केंद्रीय भूमि जल बोर्ड

जल संसाधन, नदी विकास और गंगा संरक्षण

विभाग, जल शक्ति मंत्रालय

भारत सरकार

Central Ground Water Board

Department of Water Resources, River Development and Ganga Rejuvenation,

Ministry of Jal Shakti

Government of India

AQUIFER MAPPING AND MANAGEMENT OF GROUND WATER RESOURCES

HOSAKOTE TALUK, BANGALORE RURAL DISTRICT, KARNATAKA

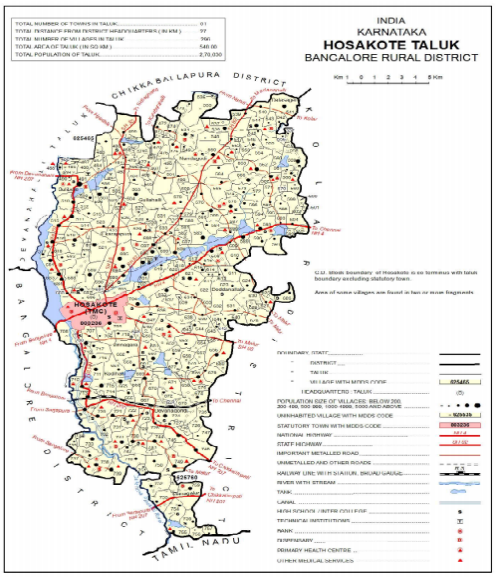
दक्षिण पश्चिमी क्षेत्र, बैंगलोर

South Western Region, Bengaluru

FOR OFFICIAL USE ONLY
No. RP/NAQUIM/2019-20/77

Government of India
Ministry of Jal Shakti
Department of Water Resources, RD & GR
Central Ground Water Board

AQUIFER MANAGEMENT PLAN OF HOSAKOTE TALUK, BANGALORE RURAL DISTRICT, KARNATAKA STATE



BY
L.J. BALACHANDRA
Scientist-D

Central Ground Water Board
South Western Region Bangalore

August 2020

AQUIFER MANAGEMENT PLAN OF HOSAKOTE TALUK, BANGALORE RURAL DISTRICT, KARNATAKA STATE

CONTENTS

1. 0 SALIENT INFORMATION

Name of the Taluk:	**HOSAKOTE**
District:	Bangalore Rural
State:	Karnataka
Area:	548 sq. km.
Population:	270818
Annual Normal Rainfall:	813 mm

1.1 Aquifer Management Studies

Hosakote Taluk is part of Bangalore Rural district 25 km away from Bangalore city. It is located in eastern portion of Bangalore Rural district, Karnataka state covering an area of 548 Sq. Km and is a part of South Pennar river basin located at North latitude $12^0$51'49" to 13^0 15' 17" and east logitude of $77^0$45'38": $77^0$57'59". It is surrounded by Sidlaghatta Taluk of Chickballapur district in the north, Devanahalli Taluk of Bangalore Rural district, Devanahalli and Anekal Taluk of Bangalore Urban district in the west, towards south by Tamil Nadu and in east it is surrounded by Kolar and Malur Taluks of Kolar district. The Location map of the Taluk is shown in **Figure-1.**

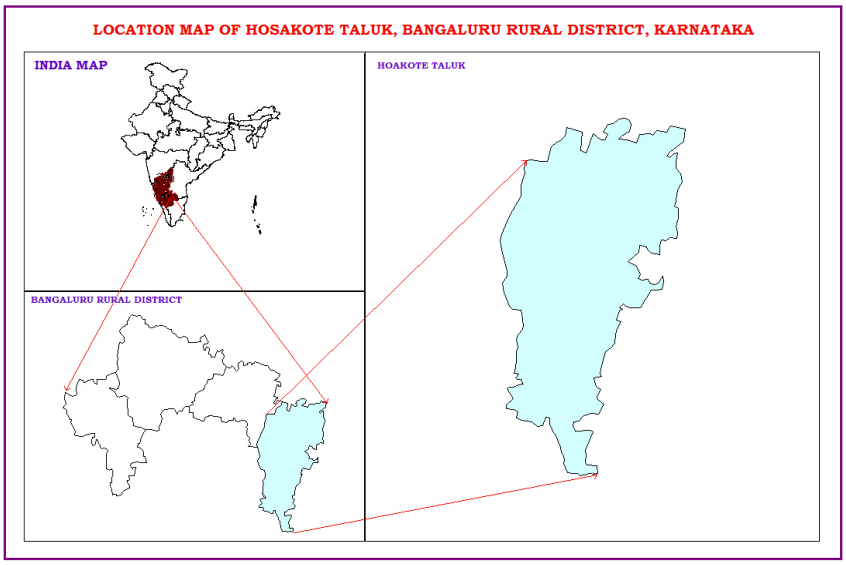


Figure-1: Location Map of Hosakote Taluk.

The Hosakote Taluk is a part of Bangalore revenue division with Hosakote as Taluk head quarter. There are five revenue hoblies – Anugondanahalli, Jadigenahalli, Kasaba, Nandigudi and Sulibele which covers 266 Inhabited and 31 un-inhabited villages. The Taluk is well connected with good network of roads with National Highway 4 and the Bangalore-Chennai railway line connecting Hosakote to Bangalore and Chennai with other district roads forming good network of transport facility.

1.2 Population:

As per 2011 census, the total population in Hosakote Taluk is 270818 (140299 males and 130519 females) of which about 213838 (78.96 %) constitutes the rural population. The Taluk has an overall population density of 494 persons per sq.km. The decadal change is 14.90% in rural and 56.87% in urban population.

1.3 Rainfall:

Hosakote Taluk enjoys semiarid to humid climate. Dryness and hot weather prevail in major part of the year. The area falls under Eastern Dry Agro-Climatic zone of Karnataka state and is categorized as drought prone. The climate of the Taluk is quite agreeable and free from extremes. The temperature in summer is in between 26.2^0C to 34.2^0C and in winter it is 15.1^0 to 21.8^0 C with normal temperature ranging from 21.1^0 to 28^0C. The rainy season or South-West monsoon is from June to September followed by North-East monsoon and post-monsoon from October to December.

The mean monthly rainfall at Hosakote Taluk is ranging from 1 mm during January to 181 mm during October. The Annual Normal rainfall (1981 to 2010) in the Taluk is 813 mm and the statistical analysis of rain fall data is presented in the **Table 1.**

Table 1: Statistical Analysis of Rainfall Data of Hosakote Taluk, Bangalore Rural District, Karnataka for the Period 1981 to 2010

STATION	Item	JAN	FEB	MAR	APR	MAY	PRE	JUN	JUL	AUG	SEP	SW	OCT	NOV	DEC	NE	Annual
HOSAKOTE	NRM	1	4	15	40	81	141	66	78	104	180	429	181	51	12	243	813
	ST.DEV	3	14	31	43	59	88	57	58	66	104	156	118	51	18	141	256
	CV%	349	332	209	108	73	63	86	74	63	58	36	65	100	149	58	31

Assessment of Drought

Rainfall data has been analyzed to assess the drought condition using for 102 years IMD Rain fall data and the results thus obtained are listed in the **Table-2.** It is observed that the Hosakote Taluk has experienced alternating no drought to acute drought conditions over the years.

Table 2: Classification of drought and its periodicity (IMD,1971)							
% of 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	Hosakote	54	24	21	3	0	Once in 4 years

Out of 102 years of analysis in Hosakote Taluk, "No Drought" condition is experienced in 54 years, "Mild Drought" condition is 24 years and "Moderate Drought" condition experienced in 21 years. Further it is observed that "Severe Drought" condition is experienced in 3 years ie, during 1920, 1923 and 2006. 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 4 years.**

1.4 Agriculture & Irrigation:

Hosakote Taluk is having 213838 (78.96 %) of rural population wholly dependent on the rainfall for their agricultural activities. The land use pattern of the Taluk is presented in the **Table-3**.

Table 3: Land use pattern of Hosakote Taluk (Ha)

Geographical area	**Area under forest**	**Area not available for cultivation**	**Uncultivable land**	**Fallow land**	**Area sown**		
					Net sown area	**Area sown more than once**	**Total sown/cropped area**
54857	3444	13085	3744	10712	23872	895	24767

1.4.1 Principle crops:

The only principle crop of the Taluk is Ragi which is grown in 9742 ha (39.33% to the total cropped area), followed by Fruits (2429 ha) and Vegetables (1953 ha) which are normally rain fed crops. Fruits are grown in 9.8 % of the area during Rabi season. This followed by vegetables grown in an area of 1953 ha (7.88% to the total cropped area). The principle crops and the area grown are shown in **Table 4**.

Table 4: Principle crops grown in Hosakote Taluk

Crops	Cereals (Area in Ha)			Pulses (Area in Ha)				Fruits (Area in Ha)	Vegetables (Area in Ha)	Oil seeds (Area in Ha)		
	Ragi	Paddy	Maize	Avare	Tur	Horse gram	Others			Mustard seed	Niger seed	Others
	9742	425	268	347	174	126	70	2429	1953	89	45	46
Total	10435			717				2429	1953	180		
	Total Food Grains -11152 Ha							**Fruits**	**Vegetables**	**Total Oilseeds-180 Ha**		

Source: District at a Glance 2014-2015, Govt. of Karnataka

1.4.2 Irrigation Practices:

In Hosakote Taluk, the ground water is being developed from ground water structures like 265 dug wells and 6452 number of shallow tube wells (Report on 4th census of Minor Irrigation Schemes 2006-2007) for irrigation purposes. The ground water thus developed from these structures were managed through water distribution irrigation practices by adopting- Open channel, Underground pipe, surface pipe, drip irrigation, sprinklers and others. The surface water is being utilized as surface flow and surface lift scheme.

1.4.3 Ground water and surface water Irrigation:

In Hosakote Taluk, Ground water tapped through bore wells is the main source of irrigation. The details of surface water and ground water irrigation are in the **Table 5**.

Table 5: Details of irrigation in Hosakote Taluk.

Sl. No.	Source		No. / Length	Net area irrigated (Ha)	Gross area irrigated (Ha)
1	Surface water	Canals	0	0	0
		Tanks	209	0	0
		Lift irrigation	1	43	43
2	Ground water	Dug Wells	2296	0	0
		Bore wells	9308	3247	4116
		Total	11814	3290	4159

Source: District at a Glance 2014-2015, Govt. of Karnataka

1.5 Geomorphology, Physiography & Drainage:

Geomorphologically Hosakote Taluk falls in southern maidan region. Physiographically, the area is characterized by undulating topography. It is located on a plateau and the highest elevation is observed at Nandigudi with 940 m msl and the average elevation ranging from 600 to 900 m amsl. It has range of hills which are actually spurs of Eastern Ghats extends from east to south made up of granites with lateritic capping. (**Figure 2)**

1.5.1 Drainage:

Hosakote Taluk is the part of South Pennar (Ponnaiyar) river basin. The main drainage of the Taluk is from north to south. The South Pennar River which rises north of Sidlghatta Taluk at Nandi hills of Chickballapur district and after entering Bangalore Rural district/ Hosakote towards southwards where it forms the large lake known as Janagama-Kote Kere and Hosakote-kere at Hosakote. The sewage waters of Bangalore city enter this river via Bellandur and Varthur lakes. The general drainage pattern is of sub-rectangular (**Figure 3)** due to marked influence of geologic structures in the basin.

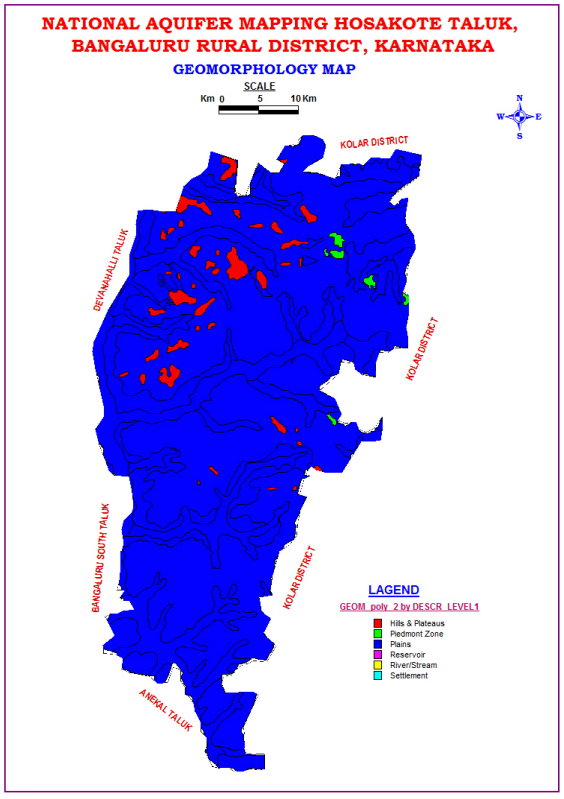


Figure 2: Geomorphology map

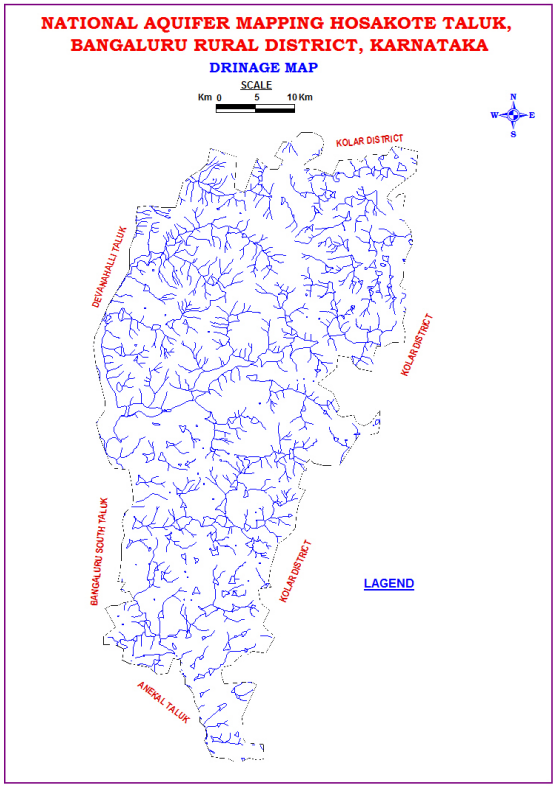


Figure 3: Drainage map

1.6 Geology:

Hosakote Taluk is occupied by Banded Gneisses called as Peninsular Gneissic Complex and small patch of laterite occurs north of Hosakote (**Figure 4**).

1.7 Soil :

The soils of the area are derived from Gneiss, Granites and Laterites. The soils are hard and poor in general. Sandy, loam, black soil are the main soil types of the Taluk. (**Figure 5)**.

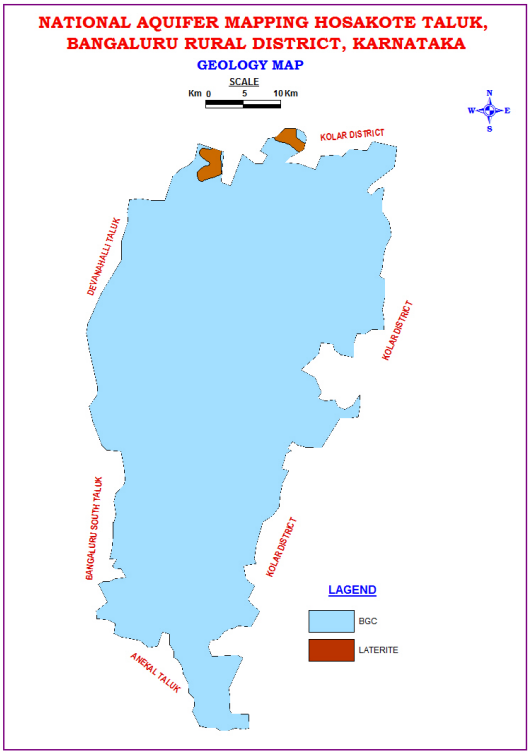


Figure 4 : Geology map

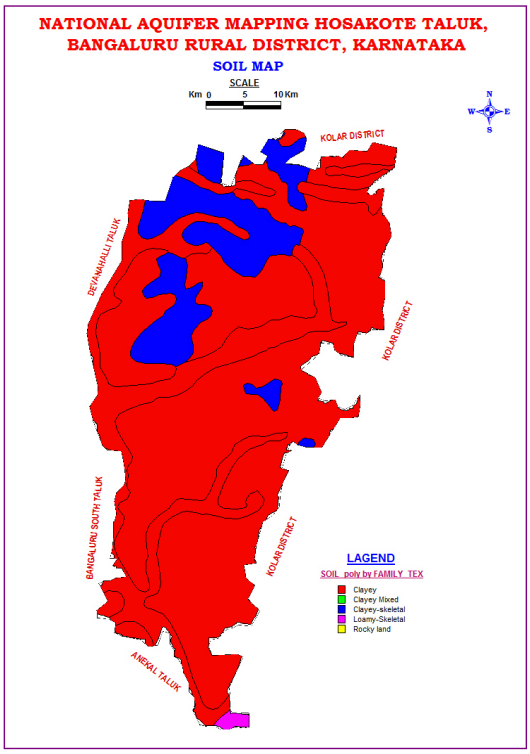


Figure 5 :Soil map

1.8 Ground water resource availability and extraction:

The Ground water availability as per Resource Estimation 2009 & 2013 is presented in the **Table 6**.

Table 6: Ground Water Resource Estimation of Hosakote Taluk (Ham)

Year	Annual replenishable GW resources	Fresh In-storage GW resources		Total availability of fresh GW resources
		Phreatic	Fractured (Down to 200 m)	Dynamic +phreatic in-storage + fractured
2009	4350	1274	2139	7763
2013	4504	10883	2139	17526

As per the estimation of GEC 2013, the ground water draft (extraction) for irrigation worked out to be 5672 ham with stage of ground water development of 138%.

1.9 Existing and future water demands

As per GEC (2013), existing ground water draft for irrigation, industrial & domestic (all use) is 6193 ham and as the stage of ground water development already reached up to 138% having nil availability for future irrigation demands. However, allocation of ground water for industrial and domestic purposes is computed to be 521 HAM.

1.10 Water level behavior:

The phreatic aquifers over the Taluk are almost dry hence no water levels are available. However, the water level maps for phreatic aquifers are generated considering the entire district. The depth to water levels during pre and post monsoon and the rate of fluctuation of water level are in the **Table 7** and depth to water level maps are in **Figure 6** to **Figure 11.**

Table-7: Depth to Water levels in Hosakote Taluk

Item	Pre-monsoon		Post monsoon		Water level Fluctuation	
	Aquifer I	Aquifer II	Aquifer I	Aquifer II	Aquifer I	Aquifer II
Range	-	34.56 to 91.04	-	25.22 to 87.10	-	3.94 to 14.69
Average	-	58.79	-	51.44	-	7.34

A.Depth to water level Aquifer I

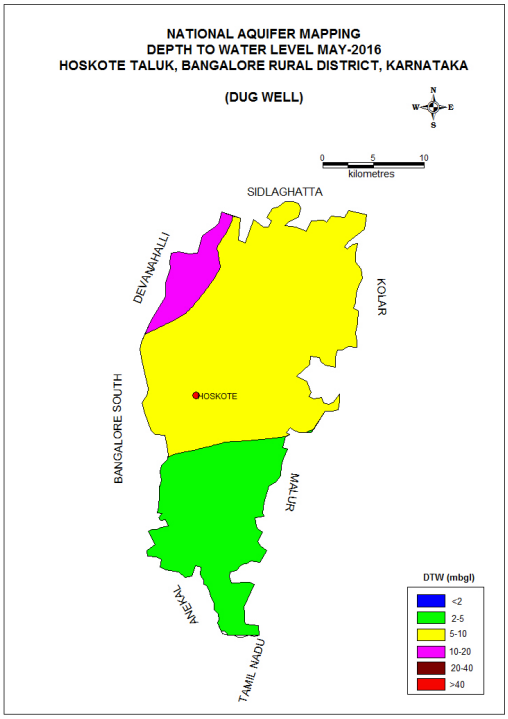


Figure 6 :Pre monsoon DTW Map Aquifer I

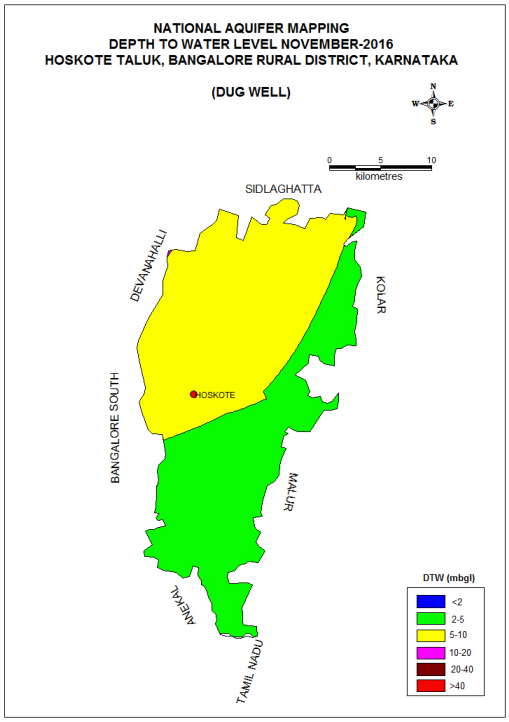


Figure 7: Post monsoon DTW map Aquifer-I

B.Depth to water level

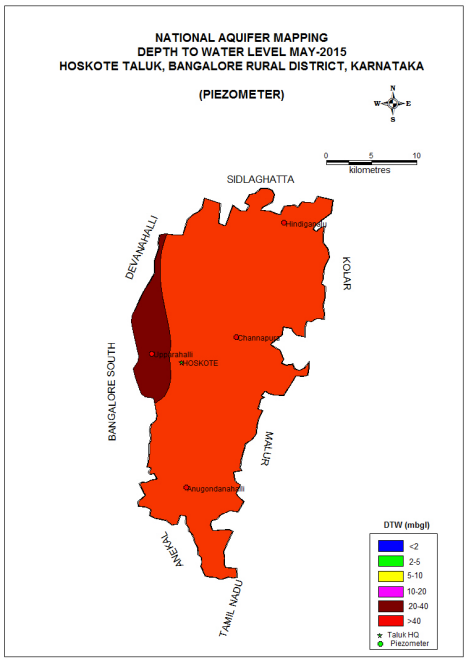


Figure 8 : Pre monsoon DTW Map Aquifer II

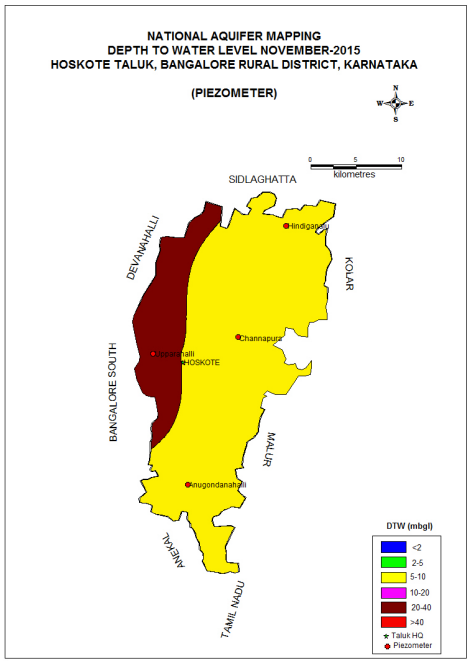
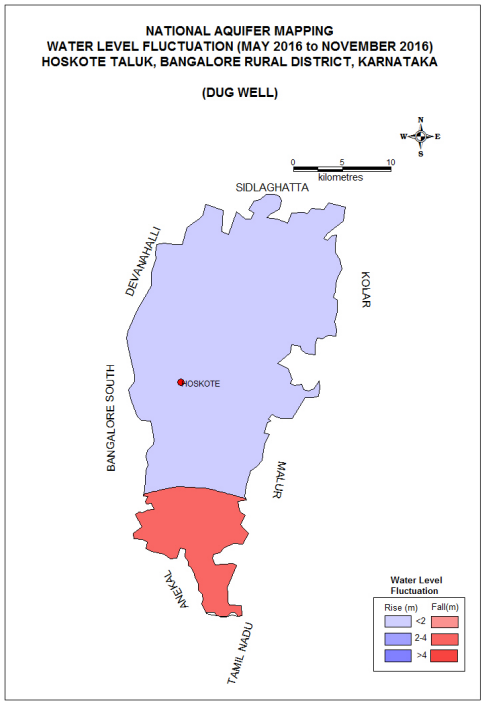


Figure 9: Post monsoon DTW map Aquifer II

C.Water level fluctuation :



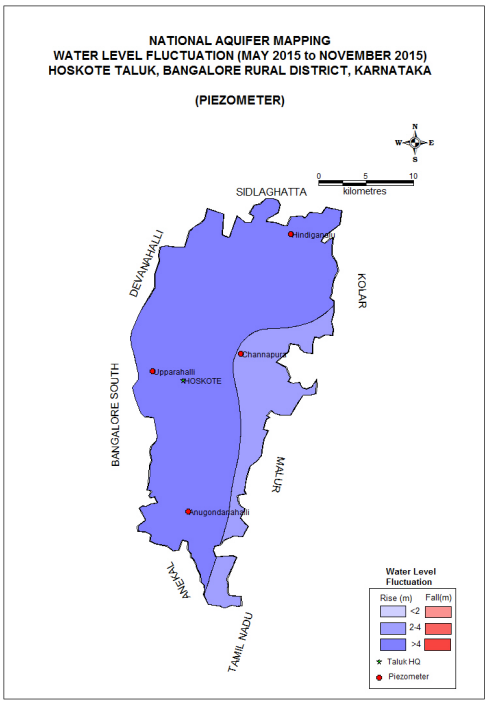


Figure 10: W/L Fluctuation map Aquifer I **Figure 11: W/L Fluctuation map Aquifer II**

The analysis of long-term water level trend in Aquifer-1 indicates that in pre-monsoon there is rising trend of 0.9098 m/year and falling trend of 0.0042 m/year. Similarly, during post monsoon there is a rising trend to the tune of 1.449 m/year and falling trend observed to be 1.0539 m/year. Overall trend indicates a falling trend to the tune of 1.6422 m/year.

2.0 Aquifer disposition

The data collected during Geophysical investigation, Ground water exploration were made use to delineate the aquifer system, geometry and the extension of aquifer in terms of both lateral and vertical extent. The details of ground water exploration are presented in **Table 8.**

Table - 8: Details of Ground water Exploration in Hosakote Taluk

Sl. No.	Details	No/Range
1	No of wells drilled	5
2	Depth range in 'm'	72.11 to 241.37
3	Depth of casing in 'm'	21.00 to 28.86
4	Discharge in lps	1.00 to 4.00
5	S.W.L. in m	22.47 to 24.88
6	Transmissivity m^2/day	2 to 40

The ground water exploration was limited in the Taluk however during 2015-2016 geophysical resistivity surveys – Vertical Electrical Soundings (VES) were carried out all over the Taluk and the results presented in **Table 9**

Table-9: Findings of Geophysical VES surveys in Hosakote Taluk

Geo-Electric Layers	**Resistivity in ohm m.**		**Thickness in m**		**Surface hydrogeological inference**
	Range	**Average**	**Range**	**Average**	
First Layer- ρ1	24 to 995	212.02	0.7 to 4.3	1.42	Top soil
Second layer- ρ2	9.5 to 136	45.73	2.3 to 52	9.74	Weathered formation
Third layer -ρ3	27 to 1169	277.61	5.5 to 200	47.96	Fractured to Hard formation
Fourth layer ρ4	644 to 2561	1249	>200	-	Massive formation
Weathered formation (m)	Range	8.00 to 200			
	Average	63.64			
Depth to Massive (m)	Range	3.00 to 37.5			
	Average	19.3			

In general, the weathered formation varies from 3.00 to 54.00 m, Depth to massive formation ranges from 8.00 to 200 m and fractures are expected at the depth of 40 to 50, 50 to 60, 80 to 100, 120 to 150, 150 to 200 m.

2.1 Number of aquifers: Based on the Ground water exploration data in Hosakote Taluk, there are mainly two types of aquifer systems;

i. **Aquifer-I- (Phreatic aquifer)** comprising Weathered Gneiss / Granite which is dry.
ii. **Aquifer-II- (Fractured multi-aquifer system)** comprising Fractured Gneiss / Granite.

3. Ground water resource, extraction, contamination

3.1 a) Aquifer wise resource availability and extraction:

Aquifer wise ground water resource (2009) has already been discussed in above chapter (1.8 & 1.9). However overall Groundwater resource estimation in Hosakote Taluk as on 2011 & 2013 indicating present and future scenario (2025), Stage of ground water development and categorization is presented in the below **Table 10**.

Table-10: Ground water resource of Hosakote Taluk

Sl. No	Resource details	As per 2011 Estimation	As per 2013 Estimation
1	Net Ground Water Availability in Ham	4866.27	4504
2	Existing Gross Ground Water Draft for Irrigation in Ham	5560.92	5672
3	Existing Gross Ground Water Draft for Domestic and Industrial Water Supply in Ham	881.69	521
4	Existing Gross Ground Water Draft for all use in Ham	6442.61	6193
5	Allocation for Domestic and Industrial Use for next 25 years in Ham	88169	521
6	Net Ground Water Availability for future Irrigation Development in Ham	0.00	0
7	Existing Stage of Ground Water Development in percentage	132	138
8	Categorization	OE	OE

b) Greywater Availability and its Management:

Greywater is described as gently used wastewater that comes from sources such as the bathroom, kitchen and laundry. It is relatively clean and cannot be compared with the water from toilets (blackwater). Generally, any water that is drained from the house other than toilet water can be described as greywater. Greywater can be reused for other purposes and does not necessarily have to be disposed of into the sewage system as other types of wastewater do. This means that it is not really wastewater but could be repurposed for safe and beneficial uses such as yard irrigation. It, therefore, serves to substitute fresh water for some purposes thus allowing for water conservation as well as reducing the amount of water that is sent into the sewage system for treatment (https://www.conserve-energy-future.com/ways-and-benefits-of-using-greywater.php).

In Hosakote taluk, the availability of total greywater is 21 MCM and the same can be utilized wisely after suitable treatment methods.

Grey water Availability	Domestic	2.31	Quantum in MCM
	Industrial	Yet to receive the data	Quantum in MCM

3.2 Chemical quality of ground water and contamination

The chemical quality data of ground water in Hosakote Taluk is not available. However as per the research papers (International Research Journal of Engineering and Tecknology (IRJET)) has reported based on the available chemical quality data at ZPED. Accordingly, about 650 number of samples whose chemical data were utilized and reported 70% of the samples are potable and the remaining 20.92% are with excess contamination of one or the chemical parameters like Total hardness, TDS, Iron, Nitrate, Fluoride and Bacteriological contamination etc.

It is also reported that the initially ground water samples drawn from shallow aquifers and it found to safe and potable with any major contamination.

The variation range and the number of samples with the excess contamination of individual parameters and its percentages are presented in the **Table 11**.

Table-11 Variation range and number of samples with excess contamination along with percentage.

→ Chemical constituents in PPM	P^H	EC in m/mhos/cm at 25 ^{0} c	Total hardness as$CaCo_3$	TDS	Ca^{++}	Fe^{+}	Alkalinity	Cl	So_3	No_3	F	Bacteria
Range	6.3 to 7.8	87 to 5670	40 to 2550	70 to 4130	16 to 1308	0.00 to 32	32 to 770	12 to 1635	1.6 to 232	0 to 25	0 to 3.60	0 to 1333
No of samples affected	-	-	136	18	338	43	-	3		120	25	33
% to the total	-	-	20.92	2.77	52	6.62	-	0.46		18	3.85	5.08

3.3.Ground water contamination :

As reported that the the ground water from shallow aquifers are safe and potable. How ever due to increase of usage of borewells and drawing water from greater depths resulted in contamination. Calcium is the major ground water contamination for drinking purpooses over Hosakote Taluk. This is a quite an intriguing situation facing quality problem. Out of 650 samples considered for calcium of which 338 samples (52%) of the samples are with Calcium beyond 75 ppm followed by contamination by total hardness with 20.92%.

4.0 Ground water resource enhancement:

Continuous drought, increase in agricultural activity, subjected to excessive ground water withdrawal leading to depletion of ground water table, reduction in yield and deterioration of ground water quality etc., suggests a need for proper ground water management and enhancement of storage capacity of aquifers, protection of ground water quality and proper utilization of ground water.

To enhance the storage capacity of aquifers, the dewatered aquifers are to be recharged, for which the artificial recharge structures like Check dams, percolation tanks, point recharge structures etc have to be constructed.

4.1 Aquifer wise space available for recharge and proposed interventions

4.1.1 Quantity of water available through non-committed surface run off:

The surplus non-committed monsoon run off is calculated to be 9.805 MCM this can be used to recharge the aquifer through suitable recharge structure which augments the net ground water

availability in the Taluk. The details of types of structure/number for recharge are presented in the **Table 12**.

Table 12: Details of Artificial structures in Hosakote Taluk

Artificial Recharge Structures available/Proposed	Hosakote Taluk	Resource available in MCM
Non committed monsoon run off available (MCM)	9.2159	
Number of Check Dams	57	3
Number of Percolation Tanks	4	2
Number of Point Recharge structures	6	0
Tentative total cost of the project (Rs. in lakhs)	212	-
Excepted recharge (MCM)	5.00	-
Expected rise in water level (m)	0.538	-
Cost Benefit Ratio (Rupees/ cu.m. of water harvested)	4.226	-

Thus, considering above source of water for ground water recharge the volume of water expected to be conserved or in the ground water resource enhancement is as detailed in the below **Table 13**.

4.1.2 Proposed Yettinahole project:

Yettinahole water project is a flagship project of the Karnataka Government that intends to divert water from the west-flowing Nethravathi River to the drought-prone districts which includes Hosakote Taluk of Bangalore Rural district. The project proposal comprises of two components namely, Drinking water and tank filling. On implementation of this project, recharge of 602 Ham of water to ground water will take place which will increase the ground water availability and thereby affecting the stage of ground water development.

Table 13: Details of resource enhancement after proposed artificial recharge & Yettinahole project

Sl. No	Resource details	As per 2013 Estimation
1	Net Ground Water Availability in Ham	4504
2	Existing Gross Ground Water Draft for All use Ham	6193
3	Existing Stage of Ground Water Development in percentage	138
4	Expected recharge from Artificial Recharge Projects Ham	500
5	Additional potential from proposed Yettinahole project	917.465
6	Cumulative ground water Availability Ham	5921.465
7	Expected improvement in stage of ground water Development after implementation of the project in percentage	104.58
8	Expected improvement in overall Stage of Ground water development in percentage	33
9	Expected additional irrigational potential in hectares	637

5. Demand Side Interventions:

5.1 Advanced irrigation practices:

Major crop of Hosakote Taluk is Ragi which is rain fed crop. Remaining crops like some of the pulses, Vegetables, Paddy and fruits are depending upon the ground water source.

The ground water for irrigation is being developed through 265 irrigation dug wells and 6452 irrigation bore wells. The existing advanced irrigation practices and the irrigation potential created over the Taluk is as detailed in **Table 14**.

Table 14: Details of Irrigation practices

Sl. No	Advanced Irrigation practices	No. of Irrigation Dug wells and potential utilized area in hectares		No. of Irrigation Bore wells and potential utilized area in hectares		Total	
		No. of Dug wells	Potential utilized (area in hectares)	No. of Bore wells	Potential utilized (area in hectares)	Total no of structures	Total Potential Utilized (area in hectares)
1	Open water channel	141	25	3161	2892	3302	2917
2	Underground pipe	80	51	1682	1407	1762	1458
3	Surface pipe	1	0	959	778	960	778
4	Drip irrigation	5	5	573	587	578	562
5	Sprinklers	0	0	3	3	3	0
6	Others	38	0	74	2	112	2
	Total	**265**	**81**	**6452**	**5669**	**6717**	**5717**

Source: 4th Census of Minor Irrigation schemes, Department of Minor irrigation, Bangalore, March 2011

The irrigation practices like Drip irrigation & sprinklers as water distribution system is comparatively very less with less irrigation potential utilized when compared to other distribution systems resulting in difficulty in economy of water conservation. If these methods of drip and sprinkler irrigation systems increased, maximum available ground water can be conserved judiciously. This ultimately enhances the area under irrigation potential.

5.2 Change in cropping pattern

Farmers are facing inadequacy of groundwater for agriculture so they have to change their cropping pattern and water economy irrigation practices like drip irrigation and sprinkler irrigation which are at present in negligible number. If they also adopt the water use efficient irrigation practices like mulching-plastic sheeting, spread on the ground around plants to prevent excessive evaporation or erosion, enrich the soil, etc., there will be additional saving in water. Therefore, encouragement from government is essential for achieving full target of water use efficiency in the Taluk.

5.3. Alternate water sources:

As per the resource estimation of 2013, Hosakote Taluk falls under Over Exploited category with the stage of ground water development of 138 % leading towards water scarcity problem. So, there is need to formulate management strategy to tackle the water source scarcity in the Taluk.

If the artificial recharge projects as proposed is implemented the Surplus non-committed monsoon runoff water available-through artificial recharge structures about 5.0 MCM of water can be conserved. This alternate water sources will create additional irrigational potential of 637 ha of agricultural land and there will be rise in water level of 0.538 m (**Table-12 and 13**). Addition to this, additional ground water potential of 917.465 Ham from proposed Yettinahole project is available for drinking water purposes.

5.4. Regulation and control:

Considering the current existing ground water draft for all use – 6193 HAM with the stage of ground water development up to 138%, it is mandatory to plan to augment the ground water through artificial recharge besides use of ground water judiciously. Apart from this, it is mandatory to adopt advanced irrigation practices like drip irrigation, sprinklers and other practices which are reported to be in no/negligible number and management of ground water for irrigation with water use efficiency methods.

5.5 Other Interventions proposed:

The major issue in the Taluk is water scarcity for drinking and irrigation. To mitigate this critical issue of scarcity for safe drinking water, construction of rain water harvesting units at the household level are must. Implementation of artificial recharge structures as proposed to recharge the ground water is also necessary.

Excess Calcium contamination in ground water leaves a distinct crusty white scaling or calcification on dishes water fixtures etc. The solution to the problem is to address the calcium in water. While there are chemical treatments to do this, including a traditional salt-based water softener that will require salt and potassium pellets. And assuming that consuming calcium is not bad for our health, the most practical solution may be catalytic water conditioner. Overall, the best solution is by installing a Hard Water bullet along with an in-line filter which treat the calcium in water.

****