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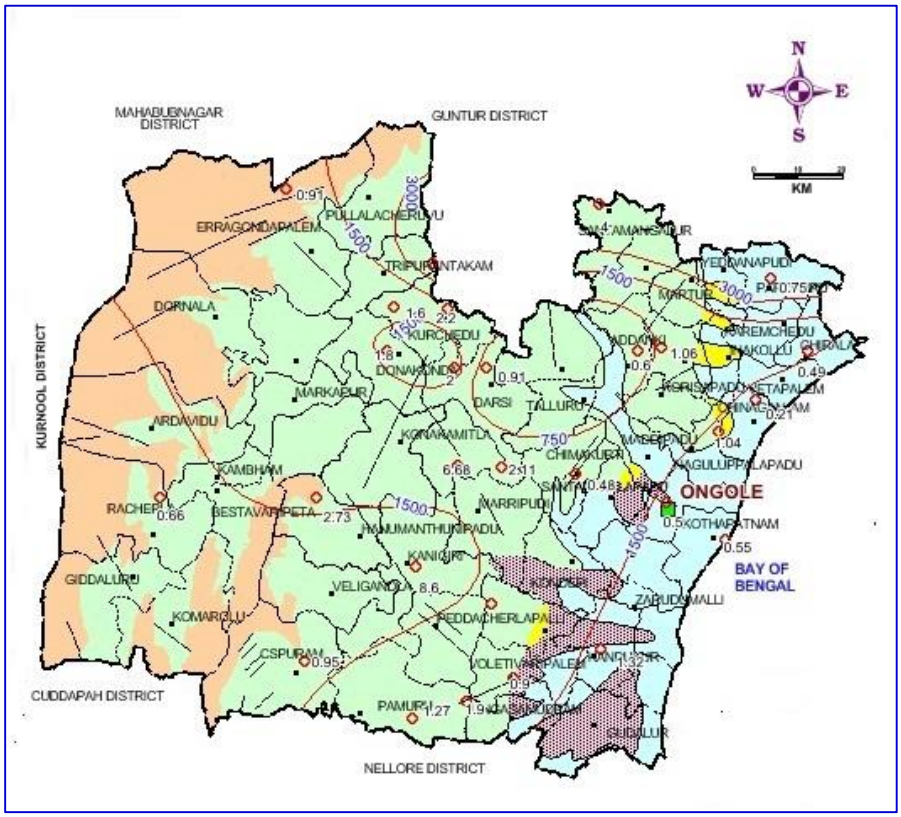
CENTRAL GROUND WATER BOARD
MINISTRY OF WATER RESOURCES
GOVERNMENT OF INDIA

GROUND WATER BROCHURE
PRAKASAM DISTRICT, ANDHRA PRADESH



SOUTHERN REGION
HYDERABAD
September 2013

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GROUND WATER BROCHURE
PRAKASAM DISTRICT, ANDHRA PRADESH
(AAP-2012-13)

BY

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PRAKASAM DISTRICT AT A GLANCE

1. GENERAL INFORMATION

Geographical Areas	**:**	17,626 Sq. km.
Administrative Divisions		
District HQ	**:**	Ongole
Mandals	**:**	56
Municipalities	**:**	04
Villages	**:**	1093
Population	**:**	33,92,764 (2011 census)
Average Annual Rainfall	**:**	796.6 mm.
Annual Rainfall (2012)	:	882 mm.

2. GEOMORPHOLOGY

Major Physiographic Units	**:**	(i) Western hilly terrain (ii) Central mid plain (iii) Eastern coastal plains
Major Drainage	**:**	Gundalakamma, Musi, Manneru and Paleru

3. LAND USE (Area in Ha.) -2012

Forest Area	**:**	4,61,983
Net Area Sown	**:**	6,07,633
Cultivable waste	**:**	63,782

4. SOIL TYPE

i) Red sandy soil
(ii) Lateritic soil
(iii) Deep black soil
(iv) Mixed red and black soil
(v) Deltaic alluvial soil
(vi) Sandy soil
(vii) Skeletal soils

5. IRRIGATION BY DIFFERENT SOURCES (Area in Ha.)

Dug Wells/Tube wells/ Bore wells	**:**	1,20,429
Tanks	**:**	12,360
Canals	**:**	83,811
Other Sources	**:**	15,821
Net Irrigated Area	**:**	2,32,421

6. GROUND WATER MONITORING WELLS

Dug Wells **:** 47

7. GEOLOGICAL FORMATIONS

Cenozoic laterites and recent alluvium
Gondwana sequence of Jurassic age
Cuddapah Formations -
Dharwar super group of proterozoic age
Khondalite suite of rocks
Charnockite group –
Unclassified metamorphics

8. Hydrogeology

Water Bearing Formation **:** **(1) Crystalline aquifer system**
(2) Cuddapah aquifer system
(3) Gondwana aquifers **(4) Alluvial & Laterite aquifers**

Pre-monsoon
Depth to Water Level, range (May, 2012) : 1.09 to 8.94 m bgl.

Post-monsoon
Depth to Water Level, range (Nov., 2012) : 0.07 to 14.80 m bgl.

9. GROUND WATER EXPLORATION

Wells Drilled	**:**	81 (EW) 18 (OW)
Depth Range	**:**	20 to 202 m bgl
Discharge	**:**	0.2 to 3.0 LPS
Transmissivity	**:**	5 to 100 (m2/day)

10. GROUND WATER QUALITY

In general good and suitable for drinking and irrigation purposes except in the coastal aquifers**.**

11. DYNAMIC GROUND WATER RESOURCES (in Ha.m)

Net Annual Ground Water Availability	**:**	142485
Total Draft	**:**	41499
Projected Demand (2025) for Domestic & Industrial Uses	**:**	8610
Stage of GW development	**:**	29%

12. AWARENESS AND TRAINING ACTIVITY

Training Programme on Rain water harvesting

Date	: 19th & 20th March, 2004
Place	: Ongole

13. GROUND WATER CONTROL & REGULATION

Over exploited	**:**	07
Critical	**:**	NIL
Semi-critical	**:**	03
No. of Notified villages (proposed)	**:**	49

14. MAJOR GROUND WATER PROBLEMS AND ISSUES

Water logging and salinity are the major considerable problems in the coastal aquifers.

GROUND WATER BROCHURE
PRAKASAM DISTRICT, ANDHRA PRADESH

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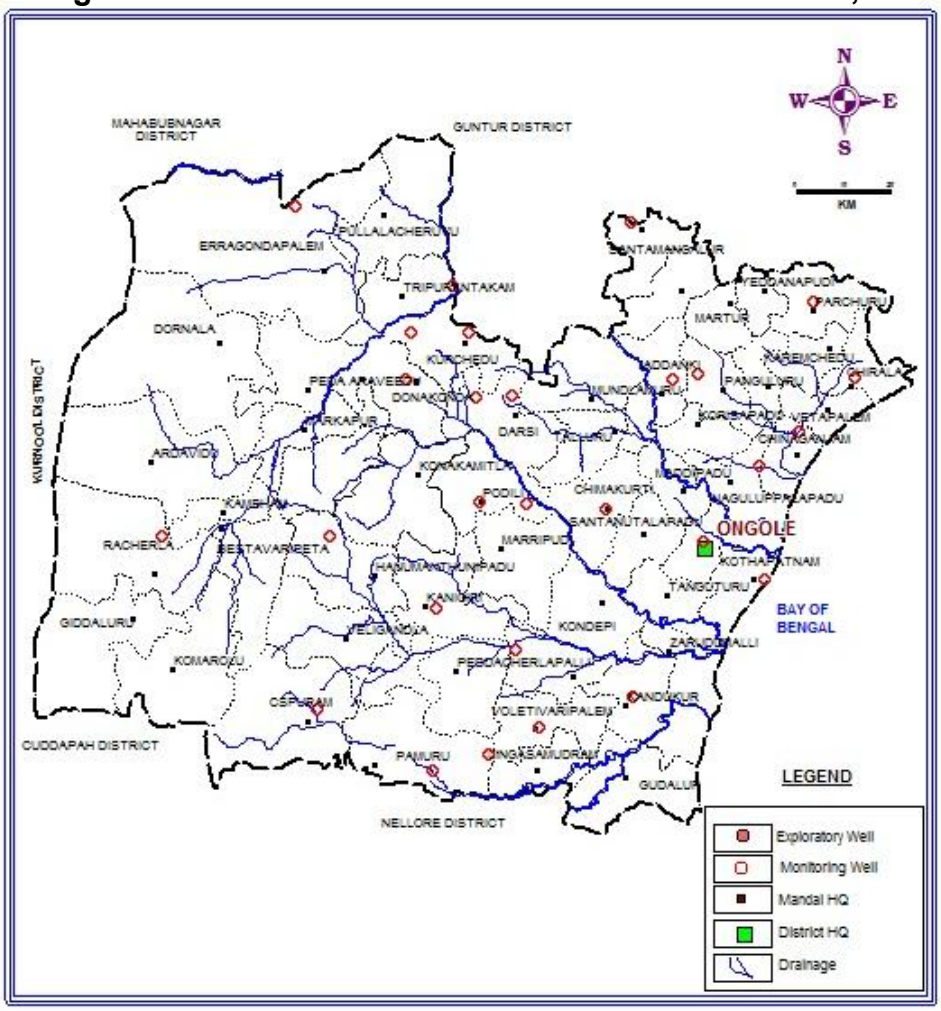
PRAKASAM DISTRICT, ANDHRA PRADESH

1.0 Introduction

The Prakasam district with its headquarters at Ongole is bounded in the North by Guntur district, in the south by Nellore and Cuddapah districts, in the west by Kurnool district and in the East by Bay of Bengal and lying between north latitudes 14°57'00": 16°17'00" and East longitudes 78°43'; 80°25'00" in parts of Survey of India toposheet Nos. 56, 57I, 57M, 57N and 65A and 66N respectively and spread over an area of 17,626 sq. km. and accounts for 6.4% of the total area of the state and occupies 4th place in the size of the area. The district is carved out of the erstwhile 3 tanks of Guntur district viz., Addanki, Chirala and Ongole; 4 taluks of Nellore district viz., Kandukuru, Kanigiri, Podili and Darsi; 2 taluks Markapur and Gidalur of Kurnool district. The district has its headquarters at Ongole and administratively divided into 56 revenue mandals (Fig.1) which are grouped under 3 revenue divisions viz., Ongole, Kandukur and Markapur. There are 1002 villages 4 municipalities in the district viz., Ongole, Kandukur, Chirala and Markapur. As per the 2011 census the population of the district is 33,92,764 out of which urban population is 6,62,116 and the rural population is 27,30,648 and the density of population is 192 persons per sq. km.

Fig-1. Administrative Divisions of Prakasham District, A.P



1.1 Drainage

The district lies in the basin between Krishna and Penner. Gundalakamma, Musi, Manneru and Paleru are the important rivers and they further split into smaller arms before it debouches into the Bay of Bengal. The general drainage pattern is dendritic to sub-dendritic. The drainage density varies from less than 0.4 km/sq.km in poorly drained alluvial areas which covers the entire southern parts of the district to 0.6 km/sq.km in the Northern parts occupied by crystalline rocks**.**

1.2 Irrigation

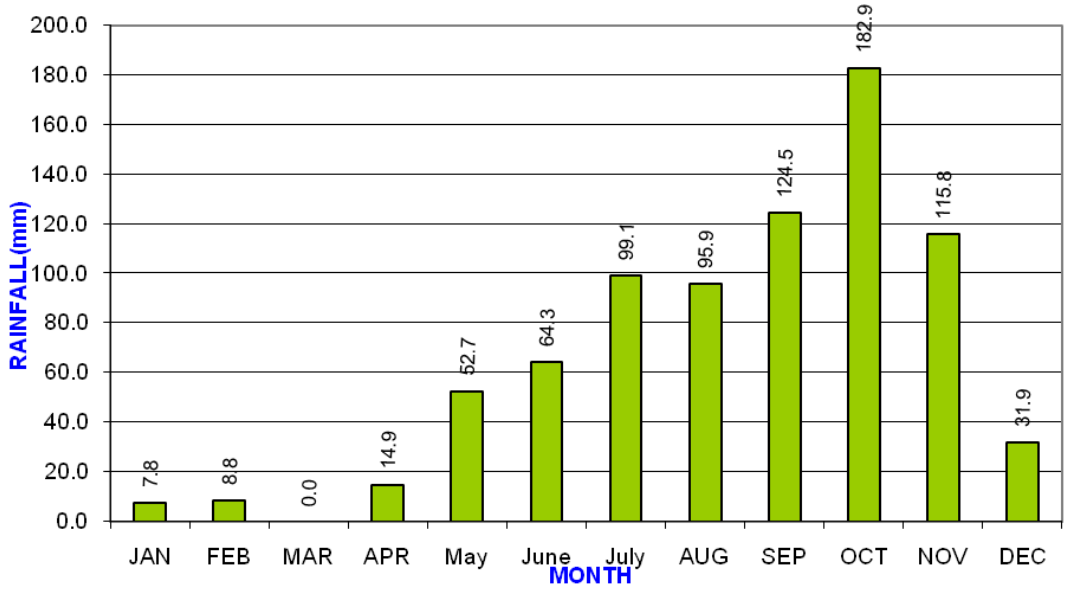
The principal crops grown in the district are paddy, jowar, maize, ragi, pulses. The net area sown is 607633 ha. As per 2012 data the area irrigated through canals 83811 ha; tank irrigation 12360 ha; tube wells and filter point wells irrigate 1165941ha. and through other sources 15821 ha. The gross area irrigated in the district is 2,44,901 ha. Net area irrigated is 2,32,421 ha.

2.0 Rainfall & Climate

2.1 Rainfall

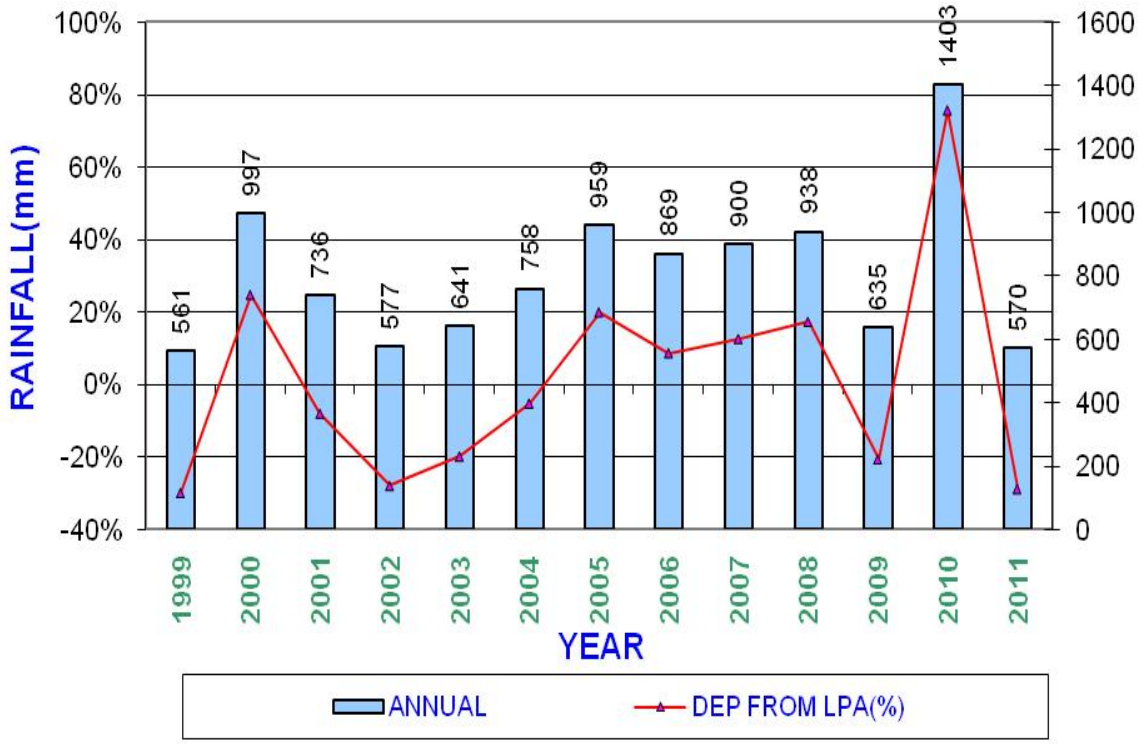
The average annual rainfall of the district is 798.6 mm, monthly rainfall ranges from nil in March to 182.9 mm in October. October is the wettest month of the year. Northeast and southwest monsoon both contributes significant rainfall in this district. The mean seasonal rainfall distribution is 384 mm in southwest monsoon (June-September), 331 mm in northeast monsoon (Oct-Dec), 17 mm rainfall in Winter (Jan-Feb) and 68 mm in summer (March – May). The percentage distribution of rainfall, season-wise, is 48.06 % in southwest monsoon, 41.39 % in northeast monsoon, 2.08% in winter and 8.47 % in summer. The mean monthly rainfall distribution is given in Fig. 2. The annual rainfall during 2012 is 882 mm.

Fig. 2: Monthly Mean Rainfall Distribution



The annual rainfall ranges from 561 mm in 1999 to 1403 mm in 2011. The annual rainfall departure ranges from -30 % in 1999 to 76 % in 2011. The annual rainfall and rainfall departure from LPA is presented in Fig-3. The southwest monsoon rainfall contributes about 48 % and northeast monsoon about 41% of annual rainfall.

Fig. 3: Annual Rainfall and Rainfall Departure From LPA



The years 1999, 2002 and 2011 experienced drought conditions as the annual rainfall recorded in these three years is 30 %, 28% and 29% less than the long period average (LPA) respectively. The cumulative departure of annual rainfall from LPA is presented in Fig.3. It indicates that, the rainfall departure as on 2011 is positive i.e. 19%, showing rainfall excess.

2.2. Climate

December is the coldest month with normal mean maximum temperature of about 27.1°c and mean minimum temperature of 19.2°C. Temperature begins to rise after February. May is the hottest month with mean daily maximum temperature of about 36.1°C and the mean daily minimum temperature of about 27.7°C. During May and early June the maximum temperature rises occasionally to 46°C and with the on set of SW monsoon by about second week of June, temperature begins to drop rapidly. The relative humidity is generally high throughout the year and is of the order of 80% in the morning and 75% in the evening. During summer season particularly in the month of May the relative humidity is 71% in the morning and 64% in the evening hours. The wind speed in the district is generally light to moderate throughout the year. The special weather phenomenon prevails in the district viz., during post monsoon season wide spread heavy rain and strong winds occur when depressions in the Bay of Bengal move Northwesterly direction.

3.0 Geomorphology & Soil Types

The coastal plains, older coastal plains and flood plains with recent alluvium, flood plain deposits and marine sediments forming the land forms in the north, north east, mid-central and south eastern parts of the district.

The structural and denudational plateaus on proterozoic rocks with pediment and pediplains occur in the North, South and Central parts of the district. Structured hills, denudational hills and valleys on sedimentary rocks and colluvial terraces are seen in the North West, Central and South Western parts of the district. The Dharwar schist, Charnockites and peninsular gneisses occur as linear ridges, residual and structural hills and as shallow to moderately weathered pediplain deposits.

4.0 Ground Water Scenario

4.1 Hydrogeology

The area in Prakasam district is underlain by diverse type of rock types belonging to Achaean to recent age. The aquifer system in Prakasam district comprises 4 groups (Fig.4), viz.

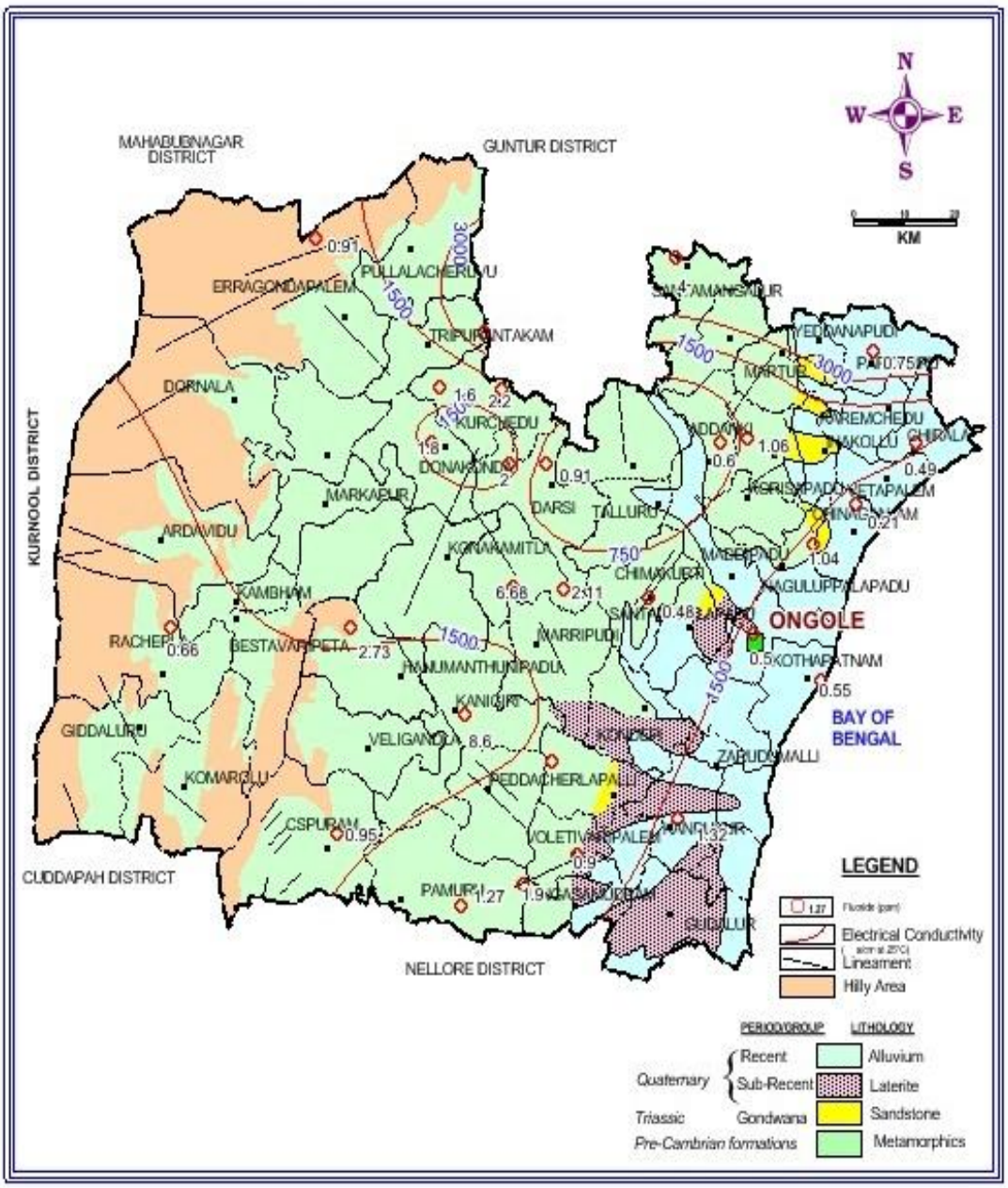
(1) Crystalline aquifer system
(2) Cuddapah aquifer system
(3) Gondwana aquifers and
(4) Alluvial & laterite aquifer system

In general ground water occurs in all the formations of the area. Ground water occurs under phreatic conditions in the weathered, fractured crystalline rocks at shallow depths and under semi confined to confined conditions in the deeper fractured crystalline rocks.

The crystalline aquifer, granite-gneiss, system occupy major parts of the district. The crystalline aquifer system lacks primary porosity and the occurrence, movement of ground water in these rock types depend on the thickness of weathered zone available and degree of fracturing/jointing. The thickness of weathered zone varies from 3.0 to 15.0m. The depth of the dug wells ranges from 6.0 to 16.0m bgl with yields of the wells varying from 50 to 100m3/day and sustain intermittent pumping for 3 to 6 hours a day. The results of the recent exploratory drilling in this formation by CGWB to depths of 150 m showed that in granite gneiss the discharge varies from 113.18 m3/day to 604.8m3/day with the transmissivity varying from 2.0 to 69m2/day. In the Hornblende – Biotite – Gneiss the discharge is 14.0 to 155.52 m^3/day and the transmissivity is 12.66 to 150$m^{2/}$day. yield varies from 38m3/day to 158.97m3/day with transmissivity values from 1.5 to 12.66 m2/day in Charnockite formations. In schistose formations the discharges varied from 63.07m3/day to 242m3/day with transmissivity of the aquifer varying from 1.06m2/day to 40m2/day. The Cuddapah aquifer system consists of quartzites, shales and limestones. The occurrence and movement of ground water in these rocks depending on the extent of weathering, degree of compaction, fracturing and occurring of bedding planes and presence of solution channels in the limestones. The dug wells range in depths between 8.0 to 15.0 m bgl. and the yields range from 20 to 120 m^3/day. Ground Water exploration

down to 150 m depth , yield in this formation vary 172.80 m^3/day to 587.52 m3/day with transmissivity of the aquifer varying from 6.87m2/day to 158.22 m2/day. In shale formation the discharge varied from 164.20m3/day to 316.26m3/day and the transmissivity values varying from 6.59m^2/day to 22.8m2.

Fig-4: Hydrogeology – Prakasam District, A.P



The alluvium consisting of fine sand, gravel and kankar is occur coastal alluvium, river alluvium and wind blown sands in the area around Chirala, Vetapalem, Chinnaganjam, Nagulappalapadu, Kothapatnam, Ulvalapadu and Tanguturu with thickness of 15.0 m has fresh water pockets along the coastal line. The filter point/tube wells constructed in alluvial areas have yielded 216m3/day to 302.4m^3/day and the transmissivity of the alluvial aquifer varies from 32 to 1400m^2/day. The river alluvium occurs along the course of Gundalakamma, Musi,

Paleru and Manneru rivers in the district are favorable for filter points down to 15.0m depth. Discharge varying from 302.4m^3/day to 561.6m^3/day but the quality of water is slightly brackish. The quality of water is mostly saline.

4.2 Water Level Scenario

The depth to water level during pre monsoon season (May, 2012) in the district ranges between 1.09 and 8.94 m bgl. Shallow water levels less than 2 m bgl occur in the north eastern parts of the district; whereas water levels more than 5 m bgl zone occur in western parts of the district (Fig. 5). The depth to water level during post monsoon season (Nov, 2012) in the district ranges between 0.07 to 14.80 m bgl (Fig. 6). Whereas water levels less than 2 m bgl occur in eastern parts of the district.

Long-term trend of water levels (2002 to 2011) indicates that, rise in water levels in the range of 0.0020 to 0.11 m/yr during pre-monsoon where as fall is in the range of 0.0022 to 0.3365 m/yr. During post monsoon period water level rise varies from 0.0028 to 0.1924 m/yr and fall in water levels observed in the range of 0.0042 to 0.5263 m/yr.

Fig-5: Depth to Water Level – Pre monsoon (May 2012)

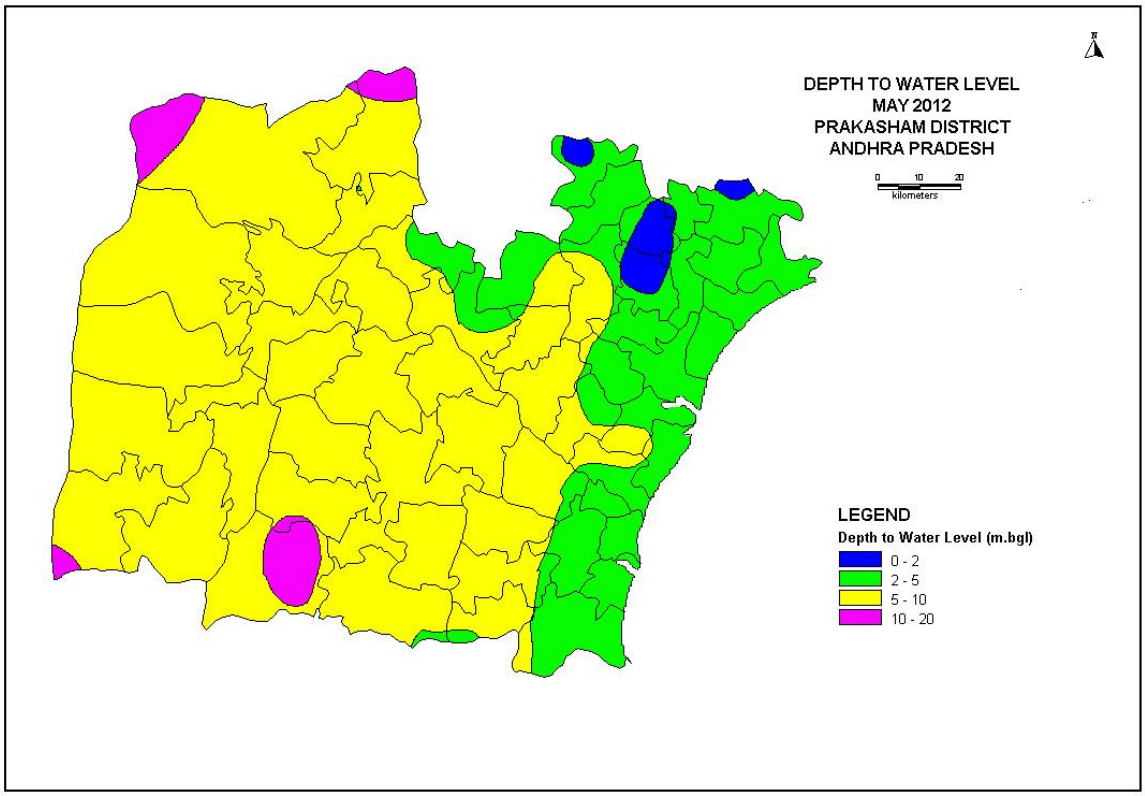
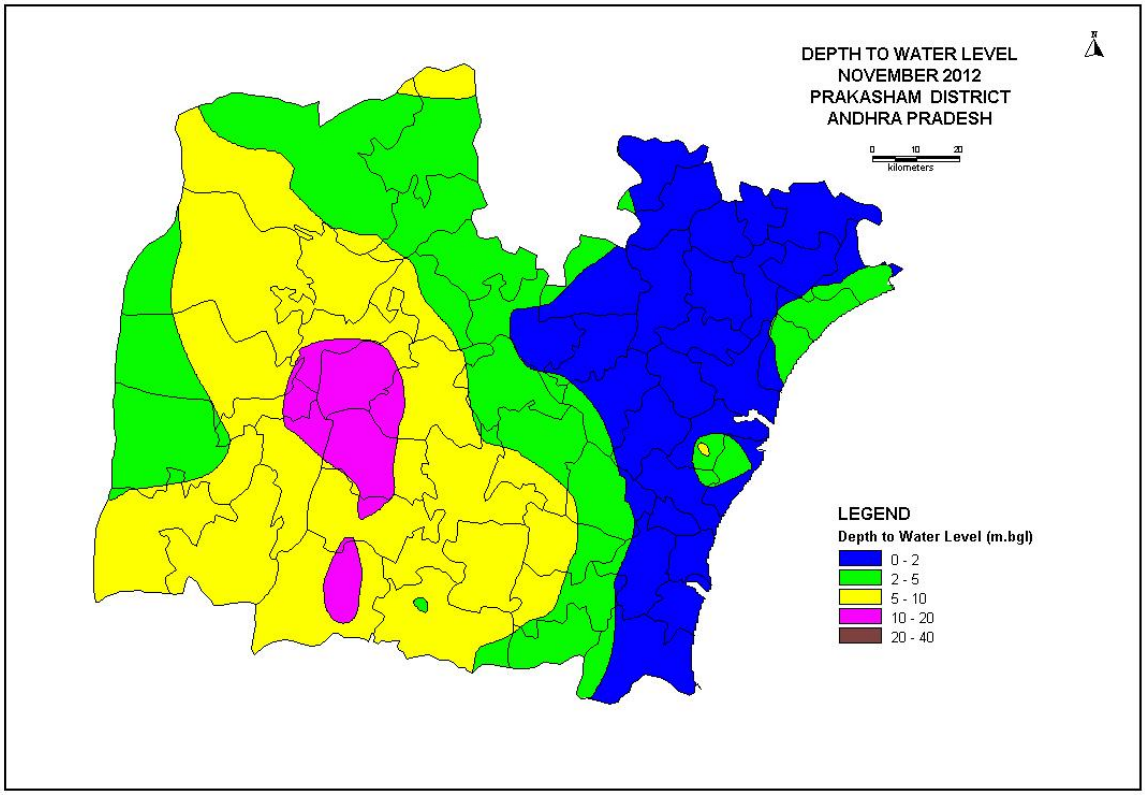


Fig-6: Depth to Water Level – Post monsoon (Nov-2012)



5.0. Ground Water Resources

5.1 Ground Water Availability

Net annual ground water availability is 80582 ha.m in the command area and 61903 ha.m in non-command area with a total of 142485 ha.m in the entire district. The gross ground water draft for all uses in the command area is in the order of 11832 ha.m whereas it is 29667 ha.m in non-command area and the total gross ground water draft for all uses in the district is 41499 ha.m. Out of this, 3513 ha.m in Command area and 5097 ha.m in non-command area with the total of 8610 ha.m in the entire district allocated to cater the domestic and industrial needs of the population in the district as on 2025. Net ground water availability for future irrigation use is 67333 ha.m in the command, 30197 ha.m in non-command area and 97530 ha.m in the entire district.

Based on the stage of development of ground water, 7 mandals are categorized as over exploited while 3 mandals comes under semi-critical category and the remaining mandals are classified as safe. Ground water resources for each mandal are presented as Table .1.

Table :1 GROUNDWATER RESOURCES - PRAKASAM DISTRICT

[in ha.m.]

Sl. No.	Administrative Unit	Sub-Unit	Net Annual Ground Water Availability	Existing gross ground water draft for all uses	Provision for domestic and industrial requirement supply to 2025	Net ground water availability for future irrigation development	Stage of ground water development	Category
1	2	3	4	5	6	7	8	9
1	Addanki	Command	6240	772	160	5371	12	Safe
		NC	0	0	0	0	0	
		Poor Quality	0	0	0	0	0	
		Total	6240	772	160	5371	12	Safe
2	Ardhaveedu	Command	0	0	0	0	0	
		NC	1421	1015	459	0	71	Semi-Critical
		Poor Quality	0	0	0	0	0	
		Total	1421	1015	459	0	71	Semi-Critical
3	Ballikurava	Command	5010	310	116	4629	6	Safe
		NC	463	49	44	392	11	Safe
		Poor Quality	0	0	0	0	0	
		Total	5473	359	160	5021	7	Safe
4	Bestavaripeta	Command	0	0	0	0	0	
		NC	1277	1308	56	0	102	Over Exploited
		Poor Quality	0	0	0	0	0	
		Total	1277	1308	56	0	102	Over Exploited
5	C.S.Puram	Command	0	0	0	0	0	
		NC	2018	937	148	994	46	Safe
		Poor Quality	0	0	0	0	0	
		Total	2018	937	148	994	46	Safe
6	Cheemakurthy	Command	3302	919	187	2266	28	Safe
		NC	0	0	0	0	0	Safe
		Poor Quality	0	0	0	0	0	
		Total	3302	919	187	2266	28	Safe
7	Chinaganjam	Command	157	1	16	141	1	Safe
		NC	470	196	112	186	42	Safe
		Poor Quality	147	0	0	0	0	
		Total	627	197	128	327	31	Safe
8	Chirala	Command	7052	583	428	6334	8	Safe
		NC	0	0	0	0	0	
		Poor Quality	0	0	0	0	0	
		Total	7052	583	428	6334	8	Safe
9	Cumbum	Command	0	0	0	0	0	
		NC	795	505	226	97	64	Safe
		Poor Quality	0	0	0	0	0	
		Total	795	505	226	97	64	Safe
10	Darsi	Command	4882	893	125	3920	18	Safe
		NC	867	367	45	568	42	Safe
		Poor Quality	38	0	0	0	0	
		Total	5749	1260	170	4488	22	Safe
11	Donakonda	Command	455	124	21	326	27	Safe
		NC	1021	327	92	660	32	Safe
		Poor Quality	0	0	0	0	0	
		Total	1476	451	113	986	31	Safe

Sl. No.	Administrative Unit	Sub-Unit	Net Annual Ground Water Availability	Existing gross ground water draft for all uses	Provision for domestic and industrial requirement supply to 2025	Net ground water availability for future irrigation development	Stage of ground water development	Category
12	Dornala	Command	0	0	0	0	0	
		NC	739	892	30	0	121	Over Exploited
		Poor Quality	0	0	0	0	0	
		Total	739	892	30	0	121	Over Exploited
13	Giddaluru	Command	0	0	0	0	0	
		NC	2179	2324	131	0	107	Over Exploited
		Poor Quality	0	0	0	0	0	
		Total	2179	2324	131	0	107	Over Exploited
14	Gudluru	Command	0	0	0	0	0	
		NC	2373	1217	158	1041	51	Safe
		Poor Quality	0	0	0	0	0	
		Total	2373	1217	158	1041	51	Safe
15	Hanumanthunipadu	Command	0	0	0	0	0	
		NC	2632	1270	112	1319	48	Safe
		Poor Quality	0	0	0	0	0	
		Total	2632	1270	112	1319	48	Safe
16	Inkollu	Command	1413	102	110	1235	7	Safe
		NC	0	0	0	0	0	Safe
		Poor Quality	388	0	0	0	0	
		Total	1413	102	110	1235	7	Safe
17	J.Panguluru	Command	4597	400	109	4159	9	Safe
		NC	47	24	23	0	51	Safe
		Poor Quality	132	0	0	0	0	
		Total	4644	424	132	4159	9	Safe
18	Jarugumalli	Command	0	0	0	0	0	
		NC	1576	388	124	1115	25	Safe
		Poor Quality	0	0	0	0	0	
		Total	1576	388	124	1115	25	Safe
19	Kandukuru	Command	0	0	0	0	0	
		NC	2185	453	276	1493	21	Safe
		Poor Quality	0	0	0	0	0	
		Total	2185	453	276	1493	21	Safe
20	Kanigiri	Command	0	0	0	0	0	
		NC	2932	1737	168	1177	59	Safe
		Poor Quality	0	0	0	0	0	
		Total	2932	1737	168	1177	59	Safe
21	Karamchedu	Command	0	17	12	0	0	
		NC	0	0	0	0	0	
		Poor Quality	1461	0	0	0	0	PQ
		Total	0	17	12	0	0	PQ
22	Komarole	Command	0	0	0	0	0	
		NC	1016	827	115	131	81	Semi-Critical
		Poor Quality	0	0	0	0	0	
		Total	1016	827	115	131	81	Semi-Critical
23	Konakanamitla	Command	0	0	0	0	0	
		NC	2710	718	143	1916	26	Safe
		Poor Quality	0	0	0	0	0	
		Total	2710	718	143	1916	26	Safe

Sl. No.	Administrative Unit	Sub-Unit	Net Annual Ground Water Availability	Existing gross ground water draft for all uses	Provision for domestic and industrial requirement supply to 2025	Net ground water availability for future irrigation development	Stage of ground water development	Category
24	Kondepi	Command	0	0	0	0	0	
		NC	1651	200	81	1394	12	Safe
		Poor Quality	0	0	0	0	0	
		Total	1651	200	81	1394	12	Safe
25	Korisapadu	Command	2381	149	75	2191	6	Safe
		NC	413	74	68	294	18	Safe
		Poor Quality	0	0	0	0	0	
		Total	2794	223	143	2485	8	Safe
26	Kothapatnam	Command	3426	1035	161	2283	30	Safe
		NC	0	0	0	0	0	
		Poor Quality	104	0	0	0	0	
		Total	3426	1035	161	2283	30	Safe
27	Kurichedu	Command	1674	169	62	1480	10	Safe
		NC	421	66	23	353	16	Safe
		Poor Quality	0	0	0	0	0	
		Total	2095	235	85	1833	11	Safe
28	LingaSamudram	Command	0	0	0	0	0	
		NC	1835	340	135	1453	19	Safe
		Poor Quality	0	0	0	0	0	
		Total	1835	340	135	1453	19	Safe
29	Maddipadu	Command	638	127	57	474	20	Safe
		NC	533	104	90	359	20	Safe
		Poor Quality	41	0	0	0	0	
		Total	1171	231	147	833	20	Safe
30	Markapuram	Command	0	0	0	0	0	
		NC	1312	1452	100	0	111	Over Exploited
		Poor Quality	0	0	0	0	0	
		Total	1312	1452	100	0	111	Over Exploited
31	Marripudi	Command	0	0	0	0	0	
		NC	2784	614	125	2077	22	Safe
		Poor Quality	0	0	0	0	0	
		Total	2784	614	125	2077	22	Safe
32	Martur	Command	4276	931	39	3522	22	Safe
		NC	77	17	63	0	22	Safe
		Poor Quality	0	0	0	0	0	
		Total	4353	948	102	3522	22	Safe
33	Mundlamur	Command	6482	1252	149	5215	19	Safe
		NC	0	0	0	0	0	
		Poor Quality	0	0	0	0	0	
		Total	6482	1252	149	5215	19	Safe
34	N.G.Padu	Command	268	5	24	241	2	Safe
		NC	1359	126	214	1070	9	Safe
		Poor Quality	166	0	0	0	0	
		Total	1627	131	238	1311	8	Safe
35	Ongole	Command	1150	306	507	447	27	Safe
		NC	0	0	0	0	0	
		Poor Quality	850	0	0	0	0	
		Total	1150	306	507	447	27	Safe

Sl. No.	Administrative Unit	Sub-Unit	Net Annual Ground Water Availability	Existing gross ground water draft for all uses	Provision for domestic and industrial requirement supply to 2025	Net ground water availability for future irrigation development	Stage of ground water development	Category
36	P.C.Palli	Command	0	0	0	0	0	
		NC	2717	986	105	1694	36	Safe
		Poor Quality	0	0	0	0	0	
		Total	2717	986	105	1694	36	Safe
37	Pamuru	Command	0	0	0	0	0	
		NC	2754	753	166	1930	27	Safe
		Poor Quality	0	0	0	0	0	
		Total	2754	753	166	1930	27	Safe
38	Parchur	Command	939	59	80	817	6	Safe
		NC	0	0	0	0	0	
		Poor Quality	1030	0	0	0	0	
		Total	939	59	80	817	8	Safe
39	Peddaraveedu	Command	0	0	0	0	0	
		NC	1203	1260	49	0	105	Over Exploited
		Poor Quality	0	0	0	0	0	
		Total	1203	1260	49	0	105	Over Exploited
40	Podili	Command	0	0	0	0	0	
		NC	2083	623	163	1376	30	Safe
		Poor Quality	0	0	0	0	0	
		Total	2083	623	163	1376	30	Safe
41	Ponnaluru	Command	0	0	0	0	0	
		NC	2179	347	127	1762	16	Safe
		Poor Quality	0	0	0	0	0	
		Total	2179	347	127	1762	16	Safe
42	Pullacheruvu	Command	1976	441	27	1529	22	Safe
		NC	1939	1198	186	635	62	Safe
		Poor Quality	0	0	0	0	0	
		Total	3915	1639	213	2164	42	Safe
43	Racherla	Command	0	0	0	0	0	
		NC	1199	1412	43	0	118	Over Exploited
		Poor Quality	0	0	0	0	0	
		Total	1199	1412	43	0	118	Over Exploited
44	S.N.Padu	Command	2120	138	155	1861	7	Safe
		NC	203	53	16	135	26	Safe
		Poor Quality	99	0	0	0	0	
		Total	2323	191	171	1996	8	Safe
45	Santamaguluru	Command	6340	519	138	5790	8	Safe
		NC	0	0	0	0	0	
		Poor Quality	0	0	0	0	0	
		Total	6340	519	138	5790	8	Safe
46	Singarayakonda	Command	0	0	0	0	0	
		NC	1093	187	109	877	17	Safe
		Poor Quality	0	0	0	0	0	
		Total	1093	187	109	877	17	Safe
47	Tallur	Command	3650	937	86	2684	26	Safe
		NC	0	0	0	0	0	
		Poor Quality	0	0	0	0	0	
		Total	3650	937	86	2684	26	Safe

Sl. No.	Administrative Unit	Sub-Unit	Net Annual Ground Water Availability	Existing gross ground water draft for all uses	Provision for domestic and industrial requirement supply to 2025	Net ground water availability for future irrigation development	Stage of ground water development	Category
48	Tanguturu	Command	1260	101	70	1109	8	Safe
		NC	837	91	131	634	11	Safe
		Poor Quality	342	0	0	0	0	
		Total	2097	192	201	1743	9	Safe
49	Tarlupadu	Command	0	0	0	0	0	
		NC	1321	1049	107	199	79	Semi-Critical
		Poor Quality	0	0	0	0	0	
		Total	1321	1049	107	199	79	Semi-Critical
50	Tripurantakam	Command	4460	663	174	3701	15	Safe
		NC	398	273	29	124	69	Semi-Critical
		Poor Quality	0	0	0	0	0	
		Total	4858	936	203	3825	19	Safe
51	Ulavapadu	Command	0	0	0	0	0	
		NC	1686	1403	229	103	83	Safe
		Poor Quality	0	0	0	0	0	
		Total	1686	1403	229	103	83	Safe
52	V.V.Palem	Command	0	0	0	0	0	
		NC	2293	526	112	1693	23	Safe
		Poor Quality	0	0	0	0	0	
		Total	2293	526	112	1693	23	Safe
53	Veligandla	Command	0	0	0	0	0	
		NC	1958	947	113	946	48	Safe
		Poor Quality	0	0	0	0	0	
		Total	1958	947	113	946	48	Safe
54	Vetapalem	Command	6038	784	381	5340	13	Safe
		NC	0	0	0	0	0	
		Poor Quality	0	0	0	0	0	
		Total	6038	784	381	5340	13	Safe
55	Y.Palem	Command	0	0	0	0	0	
		NC	934	999	38	0	107	Over Exploited
		Poor Quality	0	0	0	0	0	
		Total	934	999	38	0	107	Over Exploited
56	Yaddanapudi	Command	396	95	44	268	24	Safe
		NC	0	13	13	0	0	
		Poor Quality	525	0	0	0	0	
		Total	396	108	57	268	27	Safe
District Total		Command	80582	11832	3513	67333	15	
		NC	61903	29667	5097	30197	48	
		Poor Quality	5323	0	0	0	0	
		Total	**142485**	**41499**	**8610**	**97530**	**29**	

5.2. Ground Water Quality

The electrical conductivity values ranges from 403 to 8350 (May, 2010) µ/cm at 25°C. It is observed that the coastal areas, north, south eastern parts of the district is characterised by high electrical conductivity more than 1500 to 8350 µ/cm at 25°C (Parchuru). The chloride concentration in the phreatic aquifer is within the permissible limit except parchuru where the value of chloride is noticed 2155 mg/litre. The Nitrate concentration of about 45 mg/litre is desirable for drinking water standards but in case no alternative source of water is present Nitrate upto 100 mg litre is permissible. The chemical pollution by way of applying nitrogenous fertilizers in the agricultural sector is the root cause of high nitrate pollution in ground water. At Guttalamadivaram, Uppagunguru, Tanguturu, Donakonda, Kadavakuduru, Chandaluru, C.S.Puram and Ulavapadu high nitrate in the ground water is noticed. The presence of high nitrate in drinking water causes infantilemethinoglobinema in children and few adults leading to impure blood formation.

High fluoride concentration of above 1.5 mg/litre in ground water used for drinking purposes for long time causes, dental carries and skeletal deformation. The high fluoride concentration, more than 1.5 mg/litre, is recorded in the shallow ground water at Santhala Moguluru, Guttala madivaram, Vemulapadu, Podili, Kanigiri, Vengayyapalem, Malakonda, Gollapalli, Pasupugallu, Pallamalla, Chandalur, Markapur, where the fluoride concentration ranges from 1.60 (Gollapalli) to 8.60 mg/litre (Kanigiri).

The suitability of groundwater for irrigation based on the Sodium Absorption Ratio-SAR shows that the water is suitable for irrigation purpose as the values are in the range of 0.9 to 16.8 and falls in good, and good to permissible categories, except at Santhala moguluru, Guttala madivaram where the values of SAR are 24.9 and 24.8 respectively.

In general the quality of ground water in shallow aquifers is good and suitable for domestic, industrial and irrigation purposes except at few localities in isolated places, which is due to localised pollution. In majority of the alluvial areas the quality of ground water down to a maximum depth of 25 m bgl is suitable for domestic, industrial and irrigation purpose except in the area immediately adjoining the coast where major chemical constituents are above the maximum permissible limits and not suitable for domestic, industrial and irrigation purposes. In alluvial aquifers the deeper aquifers are invariably saline.

6.0 Status of Ground Water Development

6.1 Drinking water supply schemes

Ground water forms the main source for drinking water supply schemes in Prakasam district. The protected water supply schemes and defluoridisation plants are maintained by Panchayat Raj Department of Government of Andhra Pradesh. The ground water forms the main source of supply for drinking water schemes in both rural and urban areas of district. There are about 397 public water supply schemes, 25490 bore wells, 101 open wells and 1061 other sources of supply thus, covering 2342 inhabited villages in 56 mandals of the district catering to the drinking water

needs of the district. As many as 228 villages are identified as fluoride problem villages.

In the semi-consolidated rocks comprising Tirupathi and Rajahmundry sandstone formation the dug wells range in depth from 4.0 to 20.0 m bgl with 2.50 to 8.0 m dia. Most of the dug wells for irrigational purposes tap deeper confined aquifers by means of bores from the bottom of the wells. Dug-cum-bore wells and tube wells in confined aquifers range in depth between 27 and 80 m bgl. The dug-cum-bore wells yield 6.0 lps on an average for a draw down of about 4.0 m. The deep tube wells range in depth from 92 to 225 m bgl with yields varying from 6 to 30 lps for a draw down of 2.0 to 30 m. The confined aquifers occurring between 25 and 60 m and below were tapped in many tube wells in the area south of Kondaguntur, west of the district between Punyakshetram, Chintada, Annavaram and between Kadiyam and Dwarapudi and the most important confined aquifers occur between Kadiyam and Bikkavolu below 105 m bgl.

In the unconsolidated formation comprising coastal and deltaic river alluvium and wind blow sand deposits the ground water is developed mostly through dug wells ranging in depth from 3.0 to 11.0 m bgl. with 1.00 to 3.50 m bgl and the dia. of irrigation dug wells varies from 4.50 to 8.50 meters with 1.5 to 5.0 lps. However, the depth of fresh water aquifers varies considerably from place to place. In the different boreholes drilled in alluvium formation continuous sequence of sand silt with clay have been encountered at various depth down to a maximum drilling depth of 200 m bgl. and depth of fresh water aquifers varies considerably from place to place. Exploratory drilling at Vanampalli, Devarapally, Ambajipeta, Magam, P.Gannavaram and Jonnada have revealed the occurrence of brackish to saline water below 30 m depth at many places. In the area bordering the coast the brackish water is encountered at shallow depths.

Ground water irrigation in the district is not extensive The net area irrigated through tube wells and filter point wells is 35631 ha. and thus constituting 12.70 percent through ground water irrigation in the district. The district has urban and rural water supply schemes to provide drinking water to the people under rural water supply schemes. Villages in the district are provided with adequate drinking water facilities through 684Piped water supply schemes, 789 bore wells and 377 dug wells, and 172 other sources.

7.0. Ground Water Management Strategy

7.1. Ground Water Development

The development of ground water resources in the district can be achieved through proper scientific studies and judicious management of ground water resources through proper planning and design of wells of the area. The optimum design of wells depends on the local hydrogeological conditions, cropping pattern and also the quantum of water to be discharged. In the district dug wells and dug-cum bore wells of dimensions 3.0 to 6.0m dia and depth of 10-12m are feasible in the granite and related rocks. In limestone, sandstone, alluvium and shaly formations dug wells need masonary lining. The dug-cum-bore wells are feasible in granites, limestones, sandstones and shales, depending on the availability of fractures and weathered

zones. 100mm dia bores down to 30m from the bottom of the dug well portion of the wells are recommended.

Bore wells down to 100 to 150m depth are feasible in crystallines, shale, limestone and quartzite formations with 15 to 20m depth casing against weathered mantle to prevent caving or collapsing in the hard rock areas of the district. Tube wells of 380mm diameter down to a depth of about 100m tapping 30 to 40m saturated aquifer material in sandstone formations are feasible whereas in alluvial areas where the thickness of saturated zone exceeds 5m filter point wells of 254mm. diameter down to a depth of 15 to 20m depth are feasible.

In the coastal areas caution also should be exercised to avoid construction of wells 1 km. from coast line to prevent ingression of sea water. Because the areas adjacent to the coast extending 200 – 500m from the shore line towards landward is found to be extremely sensitive to the fluctuations of the water table and needs judicious ground water withdrawal. Ground water development in the coastal zone has to be done cautiously taking spacing norms into account especially during summer months.

7.2. Water Conservation and Artificial Recharge

Construction of artificial recharge structures like check-dams, contour trenches, percolation tanks and water conservation structures like sub-surface dykes are feasible in the areas where water levels are declining and over exploitation of ground water resources is taking place. Roof top Rainwater Harvesting is to be implemented in the Urban areas wherever deepening of water levels are taking place.

8.0. Ground Water Related Problems

8.1. Groundwater issues

In the Prakasam district due to different hydrogeological set up with complex type of structure the western, west central and north eastern hilly areas are water scarcity areas where depletion of water table is observed. In the upland areas of the district where the hard rock formation viz., granites, gneisses, shales and phyllites are encountered the depletion of water levels with approaching summer months is prevalent. Long-term trend of water levels (2002 to 2011) indicates fall in water levels in the range of 0.0022 to 0.3365 m/yr and during post monsoon period fall recorded in the range of 0.0042 to 0.5263 m/yr in the district. Based on the stage of development of ground water, 7 mandals (Bestavaripeta, Dornala, Giddaluru, Markapuram, Peddaravidu, Recherla and Y Palem) are categorized as over exploited while 3 mandals comes under semi-critical (Ardhaveedu, Komarol, Tharlapadu). The quality problem exists in all most all the mandals of the district in the upland hilly area and high coastal plains. High electrical conductivity more than 1500 to a maximum of 8350 µ/cm at 25°C (Parchuru) is observed in coastal areas, north, and south eastern parts of the district. Further, due to intensive agriculture practices with application of more and more fertilizers to soil and pesticides and its subsequent leaching effects into the sub soil water zones, ground water is found to contain high nitrates as seen at Guttalamadivaram, Uppagunguru, Tanguturu,

Donakonda, Kadavakuduru, Chandaluru,C.S.Puram and Ulavapadu areas as local pockets. The high fluoride concentration, more than 1.5 mg/litre is recorded in the shallow ground water at Santhala moguluru, Guttala madivaram, Vemulapadu, Podili, Kanigiri, Vengayyapalem, Malakonda, Gollapalli, Pasupugallu, Pallamalla, Chandalur, Markapur, where the fluoride concentration ranges from 1.60 (Gollapalli) to 8.60 mg/litre (Kanigiri). Poor quality areas are exist in parts of 12 mandals viz., Chinaganjam, Darsi, J.Pongaluru, Puruchuru, Inkollu, Yaddanapudi, Kothapatnam, N.G.Padu, Ongole, S.M.Padu, Tanguturu, Maddipadu and entire mandal of Karamchedu. Besides the proper development of ground water potential in the district stress is also laid on its management and conservation, so the feasibility of ground water harvesting through various artificial recharge schemes is to be explored.

8.2. Awareness and Training Activity

Training Programme on Rain Water Harvesting was organized in the district on 19th & 20th March, 2004 at Ongole to educate different state Govt. Departmental officers, NGOs, etc., on necessity and feasibility of Rain Water Harvesting in water scarcity areas.

8.3. Areas Notified by CGWA/ SGWA

49 villages have been notified.

9.0 Conclusions

1. The scope for further development of ground water in the district varies widely from place to place. Scientific and judicious development and management of available water resources will contribute to the overall planned development in improving the economy of the district.

2. The ground water development along the coastal plains of the district have to be carried out judiciously by installing low capacity pumps as the thickness of fresh water aquifer is limited and also due to high tide effects the areas adjacent to coastal streams are effected by salinity problems. Therefore only shallow wells have to be constructed away from the coastal streams, so that they can supply fresh water in summer.

3. In order to monitor the movement of fresh water saline water interface advancing towards in land in due course of movement with rapid ground water development along the coast, it is necessary for construction of piezometers perpendicular to the coastline to monitor the water level and chemical quality of waters.

4. In the crystalline areas of the district site selection should be based on the topography, lineaments, hydrogeology and geophysical studies. This will limit the failure of wells and also the optimum design and spacing norms for dug wells and tube wells based on the designed discharge for economically viable

command area and cropping pattern should be scrupulously followed by the financing institutions to avoid the over capitalization.

5. In the crystalline rocks area wherever the joints and fractures are present in the dug well section by putting vertical/horizontal and inclined radial bores along these joint and fracture planes will augment the dug well yields considerably. Similarly in the alluvial sands of limited thickness of 6 – 9 meters, a double point bore well fitted to single centrifugal pumps has an added advantage with sustained pumpage rather than an individual bore well.

6. In the areas where the ground water potential is limited modern irrigation methods like drip and sprinkler irrigation should be adopted to increase the command area of the well.

7. In the district wherever canal irrigation is prevalent, in such areas conjunctive use of surface and ground water will augment the irrigation potential and reduce the problems like salinity, water logging and related problems in command areas.

8. The aquaculture is developing very fast in the coastal area and it should be restricted to coastal plains only and the practice of conversion of agricultural land for aqua cultural farming should be stopped in order to avoid the pollution of fresh water aquifers in the area.

9. Under integrated watershed development programme the district may be divided into small water sheds and taking up multi disciplinary studies like Hydrogeology, agriculture and Agronomy for the comprehensive development of the area without creating any environmental disturbance.

10. There is a need to organize Mass Awareness Programme at village level to educate farmers through lectures and field demonstrations with the help of audio visual aids about the necessity of water management.

11. Based on the present stage of ground water development 7 mandals falls under over exploited, 3 mandals under semi-critical category. A total number of 98 villages in different mandals come under over exploited category. In these villages ground water usage is to be restricted and further development may be stopped. Rain Water Harvesting Structures like check dams, percolation tanks and roof top rain water harvesting structures should be encouraged in over exploited semi-critical areas.