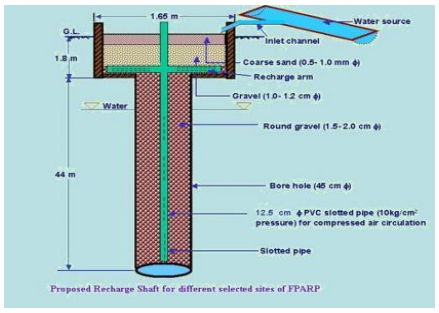
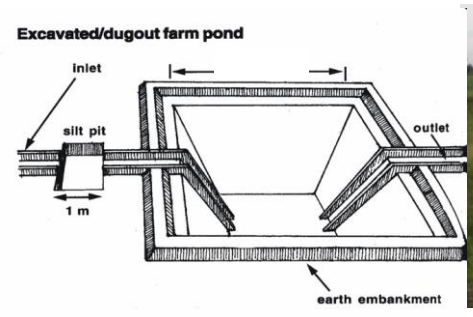
# Plan on Artificial Recharge to Groundwater and Water Conservation in Uludurpettai Firka, Ulundurpettai Taluk, Villupuram District, Tamil Nadu




**By**

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

| AT GLANCE | |
|---|---|
| Name of Firka | Ulundurpettai |
| Taluk | Ulundurpettai |
| District | Villupuram |
| State | Tamil Nadu |
| Total area | 119.62 |
| Total suitable area | 75.37 |
| Lat. & Lon. | North latitudes 11° 35’ 45.96” to 11° 46’ 30.23” and east longitudes 79° 10’ 56.7”to 79° 19’ 48.39” |
| Rainfall | 985 mm |
| Monsoon | 875 mm |
| Non- Mon soon | 110 mm |
| Geology | Gneiss complex, Lime stone, sand stone and conglomerate. |
| **WATER LEVEL** | |
| Pre - Monsoon | 5 to 12m bgl. |
| Post - Monsoon | 6 to 12 m bgl. |
| **GROUND WATER RESOURCES ESTIMATION** | |
| Replenish able ground water resources | 23.44 MCM |
| Net ground water available | 21.10 MCM |
| Ground water draft for irrigation | 26.61 MCM |
| Groundwater draft for domestic & industrial water supply | 0.74 MCM |
| Total ground water draft | 27.35 MCM |
| Stage of ground water development (%) | 129.65 |
| Uncommitted surface runoff available for the Firka | 15.7 MCM |
| Total volume of weathered zone | 38.46 MCM |
| Total volume available for recharge | 44.88 MCM |
| **ARTIFICIAL RECHARGE /CONSERVATION MEASURES** | |
| Structures Proposed ( tentative)<br>Masonry Check dam<br>Nalla Bund<br>Revival, repair of pond, tanks with recharge shaft | <br>11<br>21<br><br>16 |
| Improving Water Efficiency / saving<br>Micro irrigation system for 100 ha | 0.7 MCM |
| Excepted groundwater recharge | 2.006 MCM |
| Total expected groundwater recharge/ saving | 2.706 MCM |
| Tentative total cost of the project | Rs. 5.795 Cr |
| Expected raise in water level by recharging /saving | 2.362 m |

# Plan on Artificial Recharge to Groundwater and Water Conservation in Ulundurpettai, Ulundurpettai Taluk, Villupuram 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, 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 Ulundurpettai firka is 119.62 sq.km and Ulundurpettai firka lies between North latitudes 11° 35’ 45.96” to 11° 46’ 30.23” and east longitudes 79° 10’ 56.7”to 79° 19’ 48.39”. Location map of Ulundurpettai firka is given in Figure 1.

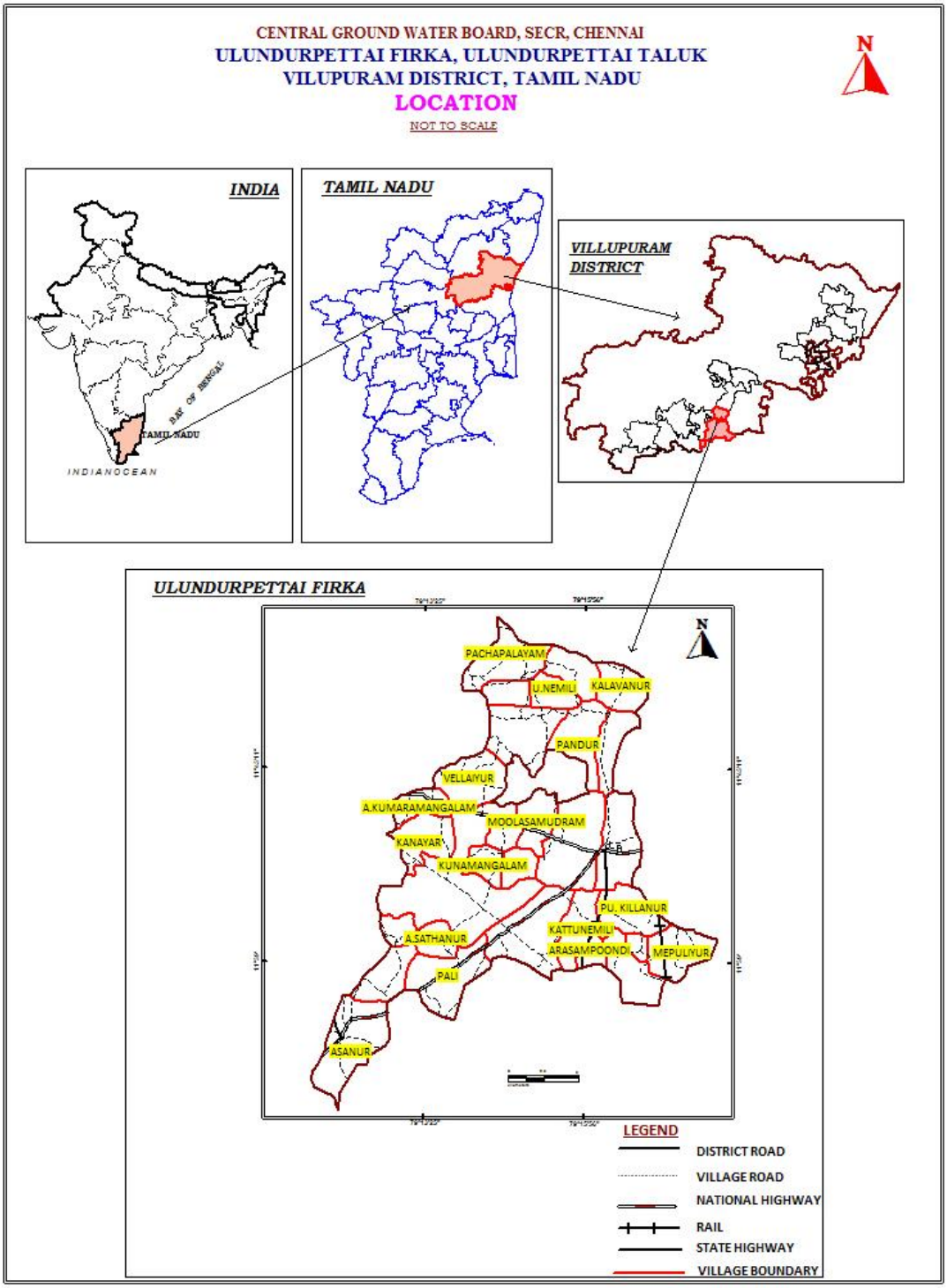



**Figure 1. Location map of Ulundurpettai firka**

### 3.2 Geomorphological Set up

Geomorphologically, the area consists of alluvial plan, dissected /undissected pediment, buried pediment moderate and shallow, tertiary upland etc.. Tertiary upland occupying eastern portion of the firka and alluvial plan covering the western as well as southern portion of the firkas These landforms are influencing the ground water recharge. (*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 within firka area is given in table 1. and shown in figure 2.

Table 1. Various Geomorphological in Ulundurpettai firka

| LANDFORMS |
|---|
| Sedimentary plan |
| Pediment DISSECTED/UNDISSECTED |
| Buried pediment - moderate |
| Pediment – inselberg complex |
| Buried pediment - Shallow |
| Buried pediment - Deep |

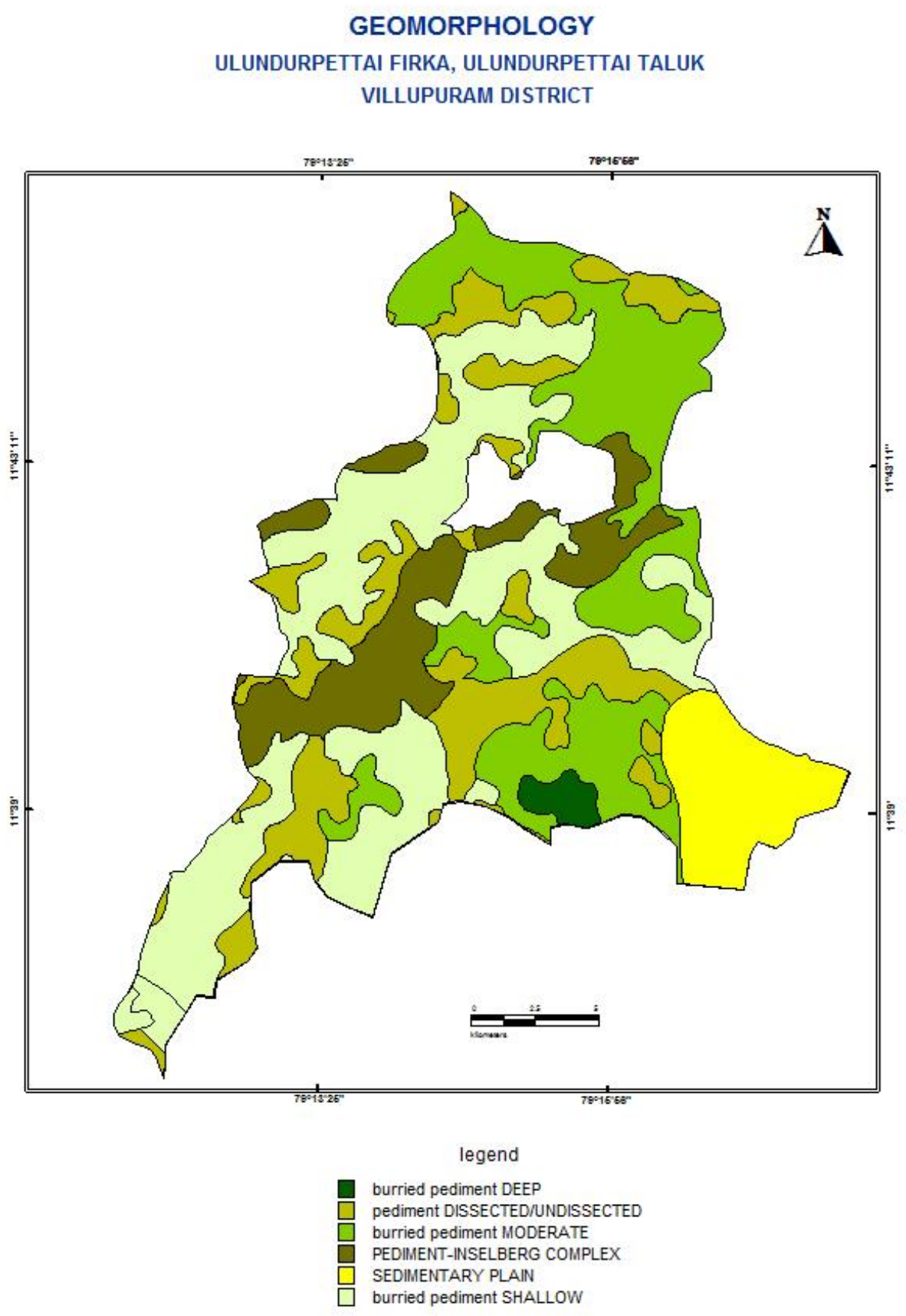



**Figure 2. Geomorphology of Ulundurpettai Firka**

### 3.3 Land use and soil

The land use pattern of the Ulundurpettai 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. Small pockets of salt affected units and fallow are occurring in the Ulundurpettai firka (Source: IRS, Anna university, Chennai Tamil Nadu).

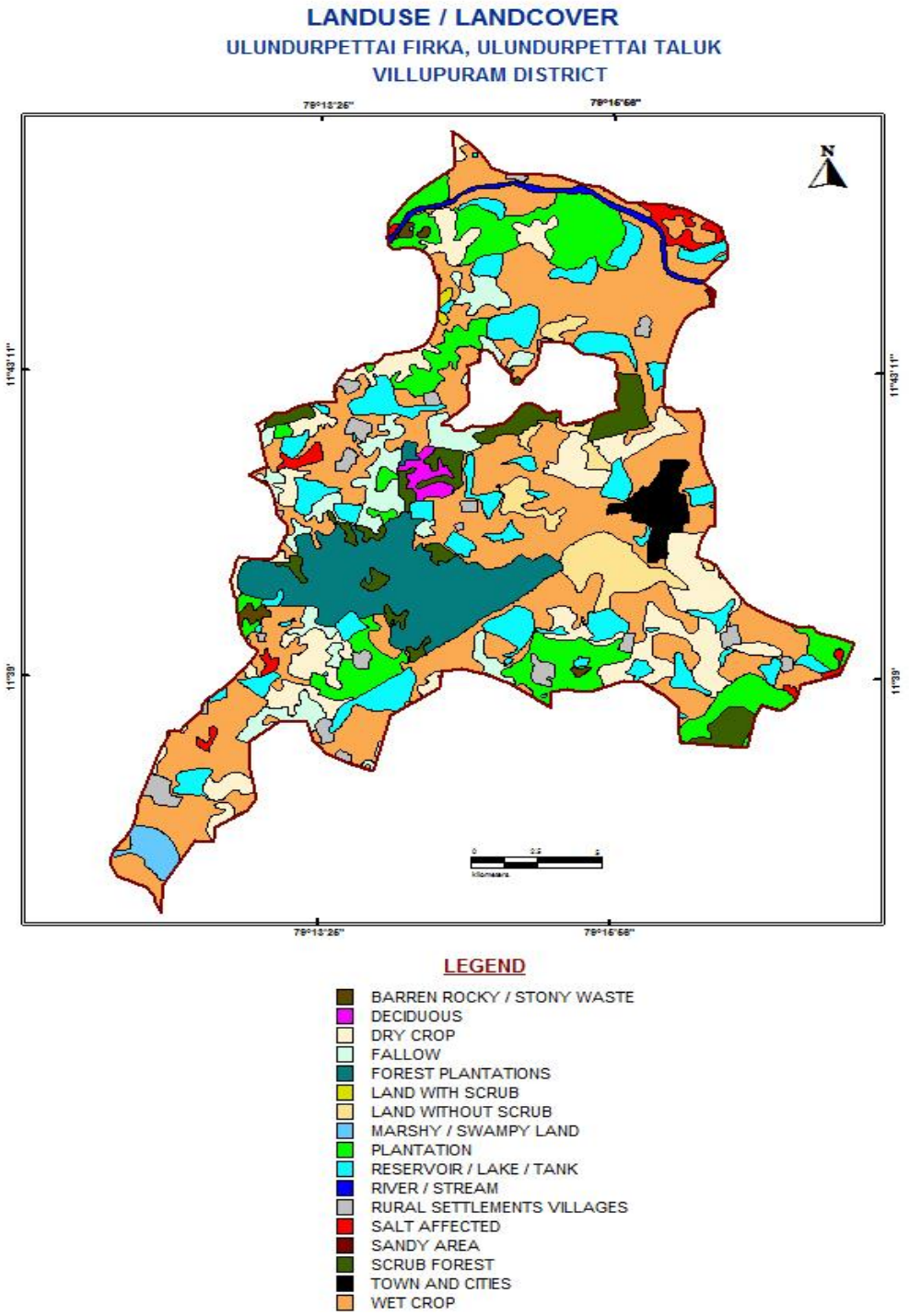



**Figure 3. Land use map of Ulundurpettai Firka**

### 3.4 Drainage

The entire Firka area is within the Vellar basin except a small portion of the firka area falls in the Pennaiyar river basin. Numbers of small streams originate from the hills located in the Ulundurpettai 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 Ulundurpettai firka is given in Fig 4.

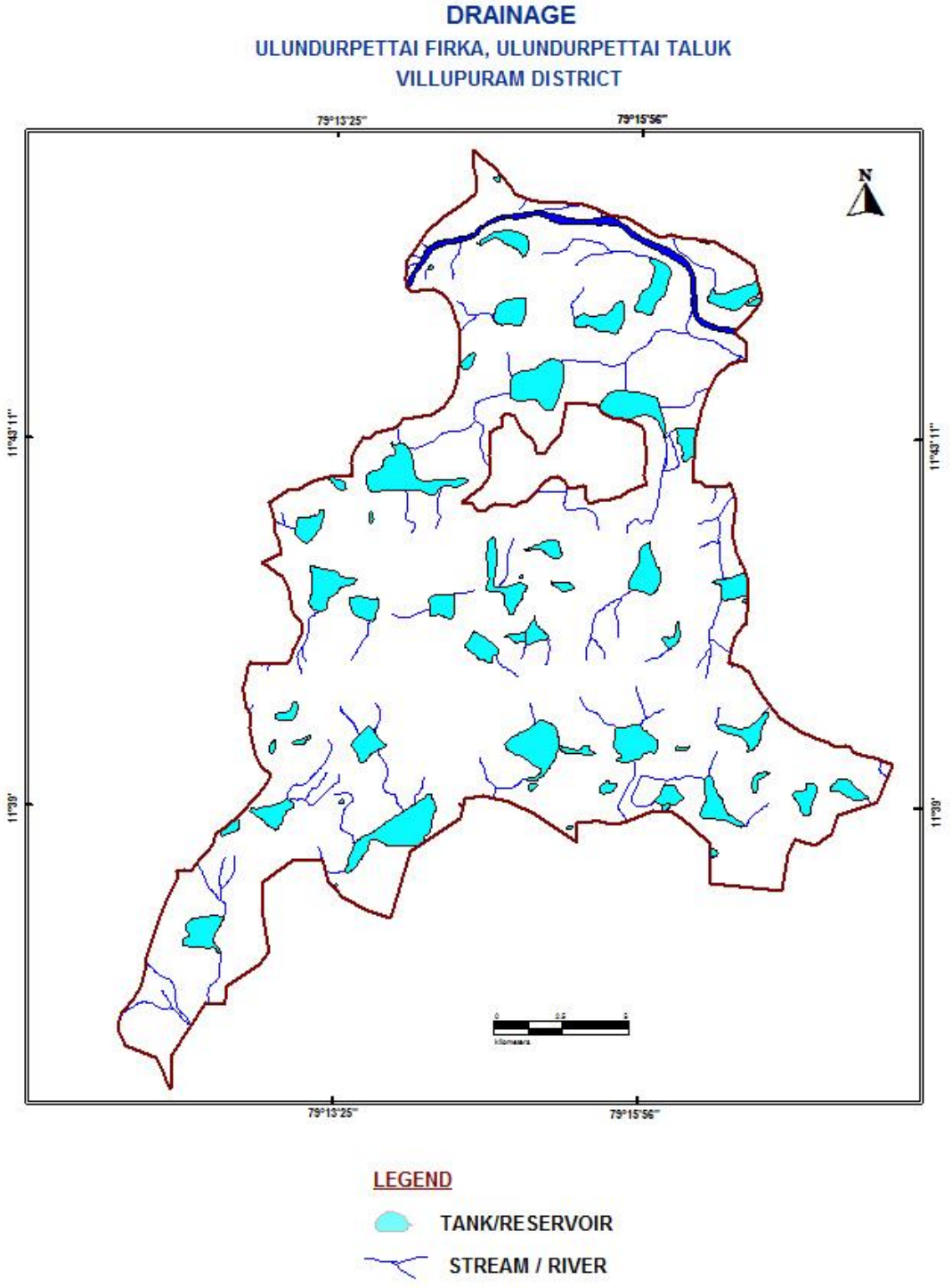



**Figure 4.Drainage map of Ulundurpettai Firka**

### 3.5 Rainfall

Ulundurpettai 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. Ulundurpettai 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 824 mm and the higher is towards coast i.e, east part of the firka.

| 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 |
|---|---|---|---|---|---|
| Ulundurpettai | Ulundurpettai | 119.62 | 0.875 | 0.110 | 0.985 |

### 3.6 Hydrogeology

Ulundurpettai firka is underlain by the gneissic complex and in south-eastern portion of the firka is covered by of limestone, sand stone and conglomerate formation. Ground water is occurring in Pheratic conditions in weathered and fractured Charnokite 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 15 to 18 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 cretaceous formations are very compact and yield prospects are low. The dug wells of 6 m diameter and 10 m bgl depth in sandy tracts give about 3.5 lps. The yield of tube wells in the sedimentary formation ranges from 2.4 to 37 lps. The diameter of the dug well in hard rock formation is in the range of 7 to 10 m and depth of dug wells range from 15 to 18 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 depth of wells varies from 6.64 to 17 m bgl. The hydrogeological map of Ulundurpettai firka is given in Figure 5. Decadal mean water level of pre-monsoon and post monsoon are given in fig 6 a & b. The present water level in the firka is in the range of 5 to 12 m bgl.

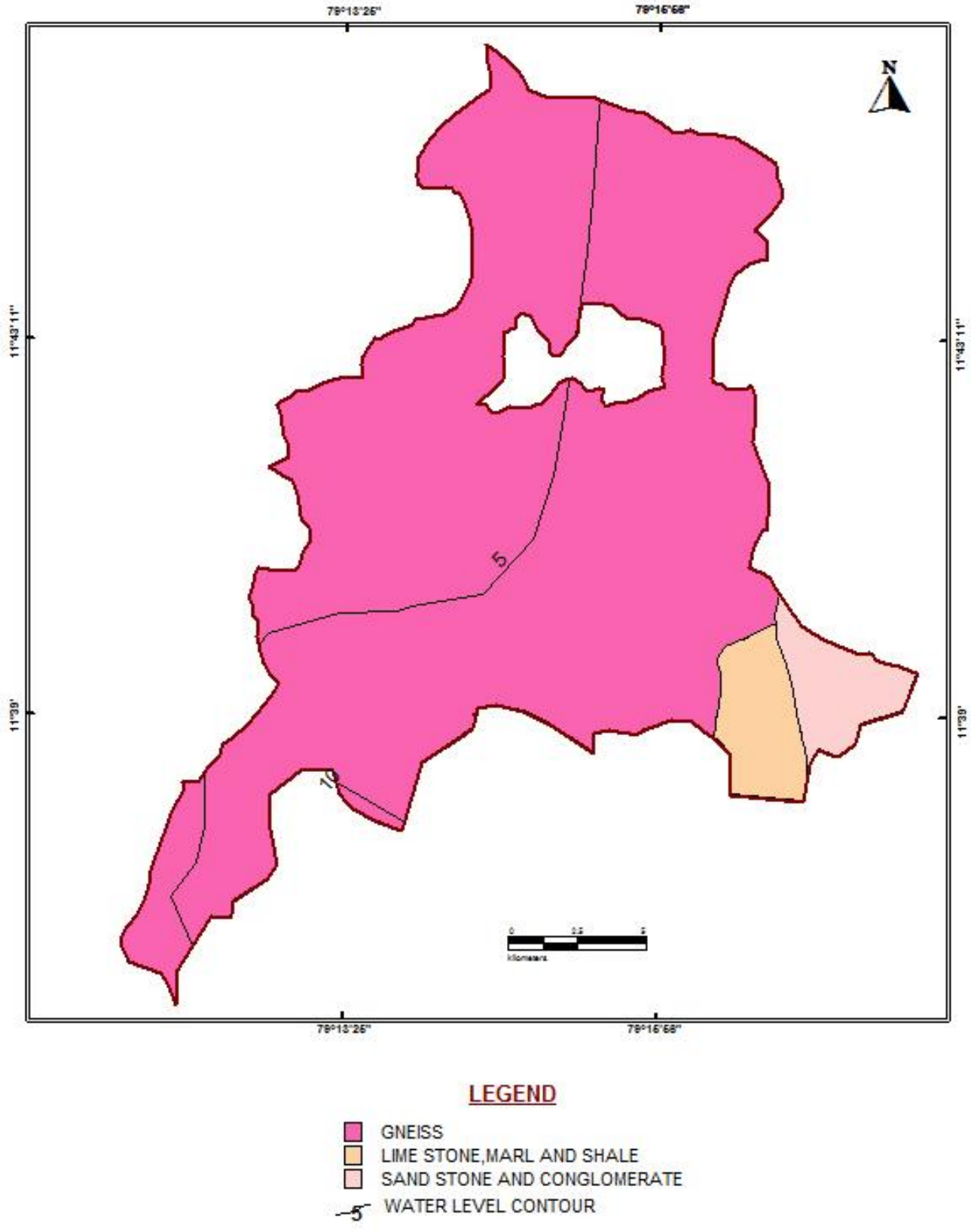



**Figure 5. Hydrogeological Map of Ulundurpettai Firka**

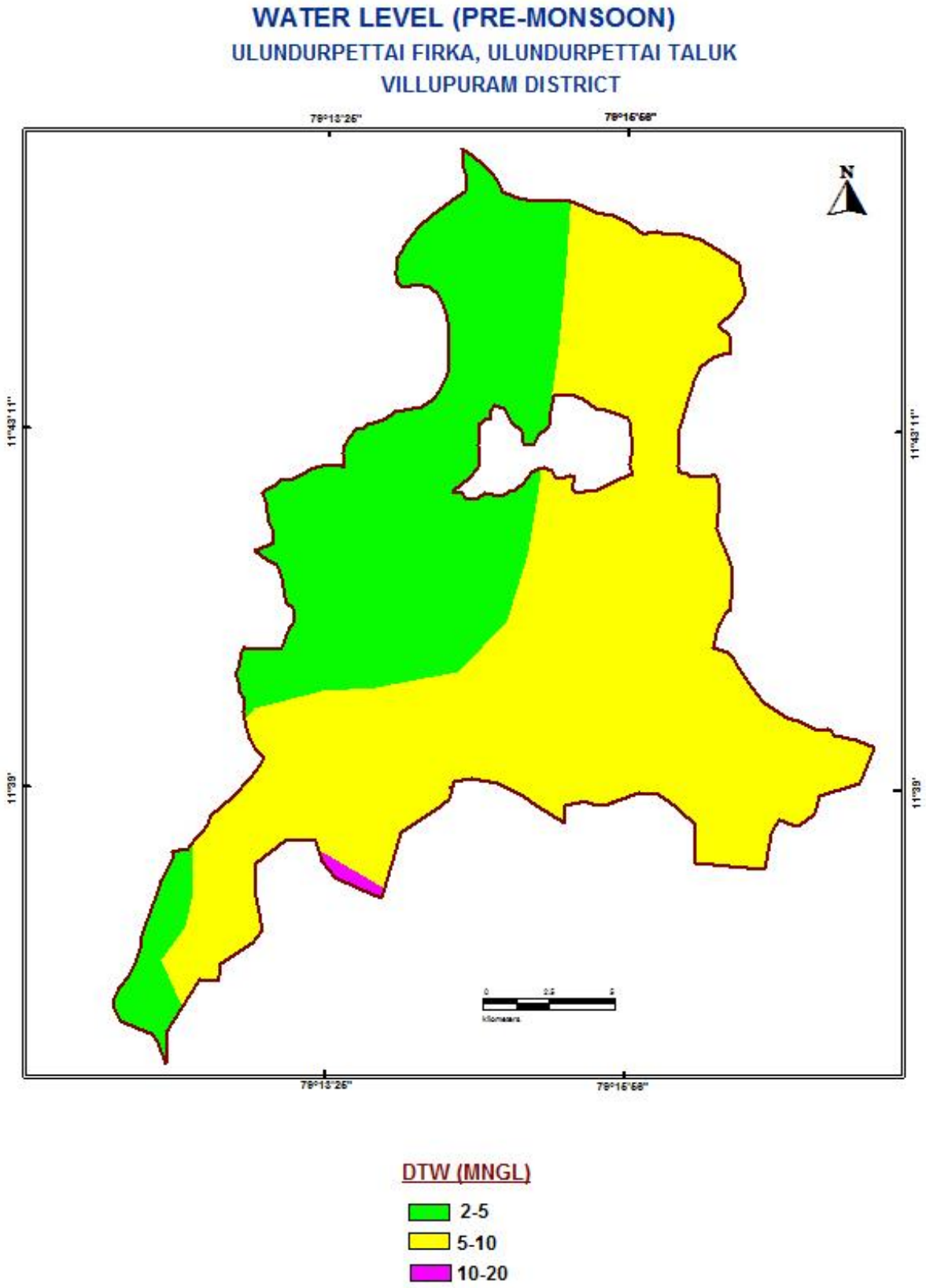



**Figure 6a. Pre -monsoon water level in Ulundurpettai firka (Decadal)**

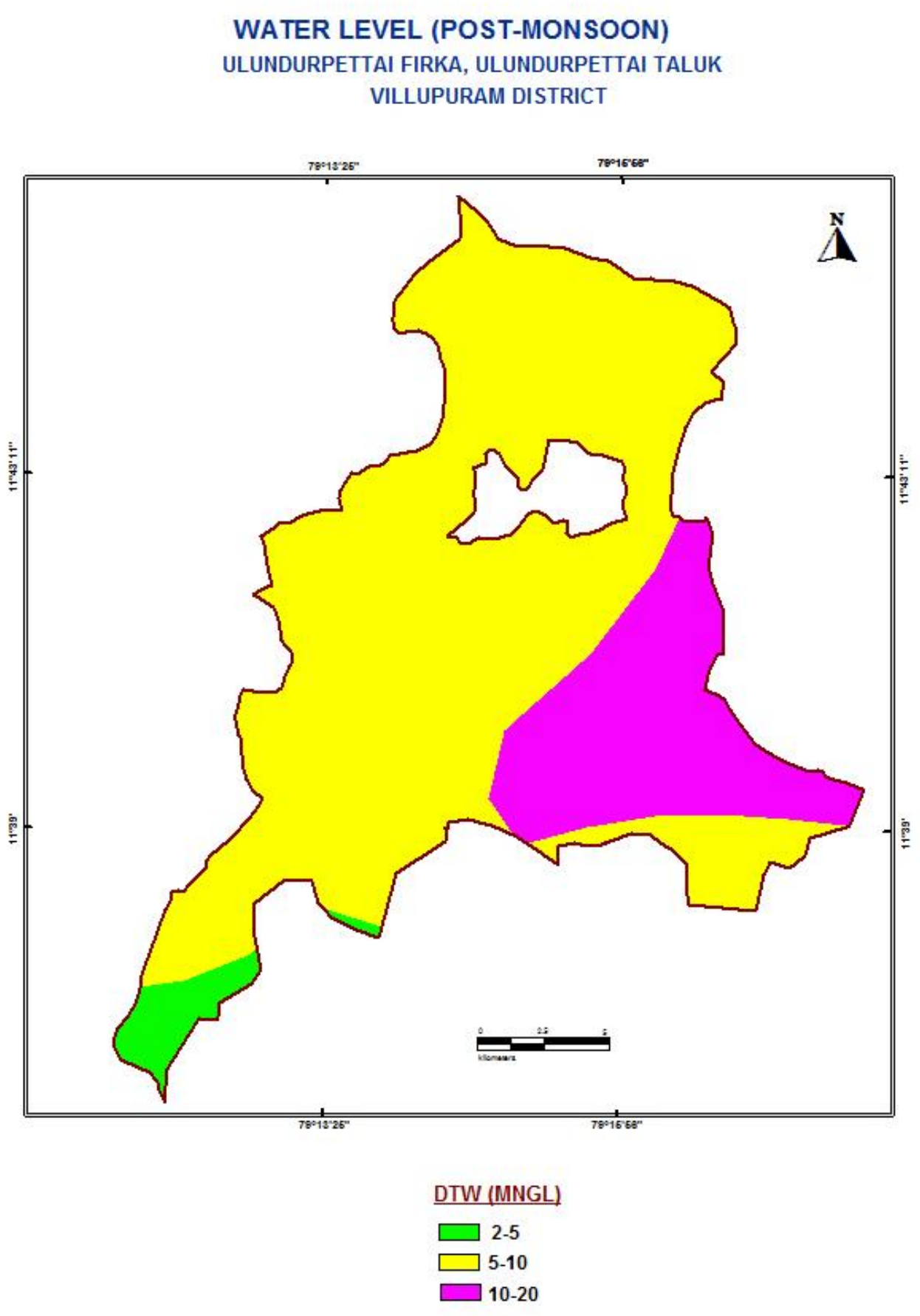



**Figure 6 b. Post-monsoon water level in Ulundurpettai firka (Decadal)**

### 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 Ulundurpettai firka**

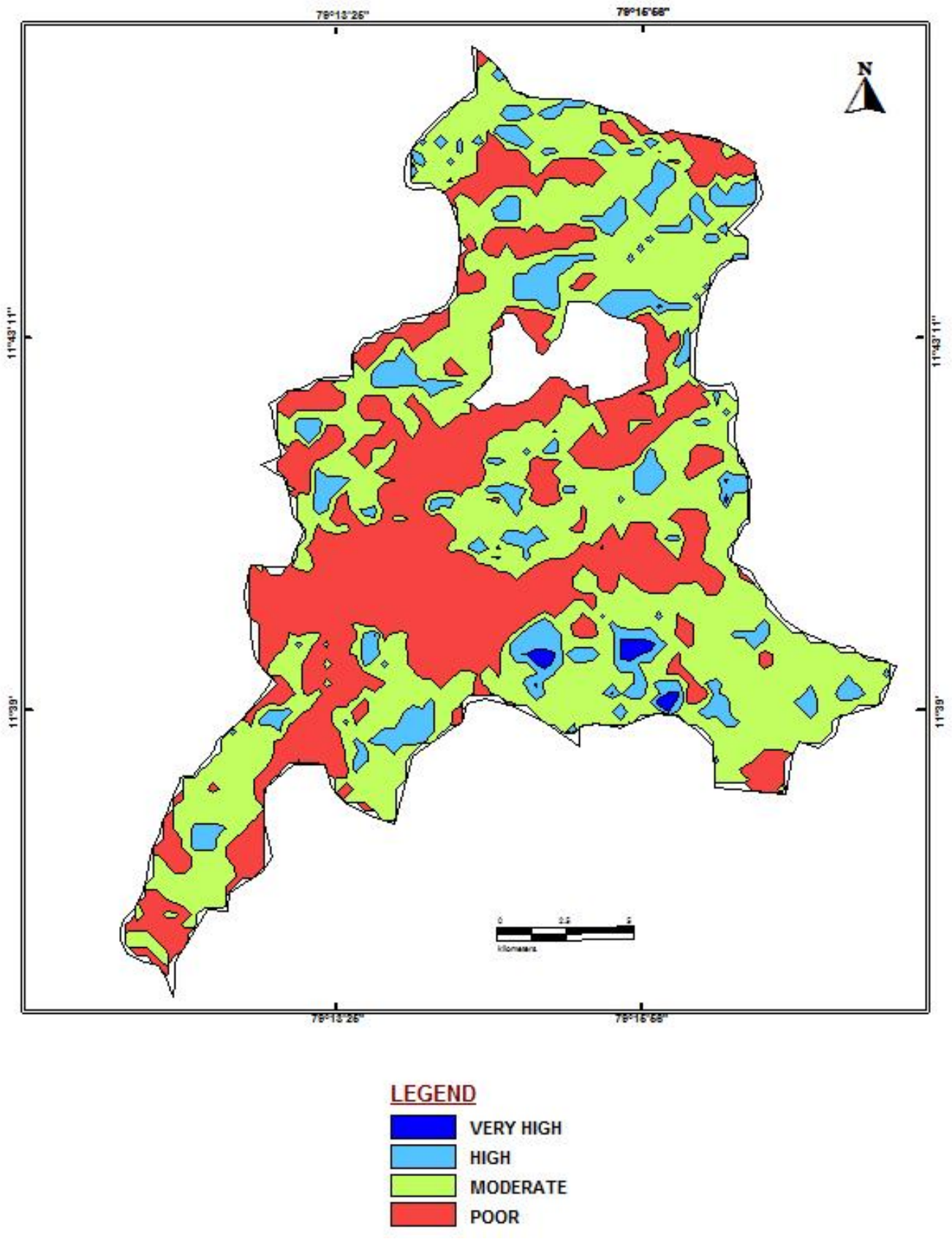
| Firka | GW WORTHY AREA | REPLENISHABLE GROUND WATER RESOURCES | NET GROUND WATER AVAILABLE | GROUND WATER DRAFT FOR IRRIGATION | GROUNDWATER DRAFT FOR DOMESTIC & INDUSTRIAL WATER SUPPLY | TOTAL GROUND WATER DRAFT | STAGE OF GROUND WATER DEVELOPMENT (%) | CATEGORY |
|---|---|---|---|---|---|---|---|---|
| | ( Sq.Km) | ( In MCM) | | | | | % | |
| Ulundurpettai | 119.62 | 23.44 | 21.10 | 26.61 | 0.74 | 27.35 | 129.65 | 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 by assigning weightage for the theme having scale of 1-100 and sub-classes of the theme between 1 & 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 | 2 | Suitable for all major recharge structures like Percolation pond and stop dam, check dam etc., |
| High | 11 | Suitable for all major recharge structures like stop dam, check dam etc., |
| Moderate | 50 | Suitable for all major recharge structures like earthen check dam, Boulder check dam and Nala bund etc., |
| Poor | 37 | Hilly/Forest /Catchment area |

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




**7showing the recharge worthy area Ulundurpettai firka**

## 5. Planning for groundwater recharge /conservation

### 5.1 Justification of the artificial recharge & conservation measures

- The Ulundurpettai firkas is with high stage of groundwater development i.e, 129.65 % and with sufficient amount of uncommitted surface runoff/flow of 15.7 MCM.
- The total weathered zone available beneath the ground in the firka is 38.46 MCM. By considering the water flotation, total of 44.88 MCM available for recharge.
- The Ulundurpettai firka consists of number of surface water bodies /lakes which are well connected by the drainage. Revival and Recharge of these ponds will enhance the sustainability of the ground water abstraction structures.
- 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 Ulundurpettai areas reveals that more than 50 % of areas are suitable for recharge.
- In Ulundurpettai 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 ground water development.

### 5.2 Availability of surplus surface water for artificial recharge or conservation

The uncommitted surface flow for Ulundurpettai 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 Ulundurpettai firka is 15.7 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

Ulundurpettai firka area is covered by the seasonal nallahs/drains which carry heavy discharge during monsoon period is debauched into the water bodies within a short duration. It is proposed that such seasonal nala 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 13 % of the firkas areas are suitable for these structures. It is proposed to construct 11 Check dam and 21 Nala bunds. The tentative location of these 32 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 11 Check dam in Ulundurpettai firka

| S. NO. | LONGITUDE | LATITUDE | TYPE OF ARS |
|---|---|---|---|
| 1 | 79.202 | 11.631 | Check Dam |
| 2 | 79.253 | 11.655 | Check Dam |
| 3 | 79.279 | 11.690 | Check Dam |
| 4 | 79.250 | 11.724 | Check Dam |
| 5 | 79.298 | 11.706 | Check Dam |
| 6 | 79.296 | 11.685 | Check Dam |
| 7 | 79.296 | 11.739 | Check Dam |
| 8 | 79.302 | 11.735 | Check Dam |
| 9 | 79.251 | 11.744 | Check Dam |
| 10 | 79.282 | 11.737 | Check Dam |
| 11 | 79.281 | 11.755 | Check Dam |

Tentative location of proposed 21 Nalla bund in Ulundurpettai firka

| SL.NO | LONGITUDE(DD) | LATITUDE (DD) | TYPE OF ARS |
|---|---|---|---|
| 1 | 79.266 | 11.764 | Nala Bund |
| 2 | 79.265 | 11.755 | Nala Bund |
| 3 | 79.274 | 11.755 | Nala Bund |
| 4 | 79.245 | 11.753 | Nala Bund |
| 5 | 79.239 | 11.754 | Nala Bund |
| 6 | 79.292 | 11.745 | Nala Bund |
| 7 | 79.279 | 11.731 | Nala Bund |
| 8 | 79.274 | 11.734 | Nala Bund |
| 9 | 79.244 | 11.710 | Nala Bund |
| 10 | 79.215 | 11.703 | Nala Bund |
| 11 | 79.294 | 11.704 | Nala Bund |
| 12 | 79.296 | 11.709 | Nala Bund |
| 13 | 79.298 | 11.695 | Nala Bund |
| 14 | 79.256 | 11.694 | Nala Bund |
| 15 | 79.274 | 11.668 | Nala Bund |
| 16 | 79.233 | 11.659 | Nala Bund |
| 17 | 79.225 | 11.648 | Nala Bund |
| 18 | 79.296 | 11.659 | Nala Bund |
| 19 | 79.283 | 11.668 | Nala Bund |
| 20 | 79.285 | 11.668 | Nala Bund |
| 21 | 79.259 | 11.655 | 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 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 16 existing ponds/tanks have been identified with latitude and longitude given below and marked on Plate 1.The above 16 tanks/ponds could be taken up for the renovation with recharge shaft.

**Tentative location of proposed de-siltation of pond/tanks with recharge shaft Ulundurpettai firka.**

| Sl. No. | LONGITUDE | LATITUDE | STRUCTURE | ACTION |
|---|---|---|---|---|
| 1 | 79.254 | 11.769 | TANK / RESERVOIR | DESILTTAION AND RECHARGE SHAFT |
| 2 | 79.280 | 11.761 | TANK / RESERVOIR | DESILTTAION AND RECHARGE SHAFT |
| 3 | 79.299 | 11.755 | TANK / RESERVOIR | DESILTTAION AND RECHARGE SHAFT |
| 4 | 79.242 | 11.752 | TANK / RESERVOIR | DESILTTAION AND RECHARGE SHAFT |
| 5 | 79.247 | 11.742 | TANK / RESERVOIR | DESILTTAION AND RECHARGE SHAFT |
| 6 | 79.230 | 11.705 | TANK / RESERVOIR | DESILTTAION AND RECHARGE SHAFT |
| 7 | 79.301 | 11.697 | TANK / RESERVOIR | DESILTTAION AND RECHARGE SHAFT |
| 8 | 79.259 | 11.694 | TANK / RESERVOIR | DESILTTAION AND RECHARGE SHAFT |
| 9 | 79.302 | 11.689 | TANK / RESERVOIR | DESILTTAION AND RECHARGE SHAFT |
| 10 | 79.219 | 11.663 | TANK / RESERVOIR | DESILTTAION AND RECHARGE SHAFT |
| 11 | 79.217 | 11.662 | TANK / RESERVOIR | DESILTTAION AND RECHARGE SHAFT |
| 12 | 79.290 | 11.661 | TANK / RESERVOIR | DESILTTAION AND RECHARGE SHAFT |
| 13 | 79.262 | 11.654 | TANK / RESERVOIR | DESILTTAION AND RECHARGE SHAFT |
| 14 | 79.225 | 11.651 | TANK / RESERVOIR | DESILTTAION AND RECHARGE SHAFT |
| 15 | 79.287 | 11.650 | TANK / RESERVOIR | DESILTTAION AND RECHARGE SHAFT |
| 16 | 79.269 | 11.646 | TANK / RESERVOIR | DESILTTAION AND RECHARGE SHAFT |

### 5.3.2 Water conservation measure

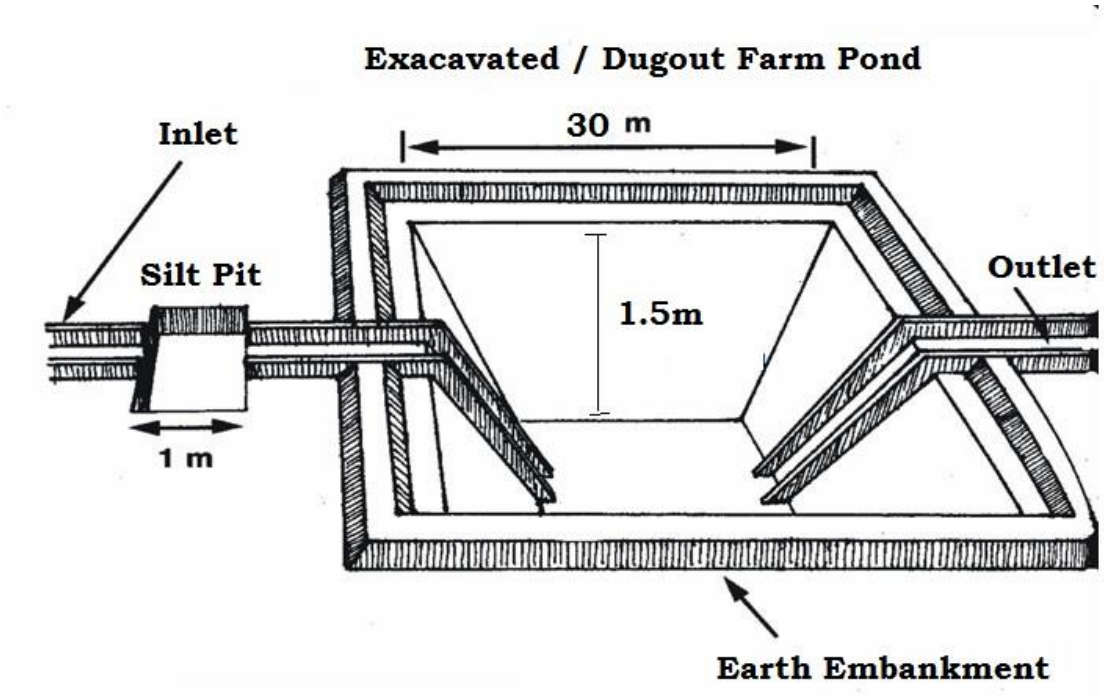
### 5.3.2.1 Farm Pond

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 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 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

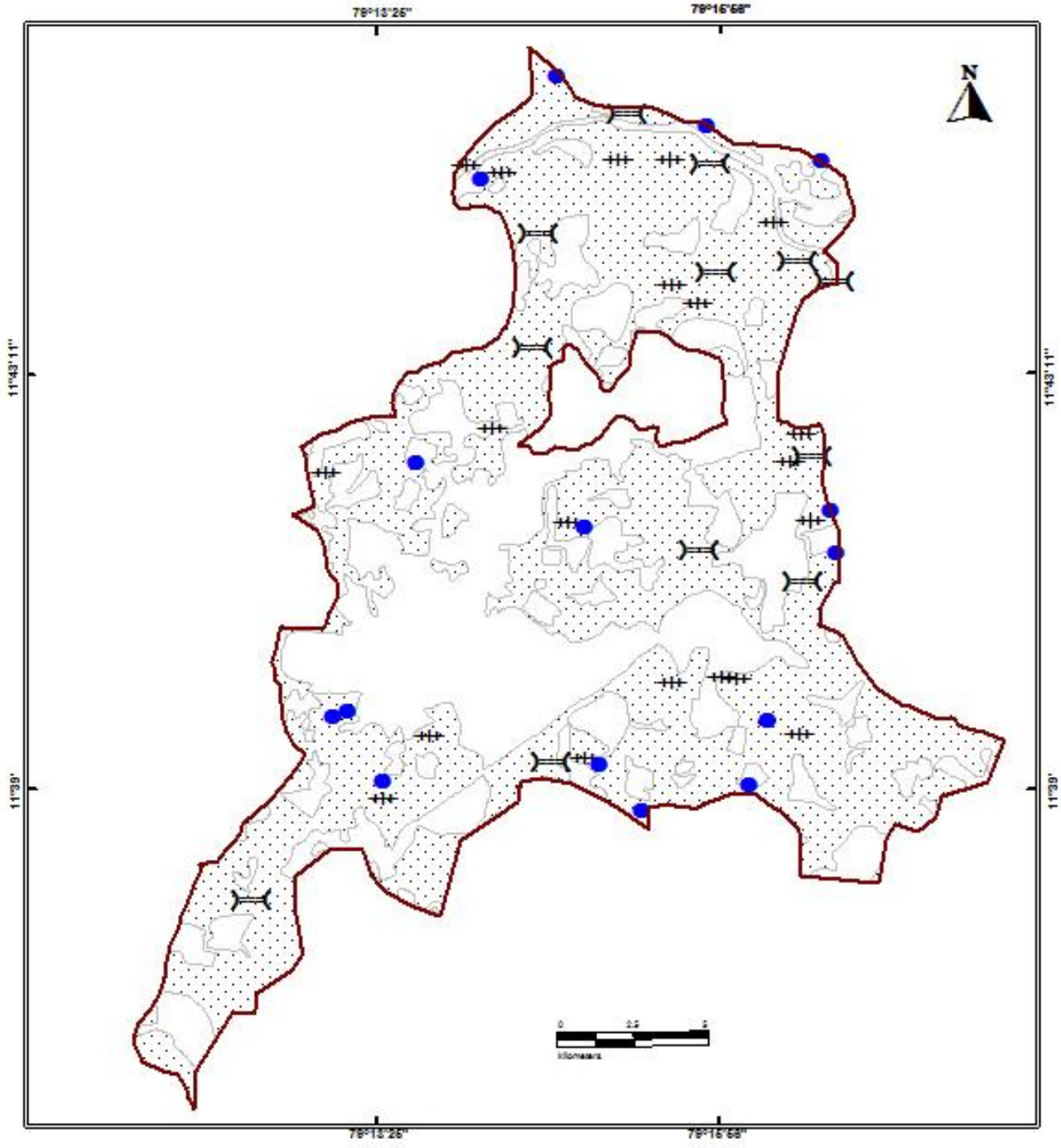
In flood/furrow irrigation method more than 50% of applied water is wasted through seepage to deeper level, localized inundation causes loss through evaporation and it leaches out the nutrients from the plant. While through drip & sprinkler irrigation wastage of irrigational water could be minimized. 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. Tentative locations of proposed micro irrigation are shown in Plate 1.

# LOCATION OF ARTIFICIAL RECHARGE STRUCTURES

## ULUNDURPETTAI FIRKA, ULUNDURPETTAI TALUK

## VILLUPURAM DISTRICT




LEGEND

- NALA BUND
- CHECK DAM
- REVIVAL OF WATERBODIES
- AREA SUITABLE FOR FARMPOND AND IRRIGATION SYSTEM

**Plate 1. Location map showing the proposed AR Structures in Ulundurpettai firka**

## 6. Tentative Cost Estimation

A tentative number of feasible structures, its cost and expected annual groundwater 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 m to 1.5 m | 11 | 187000 | 9 | 99 | 149600 |
| Nala bunds/ Gabion ( 4 Fillings) | Width: 5 to 15 m | 21 | 63000 | 2.0 | 42 | 50400 |
| Revival, repair of water bodies (3 fillings) | (~150x150mx1.5m) | 16 | 1620000 | 12 | 192 | 1296000 |
| Recharge shaft with the pond /tanks | Recharge shaft of 1.5m dia with 2m depth with filter media in lower 1m, Bore dia 10" Casing 6" Depth 30m | 16 | | 2 | 32 | |
| **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** | **525** | **2706000** |
| **Impact assessment and O & M** | | | | | | |
| Piezometers Up to 50 m bgl – 3 nos. @ 0.6 lakh | | | | | **1.8** | |
| **Total cost of the project** | | | | | **526.8** | |
| **O & M - 5 % of total cost of the scheme** | | | | | **26.34** | |
| Impact assessment to be carried out by the implementing agencies @ 5% of total cost | | | | | **26.34** | |
| | | | | **GRAND TOTAL** | **579.48** | |

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. 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 | 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 | | | | | | | | |

**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 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.