HYDROGEOLOGICAL STUDIES IN MATHADI VAGU BASIN IN ADILABAD DISTRICT, ANDHRA PRADESH, INDIA

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Water is precious

Save every drop of it

PROTECT AND SAVE

WATER FOR ALL

DEDICATED
TO
MY PARENTS
AND
SUPERVISOR

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ABSTRACT

Mathadi vagu basin is located in the northern part of Adilabad District. Mathadi vagu basin is a tributary of Sathnala River which is a tributary of the Penganga River. The study area is located Western part of Saathnala River which flows through Adilabad town. The area falls in the survey of India toposheet Nos 56 I/06,56I/10. There are more than 80 habitats in the basin. Thamsi and Thalamadugu are the main Mandal Head quarters, situated in this basin. The basin trends NW-SE and situated about 12-15 Kms from Adilabad town. The study area lies between latitudes 19°50'28" to 20°13'35" North and Longitudes 78°28'25" and 78°58'00" East. The total Geographical area covered is 525 Sq. Kms. with 43 villages in 4 mandals of the district.

Granites, Basalts and Limestones are the main lithounits in the area, realizing the immediate need and urgency of a suitable plan of groundwater investigation, development and management to improve socio-economic status of the local people, envisaged evolution of systematic and scientific research work for utilizing it for development of farmers to improve the irrigation facilities, identifying the ground water potential zones and their optimization in the study area. Adilabad, Thamsi, Thalamadugu and Gudihatnoor mandals of the area consists of three formations with Thalamadugu area being the central part. The entire hilly terrain and the reserve forest cover up to 47 percent of total geographical area. Mathadi vagu and ephemeral streams and natural springs are only water sources, which get dried up during summer period.

Precise assessment, evaluation and management of groundwater resources paved the way to create irrigation as well as drinking water sources for the downtrodden peoples of the area. As per 2011 census total geographical area of Adilabad district is 16105 Sq/km . And 52 mandals, Over-all population density of the district is 170 persons per sq.km. Population density. With regards to Sex Ratio in Adilabad, it stood at 1001 per 1000 male. Average literacy is 61.01

The research work is proceeded to accomplish the following objectives.

1. To delineate shallow and deeper ground water sources in Mathadi vagu basin.
2. To decipher the extent of industrial and agriculture pollution and suggest remediaous measures in Mathadi vagu basin.
3. To determine the Aquifer characteristics in Mathadi vagu basin.

The present research study emphasizes on detailed micro level assessment of ground water throgh systematic scientific approach by simultaneously integrating of topographical, hydrogeological, aquifer characteristic and Geophysical investigations to demarcate the zones of subsurface pollution due to industrial and agriculture activities.

The detailed plan of basins and their development is dealt in the following seven chapters as general introduction, geology, geomorphology, drainage aspects, hydrogeology, aquifer parameters, geophysical investigations, groundwater quality studies, and summary and conclusions.

First chapter consists of introduction of Adilabad district in general and study area in particular, discussion on previous literature and work carried out earlier in similar areas and also in the study area. The study area falls in survey of India toposheet numbers 56-I/6 and 56-I/10 between latitudes: 19°50'28" and 20°13'35" north and longitudes 78°28'25"

and 78°58'00" East, covering 525sq.km. The area is spread over 4 mandals covering 43 villages. For better understanding of the social limitations and behavior of people a detailed discussion regarding their culture, occupation, tradition, socio-economic conditions and land related laws of the study area are touched upon.

Second chapter deals with geology and Geomorphology of Adilabad district and study area. The district comprises major sequence of rock types from Archaean granites to recent alluvium from Northwest to Southeast, it can also be called a miniature of stratigraphy of Andhra Pradesh State. The area predominantly contains of granites and gneisses in the central part Penganga limestones and northwest to southeast comprises Deccan traps. Fifty percent of the area is covered by Deccan traps. When correlated lava flows in the study area with the flows in adjoining areas, number of lava flows with varying thickness are found ranging from 2 to 5kms. Tectonic activity and denudation in the geological past resulted in structural features favoring for groundwater occurrence.

Third chapter consists of the hydrogeological studies of micro level and Drainage aspects and basin wise morphometric analysis. Detailed systematic well inventory, carried in 18 dug wells and 107 bore wells is reported. Depth to water level data for one year post monsoon (June, 2011) and pre monsoon (December, 2012). Depth to water level in the area ranges between 5.5 to 11.5m. during post monsoon and 7.5 to 13.5m. In bore wells, the depth to water level varies from 1.6 to 12m. And 1.6 to 3.5m., during post and pre monsoon periods. Groundwater yields in granites and limestones are moderate to good, whereas a few selected areas in Deccan traps give high to very high yields. Massive and hard trap areas are not feasible for groundwater development and will yield only moderate to poor discharges.

Drainage aspects and basin wise morphometric analysis. The area is characterized by dendritic to subdendritic drainage pattern with sub-parallel drainage pattern at places. The Mathadi vagu basin in combination with different geological formations, exhibit varied local drainage system and morphometric features. Morphometric analysis shows Mathadi vagu basin as 6th order. Total stream length of all orders in the basins is 588.5.25 kms and stream segment is of 1469. Mean bifurcation ratio 4.44. Average drainage density is 1.22 Km / Sq.km. indicating coarse drainage texture. Average channel maintenance is 0.892 Sq.Km / Km.

Forth chapter deals with the aquifer parameters of the study area Clear nderstanding of the nature of aquifers and their properties to a great extent help in taking groundwater developmental activities in an area. Aquifer studies can be used to have better well design and to improve the yield of the wells. Pumping test is used to determine in –situ properties of weathered water bearing formations and define the overall hydrogeological regime. Such test can determine Transmissivity (T), hydraulic conductivity (K), Storativity (S),Specific capacity and yield factor, connection between saturated zones, identification of boundary conditions, and the cone of influence of a pumping well in a extraction system.

The transmittivity value in 4 tests conducted in granitic rocks is $3.06x10^{-5}$ m^3 /sec, $3.10x10^{-5}$ m^3 /sec, $4.06x10^{-3}$ m^3/sec and $4.09x10^{-4}$ m^3/sec during pumping phase and recovery phase determined by using Theis Method.

The transmittivity value in 4 test in basaltic is $2.19x10^{-3}$ m^3 /sec, $1.50x10^{-3}$ m^3 /sec, $1.97x10^{-5}$ m^3 /sec and$1.01x10^{-2}$ m^3/sec during pumping phase and recovery phase determined by using Theis Method .In one test in limestone area the transmissivity is

$3.29x10^{-3}$ m^3 /sec by using during pumping phase and recovery phase determined by using Theis method.

Fifth chapter contains geophysical investigations at 30 sites and correlation of VES data reveals multi layered sub-surface strata in all the three geological formations. Study along sections A - B and X - Y helped to infer resistivity ranges and thickness of different layers. The specific sites selected for bore wells and dug wells based on the above data resulted in more yield and success rate has gone up from 35 to 85%.

Geophysical investigations the analysis data, the following significant inferences are made in conceptualizing the aquifer system. Geophysical investigations VES revealed the general lithology of the study area. Among total 30 VES, 30 VES curves are 'A' type which indicates Granitic environment where geological succession is Granites and Gneisses up to 100 m depth, the geological succession is sand underlain by clay lenses. 30 VES curve are 'A' type indicating clay at depths 30-40 m where the geological succession is clay followed by Granites.

The low resistivity range 3-8 Q-m is deciphered up to 30-50 m depth at Mathdivagu basin. The low resistivity range in this area is verified by groundwater TDS value which ranges from 1000-1370 mg/I.

Sixth chapter deals with Hydrochemical studies from 37 water samples collected during post and pre monsoon are presented and discussed. The data reveals that the pH ranges between 6.28 and 7.78 during post monsoon period, whereas small pockets indicate alkaline conditions. Fluoride is within permissible limit of 1.5 mg/l. except in 3 samples, 1 in granites and 2 in Deccan traps, where it ranges in values from 1.6 to 4.5 mg/l. Its

dilution by artificial recharge is proposed. Groundwater in general is suitable for irrigation purposes. In 31 samples nitrate concentration noticed is more than permissible limit of 45 mg/l. It is attributed to poor village hygiene. There is more scope in the area to continue micro level groundwater quality studies with its increasing development and use.

Seventh chapter consists of the summary and conclusions with details of results and suggestions. Discussed mainly about the detailed ground water investigations, estimation, management and area specific observations and plan implementation. Benefits derived and change in the local peoples socioeconomic status is also discussed. Certain suggestions are made on aquifer status for well constructions in agriculture activities development. Water, Land and Trees Act (2002) of Andhra Pradesh (WALTA) implementation, groundwater quality improvement measures, improvement in cropping pattern practices, rainwater conservation, artificial recharge methods , and awareness through capacity building among the local peoples.