

## **Identify the Feasible Shallow Aquifer Zones in Coastal Sands in Part of Krishna Western Delta Region of A.P.**

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### **Abstract**

The management of groundwater plays a vital role even in Coastal zones. Coastal sands in Guntur district occupies an area of about 400 sq.km., covering Bapatla, Karlapalem, Pittalavanipalem, Nizampatnam, Cherukupally and Repallemandals. The groundwater in these coastal sands is being utilized through shallow open wells known as Doruvus. The Water table has been influenced by canal irrigation system and Krishna western delta and Precipitation.

Fresh water in the coastal sands is floating above the saline ground water which occurs in the underlying clay layers. Thickness of sand aquifer is very limited in the area and varies from 2.5 to 5.0m. Occurrence of sand aquifer is not uniform and hence these coastal sandy areas with shallow fresh water in saline ground water region need better management technologies of Skimming and recharging to maintain environmental balance and sustainable irrigation. The paper discusses the distribution of coastal sands and possibilities of management technology of skimming and recharging under Prevailing hydrogeological conditions. To assess the thickness of top sandy aquifers, subsurface lithological characteristics, detailed investigations were taken up in the study area.

**Keywords:** Groundwater, Shallow aquifer zones, Coastal sands, Krishna Western delta, Andhra Pradesh

### **INTRODUCTION**

The area covered with coastal sands consisting of mandals and lies in between East longitude from 80 25'25'00 to 80 50'00' and North latitude from 15 50'50'to 16 05'00' as shown in the map(plate-1). In Guntur District of Andhra Pradesh coastal

sands are observing in South Eastern part of the district covering Bapatla, Karlapalem, Pittalavanipalem, Nizampatnam and Repallemandals. In these areas where the shallow fresh water occurs above saline water, the fresh water is being drawn manually through dug out conical pits locally known as Doruvus. From these Doruvus, the seeped water from top coarse sandy aquifer is collected manually with pots and used for irrigation of seed beds, vegetables and nurseries etc. But these traditional Doruvu wells have some disadvantages like wastage of productive lands, evaporation losses and lack of use of modern irrigation techniques. Keeping in view of these problems NATP, Bapatla has proposed a new technology for construction of collector wells (Subbaiah et al, 2009, and Raghubabu et al, 2012) in coastal sands for skimming the floating fresh water in saline water region. The location of collector wells requires sufficient thickness of permeable sand formation for sustainable yields. Collector wells or improved Doruvu wells are not feasible in areas where clayey sands are present because of the limited inflow from clay mixed formation. To know the areas where sufficient permeable coarse sands are present, Geophysical investigations were carried-out in these areas.

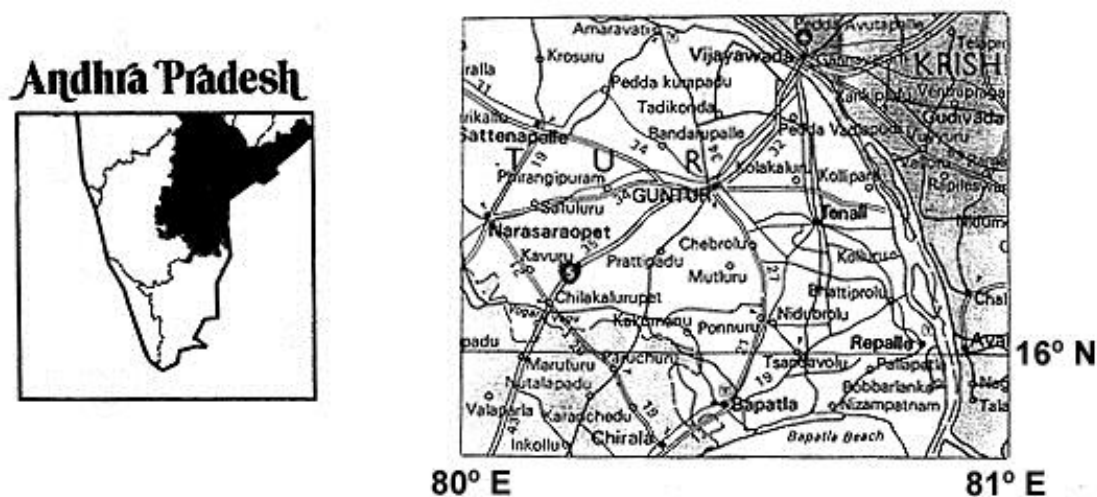


Plate-1

### PHYSIOGRAPHY

The area is plain and gentle undulating topography towards Bay of Bengal. The Highest elevation is about 5m. msl. In general the drainage is not well developed and small patches of the drainage pattern develops as irrigation channels and drains in the area. irrigation is being provided by Nizampatnam canal and Kommur canal under Krishna western delta system. The main drains present in the study area are Repalle(main) drain and Tungabhadra drains which run north to southwards and finally drained into Bay of Bengal. The small undulations are represented by ridges and sand dunes ranging in height from 1 to 4m., running parallel to the coast.

**HYDROGEOLOGY**

The area is occupied by coastal alluvium and comprises of permeable, coarse to Medium sands of present age. This top shallow sandy alluvium underlined by clays. The fresh Water occurs in this coarse to medium sandy aquifer. The thickness of aquifer ranges from 3 to 4m. only and extends down to a depth to 4 to 5m. bgl. Since, this limited shallow aquifer is not sustained for pumping, the ground water development in the area is being done through “Doruvu” wells. A “Doruvu well” is conical pit in shape through which the ground water is being extracted manually. In the area, the potted water being used for vegetables and Nurseries. Each Doruvu well can sustain for watering of 10 to 15 cents of land only.

The well inventory data indicates that the depth to water levels varies from 1.5 to 3.5m and the total depth ranges from 3 to 6m bgl. It is reported that the water levels during post-monsoon ranges from the ground surface to 1.5m. This shallow sandy aquifer is present down to a depth of 4 to 5m below ground level and beyond which the quality of water is saline. The recharge conditions to the shallow sandy aquifer in the area are limited and are influenced by canals, drains and precipitation.

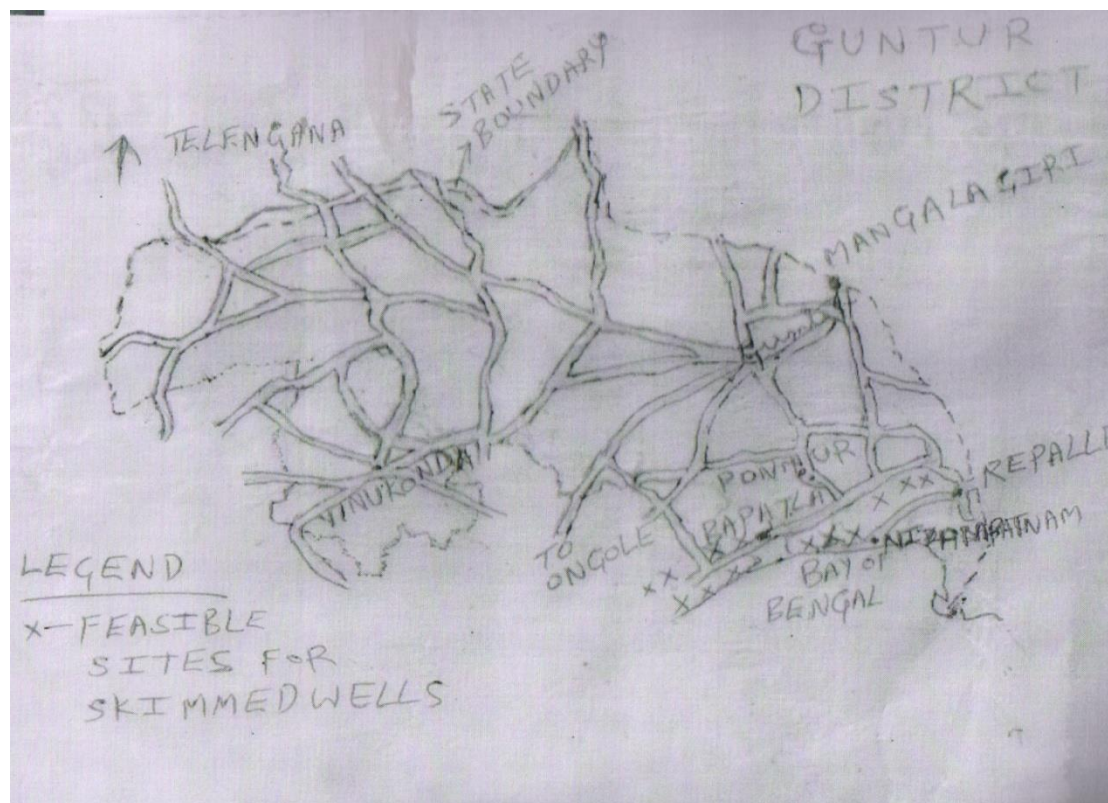
The water level data of observation wells of the Ground Water Department in Bapatla, reveal that the depth of water levels varies from 1.53 to 3.5m and water level fluctuations are small. The water level fluctuation from pre-monsoon 2014 to pre-monsoon 2015 in six observation wells ranges from 0.05 to 1.52m. Thus the small fluctuation indicates the non-stabilized aquifer conditions.

**ELECTRICAL RESISTIVITY PROFILES**

Electrical profiles were conducted in the area with station interval of 10m and 20m. of current electrode separation-4m., 8m, and 20m and potential electrode separation of 1m. The total 9 isolated patches are extent of 8 line kilometers. Electrical resistivity profiles are conducted in Saline Water Scheme (SWS) Fields, Bapatla, suryalanka-Bapatla road, west of Pothuraju Kottapalem village, along Bapatla-Kankatapalem road, south of Buddam village, along Bapatla-Chandoleroad, Dammannavaripalem Village and Gudavalli village areas. From the profile curves it is observed that the apparent resistivity values varying from 160 to 10030 ohm.m for 2m. depth represents dry sands and for 4m. depth the resistivity values varying from 50 to 250 ohm.m. represents saturated coarse sands. The clay mixed sands and slits are represented with low resistivity values below 50 ohm.m. Along the profiles in SWS fields, Bapatla the saturated sands are represented with resistivity values ranging from 60 to 300 ohm.m. In suryalanka-Bapatla road, near muttayapalem village is favourable for development of ground water by construction of Doruvu wells down to a depth of 4m to 6m. The profile curves around Pothuraju Kottapalem village along konderu drain indicates that the saturated sandy areas are represented with resistivity values varying from 60 to 356 ohm.m and feasible for skimming wells. The resistivity profiles along Bapatla-chandole road and north of Dammannavaripalem village indicates the feasibility for construction of skimming wells. (Plate-2)

The profile curves along Kankatapalem village, Buddam village and Gudavalli village indicates that the said areas consisting of clay mixed sands and not feasible for skimming wells.

Vertical electrical sounding data conducted in Bapatla, Karlapalem and Nizampatnam areas indicates that the sand aquifer is present in the area down to a depth of 5m. to 6m. followed by clay mixed sands in which the quality of ground water is poor. The areas did not contain fresh water aquifer in the deeper depths.



**Plate-2:** Biography: The author working as Assistant professor in VFSTRU, Vadlamudi, Guntur district, A.P. and pursuing Ph.D. in Acharya Nagarjuna University, Guntur district, A.P. Earlier, worked as Hydrogeologist in Raipur district in Chhattisgarh state,

## CONCLUSIONS

The geological and hydrogeological surveys conducted in the area indicates that the area covered with coastal sands followed by clays. The thickness of sandy aquifer varies from 3 to 4m. and extends down to a depth of 4 to 6m. and in some cases it is more, followed by clays in which the quality of water is saline. Depth to water level varies from 1.5 to 3.5 m below ground level and seasonal fluctuation of water levels is small and ranges from 0.4 to 1.35m,

The geophysical investigations carried out in the area indicates that the top shallow sandy aquifer is present with resistivity values ranging from 59 to 750 ohm.m. Which represents the medium to coarse grained sands. This sandy aquifer is predominant in the villages of karlapalem, muttayapalem, Bapatla, kondubotlavaripalem, Chintavaripalem, etc. In these areas the improved Doruvu wells or skimming wells can be taken up in large number.

The pump test conducted on existing skimming well in the area indicates that a minimum of 100m spacing should be maintained between skimming wells in order to avoid interference, keeping in view of the limited recharge conditions. Based on the data of geophysical and Hydrogeological information possible potential areas for construction of Improved Doruvu wells or collector wells are demarcated for larger development in the study area.

The top sand aquifer is of limited thickness and recharge are influenced by the precipitation only, and to some extent by seepages from canal and paddy irrigation fields. The influence of canal irrigation field on the water levels is clearly observed from the water levels of pre monsoon 2014 and pre monsoon 2015. Hence it is imperative to maintain surface water supply to recharge the sand aquifer so that the large number of skimming wells may be encouraged in coastal sandy areas of Guntur district.

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