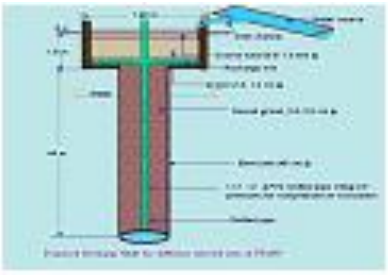
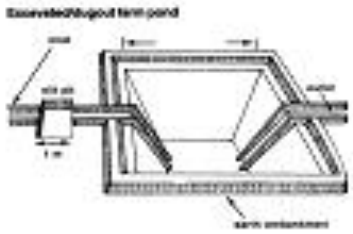
Plan on Artificial Recharge to Groundwater and Water Conservation in Periya Naiyakkan Palayam Firka, Coimbatore (North) Taluk, Coimbatore District, Tamil Nadu






By

Central Groundwater Board
South Eastern Coastal Region
Rajaji Bhawan, Besant Nagar
Chennai

Content

AT GLANCE	
Name of Firka	P. N. Palayam
Taluk	Coimbatore (North)
District	Coimbatore
State	Tamil Nadu
Total area (Sq.Kms)	96.4139
Total Area suitable for recharge	50.13
Co-ordinates Latitude. & Longitude.	11°02'28 "to 11°14'30" & 76°44'36"to 77°01'09".
Rainfall	948 mm
Monsoon	725 mm
Non- Mon soon	223 mm
Geology	Archaean Crystalline and metamorphic gneiss complex comprising Hornblende gneiss
WATER LEVEL	
Pre - Monsoon	1.02 to 18.0 m bgl.
Post - Monsoon	2.60 to 13.6 m bgl.
GROUNDWATER RESOURCES ESTIMATION	
Replenishable groundwater resources	12.1122 MCM
Net groundwater available	10.901 MCM
Groundwater draft for irrigation	14.7494 MCM
Groundwater draft for domestic & industrial water supply	1.2325 MCM
Total groundwater draft	15.9819 MCM
Stage of groundwater development (%)	146.61 %
Uncommitted surface runoff available for the Firka	10.485 MCM
Total volume of weathered zone	1156.9668 MCM
Total aquifer volume available for recharge (considering 7 m depth from 3 m bgl	674.90 MCM
ARTIFICIAL RECHARGE /CONSERVATION MEASURES	
Structures Proposed (tentative) Masonry Check dam Nalla Bund Revival, repair of pond, tanks with recharge shaft .	 107 3 1
Improving Water Efficiency /saving (Micro irrigation system for 100 ha)	0.7 MCM
Excepted ground water recharge	2.03 MCM
Excepted total ground water recharge/saving	2.73 MCM
Tentative total cost of the project	Rs.12.60 Cr
Expected raise in water level by recharging /saving	1.40 m

Plan on Artificial Recharge to Groundwater and Water Conservation in P. N. Palayam Firka, Coimbatore (North) Taluk, Coimbatore district, Tamil Nadu

1. INTRODUCTION

India is the largest user of groundwater in the world. Food grain security of the country is largely dependent on water resources and groundwater resources play major role in irrigation sector. Imprints of Over-Exploitation on groundwater resources are being observed as steep deepening of water levels, drying of shallow groundwater abstraction structures, ingress of salinity in fresh aquifers etc. which signal towards taking necessity of emergent action for artificial recharge and rainwater harvesting by utilizing surplus runoff and maintaining groundwater resources at sustainable stage.

In Tamil Nadu dependency on groundwater has increased many folds during the recent years and the groundwater extraction for irrigation, domestic and industries have resulted in lowering of water levels, long-term water level declining trend and even drying up of wells. In order to regulate the groundwater development, Central Groundwater Board in association with State Groundwater Departments has computed Dynamic Groundwater Resources and categorized blocks as Over Exploited, Critical, Semi Critical and Safe.

Out of 1129 Firkas (assessment units) in Tamil Nadu the groundwater situation in 374 Firkasoverexploited, 48 Firkas critical, 235Firkassemi-critical, 437 Firkas safe and 35 Firkas are saline. Various measures such as rainwater harvesting, artificial recharge and water use efficiency are successfully practiced by some NGOs, Central and State Govts., which need replication at larger scale in close coordination with State govt. agencies and stakeholders so that capacity building of state implementing agencies and awareness of stakeholders towards artificial recharge and rainwater harvesting can be made.

2. OBJECTIVES OF THE SCHEME

Objectives of the proposed scheme are;

- To upscale recharge activities, supplement additional groundwater resources by harvesting surplus runoff, sustainability of groundwater resources at shallow depths
- Recovery of over-exploited groundwater areas by implementing artificial recharge measures in groundwater stress areas.
- Conservation, development and sustainable management of natural resources including their use.

3. STUDY AREA DETAILS

3.1 Location

The total area of P. N. Palayam Firka is 96.41390 sq. km and lies between North latitudes 11°02'28 "to 11°14'30" and east longitudes 76°44'36"to 77°01'09". The location map of P. N. Palayam Firka is given in Figure - 1.

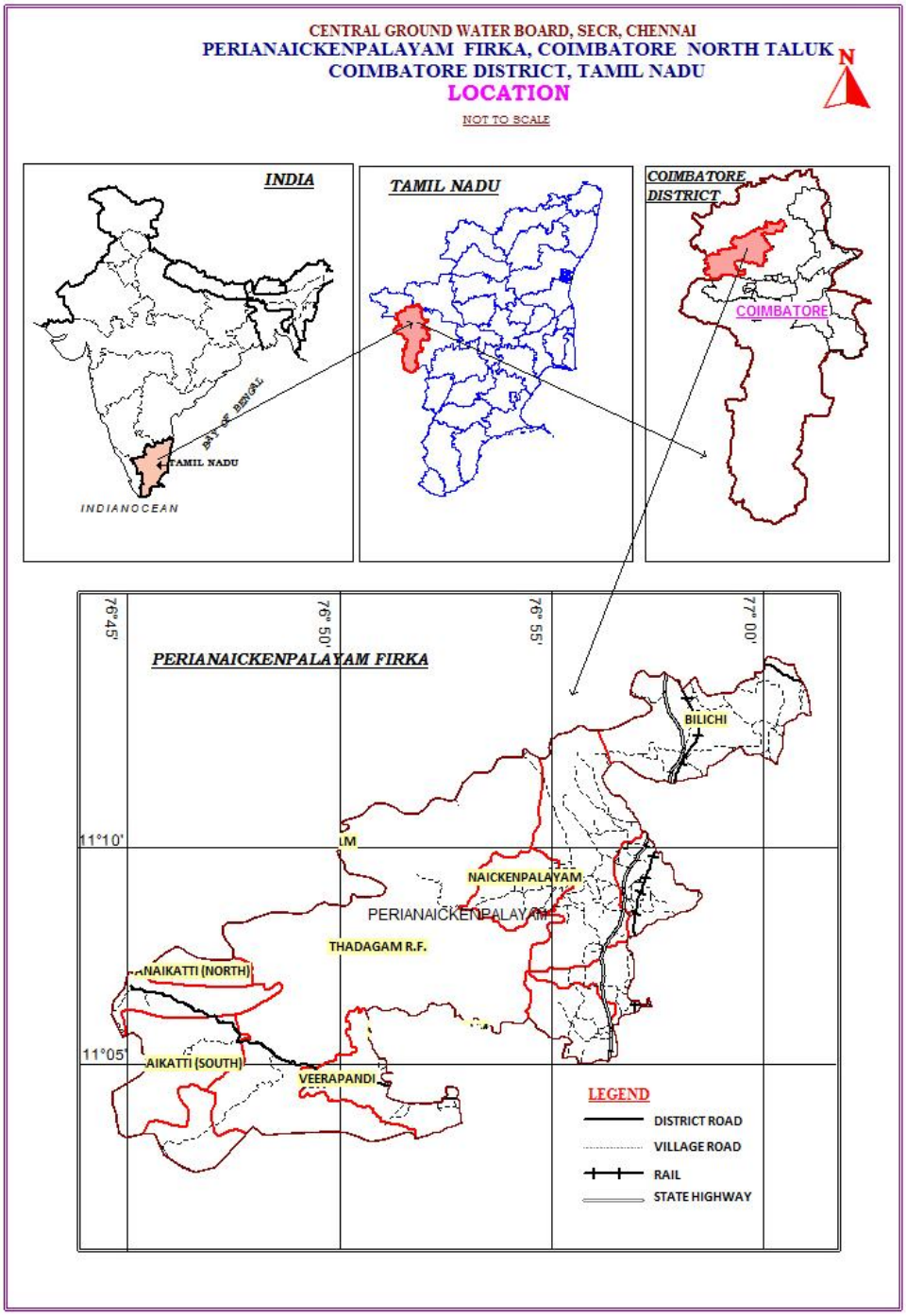


Figure - 1. Location map of P. N. Palayam Firka

3.2 Geomorphological Set up

Geomorphologically, the area consists of hills and plain landforms. In plain landforms, Pedi plain, weathered moderate and shallow pediment is occupied major part of the Firka. These landforms are influencing the groundwater recharge. Hill landform like residual hills, denudation hill and structural hills are act as runoff zone. (*Source: IRS, Anna university, Chennai Tamil Nadu). Geomorphological map prepared using IRS- 1D data on 1: 50,000 scale and units are as per NNRMS standard*s..The various geomorphological units with its % of coverage area are given in Table - 1 and shown in Figure - 2.

Table - 1 Various Geomorphological Units with Its % of Coverage Area in P. N. Palayam Firka

Landforms	% of Area
Pediplain (Weathered) Moderate	6.6
Structural Hills	16.2
Depletion Slope	6.2
Dissected/Undissected	6.7
Bajada	12.8
Highly Dissected	23.1
Moderately Dissected	6.6
Pediplain (Weathered) Shallow	7.1

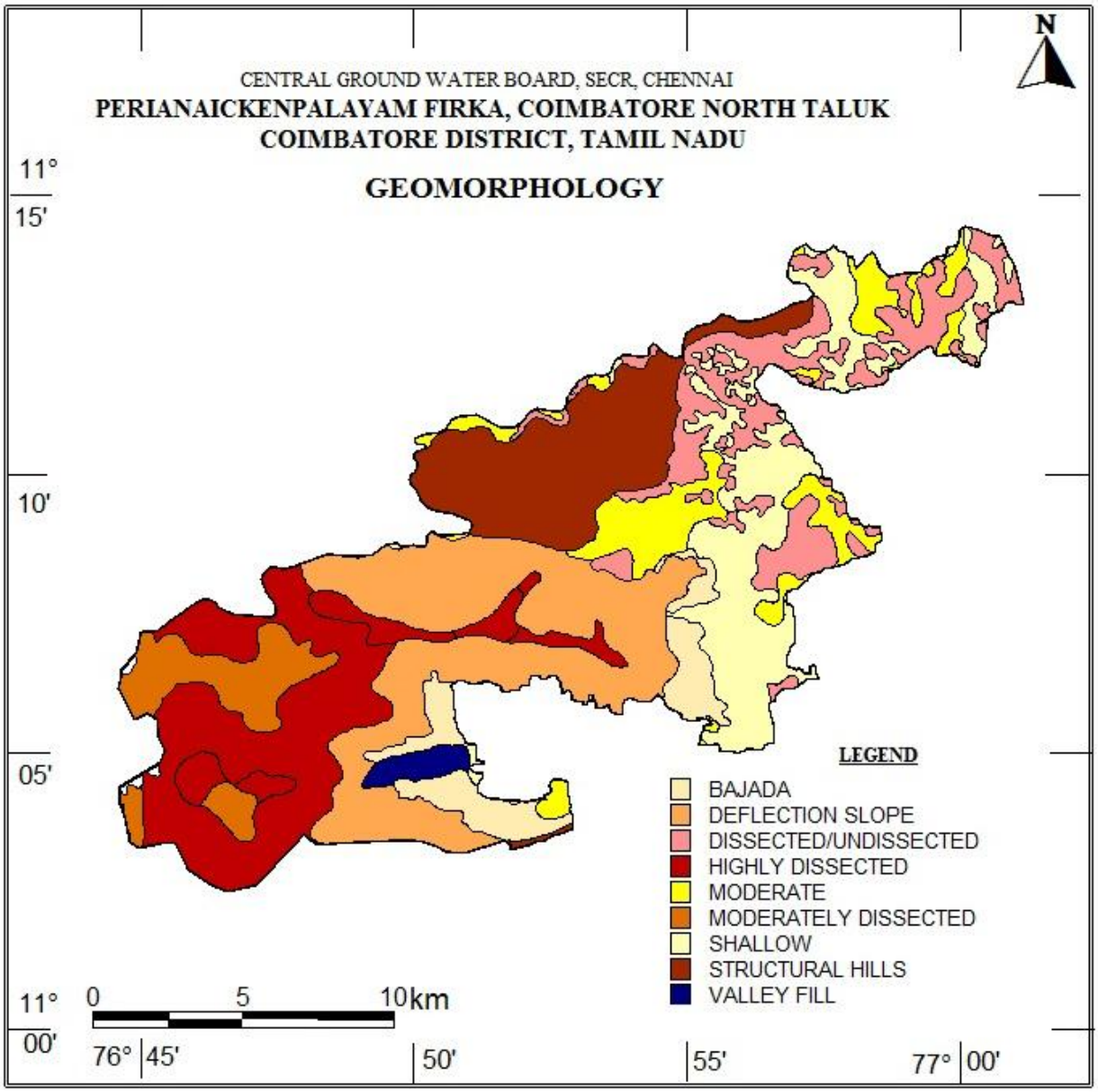


Figure - 2. Geomorphology of P. N. Palayam Firka

3.3 Land Use and Soil

The land use pattern of the P. N. Palayam Firka is given in Figure - 3. Predominantly the most of the area is characterised by the wet crop, plantation and dry crop (i.,e agricultural field) and accounts for 50 % of the total area of the Firka (Source: IRS, Anna university, Chennai Tamil Nadu). This area is highly suitable for water conservation and recharge. The entire Firkas is occupied by rock outcrops scatter with loamy soil. Soil map of the P. N. Palayam Firka is given as Figure – 3a.

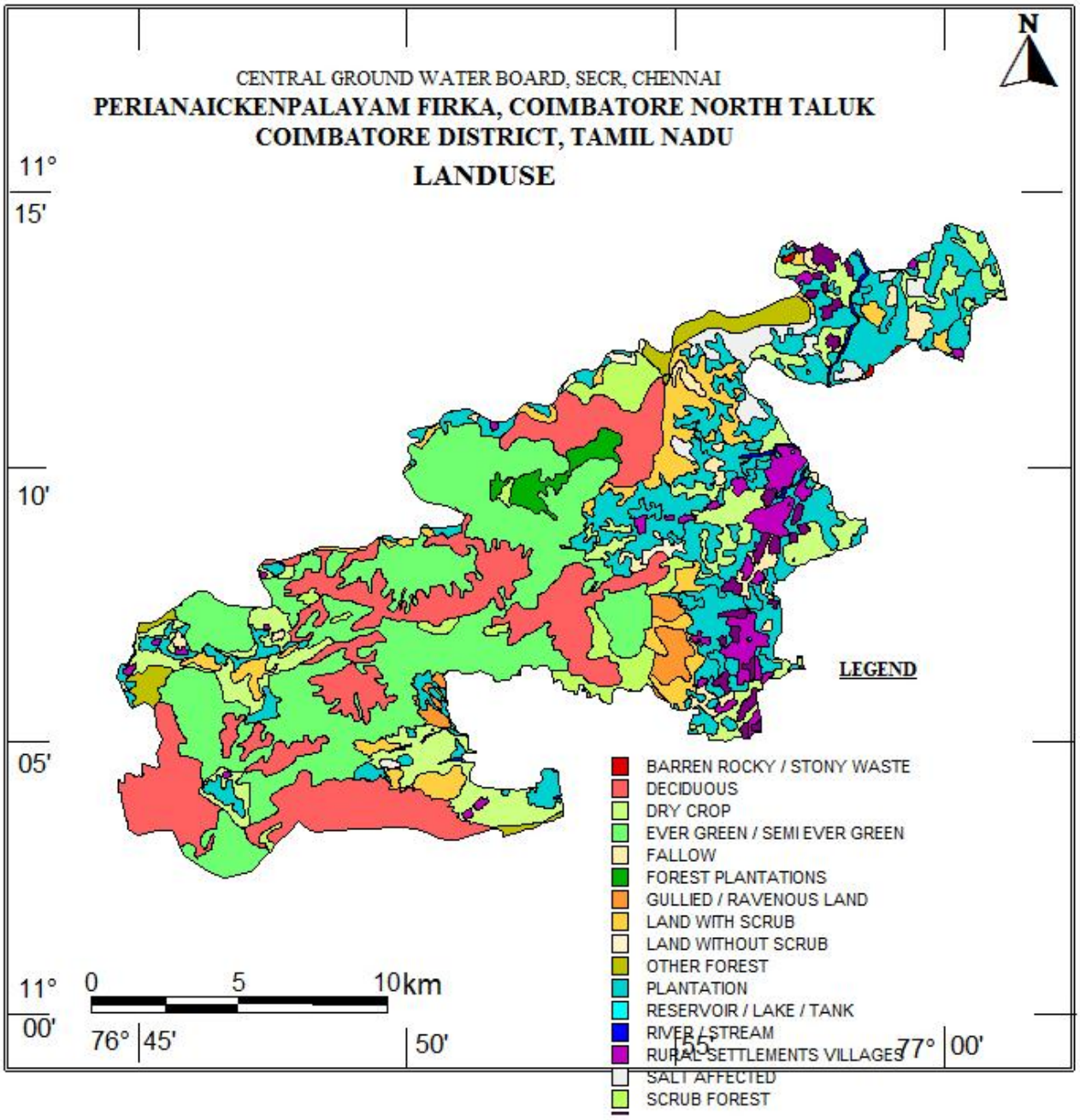


Figure - 3. Land Use map of P. N. Palayam Firka

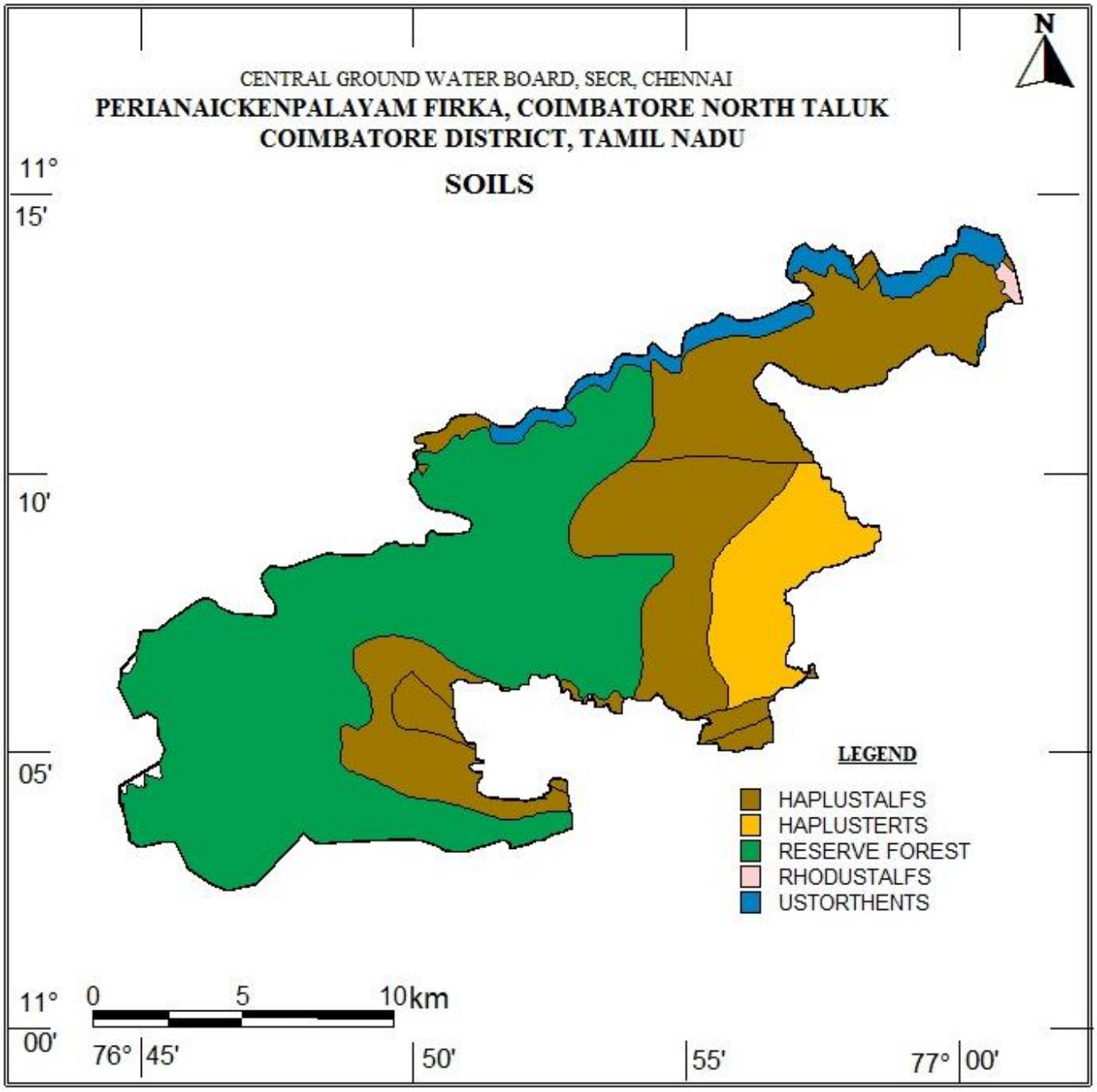


Figure - 3A. Soil map of P. N. Palayam Firka

3.4 Drainage

The entire Firka area is within the Bhavani river Basin. A number of small streams originate from the upland located in the P. N. Palayam Firka are seasonal floods inundate lower parts of the basins. Basin sub soil water is used to irrigate the lands. Tanks and surface water bodies are spread over the entire Firka. The drainage pattern is the dendritic and sub- dendritic. The drainage map of P. N. Palayam Firka is given in Figure - 4.

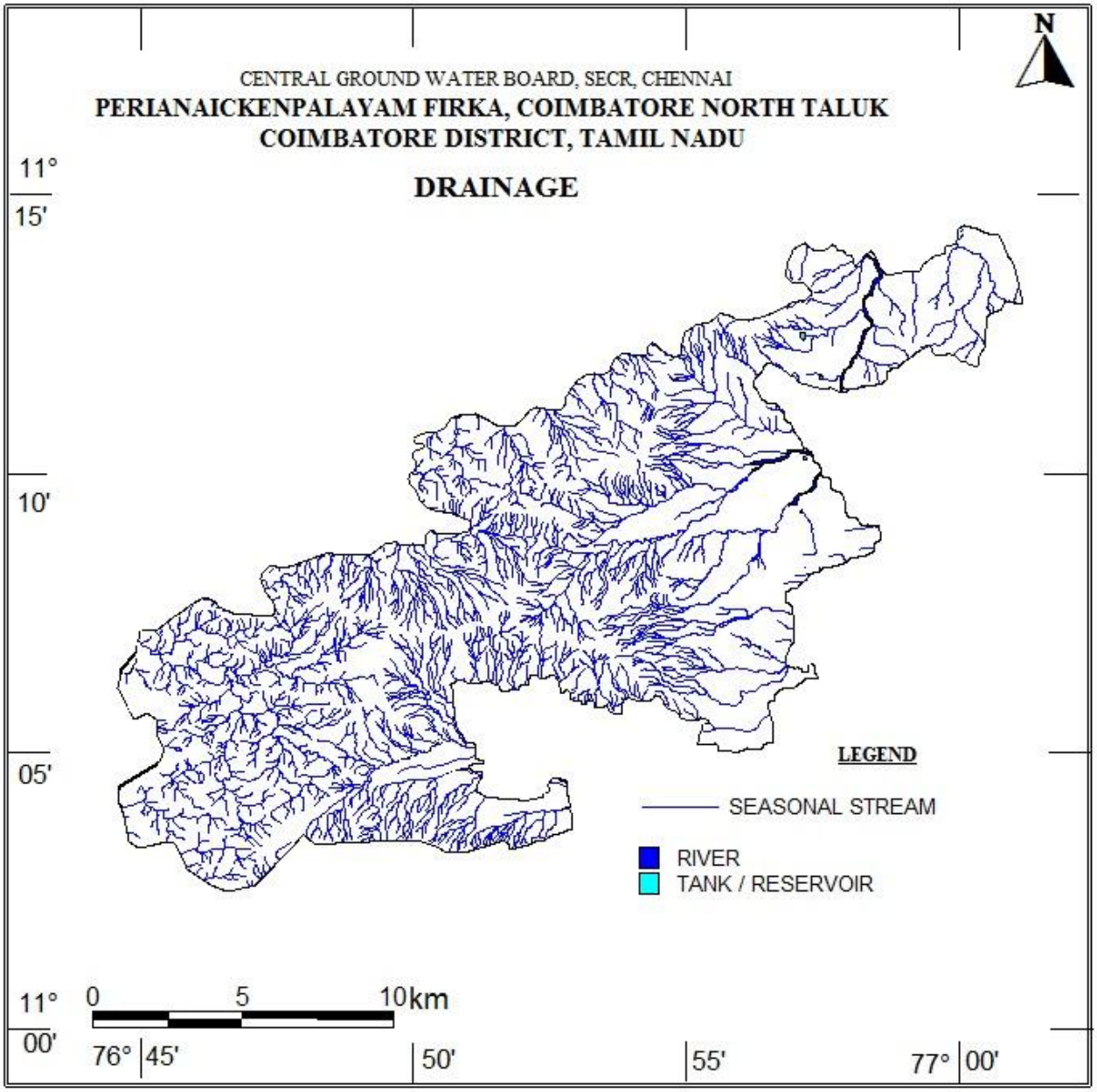


Figure - 4.Drainage map of P. N. Palayam Firka

3.5 Rainfall

P. N. Palayam area falls under tropical climate with temperature in the summer months of March to May. The average temperature varies from 26 to 41° C. The humidity is also high in the order of 80%. The wind speed is high during the months of July and August. The wind speed ranges from 7.4 to 12.6 km/hr, which increases from 100 to 120 km/hr during cyclone period.P. N. Palayam Firkas receives rainfall from southwest monsoon (June – September), northeast monsoon (October – December) and non-monsoon periods (January – May). The area receives the major rainfall from northeast monsoon. Rainfall is generally heavy during low-pressure depressions and cyclones during the northeast monsoon period. The normal annual rainfall is 948 mm.

Taluk	Name of Firkas	Area in sq.km	Monsoon rainfall (Jun to Dec) In m	Non monsoon rainfall (Jan – May) In m	Total Rainfall In m
Coimbatore (North)	P. N. Palayam	96.41390	0.725	0.223	0.948

3.6 Hydrogeology

The entire Firka is underlain by the crystalline and metamorphic gneiss complex. Groundwater is occurring in pheratic conditions in weathered and fractured gneiss rock formation of Archaean age. The weathering is erratic and the depth of abstraction structures is controlled by the intensity of weathering and fracturing.Large diameter dug well is more common groundwater abstraction structures in the area. The diameter of the dug well is in the range of 7 to 10 m and depth of dug wells range from 15 to 50 m bgl. The dug wells yield up to 1 lps in summer months and few wells remains dry. The yield is adequate for irrigation for one or two crops in monsoon period.

The hydrogeological map of P. N. Palayam Firka is given in Figure 5. Decadal mean water level ofpre-monsoon and post monsoon are given in fig 6 a & b respectively. The decadal maps reveal that, mean water level during pre-monsoon in majority area is < 6 m bgl like wise during post monsoon majority part is under < 5m below ground level.

The present water level in the firka is in the range of 2.6 to 13.6 m bgl.(May 2016)

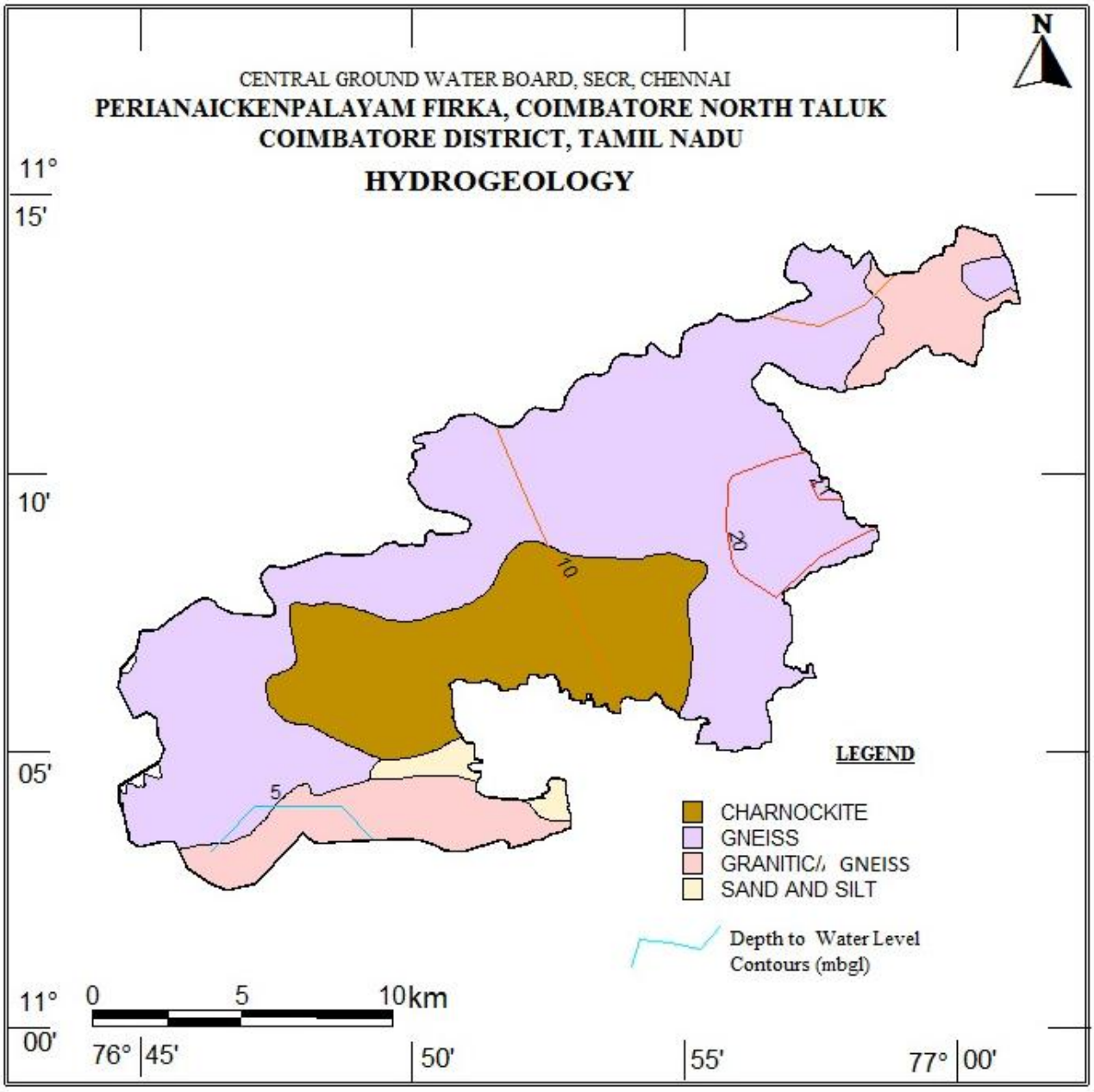


Figure - 5 Hydrogeological Map of P. N. Palayam Firka

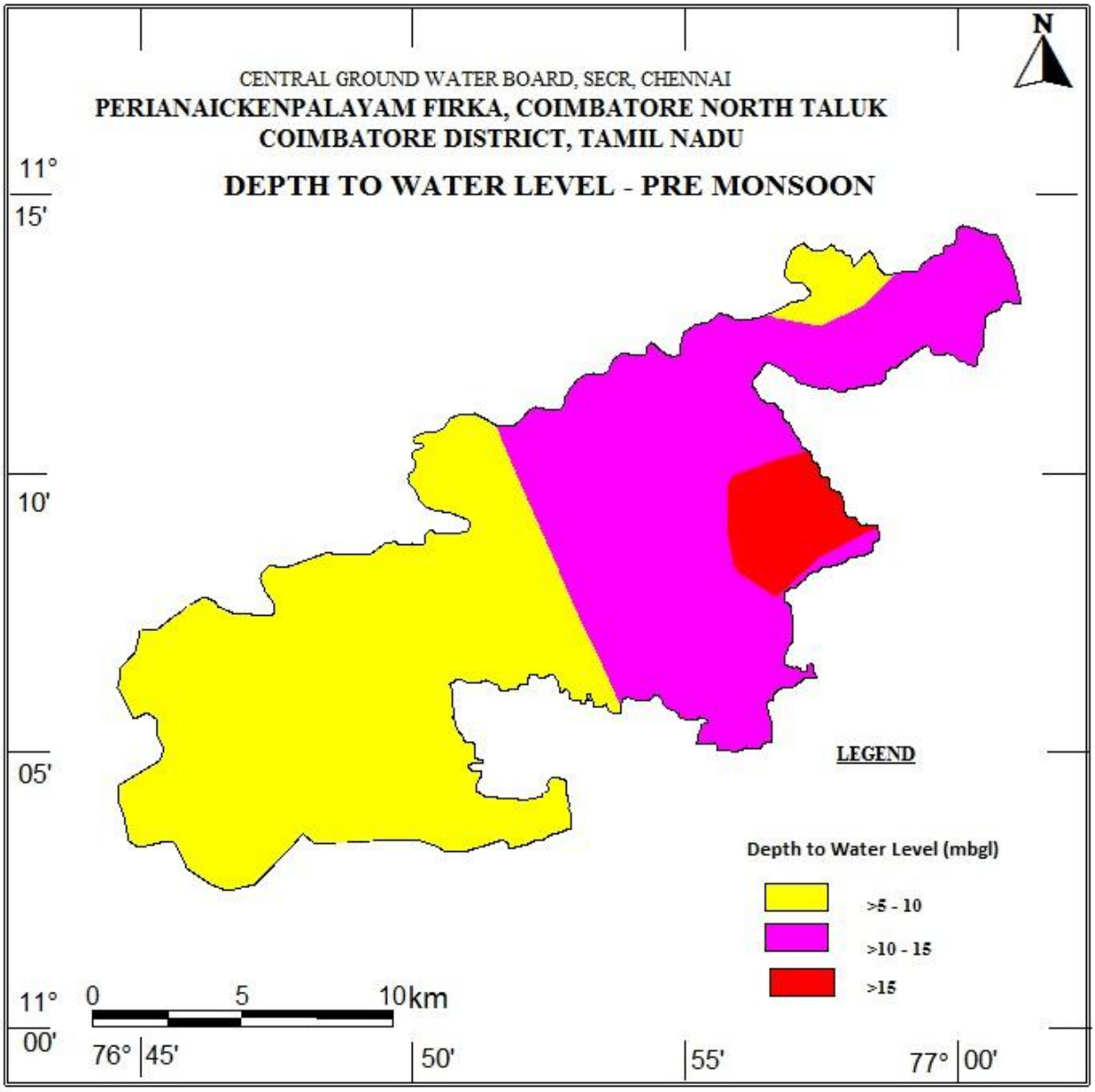


Figure - 6a.Pre -monsoon water level in P. N. Palayam Firka

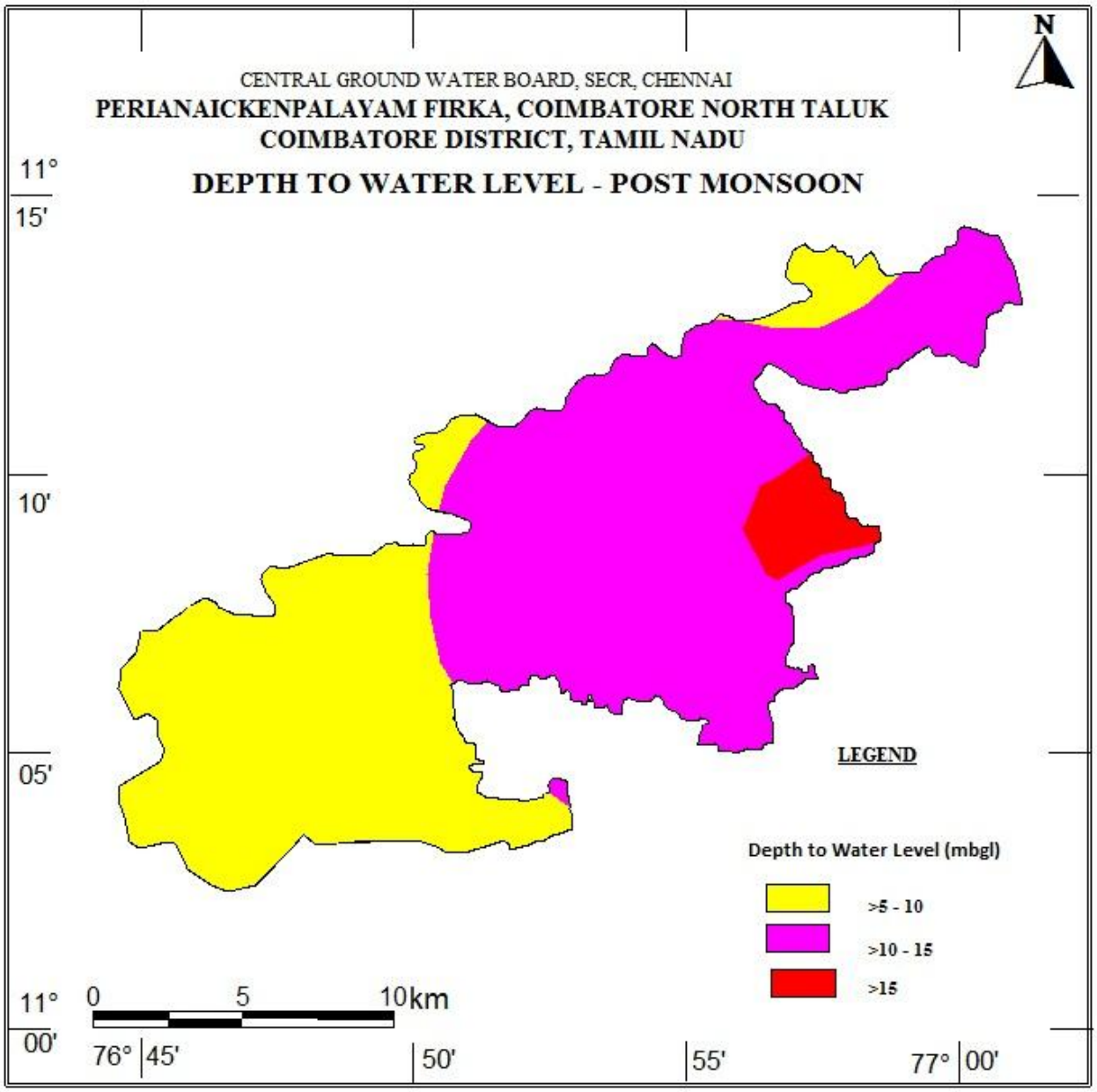


Figure 6 b. Post-monsoon water level in P. N. Palayam Firka

3.7 Dynamic Groundwater Resources

The groundwater resources have been computed jointly by Central Ground Water Board and State Groundwater Resources Data Centre (PWD, WRO, Govt. of Tamil Nadu) as on 31st March 2011. The computation has been done using GEC1997 methodology. The salient features of the computations are furnished in table 2.

Table 2. Dynamic Groundwater resources estimation of P. N. Palayam Firka

Firka	GW WORTHY AREA	REPLENISHABLE GROUNDWATER RESOURCES	NET GROUNDWATER AVAILABLE	GROUNDWATER DRAFT FOR IRRIGATION	GROUNDWATER DRAFT FOR DOMESTIC & INDUSTRIAL WATER SUPPLY	TOTAL GROUND WATER DRAFT	STAGE OF GROUND WATER DEVELOPMENT (%)	CATEGORY
	(Sq.Km)	(In MCM)					%	
P. N. Palayam	96.41390	12.1132	10.901	14.7494	1.2325	15.9819	146.61	OVER EXPLOITED

4. Spatial Data Integration

The potential area for groundwater recharge is highly influenced by Geology, Geomorphology, Land use /land cover, Drainage, Surface Water Body, Weathered Thickness and first fractured Depth in the area. In order to ascertain the suitable area for groundwater recharge in Firka, spatial data integration of have been attempted using index overlay model in GIS environ. In this model,above seven layers have been integrated byassigning weightage for the theme having scale of 1-100 and sub-classes of the theme between 1 to 10 scales.The resultant map has been reclassified into four classes(High-low integrated values) indicating the suitable area for artificial recharge and given in fig-7 and described below.

Zone	% Of Area Coverage	Significance*
Very high	0.5	Suitable for all major recharge structures like Percolation pond and Nala bund , check dam etc.,
High	13.4	Suitable for all major recharge structures like Nala bund , check dam etc.,
Moderate	38.2	Suitable for all major recharge structures like earthen check dam, Boulder check dam and Nala bund etc.,
Poor	47.9	Hilly/Forest /Catchment area

*However, the field verification is required to confirm above potential area for groundwater recharge.

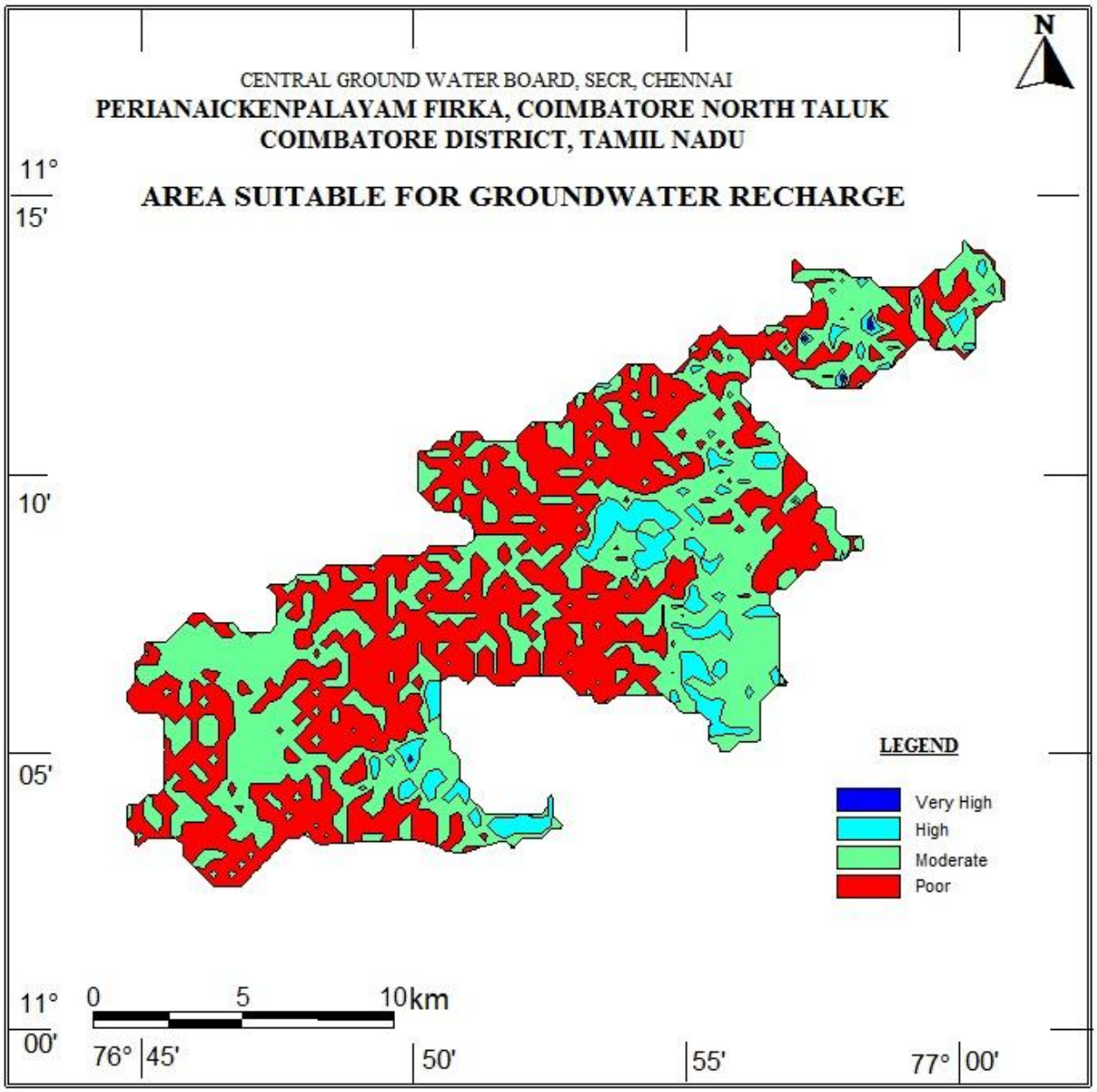


Figure 7showing the recharge worthy area P. N. Palayam Firka

5. Planning for groundwater recharge /conservation

5.1 Justification of the artificial recharge & conservation measures

- The P. N. Palayam Firka is with high stage of groundwater development i.e, 146.61 % and with sufficient amount of uncommitted surface runoff/flow of 10.485 MCM.
- The total weathered zone available beneath the ground in the Firka is 1156.9668 MCM. Out of these total volume available for recharge considering 7 m depth from 3 m) is 674.90 MCM.
- The P. N. Palayam Firka consists of surface water bodies /lakes (cover almost 10 % of the total area of the Firka) which are well connected by the drainage. Revival and Recharge of these ponds will enhance the sustainability of the groundwater abstraction structures.
- However, most of the groundwater developments for agricultural purposes are met through dug-cum bore well and bore wells only. Hence, there is sufficient scope of recharge.

- ❖ Model generated in the P. N. Palayam areas reveals that more than 80 % of areas are suitable for recharge.
- ❖ In P. N. Palayam Firka more than 50 % area is characterised by the agricultural activities, there is sufficient scope for the water conservation measures for enhance the crop production and better groundwater development.

5.2 Availability of surplus surface water for artificial recharge or conservation

The uncommitted surface flow for P. N. Palayam Firka is estimated as per the norms followed by State Ground & Surface Water Resources data centre, PWD, Taramani, Chennai (Aug 2015). The available of surplus surface water for P. N. Palayam Firka is 10.485 MCM.

5.3 Proposed interventions including tentative location of artificial recharge /conservation measures

On basis of above description the following three type of approach have been made to propose artificial recharge or conservation structures.

a. Artificial recharge
b. Water conservation measure /Water Efficiency

5.3.1 Artificial recharge

The details of artificial recharge structure proposed along with justification are given below.

5.3.1.1 Check dam/Nala bund

P. N. Palayam Firka area is covered by the seasonal nallahs/drains which carry heavy discharge during monsoon period this is debauched into the water bodies within a short duration. It is proposed that such seasonal nala rivers will be identified and the rain water will be harnessed through construction of series of check dams, nala bund and gabion structures so as to harness this water thereby increasing the resident period of the water in these channels and to increase the soil moisture content. As per the integrated model prediction around 30 % of the Firkas areas are suitable for these structures. It is proposed to construct 107 Check dam and 3 Nala bunds. The tentative location of these 110 ARs are given below and shown in Plate 1. The size and location of these structures are tentative and details field survey is essential to ascertain the exact size and location.

Tentative location of proposed 107 Check dam in P. N. Palayam Firka

S. No.	Latitude	Longitude	Type of ARS
1	11.2161	77.0009	Check Dam
2	11.2221	77.0103	Check Dam
3	11.2307	77.0074	Check Dam
4	11.2241	76.9961	Check Dam
5	11.2187	76.9790	Check Dam

S. No.	Latitude	Longitude	Type of ARS
6	11.2104	76.9746	Check Dam
7	11.2010	76.9714	Check Dam
8	11.2110	76.9624	Check Dam
9	11.2179	76.9642	Check Dam
10	11.2283	76.9613	Check Dam
11	11.2007	76.9248	Check Dam
12	11.2019	76.9306	Check Dam
13	11.1954	76.9194	Check Dam
14	11.1978	76.9213	Check Dam
15	11.1878	76.9202	Check Dam
16	11.1843	76.9213	Check Dam
17	11.1791	76.9240	Check Dam
18	11.1698	76.9277	Check Dam
19	11.1622	76.9158	Check Dam
20	11.1614	76.9294	Check Dam
21	11.1214	76.9164	Check Dam
22	11.1216	76.9262	Check Dam
23	11.1272	76.9178	Check Dam
24	11.1329	76.9196	Check Dam
25	11.1472	76.9184	Check Dam
26	11.1451	76.9210	Check Dam
27	11.1434	76.9066	Check Dam
28	11.1398	76.9034	Check Dam
29	11.1419	76.9014	Check Dam
30	11.1253	76.8731	Check Dam
31	11.1304	76.8771	Check Dam
32	11.1428	76.8869	Check Dam
33	11.1494	76.8918	Check Dam
34	11.1596	76.8924	Check Dam
35	11.1511	76.8970	Check Dam
36	11.1575	76.9078	Check Dam
37	11.1484	76.9037	Check Dam
38	11.1580	76.9026	Check Dam
39	11.1649	76.918	Check Dam
40	11.1496	76.9292	Check Dam
41	11.1617	76.8875	Check Dam
42	11.1831	76.8959	Check Dam
43	11.1939	76.8939	Check Dam
44	11.1797	76.8799	Check Dam
45	11.1806	76.8765	Check Dam
46	11.1891	76.8835	Check Dam
47	11.1929	76.9066	Check Dam
48	11.1701	76.8667	Check Dam
49	11.1767	76.2628	Check Dam
50	11.1734	76.2388	Check Dam
51	11.1680	76.8388	Check Dam
52	11.1656	76.8359	Check Dam
53	11.1649	76.8499	Check Dam
54	11.1418	76.8383	Check Dam
55	11.1470	76.8568	Check Dam

S. No.	Latitude	Longitude	Type of ARS
56	11.1362	76.8499	Check Dam
57	11.1343	76.8345	Check Dam
58	11.1469	76.8533	Check Dam
59	11.1476	76.8597	Check Dam
60	11.1542	76.8547	Check Dam
61	11.1446	76.8779	Check Dam
62	11.1383	76.8619	Check Dam
63	11.1091	76.9190	Check Dam
64	11.1007	76.9199	Check Dam
65	11.0742	76.8479	Check Dam
66	11.0751	76.8405	Check Dam
67	11.0965	76.8397	Check Dam
68	11.1006	76.8398	Check Dam
69	11.0779	76.8217	Check Dam
70	11.0621	76.7829	Check Dam
71	11.0532	76.7685	Check Dam
72	11.0636	76.7593	Check Dam
73	11.0672	76.7518	Check Dam
74	11.0706	76.7752	Check Dam
75	11.0615	76.7810	Check Dam
76	11.0841	76.7853	Check Dam
77	11.0676	76.7816	Check Dam
78	11.0949	76.7800	Check Dam
79	11.1037	76.7780	Check Dam
80	11.1027	76.7899	Check Dam
81	11.1118	76.7937	Check Dam
82	11.1088	76.7855	Check Dam
83	11.1091	76.7740	Check Dam
84	11.1108	76.7671	Check Dam
85	11.1087	76.7610	Check Dam
86	11.0881	76.7885	Check Dam
87	11.0797	76.7888	Check Dam
88	11.0854	76.7971	Check Dam
89	11.0911	76.7939	Check Dam
90	11.0913	76.7998	Check Dam
91	11.1051	76.8117	Check Dam
92	11.1129	76.7991	Check Dam
93	11.1193	76.8064	Check Dam
94	11.1210	76.7991	Check Dam
95	11.1211	76.7963	Check Dam
96	11.1181	76.7958	Check Dam
97	11.1187	76.7917	Check Dam
98	11.1187	76.7639	Check Dam
99	11.1127	76.7575	Check Dam
100	11.1073	76.7488	Check Dam
101	11.0904	76.7726	Check Dam
102	11.1334	76.8186	Check Dam
103	11.1377	76.1834	Check Dam
104	11.1332	76.7946	Check Dam
105	11.1174	76.7792	Check Dam

S. No.	Latitude	Longitude	Type of ARS
106	11.1189	76.8172	Check Dam
107	11.1304	76.8281	Check Dam

Tentative location of proposed 3 Nalla bund in P.N.Palayam Firka

Sl.No	Latitude (DD)	Longitude(DD)	Type of ARS
1	11.2052	76.9798	Nala Bund
2	11.2194	76.9864	Nala Bund
3	11.2247	76.9697	Nala Bund

5.3.1.3. Revival, repair of water bodies

The existing ponds and tanks in loose their storage capacity as well as the natural groundwater recharge through these water bodies has also become negligible due to siltation and encroachment by farmers for agriculture purposes. There are several such villages where ponds/ tanks are in dilapidated condition. These existing village tanks which are normally silted and damaged can be modified to serve as recharge structure in case these are suitably located to serve as percolation tanks. Through desilting, coupled with providing proper waste weir, the village tanks can be converted into recharge structure. Several such tanks are available in the area which can be modified for enhancing groundwater recharge. Studies, however, are needed to ascertain whether the village tanks are suitably located to serve as recharge structures. The locations of about 1 existing pond/tank have been identified with latitude and longitude given below and marked on Plate 1. The above 1 tanks/ponds could be taken up for the renovation with recharge shaft.

Tentative location of proposed de-siltation of pond/tanks with recharge shaft in P. N. Palayam Firka.

Sl.NO	LONGITUDE	LATITUDE	STRUCTURE	ACTION
1	76.9527	11.2079	TANK / RESERVOIR	DESILTING AND RECHARGE SHAFT

5.3.2 Water conservation measure

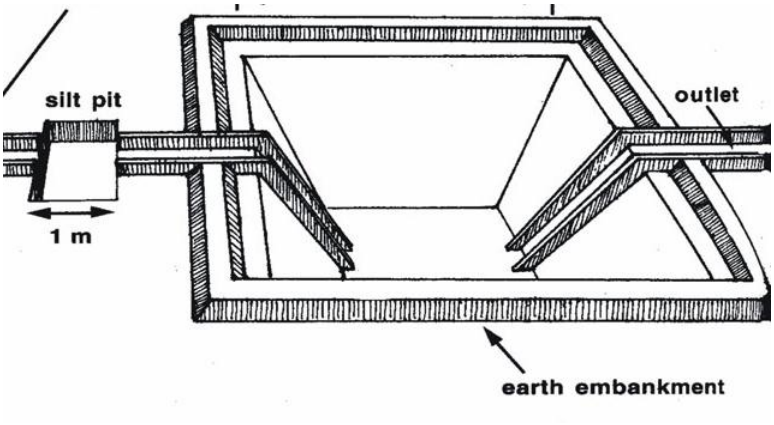
5.3.2.1 Farm Pond

A farm pond is a large dug out in the earth, usually square or rectangular in shape, which harvests rainwater and stores it for future use. It has an inlet to regulate inflow and an outlet to discharge excess water. The pond is surrounded by a small bund, which prevents erosion on the banks of the pond. The size and depth depend on the amount of land available, the type of soil, the farmer's water requirements, the cost of excavation, and the possible uses of the excavated earth. Water from the farm pond is conveyed to the fields manually, by pumping, or by both methods.

Advantages of Farm Ponds

- They provide water to start growing crops, without waiting for rain to fall.
- They provide irrigation water during dry spells between rainfalls. This increases the yield, the number of crops in one year, and the diversity of crops that can be grown.
- Bunds can be used to raise vegetables and fruit trees,thus supplying the farm household with an additional source of income and of nutritious food.
- Farmers are able to apply adequate farm inputs and perform farming operations at the appropriate time, thus increasing their productivity and their confidence in farming.
- They check soil erosion and minimize siltation of waterways and reservoirs.
- They supplies water for domestic purposes and livestock
- They promote fish rearing.
- They recharge the groundwater .
- They improve drainage.
- The excavated earth has a very high value and can be used to enrich soil in the fields, levelling land, and constructing farm roads

As per the Land use classification of the Firka, majority of the area is covered by the agricultural field. Hence it is proposed to construct 100 farm ponds as per the specification of AED, Govt. of Tamil Nadu (30 x 30 x 1.5 m).



5.3.2.2. Micro Irrigation System (Sprinkler/ drip/ HDPE pipes)

Micro irrigation is defined as the frequent application of small quantities of water directly above and below the soil surface; usually as discrete drops, continuous drops or tiny streams through emitters placed along a water delivery line

In flood/furrow irrigation method more than 50% of applied water is wasted through seepage to deeper level, localized inundation causes loss through evaporation and it leaches out the nutrients from the plant. While through drip & sprinkler irrigation wastage of irrigational water could be minimized. The studies on different crops, has revealed that irrigation water is saved drastically. The conveyance losses (mainly seepage & evaporation) can be saved up to 25 to 40% through utilization of HDPE pipes. Initially the scheme is proposed to be implemented in worst affected areas showing deepest water levels and significant declining trends. It is proposed to take up

micro irrigation system in 100 ha. The cost estimation for this component has been taken from SOR of Agricultural Engineering Department (AED), Govt. of Tamil Nadu.

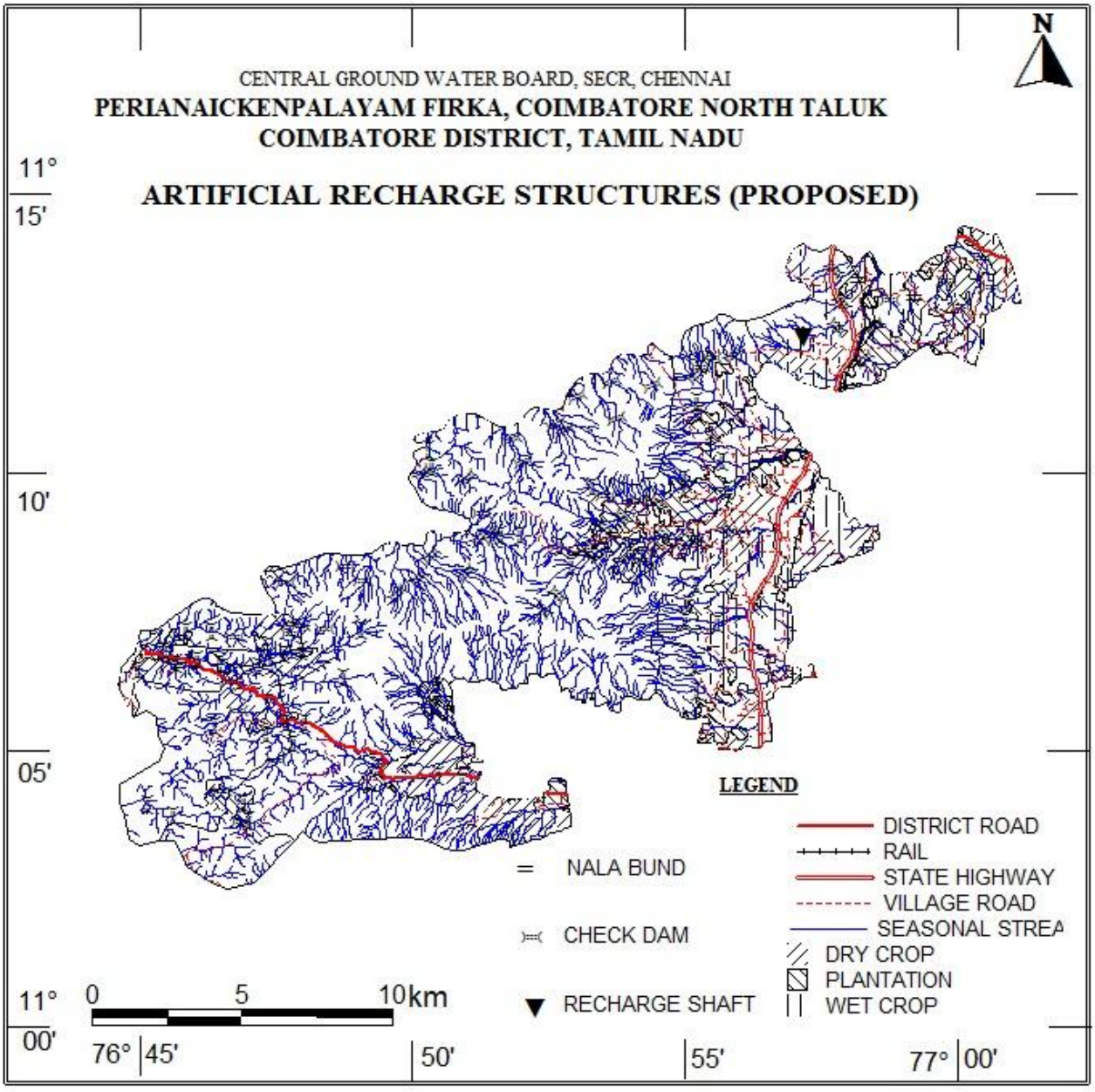


Plate 1. Location map showing the proposed AR Structures in P. N. Palayam Firka

6. Tentative Cost Estimation

A tentative number of feasible structures, its cost and expected annual ground water recharge /water saving is given in the table 7. The unit rates are as followed by the PWD, Govt. of Tamil Nadu (Sources : Schedule of rates , Govt. of Tamil Nadu 2015).

Table 7. Showing the Cost Estimation of proposed Artificial Recharge Structures

Feasible Artificial Recharge & Water Conservation structures/ activities	Tentative Design	quantity (in nos. or area in sq. m)	Total volume (cu.m)	Tentative unit cost (in Rs lakh)	Total tentative cost (in Rs lakh)	Expected Annual GW recharge /saving (cu.m)
Recharge Structures/ Activities						
Masonry Check dams (5 Fillings)	Crest- 10 -15 m; Height- 1 to 1.5 m	107	1819000	9	963	1455200
Nala bunds/ Gabion (4 Fillings)	Width: 5 to 15 m	3	9000	2.0	6	7200
Revival, repair of water bodies (3 fillings)	(~100mx100mx2.5m)	1	75000	12.0	12	60000
Recharge shaft (within pond /tank)	Recharge shaft of 1.5 m dia. with 2 m depth with filter media in lower 1 m Bore dia 10" Casing 6" Depth 30 m	1		2	2	
Water Conservation Activities						
Farm Pond (in ha) (5 filling)	(30 m x 30m x 1.5 m)	100 unit	600000	1	100	510000
Sprinkler/ drip/ HDPE pipes	For 1 ha with 5 m interval HDPE pipe	100 ha	1000000	0.6 /ha	60	700000
				Sub total	**1143**	**2732400**
Impact assessment and O & M						
PiezometersUp to 50 m bgl – 4 nos. @ 0.6 lakh					**2.4**	
Total cost of the project					**1145.4**	
O & M - 5 % of total cost of the scheme					**57.27**	
Impact assessment -5 % of total cost of the scheme					**57.27**	
				TOTAL	**1259.94**	

Note:

- The type, number and cost of structure may vary according to site, after the ground truth verification
- CD, PC – the storage of Check dams and percolation ponds is also proposed for irrigating the surrounding areas for enhancing the ground water recharge as well as effective utilisation of the artificial recharge structures.

7. Implementation modalities

The implementation of the scheme will be done by the line department of the state selected by the respective State authority. Further, it is to add that more than 50 % MGNREGA works related to water conservation/sustainable management, accordingly a convergence guideline has been made between National Rural Employment Guarantee Act (NREGA) (Ministry of Rural Development) & Programmes of Water Resources (MoWR , RD & GR). The Coimbatore district is is one among the list of districts identified for Convergence between NREGS and schemes of MoWR. The details of permissible works under convergence are envisaged in the Joint Convergence Guideline.

a.) Time schedule

Steps	1st Quarter	2th 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								

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 the rate of 5 % of the total cost of the project for 5 years from the completion of artificial recharge structures.

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