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

Dr. M. T. Maruthesa Reddy\textsuperscript{1}, Dr. Prabhakar B.C\textsuperscript{2} Brungesh K \textsuperscript{3} Akshatha M.R \textsuperscript{4}

\textsuperscript{1}Professor, Department of Civil Engineering, Acharya Institute of Technology, Bangalore, India
\textsuperscript{2}Professor, Department of Geology Jnanabharathi, Bangalore University, Bangalore, India
\textsuperscript{3}Asst.Professor, Department of Chemistry, Acharya Institute of Technology, Bangalore, India
\textsuperscript{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 water. This paper 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.

Table 1.1 Population projection of Hoskote taluk

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<th>Year</th>
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<th>Hoskote Rural</th>
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Taluk profile
Hosakote is a taluk in Bangalore Rural District. Headquartered at the Hoskote town, it consists of 5 Hoblis - Anugondanahalli, Jadigenahalli, Kasaba, Nandagudi and Sulibe. 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.
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 response 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.
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. Anugondanahally ii. Channapura
iii. Hindiganala iv. 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 situated in 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 in the water it has dried up. Initially the depth of ground water below ground in the well was minimal (6.55-8.6m bg), 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 bg), 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.

Map 1.1 Karnataka and Hoskote Map

![Map Image](image_url)
### Table 2.1 Ground Water Resources, Draft and Balance
Available development for Hoskote

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(Data source: CGWB, Bangalore-2015)

### Table 2.2 OBW-1 Augondanahally Observations Well

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<td>13.95</td>
<td>5.87</td>
</tr>
<tr>
<td>1998</td>
<td>9</td>
<td>5.87</td>
</tr>
<tr>
<td>1999</td>
<td>9</td>
<td>5.87</td>
</tr>
<tr>
<td>2000</td>
<td>4.95</td>
<td>78</td>
</tr>
<tr>
<td>2001</td>
<td>13.25</td>
<td>7.2</td>
</tr>
<tr>
<td>2002</td>
<td>13.05</td>
<td>14.35</td>
</tr>
<tr>
<td>2003</td>
<td>20.83</td>
<td>19.85</td>
</tr>
<tr>
<td>2004</td>
<td>21.35</td>
<td>5.87</td>
</tr>
<tr>
<td>2005</td>
<td>9</td>
<td>5.87</td>
</tr>
</tbody>
</table>

### Table 2.8 OBW- 7 Hoskote Town Well

<table>
<thead>
<tr>
<th>Year</th>
<th>Pre-Monsoon (May)</th>
<th>Post-Monsoon (October)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>58.79</td>
<td>51.8</td>
</tr>
<tr>
<td>2014</td>
<td>56.63</td>
<td>53.72</td>
</tr>
</tbody>
</table>

### Table 2.9 Trends of observation well, season wise.

<table>
<thead>
<tr>
<th>OBW</th>
<th>Rock Type</th>
<th>Elevation in &quot;m&quot; above MSL</th>
<th>May Min. level</th>
<th>May Max. level</th>
<th>October Min. level</th>
<th>October Max. level</th>
<th>Nature of Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anugondahally</td>
<td>Laterite</td>
<td>867.18</td>
<td>22.8</td>
<td>49.11</td>
<td>26.0</td>
<td>49.63</td>
<td>Declining</td>
</tr>
<tr>
<td>Channapatna</td>
<td>Genesis</td>
<td>882.0</td>
<td>5.81</td>
<td>18.35</td>
<td>3</td>
<td>19.5</td>
<td>Declining</td>
</tr>
<tr>
<td>Hindigana</td>
<td></td>
<td>882.99</td>
<td>16.5</td>
<td>33.98</td>
<td>14</td>
<td>32.48</td>
<td>Rising</td>
</tr>
<tr>
<td>Sulibele</td>
<td></td>
<td>880.34</td>
<td>8.5</td>
<td>12.45</td>
<td>2.11</td>
<td>12.7</td>
<td>Declining</td>
</tr>
<tr>
<td>Tavarekere</td>
<td></td>
<td>890</td>
<td>4.95</td>
<td>21.35</td>
<td>3.65</td>
<td>19.8</td>
<td>Declining</td>
</tr>
<tr>
<td>Upparahalli</td>
<td></td>
<td>880.34</td>
<td>9.19</td>
<td>19.48</td>
<td>7.25</td>
<td>18.65</td>
<td>Declining</td>
</tr>
</tbody>
</table>
Graph 2.3 Hindiganal Observations Well

Graph 2.4 Upparahalli Observations 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

<table>
<thead>
<tr>
<th>Year</th>
<th>Hoskote Town</th>
<th>Demand @ 55 lpcd in MLD</th>
<th>Hoskote Rural</th>
<th>Demand @ 55 lpcd in MLD</th>
<th>Total Population in the Taluk</th>
<th>Total demand @ 55 lpcd in MLD</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>5883</td>
<td>3.24</td>
<td>222092</td>
<td>12.22</td>
<td>280929</td>
<td>15.46</td>
</tr>
<tr>
<td>2013</td>
<td>6114</td>
<td>3.36</td>
<td>230815</td>
<td>12.69</td>
<td>291963</td>
<td>16.05</td>
</tr>
<tr>
<td>2014</td>
<td>6354</td>
<td>3.49</td>
<td>239881</td>
<td>13.19</td>
<td>303430</td>
<td>16.68</td>
</tr>
<tr>
<td>2015</td>
<td>6604</td>
<td>3.63</td>
<td>249302</td>
<td>13.71</td>
<td>315347</td>
<td>17.07</td>
</tr>
<tr>
<td>2016</td>
<td>6864</td>
<td>3.77</td>
<td>259095</td>
<td>14.25</td>
<td>327735</td>
<td>18.02</td>
</tr>
<tr>
<td>2017</td>
<td>7133</td>
<td>3.92</td>
<td>269272</td>
<td>14.81</td>
<td>340608</td>
<td>18.73</td>
</tr>
<tr>
<td>2018</td>
<td>7413</td>
<td>4.08</td>
<td>279848</td>
<td>15.39</td>
<td>353996</td>
<td>19.47</td>
</tr>
<tr>
<td>2019</td>
<td>7705</td>
<td>4.24</td>
<td>290840</td>
<td>15.99</td>
<td>367890</td>
<td>20.24</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Area</th>
<th>Existing W/S</th>
<th>Standards</th>
<th>Current demand (2015)</th>
<th>Deficit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hoskote Town</td>
<td>1.5 MLD</td>
<td>100 lpcd</td>
<td>3.63</td>
<td>2.13</td>
</tr>
<tr>
<td>2</td>
<td>Hoskote Rural</td>
<td>10.75</td>
<td>100 lpcd</td>
<td>13.712</td>
<td>2.962</td>
</tr>
</tbody>
</table>

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 LPD on an average, which falls short of Demand @ of 80 LPD. The people there meet the rest of their water demand through private tanks. 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 database.

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