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

PLAN ON
ARTIFICIAL RECHARGE TO GROUNDWATER IN HYDERABAD, CAPITAL OF TELANGANA STATE

SOUTHERN REGION
HYDERABAD
AUGUAT- 2016

REPORT ON
ARTIFICIAL RECHARGE TO GROUNDWATER IN HYDERABAD, CAPITAL OF TELANGANA STATE

CONTENTS

AT A GLANCE

District/Mandal	HYDERABAD
State	TELANGANA
Total Area sq.km.	186 sq.km
Latitude and Longitude	17°21’58” North Latitude 78°28’34” East Longitude
Average Annual Rainfall (mm)	884 mm
Geology	Granites, gneisses
Build up Area-Residential (Sq.kms)	168
Build up Area -Industrial (Sq.kms)	3.8
Open Grass land/Tree cover area (Sq.kms)	0.4
Waste Land (Sq.kms)	1.07
Water Bodies (Sq.kms)	8.7
Pre-Monsoon Water Level Trend	56 cm /yr falling
Pre-Monsoon Water Level Trend	46 cm/year falling
Ground Water Resources	
Annual Replenishable Ground Water Resources	9.13 MCM
Net Annual Ground Water Draft	73.44 MCM
Projected Demand for Domestic and Industrial Use	0
Stage of Ground Water Development	804 %
Total Volume available for Recharge	102 MCM
Artificial Recharge/Conservation Measures	
Structures Proposed	Recharge Pits with or without Shafts - 80000 Nos
Improving Water Efficiency	Recycling and Reuse
Tentative Total Cost	16000 Lakhs
Expected Recharge	51 MCM

1. INTRODUCTION

Hyderabad (Urban) District has come into existence in August, 1978 consequent on formation of a new District, Ranga Reddy from the erstwhile Hyderabad. All the rural areas of erst-while Hyderabad District have been included in Ranga Reddy District, while the area of Muncipal Corporation of Hyderabad, Secunderabad Cantonment, Lalaguda and Osmania University covering an area of 199 Sq Km are included in Hyderabad District.

2. LOCATION

Hyderabad is situated at 17°22' N Latitude and 78°27' E Longitude with an elevation of 525 m amsl. covering an area of 217 Sq Km. Hyderabad is surrounded by Rangareddy district (Fig-1). The geographical area of the mandal is 199 sq.km. According to the 2011 census, Hyderabad district has a population of 3,943,323 of which male and female were 2,018,575 and 1,924,748 respectively

3. PHYSIOGRAPHY AND DRAINAGE:

The area has undulating topography with elevation ranging from 460 to 560 m amsl. The main geomorphic units are residual Hills, pediment inselbergs, pediplains and valley fills. The River Musi, with a gradient of 2 m per kms flows from west to east and most of the streams are ephemeral in nature. The River Musi originates from Anantagiri hills in Vikarabad area of Ranga Reddy district and flows 70 kilometers before entering into the reservoirs of Osman Sagar and Himayat Sagar in Hyderabad. Apart from the River Musi, Hyderabad was endowed with a number of natural and artificial lakes which includes Hussain Sagar, Mir Alam tank, Afzal Sagar, Jalpalli, Ma-Sehaba Tank, Talab Katta, Osmansagar and Himayatsagar, Saroor Nagar Lake. The drainage pattern is mainly dendritic in nature. The soils are mostly of red lateritic, yellow sandy-clay loams and alluvial black soils. The thickness of the soil cover ranges from 0.5 m to 2.0 m.

4. RAINFALL

The average rainfall in the mandal is 884 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

The Land use patter indicates the changing pattern of land use over the years. It shows increase in residential, commercial at the expense of vacant and agricultural land. The details are given below.

The first land use survey for the Municipal Corporation area of Hyderabad was prepared and notified in 1975. The land use survey was covering 172.60 sq, km of city area (MCH) and 21.52 sq km of peripheral area which was envisaged to be urbanized in due course. The Land use pattern survey for the MCH area was done by HMDA for the master plan of MCH area in 2007-2008. The details as follows.

Land use Pattern -2008

Sr. No	Land Use	Area in (sq.kms)	%
1	Residential	76.35	44.24
2	Commercial	12.70	7.36
3	Mixed	7.49	4.34
4	Industrial (Including manufacturing, small scale, household, garages etc)	4.25	2.46
5	Public Semi Public	15.55	9.01
6	Parks & Playgrounds	11.75	6.81
7	Vacant lands, open lands, Rocks & Hills	2.73	1.58
8	River, Lakes, Nalahs, Kuntas	10.75	6.23
9	Agriculture & Gardens etc	1.04	0.6
10	Transportation & Communication (Including Roads & Circulation, streets, alleys, Airport, Bus Stations/Depots, Rly Tracks/Stns)	18.64	10.8
11	Defence	8.34	4.83
12	Burial Grounds Crematoria etc	3.00	1.74
13	Total	172.59	100

(Source: Master Plan of HMDA (MCH Area)

6. HYDROGEOLOGY

The mandal is underlain by granitic gneisses and schist of archaean age. The ground water in these formations occurs in the weathered and fractured zones under the water table conditions and semi weathered conditions. Ground water occurs under phreatic conditions in weathered zone and under semi-confined to confined conditions in the fractured zones. The piezometric elevations in northern part vary from 500 to 563 m amsl with steep gradient in NE direction. In southern part, the piezometric elevation is between 470 and 520 m amsl with gentle gradient towards Musi River. Ground water was exploited through shallow, large diameter dug wells until 1970 to meet domestic and irrigation requirements. Presently ground water is being exploited through shallow and deep bore wells with depth ranging from 100-300 m. The cumulative yield varies from 2-8 lps. The average depth to water level (decadal) during pre monsoon period is 26.50 m and post monsoon is 22.80 m.

7. GROUND WATER LEVEL SCENARIO:

It is observed that in general the depth to water levels ranged between 5 and 20 m but on an average it is around 12 m. The general depth to water level during pre-monsoon period varies from 5 m to 20 m bgl, whereas during post monsoon periods it varies from 2 m to 15 m bgl.

8. DYNAMIC GROUND WATER RESOURCES:

The dynamic ground Water Resources (2009) estimates the ground water resources of Hyderabad City as single unit and categorized as as Over-Exploited and the details are given in Table.

Ground water Resources (2011) of Hyderabad

Annual Replenishable Ground water resources (MCM)	9.13
Net Annual Ground water draft. (MCM)	73.44
Projected Demand for Domestic and Industrial use up to 2025. (MCM)	0
Stage of Ground water development (%).	804
Whether notified or not with year of notification.	No

9. NEED FOR ARTIFICIAL RECHARGE AND CONSERVATION METHODS

The Artificial recharge and water conservation plan aims to mitigate the problem of continuous decline in water levels over the area through techniques of artificial recharge utilizing surplus rain water based on scientific manner for optimal results. This also ensures improvement in quality of ground water.

10. JUSTIFICATION OF THE ARTIFICIAL RECHARGE PROJECT

Hyderabad falls under high stage of ground water development i.e., 804 %. The annual rainfall of Hyderabad is 884 mm. During the monsoon rainfall runoff quickly flows out of the area without giving sufficient time for natural recharge to ground water. The annual run-off (estimated from the rainfall and run-off coefficients) is 102 MCM and sufficient for planning and adaptation of recharge methods. It is there for necessary to apply techniques of artificial recharge so as to allow more and more recharge to ground water to cope up with the withdrawal pattern.

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

The annual rainfall of Hyderabad is 884 mm. During the monsoon rainfall runoff quickly flows out of the area without giving sufficient time for natural recharge to ground water. The annual run-off (estimated from the rainfall and run-off coefficients) is 102 MCM.

12. FEASIBLE ARTIFICIAL RECHARGE STRUCTURES:

The land use pattern is highly urbanized and there is huge availability of roof top area. Since, Roof top rain water harvesting either through storage or recharge to the aquifers are the best suited rain water harvesting methods for this area. The land use pattern of Hyderabad and the run-off generation calculated from the existing land use pattern and feasible structure diagrams are provided below.

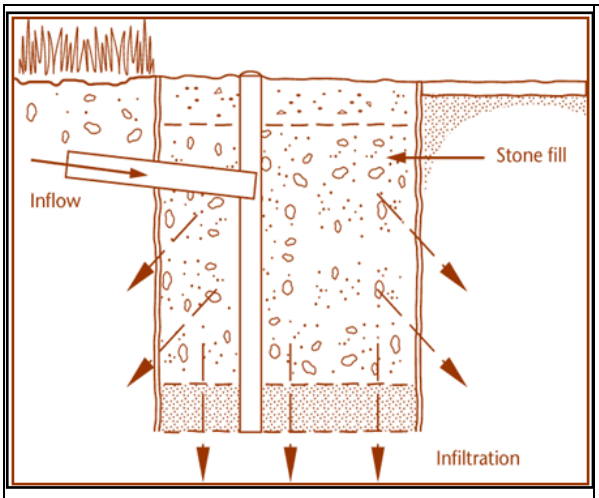
Land Use: The Land use composition of the year 2008 had shown in Table

S.No.	Land Use	Area in (sq.kms)	Remarks
1	Residential	76.35	Completely/ Partially Built up area
2	Commercial	12.70	
3	Mixed	7.49	
4	Industrial (Including manufacturing, small scale, household etc.,)	4.25	
5	Public & Semi Public	15.55	
6	Defense	8.34	
I	*Total*	*124.68*	
1	Parks & Playgrounds	11.75	Vacant Area
2	Vacant lands, open lands, Rocks & Hills	2.73	
II	*Total*	*14.48*	
1	Transportation & Communication (Including Roads & Airport, Bus Stations/Depots, Rly Tracks/Stns)	18.64	Road network
III	*Total*	*18.64*	
1	River, Lakes, Nalahs, Kuntas	10.75	Not considered for planning
2	Agriculture & Gardens etc	1.04	
3	Burial Grounds Crematoria etc	3.00	
IV	*Total*	*14.79*	
V	*Total*	*172.59*	

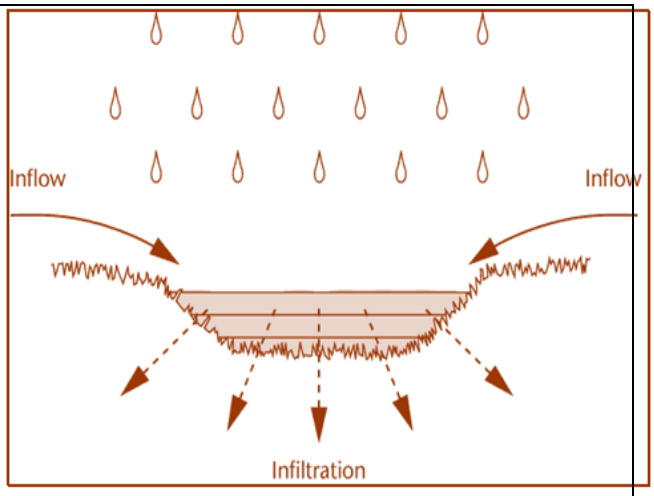
Run-Off Generation and Artificial Recharge

S.No.	Type	*Area (Sq.kms)*	Rainfall Hrly(mtr)	Runoff Coeff	*Runoff MCM/hr*	*Annual Runoff (MCM)*
1	*Built up area*	124.68	0.025	0.8	2.494	88.174
2	*Vacant Area*	14.48	0.025	0.3	0.109	3.840
3	*Roads & Pavements*	18.64	0.025	0.6	0.280	9.887
4	Total Area	157.8			2.882	101.900

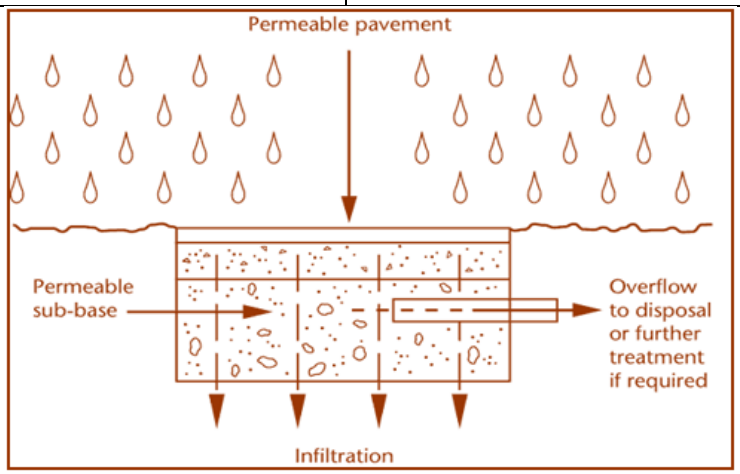
To harvest the Run-Off from Built-up area, vacant/open lands and from Road network, it is estimated to construct about 80,000 recharge pits with dimensions of 3.0*3.0*4.0 m length*width*depth The recharge bore wells of 5-15 m bgl is recommended to harvest the run-off wherever the sub-surface is underlain by the impermeable formation. These structures may be constructed at built-up areas, vacant lands and along or in the middle of road side. Filter drains along the roads are most viable option for harvesting the storm water generated on the road tops.



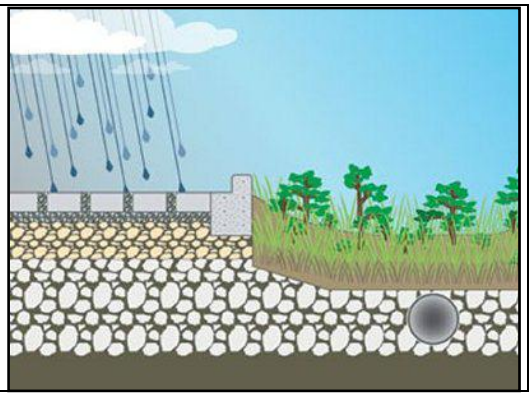
Infiltration Trench

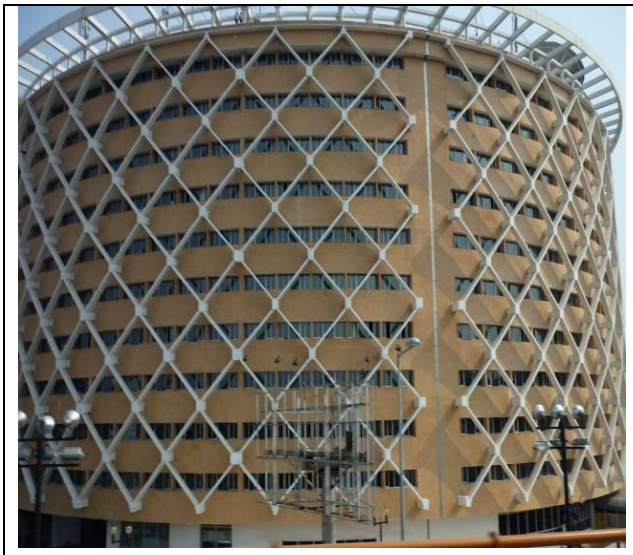


Infiltration Basin



(Figure adapted from www.ciria.org).





13. TENTATIVE COST ESTIMATES

The tentative cost for different activities is given in table below.

S.No.	Feasibe Artificial Recharge & Water Conservation structures/	Quantity	Total Volume (MCM)	Tentative unit cost (in Rs lakh)	Total tentative cost (in Rs Lakh)	Expected Annual GW recharge MCM (50% of applied Storage)	Remarks
1	Proposed Recharge Pits with or without Shafts	80000	102	0.20	16000	51	Rooftop rain water harvesting
	Grand Total	80000	102	0.20	16000	51	

Fig.1

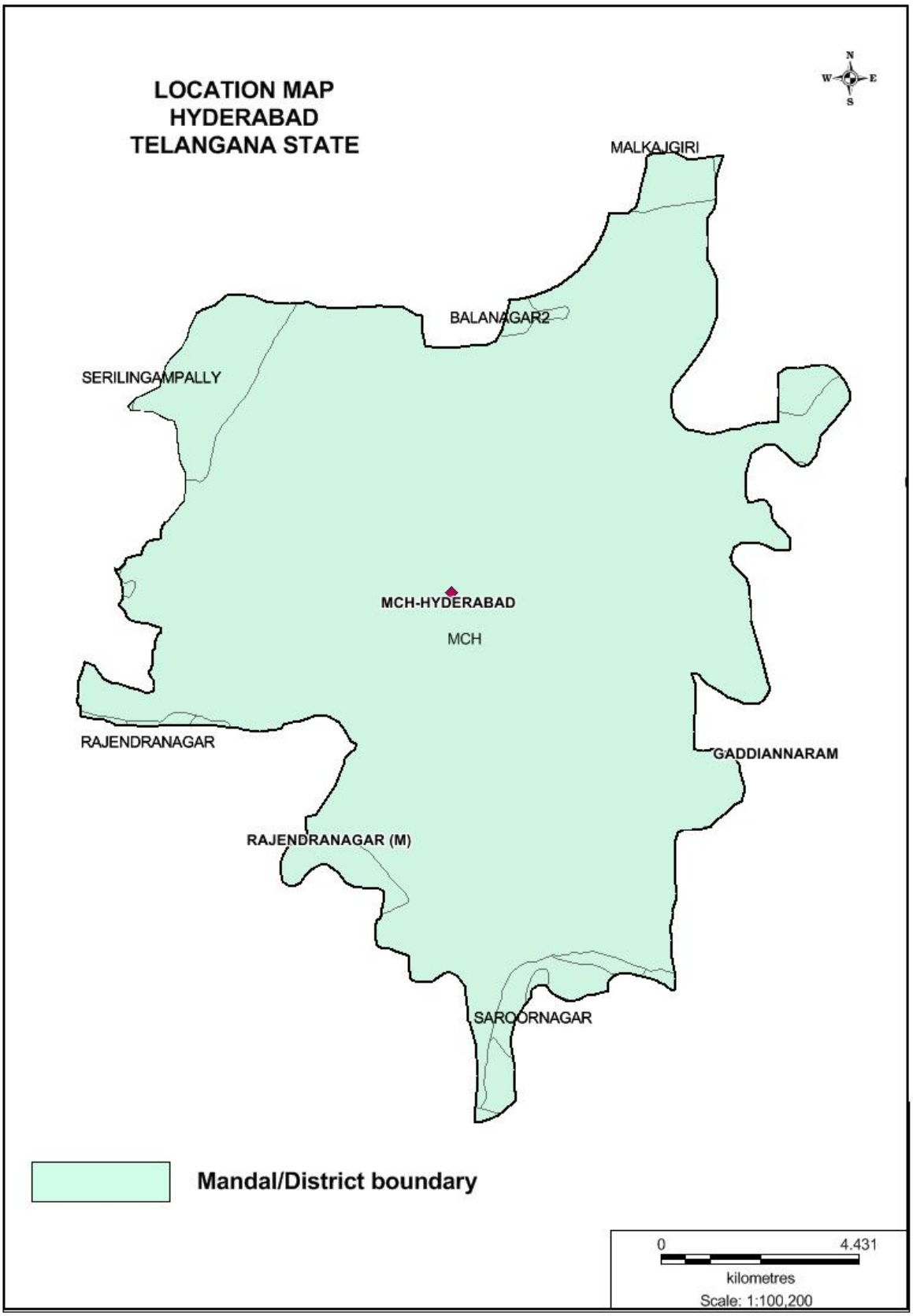

LOCATION MAP
HYDERABAD
TELANGANA STATE
N
W
E
S
MALKAJGIRI
BALANAGAR2
SERILINGAMPALLY
MCH-HYDERABAD
MCH
RAJENDRANAGAR
GADDIANNARAM
RAJENDRANAGAR (M)
SAROORNAGAR
Mandal/District boundary
0
4.431
kilometres
Scale: 1:100,200

Fig.2

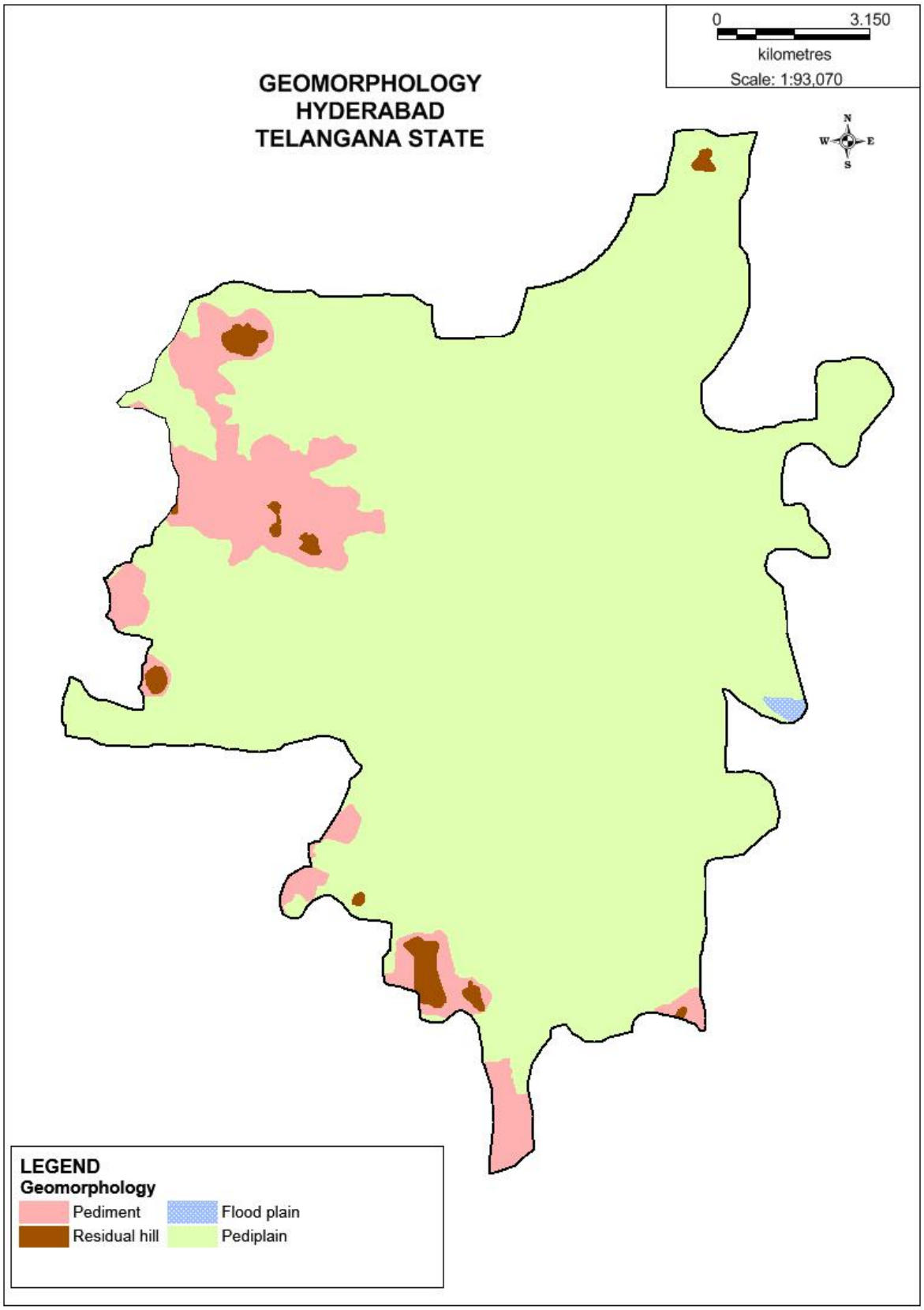

0
3.150
kilometres
Scale: 1:93,070
GEOMORPHOLOGY
HYDERABAD
TELANGANA STATE
N
W
E
S
LEGEND
Geomorphology
Pediment
Residual hill
Flood plain
Pediplain

Fig.3

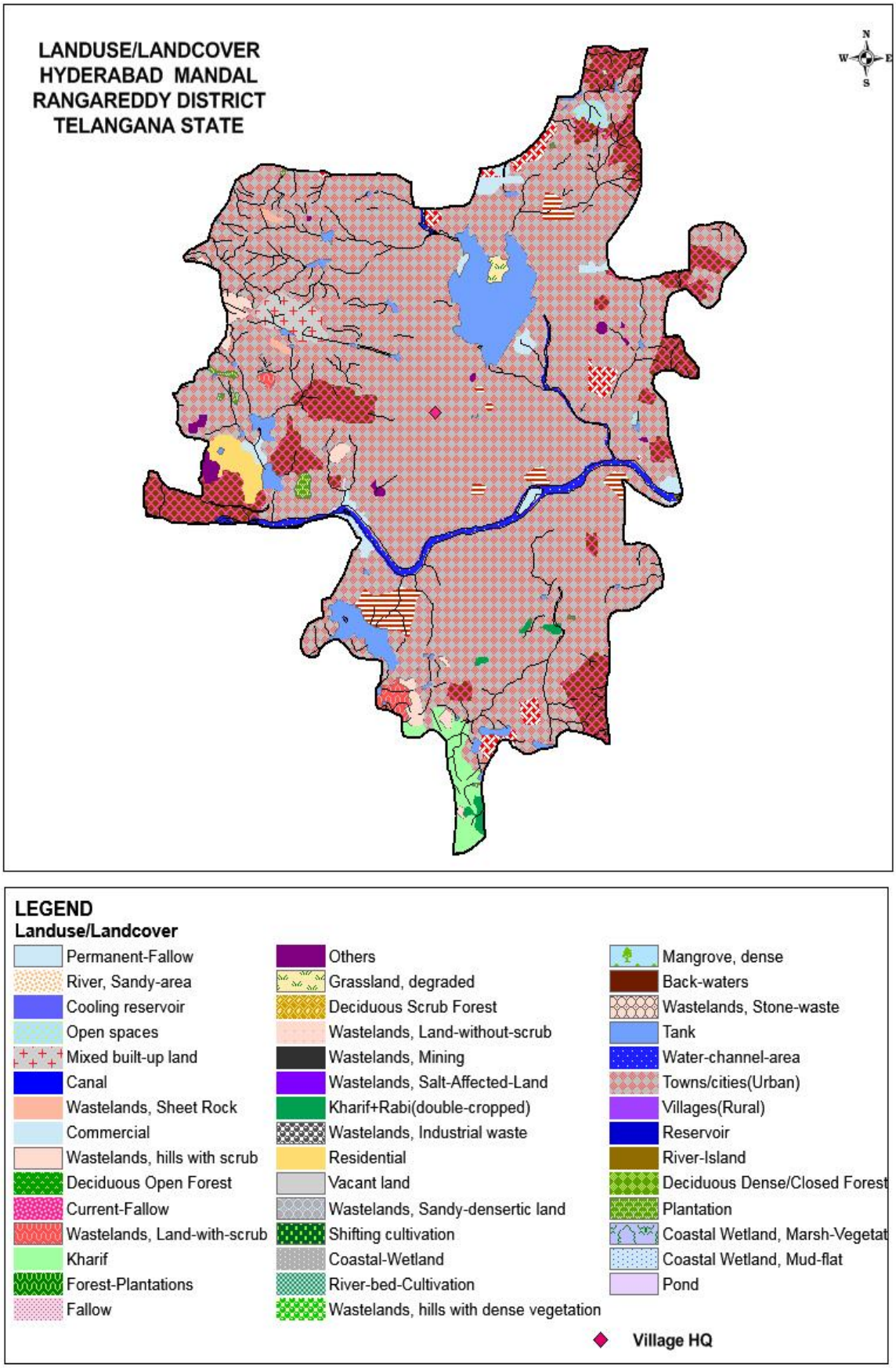

LANDUSE/LANDCOVER
HYDERABAD MANDAL
RANGAREDDY DISTRICT
TELANGANA STATE
N
W
E
S
LEGEND
Landuse/Landcover
Permanent-Fallow
River, Sandy-area
Cooling reservoir
Open spaces
Mixed built-up land
Canal
Wastelands, Sheet Rock
Commercial
Wastelands, hills with scrub
Deciduous Open Forest
Current-Fallow
Wastelands, Land-with-scrub
Kharif
Forest-Plantations
Fallow
Others
Grassland, degraded
Deciduous Scrub Forest
Wastelands, Land-without-scrub
Wastelands, Mining
Wastelands, Salt-Affected-Land
Kharif+Rabi(double-cropped)
Wastelands, Industrial waste
Residential
Vacant land
Wastelands, Sandy-densertic land
Shifting cultivation
Coastal-Wetland
River-bed-Cultivation
Wastelands, hills with dense vegetation
Mangrove, dense
Back-waters
Wastelands, Stone-waste
Tank
Water-channel-area
Towns/cities(Urban)
Villages(Rural)
Reservoir
River-Island
Deciduous Dense/Closed Forest
Plantation
Coastal Wetland, Marsh-Vegetat
Coastal Wetland, Mud-flat
Pond
Village HQ

Fig.4

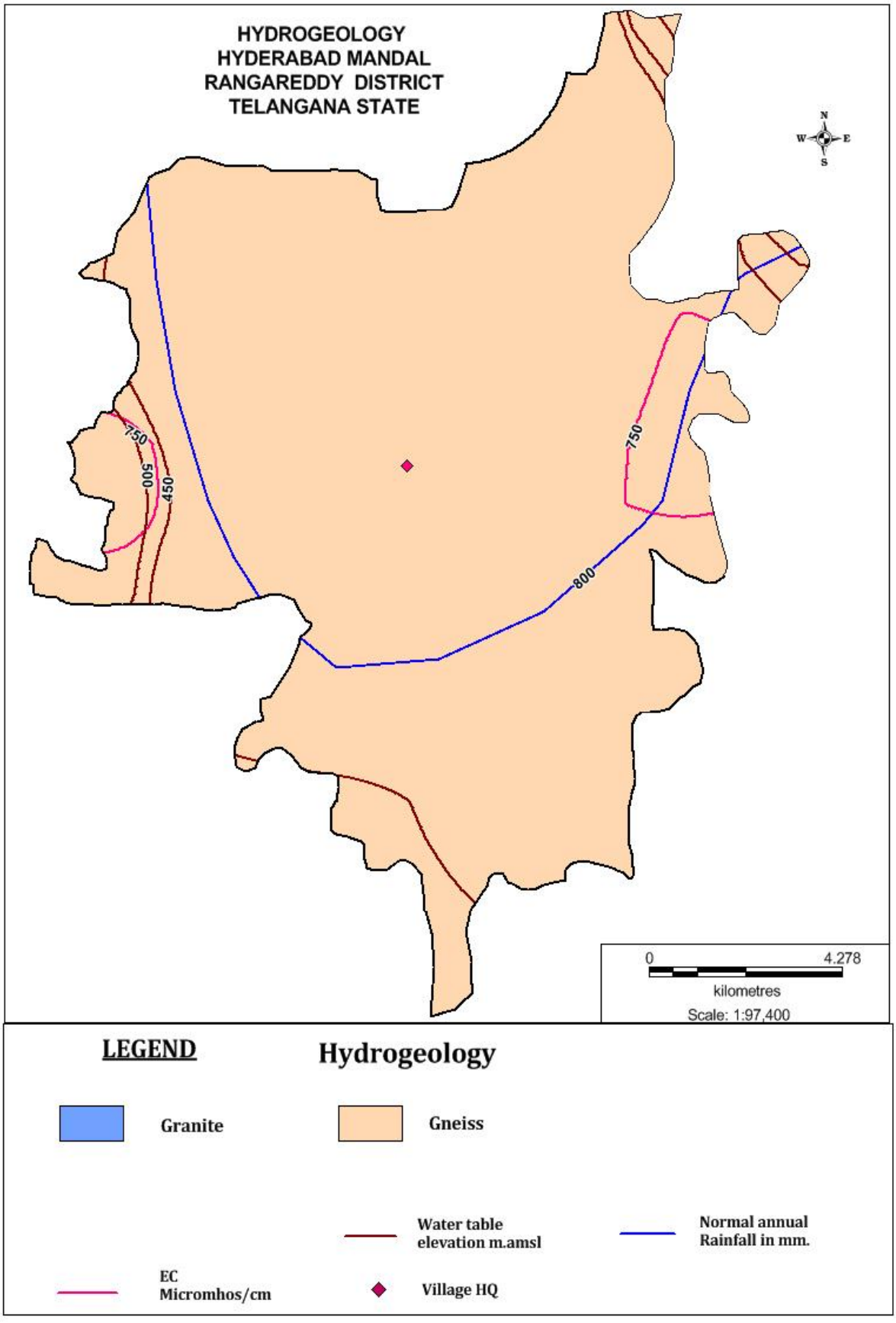

HYDROGEOLOGY
HYDERABAD MANDAL
RANGAREDDY DISTRICT
TELANGANA STATE
N
W
E
S
750
500
450
750
800
0
4.278
kilometres
Scale: 1:97,400
LEGEND
Hydrogeology
Granite
Gneiss
Water table elevation m.amsl
Normal annual Rainfall in mm.
EC Micromhos/cm
Village HQ

Fig.5

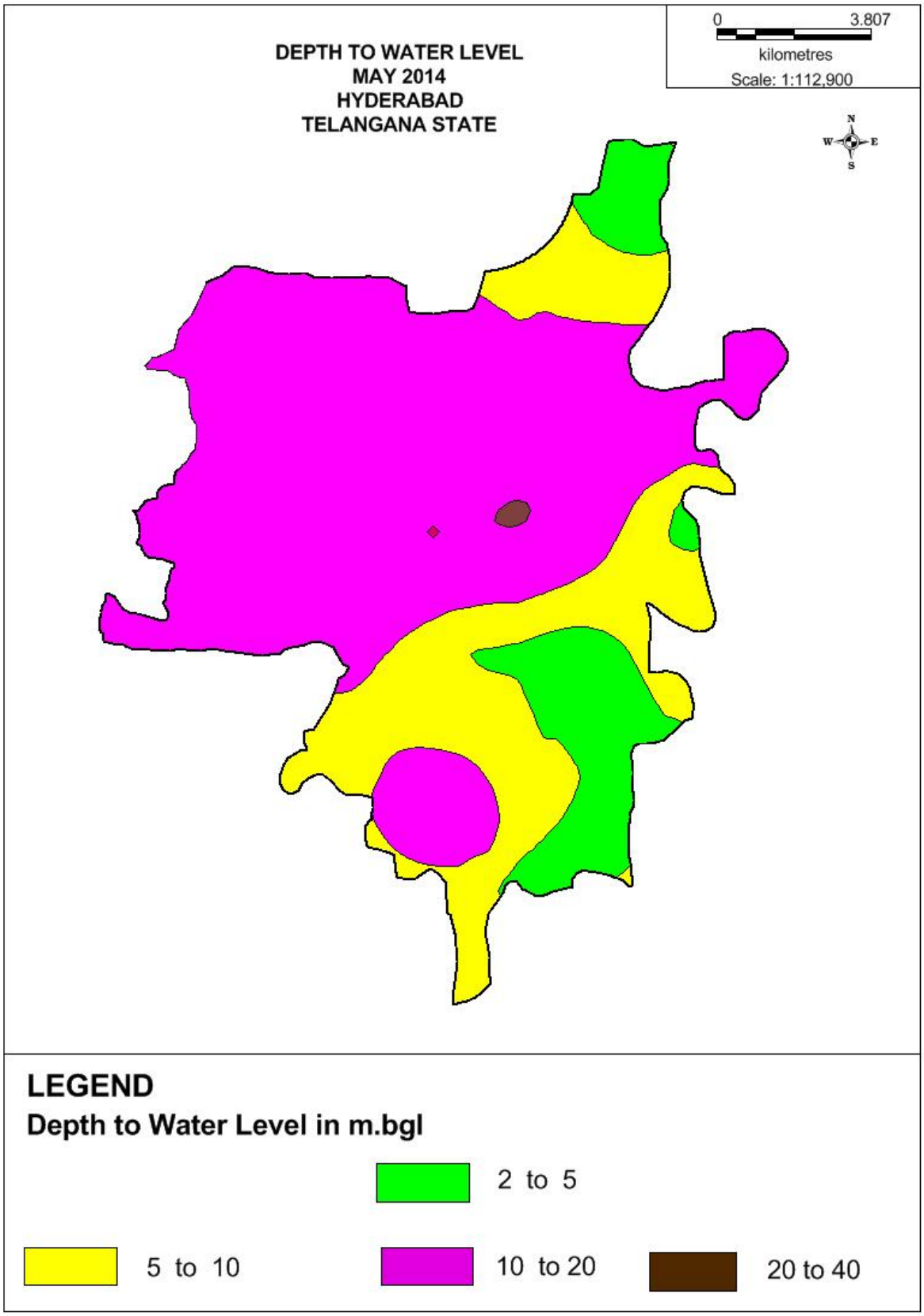
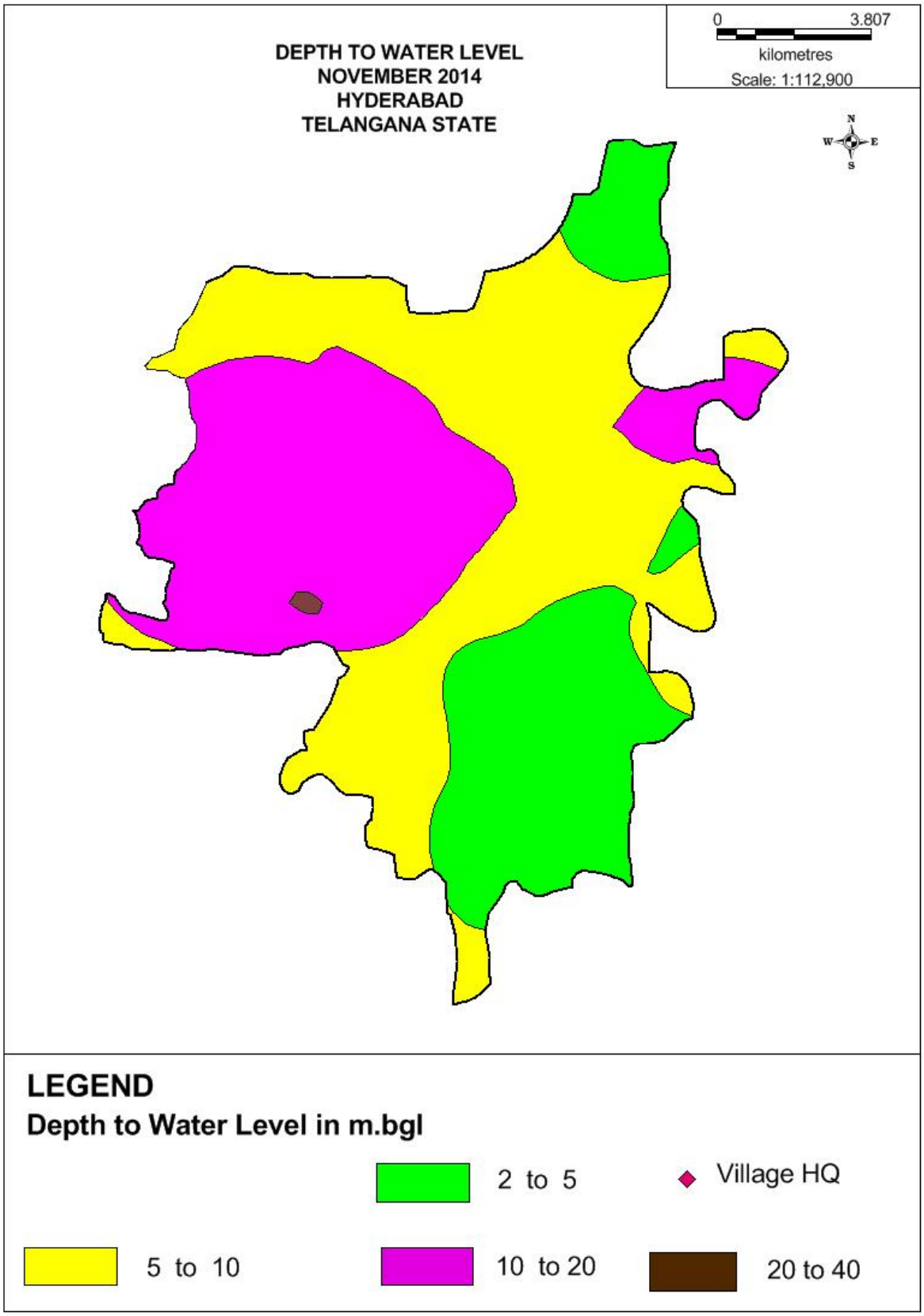

DEPTH TO WATER LEVEL
MAY 2014
HYDERABAD
TELANGANA STATE
0
3.807
kilometres
Scale: 1:112,900
N
W
E
S
LEGEND
Depth to Water Level in m.bgl
2 to 5
5 to 10
10 to 20
20 to 40

Fig.6


DEPTH TO WATER LEVEL
NOVEMBER 2014
HYDERABAD
TELANGANA STATE
0
3.807
kilometres
Scale: 1:112,900
N
W
E
S
LEGEND
Depth to Water Level in m.bgl
2 to 5
Village HQ
5 to 10
10 to 20
20 to 40