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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 CHIKBALLAPUR TALUK, CHIKBALLAPUR DISTRICT, KARNATAKA

Central Ground Water Board
South Western Region
Bangalore
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PLAN ON ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION IN CHIKBALLAPUR TALUK, CHIKBALLAPUR DISTRICT, KARNATAKA

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

AT A GLANCE	
Taluk	Chikballapur
District	Chikballapur
State	Karnataka
Taluk area	640.60 Sq km
Area Suitable for Artificial Recharge	472 Sq km
Latitude & Longitude	Longitude of 77° 35' 59" E - 77° 52' 28" E Latitude of 13° 20′ 14″ N - 13° 40′ 01″ N
Normal Rainfall	746 mm
Normal Monsoon Rainfall	453 mm
Normal Non- Mon soon Rainfall	293 mm
Geology	Granites, Gneisses and Laterites (Pink Granulites, Migmatites, Granodiorites, Laterites and Gneisses)
WATER LEVEL	
Pre - Monsoon	Approximately >30 m bgl.
Post - Monsoon	>20 m bgl. * Almost all the representative OW are dry
GROUND WATER RESOURCES ESTIMATION	
Net ground water available	46.00 MCM
Ground water draft for irrigation	60.51 MCM
Groundwater draft for domestic & industrial water supply	6.10 MCM
Total ground water draft	66.61 MCM
Stage of ground water development	145 %
Non committed monsoon runoff available for the taluk	9.25 MCM
Total volume of weathered zone available for Recharge	4720 MCM
Storage Potential Weathered/unsaturated zone available for Recharge	94.40 MCM

ARTIFICIAL RECHARGE / CONSERVATION MEASURES	
Structures Proposed (tentative)	Check Dam – 57 Percolation Tank – 4 Point Recharge structures – 6
Tentative total cost of the project	Rs.223.65 lakhs
Excepted recharge	1.11 MCM
Expected rise in water level by recharging 1.55 MCM of rain fall run off	0.1 m

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

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 Chikballapur taluk, Chikballapur District, having an area of 640.60 sq km has been prepared and presented in this report.

2. Objectives of the Scheme:

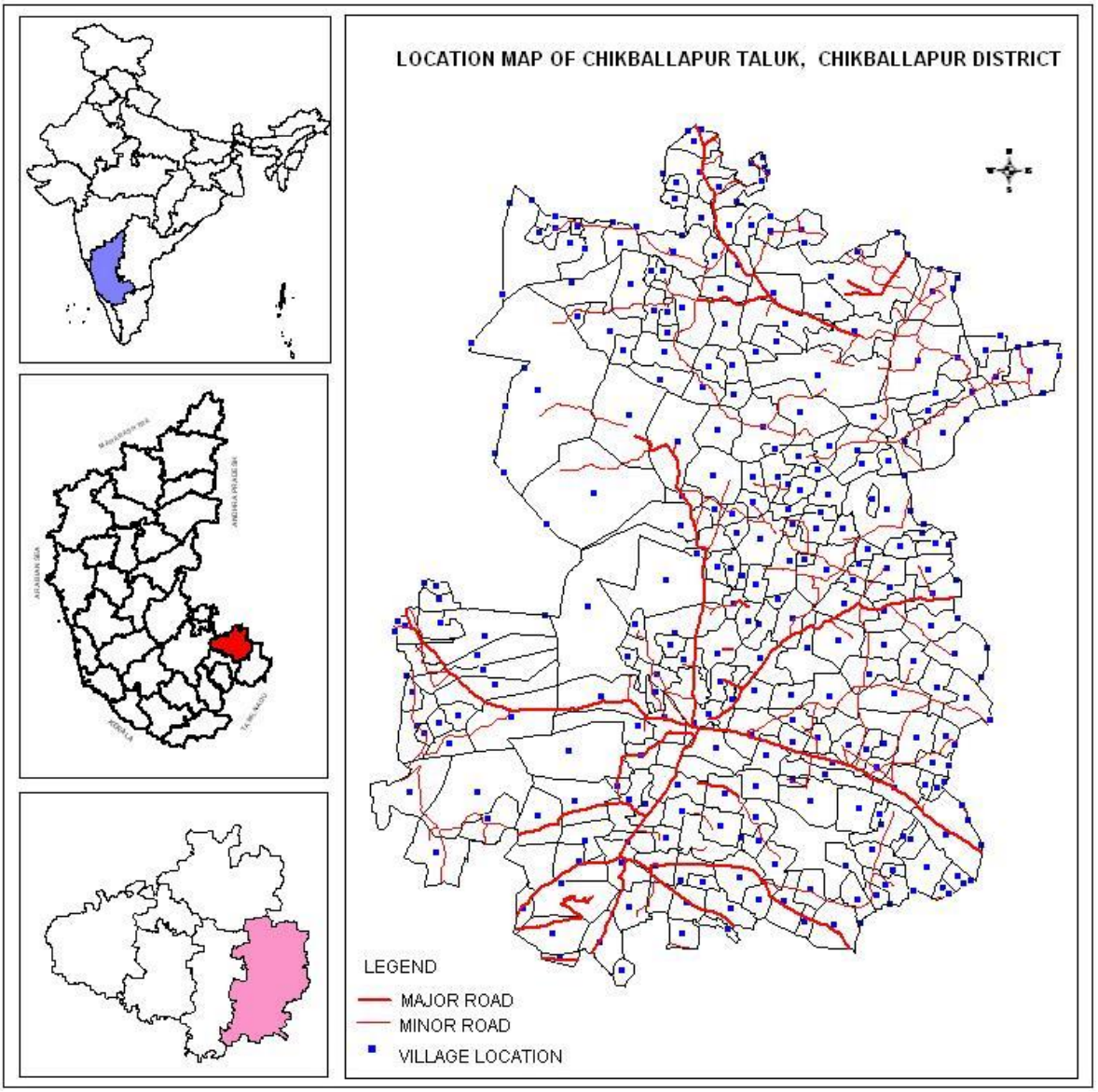
- To augment ground water resources by harvesting and conserving non committed surplus monsoon run off using artificial recharge measures.
- To overcome the inadequacy of surface water to meet the ever-increasing water demands.
- To arrest decline in ground water levels.
- To recover and transform this ‘OE’ taluk 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 resources management plan.

3. Study area details:

3.1 Location

Chikballapur taluk is located in the southeasterrn part of Chikballapur district of Karnataka. The population of the taluk as per Census 2011 is 2,12,536. There are 22 Panchayats and 222 inhabited villages in the taluk. The taluk covers a geographic area of 640.60 sq.km and lies between Longitude of 77° 35’ 59” E and 77° 52’ 28” E and Latitude of 13° 40′ 01″ N and 13° 20′ 14″ N. A map showing location of taluk is presented in Fig-1.

Fig-1: Location map of Chikballapur taluk, Chikballapur district, Karnataka



3.2 Physiography and Drainage:

Geomorphologically, it is undulating terrain intersected by low rocky ridges, Lateritic masses are occurring as irregularly distributed patches in the form of flat hills. Elevation in the taluk ranges from 960 m to 1127mamsl. Taluk is a part of Palar and Palar basin and the taluk is drained by two main rivers namely Kumudvati, S. Pinakini, Pennar, Vendman and upper Chitravati rivers. The drainage pattern in the taluk is dendritic**.** Maps showing geomorphology and drainage pattern are shown in Fig-2 and 3.

Fig-2

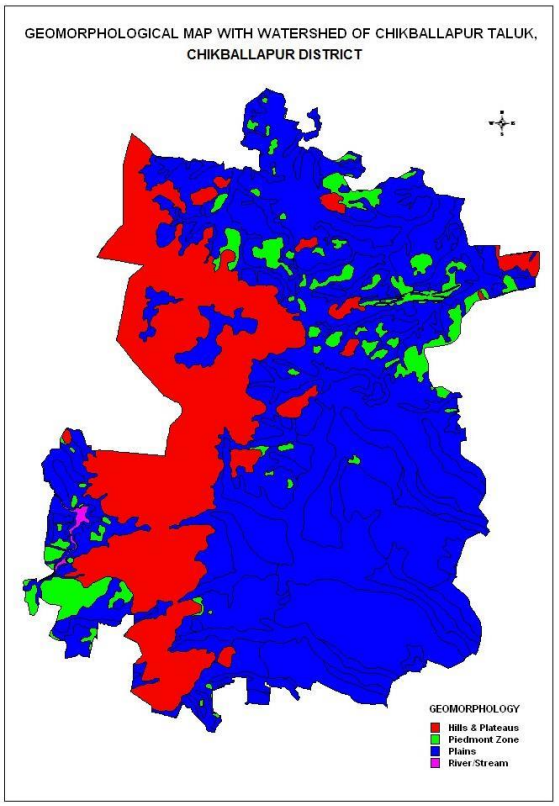
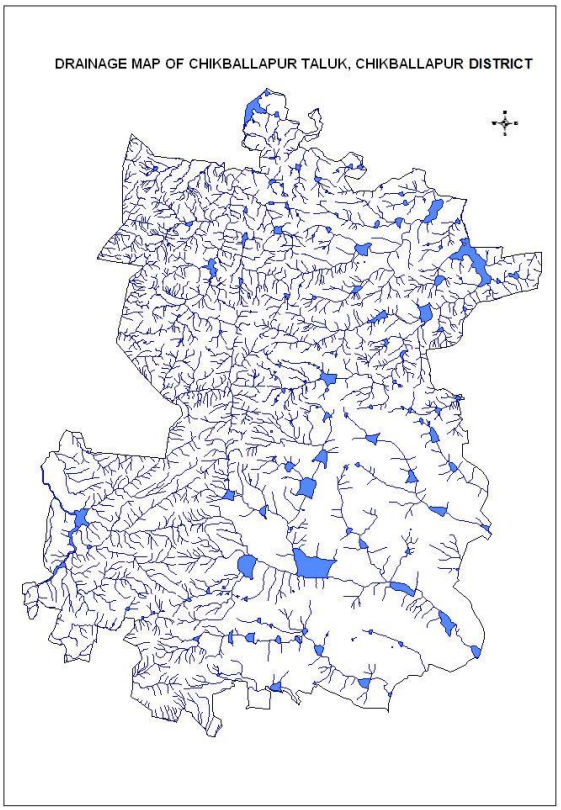


Fig-3



3.3 Land Use and Soil:

As per 2012 land use land cover data available, forest covers 19720 ha, net irrigated area is 6% of total geographical area and net area sown is19391 ha. Agriculture is practiced in major part of the taluk. An area of 435.54 sq. km in the taluk is covered by plain topography, 36.99 Sq. km by piedmont zone and 166.8 sq km by hills and plateaus.

An area of 299.2 sq km is covered by Alfisols, 89.28 by Entisols, 157.26 by Inceptisol soils and an area of 94.83 sq km is covered by rocky land. Maps showing land use land cover and soil distribution are presented in Fig-4 and 5.

Fig-4

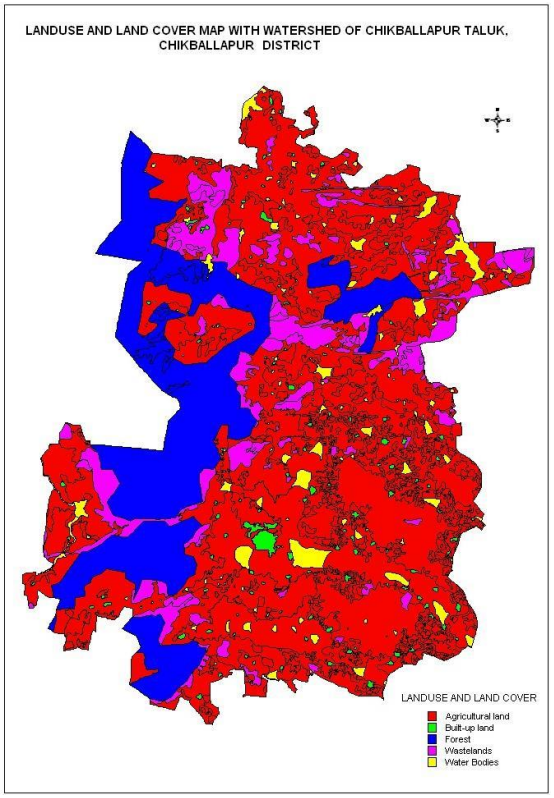
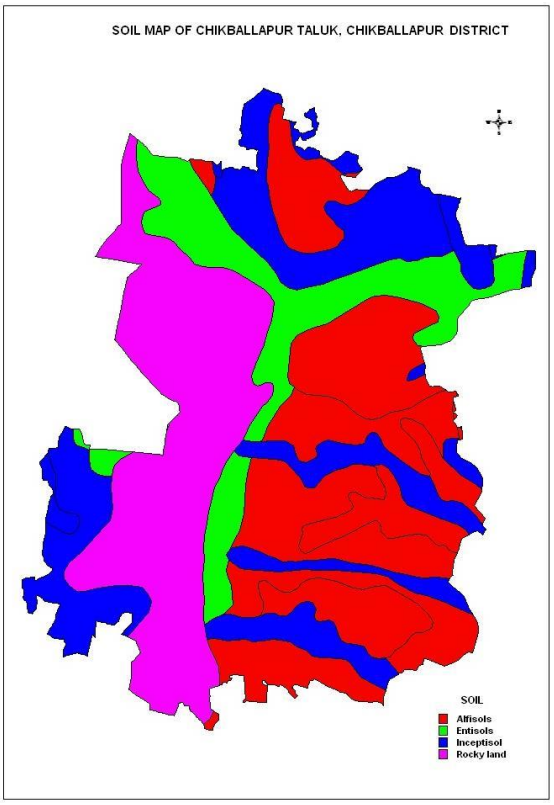


Fig-5



3.4 Hydrometeorology

Normal rainfall in the taluk is 746 mm with about 45 rainy days. Major part of the precipitation form North-East monsoon. The district falls in the semi -arid tracts of Karnataka. Temperature is in the range of 12°C to 36 °C. The details of rainfall of the taluk are given in Table 1

Table 1: Details of Rainfall in the Chikballapur Taluk

Normal Monsoon Rainfall (mm)	Normal Non-monsoon Rainfall (mm)	Normal Annual Rainfall (mm)
453	293	746

3.5 Geology:

Major water bearing formations occurring in the taluk are Pink Granulites, Migmatites and granodiorites, laterites and Gneisses. Weathered thickness of formations varies according to varying rock types from 10 m to 49 m. Lineaments are trending mainly in NE-SW and N-S directions. Map showing geology and lineament are shown in Fig 6 and 7.

Fig-6

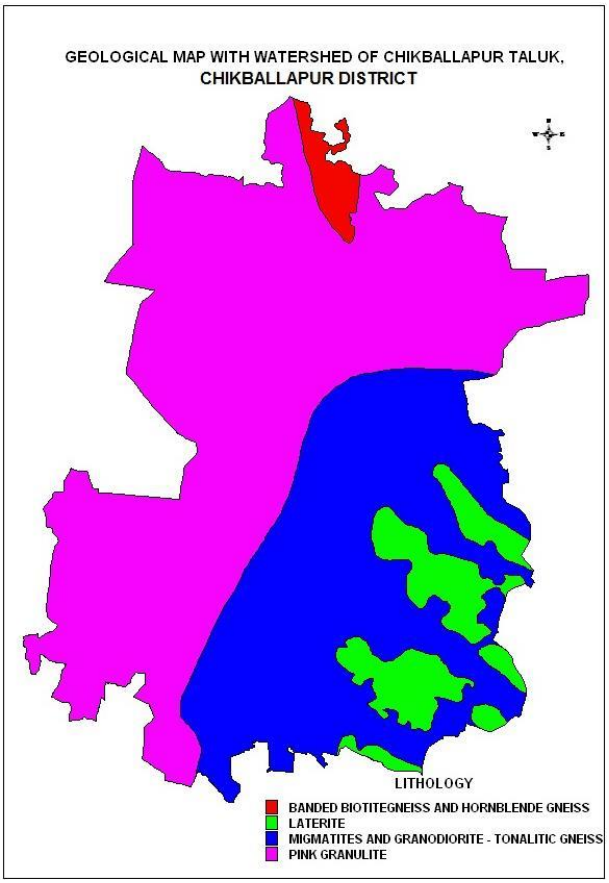
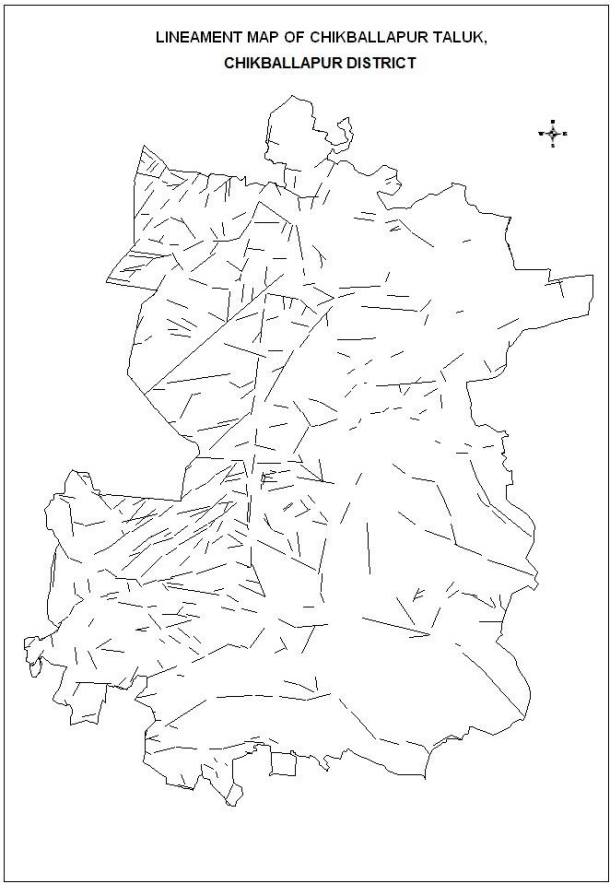


Fig-7



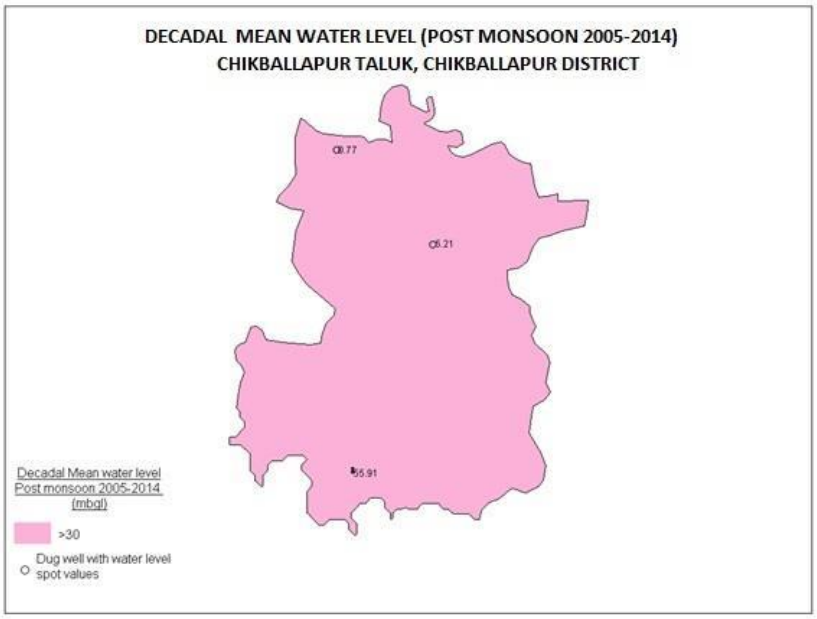
4. Hydrogeology:

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 Post monsoon Mean Depth to Water Level (2005-14)

Decadal mean post monsoon water levels were analysed for delineating area suitable for artificial recharge. Most of the wells in taluk have dried up due to declining water level. There are few wells for which water level data is available for which decadal data is available. However, the wells are not representative of general water table conditions as they are isolated wells and they are shallow and are mostly located in low lying /valley areas / adjacent to water bodies. The decadal post monsoon water level has been prepared based on water level data of piezometers. It is observed that decadal mean depth to water level in the taluk is more than 30 m. A map showing decadal mean water level is shown in Fig-8.

Fig-8: Decadal Mean Water Level (Post-monsoon 2005-2014) of Chikballapur taluk



4.2 Decadal Water Level Trend (2005-2014)

Decadal water level trend for pre monsoon was analysed for 10 wells. It is observed that 9 wells have dried up and one has recorded fall of 0.31m/year. In general there is a declining trend. Decadal water level trend for post-monsoon period was analysed for 10 wells. It is observed that 7 wells have dried up and in rest of the wells have shown average fall of 0.176 m/year. It indicates that, there is declining trend of water level in pre and post-monsoon seasons during the decade 2005-2014.

4.3 Dynamic Ground Water Resource:

The taluk is categorized as Over-Exploited (OE) as on March 2011. The net annual ground water availability in 4600 HAM, Ground water draft for irrigation is 6051 HAM and the ground water draft for drinking and industrial purposes is 610 HAM. Further, the stage of ground water development is estimated as 145%. The data are given in table 2.

Table-2: Ground water Resources of Chikballapur taluk as on 2011

Sl. No.	Item	Resources as on 2011
1.	Net Annual Ground water Availability (HAM)	4600
2.	Existing Ground water draft for irrigation (HAM)	6051
3.	Existing ground water draft for drinking & industrial purposes (HAM)	610
4.	Existing ground water draft for all uses (HAM)	6661
5.	Stage of ground water development (HAM)	145%
6.	Categorization	Over-Exploited

5. Planning for Ground water Recharge / Conservation

5.1 Justification for Artificial Recharge

- Stage of development of ground water is 145% and the area falls in Over -Exploited category.
- Phreatic zone is totally dried up due to over-exploitation of ground water resource. Availability of sufficient unsaturated thickness in weathered zone provides sufficient scope and space for artificial recharge in the project area.
- Farmers are losing their livelihood and laborers are losing jobs and many are forced to migrate for livelihood.
- The farming community is socio-economically backward.
- The topography is undulating, most of the cultivable land has become low productive due to soil erosion
- There is acute shortage of drinking water due to drying of water supply bore wells in many villages, mainly during summer months.
- 9.25 MCM of non committed surplus monsoon run off is available for recharge.
- There are many MI tanks existing in the taluk which are silted. Rejuvenation of these tanks and recharge through these tanks will enhance the sustainability of the 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 472 sq. km. was delineated for artificial recharge.

5.3 Availability of Surplus Surface water for Artificial Recharge/ conservation:

Monsoon rainfall run off is the only source water for the artificial recharge in the project area. Source water availability is 9.25 MCM. The details of source water availability are presented in Table 3.

Table 3: Details of Source Water Availability in Chikballapur Taluk

Normal Monsoon Rainfall	746 mm
Area of identified for AR	472 sq km
Run off Coefficient (Strange's Method)	9.6%
Monsoon Run off	20.50 MCM
Utilisable Monsoon Run off (50%)	10.25 MCM
Committed Monsoon Run off (10% of utilisable run off)	1.0 MCM
Non-committed surplus monsoon run off	9.25 MCM

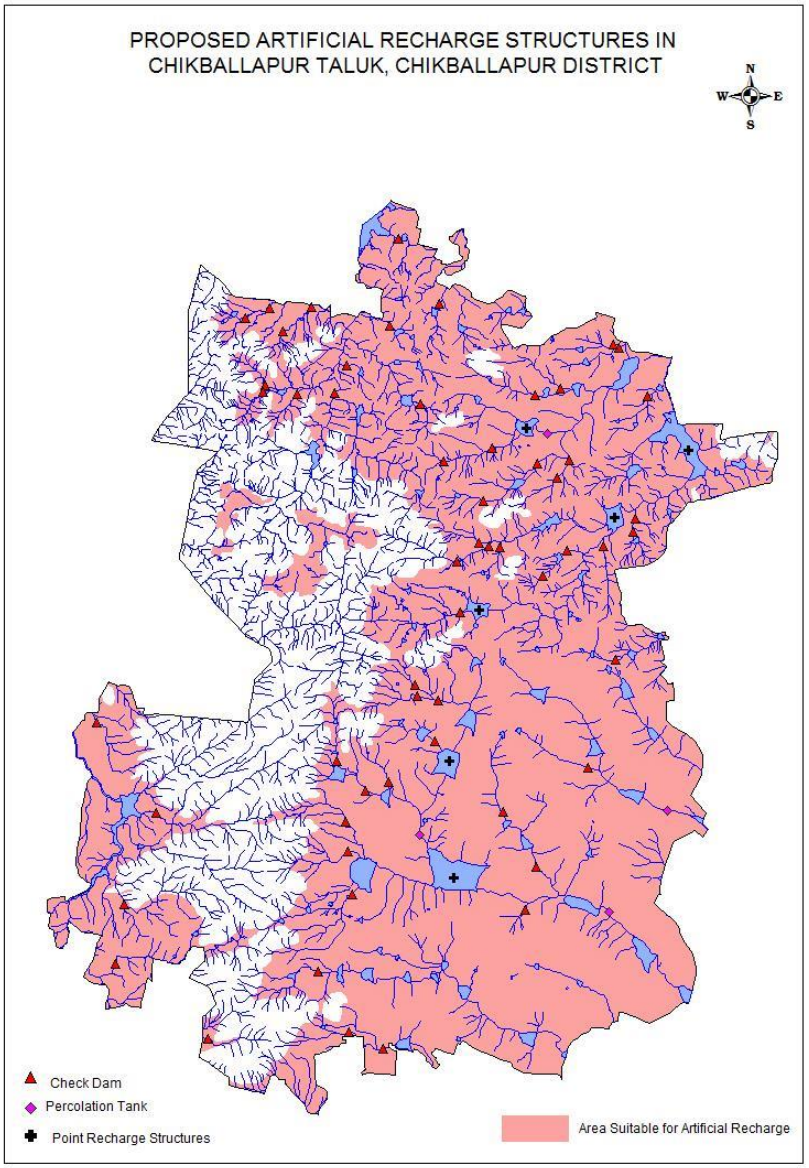
6. Proposed interventions including Tentative Locations of Artificial Recharge/conservation Structures

The feasible artificial recharge structures proposed in the taluk are Check Dams, Percolation Tanks and Point Recharge Structures. In addition to this, de-silting of tanks and micro-irrigation practices may also may be taken up for water conservation purpose. The proposed structures are as given in table 4 and locations are shown in Fig-9.

Table 4: Artificial Recharge Structures Proposed in Chikballapur Taluk

Structures Proposed	No of Structure Proposed
Check Dam	57
Percolation Tank	4
Point Recharge Structure	6
Total	67

Fig-9



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.

57 numbers of check dams are feasible in the Taluk. The location details with coordinates are given in the Table-5. The cost of 57 Check dams is estimated at 171 lakhs. The total storage capacity of these check dams is estimated at 0.75 MCM. Quantum of ground water likely to be recharged through these check dams is estimated to be 0.53 MCM.

Table-5: Tentative Locations of Check Dams in Chikballapur Taluk

Sl. No.	Longitude	Latitude
1	77.6260	13.3907
2	77.6190	13.4779
3	77.7011	13.3879
4	77.7254	13.3601
5	77.8016	13.4616
6	77.7702	13.4457
7	77.7827	13.4257
8	77.7382	13.4875
9	77.7373	13.4914
10	77.7459	13.4857
11	77.7447	13.4711
12	77.7275	13.4564
13	77.7189	13.4532
14	77.7083	13.4640
15	77.7117	13.4419
16	77.6410	13.4454
17	77.7124	13.4313
18	77.7139	13.4156
19	77.7782	13.4103
20	77.7129	13.3658
21	77.6604	13.3636
22	77.6290	13.4122
23	77.8119	13.5005
24	77.7848	13.5310

25	77.6744	13.6243
26	77.6832	13.6278
27	77.6882	13.6194
28	77.6988	13.6281
29	77.6818	13.5998
30	77.6809	13.5976
31	77.6936	13.5967
32	77.7075	13.5972
33	77.7392	13.5932
34	77.7312	13.6531
35	77.7463	13.6294
36	77.7280	13.6216
37	77.7120	13.6072
38	77.7819	13.5963
39	77.7915	13.5987
40	77.8132	13.6136
41	77.8111	13.6146
42	77.8241	13.5961
43	77.7482	13.5726
44	77.7661	13.5773
45	77.7629	13.5581
46	77.7828	13.5716
47	77.7950	13.5729
48	77.7613	13.5431
49	77.7529	13.5362
50	77.7649	13.5417
51	77.7689	13.5414
52	77.7940	13.5403
53	77.8075	13.5418
54	77.8184	13.5468
55	77.8193	13.5519
56	77.7903	13.5666
57	77.7541	13.5179

6.2 Percolation Tanks

- 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 pounded 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 4 numbers of percolation tanks are feasible in the taluk. The location details with coordinates are given in the Table-6. The cost of 4 percolation tanks is estimated at 30.0 lakhs. The annual storage capacity of these percolation tanks is estimated at 0.72 MCM. The volume of ground water likely to be recharged through these Percolation Tanks is estimated to be 0.50 MCM.

Table-6: Tentative Locations of Percolation Tanks in Chikballapur Taluk

Sl. No.	Longitude	Latitude
1	77.7389	13.4374
2	77.8315	13.4462
3	77.8096	13.4095
4	77.7866	13.5826

6.3 Point Recharge Structure (PRS)

- In hard 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 6 numbers of Point Recharge structures are feasible in the taluk The location details with coordinates are given in the Table-7. The cost of 6 PRS is estimated at 12.0 lakhs. The annual storage capacity of PRS is estimated at 0.092 MCM. The volume of ground water likely to be recharged through these PRS is estimated to be 0.083 MCM.

Table-7: Tentative Locations of Point Recharge Structures in Chikballapur Taluk

Sl. No.	Longitude	Latitude
1	77.7516	13.4218
2	77.8393	13.5762
3	77.7611	13.5187
4	77.8114	13.5521
5	77.7788	13.5845
6	77.7502	13.4638

7. Tentative Cost Estimate

Tentative cost estimates of structures/interventions proposed in the micro watershed are given in table 8. The unit rates are followed as per master plan of Artificial Recharge and State Government Schedule Rates. It is estimated that annually about 1.11 MCM of water will be recharged to ground water system which may create an additional irrigation potential of 134 hectares.

Table-8: Tentative Cost Estimates of Structures proposed in Chikballapur taluk.

Type of Structure	Number	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	57	**3.0**	171.00	0.75	0.53	134
Percolation Tank	4	**7.5**	30.00	0.72	0.50	
Point Recharge Structure	6	**2.0**	12.00	0.09	0.08	
TOTAL	**67**		**213.00**	**1.56**	**1.11**	
Impact Assessment (5% of estimate)			10.65			
Grand Total			**223.65**			

Note: Type, number and cost of structure may vary according to site after field visit/inputs.

8. Implementation Modalities

The implementation of the scheme will be done by the State Government 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 the projects, impact assessment has to be carried out to ensure that project 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 a have impact assessment at rate of 5% of the total cost of the project for 5 years from the date of completion of artificial recharge structures.