NEWS AND NOTES

Groundwater Resources and Management in the Coastal State of Tamil Nadu – A. Subburaj, Central Ground Water Board, Bengaluru.

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Tamil Nadu State is located in the southern part of India between N latitudes 08°00'00" – 13°30'00" and E longitudes 76°15'00" – 80°18'00". The state accounts for 4% of land area, 6% of population, but only 3% of the total water resources of the country. Physiographically, the state is divided into four divisions, viz. the Coastal plain, the Eastern Ghats, the Central Plateau and the Western Ghats. The State is drained by a number of major rivers, flowing eastwards. The normal annual rainfall of the state is about 945 mm, of which 48% is from the North East monsoon and 32% from the South West monsoon. But monsoon failures lead to severe drought conditions.

The cultivable land in the State is 75, 51,260 ha accounting for 58% of the total geographical area, and the land not cultivated but available for cultivation is 2.5%. The important sources of irrigation in the State are wells, canals and tanks. The surface water resources are almost fully harnessed by impounding the available water in 81 reservoirs and in 41,127 medium and major tanks. Recent data indicate that the net area irrigated is 26, 79,096 ha from all sources, while the gross area irrigated is 33, 10, 877 ha. An area of 16, 42,340 ha is irrigated by ground water, which is about 61.3% of the total area under irrigation in the State.

Nearly 73% of the total geographical area of the State is occupied by a variety of crystalline rock formations of Archaean age mainly consisting of charnockites, gneisses and granites. About 27% of the area is underlain by sedimentary formations of Mesozoic, Tertiary and Quaternary eras. Groundwater occurs under phreatic condition in the weathered residuum in hard rocks and in shallow horizons of sedimentary formations. It is under semi-confined to confined conditions in fracture zones of hard rocks, and in deeper sedimentary aquifers. Deep weathered pediments, low lying valleys and palaeo-channels generally host potential aquifers. The orientation of fractures and interconnectivity of fractures play the major role in forming the potential aquifer in deeper zones of hard rock areas. The yield and transmissivity in deep hard rock aquifers varies between 1.08-75.6 m³/hr and 0.24-1146 m²/day respectively.

The ground water exploration in sedimentary formations has revealed the presence of multi-aquifer systems down to a depth of 750 m below ground level (bgl). The multi-layered aquifers variously contain fresh, brackish/saline and brine waters. The Tertiary group of formations constitute the most prolific aquifers of the state. The yield of the tube wells in Cuddalore sandstone ranges from 290 to 400 m³/day. Hydraulic conductivity of Cuddalore sandstone is of the order of 50 m/day with storativity ranging from 9.5×10^{-5} to 8.9×10^{-4} .

The depth to water level (DTW) in the phreatic aquifers of the State ranges from ground level (Nagapattinam) to 59.2 m bgl (Villupuram) during the pre-monsoon period (May 2017). In the major part of the State DTWs are more than 10 m bgl, particularly in the central and western parts, but less than 10 m bgl in the eastern part of the state covering the coastal region. However, isolated pockets in the central and western parts have shown <10 m bgl. About 60% of the wells monitored have water level <10 m, 31% 10-20m, but 9% have more than 20 m bgl. The depth to water level ranges from 0.15 (Kanchipuram) m bgl to 68.1 m bgl (Coimbatore) during the post-

monsoon period (January 2018). Major part of the State covering the coastal plain and central midland area shows water level <10 m bgl, accounting for nearly 82% of the wells monitored. About 14% of the wells have DTW 10- 20 m bgl and 4% of wells deeper than 20 m bgl.

Analysis of long term pre-monsoon (May 2008 - May 2017) water level data shows that only 16% of wells have recorded rise in water levels and 84% of wells have recorded fall in water level in comparison to decadal mean. The water level decline of <2 m is predominant in 33% wells. Also water level decline of > 4 m is observed in 28% wells. Decline of 2-4 m is observed in 23 % of wells. The rise is predominantly in <2 m in 11% wells. During the post-monsoon period (Jan 2008-Jan 2017) 57% of wells have recorded fall in water levels and rising trend has been noticed in 43% of wells monitored. The decline of <2 m is predominant in 31% wells, 2-4 m in 16 % wells and > 4 m in 10% of the wells analysed. The rise is predominantly 0-2 m in 26%.

The depth to piezometric surface of the deeper aquifers ranges from 0.0.70 m bgl (Kanchipuram) to 117.1 m bgl (Madurai) during May 2017 (pre-monsoon). About 26% of wells have recorded depth to piezometric surface within 10 m bgl, while 52% of wells show depth to piezometric surface 10 to 40 m bgl and 22 % more than 40 m bgl. Depth to piezometric surface ranges between 0.5 (Kanchipuram) and 97.2 m bgl (Salem) during January 2017 (post-monsoon). About 44 % of wells have recorded depth to piezometric surface <10 m bgl, 20% of wells show depth to piezometric surface 10- 20 m bgl, 14% 20- 40 m bgl and 22% more than 40 m bgl.

The quality of groundwater, is in general potable, and suitable for agricultural and industrial applications in the major parts of the State. The specific electrical conductance is normally less than 2250 mS/cm at 25°C. Groundwater with various chemical constituents exceeding threshold limits prescribed for various use sectors, due to either natural or anthropogenic causes occurs in localized patches. Groundwater in coastal sedimentary aquifers in parts of Cuddalore, Ramanathapuram and Nagapattinam districts is brackish to saline due to marine depositional conditions. In recent decades, contamination of groundwater resources has assumed serious proportions in Tamil Nadu due to indiscriminate discharge of solid and liquid wastes from various industries, and leachates of fertilizers/pesticides used in agricultural sector. Groundwater overexploitation too has caused seawater ingress into coastal aquifers in places.

The stage of groundwater development in the State as on March 2013 is 77% (GEC 1997). The groundwater scenario has changed considerably in recent years owing to over-exploitation, contamination and erratic monsoon. Out of 18.59 BCM of utilizable groundwater resource in the State, more than 75% are being pumped for various requirements. Further, out of a total of 1139 firkas in the state, 358 firkas have been categorized as 'Over-exploited' (ground water development in excess of 100%), 105 firkas as 'Critical', 212 firkas as 'Semi-critical', and 429 firkas where groundwater development is less than 70%, categorized as 'Safe'. Resources have not been computed for 35 blocks in which groundwater is totally saline.