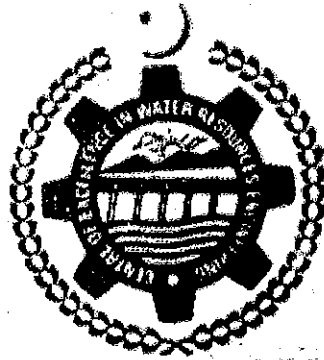


THESIS

**ESTIMATION OF RAINFALL RECHARGE IN THE POTOHAR
AREA OF DISTRICT CHAKWAL**



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2005-PG-WRM-02**

For the Degree of

MASTER OF SCIENCE

IN

WATER RESOURCES MANAGEMENT

**CENTRE OF EXCELLENCE IN WATER RESOURCES ENGINEERING
UNIVERSITY OF ENGINEERING & TECHNOLOGY LAHORE, PAKISTAN**

2007

ABSTRACT

The Potohar Plateau lies to the South of Northern Mountains bounded on the East by the Jhelum River, on the West by the Indus, on the North by the Kala Chitta Range and the Margalla Hills and on the South by the Salt Range. Chakwal is one of the districts located in the Potohar series. Chakwal is bordered by the districts of Rawalpindi and Attock in the North, district Jhelum in the East, district Khushab in the South and district Mianwali in the West. The total area of district Chakwal is 6609 square kilometers, which is equivalent to 1652443 acres and 87.7% of the total population of Chakwal lives in rural areas and 12.3% in the urban areas, making Chakwal a predominantly rural district pivoted on an agrarian economy with a very small industrial sector.

Chakwal is a Barani area with average rainfall of 558 mm to 635 mm. There is no wide spread irrigation system in Chakwal. The only major rivulets and seasonal channels that run through Chakwal are the Soan, and the Soj Nullah. A number of small dams have been constructed in the district through which some irrigation takes place. There are a large number of storm water channels which are mostly active during rainy season.

Groundwater use in Chakwal is a fundamental importance to meet the rapidly expanding agricultural water requirements, around the area. Due to the (semi-) arid climatic conditions of the area, this resource is almost the only key to economic development; hence the quantification of its current rate is a necessity for the efficient and sustainable groundwater resource management.

To quantify groundwater recharge in the area a study was carried out from June 2006 to July 2006 at the farm of Barani Agricultural Research Institute (BARI) situated at about 6 km from the Chakwal City on Talagang road. The objectives of the research were to understand rainfall-runoff-infiltration and recharge interaction for the area, estimation of rainfall recharge by different methods and comparison of these methods.

The availability of recharge estimate techniques differs climatically. Sources and processes of recharge in humid areas are different compared with (semi-) arid areas; hence the need to proceed from a well-defined conceptualization of different recharge processes is essential, as is the need to use more than one technique for verification of results. Three methods (Gravimetric method, rainfall runoff method and water table fluctuation method) were used at the BARI Farm to estimate rainfall recharge. The laboratory facilities of Soil and Water Conservation Research Institute (SAWCRI) were used to perform different experiments.

Generally the most factors contributing to recharge in the area are rainfall, evapotranspiration rates and soil types. The area experiences an annual rainfall of 635mm, which is characteristic of a semi arid climate. Since the potential evapotranspiration of the area was estimated to be higher than rainfall, direct recharge is not a permanent process in the area, but a process which occurs during rain seasons and, only when there is high intensity. The process of evapotranspiration occurs through the year for those areas that are covered with both grassland and thick natural vegetation.

The soil of the study fields was clay loam having bulk density of 1.35 gm/cm^3 and hydraulic conductivity of 16.6 cm/day . There were three rainfall events during the study period resulting in a total rainfall of 148 mm . The potential recharges estimated by gravimetric method and rainfall runoff method were 92 mm and 100.20 mm respectively for 148 mm rainfall. The recharge estimated by water table fluctuation method was only 6.20 mm . The results showed that the recharges estimated by gravimetric method and rainfall runoff method were comparable while the recharge estimated by water table fluctuation method was incomparable. The value of potential recharge may be taken as 65% of 148 mm rainfall in the area.

High recharge values are estimated in areas that are mainly dominated by grassland type of vegetation and low values in areas covered by shrubs and thick vegetation. Field measurements are the basis of recharge investigations since they give a realistic idea on recharge processes. They should work hand in hand with models for better estimations of groundwater recharge.