For Official Use Only

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

PLAN ON

ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION IN KOLAR TALUK, KOLAR DISTRICT, KARNATAKA

Central Ground Water Board
South Western Region
Bangalore
November 2015

PLAN ON ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION IN KOLAR TALUK, KOLAR DISTRICT, KARNATAKA

Sl. No. **TOPIC**

PLAN ON ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION IN KOLAR TALUK, KOLAR DISTRICT, KARNATAKA

TALUK AT A GLANCE	
Taluk	**Kolar**
District	Kolar
State	Karnataka
Taluk area	796 Sq km
Area Suitable for Artificial Recharge	760 Sq km
Latitude & Longitude	Longitude 77° 56' 16" E - 78° 17' 07" E Latitude 13° 00′ 56″ N - 13° 18′ 31″ N
Normal Rainfall	804 mm
Normal Monsoon Rainfall	431 mm
Normal Non- Monsoon Rainfall	373 mm
Geology	Granites, Gneisses and Metabasalts
WATER LEVEL	
Pre - Monsoon	>21 m bgl.
Post - Monsoon	>21 m bgl. * Almost all the representative OW are dry.
GROUND WATER RESOURCES ESTIMATION	
Net ground water available	124.05 MCM
Ground water draft for irrigation	218.82 MCM
Groundwater draft for domestic & industrial water supply	4.39 MCM
Total ground water draft	223.22 MCM
Stage of ground water development (%)	180 %
Non committed monsoon runoff available for the taluk	12.80 MCM
Total volume of weathered zone available for Recharge	12160 MCM
Storage Potential Weathered/unsaturated zone available for Recharge	243 MCM
ARTIFICIAL RECHARGE /CONSERVATION MEASURES	
Structures Proposed (tentative)	Check Dam – 79 Percolation Tank – 6 Point Recharge Structures – 9
Tentative total cost of the project	Rs. 315 lakhs
Excepted recharge	1.61 MCM
Expected rise in water level by recharging 1.61 MCM of rain fall run off.	0.11 m

PLAN ON ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION IN KOLAR TALUK, KOLAR DISTRICT, KARNATAKA

1. Introduction

Ground water is an essential component of the environment and economy. It sustains the flow in our rivers and plays an important role in maintaining the fragile ecosystem. The dependence on groundwater in agrarian states like Karnataka is high. In view of the growing concerns of sustainability of ground water sources, immediate attention is required to augment ground water resources in stress areas. Irrigated agriculture in the state is putting additional stress on the ground water system and needs proper management of the resources. This fast-depleting resource has to be augmented by suitable scientific interventions. Under this background, a plan on artificial Recharge to Ground water in Kolar taluk, Kolar District, having an area of 796 sq km has been prepared and presented in this report.

2. Objectives of the Scheme

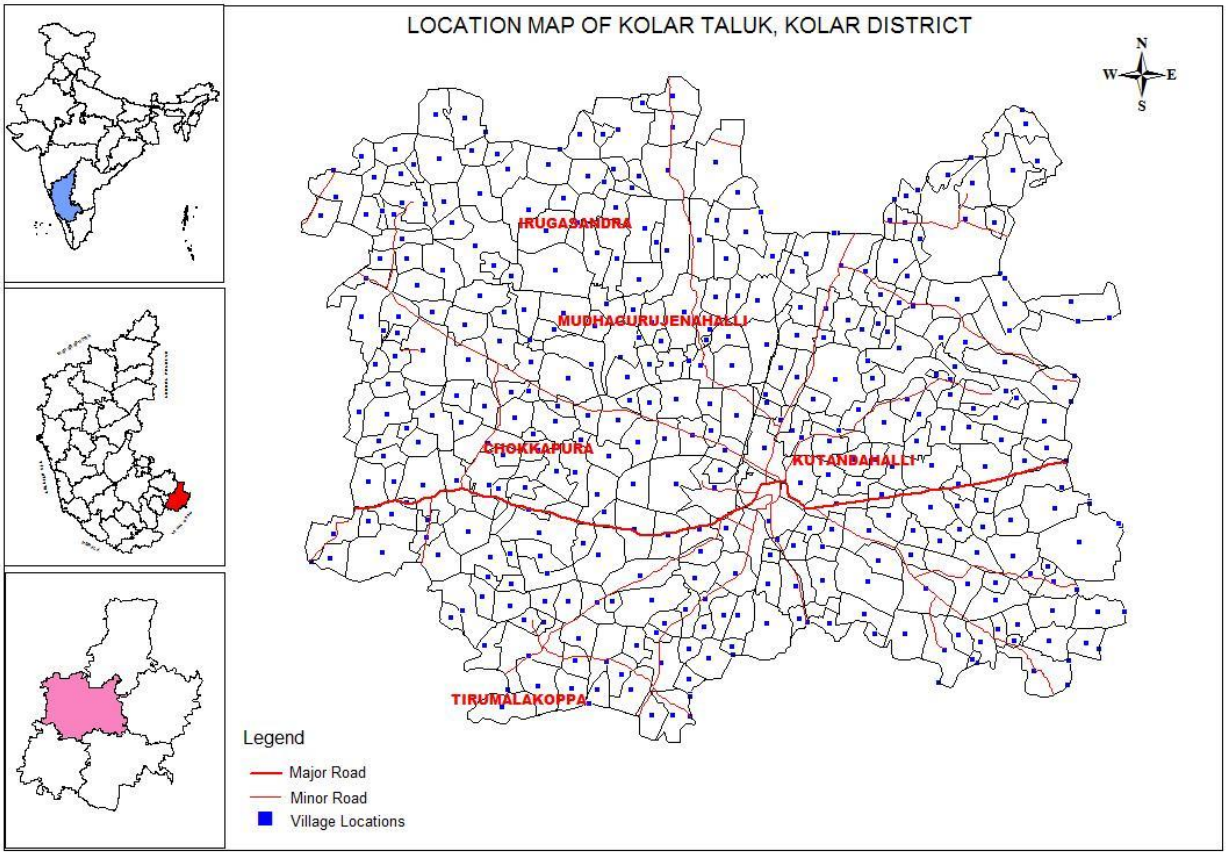
- To augment ground water resources by harvesting and conserving non committed surplus monsoon run off using artificial recharge measures.
- To overcome the inadequacy of surface water to meet the ever- increasing water demands.
- To arrest decline in ground water levels.
- To recover and transform this ‘Over Exploited’ micro-watershed into ‘Safe’ category.
- To enhance availability of ground water at specific place and time and utilize it for domestic and irrigation purposes.
- To reduce soil erosion.
- To conserve and develop ground water resource for sustainable management.
- To increase the agricultural production by judicious use of ground water by deploying water use efficiency measures.
- To achieve self-sufficiency in water supply in the taluk.
- To implement sustainable ground water resource management plan.

3. Study area details

3.1 Location

Kolar taluk is located in the west-central part of Kolar district of Karnataka (Fig-1). The population of the taluk is 138,462 (Census 2011) There are 36 Panchayats and 394 inhabited villages in the taluk. The taluk covers a geographical area of 796 sq.km and lies between Longitude 77° 56' 16" E and 78° 17' 07" E and Latitude 13° 00′ 56″ N and 13° 18′ 31″ N.

Fig-1



3.2 Physiography and Drainage

There are no perennial rivers in Kolar taluk. Major part of the taluk is drained by Palar and small part in southern part by Ponnaiyar River systems. All these rivers and their tributaries are small and carry water only during rainy season. Parts of watersheds 4C1C7, 4C1C9, 4C2B4 and 4C2B5 fall in the taluk. In general, the topography is flat with small, isolated hilly areas mainly in the Southwest central part of the taluk. The drainage pattern in the taluk is dendritic**.** The hilly areas are full of ravines and gullys. Plain topography covers 701 sq km of the taluk, whereas Piedmont Zone and hills form 50 and 36 sq km respectively. Rivers and settlements cover 0.46

and 8.36 sq km respectively. Maps showing geomorphology and drainage pattern are shown in Fig-2 and 3.

Fig-2

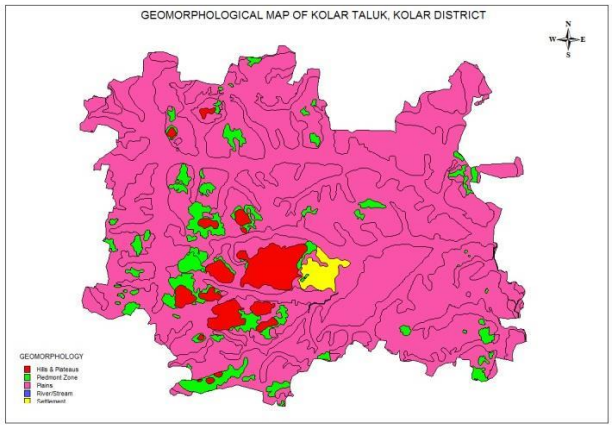
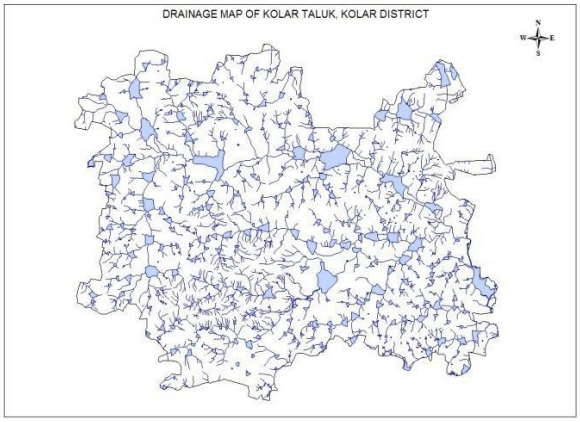


Fig-3



3.3 Land Use and Soil

The area is underlain by loamy soil having fine sand as major constituent. Agriculture is practiced in major part of the watershed area. There are 10 Major Irrigation tanks in the taluk. An area of 701 sq. km in the taluk is covered by plain topography; 50 sq. km by piedmont zone, 36 sq km by hills and plateaus; 0.46 sq. km is covered by rivers and 8.36 sq km by settlement. Maps showing soil distribution and land use are presented in Fig-4 and 5.

Fig-4

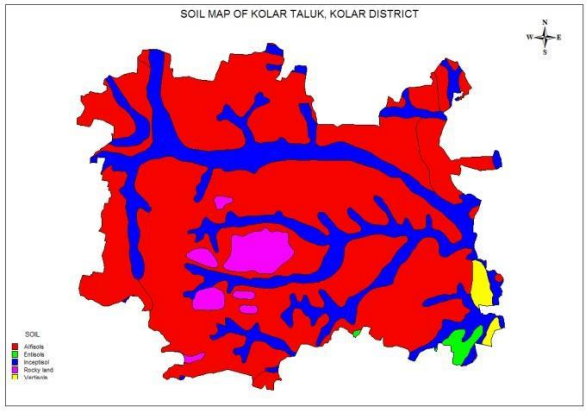
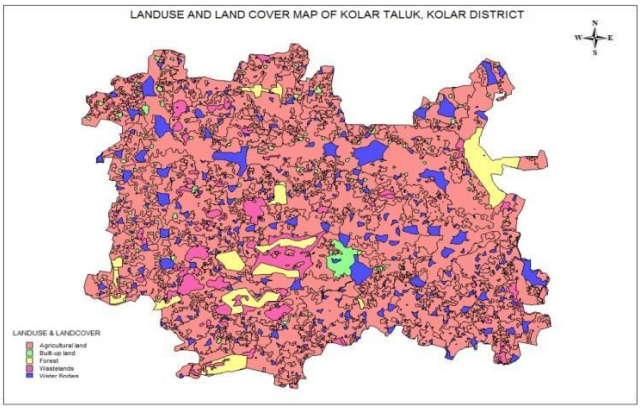


Fig-5



3.4 Hydrometeorology

The taluk is almost equally influenced by both the southwest and the northeast monsoons. The normal annual rainfall is 804 mm with about 51 rainy days. The taluk receives 431 mm of rainfall

during monsoon period and the remaining 373 mm during non monsoon. The taluk falls in chronically drought affected part of Karnataka. The details of rainfall are given in Table 1.

Table 1: Details of rainfall in the Taluk

Normal Monsoon Rainfall (mm)	Normal Non-monsoon Rainfall (mm)	Annual Normal Rainfall (mm)
431	373	804

3.5 Geology

Major portion of the taluk is occupied by granites and gneisses. Metabasalt occurs in the eastern part of the taluk. Ground water occurs under water table as well as in semi confined condition. The geology map is presented in Fig-6. High density of lineaments ate observed in the taluk trending in NS and NE-SW direction. A lineament map is presented in Fig-7.

Thickness of weathered zone varies from 10 m in the central part to 70 m in NE part of the taluk. The average thickness of weathered zone in the taluk is 36 m. A map showing distribution of weathered section is shown in Fig-8.

Fig-6

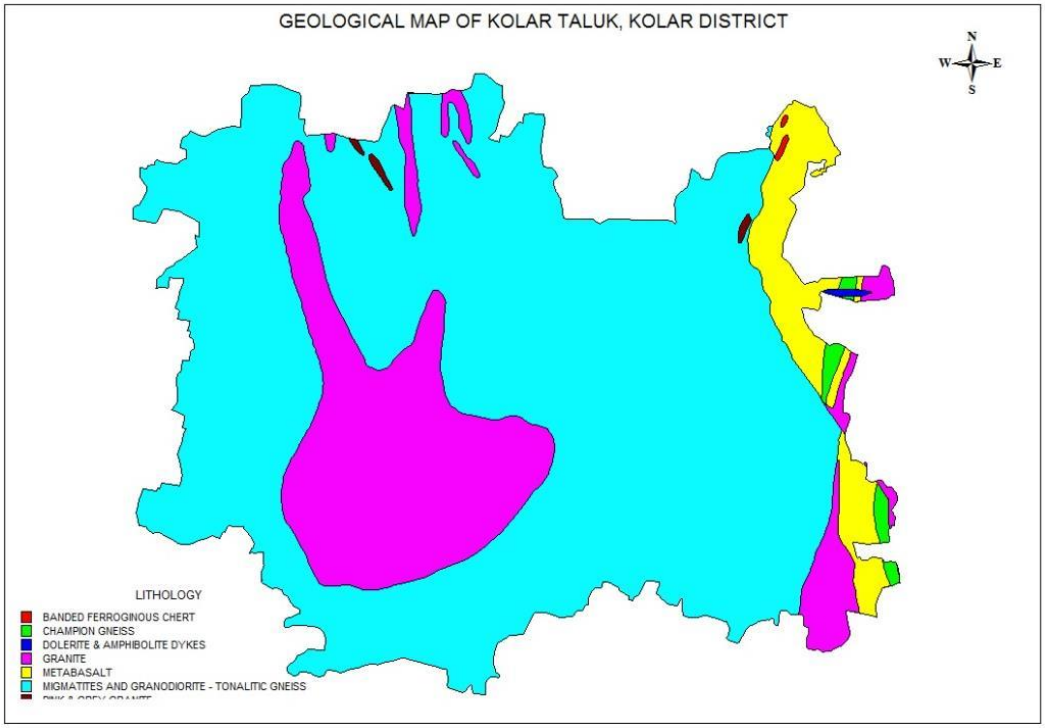


Fig-7

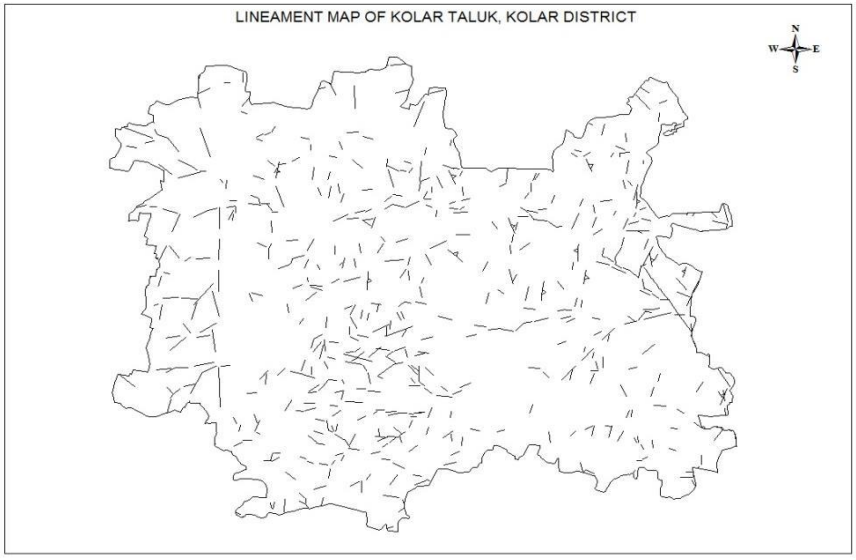
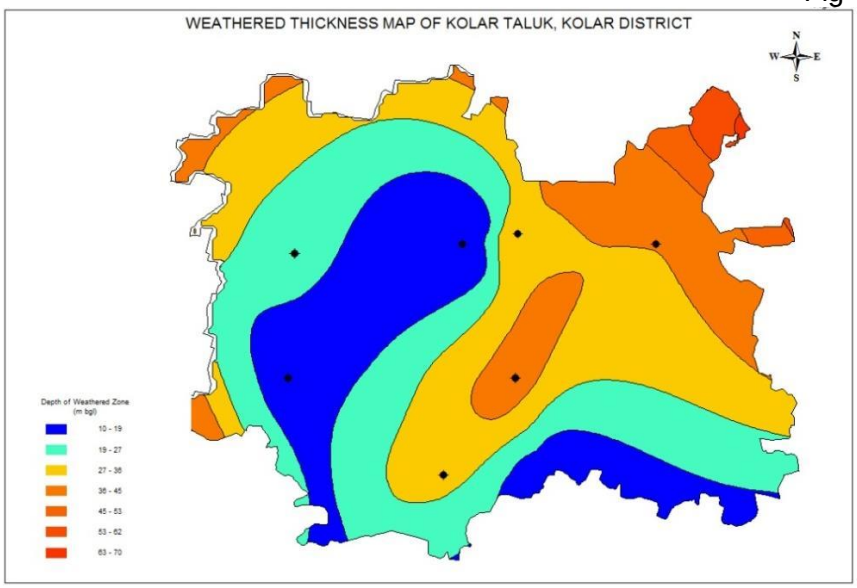


Fig-8



4. Hydrogeology

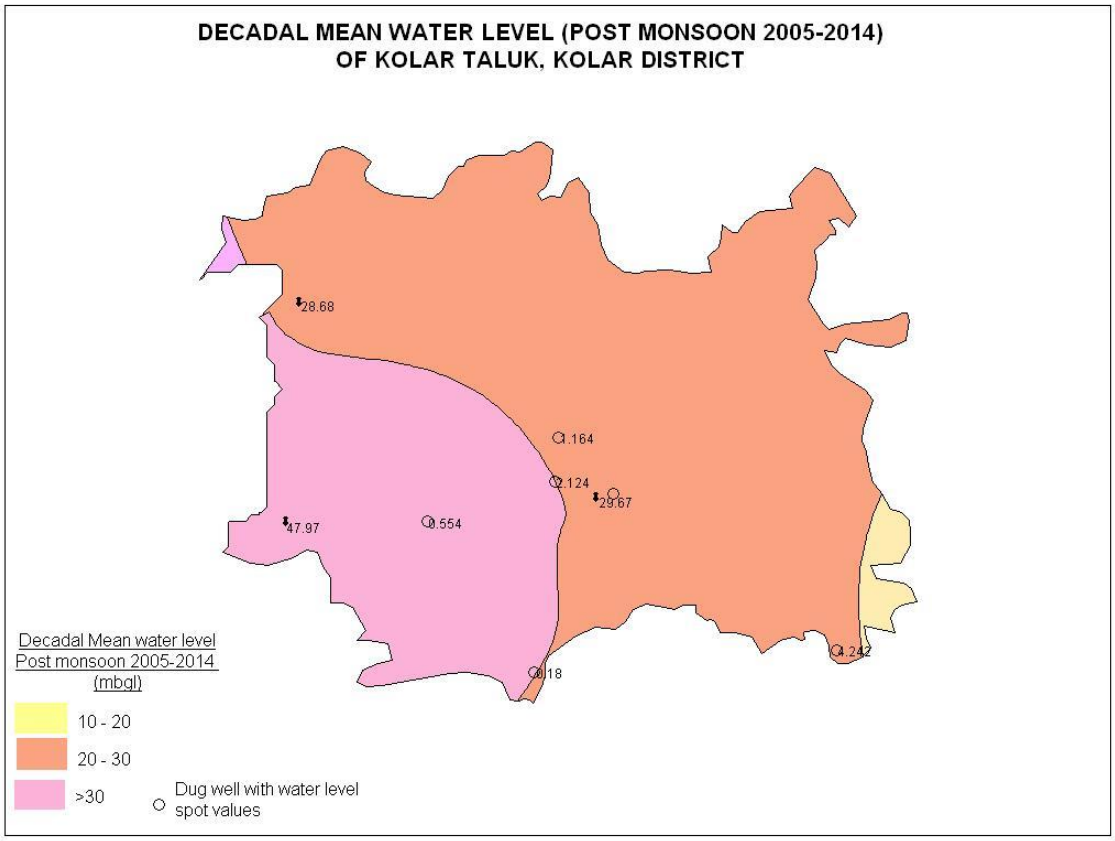
Ground water occurs in weathered formations under phreatic conditions (in small isolated and highly localized patches) at shallow level and in semi-confined to confined conditions in fractured formations at deeper level.

4.1 Decadal Mean Depth to Water Level (2005-14)

Mean post monsoon depth to water data has been considered for delineating area of the taluk suitable for artificial recharge measures. Most of the wells in taluk have dried up due to declining water level. 5 of the NHS observation dug wells for which water level data is available (0.18 to 4.24 mbgl) are located in low lying /valley areas / adjacent to water bodies and are not representative of the area. The water levels are just point values and do not represent the actual field conditions. Therefore, decadal mean water level data of piezometers has been used for preparation of mean post-monsoon water level map (Fig-9).

It is observed that in southeastern part of the taluk, mean post-monsoon water level is in the range of 10-20 m bgl, in the northern, central and south-central part of the taluk, it is in the range of 20-30 m bgl and in the southwestern part, it is in the range of >30 m bgl. Thus, considering mean post-monsoon water level data, whole taluk is suitable for artificial recharge measures.

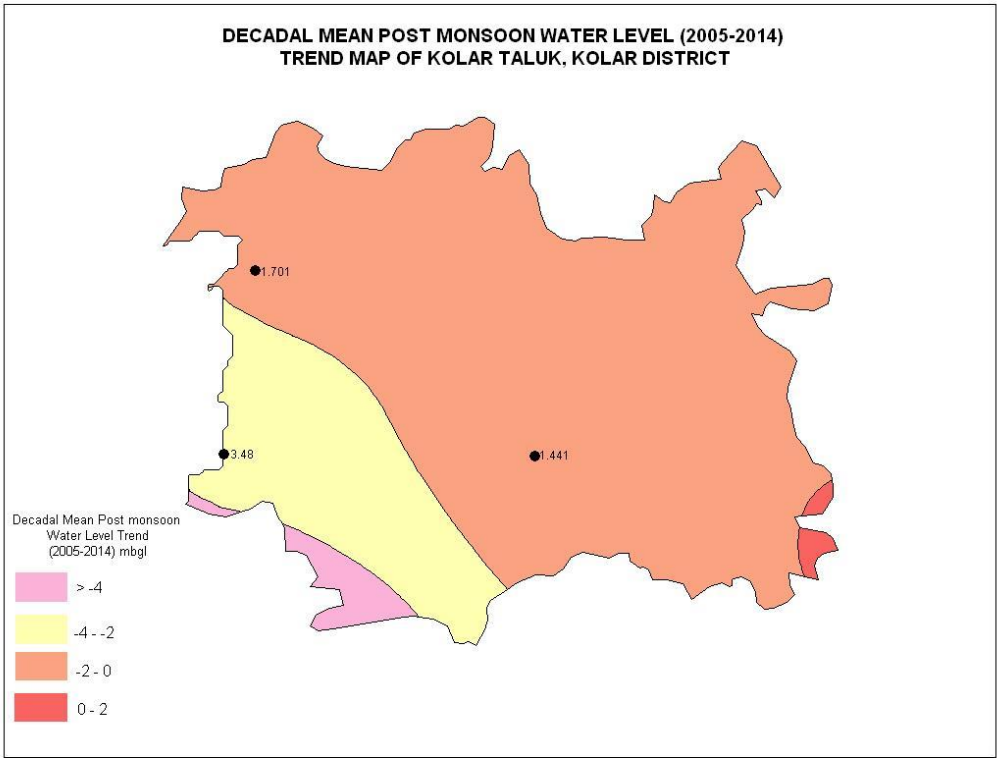
Fig-9



4.2 Decadal Water Level Trend (2005-2014)

Most of the wells have dried up/ are drying up in the taluk due to declining water level. None of the CGWB observation well located in the taluk is having continuous data for decade 2005-2014. Hence, post monsoon decadal water level data of Piezometers have been considered for the purpose. It is observed that a small area in SE part of the taluk has recorded decadal post monsoon water level rising trend in the range of 0 - 2m/year. Declining trend has been observed in rest of the taluk. Major part of the taluk has recorded declining decadal post monsoon trend of 0 - 3 m/year. SW part has recorded declining trend of 2 - 4m and more than 4m/year declining trend has been observed in a small patch southern part of the taluk. It is observed that in general there is declining trend in the taluk. A map showing decadal post monsoon water level trend has been shown in Fig-10.

Fig-10



4.3 Dynamic Ground Water Resource

Ground water resources were estimated for the watershed according to GEC 97 recommendation by Central Ground Water Board and Department of Mines and Geology, Government of Karnataka as on March 2011. The resource is presented in Table-2. The taluk falls under Over-exploited (OE) Category.

Table 2: Ground Water Resources of Kolar Taluk (March 2011)

Sl. No.	Item	Resources as on March 2011
1.	Net Annual Ground water Availability (HAM)	12405
2.	Existing Ground water draft for irrigation (HAM)	21882
3.	Existing Ground water draft for drinking and industrial purposes (HAM)	439
4.	Existing ground water draft for all uses (HAM)	22322
5.	Stage of ground water development	180%
6.	Categorization	Over-Exploited

5. Planning for Ground water Recharge / Conservation

5.1 Justification for Artificial Recharge

- Stage of development of ground water is 180% and the area falls in **Over - Exploited** category.
- Phreatic zone is totally dried up due over exploitation of ground water resource. Availability of sufficient unsaturated thickness in weathered zone provides sufficient space for artificial recharge in the project area.
- Farmers are losing their livelihood, laborers are losing jobs and many are forced to migrate for livelihood.
- The farming community is socio-economically backward.
- There is acute shortage of drinking water due to drying of water supply bore wells in many villages, mainly during summer months.
- 12.8 MCM of non committed surplus monsoon run off is available for recharge.
- 10 Major Irrigation tanks are existing in the taluk, which are silted. Rejuvenation of these tanks and recharge through these tanks will enhance the sustainability of ground water structures in the project area.

5.2 Identification of area suitable for artificial recharge

Area suitable for artificial recharge was delineated considering geology, hydrogeology, geomorphology, soil type, drainage pattern, lineament, thickness of weathered section, decadal mean depth to water level, decadal water level trend and source water availability in the taluk. An area of 760 sq km was delineated for artificial recharge.

5.3 Availability of Surplus Surface water for Artificial Recharge

Monsoon rainfall run off is the only source water for artificial recharge in the project area. Source water availability is 12.8 MCM. The details of source water availability are presented in Table-3.

Table-3: Details of Source Water Availability in Kolar Taluk

Normal Monsoon Rainfall	431 mm
Area of identified for AR	760 sq km
Run off Coefficient (Strange's Method)	0.087%
Monsoon Run off	28.5 MCM
Utilizable Run off (50% of monsoon Run off)	14.2
Committed Monsoon Run off (10% of utilizable run off)	1.4 MCM
Non-committed monsoon run off	12.8 MCM

6. Proposed interventions including Tentative Locations of Artificial Recharge/conservation Structures

Feasible artificial recharge structures proposed in the taluk are Check dam, Percolation Tank and Point Recharge Structures. In addition to this de-silting of tanks and micro-irrigation may also may be taken up for water conservation purpose. The proposed structures are as given below in Table-4 and shown in Fig-11.

Fig-11

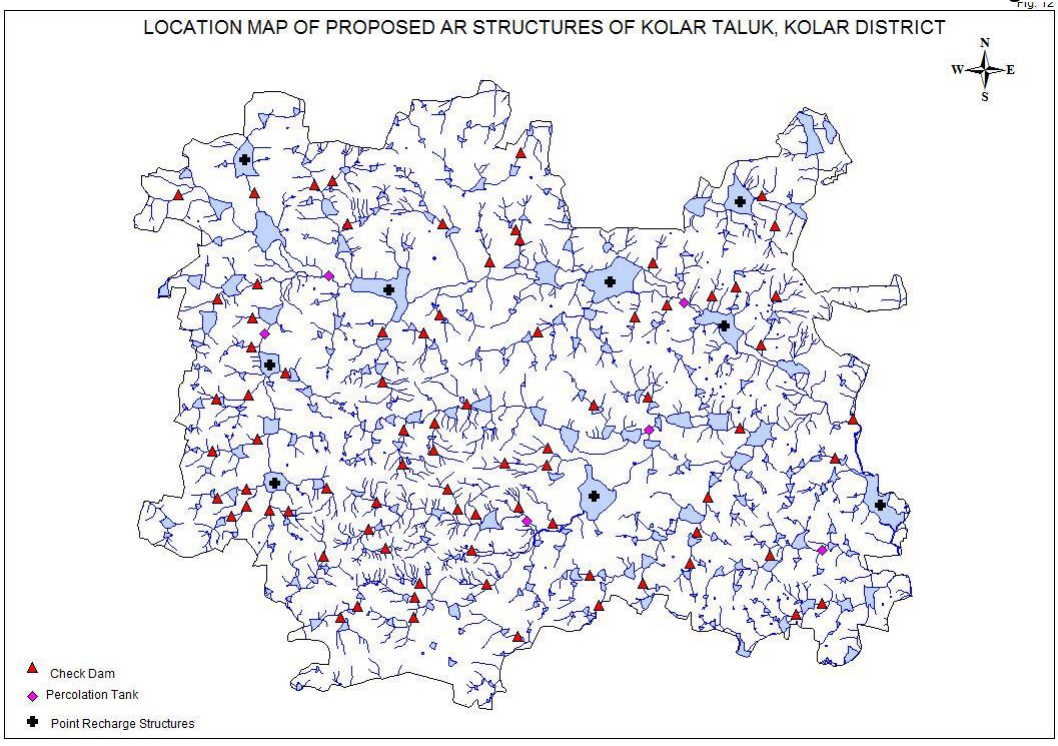


Table 4: Details of Structures Proposed in Kolar Taluk

Structures Proposed	No of Structures Proposed
Check Dam	79
Percolation Tank	6
Point Recharge Structure	9
Total	94

6.1 Check Dams

- Check dams are constructed across small streams having gentle slope. The site selected should have sufficient thickness of permeable bed or weathered formation to facilitate recharge of stored water within short span of time.
- The water stored in these structures is mostly confined to stream course and the height is normally less than 2 m and excess water is allowed to flow over the wall. In order to avoid scouring from excess run off, water cushions are provided at downstream side.
- To harness the maximum run off in the stream, series of such check dams can be constructed to have recharge on regional scale.

A total number of 79 check dams are feasible in the taluk. Location details with coordinates are given in Table-5. The cost of these 79 Check dams is estimated at 237 lakhs. The total storage capacity of check dams is estimated at 1.04 MCM. The volume of ground water likely to be recharged through these check dams is estimated to be 0.73 MCM.

Table 5: Tentative Locations of Proposed Check Dams in Kolar Taluk

Sl. No.	Longitude	Latitude
1	78.03	13.26
2	77.99	13.26
3	77.99	13.22
4	77.99	13.17
5	77.99	13.15
6	77.99	13.13
7	77.99	13.12
8	78.04	13.08
9	78.06	13.07
10	78.06	13.08
11	78.04	13.11

12	78.05	13.12
13	78.02	13.13
14	78.00	13.18
15	78.06	13.15
16	78.07	13.16
17	78.10	13.09
18	78.02	13.10
19	78.08	13.12
20	78.07	13.20
21	78.05	13.20
22	77.97	13.21
23	78.08	13.13
24	78.07	13.09
25	77.96	13.26
26	78.02	13.26
27	78.10	13.23
28	78.08	13.25
29	78.11	13.28
30	78.11	13.24
31	78.03	13.25
32	78.26	13.16
33	78.25	13.08
34	78.12	13.15
35	78.12	13.14
36	78.13	13.11
37	78.14	13.09
38	78.15	13.08
39	78.20	13.13
40	78.22	13.19
41	78.21	13.22
42	78.12	13.20
43	78.17	13.17
44	78.22	13.10
45	78.21	13.16
46	78.25	13.14
47	78.07	13.21
48	78.06	13.14
49	78.10	13.14
50	77.98	13.12
51	78.24	13.07
52	78.19	13.11

53	78.17	13.09
54	78.07	13.15
55	77.97	13.13
56	78.23	13.21
57	78.11	13.24
58	78.23	13.24
59	78.22	13.26
60	78.20	13.21
61	78.17	13.23
62	78.18	13.21
63	78.01	13.12
64	78.05	13.10
65	77.97	13.15
66	78.09	13.17
67	78.05	13.18
68	77.97	13.17
69	78.00	13.12
70	78.19	13.10
71	78.03	13.07
72	78.11	13.12
73	78.09	13.10
74	77.99	13.20
75	78.11	13.06
76	78.14	13.17
77	78.09	13.12
78	78.16	13.20
79	77.99	13.19

6.2 Percolation Tank

- Percolation tank is an artificially created surface water body, submerging in its reservoir a highly permeable land so that surface runoff is made to percolate and recharge the ground water storage.
- Percolation tank should be constructed preferably on second to third order streams, located on highly fractured and weathered rocks, which have lateral continuity down-stream.
- The recharge area down-stream should have sufficient number of wells and cultivable land to benefit from the augmented ground water.
- The size of percolation tank should be governed by percolation capacity of strata in the tank bed. It is necessary to design the tank to provide a ponded water column generally between 3 & 4.5 m.

- Percolation tanks are mostly earthen dams with masonry structure only for spillway. The purpose of the percolation tank is to recharge the ground water storage and hence seepage below the seat of the bed is permissible. For dams up to 4.5 m height, cut-off trenches are not necessary and keying and benching between the dam seat and the natural ground is sufficient.

Total 6 numbers of percolation tanks are feasible in the project area. Location details with coordinates are given in the Table-6. The cost of 6 percolation tanks is estimated at 45 lakhs. The annual storage capacity of tanks is estimated at 1.08 MCM. The volume of ground water recharged through these Percolation Tanks is estimated to be 0.76 MCM.

Table 6: Tentative locations of Proposed Percolation Tanks in Kolar Taluk

Sl. No.	Longitude	Latitude
1	77.995	13.197
2	78.114	13.115
3	78.169	13.155
4	78.185	13.211
5	78.024	13.223
6	78.247	13.102

6.3 Point Recharge Structure (PRS)

- In hard rock aquifer, when impervious layers overlie deeper aquifers, natural recharge is hindered. Hence, measures are adopted to recharge the deeper aquifers through a recharge bore well. Such a well is also called as 'Inverted well' because of the water movement in reverse direction.
- It needs a filter bed around the recharge bore well to remove silt load and other suspended materials in the source water.
- The filter bed depth bed is generally 2-3 m, with 3-4 m in length and width. It is refilled with coarse material at the bottom followed by finer material towards the top. Each successive layer is separated by *netlon* mesh.
- The bore well casing in the recharge pit limit should be slotted and covered with coir mat/*netlon* mesh to restrict the entry of finer particles into the aquifer. The complete structure with the above-mentioned design is known as Point Recharge Structure (PRS).

Total 9 numbers of Point Recharge Structures are feasible in the taluk. Location details with coordinates are given in the Table-7. The cost of these 9 PRS is estimated at 18.0 lakhs. The annual storage capacity of PRS is estimated at 0.135 MCM. The volume of ground water likely to be recharged through PRS is estimated to be 0.12 MCM.

Table 7: Tentative locations of Proposed Point Recharge Structures in Kolar Taluk

Sl. No.	Longitude	Latitude
1	78.14	13.13
2	78.00	13.13
3	78.00	13.18
4	78.27	13.12
5	78.20	13.20
6	77.99	13.27
7	78.05	13.22
8	78.15	13.22
9	78.21	13.26

7. Tentative Cost Estimate

Tentative cost estimates of structures/ interventions proposed in the taluk are given in Table 8. The unit rates are followed as per master plan of Artificial Recharge and State Govt. Schedule Rates. It is estimated that annually about 1.61 MCM of water will be recharged to ground water system, which may create an additional irrigation potential of 194 hectares.

Table 8: Tentative Cost Estimates of Structures/interventions proposed in Kolar taluk

Structures	No	Unit Cost (Rs Lakhs)	Estimated Cost (Lakhs)	Annual Storage Capacity (MCM)	Volume of water likely to recharged (MCM)	Additional Irrigation Potential Likely to be created (Hectares)
Check Dam	79	3.0	237	1.0428	0.73	194
Percolation Tank	6	7.5	45	1.08	0.76	
Point Recharge Structure	9	2.0	18	0.135	0.12	
TOTAL	94		300	**2.2578**	**1.61**	
Impact Assessment (5% of estimate)			15.0			
Grand Total			315			

8. Implementation Modalities

The implementation of the scheme will be done by the State Govt. department selected by the State Authority. Further, it is to add that more than 50% MGNREGA works are related to water conservation/ sustainable management. A convergence guideline has been made between National Rural Employment Guarantee Act (NREGA) (Ministry of Rural Development) & Programmes of Water Resources (MoWR, RD & GR). Hence, the proposal may be implemented under the convergence scheme or in any other similar scheme.

a. **Time schedule**

Steps	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	5th Quarter	6th Quarter	7th Quarter	8th Quarter
❖ Identification of line department /implementing agency and preparation of DPR								
❖ Approval of scheme and release of sanction of funds								
❖ Implementation of ARS								

Phase = one quarter or 3 months or equivalent to financial quarter

b. Operation and maintenance

In all projects Impact assessment has to be carried out to ensure that projects is economically viable, socially equitable and environmentally sustainable by inter- related socio-economic, cultural and human-health impacts, both beneficial and adverse. Accordingly, it is proposed to have impact assessment at rate of 5% of the total cost of the project for 5 years from the completion of artificial recharge.