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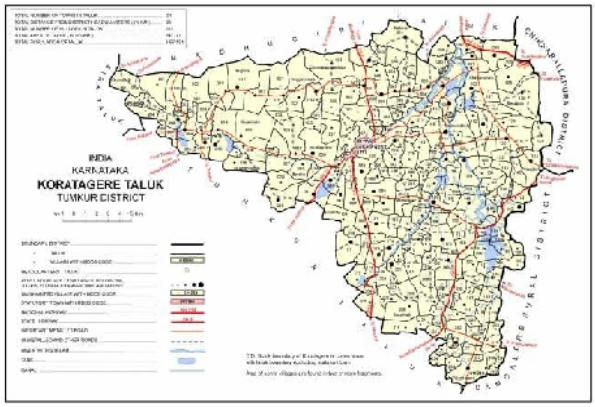
**Government of India**
**Ministry of Water Resources, River Development & Ganga Rejuvenation**
**Central Ground Water Board**

# KORATAGERE TALUK AQUIFER MAPS AND MANAGEMENT PLANS, TUMKURU DISTRICT, KARNATAKA STATE

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# KORATAGERE TALUK AQUIFER MAPS AND MANAGEMENT PLANS, TUMKURU DISTRICT, KARNATAKA STATE

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**KORATAGERE TALUK AQUIFER MAPS AND MANAGEMENT PLAN, TUMKUR DISTRICT, KARNATAKA STATE**

## 1. SALIENT FEATURES

**Name of the Taluk** : **KORATAGERE**
**District** : Tumkuru
**State** : Karnataka
**Area** : 644 sq.kms
**Population** : 1, 67,591 (**2011** Census)
**Normal Annual Rainfall** : 788 mm

Koratagere taluk, located in north eastern portion of Tumkur district, Karnataka state covering an area of 644 Sq. Kms and is a part of North Pennar river basin located at longitudes $13^0$ 19'1.3": $13^0$ 37'18.5" and east latitude of $77^0$ 01' 35.3": $77^0$ 23' 36.5". It is surrounded Madhugiri taluk towards north, Tumkur taluk towards south, Tumkur and sira taluk towards west and in east it is Doddaballapur taluk of Bangalore Rural and Gauribidanur taluk of Chikballapur district. The Location map of the taluk is in figure 1.

Koratagere taluk is a part of Madhugiri revenue sub-division with Koratagere as taluk head quarter. There are four revenue hoblies - Koratsgere, Channarayanadurga, Holavanahalli and Kolala which covers 235 Inhabited and 16 uninhabited villages. The taluk is well connected with good network of roads with State highways and district roads forming good net work of transport facility.

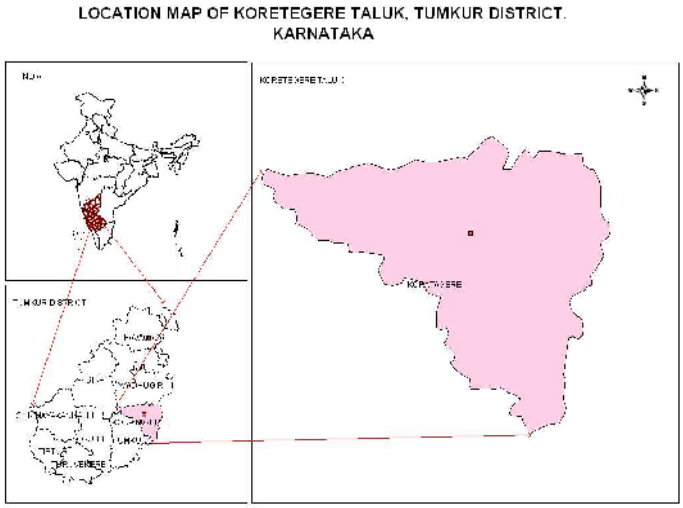


Fig 1. Location map of Koratagere taluk, Tumkuru district

### 1.2 Population

As per 2011 census, the total population in Koratagere taluk is 167591 (84349 males and 83142 Females) of which about 152326 (90.89 %) constitutes the rural population. The Taluk has an overall population density of 257.04 persons per sq.km. The decadal change is 4.35%.

### 1.3 Rainfall

Koratagere taluk enjoys semi arid climate. Dryness and hot weather prevails in major part of the year. The area falls under Central 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 $29^0$C to $37^0$C and in winter it is $16^0$ to $27^0$ C. The rainy season is South-West monsoon is from June to September followed by North-East monsoon and post-monsoon from October to December.The Annual Normal rainfall (1981 to 2010) in the taluk is 788 mm and the statistical analysis of rain fall data is presented in the table-1

Table 1: Statistical Analysis of Rainfall Data of Koratagere Station, for the Period 1981 to 2010

| | JAN | FEB | MAR | APR | MAY | PRE | JUN | JUL | AUG | SEP | SW | OCT | NOV | DEC | NE | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NRM | 3 | 7 | 11 | 33 | 76 | 130 | 78 | 97 | 112 | 164 | 452 | 142 | 57 | 8 | 207 | 788 |
| ST. DEV | 7 | 19 | 26 | 28 | 50 | 61 | 48 | 66 | 81 | 104 | 165 | 107 | 49 | 12 | 120 | 222 |
| CV% | 285 | 283 | 230 | 83 | 66 | 47 | 61 | 68 | 72 | 63 | 37 | 75 | 87 | 147 | 58 | 28 |

### Assessment of Drought

Rainfall data has been analysed to assess the drought condition using 105 years Rain fall data and the results / classification thus obtained are listed in the Table-2. It is observed that the Koratagere taluk has experienced alternating no drought to severe drought conditions over the years.

Table 2. Classification of drought and its periodicity (IMD, 1971)

| % Deviation (Di) | | >0 | 0 to -25 | -25 to -50 | 50 to 75 | Probability of drought occurrences |
|---|---|---|---|---|---|---|
| Category | | No drought | Mild (Normal) | Moderate | Severe | |
| | | Years | | | | |
| Taluk | Koratagere | 50 | 34 | 18 | 3 | Once in 5 years |

Out of 105 years of analysis in Koratagere taluk, “No Drought” condition is experienced in 50 years, “Mild Drought” condition is 28 years and “Moderate Drought” condition experienced in 22 years. Further it is observed that “Severe Drought” condition is experienced in 3 years ie, during 1908, 1920, 1923, and 1965. 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 5 years**.**

### 1.4 Agriculture & Irrigation

Koratagere taluk is having 152326 (90.89) of rural population wholly dependent on the rain fall for their agricultural activities. The land use pattern of the taluk is presented in the table-3.

Table 3. Land use pattern in Koratagere taluk

| Geographical area (Ha) | Area under forest (Ha) | Area not available for cultivation (Ha) | Uncultivable land (Ha) | Fallow land (Ha) | Area sown (Ha) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Net sown area | Area sown more than once | Total sown/cropped area |
| 70819 | 3476 | 9368 | 12957 | 7373 | 37745 | 2131 | 39876 |

Source: District at a glance 2014-2015

### 1.4.1 Principle crops

The only principal crop of the taluk is Maize - 14483 ha (36.32% to the total cropped area) followed by Ragi crops (24.23% to the total cropped area) and Ground nuts with an area of 3194 ha, (8%) which are normally rain fed crops. Overall food crops (70%) are the major crops grown during Rabi season. Vegetables and paddy crops are the Kharif crops. The principle crops and area grown are in the below table-4.

Table 4. Principal crops in Koratagere taluk

| Crops | Cereals (Ha) | | | Pulses (Ha) | | | | Fruits ( Ha) | Vegetables (Ha) | Oil seeds, (Ha) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Maize | Ragi | Others | Horse gram | Tur dal | Cow pea | Others | | | Ground nuts | Castor | others |
| | 14483 | 9662 | 1420 | 1629 | 598 | 199 | 220 | 1506 | 226 | 3194 | 115 | 26 |
| **Total** | 25565 | | | 1506 | | | | 1418 | 226 | 3433 | | |
| | **Total Food Grains - 28211 ha** | | | | | | | **-** | **-** | **Total Oilseeds- 3433 ha** | | |

Source: District at a glance 2014-2015

### 1.4.2 Irrigation Practices

In Kortagere taluk, the ground water is being developed from ground water structures like 516 dug wells and 6707 shallow tube wells (Report on 4$^{th}$ census of Minor Irrigation Schemes 2006-2007) is 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.

### 1.4.3 Ground water and surface water Irrigation

In Koratagere taluk, Ground water 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 Koratagere taluk

| Sl. No. | Source | | No. / Length | Net area irrigated | Gross area irrigated |
|---|---|---|---|---|---|
| 1 | Surface water | Canals | 0 | 0 | 0 |
| | | Tanks | 142 | 81 | 81 |
| 2 | Ground water | Dug Wells | 613 | 0 | 0 |
| | | Bore wells | 12753 | 7069 | 7790 |
| | | Total | 13508 | 7250 | 7871 |

Source: District at a glance 2014-2015

### 1.5 Geomorphology, Physiography & Drainage

Geomorphologically Koratagere taluk falls in southern maidan region. It is having rolling topography charectarised hilly country intersected by cultivated Valleys and is part of Eastern Ghats with a parallel range of hills extends from north to south made up of granites. Prominent hill ranges are Channarayanadurga (3734 feet) and Koratagiri (2885 feet) figure-2. The average elevation of taluk is 750 m a msl.

### Drainage

Koratagere taluk is part of North Pennar river basin. There are no perennial rivers in the taluk. About 88% (575 sq kms) of the taluk is drained by tributaries like Jayamangala affluent of North Pennar river which rises near Devarayanadurga in gorge called Jaladagondi flows northerly direction and receives Garudachala stream in the east and Suvarnamuhi from the west and finally joins North Pennar river. The general drainage pattern is of sub-rectangular due to marked influence of geologic structures in the basin Figure-3.

### 1.6 Geology

Koratagere taluk is occupied by Banded Gneisses called as pemninsular Gneiss and granites constituting acid rocks, pegmatites, syenite ans Rhyolite etc as major rock formation figure-4.

### 1.7 Soil

The soils of the taluk are derived from Gneiss / Granites. The soils are hard and poor in general. Sandy, clay, loam, black soil are the soil types Figure-5.

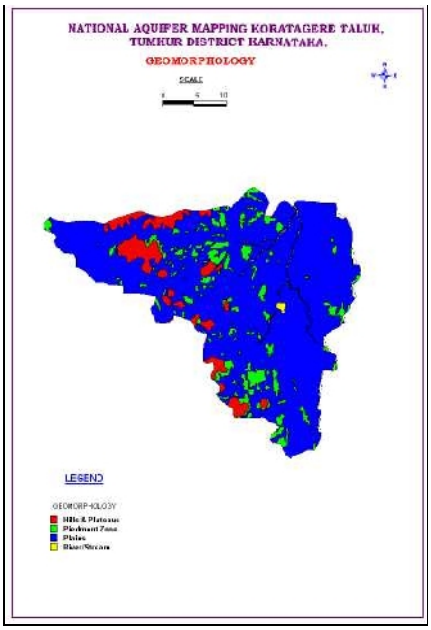


Fig 2. Geomorphology map

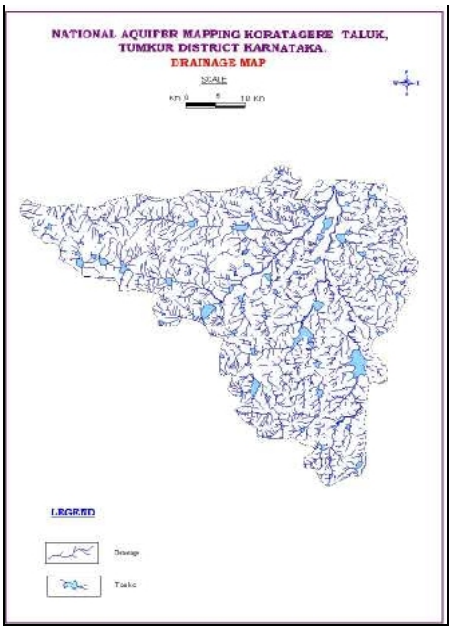


Fig 3. Drainage map


Fig 4. Gology map

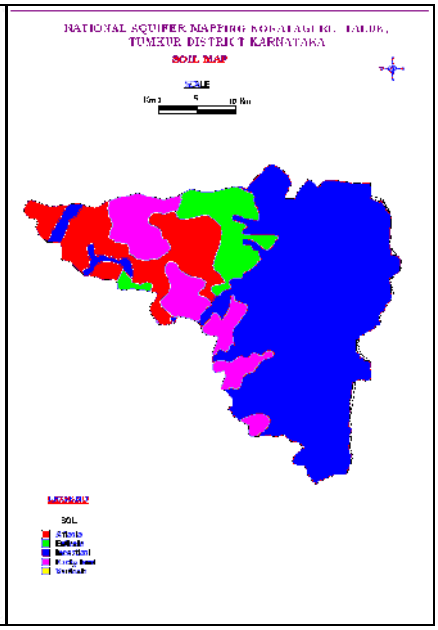


Fig 5. Soil map

### 1.8 Ground water resource availability and extraction

Ground water availability as per Resource Estimation 2009 & 2013 is as in the table-6.

Table 6. Ground water availability as per Resource Estimation 2009 & 2013

| Year | Annual replenishable GW resources | Fresh In-storage GW resources | | Total availability of fresh GW resources |
|---|---|---|---|---|
| | | Phreatic | Fractured (Down to 200m) | Dynamic +phreatic in-storage + fractured |
| 2009 | 4264 HAM | 14501 HAM | 1870 HAM | 21111 HAM |
| 2013 | 4821 HAM | 0 HAM | 1870 HAM | 6690 HAM |

As per the estimation (GEC 2013) the ground water draft (extraction) for irrigation worked out to be **7193 ham** with stage of ground water development of 151%.

### 1.9 Existing and future water demands

As per GEC (2013) existing ground water draft for irrigation, industrial & domestic (all use) is **7275** ham and availability for future demands with judicious utilization since the stage of ground water development is already reached up to **151** % having less scope it is 192 ham of which **101** ham is for domestic and industrial use and **91** ham is for future irrigation purposes.

### 1.10 Water level behavior

The depth to water levels during pre and post monsoon and the rate of fluctuation of water level are in the table 7 and figures 6 to 10.

Table 7. Depth to Water levels in Koratagere taluk

| | Pre-monsoon, mbgl | | Post-monsoon, mbgl | | Water level fluctuation, m | |
|---|---|---|---|---|---|---|
| | **Aquifer I** | **Aquifer II** | **Aquifer I** | **Aquifer II** | **Aquifer I** | **Aquifer II** |
| **Range** | 1.78 to 8.12 | - | 0.15 to 8.12 | - | 0.00 to 2.63 | - |
| **Average** | 4.66 | - | 3.43 | | 1.23 | |

### A. Depth to water level: Aquifer I

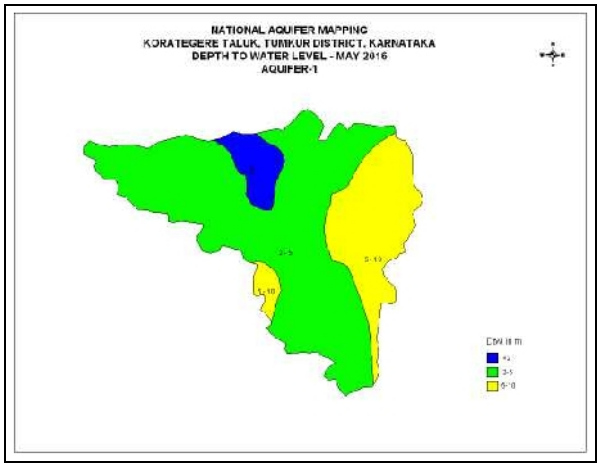


Fig 6. Pre- monsoon DTW Map Aquifer- I

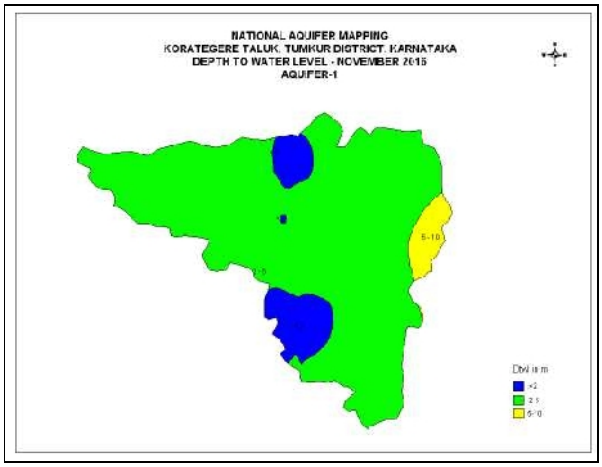


Fig 7. Post- monsoon DTW map Aquifer-I

## B. Depth to water level: Aquifer II

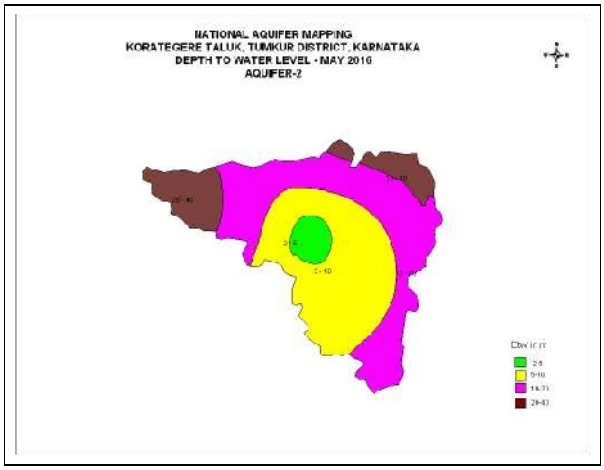


Fig 8. Pre monsoon DTW Map Aquifer- II

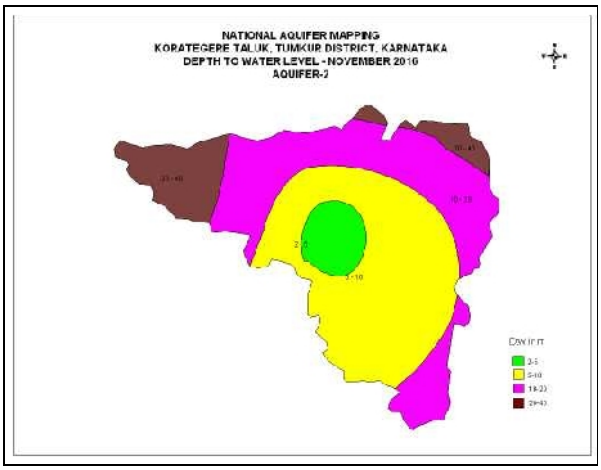


Fig 9. Post monsoon DTW map Aquifer- II

## C. Water level fluctuation

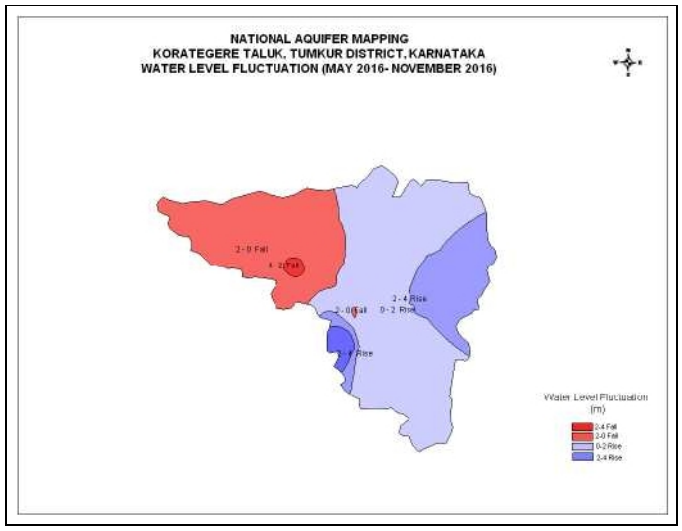


Fig 10. Water level Fluctuation map, Aquifer- I

Analysis of long term water level trend in Aquifer-1 indicates that in pre monsoon there is rising trend in between 0.047 to 0.225 m/y with an average of 0.151m/y and no falling trend. Similarly during post monsoon showed rising trend in the range of 0.033 to 0.300m/y with an average of 0.133m/y. Falling trend during post monsoon observed to be 0..131m/y. Overall trend indicates that rising trend to the tune of 0.058 to 0.298m/y with an average of 0.153 m/y and falling trend os of 0.0093.166m/y.

## 2. 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 in table-8.

Table 8. Details of Ground water Exploration in Koratagere taluk

| Sl. No. | Details | No/Range |
|---|---|---|
| 1 | No of wells drilled | 8 |
| 2 | Depth range in 'm' | 30.00 to 200 |
| 3 | Depth of Casing in 'm' | 10.90 to 26.73 |
| 4 | Discharge in LPS | 1.46 to 5 |
| 5 | S.W.L. in mbgl | 17.94 to 49.79 |
| 6 | Transmissivity, $m^2$/day | - |

The yield analysis indicated that all the wells are showing less than 5 LPS.

**2.1 Number of aquifers:** Based on the Ground water exploration data In Pavagada taluk, there are mainly two types of aquifer systems;

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

## 3. GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION

### 3.1 Aquifer wise resource availability and extraction

Aquifer wise ground water resource (2011) has already been discussed in above chapter (1.8 & 1.9). However, overall Groundwater resource estimation in Koratagere taluk as on 2011 & 2013 indicating present and future scenario (2025), Stage of ground water development and categorization is presented in the below table-9.

Table 9. Ground water resource, Koratagere taluk

| Sl. No. | Resource details | As per 2011 Estimation | As per 2013 Estimation |
|---|---|---|---|
| 1 | Net Ground Water Availability in HAM | 4730.98 | 4821 |
| 2 | Existing Gross Ground Water Draft for Irrigation in HAM | 7052.23 | 7193 |
| 3 | Existing Gross Ground Water Draft for Domestic and Industrial Water Supply in HAM | 516.98 | 82 |
| 4 | Existing Gross Ground Water Draft for all use in HAM | 7569.21 | 7275 |
| 5 | Allocation for Domestic And Industrial Use for next 25 years in HAM | 518.43 | 101 |
| 6 | Net Ground Water Availability for future Irrigation Development in HAM | 88.39 | 91 |

| | | | |
|---|---|---|---|
| 7 | Existing Stage Of Ground Water Development in percentage | 160 | 151 |
| 8 | Categorization | O.E | OE |

### 3.2 Chemical quality of ground water and contamination

The chemical quality of ground water in Koratagere taluk is assessed from the analysis results of 6 samples from dug wells (Aquifer-I). The variation range and average of the different chemical constituents are presented in the table-10 and the distribution of chloride, EC, Nitrate and Fluoride is presented in the figure 11 to 14.

Table 10. Range and average of chemical constituents in Ground water.

| Chemical consitituennts in PPM | pH | EC in m/mhos/cm at 25 $^0$ c | TH asCaCo$_3$ | Ca | Mg | Na | K | Hco$_3$ | Cl | So$_3$ | No$_3$ | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Range | 7.85 to 8.21 | 650 to 1580 | 150 to 380 | 32 to 84 | 12.21 to 41.43 | 76 to 143 | 1.6 to 70 | 183 to 293 | 43 to 277 | 19 to 95 | 5.6 to 175 | 0.67 to 1.85 |
| Average | 8.03 | 1095 | 258.33 | 56.66 | 28.43 | 118.50 | 13.53 | 243.83 | 157.50 | 57.50 | 53.60 | 1.38 |

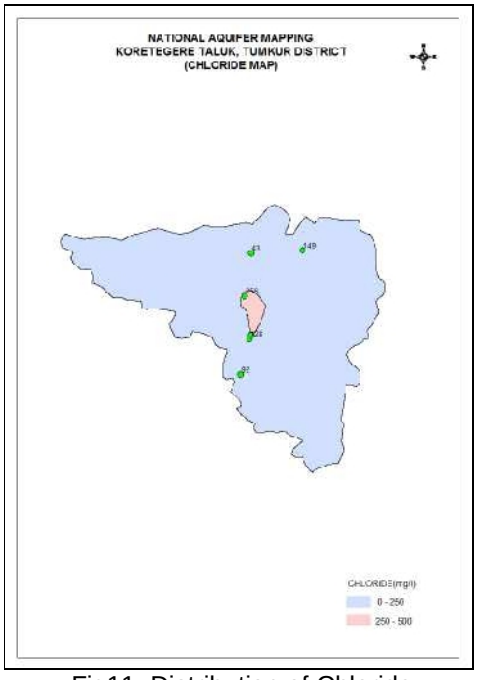


Fig11. Distribution of Chloride

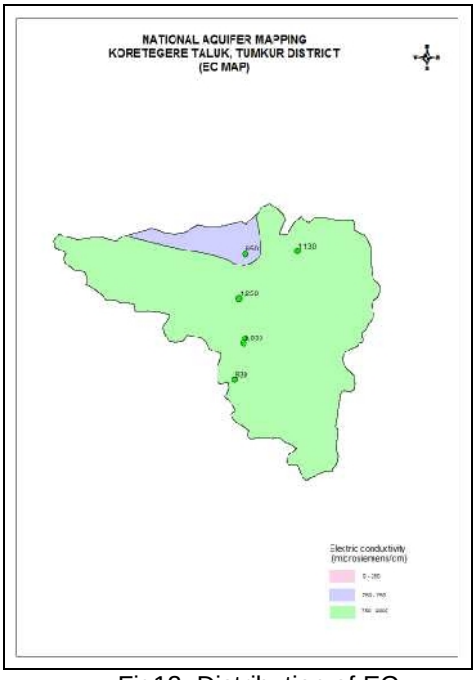


Fig12. Distribution of EC


Fig13. Distribution of Nitrate

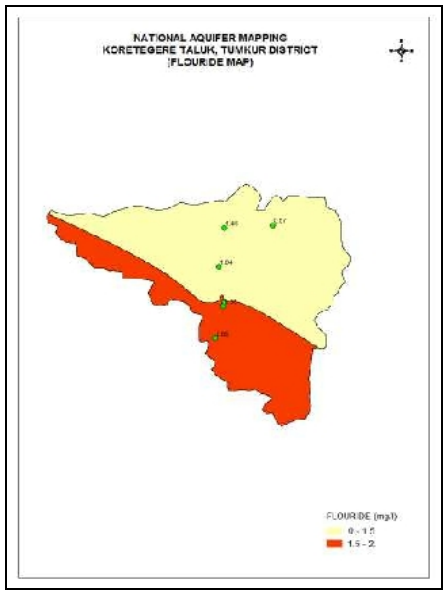


Fig14. Distribution of Fluoride

**3.2.1.** Suitability of ground water for drinking purposes is assessed as per Indian Standard Drinking water specification (IS 10500:1991) which indicates that water is potable and all the required chemical constituents is within the desirable/permissible limits. The range of chemical constituents (under NAQUIM) in ground water of the taluk is plotted in Piper diagram Figure-15.

**3.2.2.** Suitbility of ground water for irrigation purposes was assessed and the chemical analysis of the taluk is plotted in United States Regional Salinity Labaratory (1954) classification and presented in the Figure 16.

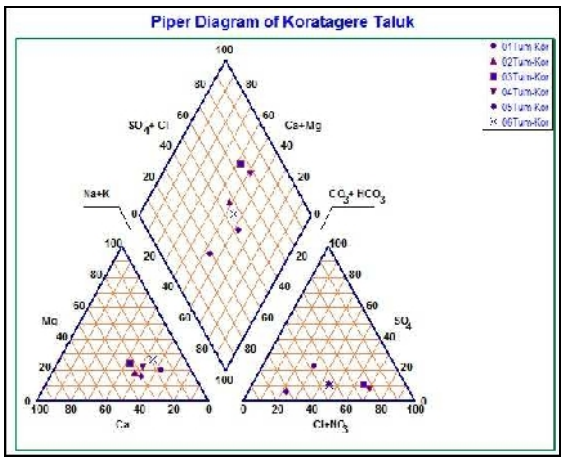


Fig 15. Chmeical anlysis Plot on Piper Diagram

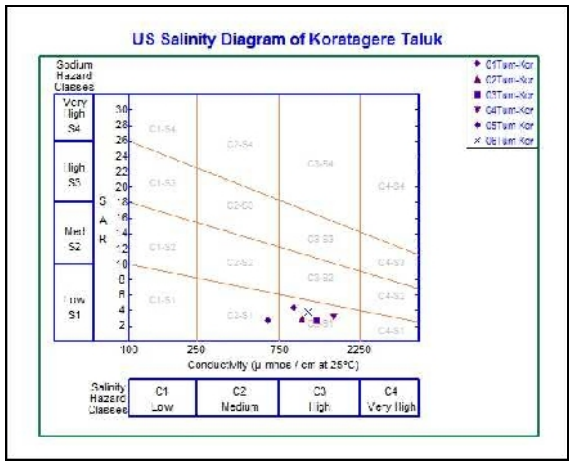


Fig 16. U.S. Salinity diagram

### 3.3.Ground water contamination

Perusal of the above analysis/interpretations of chemical data it indicates that there is no major ground water contamination except point contmination of different chemical constituents were noticed here and there in the taluk.

## 4. 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 (Table-11).

### 4.1 Aquifer wise space available for recharge and proposed interventions

#### 4.1.1 Quantity of water available through non-committed surface runoff

The surplus non-committed monsoon run off is calculated to be 10.4259 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 11.

Table 11. Details of Artificial structures

| **Artificial Recharge Structures available/Proposed** | **Koratagere taluk** | **Resource available in MCM** |
|---|---|---|
| Non committed monsoon run off available (MCM) | 10.4259 | |
| Number of Check Dams | 64 | 7.715 |
| Number of Percolation Tanks | 4 | 2.4512.606 |
| Number of Point Recharge structures | 7 | 0.0980.104 |
| Tentative total cost of the project (Rs. in lakhs) | 251.33 | - |
| Excepted recharge (MCM) | 5.906 | - |
| Expected rise in water level (m) | 0.553 | - |
| Cost Benefit Ratio (Rupees/ cu.m. of water harvested) | 4.255 | - |

Thus, considering above source 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-12.

### 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 Pavagada taluk. The project proposal comprises two components namely, Drinking water and tank filling. On implementation of this project helps to recharge 1232 HAM of water to ground water by which there will be increase in the ground water availability and stage of ground water development.

Table 12: 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 | 4821 |
| 2 | Existing Gross Ground Water Draft for All use HAM | 7275 |
| 3 | Existing Stage Of Ground Water Development in percentage | 151 |
| 4 | Expected recharge from Artificial Recharge Projects HAM | 591 |
| 5 | Additional potential from proposed Yettina hole project | 1232 |
| 6 | Cumulative ground water Availability HAM | 6644 |
| 7 | Expected improvement in stage of ground water Development after implementation of the project in percentage | 110 |
| 8 | Expected improvement in overall Stage of Ground water development in percentage | 41 |
| 9 | Expected additional irrigational potential in hectares | 686.779 |

## 5. DEMAND SIDE INTERVENTIONS

### 5.1 Advanced irrigation practices

Major crop of Koratagere taluk is Maize and 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 **516** irrigation dug wells and **5293** irrigation bore wells. The existing **advanced irrigation practices** and the irrigation potential created over the taluk is as detailed in the below table-13.

Table 13. 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. Dug wells | potential utilized ( hectares) | No. of Bore wells | potential utilized ( hectares) | Total no of structures | Total potential Utilized (hectares) |
| 1 | Open water channel | 422 | 390 | 1910 | 2354 | 2332 | 2744 |
| 2 | Underground pipe | 87 | 68 | 3143 | 4012 | 3230 | 4080 |
| 3 | Surface pipe | 1 | 1 | 168 | 261 | 169 | 262 |
| 4 | Drip irrigation | 2 | 3 | 64 | 74 | 66 | 77 |
| 5 | Sprinklers | 0 | 0 | 3 | 2 | 3 | 0 |
| 6 | Others | 4 | 2 | 5 | 4 | 9 | 6 |
| | **Total** | **516** | **464** | **5293** | **6707** | **5809** | **7169** |

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

Perusal of the above table-13, 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 farmers have to change in their cropping pattern and water economy irrigation practices like drip irrigation and sprinkler irrigation which are 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., and 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 – 2013, Koratagere taluk falls under OE category with the stage of ground water development of 151 % 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 10.4259 MCM of water can be conserved. This alternate water sources will cope up additional irrigational potential of 686.779 ha of agricultural land and there will be rise in water level of 0.553m (Table-11&12). Addition to this additional ground water potential of 1232HAM 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 – 7275 HAM with the stage of ground water development up to 151%, 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 family level are must implementation of artificial structures as proposed to recharge the ground water.