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

Sakleshpura Taluk, Hassan District, Karnataka

दक्षिण पश्चिमी क्षेत्र, बेंगलुरु

South Western Region, Bengaluru

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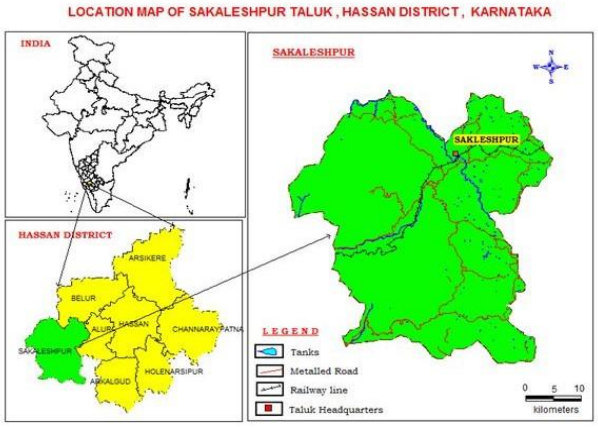
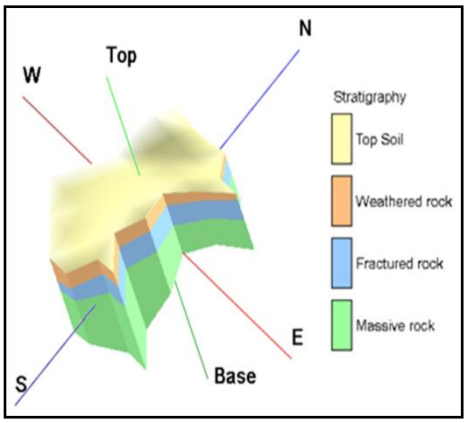
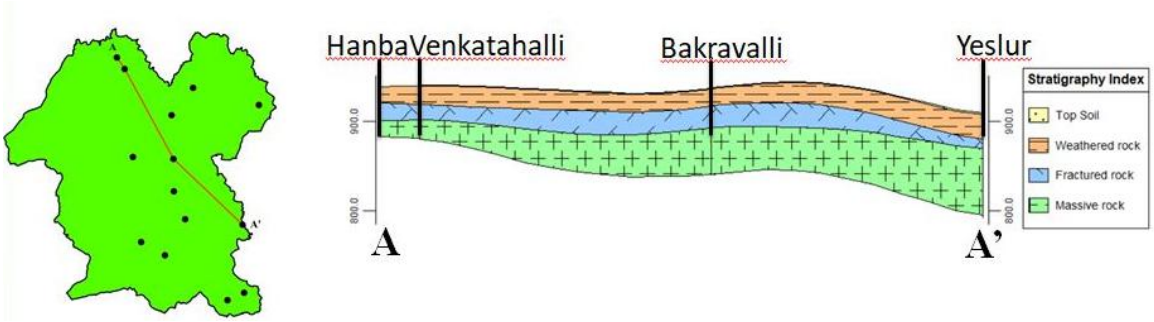
AQUIFER MAPS AND MANAGEMENT PLAN, SAKLESHPURA TALUK, HASSAN DISTRICT, KARNATAKA STATE

(AAP – 2021-2022)







By

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AUGUST2022

AQUIFER MAPS AND MANAGEMENT PLAN, SAKLESHPURA TALUK, HASSAN DISTRICT, KARNATAKA STATE

(AAP – 2021-2022)

1 Contents

AQUIFER MANAGEMENT PLAN OF SAKLESHPURA TALUK, HASSAN DISTRICT, KARNATAKA STATE

1. SALIENT INFORMATION

Name of the taluk: **SAKLESHPURA**

District: **HASSAN** ; State: Karnataka

Area: 1032 sq.km.

Population: 1,28,633 (As 2011 census)

Annual Normal Rainfall: 2211 mm

1.1 Study Area

Aquifer mapping studies have been carried out in Sakleshpura taluk, HASSAN district of Karnataka, covering an area of 1032 Sq.Km under National Aquifer Mapping Project. The Sakleshpura taluk is located between North Latitudes 12°40'5.9'' and 13°2'45.69" and East Longitudes between 75°32'46.28" to 75°54'36" and is falling in Survey of India Toposheet No forms parts of 480/12 48P/9,10,13,14. The study area is bounded on the East by Alur & Belur taluks, on the North by Mudigere taluk in Chikmagalore district, West by Beltangadi & Kadaba taluks in Dakshina Kannada district and south by Somawaripet taluk of Kodagu district. Location map of Sakleshpura taluk of HASSAN district is presented in **Fig-1.** Sakleshpura is taluk head quarter. There are 227 villages in this taluk.

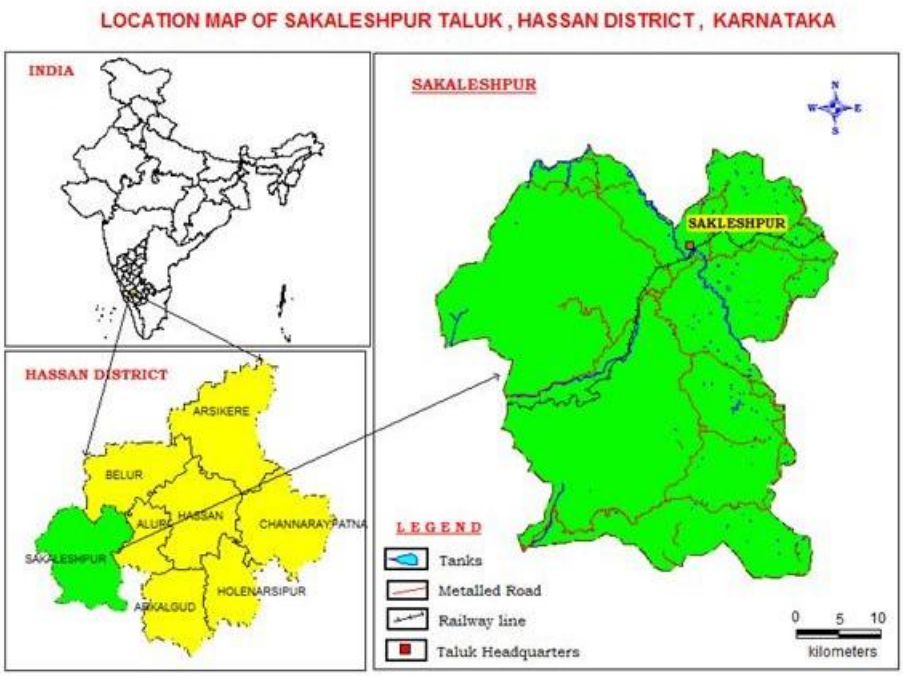

Fig-1: Location map

1.2 Population

According to 2011 census, the population in Sakleshpura taluk is 1,28,633. Out of which 63,126 are males while 65,507 are females. The average sex ratio of Sakleshpura taluk is 1038. The Sakleshpura taluk has an overall population density of 125 persons per sq.km., in which 1,05,281constitute the rural population and 23,352urban population, which works out to 82 % (rural) and 18 % (urban) of the total

population of Taluk. The decadal variation in population from 2001-2011 is 4.25% in Sakleshpura taluk shown in **Table.1**

Table-1: Population details of Sakleshpurataluk

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
1,28,633	63,126	65,507	7.24	1,05,281	23,352	4.25%	-5.59%	0.75%

Source: District at a glance 2018-19, Govt. of Karnataka

1.3 Rainfall

Sakleshpura Taluk enjoys semi-arid climate. Dryness and hot weather prevails in major part of the year. The area falls under Southern Dry agro-climatic zone of Karnataka state and. The normal annual rainfall in Belur Taluk for the period 1951 to 2018 is 2211 mm. Seasonal rainfall pattern indicates that, major amount of (1753 mm) rainfall was recorded during South-West Monsoon seasons, which contributes about 79% of the annual normal rainfall, followed by North-East Monsoon season (225 mm) constituting 10.5% and remaining (222 mm) 10.5% in Pre-Monsoon season **(Table-2).**

Table-2:Average Rainfall Data of Sakleshpura Taluk, Hassan district, Karnataka (2001-2018)

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN.RAINFALL
Sakleshpura	0	7	23	80	112	416	618	491	227	146	70	10	2200

Table-3: The annual rainfall data of Sakleshpura Taluk, Hassan district, Karnataka (2001-2018)

YEAR	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
ANN Rain	1690	1388	1430	2334	2841	2981	3247	2344	2542	2176	2335	1830	1685	2421	1898	1841	1665	2958

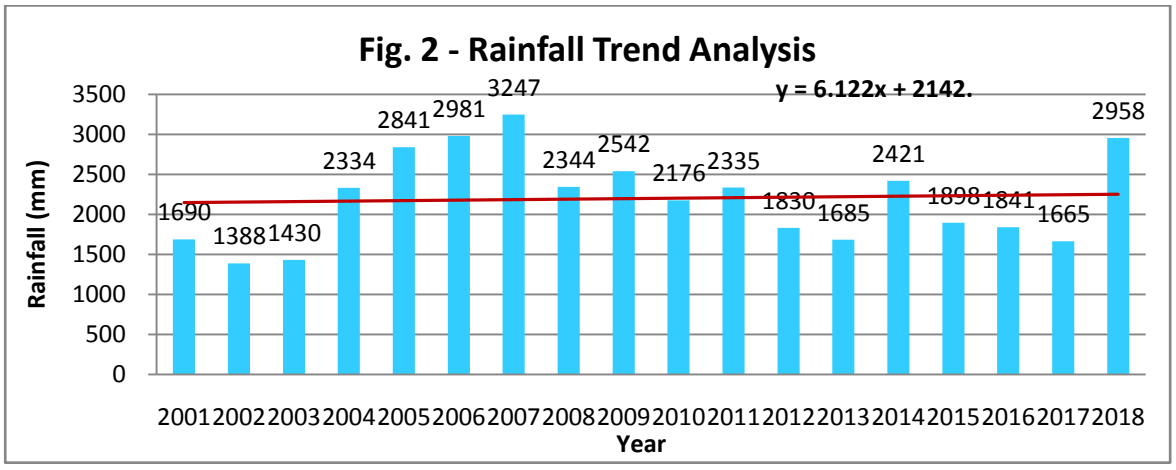

Fig. 2 - Rainfall Trend Analysis

The rainfall pattern in the Sakleshpura Talukreveals the irregularity of rainfall behaviour (**Fig-2**) and the rainfall varies from 1388 mm to 3247 mm (**Table-3**). As mentioned above, the normal annual rainfall of Sakleshpura TALUK is 1050 mm.Sakleshpura Talukreceived rainfall above normal during the years 2004-2011 and 2014 &2018.

1.4 Agriculture & Irrigation

Agriculture is the main occupation in SAKLESHPURA taluk. Major Kharif crops are Paddy, Maize, Bajra, Jowar, Tur and Vegetables. Main crops of Rabi season are Paddy, Maize, Bajra and Jowar (Table-2). Water intensive crops like Paddy is are grown in 87% of total crop area. Fruits are grown in 11% and Vegetables in 0.76% of total crop area of talukshown in **Table.4.**

Table-4: Cropping pattern in Sakleshpura Taluk 2017-18 (Ha)

Year	Paddy	Maize	Ragi	Jowar	Pulses	Fruits	Vegetables	Oil seeds	Sugarcane	Cotton
2017-18	9000	-	33	0	27	1148	79	0	0	0

It is observed that net sown area accounts 49% and area sown more than once is 43% of total geographical area in Sakleshpura taluk (Table-5). Area not available for cultivation and Fallow land cover 21% & 9% of total geographical area respectively. 80% of net area irrigated is only from tanks and 15% from bore wells (Table-6).

Table-5: Details of land use in Sakleshpura Taluk 2017-18 (Ha)

Taluk	Total Geographical Area	Area under Forest	Area not available for cultivation	Fallow land	Net sown area	Area sown more than once
Sakleshpura	102889	26169	22518	9517	51200	6515

Source: District at a glance 2018-19, Govt. of Karnataka

Table-6: Irrigation details in Sakleshpura taluk (in ha)

Source of Irrigation	Net area irrigated (Ha.)	% of area
Canals	-	0
Tanks	1071	80.3
Wells	24	1.8
Bore wells	202	15.1
Lift Irrigation	0	0.0
Other Sources	37	2.8
Total	1334	

Source: District at a glance 2018-19, Govt. of Karnataka

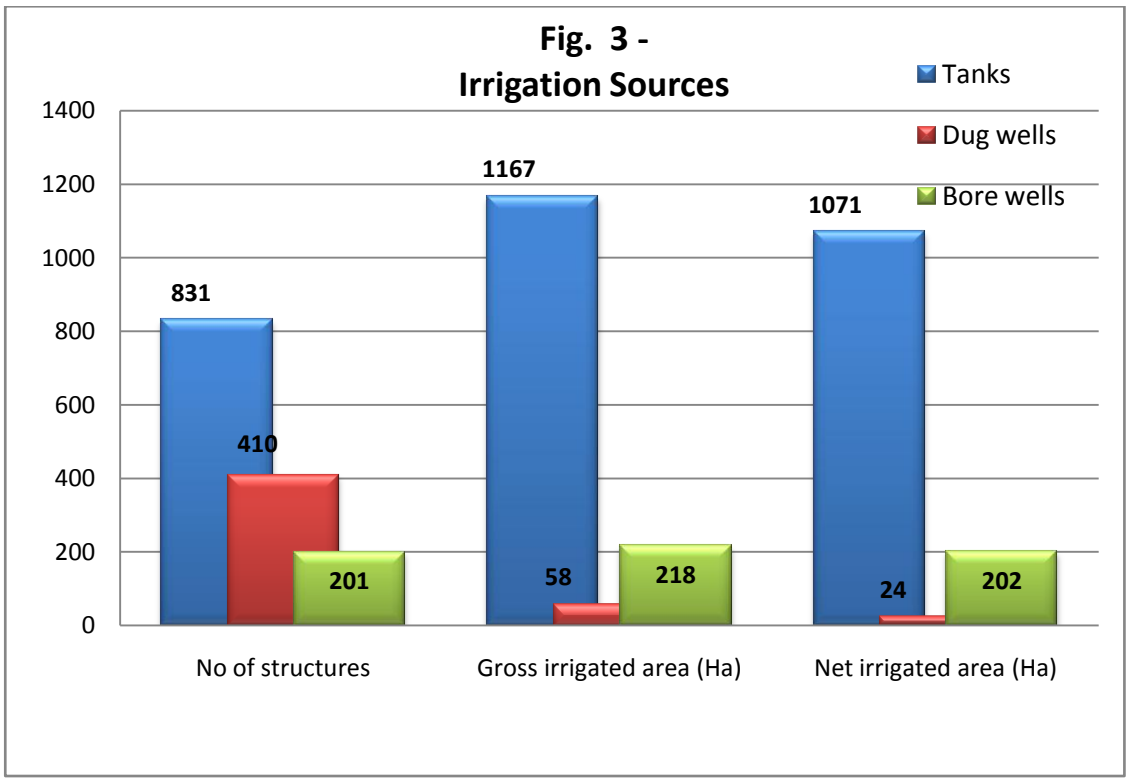

Fig.3. Irrigation source in Sakleshpura Taluk, Hassan district

1.5 Geomorphology, Physiography & Drainage

Sakleshpura taluk is a hilly region formed by Peninsular Gneissic Complex. The western parts exhibit moderate to steep "undulating terrain" and the eastern part having sparsely distributed pediments. The taluk showing NW-SE regional trending an elevation 970 to 1177 m amsl. This has its bearing on the regional slope which is towards southeast. The differential altitude is significant because, it is likely to cause irregular ground water flow patterns on the micro scale (Fig.-4). Topography is dominantly controlled by geological structures.

The entire Sakleshpura taluk falls in Hemavati River which is tributary of Cauvery river basin. The Drainage pattern is dendritic to sub dendritic (Fig.-5).

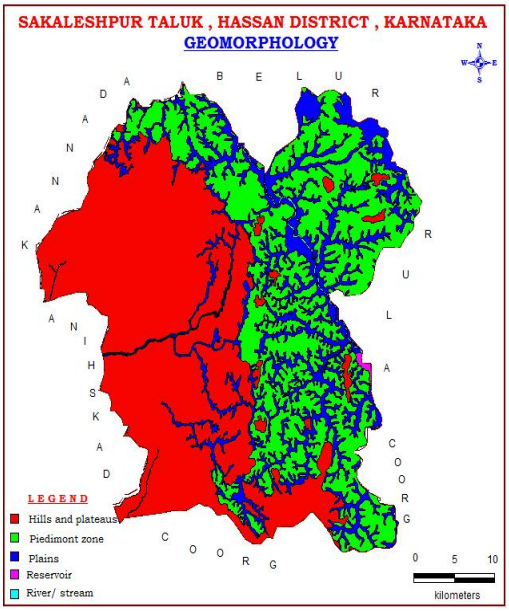

Fig.4. Geomorphology map

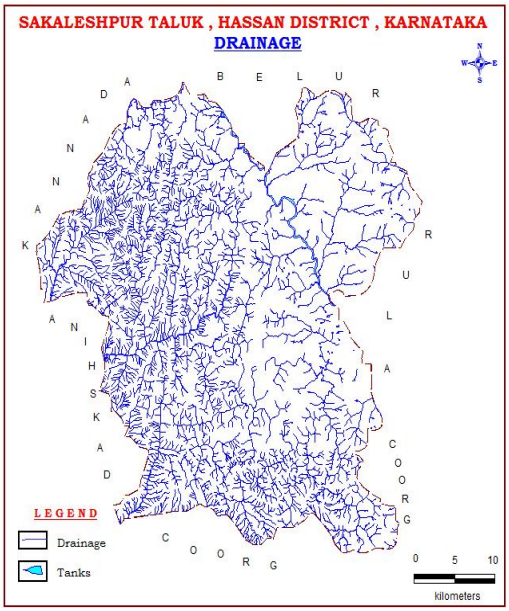

Fig.5. Drainage map

1.6 Soil

The soils of Sakleshpura taluk can broadly be classified into Clay, Clay-skeletal and Loamy soil. These soils vary in depth and texture, depending on the parent rock type, physiographic settings and climatic conditions. Along the Hemavati River, Loamy soils are overlapped by alluvial clayey materials in **Fig.6.**

The land use map of the taluk is shown in **Fig.7.** Major part of the taluk is covered by Forest and followed by agriculture activity.

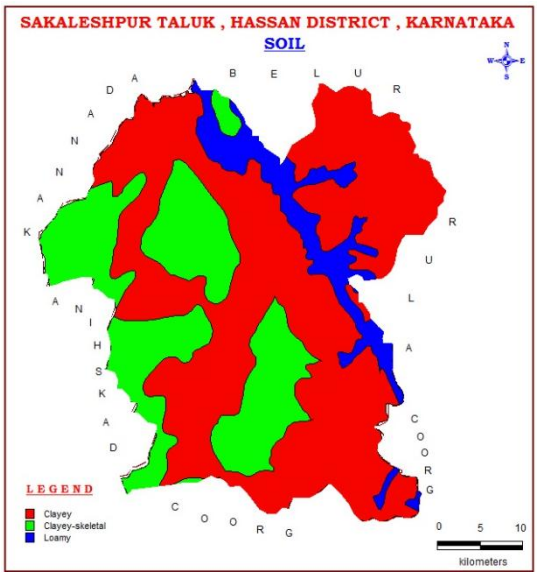

Fig-6: Soil Map

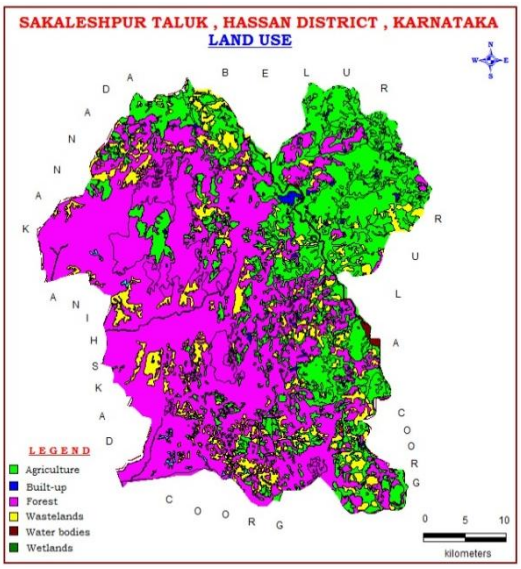

Fig-7: Land use Map

1.7 Ground water resource availability and extraction

Aquifer wise total ground water resources up to 200 m depth is given in **Table-7** below.

Table-7:Total Ground Water Resources (2017) (Ham)

Taluk	Annual replenishable GW resources	Fresh In-storage GW resources		Total availability of fresh GW resources
SAKLESHPURA	5519	Phreatic	Fractured (Down to 200m)	Dynamic + phreatic in-storage + fractured
		59689	3120	68328

1.8 Existing and future water demands (as per GEC-2017)

- Net ground water availability for future irrigation development: 40.02MCM
- Domestic (Industrial sector) demand for next 25 years: 3.39 MCM

1.9 Water level behavior

(a) Depth to water level: The depth to water level data is shown in **Table.8**

Aquifer-I

- Pre-monsoon: 3.02 – 10.50 mbgl (**Fig.-8**).
- Post-monsoon: 1.70 – 8.40(**Fig.-9**).

.

Aquifer-II

- Pre-monsoon: 8.20-18.40 mbgl
- Post-monsoon: 7.20-15.20 mbgl

(b) Water level fluctuation

Aquifer-I

- Seasonal Fluctuation: Rise ranges -0.30 – 3.60 m.

Aquifer-II

- Seasonal Fluctuation: Rise ranges 1.0-3.30 m.

(c) Long-Term Water level trend: The data is shown in **Table.9**.

- Pre-monsoon: Falling ranges 0.00743-0.3270 m
  Rising ranges 0.0910-0.1810 m
- Post-monsoon: Falling ranges 0.1859-0.5550 m
  Rising ranges 0.0910-0.1608 m

Table-8: Depth to water level for pre-monsoon and post-monsoon

Sr. No	Village	Source	Pre-monsoon Depth to water May-2019 (mbgl)	Post-monsoon Depth to water Nov-2019 (mbgl)	Water level Fluctuation
	Aquifer-I				
1	Agalahatti	DW	8.10	8.40	-0.30
2	Hetturu	DW	9.70	7.00	2.70
3	Maranahalli	DW	5.90	4.90	1.00

4	Sakaleshapura	DW	3.20	1.70	1.50
5	Shukravarasanthe	DW	10.40	7.80	2.60
6	Uchchangi	DW	10.50	6.90	3.60
Aquifer-II					
7	Agalahatti	BW	15.25	11.95	3.30
8	Balupete	BW	12.65	9.90	2.75
9	Hetturu	BW	8.90	7.50	1.40
10	Shukravarasanthe	BW	9.90	8.00	1.90
11	Uchchangi	BW	14.95	12.10	2.85
12	Sakaleshapura	BW	18.40	15.20	3.20
13	Maranahalli	BW	8.20	7.20	1.00

Table–9 Long Term Water Level Trends (Based on CGWB's National Hydrograph Stations).

Sl. No.	Location	Period of observation	Water level trend m/year			
			Pre monsoon		Post monsoon	
			Fall	Rise	Fall	Rise
1	Achangi	2011-2020			0.0465	
2	Anemall	2011-2020		0.1985		0.0184
3	Ballupet	2011-2020		0.0538	0.0041	
4	Harlakudi	2011-2020		0.3453	0.0208	
5	Hennali	2011-2020			0.0597	
6	Hullahally	2011-2020		0.0405	0.0743	
7	Kelagadale	2011-2020	0.3787			0.071
8	Kunigal	2011-2020		0.0781	0.0043	
9	Sakaleshpura	2011-2020	0.2467			0.0766
10	Sukvarsanthe	2011-2020	0.0104			0.0155
11	Srinivasapura	2011-2020				0.1065

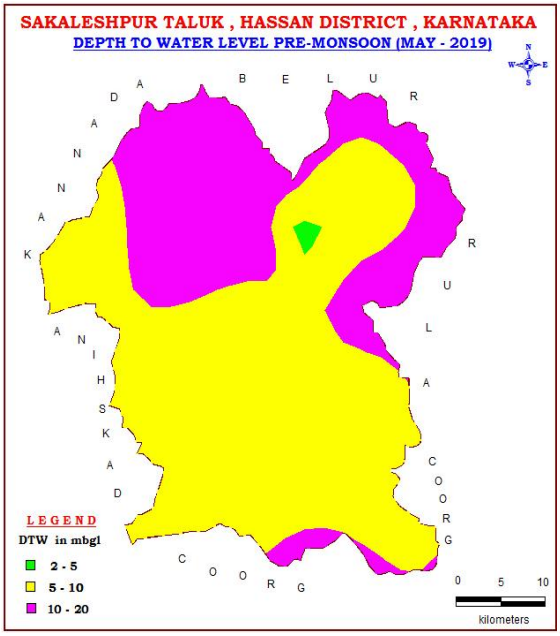

Fig-8: Pre-monsoon Depth to Water Level

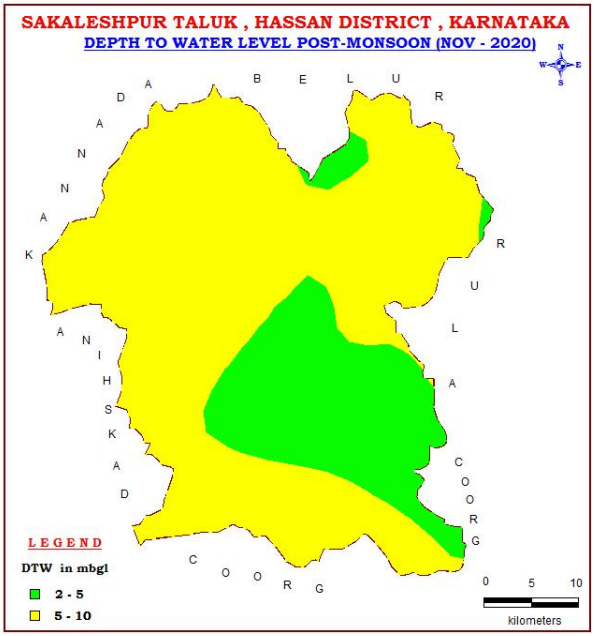

Fig-9: Post-monsoon Depth to Water Level

2 AQUIFER DISPOSITION

2.1 Number of aquifers:

In Sakleshpura taluk, there are mainly two types of aquifer systems

I. **Aquifer-I (Phreatic aquifer) Weathered Granite Gneiss**
II. **Aquifer-II (Fractured aquifer) Fractured Granite Gneiss**

In Sakleshpura Taluk, granitic-gneisses & schist are the main water bearing formations **(Figure-10).** Ground water occurs within the weathered and fractured granitic-gneisses under water table condition and semi-confined condition. In the Taluk, bore wells were drilled from a minimum depth of 50 mbgl to a maximum of 122 mbgl **(Table-10).** Depth of weathered zone (Aquifer-I) ranges from 15 mbgl to 42 mbgl (Figure-11). Ground water exploration reveals that aquifer-II fractured formation was encountered between the depths of 24 to 64 mbgl.The basic characteristics of each aquifer are summarized in **Table-11.**

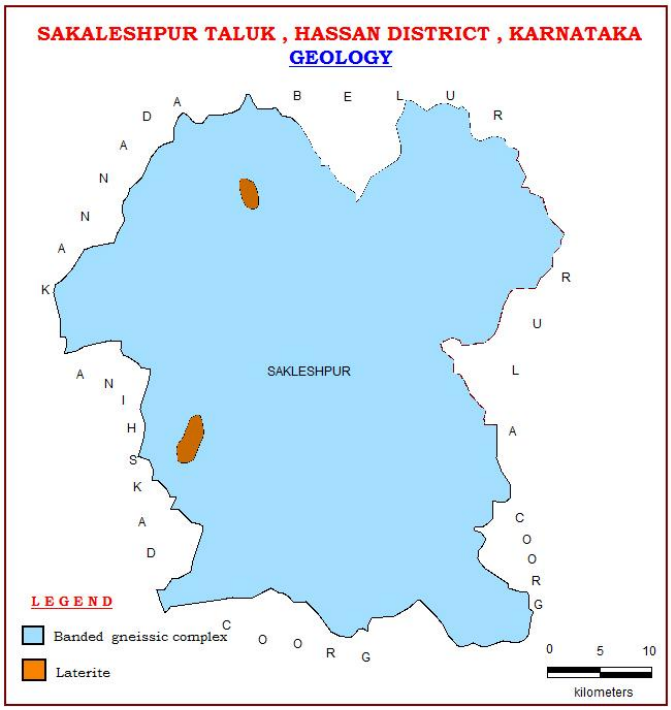

Fig.10. Geology map

Table-10: Details of Well inventory data.

S.no	Village/ GP	Latitude	longitude	Total depth(m)	Fractures(m)	Casing depth(m)
1	Yeslur / Yeslur	12.788963	75.864921	121	37	30
2	Echelbeedu / Hosur	12.699961	75.866754	61	25	22
3	Hosur / Hosur	12.690251	75.844516	77	46	15
4	Hethur/Hethur	12.79644	75.78823	118	37	30
5	Bygdahalli	12.749285	75.76093	80	44	42
6	Vangur/ Arini	12.749285	75.76093	70	25	
7	Attihally/Hangadolu	12.766744	75.729005	83	64	12
8	Hiryur	12.833031	75.77304	92	67	30
9	Bakravalli / Battur	12.875319	75.772565	100	39	17
10	Maranahalli / heggada	12.878007	75.71829	55	24	18
11	Harlekudi	12.96046	75.0946	77	36	21
12	Venkatahalli / Hanbal	12.993204	75.707591	61	36	20

13	Hanba/ /Hanbal	13.008324	75.69711	50	40	12
14	Anemal / Anemal	12.9326	75.770432	110	60	24
15	Anemal / Anemal	12.9326	75.770432	122	45, 60	30
16	Magadi / Halasanpur	12.968251	75.799328	86	50	24

Table-11: Basic characteristics of each aquifer

Aquifers	Weathered Zone (Aq.-I)	Fractured Zone (Aq.-II)
Prominent Lithology	Weathered Granite/Schist	Fractured Granite/Schist
Thickness range (mbgl)	15 - 42	Fractures up to 64 mbgl
Depth range of occurrence of fractures (mbgl)		24 - 64
Range of yield potential (lps)	-	-
Specific Yield	-	-
Quality Suitability for Domestic &Irrigation	Suitable	Suitable

2.2 3-D aquifer disposition and Cross-Sections

2.2.1 Aquifer disposition – Rockworks output

Sub-surface aquifer disposition are prepared based upon the outcome of ground exploration programme. Mainly. Four zones are categorized namely Top soil, Weathered, Fractured and Massive zones. These zones are represented using rockworks to depict the subsurface sections and models and presented in **Fig.-11, Fig.-12 and Fig.13.**

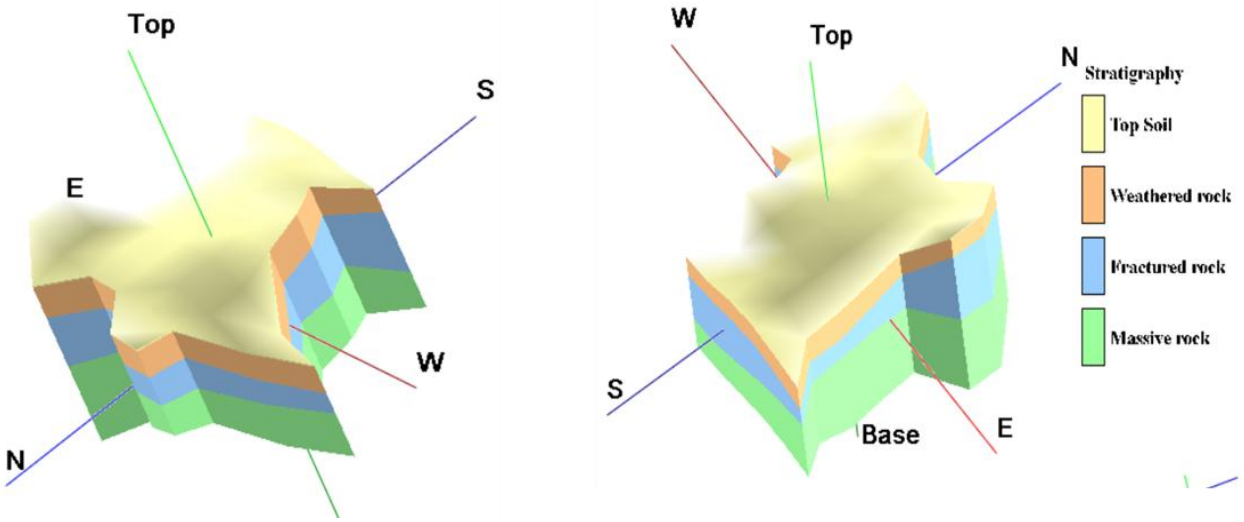

Fig-11: 3D Aquifer Disposition

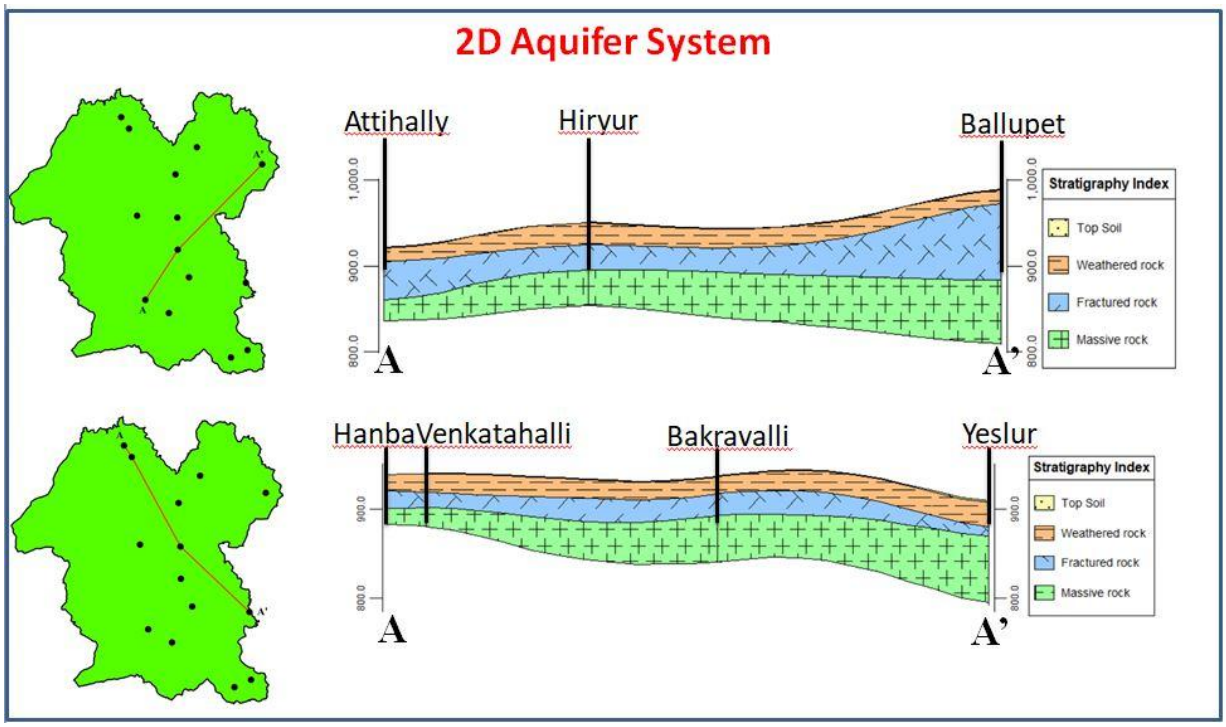

Fig-12: Cross sections in different directions

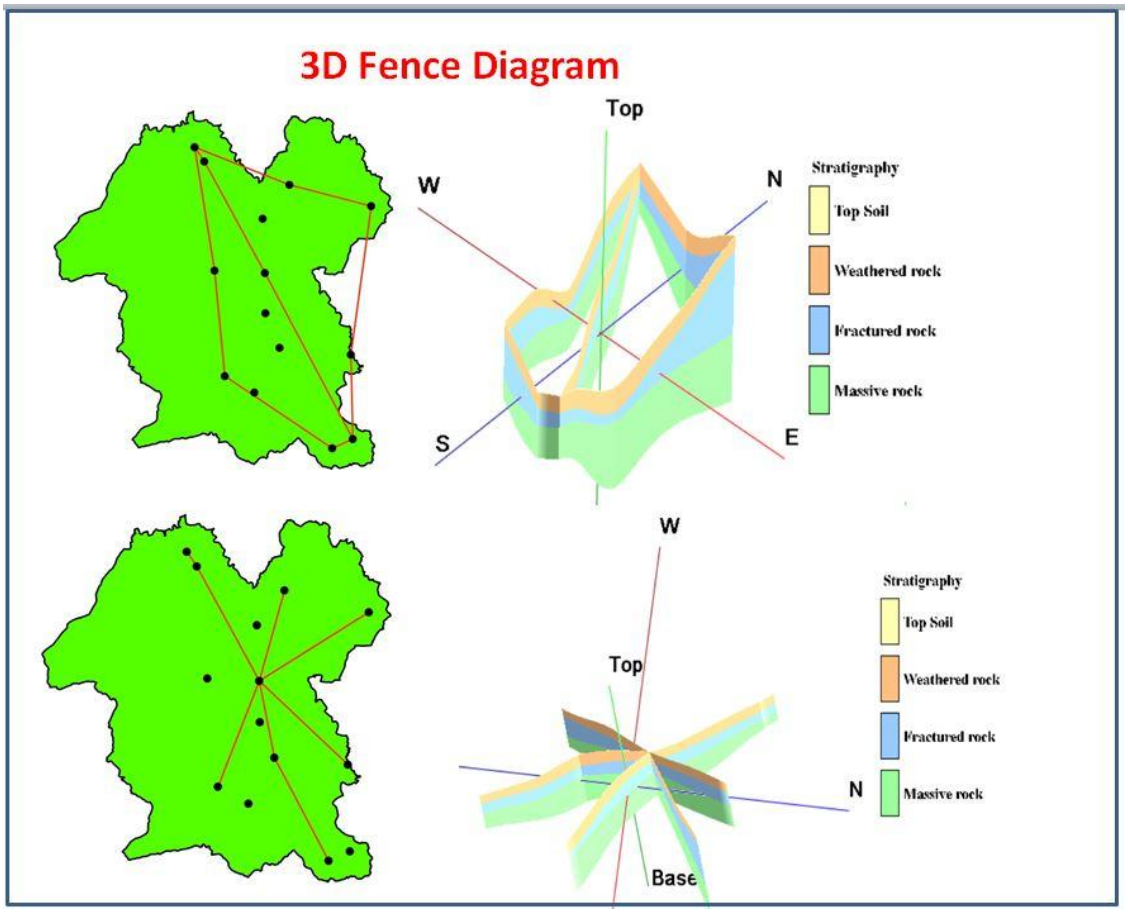

Fig-13: 3D Aquifer Fence Diagram

3 GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES

3.1 Aquifer wise resource availability and extraction

Table.12: Present Dynamic Ground Water Resource of Sakleshpura Taluk (2020)

Annual extractable ground water resources (ham)	Existing gross ground water draft for irrigation (ham)	Existing gross ground water draft for industrial water supply (ham)	Existing gross ground water draft for domestic water supply (ham)	Existing gross ground water extraction for all uses (ham)	Allocation for domestic and industrial use for next 25 years (ham)	Net ground water availability for future irrigation development (ham)	Existing stage of ground water extraction (%)	Category
6903.35	1090.35	0.00	303.35	1393.82	316.87	5495.99	20.19	safe

Table.13: Comparison of ground water availability and draft scenario in Sakleshpura Taluk

Taluk	GW availability (in ham)	GW draft (in ham)	Stage of GW development (%)	GW availability (in ham)	GW draft (in ham)	Stage of GW development (%)
	2017			**2020**		
SAKLESHPURA	5519.04	1498.49	27.15	6903.35	1393.82	20.19

It is seen that the stage of ground water extraction is improved in the taluk in comparison with 2017. However, with respect to 2017 estimations, there is an decrease of 7% in the stage of ground water development i.e.,27 to 20 % though the taluk is categorized as "**Safe**".

3.2 Chemical quality of ground water and contamination

Interpretation from Chemical Analysis results in Sakleshpura Taluk is mentioned as underand the data is shown in **Table.14.**

- **ELECTRICAL CONDUCTIVITY:** In general, EC values range from 100 to 660 μ/mhos/cm in the aquifer-I at 25^{o}C**(Fig.14)** and range from 83 to 838 μ/mhos/cm in the aquifer-II.
- **CHLORIDE:** Chloride concentration in ground water ranges between 11 and 74 mg/l in the aquifer-I**(Fig.15)**and ranges between 10 and 138 mg/l in the aquifer-II.
- **NITRATE:** Nitrate concentration in ground water ranges from 0 and 9 mg/l in the Aquifer –I **(Fig.16)**and ranges from Not Detectable range and 105 in the Aquifer –II.
- **FLUORIDE:** Fluoride concentration in ground water ranges between Not Detectable range**(Fig.17)**and 0 mg/l in the aquifer-I and ranges between Not Detectable range and 0.2 mg/l in the aquifer-II.

Table-14: Quality of ground water in Sakleshpura Talukof Hassan District

S. No.	Location	pH	EC (mg/L)	Cl (mg/L)	NO3 (mg/L)	F (mg/L)
Aquifer-I						
1.	Vangur	6.2	104	14.2	2	ND
2.	Sukravarasanta	6.252	400	50	0	0.0
3.	Hullahalli	5.318	100	11	7	0.0
4.	Harlekudi	6.122	150	14	9	0.0
5.	Anemall	5.882	230	39	0	0.0
6.	Sakaleshpura	6.729	330	28	0	0.0
7.	Achangi	6.46	390	50	0	0.0
8.	Kelagadale	6.842	660	74	0	0.0
Aquifer-II						
9.	Yeslur	6.48	233	19	6	0.2
10.	Hosur	6.94	273	24	11	0.2
11.	Hethur	6.84	237	28.4	7	ND
12.	Bygadahalli	6.63	159	14.2	ND	ND
13.	Attihally	6.05	83	10	5	ND
14.	Hiryur	6.51	154	10.65	1	ND
15.	Bakkaraval	5.8	99	10	ND	ND
16.	Harlekudi	7.36	187	17.75	ND	ND
17.	Venkatahalli	6.8	97	12	ND	ND
18.	Hanbal	6.26	203	20	7	ND
19.	Anemal	6.57	130	10.65	3	ND
20.	Magadi	6.93	408	31.95	13	ND
21.	Arehalli	5.13	428	78.1	54	ND
22.	Biccod	6.41	838	138.45	105	ND
23.	Nidigir	6.266	150	11	0	0.0
24.	Kunigal	7.399	390	11	0	0.0

In general, ground water quality in Sakleshpura Talukis good for drinking purpose except at 2 places where nitrate is found to be greater than the permissible limit as per “Indian Standard Drinking Water Specification 2012”. Ground water samples have also been tested and found suitable for agriculture & irrigation purposes in major part of the taluk, where EC is less than 750 µ/mhos/cm.

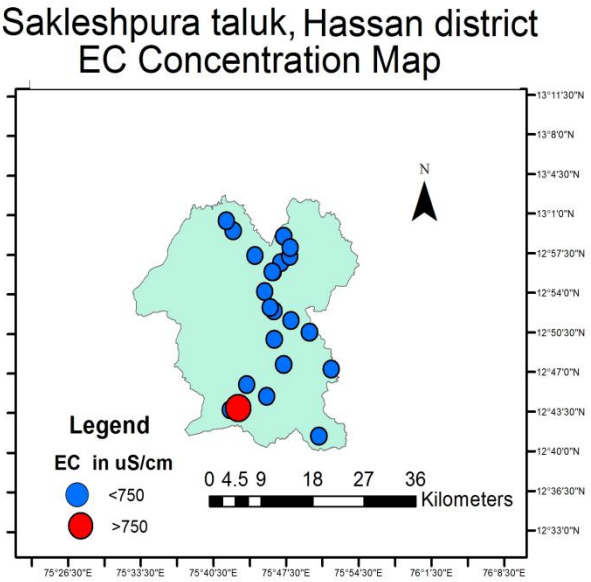

Fig-14 Distribution of Electrical Conductivity (Aq-I)

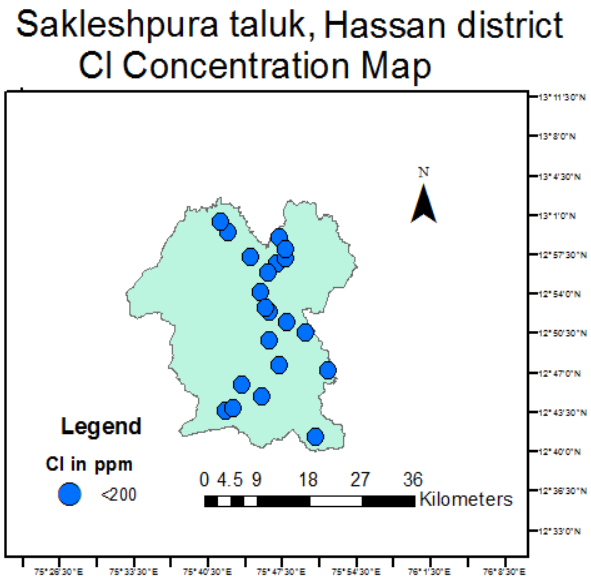

Fig-15 Distribution of Chloride (Aq-I)

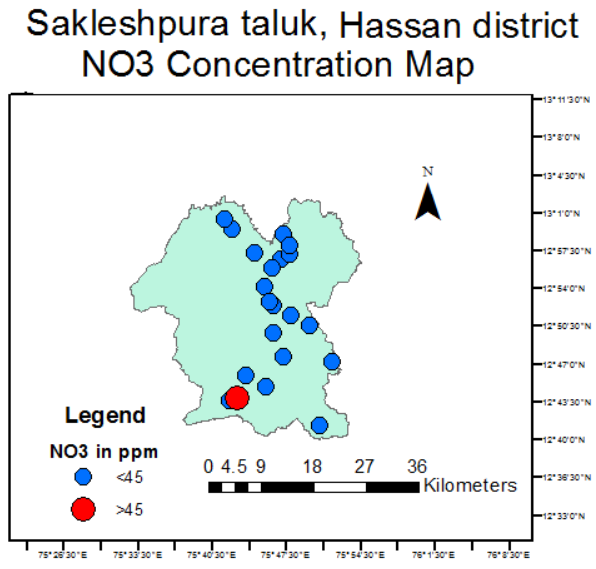

Fig-16 Distribution of Nitrate (Aq-I)

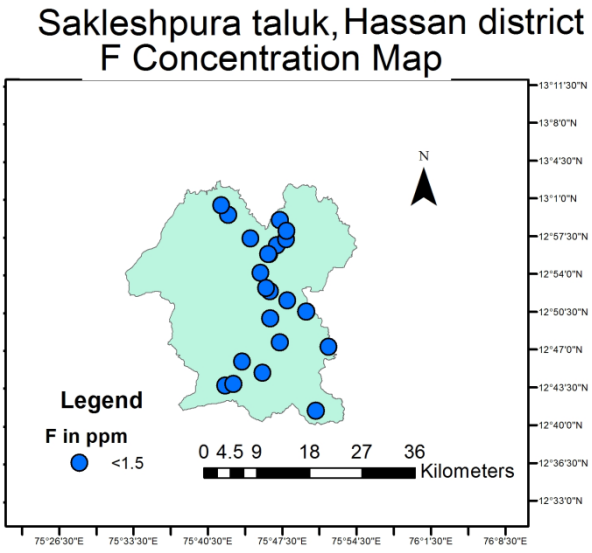

Fig-17 Distribution of Fluoride (Aq-I)

4 GROUND WATERMANAGEMENT PLAN

4.1 Resource Enhancement by Supply Side Interventions

Recharge to dry **phreatic aquifer zone (Aq-I)** through construction of artificial recharge structures, viz; check dams, percolation tanks & Sub surface dyke (**Table-15**) is recommended. The choice of recharge structures should be site specific and such structures need to be constructed in areas

already identified as feasible for artificial recharge. The area feasible for artificial recharge are given in **Fig. 18.**

The entire area of Sakleshpura Talukis feasible for rechargei.e., 762 sq.km. and the surface surplus non-committed runoff availability is 67.519 MCM, which is considered for planning of AR structures. For this, a total of 2 sub-surface dykes, 61 percolation tanksand 354 Check dams are proposed. The volume of water expected to be conserved/recharged @75% efficiency is 50.639 MCM through these AR structures. The approximate cost estimate for construction of these AR structures is Rs. 47.92 Cr. The additional area which can be brought under assured ground water irrigation will be about 6100 hectares. However, the figures given are tentative and pre-fieldstudies / DPR are recommended prior to implementation of these recharge structures.

Table-15: Quantity of non-committed surface runoff & expected recharge through AR structures

Artificial Recharge Structures Proposed	**SAKLESHPURA TALUK**
Area feasible for artificial recharge (sq.km)	**762**
Non committed monsoon runoff available (MCM)	67.519
Total no. of existing artificial recharge structures	47
Number of Check Dams	354
Number of Percolation Tanks	61
Number of Sub surface dyke	02
Tentative total cost of the project (Rs. In Cr)	47.92
Excepted recharge (MCM)	50.63
Additional irrigation potential (Hectares)	6100

Note: The numbers proposed are tentative and detailed feasibility studies are required in field to finalize the actual locations for the construction of AR structures.

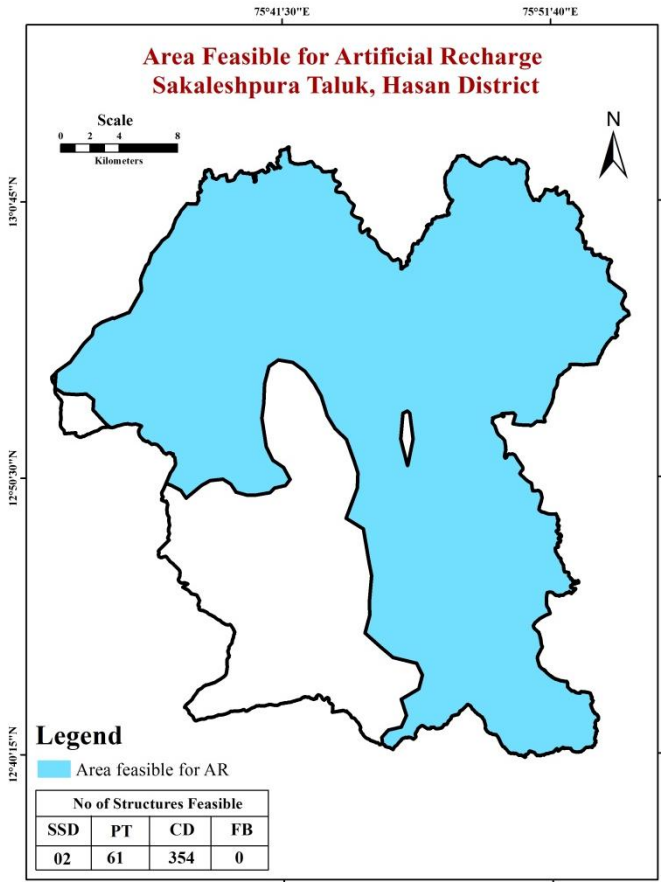

Fig. 18: Locations of Proposed Representative Artificial Recharge Structures

4.2 Resource Savings by Demand Side Interventions

4.2.1 Water Use Efficiency by Micro Irrigation Practices

It is observed that dug wells and bore wellscontribute17% of the source for irrigation in Sakleshpura Taluk. The water efficient methodology may be applied for growing paddy which is grown in 9000ha and is ground water dependent as compared to the other crops which are mainly grown during kharif. Initially, the micro irrigation techniques (drip) are proposed in 25% of paddy cultivated area of 9000 ha i.e., 2250 ha. Considering the crop water requirement of 2.00 m and savings of 25% i.e., 0.50 m by drip irrigation, it will contribute in saving ground water by 1125 ham and thus will improve stage of development marginally. However, in long run the practice of Efficient irrigation techniques will add to the ground water resource in large extent. **(Table-16).**

Table 16: Improvement in GW availability (2020) due to savings by adopting water use efficiency

Annual Extractable GW Resource(Ham)	Total GW extraction for all uses	Stage of ground water extraction	Paddy Area proposed for WUE	Unit savings	Total Saving due to adopting WUE measures	Cumulative annual Extractable GW Resource	Expected improvement in stage of ground water extraction after the implementation of the project	Expected improvement in overall stage of ground water extraction
HAM	HAM	%	HA	M	HAM	HAM	%	%
6903.35	1393	20.19	3375	0.50	1125	8028	2.84	20.19 to 17.35

4.2.2 Change in cropping pattern

Water intensive crop like paddy are grown in 80% of total cropped area. At present, the stage of ground water extraction is also on lower side @ 20.19% (2020), thus change in cropping pattern has not been suggested.

4.3 Ground Water Development Plan

In Sakleshpura Taluk, the present stage of ground water extraction (2020) is merely 20.19 %, say 20% with net ground water availability for future use of 5509.53ham and total extraction of 1393.82ham. The ground water draft for irrigation purpose is estimated to be 1090.47 ham and there is further scope for developing the resource for irrigation as a part of development with appropriate scientific backing.The implementation of the plan should be based on site specific detailed hydrogeological and scientific surveys for pinpointing the sites for construction additional abstraction structures.

As per tentative estimates, 1842dug wells and726bore wells are recommended to be constructed in feasible areas which is likely to create about3950hectares of additional irrigation potential.

Table – 17: Feasibility of Additional GW abstraction structures based on GWRA 2020 availability

Annual Extractable GW Resource (Ham)	6903.35
Net GW Availability for future use (Ham)	5509.53
Stage of GW Extraction (%)	20.19
GW Resources available to increase SOE to 60% (Ham)	2749
Total Extraction / Draft (Ham)	1393.82
Balance GWR available to enhance SOE 60% (Ham)	2761.34
DW unit draft(Ham)	1.00
BW unit draft(Ham)	1.25
No. of DW feasible considering 67% of balance GWR with unit draft of 1 ham	1842
No. of BWs feasible considering 33% of balance GWR with unit draft of 1.25 ham	**725**
Additional irrigation potential created by DW's considering crop water requirement of 0.65 m (Ha)	**2834**
Additional irrigation potential created by BW's considering crop water requirement of 0.65 m (Ha)	1116
Total irrigation potential created by DW's and BW's (Ha)	3950

Note- Hydrogeological and scientific intervention is needed for pinpointing the sites for construction of dugwells and Borewells

4.4 Regulation and Control

Sakleshpura Talukhas been categorizedas **"Safe".** However, the mandatory guidelines like rainwater harvesting and artificial recharge issued by Karnataka Ground Water Authority(KGWA) needs to be strictly implemented to avoid the taluk from safe category to semi critical or higher category in the future.

4.5 Other interventions proposed

- **Periodical maintenance of artificial recharge structures** should also be incorporated in the Recharge Plan.
- Excess nitrate concentration is found in ground water samples require remedial measures viz.

- Dilution of nitrate rich ground water through artificial recharge & water conservation.
- Roof top rain water harvesting.
- Improving quality by proper drainage and limited usage of Nitrogenous fertilizers

- Excess fluoride concentration is found in ground water samples of deeper aquifer require remedial measures viz.
  - Alternate source
  - Removal technology

5 SUMMARY AND RECOMMENDATIONS

The main ground water issues are Low Ground Water Development, Limited Ground Water Potential / Limited Aquifer Thickness / Sustainability, Deeper Water Levels particularly in Aquifer-II in some parts, hilly and plateau areas which are all inter-related or inter dependent and Inferior Ground Water Quality due to fluoride contamination especially in deeper aquifer. The summary of ground water management plan of Sakleshpura Talukis given in **Table-18.**

Table 18: Summary of Management plan of SAKLESHPURA TALUK

Present stage of Ground water Extraction and Category as per GEC-2020(%)	20.19, Safe
Annual Extractable Ground Water Resources (ham)	6903.35
Existing Gross Ground Water Extraction for all uses	1393.82
Ground Water Resource Enhancement by Supply side Interventions	
Area Feasible for Artificial Recharge (ha)	76200
Expected additional recharge from monsoon surplus runoff (ham)	50630
Additional irrigation potential (Hectares)	6100
Ground Water Resource Savings by Demand side Interventions	
Paddy Area proposed for WUE (ha)	462
Expected Saving due to adopting WUE measures (ham)	231
Expected improvement in stage of ground water extraction after adopting WUE measures and implementation of the project (%)	20.19 to 17.35
Government to take initiatives to encourage at least 70% farmers to adopt water use efficiency irrigations practices like dip & sprinkler irrigation	-
Ground Water Resource Development Plan	
Balance GWR available to enhance SOE 60% (Ham)	2749
No. of DW feasible considering 67% of balance GWR with unit draft of 1 ham	1842
No. of BWs feasible considering 33% of balance GWR with unit draft of 1.25 ham	725
Additional irrigation potential created by DW's considering crop water requirement of 0.65 m (Ha)	2834
Additional irrigation potential created by BW's considering crop water requirement of 0.65 m (Ha)	1116
Total irrigation potential created by DW's and BW's (Ha)	3950
Excess Nitrate concentration	In limited places especially in shallow aquifer Dilution of nitrate rich ground water through artificial recharge & water conservation. Roof top rain water harvesting Improving quality by controlling usage of Nitrogenous fertilizers in agriculture field and maintaining the proper domestic drainage network system
Excess Fluoride concentration	In limited places especially in deeper aquifer

	Alternate source Removal technology

As per the resource estimation – 2020, SAKLESHPURA TALUK falls under Safe category with the stage of ground water extraction is 20.19 %. However, there is need to formulate management strategy to tackle the water scarcity related issues in the taluk in the coming days to avoid water crisis in the future. It is suggested to adopt ascientific and multi-pronged ground water management strategy covering supply side interventions, demand side interventions, ground water development interventions and ground water qualityprotection aspects as mentioned in the management plan suggested above

Ground water resource enhancement by supply side interventions: The surface surplus non-committed runoff availability is 67.519 MCM, which is considered for planning of AR structures. For this, a total of 2 sub-surface dykes, 61 percolation tank and 354 Check dams are proposed. The volume of water expected to be conserved/recharged @75% efficiency is 50.639 MCM through these AR structures. The approximate cost estimate for construction of these AR structures is Rs. 47.92 Cr. The additional area which can be brought under assured ground water irrigation will be about 6100 hectares. However, the figures given are tentative and pre-fieldstudies / DPR are recommended prior to implementation of these recharge structures.

Ground water resource enhancement by demand side interventions: It is observed that dug wells and bore wellscontribute17% of the source for irrigation in Sakleshpura Taluk. The water efficient methodology may be applied for growing paddy which is grown in 9000 ha and is ground water dependent as compared to the other crops which are mainly grown during kharif. Initially, the micro irrigation techniques (drip) are proposed in 25% of paddy cultivated area of 9000 ha i.e., 2250ha. Considering the crop water requirement of 2.00 m and savings of 25% i.e., 0.50 m by drip irrigation, it will contribute in saving ground water by 1125 ham and thus will improve stage of development marginally.

Change in cropping pattern: Water intensive crop like paddy are grown in 87% of total cropped area. At present, the stage of ground water extraction is also on lower side @ 20.19% (2020), **thus change in cropping pattern has not been suggested**.

Ground Water Resource Development Plan: the present stage of ground water extraction (2020) is merely 20.19 %, say 20% with net ground water availability for future use of 5509.53ham and total extraction of 1303.35 ham. The ground water draft for irrigation purpose is estimated to be 1090.47 ham and there is further scope for developing the resource for irrigation as a part of development with appropriate scientific backing.The implementation of the plan should be based on site specific detailed hydrogeological and scientific surveys for pinpointing the sites for construction additional abstraction structures. As per tentative estimates, 1842 dug wells and 725 bore wells are recommended to be constructed in feasible an area which is likely to create about 3950 hectares of additional irrigation potential.

Nitrate Contamination: Proper drainage of sewage and scientific disposal of sewage water by the concerned urban/rural agency needs to be adopted along withlimited usage of Nitrogenous fertilizersby farmers to avoid nitrate contamination. All the ground water sources for drinking water supply may be checked for ground water quality parameters as per BIS norms.

WUE in Domestic Sector: WUE practices are the prime management option in domestic sector as well in view of having high density clusters of urban households and establishments. In premium apartments

and infrastructure projects, use of three-way line for fresh water, bathroom water and toilet water will enable reuse of grey water for gardening, car washing and flushes etc. The water saver fixtures/ aerators can be used for kitchen & bathroom pipes, bath showers and water free urinals.

Regulation and Control:Taluk is categorised as "Safe". However, the mandatory guidelines like rainwater harvesting and artificial recharge issued by Karnataka Ground Water Authority needs to be strictly implemented to avoid the taluk from deteriorating from safe category to semi critical category in the future.

Water Linkages with other Activities: Water sector has strong linkages with other developmental activities. Hence, the proposed management plans cannot be considered as static and needs to be reviewed and improved from time to time.