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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 MALLIAL MANDAL, KARIMNAGAR DISTRICT, TELANGANA STATE

SOUTHERN REGION
HYDERABAD
AUGUST-2016

PLAN ON
ARTIFICIAL RECHARGE TO GROUNDWATER AND WATER CONSERVATION IN MALLIAL MANDAL, KARIMNAGAR DISTRICT, TELANGANA STATE

CONTENTS

AT A GLANCE

Name of the Mandal	MALLIAL
District	KARIMNAGAR
State	TELANGANA
Total Area(sq. km)	167
Area suitable for Artificial Recharge (Sq.kms)	120
Latitude and Longitude	18.640510 to 18.747330 and 78.795010 to 79.008680.
Average Annual Rainfall (mm)	961
Geology	BGC
Average Depth To Water Level (Decadal) (Pre Monsoon)	4.04
Average Depth To Water Level (Decadal) (Post Monsoon)	1.95
Ground Water Resources (2011)	
Annual Replenishable Ground Water Resources (MCM/yr)	21.87
Net Annual Ground Water Availability(MCM)/yr	19.77
Net Annual Ground Water Draft(MCM)/yr	23.62
Projected Demand for Domestic and Industrial Use(MCM)/yr	0.64
Stage of Ground Water Development (%)	119
Runoff Yield in MCM/yr.	29.3
Total Storage Created in the Mandal by Various Agencies (MCM)/yr	0
Artificial Recharge/Conservation Measures	
Recharge Structures Proposed (No.s)	Check Dams-46 Farm Ponds -340,
Improving Water use Efficiency	Micro Irrigation – 1700 ha
Tentative Total Cost in Lakhs (Rs.)	1413
Expected Recharge/Savings (MCM)/yr	6.11

1. INTRODUCTION

Mallial Mandal is one of the over-exploited Mandals in Karimnagar district, Telangana State, which is economically backward and chronically drought affected. The Mandal has 15 inhabited villages, and with 17 gram panchayats.

2. LOCATION

The Mandal lies between north latitudes 18.640510 to 18.747330 and between east longitudes 78.795010 to 79.008680. The Mandal occupies the western part of the Karimnagar district and is bounded on the north by Jagtial mandal, on the east by Pegadapalle mandal, on the south by Kodimal mandal and west by Medipalle Mandal. (Fig.1) The geographical area of the Mandal is 167.km.

3. PHYSIOGRAPHY AND DRAINAGE:

The area is drained by streams, falling in Middle 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 961 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 167 Sq.km, the area under forest is 26.71 Sq.km. and the net area sown is 66.21 Sq.km. Barren and uncultivable land is 12.69 Sq.km. The land for non agricultural use accounts for 6.29 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 25m.The weathered zone has been extensively tapped by dug and dug cum bore wells up to 25mbgl depth, which are mostly dry now. Ground water occurs in the fractured granites down to a depth of 200 m bgl. However, the potential fractures are encountered between 50-100 m bgl. The cumulative yield varies from 2-5 lps. The average depth to water level (decadal) during pre and post monsoon is 4.04 and 1.95 m bgl respectively.

7. GROUND WATER LEVEL SCENARIO

The depth to water level during the pre and post-monsoon varies from 2 to 20 m bgl. The decadal mean Post Monsoon Water levels and trends are depicted in Fig-5.

8. DYNAMIC GROUND WATER RESOURCES

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

Table-1: Ground water availability, resources of Mallial Mandal, Karimnagar District.

Annual Replenishable Ground water resources (MCM)	21.87
Net Annual Ground Water Availability(MCM)/yr	19.77
Net Annual Ground Water Draft(MCM)/yr	23.62
Projected Demand for Domestic and Industrial use up to 2025. (MCM)	0.64
Stage of Ground water development (%).	119
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 upto10mbgl. 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

Mallial Mandal falls under high stage of ground water development i.e., 119 % 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)	167
Hilly Area (Sq.kms)	47
Area suitable for Artificial Recharge (sq.km.)	120
Runoff Yield in MCM/yr.	29.3
Existing No. of Check Dams	0
Storage created MCM/yr.	0
Total Existing Storage Created	0.00

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 for ground water recharge purpose within the mandal has been assessed as 29.3 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

The area is covered by seasonal nalas – drains, which carry discharge during monsoon 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 961 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.

Thus, **46 Check dams have been recommended .**

B). 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 340 farm ponds in 17 villages of the Mandal @ 20 farm ponds in each village. These 340 farm ponds can hold/harvest about 0.05 MCM of runoff rainfall.

C) 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 1700 ha @ 100 ha per village.

13. TENTATIVE COST ESTIMATES (MALLIAL 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)	46	1.288	5	230	0.966
2	Recharge shaft in Check dam (50% of the existing Check dams)	0	0	0.5	0	0
3	Proposed Percolation Tanks (100*100*2.5)* 4 fillings)	0	0	15	0	0
4	Renovation Desilting, Repairs and installation of Recharge Shafts in existing PTS (50% of the existing PTS)	0	0	1	0	0
5	Proposed Farm Pond (6 filling) 5*5*1.5 dimension @ 20 farm ponds per each village	340	0.04896	0.25	85	0.044064
6	Proposed Sprinkler/drip/HDPE pipes for 100 ha in each village	1700		0.6	1020	5.1
7	Proposed Piezometers up to 50 mbgl @ one PZ per Village	17	0	0.6	10.2	0
8 (i)	Total (No. of AR Structures)	403	1.34		325.2	1.010
8 (ii)	Total (ha)	1700			1020	5.1
	Total (8(i) + 8 (ii))				**1345.2**	**6.110**
9	Impact Assessment & O & M -5 % of Total cost of the Scheme				**67.26**	
	Grand Total				**1412.46**	

*(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	Quarter							
	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 6.11 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 119% to 91% (28%)
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.

PROPOSED ARTIFICIAL RECHARGE STRUCTURES
MALLIAL MANDAL, KARIMNAGAR DISTRICT, TELANGANA.

S.No.	Village	Lattiude	Longitude	Structure type
1	BALWANTHAPUR	18.6535	78.9526	CD
2	BALWANTHAPUR	18.6518	78.9615	CD
3	BALWANTHAPUR	18.6577	78.9721	CD
4	BALWANTHAPUR	18.6713	78.9649	CD
5	BALWANTHAPUR	18.6637	78.9567	CD
6	GORREGUNDAM	18.6850	78.8702	CD
7	GORREGUNDAM	18.6961	78.8516	CD
8	MADDUTLA	18.6883	78.8904	CD
9	MADDUTLA	18.6895	78.8824	CD
10	MADDUTLA	18.6968	78.8648	CD
11	MADDUTLA	18.7089	78.8863	CD
12	MADDUTLA	18.7174	78.8848	CD
13	MALLIAL	18.7200	78.9392	CD
14	MALLIAL	18.7251	78.9507	CD
15	MALLIAL	18.7191	78.9602	CD
16	MALLIAL	18.7304	78.9529	CD
17	MALLIAL	18.7353	78.9475	CD
18	MANALA	18.7269	78.9858	CD
19	MANALA	18.7233	78.9848	CD
20	MANALA	18.7317	78.9665	CD
21	MANALA	18.7394	78.9606	CD
22	MUTHYAMPETA	18.6936	78.9382	CD
23	MUTHYAMPETA	18.6928	78.9169	CD
24	MUTHYAMPETA	18.6853	78.9240	CD
25	MUTHYAMPETA	18.6639	78.9344	CD
26	MUTHYAMPETA	18.6767	78.9528	CD
27	MYADAMPALLE	18.7445	78.9926	CD
28	MYADAMPALLE	18.7400	79.0000	CD
29	MYADAMPALLE	18.7454	78.0024	CD
30	NOOKAPALLE	18.6913	78.9082	CD
31	NOOKAPALLE	18.6969	78.9034	CD
32	OBULAPUR	18.7325	78.8519	CD
33	OBULAPUR	18.7173	78.8560	CD
34	OBULAPUR	18.7127	78.8417	CD
35	POTHARAM	18.7430	78.8911	CD
36	POTHARAM	18.7316	78.8836	CD
37	POTHARAM	18.7266	78.8963	CD
38	SARVAPUR	18.6597	78.9772	CD
39	SARVAPUR	18.6821	78.9689	CD
40	SARVAPUR	18.6809	78.9642	CD
41	SARVAPUR	18.6898	78.9631	CD
42	THAKKALLAPALLE	18.7159	78.9840	CD
43	THAKKALLAPALLE	18.7251	78.9903	CD
44	THATIPALLE	18.6863	78.9804	CD
45	THATIPALLE	18.6942	78.9833	CD
46	THATIPALLE	18.7008	78.9789	CD

Fig.1

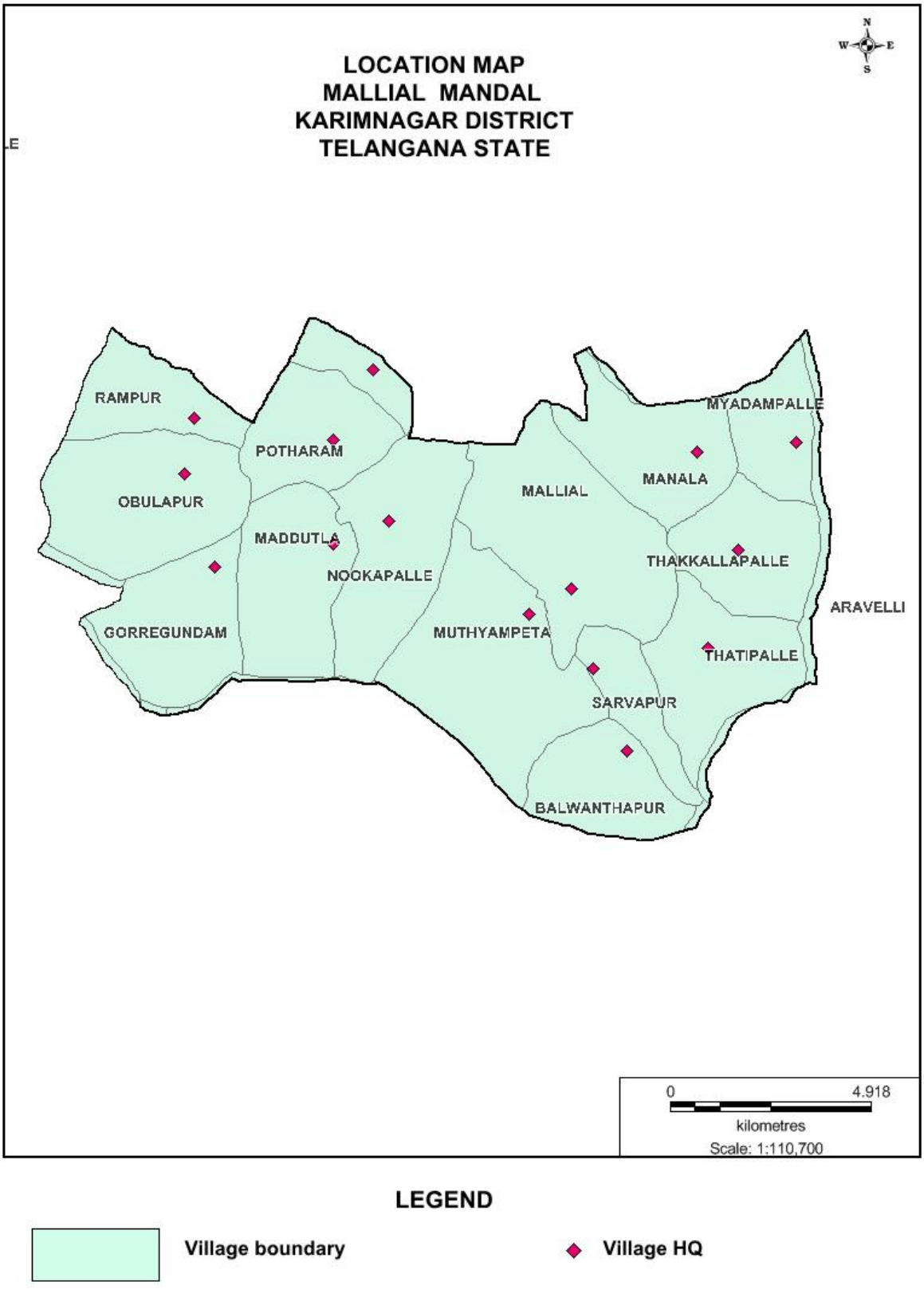

LOCATION MAP
MALLIAL MANDAL
KARIMNAGAR DISTRICT
TELANGANA STATE
N
W
E
S
RAMPUR
POTHARAM
OBULAPUR
MADDUTLA
NOOKAPALLE
GORREGUNDAM
MALLIAL
MANALA
MYADAMPALLE
THAKKALLAPALLE
ARAVELLI
MUTHYAMPETA
THATIPALLE
SARVAPUR
BALWANTHAPUR
0
4.918
kilometres
Scale: 1:110,700
LEGEND
Village boundary
Village HQ

Fig.2

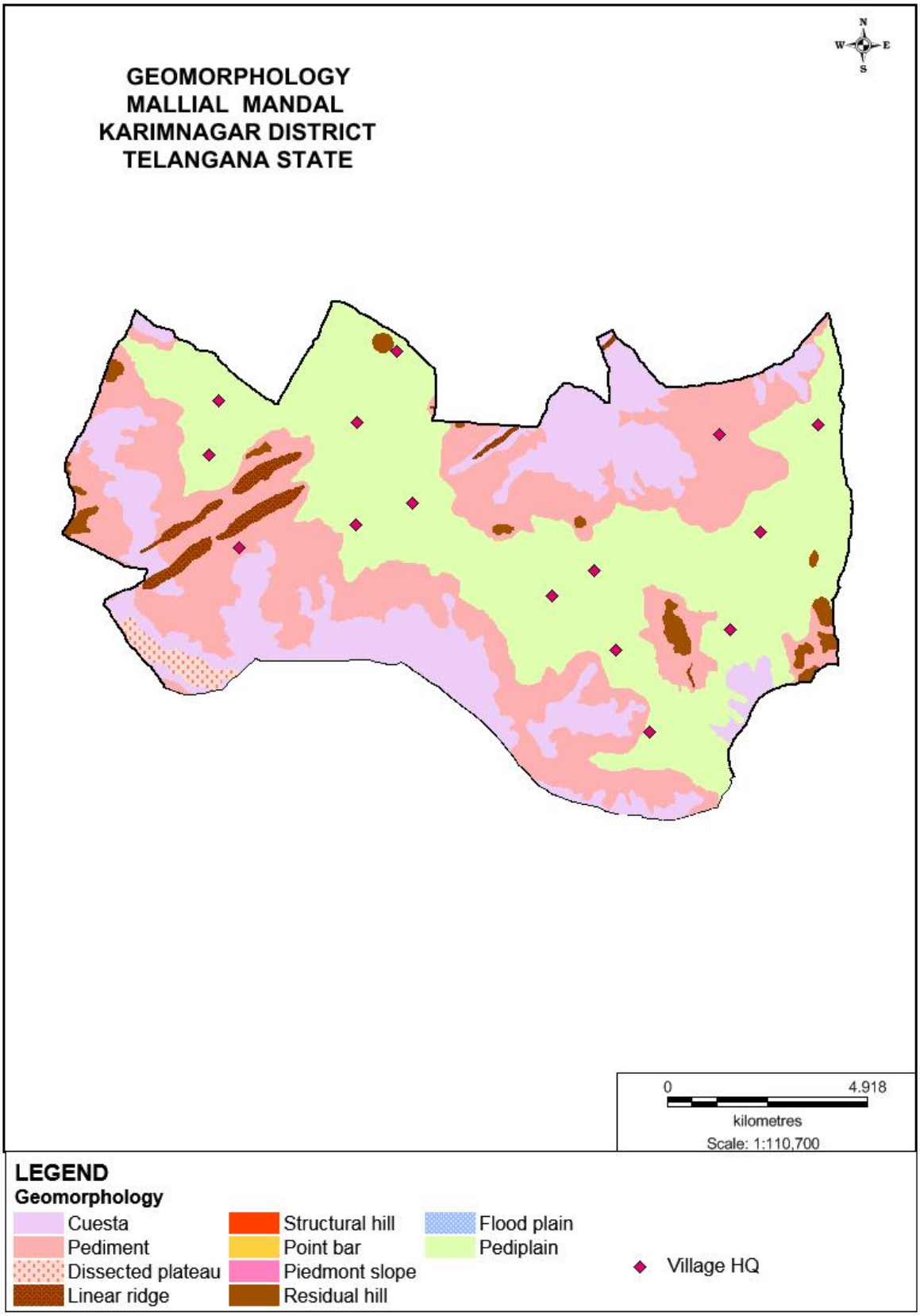

GEOMORPHOLOGY
MALLIAL MANDAL
KARIMNAGAR DISTRICT
TELANGANA STATE
N
W
E
S
0
4.918
kilometres
Scale: 1:110,700
LEGEND
Geomorphology
Cuesta
Pediment
Dissected plateau
Linear ridge
Structural hill
Point bar
Piedmont slope
Residual hill
Flood plain
Pediplain
Village HQ

Fig.3

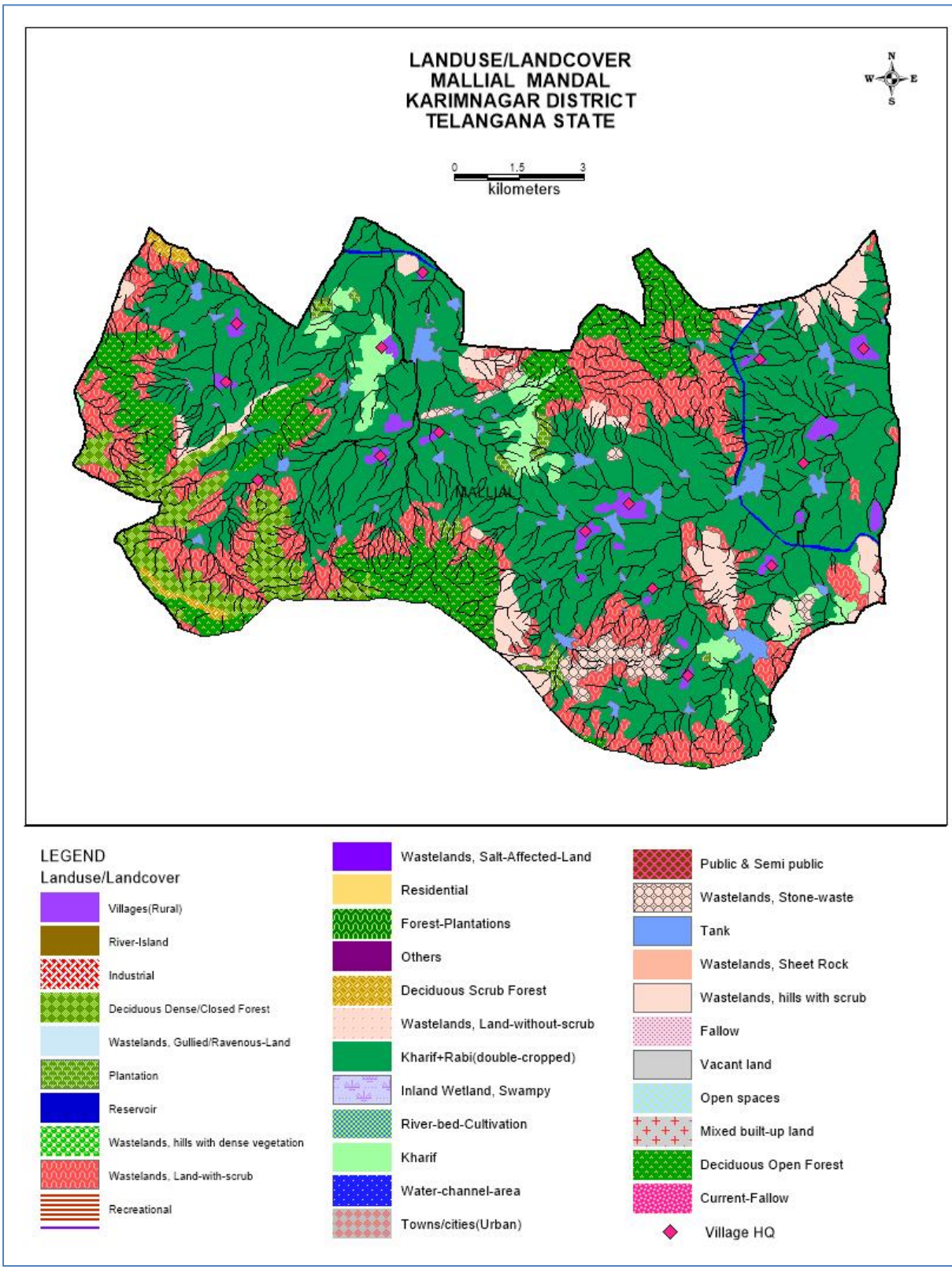

LANDUSE/LANDCOVER
MALLIAL MANDAL
KARIMNAGAR DISTRICT
TELANGANA STATE
N
W
E
S
0
1.5
3
kilometers
MALLIAL
LEGEND
Landuse/Landcover
Villages(Rural)
River-Island
Industrial
Deciduous Dense/Closed Forest
Wastelands, Gullied/Ravenous-Land
Plantation
Reservoir
Wastelands, hills with dense vegetation
Wastelands, 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

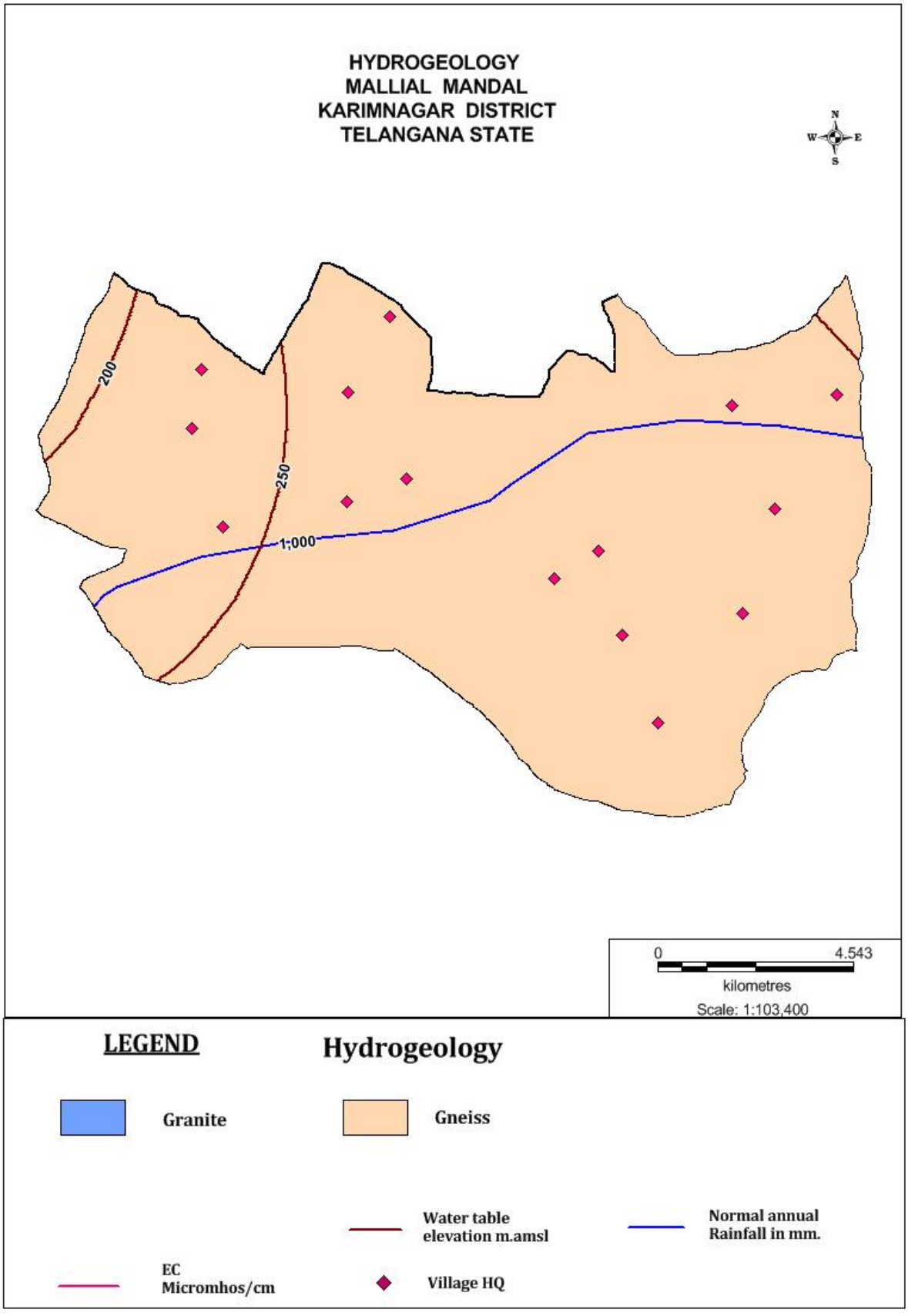
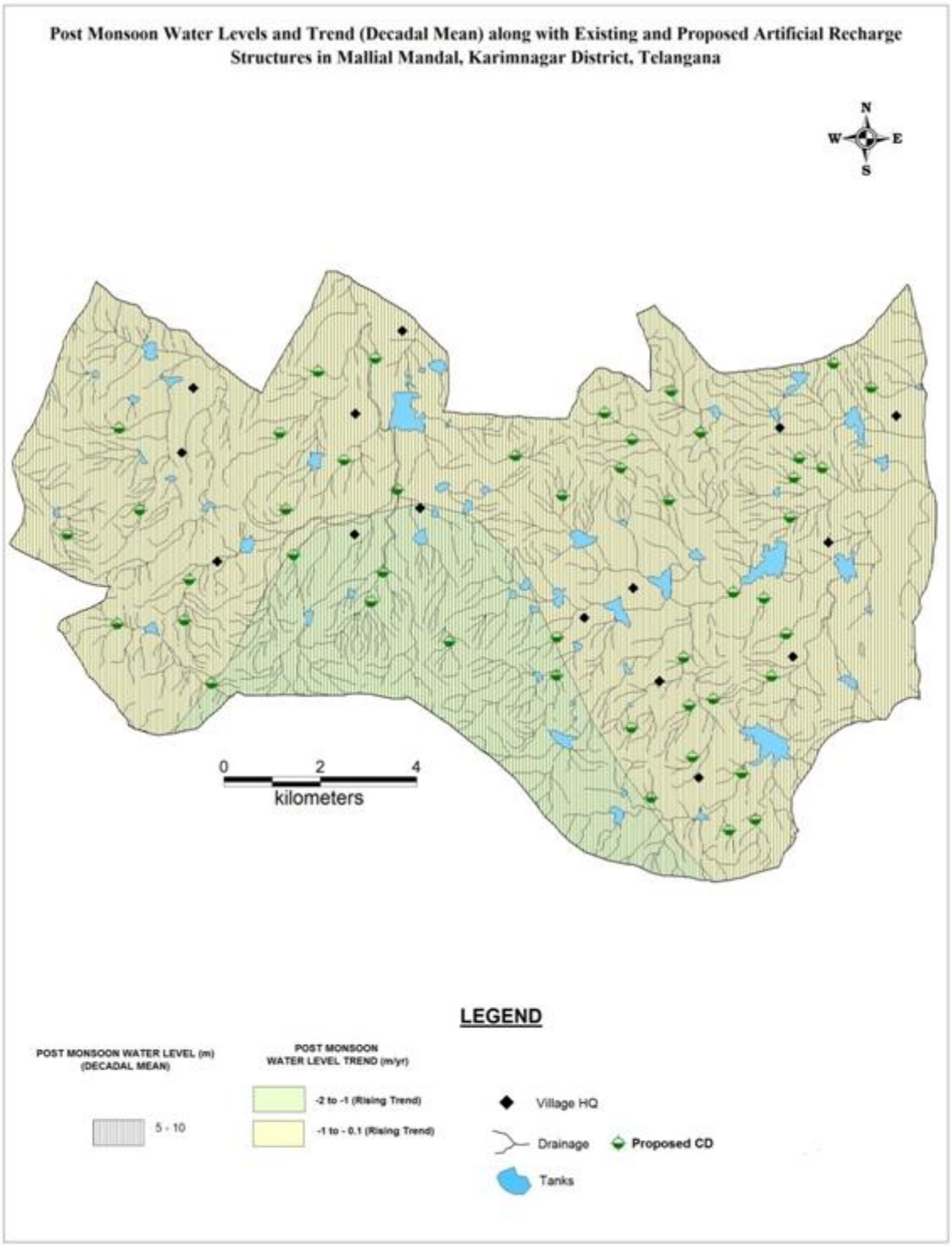

HYDROGEOLOGY
MALLIAL MANDAL
KARIMNAGAR DISTRICT
TELANGANA STATE
N
W
E
S
200
250
1;000
0
4.543
kilometres
Scale: 1:103,400
LEGEND
Hydrogeology
Granite
Gneiss
Water table elevation m.amsl
Normal annual Rainfall in mm.
EC Micromhos/cm
Village HQ

Fig.5


Post Monsoon Water Levels and Trend (Decadal Mean) along with Existing and Proposed Artificial Recharge Structures in Mallial Mandal, Karimnagar District, Telangana
N
W
E
S
0
2
4
kilometers
LEGEND
POST MONSOON WATER LEVEL (m) (DECADAL MEAN)
5 - 10
POST MONSOON WATER LEVEL TREND (m/yr)
-2 to -1 (Rising Trend)
-1 to - 0.1 (Rising Trend)
Village HQ
Drainage
Proposed CD
Tanks