केन्द्रीय भूमिजल बोर्ड

जल शक्ति मंत्रालय, जल संसाधन, नदी विकास और गंगा संरक्षण विभाग

भारत सरकार

Central Ground Water Board

Ministry of Jal Shakti,
Department of Water Resources, River Development
and Ganga Rejuvenation
Government of India

Report on

AQUIFER MAPPING AND MANAGEMENT PLAN

Siddapura Taluk, Uttara Kannada District, Karnataka

दक्षिण पश्चिमी क्षेत्र, बेंगलुरु

South Western Region, Bengaluru

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भारत सरकार
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जल संसाधन, नदी विकास एवं
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Government of India
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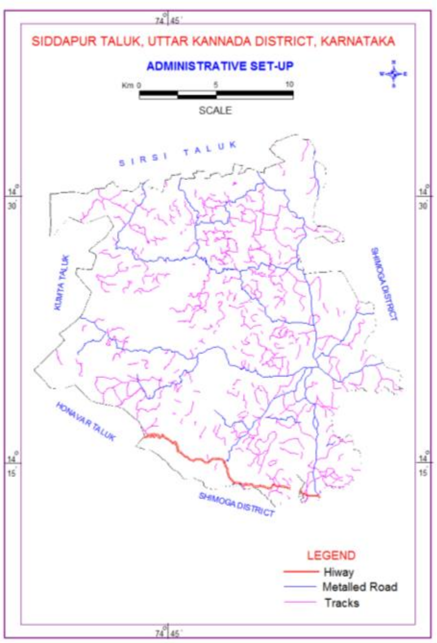
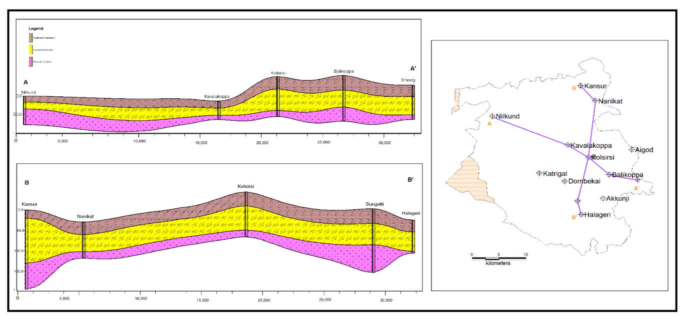
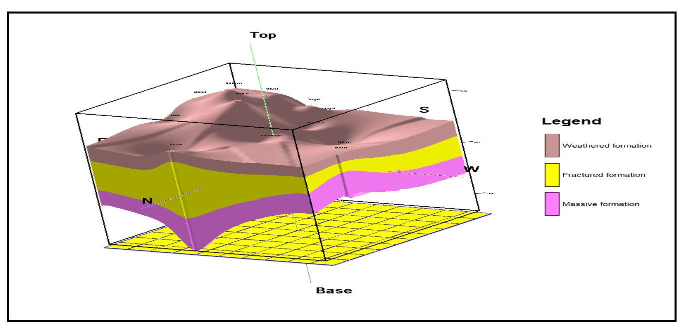
Bengaluru

Aquifer Maps and Management Plan, Siddapura Taluk, Uttara Kannada District, Karnataka State

(AAP: – 2022-2023)







By

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APRIL 2023

Aquifer Maps and Management Plan, Siddapura Taluk, Uttara Kannada District, Karnataka State

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1. Introduction

The vagaries of rainfall, inherent heterogenity, over exploitation of once copious aquifers, lack of regulation mechanism etc. has a detrimental effect on ground water scenario of the Country in last decade or so. Thus, prompting the paradigm shift from “Traditional Groundwater Development concept” to “Modern Groundwater Management concept”. Varied and diverse hydrogeological settings demand precise and comprehensive mapping of aquifers down to the optimum possible depth at appropriate scale to arrive at the robust and implementable ground water management plans. This leads to concept of Aquifer Mapping and Ground Water Management Plan. Aquifer mapping is a process wherein a combination of geologic, geophysical, hydrologic and chemical analyses is applied to characterize the quantity, quality and sustainability of ground water in aquifers. The proposed management plans will provide the “Road Map” for ensuring sustainable management and equitable distribution of ground water resources, thereby primarily improving drinking water security and irrigation coverage. Thus the crux of NAQUIM is not merely mapping, but reaching the goal-that of ground water management through community participation.

During XII five year plan (2012-17) National Aquifer Mapping (NAQUIM) study was initiated by CGWB to carry out detailed hydrogeological investigation. The Aquifer Mapping programme has been continued till 2023 to cover whole country. The present studies of Siddapura taluk of Uttar Kannada district, Karnataka have been taken up in AAP 2022-‘23 as a part of NAQUIM Programme. The aquifer maps and management plans will be shared with the administration of Uttar Kannada district and other user agencies for its effective implementation.

1.1 Objective and Scope of the Study

The major objectives of aquifer mapping are

- Delineation of lateral and vertical disposition of aquifers and their characterization
- Quantification of ground water availability and assessment of its quality to formulate aquifer management plans to facilitate sustainable management of

ground water resources at appropriate scales through participatory management approach with active involvement of stakeholders.

The groundwater management plan includes Ground Water recharge, conservation, harvesting, development options and other protocols of managing groundwater. These protocols will be the real derivatives of the aquifer mapping exercise and will find a place in the output i.e, the aquifer map and management plan. The main activities under NAQUIM are as follows:

a). Identifying the aquifer geometry

b). Aquifer characteristics and their yield potential

c). Quality of water occurring at various depths

d). Aquifer wise assessment of ground water resources

e). Preparation of aquifer maps and

f). Formulate ground water management plan.

The demarcation of aquifers and their potential will help the agencies involved in water supply in ascertaining, how much volume of water is under their control. The robust and implementable ground water management plan will provide a “Road Map” to systematically manage the ground water resources for equitable distribution across the spectrum.

With this background the following aspects are identified as most significant in the context of present study area:

- To understand the aquifer disposition of the area.
- Majority of the area of the taluk, which is part of Malnad area, is having less groundwater potential. To increase the resource of the area, suitable artificial recharge measures to be recommended.
- By considering groundwater quantity and quality aspects suitable groundwater management strategies to be adopted.

1.2 Approach and Methodology

In order to achieve above mentioned objectives, present study incorporated collection and compilation of available information on aquifer systems. The work has been approached through demarcation of aquifer extents, characterization and finally compilation of this information in form of aquifer maps at 1:50000 scale along with block-wise groundwater management plan. The approach and methodology followed for Aquifer mapping is as given below:

Compilation of existing data (Central & State Govt.)

↓

Generation of different thematic layers

↓

Identification of Primary Aquifer

↓

Identification of data gaps

↓

Data generation (water level, exploration, geophysical, hydro chemical, hydrogeological etc.

↓

Aquifer Maps with 3D disposition

↓

Preparation of Aquifer Management Plan

↓

Capacity building in all aspects of ground water through IEC Activities

Artificial recharge measures are proposed based on the feasibility in the area based upon earlier prepared Master Plan for Artificial Recharge of Groundwater. For the purpose, groundwater flow system has been conceptualized based on collected data, keeping in view of sustainable groundwater development. Groundwater quality data has been analysed and vulnerable areas were demarcated. Methodologies adopted include preparation of various thematic maps like land-use and land cover map, geomorphological map, geological & hydro geological map by using various GIS tools. Hydrogeological sections, panel diagrams, geophysical sections, hydro-chemical diagrams were prepared. Data from concerned agencies/departments were also collected for preparation of status of data gap. Groundwater resource data has been taken from 'Report on Dynamic Groundwater Resources of Karnataka State-2020' by CGWB. Groundwater level has been monitored from existing NHS wells as well as from newly established key wells. Groundwater quality data is based on water samples collected from existing NHS wells and from established key-wells during June-2022. Based on outcome of various analyses, block-wise groundwater management plan has been prepared. By considering groundwater quantity and quality aspects suitable groundwater management strategies to be adopted.

1.3 Area Details

Aquifer mapping studies have been carried out in Siddapura taluk, Uttar Kannada district of Karnataka covering an area of 862.65 sq. kms under National Aquifer Mapping Project. Siddapura taluk of Uttar Kannada district is located in between North Latitudes 14° 12' 32"and 14° 33' 40"and between East Longitudes 74° 37' 4" and 74° 58' 37"and is falling in parts of Survey of India Toposheet 48I/2, 48/5, 48I/6, 48I/7, 48I/10, 48I/11. The study area is bounded on the North by Sirsi taluk, on the East and South by Shimoga taluk, on the west by the Honavar and Kumtha taluk of Uttara kannada district. Location map of Siddapura taluk of Uttar Kannada district is presented in Fig-1.1.

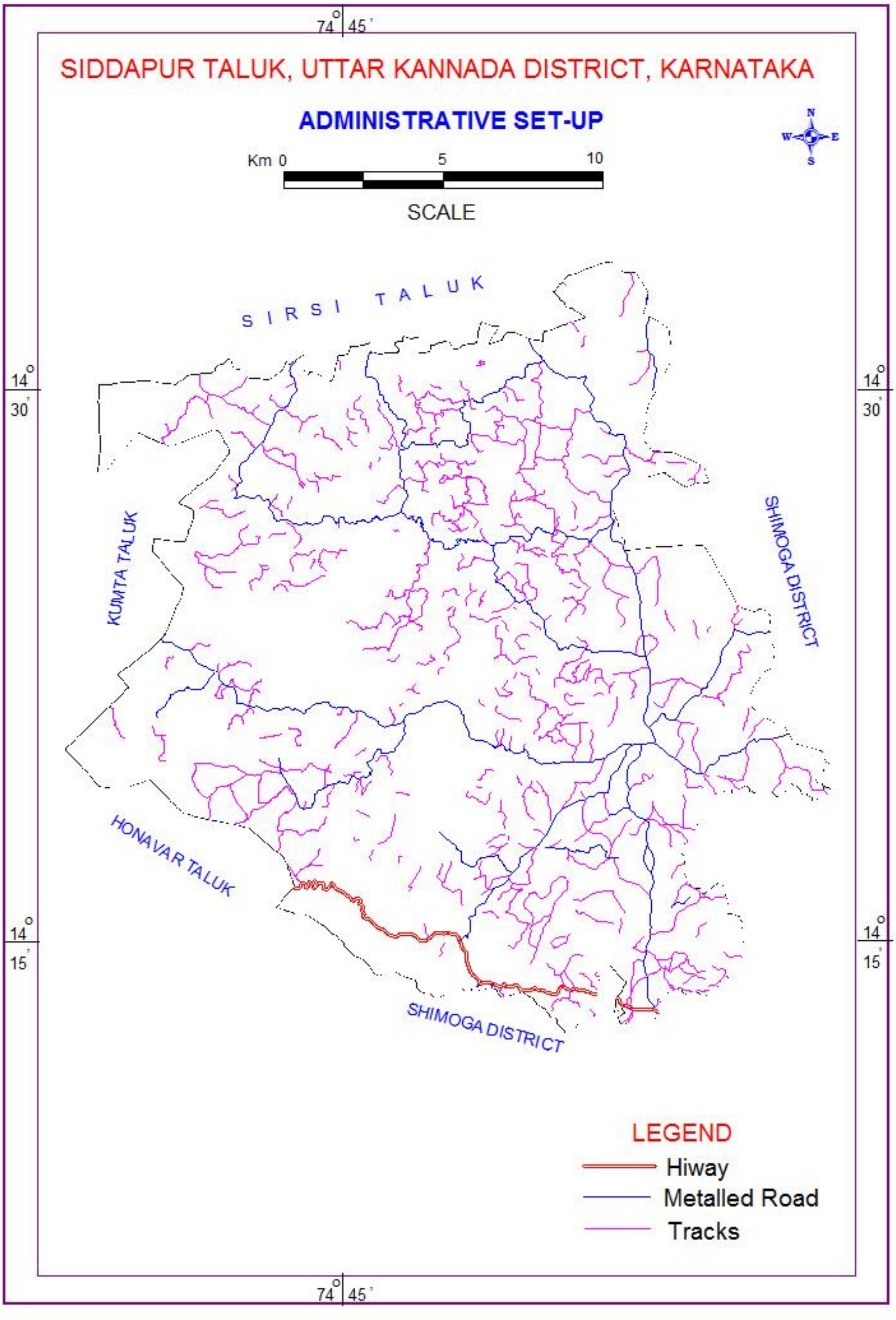

Fig. 1.1 Location Map of Siddapura taluk covered under NAQUIM

Administratively, Siddapura falls in Sirsi subdivision of Uttar Kannada district and has majority of rural settlement than urban settlement. The taluka has only 1 town Panchayat, 23 gram panchayats and 196 villages of which 195 villages are inhabited and 1 is un Inhabited.According to 2011 census, the human population in Siddapura taluk is 97322 out of which17% constitutes the urban population and 83% constitute the rural population. The taluk has an overall population density of 113 persons per sq.km. In Siddapura taluk the decadal variation in population from 2001-2011 is 1.10%. The population details are given in Table-1.1.

Table-1.1: Population details of Siddapura taluk

Total	Male	Female	Share of the district population	Rural population	Urban population	Decadal change in population	Decadal change in rural population	Decadal change in urban population
97322	48221	49101	6.77	83118	14204	-3.52	-4.26	1.10

(as per 2011 population census)

1.4 Brief Description

Siddapura taluk comes under Sirsi sub-division of Uttar Kannada district with taluk headquarter located at Siddapura. The taluk is drained by Aghanashini River, Sharavathi River and its tributaries. The taluk forms part of the Western Ghat hill ranges and therefore blessed with lush green forests and wild-life. The majority area of the taluk comprises of forest land followed by agriculture land. The taluk is part of Malnad area consisting of the Sahayadri hill ranges, valleys and undulating eastern table-land topography.

1.5 Data Availability

Central Ground Water Board carried out hydrogeological surveys, reappraisal surveys and groundwater exploration in different parts of the taluk. Ground water regime monitoring is carried out on a regular frequency during January, May, August and November every year. The data available from the earlier surveys have been compiled and data gap analysis has been carried out for working out the need for additional data generation in the study area.

1.6 Rainfall and Climate

The climate of the taluk as a whole can be termed as tropical monsoon climate. The taluk falls under Hilly agro-climatic zone. The temperature starts rising from January to peak in May, around 30°C in common. The highest day temperature may rise up to 38 °C. The humidity is lowest in the dry season and highest during monsoons. The winds are predominantly south-westerly during summer monsoon and north-easterly during winter season. The year may be classified into four seasons. The dry season from January to February with clear and bright weather followed by hot weather from March to May. During this season, thunderstorms are common in the month of May. The monsoon from June to September. The period from October to December is termed post-monsoon season. The southwest monsoon sets in usually during the early part of June. Generally, June, July and August are the months of heavy rainfall and the precipitation in July is incessant and very heavy.

Table-1.2a: Statistical Analysis of Monthly and Annual Normal Rainfall of Siddapura taluk, Uttar Kannada District

Monthly, Seasonal and Annual Normal Rainfall of Siddapura taluk, Uttar Kannada District												
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
NRM	2	1	9	35	74	612	984	705	194	151	41	11	2819
ST.DEV	12	3	26	41	64	196	371	254	119	83	64	20	534
CV%	240	178	195	70	99	37	38	49	53	55	124	184	20

Table-1. 2b: Monthly rainfall (from 2010-2019) in Siddapura taluk.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2010	66	0	0	71	45	467	1205	536	456	225	108	1.6	3181
2011	0	0	0	65	21	976	1164	621	636	113	88	0	3684
2012	0	0	0	113	3	328	673	890	253	65	61	0	2386
2013	0	7	0	13	0	328	673	890	253	65	61	0	2290
2014	0	0	1.2	34.6	125	470	1588	993	301	81	3	95	3691.8
2015	0	0	24	30	93	886	487	368	160	103	27	0	2178
2016	0	0	0	0	44	448	590	549	175	74	16	0	1896
2017	0	0	0	0	68	668	904	438	115	180	20	0	2393
2018	0	0	46	35	110	672	1145	874	71	62	7	5	3027
2019	0	0	0	15	0	323.4	1284	1634	593	444	2	0	4295.4

(Source: District at a glance, 2019-‘20)

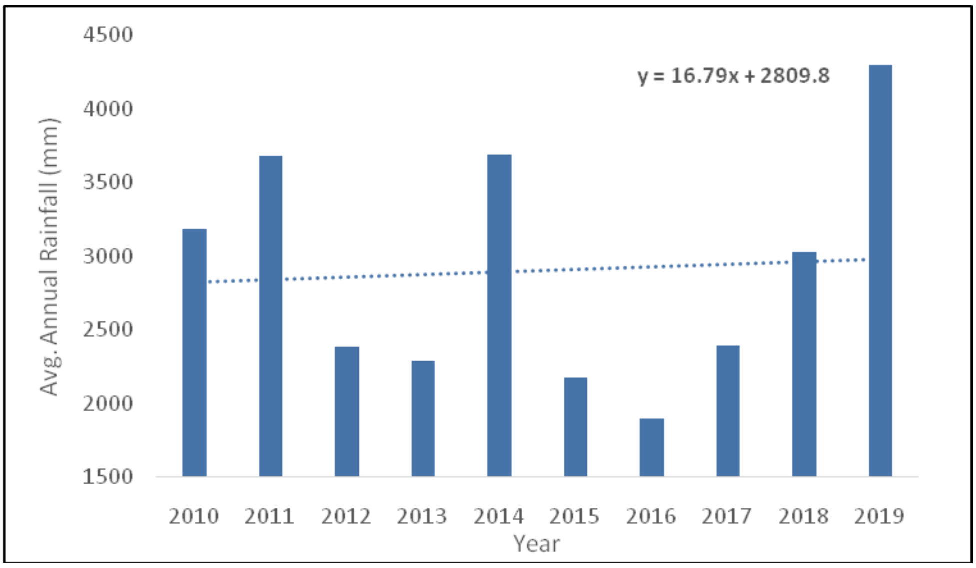

Fig.1.2: Month-wise rainfall from 2012 to 2021 (Source: IMD Website)

1.7 Physiographic Setup

The area can be broadly divided into two major physiographic units. The western hilly area made up of Sahayadri ranges and the eastern plateaus, undulating plains and table-lands forming part of Semi-Malnad region. Elevation of the hilly terrain ranges from 1000 m to 500 m above mean sea level.Eastern part of the taluk is under cultivation while the western part comprises of dense tropical rain forest. A digital elevation model (DEM) generated from SRTM has been provided in figure 1.3. The undulating topography of the area is clear from the elevation variation (from 25 m to 800 m amsl). However, in most part of the taluk, the elevation varies from 375 to 625 m amsl.

1.8 Geomorphology

Geomorphologically, the taluk can be divided into the western hill ranges, and eastern plateaus and table lands. The taluk is drained by river Aghanashini River and its tributaries. The western part of the taluk is covered by Pre-cambrian crystalline rocks. The eastern part of the taluk is covered by plateau hills, pediment-pediplain complexes and flat table lands. As per the geomorphology map (fig. 1.4), majority of the area is covered by plain table-land followed by the Sahayadri hill-valley system. In the south and south-western parts, number of meta-volcanic rock outcrops can be observed.

The Siddapura taluk form the western parts and is covered by hills and valleys. A “rugged terrain” marks the western part of the taluk with deep cutting ravines on the foothills of the

Western Ghats. The elevation of these hills varies from 858m amsl around Hulund to 1014 m amsl around Kalmani.

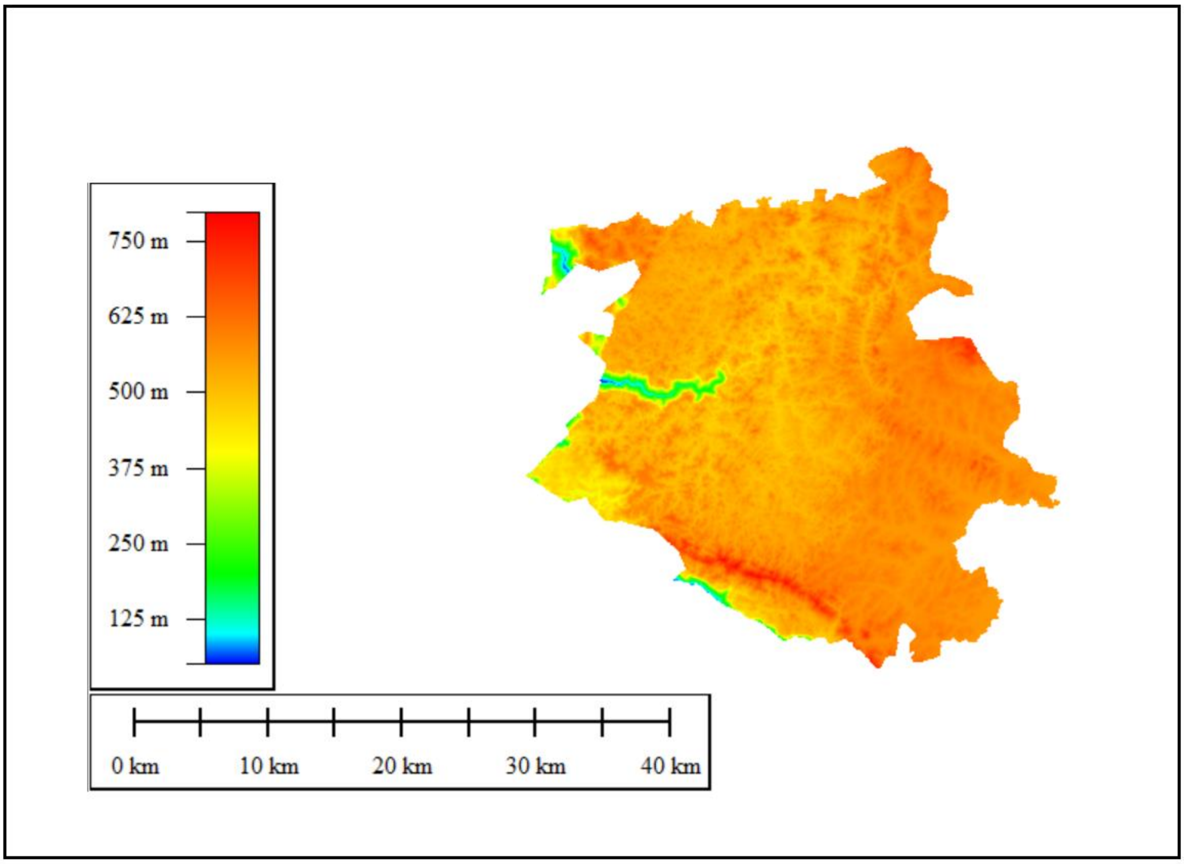

Fig. 1.3:SRTM DEM of Siddapura taluk

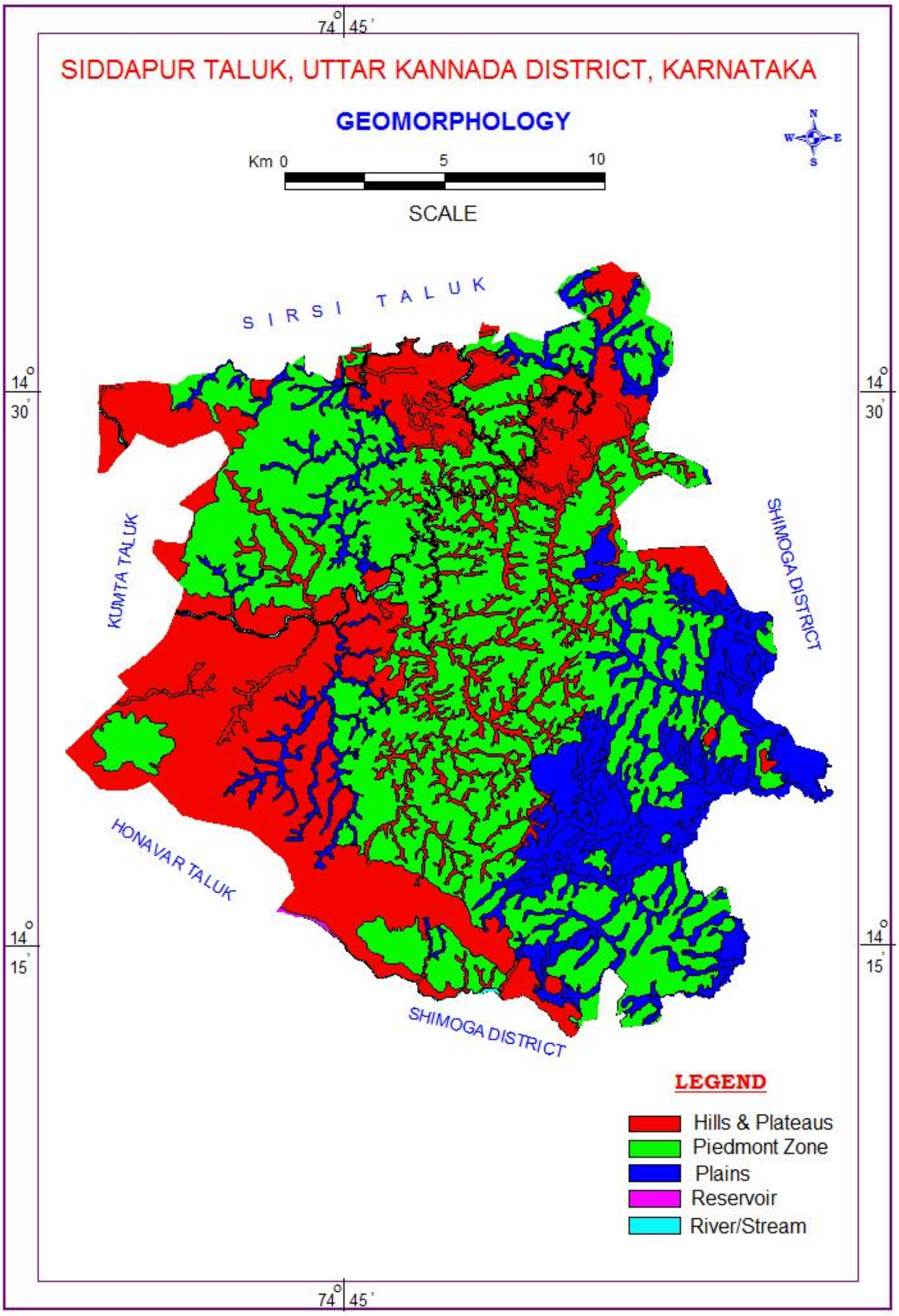

Fig. 1.4: Simplified geomorphological map of Siddapura taluk

1.9 Land-use, Land-cover Pattern

Majority of the geographical area in Siddapura taluk comprises of forest and grass land followed by agriculture land. As per the record of Department of Agriculture, Government of Karnataka, the forest covers of the taluk is 68130 ha (More than 79%). Out of the total net sown area 82.4% is contributed by cereal cultivation. A map showing landuse pattern of the area is given in fig. 1.5.

Table. 1.3: Land use land cover data of Siddapura taluk (source: Bhuvan)

Landuse type	Area (ha)	Percentage area (%)
Agriculture, Crop land	14353	16.7
Forest and grass land	68130	79.29
Agriculture, Fallow	712	0.82
Area not available for cultivation	869	1.01
Other uncultivable land	1332	1.55

1.10 Soil

Major soil class in the taluk is clayey and clay-loamy soil (Fig. 1.6). Based on the mode of origin, they are categorised into Red Soil, Mixed Red and lateritic Soils, and Lateritic soils.Lateritic soils occur in Malnad region including Siddapuraa, Sirsi, Yellapur, Sagara, Mudigere, Sakleshura and Sowarpettalukas and is covered under forest. These soils are very well drained and very deep, yellow red to dark red in color, with iron gravel (33 to 66%), slightly acidic to neutral (pH 6.4 to 6.7), with organic carbon of 1.03 to 0.67 percent, base saturation of 68 to 72 percent and CEC of 9.0 to 10.8 Cmol (+) per kg. The soil has loamy texture. These soils have problems of surface crusting and compaction with the result runoff is high and soil erosion is severe.

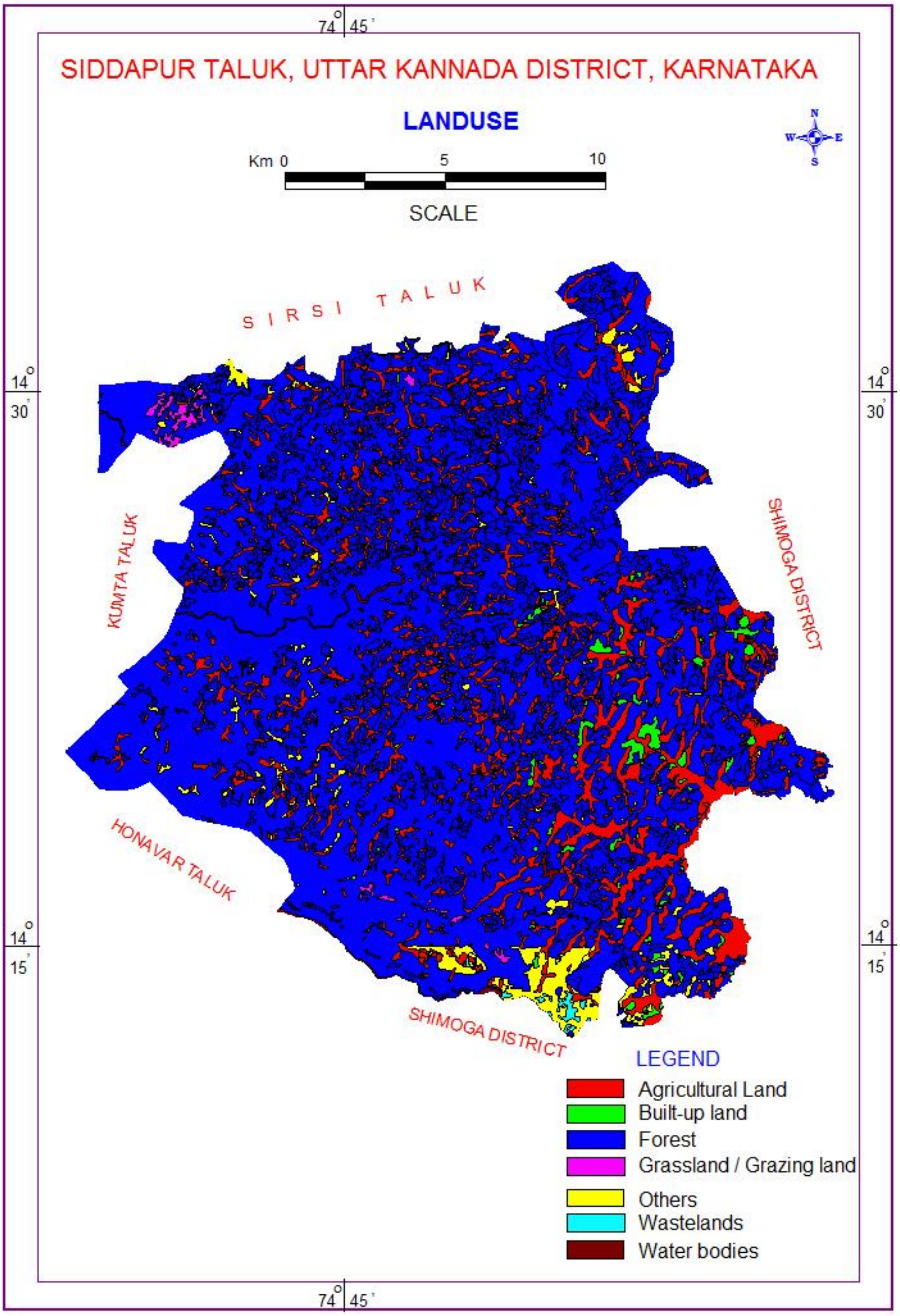

Fig. 1.5:Landuse map of Siddapura taluk

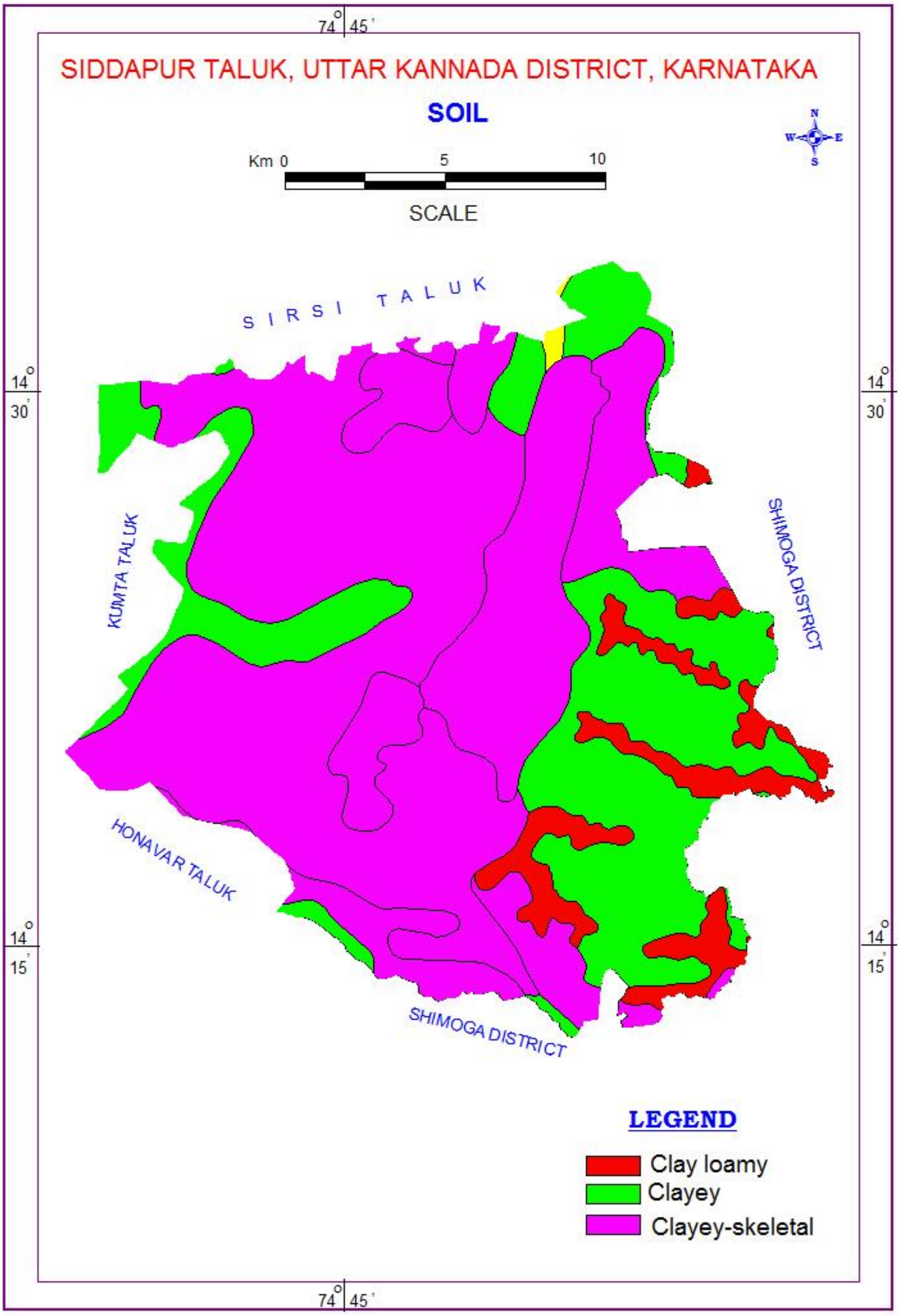

Fig. 1.6: Soil map of Siddapura taluk

1.11 Hydrology and Drainage

Drainage in Siddapura taluk is contributed by river Aghanashini, and its tributaries. Apart from these, numerous lower order streams originate from the Western Ghat hill ranges. The major part of Siddapura taluk falls in West flowing river basin and a small portion on the south-western portion of the taluk falls in Krishna basin. The river Aghanashini also known as Tadri river flows into the Arabian Sea about 10 Km south of Gangavali. This stream originates from Sirsi taluk, flows southward then westerly flows in siddapura taluk and forms a lagoon parallel to the coast near the confluence with the sea. The drainage system in the area is by and large structurally controlled and follows the lineaments. Fractures, joints, fault planes form these structurally controlled lineaments in the taluk. Drainage map of the taluk is prepared and given in fig. 1.7.

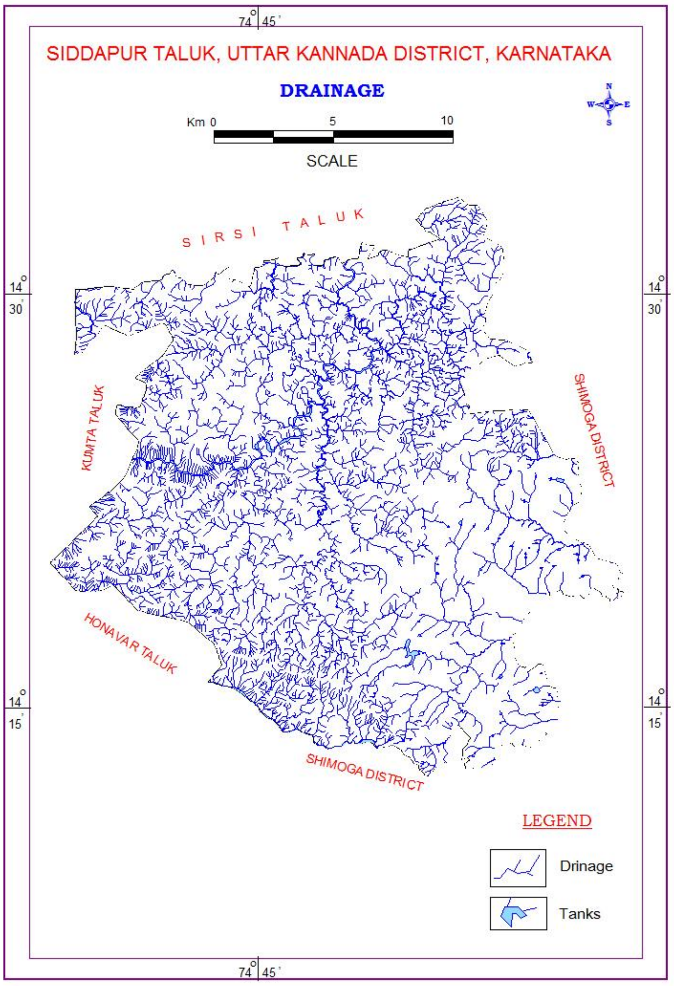

Fig. 1.7: Drainage map of Siddapura taluk

1.12 Agriculture

The taluk comes under hilly agro-climatic zones. The net sown area of the taluk is 14353 ha and cropping intensity is 111%. (Source: District at a glance-Uttara Kannada). The major crop cultivated in the taluk are cereals such as paddy (82%) followed by horticrops and commercial crops (16.29%). Rest of the area is mainly used for cultivation of other cereals, pulses, oil seeds, spices etc.. Apart from these, plantation crops are also cultivated in the taluk.

1.13 Irrigation Practices

In Siddapura taluk, out of the 14353 ha net sown area, 19.25% are being irrigated by different sources and 14.02% area are being irrigated more than once. 46.5% of the net area is irrigated by other sources. On the other hand, open wells and tube wells constitute 34.02% of the net irrigated area. The gross area irrigated through all sources in the taluk is 4776ha and net irrigated area is 2763 ha. A graph showing net area irrigated by various sources are given in fig. 1.8.

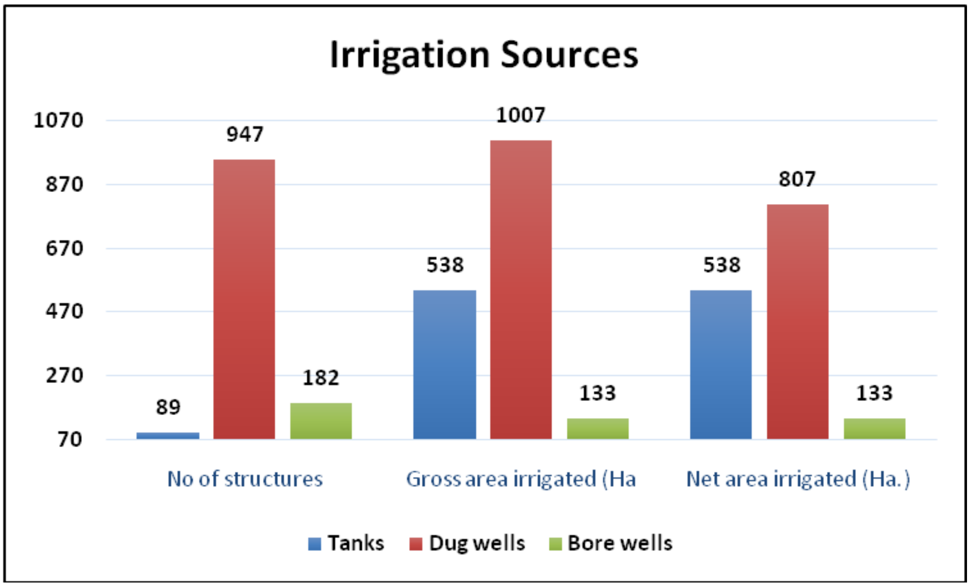

Fig. 1.8: Graph showing area irrigated by various sources in Siddapura taluk

1.14 Cropping Pattern

The cropping calendar starts from the month of July and continue to the month of June of the succeeding year before the onset of monsoon. Thus a calendar year is divided into two crop season viz., Bhadai, Aghani, Rabi and Garma. During Kharif season, irrigation in the taluk is mainly dependent on monsoon rainfall. However, both rabi and garma crops are mainly depended groundwater. The season-wise major crops under irrigation in the taluk is given in table 1.4.

Table 1.4: Season-wise crops cultivated in Siddapura taluk

	Kharif	Rabi	Summer
Paddy	6200	0	300
Pulses	0	0	75
Sugar Cane	50	0	0

1.15 Prevailing Water Conservation/Recharge Practices

In Siddapura taluk, the existing village ponds and tanks associated with agriculture field acts as water conservation structures. Apart from these, check dams, point recharge structures can be effectively utilised in the western sector while roof top rain water harvesting structures can be recommended in the eastern sector which is comparatively urbanised than the western sector.

1.16 Geology

Geologically, Siddapura taluk is characterised by various litho-units spanning from Archaean to Present day deposits. Geologically, the area forms part of Shimoga Schist belt of Western Dharwar Craton, comprises of gneisses of various grade, manganiferous phyllites, schists of various grades, greywacke and basic intrusive and its metamorphosed varieties. These litho-units are covered by on the top by ferruginous duricrusts/laterite (Radhakrishna and Vaidyanathan, 1994). Gneisses are tonalitic-trondhjemite-granodioritic in composition and form a basement for the wide spread schist, phyllites and greywackes of Archean age. Laterites of Tertiary period formsone of the major lithounits of the study area, is of in-situ in nature. It is porous/concretionary in nature and composed of higher concentration of FeO, Al2O3, MgO etc. A simplified geological map of Siddapura taluk is prepared from the existing published map of GSI and given under Fig. 1.9.

Age	Supergroup	Group	Lithology
Cenozoic			Laterite
Palaeoproterozoic			Dolerite/Basic intrusives
Archaean	Dharwar	Shimoga	Metapelites-Low grade metamorphics/ BIF
Archaean	Dharwar	Bababudan	High grade metamorphics
Archaean	Peninsular Gneissic Complex (PGC)	PGC-I	Granite Gneiss

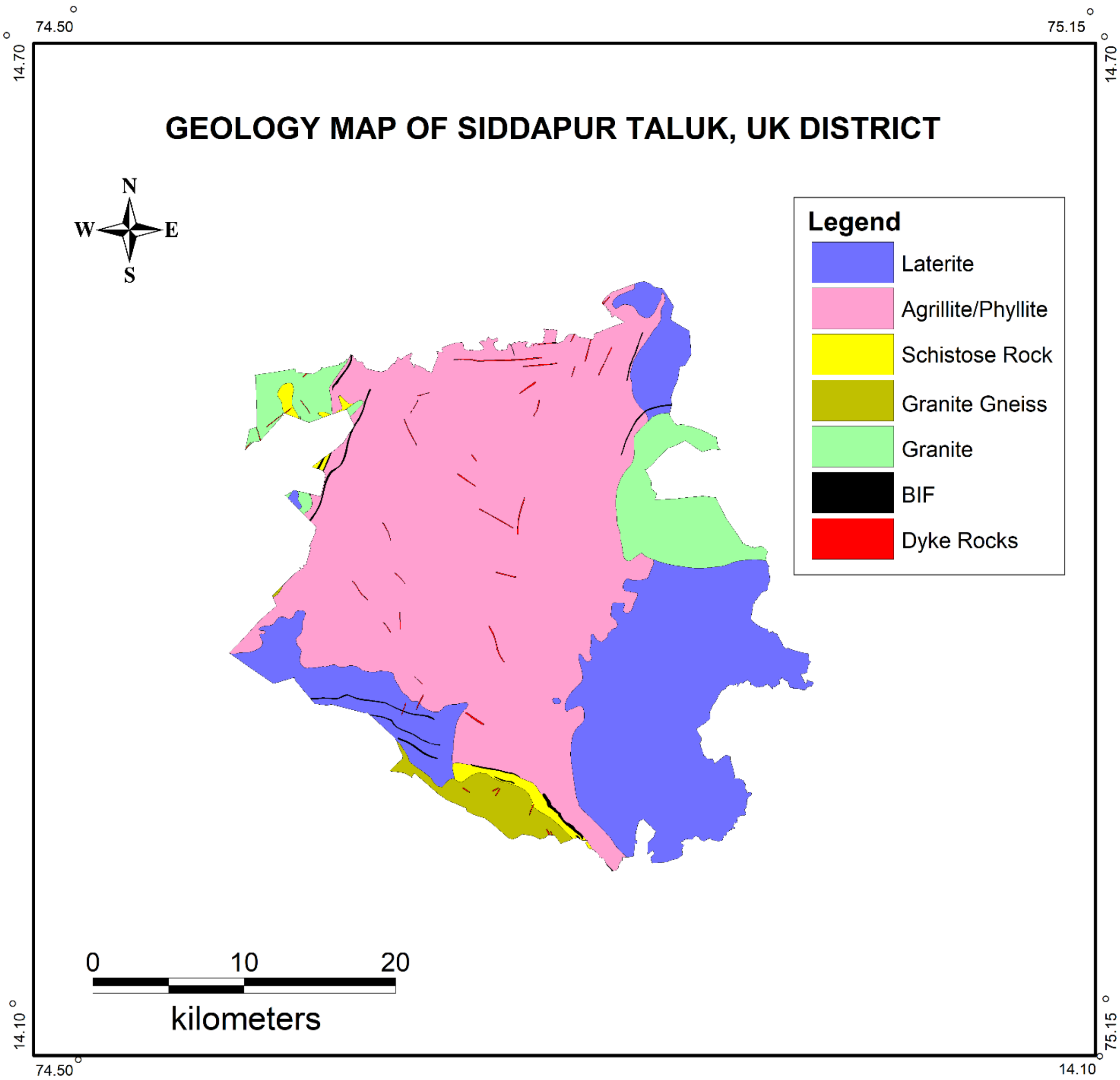

Fig. 1.9: Simplified Geological Map of Siddapura taluk

2. DATA COLLECTION AND GENERATION

The primary data such as water level, quality, and exploration details available with CGWB has been collected and utilised as baseline data. The Central Ground Water Board has established a network of observation wells under National Hydrograph Network programme to study the behaviour of ground water level and quality of ground water in the taluk. To understand the sub–surface geology, identify the various water bearing horizons including their depth, thickness and compute the hydraulic characteristics such as transmissivity and storativity of the aquifers, exploratory drilling programme was carried out by Central Ground Water Board. For other inputs such as hydrometeorological, Landuse, cropping pattern etc. were collected from concerned State and Central Govt. Departments and compiled.

2.1 Hydrogeology

Geologically, Siddapura taluk is characterised by the presence of phyllite/schistose rocks and high grade metamorphics at the central part as well as patches of BGC and lateritised gneissic and schistose rocks in the eastern and south western part. While recent alluvium of Quaternary age are confined to river channels and its old terraces. The alluvium sedimentation is considered to be the result of transport and deposition of riverine sediments by river system. However, this sedimentation does not form potential aquifer system in the taluk. In rocky uplands of Sahayadri ranges, highly weathered, fractured and jointed gneisses, schists and meta-basalts form the groundwater reservoirs.

2.2 Data-gap Analysis

Scientific data on groundwater regime available with State and central agencies were utilised for optimizing additional data requirements. Additional data were generated on ground water monitoring wells, litholog, water quality were incorporated and interpreted with the objectives of generating a visualization of the aquifer systems in the area. Identification of gaps in the existing data on various aspects of the aquifer being mapped. A table pertaining to datagap analysis is given in Table 2.1

Table 2.1: Data gap analysis of Siddapura taluk

#	Data Requirement	Data available with CGWB/State Govt. Agencies	Additional Data generated
1	Ground water level data	DW: 15	DW:13 BW: 12
2	Groundwater quality Data	DW: 15	DW: 13 BW: 12
3	Borehole Lithology Data	2	--
4	Geophysical Data (VES/TEM)	--	--
5	Pumping Test (EW/DW)	2	--

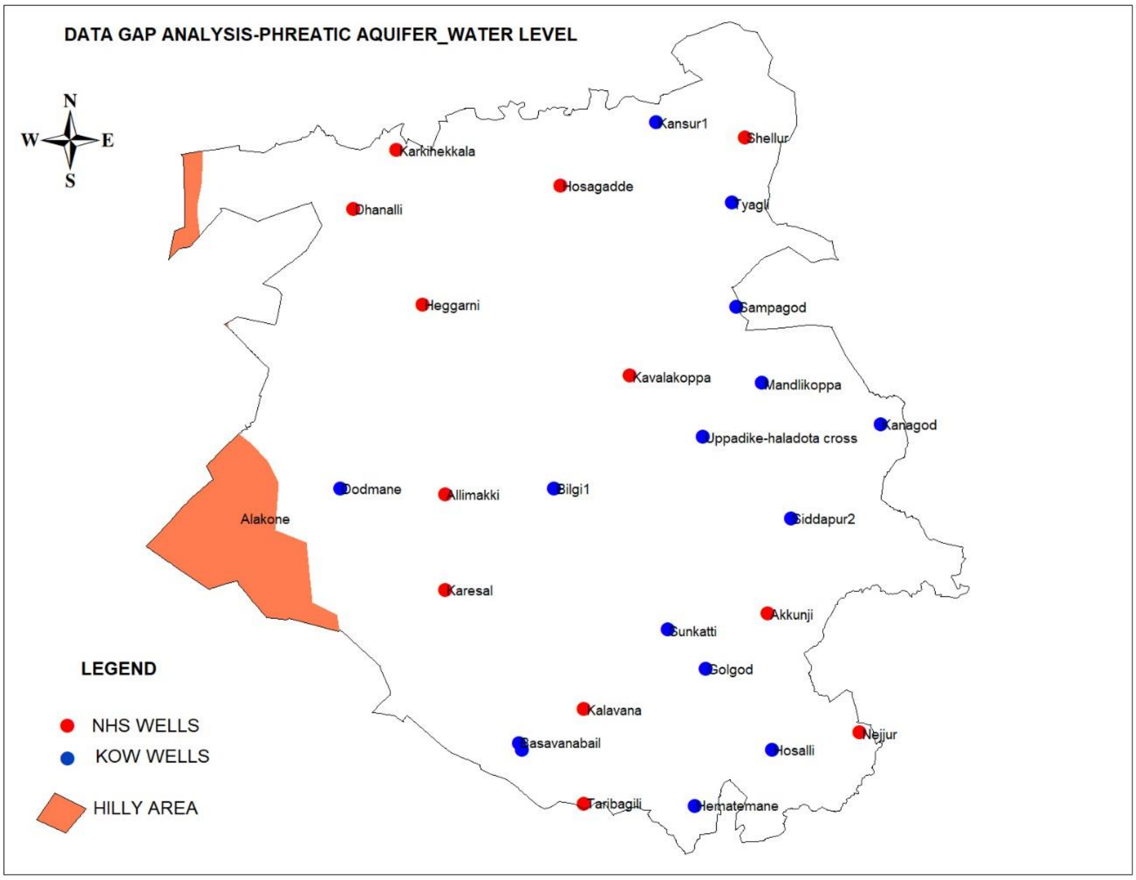

Fig.2.1: Location of monitoring Wells in Siddapura taluk

2.3 Depth to Water Level

Ground water monitoring had been carried out at 25 locations in the taluk during the course of study (2022-23) apart from the existing 15 monitoring stations. A map showing location of the established NHS monitoring stations and key wells in Siddapura taluk is prepared and given under Fig. 2.1. The depth to water level map representing the shallow/phreatic aquifer and deep/semi-confined to confined aquifer has been prepared for pre monsoon season (Fig. 2.2 & 2.3). Depth to water level map of phreatic aquifer shows that majority of the area has water level between 5 to 10 m bgl in phreatic aquifer system during both pre-monsoon and post-monsoonseasons. In the central part of the taluk, deep water levels are observed for both aquifer systems. This may be due to the presence of comparatively poor yielding meta-sedimentary rocks and Banded Gneissic Complex lithounits constituting the aquifer system present in this part, as well as clay-rich top soil which hinders the rate of recharge into the phreatic aquifers as well.

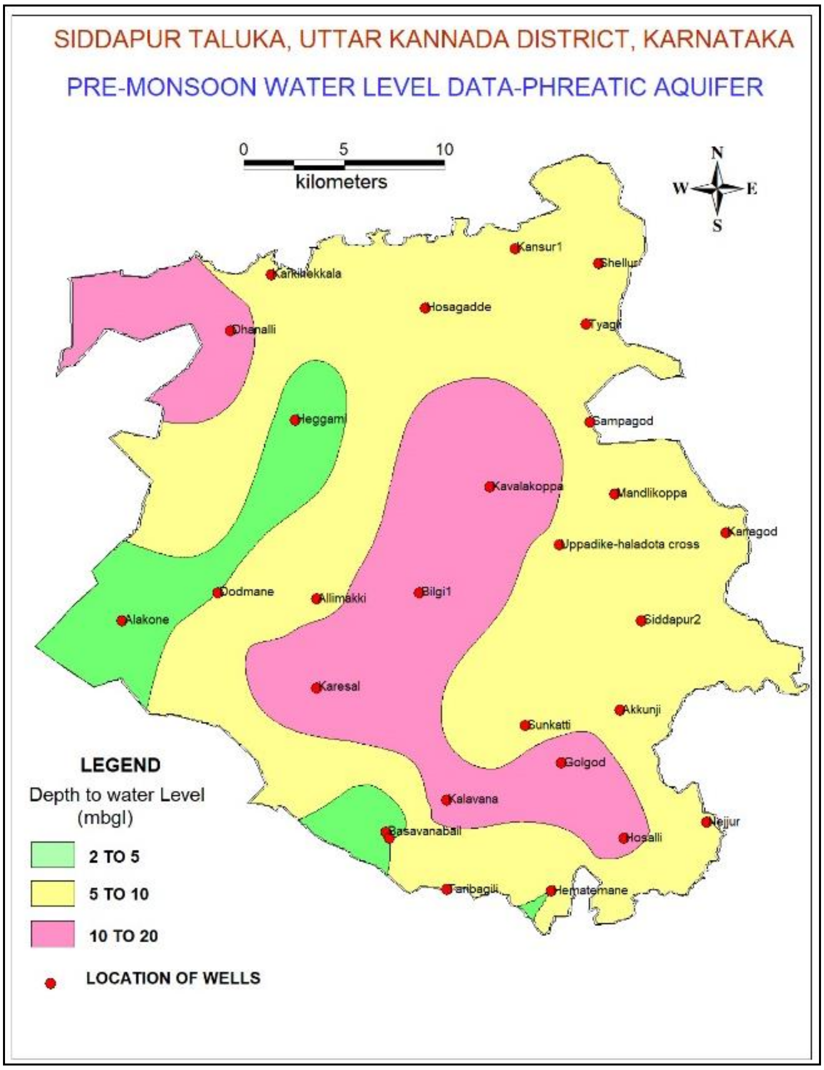

Fig. 2.2: Pre-Monsoon (May 2022)depth to water level map of phreatic aquifer of Siddapura Taluk

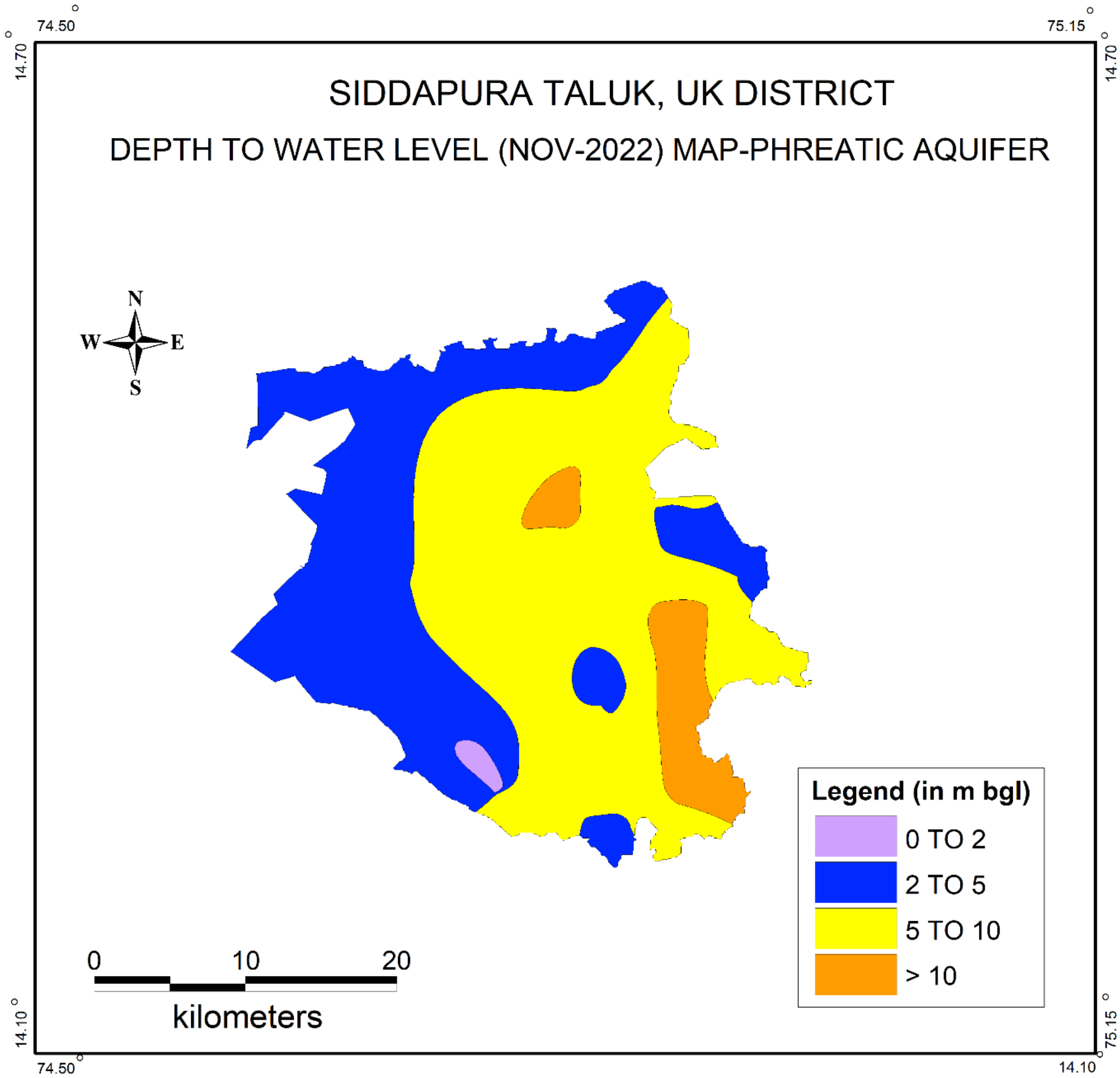

Fig 2.3:Post-monsoon (November 2022) Depth to water level Map of phreatic aquifer of Siddapura taluk

2.4 Long Term Groundwater Level Trend

Long term groundwater level trend over ten years (from 2010 to 2019) has been analysed by using data from established network monitoring stations in Siddapura taluk. Depth to water level during January, May, August and November months has been enumerated over this period and hydrographs were prepared (Fig.2.4 to 2.7). From the hydrographs, it can be seen that, most of the stations record flat trend of groundwater level over long term. The long term groundwater level trend is given in table 2.2.

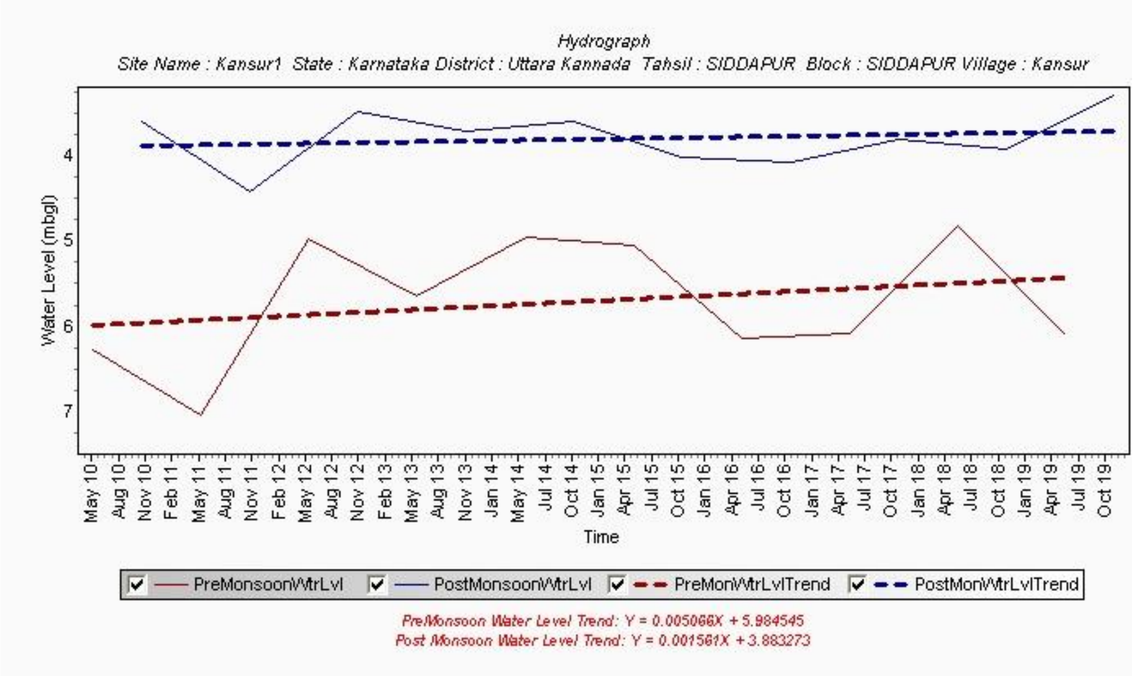

Fig. 2.4: Hydrograph of NHS monitoring Well at Kansur

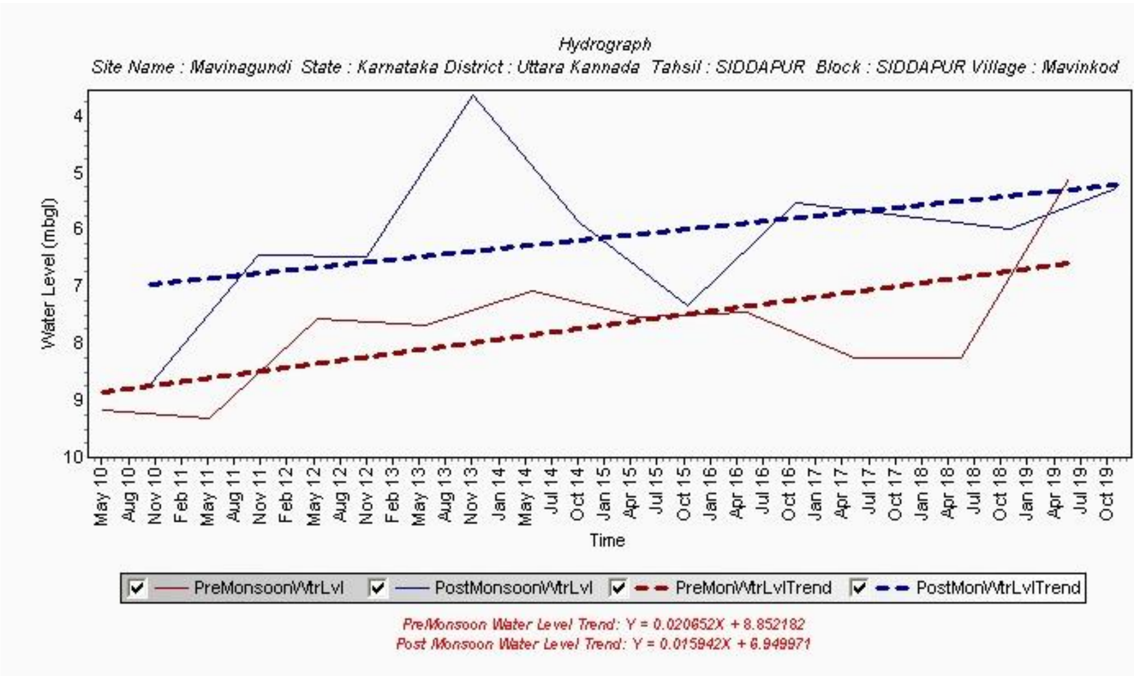

Fig. 2.5: Hydrograph of NHS monitoring Well at Mavinkod

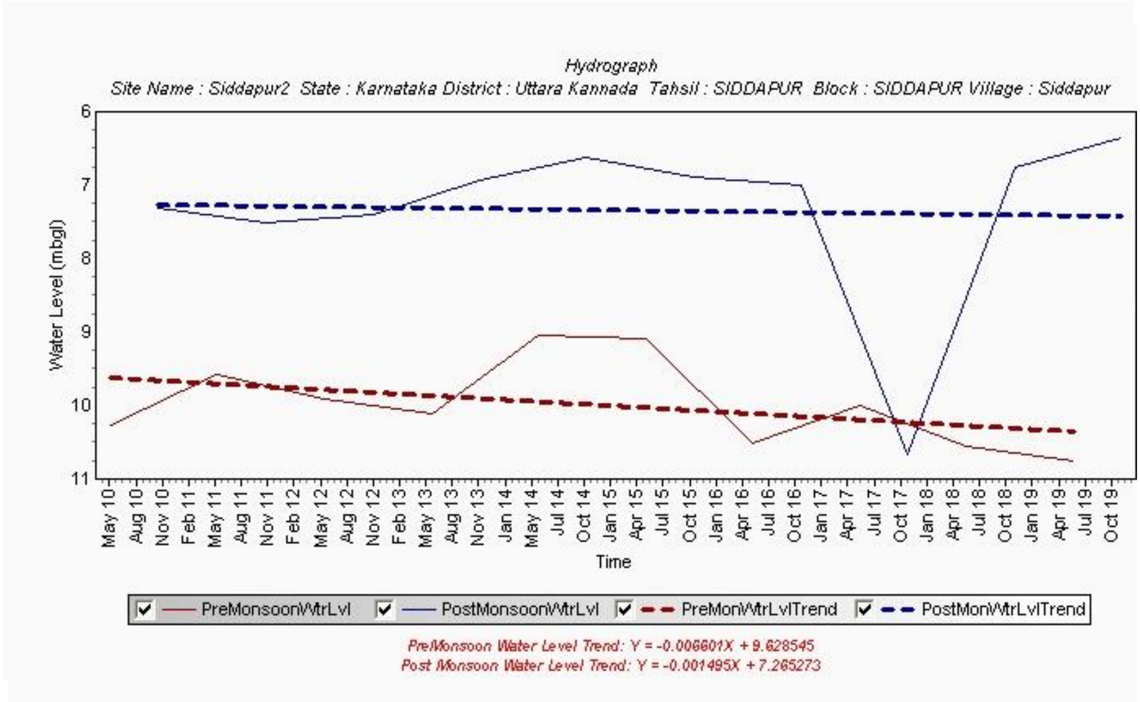

Fig. 2.6: Hydrograph of NHS monitoring Well at Siddapura

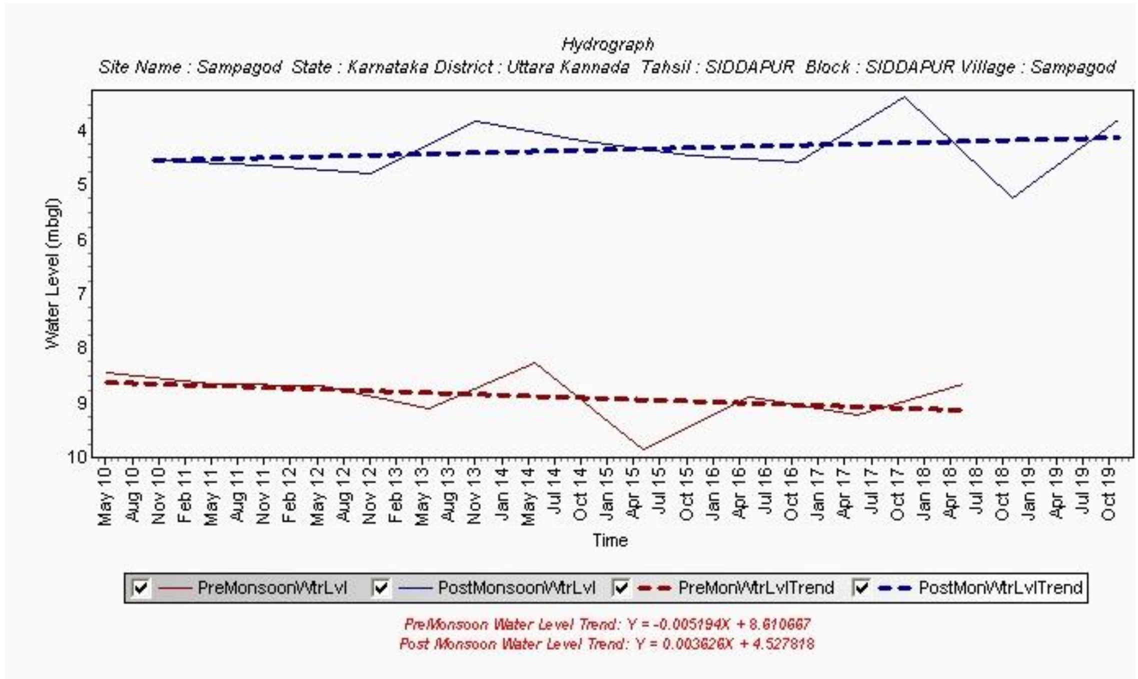

Fig. 2.7: Hydrograph of NHS monitoring Well at Sampagod

Table 2.2: Showing long term groundwater level trend of some NHS wells in Siddapura taluk

Sl. No.	NHS Well	Pre-monsoon Trend (cm/year)	Post Monsoon Trend (cm/year)	Pre/Post Trend
1	Kansur	0.51	0.15	Flat/Flat
2	Mavinkod	2.06	1.59	Slightly rising/ Slightly rising
3	Siddapura	-0.66	-0.15	Flat/Flat
4	Sampagod	-0.52	0.36	Flat/Flat

2.5 Exploratory Drilling

Sub-surface lithological information (down to 193mbgl) from the available drilling records of exploratory well of CGWB and sub-surface information obtained during field study have been tabulated in Table 2.3.

Table 2.3a: CGWB Exploratory Well Details

Sl.No.	Location	Block	Longitude	Latitude	Depth Drilled(m bgl)	Casing Depth (m)
1	Kansur	Siddapura	74.8513	14.5091	193.15	20.25
2	Halageri	Siddapura	74.8525	14.2816	80.3	29.05

The exploratory bore wells drilled in Siddapura taluk are having depths ranging from 80.3 to 193.15 m bgl. The discharge ranges between negligible to 7.5lps. The yield cum recuperation tests conducted on the wells show that the general specific capacity upto 68.28lpm/m/d.d. The transmissivity of aquifer material in upto 76.95 m2/day.

Table 2.3b: CGWB Exploratory Well Details

Sl. No.	Location	Depth/ Casing	Zones in m	SWL in mbgl	Q (LPS)	DD (m)	T (m2/day)	S
1	Kansur	193.15 / 20.25		0.5	0.6		7.42	
2	Halageri	80.3 / 29.05	44.7-45.70, 75.2-76.2, 65.05-66.05, 75.20-76.20	2.75	9.9	6.59	76.95	68.25

2.6 Hydrogeochemical Data

2.6.1 Water Quality Sampling, Number of Samples and Analysis Mechanism

Groundwater quality of an area is a function of physical and chemical parameters that are greatly influenced by geochemical characteristics of the formations and anthropogenic activities. The concentration of the major ions and other dissolved ions in ground water are function of the availability of the constituents in the aquifer matrices and their solubility. Quality of ground water is as much demanding as its quantity. Suitability of ground water for drinking and irrigational purpose is important for its safe and effective use. In Saiddapurtaluk, both irrigation and domestic requirement are mostly depended on groundwater.

Groundwater quality studies have been done based on the samples collected from the study area during May/June-2022. A total number of 24 samples (12 DW+12BW) were collected for analysis. Water samples were collected and stored in 01 litre capacity clean high-density polyethylene bottles with poly-seal caps. Before collection of samples, bottles were properly washed and were rinsed by the water to be sampled. The hand-pumps were pumped for sufficient duration before collecting ground water sample so that the stagnant water, if any, is completely removed.

These water samples were analysed in chemical laboratory of CGWB SWR-Banglore. Besides these, available previous year data of chemical analysis of ground water were also studied to have an understanding of ground water chemistry of the area. From the chemical data it can be observed that pH of the dug well samples vary from 5.39 to 6.96 indicating that waters are slightly acidic.pH of bore well sample varies from 6.31 to 7.84 indicating samples are slightly acidic to alkaline.The prominent hydro chemical facies has been identified from Hill-Piper diagram (fig. 2.8& 2.9). From the diagram, it can be observed that majority of the analysed samples comes under 'Calcium Bicarbonate Type' facies for both phreatic and fractured aquifers. Analytical results of ground water samples are given in Annexure III.

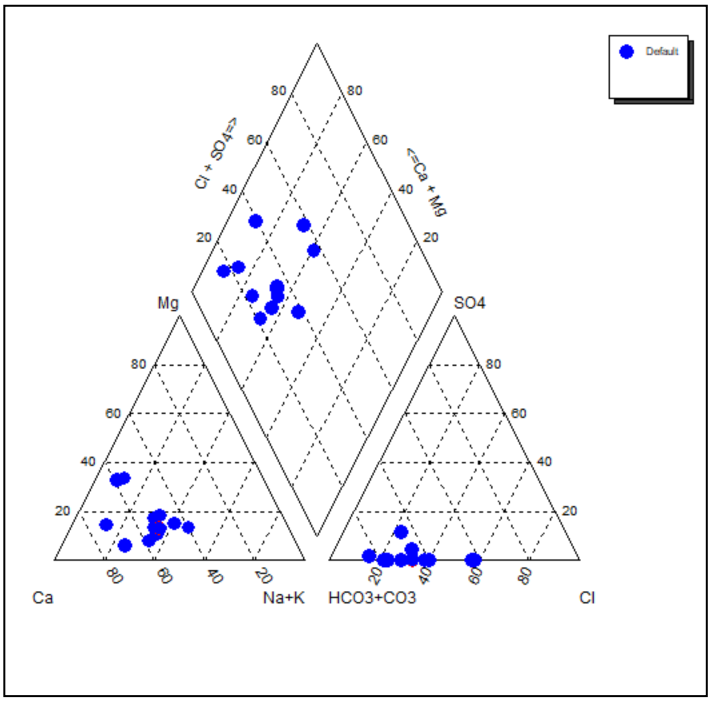

Fig. 2.8: Hill-Piper diagram for dug well samples collected from Siddapura taluk

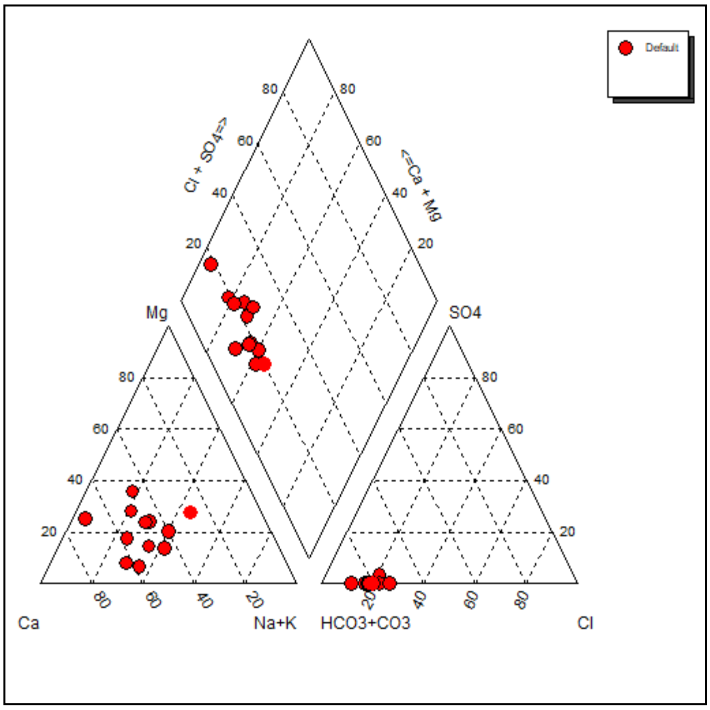

Fig. 2.9: Hill-Piper diagram for bore well samples collected from Siddapura taluk

Quality of irrigation water varies significantly based on its dissolved salts. The salts may originate from dissolution or weathering of rocks and soil. From the analysis data it can be seen that EC values ranges from 55 µS/cm (Hosagadde) to 255 µS/cm (Kalavana) for dug wells and 85 µS/cm (Nanikat) to 301 µS/cm (Kolsirsi) @ 25°, which is well within the permissible limit as per Bureau of Indian Standards (BIS) for drinking purpose. The results obtained from chemical analysis were plotted in USSL diagram as shown in figure 2.10 and 2.11. From the figure, it can be observed that all dug well and bore well samples have low SAR value and come under low salinity hazard zone. Therefore, groundwater from both dug wells and bore wells in the taluk is suitable for irrigation purposes.

From the Chemical data, it can be observed that the presence of fluoride concentration is slightly above the desirable limit in water samples collected from Aigod (1.04 mg/L). The sample is collected from domestic bore well. Presence of fluoride is suspected in the taluk where granitoid rocks are present. It is to be noted that fluoride contamination is reported in nearby Taluks such as in Sirsi and in Yellapur. Therefore, detailed investigation has to be done in order to decipher the mobilization mechanisms, spatial and temporal variation in concentration of fluoride in the taluk. Water quality data of State Govt. agencies indicate iron concentration above permissible limit (up to 2 mg/L) in Kulibeedu village.

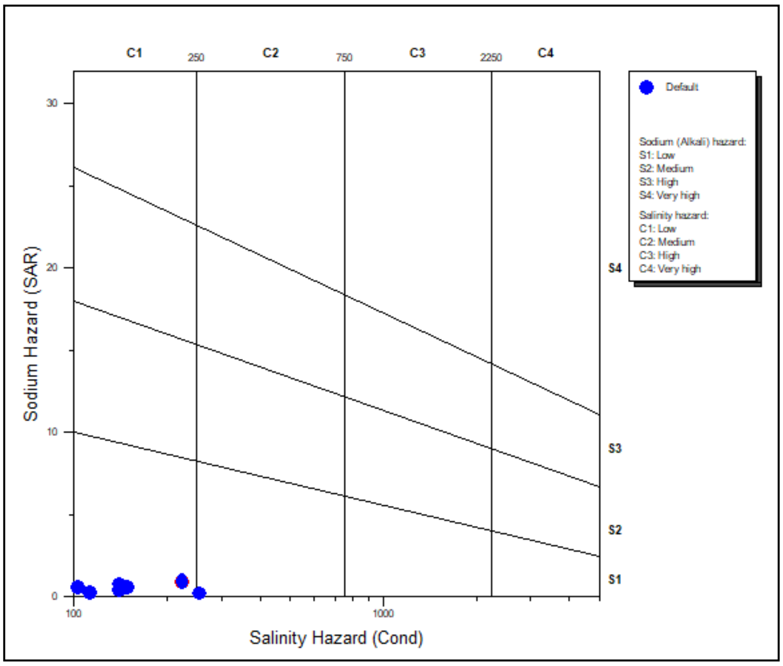

Fig. 2.10: US Salinity diagram for dug well samples collected from Siddapura taluk

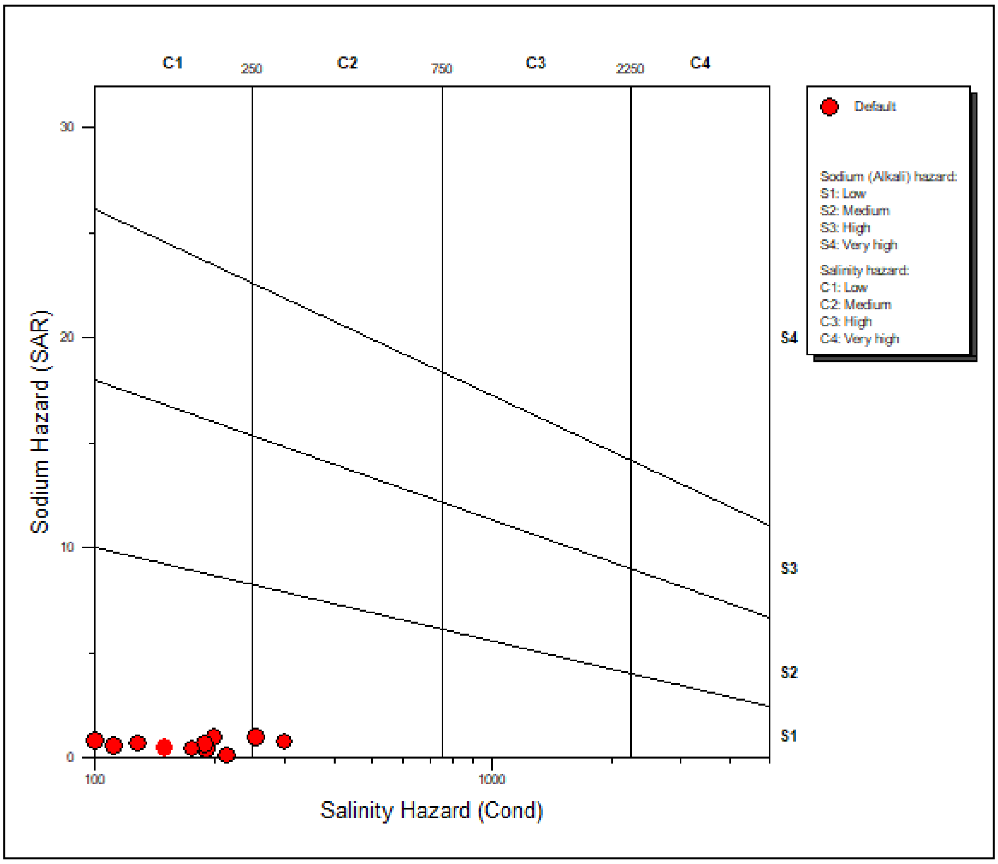

Fig. 2.11: US Salinity diagram for bore well samples collected from Siddapura taluk

3. DATA INTERPRETATION, INTEGRATION AND AQUIFER MAPPING

3.1 Hydrogeology

The study area comprises of rock formations belonging to Archaeaen to Cenozoic times. Majority of the area is comprised by low grade meta-sedimentary rocks, granite gneiss and schistose rocks. Laterites are developed in the southern and north-eastern part of the taluk over the meta-sedimentary sequences and over granite-gneisses. They are found to occur as plateau hills. Weathered rock formations and laterites form the phreatic aquifer system in the study area. While the fractured and jointed sub-surface fractured formation constitute deeper aquifer system. A table showing area covered under different lithounits are given below (Table 3.1).

Secondary porosity like joints, fissures and faults present in meta-sedimentary formation forms the deeper aquifer. Ground water occurs under phreatic condition, which generally occurs within the depth range of 3.00 to 30.00 m bgl. The sustained yield of dugwells ranges from negligible to 25 m^3/day. The fracture zones that occur at various depth zones within the depth of 193.15 m bgl are expected to be saturated with ground water. Laterite overlying the schists and gneissic-granites in moderate thickness acts as an aquifer locally. Ground water is being exploited from within the depth range of 10.00 to 30.00 m bgl through dug wells and 30.00 to 200.00 m bgl through dug-cum-bore wells and shallow bore wells.

Table3.1: Percentage area showing different lithounits of the study area

Lithology	Area (Sq. Km)	Percentage Area (%)
Dolerite	3	0.4
Granite Gneiss	20	2.4
Laterite	256	29.7
Banded Iron Formation	4	0.5
Agrillite/ManganiferousPhyllite	503	58.5
Granite	64	7.5
Chlorite-Actinolite-Hornblende Schist	9	1.1
Total	860	100.0

3.2 Aquifer Disposition

Aquifer disposition of the taluk has been studied through prepared sections based on the lithologs obtained through exploratory drilling done by CGWB and field observations. Based on this, detailed aquifer geometry on regional scale has been established in the study area. Principal aquifers in the area have been delineated by grouping the weathered/phreatic zone and fractured zones as aquifers. The fracture zones encountered at different depths are grouped into an aquifer system based on its lateral continuity.

The weathered formation and fractured meta-sedimentary rocks in the taluk are by large forms the aquifer system. A map showing depth to weathering of the formation is given in fig. 3.1. Average thickness of weathering varies from 10 to 40 m bgl. On the basis of drilling data, it can be observed that fractures in crystalline rocks are not isotropic and in many places, with limited subsurface extension. Further, schistose aquifers in the north and north western part of the taluk are poorly yielding as compared to the gneissic and laterite aquifers present in the south-eastern part of the taluk. The disposition of fractures, their attitudes, fracture density and vertical permeability are the major controlling factors responsible for the availability of groundwater yield.

3.2.1 Hydrogeological Cross-Section

The aquifer geometry and disposition of the taluk has been studied based on lithologs of exploratory bore holes as well as field observations. Hydrogeological cross-sections were prepared along A-A', B-B' and (fig. 3.2). The aquifer zones in the area have been found to occur under phreatic condition at shallow depth, primarily in the weathered formation, followed by semi – confined condition in fractured & jointed formation below the weathering zone. Geological formations occurring in the taluk are meta-sedimentary sequence, Granitic Gneiss; various grades of schists and phyllites; laterites, and limited occurrence of high grade schists.

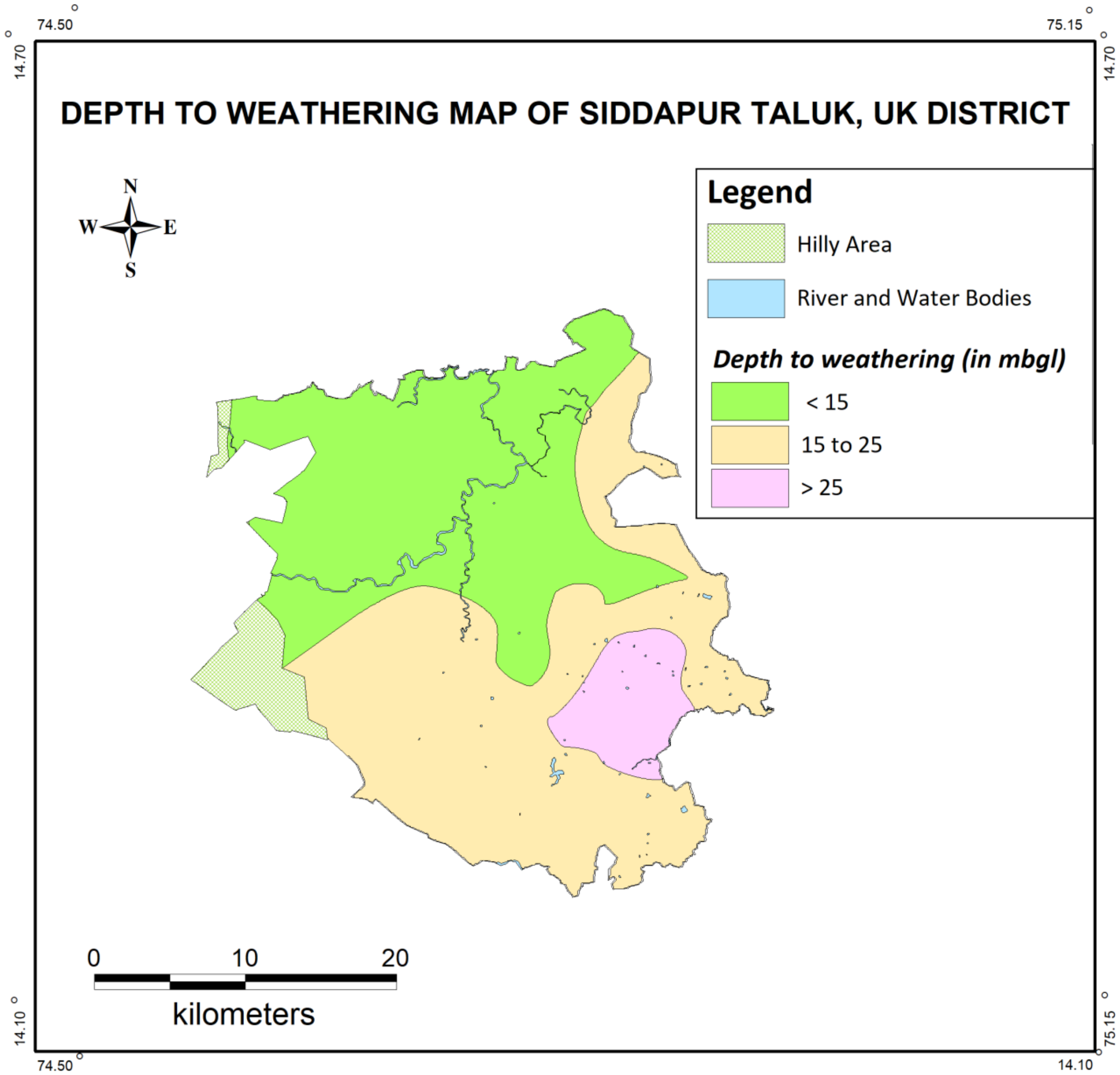

Fig. 3.1: Depth to weathering map of Siddapura taluk

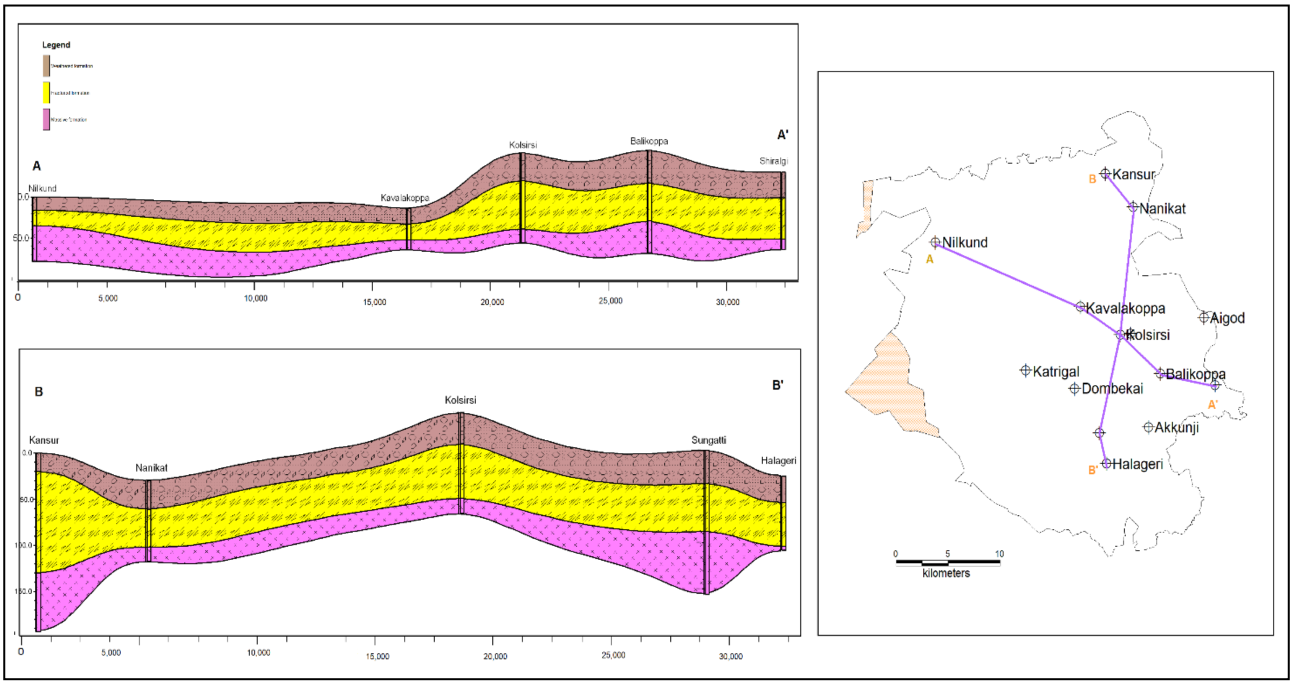

Fig. 3.2: Hydrogeological section taken along A-A' and B-B' of Siddapura taluk

Hydrogeological fence of the study area has been prepared and is shown in fig.3.3. It is to be noted that the yield of wells tapping the fractured formation is site specific and exclusively depend upon the availability of interconnected productive fractures. Fracture density in higher on the south-eastern part of the taluk while, it is limited in the north-western part. Therefore, it is obvious that wells tapping the fractured formation in south-eastern part of the taluk is more yielding than those constructed in the north-western part.

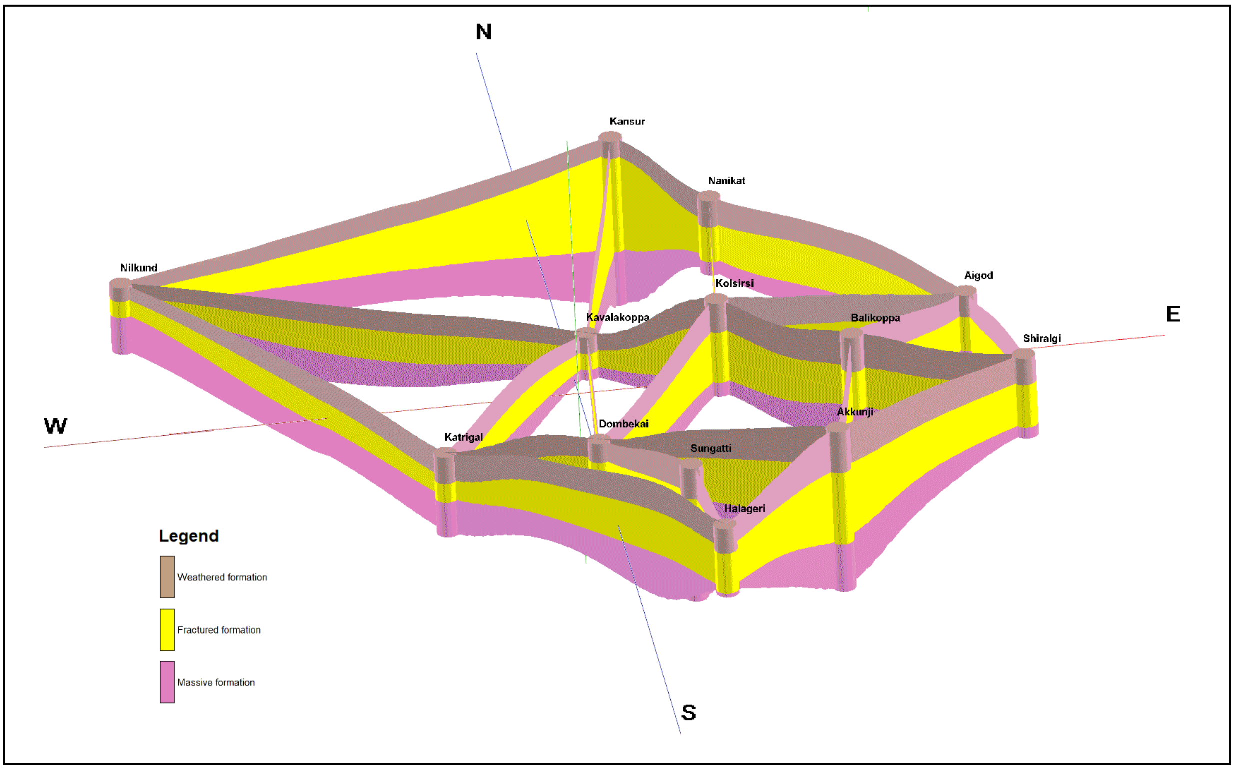

Fig. 3.3: Fence Diagram showing aquifer disposition in Siddapura taluk

3.2.2 3D Aquifer Disposition

Aquifer disposition of Siddapura taluk in 3-D has been generated based on the available borehole data and the result obtained is given in fig. 3.4. From the 3-D disposition, the two types of aquifer system in the taluk can be well demarcated. The phreatic aquifer system is constituted by weathered formation. It is also to be noted that the second aquifer is under semi-confined to confined condition in the taluk. The weathering thickness in the taluk is also variable.

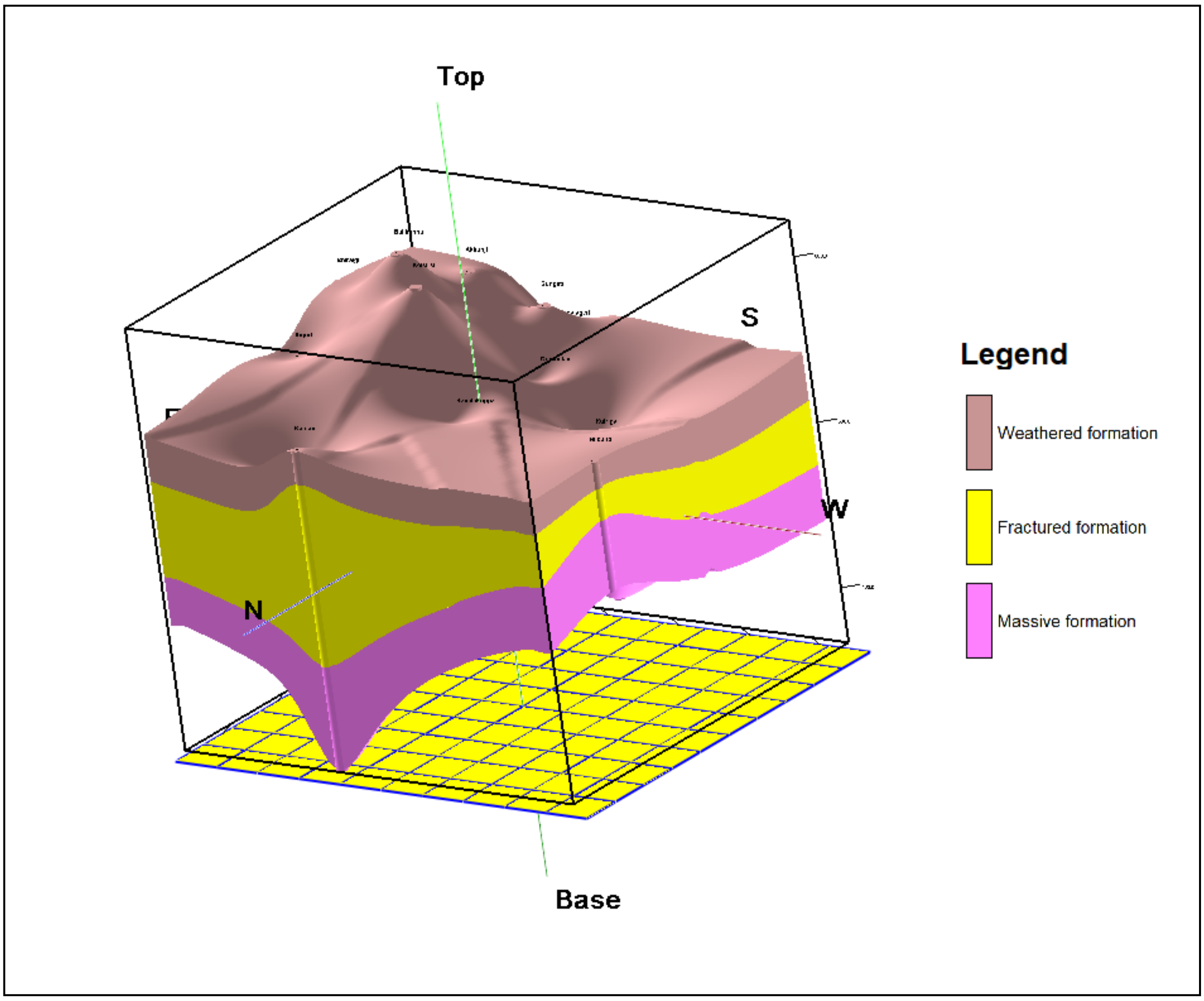

Fig. 3.4: 3D-solid model aquifer disposition in Siddapura taluk

3.2.3 Ground Water in Aquifer – I & Aquifer-II

There are two aquifer system exists in the area, both of which are genetically related and therefore groundwater in both the aquifers are hydraulically connected. In the weathered formation, groundwater is under water table condition. However, in deep fractured aquifer, groundwater occurs in semi-confined to confined condition. It is to be noted that, the yield and potentiality of fractured aquifers are area specific and is controlled by the extent of fracture density.

3.2.4 Ground Water Dynamics

Groundwater flow dynamics in the area is deciphered based on pumping test data. Pumping test was conducted at constant discharge, and drawdown has been measured at regular intervals. Also the residual drawdown has been measured periodically during recovery. The time-drawdown data has been plotted by using Cooper-Jacob’s Straight Line method and using Theis’s Recovery Method and transmissivity values are approximated. The deep aquifer from which pumping has been done seems to be sustainable but are moderately yielding. Therefore, regulated pumping may be practiced in order to avoid steep draw drown and consequent drying up of the pumping well. Based on the pumping test data, a yield prospect map of both phreatic and fractured aquifer has been prepared and given in fig. 3.5 and 3.6.

3.3 Ground Water Exploration

Groundwater exploration studies have generated baseline data in Siddapura taluk. Exploratory drilling has been carried out upto depth of193.15 m (Kansur) in order to decipher the characteristics of aquifer system of the area. Regionally extensive potential fractures are less in the north western part of the taluk. Since yield potential in these part of the taluk are poor, groundwater development for irrigation shall be restricted to the phreatic zone. Dug wells and shallow dug-cum bores can be constructed for this purpose. Lithologs of CGWB and State Govt. agencies were compiled, correlated and hydrogeological sections, fence diagram, 3 D aquifer disposition of the taluk has been prepared.

3.4 Ground Water Quality

The groundwater quality of the samples collected from both dug wells and bore wells show that all major parameters values are within the permissible limit as per Bureau of Indian Standards (BIS) for drinking purpose. pH of the dug well samples vary from 5.39 to 6.96 indicating that waters are slightly acidic. pH of bore well sample varies from 6.31 to 7.84 indicating samples are slightly acidic to alkaline.EC values are well within the permissible limit as per Bureau of Indian Standards (BIS) for drinking purpose. All samples have low SAR value and come under low salinity hazard zone indicating suitable for irrigation purposes. Water quality data of State Govt. agencies indicate iron concentration above permissible limit (up to 2 mg/L) in Kulibeedu village. Therefore, periodic monitoring of groundwater samples may be done in the taluk for quality control.

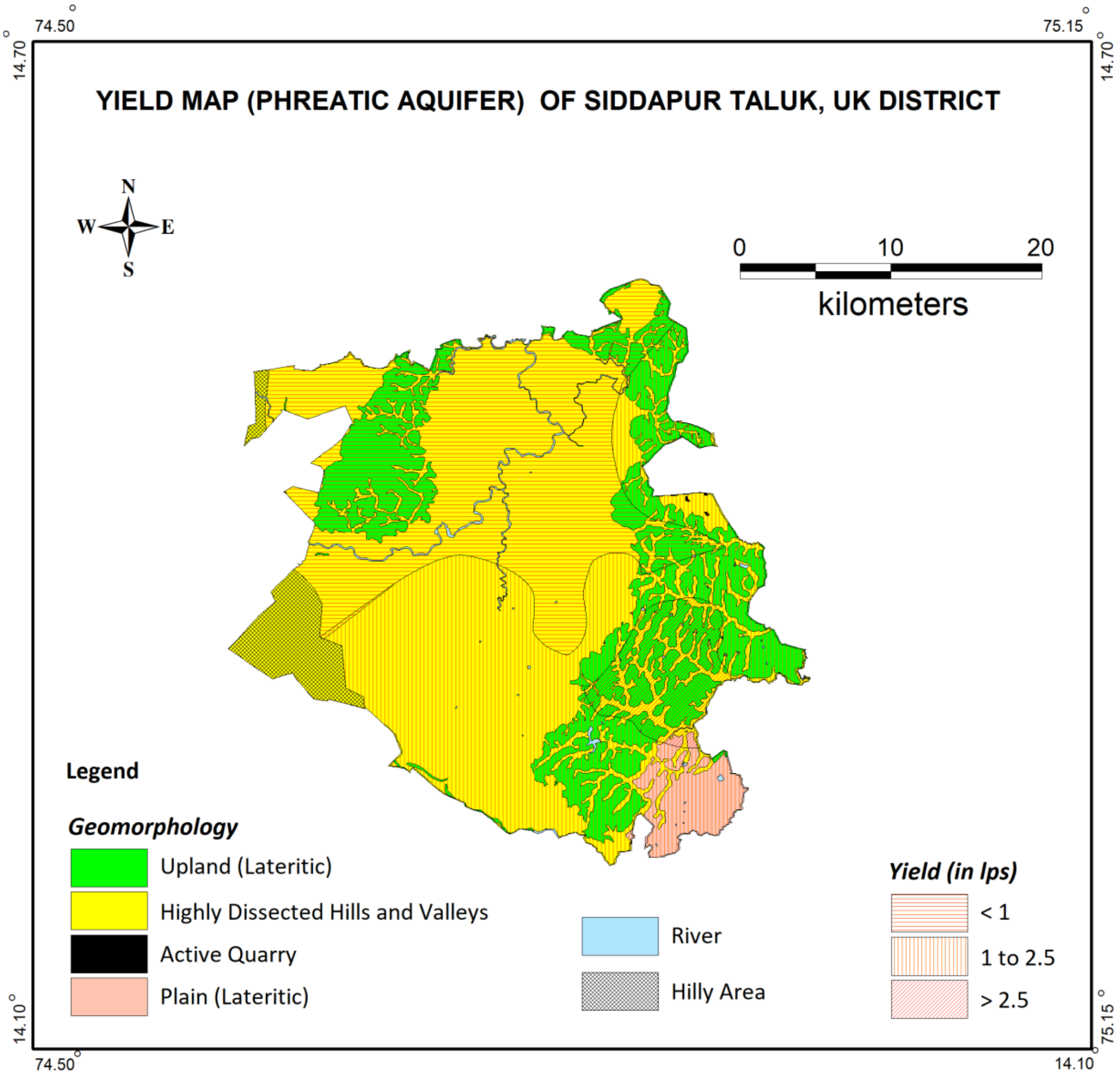

Fig. 3.5: Yield map of phreatic aquifer in Siddapura taluk

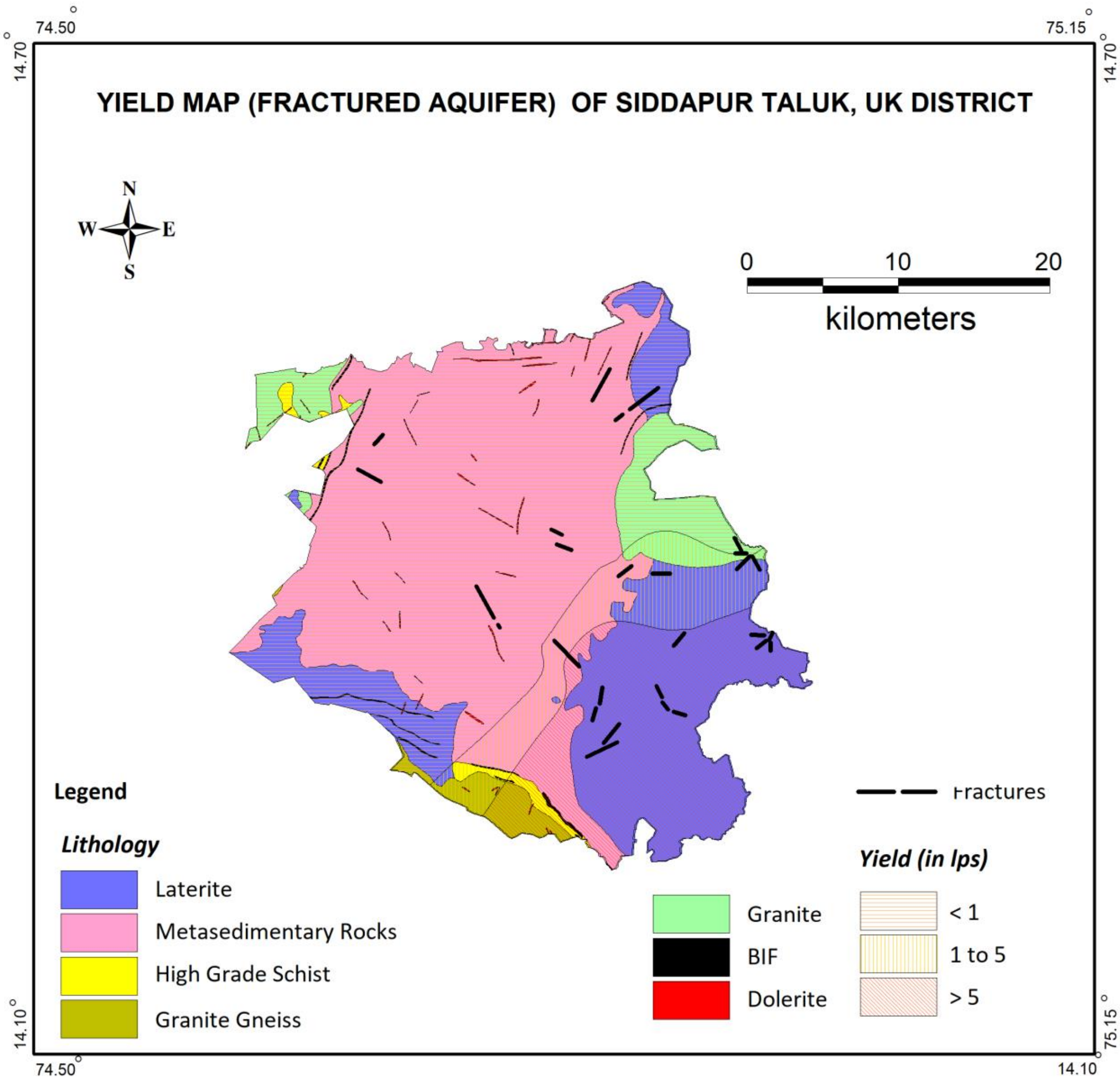

Fig. 3.6: Yield map of fractured aquifer in Siddapura taluk

3.5 Aquifer Characterization

Aquifer characterization down to depth of 193 m bgl has been done carried out by preparation of hydrogeological section, fence diagram and 3D sections. It can be observed that the phreatic aquifer is having regional cover except in the western part of the taluk, where the extension of Sahyadri hill range exists. Yield map prepared, indicates that aquifer in the south-eastern part of the taluk is more productive and sustainable. Potential fractured aquifer system in the taluk is constituted by meta-sedimentary rocks, granitoid gneisses and high grade metamorphic rocks. Potential sub-surface fractures encountered in bore holes constructed in these area clubbed with high vertical permeability and low-moderate slope allows the area to be suitable for recharge purposes (both natural and AR).

3.6 Aquifer Map

Aquifer map of the taluk is generated for both phreatic and fractured aquifer system. By integrating the yield potential, EC, water level contour, lithology etc. a thematic layer has been prepared, which describes the aquifer characteristics of the taluk. The maps are given under fig.3.7 and 3.8 respectively.

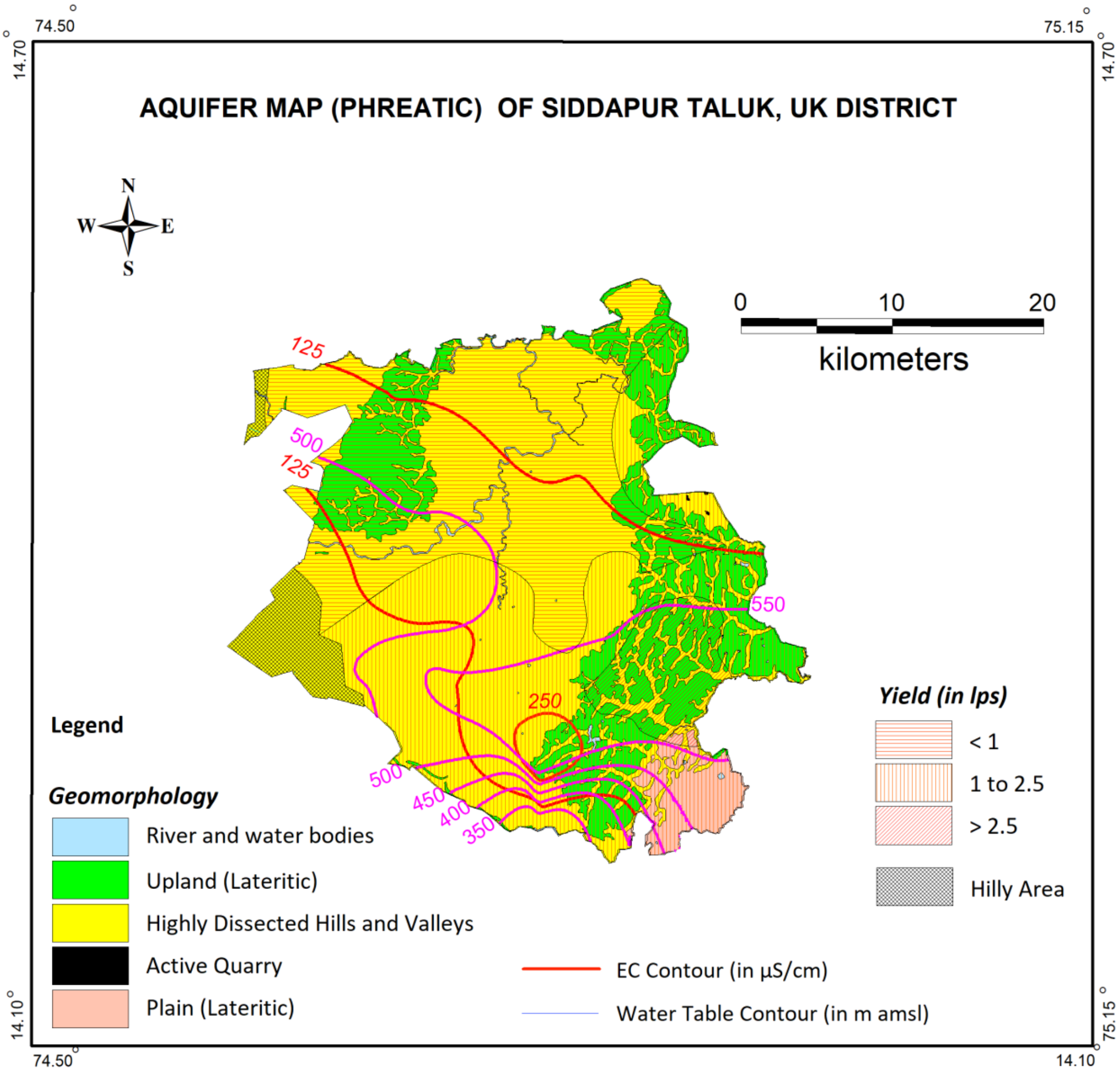

Fig. 3.7: Aquifer map of phreatic aquifer system in Siddapura taluk

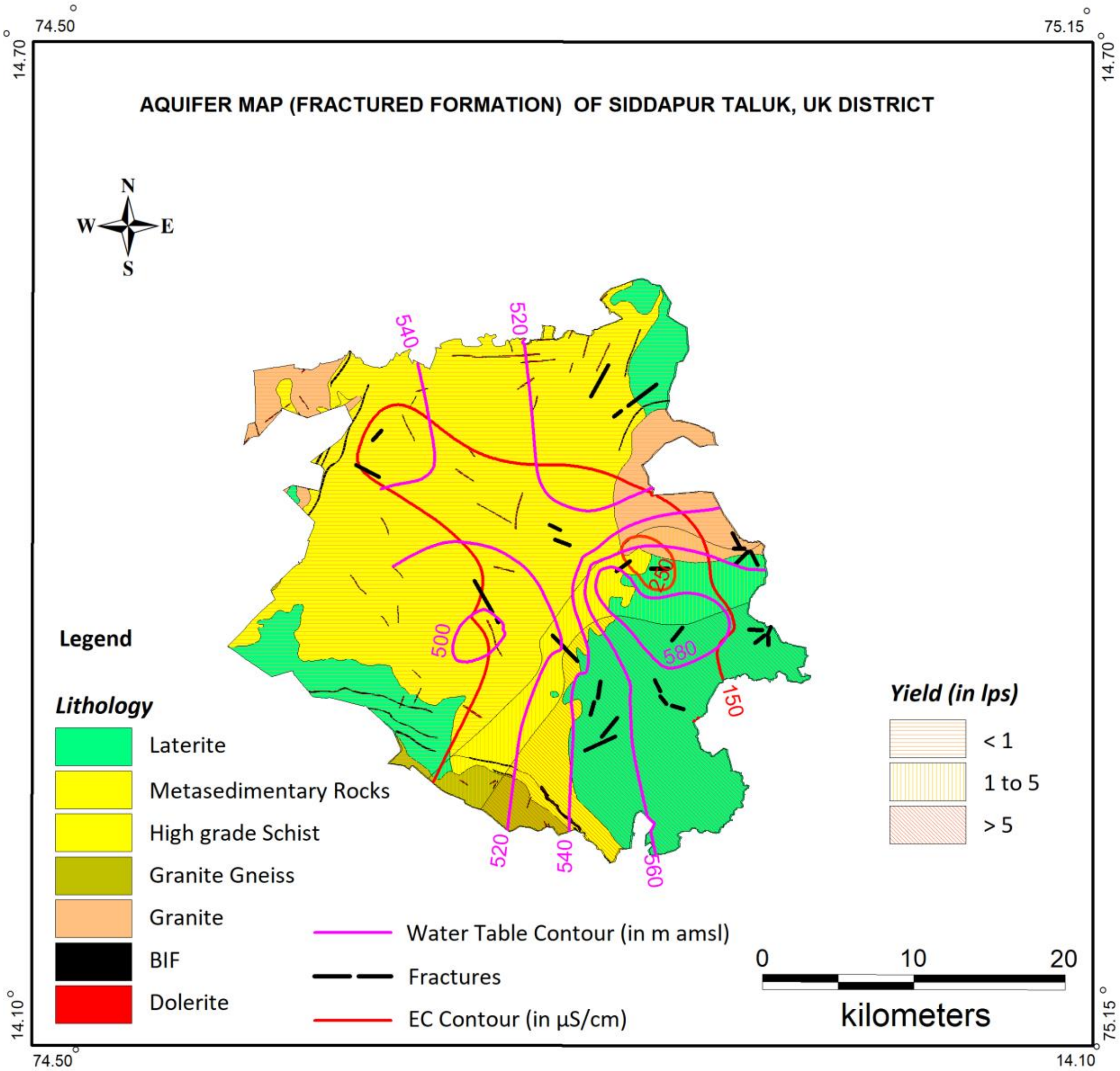

Fig. 3.8: Aquifer map of fractured aquifer system in Siddapura taluk

4. GROUND WATER RESOURCES

4.1 Dynamic Resource

Dynamic groundwater resource assessment of Karnataka State has been jointly carried out by Minor Irrigation and Groundwater Development Department, Govt. of Karnataka and Central Ground Water Board, Ministry of Jal Shakti, Govt. of India, as on March 2022. Dynamic resource of the study area has been estimated by using the norms prescribed under GEC-15. As per GWRE-2022, the annual net resource of the taluk is 82.32 MCM. Irrigation consumes about 89.38 % of total groundwater requirement in the taluk. Domestic and industrial use accounts for the rest 10.62 %requirement. A table showing resource position and allocation to various sectors as per GWRE-2020 and GWRE-20222 assessment are given in Table 4.1.

Table 4.1: Showing resource, as per GWRE-2022

Year	Assessment Unit	Assessment Unit Type	Annual Extractable GW Resource (Ham)	GW Extraction for Irrigation (Ham)	GW Extraction for Industry (Ham)	GW Extraction for Domestic (Ham)	Total Extraction (Ham)
2022	Siddapura	Taluk	8232.46	1750.86	1.29	206.59	1958.74
2020	Siddapura	Taluk	8457.09	1515.07	0	249.65	1764.71

Total Extraction (Ham)	Annual GW Allocation for for Domestic Use as on 2025 (Ham)	Net Ground Water Availability for future use (Ham)	SOE (%)	Categorization
1958.74	212.47	6267.84	23.79	Safe
1764.71	256.86	6685.17	20.87	Safe

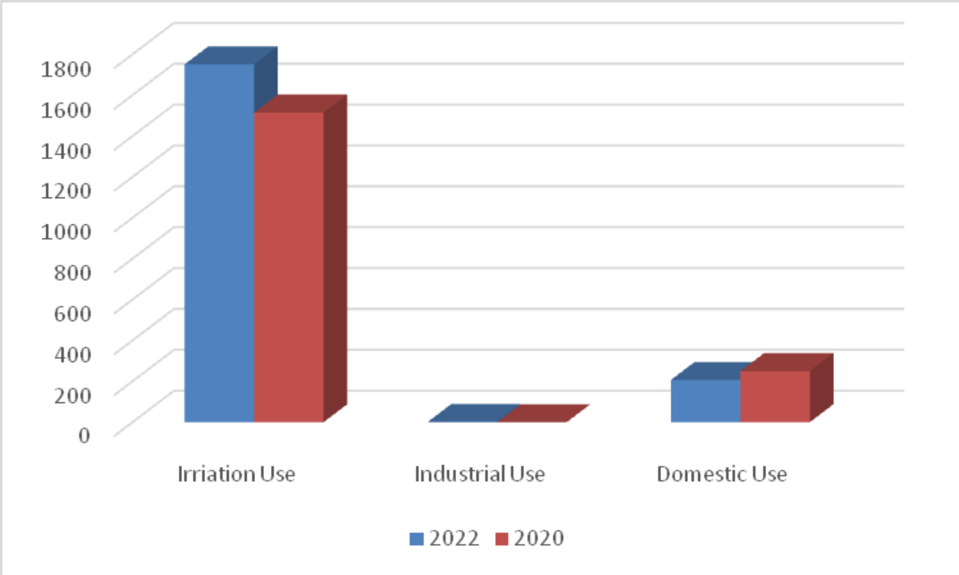

Fig. 4.1: Graph showing change in groundwater extraction, as per GWRE-2020 & 2022 (in ham)

From table 4.1 and corresponding fig. 4.1, it is clear that, from GWRE-2020 to 2022, SOE has increased by about 3%, however, the availability of resource has marked fractional decrease. Irrigation demand has increase by about 15.56 % in the last two assessment years. This may be due to the increase in number of groundwater abstraction structures in the taluk owing to the increased requirement. However, demand for domestic use has dropped fractionally. This may be due to the increase in piped supply water to individual households implemented in the taluk through various Govt. interventions.

5. GROUND WATER RELATED ISSUES

5.1 Identification of issues

Issues related to groundwater in the study area are basically focused on the aspect of quantity, quality and sustainability. Because of its geological and geomorphologic characteristics, the groundwater resource in the taluk is unevenly distributed. The south-eastern part is having potential fractured aquifer and therefore rich in groundwater resource. On the flip side, rest of thetaluk is water scarce due to the poor yield potential of fractured aquifer system. Major groundwater issues in the taluk are detailed below:

5.2 Increase in groundwater demand in agriculture and irrigation sector

Agriculture and irrigation in the taluk is mostly dependent on dug wells. However, from agriculture statistics, and minor irrigation census data and GWRE-2020 & 2022, it can be observed that demand for groundwater for agriculture and irrigation deploying bore well is steeply increasing. On comparing resource for the last two assessment years, it can be seen that the irrigation extraction is raised by 15.56%. Land use pattern indicates that the taluk is having relatively less gross irrigated area. Therefore, rise in groundwater component in this sector indicates that farmers are more depending on groundwater irrigation than surface water sources. It is also to be noted that there is a fractional rise in groundwater requirement for industrial sector also and this may also be increased in the coming years.

5.3 Low yield potential of meta-sedimentary rocks

Due to the presence of highly compact low grade meta-sedimentary rocks, groundwater yield potential of aquifers in thetaluk is poor. Ground water is limited to the top weathered residuum or in the shallow or deep seated potential fractures, cracks/joints. These fractures are not regionally extensive and yield of wells tapping these fractures is less. Further, moderate to steep slope in these area cause wastage of rainwater as runoff in very short span of time, and does not allowing water to recharge. Field data in these terrain shows that yield of the wells are 0.6lps (Nilkund), 1 lps (Katrigal), 1.2lps (Kavalakoappa), 1.5 lps (Nanikat) with lower specific capacity. Therefore the potentiality of the aquifers is limited which causes water scarcity in the taluk except in south eastern part especially during lean period.

6. MANAGEMENT STRATEGIES

6.1 Introduction

Management plan for groundwater resource of the taluk is made in order to address the issues detailed in Chapter-V. The plan has been prepared by considering both supply side and demand side interventions. It is observed from the field survey that groundwater demand for irrigation practices in the taluk are increasing. Lithology, fracture configuration and geomorphology arehave a strong impact on the distribution of groundwater resource in the taluk.

Hydrogeologically, taluk is bestowed with two aquifer system, both of which are genetically related and therefore groundwater in both the aquifers are hydraulically connected. In the weathered formation, groundwater is under water table condition. However, in deep fractured aquifer, groundwater occurs in semi-confined to confined condition. It is to be noted that, the yield and potentiality of fractured aquifers are area specific and is controlled by the extent of fracture density. By considering this variation in groundwater resource potential, management plans are made in such a way that sustainable groundwater development is recommended in the south-eastern part and demand- supply interventions in rest of the parts of the taluk. Supply side management plans for irrigation sector is discussed in sections 6.2 and 6.3. Also supply side interventions through AR structures are discussed under section 6.3. Demand side management through crop diversification is incorporated in section 6.2. Other demand side interventions such as micro irrigation practices has been discussed under 6.4.

6.2 Management Plan for Irrigation Sector

Paddy, followed by horticrops and plantation crops such as arecanut, cashew etc. constitute major part of the gross cropped area of Siddapura taluk. It is to be noted that the non-food crops which can generate high income for farmers and requires less water resource for cultivation, is less cultivated in the taluk. Crop seasons in the taluk are kharif, rabi and summer. The gross irrigated area in the taluk is 1318 ha and net irrigated area is 1285 ha and rest of the cropped area is depended on rainfed irrigation. Agriculture in the taluk by and large is the traditional kharif cultivation depending primarily on monsoon rainfall while rabi, summer and plantation crops are cultivated where irrigation facilities are available. Irrigation in the taluk is done through sources of irrigation such as dugwells, bore wells and tanks/ponds.

Table 6.1: Resource required for additional area brought under irrigation

Block	Cultivable area/Net sown area	Area under assured irrigation (ha)	Cultivable waste land+ 30% of unirrigated area(ha)	Additional irrigation Water Requirement (Delta factor:0.5 cm) for pulses and oil seeds (ham)
Siddapura	11058	1285	2982	1491

The additional area available for cultivation and one-third of the unirrigated area (2981 ha) is proposed for pulses and oil seeds cultivation, by considering the present resource scenario. Water requirement for paddy are taken as 50 cm. Thus volume of additional water required to extend irrigation to the area has been calculated from crop water requirement taking delta factor 0.5 m (Table 6.1). To bring the area under assured irrigation through ground water, an additional 1491 ham resource is required.

As per the Dynamic Resource of Ground Water Resource Assessment, 2022, total annual extractable ground water resource in Siddapura taluk is 8232.46 ham with SOE of 23.79%. Considering the safe limit of development, at 60% of SOD, the additional resource available is estimated to be 2981 ham. The additional resource can therefore be utilized for creation of additional irrigation potential for less water intense crops like pulses, oilseeds etc. Since the additional resource calculated is well within the limit of additional resource available, the entire cultivable waste land and one-third un irrigated area can be brought into assured irrigation through groundwater resource. Even if the cropping intensity is doubled in the additional cultivable area, the additional resource caters fully, for less water intensive crops.

The additional irrigation potential may be created through construction of open dug wells and shallow/medium depth bore wells. The unit draft of dug well is taken as 0.5 ham/year and for SBW/MDBW is considered 1 ham/year considering the groundwater yield potential of the taluk. The requirement of additional abstraction structures has been estimated (Table 6.2). It can be observed that additional number of 1789 dug wells and 596 bore wells are required to be constructed for the proposed irrigation potential to be created. However, installation of proposed structures should always be implemented in phase-wise as per the actual site specific feasibility. Proposed structures can bring additional 2982 ha irrigation potential in the taluk which accounts for about 2.3 times the net irrigated area of the taluk.

Table 6.2: Number of feasible tube wells in order to achieve additional irrigation potential

Volume of water available for future Irrigation development (ham) within 'safe' limit	Additional resource required for future irrigation (ham) within safe limit	Actual additional resource available 3 = (Lowest of 1 and 2)	Unit draft of DW (ham)	Unit draft of SBW/ MDBW (ham)	Required no. of DW (Considering 60% of total abstraction structures)	Required no. of SBW/ MDBW (Considering 40% of total abstraction structures)
1	2	3	4	5	6	7
2981	1491	1491	0.5	1	1789	596

6.3 Artificial Recharge to groundwater

Artificial recharge is recommended in various parts of the taluk by considering the variation in yield potential of aquifer systems. Basic requirements for recharging the aquifer are availability of surplus rainwater and availability of storage space in the aquifer system. Central Ground Water Board has published "Master Plan for Artificial Recharge to Ground Water in India" as on 2020. The Master Plan broadly identified areas which needs urgent attention. Based on this, recharge plan has been proposed considering variations in terrain type of identified areas.

Identification of the area suitable for artificial recharge has been done based on depth of post- monsoon water level and ground water level trend. Using GIS tools, post-monsoon (November, 2021) depth-to-water level map and long-term (2012-2021) trend of ground water level map has been superimposed over administrative boundary in order to identify feasible areas for recharge. Using the prepared map, feasible areas are identified, subject to fulfilling the below mentioned conditions

a) Areas showing water levels between 3 and 6 m bgl and declining trend of > 10 cm/yr;

b) Areas with depth to water level between 6 and 9 m bgl and declining trend;

c) Areas with depth to water level > 9 m bgl with or without declining trend.

An area of 859sq km has been identified in Siddapura taluk as suitable area for recharge. The available storage column/space (post-monsoon) for has been calculated by computation of average depth of unsaturated zone below 3 m water level in post monsoon time. Total volume of available storage space is calculated by multiplying storage area by specific yield. Considering the efficiency of the structure as 75%, the total water required to fill the storage space has been assessed.

By considering local hydrogeological conditions and groundwater potential in the taluk, various types of artificial recharge / conservation structure possible for augmentation and conservation of ground water resources has been proposed. Apart from these, existing village ponds and dug wells may be considered as cost-effective recharge structures. However, actual field condition, availability of suitable area are to be considered in order to implement recharge system. Proposed number and capacity of recharge structures in the taluk is given in table 6.3. A map showing tentative locations of the proposed artificial recharge structures has been prepared and is provided in fig. 6.1. The tentative locations of the same is tabled in table 6.4.

Table 6.3: Type, capacity and no. of proposed recharge structures in suitable area types

TypeofStructure	No. of proposed structures	StorageCapacity (MCM)	Total Recharge capacity (MCM)
Sub surface dyke	1	6.328	6.328
PercolationTank	38	0.56	21.093
CheckDam	220	0.048	10.547
Filter Beds	7	0.60	4.219
Total recharge capacity (MCM)			42.187
Volume of water to be recharged (MCM)			31.640
Additional irrigation potential created (lakh hectare)			0.038

6.4 Micro Irrigation Practices

Micro irrigation intended to effectively utilize water by various techniques such as drips, sprinklers, pivots, rain-guns etc. in the farm. Under Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), popularization of micro irrigation plans are one of the focus area in order to ensure 'Per drop-More crop'. Under the scheme, in Siddapura taluk, at least 10% of net irrigated area will be catered by installing drips and sprinklers (District Irrigation Plan-Uttar Kannada). The scheme will be implemented in phase-wise.

Table 6.4: Location details of proposed AR structures

Site	Latitude	Longitude	Site	Latitude	Longitude
CD-1	14° 16' 31.9708" N	74° 49' 59.9034" E	CD-111	14° 17' 16.7708" N	74° 48' 03.7034" E
CD-2	14° 17' 02.7708" N	74° 50' 50.9034" E	CD-112	14° 17' 21.7708" N	74° 47' 42.5034" E
CD-3	14° 15' 37.5708" N	74° 50' 53.9034" E	CD-113	14° 17' 25.9941" N	74° 47' 09.7480" E
CD-4	14° 15' 00.7708" N	74° 50' 34.9034" E	CD-114	14° 17' 36.7708" N	74° 47' 56.9034" E
CD-5	14° 15' 53.9708" N	74° 51' 17.9034" E	CD-115	14° 17' 59.7708" N	74° 47' 42.1034" E
CD-6	14° 15' 15.7708" N	74° 52' 00.9034" E	CD-116	14° 18' 17.7708" N	74° 47' 26.9034" E
CD-7	14° 14' 53.2208" N	74° 52' 39.9034" E	CD-117	14° 18' 25.7708" N	74° 50' 06.9034" E
CD-8	14° 14' 38.7708" N	74° 54' 07.9034" E	CD-118	14° 18' 56.7708" N	74° 48' 01.9034" E
CD-9	14° 14' 53.7708" N	74° 54' 37.9034" E	CD-119	14° 17' 55.7708" N	74° 46' 17.9034" E
CD-10	14° 14' 42.7708" N	74° 55' 52.1034" E	CD-120	14° 17' 57.9208" N	74° 45' 42.9034" E
CD-11	14° 16' 05.7708" N	74° 53' 12.4034" E	CD-121	14° 18' 22.7708" N	74° 46' 18.9034" E
CD-12	14° 16' 50.9708" N	74° 51' 52.9034" E	CD-122	14° 18' 48.7708" N	74° 46' 28.9034" E
CD-13	14° 16' 53.9708" N	74° 49' 42.9034" E	CD-123	14° 18' 33.7708" N	74° 45' 01.9034" E
CD-14	14° 17' 40.9708" N	74° 49' 40.9034" E	CD-124	14° 19' 09.7708" N	74° 45' 15.9034" E
CD-15	14° 18' 26.7708" N	74° 51' 20.9034" E	CD-125	14° 20' 09.9708" N	74° 46' 15.9034" E
CD-16	14° 18' 12.7708" N	74° 51' 41.9034" E	CD-126	14° 19' 22.7708" N	74° 47' 47.9034" E
CD-17	14° 19' 04.7708" N	74° 51' 47.7034" E	CD-127	14° 20' 46.7708" N	74° 47' 22.9034" E
CD-18	14° 18' 04.7708" N	74° 52' 02.9034" E	CD-128	14° 19' 59.7708" N	74° 44' 05.9534" E
CD-19	14° 18' 10.7708" N	74° 52' 21.9034" E	CD-129	14° 19' 36.7708" N	74° 44' 44.4534" E
CD-20	14° 17' 00.7708" N	74° 54' 03.9034" E	CD-130	14° 20' 16.7708" N	74° 39' 54.9034" E
CD-21	14° 19' 53.7708" N	74° 51' 29.9034" E	CD-131	14° 20' 02.7708" N	74° 38' 42.7034" E
CD-22	14° 20' 51.7708" N	74° 52' 23.9034" E	CD-132	14° 19' 51.7708" N	74° 40' 06.9034" E
CD-23	14° 19' 57.7708" N	74° 52' 14.9034" E	CD-133	14° 21' 26.7708" N	74° 41' 56.1034" E
CD-24	14° 19' 35.7708" N	74° 52' 33.9034" E	CD-134	14° 21' 11.7708" N	74° 41' 54.9034" E
CD-25	14° 18' 57.0395" N	74° 52' 49.0082" E	CD-135	14° 20' 37.7708" N	74° 43' 13.4534" E
CD-26	14° 18' 28.7708" N	74° 52' 59.9034" E	CD-136	14° 21' 46.7708" N	74° 44' 22.1034" E
CD-27	14° 20' 41.8208" N	74° 53' 04.9534" E	CD-137	14° 21' 27.7708" N	74° 44' 36.9034" E
CD-28	14° 20' 20.5708" N	74° 53' 47.9034" E	CD-138	14° 21' 09.7708" N	74° 45' 19.9034" E
CD-29	14° 20' 03.9708" N	74° 54' 07.9034" E	CD-139	14° 20' 12.7708" N	74° 46' 33.9034" E
CD-30	14° 19' 51.7708" N	74° 54' 24.3034" E	CD-140	14° 19' 31.7708" N	74° 46' 39.9034" E
CD-31	14° 19' 55.7708" N	74° 55' 01.9034" E	CD-141	14° 21' 36.7708" N	74° 47' 23.9034" E
CD-32	14° 19' 23.7708" N	74° 54' 57.9034" E	CD-142	14° 22' 12.7708" N	74° 47' 14.9034" E
CD-33	14° 19' 05.7708" N	74° 55' 16.7034" E	CD-143	14° 21' 12.5708" N	74° 47' 38.9034" E
CD-34	14° 20' 06.7708" N	74° 57' 43.9034" E	CD-144	14° 22' 10.9708" N	74° 45' 25.9034" E
CD-35	14° 20' 58.7708" N	74° 56' 49.9034" E	CD-145	14° 20' 00.8708" N	74° 43' 06.9034" E
CD-36	14° 20' 52.7708" N	74° 56' 31.9034" E	CD-146	14° 20' 08.7708" N	74° 49' 29.9034" E
CD-37	14° 21' 22.7708" N	74° 55' 47.9034" E	CD-147	14° 22' 10.7708" N	74° 48' 44.9034" E
CD-38	14° 21' 52.7708" N	74° 55' 12.9034" E	CD-148	14° 22' 25.7708" N	74° 48' 27.9034" E
CD-39	14° 19' 13.7708" N	74° 50' 47.7034" E	CD-149	14° 21' 45.7708" N	74° 48' 24.7034" E
CD-40	14° 19' 03.7708" N	74° 50' 34.1034" E	CD-150	14° 21' 37.7708" N	74° 49' 37.3034" E
CD-41	14° 20' 48.7708" N	74° 50' 39.9034" E	CD-151	14° 22' 16.7708" N	74° 50' 45.9034" E
CD-42	14° 21' 26.9708" N	74° 49' 58.9034" E	CD-152	14° 21' 50.7708" N	74° 51' 23.9034" E
CD-43	14° 20' 53.1117" N	74° 49' 35.8579" E	CD-153	14° 22' 14.1883" N	74° 53' 18.3453" E
CD-44	14° 21' 11.9708" N	74° 48' 52.9034" E	CD-154	14° 23' 08.7708" N	74° 47' 23.7034" E
CD-45	14° 20' 14.8208" N	74° 48' 12.9034" E	CD-155	14° 23' 08.7708" N	74° 47' 47.9034" E

Site	Latitude	Longitude	Site	Latitude	Longitude
CD-46	14° 18' 32.7708" N	74° 48' 37.9034" E	CD-156	14° 23' 35.7708" N	74° 49' 45.7034" E
CD-47	14° 21' 58.7708" N	74° 54' 19.9034" E	CD-157	14° 23' 18.7708" N	74° 49' 16.9034" E
CD-48	14° 22' 34.7708" N	74° 55' 02.9034" E	CD-158	14° 30' 09.7708" N	74° 40' 51.9034" E
CD-49	14° 23' 11.7708" N	74° 53' 53.9034" E	CD-159	14° 29' 43.7708" N	74° 40' 32.7034" E
CD-50	14° 22' 35.0225" N	74° 53' 46.9034" E	CD-160	14° 29' 48.7708" N	74° 42' 47.5034" E
CD-51	14° 22' 48.7708" N	74° 53' 00.9034" E	CD-161	14° 30' 05.7708" N	74° 44' 12.9034" E
CD-52	14° 23' 02.7708" N	74° 52' 48.9034" E	CD-162	14° 30' 04.7708" N	74° 44' 35.2034" E
CD-53	14° 23' 38.7708" N	74° 52' 47.9034" E	CD-163	14° 30' 42.7708" N	74° 45' 29.9034" E
CD-54	14° 24' 06.9708" N	74° 55' 26.9034" E	CD-164	14° 30' 21.9708" N	74° 45' 31.9034" E
CD-55	14° 24' 21.7708" N	74° 54' 31.9034" E	CD-165	14° 28' 34.7708" N	74° 44' 42.9034" E
CD-56	14° 24' 28.7708" N	74° 54' 17.9034" E	CD-166	14° 28' 45.7708" N	74° 43' 17.9034" E
CD-57	14° 25' 03.7708" N	74° 54' 00.9034" E	CD-167	14° 28' 34.7708" N	74° 43' 35.9034" E
CD-58	14° 24' 51.7708" N	74° 52' 40.9034" E	CD-168	14° 28' 23.7708" N	74° 43' 57.7034" E
CD-59	14° 24' 22.8208" N	74° 51' 52.9034" E	CD-169	14° 27' 57.7708" N	74° 42' 39.9034" E
CD-60	14° 23' 44.7708" N	74° 51' 31.9034" E	CD-170	14° 26' 56.7708" N	74° 42' 18.9034" E
CD-61	14° 23' 48.4708" N	74° 51' 10.9034" E	CD-171	14° 26' 46.7708" N	74° 42' 51.2534" E
CD-62	14° 24' 45.7708" N	74° 50' 41.7034" E	CD-172	14° 29' 22.7708" N	74° 41' 17.2534" E
CD-63	14° 25' 05.9708" N	74° 50' 39.9034" E	CD-173	14° 25' 48.7708" N	74° 42' 33.9034" E
CD-64	14° 25' 57.7708" N	74° 50' 42.1034" E	CD-174	14° 25' 08.7708" N	74° 41' 26.9034" E
CD-65	14° 26' 19.7708" N	74° 50' 51.7034" E	CD-175	14° 26' 33.7708" N	74° 41' 39.6534" E
CD-66	14° 26' 13.7708" N	74° 52' 22.9034" E	CD-176	14° 27' 30.7708" N	74° 43' 24.9034" E
CD-67	14° 25' 15.7708" N	74° 49' 27.9034" E	CD-177	14° 25' 56.0708" N	74° 43' 48.9034" E
CD-68	14° 25' 51.7708" N	74° 49' 27.9034" E	CD-178	14° 25' 41.7708" N	74° 43' 31.6034" E
CD-69	14° 26' 34.7708" N	74° 49' 43.7034" E	CD-179	14° 26' 32.7708" N	74° 44' 16.9034" E
CD-70	14° 27' 14.7708" N	74° 49' 10.9034" E	CD-180	14° 27' 13.7708" N	74° 44' 27.8534" E
CD-71	14° 27' 13.7708" N	74° 48' 32.7034" E	CD-181	14° 27' 42.9208" N	74° 45' 08.9034" E
CD-72	14° 25' 07.7708" N	74° 48' 01.9034" E	CD-182	14° 26' 21.7708" N	74° 44' 49.9034" E
CD-73	14° 24' 02.9708" N	74° 48' 43.9034" E	CD-183	14° 27' 28.8708" N	74° 46' 24.9034" E
CD-74	14° 24' 24.7708" N	74° 47' 23.9034" E	CD-184	14° 27' 30.7708" N	74° 47' 32.9034" E
CD-75	14° 32' 11.7708" N	74° 52' 49.9034" E	CD-185	14° 27' 03.7708" N	74° 47' 11.7534" E
CD-76	14° 31' 31.7708" N	74° 52' 07.0534" E	CD-186	14° 26' 10.7708" N	74° 47' 22.7034" E
CD-77	14° 31' 20.9708" N	74° 52' 23.9034" E	CD-187	14° 26' 03.3208" N	74° 47' 05.9034" E
CD-78	14° 31' 05.7708" N	74° 53' 45.5034" E	CD-188	14° 26' 04.4208" N	74° 46' 13.9034" E
CD-79	14° 30' 12.3208" N	74° 53' 27.9034" E	CD-189	14° 26' 03.7708" N	74° 45' 00.7034" E
CD-80	14° 30' 27.7708" N	74° 52' 53.1034" E	CD-190	14° 25' 47.7708" N	74° 44' 57.9034" E
CD-81	14° 32' 39.1208" N	74° 51' 59.9034" E	CD-191	14° 25' 32.7708" N	74° 45' 31.1034" E
CD-82	14° 32' 59.2708" N	74° 51' 17.9034" E	CD-192	14° 20' 22.7708" N	74° 54' 32.9034" E
CD-83	14° 30' 57.7708" N	74° 51' 58.2534" E	CD-193	14° 22' 50.7708" N	74° 56' 35.8534" E
CD-84	14° 30' 38.3208" N	74° 51' 12.9034" E	CD-194	14° 22' 20.9708" N	74° 56' 28.9034" E
CD-85	14° 30' 58.9708" N	74° 50' 20.9034" E	CD-195	14° 22' 12.7208" N	74° 56' 00.7034" E
CD-86	14° 29' 31.7708" N	74° 51' 48.9034" E	CD-196	14° 22' 54.3708" N	74° 52' 16.9034" E
CD-87	14° 29' 53.7708" N	74° 50' 27.9034" E	CD-197	14° 27' 23.7708" N	74° 52' 25.9034" E
CD-88	14° 29' 39.7708" N	74° 50' 04.9034" E	CD-198	14° 27' 31.7708" N	74° 52' 17.0034" E
CD-89	14° 29' 12.7708" N	74° 49' 59.9034" E	CD-199	14° 27' 48.7708" N	74° 52' 04.9034" E
CD-90	14° 28' 38.7708" N	74° 50' 18.9034" E	CD-200	14° 28' 15.7708" N	74° 51' 57.9034" E
CD-91	14° 28' 24.7708" N	74° 50' 18.9034" E	CD-201	14° 28' 42.7584" N	74° 52' 21.3974" E
CD-92	14° 28' 12.2208" N	74° 50' 06.9034" E	CD-202	14° 27' 26.7708" N	74° 51' 22.7034" E

Site	Latitude	Longitude	Site	Latitude	Longitude
CD-93	14° 27' 59.7708" N	74° 49' 40.9034" E	CD-203	14° 27' 19.7708" N	74° 51' 03.7034" E
CD-94	14° 28' 04.7708" N	74° 49' 31.9034" E	CD-204	14° 26' 48.7708" N	74° 50' 56.9034" E
CD-95	14° 28' 07.2708" N	74° 53' 47.9034" E	CD-205	14° 25' 43.7708" N	74° 51' 21.9034" E
CD-96	14° 28' 15.7708" N	74° 53' 05.9034" E	CD-206	14° 31' 06.7708" N	74° 52' 35.9034" E
CD-97	14° 28' 47.7708" N	74° 52' 36.9034" E	CD-207	14° 30' 49.7708" N	74° 48' 30.5534" E
CD-98	14° 29' 03.7708" N	74° 52' 55.9034" E	CD-208	14° 28' 42.9708" N	74° 42' 52.9034" E
CD-99	14° 30' 07.7708" N	74° 48' 31.7034" E	CD-209	14° 29' 24.7708" N	74° 46' 04.9034" E
CD-100	14° 30' 21.7708" N	74° 48' 07.9034" E	CD-210	14° 29' 36.7708" N	74° 46' 40.7034" E
CD-101	14° 29' 57.7708" N	74° 47' 54.9034" E	CD-211	14° 30' 35.8467" N	74° 46' 05.6677" E
CD-102	14° 29' 44.9708" N	74° 47' 55.9034" E	CD-212	14° 28' 05.7708" N	74° 43' 06.9034" E
CD-103	14° 29' 26.7708" N	74° 48' 19.9034" E	CD-213	14° 28' 01.7708" N	74° 49' 06.9034" E
CD-104	14° 29' 09.9208" N	74° 46' 50.9034" E	CD-214	14° 24' 58.7708" N	74° 42' 19.9034" E
CD-105	14° 29' 02.1616" N	74° 46' 19.6080" E	CD-215	14° 25' 00.3708" N	74° 43' 41.9034" E
CD-106	14° 28' 12.7708" N	74° 45' 15.5034" E	CD-216	14° 25' 37.7708" N	74° 46' 25.1034" E
CD-107	14° 14' 30.7708" N	74° 55' 32.1034" E	CD-217	14° 25' 04.7708" N	74° 47' 31.1034" E
CD-108	14° 15' 23.2708" N	74° 51' 29.9034" E	CD-218	14° 24' 10.7708" N	74° 47' 44.9034" E
CD-109	14° 16' 02.7708" N	74° 49' 11.9034" E	CD-219	14° 23' 21.7708" N	74° 47' 10.9034" E
CD-110	14° 17' 49.7708" N	74° 48' 41.9034" E	CD-220	14° 22' 35.8708" N	74° 48' 18.9034" E
PT-1	14° 15' 40.7708" N	74° 51' 53.9034" E	PT-20	14° 27' 56.7708" N	74° 43' 36.9034" E
PT-2	14° 15' 56.7708" N	74° 52' 28.8034" E	PT-21	14° 30' 26.7708" N	74° 51' 49.9034" E
PT-3	14° 16' 53.9708" N	74° 51' 18.9034" E	PT-22	14° 29' 43.7708" N	74° 51' 53.9034" E
PT-4	14° 16' 33.7708" N	74° 52' 45.9034" E	PT-23	14° 31' 15.7708" N	74° 52' 01.5534" E
PT-5	14° 16' 48.7708" N	74° 52' 51.9034" E	PT-24	14° 27' 14.7708" N	74° 48' 01.9034" E
PT-6	14° 16' 44.4208" N	74° 52' 21.9034" E	PT-25	14° 22' 23.7708" N	74° 53' 28.9034" E
PT-7	14° 17' 23.7708" N	74° 53' 36.9034" E	PT-26	14° 21' 05.1093" N	74° 56' 07.5523" E
PT-8	14° 17' 20.7708" N	74° 54' 05.1034" E	PT-27	14° 20' 29.7708" N	74° 52' 18.9034" E
PT-9	14° 18' 06.7708" N	74° 52' 50.9034" E	PT-28	14° 18' 50.2208" N	74° 50' 13.9034" E
PT-10	14° 19' 31.7708" N	74° 54' 49.9034" E	PT-29	14° 18' 04.7708" N	74° 49' 59.2534" E
PT-11	14° 18' 28.5708" N	74° 49' 41.9034" E	PT-30	14° 14' 47.9708" N	74° 54' 55.7534" E
PT-12	14° 21' 52.7708" N	74° 55' 03.9034" E	PT-31	14° 14' 49.1708" N	74° 55' 35.9034" E
PT-13	14° 22' 12.7708" N	74° 53' 56.9034" E	PT-32	14° 15' 10.7708" N	74° 52' 26.0534" E
PT-14	14° 28' 51.7708" N	74° 48' 39.9034" E	PT-33	14° 15' 25.7708" N	74° 52' 02.9034" E
PT-15	14° 28' 34.7708" N	74° 47' 20.9034" E	PT-34	14° 15' 50.7417" N	74° 51' 35.6480" E
PT-16	14° 28' 21.9708" N	74° 48' 14.9534" E	PT-35	14° 16' 43.9208" N	74° 50' 37.9034" E
PT-17	14° 28' 29.7708" N	74° 46' 37.9034" E	PT-36	14° 16' 25.7708" N	74° 53' 00.9034" E
PT-18	14° 27' 57.7708" N	74° 45' 23.9034" E	PT-37	14° 18' 10.7708" N	74° 48' 26.0534" E
PT-19	14° 28' 15.7708" N	74° 44' 17.9034" E	PT-38	14° 19' 03.7708" N	74° 46' 39.4034" E

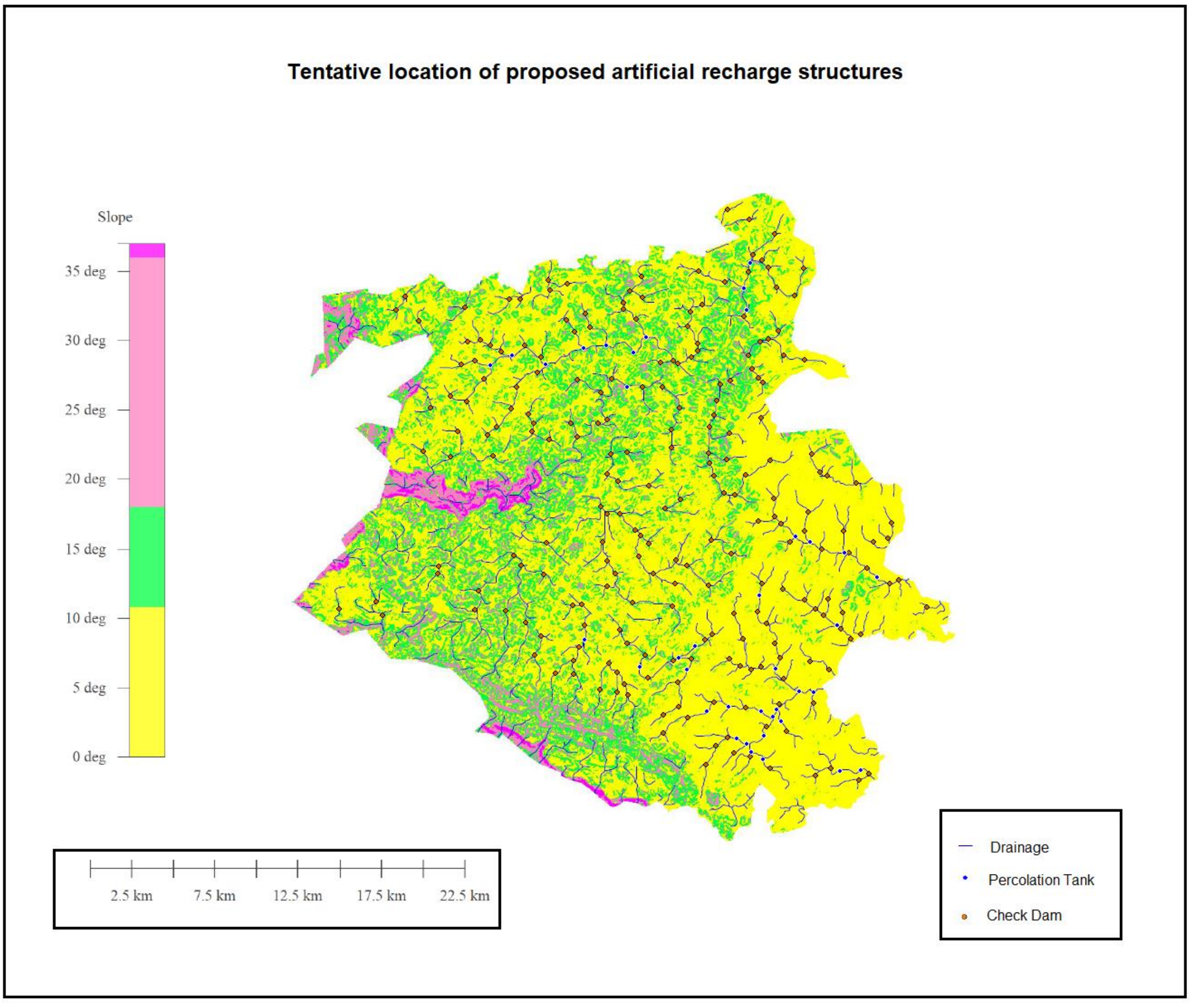

Table 6.1: Tentative location of proposed AR structures

7. SUMMARY

Siddapura taluk of Uttar Kannada district having geographical coverage of862.65 sq. kms is taken up for detailed aquifer mapping studies during AAP 2022-23. Siddapura taluk comes under Sirsi sub-division of Uttar Kannada district with taluk headquarter located at Siddapura. The taluk is drained by Aghanashini River, Sharavathi River and its tributaries. The taluk forms part of the Western Ghat hill ranges and therefore blessed with lush green forests and wild-life. Majority area of the taluk comprises of forest land (79%) followed by agriculture land. The taluk is part of Malnad area consisting of the Sahayadri hill ranges, valleys and undulating eastern table-land topography. Geomorphologically, the taluk can be divided into the western hill ranges, and eastern plateaus and table lands. Geologically, Siddapura taluk is characterized by various litho-units spanning from Archaean to Present day deposits. The area forms part of Shimoga Schist belt of Western Dharwar Craton, comprises of gneisses of various grade, manganiferous phyllites, schists of various grades, greywacke and basic intrusive and its metamorphosed varieties

The climate of the taluk as a whole can be termed as tropical monsoon type. The taluk falls under Hilly agro-climatic zone. The net sown area of the taluk is 14353 ha and cropping intensity is 111 %. In the taluk, open wells and tube wells constitute 34.02% of the net irrigated area. The gross area irrigated through all sources in the taluk is 4776ha and net irrigated area is 2763 ha.

The primary data such as water level, quality, and exploration details available with CGWB has been collected and utilized as baseline data. The Central Ground Water Board has established a network of observation wells under National Hydrograph Network programmer to study the behavior of ground water level and quality of ground water in the taluk. Exploratory drilling programmer was carried out by Central Ground Water Board in order to understand the sub–surface geology, identification of various water bearing horizons, computation of hydraulic characteristics such as transmissivity and storativity of the aquifers etc. Other inputs such as hydrometeorological, landuse, cropping pattern etc. were collected from concerned state and central govt. departments and compiled.

Depth to water level map of phreatic aquiferindicates that majority of the area has water level between 5 to 10 m bgl in phreatic aquifer system during both pre-monsoon and post-monsoonseasons. In the central part of the taluk, deep water levels are observed for both aquifer systems. This may be due to the presence of comparatively poor yielding meta-sedimentary rocks and Banded Gneissic Complex lithounits constituting the aquifer system present in this part, as well as clay-rich top soil which hinders the rate of infiltration into the phreatic aquifers as well. Long term groundwater level trend indicates that there is no significant variation in groundwater level in the taluk.

Aquifer characterization has been done based on lithologs, hydrogeological sections, fence diagram, 3D disposition. There are two aquifer system exists in the area, both of which are genetically related and therefore groundwater in both the aquifers are hydraulically connected. In the weathered formation, groundwater is under water table condition. However, in deep fractured aquifer, groundwater occurs in semi-confined to confined condition. It is to be noted that, the yield and potentiality of fractured aquifers are area specific and, is controlled by the extent of fracture density. Average thickness of weathering varies from 10 to 40 m bgl. On the basis of drilling data, it can be observed that fractures in crystalline rocks are not isotropic and in many places, with limited subsurface extension. Further, schistose aquifers in the north and north western part of the taluk are poorly yielding as compared to the gneissic and laterite aquifers present in the south-eastern part of the taluk.

Groundwater quality studies have been done based on the samples collected from the study area during May/June-2022. A total number of 24 samples (12 DW+12BW) were collected for analysis. A perusal of the hydro-chemical data shows that, in samples collected from both dug wells and bore wells, all major parameters values are within the permissible limit for drinking purpose. All samples have low SAR value and come under low salinity hazard zone indicating that water is suitable for irrigation purposes. Water quality data of State Govt. agencies indicate iron concentration above permissible limit (up to 2 mg/L) in Kulibeedu village. Therefore, periodic monitoring of groundwater samples may be done in the taluk for quality control. By integrating the yield potential, EC, water level contour, lithology etc., aquifer map has been prepared for both phreatic and fractured aquifer systems. As per GWRE-2022, the annual net resource of the taluk is 82.32 MCM with SOE of 23.79%. Major groundwater related issues in the taluk are increase in groundwater demand in agriculture and irrigation sector, and low yield potential of meta-sedimentary rocks. Management plans are made in such a way that sustainable groundwater development is recommended in the south-eastern parts, where yield potential is high; and demand- supply interventions in the middle and north-western parts of the taluk, where yield potential is less. Supply side management plans are prepared for irrigation sectors and management through construction of recommended artificial recharge structures are also discussed. Demand side management through crop diversification and adoption of micro irrigation practices has also discussed.

Annexure - I

Land-use Land-cover Details (in ha)

Name of Taluk	Geographical area	Forest	Area under waste land	Land under other uses	Fallow Land	Net sown area	Area sown more than one time	Gross sown area
1	2	3	4	5	6	7	8	9
Siddapura	85928	68130	2201	3777	762	11058	1280	12338

Annexure - II

Details of Key wells Established in Siddapura taluk with Water Level

Sl. No	Location	DW/BW	Latitude	Longitude	Elevation (m amsl)	Depth of Well	Diameter (m)	MP (m)	Pre M water level (mbgl)	Pre Mon WT (mamsl)
1	Karkihekkala	DW	14.505	74.7288	537.6	10.05	2.05	1	6.9	531
2	Dhanalli	DW	14.48	74.71	534	13	1.28	0.7	11.64	522
3	Nilkund	BW	14.46	74.7	550	88	1.6	0.55	5.1	545
4	Heggarni	DW	14.44	74.74	524	10.2	0.92	0.75	4.05	520
5	Kavalakoppa	DW	14.41	74.83	562	21.3	1.68	0.8	15.6	546
6	Kavalakoppa	BW	14.4	74.83	536	50	1.55	0.45	9.4	527
7	Kolsirsi	BW	14.38	74.86	604	109	1.5	0.5	4.05	600
8	Kolsirsi	BW	14.38	74.87	581	94	1.7	0.72	9.41	572
9	Nanikat	BW	14.48	74.88	530	88	1.65	0.6	23.25	507
10	Shellur	DW	14.51	74.88	552	12.25	1.92	0.68	8.2	544

Sl. No	Location	DW/BW	Latitude	Longitude	Elevation (m amsl)	Depth of Well	Diameter (m)	MP (m)	Pre M water level (mbgl)	Pre Mon WT (mamsl)
11	Hosagadde	DW	14.49	74.8	530	11.55	1.74	0.84	7.25	523
12	Balikoppa	BW	14.35	74.9	607	106	1.62	0.56	15.05	592
13	Aigod	BW	14.4	74.94	558	8	1.75	0.48	4.68	553
14	Shiralgi	BW	14.34	74.95	580	94	1.72	0.32	5.85	574
15	Akkunji	BW	14.31	74.89	580	188	1.6	0.25	7.5	573
16	Akkunji	DW	14.31	74.89	580	18	1.45	0.9	6.93	573
17	Dombekai	BW	14.34	74.82	535	78	1.3	0.25	17.1	518
18	Katrigal	BW	14.35	74.78	509	94	1.45	0.42	10.05	499
19	Karesal	DW	14.32	74.75	583	14.21	1.6	0.59	12.58	570
20	Alakone	DW	14.35	74.66	478	7.85	1.6	0.65	3.7	474
21	Allimakki	DW	14.36	74.75	501	14.35	1.6	0.8	9.05	492
22	Sungatti	BW	14.31	74.85	562	156	1.8	0.68	12.25	550
23	Kalavana	DW	14.27	74.81	601	13.72	1.2	0.6	11.3	590
24	Taribagili	DW	14.23	74.81	324	9.65	1.8	0.9	4.81	319
25	Nejjur	DW	14.26	74.93	565	8.23	1.6	0.5	5.1	560

Annexure - III

Results of Chemical Analysis Groundwater Samples of Siddapura Taluk

Sl. No.	Location	DW/BW	pH	EC	TH	Ca	Mg	Na	K	CO3	HCO3	Cl	SO4	NO3	F	PO4	Si
1	Karkihekkala	DW	5.73	103	40	12	2.42	8	0.79	0	30.5	24.85	ND	2.51	ND	ND	9.03
2	Dhanalli	DW	6.32	141	50	16	2.42	12.06	1.14	0	61	17.75	ND	ND	ND	ND	9.23
3	Nilkund	BW	7.35	150	65	20	3.63	8.1	3.48	0	88	14.2	3	ND	0.09	0.23	39.6
4	Heggarni	DW	6.96	225	85	30	2.42	18.72	2.6	0	103.7	21.3	14	7.01	ND	0.02	9.13
5	Kavalakoppa	DW	6.36	142	55	16	3.63	11.52	1.77	0	79.3	13	ND	6.15	0.08	0.02	25.42
6	Kavalakoppa	BW	7.22	200	65	20	3.63	17.56	6.78	0	120	14.2	ND	ND	0.27	0.05	43.17
7	Kolsirsi	BW	7.04	192	80	18	8.47	7.3	1.64	0	102	14.2	ND	ND	0.51	0.02	58.23
8	Kolsirsi	BW	7.02	301	115	30	9.68	18.39	8.79	0	183	14.2	ND	ND	ND	0.06	60.46
9	Nanikat	BW	6.72	87	30	8	2.42	8.12	1.98	0	53	8	ND	ND	ND	0.02	27.2
10	Shellur	DW	5.39	61	20	6	1.21	4	3.94	0	18.3	14.2	ND	ND	ND	ND	8.62
11	Hosagadde	DW	5.69	55	20	6	1.21	7.59	0.98	0	30.5	11	ND	ND	ND	0.02	11.45
12	Balikoppa	BW	6.98	189	75	20	6.05	12.34	3.28	0	103.7	17.75	ND	ND	0.67	ND	55.97
13	Aigod	BW	6.44	100	30	6	3.63	9.81	2.58	0	55	8	ND	0.45	1.04	0.23	40.68
14	Shiralgi	BW	7.84	129	50	18	1.21	11	2.92	0	78	10.65	ND	ND	0.45	0.07	54.61
15	Akkunji	DW	6.9	141	65	24	1.21	7.54	4.49	0	81	14.2	ND	3.67	0.61	0.02	15.44
16	Dombekai	BW	7.29	256	90	28	4.84	20.99	2.79	0	140.3	17.75	ND	ND	0.74	0.06	41.66
17	Katrigal	BW	6.97	176	70	18	6.05	8.24	1.18	0	88	13	ND	ND	0.27	0.11	24.84
18	Karesal	DW	6.85	113	60	20	2.42	4.22	0.34	0	67.1	12	ND	ND	0.88	ND	8.62

Sl. No.	Location	DW/BW	pH	EC	TH	Ca	Mg	Na	K	CO3	HCO3	Cl	SO4	NO3	F	PO4	Si
19	Alakone	DW	5.47	89	30	10	1.21	7.04	1.07	0	42.7	10	ND	ND	ND	ND	6.01
20	Allimakki	BW	6.31	112	45	16	1.21	8.21	0.97	0	61	13	ND	ND	0.03	ND	11.45
21	Sungatti	BW	7.1	216	95	28	6.05	2.21	0.27	0	106	14.2	ND	ND	0.01	0.02	46.47
22	Kalavana	DW	6.77	255	125	32	10.9	4.66	1.76	0	132	14.2	2	0.46	0.7	ND	13.3
23	Taribagili	DW	6	98	48	12	4.4	2.7	0.31	0	36.6	14.2	ND	ND	ND	ND	15.47
24	Nejjur	DW	6.8	149	50	16	2.42	8.41	5.45	0	61	17	3	1.05	0.3	ND	11.38

(All in mg/L except pH, EC, TH. ND: Not Detected)