International Journal of Combined Research & Development (IJCRD)
eISSN:2321-225X;pISSN:2321-2241 Volume: 5; Issue: 1; January -2016

www.ijcrd.com **Page : 640-649**

Trends of observation on wells, Remedial measures and feasibility studies of Hoskote taluk, Bangalore rural district, Karnataka, India

Dr. M. T. Maruthesha Reddy[1], Dr. Prabhakar B.C [2] Brungesh K V[3] Akshatha M.R [4]

[1]Professor, Department of Civil Engineering, Acharya Institute of Technology, Bangalore, India

[2]Professor, Department of Geology Jnanabharathi, Bangalore University, Bangalore, India

[3]Asst.Professor, Department of Chemistry, Acharya Institute of Technology, Bangalore, India

[4]Professor, RGIT, Bangalore, India

Abstract : Hosakote is a Taluk in Bangalore Rural District. It's headquartered at Hosakote town, 25 km away from Bangalore City. Currently, Hosakote depends on ground water (bore wells) as the main source of water supply. Due to depletion of rainfall year by year, overexploitation and less recharges, the yield from the borewells are diminishing considerably. In summer season, the water table goes much below thus creating scarcity of water. Hence, the ground water source is not dependable and there is an inevitable need to develop a project for alternate source of water supply. And as such this paper presents the water problems in the Taluk, the reasons for the problems and remedies to correct the problems. The scope of this paper includes: i. Profiling of Hosakote Taluk and understanding their water requirements and demands. ii. Identifying environmental and social impacts of the suggested remedies and to suggest mitigation measures to overcome these impacts. A preliminary feasibility report entitled, Integrated Water Supply project for Hoskote Town (2012), prepared by Infrastructure Development Department (IDD), Government of Karnataka, presents the water supply system and scenario of the Taluk. The primary objective of the project is to explore feasibility to cater to existing & future water demand of Hosakote City by providing treated water from Doddakere Lake while supplementing the source of incoming water to the lake with water from Bellandur Lake after tertiary treatment. Bellandur Lake receives water primarily from Koramangala- Challaghatta Sewage Treatment Plant (STP) which treats the sewerage to tertiary level. A report entitled Ground Water Information Booklet, Bangalore Rural District; prepared by Central Ground Water Board, Ministry of Water Resources, Government of India, reports that most of Karnataka State's ground water is in critical condition. It addresses the need to stop exploration of ground water and presents ways to improve the water resources of the Taluk.

Keywords: Observation wells, Monsoon, Rising trend, declining trend.

Taluk profile

Hoskote is a taluk in Bangalore Rural District. Headquartered at the Hoskote town, it consists of 5 Hoblis - Anugondanahalli, Jadigenahalli, Kasaba, Nandagudi and Sulibele. It is surrounded by Bangalore Urban district on its west and south west, Kolar on its east and north and Tamil Nadu State on its south. Agriculture, Apiculture and horticulture are primary occupations of people here, although the industrialization in the recent times in Hoskote and places around has thrown up new opportunities for the people. Hoskote town lies at the intersection of NH-4 and NH-207 and as such is a busy town with both resident and floating population. Lying on NH 4, and about 36 km from Bangalore City, Hosakote is well connected to Bangalore. The nearest railway stations to Hosakote are the Krishnarajapuram and Whitefield railway stations. Map 1.1 depicts the location of Hoskote Taluk in Karnataka State

Table 1.1 Population projection of Hoskote taluk

Year	Hoskote Town	Hoskote Rural	Total Population of the Taluk
2012	58837	222092	280929
2013	61148	230815	291963
2014	63549	239881	303430
2015	66045	249302	315347
2016	68640	259095	327735
2017	71336	269272	340608
2018	74138	279848	353986
2019	77050	290840	367890
2020	80076	302263	382339
2021	83221	314136	397357
2022	86490	326475	412965
2023	89887	339298	429185
2024	93418	352625	446043
2025	97087	366475	463562

ii. Ground water table fluctuation of Hoskote Taluk

There are various factors which guide the magnitude of water table fluctuation and they are as follows;

i. Climatic factors ii. Drainage

iii. Topography iv. Geological conditions

v. Amount of withdrawal by humans

vi. Atmospheric pressure, tides and earthquakes

Near streams, the water table fluctuates in responses to the change of level in river stage. Lakes also affect water table.

The water table fluctuation record can be used to

i. To find out directions of ground water flow and gradients

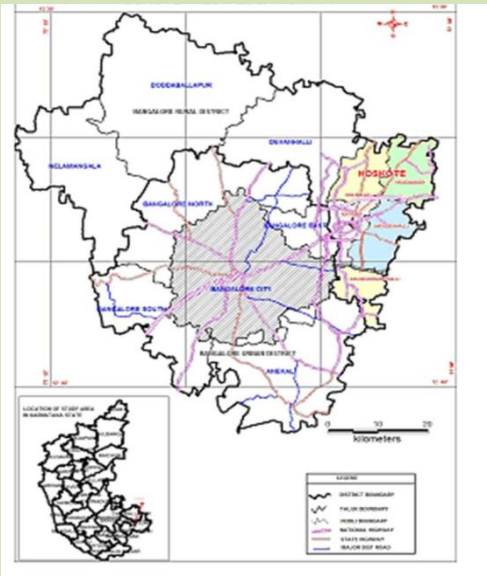
ii. To forecast the ground water levels at any given rate of withdrawal

iii.To identify effluent and influent structures of streams

iv. To find out the period of recharge and discharge

In the Taluk, CGWB and DMG have a network of observation stations to monitor ground water level. While CGWB measures the levels four times a year viz, November, January, May and August. DMG monitors once every month. Presently purpose built bore wells are drilled and fitted with data logger to obtain 4 measurements a day.

Map 1.1 Karnataka and Hoskote Map



The water level in the study area responds mainly to rainfall, groundwater recharges and discharges. There were 6 observation wells in Hoskote Taluk, of which only the following four are functional as of date (2015);

i.Anugodanahally ii.Channapura

iii.Hindiganala i v . Upparahalli

The following two wells have dried up and no more data is available for them from the year 2006;

i. Sulibele ii.Tavarekere

Hoskote town well is a newly constructed well, with data available from the year 2013.As all of the Taluk resides over granite rock, all the observations wells are situatedin gneissic area. Pre monsoon and post monsoon data of these wells for 20 years have been collected, analysed and discuss.

2.1 Behaviour of ground water table in Anugondanahally Observation Well

Ground water level data (pre-monsoon and post monsoon) for this observation well is available from the year 1993 to 2014 and is as depicted Table 2.2

2.2 Behaviour of ground water table in Channapura Observation Well

Ground water level data (pre-monsoon and post monsoon) for this observation well is available from the year 1993 to 2014 and is as depicted by Table 2.3

Exponential increase in the depth of ground water level below ground from the year 2005 to 2006 and from 2010 to 2011, which means decrease in the ground water level and also decrease in the volume of the ground water.

2.3 Behaviour of ground water table in Hindiganal Observation Well

Ground water level data (pre-monsoon and post monsoon) for this observation well is available from the year 1993 to 2014 and is as depicted by Table 2.4

Exponential increase in the depth of ground water level below ground from the year 2005 to 2006.

2.4 Behaviour of ground water table in Upparahalli Observation Well

Ground water level data (pre-monsoon and post monsoon) for this observation well is available from the year 1993 to 2014 and is as depicted by Table 2.5.

Steady increase in the depth of ground water level below ground from 2005 to 2014.

2.5 Behaviour of ground water table in Sulibele Observation Well

Ground water level data (pre-monsoon and post monsoon) for this observation well is available from the year 1993 to 2005 and is as depicted by Table 2.6 This well is however, now no more functional as the water in it has dried up.

This well is no longer functional as the water in it has dried up. Initially the depth of ground water below ground in the well was minimal (6.55-8.6m bgl), but however the water in the well had dried up after 2006, indicating the possibility of lesser amount to ground water in that area even before the commencement of pumping the water.

2.6 Behaviour of ground water table in Tavarekere Observation Well

Ground water level data (pre-monsoon and post monsoon) for this observation well is available from the year 1993 to 2005 and is as depicted by Table 2.7 This well is however, now no more functional as the water in it has dried up.

This well is no longer functional as the water in it has dried up. Initially the depth of ground water below ground in the well was minimal (6.55-8.6m bgl), but however the water in the well had dried up after 2006, indicating the possibility of lesser amount to ground water in that area even before the commencement of pumping the water.

2.7 Hoskote Town Observation Well

Hoskote Town well is a newly constructed well (2013) to record the ground water in Hoskote Town and as such water table fluctuation data is available from the year 2013-2014. and is as depicted by Table 2.8

From the data collected, it can be seen that the depth of water level below ground is already very high in Hoskote Town (above 50m) and should be monitored carefully to prevent water shortage conditions in the future.

Table 2.1 Ground Water Resources, Draft and Balance Available development for Hoskote

Sl. No.	Particulars	Hoskote Taluk (ham)
1	Total annual ground water available	6081.62
2	Net annual ground water availability	5777.54
3	Existing gross ground water draft for	12521.32
4	Existing gross ground water draft for domestic and	390.98
5	Existing gross ground water for all uses	1291.31
6	Allocation for domestic and industrial use for next 25	554.16
7	Net ground water availability for future	0
8	Category	Over

(Data source: CGWB, Bangalore-2015)

Table 2.2 OBW-1 Anugondanahally Observations Well

Year	Pre-Monsoon (May)	Post-Monsoon (October)
1993	22.8	46.05
1994	36.05	32.55
1995	36.65	26.8
1996	22.8	46.05
1997	22.8	47.9
1998	22.8	26.8
1999	22.8	26.8
2000	42.35	42
2001	40.17	26.8
2002	22.8	42.94
2003	46.3	49.63
2004	49.11	59.7
2005	22.8	26.8
2006	25.35	33.56
2007	38.35	34.75
2008	31.7	24.95
2009	30.6	30.9
2010	36.25	32.25
2011	37.21	36.42
2012	40.13	44.63
2013	48.82	46.79
2014	51.92	48.95

Table 2.3 OBW- 2 Channapura Observations Well

Year	Pre-Monsoon (May)	Post-Monsoon (October)
1993	6.25	2.55
1994	5.81	7.1
1995	6.25	5.8
1996	6.25	6.3
1997	5.65	5.8
1998	6.25	3
1999	6.25	5.8
2000	6.25	4.51
2001	8.31	5.8
2002	9.5	11.67
2003	15.45	16.04
2004	18.35	19.52
2005	6.25	5.8
2006	23.10	24.12
2007	26.90	25.6
2008	28.20	26.8
2009	29.50	29.25
2010	35.1	33.35
2011		72.83
2012	76.56	81.35
2013	85.83	86.99
2014	91.52	88.56

Table 2.4 OBW- 3 Hindiganal Observations Well

Year	Pre-Monsoon (May)	Post-Monsoon (October)
1993	21.6	19.7
1994	29.7	21
1995	26.2	24.3
1996	24.9	24.7
1997	23.5	22.25
1998	24.25	24
1999	16.5	14
2000	26.5	21.55
2001	20.75	18.82
2002	19.96	20.65
2003	26.2	30.23
2004	33.8	32.48
2005	16.5	14
2006	40.70	42.74
2007	43.8	37.5
2008	38.9	40.15
2009	39.1	39.05
2010	43.3	39.14
2011	38.82	36.53
2012	42.42	46.25
2013	50.78	51.19
2014	56.49	53.47

Table 2.5 OBW- 4 Upparahalli Observations Well

Year	Pre-Monsoon (May)	Post-Monsoon (October)
1993	12.9	7.97
1994	12.7	10.3
1995	11.9	13.2
1996	17.4	7.97
1997	9.19	7.97
1998	9.19	7.97
1999	9.19	7.97
2000	10.45	8.75
2001	11.3	7.25
2002	9.75	14.75
2003	17.5	17.83
2004	19.48	18.65
2005	9.19	7.97
2006	14.25	15.96
2007	19.70	20.15
2008	21.10	16.75
2009	20.05	19.21
2010	25.40	23.65
2011	27.65	24
2012	27.65	30.31
2013	33.33	30.43
2014	34.54	31.66

Table 2.6 OBW- 5 Sulibele Observation Well

Year	Pre-Monsoon (May)	Post-Monsoon (October)
1993	12.5	8.5
1994	8.6	10.7
1995	12.45	12.7
1996	8.9	11.68
1997	8.9	7.26
1998	8.9	7.26
1999	8.9	7.26
2000	8.9	2.11
2001	6.55	2.39
2002	8.5	8.38
2003	8.9	7.26
2004	8.9	7.26
2005	8.9	7.26

Table 2.7 OBW- 6 Tavarekere Observations Well

Year	Pre-Monsoon (May)	Post-Monsoon (October)
1993	12.9	3.65
1994	12.7	10.3
1995	11.9	13.2
1996	17.4	5.87
1997	13.95	5.87
1998	9	5.87
1999	9	5.87
2000	4.95	78
2001	13.25	7.2
2002	13.05	14.35
2003	20.83	19.85
2004	21.35	5.87
2005	9	5.87

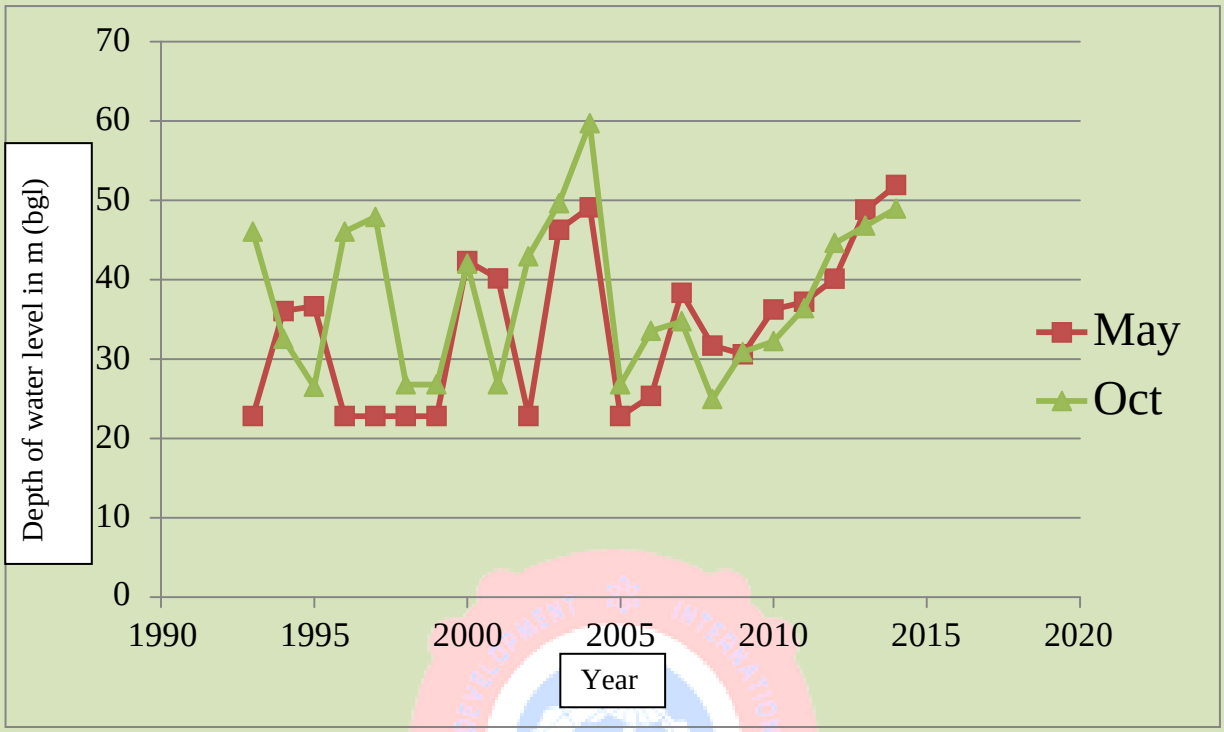
Table 2.8 OBW- 7 Hoskote Town Well

Year	Pre-Monsoon (May)	Post-Monsoon (October)
2013	58.79	51.8
2014	56.63	53.72

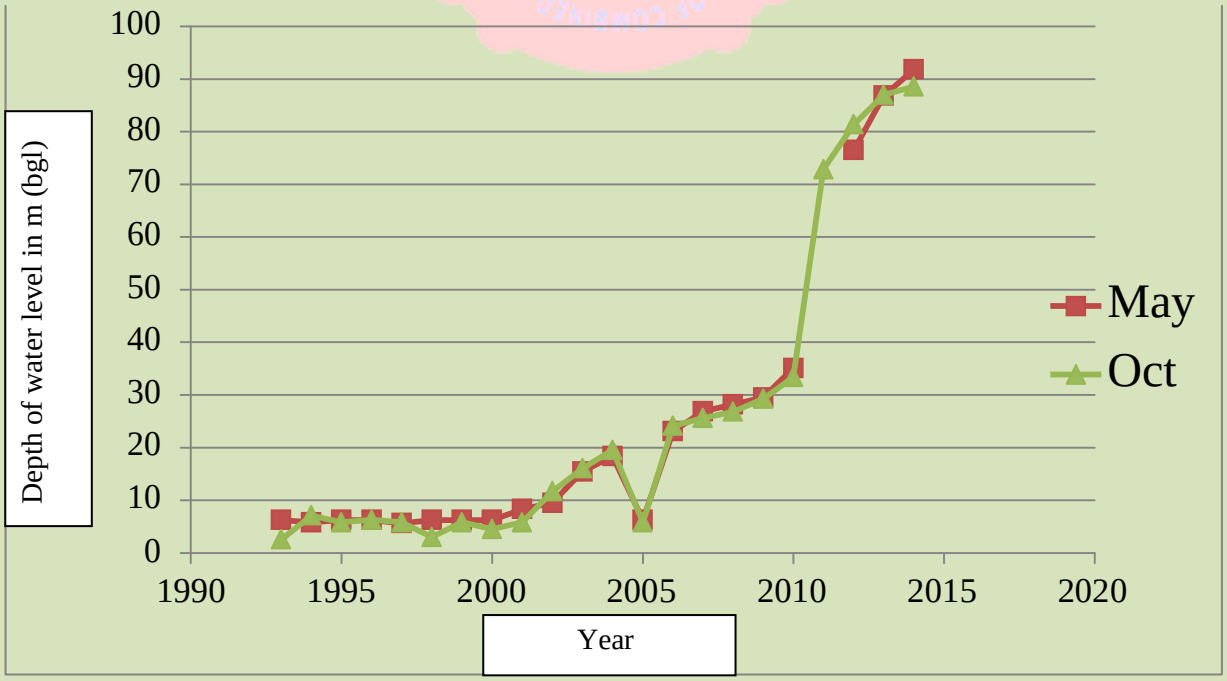
Table 2.9 Trends of observation well, season wise.

OBW	Rock Type	Elevation in 'm' above MSL	May		October		Nature of Trend
			Min. level	Max. level	Min. level	Max. level	
Anugondanahally	Laterite Genesis	867.18	22.8	49.11	26.8	49.63	Declining
Channapu		882.0	5.81	18.35	3	19.5	Declining
Hindigana		882.99	16.5	33.98	14	32.48	Rising
Sulibele		880.34	8.5	12.45	2.11	12.7	Declining
Tavareker		890	4.95	21.35	3.65	19.8	Declining
Upparahal		880.34	9.19	19.48	7.25	18.65	Declining

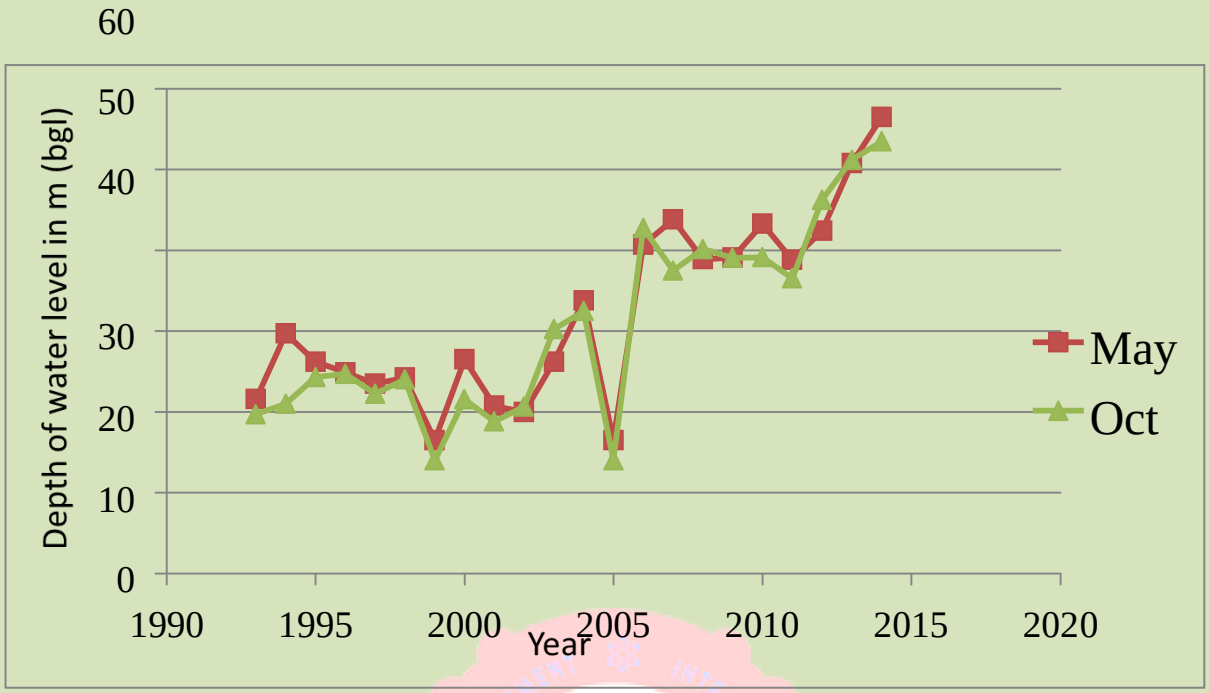
Graph 2.1 Anugondanahally Observation Well



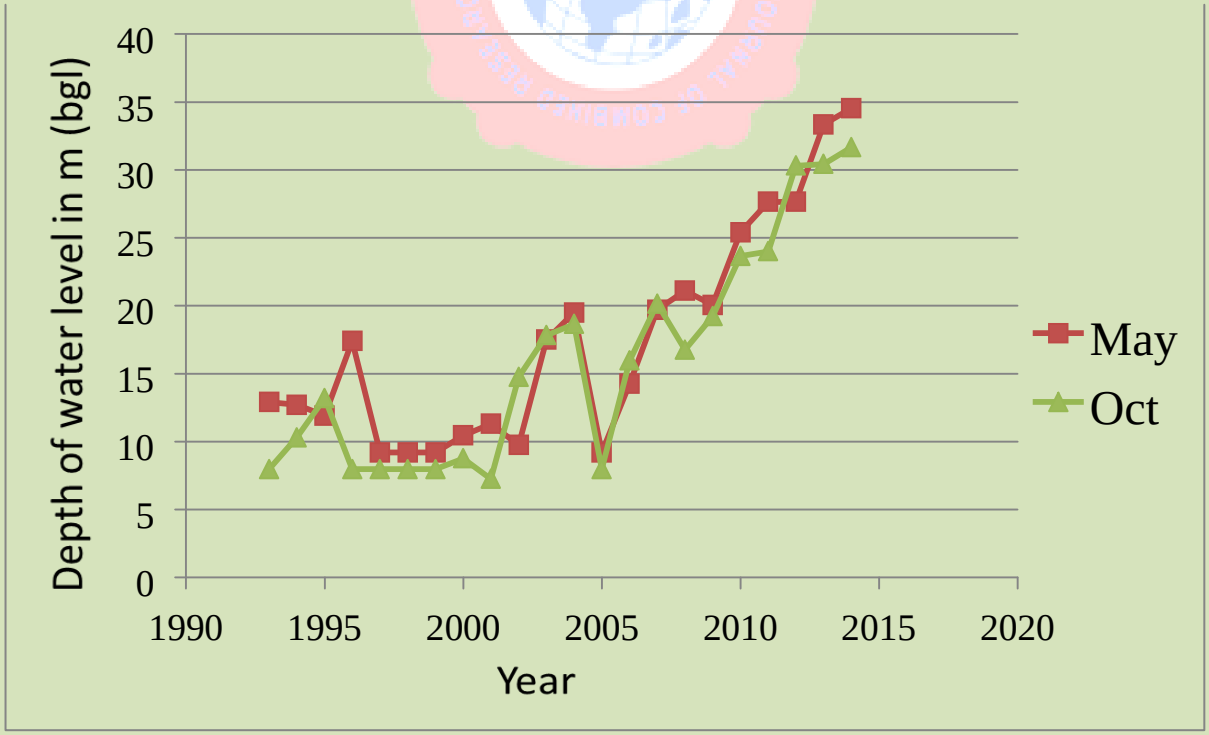
Graph 2.2 Channapura Observation Well



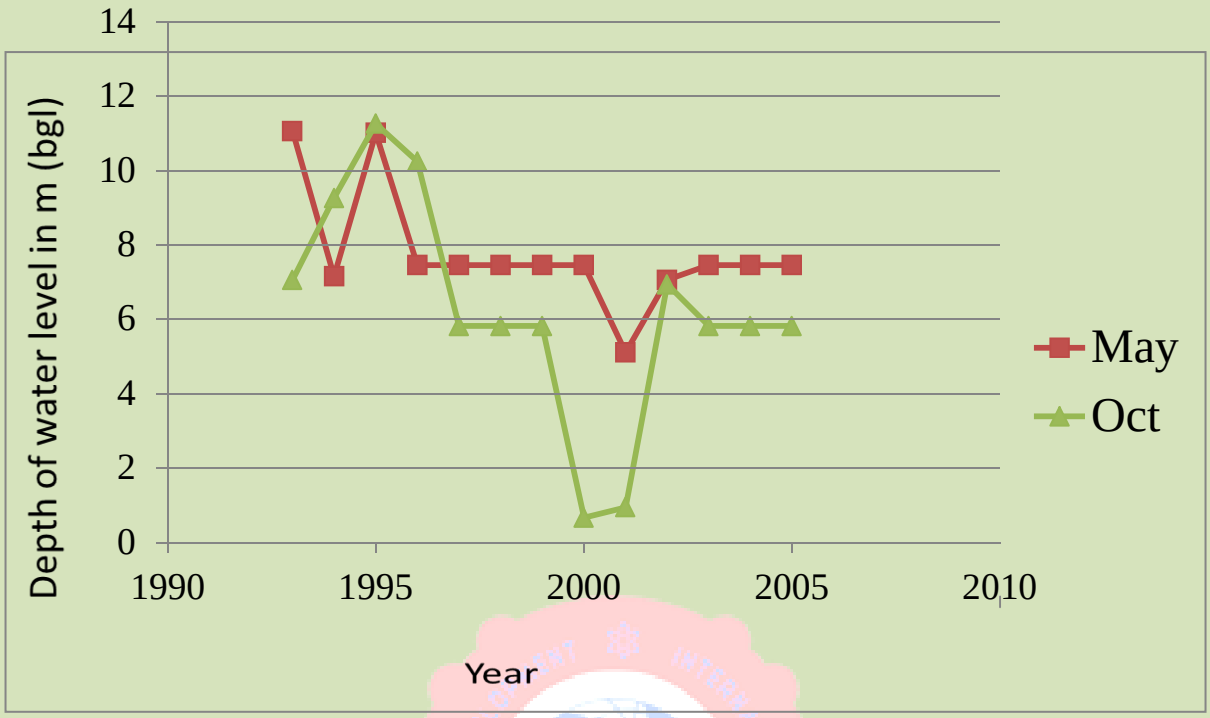
Graph 2.3 Hindiganal Observations Well



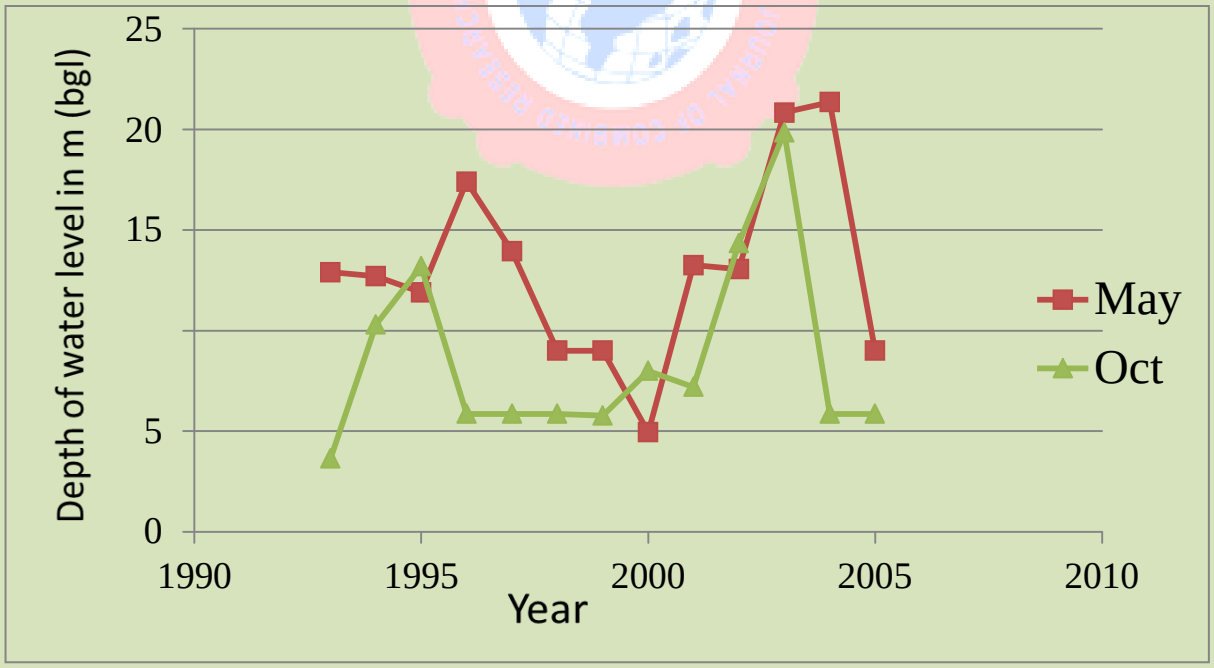
Graph 2.4 Upparahalli Observations Well



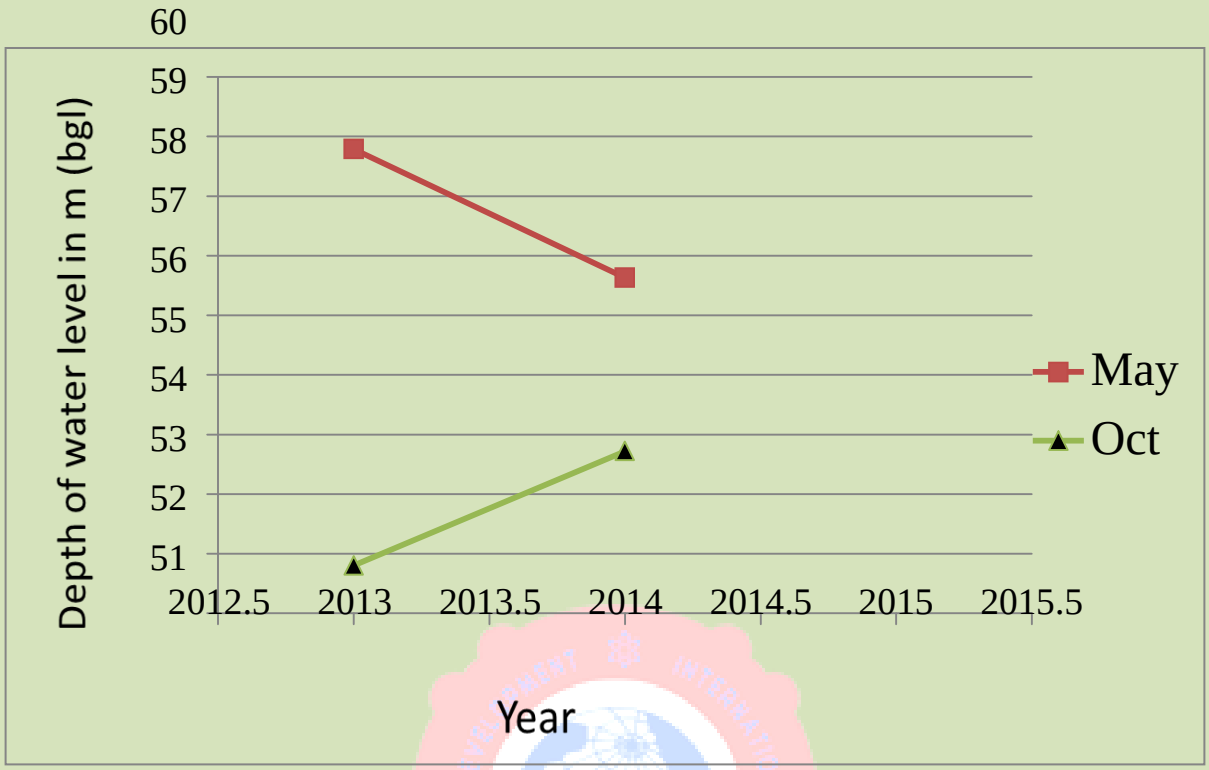
Graph 2.5 OBW- 5 Sulibele Observations Well



Graph 2.6 OBW- 6 Tavarekere Observation Well



Graph 2.7 Hoskote Town Well



Map 2.1 Allocation of the 7 Observation Wells over the Taluk

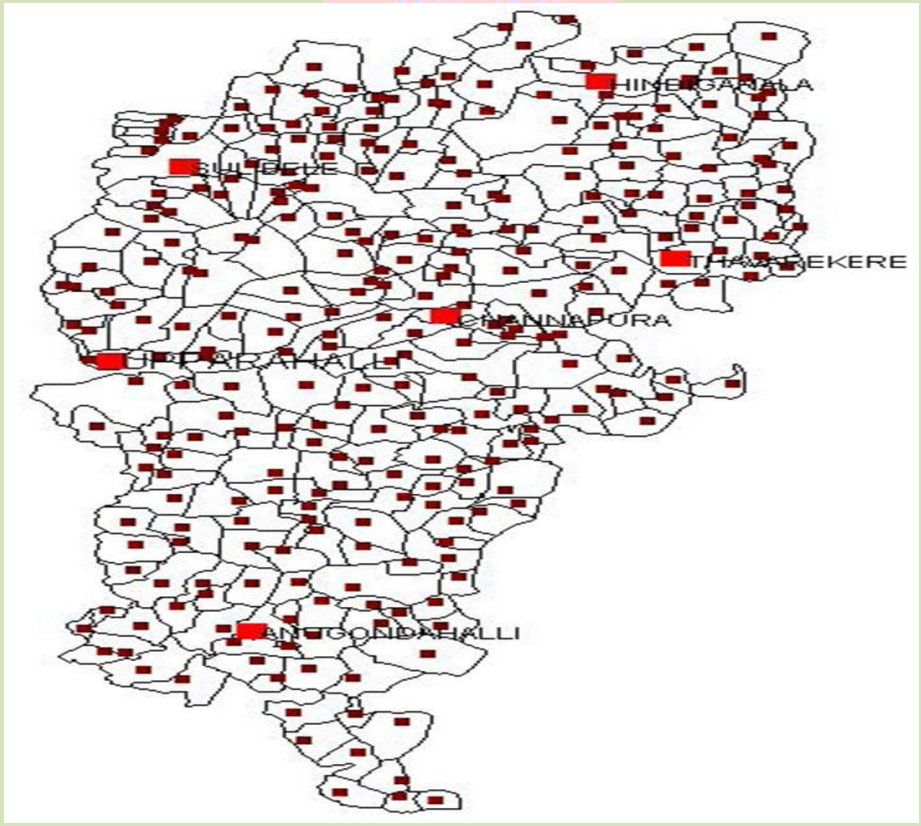


Table 2.10 Population projection and water demand of Hoskote Taluk

Year	Hoskote Town	Demand @ 55 lpcd in MLD	Hoskote Rural	Demand @ 55 lpcd in MLD	Total Population of the Taluk	Total demand @ 55 lpcd in MLD
2012	5883	3.24	222092	12.22	280929	15.46
2013	6114	3.36	230815	12.69	291963	16.05
2014	6354	3.49	239881	13.19	303430	16.68
2015	6604	3.63	249302	13.71	315347	17.072
2016	6864	3.77	259095	14.25	327735	18.02
2017	7133	3.92	269272	14.81	340608	18.73
2018	7413	4.08	279848	15.39	353986	19.47
2019	7705	4.24	290840	15.99	367890	20.24
2020	8007	4.4	302263	16.62	382339	21.02
2021	8322	4.58	314136	17.27	397357	21.85
2022	8649	4.756	326475	17.956	412965	22.712
2023	8988	4.94	339298	18.66	429185	23.6
2024	9341	5.138	352625	19.39	446043	24.528
2025	9708	5.34	366475	20.16	463562	24.5

Table 2.11 Gap in Domestic water supply of Hoskote Town and Hoskote Rural

Sl. No	Area	Existing W/S	Standards	Current demand (2015)	Deficit
1	Hoskote Town	1.5 MLD	100 lpcd	3.63	2.13
2	Hoskote Rural	10.75	100 lpcd	13.712	2.962

III. REMEDIAL MEASURES

The ground water of the taluk is over exploited (225%), and designated a dark area by DMG of Govt. of Karnataka. Water supply is 20 % of demand (even @ of 100 lpcd) Hence there is an urgent need to revive the water resources of the Taluk, to I. Conserve the ground water ii. To.Meet the demand iii. To prevent future water shortage problems. And as such the following are the remedies suggested to improve the water other establishments.

3.1 Construction of Nalabunds, Check Dams and Weirs

3.2 Construction of Farm Ponds

3.3 Agro Forestry

3.4 Recharging of Ground Water

3.5 Conservation of Water

3.6 Waste Water Treatment and Recycling

With the awareness created among rural public, who are health conscious, and more number of industries coming up and due to urbanisation, the generation of wastewater is also going up. Recycling of wastewater can be taken up by settling up waste treatment plant at Hoskote town and the recycled water can be utilized for meeting domestic gardening and even industrial needs. The industries, hospital complex, (The MVJ Medical College at Hoskote is already having a waste treatment plant) can be encouraged to go in for such plants which will meet their water requirement partially.

3.7 Regulation of Ground Water Development

IV. FEASIBILITY OF SUGGESTED MITIGATION MEASURES

4.1 Environmental Impacts

The current water demand of Hoskote is met by extraction of ground water leading to depletion of ground water table. Provisions of indirect reuse of recycled wastewater for potable purpose will inhibit rapid groundwater depletion and save it for future use.

The other environmental benefit to using recycled water is the decrease in the pollution load on downstream water body of diverting treated wastewater.

4.2 Social Impacts

As ground water with its seasonal highs and lows, is not a dependable source, the suggested remedial measures would provide a reliable source of potable water.

Another impact would be increase in employment opportunities due to the new jobs created by the organisations directly connected to the operation and maintenance of the water and sewage treatment plants; water engineering companies; suppliers of systems, equipment and chemicals for waste water treatment and water reuse.

4.3 Mitigation Measures

The study is a green initiative and does not pose any threat to environment or society and hence any mitigation measures are not required to be adopted.

V. CONCLUSION

With a current approximate population of 3,03,428, Hoskote Taluk is facing severe water problems and it is seen that with the current availability of water resources in the Taluk, it is impossible to meet the demand for water. Hoskote Taluk can no longer depend on its main source of water, the ground water, as it has been exhausted to its core and is now in its critical stages. The next main source of water for both drinking and irrigation are Tanks, which too are now running on their 50 % capacity owing to unpredictable rainfall and deposition of silts.Hoskote TMC supplies water for 1-2 hours @ of 50 LPCD on an average, which falls short of Demand@ of 80 LPCD. The people there meet the rest of their water demand through private tankers. Rainfall though very variable, both seasonally and yearly, it still has provided an average minimum of 450 mm of water yearly. But however rainfall harvesting is still in its initial stages in the Taluk. Therefore, there is a direct need of an alternate source of water for the Taluk. Ground water can now not be further exhausted at any cost and recharge of the

same must be taken up as soon as possible.

The best and most economical methods of improving the water scenario would be not to concentrate on a single source of water but to give equal importance to every source. Rain water harvesting on large scale would be economical and will be able to meet the demand set by the population. Small projects like construction of Nalabunds, Check Dams, etc, must be taken up at all the places possible, for they will check the surface flow of rain water, form percolation ponds and ultimately help in the recharge of ground water.

Later on, all the waste water can from the Taluk can be treated on a large scale and reused, which seems to be the best remedial measure to improve the water problems in the Taluk, and for that the required data, such as water demand of population, quality of sewage, etc, must be collected and examined, to create a data base.

VI. ACKNOWLEDGEMENTS

The author is extremely grateful to the RDED, Bangalore, for the immaculate data provided by them during the course of this work. The authors also thanks to our final year students namely **Ugyen Tshering, Shruthi, Sushmitha Pandit and Anupam Anand** have collected lot of literature, analyzed and drawn graphs in connection with this study.

References

[1]. Hoskote Interim Master Plan (IMP), Water and power consultancy services (India) limited, Annexure- 111, page 1-6.

[2] .ISI: 10,500 (1983) Indian Standard Specification for drinking water, Indian Standards Institutions, Manak Bhavan, New Delhi, India.

[3]. Maruthesha Reddy, M.T and Shankar, B.S (2006) Aquifer performance of the site at M.V.J Medical college and hospital, Dandupalya, Bangalore. National conference on civil engineering: 'Meeting challenges of tomorrow' at Guru Nanak Dev engineering college, Ludhiana.

[4]. Maruthesha Reddy, M.T, Shankar, B.S and Prabhakar, B.C (2008), Water Resources of Hoskote, Jest, Satyamangala, Tamil Nadu, Vol.1 No.2, July-Dec, (page 52-55).

[5]. Shankar, B.S, and Maruthesha Reddy, M.T (2007), Impact of industrialisation on ground water quality, International conference on 'Integrated water resources management' at the T NU, Coimbatore, Feb 8-10, 2007

[6]. Shankar, B.S, Maruthesha Reddy, M.T and Dayananda Reddy, L, (2007). Fluoride levels in the ground water of Hoskote industrial area, Bangalore, National conference on "Watershed management and impact on environmental changes on water resources, at JNTU, Hyderabad, WMEC- 2007.

[7]. Todd, D.k. (1959) Ground water hydrology, John Wiley and sons,inc.,London,(page-336)