

**GROUND WATER MANAGEMENT – A CASE STUDY ON ELECTRICAL
SUBSTATION UNIT OF YELESWARAM MANDAL OF EAST GODAVARI
DISTRICT IN ANDHRA PRADESH**

N.Gopi, Assistant Executive Engineer,
I&CAD Department,
Government of Andhra Pradesh,
India

M.Sreedevi, Assistant Executive Engineer,
I&CAD Department,
Government of Andhra Pradesh,
India

B.K.Nageswara Rao, Deputy Executive Engineer,
I&CAD Department,
Government of Andhra Pradesh,
India

K.Siddartha Kumar, Consultant
Sphurthi Entrepreneurs & Technocrats
Rajahmundry, Andhra Pradesh
India

Keywords

Ground Water, Electricity, Irrigated Ayacut, Efficient Management Methods.

Synopsis

Ground water is a vital resource for upland Irrigation and also drinking water for rural areas in India. As per the Environmental Sustainability Index 2011, “India is the largest Ground Water user in the World, with an estimated usage of around 230 cubic kilometres per year, more than a quarter of the Global total”. This is an alarming situation and hence there is a necessity to study the actual scenario of the Ground water usage.

In Andhra Pradesh, East Godavari District is located in the Coastal Region having Geographical area of 26.74 Lakh Acres (10.821 Lakh Hact). In this area, only 13.54 Lakh Acres area is suitable for cultivation and 9.12 Lakh Acres is being irrigated in East Godavari District. Out of 9.12 Lakh Acres, only 6.39 Lakh Acres is having Irrigation facilities. The details are given below.

S.No.	Source of Irrigation	Irrigated Area (Lakh Acres)
1	Major & Medium Irrigation Projects	4.38
2	Minor Irrigation Tanks	0.67
3	Wells & Pumps	1.34
	TOTAL	6.39

Ground Water utilization mainly carried out by using the submersible pumps and deep drilling technology. Drawing Ground water from the deep wells requires consumption of High amount of Electricity. Electricity is another limited resource. The exploitation of Ground Water is resulting in failure of bores laid earlier at lesser depths and over utilization of Electricity by deep wells.

This paper deals with the detailed study of Ground Water Utilization in a particular substation in East Godavari District under the jurisdiction of Andhra Pradesh Eastern Power Distribution Corporation Limited (APEPDCL). This study deals with the total utilization of Electricity, utilization of Ground Water, Irrigated ayacut, Cropping pattern, Average yield of the crops and suggestions on the efficient management methods.

1.0 INTRODUCTION:

Surface Water and Ground Water are the two important resources for Irrigation. Surface Water availability mainly depends on the annual rainfall of catchment area. If the rainfall is less than that of average rainfall, surface flows are less than that the expected flows, resulting in reduction of Water Storage Capacity of the Reservoirs in the Catchment area. Sedimentation is another important consideration that affects the storage capacity of the Reservoir. The above two main parameters along with the other parameters influences the supply of the water to the tail end ayacut from surface irrigation sources.

Andhra Pradesh has a total Geographical area of 2,75,045 sq.km and it is situated in a tropical regions between 13° N to 20° N and longitudes 77° E to 85° E. The State and comprises of 23 Districts has a long coast line of 960 Km. In Andhra Pradesh water utilisation from surface sources (Rivers) is 1765 TMC out of total yield of 2764.5 TMC and it Irrigates 62.60 lakh Hactares against cultivable area of 157.78 lakh Hactares. About 70 % of the population depends on the agriculture. In Andhra Pradesh annual available Ground Water is 3.11 million ha.m and 1.20 million ha.m ground water is utilised for irrigation and 0.21 million ha.m is used for industrial and domestic purposes.

In Andhra Pradesh, East Godavari district located in the coastal region having geographical area of 26.74 Lakh acres. Out of this, only 13.54 Lakh Acres area is suitable for cultivation. As per the statistical report ⁽¹⁾ given by the I& CAD Dept, Andhra Pradesh, 9.12 Lakh Acres is being irrigated in the East Godavari District. Out of that, only 6.39 Lakh Acres is having Irrigation facilities. The brief details are as follows.

Table - 1

Sl.No.	Source of Irrigation	Irrigated Area (Lakh Acres)
1	Major & Medium Irrigation Projects	4.38
2	Minor Irrigation Tanks	0.67
3	Wells & Pumps	1.34
	TOTAL	6.39

This case study focuses on part command area of the Yeleswaram Reservoir in East Godavari District having an ayacut of 67,586 Acres. The command area mainly utilizing surface water coming from the Yeleswaram Reservoir. In addition to this, the ayacut also draws ground water by means of electrical pumps & motors.

The Rainfall scenario and Ground Water availability scenario in East Godavari District is tabulated as follows.

2.0 Rainfall scenario in East Godavari District:

Average Rainfall of East Godavari district: 1219 mm.

Table – 2

S.No.	Year	Actual Rainfall in mm	Deviation
1	2004 -05	873	-28%
2	2005 -06	1389	14%
3	2006 -07	1167	-04%
4	2007 -08	1404.6	15%
5	2008-09	1035.1	-15%

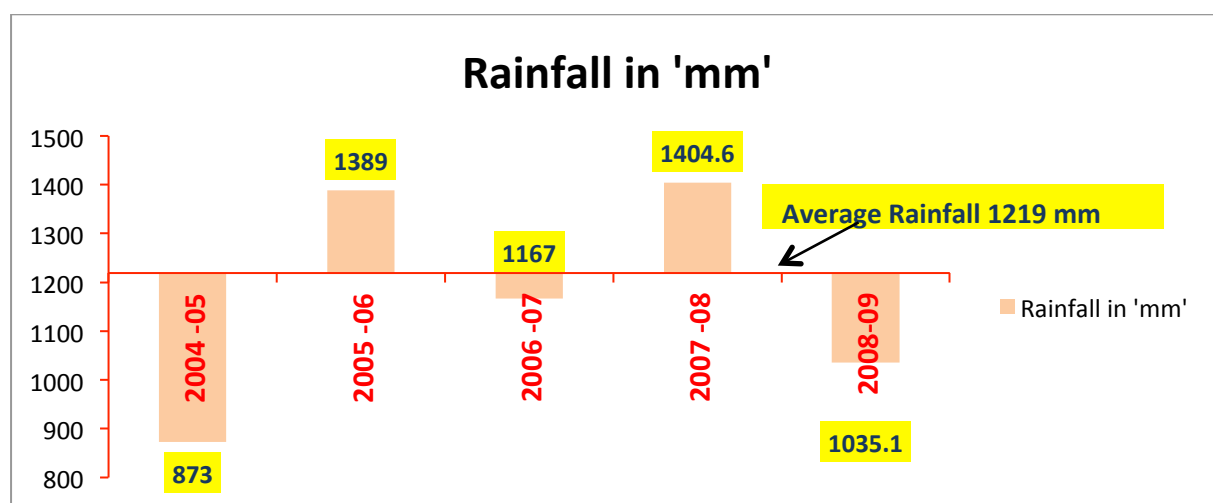


Fig-1; Rainfall data

3.0 Ground Water availability Scenario in East Godavari District:

Table - 3

S.No.	Description	Command area	Non Command Area	Total
1	Recharge area of Ground Water	2931 sq.km	2760 sq.km	5691 sq.km
2	Annual availability of Ground Water	122413 ha.m	36576ha.m	158989 ha.m
3	Ground Water used for irrigation	12754 ha.m	13499 ha.m	26253 ha.m
4	Ground Water usedfor Industrial and domestic use	8475 ha.m	5597 ha.m	14072 ha.m
5	Net Balance of Ground Water	101184 ha.m	17480 ha.m	118664 ha.m

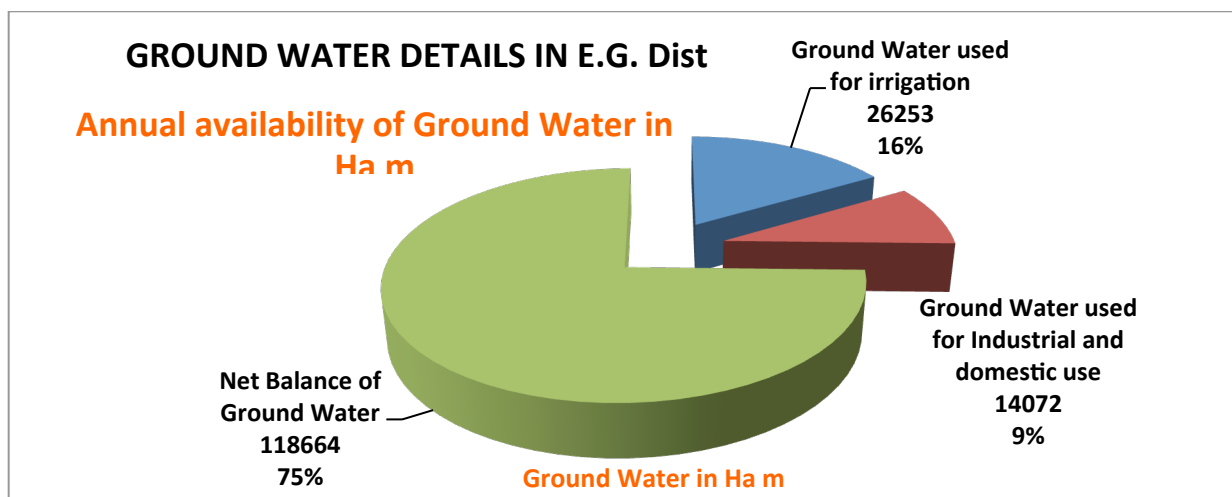


Fig-2

The annual Ground water availability in the district is 158989 ha.m in that 26253 ha.m (i.e.,16%) utilised for irrigation and 14072 ha.m (i.e., 9%) utilised for industrial and domestic purposes.

Our study mainly focused on the ground water scenario and electricity consumption for agriculture of Yeleswaram Substation Unit in East Godavari District.

Ground water exploration details of YeleswaramMandal.

Table - 4

S.No.	Description	Command Areas in ha.m	Non-Command Areas in ha.m	Total In ha.m
1	Net Ground Availability per annum	2156	986	3142
2	Ground Water Draft for Irrigation	1225	32	1257
3	Ground water Draft for all uses	1321	37	1358
4	Actual balance Ground water available for future use	835	948	1783
5	Status of Deviation	61.27%	3.76%	43.22%

(Source: Dept. of Ground Water GoAP)

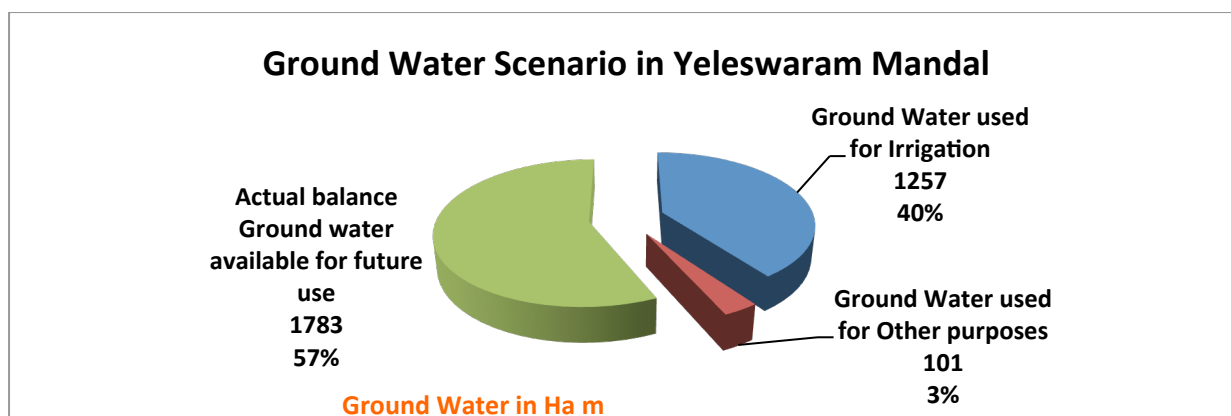


Fig-3

It is observed that, Ground Water exploration in the command areas is 61.27 % and Non- Command areas 3.76 % and over all exploration is 43.22% and it indicates in the zone of 'Safe'.

A survey conducted in the 13 Revenue Villages of Yeleswaram Mandal and required information is collected from different farmers those are using ground water as one of the source for irrigation. These details are analysed and tabulated below. The sample survey form is enclosed as Annexure –I.

Table -5

S. No.		NAME OF THE VILLAGE	NO.OF AGR. SERVICES	TOTAL LOAD IN H.P	STATUS OF DEVIATION OF G.W	VILLAGE CATEGORY
1	YELESWARAM MANDAL	BHADRAVARAM	65	499.00	64	SAFE
2		EAST LAKSHMIPURAM	72	432.50	51	SAFE
3		J. ANNAVARAM	57	350.00	21	SAFE
4		LAKKAVARAM	---	---	0	SAFE
5		LINGAMPARTHI	312	2257.50	53	SAFE
6		MARRIVEEDU	123	928.00	0	SAFE
7		PEDDANAPALLE	167	1702.50	97	CRITICAL
8		PERAVARAM	70	580.00	69	SAFE
9		RAMANAYYAPETA	41	315.00	14	SAFE
10		SIRIPURAM	138	1295.00	58	SAFE
11		TIRUMALI	218	1947.50	97	CRITICAL
12		YELESWARAM	101	820.00	80	SEMI CRITICAL
13		YERRAVARAM	238	2285.00	66	SAFE
14		FOREST			0	SAFE
		TOTAL	1602	13412		

(Source:EPDCL, GoAP & Dept. of Ground Water, GoAP)

Table -6

S.NO.	DESCRIPTION	DETAILS	REMARKS
1	NAME OF THE MANDAL	: YELESWARAM	
2	POPULATION AS PER 2011	:77,925	
3	NO.OF MINOR IRRIGATION TANKS	:7	
4	AYACUT UNDER YELESWARAM HEAD CHANNEL	:6454 ACRES	
5	AYACUT UNDER LIFT IRRIGATION SCHEME	:1200 ACRES	
6	AYACUT UNDER M.I.TANKS	:1839 ACRES	
	TOTAL	:9493 ACRES	
7	AYACUT UNDER BORE WELLS(APPROX)	:6706 ACRES	(13412/10) X 5 = 6706 ACRES
8	SURFACE WATER UTILISATION	:2.414 TMC	
9	GROUND WATER UTILISATION	:1358 ha.m	
10	TOTALGROUND WATER AVAILABILITY PER ANNUM	:3142 ha.m	
11	STATUS OF DEVITATION	:43%	
12	TOTAL NO.OF AGRL.SERVICES	:1602	
13	TOTAL LOAD IN H.P	:13412 H.P	
14	AVERAGE LOAD OF EACH AGRL.SERVICE	:8.37 H.P	
15	DEPTH OF GROUND WATER TABLE BELOW GROUND LEVEL PRESENT YEAR	:10 m	
16	DEPTH OF GROUND WATER TABLE BELOW GROUND LEVEL PREVIOUS YEAR	:10 m	
17	OBSERVED VARIATIAON OF GROUND WATER TABLE FOR THE LAST 10 YEARS	:5 m	

18	GROUND WATER EXPLORVATION CRITICAL VILLAGES	:PEDDANAPALLE, TIRUMALI	
19	GROUND WATER EXPLORATION SEMI -CRITICAL VILLAGES	: YELESWARAM	
20	GROUND WATER EXPLORATION CLOSE TO SEMI -CRITICAL VILLAGES	: PERAVARAM, YERRAVARAM	
21	AVERAGE AYACUT ON EACH SERVICE (APPROX)	:4 ACRES	
22	AVERAGE PUMP RUNNING HOURS/DAY	:5 HOURS	
23	PUMP RUNING DAYS DURING KHARIFF	:120 Days	
24	PUMP RUNNING DAYS DURING RABI	:150 DAYS	
25	TOTAL CONSUMED ELECTRICAL UNITS=270 X 5 X 13412 X 0.75	:1,35,79,650 UNITS	
26	COST OF ELECTRICITY PER YEAR (RS.5/- PER UNIT)	:Rs.6,78,98,250=00	
27	TYPE OF SOIL	:LIGHT WEIGHT LOAMY SOILS	LOCALLY IT IS CALLED 'GARUVU NELALU'
28	MAIN CROPS	:PADDY , SUGAR CANE	
29	AVERAGE ANNAUL YIELD PADDY	:1800 KGS	
30	AVERAGE ANNAUL YIELD SUGAR CANE	: 32 TONNES	

4.0 OBSERVATIONS:

1. It is observed from the Figure.1 that the rainfall is inconsistent for last 5 years, it directly affects the recharge of ground water.
2. The Ground water utilization for irrigation is about 16% in East Godavari District.
3. It is observed that in Table 1, the Ground water exploration is Critical in Tirumali and Peddanapalli Villages, Semi-Critical in Yeleswaram and close to Semi-Critical in Peravaram and Yerravaram villages. And also the average ground water level depleted rapidly by 5 m in past 10 years. It indicates an alarming situation.
4. As per the survey it is observed that, the Ayacut comes under bore wells is 6706 Acres out of 9493 acres which is 70.62% of the total ayacut.
5. Agricultural electricity services are more in the above villages are also indirectly resulting in exploitation of ground water.
6. As per the data given by the APEPDCL, Total consumed electrical units per annum for agricultural purpose in the Yeleswaram Mandal are 1,35,79,650 Which results a Cost of Rs.6,78,98,250/- per annum on average rate of Rs 5/- per Unit.
7. Also Observed 40% of the ayacut in the Mandal is sugar cane which requires more water from January to June.

5.0 Conclusions:

The study reveals that the Farmers in the Mandal are cultivating both Khariff and Rabi crops by utilising the surface water supplied from the Yeleswaram Reservoir and Ground water for Irrigation. The Critical villages can be made safe by evolving suitable scheme for utilising the surface water available nearby.

By optimum utilisation of water for Irrigation, the Ground water exploration in the villages near to critical can be reducing bringing the status of ground water exploration to safe and also saving in Electricity which is already short of requirement. Further there will be considerable savings of electricity in the other villages of Yeleswaram Mandal.

Reduction in exploration of ground water not only keeps ground water at shallow depth but also saves electricity which greatly helps for utilisation at nearby Mandals in the District.

Government may encourage the Farmers utilising less electricity by depositing savings in the electricity bills to their bank accounts directly based on the electricity utilisation in the present year in comparison with their previous year's electricity utilisation. This will help indirectly to overcome the electricity crisis in the state.

Annexure-I

SAMPLE SURVEY FORM

Name of the Village:

S.No.	Description	Details	
1	Name of the Farmer	:	
2	Source for the Irrigation	: Surface Water/Ground Water	
3	Type of Bore Well	: Dug Well/ Shallow Tube Well/Deep Tube Well	
4	Depth of Ground Water Present Year/Previous Year(in M)	:	:
5	Observed Variation of Ground Water in Last 10 years(in M)	:	
6	Pump Capacity in H.P(Load of the Motor)	:	
7	Total extent of land in Acres	:	
8	Type of Soil	: Black Cotton/Red soil/Light weight Soil	
		Khariff	Rabi
9	Pump Running Hours	:	:
10	Extent of land Irrigated by using the Source	:	:
11	Type of Crop	:	:
12	Average Annual Yield In Quintals	:	:

Other information:

References:

1. I & CAD Department (2010). Water Resources Statistical abstract, Andhra Pradesh.
2. Central Ground Water Board (2012). Ground water Year Book – India, 2011 -12.
3. IFMR Research, Centre for Development and Finance, Environmental sustainability Index 2011, Environmental sustainability: Andhra Pradesh
4. WASH COST – CESS Working Paper No.3, Ground Water scenario in Andhra Pradesh, from www.cess.ac.in
5. Directorate of Economics and Statistics, GoAP
6. Department of Ground Water, GoAP
7. Eastern Power Distribution Corporation Limited, GoAP
8. Department of Irrigation & CAD, GoAP

Acknowledgments:

The authors acknowledge the sources of information presented in the paper.