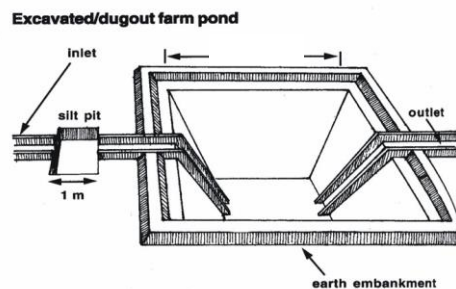




Plan on Artificial Recharge to Groundwater and Water Conservation in Vaiyappamalai Firka, Thiruchengode Taluk, Namakkal District, Tamil Nadu



By

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

August 2015

Content

S.No.	TOPIC
	At a Glance
1	Introduction
2	Objectives
3.	Study area details
	3.1 Location
	3.2 Geomorphological Setup
	3.3 Landuse and Soil
	3.4 Drainage
	3.5 Rainfall
	3.6 Hydrogeology
	3.7 Dynamic Ground water Resources
4	Spatial data integration/ conservation
5	Planning for recharge
	5.1 Justification of the artificial recharge
	5.2 Availability of surplus surface water for artificial recharge or conservation
	5.3 Proposed interventions including tentative location of artificial recharge structures and water conservation
	5.3.1 Artificial recharge
	5.3.1.1 Check Dam /Nala Bund
	5.3.1.2 Recharge shaft
	5.3.1.3. Revival , repair of water bodies
	5.3.2. Water Conservation Measure
	5.3.2.1 Farm Pond
	5.3.2.2 Micro irrigation system
6.	Tentative Cost Estimation
7.	Implication modalities
	a) Time schedule
	b) Operation and Maintenance

AT GLANCE	
Name of Firka	Vaiyappamalai
Taluk	Tiruchengode
District	Namakkal
State	Tamil Nadu
Total area	76.58
Total suitable area	75.05
Lat. & Lon.	11°23'08.16"to 11°28'57" & 77° 57' 54"to 78°07' 01.92".
Rainfall	0.789 m
Monsoon	0.608 m
Non- Mon soon	0.181 m
Geology	Charnockite, Gneiss and granitic acidic rock.
WATER LEVEL	
Pre - Monsoon	15.51 m bgl.
Post - Monsoon	7.18 m bgl.
GROUND WATER RESOURCES ESTIMATION	
Replenish able ground water resources	8.56 MCM
Net ground water available	7.7054 MCM
Ground water draft for irrigation	12.3110 MCM
Groundwater draft for domestic & industrial water supply	00.4110 MCM
Total ground water draft	12.7220MCM
Stage of ground water development	165%
Uncommitted surface runoff available for the Firka	6.985 MCM
Total volume of weathered zone	612.71 MCM
Total aquifer volume available for recharge (considering 7 m depth from 3 m bgl)	536.12 MCM
ARTIFICIAL RECHARGE /CONSERVATION MEASURES	
Structures Proposed (tentative)	
Masonry Check dam	2
Nalla Bund	6
Revival, repair of pond, tanks with recharge shaft	9
Improving Water Efficiency Micro irrigation system for 100 ha	7.0 MCM
Excepted groundwater recharge	1.0916 MCM
Total excepted groundwater recharge/saving	1.7916 MCM
Tentative total cost of the project	Rs:- 3.49 cr
Expected raise in water level by recharging/saving	0.79

Plan on Artificial Recharge to Groundwater and Water Conservation in Vaiyappamalai Firka, Thiruchengode Taluk, Namakkal 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 Ground Water Board in association with State Ground Water 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 firkas overexploited, 48 firkas critical, 235 firkas semi-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 Vaiyappamalai firka is 76.58 sq.km and Vaippamalai firka lies between North latitudes 23'08.16"to 11°28'57" and east longitudes 77° 57' 54"to 78°07' 01.92". Location map of Vaiyappamalai firka is given in Figure 1.

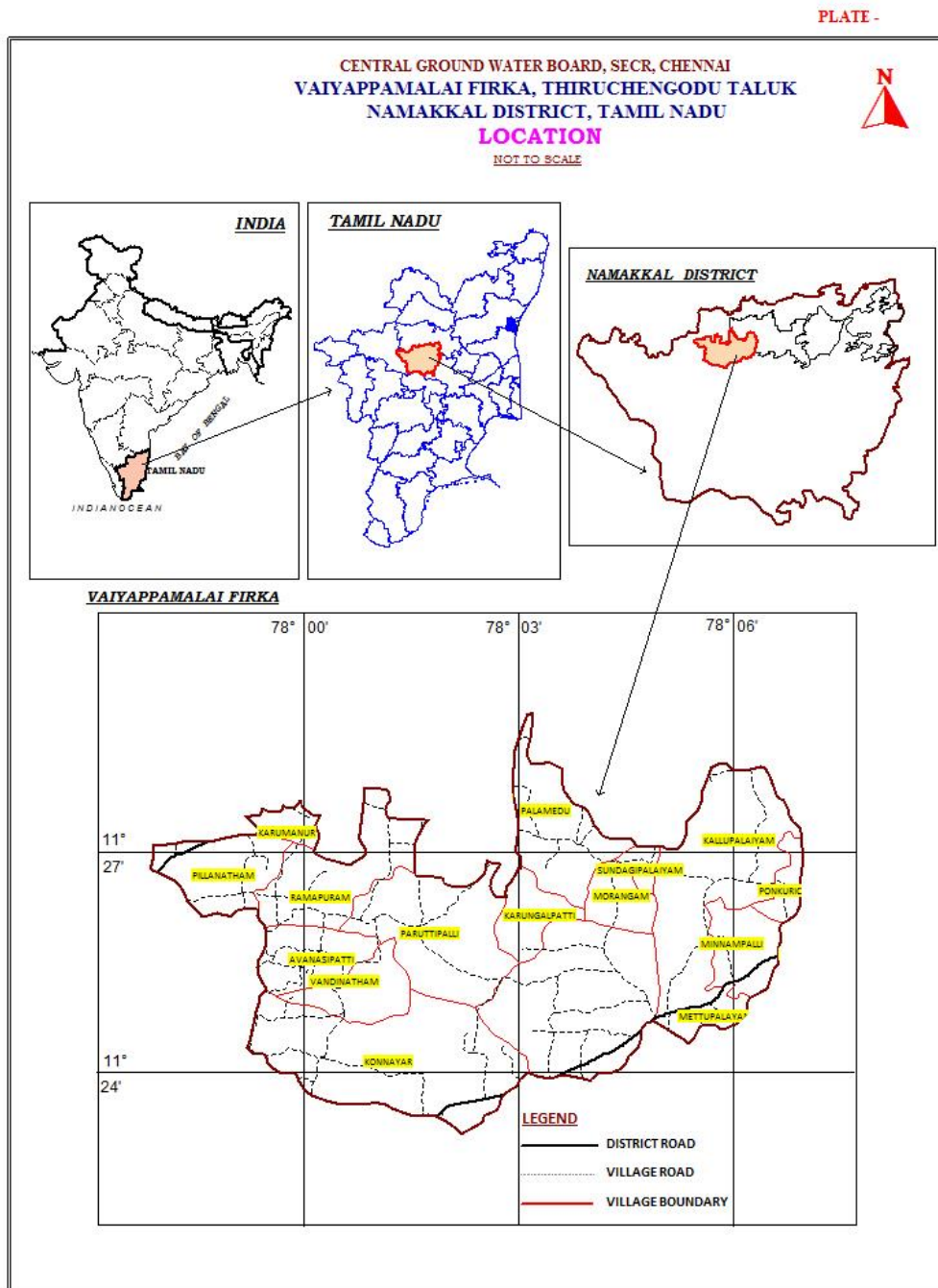


Figure 1. Location map of Vaiyappamalai firka

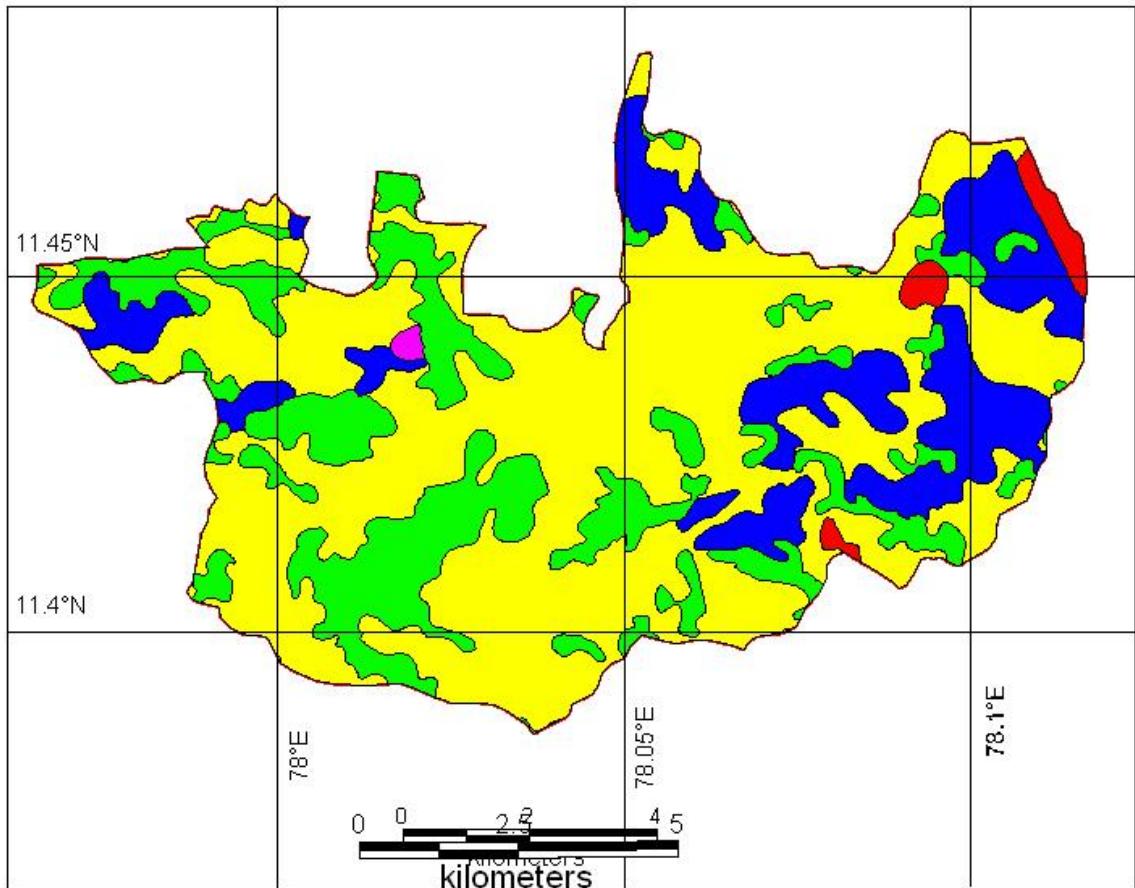
3.2 Geomorphological Set up

Geomorphologically, the area consists of hills and plain landforms. In plain landforms, Pediplain weathered moderate and shallow are occupied major part of the firka. These landforms are influencing the ground water 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 standards. The hills tract on the North West part of firka are collectively called Vaiyappamalai Hills. The range consists of a series of detached hills covered by reserved forests. 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 Vaiyappamalai firka

LAND FORM	AREA (Sq.km)	% AREA
SHALLOW	53.51	58.76
DISSECTED/UNDISSECTED	21.08	23.15
DENUDATIONAL HILLS / RESIDUAL HILLS	1.40	1.53
MODERATE	14.86	16.32
INSELBERG	0.22	0.24

Geomorpholgy
Vaiyappamalai Firka, Thiruchengode Taluk, Namakkal District, Tamil Nadu



Explanation

- DENUDATIONAL HILLS / RES
- DISSECTED/UNDISSECTED
- MODERATE
- PIEDMONT ZONE
- SHALLOW

Figure 2. Geomorphology of Vaiyappamalai Firka

3.3 Land use and soil

The land use pattern of the Vaiyappamalai 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 60 % 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 with loamy soil.

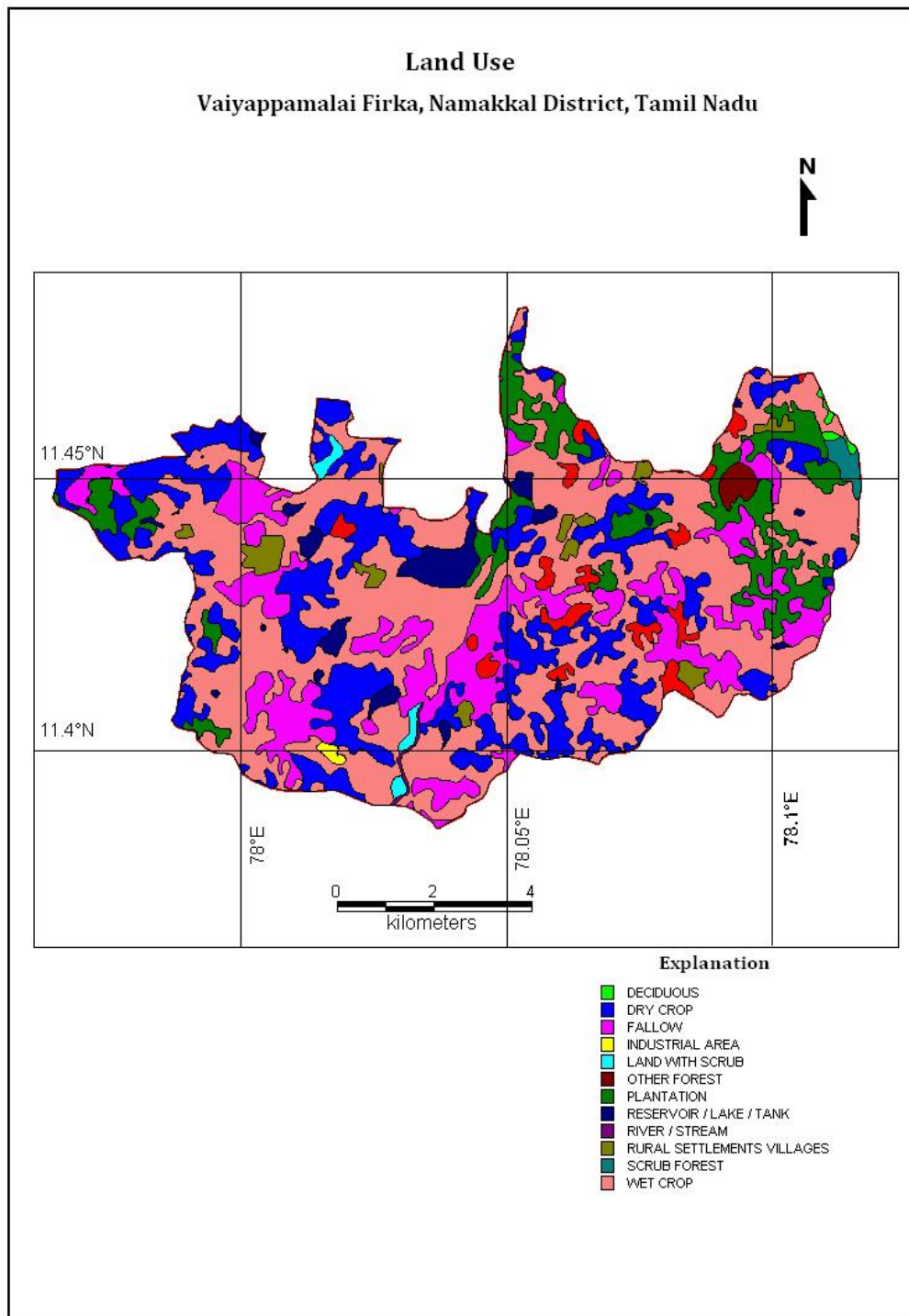


Figure 3. Landuse map of Vaiyappalai Firka

3.4 Drainage

The entire Firka area is within the cavuary river basin and number of small streams originate from the hills located in the Vaiyappamalai firka. Only 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 Vaiyappamalai firka is given in Fig 4.

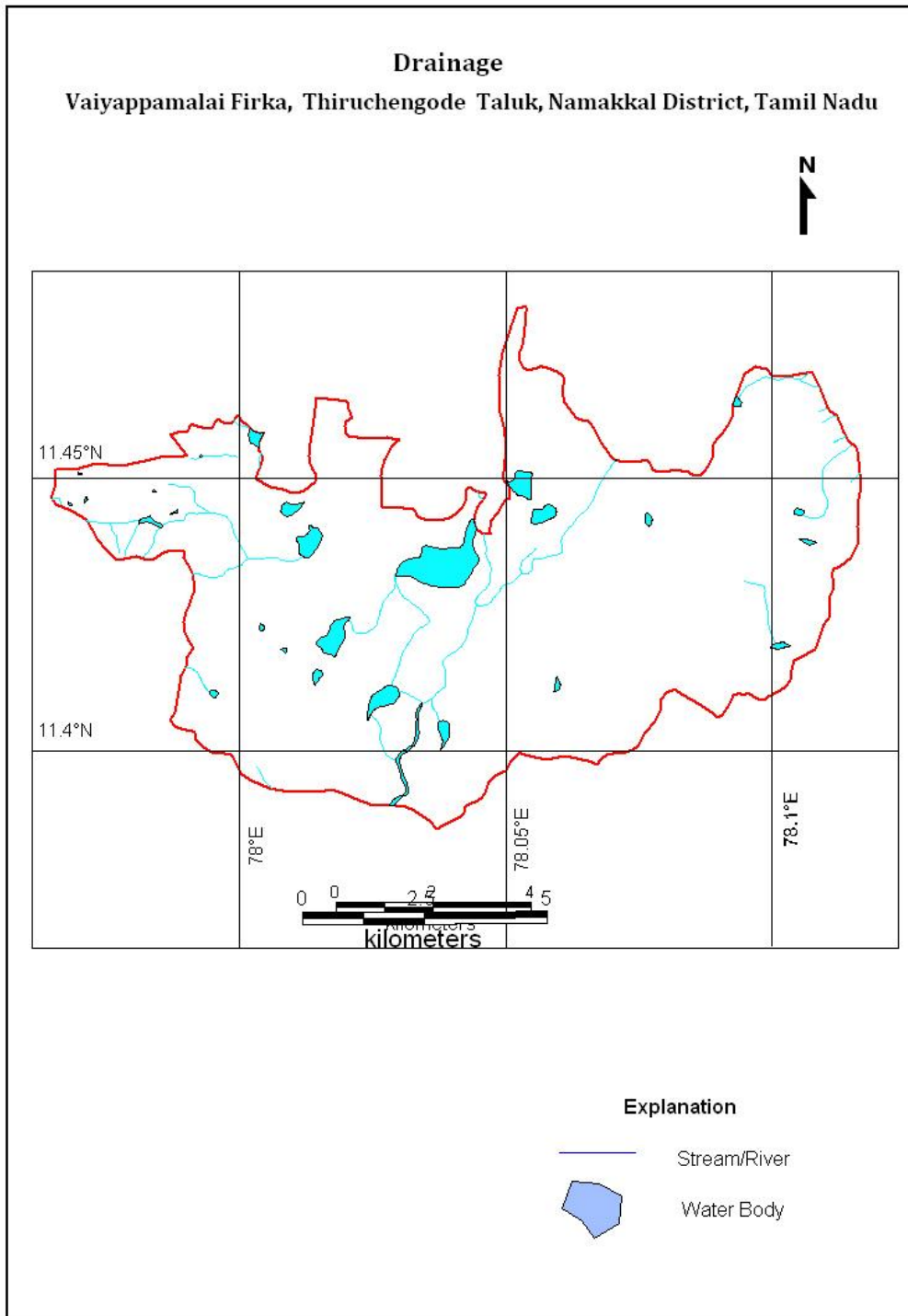


Figure 4. Drainage map of Vaiyappamalai Firka

3.5 Rainfall

Vaiyappamalai 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. Vaiyappamalai 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 0.789 mm and the higher is towards coasti.e, east part of the firka.

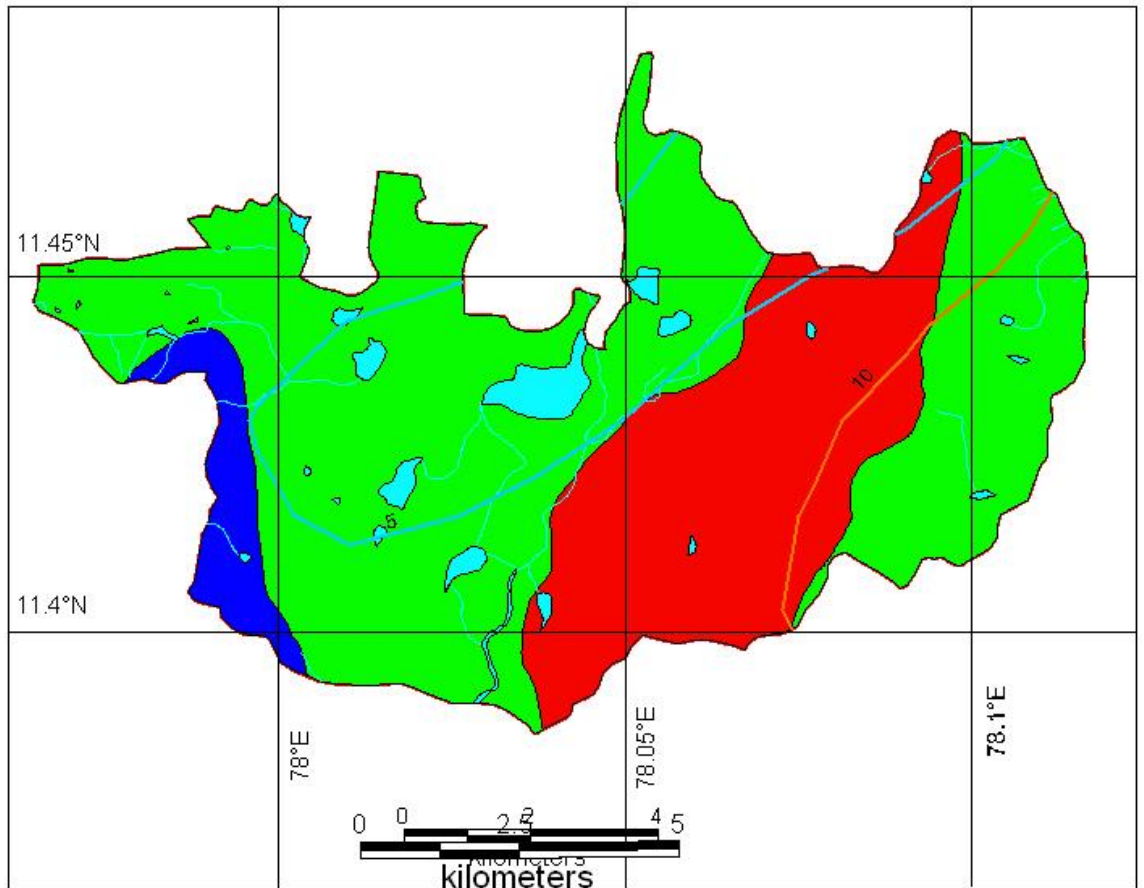
Taluk	Name of Firkas	Area sq.km	in	Monsoon rainfall (Jun to Dec) In m	Non monsoon rainfall (Jan – May) In m	Total Rainfall In m
	Vaiyappamalai	76.58		0.608	0.181	0.789

3.6 Hydrogeology

The entire firka is underlain by Charnockite gneiss and granitic with recent alluvial deposits occurring along the river courses and Colluvium at the foot hills. Ground water is occurring in pheratic conditions in weathered and fractured gneiss rock formation. The weathering is highly erratic and the depth of abstraction structures is controlled by the intensity of weathering and fracturing. Large diameter dug well is more common ground water 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 7 to 45m bgl. The yield of the poen wells ranges from less than 50 to 200 m³/day in the weathered crystalline rocks and upto 400m³/day in recent alluvial formations along major drainage courses. The yield is adequate for irrigation for one or two crops in monsoon period.

The depth of wells varies from 7 - 45 m bgl. Water levels in observation wells tapping shallow aquifers is 15.51 m bgl during pre- monsoon (May2014) and 7.18 m bgl during post monsoon (Jan'2015). The hydrogeological map of Vaiyappamalai firka is given in Figure 5. Decadal mean water level of pre-monsoon and post monsoon are given in fig 6 a & b. The decadal maps reveal that mean water level during pre-monsoon in majority area is 2 to 20 m bgl likewise during post monsoon majority part is under 2 to 10 ground water level.

Hydrogeology
Vaiyappamalai Firka, Thiruchengode Taluk, Namakkal District, Tamil Nadu



Explanation

- CHARNOCKITE
- GNEISS
- GRANITIC/ACIDIC ROCKS

Depth to water level (m bgl)

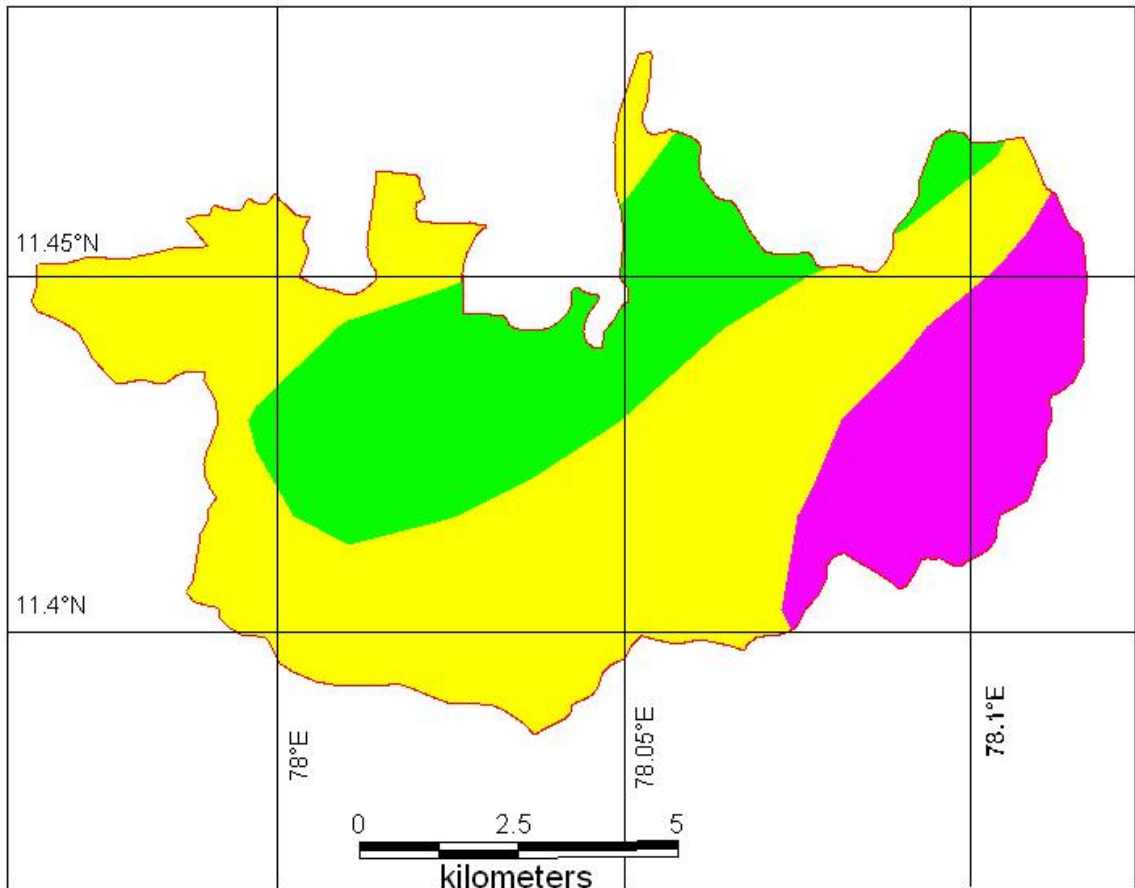
- 5
- 10

Stream/River

Water Body

Figure 5 Hydrogeological Map of Vaiyappamalai Firka

Depth to water level - Premonsoon
Vaiyappamalai Firka, Thiruchengode Taluk, Namakkal District, Tamil Nadu



Depth to water level (m bgl)

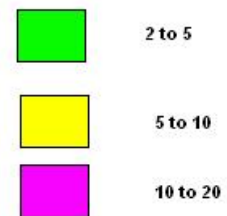
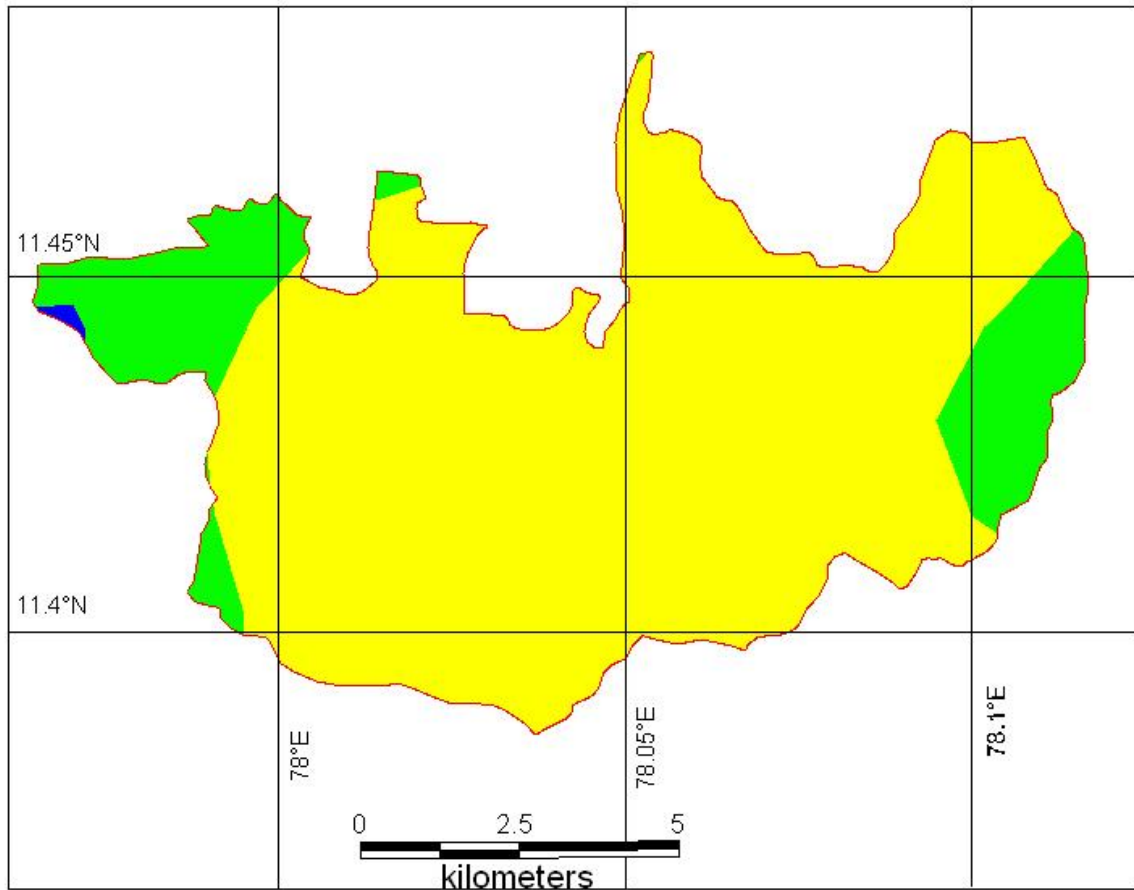


Figure 6a. Pre -monsoon water level in Vaiyappamalai firka(Decadal)

Depth to water level - Postmonsoon
Vaiyappamalai Firka, Thiruchengode Taluk, Namakkal District, Tamil Nadu



Depth to water level (m bgl)

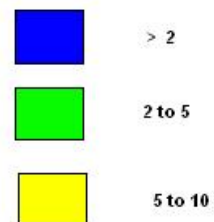


Figure 6 b. Post-monsoon water level in Vaiyappamalai firka(Decadal)

3.7 Dynamic Ground water Resources

The ground water resources have been computed jointly by Central Ground Water Board and State Ground Water 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 Ground water resources estimation of Gingee firka

Firka	GW WORTHY AREA	REPLENISHABLE GROUND WATER RESOURCES	NET GROUND WATER AVAILABLE	GROUND WATER DRAFT FOR IRRIGATION	GROUNDWATER DRAFT FOR DOMESTIC & INDUSTRIAL WATER SUPPLY	TOTAL GROUND WATER DRAFT	STAGE OF GROUND WATER DEVELOPMENT (%)	CATEGORY
	(Sq.Km)	(In MCM)					%	
Vaiyapp amalai	76.58	8.5615	7.7054	12.3110	00.4110	12.722	165	OVER EXPLOITED

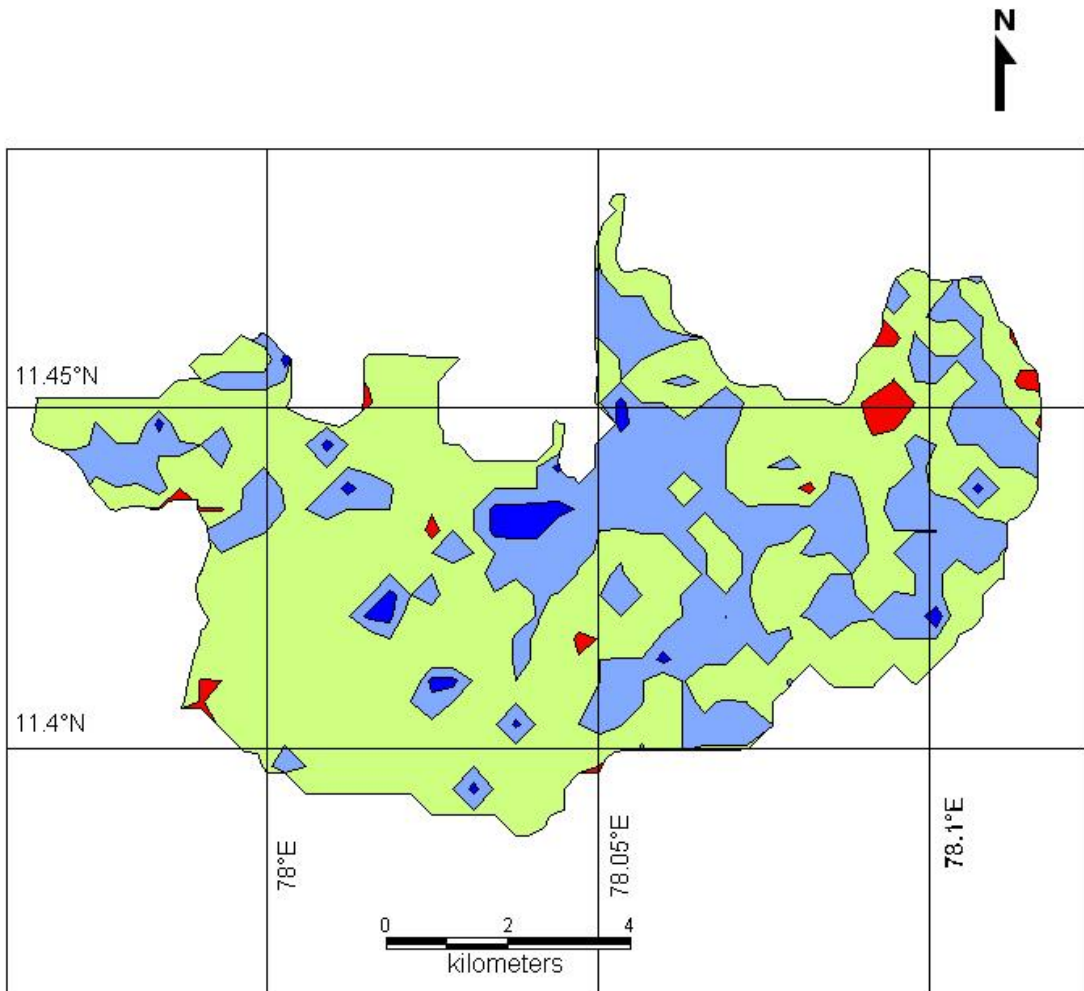
4. Spatial Data Integration

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 have been attempted using index overlay model in GIS environ. In this model, above seven layers have been integrated by assigning 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	1	Suitable for all major recharge structures like Percolation pond and nalla bund, check dam etc.,
High	31	Suitable for all major recharge structures like nalla bund, check dam etc.,
Moderate	67	Suitable for all major recharge structures like earthen check dam, Boulder check dam and Nala bund etc.,
Poor	1	Hilly/Forest /Catchment area

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

Area suitable for artificial recharge
Vaiyappamalai Firka, Thiruchengode Taluk, Namakkal District, Tamil Nadu



Explanation

Area suitable for recharge

-  Very High
-  High
-  Moderate
-  Poor

Figure 7: showing the recharge worthy area Vaiyappamalai firka

5. Planning for groundwater recharge /conservation

5.1 Justification of the artificial recharge & conservation measures

- ❖ The Vaiyappamalai is with high stage of groundwater development i.e, 165 % and with sufficient amount of uncommitted surface runoff/flow of 6.98 MCM.
- ❖ The total weathered zone available beneath the ground in the firka is 10 m. Out of these total volume available for recharge is 536 MCM.
- ❖ The water levels in the pre and post season are within range of 10 to 15 m
- ❖ However, most of the ground water 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 Vaiyappamalai areas reveals that more than 99 % of areas are suitable for recharge.
- ❖ In Vaiyappamalai firka more than 70 % area is characterised by the agricultural activities, there is sufficient scope for the water conservation measures for enhance the crop production and better ground water development.

5.2 Availability of surplus surface water for artificial recharge or conservation

The uncommitted surface flow for Vaiyappamalai 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 Vaiyappamalai Firka is 6.98 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
- c. 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

Vaiyappamala firka area is covered by the seasonal nallahs/drains which carry heavy discharge during monsoon period along with heavy silt load and 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 dam and nalla bund 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 2 Check dam and 6 Nala

bunds. The tentative location of these 8 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 2 nos of Check dam in Vaiyappamalai firka

S.No	Longitude	Latitude	Structure
1	78.0435	11.4235	Check Dam
2	78.0024	11.435	Check Dam

Tentative location of proposed 6 nos of Nalla bund in Vaiyappamalai firka

S.No	Longitude	Latitude	Structure
1	77.9738	11.442	Nalla Bund
2	77.9942	11.4319	Nalla Bund
3	77.992	11.4457	Nalla Bund
4	78.0672	11.4471	Nalla Bund
5	78.1099	11.4512	Nalla Bund
6	78.1078	11.4674	Nalla Bund

5.3.1.2. Recharge Shaft

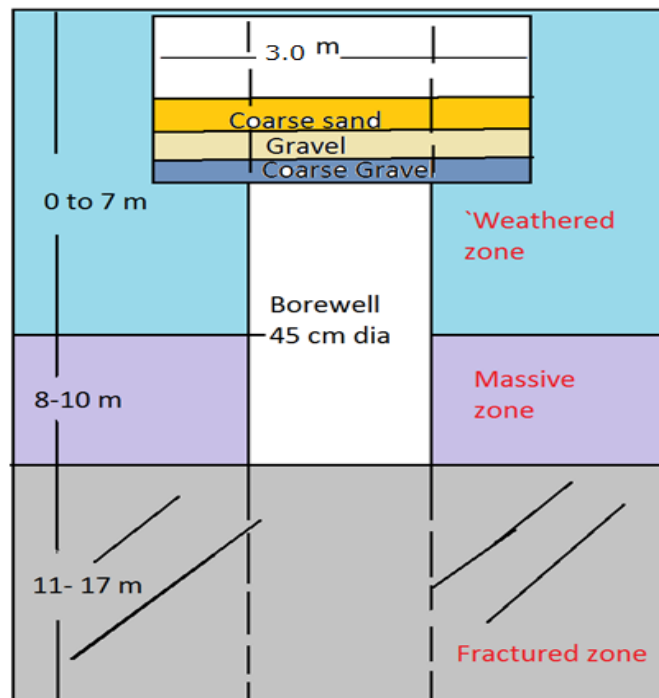


Figure 8. b Cross section of Recharge shaft

5.3.1.3. Revival, repair of water bodies

The existing ponds and tanks in loose their storage capacity as well as the natural ground water 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 ground water recharge. Studies, however, are needed to ascertain whether the village tanks are suitably located to serve as recharge structures. The locations of about 9 nos of existing ponds/tanks have been identified with latitude and longitude given below and marked on Plate 1. The above 9 tanks/ponds could be taken up for the renovation with recharge shaft (recharge shaft as per design described above) on priority. Thus total 270000 cu. m of rainwater could be harvested by revival of ponds/tanks alone.

Tentative location of proposed de-siltation of pond/tanks with recharge shaft in Vaiyappamalai firka.

S.No	Longitude	Latitude	Structure
1	78.0598	11.4118	Desiltation with recharge shaft
2	77.9953	11.4107	Desiltation with recharge shaft
3	78.0041	11.4228	Desiltation with recharge shaft
4	77.9833	11.4426	Desiltation with recharge shaft
5	78.0767	11.4424	Desiltation with recharge shaft
6	78.0935	11.4641	Desiltation with recharge shaft
7	78.1053	11.4439	Desiltation with recharge shaft
8	78.1073	11.4381	Desiltation with recharge shaft
9	78.1016	11.4192	Desiltation with recharge shaft

Water conservation measure

5.3.2.1 Farm Pond

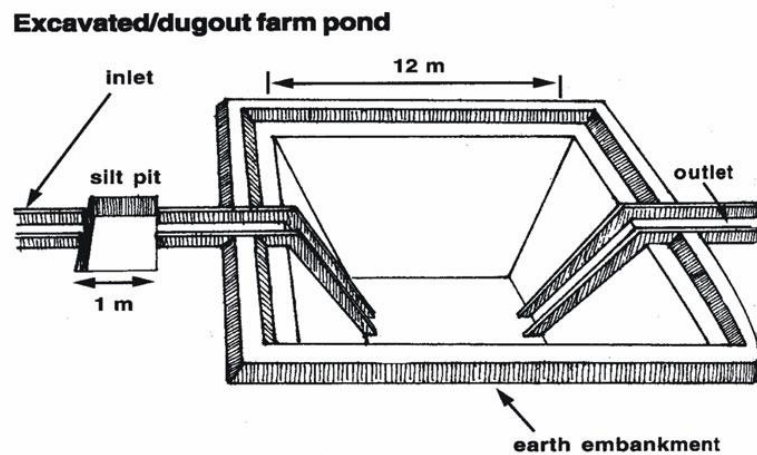
A farm pond is a large dug out in the earth, usually square or rectangular in shape, which harvests rainwater and stores it for future use. It has an inlet to regulate inflow and an outlet to discharge excess water. The pond is surrounded by a small bund, which prevents erosion on the banks of the pond. 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 ground water.
- 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 Landuse 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). These 100 farm ponds can hold/ harvest about 202500 cum of rainfall runoff in Single Filling. Considering 4 filling this can accommodate 540000 MCM of runoff rainfall.



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

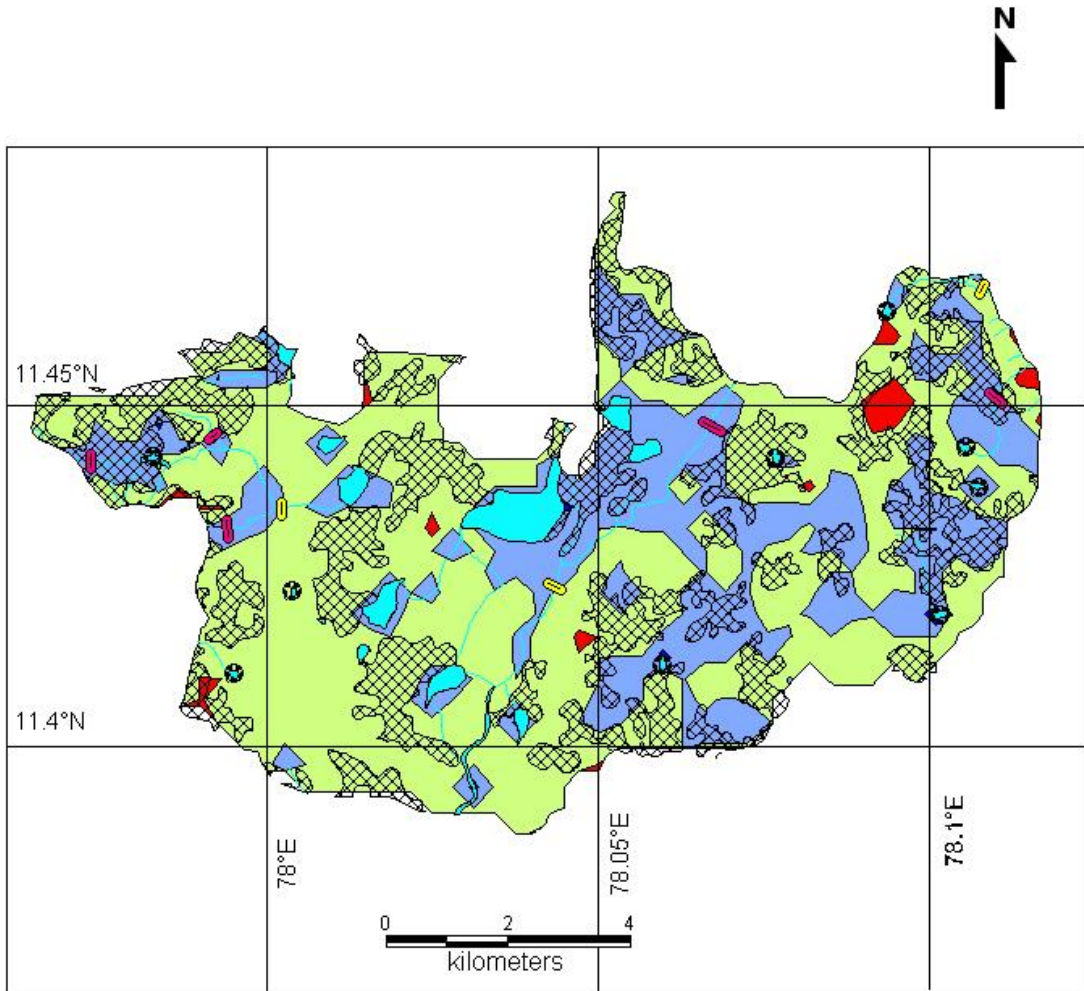
Micro irrigation is defined as the frequent application of small quantities of water directly above and below the soil surface; usually as discrete drops, continuous drops or tiny streams through emitters placed along a water delivery line

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. Tentative locations of proposed micro irrigation are shown in Plate 1.

Artificial recharge structures (Proposed)

Vaiyappamalai Firka, Thiruchengode Taluk, Namakkal District, Tamil Nadu



Explanation

Area suitable for recharge

- Very High
- High
- Moderate
- Poor

Area suitable for recharge

- Nalla Band
- Check dam
- ⊗ Desiltation of tanks cum recharge shaft
- Area suitable for micro irrigation and farm pond

- water body
- Stream

Figure.8 Location map showing the proposed AR Structures in Vaiyappamalai firka

6. Tentative Cost Estimation

The tentative cost for different activities is given in table below. The unit rates are as followed by the PWD, Govt. of Tamil Nadu (Sources the total estimated cost of the project is Rs 5.004 crores. It is expected that 60 % of total annually recharge is about 48.96 ham (0.49 MCM) of available monsoon runoff can be recharged to ground water. It is also expected to reduce ground water withdrawal through best irrigational and on-farm practices. A tentative number of feasible structures and cost is given in the table 7.

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 (cu.m)
Recharge Structures/ Activities						
Masonry Check dams (4 Fillings)	Crest- 20 -15 m; Height- to 1 m	2	34000	9	18	27200
Nala bunds/ Gabion (4 Fillings)	Width: 10 to 15 m	6	18000	2	12	14400
Revival, repair of water bodies (3 fillings)	(~100mx100mx1m)	9	675000	12	108	540000
Recharge shaft with the pond /tanks	(3 m dia. with bore well up to 20 m)	9		2	18	
Water Conservation Activities						
Farm Pond (in ha) (4 filling)	(30 m x 30m x 1.5 m) 900 sq.m or 0.1 ha	100 unit	600000	1	100	510000
Sprinkler/ drip/ HDPE pipes for 300 ha select area	For 1 ha with 5 m interval HDPE pipe	100 ha	1000000	0.6	60	700000
Sub total					316	1791600
Impact assessment and O & M						
Piezometers Up to 50 m bgl – 3 nos. @ 0.6 lakh					1.8	
Total cost of the project					317.8	
O & M - 5 % of total cost of the scheme					15.89	
Impact assessment to be carried out by the implementing agencies @ 5% of total cost					15.89	
TOTAL					349.58	

Note: The type, number and cost of structure may vary according to site, after the ground truth verification

7. Implication 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 district Villupuram 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	1 st Quarter	2 th Quarter	3 rd Quarter	4 th Quarter	5 th Quarter	6 th Quarter	7 th Quarter	8 th 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 a have impact assessment at rate of 5 % of the total cost of the project for 5 years from the completion of artificial recharge.

Prepared under Supervision of

Shri. A. Subburaj, Head of Office, CGWB, SECR, Chennai

Nodal Officer

Dr.S.Subramanian, Senior Hydrogeologist, CGWB, SECR, Chennai

Program – Core Working Committee

Shri. A. Ravi, Sr.Hg (Scientist- D, **CGWB, SECR, Chennai**)

Dr. S. Subramanian, Sr.Hg (Scientist- D, **CGWB, SECR, Chennai**)

Ms. D. Dhayamalar, Sr.Hg (Scientist- D, **CGWB, SECR, Chennai**)

Dr.B. Umapathi, Sr.Hg (Scientist- D, **CGWB, SECR, Chennai**)

Shri. R. Arumugam , Scientist D, **CGWB, SECR, Chennai**

Compiled by

Dr.S.Subramanian, Senior Hydrogeologist, **CGWB, SECR, Chennai**



CONSERVE WATER FOR SUSTENANCE, PROSPERITY AND HAPPINESS



Contact for further details

The Regional Director

Central Ground Water Board

South Eastern Coastal Region

E1, C Block, Rajaji Bhawan

Besant Nagar

Chennai –600090

