularity with a focus on increasing density of dynamic data like ground water level and ground water quality for each aquifer.
- Improving the data base of aquifers upto 200m in 1: 10,000 scale.
- To determine the effects of urbanization and industrialisation on ground water regime in terms of quantity and quality.
- To demarcate areas which are highly prone to ground water quality issues due to urbanization and industrialization based on Water Quality Index.
- To estimate the actual urban recharge considering the underground leakage, which provide insight into the extent of ground water contamination.
- Water budgeting along with source sustainability measures specifically for each ward/village.
- Change detection in LULC over a period of time and its effect on Ground Water scenario
- Improvising issue based scientific inputs for ground water management up to ward/ village level.
- Providing printed maps to the users
- Putting in place a strategy to ensure implementation of the recommended strategies. Involving state agencies in the studies for a sense of ownership.
- Site –specific Aquifer Management Interventions and scope for Managed Aquifer Recharge
- Estimate grey water production of Industrial and Domestic sector. Recommend ETP/STP and proper site for utilisation
- Explore the possibility of Managed Aquifer Recharge in each urban area and standardise the quality of grey water for Irrigation and green belt.
- Cost – benefit ratio to be included based on existing standard norms of respective states.
- Include future plan based on Smart City project report.

6.0 Existing Data and Data gap Analysis:

The data generated through various hydrogeological surveys, exploration, geophysical and hydrochemical studies had been utilized to assess the data gap in the study area.

Ground Water Level & Quality Monitoring:

To identify the requirement of key wells for micro-level study, the existing monitoring stations of CGWB and SGWD has been considered. In order to meet the objective of the present study, a grid of 0.5*0.5 km has been drawn and identified the data gap. Moreover, minimum 3 wells per urban unit was also taken care off and details are given in Table 2 and Figure 4.

Table 2: Details of exiting monitoring wells and proposed key well

S.No	District Name/ Zone	Existing NHS wells of CGWB	Existing SGWD Monitoring Wells	Proposed for Key well & water Quality
1	Hyderabad	23	41	106
2	Medchal Malkajgiri	6	80	132
3	Rangareddy	8	41	125
4	Serilingampally Zone	5	15	10
	Total	**42**	**177**	**373**

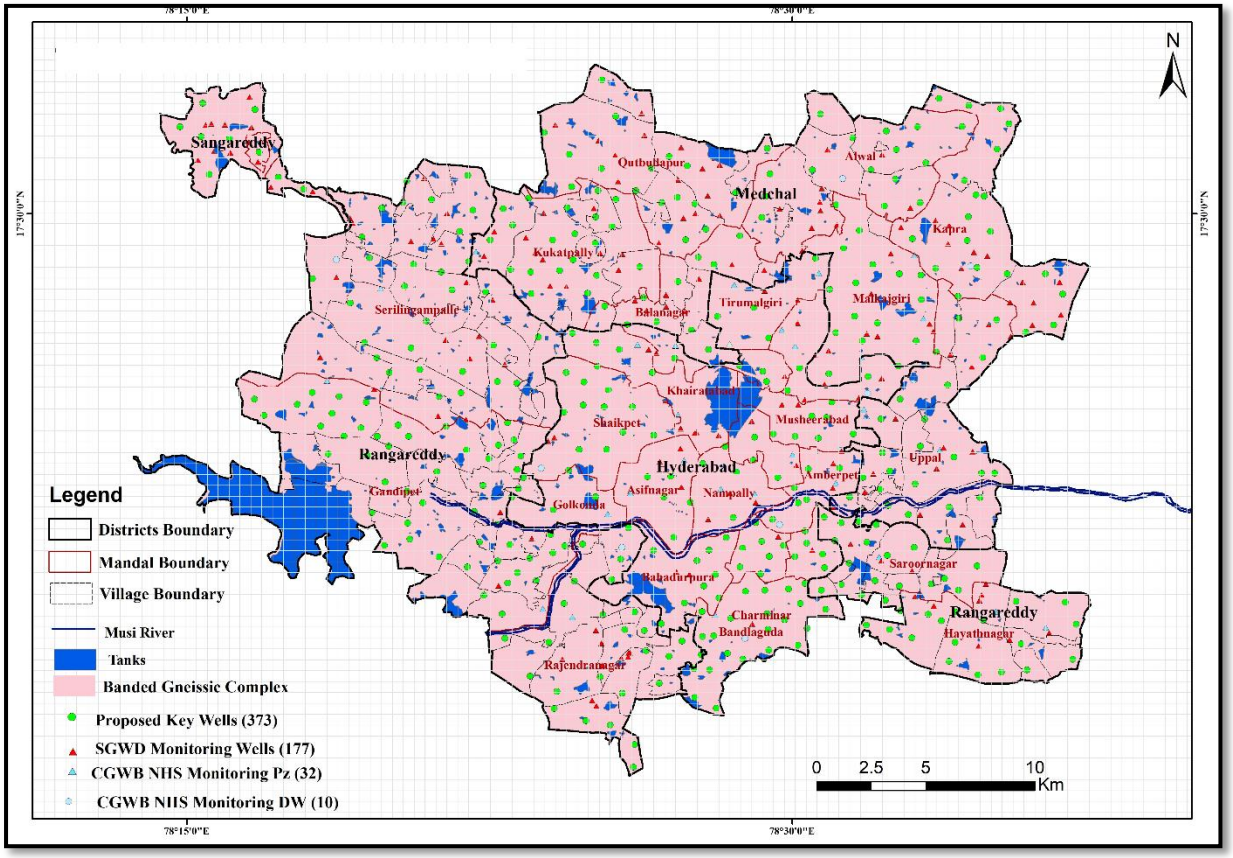

Fig 4 : Proposed Key wells for water level monitoring and Quality

Exploration: The available CGWB in-house Exploration data in different mandals within the study area have been compiled. CGWB has constructed 6 wells within the study area. The data insufficiency within the study area is thereby identified and 47 locations have been recommended for exploration and details are given in Table 3 and Figure 5.

Table 3 : Details of existing Exploratory wells and Proposed exploratory wells

S.No	District Name	Existing Exploratory Wells	Proposed Exploratory Wells under PIB	Proposed Piezometers under Industrial clusters	Proposed Exploratory Wells
1	Rangareddy	5	5	12	6
2	Hyderabad	1	0	5	4
3	Sangareddy	2	3	0	0
4	Medchal Malkajgiri	0	6	17	4
		6	**14**	**34**	**13**

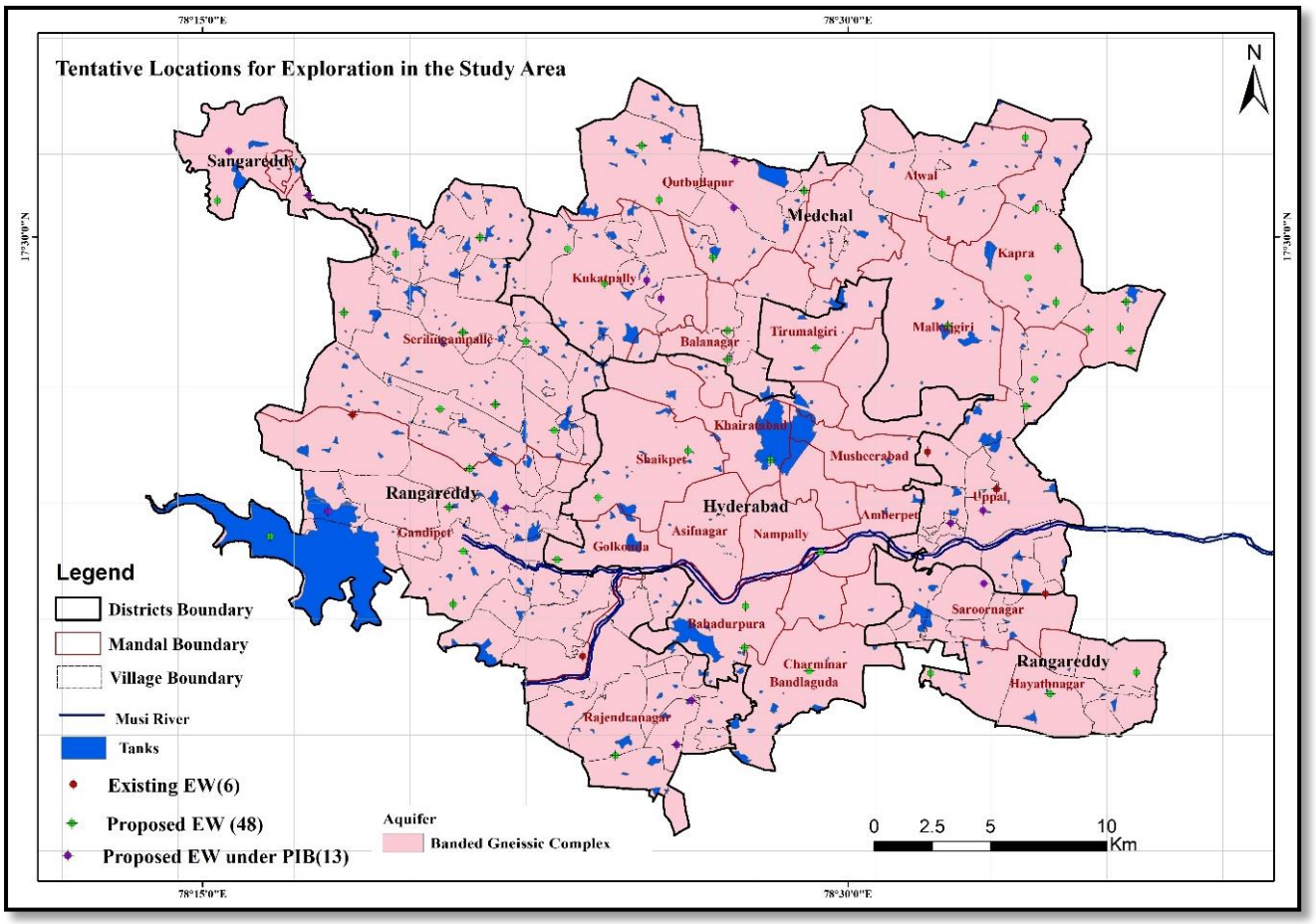

Fig 5: Existing and proposed exploratory wells in the study area.

Geophysical Data: VES/TEM:

As no VES data is available within the study area, considering the exiting exploration database, 174 locations have been identified and given for recommendations and details are given in Table 4 and Figure 6.

Table 4 : Details of Proposed VES/TEM

S.No	District Name	Proposed VES/TEM
1	Rangareddy	14
2	Hyderabad	90
3	Sangareddy	10
4	Medchal Malkajgiri	60
	Total	**174**

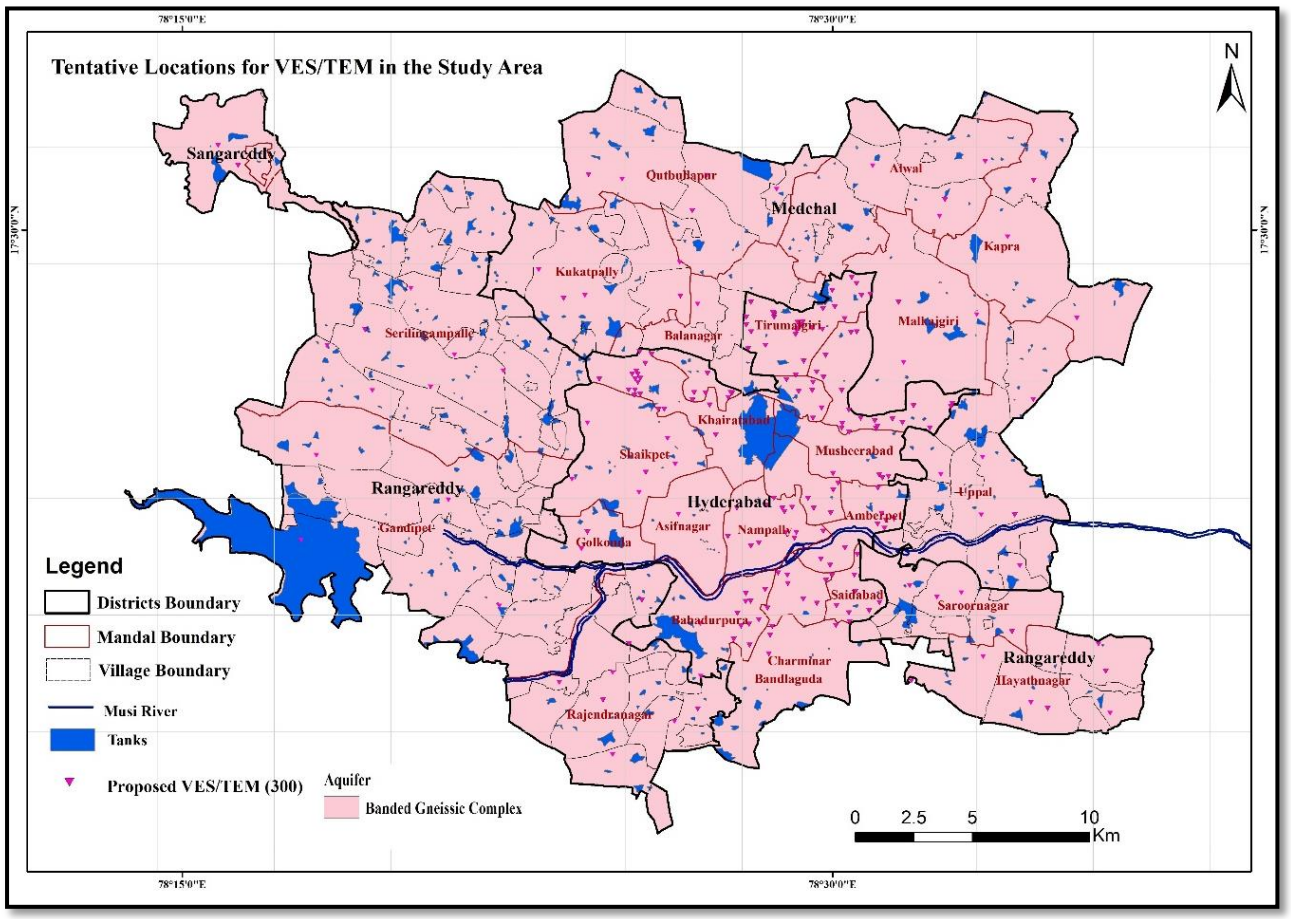

Fig 6: Proposed VES/TEM in the study area

Soil Infiltration/ pumping test:

As per the existing database, no infiltration test has been carried out. Thus in the study 10 soil infiltration test and 5 pumping tests is proposed.

7.0 Month-wise activity plan

Period	Assignments to be carried out
4th week of April	• Base map Preparation • Preparation of the Inception Report
4th week of April to 3rd week of May	• Field Data Collection (Pre-Monsoon) • Sample Surveys and User Feedback • Data collection from HWS&SB, GWD, Irrigation, Agriculture, TSRSA
June to October	• Data Analysis and Interpretation • Identifying water quality issue areas for detailed quality sampling • Workshops and mid-term review by NLEC
October to December	• Field Data Collection (Post Monsson) • Sample Surveys and User Feedback
December to January	• Data Analysis and Draft Report Preparation • Other ongoing field activities
January to February	• Field truthing of Management plan & RWH & AR Plan • Final Stage field visit for various field data collection & generation based on the requirement (data gap filling) as observed during draft report preparation
February to March	• Modification of draft report with additional information collected by the above mentioned field checks • Scrutiny and Finalisation of the Report
March	• Sharing of the reports with CHQ, SGWCC and DM/DC

8.0 : Composition of the team.

Composition of the Team:		
1	Team Leader	Smt. Rani V.R., Sc-D
2	Hydrogeologist-1	Smt. Monika, Sc-C
3	Hydrogeologist-2	Sh. B.J Madhusudhan, AHG
4	Geophysicist	Smt. A. Rama Devi, AGP
5	Chemist	Swati Dhenkula, ACH

9.0 Team-member-wise responsibilities

Role	Responsibilities
Team Lead	- Planning, Supervision and Execution of the Project - Work distribution and monitoring of activities of other team members - Preparation of the inception report.

	- Timely Delivery of the envisaged Outputs - Finalisation of the management plan - Presentations at different forums, sharing of the outputs. - Preparation of the draft report as per the approved Quality Standards and its Final Submission.
Expert (Hydrogeology)-1 Expert (Hydrogeology)-2	- Field Data Collection (Exploration, Pz construction, Water Level, Water Quality, Pumping Tests, Infiltration tests, demand/supply data, sample surveys and others) - Sample collection for quality studies - Secondary Data collection - Entering data in database (WIMS) - Integration of data, preparation of thematic maps, preparation cross sections etc. - Consultation with allied experts like agriculture, irrigation, agro-economics etc. - Preparation of Management Plan - Assisting the Team Lead in preparing maps and reports
Expert (Geophysics)	- Field Geophysical Surveys - Interpretation of field data - Entering data in database (WIMS) - Integration with existing geophysical and lithology data - Preparation of inferred lithologs - Suggesting potential sites for construction of water wells/artificial recharge - Preparation of Tables, graphs and maps for reports - Assisting the Team Lead in preparing the Report
Expert (Hydro chemistry)	- Sample collection for quality studies - Analysis of samples. - Integration with existing data - Validation and interpretation of data - Entering data in database (WIMS) - Preparation of Tables, graphs and maps for reports - Assisting the Team Lead in preparing the reports

10.0 Monthly targets

Sr No.	Activity	Officer Deployed	Months (April to March)											
			Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
A	HYDROGEOLGY													
1	Compilation of available data	Ms. Rani V. R., Ms. Monika,Sh. B.J Madhusudhan												
2	Preparation of base maps	Ms. Rani V. R., Ms. Monika												
3	Identification of data gap and planning for data generation	Ms. Monika, Sh. B.J Madhusudhan												
4	Preparation of Inception report	Ms. Rani V. R., Ms. Monika, Sh. B.J Madhusudhan												
5	Field work for establishment of key wells, pre-monsoon water level monitoring and groundwater sampling	Ms. Monika, Sh. B.J Madhusudhan,												
6	Collection of data on existing water supply, sewerage network, industrial clusters	Ms. Rani V. R., Sh. B.J Madhusudhan												
7	Collection of samples for GW Quality	B.J Madhusudhan, Ms. Swati Dhenkula, ACH												
8	Field work for additional data and information	Ms. Monika, Sh. B.J Madhusudhan,												
9	Post-monsoon WL monitoring from key wells and groundwater sampling	Ms. Monika, Sh. B.J Madhusudhan												
10	Final Stage field visit for various field data collection & generation based on the requirement (data gap filling) as observed during draft report preparation	Ms. Rani V. R., Ms. Monika,Sh. B.J Madhusudhan Smt. A. Rama Devi, AGP Ms. Swati Dhenkula, ACH												
B	GW EXPLORATION	GW EXPLORATION												
11	EW Data gap identification	Ms. Monika, Sh. B.J Madhusudhan,												
12	Site selection for drilling	Hydrogeologist												
13	Attending Drilling, preparation of lithologs, Conducting Pumping test	Hydrogeologist												
14	Preparation of Basic Data Report	Hydrogeologist												

C	GEOPHYSICAL STUDIES	GEOPHYSICAL STUDIES												
15	Data gap identification for VES/TEM	Smt. A. Rama Devi, AGP												
16	Field work -VES/TEM	Smt. A. Rama Devi, AGP												
17	Analysis and interpretation of VES/TEM data	Smt. A. Rama Devi, AGP												
C	CHEMICAL ANALYSIS	CHEMICAL ANALYSIS												
18	Analysis of sample collected during pre-monsoon from key wells	Ms. Swati Dhenkula, ACH												
19	Analysis of sample collected during post-monsoon from key wells	Ms. Swati Dhenkula, ACH												
20	Analysis of samples collected during exploration	Ms. Swati Dhenkula, ACH												
D	FIELD TRUTHING AND PREPARATION OF AQUIFER MAPS, MANAGEMENT PLANS	FIELD TRUTHING AND PREPARATION OF AQUIFER MAPS, MANAGEMENT PLANS												
21	Compilation of data and preparation of GIS based maps and management plans	Ms. Rani V. R., Ms. Monika												
22	Report Preparation	Ms. Rani V. R.												
23	Field Truthing of Management Plan	Ms. Rani V. R., Ms. Monika												
24	Modification of Draft report. Scrutiny and Finalisation of the report	Ms. Rani V. R.												
25	Sharing of the reports with CHQ, SGWCC and DM/DC	Ms. Rani V. R., Ms. Monika, Sh. B.J Madhusudhan,												