



**Central Ground Water Board
Department of Water Resources, River
Development and Ganga Rejuvenation,
Ministry of Jal Shakti
Government of India**

INCEPTION REPORT-NAQUIM 2.0

ON

**Aquifer Mapping & Ground Water Management Plan of
Visakhapatnam and Anakapalli Urban Agglomerations**

AP STATE UNIT OFFICE

VISAKHAPATNAM

APRIL-2023

INCEPTION REPORT-NAQUIM 2.0

ON

Aquifer Mapping & Ground Water Management Plan of Visakhapatnam and Anakapalli Urban Agglomerations

Contents

1.	Introduction
2.	Study area
3.	Priority Types
4.	Previous studies
5.	Objective of the Study
6.	Methodology
7.	Existing Data and Data gap analysis
8.	New Data Generation Plan
9.	Month Wise Activity Plan
10	Composition of team
11	Team member wise Responsibilities
12	Monthly Targets

1.0 Introduction

The National Aquifer Mapping and Management programme (NAQUIM) was launched by CGWB with the objectives of delineating aquifers, characterizing aquifers and preparing aquifer management plans. National level mapping of Aquifers on 1:50,000 scale was considered sufficient for planning requirements up to block level. Aquifer mapping is a process wherein a combination of geologic, geophysical, hydrological and chemical analyses is applied to characterize the quantity, quality and sustainability of ground water in aquifers. In recent past, there has been a paradigm shift from “ground water development” to “groundwater management”. As large parts of India particularly hard rock’s have become water stressed due to rapid growth in demand for water due to population growth, irrigation, urbanization and changing life style. Therefore, in order to have an accurate and comprehensive micro-level picture of groundwater in India, aquifer mapping in different hydro geological settings at the appropriate scale is devised and implemented, to enable robust groundwater management plans. This will help in achieving drinking water security, improved irrigation facility and sustainability in water resources development in large parts of rural and many parts of urban India. The aquifer mapping program is important for planning suitable adaptation strategies to meet climate change also. Thus the crux of National Aquifer Mapping (NAQUIM) is not merely mapping, but reaching the goal-that of groundwater management through community participation. 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 of its recommendations at ground level by the user agencies has been lacking. Keeping the above limitations in mind and considering the future requirements, NAQUIM 2.0 is now taken up.

The objectives of NAQUIM 2.0 studies are:

- i) Providing information in higher granularity with a focus on increasing density of dynamic data like ground water level, ground water quality etc.
- ii) Providing issue based scientific inputs for ground water management up to Panchayat level
- iii) Providing printed maps to the users
- iv) Putting in place a strategy to ensure implementation of the recommended strategies.
- v) Involving state agencies in the studies for a sense of ownership.

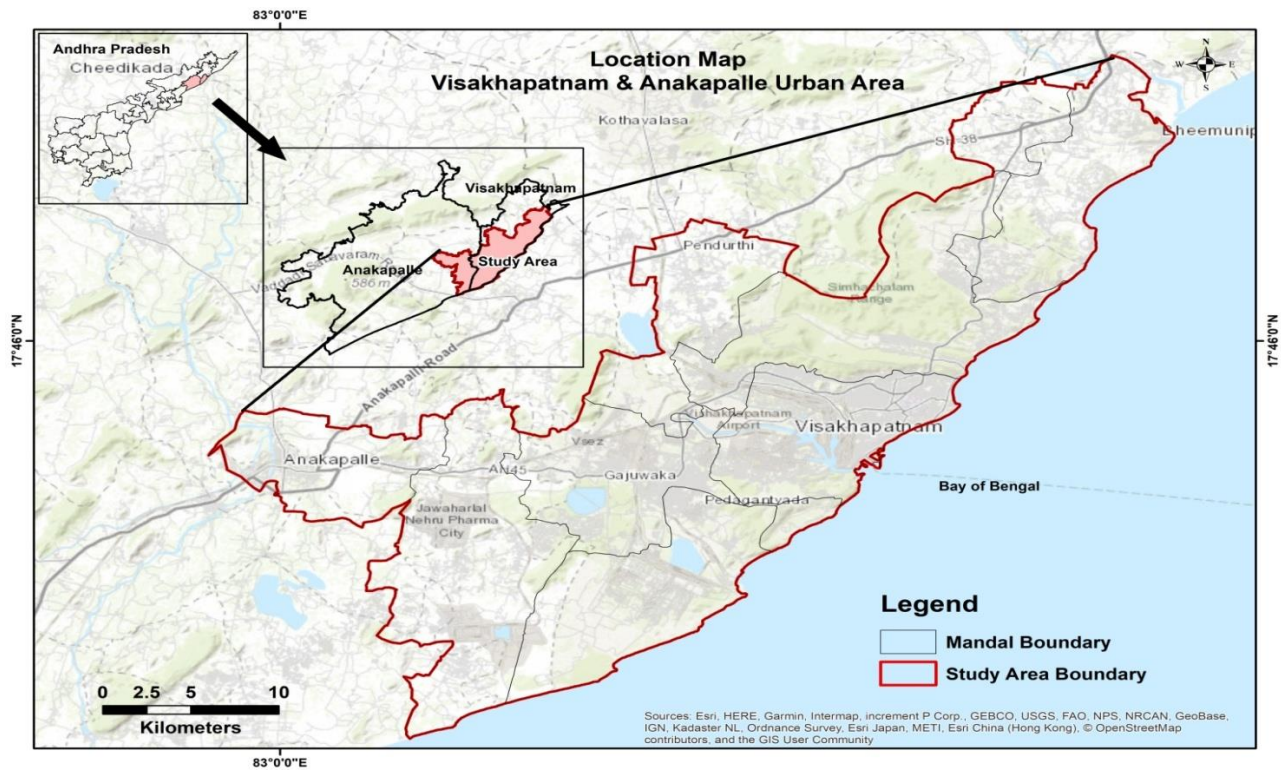
This inception report is in accordance with the requirement of the NAQUIM 2.0 programme. It provides an overview of the studies to be taken-up and contains a description of the generation of a preliminary knowledge base, the detail work plan, methodologies, deliverables, list of activities, targets and deadlines and an estimate of the time allocation for involved personal in the study.

2.0 Study area

The Visakhapatnam and Anakapalli **Urban Area** has been taken up for NAQUIM-2.0 studies during Annual action plan (2023-2024). The total geographical area of study area is 775 sq.km which includes urban areas of both Visakhapatnam (578 sq.km) and Anakapalli (197 sq.km). The study area is located between 17° 31' 1.2" to 17° 56' 42"N Lat. and 82° 57' 14" to 83° 27' 39.6"E Long covered by SOI Topo

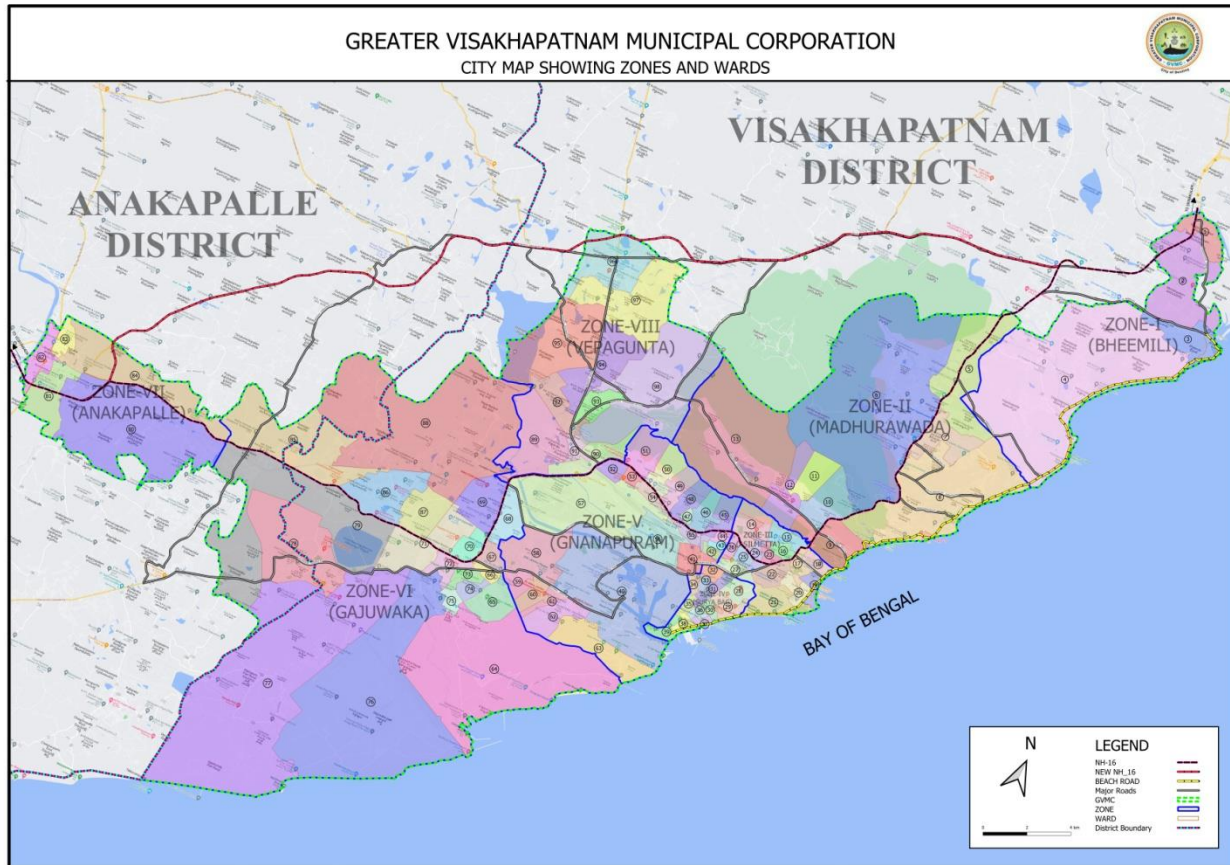
sheets no. 650/1,2,5,6 & 65K/1. The Visakhapatnam urban area ranked as second largest urban agglomeration in Andhra Pradesh and major hub for Pharma, Industry, Tourism and Education etc. Visakhapatnam has been home for a number of large and medium industries such as the Hindustan Petroleum Corporation, Visakhapatnam Steel plant, Bharat Heavy Plates and Vessels, Hindustan Polymers and Coramandal Fertilizers.

The Visakhapatnam urban is one of the fastest developing cities in India and located in the East coast India. This is the one of the smart city declared by Govt India in the Country and implementing projects for its development in the area such as industry, tourism, education, transportation etc. The population increase in this city is very alarming because people are migrating to this city from rural areas for employment, business etc this is causing severe pressure on natural resources like land, water etc. In this way the ground water resources are under severe threat of depletion due to increasing consumption at the same time the decreasing of recharge potential. This is because of the fact the recharge areas are being converted into residential areas preventing the rainwater entering into the aquifer in the subsurface. Under these circumstances „the groundwater information system will help to manage the groundwater resources in a more scientific and effective manner.



The study area receives an average annual rainfall of 999 mm and the period from the middle of June to the first week of December is marked as rainy season. The study area is characterized by Eastern Ghats mobile belt. This area covered with denudational hills of range between 30 m to 594 m above mean sea level. Kailasa range and Yarada range are two important hill ranges. The study area geologically belongs to Precambrian age and is characterized by the occurrence of meta-sediments and intrusive Meta igneous bodies. Apart from Meta sediments the area is also marked by the occurrence of recent

sediments such as red sediments with calcium carbonate calcretes, dune sands and beach sands with economically important black sand concentrations. All these rocks and sediments characteristically exhibit a variety of geomorphic features distributed from deepest hinterland to near coastal plains.



(Source: Greater Visakhapatnam Municipal Corporation)

3.0 Priority types: As per AAP 2023-2024 Visakhapatnam and Anakapalli **Urban Area** has been taken up for NAQUIM-2.0 studies. The details of the urban area taken for study are follows.

Sl.No.	District	Mandal	Area (Sq.km)
1	Anakapalle	Anakapalli	63
2	Anakapalle	Paravada	134
3	Visakhapatnam	Anandapuram	29
4	Visakhapatnam	Bheemunipatnam	83
5	Visakhapatnam	Gajuwaka	87
6	Visakhapatnam	Pedagantyada	100
7	Visakhapatnam	Pendurthi	69
8	Visakhapatnam	Visakhapatnam(R)	131
9	Visakhapatnam	Visakhapatnam(U)	82
		Total	777

4.0 Previous Studies:

Various hydrogeological investigations were carried out by CGWB in parts of Visakhapatnam district during year 1974 to 2008. As a part of ground water exploration studies, there are 93 numbers of exploratory wells/ observation wells/ piezometers/ slimholes had been constructed in 38 locations in erstwhile Visakhapatnam district during this era with main objective of generation of all hydrogeological parameters from production wells.

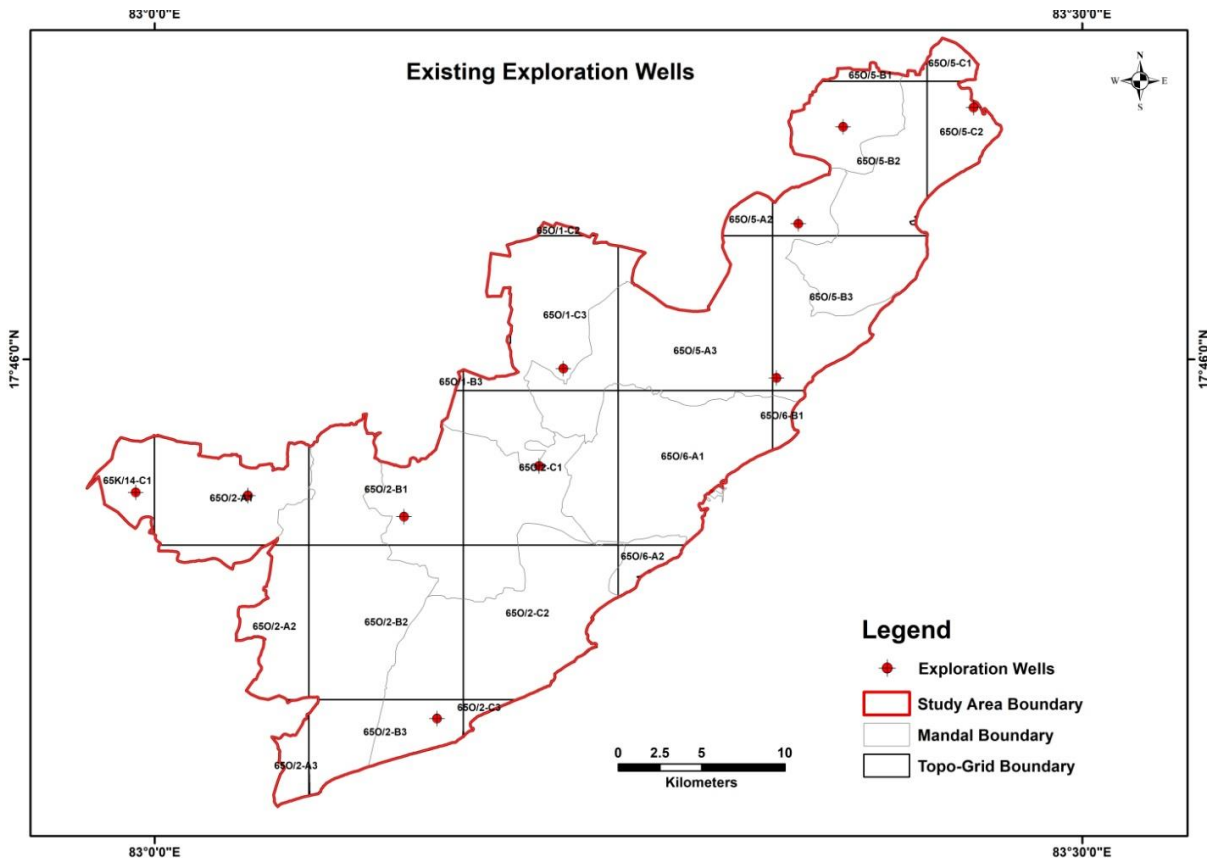
1. Urban hydrogeological surveys were carried out by Dr.A.Srisailanath, Regional Director, Dr.P.N.Rao, Scientist 'D' and others during Annual Action Plan 1998-1999.
2. Reappraisal hydrogeological surveys were carried out by S/Sri C.Paul Prabhakar, Scientist 'D' and G.V.V.R.G.Siva Prasada Rao, Scientist 'D' during Annual Action Plan 2003-2004.
3. Short Term Water Supply Investigations For Bharat Sanchar Nigam Limited (Bsnl)Visakhapatnam by G.V.V.R.G.S.PRASADA RAO, Scientist – D, SR, Hyderabad ,June-2004.
4. Report On The Hydrogeological Investigations For Augmentation Of Water Supply To Ins-Dega, Visakhapatnam, Andhra Pradesh (Aap 2010-2011) by G. BHASKARA RAO Scientist 'D' & Dr. V.S.R. KRISHNA Assistant Hydrogeologist , CGWB, APSUO, Visakhapatnam, AP.
5. Hydrogeological And Hydrochemical Framework In And Around Chukkavanipalem, Visakhapatnam Urban Area, Andhra Pradesh (Aap 2001 – 02) By Dr V.S.R. Krishna Assistant Hydrogeologist , CGWB, APSUO, Visakhapatnam, AP.
6. Water Balance Studies In Gorregedda Watershed, Visakhapatnam District Andhra Pradesh (Aap 2001-02) By C.Paul Prabhakar Scientist-C , CGWB, APSUO, Visakhapatnam, AP.
7. GROUND WATER MANAGEMENT STUDIES
8. In Parts Of Tribal Area Of Visakhapatnam District, Andhra Pradesh By V.S.R. Krishna Assistant Hydrogeologist, CGWB, APSUO, Visakhapatnam, AP. November, 2005
9. Hydrogeological Studies In Parts Of Visakhapatnam Urban Area (Aap 2009-10) By K.Dwarakanath Scientist – C, SR, Hyderabad.
10. Ground Water Management Studies In Parts Of Visakhapatnam District, Andhra Pradesh (AAP 2003-04) By G.V.V.R.G.SIVA PRASADA RAO Scientist 'D', Southern Region Hyderabad December, 2005.
11. Ground Water Management Studies In Parts Of Visakhapatnam District, Andhra Pradesh By C.Paul Prabhakar Scientist – D, CGWB, APSUO, Visakhapatnam, AP , (November, 2006).
12. Ground Water Brochure, Visakhapatnam district A.P.(2013) by G. Bhaskara Rao, Scientist-D, SR, Hyderabad.
13. Report on Hydrogeological Investigations at Indian Coastal Guard, Malkapuram, Visakhapatnam, Andhra Pradesh By MD Sarif Khan Scientist-'B' Southern Region Hyderabad July 2021.
14. Report on the Hydro geological Investigations at Pocket 3 of INS Eksila, Visakhapatnam, Andhra Pradesh By MD Sarif Khan Scientist-'B' Southern Region Hyderabad Feb 2021.
15. Aquifer Mapping and Management of Groundwater Resources in Visakhapatnam District, Andhra Pradesh State (2022) by Shri . Dr. D. Anantha Rao, Assistant Hydrogeologist CGWB, APSUO, Visakhapatnam, AP.

5.0 Objectives of the present study

- Aquifer wise Micro level data generation of water level and water Quality
- To Decipher the Aquifer disposition of Visakhapatnam urban in 1:10,000 scale by generating and integrating Geological, Geophysical, Geochemical and well inventory data in micro level.
- Aquifer wise characterization up to the depth of 200 m in Hard rock both qualitatively and quantitatively.
- Impact of urbanization on ground water scenario in terms of quality and quantity.
- To delineation of Recharge and Discharge areas.
- To delineate the fresh and saline water interface and extent of saline water ingress if any.
- To study the impact of industrialization/ urbanization in Anakapalli industrial belt.
- Aquifer management interventions.
- Existing Demand – Supply with dependence to Ground Water / Surface Water to be quantified and identify the Gap
- Estimate grey water production of Industrial and Domestic sector. Recommend ETP/STP and proper site for utilization.

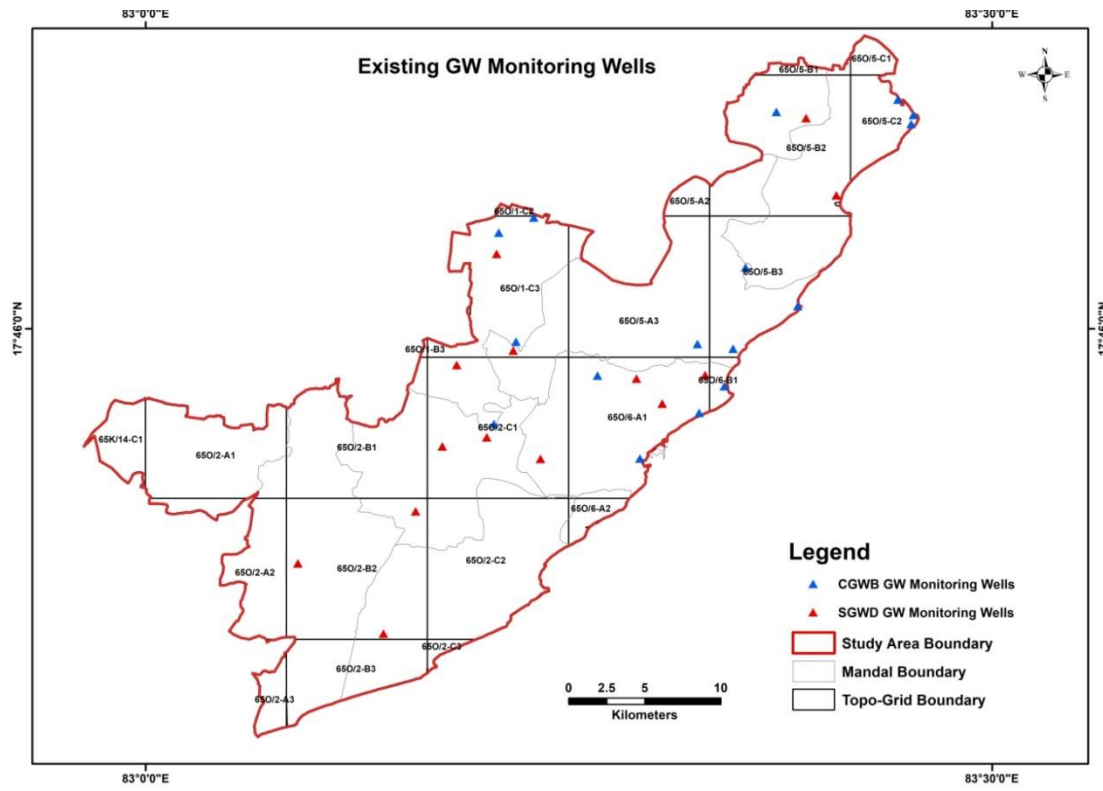
6.0 Existing Data

Exploration Data: The available CGWB in-house Exploration data in different blocks along with the topo sheet No's within the study area have been compiled and tabulated.



Existing Exploration Wells in the Study Area							
Sl.No.	Well_No	Village	Mandal	District	Long	Lat	Well Type
1	VSP-012	Koppaka	Anakapalle	Visakhapatnam	83.05028	17.69333	EW
2	VSP-013	Koppaka	Anakapalle	Visakhapatnam	83.05028	17.69333	EW
3	VSP-014	Koppaka-II	Anakapalle	Visakhapatnam	83.05028	17.69333	EW
4	VSP-015	Aganampudi	Gajuvaka	Visakhapatnam	83.13445	17.68194	EW
5	VSP-016	Palavalasa	Peddagantyada	Visakhapatnam	83.15222	17.57306	EW
6	VSP-017	Satyanarayanapuram	Anakapalle	Visakhapatnam	82.98972	17.695	EW
7	VSP-044	Nagarampalem	Visakhapatnam(R)	Visakhapatnam	83.34695	17.83972	EW
8	VSP-045	Visalakshinagar	Visakhapatnam(R)	Visakhapatnam	83.33528	17.75667	EW
9	VSP-046	Gopalapatnam	Pendurti	Visakhapatnam	83.22028	17.7617	PZ
10	VSP-047	Anandapuram	Bheemunipatnam	Visakhapatnam	83.37111	17.89194	PZ
11	VSP-048	Akkireddipalem	Visakhapatnam(U)	Visakhapatnam	83.20722	17.70917	PZ

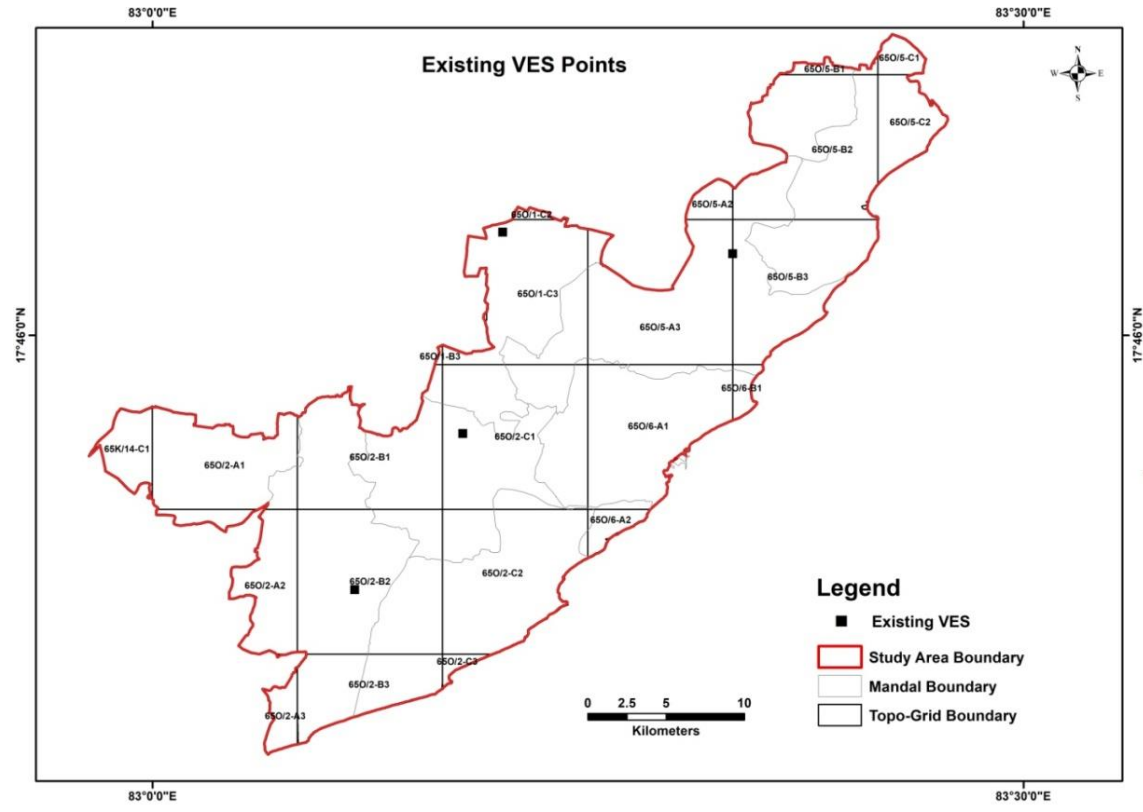
GW Monitoring Wells: Currently CGWB & SGWD have established 30 numbers of monitoring and sampling stations in the study area. As the NAQUIM 2.0 will be carried out at a scale of 1:10,000, the study needs higher data density related to ground water level and quality with good spatial and depth wise distribution.



Existing Ground Water Monitoring Wells in the Study Area						
Sl.No	Mandal	Village	District	Latitude	Longitude	Source

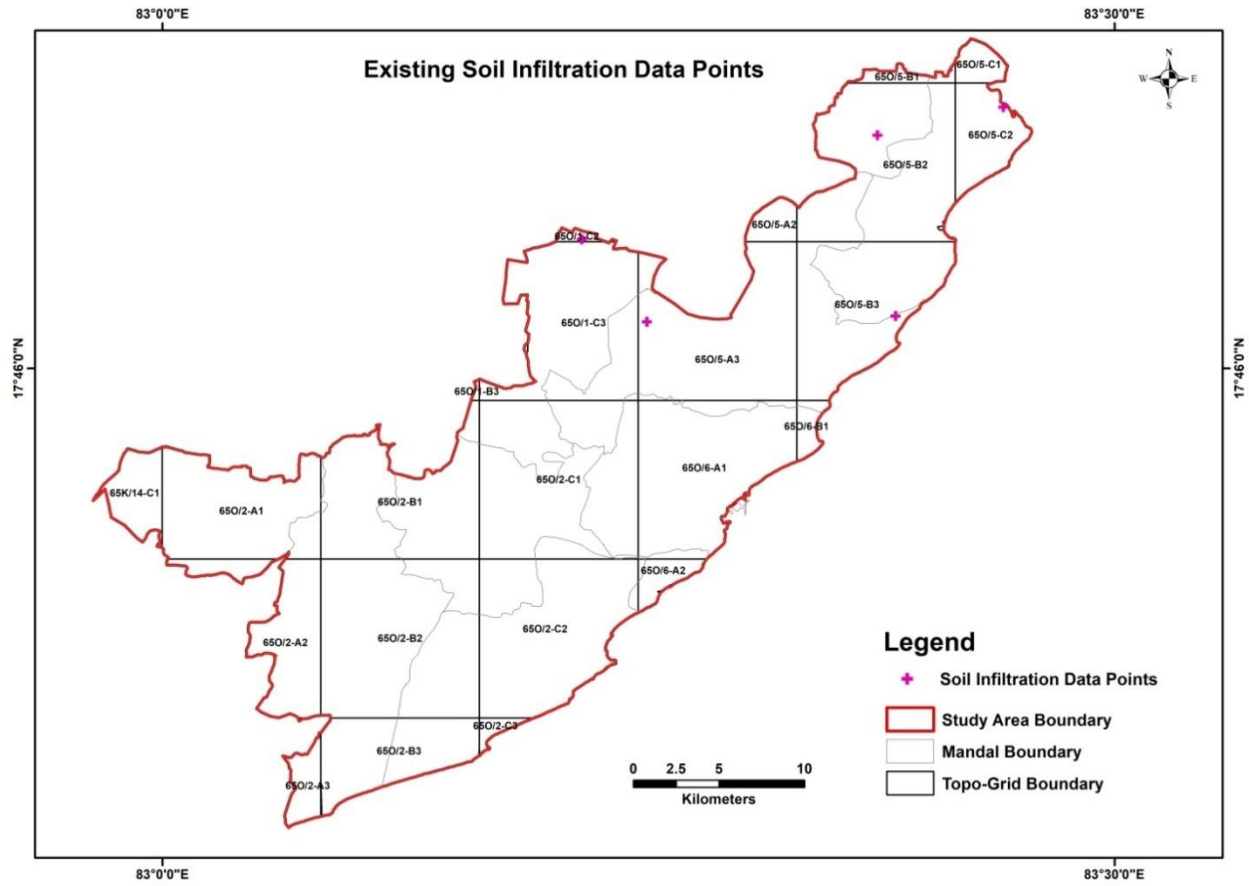
1	Bheemunipatnam	Bhimunipatnam-1	Visakhapatnam	17.893016	83.45341	CGWB
2	Bheemunipatnam	Bheemunipatnam	Visakhapatnam	17.902089	83.44423	CGWB
3	Pendurthi	Pendurthi	Visakhapatnam	17.823467	83.20844	CGWB
4	Pendurthi	Bandavaripalem x	Visakhapatnam	17.832418	83.22914	CGWB
5	Visakhapatnam	Rishikonda	Visakhapatnam	17.780096	83.38513	CGWB
6	Visakhapatnam	Visalakshinagar	Visakhapatnam	17.754902	83.3469	CGWB
7	Visakhapatnam(U)	Lawson's Bay	Visakhapatnam	17.73279	83.34172	CGWB
8	Bheemunipatnam	Bhimunipatnam-2	Visakhapatnam	17.887634	83.45207	CGWB
9	Visakhapatnam(U)	Kancherapalem (Govt. Polytechnic)	Visakhapatnam	17.739024	83.26686	CGWB
10	Pendurthi	Gopalpatnam Pz	Visakhapatnam	17.759064	83.2186	CGWB
11	Visakhapatnam	Kotaveedhi	Visakhapatnam	17.6901	83.2919	CGWB
12	Visakhapatnam(U)	Pithapuram	Visakhapatnam	17.716983	83.32689	CGWB
13	Visakhapatnam(U)	Akkireddipalem Pz	Visakhapatnam	17.710432	83.20563	CGWB
14	Anandapuram	Anandapuram Pz	Visakhapatnam	17.894765	83.37243	CGWB
15	Visakhapatnam	Peddagadili	Visakhapatnam	17.7577	83.3258	CGWB
16	Visakhapatnam	Potnamallayapalem	Visakhapatnam	17.802921	83.3542	CGWB
17	Parawada	Parawada	Anakapalli	17.6281	83.0898	GWD
18	Parawada	T.Devada	Anakapalli	17.5867	83.1404	GWD
19	Anandapuram	Vellanki	Visakhapatnam	17.8911	83.39	GWD
20	Bhimili	Chukkavanipalem	Visakhapatnam	17.8455	83.4079	GWD
21	Gajuwaka	Visakhapatnam (BHPV)	Visakhapatnam	17.7026	83.2014	GWD
22	Gajuwaka	Visakhapatnam (Gollalapalem)	Visakhapatnam	17.6898	83.2332	GWD
23	Gajuwaka	Visakhapatnam (Kanithi Colony)	Visakhapatnam	17.6972	83.1751	GWD
24	Pedagantyada	Visakhapatnam (Steel Plant)	Visakhapatnam	17.6589	83.1594	GWD
25	Pendurthi	Narava	Visakhapatnam	17.7453	83.1836	GWD
26	Pendurthi	Pendurthi	Visakhapatnam	17.8109	83.2072	GWD
27	VSP Rural	Visakhapatnam (Gopalapatnam)	Visakhapatnam	17.7538	83.217	GWD
28	VSP Urban	Visakhapatnam (APSIDC)	Visakhapatnam	17.7372	83.2898	GWD
29	VSP Urban	Visakhapatnam (Sivajipalem)	Visakhapatnam	17.7394	83.3304	GWD
30	VSP Urban	Visakhapatnam (YSR PARK)	Visakhapatnam	17.7225	83.3051	GWD

Ves Data: The available CGWB in-house VES/TEM data in different blocks within the study area have been compiled.



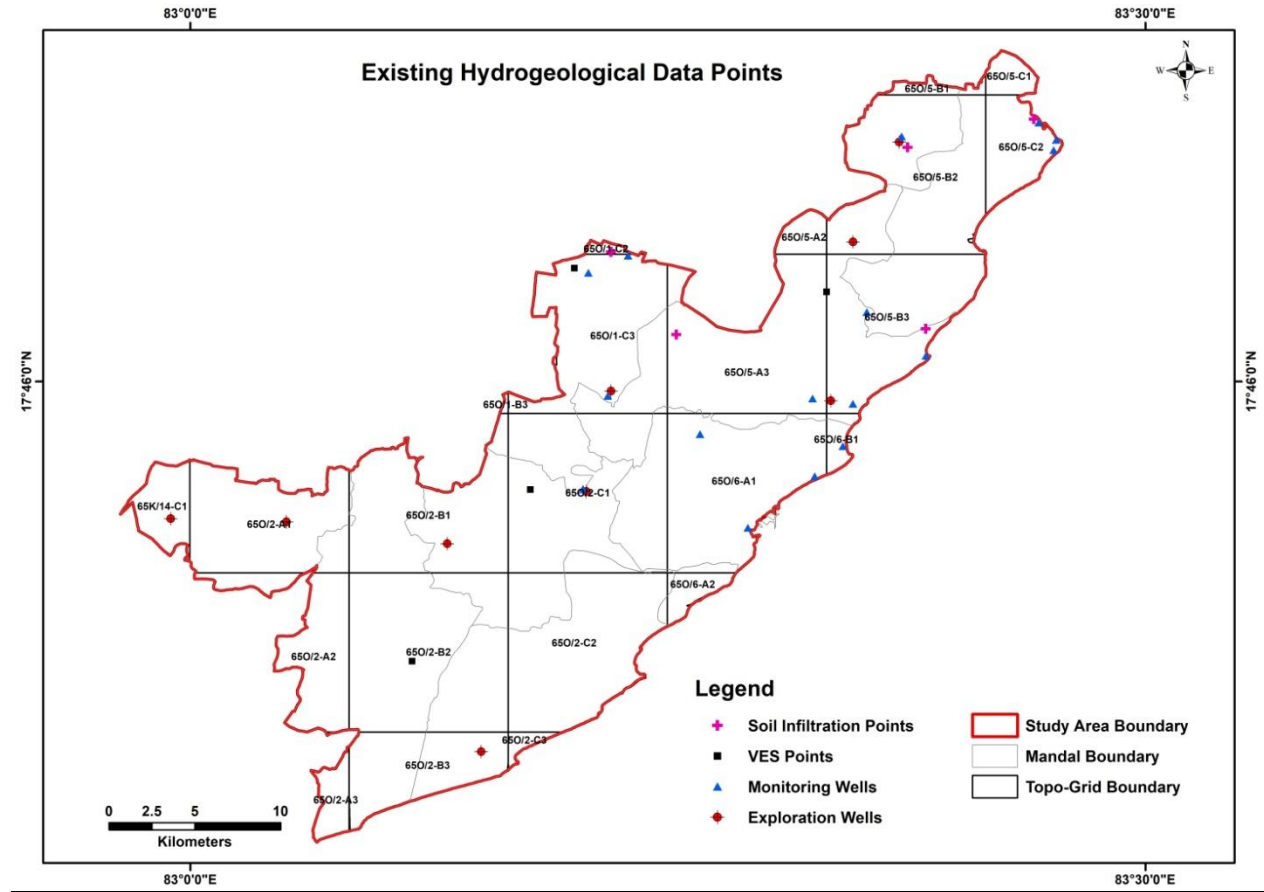
Existing VES points in the Study Area							
Sl.No.	District	Location	Longitude	Latitude	Survey Type	AAP	Infered Lithology
1	Visakhapatnam	Venkatapathirajupet	83.178	17.7102	VES	2019-20	Gneiss
2	Visakhapatnam	P.S.Bonangi	83.116	17.6204	VES	2019-20	Gneiss
3	Visakhapatnam	Pendurti	83.201	17.826	VES	2019-20	Khondalite
4	Visakhapatnam	PM Palem	83.333	17.8136	VES	2019-20	Khondalite

Soil Infiltration Data: The available CGWB in-house Soil Infiltration test data in different blocks within the study area have been compiled.



Existing Soil Infiltration data points in the Study Area							
Sl.No.	Location	Mandal	District	Long	Lat	Basic Infiltration Rate	Soil Type
1	Rishikonda	Visakhapatnam Urban	Visakhapatnam	83.385	17.7941	3	Silty Clay with Sand mixed (Brown colour)
2	Bhemunipatnam	Bhemunipatnam	Visakhapatnam	83.4416	17.9038	1.5	Silty Clay with fine Sand mixed (Brown colour)
3	Adavivaram	Simhachalam	Visakhapatnam	83.2544	17.7911	3.3	Silty Clay with Sand mixed (Brown colour)
4	Gurrampalem	Pendurthi	Visakhapatnam	83.2202	17.8344	2.7	Silty Clay with Sand mixed (Brown colour)
5	Anandapuram	Anandapuram	Visakhapatnam	83.3755	17.8891	1.8	Silty Clay with fine Sand mixed (Brown colour)

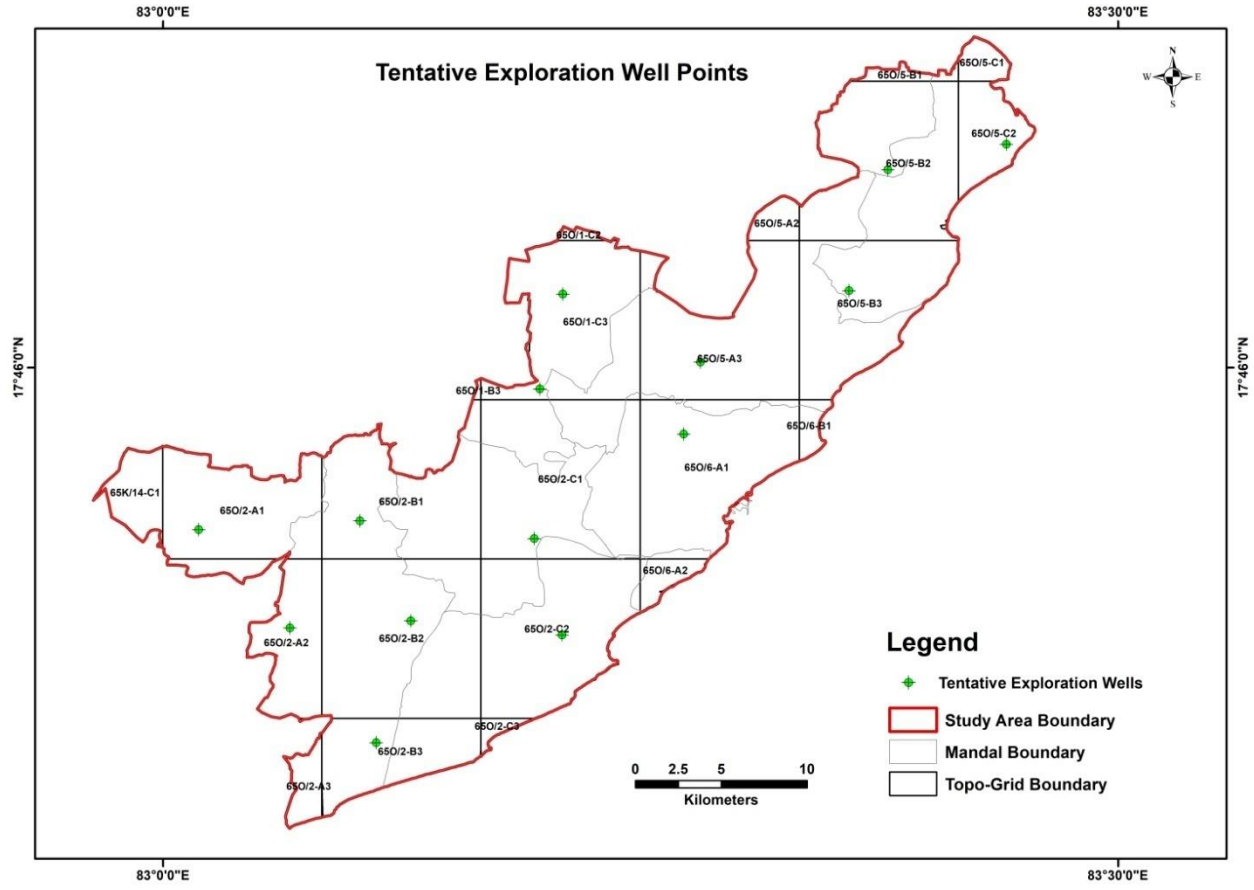
Total Hydrogeological Data Points in the Study Area:



7.0 Data Gap Analysis & New Data Generation: The historically available data of Geology, Geophysics, Hydrogeology, and Hydrochemistry generated under various studies by the CGWB through Systematic Hydrogeological studies, Reappraisal Hydrogeological studies, Groundwater Management studies, Exploratory drilling, and special studies have been compiled for data gap analysis. The data generation has been done based upon the analysis of exiting data and the details are provided below.

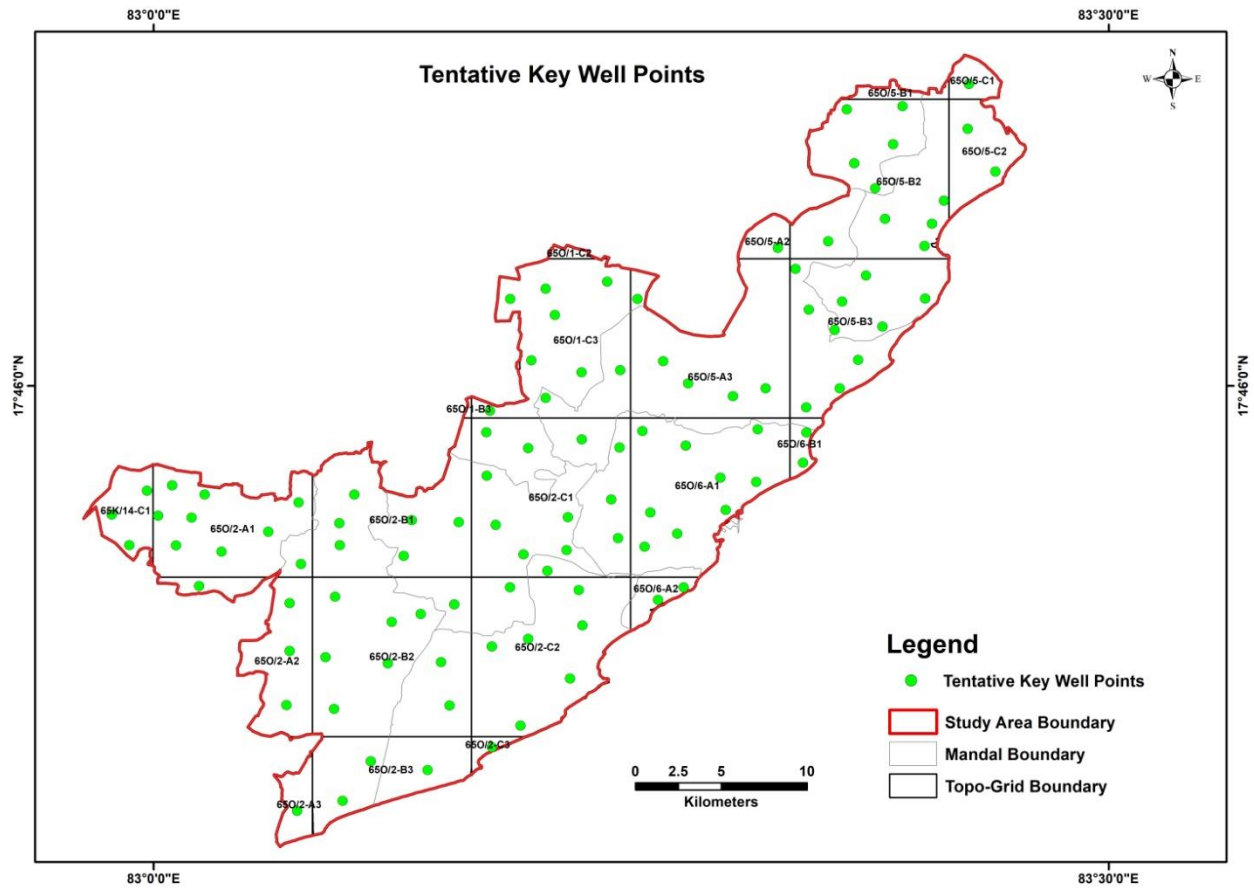
S.No	Name of Study Area	Existing Exploratory Wells	Proposed Exploratory Wells	Existing Key Wells	Proposed Key Wells	Existing VES	Proposed VES
1	Visakhapatnam & Anakapalli Urban	11	14	0	120	4	70

Tentative Exploration Locations: The data insufficiency within the study area is thereby identified and given for recommendations for 14 Exploration wells in total study area.



Tentative Exploration Locations						
Sl.No.	Mandal	Location	District	Latitude	Longitude	Toposheet
1	PARAVADA	Lankelapalem	ANAKAPALLI	17.6867	83.103	650/2-B1
2	PARAVADA	Dasapatrunipalem	ANAKAPALLI	17.6344	83.1297	650/2-B2
3	PARAVADA	Cheepurupalle (West)	ANAKAPALLI	17.5706	83.1114	650/2-B3
4	PENDURTHI	Chinamushidivada	VISAKHAPATNAM	17.8053	83.2093	650/1-C3
5	PENDURTHI	Narava	VISAKHAPATNAM	17.7688	83.2819	650/1-C3
6	GAJUWAKA	CHINAGANTYADA	VISAKHAPATNAM	17.6774	83.1943	650/2-C1
7	PEDAGANTYADA	Nadupuru (Part)	VISAKHAPATNAM	17.6269	83.2088	650/2-C2
8	VISAKHAPATNAM	Adiviram	VISAKHAPATNAM	17.7608	83.1992	650/5-A3
9	VISAKHAPATNAM(U)	VISAKHAPATNAM (M)	VISAKHAPATNAM	17.7321	83.2725	650/6-A1
10	ANANDAPURAM	Vellanki	VISAKHAPATNAM	17.8704	83.3794	650/5-B2
11	BHEEMUNIPATNAM	Kapuluppada	VISAKHAPATNAM	17.807	83.3591	650/5-B3
12	BHEEMUNIPATNAM	Nerallavalasa	VISAKHAPATNAM	17.8836	83.4415	650/5-C2
13	ANAKAPALLI	ANAKAPALLI (M)	ANAKAPALLI	17.6821	83.0186	650/2-A1
14	PARAVADA	Bharinikam	ANAKAPALLI	17.6306	83.0663	650/2-A2

Tentative Key Well Locations: In order to establish new monitoring and sampling key-wells 01 Key well for each 6-7 sq km is suggested around 120 key wells in 775 sq km area. Depth to water level and ground water samples will be collected from the key-wells.



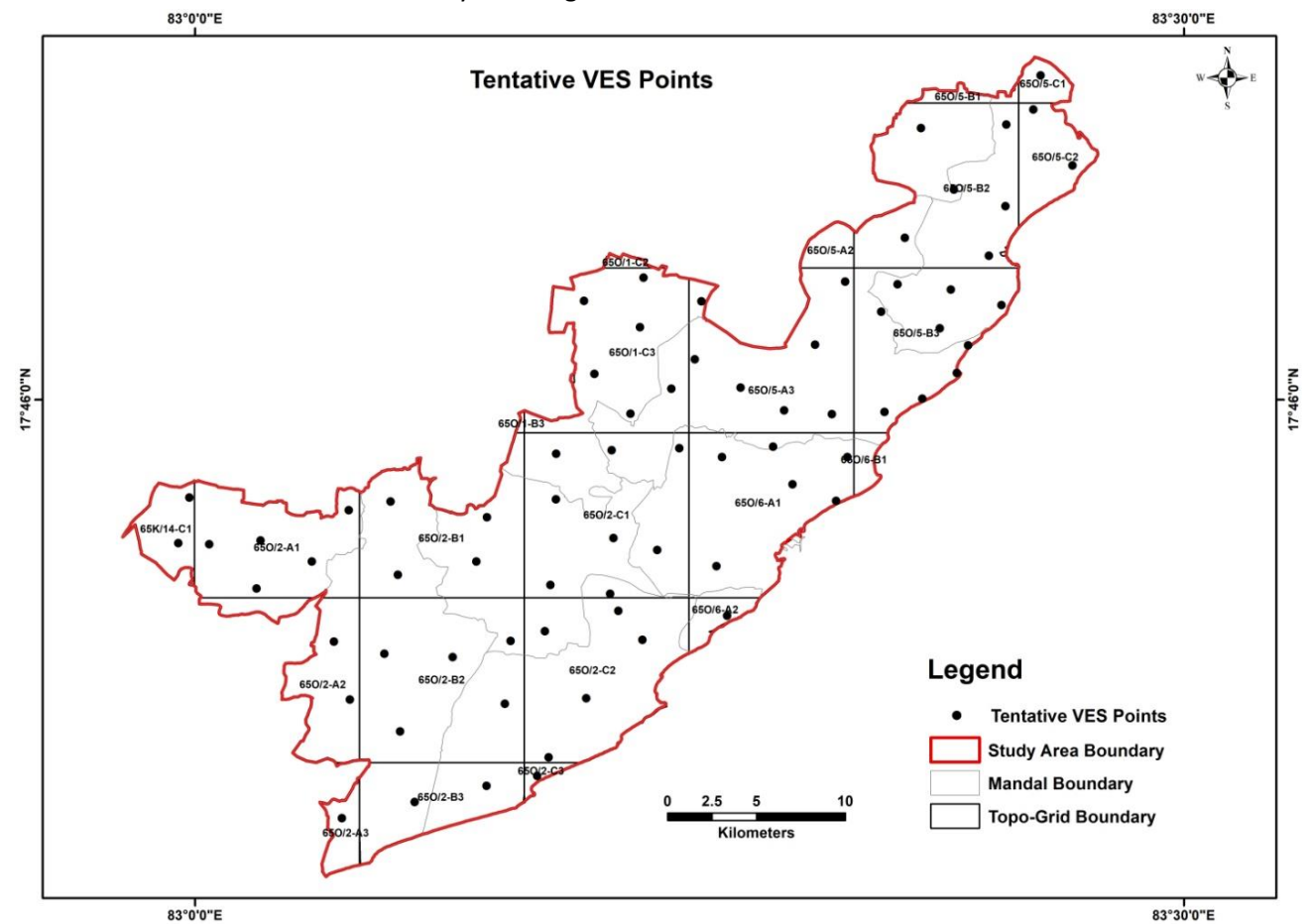
Tentative Location of Key Wells in the Study Area						
Sl.No.	Location	Mandal	District	Latitude	Longitude	Toposheet
1	ANAKAPALLI (M)	ANAKAPALLI	ANAKAPALLI	17.6831	83.0117	650/2-A1
2	ANAKAPALLI (M)	ANAKAPALLI	ANAKAPALLI	17.6988	83.0023	650/2-A1
3	ANAKAPALLI NARTH (M)	ANAKAPALLI	ANAKAPALLI	17.6978	83.0199	650/2-A1
4	ANAKAPALLI SOUTH (M)	ANAKAPALLI	ANAKAPALLI	17.6799	83.0355	650/2-A1
5	ANAKAPALLI SOUTH (M)	ANAKAPALLI	ANAKAPALLI	17.662	83.0238	650/2-A2
6	Maredupudi	ANAKAPALLI	ANAKAPALLI	17.7056	83.0759	650/2-A1
7	Sankaram	ANAKAPALLI	ANAKAPALLI	17.7098	83.0267	650/2-A1
8	Thummapala	ANAKAPALLI	ANAKAPALLI	17.6833	82.9872	65K/14-C1
9	Thummapala	ANAKAPALLI	ANAKAPALLI	17.7118	82.9965	65K/14-C1
10	Thummapala	ANAKAPALLI	ANAKAPALLI	17.6993	82.9781	65K/14-C1
11	Thummapala	ANAKAPALLI	ANAKAPALLI	17.7146	83.0097	650/2-A1
12	Velluru	ANAKAPALLI	ANAKAPALLI	17.6904	83.0601	650/2-A1
13	Anandapuram	ANANDAPURAM	VISAKHAPATNAM	17.9113	83.3629	650/5-B2
14	Gambheeram	ANANDAPURAM	VISAKHAPATNAM	17.883	83.3668	650/5-B2
15	Peddipalem	ANANDAPURAM	VISAKHAPATNAM	17.9129	83.3921	650/5-B2

16	Vellanki	ANANDAPURAM	VISAKHAPATNAM	17.893	83.3872	650/5-B2
17	Vellanki	ANANDAPURAM	VISAKHAPATNAM	17.87	83.3778	650/5-B2
18	BHIMUNIPATNAM (M)	BHEEMUNIPATNAM	VISAKHAPATNAM	17.9246	83.4268	650/5-C1
19	BHIMUNIPATNAM (M)	BHEEMUNIPATNAM	VISAKHAPATNAM	17.9011	83.4262	650/5-C2
20	Chepaluppada	BHEEMUNIPATNAM	VISAKHAPATNAM	17.8515	83.4075	650/5-B2
21	Kapuluppada	BHEEMUNIPATNAM	VISAKHAPATNAM	17.8399	83.4036	650/5-B2
22	Kapuluppada	BHEEMUNIPATNAM	VISAKHAPATNAM	17.8541	83.383	650/5-B2
23	Kapuluppada	BHEEMUNIPATNAM	VISAKHAPATNAM	17.7958	83.3565	650/5-B3
24	Kapuluppada	BHEEMUNIPATNAM	VISAKHAPATNAM	17.8107	83.3604	650/5-B3
25	Kapuluppada	BHEEMUNIPATNAM	VISAKHAPATNAM	17.7977	83.3816	650/5-B3
26	Kapuluppada	BHEEMUNIPATNAM	VISAKHAPATNAM	17.8123	83.4039	650/5-B3
27	Kapuluppada	BHEEMUNIPATNAM	VISAKHAPATNAM	17.8244	83.373	650/5-B3
28	Nerallavalasa	BHEEMUNIPATNAM	VISAKHAPATNAM	17.8635	83.4137	650/5-B2
29	Nerallavalasa	BHEEMUNIPATNAM	VISAKHAPATNAM	17.8787	83.4407	650/5-C2
30	Aganampudi (PT)	GAJUWAKA	VISAKHAPATNAM	17.6777	83.1309	650/2-B1
31	CHINAGANTYADA	GAJUWAKA	VISAKHAPATNAM	17.6785	83.1937	650/2-C1
32	GAJUWAKA (M)	GAJUWAKA	VISAKHAPATNAM	17.6954	83.1598	650/2-B1
33	GAJUWAKA (M)	GAJUWAKA	VISAKHAPATNAM	17.694	83.179	650/2-C1
34	GAJUWAKA (M)	GAJUWAKA	VISAKHAPATNAM	17.7196	83.1744	650/2-C1
35	GAJUWAKA (M)	GAJUWAKA	VISAKHAPATNAM	17.6807	83.2162	650/2-C1
36	GAJUWAKA (M)	GAJUWAKA	VISAKHAPATNAM	17.6547	83.264	650/6-A2
37	GAJUWAKA (M)	GAJUWAKA	VISAKHAPATNAM	17.6613	83.2774	650/6-A2
38	KANITHI	GAJUWAKA	VISAKHAPATNAM	17.6523	83.1574	650/2-B2
39	KANITHI	GAJUWAKA	VISAKHAPATNAM	17.6613	83.1866	650/2-C2
40	MINDI	GAJUWAKA	VISAKHAPATNAM	17.698	83.2169	650/2-C1
41	Talarivanipalem	GAJUWAKA	VISAKHAPATNAM	17.6964	83.1351	650/2-B1
42	Bharinikam	PARAVADA	ANAKAPALLI	17.628	83.0712	650/2-A2
43	Cheepurupalle (East)	PARAVADA	ANAKAPALLI	17.5496	83.0989	650/2-B3
44	Cheepurupalle (East)	PARAVADA	ANAKAPALLI	17.5443	83.0751	650/2-A3
45	Cheepurupalle (West)	PARAVADA	ANAKAPALLI	17.5702	83.1137	650/2-B3
46	Dasapatrunipalem	PARAVADA	ANAKAPALLI	17.6431	83.1246	650/2-B2
47	Lamarthi Agraharam	PARAVADA	ANAKAPALLI	17.6563	83.095	650/2-B2
48	Lankelapalem	PARAVADA	ANAKAPALLI	17.6833	83.0975	650/2-B1
49	Mantripalem	PARAVADA	ANAKAPALLI	17.6948	83.0973	650/2-B1
50	P.S. Bonangi	PARAVADA	ANAKAPALLI	17.6215	83.1227	650/2-B2
51	Paravada	PARAVADA	ANAKAPALLI	17.6247	83.09	650/2-B2
52	Pedamadaka	PARAVADA	ANAKAPALLI	17.6473	83.1399	650/2-B2
53	Pedamusidivada	PARAVADA	ANAKAPALLI	17.7098	83.1051	650/2-B1
54	Ravada	PARAVADA	ANAKAPALLI	17.5977	83.0945	650/2-B2
55	Ravada	PARAVADA	ANAKAPALLI	17.5996	83.0695	650/2-A2
56	Thadi	PARAVADA	ANAKAPALLI	17.6735	83.0771	650/2-A1

57	Thanam	PARAVADA	ANAKAPALLI	17.653	83.0712	650/2-A2
58	Appikonda (part)	PEDAGANTYADA	VISAKHAPATNAM	17.5776	83.1771	650/2-C3
59	Devada	PEDAGANTYADA	VISAKHAPATNAM	17.5994	83.1549	650/2-B2
60	Devada	PEDAGANTYADA	VISAKHAPATNAM	17.5656	83.1434	650/2-B3
61	Nadupuru (Part)	PEDAGANTYADA	VISAKHAPATNAM	17.6221	83.1504	650/2-B2
62	Nadupuru (Part)	PEDAGANTYADA	VISAKHAPATNAM	17.6699	83.2061	650/2-C1
63	Nadupuru (Part)	PEDAGANTYADA	VISAKHAPATNAM	17.5889	83.1921	650/2-C2
64	Nadupuru (Part)	PEDAGANTYADA	VISAKHAPATNAM	17.6303	83.1771	650/2-C2
65	Nadupuru (Part)	PEDAGANTYADA	VISAKHAPATNAM	17.6414	83.2245	650/2-C2
66	Nadupuru (Part)	PEDAGANTYADA	VISAKHAPATNAM	17.6135	83.2179	650/2-C2
67	Nadupuru (Part)	PEDAGANTYADA	VISAKHAPATNAM	17.6599	83.2225	650/2-C2
68	Nadupuru (Part)	PEDAGANTYADA	VISAKHAPATNAM	17.6343	83.1961	650/2-C2
69	Cheemalapalle	PENDURTHI	VISAKHAPATNAM	17.78	83.1978	650/1-C3
70	Chinamushdivada	PENDURTHI	VISAKHAPATNAM	17.8037	83.2101	650/1-C3
71	Narava	PENDURTHI	VISAKHAPATNAM	17.7536	83.1761	650/1-C3
72	Narava	PENDURTHI	VISAKHAPATNAM	17.734	83.1961	650/2-C1
73	Narava	PENDURTHI	VISAKHAPATNAM	17.7423	83.1742	650/2-C1
74	Pendurthi	PENDURTHI	VISAKHAPATNAM	17.8174	83.2052	650/1-C3
75	Rampuram	PENDURTHI	VISAKHAPATNAM	17.8121	83.1867	650/1-C3
76	Sowbhagya rayapuram	PENDURTHI	VISAKHAPATNAM	17.8121	83.2533	650/5-A3
77	Valimeraka	PENDURTHI	VISAKHAPATNAM	17.8212	83.2375	650/1-C3
78	Vepagunta	PENDURTHI	VISAKHAPATNAM	17.7737	83.224	650/1-C3
79	ADAVIVARAM	VISAKHAPATNAM	VISAKHAPATNAM	17.7749	83.2442	650/1-C3
80	Adiviram	VISAKHAPATNAM	VISAKHAPATNAM	17.7654	83.3205	650/5-A3
81	Adiviram	VISAKHAPATNAM	VISAKHAPATNAM	17.7612	83.3033	650/5-A3
82	Adiviram	VISAKHAPATNAM	VISAKHAPATNAM	17.7679	83.2798	650/5-A3
83	Adiviram	VISAKHAPATNAM	VISAKHAPATNAM	17.7796	83.2668	650/5-A3
84	Bakkannapalem	VISAKHAPATNAM	VISAKHAPATNAM	17.8065	83.343	650/5-B3
85	ENDADA	VISAKHAPATNAM	VISAKHAPATNAM	17.7554	83.3416	650/5-B3
86	ENDADA	VISAKHAPATNAM	VISAKHAPATNAM	17.7654	83.3593	650/5-B3
87	ENDADA	VISAKHAPATNAM	VISAKHAPATNAM	17.7803	83.3688	650/5-B3
88	FOREST	VISAKHAPATNAM	VISAKHAPATNAM	17.8388	83.3267	650/5-A2
89	GOPALAPATNAM	VISAKHAPATNAM	VISAKHAPATNAM	17.7603	83.2053	650/1-C3
90	GOPALAPATNAM	VISAKHAPATNAM	VISAKHAPATNAM	17.7386	83.2241	650/2-C1
91	Kommadi	VISAKHAPATNAM	VISAKHAPATNAM	17.8279	83.336	650/5-B3
92	Paradesipalem	VISAKHAPATNAM	VISAKHAPATNAM	17.8423	83.3532	650/5-B2
93	VISAKHAPATNAM (M)	VISAKHAPATNAM(U)	VISAKHAPATNAM	17.6869	83.2432	650/2-C1
94	VISAKHAPATNAM (M)	VISAKHAPATNAM(U)	VISAKHAPATNAM	17.7072	83.2396	650/2-C1
95	VISAKHAPATNAM (M)	VISAKHAPATNAM(U)	VISAKHAPATNAM	17.7344	83.244	650/2-C1
96	VISAKHAPATNAM (M)	VISAKHAPATNAM(U)	VISAKHAPATNAM	17.6825	83.257	650/6-A1
97	VISAKHAPATNAM (M)	VISAKHAPATNAM(U)	VISAKHAPATNAM	17.7004	83.26	650/6-A1

98	VISAKHAPATNAM (M)	VISAKHAPATNAM(U)	VISAKHAPATNAM	17.7018	83.2995	650/6-A1
99	VISAKHAPATNAM (M)	VISAKHAPATNAM(U)	VISAKHAPATNAM	17.7164	83.3155	650/6-A1
100	VISAKHAPATNAM (M)	VISAKHAPATNAM(U)	VISAKHAPATNAM	17.7354	83.2786	650/6-A1
101	VISAKHAPATNAM (M)	VISAKHAPATNAM(U)	VISAKHAPATNAM	17.7186	83.2967	650/6-A1
102	VISAKHAPATNAM (M)	VISAKHAPATNAM(U)	VISAKHAPATNAM	17.7439	83.3163	650/6-A1
103	VISAKHAPATNAM (M)	VISAKHAPATNAM(U)	VISAKHAPATNAM	17.743	83.2559	650/6-A1
104	VISAKHAPATNAM (M)	VISAKHAPATNAM(U)	VISAKHAPATNAM	17.6894	83.2741	650/6-A1
105	VISAKHAPATNAM (M)	VISAKHAPATNAM(U)	VISAKHAPATNAM	17.7264	83.34	650/6-B1
106	VISAKHAPATNAM (M)	VISAKHAPATNAM(U)	VISAKHAPATNAM	17.7423	83.3418	650/6-B1

Tentative VES Points: The VES data insufficiency within the study area is thereby identified and given for recommendations for 01 VES for each 10 sq km is suggested and total 71 VES in 775 sq km area. The Tentative Locations of VES in the Study Area is given below.



Tentative Location of VES in the Study Area					
S.No.	Location	Mandal	Lat	Long	Topo_No
1	Duvvada	GAJUWAKA	17.7071	83.1476	650/2-B1
2	Talarivanipalem	GAJUWAKA	17.6849	83.1422	650/2-B1

3	KANITHI	GAJUWAKA	17.6446	83.1596	650/2-B2
4	Nadupuru (Part)	PEDAGANTYADA	17.6129	83.1566	650/2-B2
5	Devada	PEDAGANTYADA	17.5714	83.1473	650/2-B3
6	Pendurthi	PENDURTHI	17.8165	83.1967	650/1-C3
7	Juthada	PENDURTHI	17.8283	83.2268	650/1-C3
8	Chinamushidivada	PENDURTHI	17.8032	83.2250	650/1-C3
9	Vepagunta	PENDURTHI	17.7595	83.2201	650/1-C3
10	Cheemalapalle	PENDURTHI	17.7796	83.2019	650/1-C3
11	ADAVIVARAM	VISAKHAPATNAM	17.7721	83.2408	650/1-C3
12	GAJUWAKA (M)	GAJUWAKA	17.7162	83.1824	650/2-C1
13	MINDI	GAJUWAKA	17.6967	83.2115	650/2-C1
14	KANITHI	GAJUWAKA	17.6730	83.1797	650/2-C1
15	Nadupuru (Part)	PEDAGANTYADA	17.6685	83.2099	650/2-C1
16	Narava	PENDURTHI	17.7393	83.1825	650/2-C1
17	GOPALAPATNAM	VISAKHAPATNAM	17.7411	83.2106	650/2-C1
18	VISAKHAPATNAM (M)	VISAKHAPATNAM(U)	17.6906	83.2337	650/2-C1
19	VISAKHAPATNAM (M)	VISAKHAPATNAM(U)	17.7420	83.2449	650/2-C1
20	KANITHI	GAJUWAKA	17.6495	83.1768	650/2-C2
21	Appikonda (part)	PEDAGANTYADA	17.5858	83.1787	650/2-C2
22	Nadupuru (Part)	PEDAGANTYADA	17.6453	83.2262	650/2-C2
23	Nadupuru (Part)	PEDAGANTYADA	17.6599	83.2140	650/2-C2
24	Appikonda (part)	PEDAGANTYADA	17.5764	83.1729	650/2-C3
25	Sowbhagya rayapuram	PENDURTHI	17.8162	83.2560	650/5-A3
26	FOREST	VISAKHAPATNAM	17.8262	83.3287	650/5-A3
27	ADAVIVARAM	VISAKHAPATNAM	17.7870	83.2527	650/5-A3
28	Adiviram	VISAKHAPATNAM	17.7593	83.3220	650/5-A3
29	Adiviram	VISAKHAPATNAM	17.7612	83.2978	650/5-A3
30	Adiviram	VISAKHAPATNAM	17.7727	83.2758	650/5-A3
31	Adiviram	VISAKHAPATNAM	17.7428	83.2922	650/6-A1
32	VISAKHAPATNAM (M)	VISAKHAPATNAM(U)	17.7376	83.2664	650/6-A1
33	VISAKHAPATNAM (M)	VISAKHAPATNAM(U)	17.7155	83.3241	650/6-A1
34	VISAKHAPATNAM (M)	VISAKHAPATNAM(U)	17.6824	83.2637	650/6-A1
35	VISAKHAPATNAM (M)	VISAKHAPATNAM(U)	17.7376	83.3298	650/6-A1
36	VISAKHAPATNAM (M)	VISAKHAPATNAM(U)	17.7238	83.3021	650/6-A1
37	GAJUWAKA (M)	GAJUWAKA	17.6574	83.2690	650/6-A2
38	Anandapuram	ANANDAPURAM	17.9038	83.3670	650/5-B2
39	Vellanki	ANANDAPURAM	17.8727	83.3837	650/5-B2
40	Tallavalasa	BHEEMUNIPATNAM	17.9056	83.4102	650/5-B2
41	Nerallavalasa	BHEEMUNIPATNAM	17.8644	83.4098	650/5-B2
42	Kapuluppada	BHEEMUNIPATNAM	17.8394	83.4014	650/5-B2
43	Paradesipalem	VISAKHAPATNAM	17.8484	83.3588	650/5-B2

44	Kapuluppada	BHEEMUNIPATNAM	17.8026	83.3765	650/5-B3
45	Kapuluppada	BHEEMUNIPATNAM	17.8144	83.4077	650/5-B3
46	Kapuluppada	BHEEMUNIPATNAM	17.8249	83.3552	650/5-B3
47	Kapuluppada	BHEEMUNIPATNAM	17.8222	83.3822	650/5-B3
48	Bakkannapalem	VISAKHAPATNAM	17.8111	83.3469	650/5-B3
49	RUSHIKONDA	VISAKHAPATNAM	17.7801	83.3851	650/5-B3
50	RUSHIKONDA	VISAKHAPATNAM	17.7940	83.3908	650/5-B3
51	ENDADA	VISAKHAPATNAM	17.7603	83.3486	650/5-B3
52	ENDADA	VISAKHAPATNAM	17.7671	83.3678	650/5-B3
53	BHIMUNIPATNAM (M)	BHEEMUNIPATNAM	17.9304	83.4276	650/5-C1
54	BHIMUNIPATNAM (M)	BHEEMUNIPATNAM	17.9132	83.4239	650/5-C2
55	Nerallavalasa	BHEEMUNIPATNAM	17.8849	83.4436	650/5-C2
56	Thummapala	ANAKAPALLI	17.6941	82.9915	65K/14-C1
57	Thummapala	ANAKAPALLI	17.7171	82.9971	65K/14-C1
58	Maredupudi	ANAKAPALLI	17.7107	83.0777	650/2-A1
59	ANAKAPALLI NARTH (M)	ANAKAPALLI	17.6954	83.0331	650/2-A1
60	ANAKAPALLI (M)	ANAKAPALLI	17.6935	83.0071	650/2-A1
61	Velluru	ANAKAPALLI	17.6848	83.0590	650/2-A1
62	ANAKAPALLI SOUTH (M)	ANAKAPALLI	17.6711	83.0311	650/2-A1
63	Thanam	PARAVADA	17.6443	83.0702	650/2-A2
64	Paravada	PARAVADA	17.6150	83.0782	650/2-A2
65	Cheepurupalle (East)	PARAVADA	17.5551	83.0742	650/2-A3
66	Pedamusidivada	PARAVADA	17.7151	83.0988	650/2-B1
67	Lankelapalem	PARAVADA	17.6781	83.1025	650/2-B1
68	Swayambuvaram	PARAVADA	17.5989	83.1036	650/2-B2
69	yidulapaka bonangi	PARAVADA	17.6382	83.0956	650/2-B2
70	Dasatrunipalem	PARAVADA	17.6365	83.1302	650/2-B2
71	Cheepurupalle (East)	PARAVADA	17.5632	83.1110	650/2-B3

	preparation of GIS based maps and management plans	& Expert (Hydrogeology)-2												
20	Report Preparation	Team Leader & Expert (Hydrogeology)-1 & Expert (Hydrogeology)-2												
21	Field Truthing of Management Plan	Team Leader & Expert (Hydrogeology)-1 & Expert (Hydrogeology)-2												
22	Modification of Draft report. Scrutiny and Finalisation of the report	Team Leader												
23	Sharing of the reports with CHQ, SGWCC and DM/DC	Team Leader												

Composition of the team:

Composition of the Team:		
1	Team Leader	Lakshmi Narayana Damodara, Scientist-C
2	Hydrogeologist-1	Md Sarif Khan, Scientist-C
3	Hydrogeologist-2	Nilima Patra, Assistant Hydrogeologist
4	Geophysicist	T .Venkatgiri, Scientist-B
5	Chemist	S.K Ratha, Scientist-B

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	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.
Expert (Hydrogeology)- 2	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