RECHARGE ZONES AND SOURCES TO DEEPER AQUIFERS

Groundwater forms 85 – 90 % of potable water as it is believed to be safe and free from pathogenic bacteria and suspended matter. Most of our observations and investigations are limited to the shallow aquifers. However, shallow aquifers are either drying up or getting contaminated in densely urbanized areas in the country. This has lead to greater dependency on deeper aquifers which have not been given due importance so far from investigation point of view. Thus, deeper aquifers are becoming increasingly important with the increase in urban area and density of urban population. In fact, the deeper aquifers not only cater to the maximum present day need of fresh water but these will also serve as the potential source of fresh water in future.

The area of groundwater recharge for deep aquifers may be located in remote places far away from the area of utilization. Thus, deeper aquifers may suffer adversely by the various anthropological activities that either reduce the recharge area or contaminate the recharge source. This has increased the concern on groundwater resource mapping and its management which requires identification of recharge zones to deeper aquifers. Once identified, the recharge zones can be protected from the anthropogenic activities and important recharge sources can be given due importance for better management.

TECHNOLOGY

Environmental isotopes like ^{3}H (tritium-3), ^{14}C (carbon-14), ^{2}H (deuterium-D), and ^{18}O (oxygen-18) are used to identify the recharge zones and recharge sources to deeper aquifers. Geo-hydrological details like groundwater level conditions, geological cross sections etc. and water quality data like major and minor ion chemistry, physico-chemical parameters etc. are used as supporting tools. Groundwater samples are collected from different aquifers for the measurement of ^{3}H, ^{14}C, ^{2}H, and ^{18}O. The dating of groundwater using tritium and carbon-14 provides the age of groundwater and its spatial distribution provides the information about recharge zones, groundwater flow velocity and flow pattern. Deuterium-D and oxygen-18 analysis helps in understanding the contribution of different recharge sources and in identifying the most important recharge source. The use of this technology has been established in India by the National Institute of Hydrology,

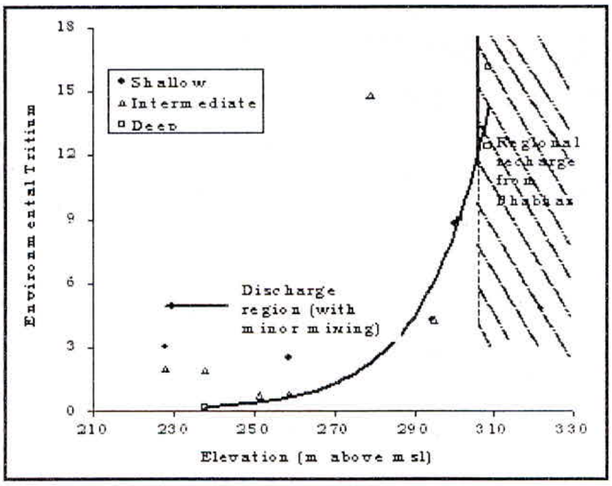

Figure – 1 Variation of environmental tritium with elevation in Solani-Ganga interfluve

Roorkee and applied in the districts of Haridwar and Saharanpur while it is being applied in NCT of Delhi and the area between Hindon and Yamuna Rivers.

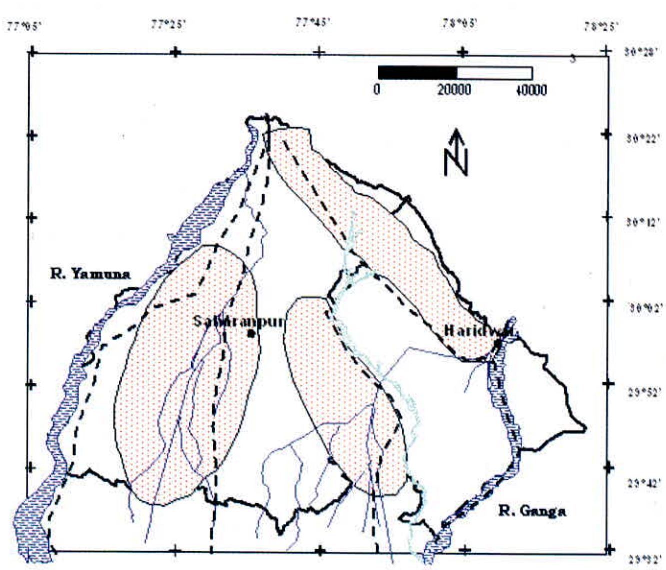

Figure – 2 Different recharge zones identified on the basis of environmental tritium concentrations

ENVIRONMENTAL IMPACT

As this technology involves the use of environmental isotopes (natural level activity), therefore, it does not have any adverse effect on environment.

ECONOMICS

An expenditure of Rs. 1.0 lakh per 100 sq km of area is required for sample collection, measurements and interpretation excluding travel cost. The measurements can be done either at NIH, Roorkee or other isotope hydrology laboratories in the country. Therefore, the cost of instrumentation is not indicated.

This technology will have long-term impact in terms of availability of groundwater in deeper aquifers, measures to control groundwater contamination and in preparing strategies for groundwater management. Thus, it will have direct and indirect benefits that can not be spelled out in digits.

BENEFICIARIES

All State and Central Groundwater Organisations, individual exploiters of groundwater, municipal boards, Jal-nigams, Jal Sansthans, and Tubewell Corporations will benefit from this technology.

INTELLECTUAL PROPERTY RIGHTS

The National Institute of Hydrology, Roorkee owns the Intellectual Property Rights for the technology.