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

Supa Taluk, Uttara Kannada District, Karnataka

दक्षिण पश्चिमी क्षेत्र, बेंगलुरु

South Western Region, Bengaluru

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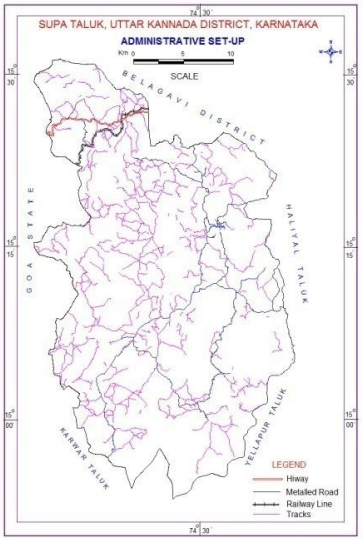
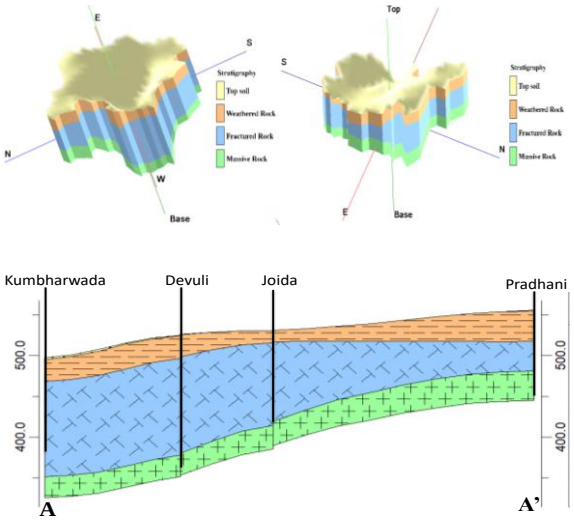
Bengaluru

AQUIFER MAPS AND MANAGEMENT PLAN, SUPA(JOIDA) TALUK, UTTARA KANNADA DISTRICT, KARNATAKA STATE

(AAP – 2022-2023)





By

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MAY 2023

AQUIFER MAPS AND MANAGEMENT PLAN, SUPA(JOIDA) TALUK, UTTARA KANNADA DISTRICT, KARNATAKA STATE

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AQUIFER MAPS AND MANAGEMENT PLAN, SUPA(JOIDA) TALUK, UTTARA KANNADA DISTRICT, KARNATAKA STATE

1. SALIENT INFORMATION

Name of the Taluk: **Supa (Renamed as Joida)**

District: Uttar Kannada

State: Karnataka

Area: 1897 sq.km.

Population: 52012 (Census 2011)

Annual Normal Rainfall: 2578 mm

1.1 Introduction

Aquifer mapping studies have been carried out in Supa Taluk, Uttar Kannada district of Karnataka covering an area of 1897 sq.km underNational Aquifer Mapping Project during the year 2022-23. Supa Taluk of Uttar Kannada district is located between North Latitudes 14°53’9.6” and 15°31’30”and East Longitudes between 74° 15’3.6” to 74°38’34.8” and is falling in Survey of India Toposheet No48 I/5, 8, 11 and 12. **Supa Taluk is an eponymous one as Supa village get submerged due to construction of Supa dam across Kali Riverand now it is named as Joida.**The study area is bounded on the North mainly by parts of Belgaum district and minor parts of Goa state. On the Eastit is bounded by Haliyaltaluk, on the South by Yellapur and Karwartaluks of Uttar Kannada andon the west by Goa state. Location map of Supa Taluk of Uttar Kannada district is presented in **Figure-1.1**. Joida is the Taluk head quarter and there are 120 villages in total. There are no towns or urban areas in the taluk and is the largest in terms of area.

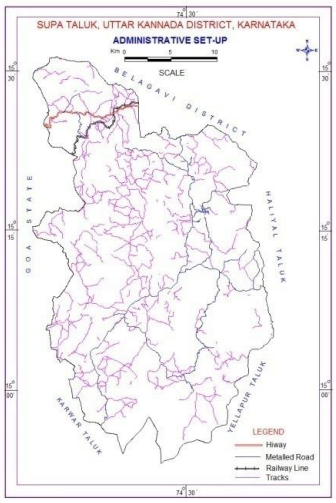


Figure 1.1: Location Map of Supa Taluk, Uttar Kannada district

1.2 Population

According to 2011 census, the population of Supa Taluk is52012, out of which,26167 are males and25845are females. The average sex ratio of Supa Taluk is 988.It has an overall population density of 28 persons per sq.km which contribute to 3.62% share of the total population. The decadal variation in population from 2001-2011 is 6.33% in Supa Taluk. Total households in the taluk are11648 and all belonged to the rural areas. There are total 14 Village accountant circle with 3 Hoblies and 16 Gram Panchayats. In total there are 120 villages, out of which 114 are inhabited and 6 are un-inhabited.

1.3 Climate and Rainfall

Supa Taluk enjoys tropical monsoon climate. It belongs to the coastal region of Karnataka and falls under Hilly agro-climatic zone. Dryness and hot weather prevail in major part of the year. The climate of the study area is quite pleasant and free from extremes. The temperatures start rising from January reaching peak in May which hovers around 30°c. Humidity is lowest during the dry season and highest during the monsoons. The year is usually divided into four seasons: Summer from March to May; rainy season or south-west monsoon season from June to September; post-monsoon season covering the months of October and November and dry or winter. The winds are predominantly south westerly during the summer monsoon and northeasterly during the winter monsoon.

The rainfall data in respect of Supa station from the year 2010 to 2020 is analyzed and presented in Table-1.1. Normal annual rainfall for the period is 2578 mm with 94 rainy days.

Table1.1: Annual Rainfall Data (mm) of Supa taluk, Uttar Kannada district (2010 to 2020)

STATION	Rainfall (mm)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Annual
Supa		3073	4491	3396	4559	3987	2742	3066	3040	4268	4412	3063	2578

(Source: District at a Glance, 2020-21)

There are 16 rain gauge stations. Seasonal rainfall pattern indicates that major amount of rainfall is recorded during South-West Monsoon season which is active from June to September. The north eastern monsoon is dry with humidity of 55%.

1.3.1 Statistical analysis

Computations were carried out for the 30year blocks of 1981- 2010 on Mean, Standard deviation and coefficient of variation of each month pre monsoon, monsoon, post monsoon and annual and are shown in **Table 1.3.1**.

Table 1.3.1: Statistical Analysis of Rainfall Data of SupaTaluk, Uttar Kannada District, Karnataka for the Period 1981 to 2010

Station		Jan	Feb	Mar	Apr	May	Pre Monsoon	Jun	Jul	Aug	Sep	South West Monsoon	Oct	Nov	Dec	North East Monsoon	Annual Rainfall
Supa	Normal Rainfall (mm)	4	0	9	29	63	105	531	814	602	173	2119	142	32	7	181	2405
	ST.DEV	20	1	25	38	71	104	179	306	199	106	458	95	37	19	107	514
	CV%	240	178	195	70	99	62	37	38	49	53	26	55	124	184	43	20

The mean monthly rainfall at Supa taluk is ranging between 4 mm during January to 814 mm during July. The CV percent for pre monsoon, monsoon and post monsoon season is 62, 26 & 43 percent respectively. Annual CV at this station works out to be 20 percent.

1.3.2 Assessment of Drought

Rainfall data of Supa Taluk has been analyzed for 58 years (1961 – 2019) using IMD method to assess the drought condition in Supa Taluk. The results of the classification are listed in the **Table 1.3**. It is observed that the Supa Taluk has experienced alternating no drought to moderate drought conditions over the years.

Table 1.3.2 : Classification of drought and its periodicity (IMD, 1971)							
% Deviation (Di)		**>0**	**0 to -25**	**-25 to -50**	**50 to -75**	**<-75**	**Probability of drought occurrences**
Category		**No drought**	**Mild (Normal)**	**Moderate**	**Severe**	**Acute**	
		Years					
Taluk	Supa	6	48	4	0	0	Once in 15 years

The details of the drought assessment are discussed as herein under. Out of 58 years of analysis in Supa Taluk, "No Drought" condition is experienced in 6 years, "Mild Drought" condition is experienced in 48 years and "Moderate Drought" condition experienced in 4 years in Supa Taluk. Based on occurrence and frequency of past drought events, the probability of occurrence of various intensities of drought at each station has been studied. It has been observed that the frequency of occurrence of drought is **once in 15 years** at Supataluk.

The rainfall data for the last 6 years from KSNDMC, Govt. of Karnataka is presented in **Table 1.3.2** and the talukhas received good rainfall.

Table 1.3.2: Annual Rainfall Pattern (mm) of Supataluk from 2017 to 2022

Annual Rainfall Pattern of SupaTaluk			
Year	**Normal (mm)**	**Actual (mm)**	**DEP%**
2017	2525	2582	2
2018	2525	3233	28
2019	2525	4412	75
2020	2578	3063	19
2021	2578	3483	35
2022	2578	2723	6

1.4 Agriculture & Irrigation

Agriculture is the main occupation in Supa Taluk. Major crop grown is Paddy. **(Table 1.4.1 and Figure 1.2).** It is grown in an area of 3962 Ha followed by Arecanut. Among horticulture crops, Banana and Mango constitute a major area. 212.33 Ha is the total area under banana cultivation. Among pulses, Tur are Bengal grams are grown. Maize and Jowar are not grown .64.15 % is the percentage of the area under food grain to the total area sown.

Table 1.4.1: Cropping pattern in Supa taluk (Ha)

Year	Paddy	Areca nut	Banana	Sugar cane	Oil seeds	Tur and Bengal Gram	Maize&Jowar
2019-20	3962	782	212.33	88	13	3	0

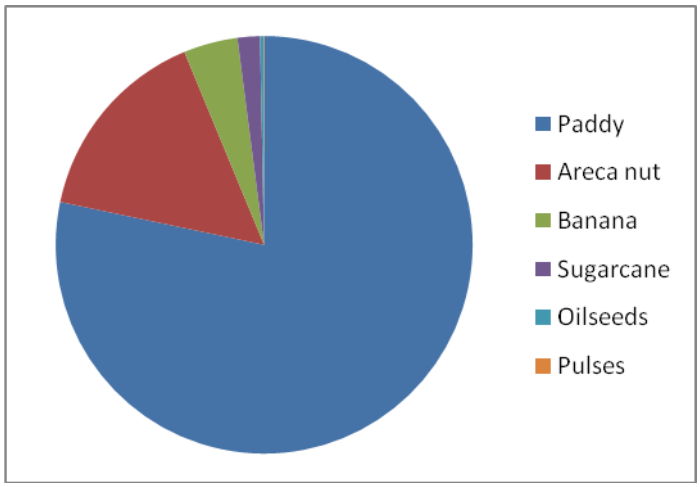


Figure 1.2: Cropping Pattern in Supa taluk (2019-20)

It is observed **(Table-1.4.2)** that the total forest area is 165873 Ha which accounts for 87 % of the total geographical area. It is third most heavily forested taluk of Uttar Kannada district after Dandeli and Yellapur Taluk. It belongs to the Western Ghats which is a mountain range that runs almost parallel to the western coast of Indian peninsula. It is an**UNESCO World Heritage Site** and is one of the eight "hotspots of biological diversity'' in the world. (Draft Working Plan for Supa Division, 2012-13 to 2022-23, Forest Department). The net sown area is 5776 Ha which is 3 %of the total area of the taluk**.** Areas not available for cultivation cover 8% of total geographical area. (**Figure 1.3 and 1.4**)

Table 1.4.2: Details of land use in SupaTaluk in 2019-2020 (Ha)

Taluk	Total Geographical Area	Area under Forest	Area not available for cultivation	Other uncultivated land	Total fallow land	Net sown area	Area sown more than once
Supa	191069	165873	15449	1468	2502	5776	405

(Source: District at a Glance, 2020-21)

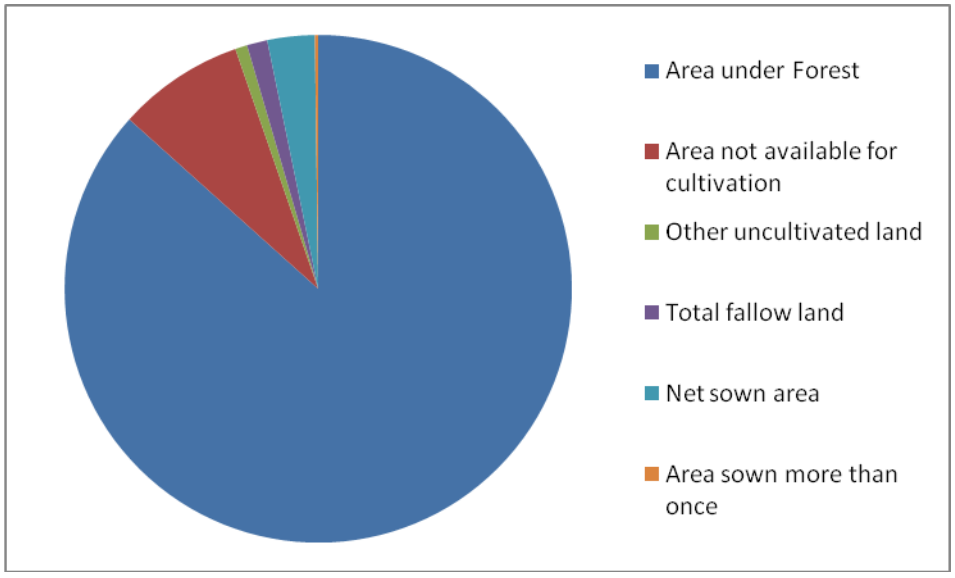


Figure 1.3: Land Use Pattern of Supataluk

Among the groundwater abstraction structures, there are 58 numbers of open well and 43 numbers of hand pump or bore well.The percentage of net area irrigated is 18.54% to net area sown. (Table- 1.4.3**).**Through surface water is present, but for irrigation purpose it is not used and there is no major or minor irrigation project. There is no command area. The highest area of 866 Ha is irrigated by other sources which comprises of perennial nallas, small ponds and rainwater harvesting impounded storage units.

As per Directorate of Economics and Statistics and Annual Season Crop report of 2019-20, a total area of 955.11 Ha is under micro irrigation,where an area of 810 Ha is under Agriculture department, 138.81 Ha is under Horticulture and6.3 Ha is under Sericulture Department.

Table 1.4.3: Irrigation details in Supa Taluk in 2019-20

Source of Irrigation	No.	Net area irrigated (Ha)	Gross Irrigated area (Ha)
Canals	0	0	0
Tanks	0	0	0
Open /Dug Wells	58	105	105
Tube/Bore wells	43	100	125
Lift Irrigation	0	0	0
Other Sources	--	866	1260
Total		**1071**	**1490**

(Source: District at a Glance, 2020-21)

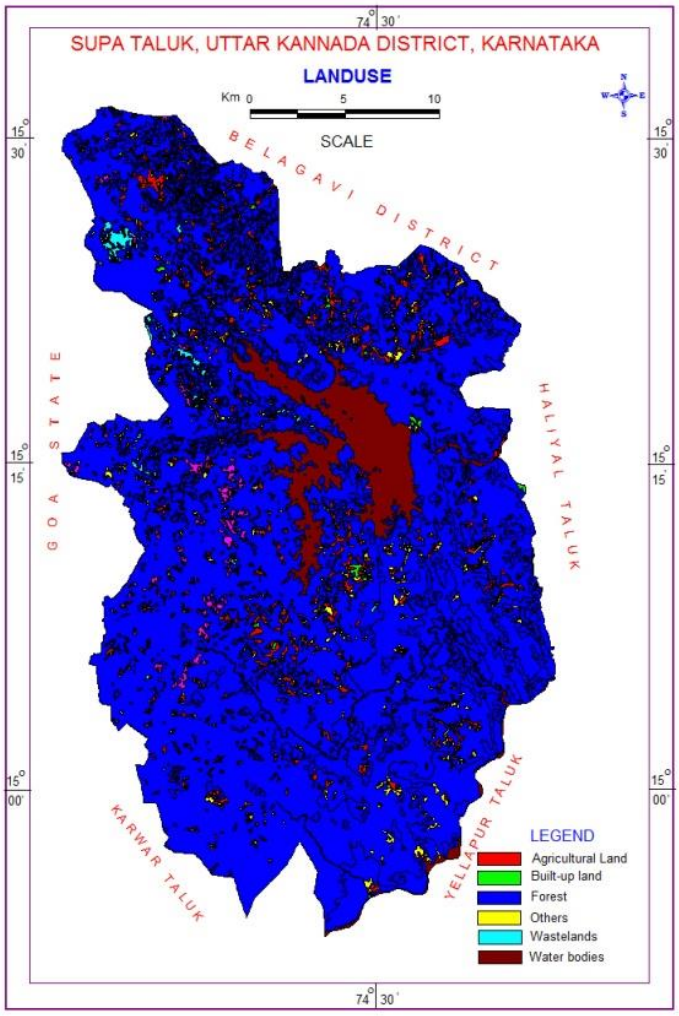


Figure 1.4: Land Use and Land cover

During the pre and post monsoon survey in the taluk, it was observed that the dug wells are yielding water throughout the year, though the quantum may vary seasonally. This indicates that the good / excessrainfall received (Table 1.3.2) in the talukis recharging the phreatic aquifer. The hand pumps in some areas like Pradhani (15.06682, 74.571457), Bapeli Cross (15.200006, 74.524229) (Photo 1.1) is in use whereas in other areaslike Joida (15.172284, 74.485582), Anashi (14.994104, 74.368873) it warrants repair (Photo 1.2). Majority of the hand pumps are becoming dysfunctional due to non-usage, negligence operation and maintenance issue. In Anashi, near the post office and government hospital area during lean period, this above phenomena is observed where borewell (14.994104, 74.368873) and dug well both are catering water (Photo 1.3), whereas the hand pump is lying defunct.

Photo 1.1: Hand pump in use in Bapeli Cross

Photo 1.2: Defunct Hand pump in Anashi

Photo1. 3: Borewell catering water in Anashi

1.5 Geomorphology, Physiography & Drainage

The major part of the area is covered by hilly areas belonging to Sahyadri hill ranges and falls under Hill agro-climatic zone. The dense to moderately dense forest of Western Ghats are the typical characteristics of the taluk (Figure 1.5.1). An area of 92663 ha is hilly area which is not worthy of recharge. The Western Ghat forms the watershed from which all the east flowing and west flowing rivers originate. The taluk falls in West flowing river basin and is drained by KaliRiver (Photo 1.4). This west flowing river originated at a village called Kushavali in Western Ghats that runs for 184 km ultimately joining the Arabian Sea.One of the largest dam in Karnataka called Supa dam (second largest dam in the State) isbuilt across this Kali river at Ganeshgudi. It is a concrete gravity dam built by Hindustan Steel Works Construction Limited in the year 1986 and now operated by Karnataka Power Corporation limited (KPCL). The power

house at the foot of the dam has two electricity generators of fifty megawatt each. The electricity generated is supplied to different parts of Karnataka.The height of the dam is 101 meters with catchment area of 1100 sq km with a storage capacity of 147 Thousand Million Cubic Feet (TMCft). Three radial gates of size 15 x 10 Mtrs are provided to regulate the flood discharge. The reservoir has two saddle dams of length 705 Mtrs and 940 Mtrs. (Source: KPCL). The drainage pattern is mostly dendritic in nature **(Figure 1.5.2).**

The construction of the dam has resulted in submergence of many villages (**Fig 1.5.3**) including Supa and the taluk which was once known as Supa is now renamed Joida.Two branches of stream namely Pandri (**Photo 1. 5)**and Ujji originated in the extreme north joins at Supa after running for 32 km. Tattihalla stream joins these two forming the Lalguli falls. Two tributaries namely Kaneri (originating in Kundal village) and Vakki (originating in Nujji village) joins Suparivernear Tulasgeri village. Totally four major dams are built across Kali river-Supa reservoir at its headwater, Bommanhalli at Dandeli, Kodasalli near Ganeshgudi and Kadra which is a part of Kaiga nuclear plant. Two minor dams are built at Kaneri and Tattihalli. These six dams in total generate 1200 MW of electricity.

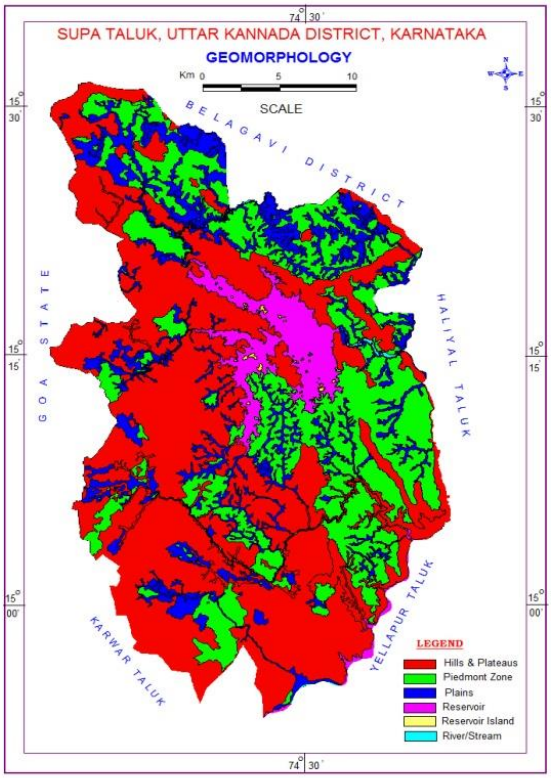


Fig.1.5.1: Geomorphology Map

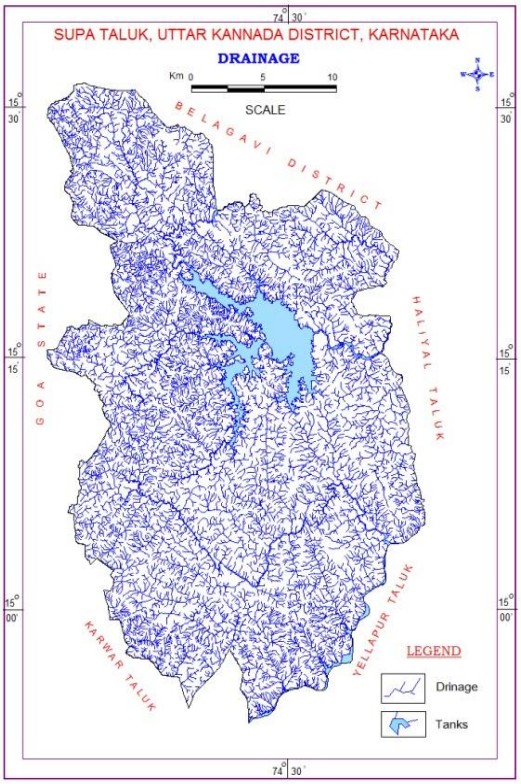


Fig.1.5.2: Drainage Map

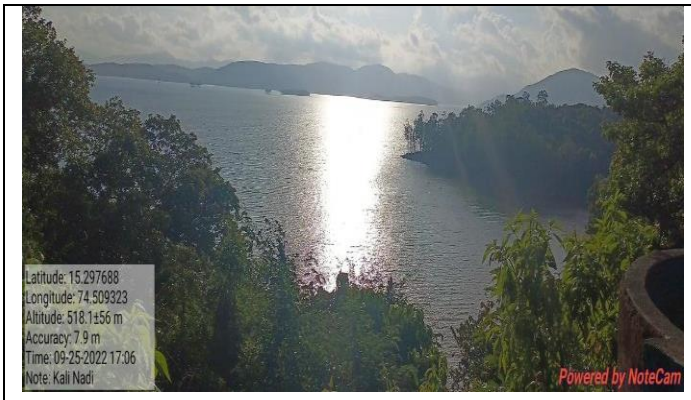


Photo 1.4: Kali River	**Photo 1.5: PandriRiver**

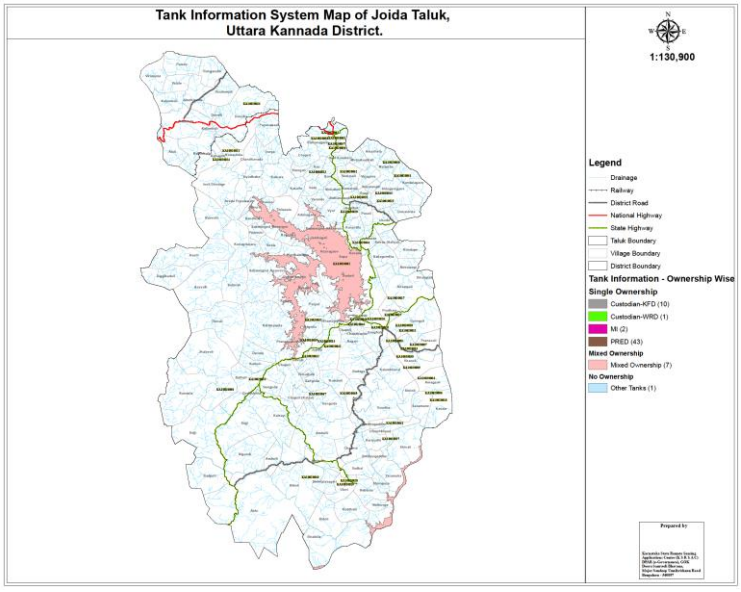


Fig 1.5.3: Map showing Tanks and submerged area (Source: KSRSAC)

1.6 Soil

The soil type found in the taluk is mainly of clayey variety. Clayey Skeletal covers the major portion of the taluk followed by clayey. Thin veneer of alluvial patches is seen around rivers Kali having varying thickness. (Fig.1.6)

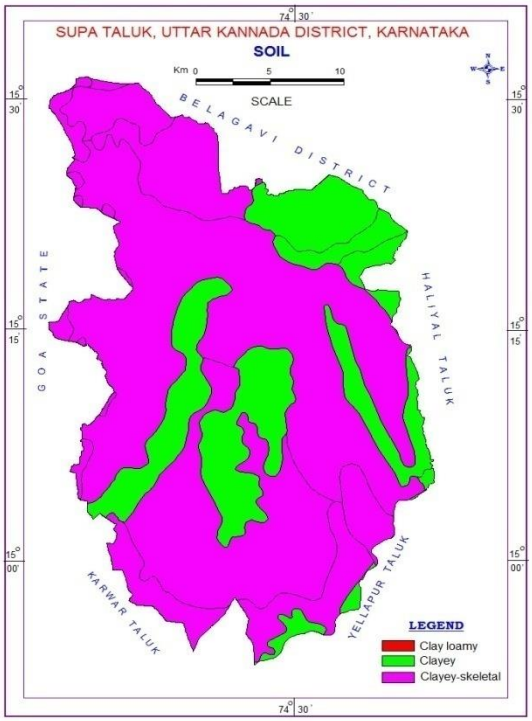


Fig. 1.6: Soil map

1.7 Ground water resource availability and extraction

Aquifer wise total groundwater resources up to 200 m depth are given in **Table-1.6** below.

Table-1.6: Total Ground Water Resources (2017) (Ham)

Taluk	Annual Extractable Groundwater Resource	Fresh In-storage GW resources (2017)		Total availability of fresh GW resources
Supa	6410.51	Phreatic	Fractured (Down to 200m)	Dynamic + phreatic in-storage + fractured
		33435.73	5578.22	45424.46

1.8 Existing and future water demands (As per GWRA 2022)

- Annual Extractable Groundwater Resource: 10256.48 Ham
- Groundwater Extraction for Irrigation: 1519.732 Ham
- Groundwater Extraction for domestic use:122.6772 Ham
- Total Extraction for all uses: 1642.409 Ham
- Annual GW allocation for domestic use as on 2025: 126.17 Ham
- Net GW availability for future Use: 8610.59 Ham

- Stage of Groundwater development: 16.013 %
- Category: Safe

1.9 Previous Work

Hydrogeological surveys were carried out by Shri K.Keerthiseelan, Scientist-C covering Supa Taluk of Uttara Kannada district during the years 1987-88. A report was compiled by Shri K. Keerthiseelan, Scientist-C, on “Hydrogeology and Ground Water Potential in Uttara Kannada district, Karnataka State” during the year 1990-91.

2. 0 HYDROGEOLOGY

2.1 Spatial Aquifer System

Main aquifers in the study area are the weathered and fractured zones of granites and gneisses, laterites along with fringes of alluvial veneer found along the major stream courses. In Supa Taluk, weathered Schist, Granite and gneissesare the main geological formations (Fig-2.1).The hilly tracks have thin weathered covers and the valley portions have thicker weathered zones. Since, the hard rocks in the area do not possesses the primary porosity, the secondary structures like joints, fissures and faults present in this formation act as a porous media. The ground water under atmospheric influence is the phreatic zone, which generally occurs within the depth rangeof 3.00 to 20.00 mbgl. In few localities it extends up to 35 mbgl.

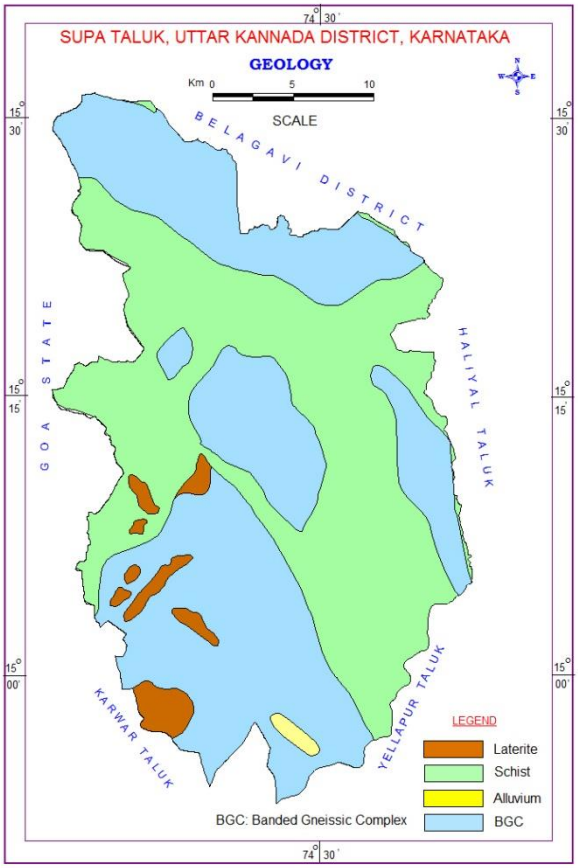


Fig-2.1: Geology Map

The fracture zones occur at various depth zones within the depth of 150.00 mbgl are expected to be saturated with ground water. It is found that the water bearing characteristics of schist rocks are more or less similar to that of gneisses and granites. But the weathered zones of schist may not yield as granites and gneisses because of their compact and fine-grained nature. Alluvium occurs along the river banks of Kali with varying thickness.

Ground water in the above aquifer material generally occurs under unconfined to semi-confined and confined conditions, in the shallower zones under phreatic condition and under semi-confined and confined condition in the deeper zones.

Groundwater exploration program was taken up in the taluk during 2004-05 and seven wells were drilled. The depth ranged from 16 m bgl upto 200 m bgl. The yield ranged from negligible to 506 lpm. Transmissivity value ranged from 2.09 to 17.06 m^2/day. The static water level ranged from 2.35 m bgl to 7.12 mbgl (Table 2.1). The salient characteristics of the aquifer are summarized in Table 2.2.

Table-2.1: Details of Ground Water Exploration in Supa taluk

No	Location	Depth drilled (mbgl)	Casing (mbgl)	Discharge (lpm)	DTW (mbgl)	DD (m)	C (m^3/day/m	T m^2/day	Aquifer
1	Joida EW	104.70	23.50	506	4.02	7.60	95.45	NA	Granite/Granite gneiss
2	Joida OW	105.70	21.5	203.40	7.12	17.70	16.55	NA	Granite/Granite gneiss
3	Joida OWI	16.25	10.25 BP 10.25-16.0 SP	Negligible	6.32	NA	NA	NA	Granite/Granite gneiss
4	Joida OW II	16.25	7.00 BP 7.00-13.00 SP	Negligible	5.64	NA	NA	NA	Granite/Granite gneiss
5	Kumbharwada EW	165.7	20.60	199.20	9.2	16.24	17.66	6.56	Granite/Granite gneiss
6	Kumbharwada OW	200.00	12.70	252.60	7.06	16.74	21.72	17.06	Granite/Granite gneiss
7	Kumbharwada OW II	25.40	13.0 BP 13.3 SP 19.4 BP 21.3 SP	Negligible	2.35	-	-	2.09 (Slug test)	Granite/Granite gneiss

NA: Not available

Table-2.2: Basic characteristics of each aquifer

Aquifers	Weathered Zone (Aq.-I)	Fractured Zone (Aq.-II)
Prominent Lithology	Laterite and weathered Granitic Gneiss	Fractured Granitic Gneiss
Thickness range (mbgl)	Upto 12	Upto150
Depth range of occurrence of fractures (mbgl)	10-35	Mostly 60-90
Range of yield potential (lps)	---	Negligible to 8.3
T (m^2/day)	---	2.09 to 17.06
Quality Suitability for Domestic &Irrigation	No quality problem reported so far	No quality problem reported so far

2.2 Depth wise Aquifer System:

The data generated from ground water monitoring wells, micro level hydrogeological

inventories, exploratory and observation wells, various thematic layers was utilized to decipher the aquifer disposition of the taluk. If we consider the vertical distribution of aquifer, two types of aquifer system are observed i.e., Aquifer – I which is a shallow phreatic aquifer and Aquifer – II which constitutes the deeper fractured aquifer.

- Aquifer-I (Phreatic aquifer) comprises of Weathered Laterite and Schist.
- Aquifer-II (Fractured aquifer) comprises of Fractured Schist, GraniticGneiss.

2.2.1 Aquifer-I (Shallow Phreaticaquifer)

Aquifer I comprises of weathered laterite and schist. The spatial distribution of depth of occurrence of Aquifer-I is depicted in Figure 2.2.1.It indicate that the depth of occurrence of Aquifer I ranges upto 25 m bgl and in few localities it ranged beyond 30 m bgl.

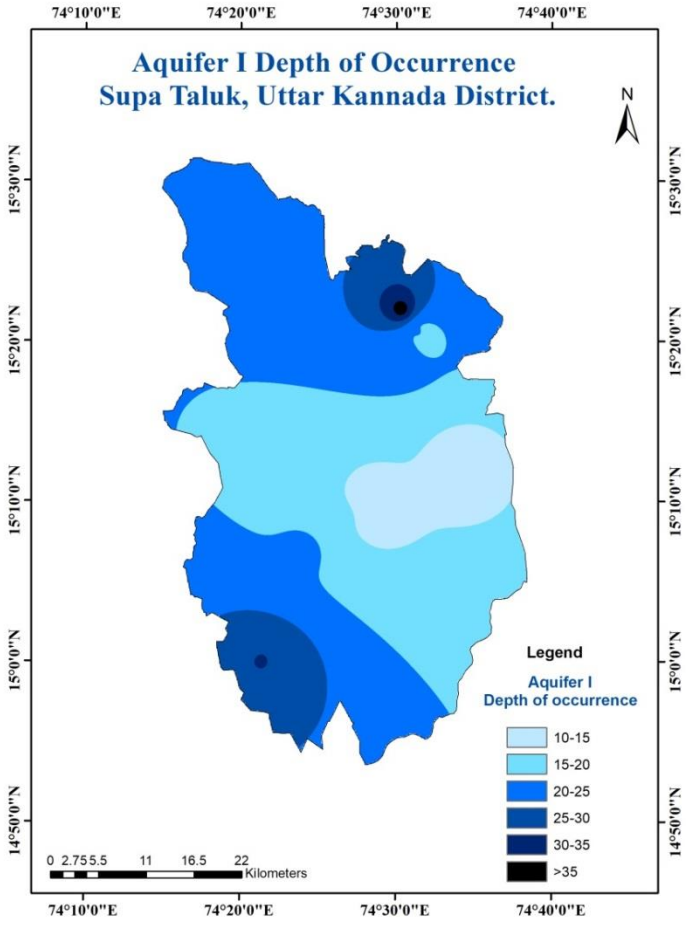


Figure 2.2.1: Depth of Occurrence of Aquifer I

2.2.2 Aquifer-II(Deeper Fractured aquifer)

The deeper aquifer comprises of the fractured schist and granitic gneiss. The spatial distribution of depth of occurrence of Aquifer-II is depicted in Figure 2.2.2. It indicates that the depth of occurrence of aquifer – II ranges from 60 m bgl onwards and in majority of the area 60 to 65 m bgl is the most frequented zone.

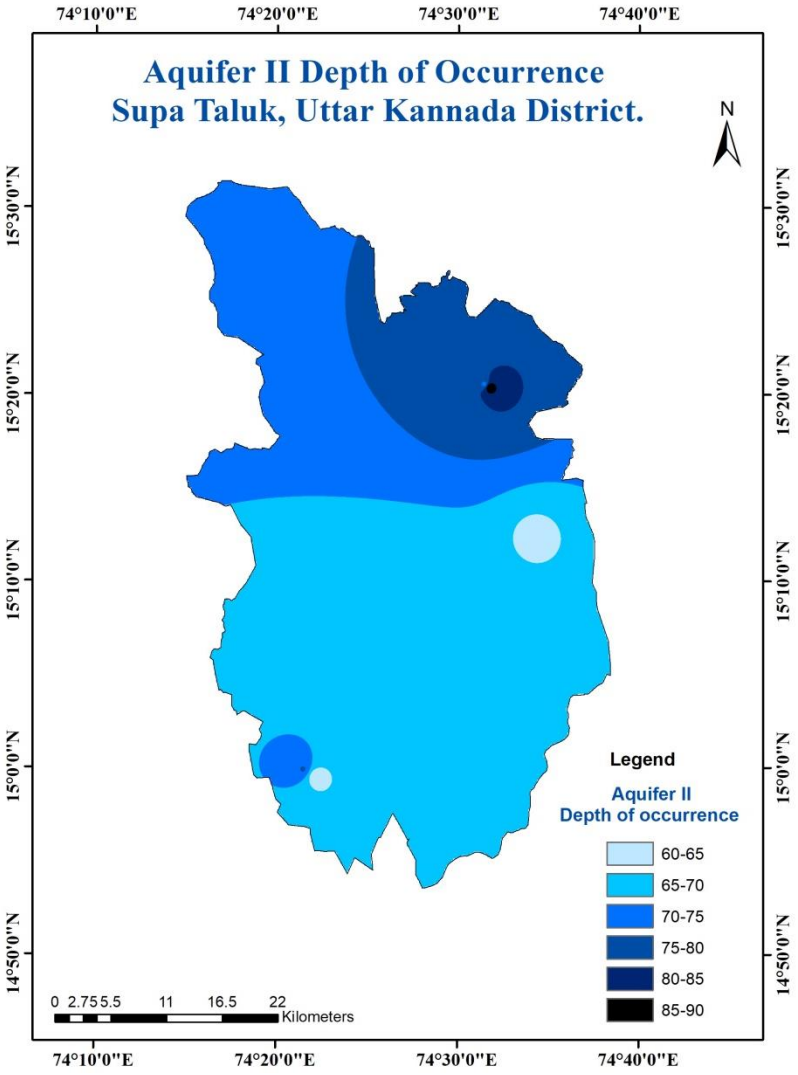


Figure 2.2.2: Depth of Occurrence of Aquifer II

2.2.3 2D and 3D aquifer disposition:

The 2D aquifer disposition is shown in Figure 2.2.3.1 and Figure 2.2.3.2respectively.

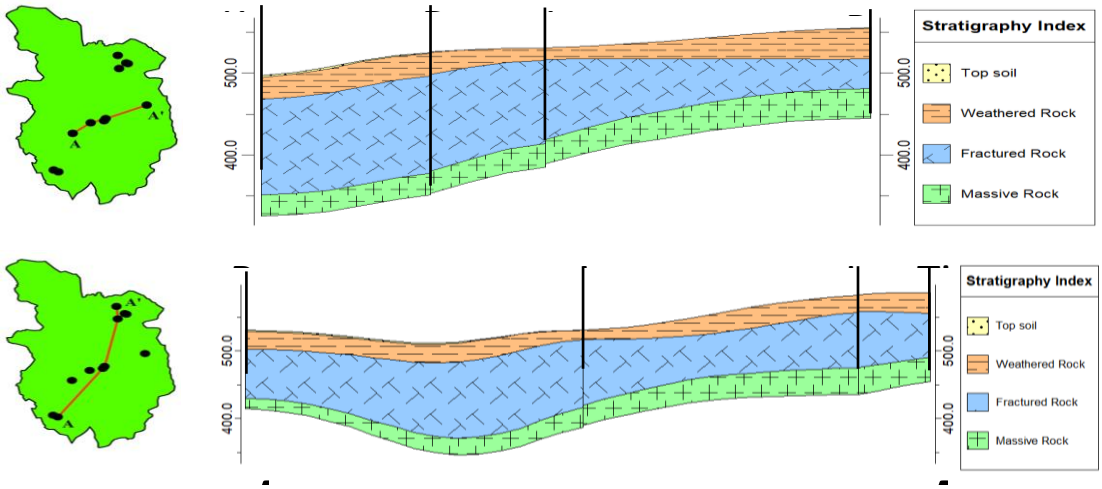
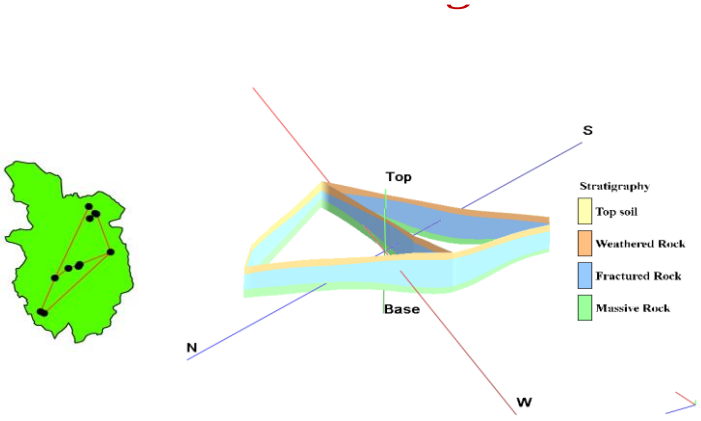


Figure 2.2.3.1: 2D aquifer disposition in Supa taluk



3D Aquifer Disposition

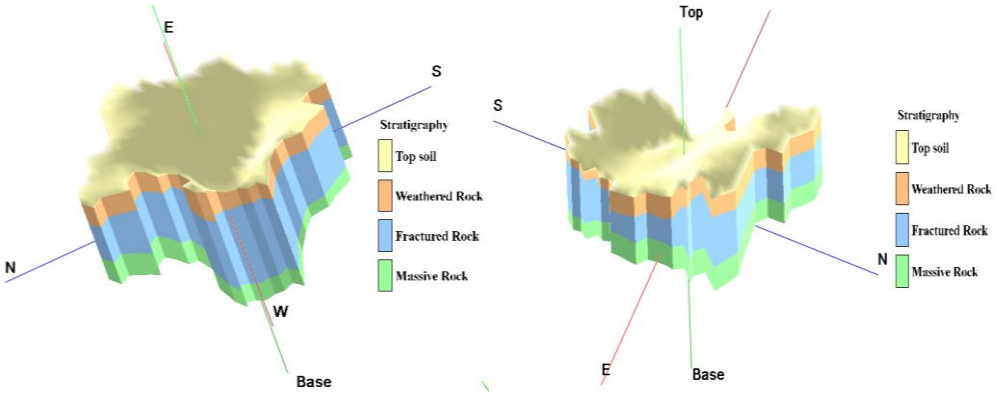


Figure 2.2.3.2.: 3D aquifer disposition and fence diagram in Supa taluk

2.3 Groundwater Regime

The depth to water level has been monitored during May and November 2022 from a total of 15 key observation wells (Annexure I) comprising of 12 dug wells (includes 2 NHS) and 3 hand pumps which were established during the survey. Water level data is also taken from 2 dug wells (Phreatic Aquifer) and 1 peizometer (deeper Aquifer) of CGWB's NHS and 5 dug wells and 4 borewell of SGWD in Supa to depict the ground water regime.

2.3.1 Aquifer-I (Phreatic)

The pre-monsoon (May 2022) depth to water level of Phreatic Aquifer indicates that depth to water level ranged from 0.6 to 10.58 m bgl. (Figure 2.3.1). In the post monsoon, depth to water level varies from 0.8 to 4.49 m bgl (Figure 2.3.2) and majority of the area shows water level in the range of 2 to 5 mbgl. The water level fluctuation map (Figure 2.3.3) shows a rise in water level in the range upto 4 m.

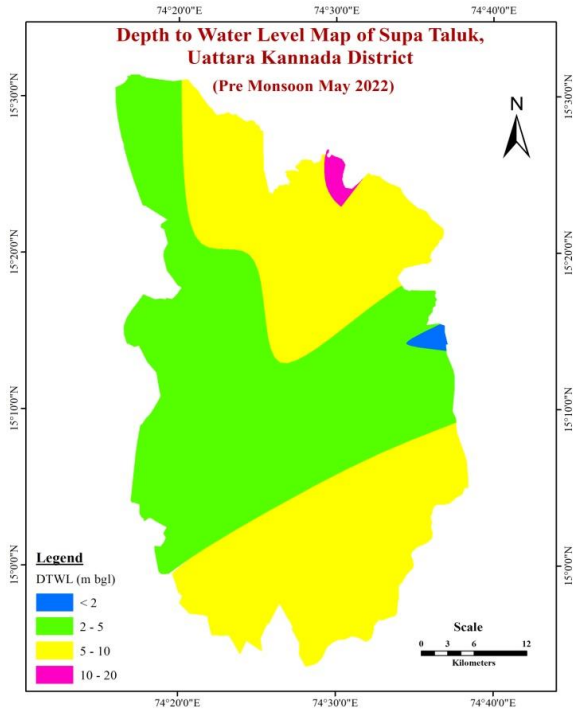


Figure 2.3.1: Pre Monsoon Depth to Water Level of Aquifer I

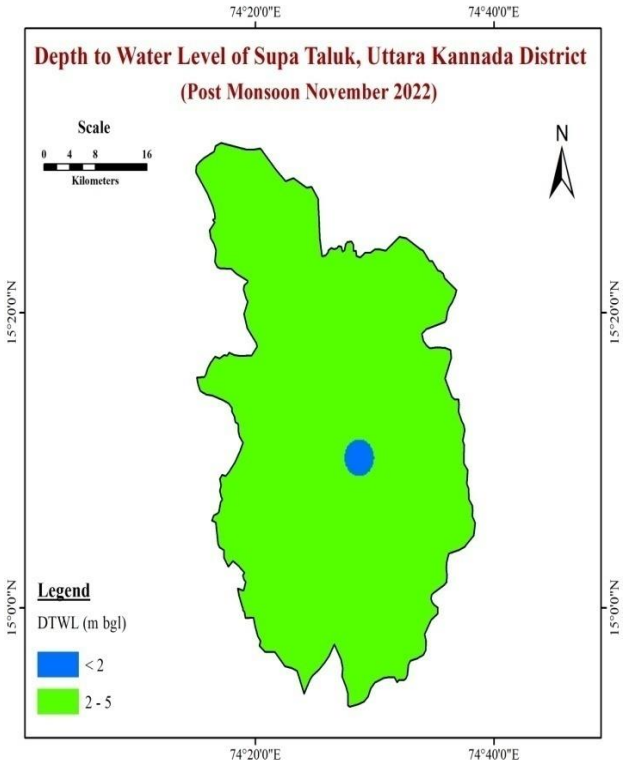


Figure -2.3.2: Post monsoon Depth to Water Level Map (Aquifer I)

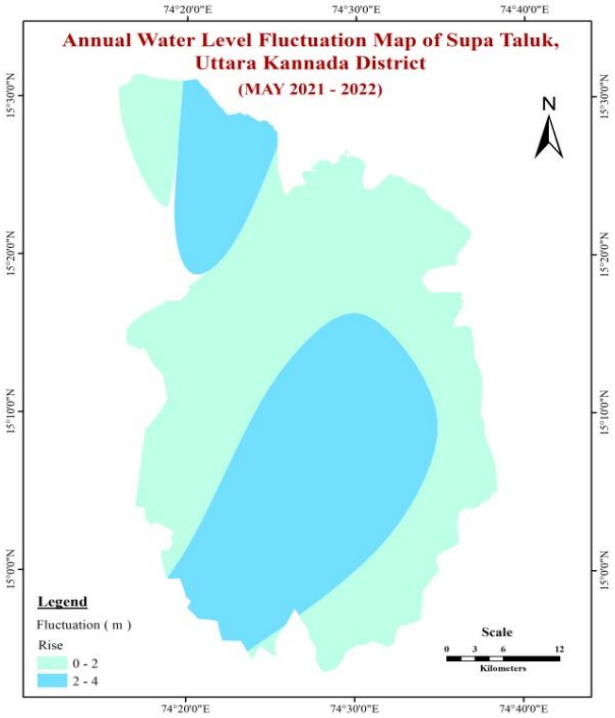


Fig 2.3.3: Water level Fluctuation Map

2.3.2 Aquifer II (Deeper Aquifer)

The pre-monsoon (May 2022) piezometric water level of deeper aquifer (Bore well) data indicates that the depth to water level ranged from 7.15 to 15.6 m bgl (Figure 2.3.2) and in post monsoon season it ranges from 4.9 to 10.36 mgl.(Figure 2.3.3).During the pre-monsoon period, majority of the taluk depth to peizometric level falls in the range of 5 to 10 m bgl and the western part falls in the range of 10 to 20 m bgl. Whereas in the post monsoon period, the peizometric level is within 5 to 10 m bgl,

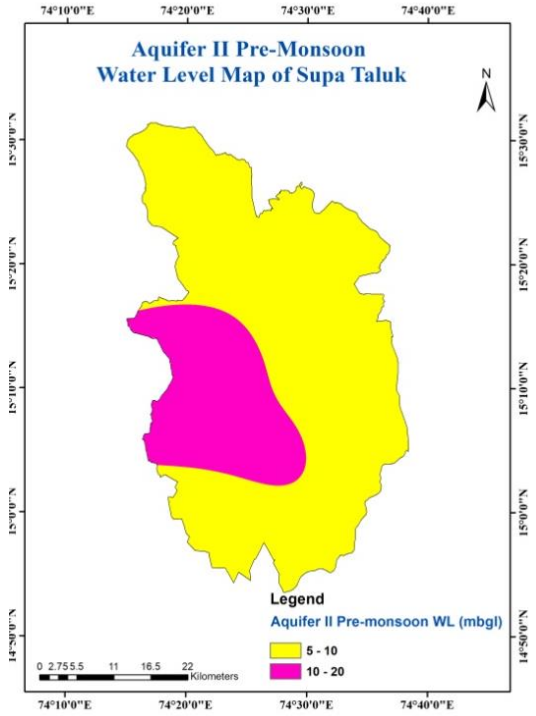


Fig 2.3.2.1:Pre-monsoon Depth to Water Level Map (Aquifer II)

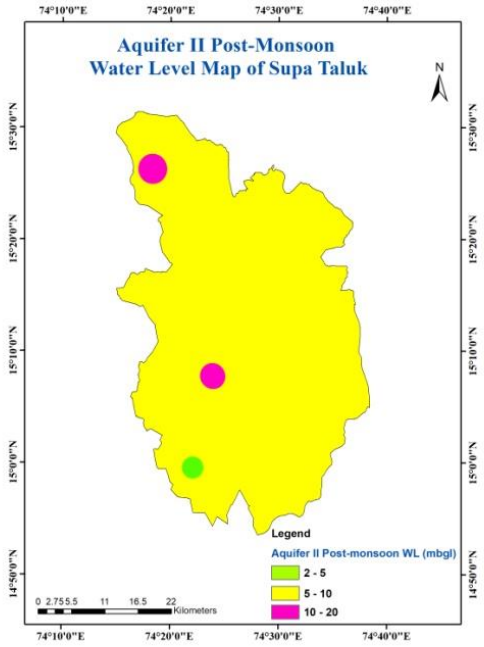


Fig 2.3.2.2:Post-monsoon Depth to Water Level Map (Aquifer II)

3. OTHER ISSUES

3.1 Aquifer wise resource availability and extraction

(a) Table 3.1.1: Present Dynamic Ground Water Resource (2022) ham

Taluk	Annual extractable Groundwater Resource	Groundwater Extraction for Irrigation	Groundwater Extraction for domestic use	Total extraction	Annual Groundwater Allocation For Domestic use as on 2025	Net Ground Water Availability for Future use	Existing Stage of Ground Water Development	Category
Supa	10256.48	1519.732	122.6772	1642.409	126.17	8610.59	16.013	Safe

(b) **Table 3.1.2: Total Ground Water Resources (2017) (Ham)**

Taluk	Annual Extractable Groundwater Resource	Fresh In-storage GW resources (2017)		Total availability of fresh GW resources
Supa	12209.59	**Phreatic**	**Fractured (Down to 200m)**	**Dynamic + phreatic in-storage + fractured**
		33435.73	5578.22	51223.54

Table 3.1.3 Comparison of ground water availability and draft scenario in Supa taluk

Taluk	2020			2022		
	GW Availability	Total extraction	Stage of GW withdrawal	GW Availability	Total extraction	Stage of GW withdrawal
Supa	12209.59	1491.86	12.22%	10256.48	1642.409	16.013

The taluk is in safe category in both GWRA 2020 (Fig 3.1) and in 2022 (Fig 3.2). However the total groundwater availability has decreased from 12209.59 Ham in 2020 to 10256.48 ham in the year 2022. The stage of development has also increased from 12.22 % to 16.013%. (Table 3.1.3)

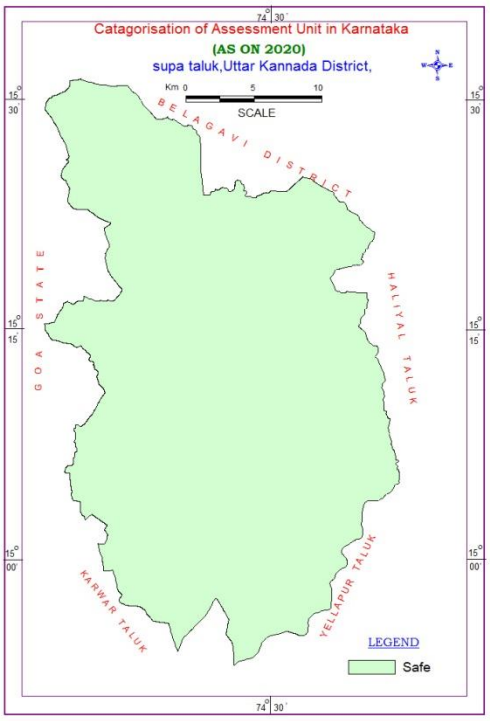


Fig 3.1: GWRA 2020

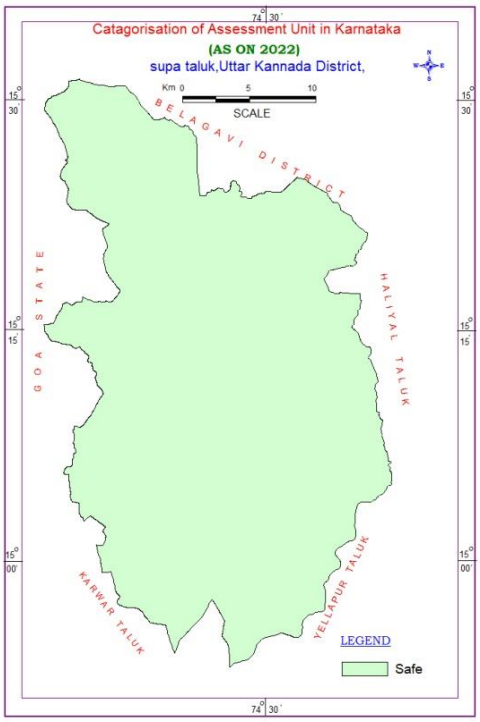


Fig 3.2: GWRA 2022

3.2 Chemical quality of ground water and contamination

To understand the chemical quality of groundwater, samples were collected mainly from abstraction structures like dug wells and hand pumps representing the Aquifer I and Aquifer II. About 15 samples were collected and all the geo tagged locations are shown in **Table 3.1**. The chemical result is awaited.However perusal of earlier chemical analysis during 2018 and 2019 is shown in **Table 3.2**

Table 3.1: Geo tagged locations of Groundwater sampling in Supataluk


Latitude: 15.159997
Longitude: 74.590245
Altitude: 475.8±100 m
Accuracy: 5.7 m
Time: 09-25-2022 11:54
Note: S3 Virnoli DW
Powered by NoteCam


Latitude: 15.16879
Longitude: 74.480923
Altitude: 509.7±72 m
Accuracy: 5.6 m
Time: 09-25-2022 12:36
Note: S4 Joida DW
Powered by NoteCam


Latitude: 15.133091
Longitude: 74.406962
Elevation: 579.16±98 m
Accuracy: 9.9 m
Time: 09-25-2022 12:59
Note: S5 Kumbharwada DW
Powered by NoteCam


Latitude: 15.100065
Longitude: 74.419083
Elevation: 559.08±100 m
Accuracy: 4.6 m
Time: 09-25-2022 13:42
Note: S6 Kondur DW
Powered by NoteCam


Latitude: 15.080395
Longitude: 74.435397
Altitude: 511.4±222 m
Accuracy: 181.2 m
Time: 09-25-2022 13:57
Note: S7 Kalsai DW
Powered by NoteCam


Latitude: 15.057618
Longitude: 74.345048
Altitude: 491.7±100 m
Accuracy: 8.9 m
Time: 09-25-2022 14:30
Note: S8 Nuji DW
Powered by NoteCam


Latitude: 15.200006
Longitude: 74.524229
Elevation: 605.12±100 m
Accuracy: 10.4 m
Time: 09-25-2022 16:18
Note: S9 Baplei Cross HP
Powered by NoteCam


Latitude: 15.283113
Longitude: 74.534852
Elevation: 498.54±36 m
Accuracy: 31.3 m
Time: 09-25-2022 16:52
Note: S10 Ganeshgudi DW
Powered by NoteCam


Latitude: 15.331178
Longitude: 74.509694
Elevation: 669.23±50 m
Accuracy: 15.9 m
Time: 09-25-2022 17:29
Note: S11 Jogalbet DW
Powered by NoteCam

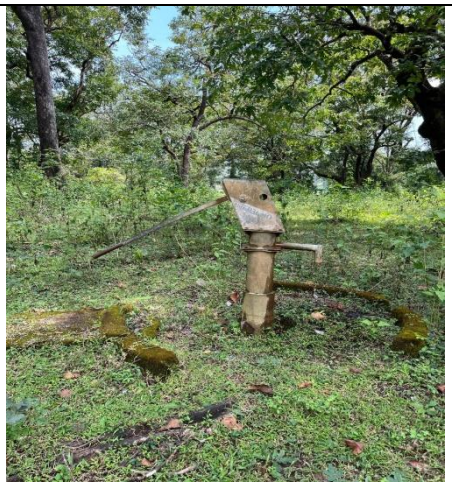


Table 3.2: Chemical analysis of Supa Taluk (2018-2019)

SITE_NAME	PH	EC us/cm at 25º	Chloride	Nitrate	Fluoride
Anshi	8.90	795	28	3	0.37
Nujje	7.67	145	21	2	0.33
Kumbarwada	7.61	192	31	11	0.33
Joida	7.63	223	24	7	0.33

The analysis results shows that all the parameters like EC (Fig 3.3), Fluoride (Fig 3.4), Nitrate (Fig 3.5) are within permissible limit as per BIS, 2012. Nitrate value ranges from 2 to 11 mg/l and Fluoride value ranges from 0.32 to 0.33 mg/l.

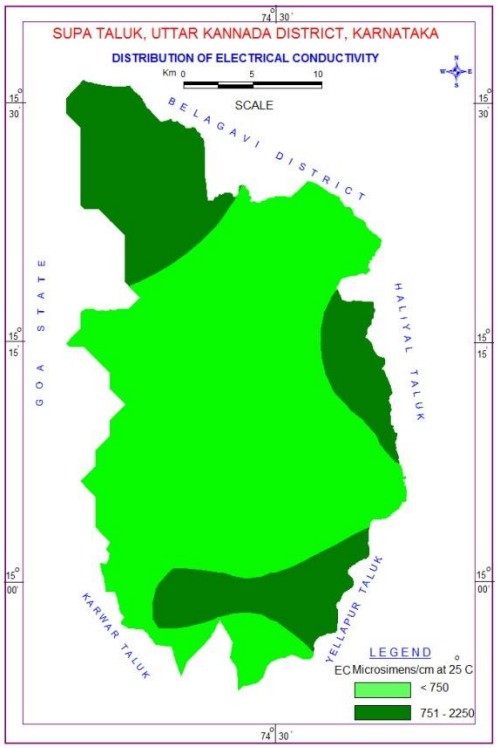


Fig 3.3: Distribution of EC in Supataluk

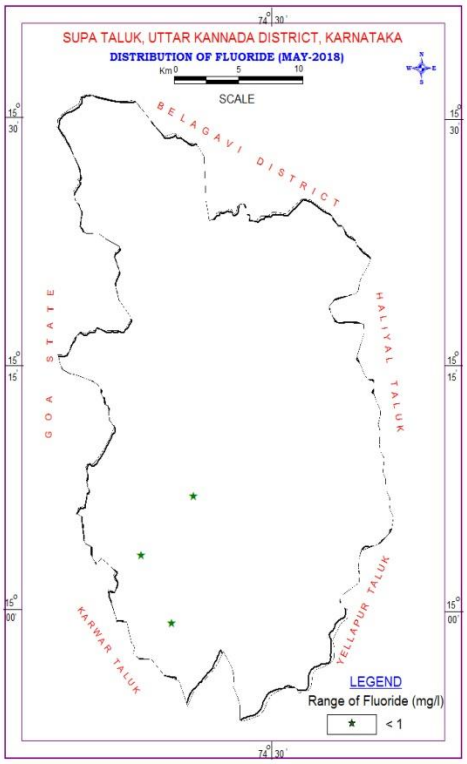


Fig 3.4 Distribution of Fluoride in Supataluk

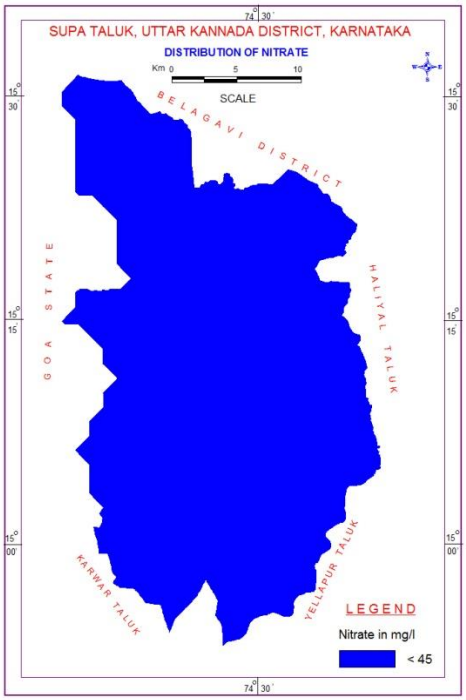


Fig 3.5 Distribution of Nitrate in Supataluk

4.0 GROUND WATER RESOURCE ENHANCEMENT

4.1 Aquifer wise space available for recharge and proposed interventions

Recharging dry phreatic aquifer (Aq-I) in the taluk, through construction of artificial recharge structures, viz; check dams and percolation tanks has already been taken up by state Government agencies and the area feasible for Artificial recharge is shown in Fig 4. 1. As per Master Plan for Artificial recharge, an area of 1451 sq.km is found feasible in the taluk. The salient feature of the artificial recharge scheme is shown in Table 4.1.21 check dams are proposed which needs to be constructed at scientifically feasible sites after ground truthing. An additional 1080.7 Ham will be created after implementation of the scheme which will lead to an increase in availability of groundwater to 11337.18 Ham resulting in decrease in the stage of development from 16.013% to14.48 % with an improvement of 1.5 %. (**Table 4.2**)

Table-4.1: Quantity of non-committed surface runoff & expected recharge through AR structures in SupaTaluk

Artificial Recharge Structures	**SupaTaluk**
Non committed monsoon runoff available (MCM)	10.807
Number of Check Dams proposed	21
Number of Percolation Tanks proposed	0
Number of Sub surface Dyke proposed	0
Tentative total cost of the project (Rs. in lakhs)	212.14
Excepted recharge (MCM)	10.807
Additional Irrigation Potential by ARS & RWH (Lakh Hectare)	0.010
Volume of water likely to be recharged (MCM)	8.105

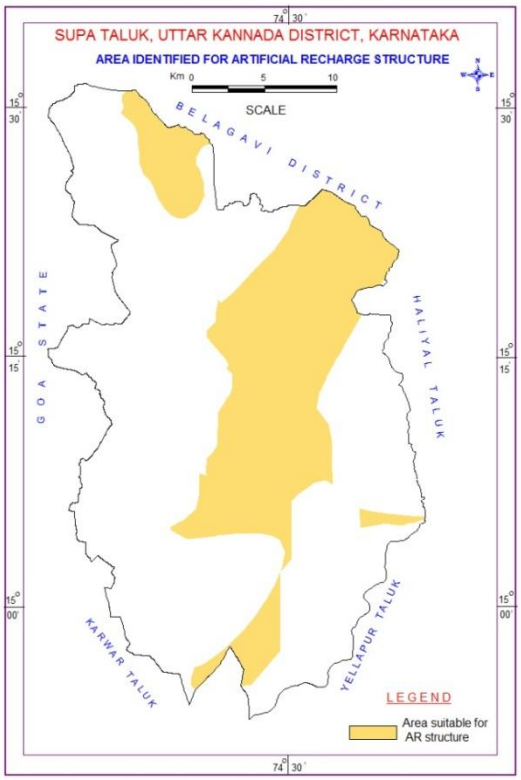


Fig 4.1: Area suitable for Artificial Recharge

Table-4.2: Improvement in GW availability due to Recharge, SupaTaluk (Ham)

Taluk	Annual extractable Groundwater Resource	Total extraction	Existing Stage of Ground Water Development	Expected recharge from proposed artificial recharge structures	Total availability of groundwater after implementation of ARS scheme	Expected improvement in stage of ground water development after the implementation of the artificial recharge project	Expected improvement in overall stage of ground water development
Supa	10256.48	1642.409	16.013 %	1080.7	11337.18	14.48 %	1.5%

5. DEMAND SIDE INTERVENTIONS

5.1 Advanced irrigation practices:

Agriculture is the main occupation of the people which depends exclusively on ground water. Increase in agricultural activity, ground water withdrawal, depletion of ground water levels in some pocketsand reduction in yield suggests the need for scientific ground water management, enhancement of storage capacity of the aquifers.

The important crops grown are paddy, arecanut and banana. An area of 3962 ha is under water intensive crop like paddy, 782 ha are under arecanut and 212 ha are under banana. Water Use Efficiency (WUE)practices like drip irrigation and sprinkler are yet to pick-up in the taluk to the fullest extent which needs to be expanded. Such irrigation practices are recommended mainly for the cash crops like arecanut and the horticulture crops like Banana. This ultimately enhances the area under irrigation potential. This will help in enhancing a quantum of 456Ham and will ultimately enhances the area under irrigation potential resulting a stage of groundwater development improvement from 14.48 % to 13.9 % with an improvement of 0.58 % (Table 5.1).

Table-5.1:ImprovementinGWavailabilityduetosavingbyadoptingwateruseefficiency (WUE) in Supa taluk

Taluk	Annual extractable Groundwater Resource	Total extraction	Existing stage of ground water development	SavingduetoadoptingWUEmeasures	Cumulativeannualgroundwateravailability after ARS and WUE	Expectedimprovementinstageofground waterdevelopment afteradopting WUE	Expectedimprovementinoverallstageof groundwaterdevelopment
	Ham	Ham	%	Ham	Ham	Ham	%
Supa	10256.48	1642.409	16.013	456	11793.18	13.9%	0.58 %

5.2 Change in cropping pattern

Change in cropping pattern may not be immediately warranted as the taluk is safe. However farmers may think of implementing a change in cropping keeping in view about long term sustainability from paddy to less water intensive crops in future.

6.0 GROUND WATER MANAGEMENT STRATEGY

Even though the district receives good rainfall, because of undulating topography and very permeable formation at the surface most of the rainwater escapes both as surface flow or base flow and in many parts of the district after March there is shortage of water for drinking. So the water supply sources should be supported by suitable artificial recharge structures or ground water conservation structures in the vicinity to augment the present water supply. Rainwater harvesting structures can be popularized through government incentives and schemes as the taluk receive abundant rainfall.

The present ground water development is of low key and falls under safe category as per GWRA 2022. However, there is still plenty of scope for further development. Dugwells are the more common abstraction structures for ground water irrigation. In most of the topographic lows or valley portion, dug wells are still the preferred abstraction structure (Photo 6.1) as they are economic and cost effective in nature ensuring a continuous supply of water throughout the year. In recent times Hand pumps/Bore wells are also being drilled for water supply schemes. But for irrigation, dug wells only are used. It was found that majority of the hand pumps are not is use or lying unused due to operation and maintenance issues. As the dug wells depends only on phreatic aquifers, the cropping pattern will be as per the availability from the phreatic aquifer but borewells taps water from phreatic as well as deep seated aquifers, the cropping pattern will not respond to the changes in shallow aquifers and in long run it may lead to over development of ground water.

Photo: 6.1: An old sustainable dugwell (Kondar15.100065, 74.419083) with a new dugwell (background)

The ground water worthy areas such as topographic lows, valley portions, area with low groundwater level fluctuations zones should be developed with an adequate soil conservation measures to prevent the soil erosions during rainy seasons.

The selection of sites for construction of artificial structures and ground water abstraction structures is site specific so after detail hydro geological scientific investigation and truthingonly sites may be selected. Even though the district receives good rainfall, considering the water scarcity in some pockets during peak summer, a comprehensive programme may be formulated to harvest the rain water through roof top, check dams, to enhance the artificial recharge to the ground water.

Some unique irrigation practices were observed in the taluk locally called as *Basi Kaaluve (Basi means to drain and kaaluve meaning channel or canal)*. In Gavegali (15.203589, 74.58538), areca nut farmer Sri Charmappa has adopted channel/canal type irrigation typeand drip irrigation for areca nut cultivation. In this type of irrigation, channels (Photo 6.2) are made to supports a unidirectional flow of waterwhich helps to create a pond-like system where the roots of the crops are submerged to retain the soil moisture in the summer season. During the rainy season, these channels act as a conduit to drain out the rainwater to avoid stagnation of water. This method has good control on irrigation water and high water application efficiency. Though the initial cost is high, it requires less labour and has low maintenance cost.

Photo 6.2: Basi Kaaluve Irrigation

People should be encouraged more for adopting conjunctive use of surface and ground water to maintain a balance. Training programme may be organized among farmers, NGOs, self -help group to impart the knowledge of sustainable development, management and conservative aspects in the taluk. Awareness may be raised on proper and solid waste management among the grass root stake holders not to litter in and around water source (**Photo 6.3**) as it may lead to contamination of the nearby water sources. Regular monitoring of water level and water quality for creation of scientific database and dissemination of data among the line department is recommended.

Photo 6.3: Littering and dumping of solid water around a dug well at Janatha Colony at Joida.

The farming community in the valley and low lying regions should be encouraged with financial assistance, incentives and necessary technical guidance to sink appropriate abstraction structures, to install pump sets, to practice modern irrigation methods thereby to strengthen their economy and improving their financial position and creating water security in the taluk.

APPENDIX I

Sl.No.	Location and details	Topo sheet No	Type of well / use	Lifting device	Depth of well (mbgl)	Dia. of the well (m)	Type of aquifer	DTW (mbgl)		
								Pre-monsoon 2022	Post Monsoon 2022	Fluctuation
1	**Gavegali.** Inside the village, 1/2 km from DandeliJoida Road. Private well owner Charmappa	48I/12	DW/D	R&P	10	1.5	Laterite	2.3	1.37	0.93
2	**Marada.** Well is in the premises of Shri.GaneshVelli's land.	48I/12	DW/D	R&P	8.30	2.00	Laterite	5.20	3.85	1.35
3	**Ulvi.** Well is in the premises of Sri. Channabasaveshwar.	48I/12	DW/D	R&P	6.20	1.60	Laterite	5.32	4.10	1.22
4	**Anshi**. Well is located behind forest quarter's near PWD IB. (NHS)	48I/5	DW/D	R&P	10.56	2.50	Laterite / Wt.Gr.Gn	6.28	2.68	3.6
5	**Kalasai**. Well is located near small bridge.	48I/8	DW/D	R&P	7.60	1.90	Laterite / Wt.Gr.Gn	4.59	2.39	2.2
6	**Pradhani.** Well is located on Dandeli-Joida road, Opposite to Post office and adjacent to KrishiSeva Kendra.	48I/12	HP/D	Manually Pumped	50.00	0.20	Fractured Schist and Granitic gneiss	7.5	5.2	2.3
7	**Virnoli.** On Chauvali-Virnoli Road. Well is located in the valley portion inside the village.	48I/12	DW/D	R&P	8.00	2.00	Laterite	2.82	0.8	2.02
8	**Joida.** On Joida-Karwar-Kumbarwada Road. Well is located in Janata Colony, 1/2 km from the junction.	48I/8	DW/D	R&P	8.25	2.00	Laterite	4.70	3.50	1.20
9	**Kumbharvada.** On Rightside of Joida-Kumbharvada road. Opposite to Mahashanti temple.	48I/8	DW/D	R&P	9.00	1.84	Laterite	6	2.1	3.9

10	**Kondar.** On Ulvi Road. Private well owner Sumitra. Near paddy field.	48I/8	DW/D	R&P	8.00	1.85	Laterite	8	2.58	5.42
11	**Kalsai .**4 km from Kondar on UlviRoad.In the topographic low after the culvert.	48I/8	DW/I	Pump	10	2.00	Laterite	4.59	2.39	2.2
12	**Nujji.** On SH 34 Anshi-Karwar Road. In the open playground in the middle of the village.(NHS)	48I/8	DW/D	R&P	12	2.20	Laterite	3.3	1.27	2.03
13	**Bapheli Cross.** At the junction of Dandeli-Joida Road	48I/12	HP/D	Manually drawn	65	0.1524	Fractured Granitic Gneiss	8.5	6.74	1.76
14	**Ganeshgudi**. In the village, topographic low near nala.	48I/11	DW/D	R&P	2.75	2.30	Weathered Granitic gneiss	0.7	0.6	0.1
15	**Jagalbhet**. Well is located in the agricultural field after Laxmi Temple.	48I/11	DW/D	R&P	5.00	2.00	Laterite / Wt.Gr.Gn	1.42	0.9	0.52