For official use only
CGWB/SR/AR/2015-16/63

GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES,
RIVER DEVELOPMENT & GANGA REJUVENATION
CENTRAL GROUND WATER BOARD

PLAN ON
ARTIFICIAL RECHARGE TO GROUNDWATER AND WATER CONSERVATION IN NARSAPUR MANDAL, MEDAK DISTRICT, TELANGANA STATE

SOUTHERN REGION
HYDERABAD
AUGUST 2016

PLAN ON
ARTIFICIAL RECHARGE TO GROUNDWATER AND WATER CONSERVATION IN NARSAPUR MANDAL, MEDAK DISTRICT, TELANGANA STATE

CONTENTS

AT A GLANCE

Name of the Mandal	NARSAPUR
District	MEDAK
State	TELANGANA
Total Area sq.km.	173.94
Area suitable for Artificial Recharge (sq.km.)	147.94
Latitude and Longitude	17.650650 to 17.844270 and 78.156610 to 78.347010
Average Annual Rainfall (mm)	959
Geology	BGC
Average Depth To Water Level (Decadal) (Pre Monsoon)	23.40
Average Depth To Water Level (Decadal) (Post Monsoon)	20.70
Ground Water Resources (2011)	
Annual Replenishable Ground Water Resources (MCM/yr)	24.02
Net Annual Ground Water Availability(MCM)/yr	21.62
Net Annual Ground Water Draft(MCM)/yr	24.39
Projected Demand for Domestic and Industrial Use(MCM)/yr	0.08
Stage of Ground Water Development (%)	113
Surface runoff available (MCM)/yr	24.29
Total Storage Created in the Mandal by Various Agencies (MCM)/yr	0.62
Artificial Recharge/Conservation Measures	
Recharge Structures Proposed (No.s)	Percolation Tanks-6, Check Dams-11 Farm ponds-660, Recharge Shafts-19
Improving Water use Efficiency	Micro Irrigation System -3300 ha
Tentative Total Cost in Lakhs (Rs.)	2440.515 Lakhs
Expected Recharge/Savings (MCM)/yr	10.876

1. INTRODUCTION

Narsapur Mandal is one of over-exploited mandal in Medak district, Telangana State, which is economically backward and chronically drought affected. The mandal has 33 inhabited villages and 2 un inhabited villages with 19 gram panchayats.

2. LOCATION

The mandal lies between north latitudes 17.650650 to 17.844270 and between east longitudes 78.156610 to 78.347010. The mandal occupies the centre part of the Medak district and is bounded on the north by Kowdipalle mandal, on the east by Shivampet mandal, on the south by Hathnura mandal (Fig.1). The geographical area of the mandal is 173.94 sq.km.

3. PHYSIOGRAPHY AND DRAINAGE:

The area is drained by streams, falling in Manjeera sub-basin of Godavari basin. The streams are mostly ephemeral in nature. The drainage pattern is dendritic, rectangular to sub rectangular due to the influence of geological structures. (Fig.2)

4. RAINFALL

The average rainfall in the mandal is 959 mm. The rainfall during the South-west monsoon season i.e., June-September accounts for about 85% of the total rainfall.

5. LAND USE PATTERN

Out of the total geographical area of 173.94 sq.km, the area covered by forest is 43.63 sq.km and the net area sown is 39.37 sq.km. Barren and uncultivable land is 7.4 sq.km. The land for non agricultural use accounts for 14.92 sq.km. (Fig.3)

6. HYDROGEOLOGY

The area is underlain by granitic gneisses of Archaean age (Fig.4). Ground water occurs in weathered and fractured zones under water table and semi- confined conditions. The weathered zone thickness as per the GEC report is 30 m. The weathered zone has been extensively tapped by dug and dug cum bore wells up to 30 m depth, which are mostly dry now. Ground water occurs in the fractured granites up to 200 m bgl. However, the potential fractures are encountered between 50-100 m bgl. The cumulative yield varies from 2-5 lps.

7. GROUND WATER LEVEL SCENARIO

The depth to water level during pre and post-monsoon varies from 5 to 20 m bgl. The average depth to water level (decadal) during pre and post monsoon is 23.4 and 20.7 m bgl respectively. The depth to water levels maps for pre and post monsoon period (2014) are shown in Fig. 5 & 6 respectively. Decadal mean water level trend during post monsoon is depicted in the Fig.7.

8. DYNAMIC GROUND WATER RESOURCES

The Ground water availability, Utilization and stage of Development in Narsapur Mandal, Medak District is given in Table-1.

Table-1: Ground water resources of Narsapur Mandal, Medak District.

Annual Replenishable Ground water resources (MCM)	24.02
Net Annual Ground Water Availability(MCM)/yr	21.62
Net Annual Ground Water Draft(MCM)/yr	24.39
Projected Demand for Domestic and Industrial use up to 2025. (MCM)	0.08
Stage of Ground water development (%).	113
Whether notified or not with year of notification.	No

9. NEED FOR ARTIFICIAL RECHARGE AND CONSERVATION METHODS

The ground water withdrawal is more than the recharge with a stage of development above hundred percent. The long term water level trend mostly shows a declining trend and the water levels are very deep ranging upto30m. The sustainability of bore wells has become questionable as many bore wells are either drying up or have recorded reduced yields. There is no surface water irrigation facility in the area. All these factors indicate that there is an urgent need for artificial recharge and water conservation in the Mandal.

10. JUSTIFICATION OF THE ARTIFICIAL RECHARGE PROJECT

Narsapur Mandal falls under high stage of ground water development i.e., 113 % and with sufficient amount of uncommitted surface runoff. The area is completely dependent on ground water for domestic, industrial and irrigation purposes. During the monsoons runoff quickly flows out of the area without natural recharge to ground water. It is necessary to apply artificial recharge techniques to allow more and more recharge through check dams, PTs, MPTs, farm ponds, recharge shafts to cope up with the withdrawal pattern and also to improve ground water situation through various interventions including on farm activities and micro irrigation systems (Sprinkler-Drip-HDPE).

11. AVAILABILITY OF SURPLUS, SURFACE WATER FOR ARTIFICIAL RECAHRGE OR CONSERVATION

The runoff was calculated by taking into account of normal rainfall of the mandal and corresponding runoff yield from Strangers table. The existing storage created by various artificial recharge structures constructed by the State Government, if any, was deducted for calculating the runoff yield to recommend new AR structures.

Total Geographical area (Sq.kms)	173.94
Hilly Area (Sq.kms)	26
Area suitable for Artificial Recharge (sq.km.)	147.94
Runoff Yield in MCM/yr	24.29
Existing No. of Check Dams	40
Storage created MCM/yr	0.28
Existing No. of Percolation Tanks	48
Storage created MCM/yr	0.34
Total Existing Storage Created	0.62

12. FEASIBLE ARTIFICIAL RECHARGE STRUCTURES

Since the mandal is categorized as over exploited, there is an immediate need for improving ground water scenario and to ensure sustainability of ground water sources. It is also suggested to create additional storage capacity of surface water bodies which would result in supplementing irrigation thereby reducing the ground water draft. The run off available in the mandal has been assessed as 23.67 MCM/yr, which could be considered for further planning of artificial recharge. However, the number of artificial recharge structures feasible has been recommended in areas, by considering the utilizable yield, number of existing structures, land use, drainage pattern and also where the post monsoon water levels (decadal mean) are more than 5 m bgl., and or decadal trends are either falling or showing insignificant raising trend.

A) Check dams and Percolation Tanks

The area is covered by seasonal nalas – drains, which carry discharge during monsoon period debauched into the water bodies within a short duration. It is proposed to identify such nalas for construction of check dams/Percolation tank with recharge shafts, so as to harness ground water and to increase soil moisture content.

- The site selected for check dam/Percolation Tank should have sufficient thickness of permeable soils or weathered material to facilitate recharge of stored water within a short span of time. The water stored in these structures is mostly confined to the stream course and height is normally less than 2m.

- These are designed based on stream width and excess water is allowed to flow over the crest wall. In order to avoid scouring from excess runoff water cushions are provided on the downstream side. To harness maximum runoff in the stream, a series of such check dams can be constructed to have recharge on a regional scale.

- Considering the annual monsoon rainfall of 959 mm, sufficient rain water can be harnessed. This will improve ground water regime as well as delaying the instant flow into the main river.

- The flow in these seasonal rivers can be sustained up to about 2 to 3 months after monsoon.

- Recharge trenches can also be constructed along upstream side of the check dam/Percolation Tank in the impoundment area for enhancing the ground water recharge rate.

A total of **11 Check dams and 6 Percolation tanks** are recommended.

B) Recharge Shafts:

The existing check dams and percolation tanks lose their storage capacity as well as recharge capacity due to siltation. Hence, Recharge shafts are recommended in the existing Check dams and Percolation tanks to enhance the ground water recharge. During the heavy downpours, there will be sufficient accumulation of runoff, which can also effectively be utilized for recharge by constructing recharge shafts. Hence, it is proposed to construct 9 and 10 recharge shafts of 165 mm dia with 30 m depth in the existing check dams and percolation tanks respectively.

C) Farm Ponds:

A farm pond is a large dug out in the earth, usually square or rectangular in shape, which harvests rain water 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 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, majority of the area is covered by the agricultural field. Hence, it is proposed to construct 660 farm ponds in 33 villages of the Mandal @ 20 farm ponds in each village.

D). 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 wastages 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 3300 ha @ 100 ha per village.

13. TENTATIVE COST ESTIMATES (NARSAPUR MANDAL)

S.No.	Feasible Artificial Recharge & Water Conservation structures/	No. of Structures/ Quantity	Total Volume (MCM)	Tentative unit cost (in Rs lakh)	Total tentative cost (in Rs Lakh)	Expected Annual GW recharge/savings (MCM)
1	Proposed Masonry Check dams Crest Length -10-15 m, Height-1-2 m) (0.007 MCM*4 fillings)	11	0.308	5	55	0.231
2	Recharge shaft in Check dam (50% of the existing Check dams)	9	0.099	0.5	4.5	0.099
3	Proposed Percolation Tanks (100*100*2.5)* 4 fillings)	6	0.6	15	90	0.45
4	Renovation Desilting, Repairs and installation of Recharge Shafts in existing PTS (50% of the existing PTS)	10	0.11	1	10	0.11
5	Proposed Farm Pond (6 filling) 5*5*1.5 dimension @ 20 farm ponds per each village	660	0.09504	0.25	165	0.085536
6	Proposed Sprinkler/drip/HDPE pipes for 100 ha in each village	3300		0.6	1980	9.9
7	Proposed Piezometers up to 50 mbgl @ one PZ per Village	33	0	0.6	19.8	0
8 (i)	Total (No. of AR Structures)	729	1.21		344.3	0.976
8 (ii)	Total (ha)	3300			1980	9.9
	Total (8(i) + 8 (ii))				**2324.3**	**10.876**
9	Impact Assessment & O & M -5 % of Total cost of the Scheme				**116.215**	
	Grand Total				**2440.515**	

*(Expected annual GW Recharge/Savings MCM - CDS& PTS: 75%, Farm ponds - 90%, Sprinklers-50%, Recharge shafts in existing CDS and PTS-100%)

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

14. TIME SCHEDULE

Steps	Quarters							
	1st	2nd	3rd	4th	5th	6th	7th	8th
Identification of line department/implementing agency and preparation of DPR								
Approval of Scheme and releases of sanction of funds								
Implementation of ARS								

Phase = one quarter or 3 months or equivalent to financial quarter

A). Operation and Maintenance

In all 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 to have impact assessment as well as operation & Maintenance at the rate of 5% of the total cost of the project for 5 years from the completion of artificial recharge project.

B). Expected Benefits

The benefits of the project are:

1. The implementation of the project would result in additional recharge/Ground water savings to the tune of 10.876 MCM.
2. Ground water recharge will help in arresting the rapid decline in ground water resources and will also ensure improvement in quality of ground water by dilution.
3. Proposed structures and measures will also enhance the ground water potential and would ensure sustainability of ground water resources. It is estimated that the stage of ground water development may likely to be reduced from the present 113% to 75% (38%)
4. It will also help in controlling soil erosion.

Acknowledgements

The inputs with regard to the Utilizable Yield, existing and proposed Artificial Recharge Structures have been provided by the Director, State Ground Water Department, Government of Telangana. The same is duly acknowledged.

EXISTING ARTIFICIAL RECHARGE STRUCTURES NARSAPUR MANDAL, MEDAK DISTRICT, TELANGANA

Sno	Name_Vill	Long_	Lat	Name_ARS	ExucutingA
1	Moosapet	78.2198	17.7349	Check Dam	IWMP
2	Narsapur	78.2693	17.7291	Check Dam	IWMP
3	Narsapur	78.2638	17.7314	Check Dam	IWMP
4	Narsapur	78.2790	17.7280	Check Dam	IWMP
5	Narsapur	78.2724	17.7290	Check Dam	IWMP
6	Ramchandrapur	78.2423	17.7334	Check Dam	IWMP
7	Rustumpet	78.2658	17.7588	Check Dam	IWMP
8	Rustumpet	78.2467	17.7376	Check Dam	IWMP
9	Rustumpet	78.2477	17.7375	Check Dam	IWMP
10	Rustumpet	78.2486	17.7389	Check Dam	IWMP
11	Rustumpet	78.2406	17.7427	Check Dam	IWMP
12	Rustumpet	78.2523	17.7372	Check Dam	IWMP
13	Rustumpet	78.2501	17.7371	Check Dam	IWMP
14	Rustumpet	78.2570	17.7334	Check Dam	IWMP
15	Moosapet	78.2583	17.7686	Check Wall	IWMP
16	Rustumpet	78.2477	17.7409	Check Wall	IWMP
17	Rustumpet	78.2464	17.7417	Check Wall	IWMP
18	Nagulapally	78.2211	17.7524	Farm Pond	IWMP
19	Nagulapally	78.2045	17.7464	Farm Pond	IWMP
20	Nagulapally	78.2106	17.7470	Farm Pond	IWMP
21	Mohammadabad	78.2381	17.7634	PTS/MPTS	IWMP
22	Moosapet	78.2553	17.7701	PTS/MPTS	IWMP
23	Moosapet	78.2248	17.7493	PTS/MPTS	IWMP
24	Moosapet	78.2578	17.7690	PTS/MPTS	IWMP
25	Moosapet	78.2580	17.7747	PTS/MPTS	IWMP
26	Moosapet	78.2365	17.7417	PTS/MPTS	IWMP
27	Moosapet	78.2506	17.7599	PTS/MPTS	IWMP
28	Moosapet	78.2184	17.7434	PTS/MPTS	IWMP
29	Nagulapally	78.2186	17.7469	PTS/MPTS	IWMP
30	Nagulapally	78.2175	17.7467	PTS/MPTS	IWMP
31	Nagulapally	78.2110	17.7472	PTS/MPTS	IWMP
32	Ramchandrapur	78.2383	17.7273	PTS/MPTS	IWMP
33	Ramchandrapur	78.2377	17.7332	PTS/MPTS	IWMP
34	Rustumpet	78.2619	17.7514	PTS/MPTS	IWMP
35	Rustumpet	78.2560	17.6870	PTS/MPTS	IWMP
36	Rustumpet	78.2539	17.7518	PTS/MPTS	IWMP
37	Moosapet	78.2519	17.7623	PTS/MPTS	IWMP
38	Nagulapally	78.2126	17.7449	PTS/MPTS	IWMP
39	Nagulapally	78.2080	17.7413	PTS/MPTS	IWMP
40	Ramchandrapur	78.2349	17.7523	PTS/MPTS	IWMP

PROPOSED ARTIFICIAL RECHARGE STRUCTURES NARSAPUR MANDAL,
MEDAK DISTRICT, TELANGANA.

S.No.	VNAME	Longitude	Latitude	Type of Structure
1	AHMEDNAGAR	78.1976	17.8257	Checkdam
2	IBRAHIMBAD	78.1928	17.8067	Checkdam
3	ADMAPUR	78.2183	17.7934	Checkdam
4	JAKKUPALLE	78.2364	17.7761	Checkdam
5	NARSAPUR	78.2912	17.7326	Checkdam
6	NARSAPUR	78.3095	17.7247	Checkdam
7	KONDAPUR	78.2809	17.7074	Checkdam
8	TUJALPUR	78.2855	17.8291	Checkdam
9	BRAHMANPALLE	78.3251	17.7863	Checkdam
10	BRAHMANPALLE	78.3275	17.7866	Checkdam
11	ACHAMPET	78.3149	17.7703	Checkdam
12	KAGAZMADDUR	78.2989	17.7019	PTS/MPTS
13	AHMEDNAGAR	78.2154	17.8275	PTS/MPTS
14	CHIPPALTURTHI	78.2259	17.7837	PTS/MPTS
15	NARSAPUR	78.2703	17.7146	PTS/MPTS
16	KAGAZMADDUR	78.3100	17.7066	PTS/MPTS
17	NATHINOIPALLE	78.3179	17.6993	PTS/MPTS

Fig.1

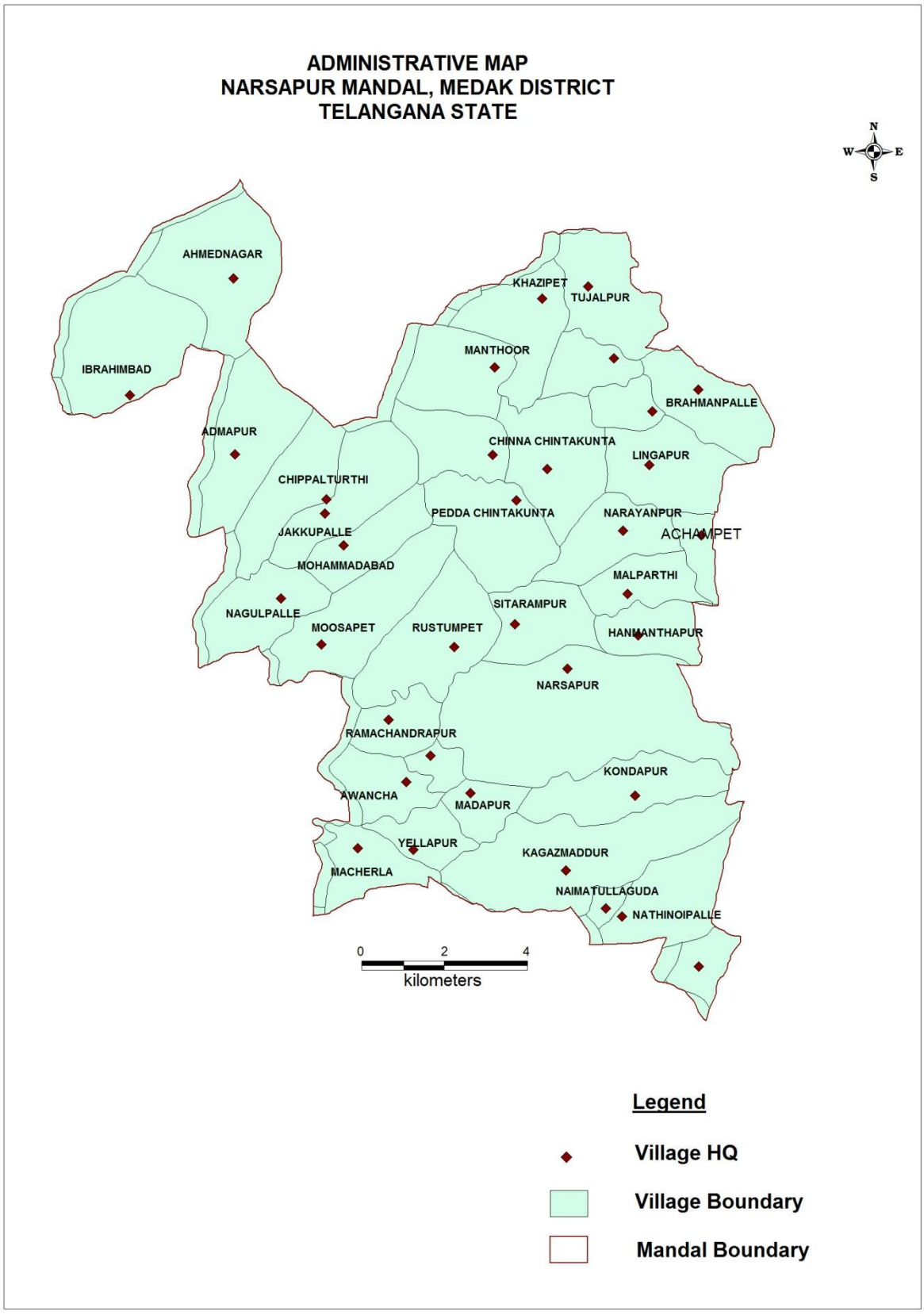

ADMINISTRATIVE MAP
NARSAPUR MANDAL, MEDAK DISTRICT
TELANGANA STATE
N
W
E
S
AHMEDNAGAR
KHAZIPET
TUJALPUR
MANTHOOR
IBRAHIMBAD
BRAHMANPALLE
ADMAPUR
CHINNA CHINTAKUNTA
LINGAPUR
CHIPPALTURTHI
PEDDA CHINTAKUNTA
NARAYANPUR
ACHAMPET
JAKKUPALLE
MOHAMMADABAD
MALPARTHI
SITARAMPUR
NAGULPALLE
MOOSAPET
RUSTUMPET
HANMANTHAPUR
NARSAPUR
RAMACHANDRAPUR
KONDAPUR
AWANCHA
MADAPUR
YELLAPUR
KAGAZMADDUR
MACHERLA
NAIMATULLAGUDA
NATHINOIPALLE
0
2
4
kilometers
Legend
Village HQ
Village Boundary
Mandal Boundary

Fig.2

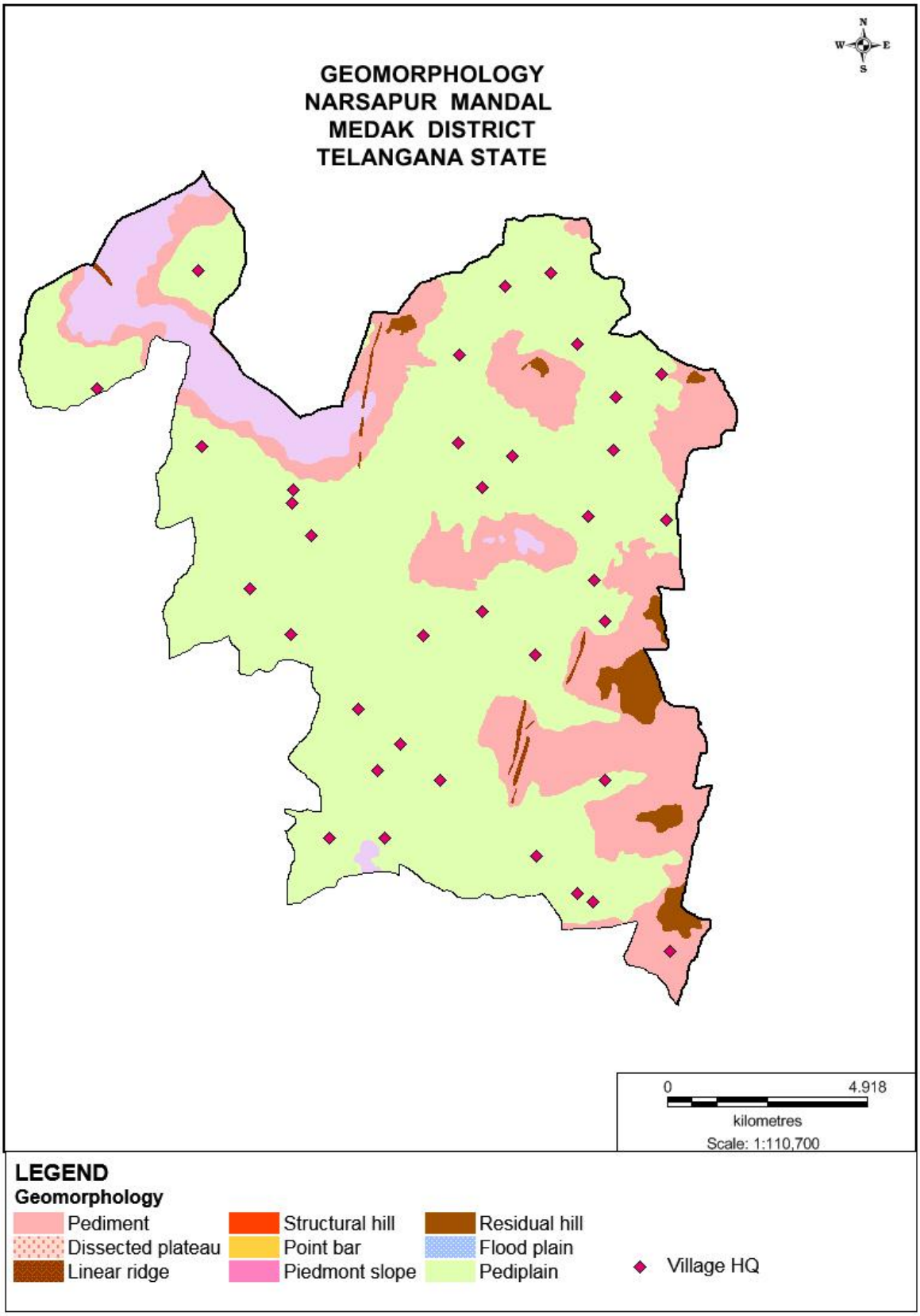

GEOMORPHOLOGY
NARSAPUR MANDAL
MEDAK DISTRICT
TELANGANA STATE
N
W
E
S
0
4.918
kilometres
Scale: 1:110,700
LEGEND
Geomorphology
Pediment
Dissected plateau
Linear ridge
Structural hill
Point bar
Piedmont slope
Residual hill
Flood plain
Pediplain
Village HQ

Fig.3

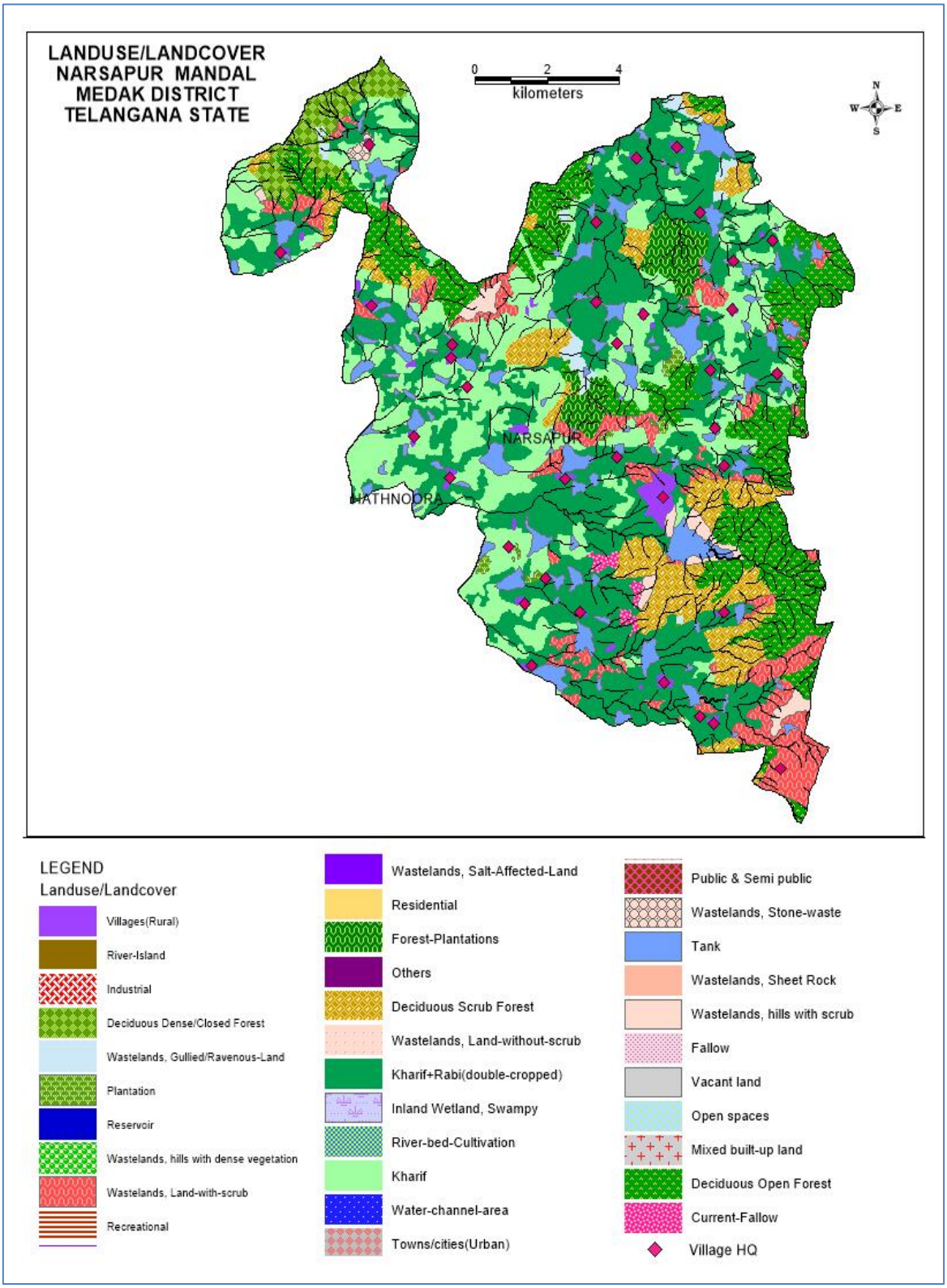

LANDUSE/LANDCOVER
NARSAPUR MANDAL
MEDAK DISTRICT
TELANGANA STATE
0
2
4
kilometers
N
W
E
S
NARSAPUR
HATHNOORA
LEGEND
Landuse/Landcover
Villages(Rural)
River-Island
Industrial
Deciduous Dense/Closed Forest
Wastelands, Gullied/Ravenous-Land
Plantation
Reservoir
Wastelands, hills with dense vegetation
Wastelands, Land-with-scrub
Recreational
Wastelands, Salt-Affected-Land
Residential
Forest-Plantations
Others
Deciduous Scrub Forest
Wastelands, Land-without-scrub
Kharif+Rabi(double-cropped)
Inland Wetland, Swampy
River-bed-Cultivation
Kharif
Water-channel-area
Towns/cities(Urban)
Public & Semi public
Wastelands, Stone-waste
Tank
Wastelands, Sheet Rock
Wastelands, hills with scrub
Fallow
Vacant land
Open spaces
Mixed built-up land
Deciduous Open Forest
Current-Fallow
Village HQ

Fig.4

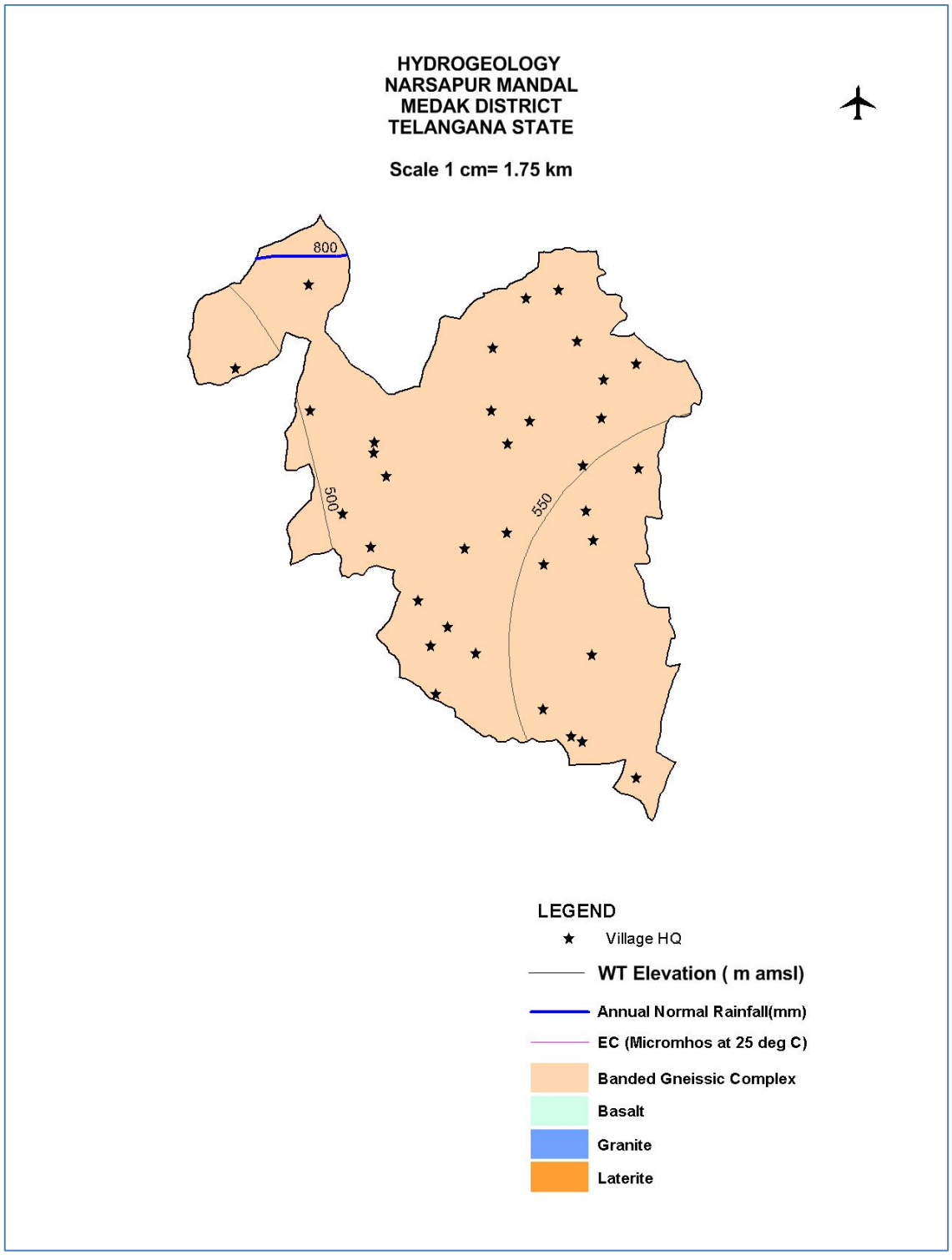

HYDROGEOLOGY
NARSAPUR MANDAL
MEDAK DISTRICT
TELANGANA STATE
Scale 1 cm= 1.75 km
800
500
550
LEGEND
Village HQ
WT Elevation (m amsl)
Annual Normal Rainfall(mm)
EC (Micromhos at 25 deg C)
Banded Gneissic Complex
Basalt
Granite
Laterite

Fig.5

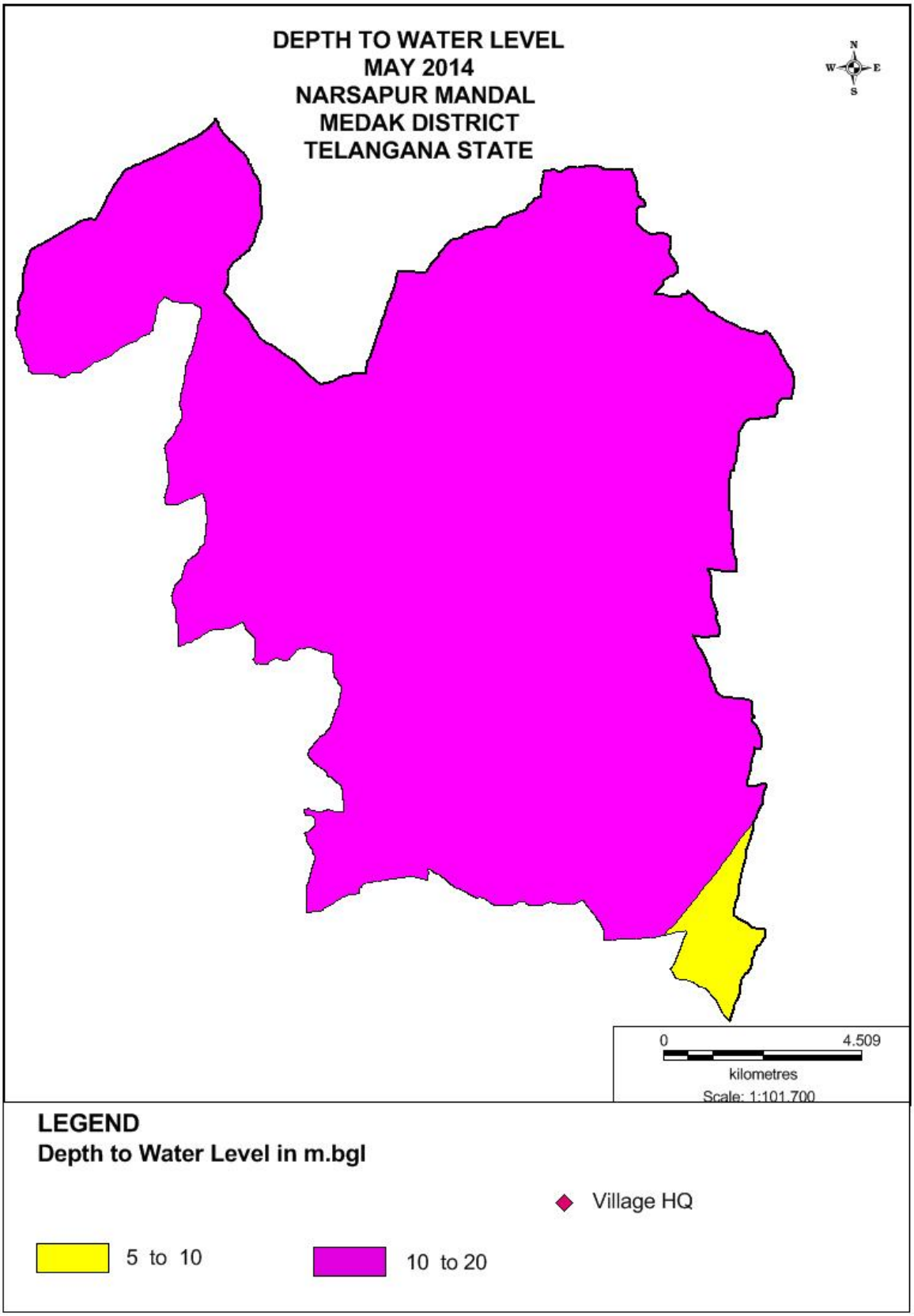

DEPTH TO WATER LEVEL
MAY 2014
NARSAPUR MANDAL
MEDAK DISTRICT
TELANGANA STATE
N
W
E
S
0
4.509
kilometres
Scale: 1:101,700
LEGEND
Depth to Water Level in m.bgl
Village HQ
5 to 10
10 to 20

Fig.6

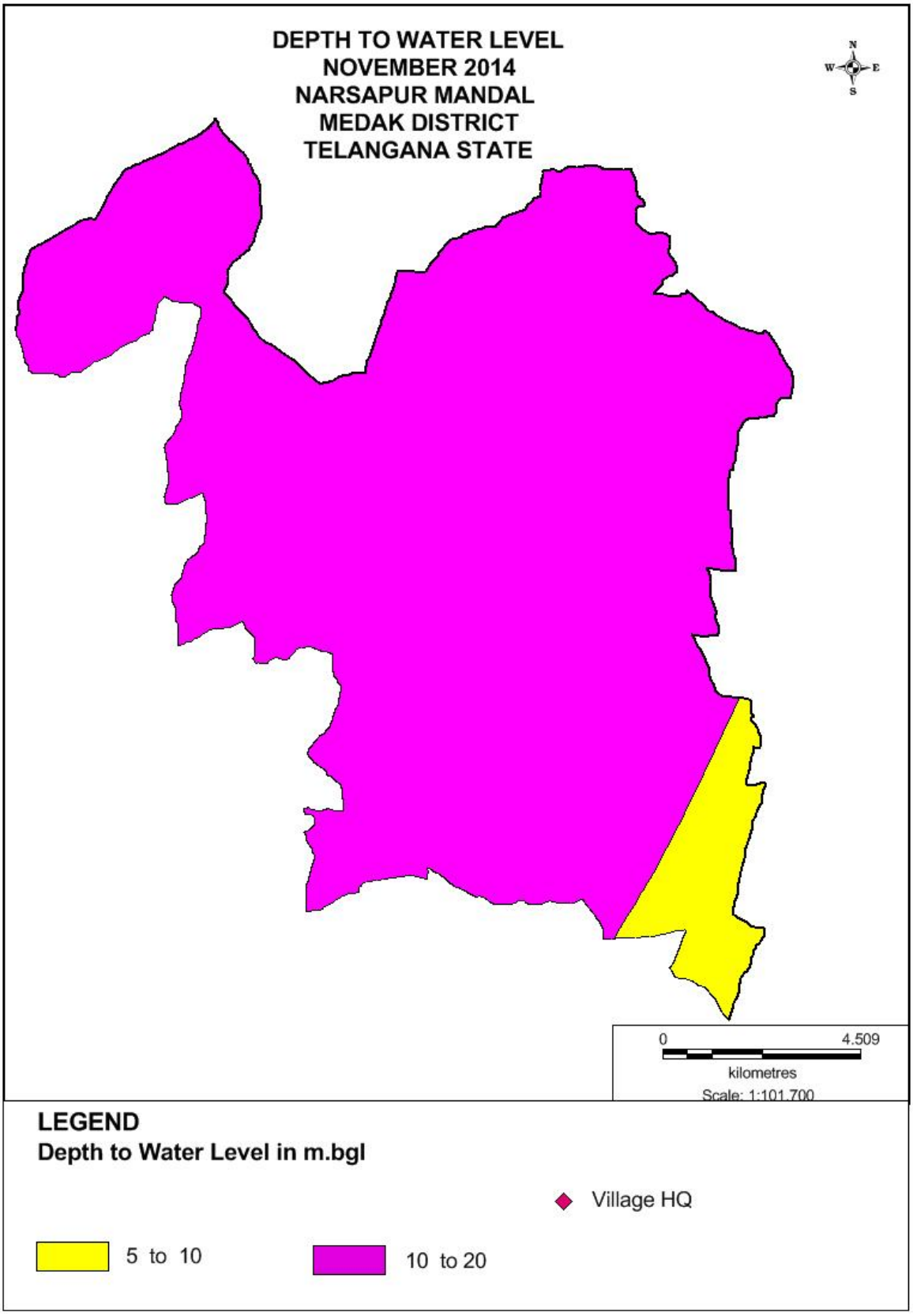
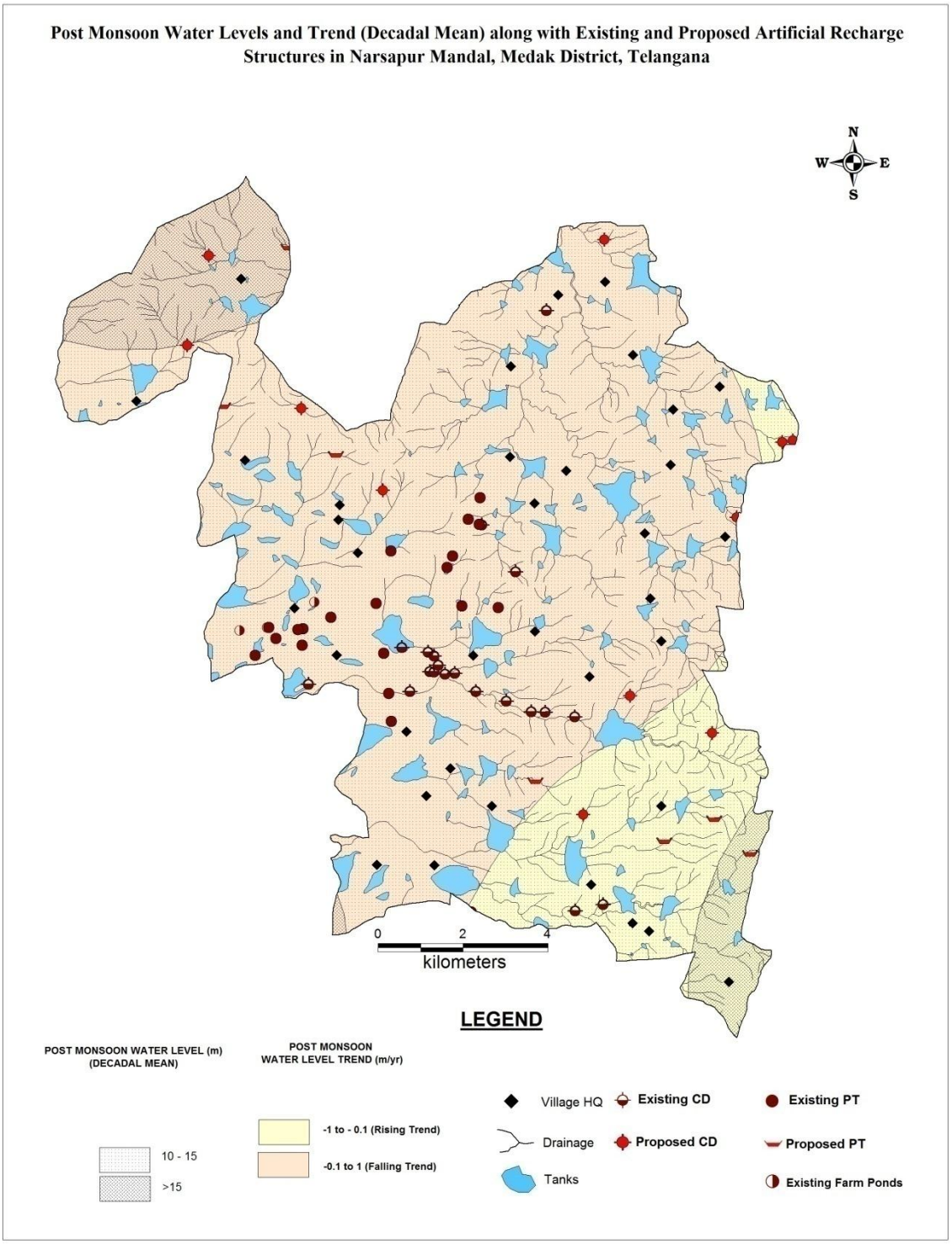

DEPTH TO WATER LEVEL
NOVEMBER 2014
NARSAPUR MANDAL
MEDAK DISTRICT
TELANGANA STATE
N
W
E
S
0
4.509
kilometres
Scale: 1:101,700
LEGEND
Depth to Water Level in m.bgl
Village HQ
5 to 10
10 to 20

Fig.7


Post Monsoon Water Levels and Trend (Decadal Mean) along with Existing and Proposed Artificial Recharge Structures in Narsapur Mandal, Medak District, Telangana
N
W
E
S
0
2
4
kilometers
LEGEND
POST MONSOON WATER LEVEL (m) (DECADAL MEAN)
10 - 15
>15
POST MONSOON WATER LEVEL TREND (m/yr)
-1 to - 0.1 (Rising Trend)
-0.1 to 1 (Falling Trend)
Village HQ
Drainage
Tanks
Existing CD
Proposed CD
Existing PT
Proposed PT
Existing Farm Ponds