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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 RAMDURG TALUK, BELGAUM DISTRICT, KARNATAKA

Central Ground Water Board
South Western Region
Bangalore
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AT A GLANCE	
Taluk	Ramdurg
District	Belgaum
State	Karnataka
Taluk area	1221 Sq km
Area Suitable for Artificial Recharge	640.95 Sq km
Latitude & Longitude	Longitude: 75° 04' 16" E - 75° 27' 28" E Latitude: 15° 46′ 50″ N - 16° 12′ 29″ N
Annual Normal Rainfall	545 mm
Normal Monsoon Rainfall	326 mm
Normal Non- Monsoon Rainfall	219 mm
Geology	Granite, Schist, Shale, undifferentiated flows, Dolomite limestone,
WATER LEVEL	
Pre - Monsoon	Approximately >20 m bgl.
Post - Monsoon	Average 16.40 m bgl. * Almost all the representative OW are dry
GROUND WATER RESOURCES ESTIMATION	
Net ground water available	54.44 MCM
Ground water draft for irrigation	70.36 MCM
Groundwater draft for domestic & industrial water supply	4.50 MCM
Total ground water draft	74.86 MCM
Stage of ground water development	138%
Non- committed monsoon runoff available for the taluk	5.08 MCM
Total volume of weathered zone available for Recharge	3204.75 MCM
Storage Potential Weathered/unsaturated zone available for Recharge	64.10 MCM

ARTIFICIAL RECHARGE /CONSERVATION MEASURES	
Structures Proposed (tentative)	Check Dam – 31 Percolation Tank – 2 Point Recharge Structures – 3
Tentative total cost of the project	Rs.119.70 lakhs
Excepted Recharge	0.58 MCM
Expected rise in water level by recharging 0.58 MCM of rain fall runoff	0.05 m

PLAN ON ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION IN RAMDURG TALUK, BELGAUM 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 Ramdurg Taluk, Belgaum District, having an area of 1221 sq. km has been presented in this report.

2. Objectives of the Scheme:

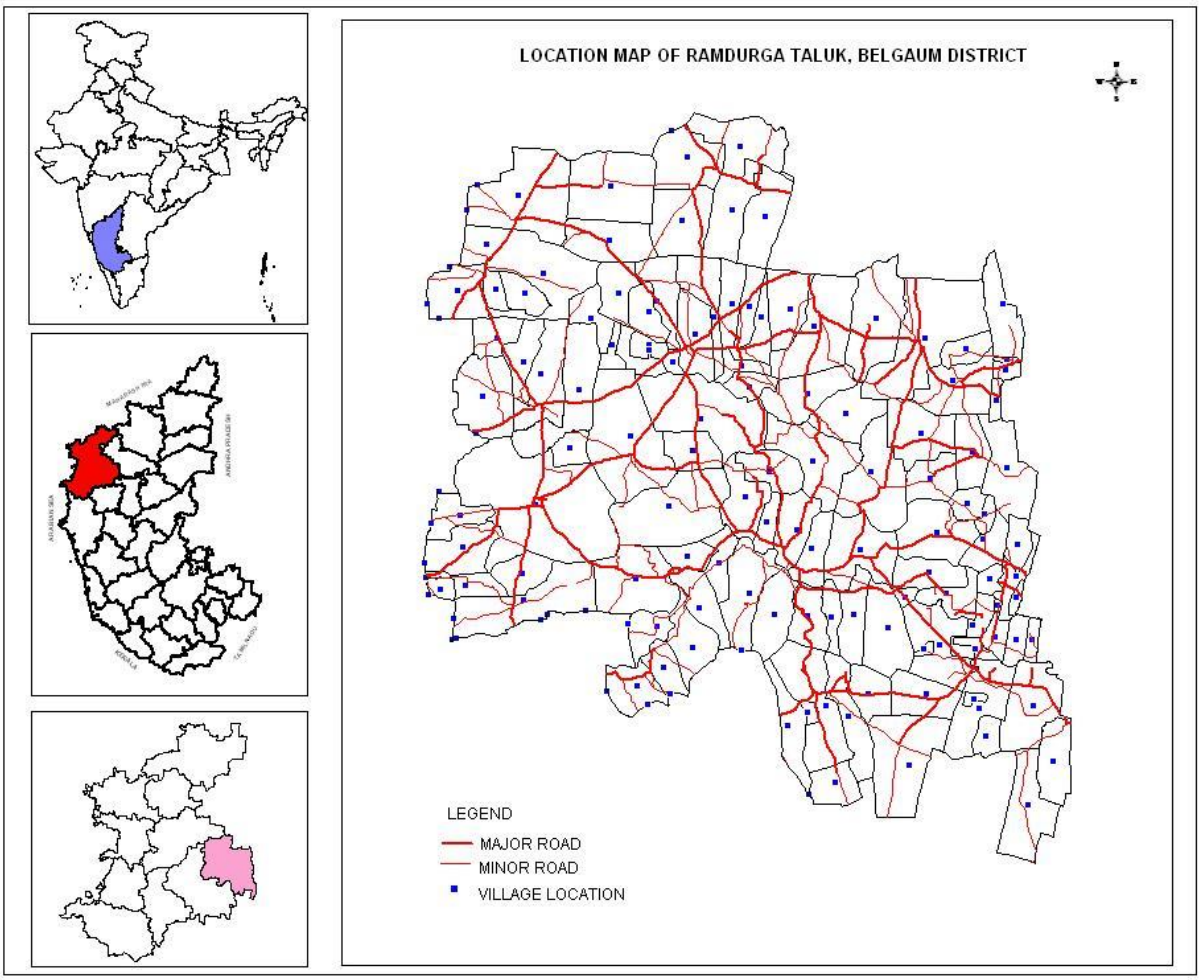
- To augment ground water resources by harvesting and conserving non-committed surplus monsoon run off using artificial recharge measures.
- To overcome the inadequacy of surface water to meet the ever-increasing water demands.
- To arrest decline in ground water levels.
- To recover and transform this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

Ramdurg taluk is located in the eastern part of Belgaum district of Karnataka. The taluk covers a geographic area of 1221 sq.km and lies between Longitude of 75° 04' 16" E and 75° 27' 28" E and Latitude of 15° 46′ 50″ N and 16° 12′ 29″ N. A map showing location of taluk is presented in Fig-1.

Fig-1



3.2 Physiography and Drainage:

Geomorphologically, it is a rugged and undulating terrain and traversed by chains of detached hills trending in EW direction. Elevation in the taluk ranges from 526 m to 560 m amsl. An area of 638.33 sq. km in the taluk is covered by plain topography, 2.62 Sq. km by piedmont zone and 658.4 sq km by hills and plateaus.

The taluk is a part of Krishna River Basin, Ghataprabha and Malapraphaha rivers flow through the district. The drainage pattern in the taluk is dendritic**.** Maps showing geomorphology and drainage pattern are presented in Fig-2 and 3.

Fig-2

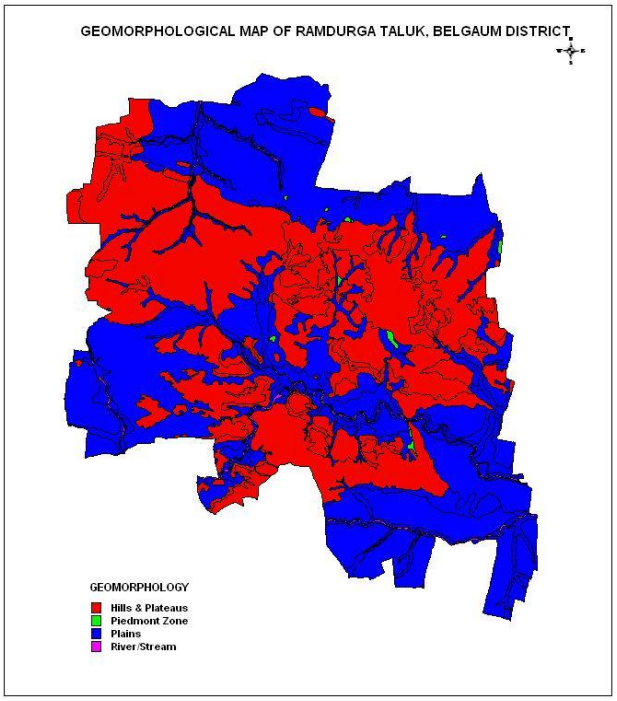
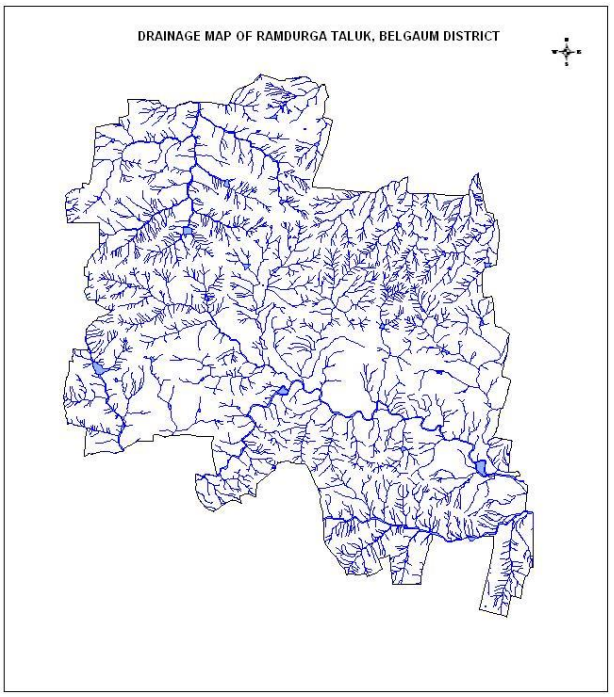


Fig-3



3.3 Land Use and Soil:

As on 2012-13, Forest covers 15,081 ha, net irrigated area is 26,923 and net area sown is 84,962 ha. Agriculture is practiced in major part of the taluk.

An area of 851.79 sq km is covered by by Entisols and 369.21 Sq km by Vertisol soils. Maps showing Land use and Soil distribution are presented in Fig-4 and 5.

Fig-4

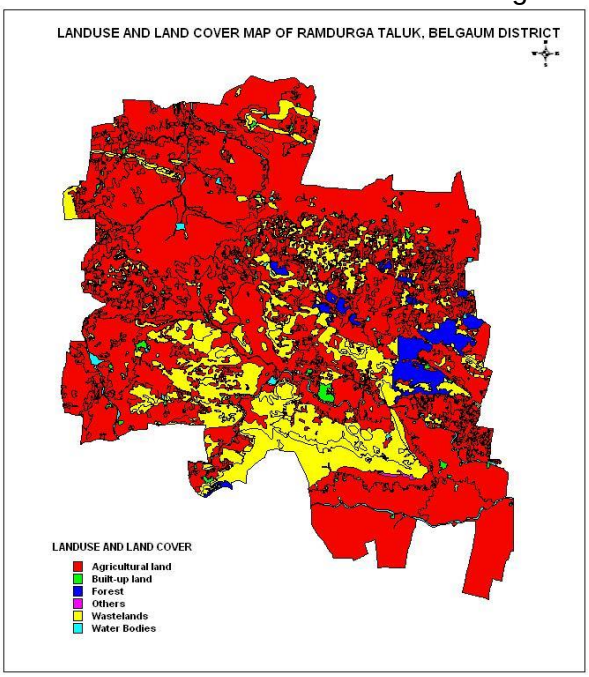
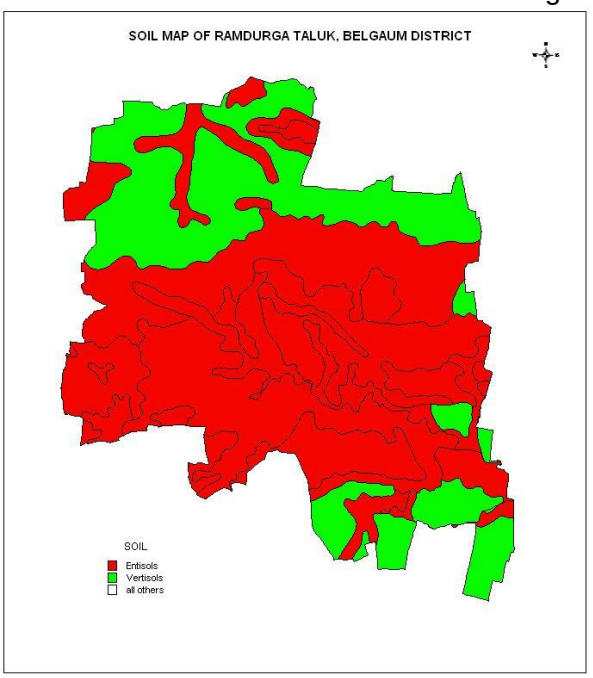


Fig-5



3.4 Hydrometeorology

Annual Normal rainfall in the taluk is 545 mm. Major part of the precipitation is form South-West monsoon. The taluk falls in the semi - arid tracts of Karnataka. Winter temperature varies from 14° to 21°C, whereas, in summer it varies between 27° and 36 °C. The average monsoon rainfall of the taluk is 326 mm. The details of rainfall are given in Table 1.

Table 1: Details of Rainfall in Ramdurg Taluk

Normal Monsoon Rainfall (mm)	Normal Non-monsoon Rainfall (mm)	Total Normal Annual Rainfall (mm)
326	219	545

3.5 Geology:

Major water bearing formations occurring in the taluk are Granite, Schist, Shale, and undifferentiated flows, Dolomite lime stone, and Chert breccias, argillite. Weathered thickness of formations varies according to varying rock types from 8 m to 22 m with an average of 10 m. Lineaments are trending mainly in NE – SW and NW – SE directions. Maps showing geology and lineament are presented in Fig-6 and 7.

Fig-6

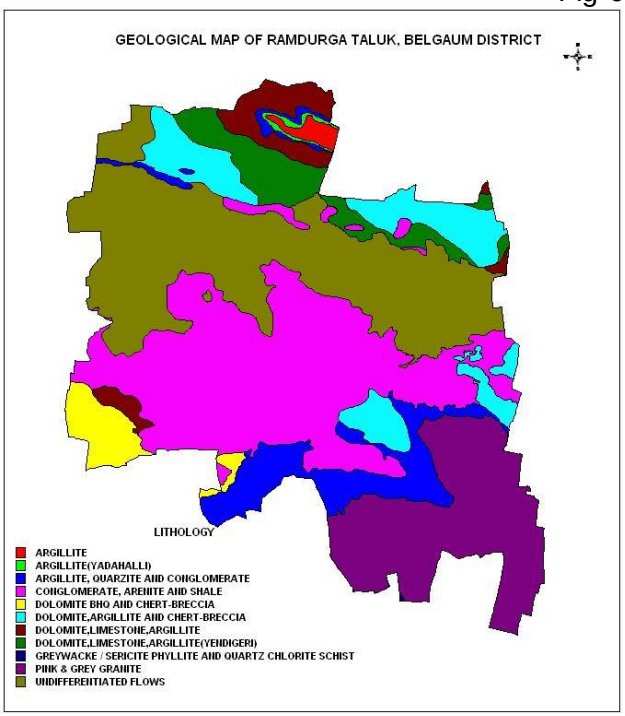
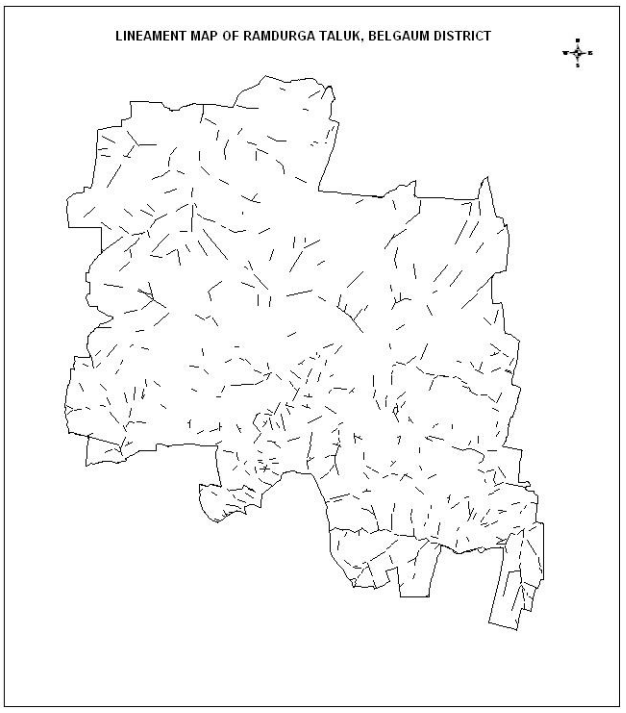


Fig-7



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 analyzed 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, these shallow wells are not representative of general water-table conditions as these are isolated wells, mostly located in low lying /valley areas / adjacent to water bodies.

The decadal post-monsoon water level data of piezometers has been analyzed. The data is available only for three piezometers. It ranges from 1.72 to 31.35 m bgl. The depth to water level map, however, could not be prepared due to insufficient data.

4.2 Decadal Water Level Trend (2005-2014)

An attempt was made to analyze decadal water level trend of the taluk. It is observed that only two piezometers are having continuous data of post-monsoon period and rest have dried up. One has recorded a rise of 0.5m/year where as the other has declining trend of 0.262m/year. Drying of wells indicates that there is declining trend of water level in the taluk.

4.3 Dynamic Ground Water Resource:

The taluk is categorized as Over-Exploited as on March 2011. The net annual ground water availability in 5444 HAM, Ground water draft for irrigation is 7036 HAM and the ground water draft for drinking and industrial purposes is 450 HAM. Further, the stage of ground water development is estimated as 138%. The data are given in Table-2

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

Sl. No.	Item	Resources as on 2011
1.	Net Annual Ground water Availability (HAM)	5444
2.	Existing Ground water draft for irrigation (HAM)	7036
3.	Existing ground water draft for drinking & industrial purposes (HAM)	450
4.	Existing ground water draft for all uses (HAM)	7486
5.	Stage of ground water development (HAM)	138%
6.	Categorization	Over-Exploited

5. Planning for Ground water Recharge / Conservation

5.1 Justification for Artificial Recharge

- Stage of development of ground water is 138% 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 space and scope 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.
- 5.08 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, water level trend and source water availability in the taluk. An area of 640.95 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 5.08 MCM. The details of source water availability are presented in Table-3.

Table-3: Details of Source Water Availability in RamdurgTaluk

Normal Monsoon Rainfall	326 mm
Area of identified for Artificial Recharge	640.95 Sq km
Run off Coefficient (Strange's Method)	5.4%
Monsoon Run off	11.28 MCM
Utilisable Monsoon Run off (50%)	5.64 MCM
Committed Monsoon Run off (10% of utilisable run off)	0.56 MCM
Non-committed surplus monsoon run off	5.08 MCM

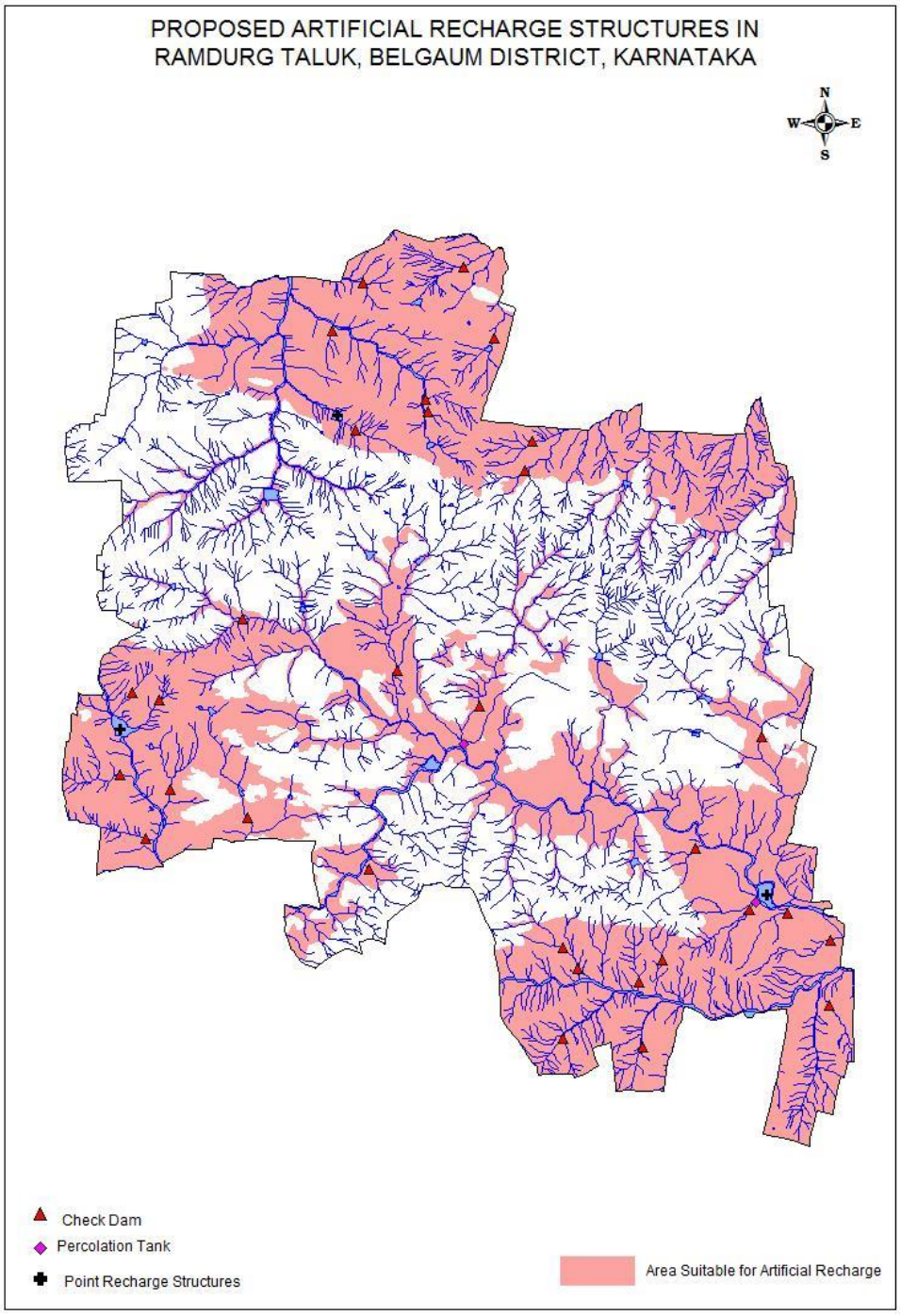
6. Proposed interventions including Tentative Locations of Artificial Recharge/conservation Structures

The feasible artificial recharge structures proposed in the taluk are Check Dams, Percolation Tanks and Point Recharge Structures (PRS). In addition to this, de-silting of tanks and micro-irrigation may also be taken up for water conservation purpose. The proposed structures are as given in table-4 and tentative locations are shown in Fig-8.

Table 4: Artificial Recharge Structures Proposed in RamdurgTaluk

Structure Proposed	Number of Structures Proposed
Check Dam	31
Percolation Tank	2
Point Recharge Structure	3
Total	36

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 31 Check Dams are feasible in the taluk. Location details with coordinates are given in the Table-5. The cost of 31 Check dams is estimated at 93 lakhs. The total storage capacity of check dams is estimated at 0.41 MCM. The volume of ground water likely to be recharged through these check dams is estimated to be 0.29 MCM.

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

Sl. No.	Longitude	Latitude
1	75.4263	15.8873
2	75.3240	15.8609
3	75.3168	15.8284
4	75.3555	15.8240
5	75.4469	15.8439
6	75.4081	15.8890
7	75.3538	15.8550
8	75.3650	15.8652
9	75.1242	15.9456
10	75.0996	15.9523
11	75.1057	15.9909
12	75.1188	15.9876
13	75.2354	16.0017
14	75.1121	15.9223
15	75.1619	15.9324
16	75.2219	15.9082
17	75.3167	15.8708
18	75.4475	15.8745
19	75.3814	15.9175
20	75.4140	15.9705
21	75.2758	15.9845
22	75.1597	16.0255
23	75.2186	16.1840
24	75.2680	16.1917
25	75.2830	16.1579
26	75.2495	16.1290
27	75.2506	16.1235
28	75.2148	16.1145
29	75.2037	16.1615
30	75.3015	16.1093
31	75.2980	16.0953

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 Ramdurg Taluk

Sl. No.	Longitude	Latitude
1	75.2679	15.9668
2	75.4107	15.8923

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 0.040 MCM.

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

Sl. No.	Longitude	Latitude
1	75.0995	15.9739
2	75.4163	15.8960
3	75.2059	16.1214

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 0.58 MCM of water will be recharged to ground water system which may create an additional irrigation potential of 70 hectares.

Table-9: Tentative Cost Estimates of structures proposed in Ramdurg 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	31	3.0	93.0	0.4092	0.29	70
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**		**114.0**	**0.8142**	**0.58**	
Impact Assessment (5% of estimate)			5.70			
Grand Total			**119.70**			

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.