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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 JAGALUR TALUK, DAVANAGERE DISTRICT, KARNATAKA

Central Ground Water Board
South Western Region
Bangalore
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Sl. No. **TOPIC**

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

AT GLANCE	
Taluk	Jagalur
District	Davanagere
State	Karnataka
Taluk area	973.5 Sq km
Area Suitable for Artificial Recharge	936.54 Sq km
Latitude & Longitude	Longitude 76° 06' 33" E - 76° 32' 10" E Latitude 14° 24′ 10″ N - 14° 42′ 15″ N
Annual Normal Rainfall	546 mm
Normal Monsoon Rainfall	298 mm
Normal Non- Monsoon Rainfall	248 mm
Geology	Granitic-gneisses, Greywacke, Basalts and Schists
WATER LEVEL	
Pre - Monsoon	Approximately >15 m bgl.
Post - Monsoon	>10 m bgl. * Almost all the representative OW are dry
GROUND WATER RESOURCES ESTIMATION	
Net ground water available	82.87 MCM
Ground water draft for irrigation	86.81 MCM
Groundwater draft for domestic& industrial water supply	4.93 MCM
Total ground water draft	91.74 MCM
Stage of ground water development (%)	111 %
Non commited monsoon runoff available for the taluk	4.0 MCM
Total volume of weathered zone available for Recharge	9365.4 MCM
Storage Potential Weathered/unsaturated zone available for Recharge	187.31 MCM

ARTIFICIAL RECHARGE /CONSERVATION MEASURES	
Structures Proposed (tentative)	Check Dam – 25 Percolation Tank – 2 Point Recharge Structures – 3
Tentative total cost of the project	Rs.100.8 lakhs
Excepted Recharge	0.52 MCM
Expected rise in water level by recharging 0.52 MCM of rain fall run off.	0.028 m

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 Jagalur Taluk, Davanagere District, Karnataka, having an area of 973.5 sq. km has been presented in this report.

2. Objectives of the Scheme:

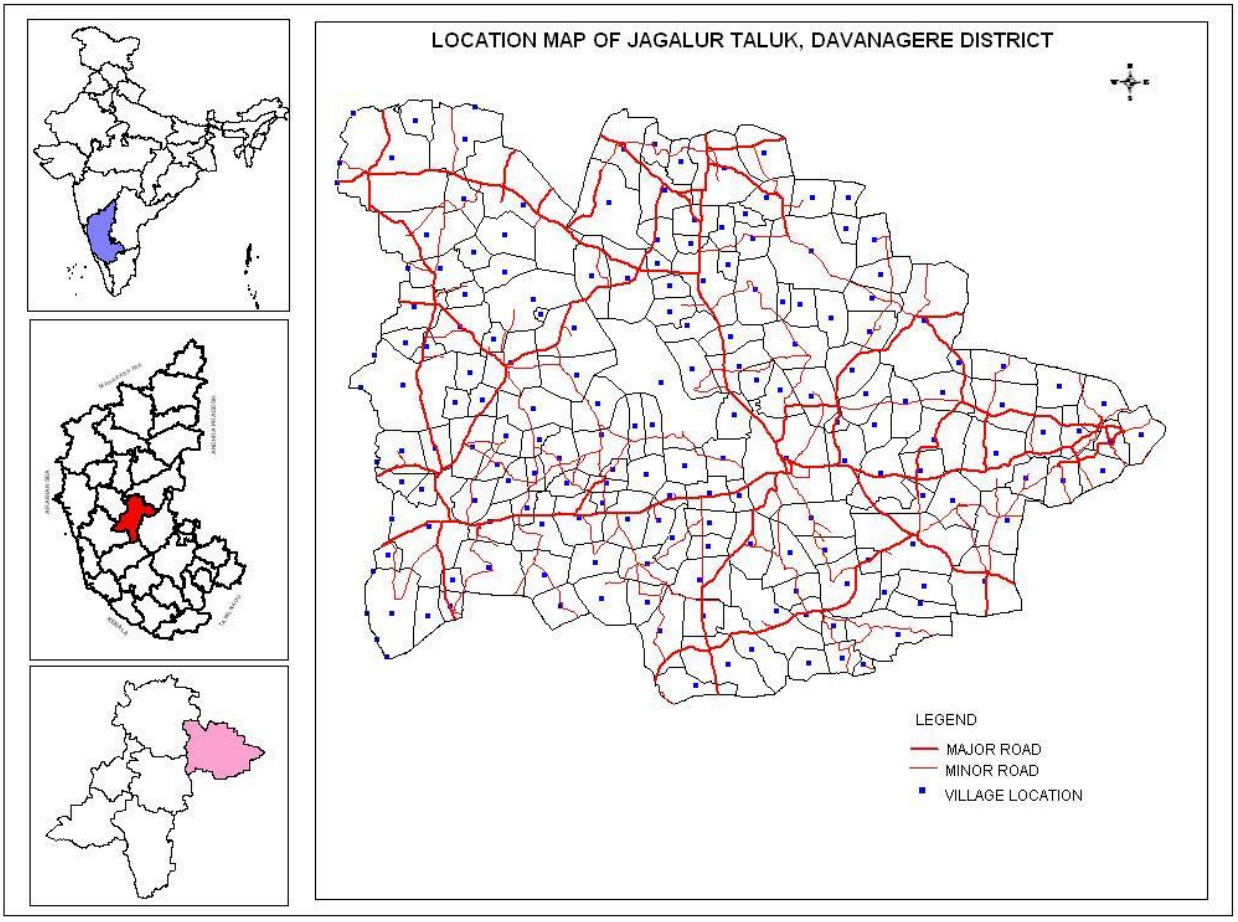
- To augment ground water resources by harvesting and conserving non committed surplus monsoon run off using artificial recharge measures.
- To overcome the inadequacy of surface water to meet the ever-increasing water demands.
- To arrest decline in ground water levels.
- To recover and transform this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

Jagalur taluk is located in the NE part of Davangere district of Karnataka. The taluk covers a geographic area of 973.5 sq.km and lies between Longitude of 76° 06' 33" E and 76° 32' 10" E and Latitude of 14° 24′ 10″ N and 14° 42′ 15″ N and. A map showing location of taluk is shown in Fig 1.

Fig-1



3.2 Physiography and Drainage:

Geomorphologically, Jagalur taluk is characterized by vast stretches of undulated plains interspersed with sporadic ranges or isolated clusters of low ranges of rocky hills. Average elevation of the taluk is 733 m amsl. Taluk lies in Krishna basin and is drained by Tungabhadra & Chikkahagari Rivers. An area of 868.335 sq. km in the taluk is covered by plain topography, 68.21 Sq. km by piedmont zone, 33.64 sq km by hills and plateau. The drainage pattern in the taluk is dendritic**.** Maps showing geomorphology and drainage pattern are shown in Fig 2 and 3.

Fig-2

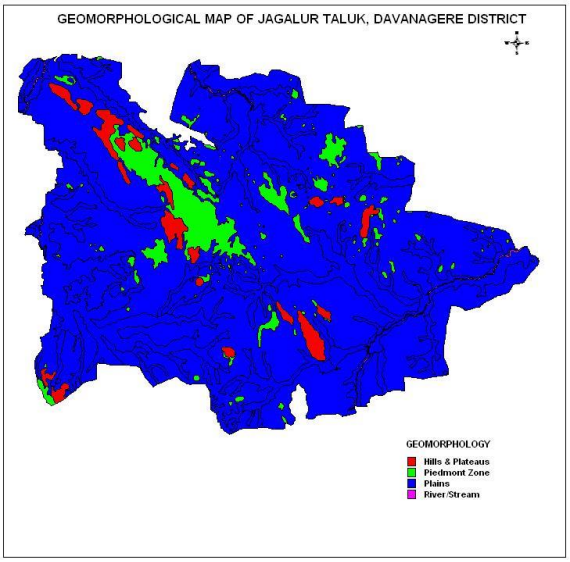
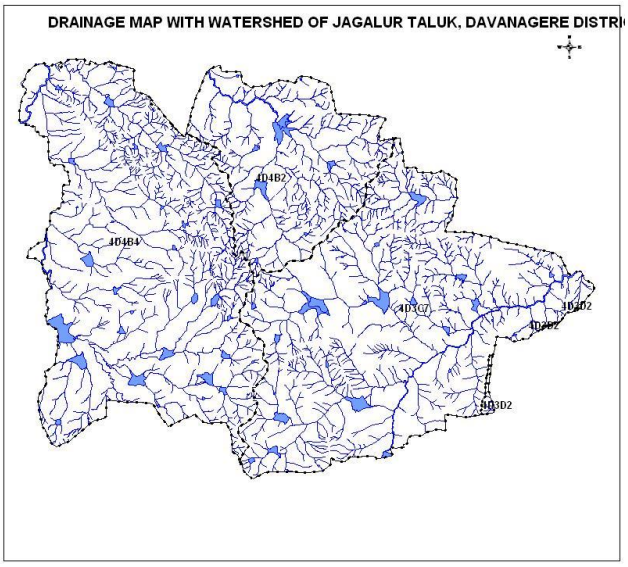


Fig-3



3.3 Land Use and Soil:

As on 2012-13, Forest covers 12688ha, net irrigated area is 13404 and net area sown is 65233 ha. Agriculture is practiced in major part of the taluk.

An area of 458.24 is covered by Alfisols, 39.75 sq km by Entisols, 241.4 sq km by Inceptisol, 36.92 sq km by Aridisol and 197.24 Sq km by Vertisol soils. Maps showing Land use and Soil distribution are presented in Fig-4 and 5.

Fig-4

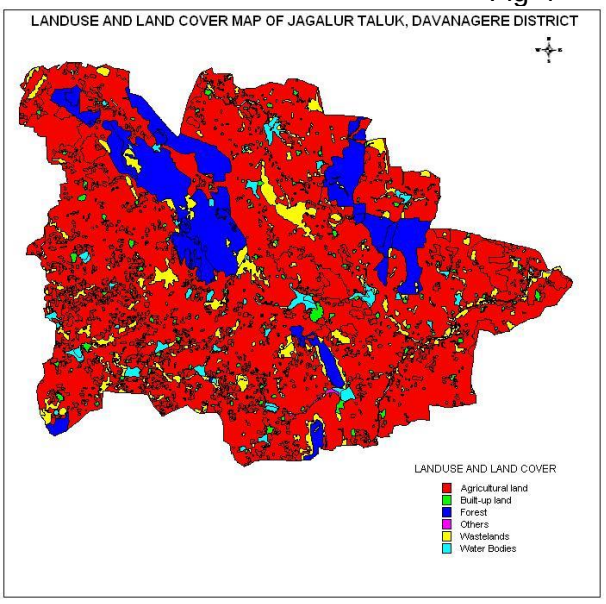
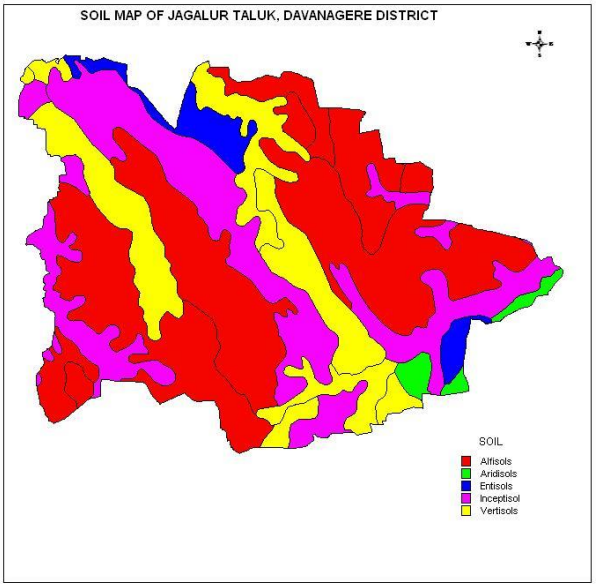


Fig-5



3.4 Hydrometeorology

Normal rainfall in the Taluk is 546 mm. Major part of the precipitation form South-West monsoon. The taluk falls in the Central Dry Agro-climatic zone of Karnataka. The temperature varies from 16° to 39 °C. The normal monsoon rainfall of the taluk is 298 mm. The details of rainfall are given in Table-1.

Table 1: Details of Rainfall in Jagalur Taluk

Normal Monsoon Rainfall (mm)	Normal Non-monsoon Rainfall (mm)	Total Normal Annual Rainfall (mm)
298	248	546

3.5 Geology:

Granitic-gneisses, Greywacke, Basalts and Schists are the main water bearing formations. Depth of weathered zone ranges from 5.7 m bgl to 36.74 m bgl.

Lineaments are trending mainly in NE – SW and NW – SE directions. Map showing geology and lineament are shown in Fig-6 and 7.

Fig-6

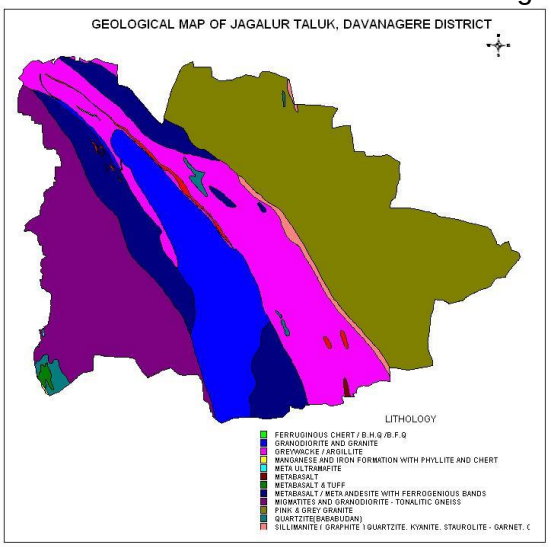
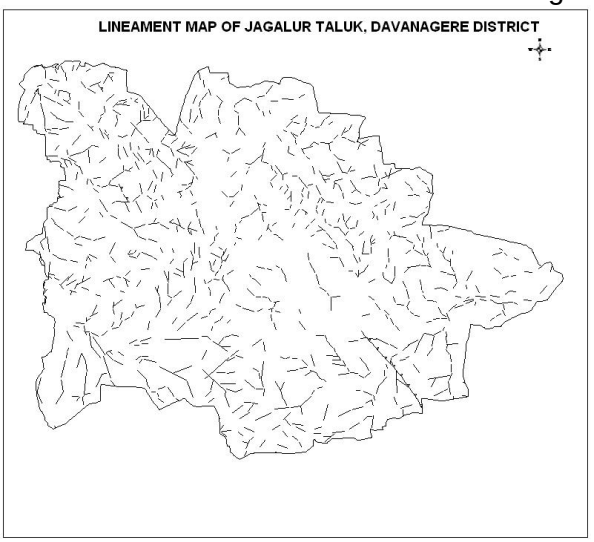


Fig-7



4. Hydrogeology:

Ground water occurs in weathered formations under phreatic conditions (in shallow isolated and highly localizes 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 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 decadal water level 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. It is observed that post monsoon depth to water level is >10 m bgl

4.2 Decadal Water Level Trend (2005-2014)

An attempt was made to analyse decadal water level trend of the taluk. Only two Piezometers are having water level data for decade 2005-14. One is showing decadal falling trend of 0.223m/year whereas the other one is showing rising trend of 0.882m/year. However, drying of wells in the taluk indicate that there is declining trend of water level in general.

4.3 Dynamic Ground Water Resource:

The taluk is categorized as Over Exploited as on March 2011. The net annual ground water availability in 8287.01 HAM, Ground water draft for irrigation is 8680.91 HAM and the ground water draft for drinking and industrial purposes is 493.75 HAM. Further, the stage of ground water development is estimated as 111%. The data are given in table-2.

Table-2: Ground water Resources of Jagalur Taluk as on 2011

Sl. No.	Item	Resources as on 2011
1.	Net Annual Ground water Availability (HAM)	8287.01
2.	Existing Ground water draft for irrigation (HAM)	8680.91
3.	Existing ground water draft for drinking & industrial purposes (HAM)	493.75
4.	Existing ground water draft for all uses (HAM)	9174.66
5.	Stage of ground water development (HAM)	111%
6.	Categorization	Over-Exploited

5. Planning for Ground water Recharge / Conservation

5.1 Justification for Artificial Recharge

- Stage of development of ground water is 111% 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 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.

- 4.0 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 936.54 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 4.0 MCM. The details of source water availability are presented in Table-3.

Table-3: Details of Source Water Availability in JagalurTaluk

Normal Monsoon Rainfall	298 mm
Area of identified for Artificial Recharge	936.54 Sq km
Run off Coefficient (Strange's Method)	3.2%
Monsoon Run off	8.90 MCM
Utilisable Monsoon Run off (50%)	4.45 MCM
Committed Monsoon Run off (10% of utilisable run off)	0.44 MCM
Non-committed surplus monsoon run off	4.0 MCM

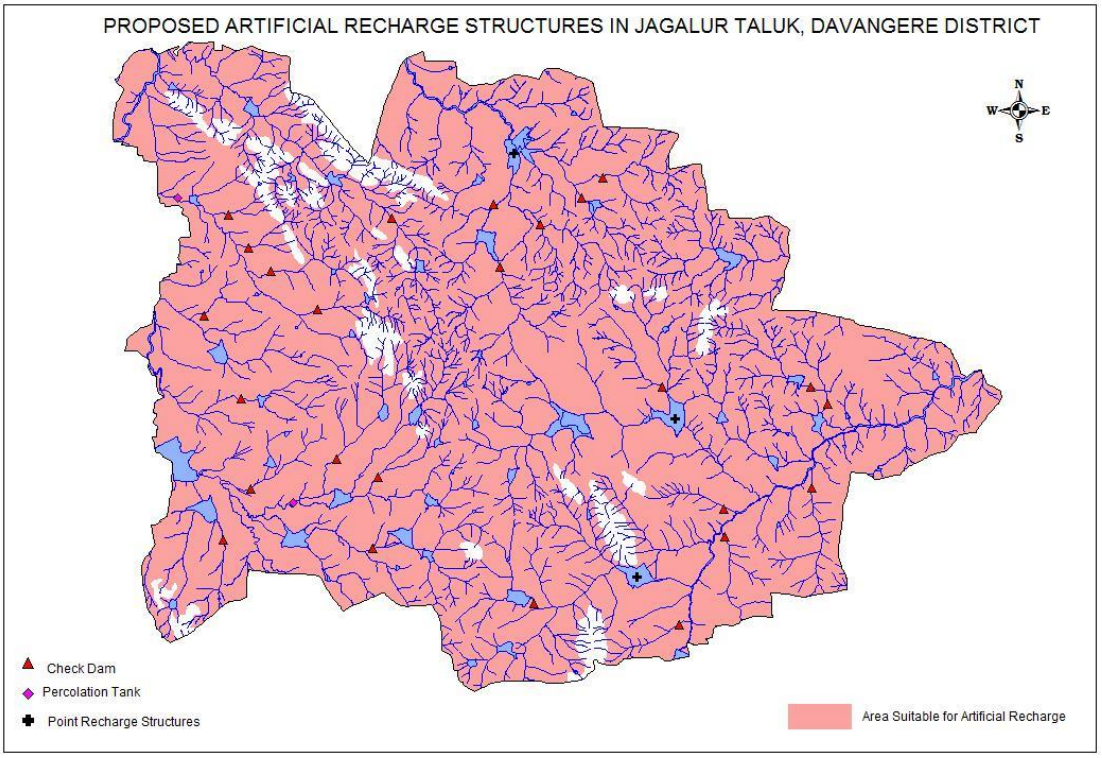
6. Proposed interventions including Tentative Locations of Artificial Recharge/conservation Structures

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 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-8.

Table 4: Artificial Recharge Structures Proposed in JagalurTaluk

Structure Proposed	Number of Structures Proposed
Check Dam	25
Percolation Tank	2
Point Recharge Structure	3
Total	30

Fig-8



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 25 check dams are feasible in the taluk. Location details with coordinates are given in the Table-5. The cost of 25 Check dams is estimated at 75 lakhs. The total storage capacity of check dams is estimated at 0.33 MCM. The volume of ground water likely to be recharged through these check dams is estimated to be 0.23 MCM.

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

Sl. No.	Longitude	Latitude
1	76.1709	14.5387
2	76.1752	14.4968
3	76.1623	14.4734
4	76.3803	14.4341
5	76.4022	14.4749
6	76.4442	14.4974
7	76.2364	14.5022
8	76.2168	14.5107
9	76.2074	14.5800
10	76.2919	14.6285
11	76.3723	14.5440
12	76.4018	14.4877
13	76.1850	14.5975
14	76.1746	14.6087
15	76.1647	14.6239
16	76.1531	14.5771
17	76.3109	14.4440
18	76.2336	14.4694
19	76.4516	14.5363
20	76.4437	14.5440
21	76.3442	14.6412
22	76.3340	14.6317
23	76.3142	14.6192
24	76.2429	14.6222
25	76.2948	14.5998

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 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 2 numbers of Percolation Tanks are feasible in the project area. Location details with coordinates are given in the Table-6. The cost of 2 percolation tanks is estimated at 15 lakhs. The annual storage capacity of tanks is estimated at 0.36 MCM. The volume of ground water recharged through these Percolation Tanks is estimated to be 0.25 MCM.

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

Sl. No.	Longitude	Latitude
1	76.1403	14.6316
2	76.1958	14.4906

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 3 numbers of Point Recharge Structures are feasible in the taluk. Location details with coordinates are given in the Table-7. The cost of 3 PRS is estimated at 6.0 lakhs. The annual storage capacity of PRS is estimated at 0.045 MCM. The volume of ground water likely to be recharged through PRS is estimated to be 0.04 MCM.

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

Sl. No.	Longitude	Latitude
1	76.3600	14.4560
2	76.3787	14.5292
3	76.3014	14.6523

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 0.52 MCM of water will be recharged to ground water system which may create an additional irrigation potential of 63 hectares.

Table-9: Tentative Cost Estimates of structures proposed in Jagalur 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	25	3.0	75.0	0.33	0.23	63
Percolation Tank	2	7.5	15.0	0.36	0.25	
Point Recharge Structure	3	2.0	6.0	0.045	0.04	
TOTAL	**30**		**96.0**	**0.735**	**0.52**	
Impact Assessment (5% of estimate)			4.8			
Grand Total			**100.8**			

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								
• 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.