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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
YELLANUR MANDAL, ANANTAPUR DISTRICT,
ANDHRA PRADESH

SOUTHERN REGION
HYDERABAD
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PLAN ON
ARTIFICIAL RECHARGE TO GROUNDWATER AND
WATER CONSERVATION IN
YELLANUR MANDAL, ANANTAPUR DISTRICT,
ANDHRA PRADESH

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AT A GLANCE

Name of the Mandal	YELLANUR
District	ANANTAPUR
State	ANDHRA PRADESH
Total Area sq.km	297
Area suitable for Artificial Recharge (sq.km.)	273
Latitude and Longitude	14.530990 to 14.764620 and 77.919050 to 78.132510
Average Annual Rainfall (mm)	631
Geology	Shales, Limestones
Average Depth To Water Level (Decadal) (Pre Monsoon)	15.20
Average Depth To Water Level (Decadal) (Post Monsoon)	7.40
Ground Water Resources (2011)	
Annual Replenishable Ground Water Resources (MCM/yr)	14.13
Net Annual Ground Water Availability(MCM)/yr	12.71
Net Annual Ground Water Draft(MCM)/yr	20.46
Projected Demand for Domestic and Industrial Use(MCM)/yr	1.87
Stage of Ground Water Development (%)	161
Surface Runoff (MCM/yr)	24.71
Total Storage Created in the Mandal by Various Agencies (MCM)/yr	1.82
Artificial Recharge/Conservation Measures	
Recharge Structures Proposed (No.s)	Percolation Tanks: 0, Check Dams:42 Farm ponds: 440, Recharge Shafts: 129
Improving Water use Efficiency	Micro Irrigation System: 2200 ha
Tentative Total Cost in Lakhs (Rs.)	1815.66
Expected Recharge/Savings (MCM)/yr	8.958

1. INTRODUCTION

Yellanur Mandal is one of over-exploited mandal in Anantapur district, Andhra Pradesh State, which is economically backward and chronically drought affected. The mandal has 19 inhabited villages and with 22 gram panchayats.

2. LOCATION

The mandal lies between north latitudes 14.530990 to 14.764620 and between east longitudes 77.919050 to 78.132510. The mandal occupies the Eastern part of the Anantapur district and is bounded on the north by Putlur Mandal, on the east by Kadapa district, on the south by Kadapa District and west by Tadimarri mandal. (Fig.1) The geographical area of the mandal is 297 sq.km.

3. PHYSIOGRAPHY AND DRAINAGE:

The area is drained by streams which are tributaries of Pennar River. 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 631 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 297 sq.km, the area covered by forest is 44.1 sq.km and the net area sown is 139.77 sq.km. Barren and uncultivable land is 18.49 sq.km. The land for non agricultural use accounts for 22.44 sq.km (Fig.3).

6. HYDROGEOLOGY

The area is underlain by Shales and lime stones. 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 12 m. The weathered zone has been extensively tapped by dug and dug cum bore wells up to 20 m depth, which are mostly dry now. Ground water occurs in the fractured rock formations up to 200 m bgl. The cumulative yield varies from 2-5 lps. (Fig.4).

7. GROUND WATER LEVEL SCENARIO

The depth to water level during the pre-monsoon and post-monsoon varies from 5 to 20 m. The depth to water levels maps for pre and post monsoon period (2014) are shown in Fig 5 & 6 respectively. The average depth to water level (decadal) during pre and post monsoon is 15.2 and 7.4 m bgl respectively. The 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 Yellanuru Mandal, Ananthapur District is given in Table-1.

Table-1: Ground water resources of Yellanuru Mandal, Anantapur District.

Annual Replenishable Ground water resources (MCM)	14.13
Net Annual Ground Water Availability(MCM)/yr	12.71
Net Annual Ground Water Draft(MCM)/yr	20.46
Projected Demand for Domestic and Industrial use up to 2025. (MCM)	1.87
Stage of Ground water development (%).	161
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 up to 20 m. 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

Yellanuru Mandal falls under high stage of ground water development i.e., 161 % 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)	297
Hilly Area (Sq.kms)	24
Area suitable for Artificial Recharge (sq.km.)	273
Runoff Yield in MCM/yr.	24.71
Existing No. of Check Dams	212
Storage created MCM/yr.	1.50
Existing No. of Percolation Tanks	45
Storage created MCM/yr.	0.32
Total Existing Storage Created	1.82

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 runoff available in the mandal has been assessed as 22.89 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 631 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, a total of **42 Check dams** 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 42 and 23 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 440 farm ponds in 22 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 2200 ha @ 100 ha per village.

13. TENTATIVE COST ESTIMATES (YELLANURU 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)	42	1.176	5	210	0.882
2	Recharge shaft in Check dam (50% of the existing Check dams)	106	1.166	0.5	53	1.166
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)	23	0.253	1	23	0.253
5	Proposed Farm Pond (6 filling) 5*5*1.5 dimension @ 20 farm ponds per each village	440	0.06336	0.25	110	0.057024
6	Proposed Sprinkler/drip/HDPE pipes for 100 ha in each village	2200	13.2	0.6	1320	6.6
7	Proposed Piezometers up to 50 mbgl @ one PZ per Village	22	0	0.6	13.2	0
8 (i)	Total (No. of AR Structures)	633	2.66		409.2	2.358
8 (ii)	Total (ha)	2200			1320	6.6
	Total (8(i) + 8 (ii))				1729.2	8.958
9	Impact Assessment & O & M -5 % of Total cost of the Scheme				86.46	
	Grand Total				1815.66	

*(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	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th
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 8.952 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 161% to 94% (67%)
4. It will also help in controlling soil erosion.

Acknowledgements

The data received from the Director Ground Water Department Andhra Pradesh in respect of the basic inputs is duly acknowledged. The information on existing Artificial Recharge Structures have been taken from the EMUSTER, Department of Rural Development, Government of AP.

EXISTING ARTIFICIAL RECHARGE STRUCTURES
YELLANUR MANDAL, ANANTAPUR DISTRICT, AP

S.no	Gram Panchayat	Habitation	Structure Type	Longitude	Latitude	Scheme
1	Goddumarri	Goddumarri	Check Dam	77.9917	14.6074	NREGS
2	Goddumarri	Goddumarri	Check Dam	77.9910	14.6047	NREGS
3	Goddumarri	Goddumarri	Check Dam	77.9910	14.6047	NREGS
4	Goddumarri	Goddumarri	Check Dam	77.9999	14.5904	NREGS
5	Goddumarri	Goddumarri	Check Dam	78.0010	14.5887	NREGS
6	Goddumarri	Goddumarri	Check Dam	78.0036	14.5926	NREGS
7	Kalluru	Kalluru	Check Dam	78.0472	14.6049	NREGS
8	Kalluru	Kalluru	Check Dam	78.0574	14.6265	NREGS
9	Kalluru	Kalluru	Check Dam	78.0553	14.6272	NREGS
10	Kalluru	Kalluru	Check Dam	78.0469	14.6062	NREGS
11	Kuchivaripalli	Kuchivaripalli	Check Dam	77.9714	14.6749	NREGS
12	Kuchivaripalli	Kuchivaripalli	Check Dam	77.9696	14.6509	NREGS
13	Kuchivaripalli	Kuchivaripalli	Check Dam	77.9519	14.6756	NREGS
14	Medikurthi	Medikurthi	Check Dam	78.0482	14.7558	NREGS
15	Medikurthi	Medikurthi	Check Dam	78.0495	14.7529	NREGS
16	Medikurthi	Medikurthi	Check Dam	78.0564	14.7556	NREGS
17	Medikurthi	Medikurthi	Check Dam	78.0561	14.7538	NREGS
18	Medikurthi	Medikurthi	Check Dam	78.0569	14.7556	NREGS
19	Medikurthi	Medikurthi	Check Dam	78.0633	14.7544	NREGS
20	Medikurthi	Medikurthi	Check Dam	78.0684	14.7476	NREGS
21	Singavaram	Singavaram	Check Dam	78.0366	14.5899	NREGS
22	Singavaram	Singavaram	Check Dam	78.0354	14.5913	NREGS
23	Singavaram	Singavaram	Check Dam	78.0357	14.5977	NREGS
24	Singavaram	Singavaram	Check Dam	78.0452	14.5891	NREGS
25	Singavaram	Singavaram	Check Dam	78.0367	14.5941	NREGS
26	Thirumalapuram	Thirumalapuram	Check Dam	78.0322	14.7064	NREGS
27	Thirumalapuram	Thirumalapuram	Check Dam	78.0145	14.7171	NREGS
28	Thirumalapuram	Thirumalapuram	Check Dam	78.0143	14.7180	NREGS
29	Vennapusapalle	Vennapusapalle	Check Dam	78.0826	14.6608	NREGS
30	Vennapusapalle	Vennapusapalle	Check Dam	78.0845	14.6641	NREGS
31	Vennapusapalle	Vennapusapalle	Check Dam	78.0851	14.6664	NREGS
32	Vennapusapalle	Vennapusapalle	Check Dam	78.0663	14.6598	NREGS
33	Vennapusapalle	Vennapusapalle	Check Dam	78.0781	14.6442	NREGS
34	Yellanur	Yellanur	Check Dam	78.0896	14.7116	NREGS
35	Yellanur	Yellanur	Check Dam	78.0650	14.6684	NREGS
36	Yellanur	Yellanur	Check Dam	78.0613	14.6610	NREGS
37	Yellanur	Yellanur	Check Dam	78.0567	14.6552	NREGS
38	Pathapalle	Pathapalle	Check Dam	78.1258	14.6657	NREGS
39	Pathapalle	Pathapalle	Check Dam	78.1278	14.6701	NREGS
40	Pathapalle	Pathapalle	Check Dam	78.1301	14.6733	NREGS

41	Pathapalle	Pathapalle	Check Dam	78.1303	14.6769	NREGS
42	Peddammallepalle	Kondapuram	Check Dam	78.0428	14.7179	NREGS
43	Peddammallepalle	Kondapuram	Check Dam	78.0309	14.7235	NREGS
44	Peddammallepalle	Peddammallepalle	Check Dam	78.0502	14.7264	NREGS
45	Peddammallepalle	Peddammallepalle	Check Dam	78.0446	14.7160	NREGS
46	Peddammallepalle	Peddammallepalle	Check Dam	78.0456	14.7142	NREGS
47	Peddammallepalle	Peddammallepalle	Check Dam	78.0457	14.7337	NREGS
48	Peddammallepalle	Peddammallepalle	Check Dam	78.0486	14.7120	NREGS
49	Peddammallepalle	Peddammallepalle	Check Dam	78.0495	14.7283	NREGS
50	Peddammallepalle	Peddammallepalle	Check Dam	78.0500	14.7110	NREGS
51	Jangampalli	Jangampalli	Check Dam	78.1308	14.6817	NREGS
52	Jangampalli	Jangampalli	Check Dam	78.1296	14.6851	NREGS
53	Jangampalli	Jangampalli	Check Dam	78.1277	14.6900	NREGS
54	Jangampalli	Jangampalli	Check Dam	78.1280	14.6890	NREGS
55	Jangampalli	Venkatadripalle	Check Dam	78.0880	14.7159	NREGS
56	Boppepalle	Boppepalle	Check Dam	77.9850	14.6970	NREGS
57	Boppepalle	Boppepalle	Check Dam	77.9853	14.6957	NREGS
58	Boppepalle	Boppepalle	Check Dam	77.9893	14.6938	NREGS
59	Boppepalle	Boppepalle	Check Dam	77.9915	14.6917	NREGS
60	Boppepalle	Boppepalle	Check Dam	77.9906	14.6911	NREGS
61	Boppepalle	Boppepalle	Check Dam	77.9897	14.6885	NREGS
62	Boppepalle	Boppepalle	Check Dam	77.9748	14.6966	NREGS
63	Boppepalle	Boppepalle	Check Dam	77.9870	14.6948	NREGS
64	Boppepalle	Vasapuram	Check Dam	77.9937	14.6887	NREGS
65	Venkatampalli	Duggupalli	Check Dam	78.0554	14.6411	NREGS
66	Venkatampalli	Duggupalli	Check Dam	78.0517	14.6387	NREGS
67	Venkatampalli	Duggupalli	Check Dam	78.0575	14.6410	NREGS
68	Venkatampalli	Duggupalli	Check Dam	78.0558	14.6346	NREGS
69	Venkatampalli	Duggupalli	Check Dam	78.0573	14.6341	NREGS
70	Venkatampalli	Duggupalli	Check Dam	78.0588	14.6320	NREGS
71	Venkatampalli	Venkatampalli	Check Dam	78.0674	14.5950	NREGS
72	Venkatampalli	Venkatampalli	Check Dam	78.0703	14.5877	NREGS
73	Venkatampalli	Venkatampalli	Check Dam	78.0676	14.6055	NREGS
74	Venkatampalli	Venkatampalli	Check Dam	78.0620	14.6005	NREGS
75	Venkatampalli	Venkatampalli	Check Dam	78.0595	14.5978	NREGS
76	Bukkapuram	Bukkapuram	Check Dam	77.9810	14.6518	NREGS
77	Bukkapuram	Bukkapuram	Check Dam	77.9797	14.6545	NREGS
78	Bukkapuram	Bukkapuram	Check Dam	77.9803	14.6505	NREGS
79	Bukkapuram	Bukkapuram	Check Dam	78.0078	14.6587	NREGS
80	Bukkapuram	Bukkapuram	Check Dam	77.9782	14.6568	NREGS
81	Bukkapuram	Bukkapuram	Check Dam	77.9810	14.6601	NREGS
82	Bukkapuram	Bukkapuram	Check Dam	77.9894	14.6449	NREGS
83	Chilamakuru	Achutapuram	Check Dam	77.9937	14.6888	NREGS
84	Chilamakuru	Achutapuram	Check Dam	77.9897	14.6885	NREGS

85	Chilamakuru	Achutapuram	Check Dam	77.9851	14.6960	NREGS
86	Chilamakuru	Achutapuram	Check Dam	77.9840	14.6959	NREGS
87	Chilamakuru	Achutapuram	Check Dam	77.9907	14.6912	NREGS
88	Chilamakuru	Kodumurthy	Check Dam	78.0468	14.6751	NREGS
89	Chilamakuru	Kodumurthy	Check Dam	78.0476	14.6682	NREGS
90	Chilamakuru	Kodumurthy	Check Dam	78.0452	14.6689	NREGS
91	Chilamakuru	Kodumurthy	Check Dam	78.0400	14.6743	NREGS
92	Chilamakuru	Kodumurthy	Check Dam	77.9915	14.6919	NREGS
93	Chinthakayamanda	Chinthakayamanda	Check Dam	78.0114	14.6245	NREGS
94	Chinthakayamanda	Chinthakayamanda	Check Dam	78.0123	14.6247	NREGS
95	Chinthakayamanda	Chinthakayamanda	Check Dam	78.0148	14.6269	NREGS
96	Danthalapalli	Danthalapalli	Check Dam	78.0360	14.5731	NREGS
97	Danthalapalli	Danthalapalli	Check Dam	78.0396	14.5852	NREGS
98	Danthalapalli	Danthalapalli	Check Dam	78.0390	14.5880	NREGS
99	Danthalapalli	Danthalapalli	Check Dam	78.0366	14.5681	NREGS
100	Danthalapalli	Danthalapalli	Check Dam	78.0441	14.5860	NREGS
101	Mallagundala	Gaddamvaripalli	Check Dam	78.0393	14.6421	NREGS
102	Mallagundala	Gaddamvaripalli	Check Dam	78.0509	14.6433	NREGS
103	Mallagundala	Gaddamvaripalli	Check Dam	78.0500	14.6449	NREGS
104	Mallagundala	Gaddamvaripalli	Check Dam	78.0499	14.6460	NREGS
105	Mallagundala	Gaddamvaripalli	Check Dam	78.0463	14.6536	NREGS
106	Mallagundala	Gaddamvaripalli	Check Dam	78.0337	14.6519	NREGS
107	Mallagundala	Gaddamvaripalli	Check Dam	78.0270	14.6521	NREGS
108	Mallagundala	Gaddamvaripalli	Check Dam	78.0548	14.6513	NREGS
109	Mallagundala	Gaddamvaripalli	Check Dam	78.0378	14.6562	NREGS
110	Mallagundala	Gaddamvaripalli	Check Dam	78.0378	14.6541	NREGS
111	Mallagundala	Gaddamvaripalli	Check Dam	78.0479	14.6555	NREGS
112	Mallagundala	Gaddamvaripalli	Check Dam	78.0439	14.6571	NREGS
113	Mallagundala	Gaddamvaripalli	Check Dam	78.0528	14.6536	NREGS
114	Mallagundala	Gaddamvaripalli	Check Dam	78.0537	14.6556	NREGS
115	Mallagundala	Lingareddipalli	Check Dam	78.0197	14.6485	NREGS
116	Mallagundala	Lingareddipalli	Check Dam	78.0190	14.6499	NREGS
117	Mallagundala	Mallagundala	Check Dam	78.0348	14.6335	NREGS
118	Mallagundala	Mallagundala	Check Dam	78.0217	14.6468	NREGS
119	Neerajampalli	Neerajampalli	Check Dam	78.0221	14.5332	NREGS
120	Neerajampalli	Neerajampalli	Check Dam	78.0086	14.5535	NREGS
121	Neerajampalli	Neerajampalli	Check Dam	78.0063	14.5556	NREGS
122	Neerajampalli	Neerajampalli	Check Dam	78.0130	14.5403	NREGS
123	Neerajampalli	Neerajampalli	Check Dam	78.0325	14.5967	NREGS
124	Vemulapalle	Bhagyanagaram	Check Dam	78.0341	14.7458	NREGS
125	Vemulapalle	Bhagyanagaram	Check Dam	78.0365	14.7397	NREGS
126	Vemulapalle	Bhagyanagaram	Check Dam	78.0377	14.7399	NREGS
127	Vemulapalle	Vemulapalle	Check Dam	78.0358	14.7534	NREGS
128	Vemulapalle	Vemulapalle	Check Dam	78.0190	14.7513	NREGS

129	Vemulapalle	Vemulapalle	Check Dam	78.0142	14.7523	NREGS
130	Vemulapalle	Vemulapalle	Check Dam	78.0218	14.7614	NREGS
131	Vemulapalle	Vemulapalle	Check Dam	78.0330	14.7543	NREGS
132	Vemulapalle	Vemulapalle	Check Dam	78.0092	14.7507	NREGS
133	Vemulapalle	Vemulapalle	Check Dam	78.0122	14.7513	NREGS
134	Vemulapalle	Vijayanagaram	Check Dam	78.0202	14.7486	NREGS
135	Vemulapalle	Vijayanagaram	Check Dam	78.0225	14.7468	NREGS
136	Vemulapalle	Vijayanagaram	Check Dam	78.0177	14.7469	NREGS
137	Vemulapalle	Vijayanagaram	Check Dam	78.0191	14.7467	NREGS
138	Vemulapalle	Vijayanagaram	Check Dam	78.0129	14.7420	NREGS
139	Kalluru	Kalluru	Check Dam	78.0472	14.6049	IWMP
140	Kalluru	Kalluru	Check Dam	78.0574	14.6265	IWMP
141	Kalluru	Kalluru	Check Dam	78.0553	14.6272	IWMP
142	Kalluru	Kalluru	Check Dam	78.0469	14.6062	IWMP
143	Vennapusapalle	Vennapusapalle	Check Dam	78.0826	14.6608	IWMP
144	Vennapusapalle	Vennapusapalle	Check Dam	78.0845	14.6641	IWMP
145	Vennapusapalle	Vennapusapalle	Check Dam	78.0851	14.6664	IWMP
146	Vennapusapalle	Vennapusapalle	Check Dam	78.0663	14.6598	IWMP
147	Vennapusapalle	Vennapusapalle	Check Dam	78.0781	14.6442	IWMP
148	Yellanur	Yellanur	Check Dam	78.0896	14.7116	IWMP
149	Yellanur	Yellanur	Check Dam	78.0650	14.6684	IWMP
150	Yellanur	Yellanur	Check Dam	78.0613	14.6610	IWMP
151	Yellanur	Yellanur	Check Dam	78.0567	14.6552	IWMP
152	Venkatampalli	Duggupalli	Check Dam	78.0554	14.6411	IWMP
153	Venkatampalli	Duggupalli	Check Dam	78.0517	14.6387	IWMP
154	Venkatampalli	Duggupalli	Check Dam	78.0575	14.6410	IWMP
155	Venkatampalli	Duggupalli	Check Dam	78.0558	14.6346	IWMP
156	Venkatampalli	Duggupalli	Check Dam	78.0573	14.6341	IWMP
157	Venkatampalli	Duggupalli	Check Dam	78.0588	14.6320	IWMP
158	Chilamakuru	Kodumurthy	Check Dam	78.0468	14.6751	IWMP
159	Chilamakuru	Kodumurthy	Check Dam	78.0476	14.6682	IWMP
160	Chilamakuru	Kodumurthy	Check Dam	78.0452	14.6689	IWMP
161	Chilamakuru	Kodumurthy	Check Dam	78.0400	14.6743	IWMP
162	Chilamakuru	Kodumurthy	Check Dam	77.9915	14.6919	IWMP
163	Mallagundala	Gaddamvaripalli	Check Dam	78.0509	14.6433	IWMP
164	Mallagundala	Gaddamvaripalli	Check Dam	78.0500	14.6449	IWMP
165	Mallagundala	Gaddamvaripalli	Check Dam	78.0499	14.6460	IWMP
166	Mallagundala	Gaddamvaripalli	Check Dam	78.0463	14.6536	IWMP
167	Mallagundala	Gaddamvaripalli	Check Dam	78.0479	14.6555	IWMP
168	Mallagundala	Gaddamvaripalli	Check Dam	78.0439	14.6571	IWMP
169	Mallagundala	Gaddamvaripalli	Check Dam	78.0393	14.6421	IWMP
170	Mallagundala	Gaddamvaripalli	Check Dam	78.0378	14.6562	IWMP
171	Mallagundala	Gaddamvaripalli	Check Dam	78.0378	14.6541	IWMP
172	Mallagundala	Gaddamvaripalli	Check Dam	78.0337	14.6519	IWMP

173	Mallagundala	Gaddamvaripalli	Check Dam	78.0270	14.6521	IWMP
174	Mallagundala	Gaddamvaripalli	Check Dam	78.0528	14.6536	IWMP
175	Mallagundala	Gaddamvaripalli	Check Dam	78.0537	14.6556	IWMP
176	Mallagundala	Gaddamvaripalli	Check Dam	78.0548	14.6513	IWMP
177	Mallagundala	Lingareddipalli	Check Dam	78.0197	14.6485	IWMP
178	Mallagundala	Lingareddipalli	Check Dam	78.0190	14.6499	IWMP
179	Mallagundala	Mallagundala	Check Dam	78.0348	14.6335	IWMP
180	Mallagundala	Mallagundala	Check Dam	78.0217	14.6468	IWMP
181	Kalluru	Kalluru	Check Wall	78.0498	14.6107	NREGS
182	Thirumalapuram	Thirumalapuram	Check Wall	78.0368	14.7122	NREGS
183	Thirumalapuram	Thirumalapuram	Check Wall	78.0315	14.7069	NREGS
184	Peddammallepalle	Peddammallepalle	Check Wall	78.0488	14.7112	NREGS
185	Jangampalli	Jangampalli	Check Wall	78.1247	14.6863	NREGS
186	Boppepalle	Vasapuram	Check Wall	77.9879	14.6867	NREGS
187	Venkatampalli	Duggupalli	Check Wall	78.0541	14.6408	NREGS
188	Venkatampalli	Duggupalli	Check Wall	78.0564	14.6360	NREGS
189	Venkatampalli	Duggupalli	Check Wall	78.0561	14.6375	NREGS
190	Venkatampalli	Duggupalli	Check Wall	78.0575	14.6325	NREGS
191	Bukkapuram	Bukkapuram	Check Wall	77.9793	14.6429	NREGS
192	Bukkapuram	Bukkapuram	Check Wall	77.9792	14.6565	NREGS
193	Chilamakuru	Kodumurthy	Check Wall	78.0460	14.6667	NREGS
194	Chilamakuru	Kodumurthy	Check Wall	78.0392	14.6731	NREGS
195	Chinthakayamanda	Kodavandlapalli	Check Wall	78.0019	14.6289	NREGS
196	Mallagundala	Gaddamvaripalli	Check Wall	78.0471	14.6494	NREGS
197	Mallagundala	Gaddamvaripalli	Check Wall	78.0546	14.6521	NREGS
198	Mallagundala	Gaddamvaripalli	Check Wall	78.0406	14.6606	NREGS
199	Mallagundala	Mallagundala	Check Wall	78.0331	14.6334	NREGS
200	Mallagundala	Mallagundala	Check Wall	78.0291	14.6357	NREGS
201	Kalluru	Kalluru	Check Wall	78.0498	14.6107	IWMP
202	Venkatampalli	Duggupalli	Check Wall	78.0541	14.6408	IWMP
203	Venkatampalli	Duggupalli	Check Wall	78.0564	14.6360	IWMP
204	Venkatampalli	Duggupalli	Check Wall	78.0561	14.6375	IWMP
205	Venkatampalli	Duggupalli	Check Wall	78.0575	14.6325	IWMP
206	Chilamakuru	Kodumurthy	Check Wall	78.0460	14.6667	IWMP
207	Chilamakuru	Kodumurthy	Check Wall	78.0392	14.6731	IWMP
208	Mallagundala	Gaddamvaripalli	Check Wall	78.0471	14.6494	IWMP
209	Mallagundala	Gaddamvaripalli	Check Wall	78.0406	14.6606	IWMP
210	Mallagundala	Gaddamvaripalli	Check Wall	78.0546	14.6521	IWMP
211	Mallagundala	Mallagundala	Check Wall	78.0331	14.6334	IWMP
212	Mallagundala	Mallagundala	Check Wall	78.0291	14.6357	IWMP
213	Singavaram	Singavaram	MPT	78.0455	14.5901	NREGS
214	Mallagundala	Gaddamvaripalli	MPT	78.0375	14.6554	NREGS
215	Mallagundala	Gaddamvaripalli	MPT	78.0362	14.6611	NREGS
216	Mallagundala	Gaddamvaripalli	MPT	78.0445	14.6521	NREGS

217	Mallagundala	Gaddamvaripalli	MPT	78.0375	14.6554	IWMP
218	Mallagundala	Gaddamvaripalli	MPT	78.0362	14.6611	IWMP
219	Mallagundala	Gaddamvaripalli	MPT	78.0445	14.6521	IWMP
220	85 nittor	85 Nittor	PT	78.0585	14.7491	NREGS
221	85 nittor	85 Nittor	PT	78.0564	14.7485	NREGS
222	Goddumarri	Goddumarri	PT	77.9998	14.5780	NREGS
223	Kalluru	Kalluru	PT	78.0471	14.6010	NREGS
224	Kalluru	Kalluru	PT	78.0643	14.6274	NREGS
225	Kuchivaripalli	Kuchivaripalli	PT	77.9727	14.6743	NREGS
226	Kuchivaripalli	Kuchivaripalli	PT	77.9784	14.6608	NREGS
227	Kuchivaripalli	Kuchivaripalli	PT	77.9693	14.6523	NREGS
228	Kuchivaripalli	Kuchivaripalli	PT	77.9567	14.6828	NREGS
229	Kuchivaripalli	Kuchivaripalli	PT	77.9544	14.6876	NREGS
230	Medikurthi	Medikurthi	PT	78.0431	14.7600	NREGS
231	Thirumalapuram	Thirumalapuram	PT	78.0352	14.7132	NREGS
232	Thirumalapuram	Thirumalapuram	PT	78.0162	14.7079	NREGS
233	Thirumalapuram	Thirumalapuram	PT	78.0135	14.7143	NREGS
234	Thirumalapuram	Thirumalapuram	PT	78.0254	14.7159	NREGS
235	Vennapusapalle	Vennapusapalle	PT	78.0816	14.6596	NREGS
236	Vennapusapalle	Vennapusapalle	PT	78.0796	14.6490	NREGS
237	Yellanur	Yellanur	PT	78.0866	14.7075	NREGS
238	Yellanur	Yellanur	PT	78.0873	14.7100	NREGS
239	Yellanur	Yellanur	PT	78.0882	14.7106	NREGS
240	Yellanur	Yellanur	PT	78.0915	14.7117	NREGS
241	Peddammallepalle	Peddammallepalle	PT	78.0516	14.7233	NREGS
242	Jangampalli	Venkatadripalle	PT	78.0929	14.7112	NREGS
243	Jangampalli	Venkatadripalle	PT	78.0943	14.7120	NREGS
244	Jangampalli	Venkatadripalle	PT	78.0917	14.7107	NREGS
245	Bukkapuram	Bukkapuram	PT	77.9813	14.6642	NREGS
246	Chinthakayamanda	Chinthakayamanda	PT	77.9950	14.6137	NREGS
247	Mallagundala	Gaddamvaripalli	PT	78.0315	14.6488	NREGS
248	Neerajampalli	Neerajampalli	PT	78.0159	14.5435	NREGS
249	Kalluru	Kalluru	PT	78.0471	14.6010	IWMP
250	Kalluru	Kalluru	PT	78.0643	14.6274	IWMP
251	Vennapusapalle	Vennapusapalle	PT	78.0816	14.6596	IWMP
252	Vennapusapalle	Vennapusapalle	PT	78.0796	14.6490	IWMP
253	Yellanur	Yellanur	PT	78.0866	14.7075	IWMP
254	Yellanur	Yellanur	PT	78.0873	14.7100	IWMP
255	Yellanur	Yellanur	PT	78.0882	14.7106	IWMP
256	Yellanur	Yellanur	PT	78.0915	14.7117	IWMP
257	Mallagundala	Gaddamvaripalli	PT	78.0315	14.6488	IWMP

PROPOSED ARTIFICIAL RECHARGE STRUCTURES
YELLANUR MANDAL, ANANTAPUR DISTRICT, AP

S.No.	Mandal	Lattitude	Longitude	Structure_Type
1	Yellanur	14.5775	77.9899	CheckDam
2	Yellanur	14.5712	77.9967	CheckDam
3	Yellanur	14.5654	77.9899	CheckDam
4	Yellanur	14.5554	77.9988	CheckDam
5	Yellanur	14.5583	78.0284	CheckDam
6	Yellanur	14.5841	78.0295	CheckDam
7	Yellanur	14.5836	78.0208	CheckDam
8	Yellanur	14.6322	77.9641	CheckDam
9	Yellanur	14.6290	77.9701	CheckDam
10	Yellanur	14.6516	77.9614	CheckDam
11	Yellanur	14.6571	77.9510	CheckDam
12	Yellanur	14.6634	77.9467	CheckDam
13	Yellanur	14.6676	77.9364	CheckDam
14	Yellanur	14.6190	77.9589	CheckDam
15	Yellanur	14.7029	78.0094	CheckDam
16	Yellanur	14.6981	78.0303	CheckDam
17	Yellanur	14.6655	77.9961	CheckDam
18	Yellanur	14.6771	77.9910	CheckDam
19	Yellanur	14.6511	78.1192	CheckDam
20	Yellanur	14.5447	77.9874	CheckDam
21	Yellanur	14.5473	78.0396	CheckDam
22	Yellanur	14.5696	78.0187	CheckDam
23	Yellanur	14.5793	78.0488	CheckDam
24	Yellanur	14.5833	77.9836	CheckDam
25	Yellanur	14.6041	77.9834	CheckDam
26	Yellanur	14.5967	77.9910	CheckDam
27	Yellanur	14.5993	77.9858	CheckDam
28	Yellanur	14.5846	78.0016	CheckDam
29	Yellanur	14.6316	77.9975	CheckDam
30	Yellanur	14.6485	77.9440	CheckDam
31	Yellanur	14.6401	77.9611	CheckDam
32	Yellanur	14.6256	77.9494	CheckDam
33	Yellanur	14.6805	77.9451	CheckDam

34	Yellanur	14.6784	77.9290	CheckDam
35	Yellanur	14.6726	77.9483	CheckDam
36	Yellanur	14.6648	77.9247	CheckDam
37	Yellanur	14.6387	77.9891	CheckDam
38	Yellanur	14.6280	77.9796	CheckDam
39	Yellanur	14.7531	78.0249	CheckDam
40	Yellanur	14.7234	78.0366	CheckDam
41	Yellanur	14.7042	78.0211	CheckDam
42	Yellanur	14.7512	78.0437	CheckDam

Fig.1

U 1.0 3

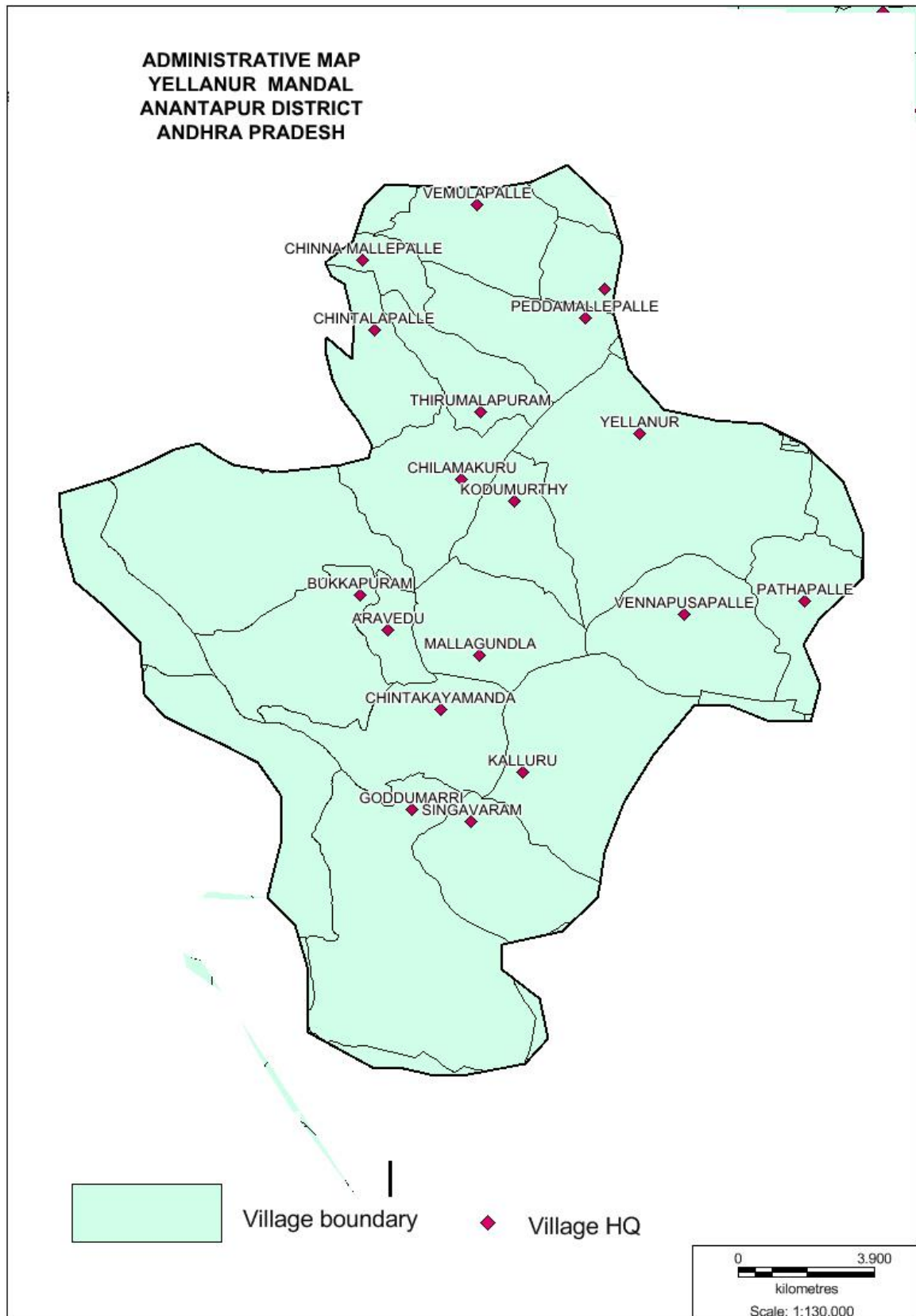


Fig.2

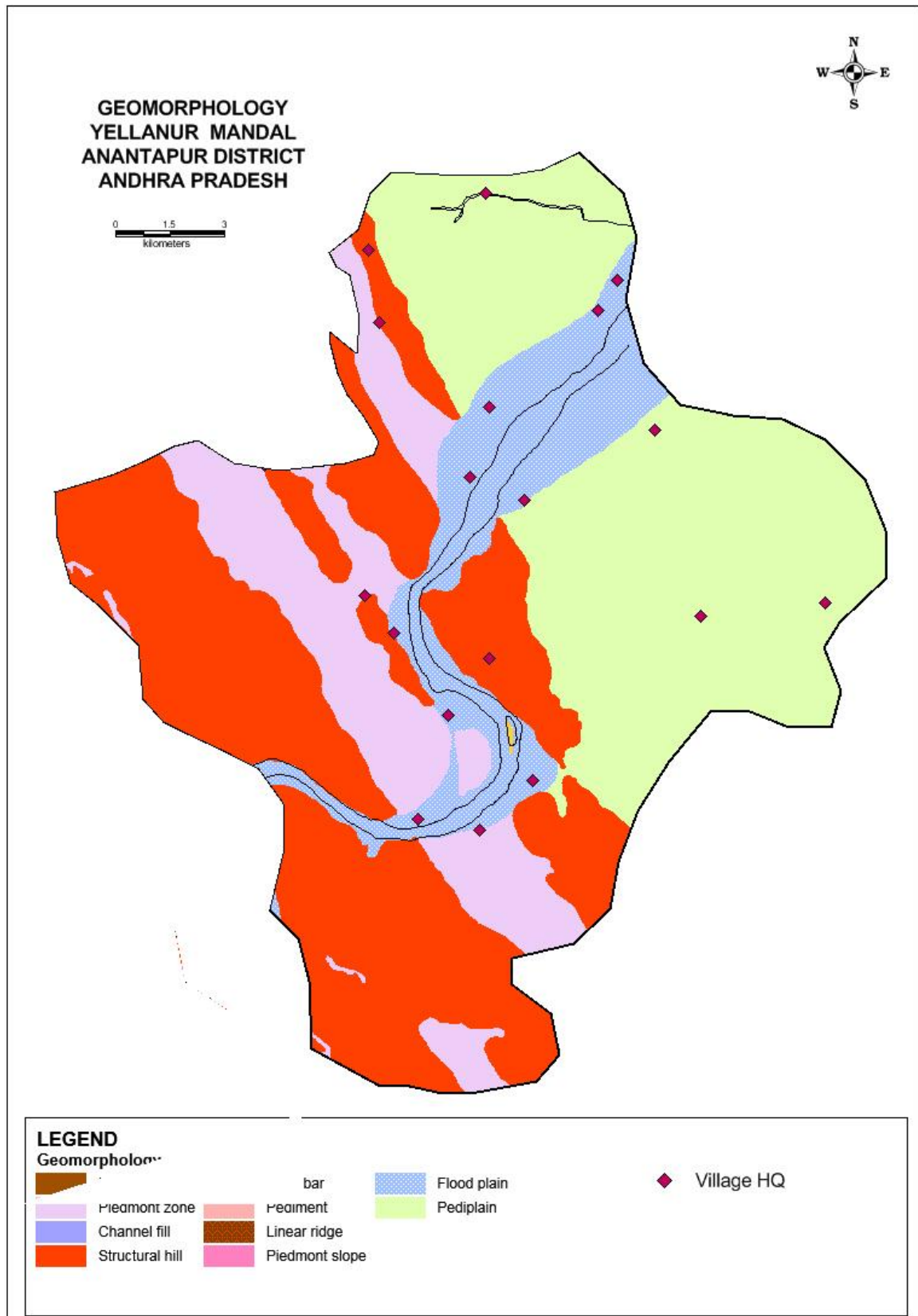


Fig.3

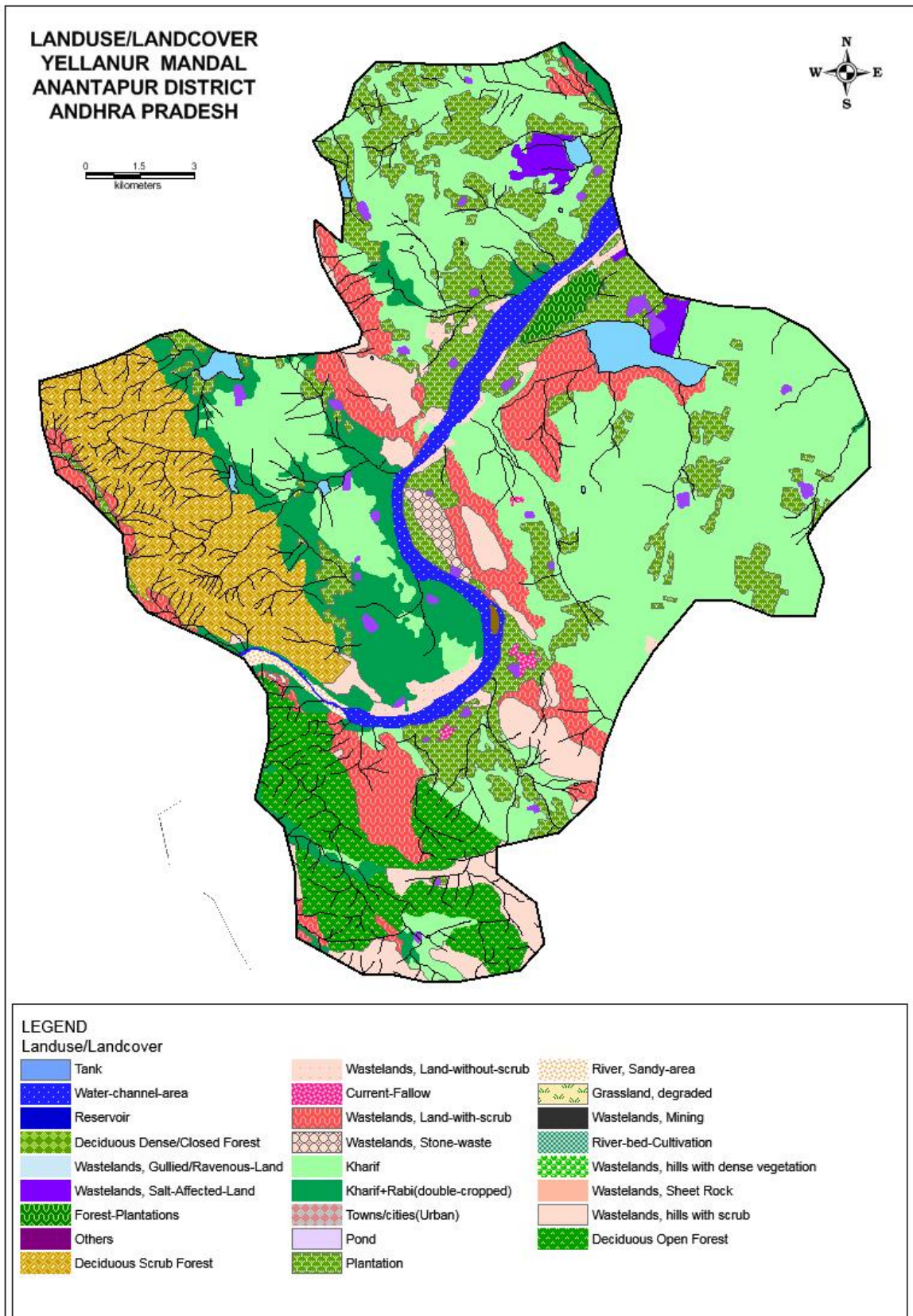


Fig.4

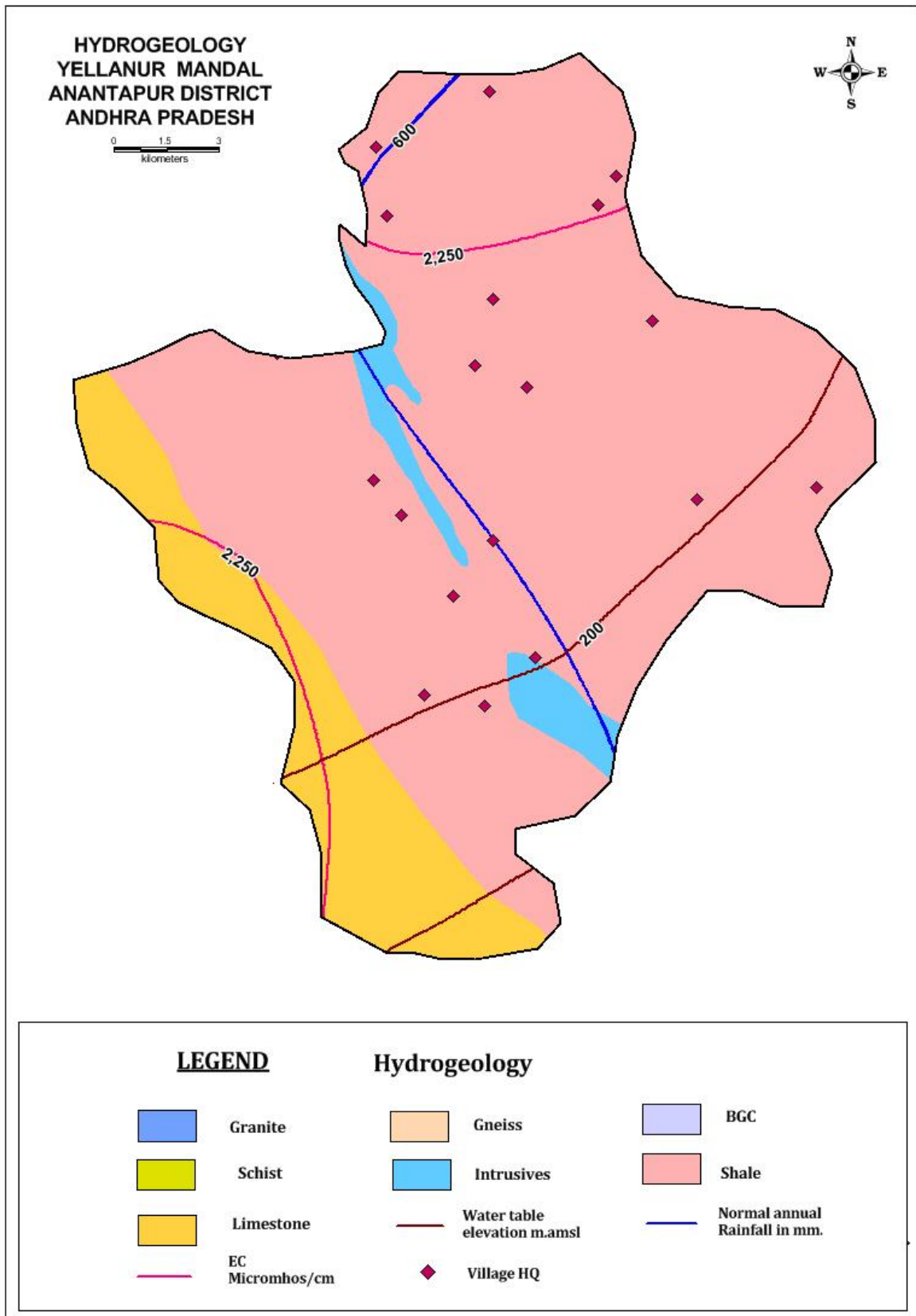


Fig.5

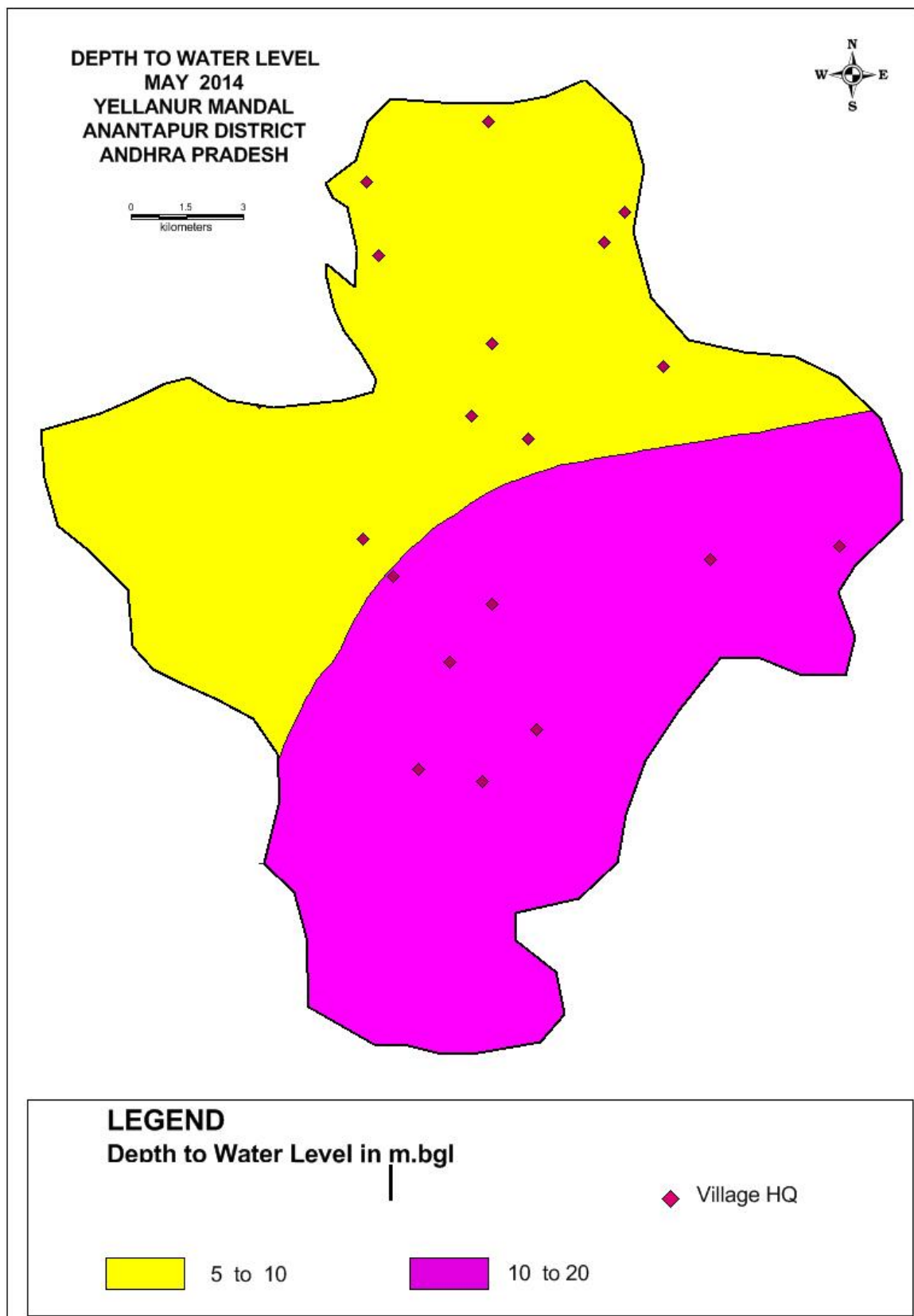


Fig.6

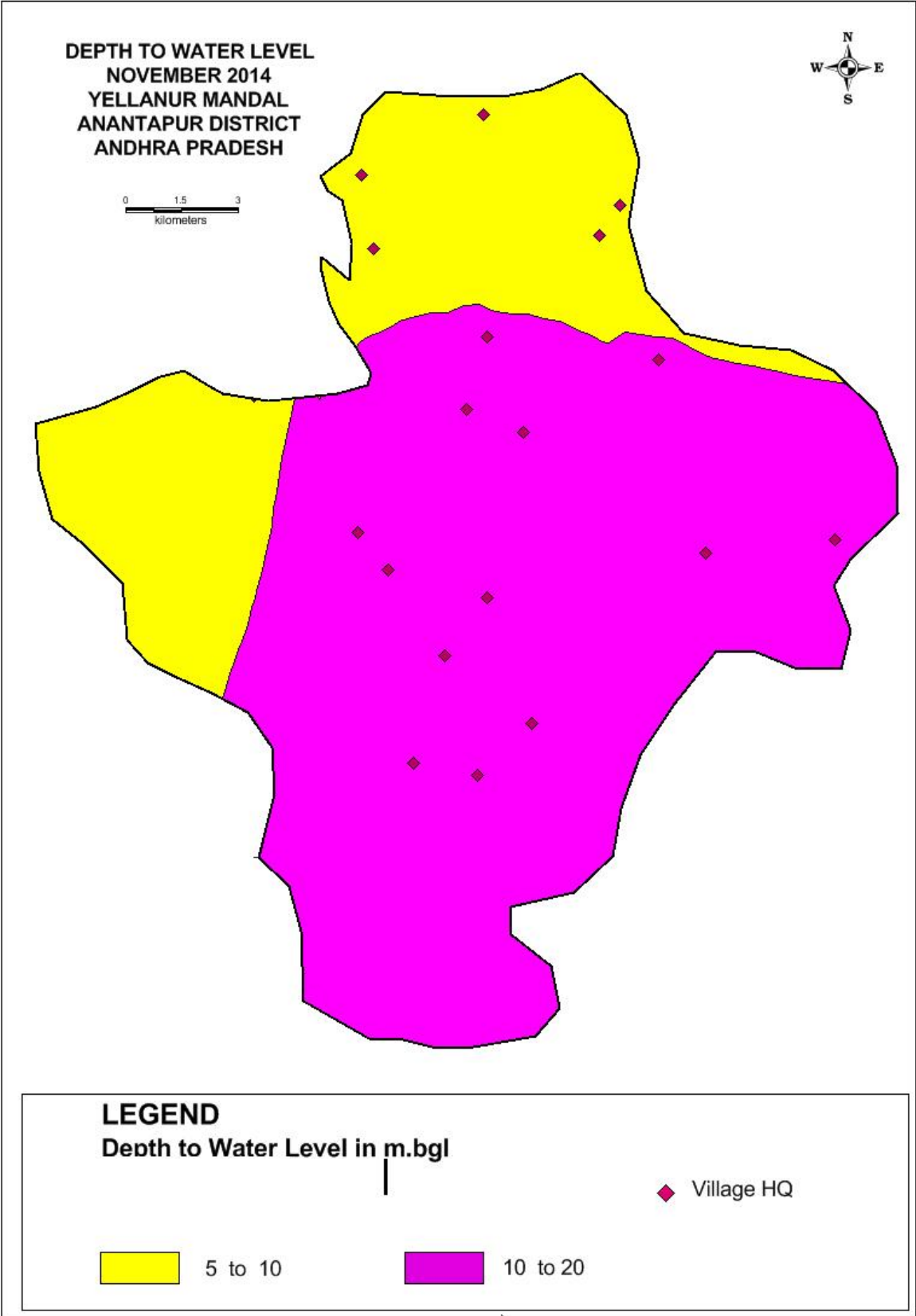


Fig.7

