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International Journal of Current Research
Vol. 6, Issue, 08, pp.7816-7821, August, 2014

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

ASSESSMENT OF DEPTH TO GROUNDWATER LEVELS (DTW)IN KALYANDURG AREA OF ANANTAPUR DISTRICT, ANDHRA PRADESH, INDIA USING GEOSPATIAL TECHNIQUES

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ARTICLE INFO

Article History:
Received 20th May, 2014
Received in revised form
15th June, 2014
Accepted 17th July, 2014
Published online 06th August, 2014

Key words:

Groundwater,
DTW,
Samples,
Andhra Pradesh.

ABSTRACT

The present paper examines the Depth to Groundwater levels and stage of the groundwater development in the study area of Kalyandurg, Anantapur District of Andhra Pradesh. The Depth to Water levels (DTW) for pre and post monsoon period of 2000 and 2012 year assessed. For this study Groundwater Samples collected for 6 locations in the study area from Groundwater department, Anantapur, A.P, the study has found that the depth to water level of pre (May) and Post Monsoon (Nov) period of 2000 observed deep water levels 10.36 and 12.55 m (bgl) in Setturu and Shallow groundwater zones is observed at Vepulaparthi 3.75 m (bgl) Golla 4.54 m (bgl) in Kalyandurg mandal, at the same time for 2012 water level depth has been increased compare to 2000. Deep water levels 12.86 m (bgl) and 16.79 m (bgl) in Setturu and shallow groundwater levels observed in Golla 2012m (bgl) and 4.96 m (bgl) for pre and post monsoon period of 2012. Present's Stage of ground water development in the study area as estimated by the A.P.Groundwater Department collected this data and analyzed, ground water development has reached the critical or overexploited Stage in two thirds of the villages in the study area.

INTRODUCTION

Groundwater is a replenish able and dynamic natural resource widely distributed on the earth. Infact the largest source of fresh water lies underground and it accounts for 97 per cent of the fresh water if glaciers are excluded. The arid and semi-arid regions depend upon more ground water for major part of the water requirements. The available ground water has to be investigated and developed on scientific lines. The challenges to facilitate the livelihoods of any region to adopt a judicial and scientific utilization of land and water resources for a sustainable well-being are huge, diversified, quite complex and dynamics. The major problems like over-exploitation, under-utilization and miss-utilization of water resources are presented in one way or other as the significant regional claims and conflicts and ultimately leading to jeopardizing the local environment from micro to macro spatial levels. In view of these problems, spatial understanding and analysis of water resource use for human welfare with environmental safeguards seems to be a paramount need now. Ground water study is multi-disciplinary in approach and knowledge of different disciplines such as Hydrometeology, Hydrology, Geology, Geophysics, Hydrologeology, Engineering, well hydraulics and chemistry is necessary for its evaluation and development. As different factors like morphology, slope, drainage pattern, rock type, attitude of the rock, joint patterns and texture and structure control, the occurrence and distribution of ground water, a detailed study of these aspects is made here with the help of geological and topographical maps and high resolution satellite images. Material from the reports of the State and Central Ground water Department is also used. In this contest about wells distribution, use, other well statistics and domestic water. The Kalyandurg area has been selected for this study because a) it falls in the backward region of Rayalaseema, which has been experiencing droughts and famines for several decades, at the same time India's second lowest Rainfall was recorded at Hagiri Valley is located in this region. b) it has diversified landforms. C) The easy availability of remotely sensed data and other socio-economic data.

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Study area

The present Study area of Kalyandurg, consisting of Kalyandurg, Brahmasamudram and Settur Mandals of Ananthapur district of Andhra Pradesh. Lies between 14^0 17' and 14^0 40' north latitude and 76^0 50' and 77^0 24' east longitude. It is located in the middle of the peninsular region and is confined to southwestern part of Andhra Pradesh. It is bounded by Gummagatta, Beluguppa, Atmakur, Kanaganapalli and Kambadur Kundurphi mandals of the same district and western side bounded by Karnataka state. The total geographical area of the study area is 1101.25 Sq Km.,

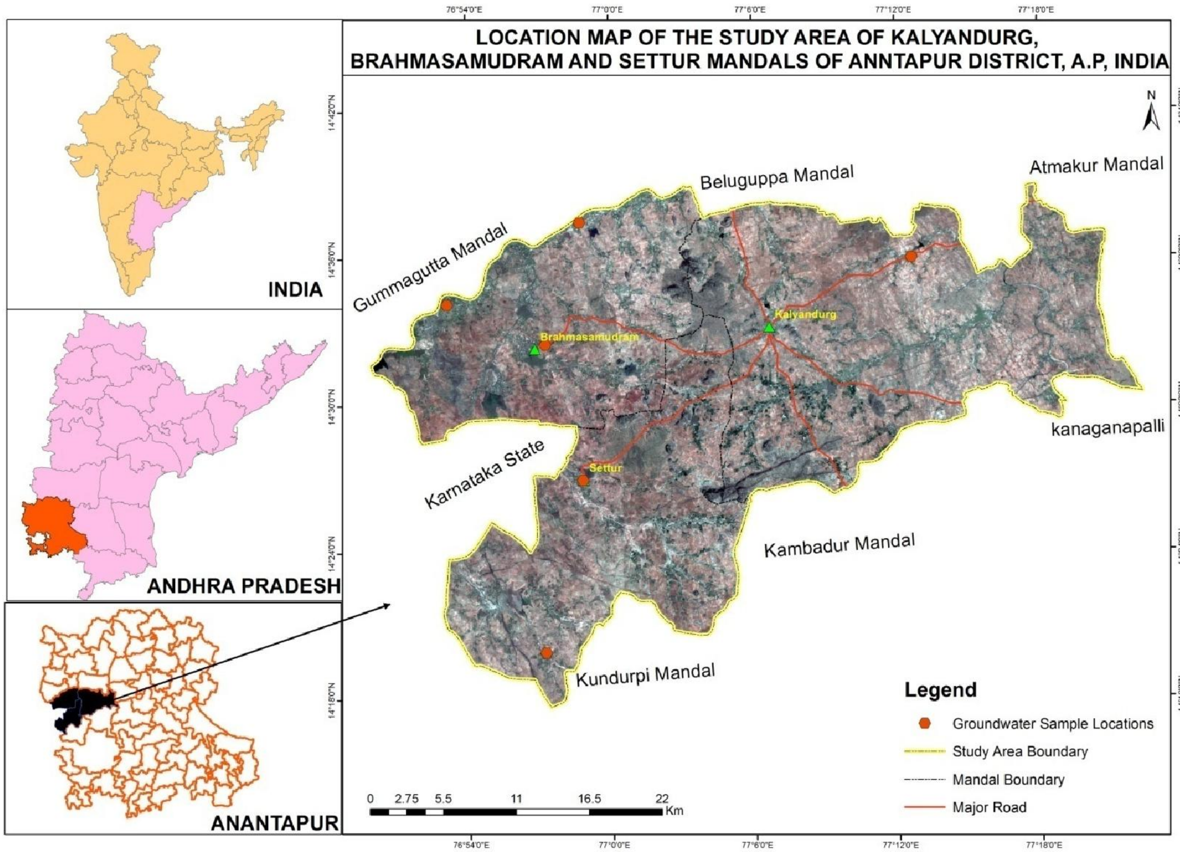

Fig 1. Location Map of the Study Area of Kalyandurg

According to 2011 census the total population is 1, 76,297 of which urban population is 32,335 (18 %), with literacy rate of 60.92 % and the sex ratio of total population is 964. Kalyandurg area is the most chronicle drought prone part and also the most backward area located on western side of Anantapr district. Annual temperatures vary between 21 and 42^{O}C. In summer, temperatures will reach up to 42^{O}C for three months from March to May. Annual average rain fall varies between 370 m.m. and 760 m.m. Soil cover in the study area is predominantly red loamy soils followed by black soils and alluvial soils. Natural vegetation is very thin and scanty and mostly thorn scrub jungle type. The terrain is largely undulating and closely disclosing the characteristic feature of plateau topography.

DATA BASE AND METHODOLOGY

In the present study an application of geospatial technologies like Remote sensing and GIS techniques is vigorous for assessment of water resources in the present study area.

REMOTE SENSING

Remote sensing is the process of sensing and measuring objects from a distance without directly coming physically into contact with them. This technique employs a sensor, positioned on a platform, which detects and records data from one or more bands within the electromagnetic spectrum. In this chapter, the basic parameters of remote sensing: electromagnetic spectrum, and the past and present satellites available and its capabilities for earth resources observation were discussed.

GEOGRAPHIC INFORMATION SYSTEM (GIS)

Geographic information system tools are used for the processing of spatial data into information, generally information explicitly used to make decisions. GIS can be defined as “a computer system for collecting, checking, integrating and analyzing information related to the surface of the earth” (Fundamentals of Geographic Information Systems” by Michael N Demers from John Wiley & sons Inc). Some of the major components of GIS are: a). Hardware b). Software c). Data Material requirement for mapping of DTW (Depth to Water Levels) are Basic Requirements a). Hardware requirement for interpretation for robust handling and timely accomplishment of the steps involved in image analysis, the following minimum standard hardware configuration is required. i. Processor: Minimum of 2.0 GHz P –IV make or equivalent processor ii. Disk space: Minimum of 80 Gigabyte iii. RAM: Minimum of 512 Mb iv. Display size: At least 17 inch monitor iii. Topographical maps iv. District profiles b). Field work: Optimal ground data collection in terms of precision and content needs to be carried out by involving following instruments i.GPS ii. Good quality photographic camera (Digital camera is preferred) iii. Hardcopies of images for ground data collection.

Survey of India Topographic maps on 1: 50000 scale has been used for preparation of base features such as Settlements, Transportation, Forest boundaries Drainage features and other Resource maps. The study area falls under Survey of India topo sheet No D43 K14, K15, L2, L3, L6 and L7 of 1: 50,000 scale (latest series).and Secondary data Collected from Groundwater department for preparing the Depth to Groundwater levels (DTW) maps. Base Map and other maps prepared using Survey of India Topographic maps on 1: 50,000 scale and Depth to Groundwater level (DTW) maps prepared based on Ground water samples collected from Groundwater department, initially this excel table joined into spatial data and using Spline with Barriers tool prepared DTW mps (Interpolates a raster surface, using barriers, from points using a minimum curvature spline technique. The barriers are entered as either polygon or polyline features) –using Arc GIS 10.1tool and for Geo-rectification of Toposheets used ERDAS 8.6.

RESULTS AND DISCUSSION

DYNAMICS OF GROUND WATER RESOURCES

The dynamics of ground water reserves for the study area are collected from Ground water department, Anantapur, A.P. prepared shown in tables and figures, pre and post monsoon period of 2000 and 2011.

DEPTH TO WATER LEVELS (DTW)

Depth to Water levels for pre and Post monsoon period of 2000: The study of depth to water level of pre (May) and post monsoon (Nov) period of 2000 as shown in the Figure 2 and 3 and Table 1, indicates deep water levels 10.36 m (bgl) Is observed in Setturu and 9.55 m (bgl) Brahmasamudram at the same time post monsoon period (November) also observed 12.55 m (bgl) in Setturu and 8.64 in Brahmasamudram.

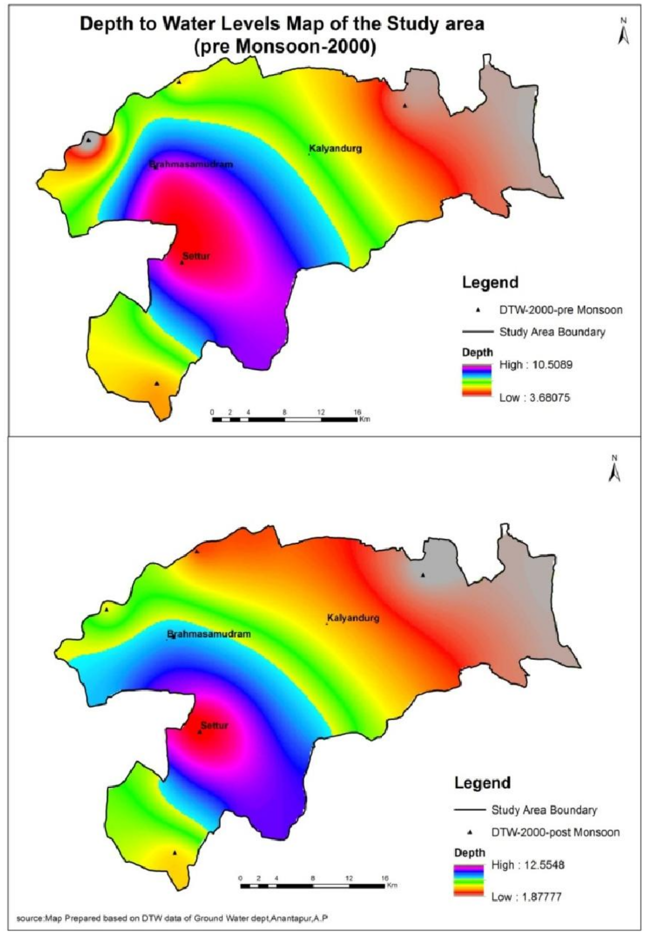

Fig.3. Depth to Water Levels Map for the Study Area for the year of 2000

Table 1. Depth to Ground water (DTW) levels for 2000

S. No.	Location of the well		Pre-Post(May-Nov) Monsoon depth to groundwater level in m.(bgl) in 2000	
	Mandal	Village	May	November
1	Brahmasamudram	Brahmasamudram	9.55	8.64
2	Brahmasamudram	Kannepalli	6.19	3.59
3	Brahmasamudram	Vepulaparthi	3.75	5.65
4	Kalyandurg	Golla	4.54	2.05
5	Settur	Settur	10.36	12.55
6	Settur	Anumapalli	5.75	5.2

Source: District ground water department, Anantapur

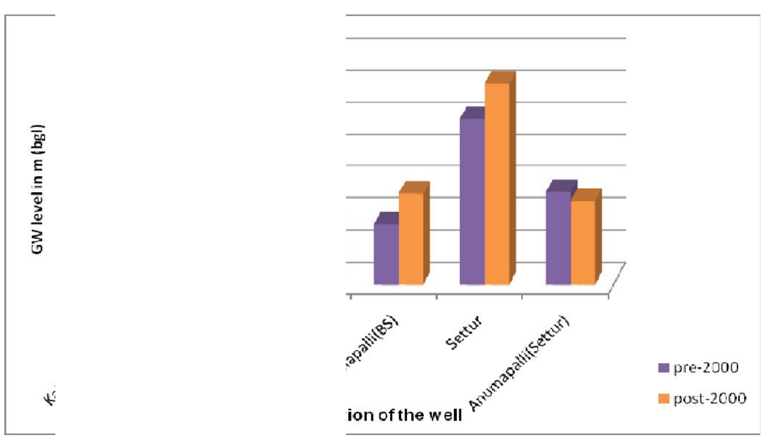

Table 2. Depth to Ground water levels for 2012

S. No.	Location of the well		Pre-Post(May-Nov) Monsoon depth to groundwater level in m. (bgl) in 2012	
	Mandal	Village	May	November
1	Brahmasamudram	Brahmasamudram	10.76	12.62
2	Brahmasamudram	Kannepalli	6.35	6.87
3	Brahmasamudram	Vepulapalli	3.25	11.49
4	Kalyandurg	Golla	2.12	4.96
5	Settur	Settur	12.86	16.79
6	Settur	Anumapalli	7.62	11.99

Source: District ground water department, Anantapur

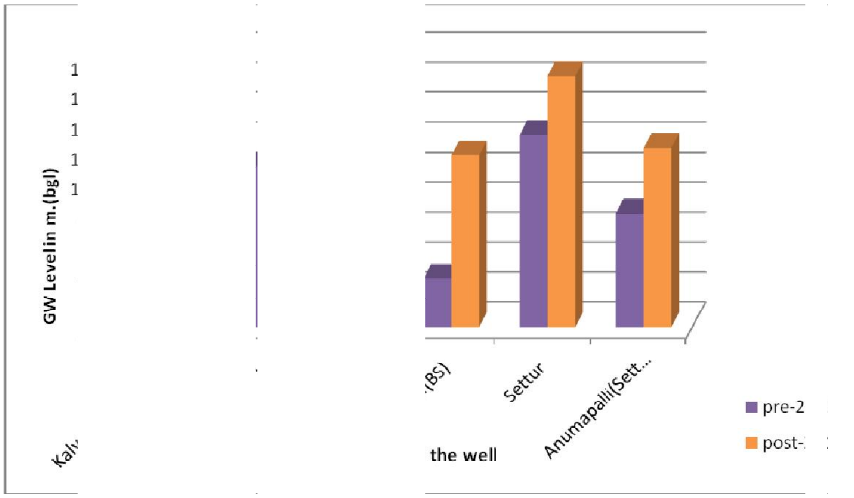

Fig. 4. Depth to Ground water levels for 2012

Moderate ground water levels are observed for pre monsoon period in Kannepalli 6.19 m (bgl) in Brahmasamudram mandal and Anumpalli 5.75 m (bgl) in Setturu mandal at the same time for post monsoon period Vepulaparthi 5.65 m (bgl) Brahmasamudram mandal, Anumpalli 5.2 m (bgl). Shallow groundwater zones with water levels <5m. is observed in Golla 4.54 m (bgl) in Kalyndurg mandal and Vepulaparthi 3.75 m (bgl) for pre monsoon period, for post monsoon period Kannepalli 3.59 m (bgl) and Golla 2.05 m (bgl) was observed as shown in Table 1 and Figure 2 and 3

Depth to Water levels for pre and Post monsoon period of 2012: DTW Figures and Table indicate water level depth has been increased compare to the 2000. Deep water levels 12.86 m (bgl) is observed in Setturu and 10.76 m (bgl) Brahmasamudram at the same time post monsoon period (November) depth has been increased more and observed 16.79 m (bgl) in Setturu, 12.62 m (bgl) in Brahmasamudram, Vepulaprthi 11.49 m (bgl) and Anumpalli 11.99 m (bgl). Moderate ground water levels are observed for pre monsoon period in Anumpalli 7.62 m (bgl). Kannepalli 6.35 m (bgl) in Brahmasamudram mandal, at the same time for post monsoon period Kannepalli 6.87 m (bgl) observed. Shallow groundwater zones with water levels <5m is observed in Golla 2.12 m (bgl) in Kalyndurg mandal and Vepulaparthi 3.25 m (bgl) for pre monsoon period, for post monsoon period Golla 4.96 m (bgl) was observed shown in Table 2 and Figure 4 and 5

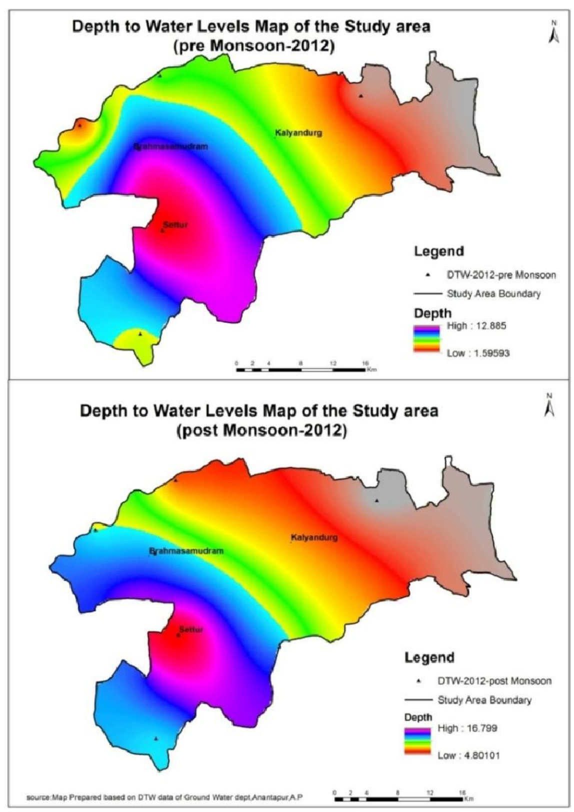

Fig.5. Depth to Water Levels Map for the Study Area for the year of 2012

Stage of Ground water Development in the study area

Figure. 6 present's stage of groundwater development in the study area as estimated by the A.P. Groundwater Department collected this data and analyzed. Safe zone of the Ground water

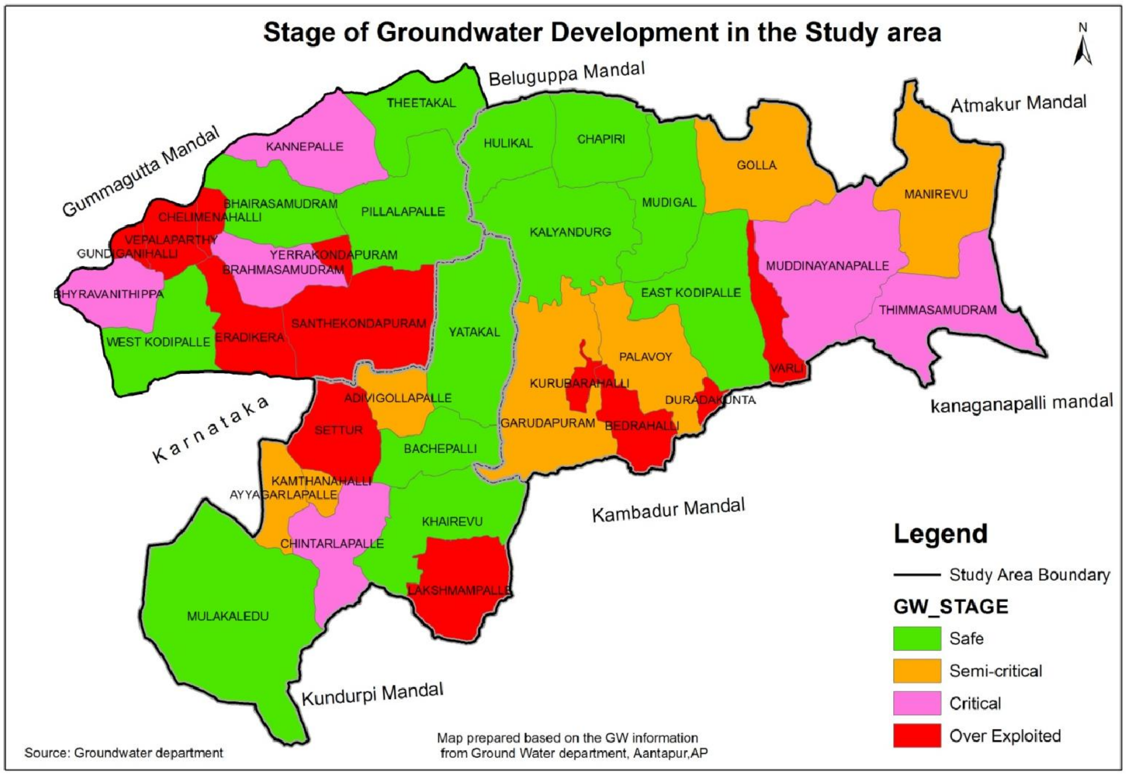

Fig.6. Stage of Groundwater Development in the Study Area

stage villages are observed in Kalyandurg mandal are East Kodipalli, Mudigal, Chapari, Hulikal and Kalyandurg, in Brahmasamudram mandal Safe stage villages are Teetakal, Pillalapalli, Bhairasamudram and West kodipalli and in Setturu mandal Mulakaledu, Khairevu, Bachepalli and Yatakal. Semi-critical Villages are observed in Manirevu, Golla, Palavoy and Garudapuram in kalyandurg mandal and Adiviganipalli, Kamthanahalli and Ayyagarlapalli in Setturu mandal. Critical villages in Kalyandurg Mandal are Muddinayanapalle and Thimmasamudram, in Brahmasamudram mandal Kannepalli, Bhyravanithippa and Brahmasamudram and in Setturu mandal Chintarlapalle Villages are observed.

This Figure shows that ground water development has reached the critical or over-exploited Stage in two thirds of the villages in the study area. All The mandals in the study area belongs to very high groundwater usage (over all stage of ground water development > 70 %). Critical Groundwater stage villages are observed, Varli, Duradakunta, Bedrahalli and Kurubarahalli villages in Kalyandurg mandal, Chelimenahalli, Vepulaparthy, Eradikera, Santhekondapuram and Yerrakondapuram in Brahmasmudram mandal and Settur and Lakshmampalle villages in Setturu mandal in the study area.

Conclusion

The present study has brought out the following conclusions. Based on Depth to water level maps (DTW) Groundwater distribution is very low in Setturu and highest in Brahmasamudram Mandal. The state ground water department estimated, that Annual ground water availability in the study area has 7594 ha.m, Existing gross Ground water draft for all uses 6821 ha.m, Ground water balance is 945 ha.m and Stage of ground water development in the study area estimated as 91 %.

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