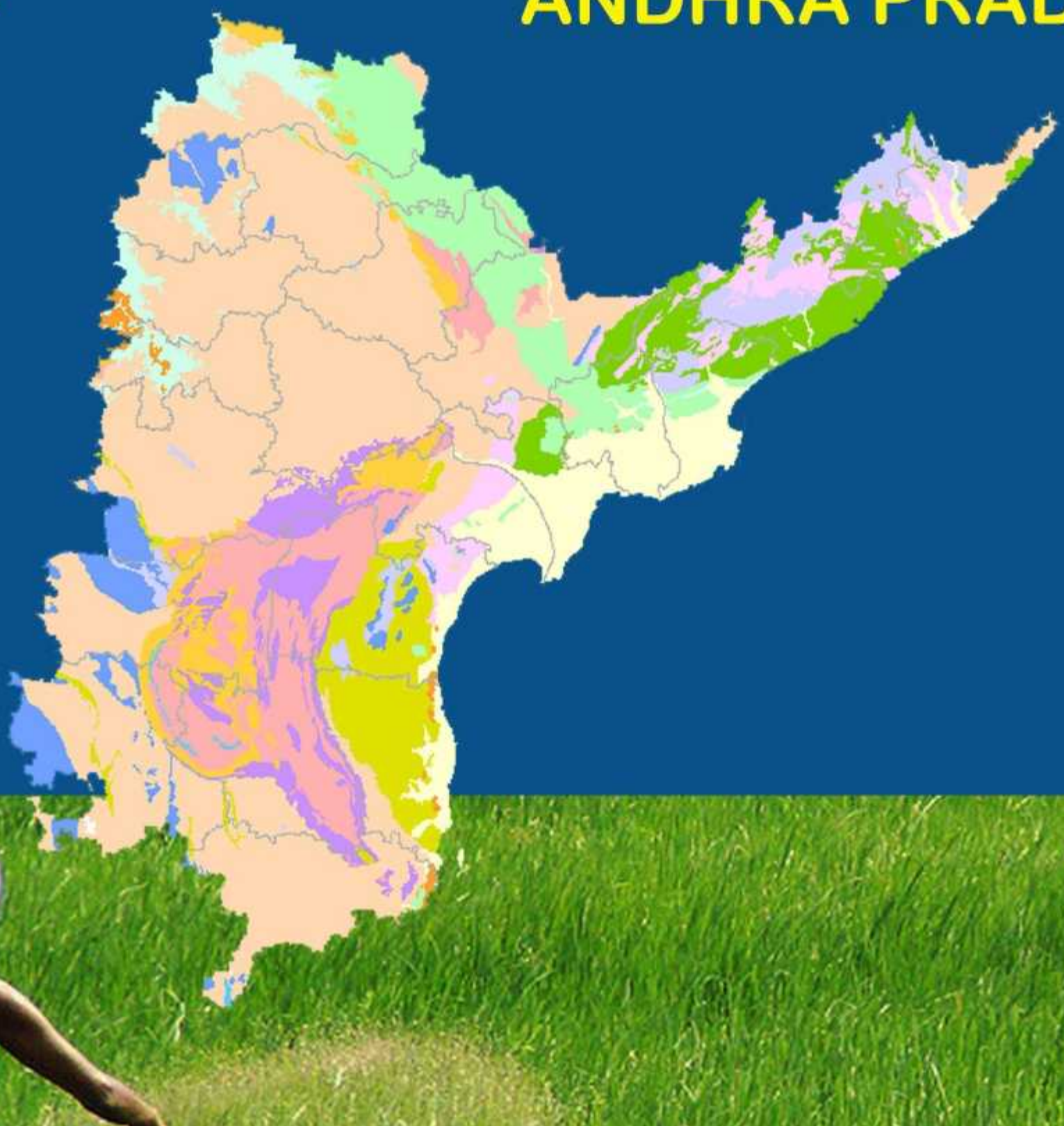
AQUIFER SYSTEMS OF ANDHRA PRADESH



CENTRAL GROUND WATER BOARD

MINISTRY OF WATER RESOURCES, GOVT. OF INDIA

SOUTHERN REGION, HYDERABAD

DECEMBER 2013

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GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD

AQUIFER SYSTEMS OF ANDHRA PRADESH

SOUTHERN REGION
HYDERABAD
DECEMBER, 2013

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AQUIFER SYSTEMS
OF
ANDHRA PRADESH

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सुशील गुप्ता
Sushil Gupta

अध्यक्ष
केंद्रीय भूमिजल बोर्ड
जल संसाधन मंत्रालय
भारत सरकार
भूजल भवन
फरीदाबाद

Chairman
Central Ground Water Board
Ministry of Water Resources
Government of India
Bhujal Bhawan,
Faridabad

प्राक्कथन

विश्व के स्वच्छ जल संसाधन के सबसे अधिक उपयोगी घटक के रूप में भूजल ने समाज के सतत विकास की दिशा में अपनी महत्वपूर्ण भूमिका निभाई है। स्वच्छ एवं पेयजल की बढ़ती मांग के कारण भूजल के दोहन में अप्रत्याशित वृद्धि हुई है जिसके कारण कुछ स्थानों में जल तालिका में गिरावट आती है तथा कई स्थानों पर जल की गुणवत्ता पर विपरीत प्रभाव पड़ता है। भूजल संसाधन की स्थायित्वता जलभृतों के समग्र प्रबंधन के माध्यम से ही संभव है जो भूजल के भंडार के रूप में कार्य करता है।

केंद्रीय भूमिजल बोर्ड द्वारा राष्ट्रीय जलभृत प्रबंधन कार्यक्रम प्रारम्भ किया गया है जिसके अंतर्गत भूजलविज्ञान, भूभौतिकी, वेधन, दूरसंवेदी, गणितीय मॉडलिंग आदि के क्षेत्र में उपलब्ध नवीनतम प्रौद्योगिकी के उपयोग द्वारा उपयुक्त पैमाने पर जलभृतों की उपसतही अवस्थिति एवं विशिष्टता का निर्धारण किया जाएगा। इसका लक्ष्य हितधारकों एवं आयोजकों के उपयोग के लिए जलभृत स्तरीय प्रबंधन योजना तैयार करना है ताकि इस अमूल्य संसाधन का सामुदायिक स्तर पर प्रबंधन सुनिश्चित किया जा सके। इस दिशा में पहले कदम के रूप में उपलब्ध आंकड़ों पर आधारित जलभृतों के विभिन्न लक्षणों पर विषयपरक मानचित्रों एवं डेटाबेस का संकलन कर जलभृत एटलस तैयार किया जा रहा है। इस क्रम में आंध्र प्रदेश का जलभृत एटलस एक संग्रह है जिसके माध्यम से राज्य की भूजल स्थिति तथा भूजल विकास एवं प्रबंधन संबंधी विषयों को प्रकाशित किया गया है।

आंध्र प्रदेश के जलभृत एटलस को तैयार करने की दिशा में केंद्रीय भूमिजल बोर्ड, दक्षिण क्षेत्र, हैदराबाद के अधिकारियों के दल द्वारा किए गए सार्थक प्रयासों की मैं सराहना करता हूँ। यह एटलस, क्षेत्र विशिष्ट भूजल विकास एवं प्रबंधन योजनाओं को तैयार करने में उपयोगी सिद्ध होगा। मुझे विश्वास है कि राज्य में भूजल प्रयोक्ता एवं वैज्ञानिक समुदाय के साथ-साथ आयोजक भी इससे लाभान्वित होंगे।

सुशील गुप्ता

(सुशील गुप्ता)
अध्यक्ष, केंद्रीय भूमिजल बोर्ड

FOREWORD

Ground Water, one of the most widely used components of the World's fresh water resource, has played a pivotal role towards development of society. Increased demand for fresh and potable water has resulted in an unprecedented withdrawal of ground water, which often results in lowering of the water table as also deterioration in ground water quality at some places. Sustainability of ground water resource can be achieved through a holistic management of aquifers which act as the repository of ground water.

Central Ground Water Board has taken up the National Aquifer Management Programme under which subsurface disposition and characteristics of underlying aquifers will be established on an appropriate scale by using the latest available technologies in the field of hydrogeology, geophysics, drilling, remote sensing, mathematical modelling etc. The ultimate goal is to formulate aquifer level management plans for use of the stakeholders and planners to foster community level management of this precious resource. As a first step in this regard, thematic maps and database on various attributes of the aquifers have been compiled in the form of an Aquifer Atlas based on the available data. The Aquifer Atlas of Andhra Pradesh is a compendium, which brings out a framework of ground water situation and issues for ground water development and management in the State.

I appreciate the sincere efforts made by the team of officers of Central Ground Water Board, Southern Region, Hyderabad in bringing out the Aquifer Atlas of Andhra Pradesh. I am confident that the Atlas will prove useful in formulating area specific ground water development and management plans and will benefit ground water users, scientific community as well as planners in the State.

Sushil Gupta

(Sushil Gupta)
Chairman, CGWB

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भारत सरकार
जल संसाधन मंत्रालय
केन्द्रीय भूमिजल बोर्ड
दक्षिण श्रेत्र
बंडलगुडा,
पोस्ट जी.एस.आई,
हैदराबाद–500 068

Government of India
Ministry of Water Resources
Central Ground Water Board
Southern Region
Bandlaguda
Post GSI
HYDERABAD – 500 068

PREFACE

The ubiquitous nature of ground water and the absence of regulatory measures in ground water development have led to indiscriminate extraction of ground water, which resulted in dwindling of this precious resource. In this context, information on ground water needs to be shared or made available to all the end users, for better understanding and planning of this replenishable resource even at stakeholder level. Hence, it is felt appropriate to bridge the existing data gap and to create a scientific understanding on sustainability of aquifer systems, both at national and also at the state level.

Central Ground Water Board (CGWB), during the last five decades has generated voluminous data. Presently, this data is available in the form of technical reports. In an effort to make this valuable information user friendly, CGWB has made efforts to bring out this compilation on ground water. In this, emphasis is given to bring out information of the aquifer systems, highlighting the aquifer parameters, development, management plans, quality issues and all related aspects of aquifer-wise planning and development.

This document has been prepared under the guidance of Shri. Sushil Gupta, Chairman, Central Ground Water Board. This will go a long way in helping the planners, managers as well as the academicians, as a guide for reference. The contribution of all the officers of CGWB, SR, who have generated enormous data under different activities during all these years, is duly acknowledged.

Hyderabad
18.12.2013

(G.Sudarshan)
Regional Director

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AQUIFER SYSTEMS OF ANDHRA PRADESH

AQUIFER SYSTEMS OF ANDHRA PRADESH

AQUIFER SYSTEMS OF ANDHRA PRADESH

Population growth, urbanization, growing industrialization and food security increased the demand for fresh water resource, and correspondingly the stress is more on the ground water resource. The sustainability of ground water sources are jeoparadised due to various reasons like depletion of water levels, declining yields etc. In order to evolve remedies for such issues, understanding the ground water system is very essential. The understanding of occurrence and distribution of ground water in time and space requires to establish lateral and vertical extent of aquifer systems, along with their characteristics. In view of this, an exercise of aquifer mapping has been carried out by CGWB by collating the existing data on ground water and bringing them into common GIS platform. Data generated through extensive hydrogeological studies for the past many decades, incorporated in this document, provides an overview of the most important information available for each principal and major aquifer system of the state. This document is an outcome of aquifer mapping on 1:250,000 scale by integrating the geological data of GSI and hydrogeological data of CGWB, and related thematic data from other agencies. The output in the form of thematic layers and corresponding data tables are generated for easy reference

The state of Andhra Pradesh is one of the peninsular states of India, with geographical area of 2, 75,068 sq km. The state is divided into 23 districts and 1128 mandals. Three major rivers Godavari, Krishna and Pennar drain the state. Normal annual rainfall of the state is 912 mm, and ranges from 573 mm in Anantapur district in south-western part to 1165 mm in Srikakulam district in the northeastern part of the state. During the decade (2003-2012) the mean rainfall of the state was 927 mm.

Decline in water levels, over-exploitation, reduction in well yields, subsequent drying up of wells, deterioration in quality and related issues are major problems observed in the state pertaining to ground water. Now it is common to see both domestic and irrigation bore wells of 100 to 200 m depth, in different parts of the state. Scientific management of the aquifers is undoubtedly a tough task. Sustainable management of the ground water resource depends on proper understanding of the aquifers. For better understanding of existing aquifers, all the available data, generated from various studies, under different activities is being compiled and presented so as to make it handy for the administrators and other user agencies to prepare ground water development and management plan.

Major part (83%) of the state is occupied by hard rock aquifers while the rest is composed of soft formations. The rock formations of the state have been grouped into fourteen Principal Aquifer Systems, depending upon their mineral composition, age, nature of formation and distribution. They are Alluvium, Laterite, Basalt, Sandstone, Shale, Limestone, Granite, Schist, Quartzite, Charnockite, Khondalite, Gneiss, Banded Gneissic Complex (BGC), and Intrusives. These Principal Aquifers have been further divided into 29 Major Aquifer Systems (sub-units) based on their age, mineral composition and their availability in the state. These major aquifers were then superimposed over the state map with administrative district boundaries to arrive at the district wise aquifer characteristics. Both thematic layers and corresponding data tables are presented for easy reference. District-wise and Aquifer-wise tables containing important characteristics like depth to water level, their seasonal fluctuation, decadal mean of pre monsoon, post monsoon, over burden thickness, formation thickness, fracture depth, granular zones, yield range, transmissivity are presented. Similarly, maps showing distribution of ground water quality with reference to electrical conductivity, nitrate and fluoride are presented. Details like population density, river basins are also included. Map showing the parliamentary constituencies of the state is also presented.

About 21,211 sq. km (8 %) of the area of the state is over-exploited. In about 5,334 sq.km (2 %) of the area, the stage of development has touched critical level. Maps showing the present stage of ground water development, areas prioritized for artificial recharge, area delineated for water conservation and harvesting, area suitable for ground water development, aquifer wise ground water management plan and aquifer wise unit recharge are presented in this compilation.

Table I - Administrative Divisions of Andhra Pradesh

S.No.	District	Head Quarter	Area (sq.km.)	No of Mandals	Total no of Villages	Inhabited Villages	Uninhabited Villages
1	Adilabad	Adilabad	16100	52	1729	1,586	143
2	Anantapur	Anantapur	19123	63	952	925	27
3	Chittoor	Chittoor	15224	66	1518	1,480	38
4	YSR Kadapa	Kadapa	15421	51	954	876	78
5	East Godavari	Kakinada	10800	57	1379	1,323	56
6	Guntur	Guntur	11400	57	717	694	23
7	Hyderabad	Hyderabad	200	21	-	-	-
8	Karimnagar	Karimnagar	11800	57	1092	1,047	45
9	Khammam	Khammam	16000	46	1229	1,101	128
10	Krishna	Machilipatnam	8700	50	986	948	38
11	Kurnool	Kurnool	17700	54	913	884	29
12	Mahabubnagar	Mahabubnagar	18400	64	1550	1,477	73
13	Medak	sangareddy	9700	45	1254	1,225	29
14	Nalgonda	Nalgonda	14200	59	1148	1,124	24
15	SPS Nellore	Nellore	13100	46	1192	1,110	82
16	Nizamabad	Nizamabad	8000	36	918	854	64
17	Prakasam	Ongole	17600	56	1083	992	91
18	Ranga Reddy	Hyderabad	7500	37	923	860	63
19	Srikakulam	Srikakulam	5800	38	1814	1,715	99
20	Visakhapatnam	Visakhapatnam	11200	43	3294	3,108	186
21	Vizianagaram	Vizianagaram	6500	34	1524	1,455	69
22	Warangal	Warangal	12900	50	1071	984	87
23	West Godavari	Eluru	7700	46	883	845	38
Total			275068	1128	28123	26613	1510

Source: Directorate of Census Operations, Andhra Pradesh.

ADMINISTRATIVE DIVISIONS

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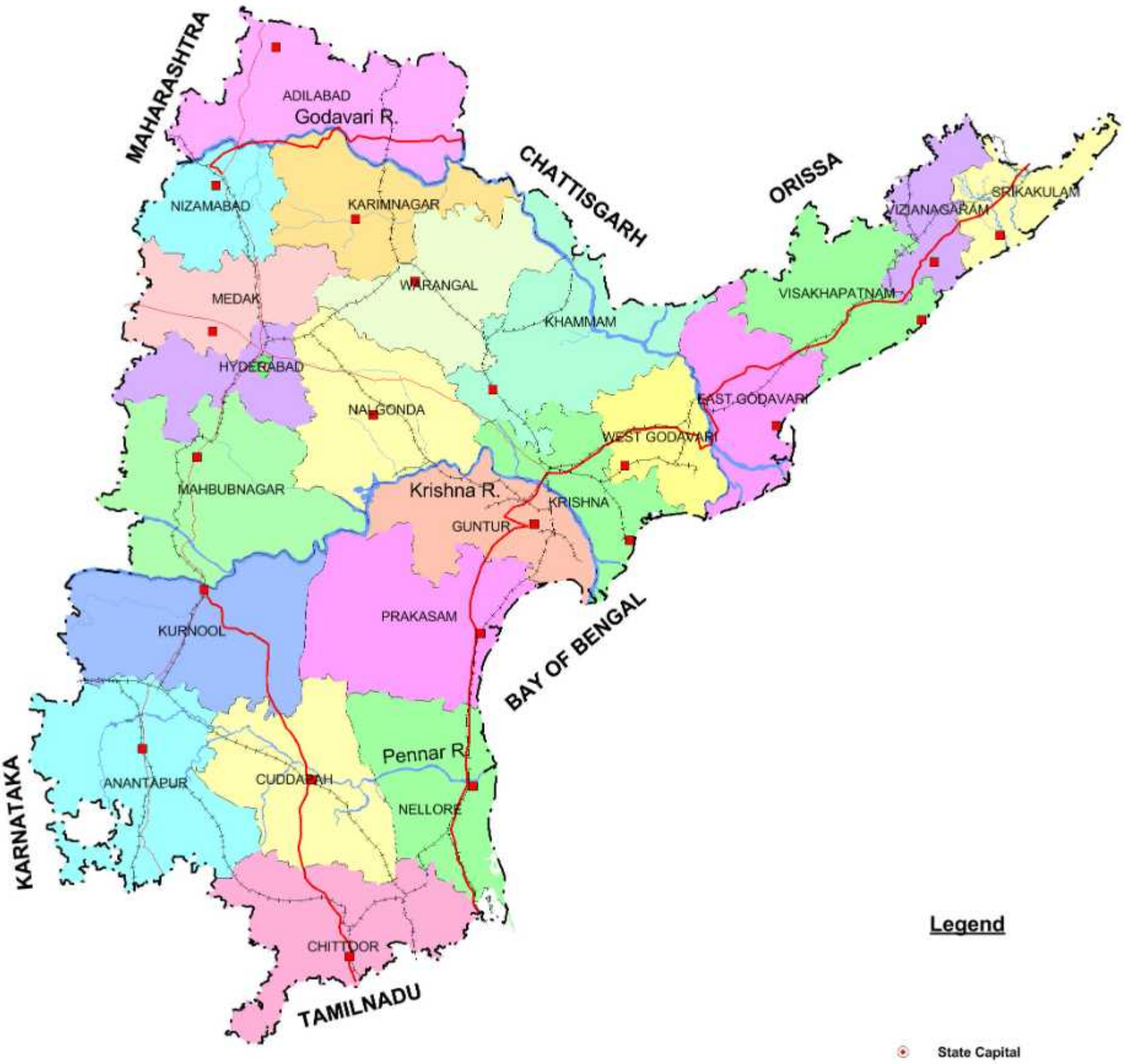

Legend

- State Capital
- District Headquarters
- District Boundary
- State Boundary
- National Highway
- Railway Line
- River

Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table II- River Basins of Andhra Pradesh

S NO	BASIN NAME	BASIN AREA (Sq.kms)	% OF AREA	S NO	SUB-BASIN NAME	SUB-BASIN AREA (SQ.KM.)	DISTRICTS COVERED
1	GODAVARI	74150	27.0%	1	INDRAVATI	32	Khammam
				2	LOWER GODAVARI	24862	Warangal, Khammam, West Godavari, East Godavari and Visakhapatnam
				3	MIDDLE GODAVARI	3152	Nizamabad and Adilabad
				4	MANJIRA	11064	Nizamabad , Medak, Ranga Reddy
				5	WARDHA	1630	Adilabad
				6	PRANAHITA	33038	Adilabad, Karimnagar, Nizamabad, Warangal, Medak
				7	WEINGANGA	372	Adilabad
2	KRISHNA	89095	32.0%	8	LOWER TUNGABHADRA	13666	Mahabubnagar, Kurnool, Anantapur
				9	LOWER BHIMA	2497	Ranga Reddy, Medak and Mahabubnagar
				10	MIDDLE KRISHNA	21326	Mahabubnagar, Ranga Reddy, Nalgonda, Prakasam, Kurnool, Guntur
				11	LOWER KRISHNA	51606	Nalgonda, Ranga Reddy, Mahabubnagar, Warangal, Khammam, Guntur, Krishna, West Godavari
3	CAUVERY TO KRISHNA	87513	32.0%	12	PALAR	15276	Chittoor and Nellore
				13	PONNAIYAR	121	Chittoor
				14	PENNAR	48761	Kurnool, Prakasam, Cuddapah, Anantapur, Chittoor and Nellore
				15	MUSI	23355	Guntur, Prakasam and Nellore
4	GODAVARI TO MAHANADI	24310	9.0%	16	NAGAVALI	20446	East Godavari, Visakhapatnam, Vizianagaram and Srikakulam
				17	VAMSADHARA	3864	Srikakulam and Vizianagaram

MAJOR RIVER BASINS

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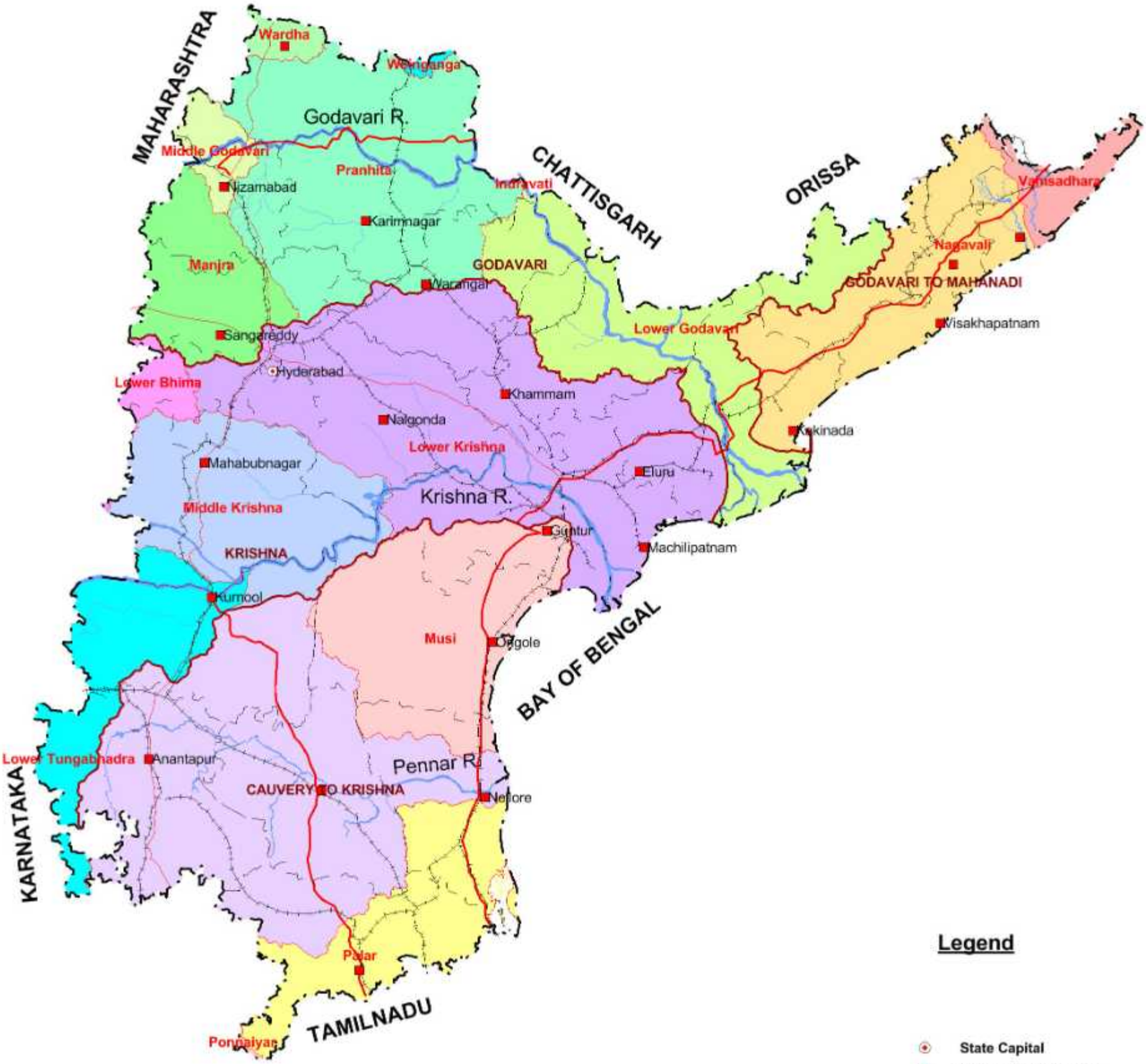

Legend

- State Capital
- District Headquarters
- District Boundary
- State Boundary
- Basin Boundary
- Sub Basin Boundary
- National Highway
- Railway Line
- River

Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table III : District wise Distribution of Principal Aquifer Systems

S No	District Name	Alluvium	Laterite	Basalt	Sandstone	Shale	Limestone	Granite	Schist	Quartzite	Charnockite	Khondalite	BGC	Gneiss	Intrusives	TOTAL
		Area (%)	Area (%)	Area (%)	Area (%)	Area (%)	Area (%)	Area (%)	Area (%)	Area (%)	Area (%)	Area (%)	Area (%)	Area (%)	Area (%)	Area (%)
1	Adilabad			4187	5681		1084	3					5146			16100
				26.0%	35.3%		6.7%	0.02%					32.0%			
2	Anantapur					1028	576	3976	568	22			12714	137	102	19123
						5.4%	3.0%	20.8%	3.0%	0.12%			66.5%	0.72%	0.53%	
3	Chittoor	87	205		136	216		243	100	545			13482	105	105	15224
		0.57%	1.3%		0.89%	1.4%		1.6%	0.66%	3.6%			88.6%	0.69%	0.69%	
4	East Godavari	3847		97	940						970	3753		1192		10800
		35.6%		0.90%	8.7%						9.0%	34.8%		11.0%		
5	Guntur	3136			175	1343	1586	123	654	797	1434	5	2147			11400
		27.5%			1.5%	11.8%	13.9%	1.1%	5.7%	7.0%	12.6%	0.04%	18.8%			
6	Karimnagar			81	2455		208	81					8965	10		11800
				0.69%	20.8%		1.8%	0.7%					76.0%	0.08%		
7	Khammam	90			5041	1548	2	188		20	677	540	7869	25		16000
		0.56%			31.5%	9.7%	0.01%	1.2%		0.13%	4.2%	3.4%	49.2%	0.16%		
8	Krishna	4124			476	29	38			58	869	1451	1655			8700
		47.4%			5.5%	0.33%	0.4%			0.67%	10.0%	16.7%	19.0%			
9	Kurnool					4717	3893	2049		1349			4979	663	50	17700
						26.6%	22.0%	11.6%		7.6%			28.1%	3.7%	0.28%	
10	Mahabubnagar			128		463	527	1567	292	1500			13643	280		18400
				0.70%		2.5%	2.9%	8.5%	1.6%	8.2%			74.1%	1.5%		
11	Medak		609	1513				2					7576			9700
			6.3%	15.6%				0.02%					78.1%			
12	Nalgonda					43	378		36	589			13154			14200
						0.30%	2.7%		0.25%	4.1%			92.6%			
13	Nizamabad			701				1911					5388			8000
				8.8%				23.9%					67.4%			
14	Prakasam	1413	51		121	4456		939	4962	2696	1665	62	228	1007		17600
		8.0%	0.29%		0.69%	25.3%		5.3%	28.2%	15.3%	9.5%	0.35%	1.3%	5.7%		
15	Ranga Reddy & Hyderabad		307	1682		61	70						5580			7700
			4.0%	21.8%		0.79%	0.91%						72.5%			
16	SPS Nellore	2728	511		143			70	7478	374			1726	70		13100
		20.8%	3.9%		1.1%			0.53%	57.1%	2.9%			13.2%	0.53%		
17	Srikakulam	933	48		22					13	1336	738	1894	816		5800
		16.1%	0.83%		0.38%					0.22%	23.0%	12.7%	32.7%	14.1%		
18	Visakhapatnam	160									3406	4467		3167		11200
		1.4%									30.4%	39.9%		28.3%		
19	Vizianagaram	12	45							42	1014	2871		2516		6500
		0.18%	0.69%							0.65%	15.6%	44.2%		38.7%		
20	Warangal				3066	828	902						8079	25		12900
					23.8%	6.4%	7.0%						62.6%	0.19%		
21	West Godavari	3829	28	49	2577						210	959	10	38		7700
		49.7%	0.36%	0.64%	33.5%						2.7%	12.5%	0.1%	0.49%		
22	YSR Kadapa					7912	1484		9	3483			2295	122	116	15421
						51.3%	9.6%		0.06%	22.6%			14.9%	0.8%	0.75%	
	Grand Total	20359	1804	8438	20833	22644	10748	11152	14099	11488	11581	14846	116530	10173	373	275068
		7.4%	0.66%	3.1%	7.6%	8.2%	3.9%	4.1%	5.1%	4.2%	4.2%	5.4%	42.4%	3.7%	0.14%	

PRINCIPAL AQUIFER SYSTEMS

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kilometers

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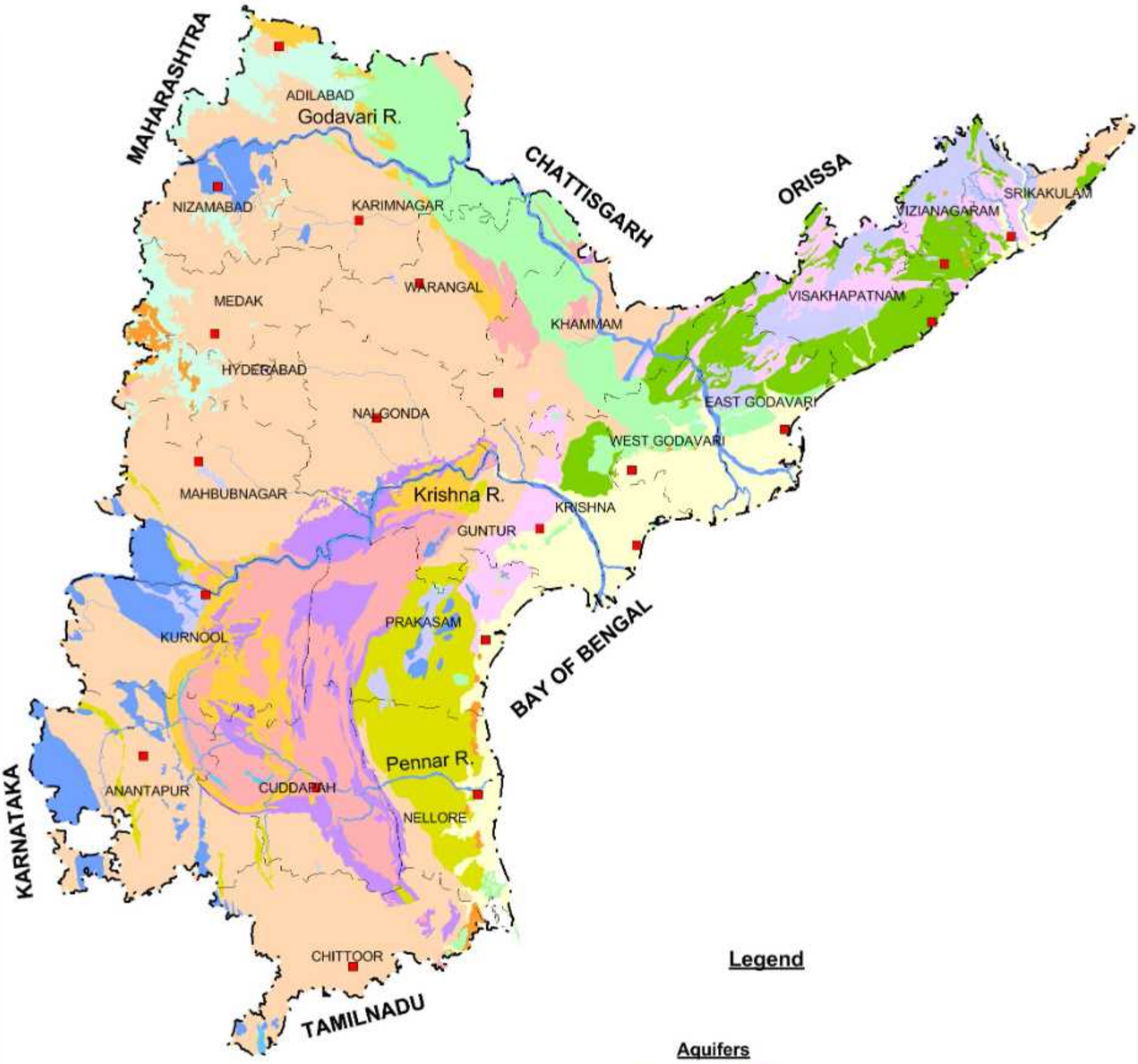


Legend

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Charnockite
- Khondalite
- Gneiss
- BGC
- Intrusives

- State Capital
- District Headquarters
- District Boundary
- State Boundary
- River

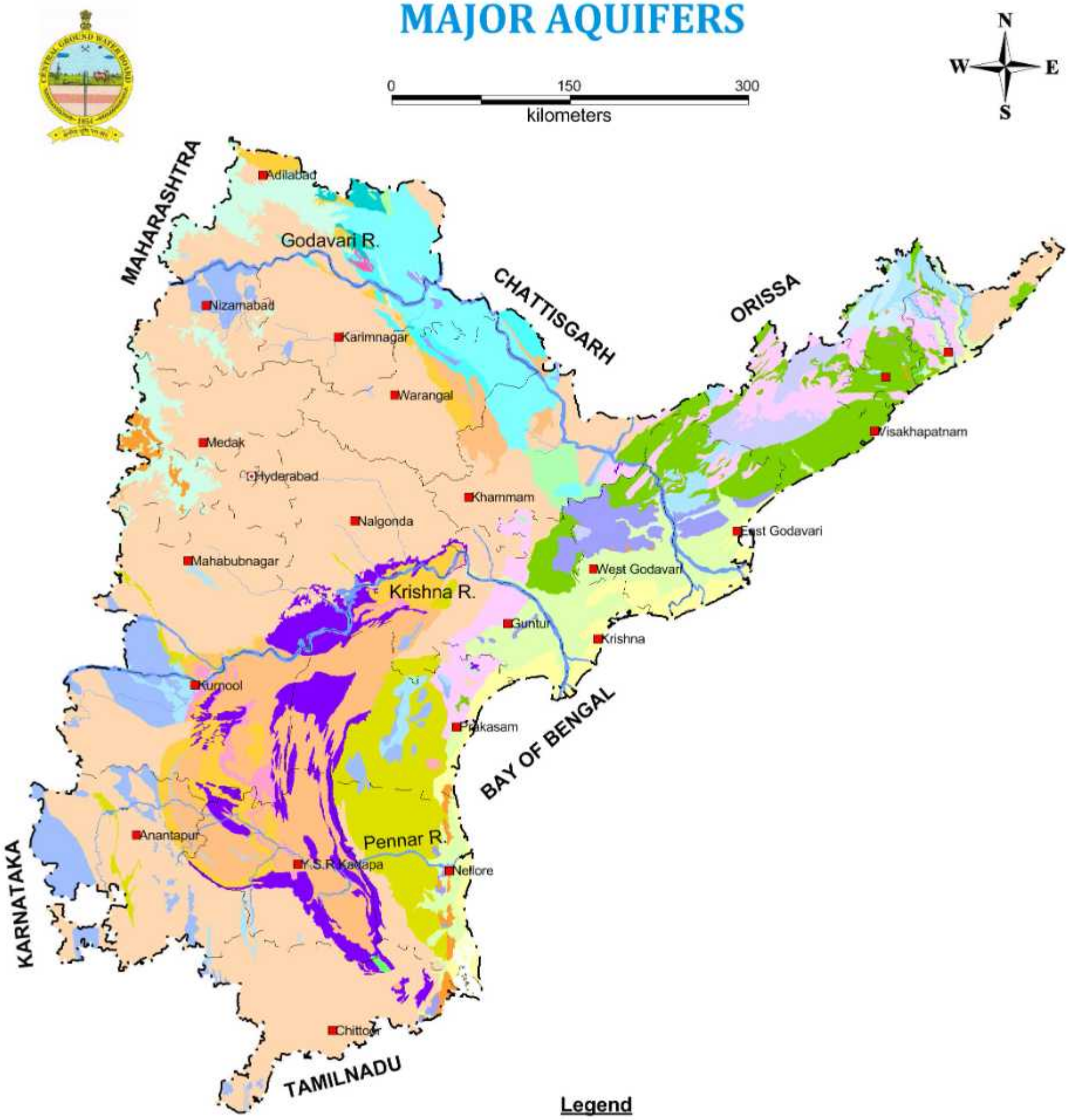
Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table IV - Major Aquifer Systems of Andhra Pradesh

S No	Principle Aquifer				Aquifer Charecteristics				Major Aquifers		Area (sq.km.)	Age as per Geological Time Scale
	Code	Name	Area (sq.km.)	Area (%)	DTW (Decadal Mean in mbgl)	Thickness of - weathered Zone #/ For-mation* (mbgl)	Granular / Fracture Zone* En-countered (mbgl)	Yield (cum / day)	Code	Name		
1	AL	Alluvium	20359	7.4	0.0 - 10.0	601*	20-248	68.0-4406	AL01	Younger or Deltaic allu-vium	13461	Quaternary
									AL05	Coastal Alluvium	6898	Quaternary
2	LT	Laterite	1804	0.66	0.0-20.0	1.0-30.0*	NE	NE	LT01	Laterite	1804	Quaternary
3	BS	Basalt	8438	3.1	2.0-20.0	2.0-36.0#	6.0-164*	1.0-1987	BS01	Basalt	8438	Mesozoic to Cenozoic
4	ST	Sandstone	20833	7.6	2.0-20.0	750.0*	10.0-650	12-11063	ST01	Sandstone with Conglomerate	4652	Upper Palaeozoic to Cenozoic
									ST02	Sandstone with Shale	2020	Upper Palaeozoic to Cenozoic
									ST03	Sandstone with Shale Local Beds	66	Upper Palaeozoic to Cenozoic
									ST04	Sandstone with Clay	11220	Upper Palaeozoic to Cenozoic
									ST05	Sandstone Conglomerate	2044	Proterozoic to Cenozoic
									ST06	Sandstone with Shale	831	Proterozoic to Cenozoic
5	SH	Shale	22644	8.2	0.0-15.0	1.0-26#	12.0-186*	1.0-1632	SH02	Shale with Sandstone	91	Upper Palaeozoic to Cenozoic
									SH04	Shale	99	Upper Palaeozoic to Cenozoic
									SH05	Shale/Shale with Sandstone	22454	Proterozoic to Cenozoic
6	LS	Limestone	10748	3.9	0.0-20.0	2.0-28.0#	10.0-197*	11.0-2333	LS02	Limestone/Dolomite	70	Upper Palaeozoic to Cenozoic
									LS03	Limestone/Dolomite	8920	Proterozoic
									LS04	Limestone with Shale	1758	Proterozoic
7	GR	Granite	11152	4.1	0.0-10.0	2.0-83#	5.0-199*	11.0-1357	GR02	Acidic rocks (Pegmatite,Granite, Syenite, Rhyolite etc)	11152	Proterozoic to Cenozoic
8	SC	Schist	14099	5.1	2.0-20.0	2.0-31#	7.0-149*	38.0-1700	SC01	Schist	13990	Azoic to Proterozoic
									SC02	Phyllite	109	Azoic to Proterozoic
9	QZ	Quartzite	11488	4.2	0.0-20.0	1.0-22#	11.0-156*	30.0-518	QZ01	Quartzite	11475	Proterozoic to Cenozoic
									QZ02	Quartzite	13	Azoic to Proterozoic
10	CK	Charnockite	11581	4.2	0.0-10.0	2.0-39.0#	9.0-166*	11.0-432	CK01	Charnockite	11581	Azoic
11	KH	Khondalite	14846	5.4	0.0-20.0	3.0-46#	12.0-198*	17.0-1874	KH01	Khondalites & Granulites	14846	Azoic
12	BG	Banded Gneissic Complex	116530	42.4	0.0-40.0	2.0-37#	5.0-243*	2.0-1600	BG01	Banded Gneissic Complex(BGC)	116531	Azoic
13	GN	Gneiss	10173	3.7	0.0-15.0	2.0-36#	5.0-243*	12.0-1356	GN01	Undifferentiated meta-sedimentaries / Undif-ferentiated metamorphic	3164	Azoic to Proterozoic
									GN02	Gneiss	2024	Azoic to Proterozoic
									GN03	Migmatitic Gneiss	4985	Azoic
14	IN	Intrusives	373	0.14	2.0-10.0	1.0-16#	12.0-183*	172.0-516	IN02	Ultra Basics (Epidiorite, Granophyre etc)	373	Proterozoic to Cenozoic

: weathered zone thickness in Hard Rocks ; ** : Fractured zone thickness in Hard Rocks ; * - Thickness of soft formations

MAJOR AQUIFERS



Legend

Alluvium
- AL01
- AL05

BGC
- BG01

Basalt
- BS01

Charnockite
- CK01

Gneiss
- GN01
- GN02
- GN03

Granite
- GR02

Intrusives
- IN02

Khondalite
- KH01

Limestone
- LS02
- LS03
- LS04

Laterite
- LT01

Quartite
- QZ01
- QZ02

Schist
- SC01
- SC02

Shale
- SH02
- SH03
- SH04
- SH05

Sandstone
- ST01
- ST02
- ST03
- ST04
- ST05
- ST06

- State Capital
- District Headquarters
- District Boundary
- State Boundary
- River

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Southern Region, Hyderabad, Andhra Pradesh, India

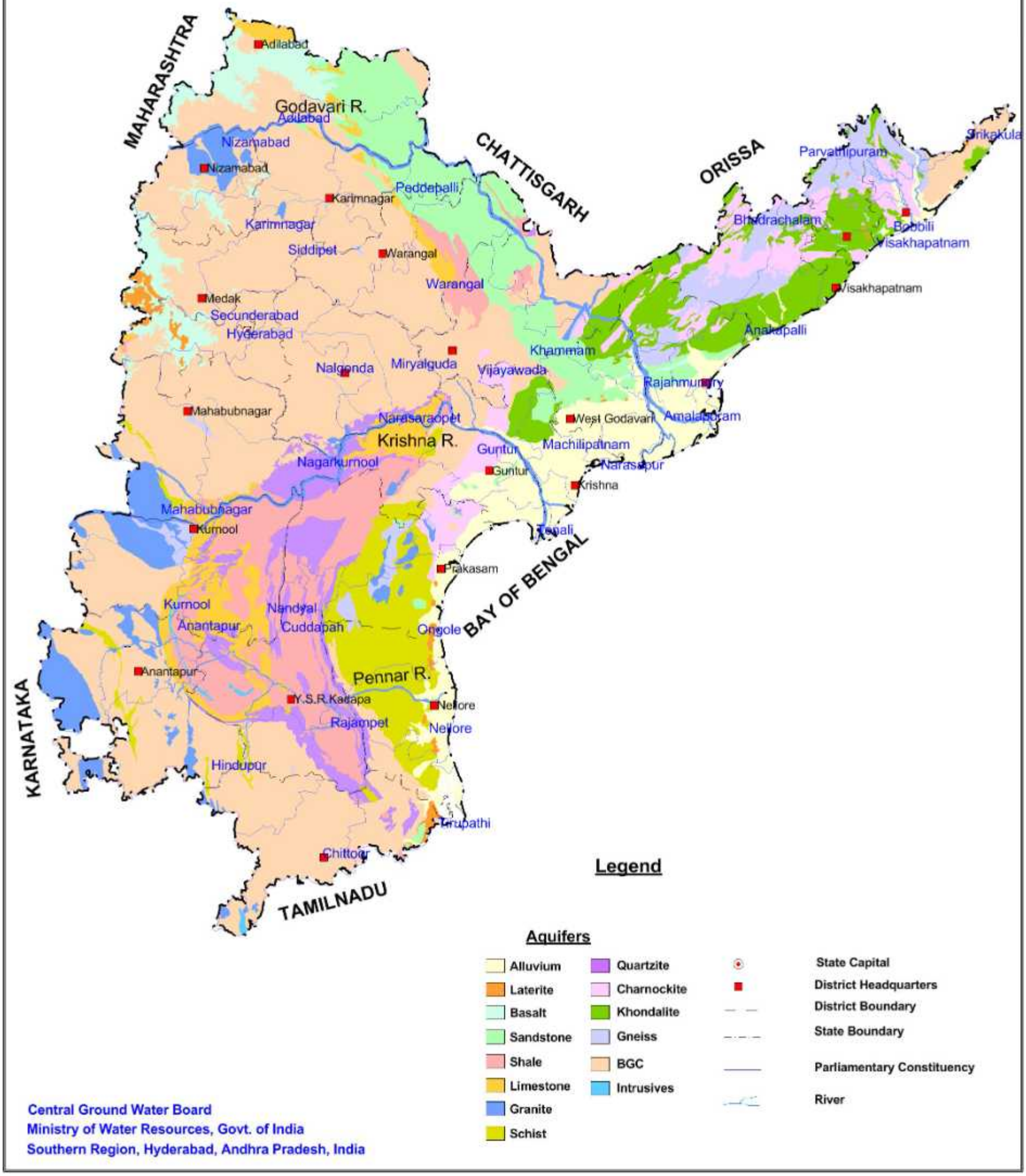
Table V: Parliamentary Constituency wise Principal Aquifer Distribution

S.No	Constituency	Alluvium	Laterite	Basalt	Sandstone	Shale	Limestone	Granite	Schist	Quartzite	Charnockite	Khondalite	BGC	Gneiss	Intrusives	Grand Total
1	Adilabad	0	0	3816	3133	641	855	73	0	0	0	0	4309	19	0	12845
2	Amalapuram	2029	0	5	7	0	0	0	0	0	0	0	0	0	0	2041
3	Anakapalli	85	0	0	0	0	0	0	0	0	818	2640	0	572	0	4115
4	Anantapur	0	0	0	0	755	509	3186	235	0	0	0	5458	0	68	10211
5	Bapatla	1730	0	0	30	0	0	77	312	27	1359	32	223	53	0	3844
6	Bhadrachalam	363	0	40	3916	350	0	104	0	16	3718	4757	2655	3117	0	19036
7	Bobbili	264	22	0	18	0	0	0	0	47	759	1674	0	513	0	3298
8	Chittoor	0	0	0	0	27	0	131	0	70	0	0	6945	0	107	7280
9	Y.S.R.Kadapa	0	0	0	0	6014	1489	0	0	1761	0	0	70	4	116	9454
10	Eluru	2406	29	6	1749	0	0	0	0	0	0	115	0	128	0	4434
11	Guntur	919	0	0	110	155	44	0	138	21	1111	0	1171	0	0	3668
12	Hanmakonda	0	0	0	549	2	183	0	0	0	0	0	4660	23	0	5417
13	Hindupur	0	0	0	0	381	92	817	255	50	0	0	7271	178	29	9073
14	Hyderabad	0	306	1520	0	62	0	0	0	0	0	0	2868	0	0	4757
15	Kakinada	712	0	48	553	0	0	0	0	0	115	1158	0	59	0	2645
16	Karimnagar	0	0	27	63	0	52	82	0	0	0	0	5150	0	0	5374
17	Khammam	0	0	0	2082	1183	14	82	0	3	261	10	5193	49	0	8877
18	Kurnool	0	0	0	0	132	734	1983	0	68	0	0	4827	642	49	8435
19	Machilipatnam	1715	0	0	388	0	0	0	0	0	0	677	0	0	0	2781
20	Mahabubnagar	0	0	107	0	121	296	1605	296	0	0	0	5907	256	0	8589
21	Medak	0	577	1742	0	0	0	0	0	0	0	0	4672	0	0	6991
22	Miryalaguda	0	0	0	0	44	389	0	13	445	0	0	6664	0	0	7555
23	Nagarkurnool	0	22	276	0	406	261	0	0	1638	0	0	8609	35	0	11246
24	Nalgonda	0	0	0	0	0	0	0	23	173	0	0	8366	0	0	8562
25	Nandyal	0	0	0	0	5653	2803	0	150	1856	0	0	107	11	7	10587
26	Narsapur	1657	0	0	0	0	0	0	0	0	0	0	0	0	0	1657
27	Narsaraopet	2	0	0	38	4800	1558	428	2112	2822	258	0	954	475	0	13446
28	Nellore	1824	190	0	125	2	0	0	2916	162	0	0	590	0	0	5809
29	Nizamabad	0	0	339	0	0	0	1838	0	0	0	0	3624	0	0	5801
30	Ongole	1134	166	0	0	96	0	662	6499	210	329	32	258	222	0	9608
31	Parvathipuram	169	0	0	0	0	0	0	0	0	747	322	153	1883	0	3275
32	Peddapalli	0	0	166	4722	0	362	0	0	0	0	0	3936	11	0	9197
33	Rajahmundry	1044	0	48	387	0	0	0	0	0	10	63	0	387	0	1939
34	Rajampet	0	0	0	0	1841	10	95	5	1603	0	0	5884	184	0	9623
35	Secunderabad	0	0	0	0	0	0	0	0	0	0	0	345	0	0	345
36	Siddipet	0	0	14	0	0	0	0	0	0	0	0	4574	0	0	4588
37	Srikakulam	520	0	0	0	0	0	0	0	0	391	260	1874	132	0	3177
38	Tenali	2082	0	0	29	0	0	0	0	0	95	5	1	0	0	2212
39	Tirupathi	869	486	0	179	106	0	0	810	730	0	0	4220	0	0	7400
40	Vijayawada	492	0	0	87	33	26	0	0	44	854	781	1650	0	0	3968
41	Visakhapatnam	16	19	0	5	0	0	0	0	3	845	2231	0	891	0	4011
42	Warangal	0	0	0	2448	844	707	0	0	0	0	0	3899	0	0	7898
Total		**20033**	**1819**	**8154**	**20617**	**23647**	**10384**	**11163**	**13764**	**11749**	**11671**	**14759**	**117088**	**9843**	**376**	**275068**

PARLIAMENTARY CONSTITUENCIES

0 150 300
kilometers

N
W E
S



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Southern Region, Hyderabad, Andhra Pradesh, India

Table VI - Population Census of Andhra Pradesh

S.No.	District	Area (sq.km.)	Population(2011)			Density (per sq.km.)
			Total	Males	Females	
1	Adilabad	16100	2741239	13,69,597	1371642	170
2	Anantapur	19123	4081148	2064495	2016653	213
3	Chittoor	15224	4174064	2090204	2083860	274
4	East Godavari	10800	5154296	2569688	2584608	477
5	Guntur	11400	4887813	2440521	2447292	429
6	Hyderabad	200	3943323	2018575	1924748	19717
7	Karimnagar	11800	3776269	1880800	1895469	320
8	Khammam	16000	2797370	1390988	1406382	175
9	Krishna	8700	4517398	2267375	2250023	519
10	Kurnool	17700	4053463	2039227	2014236	229
11	Mahabubnagar	18400	4053028	2050386	2002642	220
12	Medak	9700	3033288	1523030	1510258	313
13	Nalgonda	14200	3488809	1759772	1729037	246
14	Nizamabad	8000	2551335	1250641	1300694	319
15	Prakasam	17600	3397448	1714764	1682684	193
16	Ranga Reddy	7500	5296741	2701008	2595733	706
17	SPS Nellore	13100	2963557	1492974	1470583	226
18	Srikakulam	5800	2703114	1341738	1361376	466
19	Visakhapatnam	11200	4290589	2138910	2151679	383
20	Vizianagaram	6500	2344474	1161477	1182997	361
21	Warangal	12900	3512576	1759281	1753295	272
22	West Godavari	7700	3936966	1964918	1972048	511
23	YSR Kadapa	15421	2882469	1451777	1430692	187
Total		**275068**	**84580777**	**42442146**	**42138631**	**307**

Source: Directorate of Census Operations, Andhra Pradesh,

POPULATION DENSITY

0 150 300
kilometers

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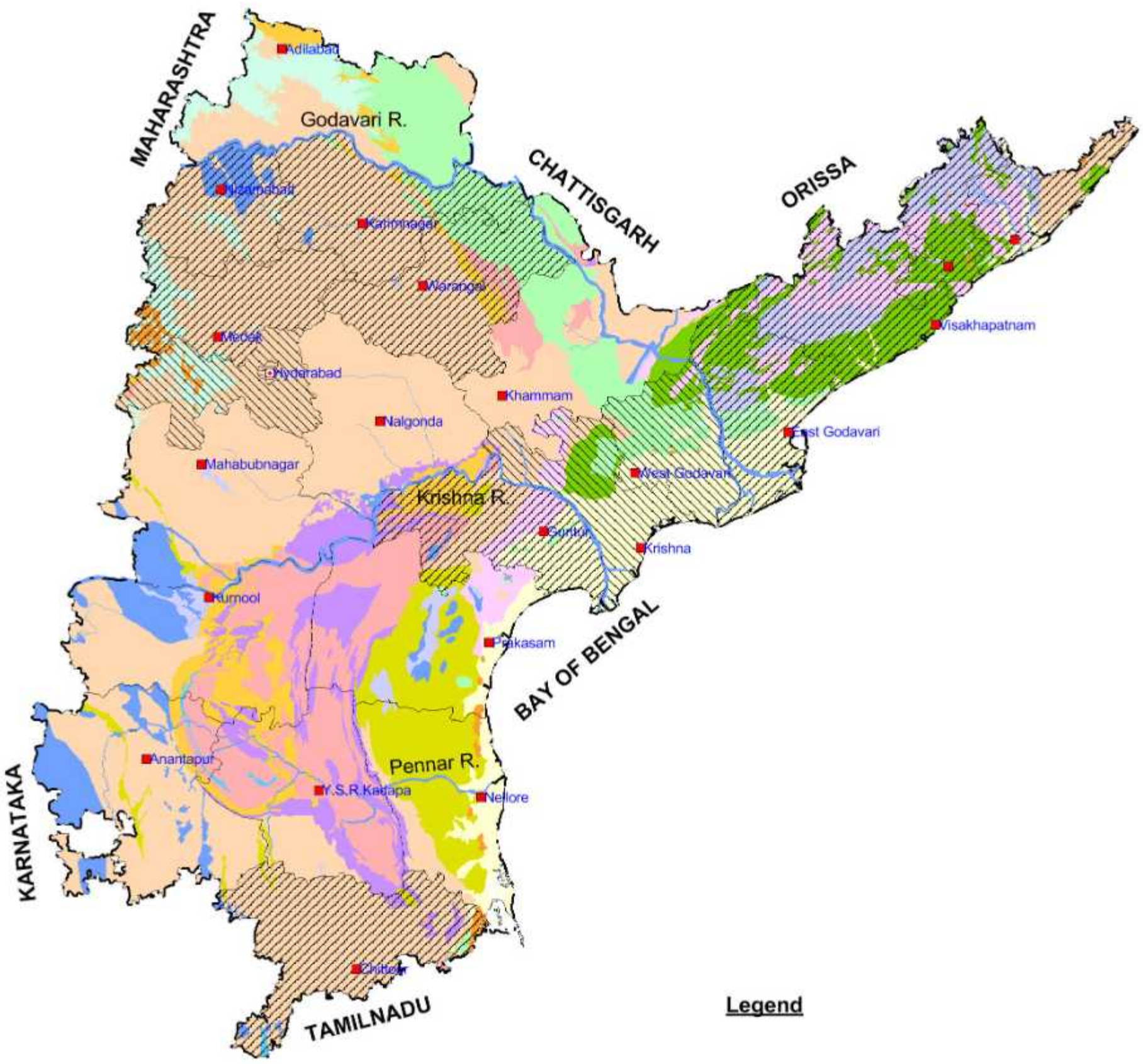

Legend

Population Density (Persons/Sq. Km)

- 0 - 250
- 250 - 500
- 500 - 1000
- 1000 - 5000
- > 5000

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Charnockite
- Khondalite
- Gneiss
- BGC
- Intrusives

- State Capital
- District Headquarters
- District Boundary
- State Boundary
- River

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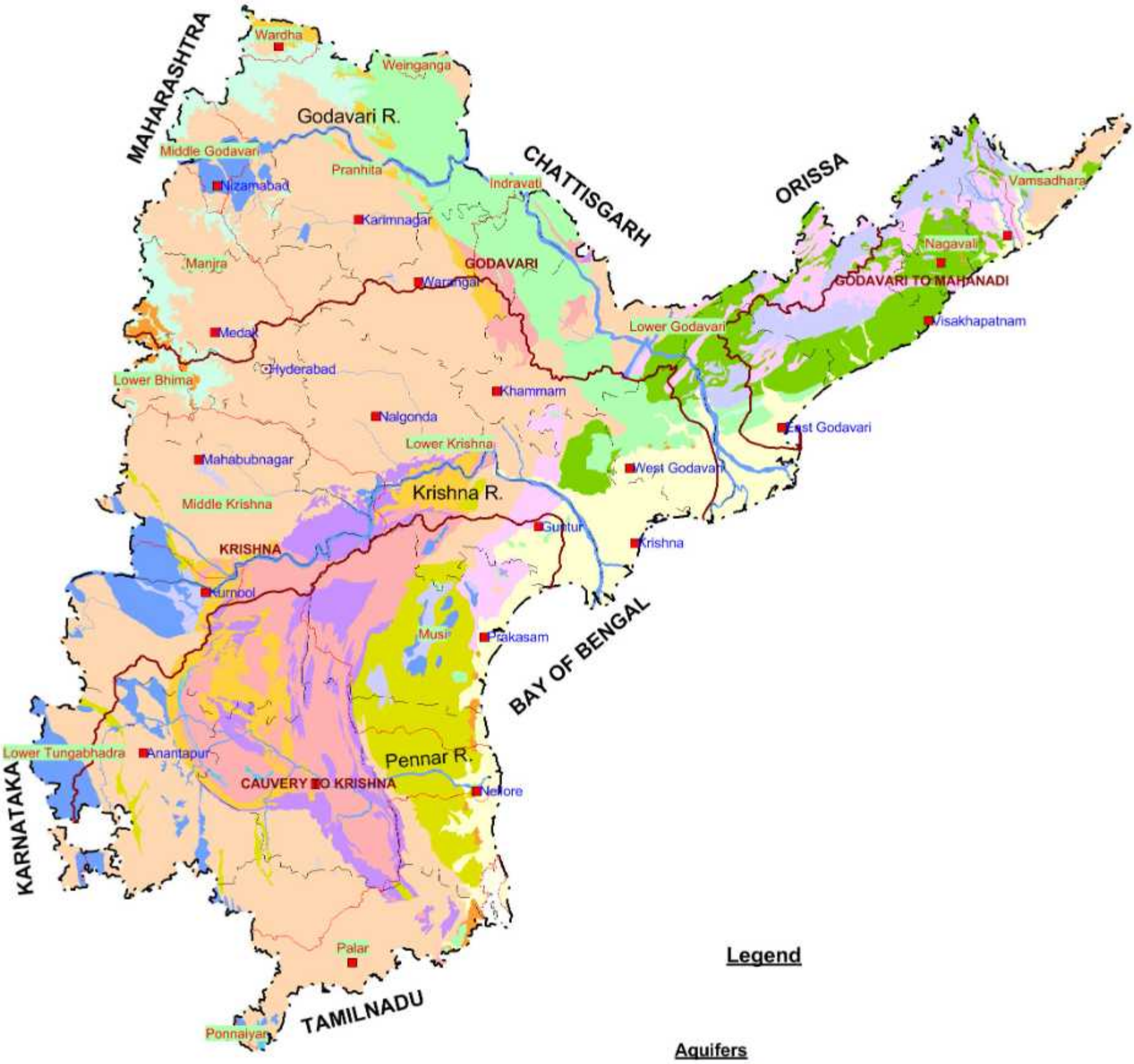
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table VII - River Basin Wise Aquifer Distribution

S NO	SUB-BASIN NAME	Alluvium	Laterite	Basalt	Sandstone	Shale	Limestone	Granite	Schist	Quartzite	Charnockite	Khondalite	BGC	Gneiss	Intrusives	Grand Total
1	INDRAVATI				32											32
2	LOWER GODAVARI	3532		98	7383	1402	30	122		45	2676	3721	3719	2134		24862
3	MIDDLE GODAVARI			553				1117					1482			3152
4	MANJIRA		549	2178				17					8320			11064
5	WARDHA			614			681						335			1630
6	PRANAHITA			3246	8417	139	988	834					19379	35		33038
7	WEINGANGA				312								60			372
8	LOWER TUNGABHADRA					102	838	5108	181	50			6592	795		13666
9	LOWER BHIMA		250	788		65	76						1318			2497
10	MIDDLE KRISHNA			41		2097	490	594	234	2665			15057	148		21326
11	LOWER KRISHNA	8866	163	769	3652	1605	2500	13	252	945	1854	1877	29110			51606
12	PALAR	1800	362		140	123		125	2061	792			9765		108	15276
13	PONNAIYAR												121			121
14	PENNAR	815	15			12738	5157	2080	4074	5018			18577	18	269	48761
15	MUSI	3260	210		280	4442		800	7755	2060	2183		1256	1109		23355
16	NAGAVALI	1740	47	30	568					51	4342	8847		4821		20446
17	VAMSADHARA	583	50								232	360	1929	710		3864
TOTAL		20596	1646	8317	20784	22713	10760	10810	14557	11626	11287	14805	117020	9770	377	275068

RIVER BASIN WISE AQUIFER DISTRIBUTION

0 150 300
kilometers



Legend

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Charnockite
- Khondalite
- Gneiss
- BGC
- Intrusives

- State Capital
- District Headquarters
- District Boundary
- State Boundary
- River

Central Ground Water Board
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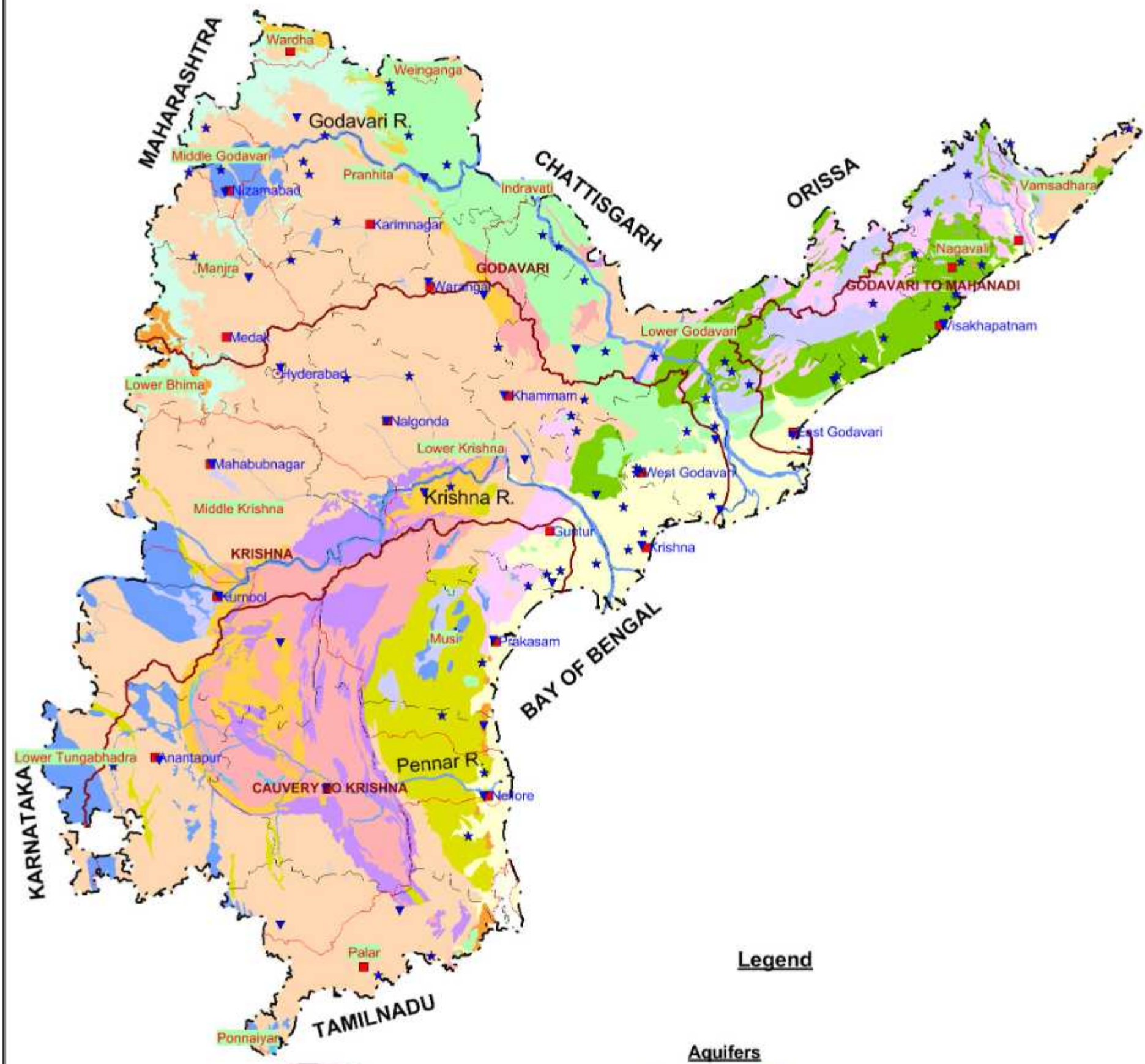
Southern Region, Hyderabad, Andhra Pradesh, India

Table VIII - Number of Rain Gauges, River Gauging and Discharge sites in Different Aquifers

S No	Aquifer Code	Aquifer system	Number of G & D Sites		Number of Rain gauges
			Central	State	
1	AL	Alluvium	0	15	6
2	LT	Laterite	0	0	1
3	BS	Basalt	0	0	0
4	ST	Sandstone	5	8	3
5	SH	Shale	4	0	1
6	LS	Limestone	3	1	3
7	GR	Granite	3	2	1
8	SC	Schist	0	2	0
9	QZ	Quartzite	4	0	0
10	CK	Charnockite	3	3	1
11	KH	Khondalite	1	10	4
12	BG	BGC	5	16	11
13	GN	Gneiss	0	6	1
14	IN	Intrusives	0	0	0
Total			28	63	32

RAIN GAUGES AND RIVER GAUGES

0 150 300
kilometers



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Southern Region, Hyderabad, Andhra Pradesh, India

Table IX - District wise and Aquifer wise Distribution of Ground Water Exploratory Wells & Observation Wells

S.No	District	Alluvium	Laterite	Basalt	Sandstone	Shale	Limestone	Granite	Schist	Quartzite	Charnockite	Khondalite	BGC	Gneiss	Intrusives	Grand Total
1	Adilabad			5	4								12			21
2	Anantapur					13	2	27					86	3		131
3	Chittoor												70			70
4	East Godavari	52		1	38							3		3		97
5	Guntur	22			2	9	37	1	7	4	11		27			120
6	Karimnagar				38		1						100			139
7	Khammam	1			28	15					1	3	71			119
8	Krishna	18			9	5				1	3	16	17			69
9	Kurnool					1		26					33	1		61
10	Mahabubnagar						2	6	1	5			131	6		151
11	Medak		22	27									87			136
12	Nalgonda						1			3			120			124
13	Nizamabad			6				15					42			63
14	Prakasam	10	1			22		7	18	8	13	2	6	3		90
15	Ranga Reddy & Hyderabad		10	43									119			172
16	SPS Nellore	21	6		1				58				13			99
17	Srikakulam	3									3	4	9	5		24
18	Visakhapatnam	1									5	35		4		45
19	Vizianagaram		1								7	26		28		62
20	Warangal				33		1						31			65
21	West Godavari	29	1	1	44											75
22	YSR Kadapa					64	3						7			74
Grand Total		157	41	83	197	129	47	82	84	21	43	89	981	53		2007

GROUND WATER EXPLORATORY WELLS

0 150 300
kilometers

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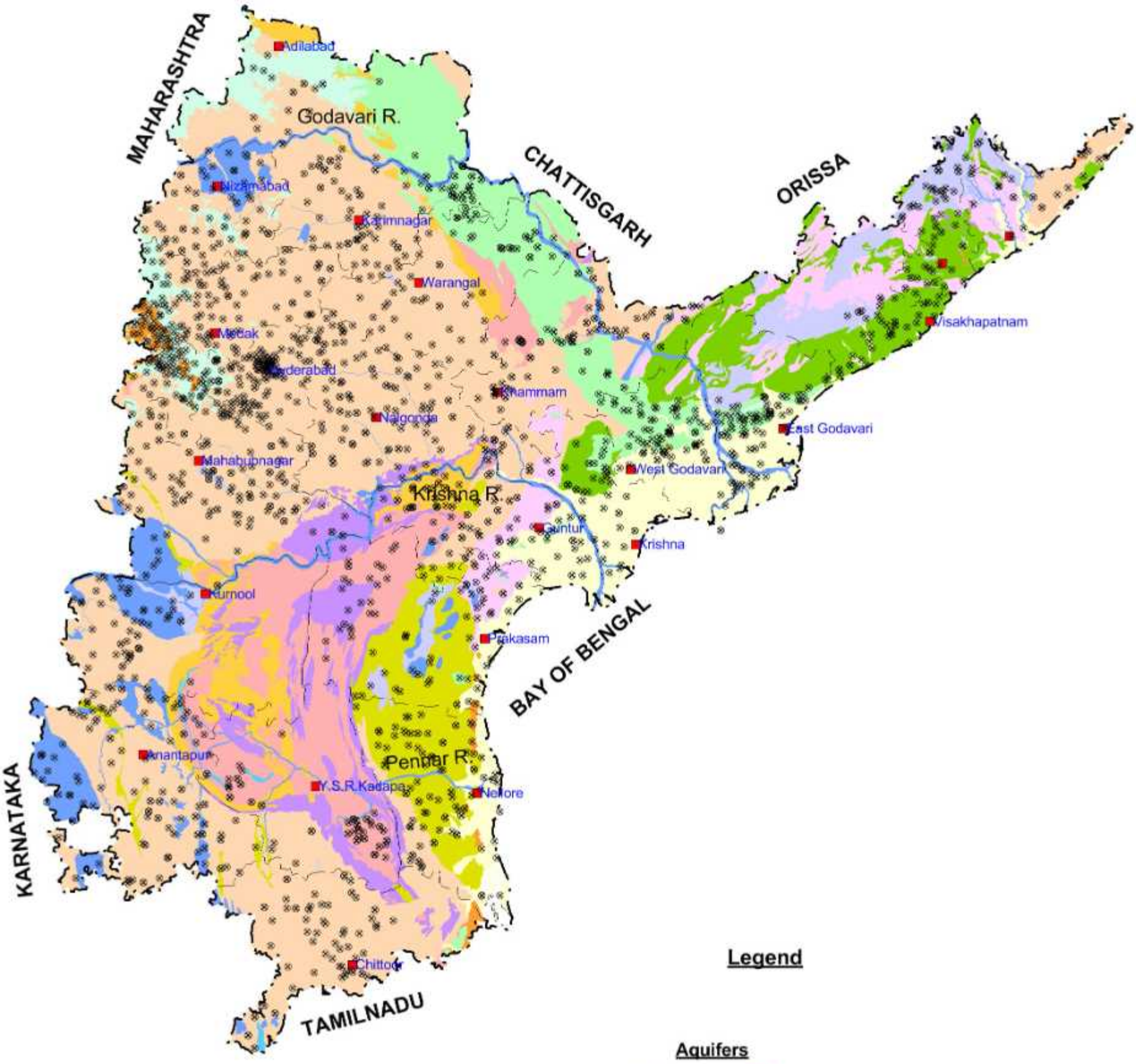


⊗ Exploratory Tube Well / Bore Well

Legend

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Charnockite
- Khondalite
- Gneiss
- BGC
- Intrusives

- State Capital
- District Headquarters
- District Boundary
- State Boundary
- River

Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

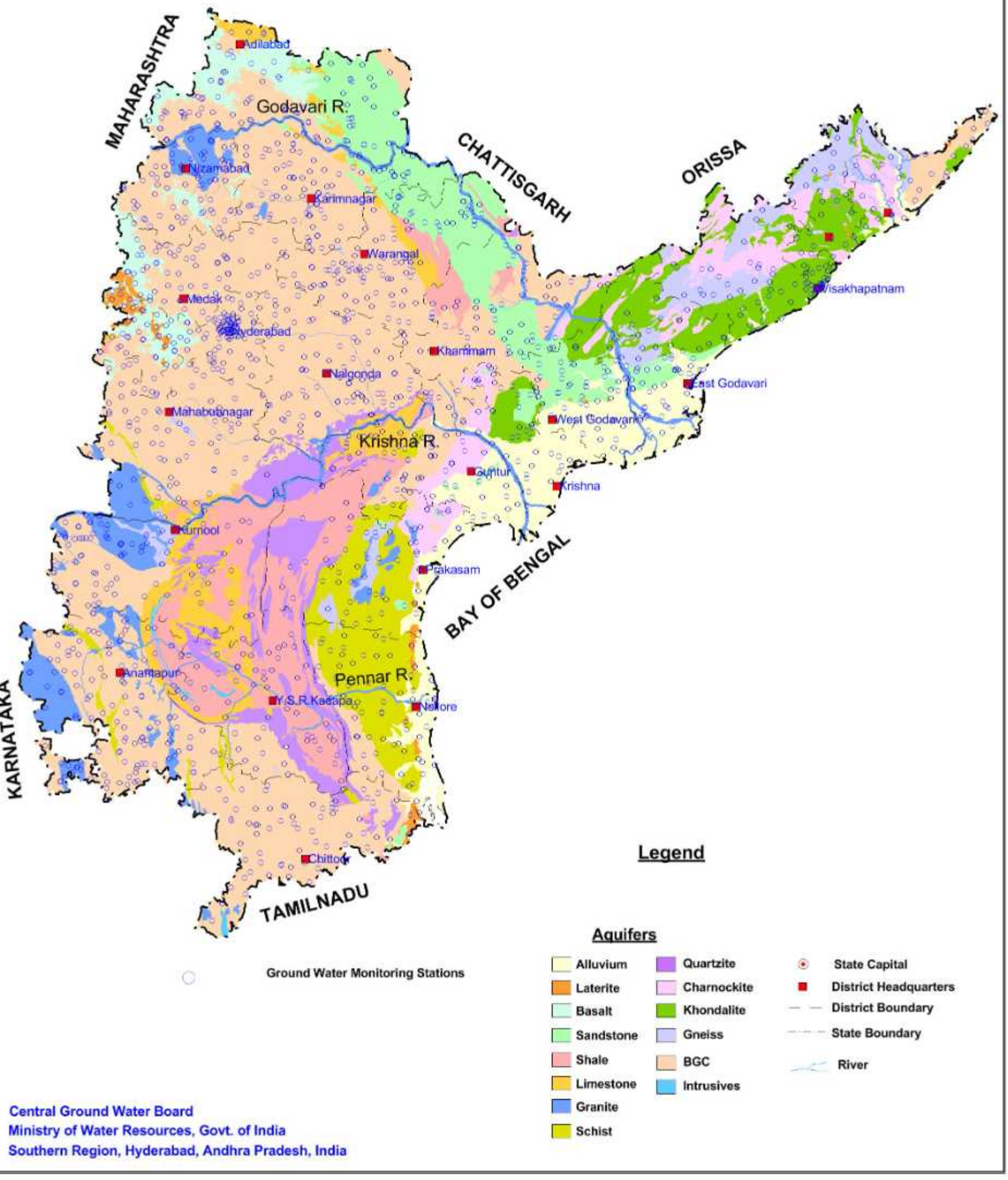
Table X - District wise and Aquifer wise Distribution of Ground Water Monitoring Wells

S No	District	Alluvium		Laterite		Basalt		Sandstone		Shale		Limestone		Granite		Schist		Quartzite		Charnockite		Khondalite		BGC		Greiss		Intrusives		Grand Total		
		DW	PZ	DW	PZ	DW	PZ	DW	PZ	DW	PZ	DW	PZ	DW	PZ	DW	PZ	DW	PZ	DW	PZ	DW	PZ	DW	PZ	DW	PZ	DW	PZ	TOTAL
1	Adilabad					9	3	5	10			4	1		1									15	9					33	24	57
2	Anantapur							6			3	1		7	3	1	2							16	12					31	20	51
3	Chittoor	1		1	1					1				2		2		2						26	0	2				37	1	38
4	East Godavari	19	8	1	1	1	0		1									1	1	1		8	1	1		5				37	12	49
5	Guntur	8		3				1		3	2	8	4	2		2	2	3		5				8	3					43	11	54
6	Karimnagar					1		5	17			2		2		0		1						13	34					24	51	75
7	Khammam	1	1					7	6	2	1	3		1						2	0			21	4	1				38	12	50
8	Krishna	15	0					0				1								4	0	3	3	3	3					26	6	32
9	Kurnool										4	8		7	5			1	1					5	7	3	2			24	19	43
10	Mahabubnagar									2	1	1		1	1		1	1						13	12	1	2			19	17	36
11	Medak			2	6	2	9																	10	14					14	29	43
12	Nalgonda												1					2						12	30					14	31	45
13	Nizamabad			0		6								3	9									4	12					13	21	34
14	Prakasam	5	1	6	0	1	0							2	0	8	4	2	2	2	1	1		1	0	3	0			31	8	39
15	Ranga Reddy & Hyderabad				5	5	12			1								1						13	56					20	73	93
16	SPS Nellore	11	1	5	2							2				5		4						6	0					33	3	36
17	Srikakulam	3	0																	6	0	2		10	0	3	0			24	0	24
18	Visakhapatnam	1	0																	5	0	20				11	0			37	0	37
19	Vizianagaram																			7	0	10				8	0			25	0	25
20	Warangal							3	11		2		1											22	22					25	36	61
21	West Godavari	8	6					5	7	2												3				3	0			21	13	34
22	YSR Kadapa							3		3	0	3	1			3	1	3						6	1	2				23	3	26
Grand Total		72	17	18	15	25	24	35	52	14	13	33	8	27	19	21	10	21	4	32	1	47	4	205	219	42	4			**592**	**390**	**982**

Dw: Dug Well, Pz: Piezometer

GROUND WATER MONITORING STATIONS

0 150 300
kilometers



Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XI - District wise and Aquifer wise Pre-monsoon Depth to Water Levels (May 2011)

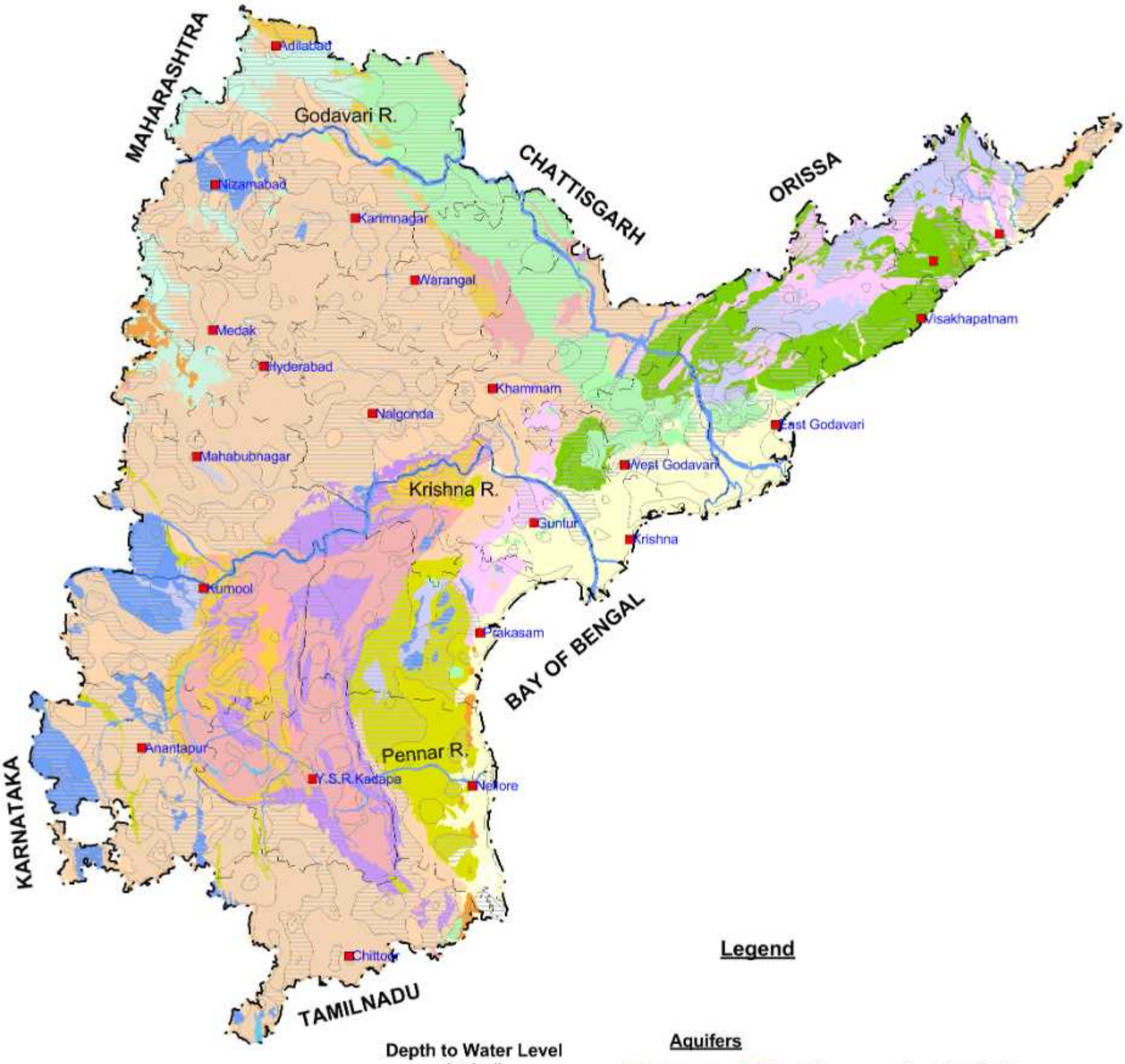
S No	District	Alluvium		Laterite		Basalt		Sandstone		Shale		Limestone		Granite		Schist		Quartzite		Charnockite		Khondalite		BGC		Gneiss		Intrusives	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1	Adilabad					3.87	10.92	4.15				6.53	7.45											1.88	13.05				
2	Anantapur							12	11.56	10.1	12.5	12.4	12.37	0.85	12.7	6.56	6.56							1.47	12.65				
3	Chittoor			4.2	6.86									11.45	11.5	7.04	7.04	6.4	6.4					1.32	13.03				
4	East Godavari	0.89	9.02			2.58	2.58	0.92	0.9											2.53	4.52	2.68	11.25			1.81	8.97		
5	Guntur	0.35	9.53					0.68	8.15	1.36	8.15	0.78	11.94	4.82	4.82	1.56	3.2	5.09	5.09	0.86	11.67			1.61	5.83				
6	Karimnagar							5.68																2.46	13.16				
7	Khammam	7.44	7.44					1.21	12.97	4.5	6.05			7.44	7.44					2.78	2.78			1.25	12.37				
8	Krishna	0.28	9.2					4.13	11.27			9.12	9.12					5.44	5.44	2.16	5.67	2.66	12.35	1.54	13.12				
9	Kurnool							4.8	4.8	1.5	11.5	1.75	11.35	0.85	11.7			5.7	12.56					3.08	12.03	2.55	9.08		
10	Mahabubnagar									3.3	3.3	4.55	8.2	1.97	13	3.16	6.06	9.26	11.1					1.98	12.08	8.26	8.26		
11	Medak			11.3	11.3	3.47	7.87																	3.63	12.68				
12	Nalgonda																	6.26	6.26					1.64	12.68				
13	Nizamabad					6.12	7.91							1.79	10.5									1.71	12.91				
14	Prakasam	1.08	6.94							3.27	13.2			1.95	10.2	2.12	10.1	4.75	9.87	0.93	6.6			0.96	2.52	2.87	3.78		
15	Ranga Reddy & Hyderabad					7.7	10.98			11	11													1.46	12.83				
16	SPS Nellore	0.91	6.08	3	7.65											0.56	11.1							2.4	7.44				
17	Srikakulam	2.32	7.34																	0.31	8.64	2.27	12.71	1.83	7.74	1.69	8.4		
18	Visakhapatnam	2.85	2.85																	1.06	7.75	1.46	11.39			1.08	11.53		
19	Vizianagaram			0.75	0.75															1.43	10.85	1.17	9.16			1.1	9.03		
20	Warangal							2.89	2.9	4.66	10.1	4.46	5.39											1.28	12.2				
21	West Godavari	0.79	9.2					0.79	12.27											6.59	6.59	7.45	12.95			4.32	6.94		
22	YSR Kadapa							6.7	6.69	1.85	11.9	2.8	12.22			9.43	9.43	3.95	5.4					2.98	12.95	8.8	8.8		

Depth to Water Level in m below ground level

DEPTH TO WATER LEVELS
(Pre-monsoon,2011)

0 150 300
kilometers

N
W E
S



Legend

Depth to Water Level (m bgl)

- < 5.0
- 5.0 - 10.0
- 10.0 - 20.0
- > 20.0

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Charnockite
- Khondalite
- Gneiss
- BGC
- Intrusives

- State Capital
- District Headquarters
- District Boundary
- State Boundary
- River

Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XII- District wise and Aquifer wise Post-monsoon Depth to Water Levels (Nov 2011)

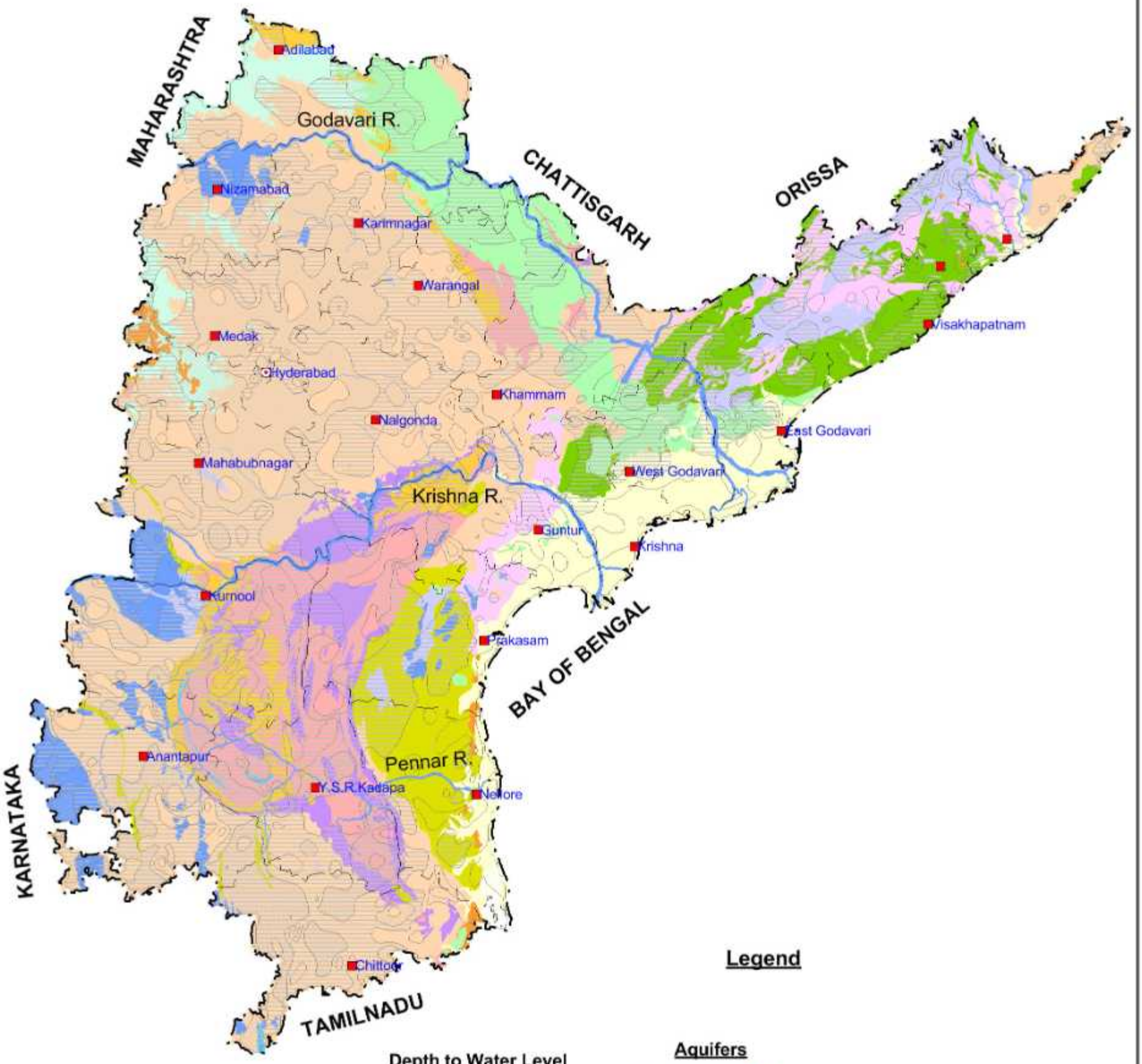
S No	District	Alluvium		Laterite		Basalt		Sandstone		Shale		Limestone		Granite		Schist		Quartzite		Charnockite		Khondalite		BGC		Gneiss		Intrusives	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1	Adilabad					1.47	1.47	2.85	9.99			2.79	4.72											0.99	11.41				
2	Anantapur									5.74	10.3			0.62	12.3	10.97	11							0.48	11.57				
3	Chittoor			0.47	6.72									8.24	8.24	6.14	6.14	3.3	3.3					0.02	11.84				
4	East Godavari	0.48	8.5			1.19	4.24	0.63	4.8											1.77	4.24	1.28	10.77			1.26	9.7		
5	Guntur	0.39	8.69				9.36	0.64	5.98	0.43	10.8	0.54	9.55	5.12	5.12	0.34	3.09			0.63	9.36			0.2	5.82				
6	Karimnagar							2.5	12															1.87	12.18				
7	Khammam	6.48	6.48				1.81	0.51	9.82	2.15	2.15			5.93	5.93					1.81	1.81			0.89	10.77				
8	Krishna	0.66	5.57				5.54	2.61	2.61			8.96	8.96					4.8	4.8	1.69	5.54	2.55	11.37	1.39	7.21				
9	Kurnool									0.58	10.6	0.36	12.2	1.02	11.2			3.78	3.78					2.89	11.71	1.89	10.13		
10	Mahabubnagar									3.35	3.35	4.3	10.4	1.69	7.87	3.37	5.86	9.03	11.47					1.45	11.58	6.54	6.54		
11	Medak			6.99	10.36	2.35	2.35																	1.51	12.2				
12	Nalgonda																	2.55	2.55					0.39	11.85				
13	Nizamabad					7.64	7.64							0.71	11									1.36	12.11				
14	Prakasam	0.94	6.21				6.7			1.32	12.3			2.79	9.8	0.86	11.5	5.08	7.42	0.09	6.7			2.74	2.74	2.1	5.28		
15	Ranga Reddy & Hyderabad			10.78	11.7	4.97	4.97			8.6	8.6													0.45	12.15				
16	SPS Nellore	0.33	5.14	0.09	5.49											0.34	8.45							1.54	8.18				
17	Srikakulam	1.3	5.04				6.18													0.64	6.18	1.42	11.46	1.34	6.03	1.81	6.35		
18	Visakhapatnam	1.8	1.8				7.94													0.62	7.94	1.2	10.82			0.98	11.45		
19	Vizianagaram			0.36	0.36		10.3													1.3	10.28	0.25	7.85			0.77	8.4		
20	Warangal							1.8	9.54	3.27	9.02	3.66	3.99											1.1	11.56				
21	West Godavari	0.43	9.29					1.07	9.82											7.04	7.04	6.6	10.72			3.52	6.96		
22	YSR Kadapa									0.75	12.3	1.82	5.13			6.52	6.52	0.56	3.08					3.24	12.25	4.36	4.36		

Depth to Water Level in m below ground level

DEPTH TO WATER LEVELS
(Post-monsoon,2011)

0 150 300
kilometers

N
W E
S



Depth to Water Level (m bgl)

- < 5.0
- 5.0 - 10.0
- 10.0 - 20.0
- > 20.0

Legend

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Charnockite
- Khondalite
- Gneiss
- BGC
- Intrusives

- State Capital
- District Headquarters
- District Boundary
- State Boundary
- River

Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XIII - District wise and Aquifer wise Water Level Fluctuation in Andhra Pradesh (May 2011 - Nov 2011)

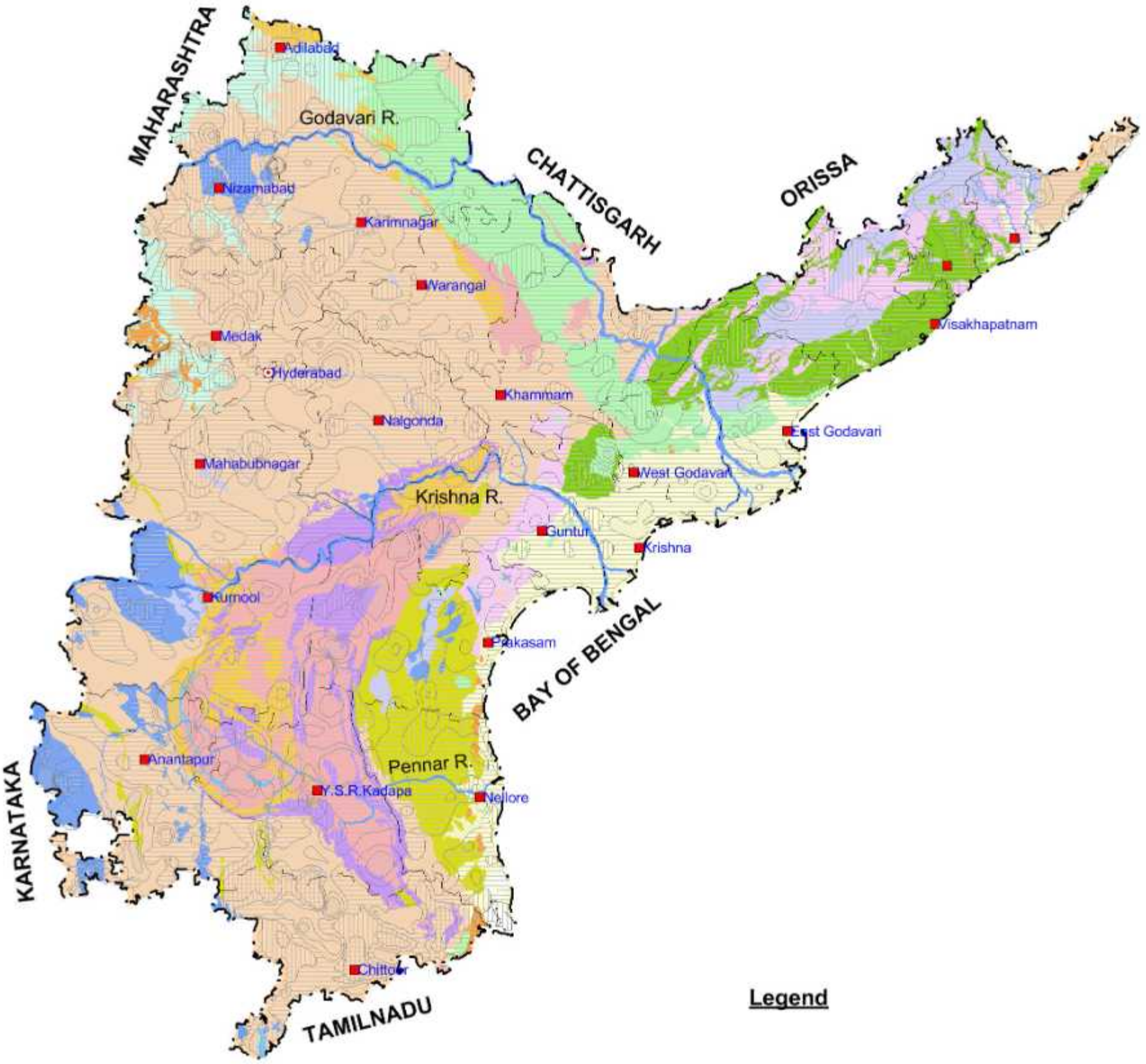
(in meters)

S No	District	Alluvium		Laterite		Basalt		Sandstone		Shale		Limestone		Granite		Schist		Quartzite		Charnockite		Khondalite		BGC		Gneiss		Intrusives	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1	Adilabad					-0.71	5.05	-0.22	3.18			1.9	3.59											-5.55	15.22				
2	Anantapur									-4.92	6.75	-15.8	-15.8	-8.24	9.71	-4.41	-4.41							-5.47	7.88	4.27	4.27		
3	Chittoor			0.14	1.44									-3.19	3.21	0.9	0.9	-0.44	-0.44					-7.91	22.06	5.81	5.81		
4	East Godavari	-2.5	4.37			0.15	0.15	-2.4	5.26											0.28	0.76	-1.6	4.28			-1.54	2.87		
5	Guntur	-0.62	2.3					-0.13	3.26	-2.69	6.15	-0.61	3.21	-0.3	-0.3	0.36	1.08	2.07	2.07	-7.24	1.58			-1.55	2.11				
6	Karimnagar							0.59	4.13															-2.7	6.75				
7	Khammam	1.04	1.04					-0.84	4.67	0.08	3.9			-3.98	-3.98					1.12	1.12			-3.33	7.1				
8	Krishna	-1.72	2.83					-11.24	1.52	4.34	4.34							0.64	0.64	-1.2	2.62	-2.54	4.7	-2.65	0.84				
9	Kurnool									-2.12	4.8	-3.05	5.13	-1.9	7.38			-1.68	0.15					-4.51	2.07	-1.05	0.36		
10	Mahabubnagar									3.07	3.07	-2.22	3	-1.07	2.65	-0.37	0.43	0.23	0.45					-3.94	14.7	0.03	0.03		
11	Medak			-2.8	0.64	0.08	0.87																	-6.1	12.24				
12	Nalgonda																	3.71	3.71					-7.29	8.06				
13	Nizamabad					-1.52	-1.52							-2.92	13.77									-17.6	17.57				
14	Prakasam	-0.34	3.85							-12.05	6			-2.3	0.43	-4.6	4.34	-7.73	2.03	-1.66	1.92	-1.89	-1.89	-0.22	-0.22	-1.48	0.87		
15	Ranga Reddy & Hyderabad					-0.37	12.87			2.4	2.4													-7.65	5.42				
16	SPS Nellore	-3.54	4.79	-3.65	3.34											-3.65	5.7							-3.43	3.42				
17	Srikakulam	0.1	3.95																	-0.6	3.75	-0.52	1.87	-0.18	6.05	-0.12	4.52		
18	Visakhapatnam	0.87	4.85																	-1.15	2.39	-4.94	4.91			-5.3	5.02		
19	Vizianagaram			0.39	0.39															-1.35	4.95	-5.36	9.95			-1.11	4.6		
20	Warangal							-0.03	3.72	0.49	1.07	0.51	1.4											-3.38	5.89				
21	West Godavari	-2.88	6.77					-1.83	4.33											-0.45	1.68	0.92	2.5			-0.88	0.83		
22	YSR Kadapa									-6.24	13.13	-0.35	3.97					-0.69	6.15					-2.7	7.09			1.43	1.43

GROUND WATER LEVEL FLUCTUATION
(May 2011 - Nov 2011)

N
W E
S

0 150 300
kilometers



Legend

Ground Water Level Fluctuation (m)

Rise	Fall
< 2.0	< 2.0
2.0 - 4.0	2.0 - 4.0
> 4.0	> 4.0

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Charnockite
- Khondalite
- Gneiss
- BGC
- Intrusives

- State Capital
- District Head Quarters
- District Boundary
- State Boundary
- River

Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XIV -District wise and Aquifer wise Pre-monsoon Depth to Water Levels (Decadal Mean 2002-2011)

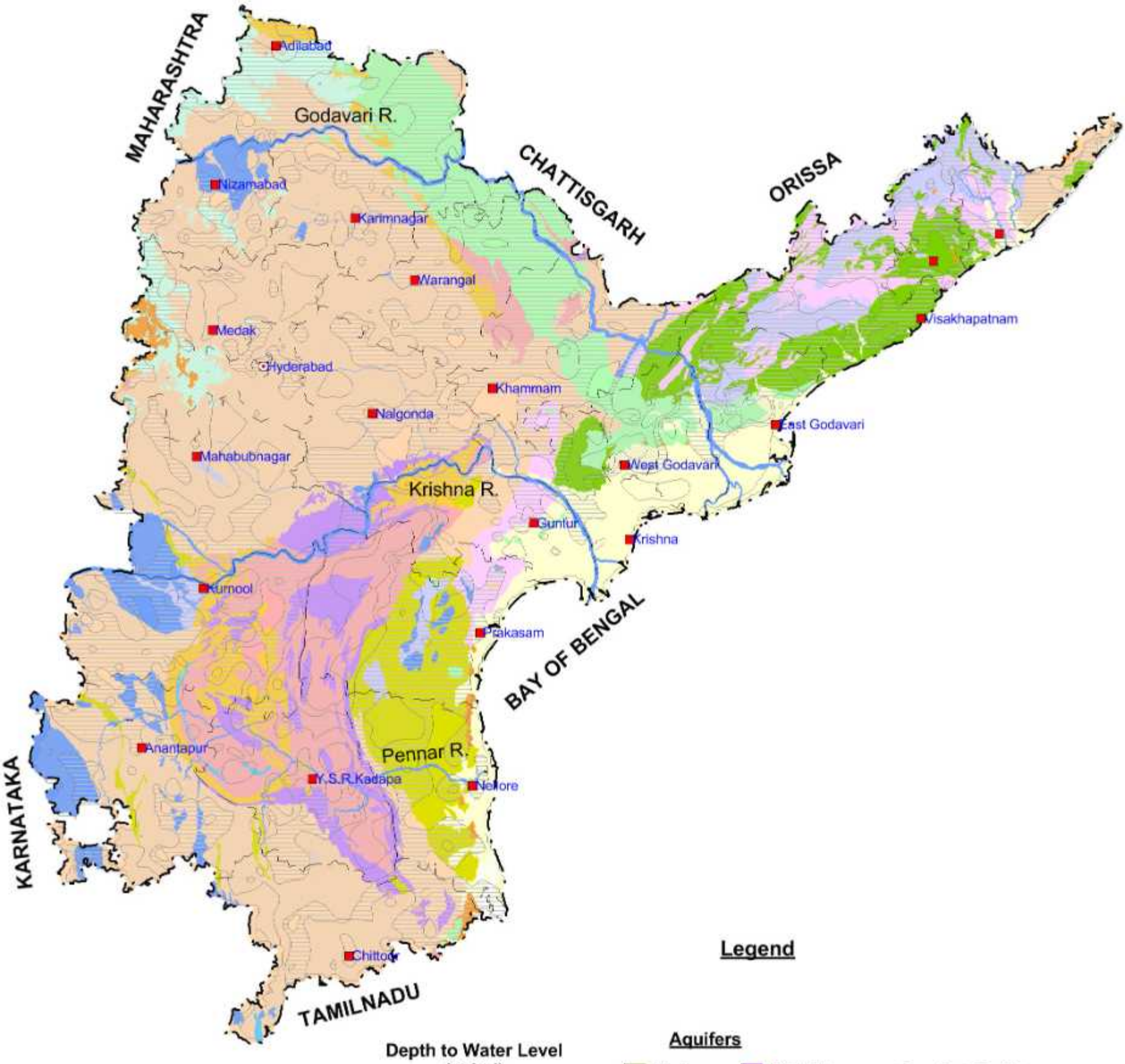
S No	District	Alluvium		Laterite		Basalt		Sandstone		Shale		Limestone		Granite		Schist		Quartzite		Charnockite		Khondalite		BGC		Gneiss		Intrusives	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1	Adilabad					4.36	20.2	6.03	24.31			7.36	7.82											3.37	23.9				
2	Anantapur									10.49	26.66	27.31	27.31	3.59	20.82	11	11							2.18	58.5	15.7	15.7		
3	Chittoor			5.51	7.01									13.5	33.36	7.18	7.18	6.53	6.53					2.33	40.5	23	23		
4	East Godavari	1.4	9.9			3.59	3.59	1.72	26.9											5.29	5.77	3.42	11.5			2.58	15.6		
5	Guntur	0.59	11.5					1.54	7.51	1.58	24.58	1.4	16.16	5.96	5.96	2.5	4.58			0.57	12.21			1.48	10.2				
6	Karimnagar							5.57	13.35					10.4	10.4									2.84	25.2				
7	Khammam	9.63	9.63					2.49	29.04	6.3	6.3			8.39	8.39					3.6	3.6			2.69	14.7				
8	Krishna	1.28	10.89					8.81	28.3			9.57	9.57					8.55	8.55	3.12	8.56	2.99	24	2.88	22.2				
9	Kurnool									3.04	17.3	3.52	30.14	2.45	11.5			4.34	8.36					3.74	31	3.61	12		
10	Mahabubnagar									6.14	6.14	4.8	9.56	3.54	26.79	3.41	10.07	12.4	16.84					4.25	41.8	8.08	8.08		
11	Medak			20.05	20.05	3.65	20.57																	4.21	36.1				
12	Nalgonda																	8	8					2.68	25.7				
13	Nizamabad					5.94	5.94							3.7	18.85									2.29	26.9				
14	Prakasam	1.92	9.13							4.41	37.43			3.46	14.59	2.59	14.63	6.27	18.26	2.28	13.06	8.84	8.84	3.51	3.67	3.39	6.2		
15	Ranga Reddy & Hyderabad					7.52	19.07			12.67	12.67													3.71	22.5				
16	SPS Nellore	2.09	7.37	3.17	9.08											1.87	14.74							3.27	8.81				
17	Srikakulam	2.38	7.97																	1.63	13.35	4.09	12.8	3.02	33.1	1.32	8.23		
18	Visakhapatnam	2.6	2.6																	1.7	15.32	2.27	16.2			2.2	17.1		
19	Vizianagaram			1.88	1.88															2.25	11.39	1.08	11			2.26	10.9		
20	Warangal							3.06	14.74	6.11	13.9	5.71	17.73											1.38	20.3				
21	West Godavari	0.65	29.26					1.09												7.24	22.24	7.97	16.5			6.72	15.1		
22	YSR Kadapa									4.23	51	5.36	42.38			9.07	9.07	5.05	39.14					3.58	33.6	6.48	6.48		

Depth to Water Level in m belowground level

DEPTH TO WATER LEVELS
(Decadal Mean Pre-monsoon)

0 150 300
kilometers

N
W E
S



Depth to Water Level (m bgl)

- < 5.0
- 5.0 - 10.0
- 10.0 - 20.0
- > 20.0

Legend

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Charnockite
- Khondalite
- Gneiss
- BGC
- Intrusives

- State Capital
- District Headquarters
- District Boundary
- State Boundary
- River

Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XV - District wise and Aquifer wise Post-monsoon Depth to Water Levels (Decadal Mean 2002-2011)

S No	District	Alluvium		Laterite		Basalt		Sandstone		Shale		Limestone		Granite		Schist		Quartzite		Charnockite		Khondalite		BGC		Gneiss		Intrusives	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1	Adilabad					1.8	9.6	3.3	22.4			3.5	5.1											1.6	17.6				
2	Anantapur									7.0	21.6	28.1	28.1	1.1	19.4	8.0	8.0							1.5	56.1	12.0	12.0		
3	Chittoor			1.9	6.0									9.2	24.6	3.3	3.3	4.5	4.5					1.1	30.0	21.1	21.1		
4	East Godavari	0.3	8.2			1.4	1.4	0.9	47.4											2.5	13.0	1.0	10.7			1.3	14.6		
5	Guntur	0.3	9.9					0.6	5.5	0.8	16.8	0.9	14.2	4.8	4.8	0.5	3.1			0.4	9.6			0.3	7.4				
6	Karimnagar							4.0	11.0					7.2	7.2									1.6	18.8				
7	Khammam	4.1	4.1					1.1	28.1	2.3	2.3			5.3	5.3					1.8	1.8			0.6	9.6				
8	Krishna	0.2	23.0					5.1	49.9			8.5	8.5					6.1	6.1	1.6	6.1	2.5	19.7	1.3	18.6				
9	Kurnool									0.7	13.6	1.4	25.3	0.9	10.6			2.6	3.2					2.2	28.5	2.3	11.1		
10	Mahabubnagar									3.0	3.0	3.0	7.6	2.6	18.5	1.8	8.2	9.2	9.4					2.1	36.6	6.1	6.1		
11	Medak			14.1	14.1	1.9	18.0																	1.1	31.8				
12	Nalgonda																	4.0	4.0					1.1	20.7				
13	Nizamabad					3.1	3.1							0.7	13.6									1.9	24.1				
14	Prakasam	0.9	5.5							1.5	30.4			2.8	13.0	1.5	14.5	5.2	11.8	1.2	11.5			1.4	2.2	2.8	5.7		
15	Ranga Reddy					3.8	11.0			8.9	8.9													0.3	21.0				
16	SPS Nellore	1.2	6.6	0.7	6.1											0.7	12.1							1.7	6.2				
17	Srikakulam	1.0	4.0																	0.5	6.6	1.5	7.6	0.8	33.0	1.3	4.1		
18	Visakhapatnam	1.5	1.5																	0.9	8.9	1.0	11.1			1.0	17.1		
19	Vizianagaram			0.7	0.7															1.4	10.2	0.2	8.0			0.9	8.3		
20	Warangal							2.2	12.9	2.6	11.0	3.4	10.6											0.9	18.4				
21	West Godavari	0.1	36.4					1.1	55.3											5.1	17.7	5.4	14.1			4.2	10.7		
22	YSR Kadapa									0.9	33.8	1.9	38.1			5.2	5.2	0.9	31.4					2.2	18.2	4.2	4.2		

Depth to Water Level in m below ground level

DEPTH TO WATER LEVELS
(Decadal Mean Post-monsoon)

0 150 300
kilometers

N
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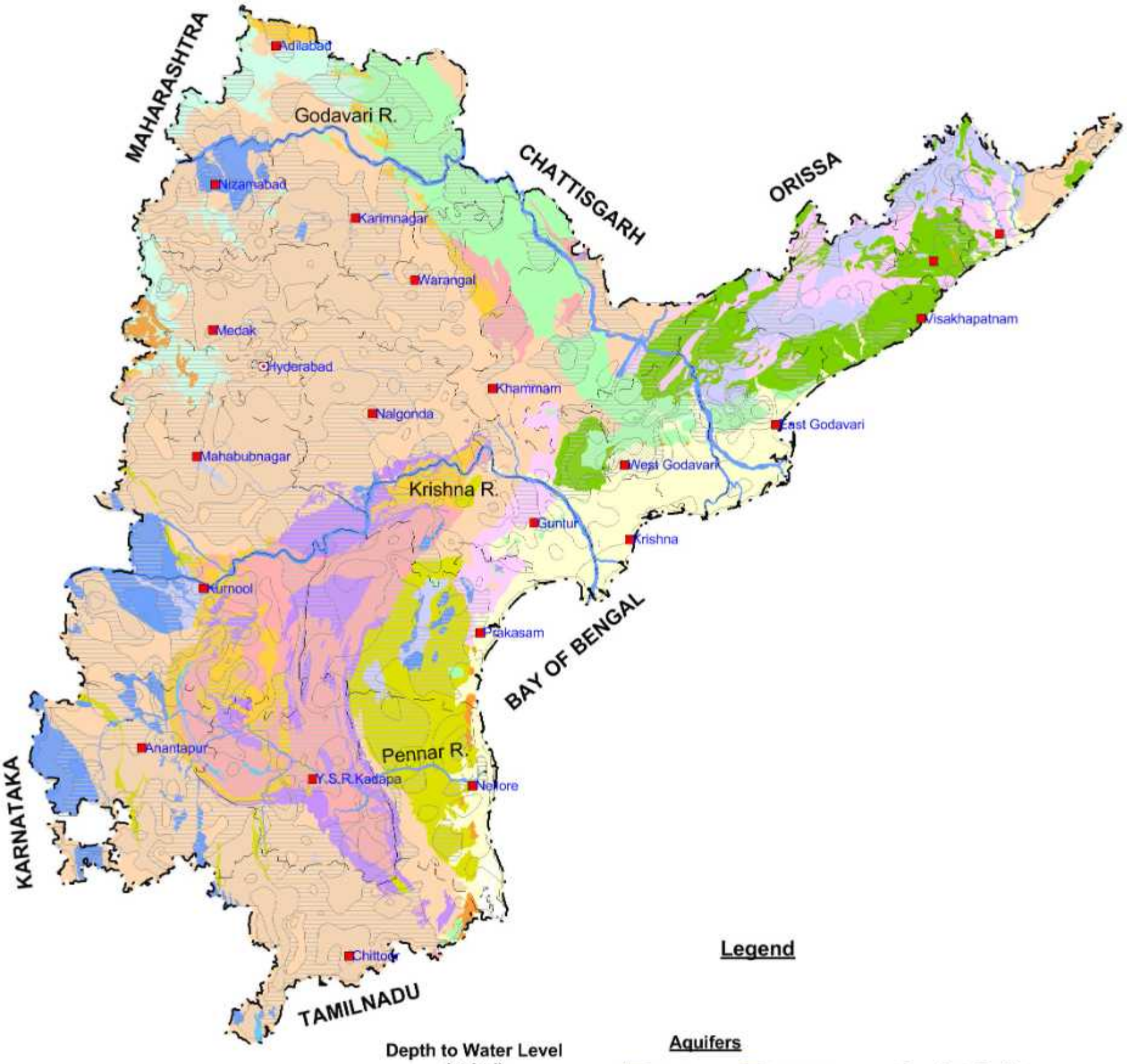

Depth to Water Level (m bgl)

- < 5.0
- 5.0 - 10.0
- 10.0 - 20.0
- > 20.0

Legend

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Charnockite
- Khondalite
- Gneiss
- BGC
- Intrusives

- State Capital
- District Headquarters
- District Boundary
- State Boundary
- River

Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XVI - District wise and Aquifer wise Water Table Elevation (Pre-monsoon 2011)

S No	District	Alluvium		Laterite		Basalt		Sandstone		Shale		Limestone		Granite		Schist		Quartzite		Charnockite		Khondalite		BGC		Gneiss		Intrusives	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1	Adilabad					329.8	517.1	117.1	282.5			183.7	218.7											141.4	433.5				
2	Anantapur									222.2	273.2	269.8	272.5	326.5	724.3	511.3	511.3							277.7	706.5	413.5	413.5		
3	Chittoor			28.3	53.7									707.7	724.4	164.4	164.4	790.0	790.0					19.3	743.9	620.6	620.6		
4	East Godavari	0.8	11.6			38.6	38.6	7.6	38.7													16.8	340.5			21.6	169.1		
5	Guntur	1.2	86.7					8.8	16.5	118.3	195.2	55.3	136.7	133.9	133.9	29.3	94.6			20.0	71.8			26.3	96.7				
6	Karimnagar							97.5	410.5															46.3	436.0				
7	Khammam	46.6	46.6					53.7	206.7	172.5	210.9			38.4	38.4					41.0	41.0			32.3	228.0				
8	Krishna	1.5	135.0					19.0	93.1			50.4	50.4					59.6	59.6	22.9	93.7	2.9	134.8	15.1	119.0				
9	Kurnool									157.2	312.7	219.7	283.1	310.9	416.6			328.0	328.0					337.2	496.4	331.9	333.8		
10	Mahabubnagar									305.7	305.7	266.9	375.7	311.5	597.5	319.0	557.5	298.9	409.1					235.3	653.2	268.7	391.0		
11	Medak			600.6	634.8	447.0	621.3																	460.0	599.1				
12	Nalgonda																	74.8	77.0					77.2	529.4				
13	Nizamabad													307.0	389.5									207.6	529.2				
14	Prakasam	2.8	131.2							8.9	212.1			5.1	157.8	0.4	251.1	4.3	211.3	5.9	220.9			3.1	76.9	33.4	177.8		
15	Ranga Reddy & Hyderabad			523.1	523.1	453.1	629.1			583.8	583.8													190.2	681.9				
16	SPS Nellore	0.8	59.7	1.0	56.1											0.7	297.3							0.7	118.3				
17	Srikakulam	0.3	120.4																	1.6	462.8	22.7	88.3	9.6	65.5	25.1	81.0		
18	Visakhapatnam	1.5	1.5																	12.1	827.2	1.5	931.4			2.3	930.6		
19	Vizianagaram			148.9	148.9															12.8	955.8	6.6	872.9			17.5	218.1		
20	Warangal							78.1	291.6	203.3	218.5	172.5	253.0											62.3	518.0				
21	West Godavari	0.8	30.0					2.6	148.6											14.4	68.3	12.1	181.6			57.6	124.7		
22	YSR Kadapa									66.2	318.5	116.8	191.3			158.8	158.8	99.1	207.6					131.8	414.1				

Water Table is m above mean sea level

WATER TABLE ELEVATION

(Pre-monsoon, 2011)

0 150 300

kilometers

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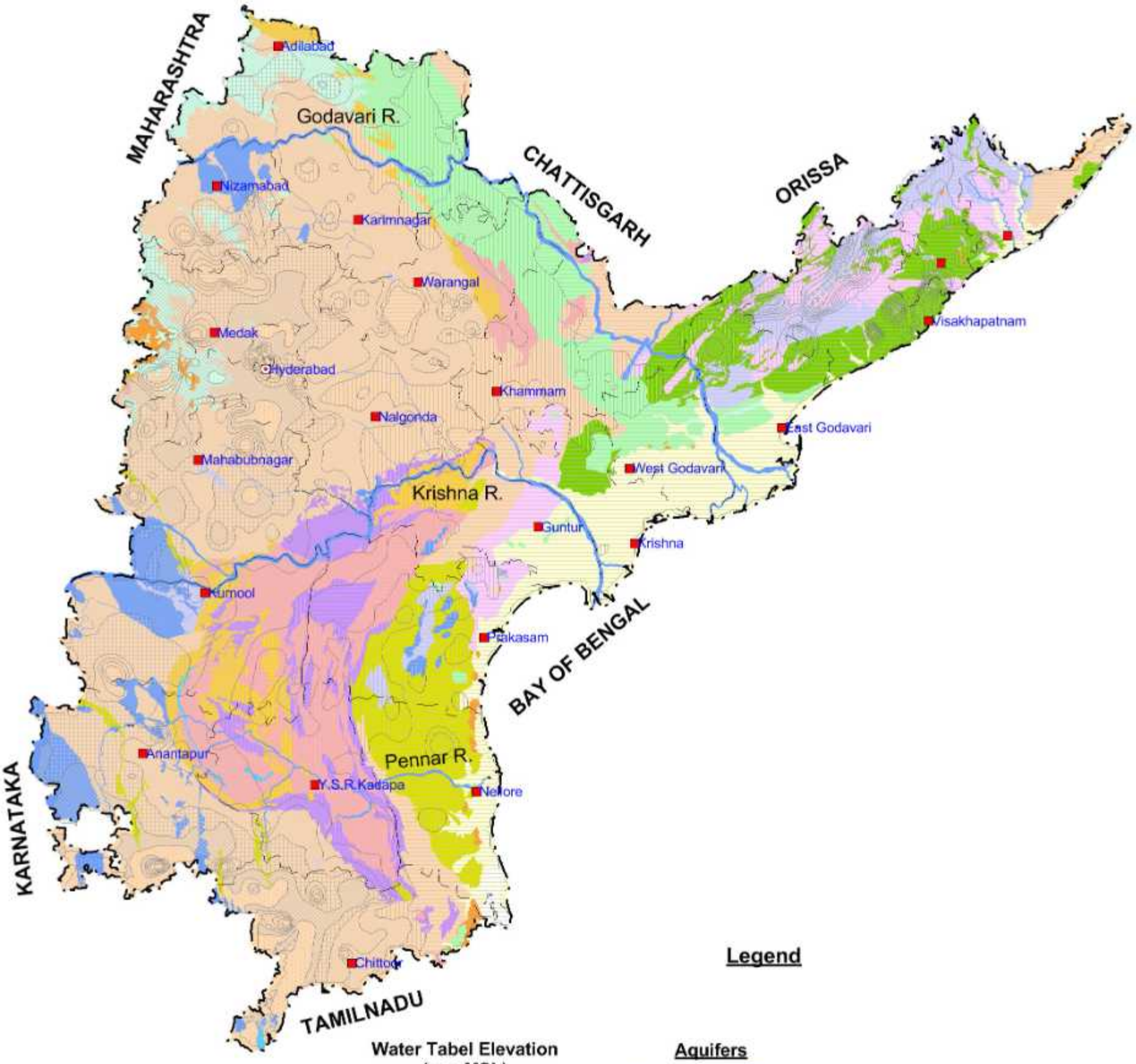

Water Tabel Elevation (m a MSL)

- < 100
- 100 - 200
- 200 - 300
- 300 - 400
- 400 - 500
- 500 - 600
- 600 - 700
- > 700

Legend

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Charnockite
- Khondalite
- Gneiss
- BGC
- Intrusives

- State Capital
- District Headquarters
- District Boundary
- State Boundary
- River

Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XVII - Locations Showing Salinity of Ground Water in Different Districts of Andhra Pradesh (Shallow Aquifer)

S No	District Name	No of Samples analyzed	Villages where EC > 3000 microsiemens /cm at 25°C
1	Adilabad	21	Khanapur
2	Anantapur	16	Narpala(sultanpet, Bontula Dinne
3	Chittoor	30	Nil
4	East Godavari	35	Gurajanpalle, Vakalpudi, Muddidivaram, Gollaprolu
5	Guntur	38	Gurzala, Bellamkonda, Utukuru, Krosur, Pisapadu, Sirigiripadu, Chilkaluripet, Nijampatnam, Sekuru, Prattipadu, Mandadi, Rompicherla, Amaravathi
6	Karimnagar	20	Nil
7	Khammam	38	Thotapally, Sujatanagaram, Yerupalem, Konijarla
8	Krishna	25	Kaikaluru, Pamarru, Bantumilli, Balliparru, Kopparagu, Gopalapuram, Pedda Autapalle, Gampalagudem
9	Kurnool	14	Naganathanahalli, Madhavaram, Mantralayam-new, Holagondi
10	Mahbubnagar	13	Gundimal, Peddakottapalle
11	Medak	6	Papannapet(narsingi), Peroor
12	Nalgonda	7	Thungapadu, Pochampalli, Kondrapolu
13	Nizamabad	4	Chinnakodapgal
14	Prakasam	28	Narzamala Tanda, Santamaguluru, Guttalamummadivaram, Podili, Uppugundur, Patnam, Kadavakuduru, Chandalur, Parchuru, Elchur
15	Ranga Reddy & Hyderabad	11	Nil
16	SPS Nellore	31	Kanupurupalli, Krishnapuram, Dachuru, Tadaparthi, Tikkavaram
17	Srikakulam	24	Aldu
18	Visakhapatnam	37	Addaroddu, Gurrajupeta, Revupolavaram, Rayavaram.
19	Vizianagaram	25	Nil
20	Warangal	25	Ippagudem
21	West Godavari	15	Brahmanacheruvu, K.Bhetipudi
22	YSR Kadapa	15	Mudimala

ELECTRICAL CONDUCTIVITY

(micro siemens/cm)

0 150 300

kilometers

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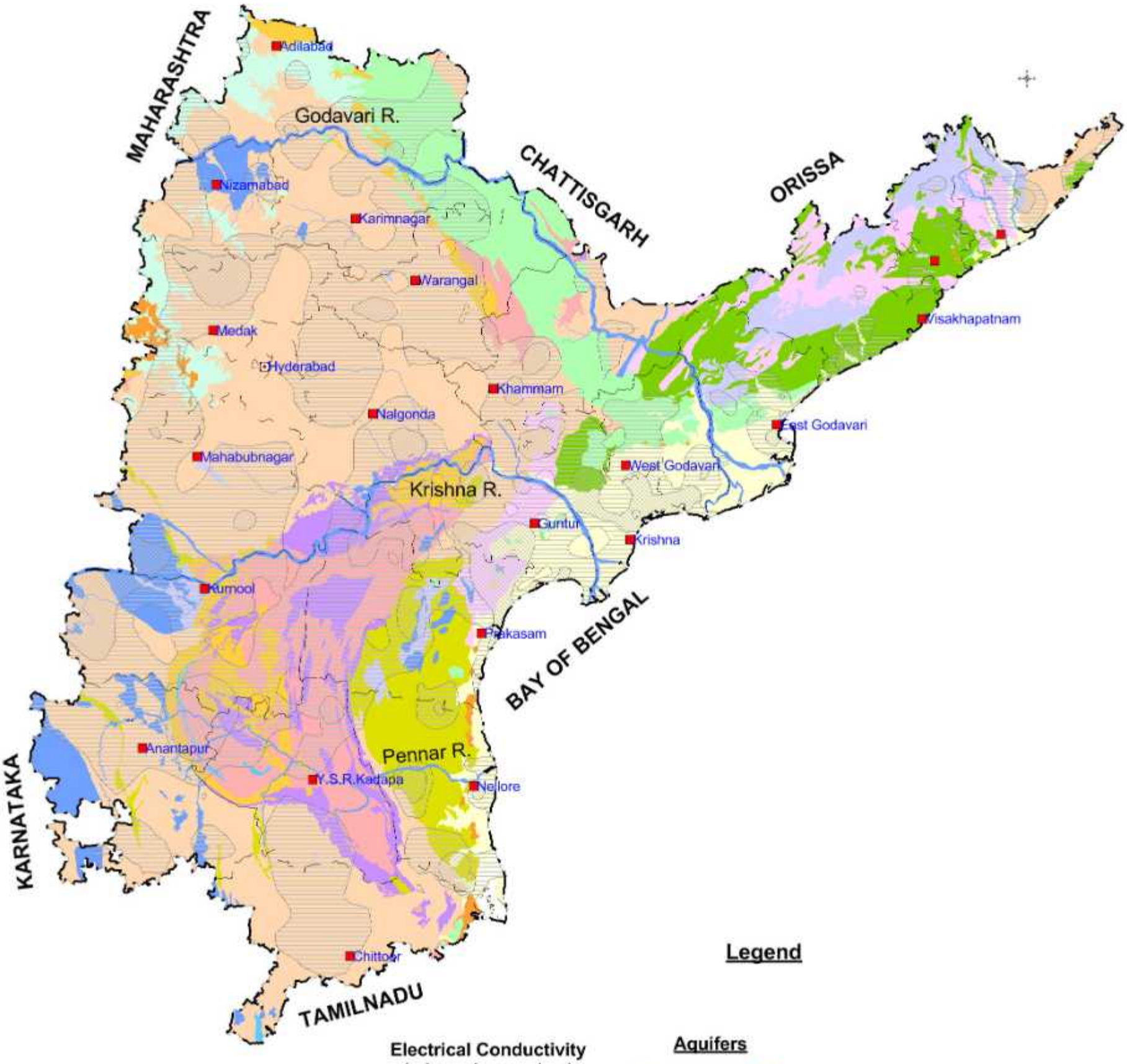

Legend

Electrical Conductivity (micro siemens/cm)

- < 1500
- 1500 - 3000
- > 3000

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Charnockite
- Khondalite
- Gneiss
- BGC
- Intrusives

- State Capital
- District Headquarters
- District Boundary
- State Boundary
- River

Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XVIII - Locations Showing Fluoride in Ground Water in Different Districts of Andhra Pradesh (Shallow Aquifer)

SNo	District	No of Samples analyzed	Villages where Fluoride > 1.5 mg/l
1	Adilabad	21	Ushegaon,Jankapur,Malyal,Bommena,Nirmal
2	Anantapur	16	Talupuru,Kalyan Durg,Dorigallu,Reddi palle,Alampur,Gownivari palle,Kekathi,Bommagondanahalli
3	Chittoor	30	Nil
4	East Godavari	35	Jagametla palem,
5	Guntur	38	Amaravati,Peesapadu,Challagundla,Rompicherla,
6	Karimnagar	20	Gollapalle,Peddapalle
7	Khammam	38	Samathsingaram,Dugutta,Khankhapet
8	Krishna	25	Nil
9	Kurnool	14	Siddapuram,Veldurthi,Mettupalle,Naganathana halli
10	Mahbubnagar	13	Bomarspeta
11	Medak	6	Narsing
12	Nalgonda	7	Tungapahad,Mallapuram
13	Nizamabad	4	Lolam
14	Prakasam	28	Kanchipalli,Bandellapaya,Chintagurupalli,Podeli medapi,Tanguturu,Vemulapadu,Kanigiri,Ayyavaripalli
15	Ranga Reddy & Hyderabad	11	Alwal,Kesari,Bata Singaram, Manchal
16	SPS Nellore	31	Thurpu Brahmanapalle,Aruru, Sangavaram
17	Srikakulam	24	Nil
18	Visakhapatnam	37	Kondapalem
19	Vizianagaram	25	Nil
20	Warangal	25	Narsampet
21	West Godavari	15	Dharmaji gudem
22	YSR Kadapa	15	Mudumala,Itigullapadu,Chennamukkapalle,Nersupalle.Somi reddi palle,

FLUORIDE IN GROUND WATER

(mg/l)

0 150 300

kilometers

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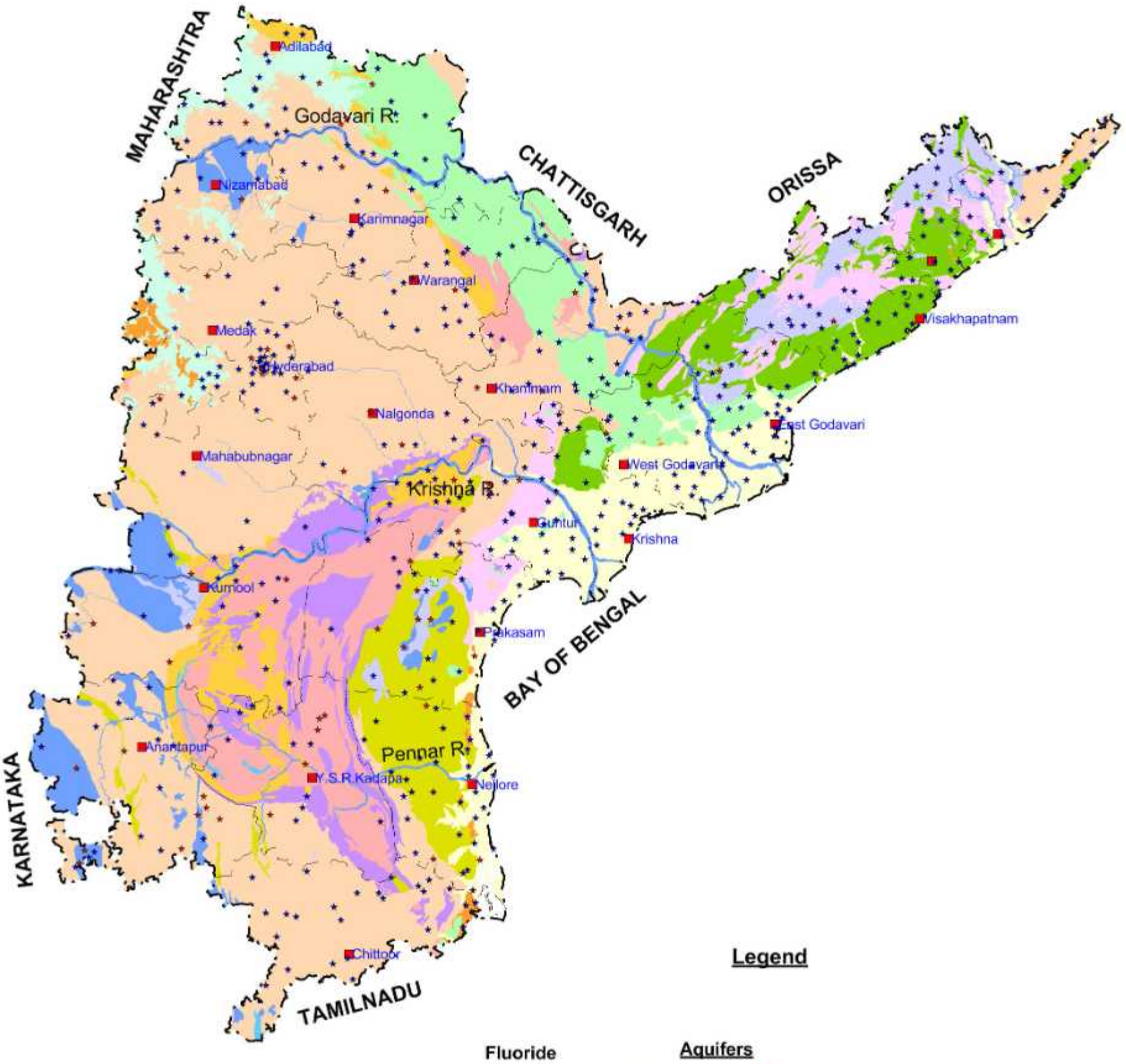

Legend

Fluoride (mg/l)

- < 1.5
- > 1.5

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Charnockite
- Khondalite
- Gneiss
- BGC
- Intrusives

- State Capital
- District Headquarters
- District Boundary
- State Boundary
- River

Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XIX - Locations Showing Nitrate in Ground Water in Different Districts of Andhra Pradesh (Shallow Aquifer)

S No	District	No of Samples Analyzed	Villages where Nitrate > 45 mg/l
1	Adilabad	21	Bela,Bhimavaram, Gudihatnoor Hajipur, Hasapur, Jainad, Jannaram, Kalamadgu, Khanpur, Lolam, Luxettiprt, Mamda, Manchirial, Narsapur, Nirmal, Palsi, Pembi, Potharam
2	Anantapur	16	Adivi Brahmanapalli, Amidala, Bontula dinne, Budipalli,Govinavaripalli,Guntakal,Ingaluru Korrpadu, Madakasira,Malakavemula-rs, Narpala, Sutapet, Nilakanthapram, Palasamdram, Penukoda, Raydurg, Reddipalli,Vajrakarur,Waddipalli
3	Chittoor	30	Bhakrapet,C.Kandriga,Erpedu,Isukagutta,Kalakonda,Kallur,Nimmapalli,Panatoor,Srikalahasti,Surtipalli,Tirupati(U)
4	East Godavari	35	Gollaprolu,Pattipadu,Pithapuram,Rampachodavaram
5	Guntur	38	Adigoppula,Amaravthi,Ananeyapuram,Bellamkonda,Chilkaluripet,Chintala tanda, Guzala,Rompicherla,Sekuru,Sirigiripadu,Srinagar,Utukuru,Varagami, Vinukoda, Guttikonda, Krosur, Mandadi, Mangalagiri, Murjampadu,Nijampatnam,Pirangipuram,Pisapadu,Ponnor(old),Prattipadu,Zupudi,Renttachintala,Rentapalle
6	Karimnagar	20	Arunakonda,Buswapuram,Dharmapuri,Garepalli,Husnabad,Jagityal,Kalwacherla,Karimnagar,Kothapally,Kudurupaka,Mahadevpur,Manukonduru,Mohanraopet,Mustafabad,Peddapalli,VenkatapurYelakaturti
7	Khammam	38	Annapareddipalli,Annarugudem,Aspaka,Dhammapeta,Dummagudem,Gandhampally,Garla,Jagannathapuram,Konijarla,Kunavaram,Sitarampuram,Sujatanagaram,Tegad,Thotapally,Yerupalem
8	Krishna	25	Bantumilli,Gampalagudem,Garikapdu,Gopalapuram,Kagraharam,Kopparagudem,Kummarkuntla,Nuzivedu,Sultan Nagar,Tiruvur,Vijayawada,Vissannapet
9	Kurnool	14	Chagalmarri,Madhavaram,Mantralayam,Moravakonda,Nandikotkur,Nossam,Orvakallu,Sanatajutur,Yemignur
10	Mahabubnagar	13	Bandrapal,Bongkur,Gadwal,Gundimal,Metlakunta,Peddakottapalle,Ragidimailaram,Ravalpalle,Vattivelipalli,Y.Chowrasta
11	Medak	6	Gatpalli,Gumardalla,Kothur,Narayankhad,Papnnapet,Peroor,
12	Nalgonda	7	Devarakonda,Huzurnagar,Kondrapolu,Nagaram,Nalgonda,Nidamanuru,Peddavoora,Pochampalli,Thungapadu
13	Nizamabad	4	Balkonda,Banswada,Bheemgal,Chinnakongal,Jannakpet,Mohamadnagar,Tadavai
14	Prakasam	28	Botlaguduru,C.s.puram,Chandalur,Darsi,Donakonda,G.Ummadivaram,Gollapalli, Kadavakuduru,Kottapatnam,Malakonda,Narzamulatanda,Parchuru, Podili,Santamagaluru,Tanguturu, Turu-mella,Uppugundur, Voletivaripalem,Voolgallu
15	Ranga Reddy & Hyderabad	11	Bagh Lingampally,Chandrayangutta,Phoolbagh Chaman,Angadichittamaplli,Bandlaguda,Batasingaram,Chevella,Hayatnagar, Hyderabad,Ibrahimpatnam,Kandukur,Keesara,Madanapally, Maheswaram, Nagarguda, Qutubullapur, Vanasthalipuram
16	SPS Nellore	31	A.Reddy palem,Budamam,Dacheru,Gollapalle,Kanpurpalli,Kavali,Kondapuram,Kovuru,Muthukuru,Penubarti,Ramathirdam,Rapur,Sullurpeta,Sunnapubatti,Tikkavaram,Vidayanagar
17	Srikakulam	24	Amudalavalasa,Chilkapalem,Haripuram,Heeramandalam,Ichapuram,Kasibugga,Narsannapeta,Patatekkali,Ponduru,Sitampeta,Tekkalipatnam
18	Visakhapatnam	37	Anakapalli,Bangarumitta,Bhimunipatnam,Gurrajupeta,Haripalem,Kotauratla,Medivoda,Mindivanipalem,Pudimadaka,Purshotta puram,Revupolavaram,Rolugunta,Shriharipuram,Tallapalem,Yelamanchilli
19	Vizianagaram	25	Bobbili,Chipurupalli,Garbham,Gumma,Kurupana,Natavalasa,Payakapadu,Rajapulova,Sitanagaram
20	Warangal	25	Alimpuram,Cherial,Gudur,Ingurti,Ippagudem,Kamalapuram,Kazipet,Kesamudram,Lakshmidevpet,Mahabubabad,Mulug,Mylaram,Narsampet,Nekkonda,Parakal,Peddapeno,pochannapalli,Tadvai
21	West Godavari	15	Attili,Jangareddigudem,K.Bhetipudi,Kamavarapukota,Polavaram,Pragadavaram
22	YSR Kadapa	15	Anjaneyapuram,Diguvalingala,Guvvalacheruvu,Kondapuram(rs),Lakkireddipalli,Nandyalampet,Talamanchipatnam

NITRATE IN GROUND WATER

(mg/l)

0 150 300

kilometers

N

W E

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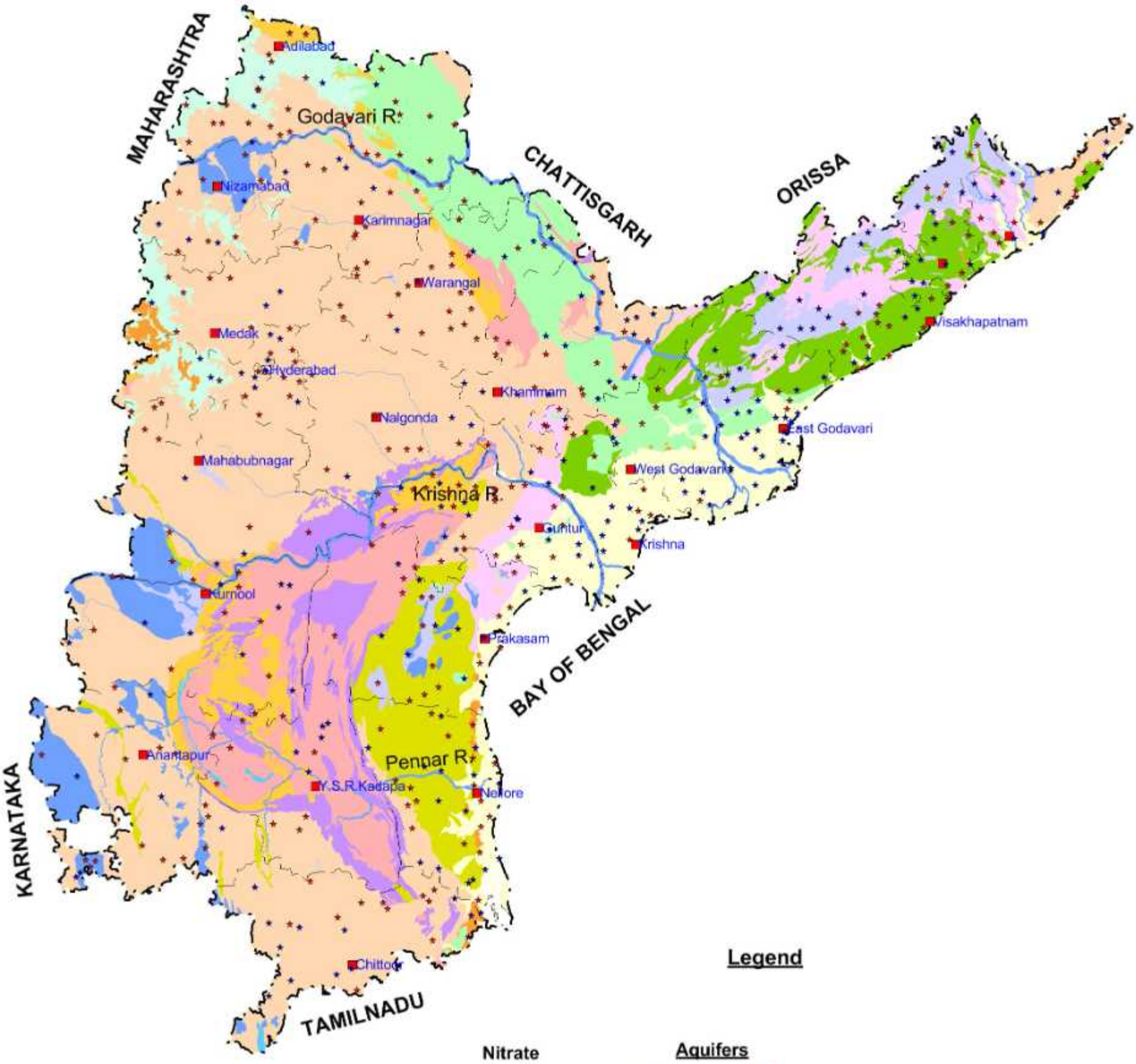


Legend

Nitrate (mg/l)

- < 45
- > 45

Aquifers

Alluvium	Quartzite	State Capital
Laterite	Charnockite	District Headquarters
Basalt	Khondalite	District Boundary
Sandstone	Gneiss	State Boundary
Shale	BGC	River
Limestone	Intrusives	
Granite		
Schist		

Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

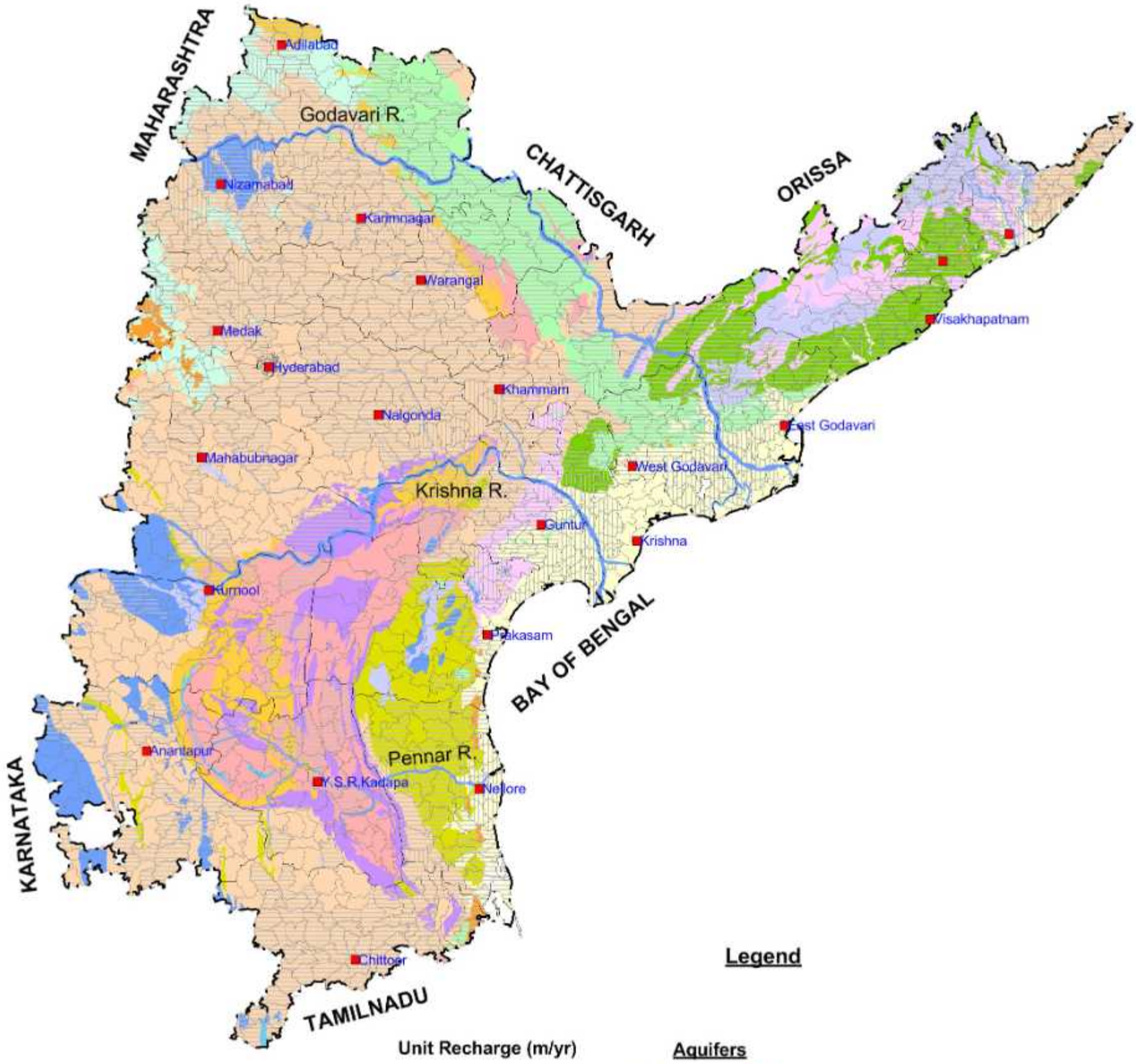
Table XX - District wise and Aquifer wise Annual Replenishable Recharge (2009)

SNO	Ditrict	Alluvium	Laterite	Basalt	Sandstone	Shale	Limestone	Granite	Schist	Quartzite	Charnockite	Khondalite	BGC	Gneiss	Intrusives
1	Adilabad			0.1431	0.1153		0.1337						0.1458		
2	Anantapur					0.0537	0.0403	0.0854	0.0933				0.0973	0.0864	
3	Chittoor		0.1107			0.1148		0.1197		0.1100			0.1203		0.1201
4	East Godavari	0.2492		0.2188	0.2327						0.1279	0.1659		0.2098	
5	Guntur	0.2759				0.1036	0.1467		0.1365	0.1260	0.1839	0.2059	0.1584		
6	Hyderabad												0.1010		
7	Karimnagar				0.1371		0.1727						0.1684		
8	Khammam				0.1354	0.1132				0.1178	0.1579	0.1210	0.1623		
9	Krishna	0.2783			0.1509						0.2693	0.2113	0.1913		
10	Kurnool					0.0948	0.0799	0.1029		0.0681			0.0849	0.0878	
11	Mahabubnagar						0.1285	0.0723	0.0755	0.0999			0.1029	0.0941	
12	Medak		0.0000	0.1161									0.1857		
13	Nalgonda						0.3817			0.2280			0.1643		
14	Nizamabad			0.1388				0.2088					0.2010		
15	Prakasam	0.2209				0.0720		0.1737	0.1073	0.1150	0.1372		0.3170	0.1205	
16	Ranga Reddy & Hyderabad			0.0873									0.1058		
17	SPS Nellore	0.2865	0.2517		0.3385				0.1706				0.1589		
18	Srikakulam	0.2313									0.1930	0.1933	0.1978	0.2027	
19	Visakhapatnam										0.0719	0.1288		0.0962	
20	Vizianagaram										0.1402	0.1346		0.1734	
21	Warangal				0.1534	0.1624	0.1594						0.1799	0.164109	
22	West Godavari	0.8424		0.1965	0.1951						0.1690	0.1811		0.1954	
23	YSR Kadapa					0.0944	0.1097			0.0663			0.0988		

ANNUAL REPLENISHABLE RESOURCE

N
W E
S

0 150 300
kilometers



Legend

Unit Recharge (m/yr)

- < 0.10
- 0.10 - 0.25
- > 0.25

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Charnockite
- Khondalite
- Gneiss
- BGC
- Intrusives

- State Capital
- District Headquarters
- District Boundary
- State Boundary
- River

Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XXI A - District wise Area Under Over Exploited Category in Different Aquifers of Andhra Pradesh

SNO	District	Alluvium	Laterite	Basalt	Sandstone	Shale	Limestone	Granite	Schist	Quartzite	Charnockite	Khondalite	BGC	Gneiss	Intrusives	Grand Total
1	Anantapur					1402	213	1292					2542			5449
2	Chittoor							287		579			1399			2265
3	YSR Kadapa					561							228			789
4	Khammam												270			270
5	Krishna				525											525
6	Medak			219									1509			1728
7	Nalgonda												963			963
8	Nizamabad							210					771			981
9	Prakasam					2957				1520						4477
10	Ranga Reddy & Hyderabad												375			375
11	Srikakulam	195														195
12	Warangal				129								3065			3194
Grand Total		195	0	219	654	4920	213	1789	0	2099	0	0	11122	0	0	21211

Table XXI B - District wise Area Under Critical Category in Different Aquifers of Andhra Pradesh

SNO	District	Alluvium	Laterite	Basalt	Sandstone	Shale	Limestone	Granite	Schist	Quartzite	Charnockite	Khondalite	BGC	Gneiss	Intrusives	Grand Total
1	Anantapur												1434			1434
2	Chittoor												1522			1522
3	Medak			605									753			1358
4	Nizamabad												221			221
5	Ranga Reddy & Hyderabad												102			102
6	Warangal												697			697
Grand Total		0	0	605	0	0	0	0	0	0	0	0	4729	0	0	5334

CATEGORIZATION OF GROUND WATER ASSESSMENT UNITS

0 150 300
kilometers

N
W E
S

MAHARASHTRA
CHATTISGARH
ORISSA
KARNATAKA
TAMILNADU
BAY OF BENGAL
Godavari R.
Krishna R.
Pennar R.
Adilabad
Nizamabad
Karimnagar
Warangal
Medak
Hyderabad
Nalgonda
Khammam
Mahabubnagar
Kurnool
Anantapur
Y.S.R.Kadapa
Chittoor
Nellore
Prakasam
Guntur
Krishna
West Godavari
East Godavari
Visakhapatnam

Legend

Category

- Safe
- Semi-Critical
- Critical
- Over Exploited
- Saline

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Charnockite
- Khondalite
- Gneiss
- BGC
- Intrusives

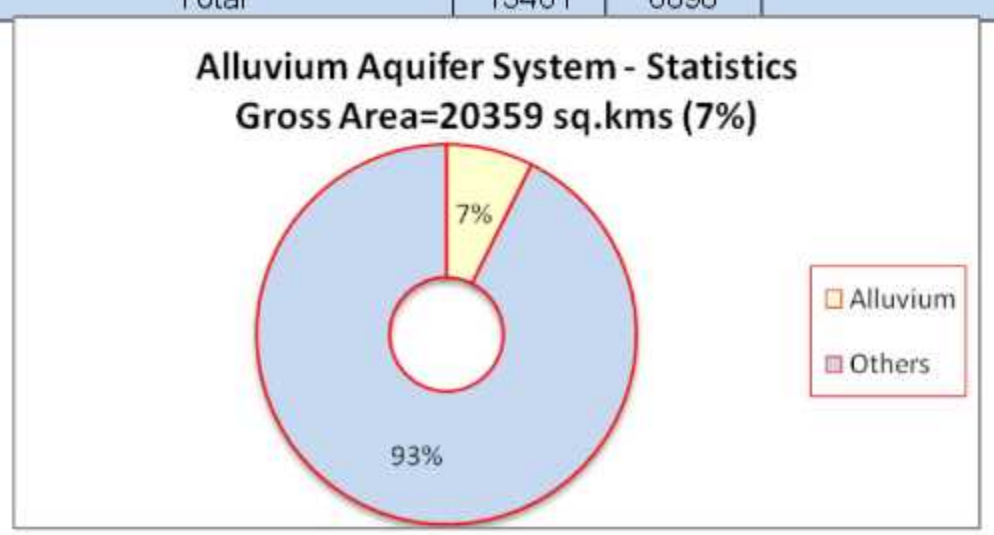
- State Capital
- District Headquarters
- District Boundary
- State Boundary
- River

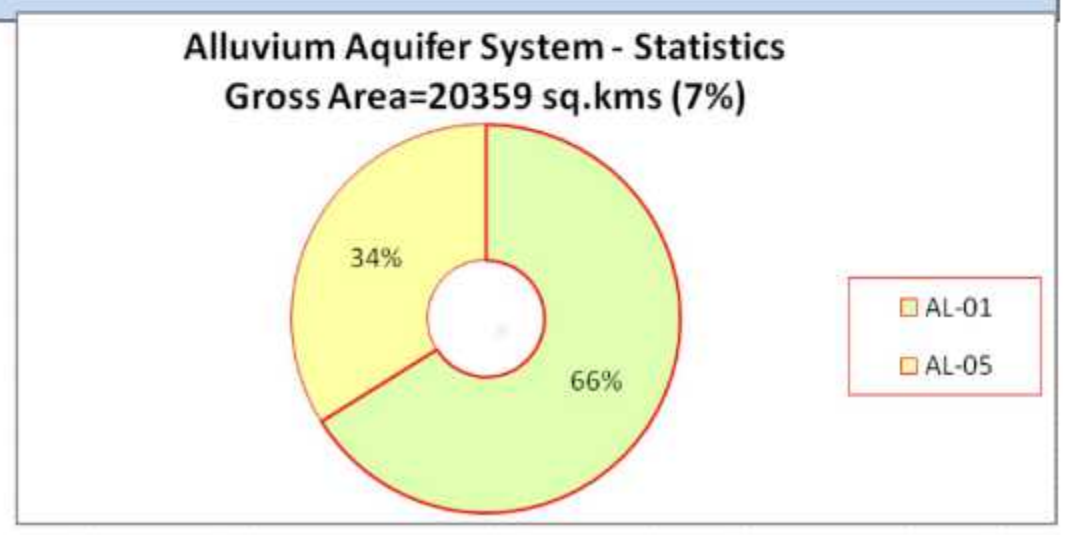
Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XXII - District wise Distribution and Characteristics of Alluvium Aquifer System

S No	District Name	Area (sq.km.)		Aquifer System	Type of Aquifer	Thickness of Alluvium (m)	Depth of Granular Zones Encountered (m bgl)	DTW (Decadal Average in m bgl) (2002-11)	Transmissivity (sq.m./day)	Yield (cum/day)	Specific Yield (%)	Quality (EC in µ Siemens/cm)
		AL01	AL05									
1	Adilabad											
2	Anantapur											
3	Chittoor	87			NE	NE	NE	NE	NE	NE	NE	NE
4	East Godavari	2428	1419	Multiple	U/S/C	292	27-248	0-5	210-6215	68-2592	4.0-8.0	1157-40548
5	Guntur	2359	777	Multiple	U/S/C	601	20-135	0-10	ND	72-531	4.0-8.0	1200-12450
6	Karimnagar											
7	Khammam	90			NE	NE	NE	NE	NE	NE	NE	ND
8	Krishna	2739	1385	Multiple	U/S/C	601	20-150	0-5	299-5557	1166-4406	4.0-8.0	235-12900
9	Kurnool											
10	Mahabubnagar											
11	Medak											
12	Nalgonda											
13	Nizamabad											
14	Prakasam	272	1141	Multiple	U/S	202	6-32	0-5	32-1400	216-302	4.0-8.0	696-46300
15	Ranga Reddy & Hyderabad											
16	SPS Nellore	1708	1020	Multiple	U/S	457	27-74	2-10	30-250	86-2160	4.0-8.0	205-83500
17	Srikakulam	808	125			NE	NE	NE	NE	NE	NE	ND
18	Visakhapatnam	113	47			NE	NE	NE	NE	NE	NE	ND
19	Vizianagaram		12			NE	NE	NE	NE	NE	NE	ND
20	Warangal											
21	West Godavari	2857	972	Multiple	U/S/C	402	56-130	0-5	ND	1296	4.0-8.0	6025-20880
22	YSR Kadapa											
Total		13461	6898									

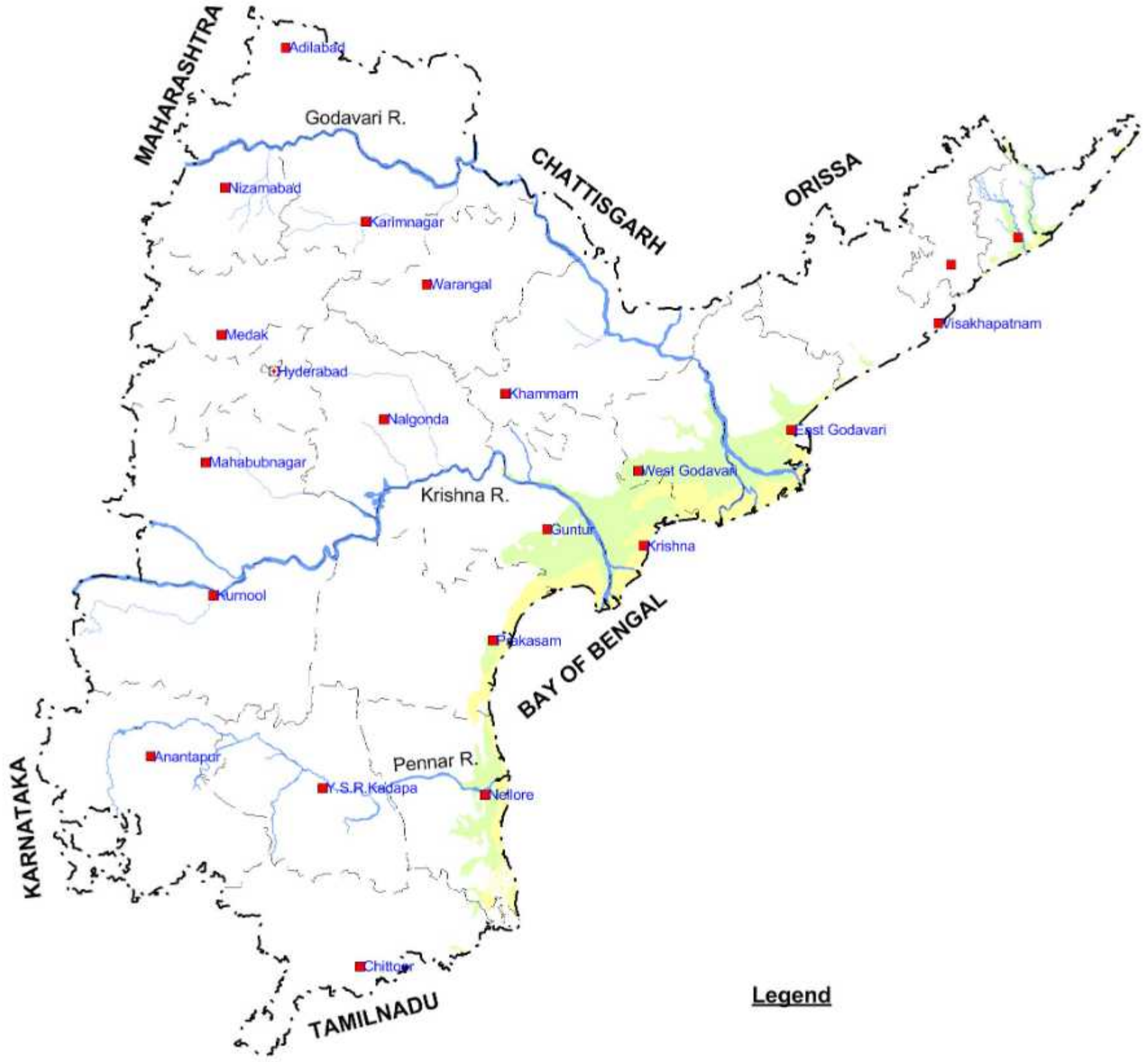
U-Unconfined; **S**-Semi-confined; **C**-Confined





ALLUVIUM - AQUIFER SYSTEM

0 150 300
kilometers



Legend

Aquifers

ALLUVIUM

- Younger Alluvium (AL01)
- Coastal Alluvium (AL05)

- State Capital
- District Head Quarters
- District Boundary
- State Boundary
- River

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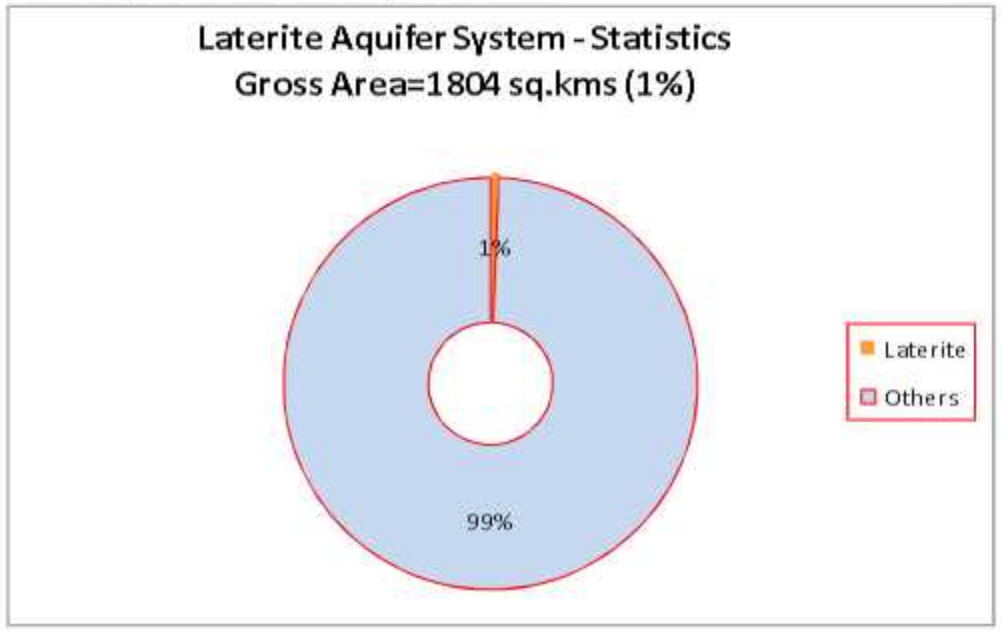
Southern Region, Hyderabad, Andhra Pradesh, India

Table XXIII - District wise Distribution and Characteristics of Laterite Aquifer System

S No	District Name	Area (sq.km.) LT01	Aquifer System	Type of Aquifer	Thickness of Laterite (m)	Depth of Fractures Encountered (m bgl)	DTW (Decadal Average in m bgl)	Transmissivity (sq.m./day)	Yield (cum/day)	Specific Yield (%)	Quality (EC in micro Siemens/cm)
1	Adilabad										
2	Anantapur										
3	Chittoor	205			NE	NE	NE	NE	NE	NE	ND
4	East Godavari										
5	Guntur										
6	Karimnagar										
7	Khammam										
8	Krishna										
9	Kurnool										
10	Mahabubnagar										
11	Medak	609	Single	U/S	10-30	NE	5-20	NE	NE	2.0-3.0	334-1980
12	Nalgonda										
13	Nizamabad										
14	Prakasam	51			NE	NE	NE	NE	NE	NE	ND
15	Ranga Reddy & Hyderabad	307	Single	U	2-18	NE	NE	10-15	NE	2.0-3.0	216-1600
16	SPS Nellore	511	Single	U	1-8	NE	0-10	NE	86-172	2.0-3.0	300-720
17	Srikakulam	48			NE	NE	NE	NE	NE	NE	ND
18	Visakhapatnam										
19	Vizianagaram	45			NE	NE	NE	NE	NE	NE	ND
20	Warangal										
21	West Godavari	28			NE	NE	NE	NE	NE	NE	ND
22	YSR Kadapa										
	Total	1804									

NE- Not Explored ND-Not Determined U-Unconfined; S-Semi-confined; C-Confined NA-Not Applicable



LATERITE - AQUIFER SYSTEM

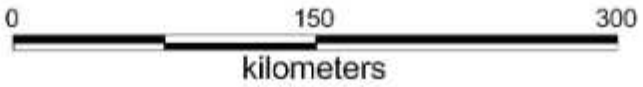


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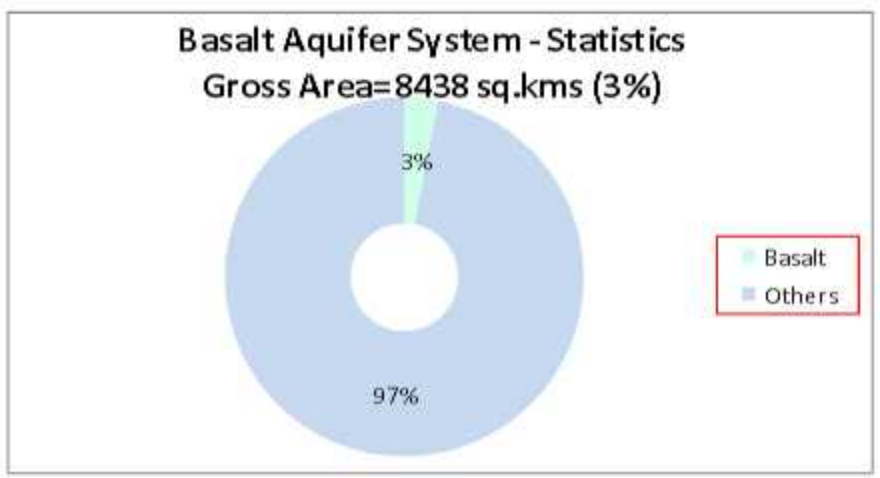
Table XXIV - District wise Distribution and Characteristics of Basalt Aquifer System

S No	District Name	Area (sq.km.) BS01	Aquifer System	Type of Aquifer	Thickness of Weathered Zone (m)	Depth of Fractures Encountered (m bgl)	DTW (Decadal Average in m bgl)	Transmissivity (sq.m./day)	Yield (cum/day)	Specific Yield (%)	Quality (Ec in micro Siemens/cm)
1	Adilabad	4187	Single	U/S/C	5-20	6-125	2-20	2-8	73-259	1.0-3.0	510-865
2	Anantapur										
3	Chittoor										
4	East Godavari	97			NE	NE	NE	NE	NE	NE	ND
5	Guntur										
6	Karimnagar	81			NE	NE	NE	NE	NE	NE	ND
7	Khammam										
8	Krishna										
9	Kurnool										
10	Mahabubnagar	128			NE	NE	NE	NE	NE	NE	ND
11	Medak	1513	Single	U/S	4-36	12-164	2-20	27-125	12-1987	1.0-3.0	400-875
12	Nalgonda										
13	Nizamabad	701	Single	U/S	3-21	12-58	5-20	0.7-6.3	1-52	1.0-3.0	410-1120
14	Prakasam										
15	Ranga Reddy & Hyderabad	1682	Single	U/S	2-18	27-62	5-15	1-198	43-130	1.0-3.0	480-900
16	SPS Nellore										
17	Srikakulam										
18	Visakhapatnam										
19	Vizianagaram										
20	Warangal										
21	West Godavari	49			NE	NE	NE	NE	NE	NE	ND
22	YSR Kadapa										
Total		**8438**									

NE- Not Explored **ND**-Not Determined **U**-Unconfined; **S**-Semi-confined; **C**-Confined



BASALT - AQUIFER SYSTEM

N
W E
S

0 150 300
kilometers

Legend

Aquifers

BASALT

Basalt (BS01)

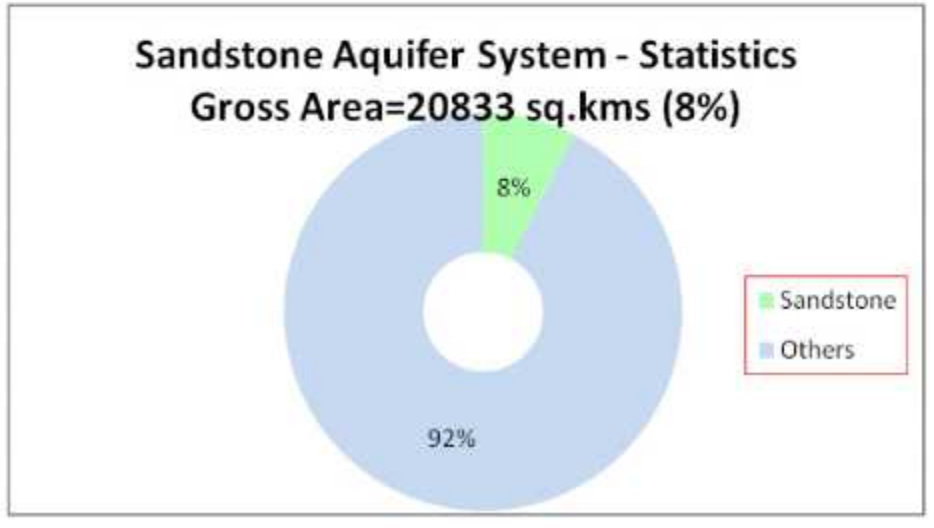
State Capital
District Head Quarters
District Boundary
State Boundary
River

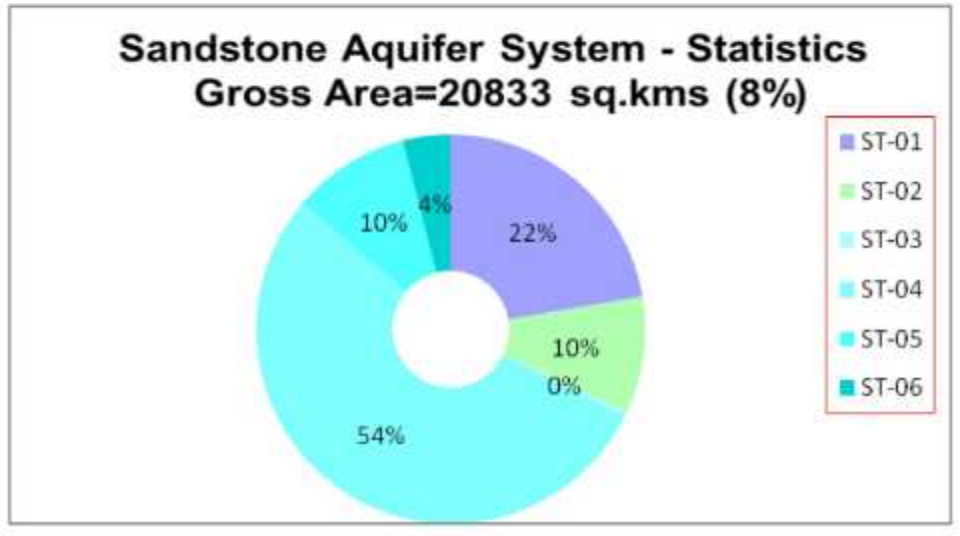
Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XXV - District wise Distribution and Characteristics of Sandstone Aquifer System

S No	District Name	Area (sq.km.)						Aquifer system	Type of Aquifer	Thickness of Sandstone (m)	Depth of Granular Zones encountered (m bgl)	DTW (Decadal Average in m bgl)	Transmissivity (sq.m./day)	Yield (cum/day)	Specific Yield (%)	Quality (Ec in µ Siemens/cm)
		ST01	ST02	ST03	ST04	ST05	ST06									
1	Adilabad	96	205	40	4185	324	831	Multiple	U/S/C	196	31-215	2-10	1-196	19-1440	1.0-5.0	660-3540
2	Anantapur															
3	Chittoor	136						NE	NE	NE	NE	NE	NE	NE	NE	ND
4	East Godavari	940						Multiple	U/S/C	750	19-650	0-10	14-3168	26-3456	1.0-5.0	300-10390
5	Guntur	138	37					Multiple	U/S/C	600	37-382	0-5	NE	40-1872	1.0-5.0	1130-7980
6	Karimnagar	66		26	2012	351		Multiple	U/S/C	450	10-293	5-10	80-700	1143-4197	1.0-5.0	309-1960
7	Khammam	8	1628		2786	619		Multiple	U/S/C	422	45-420	2-10	4-954	12-55	1.0-5.0	430-2160
8	Krishna	449	27					Multiple	U/S/C	300	22-154	5-20	ND	36-3045	1.0-5.0	1143-1836
9	Kurnool															
10	Mahabubnagar															
11	Medak															
12	Nalgonda															
13	Nizamabad															
14	Prakasam		121					Single	U/S	70	9-25	0-5	1-29	73-92	1.0-5.0	300-2240
15	Ranga Reddy & Hyderabad															
16	SPS Nellore	143						Single	U/S	75	23-41	2-5	46	604	1.0-5.0	970
17	Srikakulam				22					NE	NE	NE	NE	NE	NE	ND
18	Visakhapatnam															
19	Vizianagaram															
20	Warangal	101			2215	750		Multiple	U/S/C	458	11-270	2-10	36-226	86-4175	1.0-5.0	68-2421
21	West Godavari	2575	2					Multiple	U/S/C	611	30-561	2-10	85-3540	168-11063	1.0-5.0	454-1142
22	YSR Kadapa															
	Total	**4652**	**2020**	**66**	**11220**	**2044**	**831**									

NE- Not Explored **ND**-Not Determined **U**-Unconfined; **S**-Semi-confined; **C**-Confined





SANDSTONE - AQUIFER SYSTEM

0 150 300

kilometers

Legend

Aquifers

SANDSTONE

- Sandstone/Conglomerate (ST01)
- Sandstone with Shale (ST02)
- Sandstone with Shale/Coal Beds (ST03)
- Sanstone with Clay (ST04)
- Sandstone with Conglomerate (ST05)
- Sandstone with Shale (ST06)

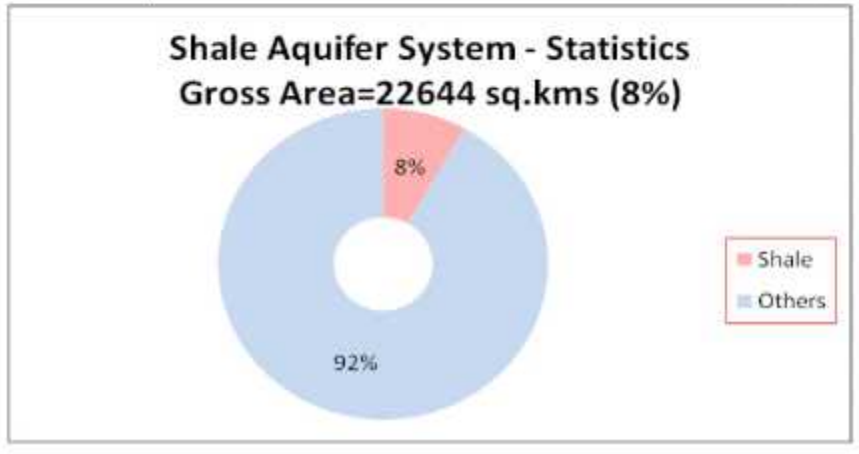
- State Capital
- District Head Quarters
- District Boundary
- State Boundary
- River

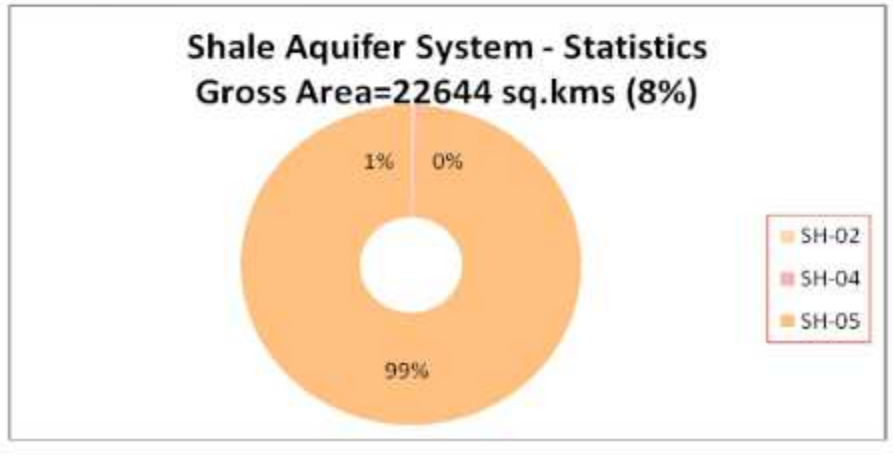
Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XXVI - District wise Distribution and Characteristics of Shale Aquifer System

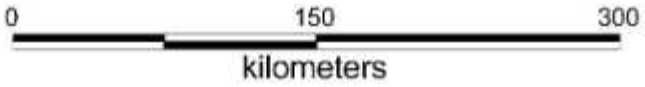
S No	District Name	Area (sq.km.)			Aquifer system	Type of Aquifer	Thickness of Weathered zone (m)	Depth of Fractures Encountered (m bgl)	DTW (Decadal Average in m bgl)	Transmissivity (sq.m./day)	Yield (cum/day)	Specific Yield (%)	Quality (EC in µ Siemens/cm)
		SH02	SH04	SH05									
1	Adilabad												
2	Anantapur			1028	Multiple	U/S/C	5-26	18-136	10-15	2-64	24-250	1.0-2.0	771-1735
3	Chittoor		99	117			NE	NE	NE	NE	NE	NE	ND
4	East Godavari												
5	Guntur			1343	Multiple	U/S/C	5-18	13-167	0-2	ND	38-376	1.0-2.0	ND
6	Karimnagar												
7	Khammam			1548	Multiple	U/S/C	3-28	16-50	2-5	ND	43-130	1.0-2.0	1660
8	Krishna			29	Multiple	U/S	1-3	31-50	5-10	ND	725	1.0-2.0	ND
9	Kurnool			4717	Multiple	U/S/C	1-10	12-60	2-10	67-1910	190-1416	1.0-2.0	764-2250
10	Mahabubnagar			463	Multiple	U/S/C	15-25	40-60	2-5	NE	80-240	1.0-2.0	2711
11	Medak												
12	Nalgonda			43			NE	NE	NE	NE	NE	NE	ND
13	Nizamabad												
14	Prakasam	91		4365	Multiple	U/S/C	2-15	41-144	2-10	1-193	15-630	1.0-2.0	590-2880
15	Ranga Reddy & Hyderabad			61			NE	NE	NE	NE	NE	NE	ND
16	SPS Nellore												
17	Srikakulam												
18	Visakhapatnam												
19	Vizianagaram												
20	Warangal			828	Multiple	U/S/C	2-15	24-94	2-10	15-34	456-792	1.0-2.0	1383-2992
21	West Godavari												
22	YSR Kadapa			7912	Multiple	U/S/C	5-20	15-186	2-15	12-912	1-1632	1.0-2.0	444-1835
Total		**91**	**99**	**22454**									

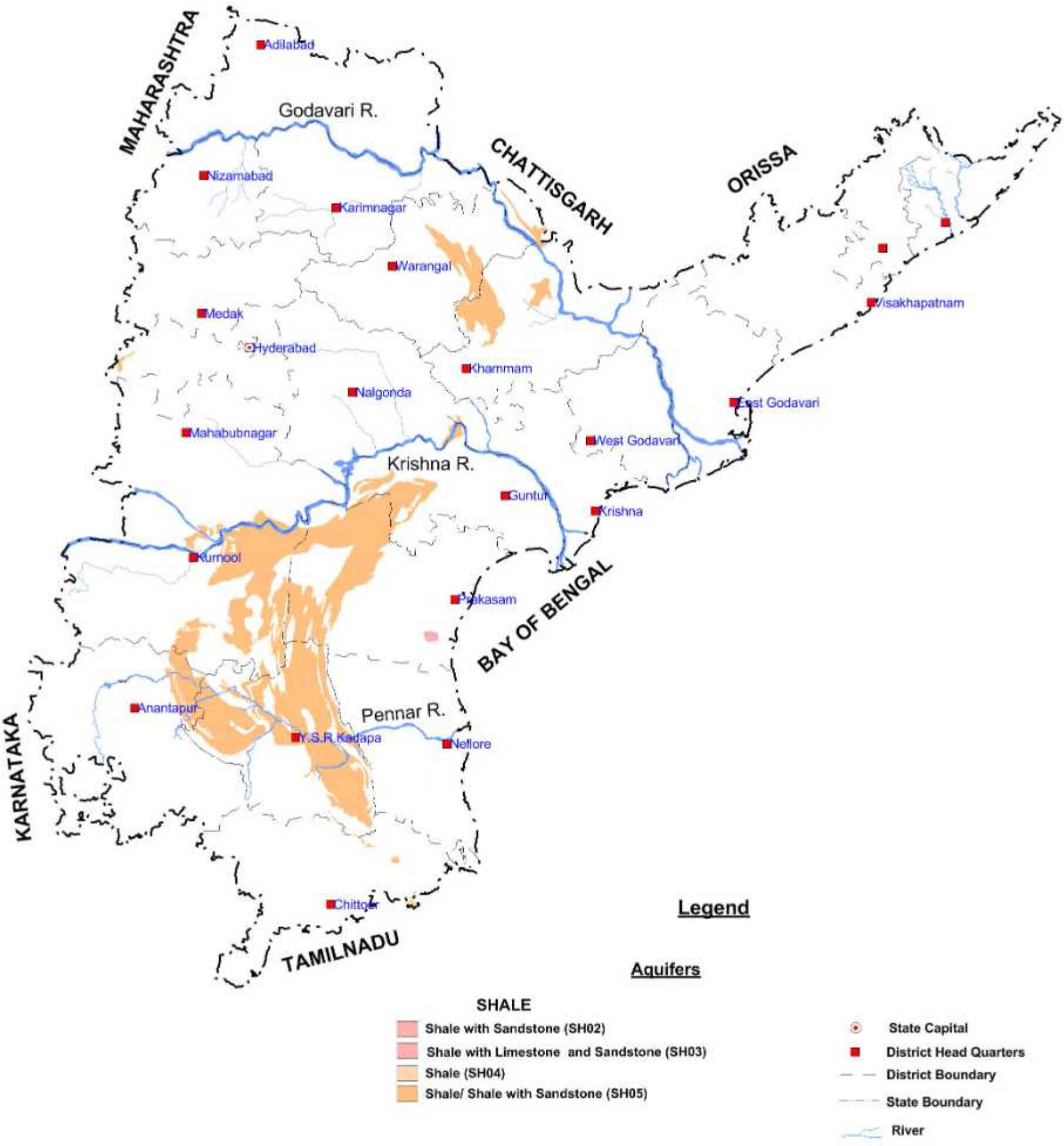
NE- Not Explored **ND**-Not Determined **U**-Unconfined; **S**-Semi-confined; **C**-Confined





SHALE - AQUIFER SYSTEM



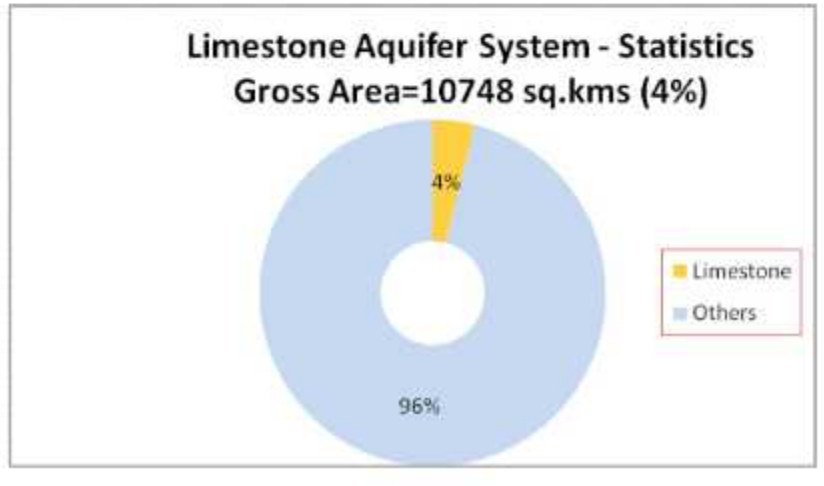


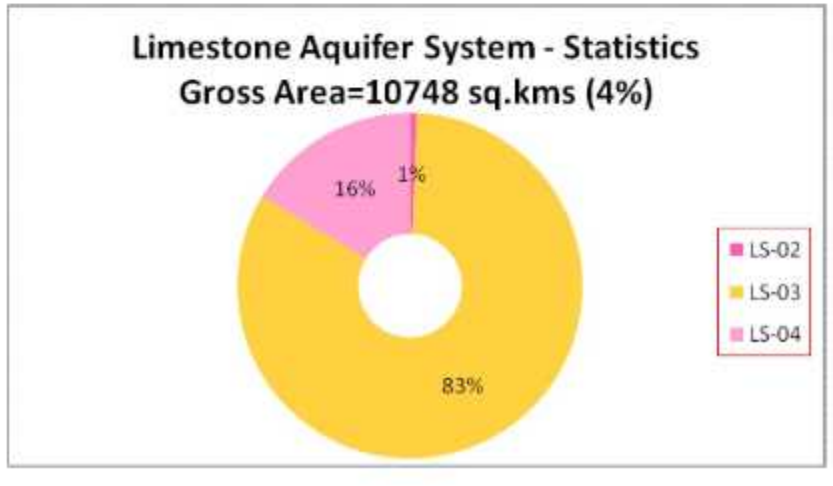
Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XXVII -District wise Distribution and Characteristics of Limestone Aquifer System

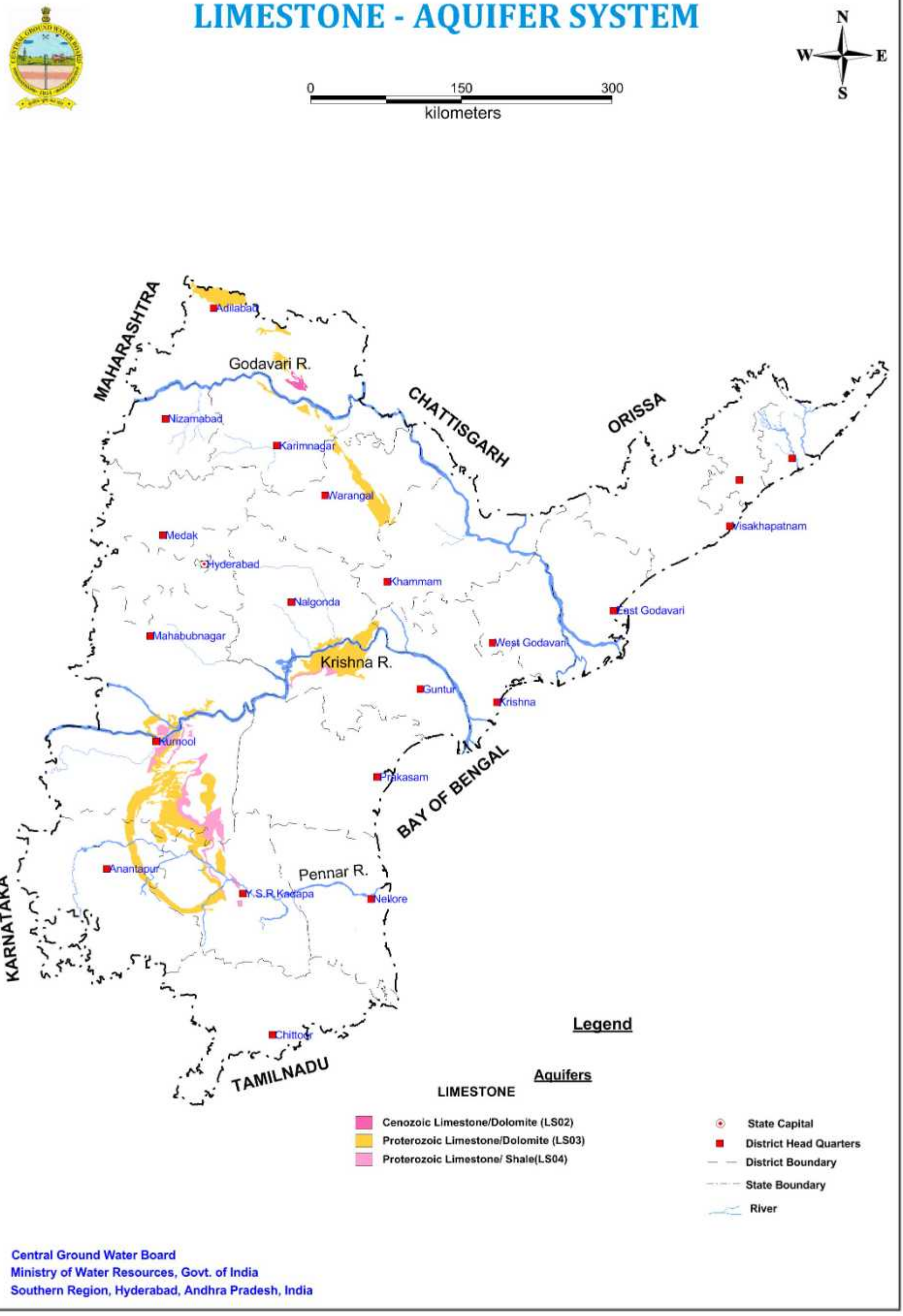
S No	District Name	Area (sq.km.)			Aquifer system	Type of Aquifer	Thickness of Weathered zone (m)	Depth of Fractures Encountered (m bgl)	DTW (Decadal Average in m bgl)	Transmissivity (sq.m./day)	Yield (cum/day)	Specific Yield (%)	Quality (Ec in micro Siemens/cm)
		LS02	LS03	LS04									
1	Adilabad		1084		Multiple	U/S/C	4-17	15-77	5-10	2-34	100-259	1.0-3.0	770-940
2	Anantapur		576		Multiple	U/S/C	5-15	23-197	5-20	16-112	173-432	1.0-3.0	680-980
3	Chittoor												
4	East Godavari												
5	Guntur		1430	156	Multiple	U/S/C	3-25	36-167	0-20	25-140	19-993	1.0-3.0	630-5000
6	Karimnagar		208		Multiple	U	2-12	NE	5-10	ND	45	1.0-3.0	ND
7	Khammam		2		Multiple	U/S	3-15	15-45	5-20	25-450	26-2333	1.0-3.0	ND
8	Krishna		38		Multiple	U/S	5-18	14-49	0-10	ND	216	1.0-3.0	1280
9	Kurnool		2642	1251	Multiple	U/S/C	1-18	26-90	0-10	68-1910	11-2194	1.0-3.0	920-2754
10	Mahabubnagar		407	120	Multiple	U/S/C	5-28	134-135	5-10	NE	63-332	1.0-3.0	2417
11	Medak												
12	Nalgonda		378		Multiple	U/S	2-19	11-61	5-20	12-194	173-475	1.0-3.0	ND
13	Nizamabad												
14	Prakasam												
15	Ranga Reddy & Hyderabad	70			Multiple	U/S	1-8	10-59	5-10	14	102	1.0-3.0	534
16	SPS Nellore												
17	Srikakulam												
18	Visakhapatnam												
19	Vizianagaram												
20	Warangal		902		Multiple	U/S	2-10	24-76	5-10	168-834	144-768	1.0-3.0	ND
21	West Godavari												
22	YSR Kadapa		1253	231	Multiple	U/S/C	4-17	20-117	5-20	5-164	129-1425	1.0-3.0	1963
Total		**70**	**8920**	**1758**									

NE- Not Explored **ND**-Not Determined **U**-Unconfined; **S**-Semi-confined; **C**-Confined





LIMESTONE - AQUIFER SYSTEM



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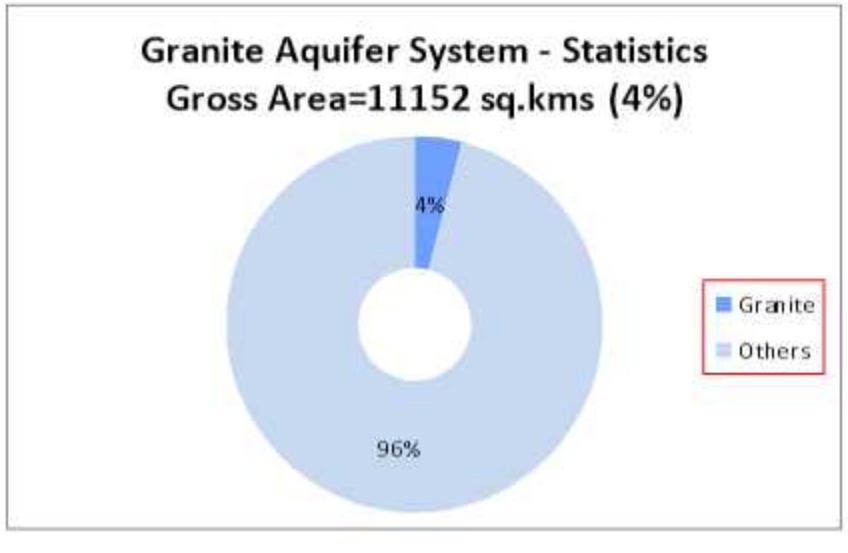
Southern Region, Hyderabad, Andhra Pradesh, India

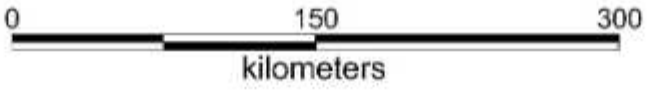
Table XXVIII - District wise Distribution and Characteristics of Granite Aquifer System

S No	District Name	Area (sq.km.) GR02	Aquifer system	Type of Aquifer	Thickness of Weathered zone (m)	Depth of Fractures Encountered (m bgl)	DTW (Decadal Average in m bgl)	Transmissivity (sq.m./day)	Yield (cum/ day)	Specific Yield (%)	Quality (EC in micromhos/cm)
1	Adilabad	3	Single	U/S/C	6-15	30-198	5-10	2-374	18-1036	2.0-4.0	ND
2	Anantapur	3976	Single	U/S/C	4-42	6-243	2-10	1-843	28-1357	2.0-4.0	496-8810
3	Chittoor	243	Single	U/S/C	3-34	14-199	5-10	1-831	17-1036	2.0-4.0	ND
4	East Godavari										
5	Guntur	123	Single	U/S/C	4-13	15-137	0-5	NE	11-777	2.0-4.0	ND
6	Karimnagar	81	Single	U/S	8-18	20-42	5-10	3-48	19-103	2.0-4.0	450-1120
7	Khammam	188	Single	U/S/C	2-15	5-131	5-10	8-38	13-380	2.0-4.0	900-1890
8	Krishna										
9	Kurnool	2049	Single	U/S/C	2-25	6-187	2-10	1-210	108-1216	2.0-4.0	330-1200
10	Mahabubnagar	1567	Single	U/S/C	2-25	11-161	0-5	1-923	43-516	2.0-4.0	324-2290
11	Medak	2			NE	NE	NE	NE	NE	NE	ND
12	Nalgonda										
13	Nizamabad	1911	Single	U/S/C	5-36	7-167	2-5	1-249	26-475	2.0-4.0	380-1200
14	Prakasam	939	Single	U/S/C	3-15	15-132	2-10	2-69	113	2.0-4.0	1370-1490
15	Ranga Reddy										
16	SPS Nellore	70	Single	U/S/C	13-83	23-76	2-10	1-55	69-587	2.0-4.0	ND
17	Srikakulam										
18	Visakhapatnam										
19	Vizianagaram										
20	Warangal										
21	West Godavari										
22	YSR Kadapa										
Total		**11152**									

NE- Not Explored **ND**-Not Determined **U**-Unconfined; **S**-Semi-cionfined; **C**-Confined



GRANITE- AQUIFER SYSTEM

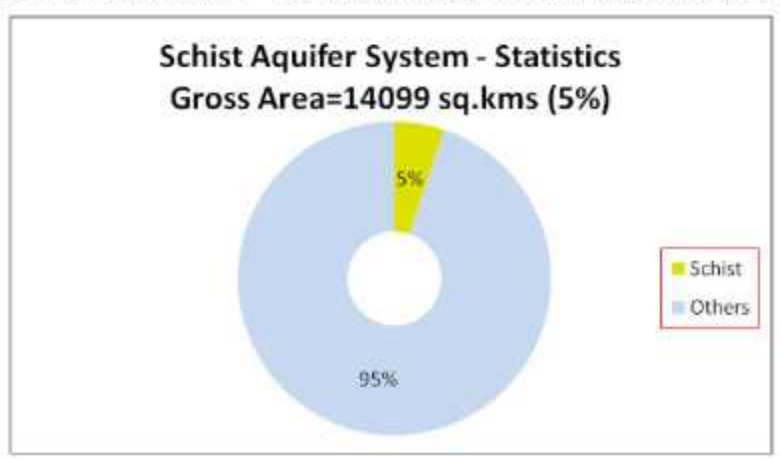


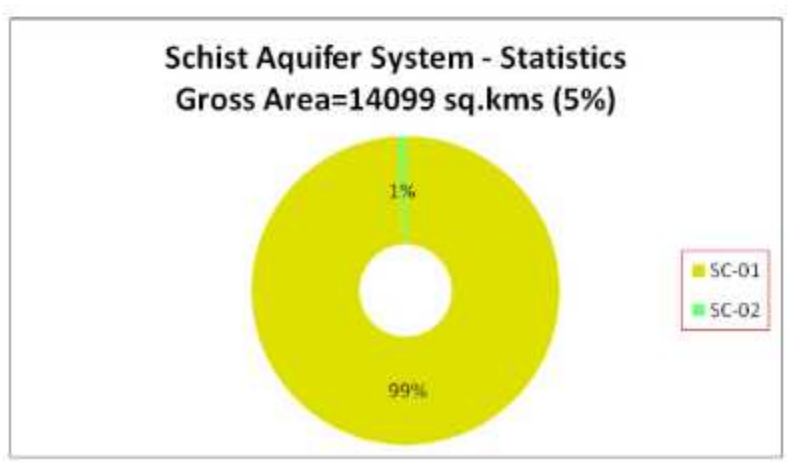
Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XXIX - District wise Distribution and Characteristics of Schist Aquifer System

S No	District Name	Area (sq.km.)		Aquifer system	Type of Aquifer	Thickness of Weathered zone (m)	Depth of Fractures Encountered (m bgl)	DTW (Decadal Average in m bgl)	Transmissivity (sq.m./day)	Yield (cum/day)	Specific Yield (%)	Quality (Ec in micro Siemens/cm)
		SC01	SC02									
1	Adilabad											
2	Anantapur	568		Single	U/S/C	2-16	8-149	2-20	1-424	86-1296	2.0-4.0	ND
3	Chittoor		100			NE	NE	NE	NE	NE	NE	ND
4	East Godavari											
5	Guntur	654		Single	U	2-7	7-8	2-5	NE	38	2.0-4.0	820-7240
6	Karimnagar											
7	Khammam											
8	Krishna											
9	Kurnool											
10	Mahabubnagar	292				NE	NE	NE	NE	NE	NE	ND
11	Medak											
12	Nalgonda	36				NE	NE	NE	NE	NE	NE	ND
13	Nizamabad											
14	Prakasam	4962		Single	U/S/C	3-15	10-115	2-10	1-40	63-242	2.0-4.0	680-1380
15	Ranga Reddy & Hyderabad											
16	SPS Nellore	7478		Single	U/S/C	6-31	11-178	2-10	1-1978	43-1700	2.0-4.0	555-2220
17	Srikakulam											
18	Visakhapatnam											
19	Vizianagaram											
20	Warangal											
21	West Godavari											
22	YSR Kadapa		9			NE	NE	NE	NE	NE	NE	ND
Total		**13990**	**109**									

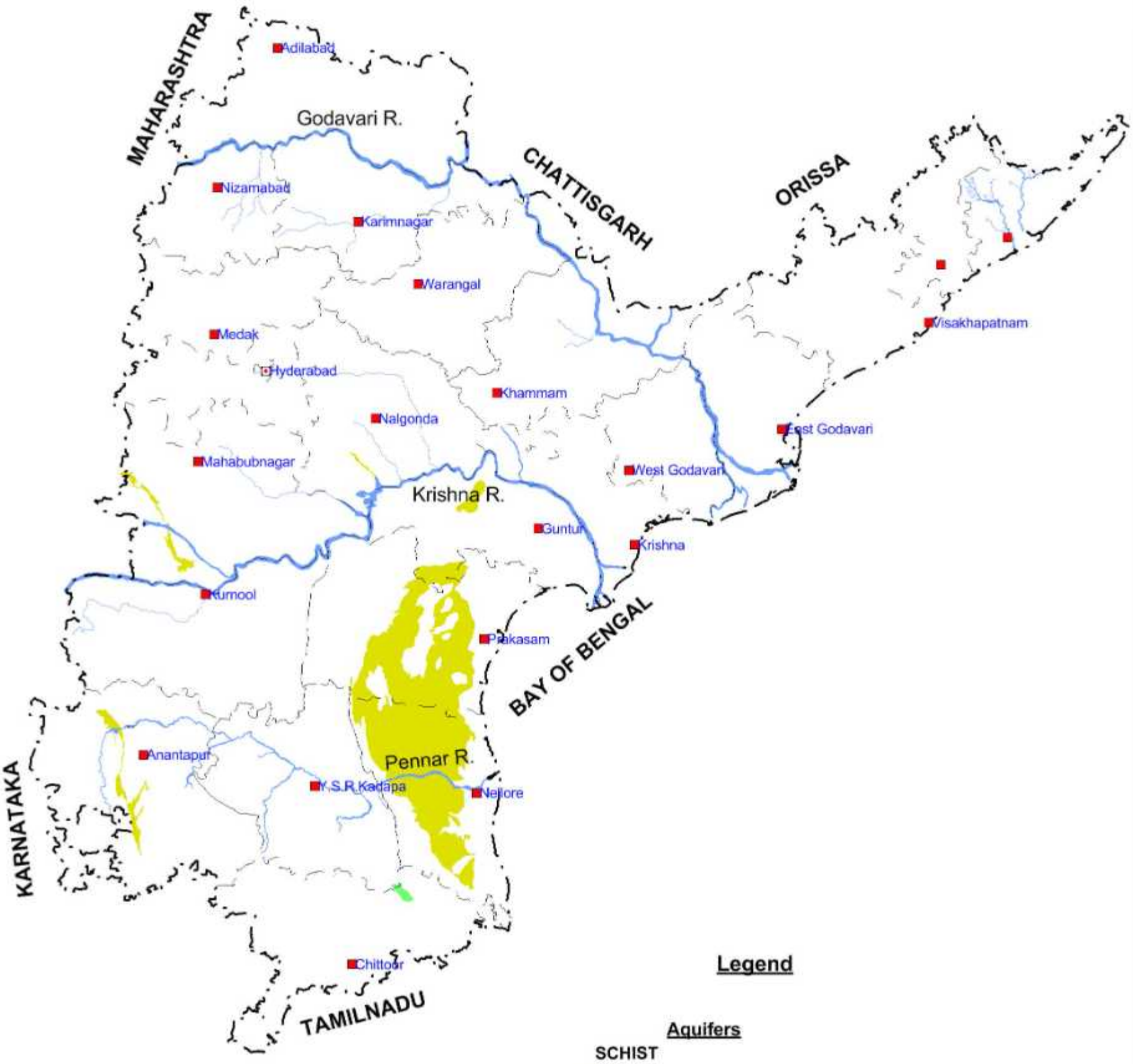
NE- Not Explored **ND**-Not Determined **U**-Unconfined; **S**-Semi-confined; **C**-Confined





SCHIST - AQUIFER SYSTEM

0 150 300
kilometers



Legend

Aquifers

SCHIST

- Schist (SC01)
- Phyllite (SC02)

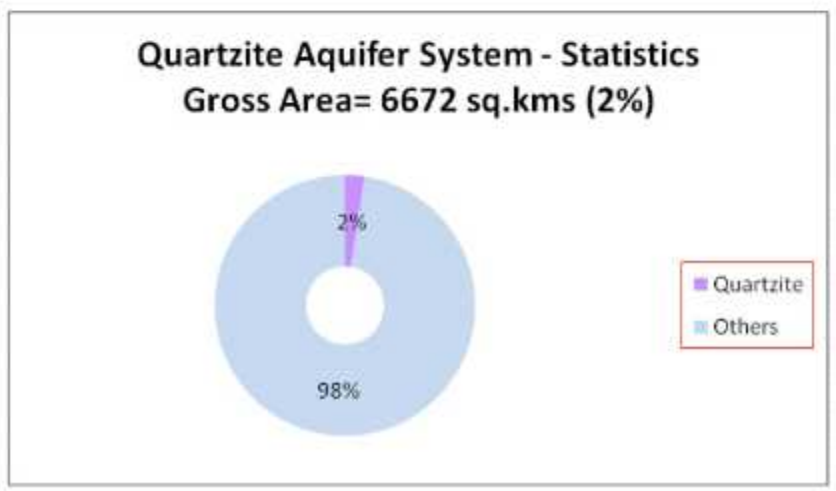
- State Capital
- District Head Quarters
- District Boundary
- State Boundary
- River

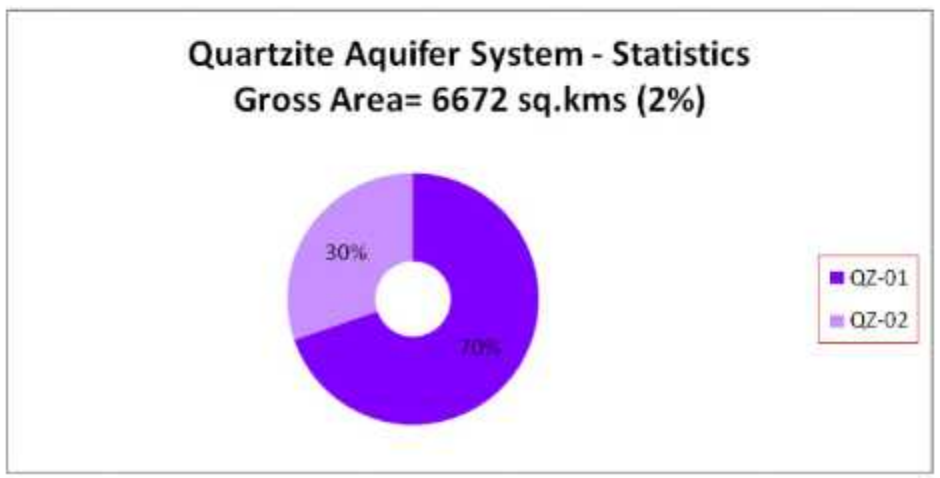
Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XXX - District wise Distribution and Characteristics of Quartzite Aquifer System

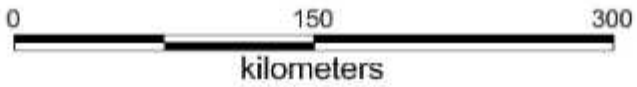
S No	District Name	Area (sq.km.)		Aquifer system	Type of Aquifer	Thickness of Weathered zone (m)	Depth of Fractures Encountered (m bgl)	DTW (Decadal Average in m bgl)	Transmissivity (sq.m./day)	Yield (cum/day)	Specific Yield (%)	Quality (Ec in micro Siemens/cm)
		QZ01	QZ02									
1	Adilabad											
2	Anantapur	22		Single	U/S/C	5-15	11-156	5-20	31	388	1.0-2.0	987
3	Chittoor	545				NE	NE	NE	NE	NE	NE	ND
4	East Godavari											
5	Guntur	797		Single	U	5-18	10-36	0-10	ND	39-52	1.0-2.0	2590
6	Karimnagar											
7	Khammam	20				NE	NE	NE	NE	NE	NE	ND
8	Krishna	58				NE	NE	NE	NE	NE	NE	ND
9	Kurnool	1349		Single	U	2-13	13-30	2-5	107	30-100	1.0-2.0	450
10	Mahabubnagar	1500		Single	U	1-22	19-20	10-15	NE	380	1.0-2.0	542-1150
11	Medak											
12	Nalgonda	589				NE	NE	NE	NE	NE	NE	ND
13	Nizamabad											
14	Prakasam	2696		Single	U/S	2-15	28-46	5-10	6-7	173-587	1.0-2.0	535-1090
15	Ranga Reddy & Hyderabad											
16	SPS Nellore	374				NE	NE	NE	NE	NE	NE	ND
17	Srikakulam		13			NE	NE	NE	NE	NE	NE	ND
18	Visakhapatnam											
19	Vizianagaram	42				NE	NE	NE	NE	NE	NE	ND
20	Warangal											
21	West Godavari											
22	YSR Kadapa	3483		Single	U/S	5-20	28-69	2-5	12-884	86-518	1.0-2.0	690-2736
Total		**11475**	**13**									

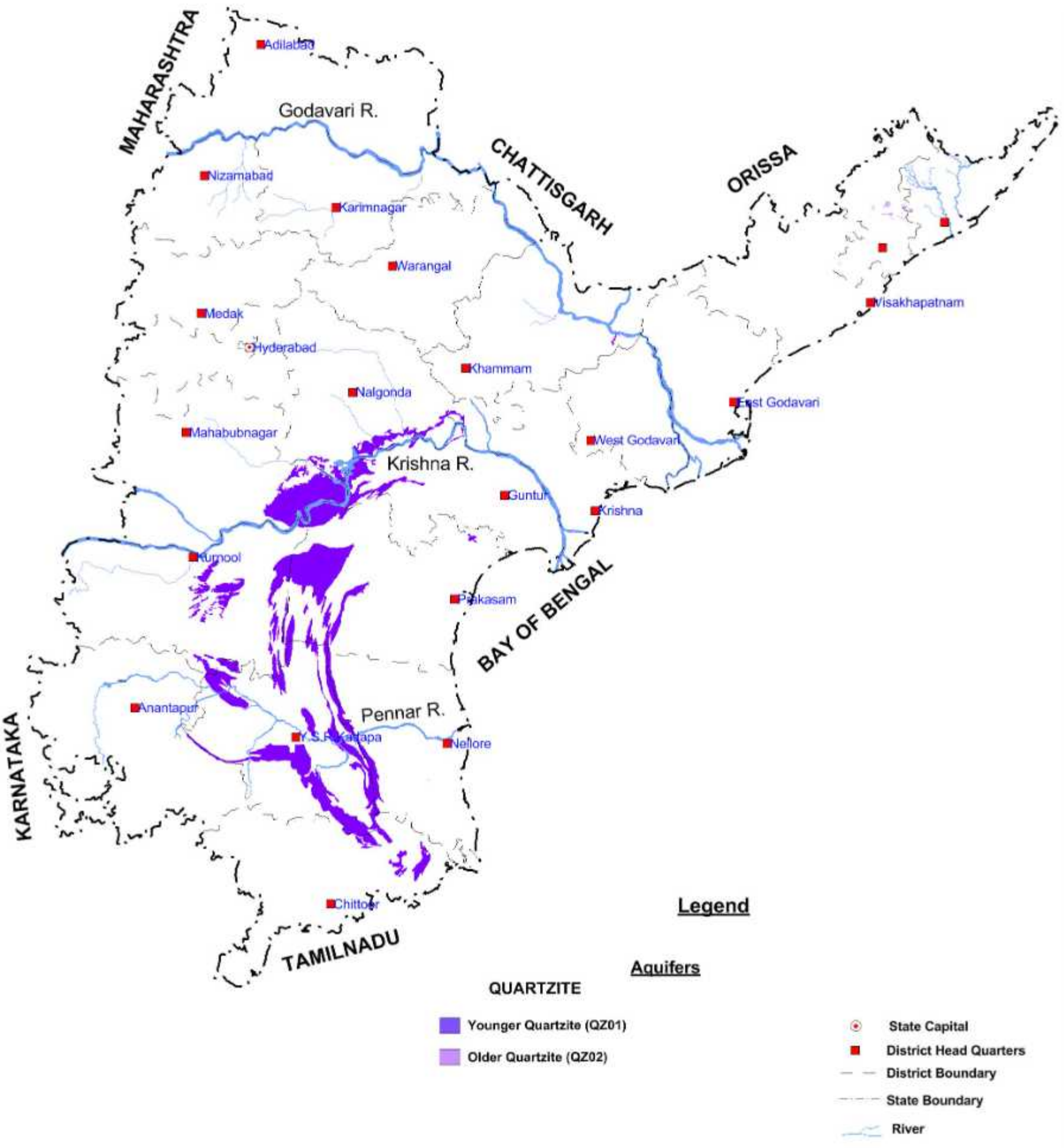
NE- Not Explored **ND**-Not Determined **U**-Unconfined; **S**-Semi-confined; **C**-Confined





QUARTZITE - AQUIFER SYSTEM



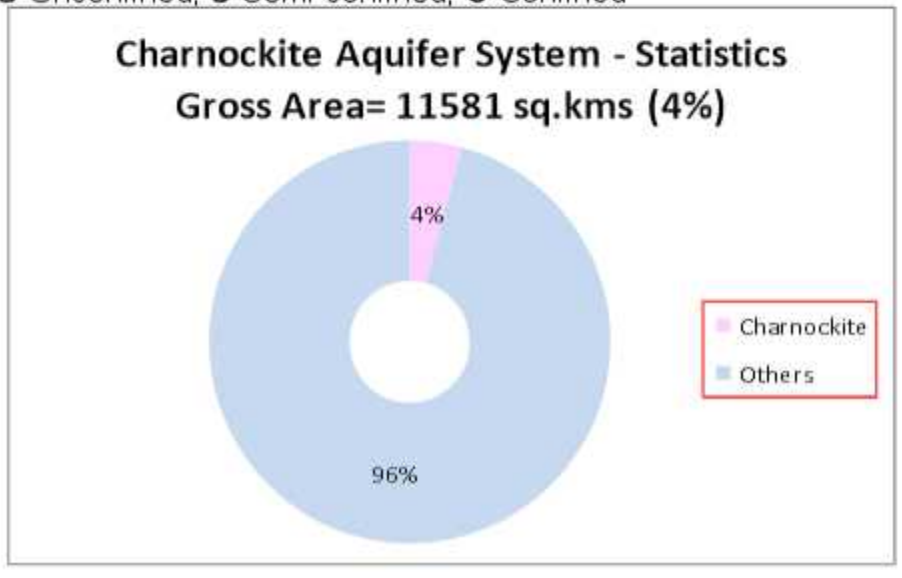


Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XXXI - District wise Distribution and Characteristics of Charnockite Aquifer System

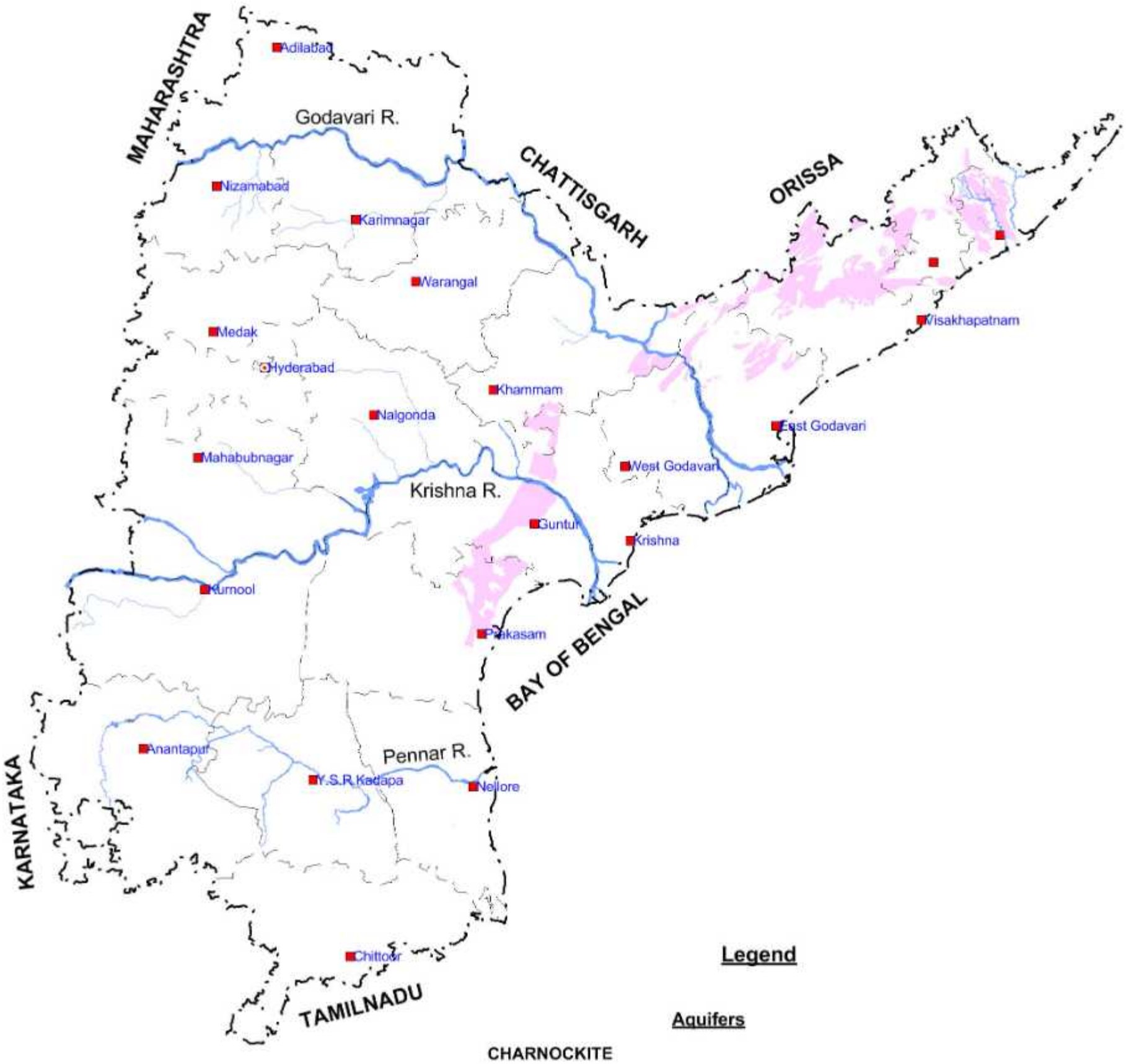
S No	District Name	Area (sq.km.) CK01	Aquifer system	Type of Aquifer	Thickness of Weathered zone (m)	Depth of Fractures Encountered (m bgl)	DTW (Decadal Average in m bgl)	Transmissivity (sq.m./day)	Yield (cum/day)	Specific Yield (%)	Quality (EC in micro Siemens/cm)
1	Adilabad										
2	Anantapur										
3	Chittoor										
4	East Godavari	970			NE	NE	NE	NE	NE	NE	ND
5	Guntur	1434	Single	U/S/C	5-39	14-94	2-5	ND	11-103	2.0-4.0	770-2970
6	Karimnagar										
7	Khammam	677			NE	NE	NE	NE	NE	NE	ND
8	Krishna	869	Single	U	2-25	9-10	2-10	5	130	2.0-4.0	2180-3420
9	Kurnool										
10	Mahabubnagar										
11	Medak										
12	Nalgonda										
13	Nizamabad										
14	Prakasam	1665	Single	U/S/C	4-25	10-98	2-5	13-69	19-285	2.0-4.0	790-3080
15	Ranga Reddy & Hyderabad										
16	SPS Nellore										
17	Srikakulam	1336	Single	U/S/C	2-18	9-166	0-10	13-23	19-216	2.0-4.0	880-1880
18	Visakhapatnam	3406	Single	U/S/C	5-18	31-92	0-5	1.5-10.0	27-35	2.0-4.0	121-1740
19	Vizianagaram	1014	Single	U/S/C	10-33	15-159	2-5	9-52	34-432	2.0-4.0	720-2870
20	Warangal										
21	West Godavari	210			NE	NE	NE	NE	NE	NE	ND
22	YSR Kadapa										
	Total	**11581**									

NE- Not Explored ND-Not Determined **U**-Unconfined; **S**-Semi-confined; **C**-Confined



CHARNOCKITE - AQUIFER SYSTEM

0 150 300
kilometers



Legend

Aquifers

CHARNOCKITE

Charnockite (CK01)

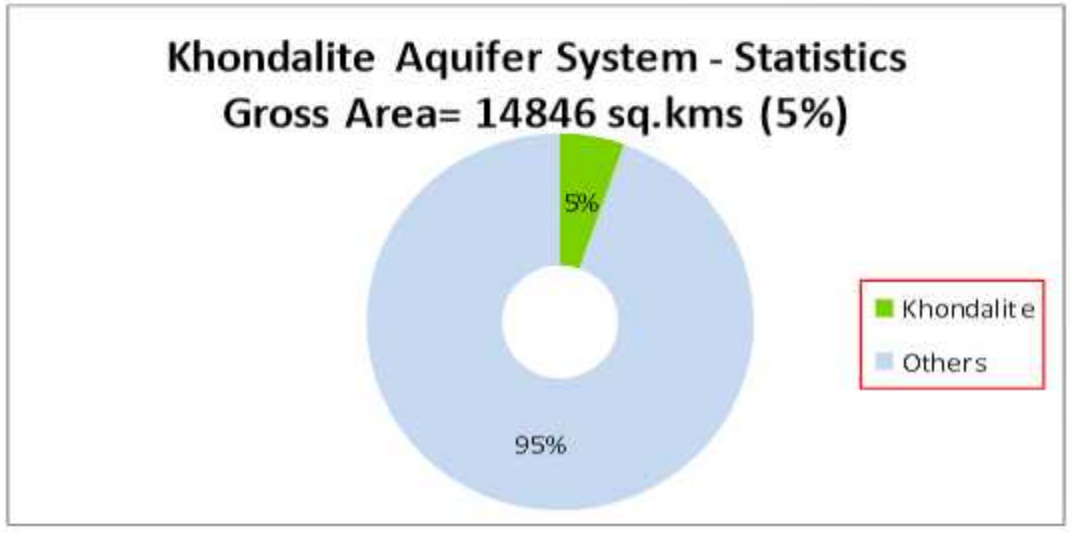
State Capital
District Head Quarters
District Boundary
State Boundary
River

Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XXXII - District wise Distribution and Characteristics of Khondalite Aquifer System

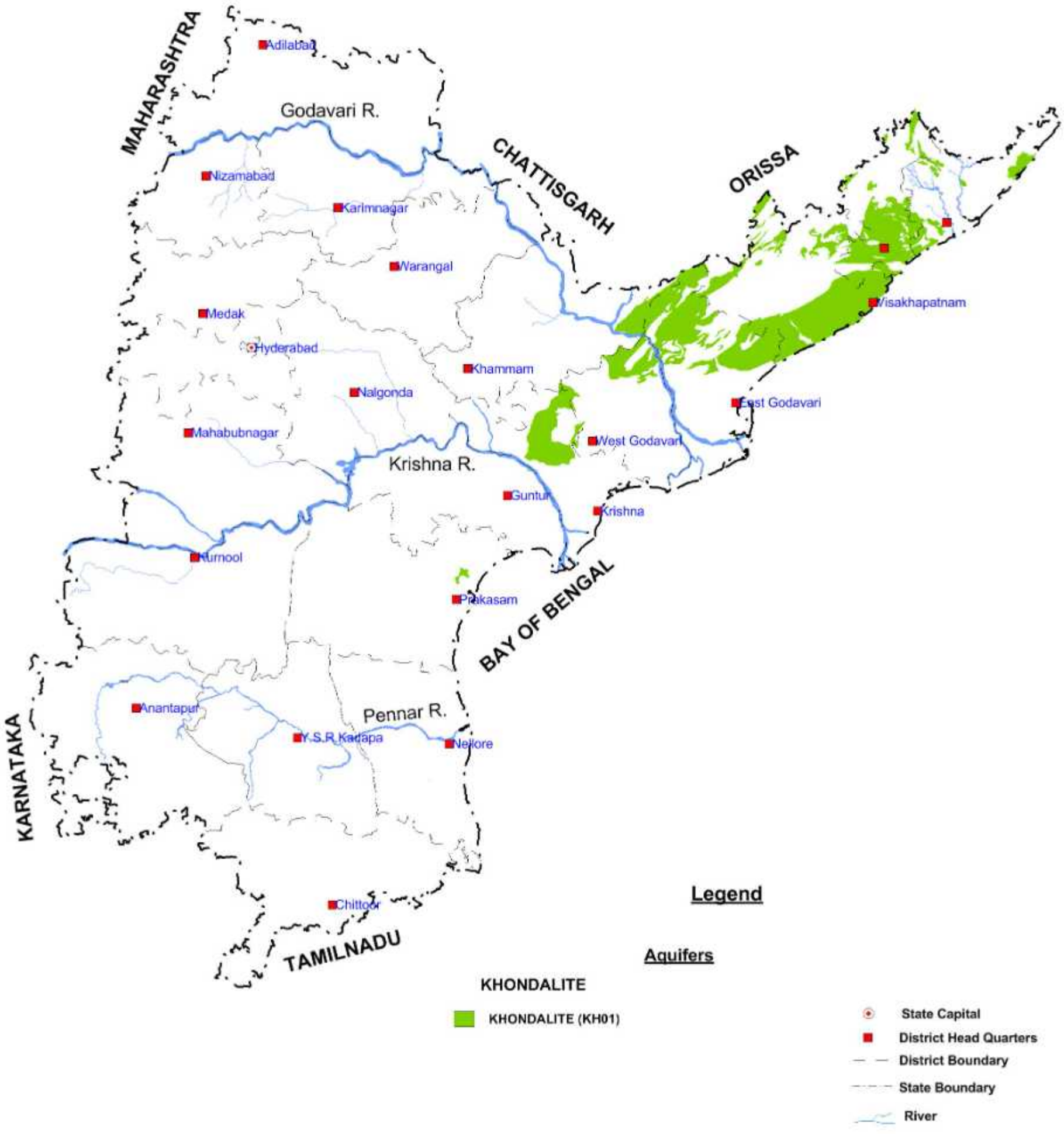
S No	District Name	Area (sq.km.) KH01	Aquifer system	Type of Aquifer	Thickness of Weathered zone (m)	Depth of Fractures Encountered (m bgl)	DTW (Decadal Average in m bgl)	Transmissivity (sq.m./day)	Yield (cum/ day)	Specific Yield (%)	Quality (Ec in micromhos/cm)
1	Adilabad										
2	Anantapur										
3	Chittoor										
4	East Godavari	3753	Single	U/S	3-14	15-52	2-10	1.0	43	2.0-4.0	380-2450
5	Guntur	5			NE	NE	NE	NE	NE	NE	ND
6	Karimnagar										
7	Khammam	540			NE	NE	NE	NE	NE	NE	ND
8	Krishna	1451	Single	U/S/C	14-46	24-156	2-10	5-16	38-1874	2.0-4.0	245-2880
9	Kurnool										
10	Mahabubnagar										
11	Medak										
12	Nalgonda										
13	Nizamabad										
14	Prakasam	62			NE	NE	NE	NE	NE	NE	ND
15	Ranga Reddy										
16	SPS Nellore										
17	Srikakulam	738	Single	U/S	2-25	18-49	0-5	6-45	155-345	2.0-4.0	1840-2200
18	Visakhapatnam	4467	Single	U/S/C	5-44	12-198	0-10	1-580	86-907	2.0-4.0	109-7680
19	Vizianagaram	2871	Single	U/S/C	2-12	21-180	2-10	6-115	17-172	2.0-4.0	434-1640
20	Warangal										
21	West Godavari	959	Single	U/S/C	6-13	60-80	5-20	NE	NE	2.0-4.0	1320
22	YSR Kadapa										
Total		**14846**									

NE- Not Explored **ND**-Not Determined **U**-Unconfined; **S**-Semi-cionfined; **C**-Confined



KHONDALITE - AQUIFER SYSTEM

0 150 300
kilometers



Legend

Aquifers

KHONDALITE

KHONDALITE (KH01)

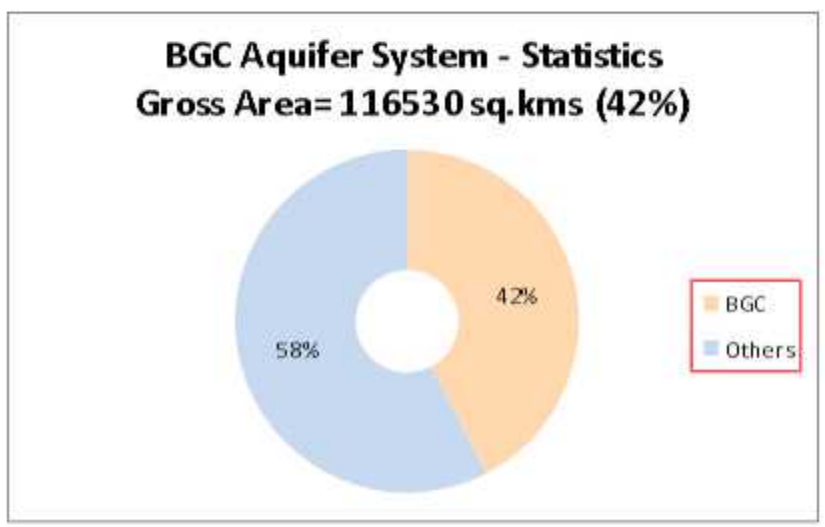
State Capital
District Head Quarters
District Boundary
State Boundary
River

Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XXXIII - District wise Distribution and Characteristics of Banded Gneissic Complex (BGC) Aquifer System

S No	District Name	Area (sq.km.) BG01	Aquifer system	Type of Aquifer	Thickness of Weathered zone(m)	Depth of Fractures Encountered (m bgl)	DTW (Decadal Average in m bgl)	Transmissivity (sq.m./day)	Yield (cum/day)	Specific Yield (%)	Quality (EC in micro Siemens/cm)
1	Adilabad	5146	Single	U/S/C	6-15	30-198	2-10	2-374	86-432	2.0-4.0	633-3680
2	Anantapur	12714	Single	U/S/C	4-20	5-243	0-15	1-71	190-561	2.0-4.0	569-3226
3	Chittoor	13482	Single	U/S/C	2-34	102-175	0-15	1-489	28-1176	2.0-4.0	635-2920
4	East Godavari										
5	Guntur	2147	Single	U/S/C	5-20	13-157	0-10	ND	17-425	2.0-4.0	780-4650
6	Karimnagar	8965	Single	U/S	4-18	22-50	2-15	3-48	28-432	2.0-4.0	540-2250
7	Khammam	7869	Single	U/S/C	3-15	10-170	0-15	8-257	43-518	2.0-4.0	940-1320
8	Krishna	1655	Single	U/S/C	7-14	13-84	2-15	8-127	19-182	2.0-4.0	2370-3700
9	Kurnool	4979	Single	U/S/C	2-14	15-128	2-10	17-127	38-1204	2.0-4.0	1470-4260
10	Mahabubnagar	13643	Single	U/S/C	2-25	26-163	0-40	5-339	40-432	2.0-4.0	673-3240
11	Medak	7576	Single	U/S/C	6-18	25-70	2-15	2-40	7-844	2.0-4.0	733-5266
12	Nalgonda	13154	Single	U/S/C	2-32	2-192	0-15	5-400	86-1600	2.0-4.0	740-5300
13	Nizamabad	5388	Single	U/S/C	5-36	7-167	2-20	1-249	9-725	2.0-4.0	390-3530
14	Prakasam	228	Single	U/S/C	2-16	6-131	2-5	12-150	14-155	2.0-4.0	3150-6840
15	Ranga Reddy & Hyderabad	5580	Single	U/S/C	2-26	14-160	2-20	2-904	60-691	2.0-4.0	562-1790
16	SPS Nellore	1726	Single	U/S/C	7-20	16-170	2-10	1-59	69-518	2.0-4.0	940-1489
17	Srikakulam	1894	Single	U/S	6-37	18-54	2-10	5-110	39-450	2.0-4.0	274-2470
18	Visakhapatnam										
19	Vizianagaram										
20	Warangal	8079	Single	U/S	8-27	11-67	2-20	1-43	2-103	2.0-4.0	990-4960
21	West Godavari	10	Single	U	5-20	6-23	5-10	77	17-907	2.0-4.0	937-2100
22	YSR Kadapa	2295	Single	U/S/C	6-15	25-146	2-10	45-910	43-1296	2.0-4.0	1500-2918
	Total	**116530**									

NE- Not Explored **ND**-Not Determined **U**-Unconfined; **S**-Semi-confined; **C**-Confined



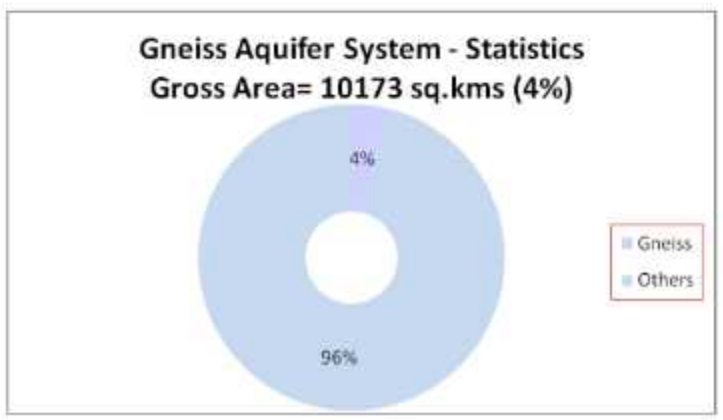
BANDED GNEISSIC COMPLEX

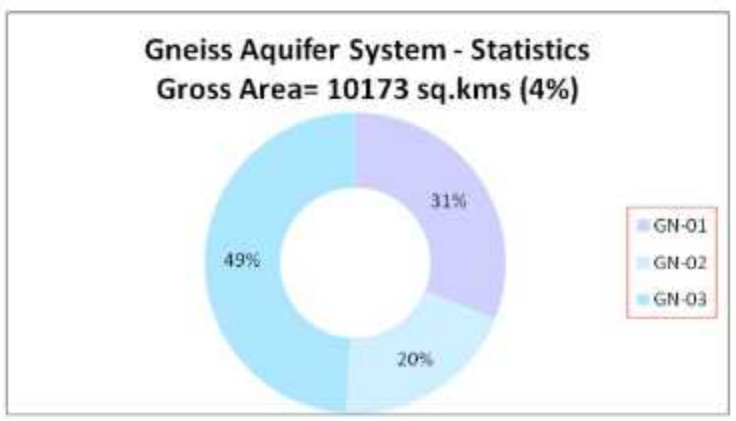
Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XXXIV - District wise Distribution and Characteristics of Gneiss Aquifer System

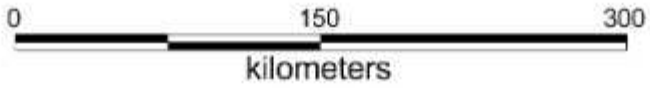
S No	District Name	Area (sq.km.)			Aquifer system	Type of Aquifer	Thickness of Weathered zone (m)	Depth of Fracture Encountered (m bgl)	DTW (Decadal Average in m bgl)	Transmissivity (sq.m./day)	Yield (cum/day)	Specific Yield (%)	Quality (EC in micro Siemens/cm)
		GN01	GN02	GN03									
1	Adilabad												
2	Anantapur			137	Single	U/S/C	5-19	19-243	5-10	4-445	43-432	2.0-4.0	670-2590
3	Chittoor			105	Single	U/S/C	2-34	19-175	5-10	2-489	40-210	2.0-4.0	1023
4	East Godavari	86		1106	Single	U/S/C	3-15	17-51	2-5	ND	120-240	2.0-4.0	760-1960
5	Guntur												
6	Karimnagar	10			Single	U/S	8-18	20-50	5-10	24-96	40-150	2.0-4.0	ND
7	Khammam			25	Single	U/S/C	6-25	5-154	2-10	8-257	12-1100	2.0-4.0	540-2270
8	Krishna												
9	Kurnool			663	Single	U/S	1-13	40-52	2-5	585-1370	86-1290	2.0-4.0	1800
10	Mahabubnagar			280	Single	U/S/C	2-25	11-163	5-10	5-50	43-523	2.0-4.0	2419
11	Medak												
12	Nalgonda												
13	Nizamabad												
14	Prakasam			1007	Single	U/S/C	2-16	7-131	2-10	2-69	113-604	2.0-4.0	650-1335
15	Ranga Reddy & Hyderabad												
16	SPS Nellore			70	Single	U/S/C	7-20	11-96	5-10	2-45	99-388	2.0-4.0	440-1995
17	Srikakulam		627	189	Single	U/S/C	6-24	9-166	5-10	3-114	19-250	2.0-4.0	236-2640
18	Visakhapatnam	3005	27	135	Single	U/S/C	4-36	9-178	2-15	1-219	86-1356	2.0-4.0	620-2590
19	Vizianagaram		1370	1146	Single	U/S/C	2-12	13-188	0-10	1-54	18-432	2.0-4.0	345-42130
20	Warangal	25			Single	U/S	6-9	13-65	5-10	1	ND	2.0-4.0	ND
21	West Godavari	38			Single	U	5-20	6-23	2-10	78	17-907	2.0-4.0	980-2200
22	YSR Kadapa			122	Single	U/S/C	1-18	23-145	5-10	34-45	43-259	2.0-4.0	ND
	Total	**3164**	**2024**	**4985**									

NE- Not Explored **ND**-Not Determined **U**-Unconfined; **S**-Semi-confined; **C**-Confined





GNEISS - AQUIFER SYSTEM

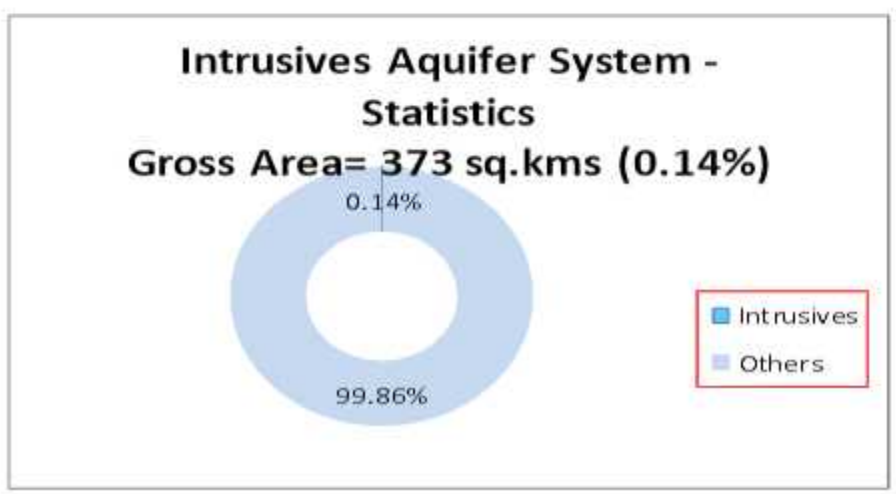


Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XXXV - District wise Distribution and Characteristics of Intrusives Aquifer System

S No	District Name	Area (sq.km.) IN02	Aquifer system	Type of Aquifer	Thickness of Weathered zone (m)	Depth of Fractures Encountered (m bgl)	DTW (Decadal Average in m bgl)	Transmissivity (sq.m./day)	Yield (cum/day)	Specific Yield (%)	Quality (EC in micro Siemens/cm)
1	Adilabad										
2	Anantapur	102	Multiple	U/S/C	5-16	12-183	5-10	3-306	172-560	0.2-0.5	ND
3	Chittoor	105			NE	NE	NE	NE	NE	NE	ND
4	East Godavari										
5	Guntur										
6	Karimnagar										
7	Khammam										
8	Krishna										
9	Kurnool	50	Multiple	U/S/C	1-13	104-105	2-5	8-107	216-302	0.2-0.5	ND
10	Mahabubnagar										
11	Medak										
12	Nalgonda										
13	Nizamabad										
14	Prakasam										
15	Ranga Reddy & Hyderabad										
16	SPS Nellore										
17	Srikakulam										
18	Visakhapatnam										
19	Vizianagaram										
20	Warangal										
21	West Godavari										
22	YSR Kadapa	116			NE	NE	NE	NE	NE	NE	ND
Total		**373**									

NE- Not Explored **ND**-Not Determined **U**-Unconfined; **S**-Semi-confined; **C**-Confined



INTRUSIVES

0 150 300
kilometers

Legend

Aquifers

INTRUSIVES

INTRUSIVES (IN02)

State Capital
District Head Quarters
District Boundary
State Boundary
River

Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XXXVI - District wise Area Prioritized for Artificial Recharge

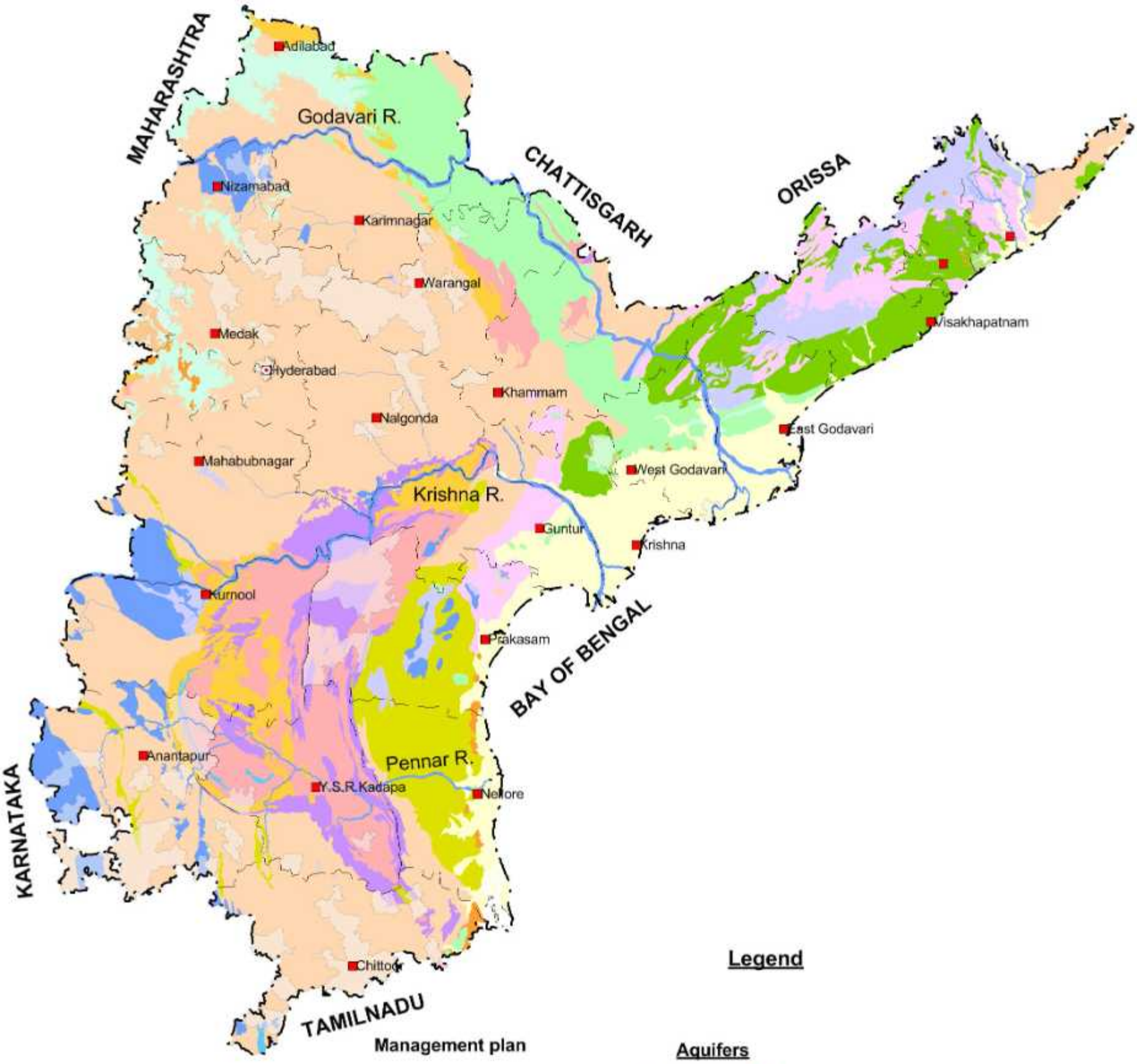
(in sq.km.)

S No	District	Alluvium	Laterite	Basalt	Sandstone	Shale	Limestone	Granite	Schist	Quartzite	Charnockite	Khondalite	BGC	Gneiss	Intrusives	Grand Total
1	Adilabad															
2	Anantapur					1402	213	1292					3976			6883
3	Chittoor							287		579			2921			3787
4	East Godavari															
5	Guntur															
6	Karimnagar															
7	Khammam												270			270
8	Krishna				525											525
9	Kurnool															
10	Mahabubnagar												227			227
11	Medak		1075	823									2329			4227
12	Nalgonda												963			963
13	Nizamabad							210					992			1202
14	Prakasam					2957				1520						4477
15	Ranga Reddy & Hyderabad												477			477
16	SPS Nellore															
17	Srikakulam	195														195
18	Visakhapatnam															
19	Vizianagaram															
20	Warangal				127								3762			3889
21	West Godavari	136														136
22	YSR Kadapa					561	100						228			889
Grand Total		**331**	**1075**	**823**	**652**	**4920**	**313**	**1789**		**2099**			**16145**			**28147**

ARTIFICIAL RECHARGE - PRIORITY AREA
(Aquifer Management Plan)

0 150 300
kilometers

N
W E
S



Management plan

Area Suitable For Artificial Recharge

Legend

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Charnockite
- Khondalite
- Gneiss
- BGC
- Intrusives

- State Capital
- District Head Quarters
- District Boundary
- State Boundary
- River

Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XXXVII - Area Delineated for Water Conservation and Harvesting

(in sq.km.)

S No	District	Alluvium	Laterite	Basalt	Sandstone	Shale	Limestone	Granite	Schist	Quartzite	Charnockite	Khondalite	BGC	Gneiss	Intrusives	Grand Total
1	Adilabad			676	1654		207						4980			7517
2	Anantapur						49	199					448			696
3	Chittoor					30			53	95			1247	15		1440
4	East Godavari										60	194				254
5	YSR Kadapa					826				186			623			1635
6	Karimnagar				1043		30						362			1435
7	Khammam				594	105						137	595			1431
8	Krishna										169	69				238
9	Guntur															
10	Kurnool					1429	304									1733
11	Mahabubnagar					148	89			148			379			764
12	Medak			37									154			191
13	Nalgonda									50			166			216
14	SPS Nellore															
15	Nizamabad			231									346			577
16	Prakasam					929				500						1429
17	Rangareddy & Hyderabad												475			475
18	Srikakulam											225				225
19	Visakhapatnam										555	310				865
20	Vizianagaram										199	1		87		287
21	Warangal				2533	344	15						13			2905
22	West Godavari										161	242				403
Total				**944**	**5824**	**3811**	**694**	**199**	**53**	**979**	**1144**	**1178**	**9788**	**102**		**24716**

WATER CONSERVATION AND HARVESTING - PRIORITY AREA

(Aquifer Management Plan)

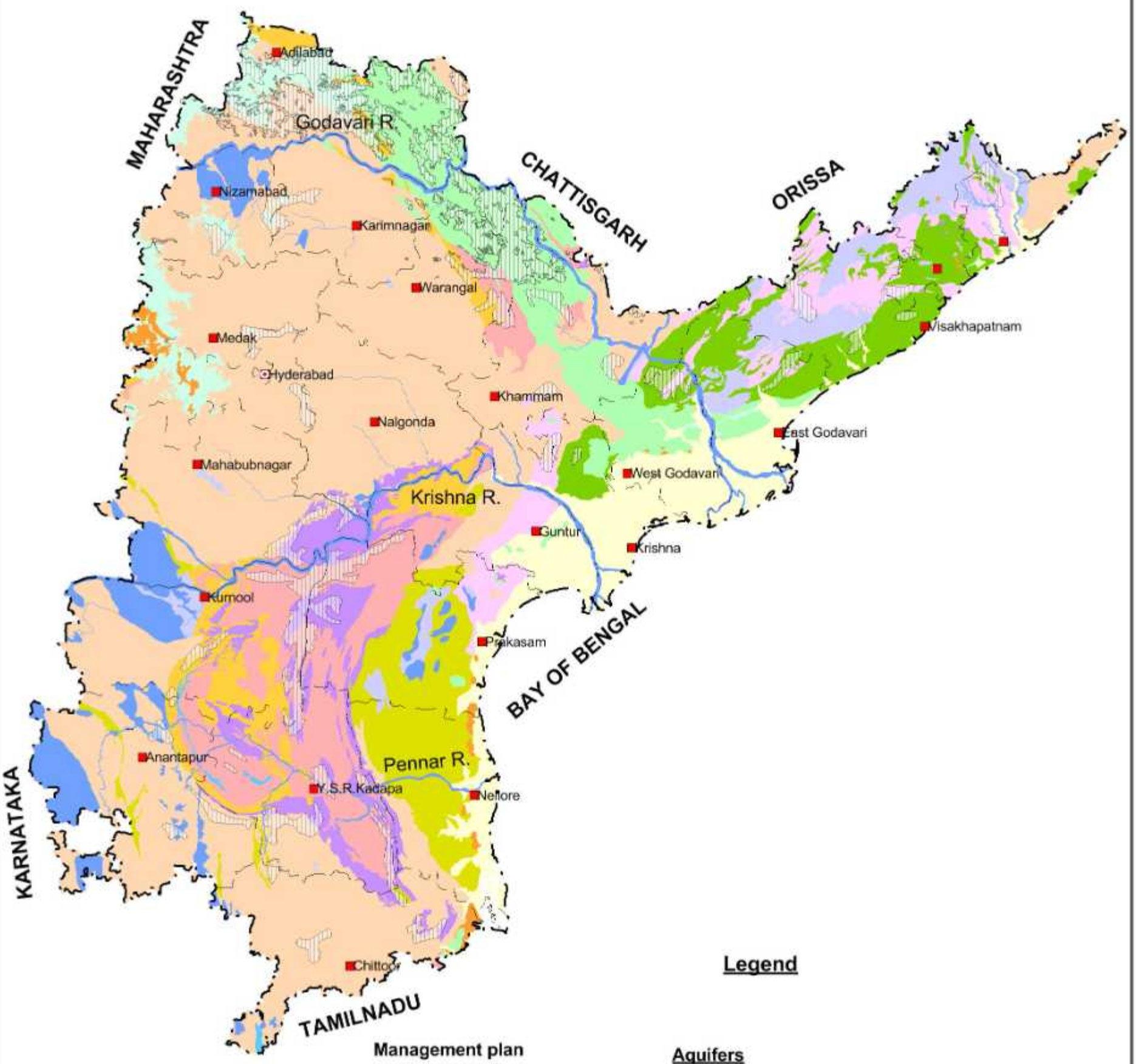
0 150 300

kilometers

N

W E

S



Management plan

Area suitable for water conservation and harvesting

Legend

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Charnockite
- Khondalite
- Gneiss
- BGC
- Intrusives

- State Capital
- District Head Quarters
- District Boundary
- State Boundary
- River

Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

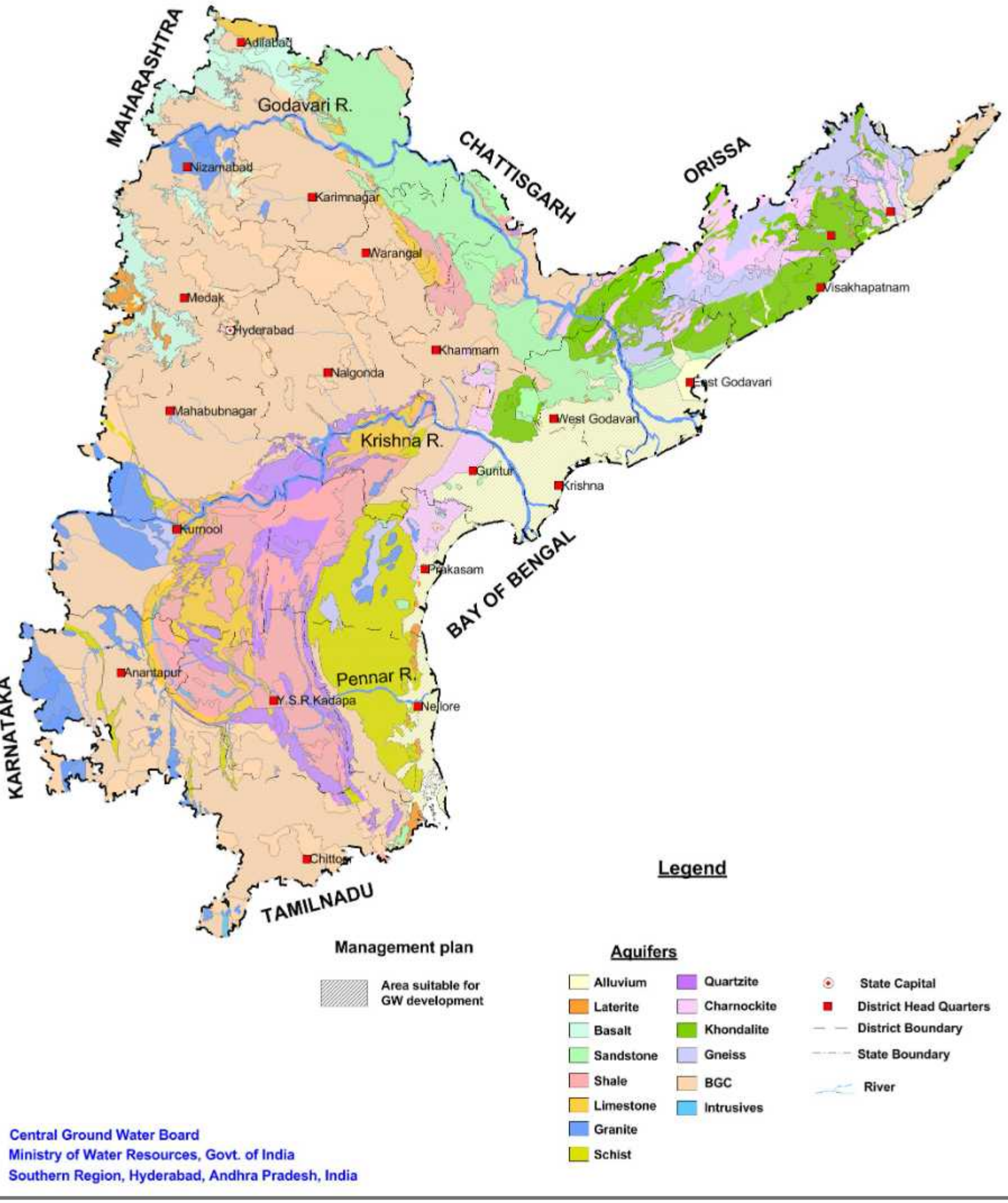
Table XXXVIII - Area Suitable for Ground Water Development

(in sq.km.)

S No	District	Alluvium	Laterite	Basalt	Sandstone	Shale	Limestone	Granite	Schist	Quartzite	Charnockite	Khondalite	BGC	Gneiss	Intrusives	Grand Total
1	Adilabad			1555	5520	653	653	3037					3037	20		14475
2	Anantapur					21	109	2742	485	14			9434	136	9	12950
3	Chittoor	86	204		136	26		186	20	332			10871	94	97	12051
4	YSR Kadapa					6786	1342		3	3002			1635	123	116	13007
5	East Godavari	3252		98	914						608	2175		72		7119
6	Guntur	3137			139	1341	1584	123	805	791	1433	5	1990	0		11346
7	Karimnagar			1	2483		210						192	9		2896
8	Khammam	90			4279	508		188		12	526	181	7047	67		12898
9	Krishna	4073			96	29	38			57	702	1216	1679			7890
10	Kurnol					3651	3583	2034		960			4898	658	50	15835
11	Mahabubnagar			130		350	498	1073	193	1180			11970	285		15679
12	Medak		458	1407				1					5591			7457
13	Nalgonda						152		36	536			8			733
14	SPS Nellore	2905	510		143			70	6903	373			1723			12626
15	Nizamabad			493				1511					4427			6431
16	Prakasam	1300	53		30	1702		677	5076	933	1716	64	235	1039		12825
17	Rangareddy & Hyderabad		311	1722		62							4946			7041
18	Srikakulam	928			4					13	1275	580	1791	790		5381
19	Visakhapatnam	95									883	1529				2507
20	Vizianagaram	11	46							38	469	2447		2024		5034
21	Warangal				2871	615	606						4966	25		9082
22	West Godavari	3704	29	49	2573						71	600		255		7282
Total		**19580**	**1611**	**5454**	**19186**	**15743**	**8776**	**11643**	**13521**	**8242**	**7683**	**8798**	**76440**	**5597**	**273**	**202546**

SUITABLE AREA FOR GROUND WATER DEVELOPMENT
(Aquifer Management Plan)

0 150 300
kilometers



Management plan

Area suitable for GW development

Legend

Aquifers

- Alluvium
- Laterite
- Basalt
- Sandstone
- Shale
- Limestone
- Granite
- Schist
- Quartzite
- Charnockite
- Khondalite
- Gneiss
- BGC
- Intrusives

- State Capital
- District Head Quarters
- District Boundary
- State Boundary
- River

Central Ground Water Board
Ministry of Water Resources, Govt. of India
Southern Region, Hyderabad, Andhra Pradesh, India

Table XXXIX Aquifer wise Ground Water Management Plan

S No	Aquifer	Total Area(sq.km.)	Area Suitable for Artificial Recharge		Area Suitable for Development		Area Suitable for Conservation	
			Sq.Km.	%	Sq.Km.	%	Sq.Km.	%
1	Alluvium	20359	331	0.12	19580	7.12		
2	Laterite	1804	1075	0.39	1611	0.59		
3	Basalt	8438	823	0.30	5454	1.98	944	0.34
4	Sandstone	20833	652	0.24	16315	5.93	5824	2.12
5	Shale	22644	4920	1.79	15128	5.50	3811	1.39
6	Limestone	10748	313	0.11	8170	2.97	694	0.25
7	Granite	11152	1789	0.65	11643	4.23	199	0.07
8	Schist	14099			13521	4.92	53	0.02
9	Quartzite	11488	2099	0.76	8242	3.00	979	0.36
10	Charnockite	11581			7683	2.79	1144	0.42
11	Khondalite	14846			8798	3.20	1178	0.43
12	BGC	116530	16145	5.87	71474	25.98	9788	3.56
13	Gniess	10173			5572	2.03	102	0.04
14	Intrusives	373			273	0.10		
Total		275068	28147	10.23	193464	70.33	24716	8.99

WAY FORWARD

This is an effort by Central Ground Water Board, Southern Region to compile the available information on the important water- bearing formations in Andhra Pradesh and to group them into a manageable number of aquifer categories based on their hydrogeological and geological characteristics. The formations are divided into 14 principal aquifer systems. This compilation will serve as the base for the National Aquifer Mapping Programme of Central Ground Water Board during the XII and XIII Plans in the State, which aims at detailed and systematic mapping of the aquifers on scales of 1:50,000 or larger.

"Aquifer Systems of Andhra Pradesh" provides valuable information on the areal and vertical extents of Principal aquifers, the nature and behavior of ground water in these aquifers as well as the hydrochemical characteristics of the formation waters based on the available data and information. It also helps in the quantitative and qualitative assessment of ground water resources and also in understanding its vulnerability to various stresses on a regional scale.

However, considering the diverse geomorphic and hydrogeological settings and the hydrochemical variations in the aquifer systems of the state, this is the first step in this direction for better planning and management and for long- term sustainability of ground water resource.

The following activities will certainly help in realizing the above goals:

- Collection and compilation of all the available information on ground water resources of identified aquifer systems on 1:50,000 scale in general and at larger scales for critical and vulnerable areas for the state as a whole.
- Identification of data gaps of different aquifers, ground water conditions, water level variations in time and space, groundwater development status and hydrochemical characteristics. Evolving suitable methodologies aimed at filling the data gaps.
- Micro-level hydrogeological investigations supplemented by hydrometeorological, hydrological, remote sensing, geophysical and hydrochemical studies on the status of ground water regime and its characteristics.
- Demarcation of vulnerable areas in terms of ground water depletion, contamination from natural and anthropogenic sources and quantitative assessment of the extent of vulnerability of each aquifer system. This will help formulate plans for addressing location -specific vulnerability concerns in the areas of over-exploitation, water level decline, ground water contamination, sea water ingress into coastal freshwater aquifers etc.
- Quantitative assessment of the ground water resources in each aquifer, status of their utilization, scope for future development for various uses and sectoral allocation of the resources based on assigned priorities. Integration of the data collected on a suitable GIS platform and preparation of thematic layers at suitable scales, depicting important parameters having a direct or indirect impact on ground water resources.
- Integration of thematic maps to form comprehensive aquifer maps at sub-basin, watershed and micro - watershed scales.
- Development of calibrated ground water flow and solute transport models of appropriate scales to assist the planners, in selecting appropriate management plans for aquifer management.
- Formulation of strategies to ensure long-term sustainability of ground water resources in identified aquifers and for protecting their quality through a judicious mix of supply side and demand side strategies.
- Giving impetus to various measures such as recharge augmentation, ground water regulation, water conservation, aquifer remediation, improvements in water use efficiency etc.

The aquifer mapping programme was conceived for the development of aquifer management methodologies and water security plans, at the village level. Coordinated efforts through central, state government agencies, NGO's, social service organizations, academic institutions, local communities and user agencies in the management of ground water resources at village level for long term sustainability is need of the hour.

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