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A Geographical Study of Ground Water in Rohtak District

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ABSTRACT

In Haryana all districts are affected with salt concentration. In Rohtak district the area under usar lands is 1358, 513, 523, 455 and 390 ha in Rohtak, Sampla, Kalanaur, Lakhan Majra and Meham blocks, respectively.The present study was conducted in five villages namely Rithal Narwal (Rohtak Block), Ismaila (Sampla Block), Lahli (Kalanaur Block), Kharak Jattan (Lakhan Majra Block), and Madina Korsan (Meham Block), which were affected by usar lands (salt-affected soils) above 10 per cent to the cultivable area of the village. Lahli village (Kalanaur Block) covered the highest usar lands area (248 ha) in Rohtak district. It is about 22.75 per cent of the cultivable area. Kharak Jattan (Lakhan Majra Block) covered the lowest usar lands area (50 ha). It is about 10.86 per cent of the cultivable area.

Keywords : Ground Water, Rohtak, Soil, Rainfall, Climate

I. INTRODUCTION

Rohtak district of Haryana lies between 28o 40' : 29o 05' north latitudes and 76o 13' : 76o 51' east longitudes. Total geographical area of the district is 1745 sq.km. Administratively, Rohtak division controls the district. It is divided into two tehsils namely Rohtak and Meham, and sub-divided into 5 development blocks namely Kalanaur, LakhanMajra. MehamRohtak and Sampla. The district area falls in Yamuna subbasin of Ganga basin, and is mainly drained by the artificial drain No. 8 which flows from north to south. JawaharLal Nehru feeder and Bhalaut sub Branch are main canals of the district. Bhalaut sub branch irrigate the area falling in Kalanaur, Rohtak and Sampla blocks. The Bhiwani sub branch and Kahnaur distributary irrigates the areas covering Kalanaur, Meham and LakhanMajra blocks. Area under Canal irrigation is about 84193 hact. in the district. CGWB has carried out ground water exploration besides other hydro geological and geophysical studies in the district.

II. METHODS AND MATERIAL

In the present study wherever required percentages has been calculated and data for various attributes has been represented in a tabular form or by statistical diagram. No mechanical aid has been taken in either processing or the tabulation of field data. The whole affair has been managed manually. The data was processed in older to make it useful interpretative. This was done with a view to economising time, labour and finance. But the main purpose was accuracy and authenticity. Map is the highest tool of the geographer. The bulk of the statistical data was therefore, used to the preparation of most of the maps. The data was converted into per centage for their use in the tables. In fact, all the rationalizations have done on the basis of these maps using, statistical and semi-statistical methods. A graphic representation of the data has also been made in order to facilitate the projection of trends.

III. STUDY AREA

Haryana is one of the fast developing states of India. It lies between 27° 39' to 30° 55' North latitude and 74° 28' to 77° 36' East longitude comprises large part of Indo-Gangetic plain. Agriculture is the main stay, since soil constitutes its major natural resources. The present study relates to the Rohtak district of Haryana state. The Rohtak district lies in the south east of Haryana state between 28° 19' to 29° 18' North latitude and 76° 13' to 77°.

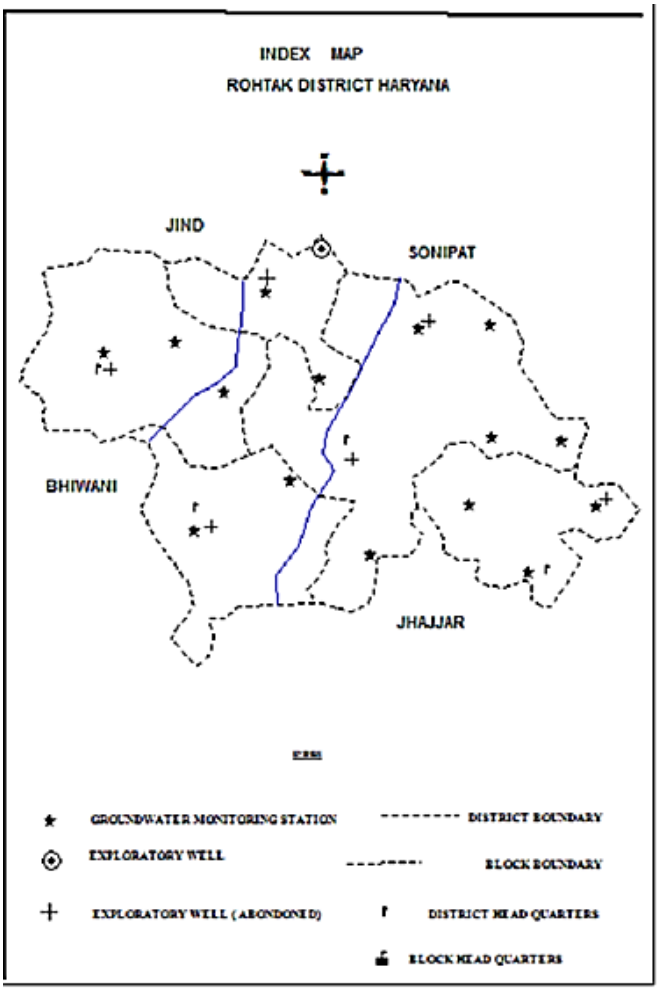
IV. RAINFALL AND CLIMATE

The climate of Rohtak district can be classified as subtropical monsoon, mild &dry winter, hot summer and sub-humid which is mainly dry with very hot summer and cold winter except during monsoon season when moist air of oceanic origin penetrate into the district. The hot weather season starts from mid March to last week of the June followed by the south west monsoon which lasts upto September. The transition period from September to November forms the post monsoon season. The winter season starts late in November and remains upto first week of March. RAINFALL The normal annual rainfall in Rohtak district is about 592 mm spread over 23 days. The south west monsoon sets in the last week of June and withdraws towards the end of September and contributes about 84% of the annual rainfall. July and August are the wettest months. 16% of the annual rainfall occurs during the nonmonsoon months in the wake of thunder storms and western disturbances.

Normal Annual Rainfall: 592 mm
Normal monsoon Rainfall: 499 mm
Temperature: Mean Maximum 40.5ºC (May-June)
Mean Minimum 7ºC (Jan.)
Normal Rainy days: 23

V. GEOMORPHOLOGY AND SOIL TYPES

The district area is occupied by Indo-Gangetic alluvium. There are no surface features worth to mention. Physiographically the area is flat terrain. The area slopes towards northeast to southwest with an average gradient of 0.19 m/km.The general elevation in the district varies between 215 m to 222m above MSL. The soils of the district arefine to medium textured. It comprises sandy loam in Rohtak, Sampla, and Lakhan Majra blocks whereas it is loamy sand with occasional clay loam in Kalanaur and Meham Blocks. High potassium, medium phosphorus and low nitrogen occur in the soils. The soils of the district are classified as arid brown (Solemnized) and sierozem.



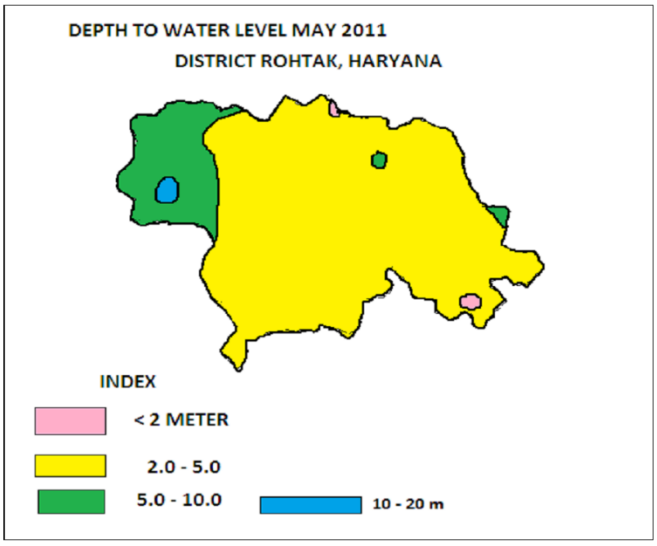
Source: CGWB

VI. GROUNDWATER SCENARIO

1. Hydrogeology:

The district is occupied by Indo-Gangetic alluvial plain of Quaternary age, and falls in Yamuna sub - basin of Ganga basin. The Central Ground Water Board has drilled 6 exploratory boreholes to delineate and determine potential aquifer zones, evaluation of aquifer characteristics. The permeable granular zones comprising fine to medium grained sand and occasionally coarse sand and gravel. Their lateral and as well as vertical extent is limited. The borehole data reveals that clay group of formations dominate over the sand group in the district area. The bed rock in the district area was encountered at a depth of 370.0 m at Hasangarh in Sampla block. The boreholes drilled in the district were abandoned either due to bad quality of water or poor discharge.

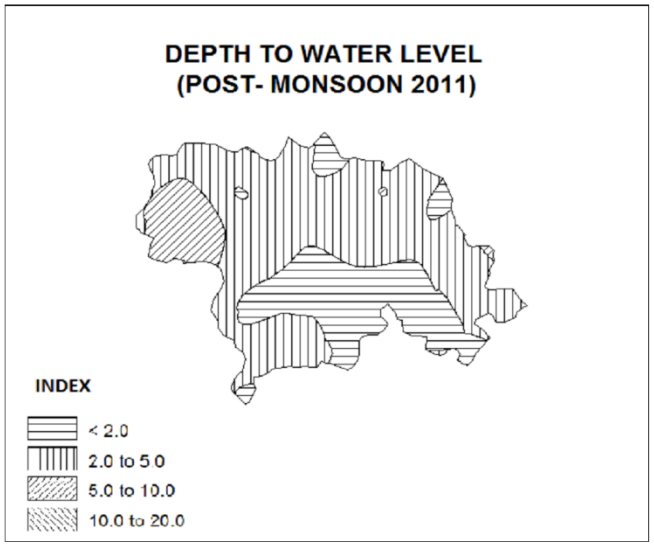
Ground water in the district occurs in the alluvium under water table and semi confined to confined conditions. Two to four granular zones with aggregate th ickness from 23m to 52m are present in the area up to bed rock. There has however been a successful well at Sondhi, Rohtak block, tapping the zones27m-34m,37m-40m, and 46m-52m. The discharge of the well was 870lpm at a drawdown of 7.5m. The transmissivi ty 'T' value 207m^2/day was determined. Shallow tube wells for irrigation use are generally constructed upto a depth of 20 m and are of cavity type. The discharge of these shallow tubewells/ cavity wells range 360 -600 litres per minutes. Deep tube wells are not constructed in the district due to increase in salinity with depth.



Source: CGWB

Water level behaviour:

The depth to water level ranges from less than 1.72m bgl to 10.75m bgl during pre monsoon period, and1.46 m to 9.07 m during post monsoon period. The water level trend during pre monsoon period indicates average fall of 0.06m/year and rise at places ranging from 0.02m to 1.74m during the same period. The long term water level trend is show small decline and other places rise in district.



Source: CGWB

Ground Water Flow:

The elevation of the water table in the district varies from 213 m to 219 m above mean sea level. The

average gradient of the water table is of the order of 1 m/km. The overall flow of ground water is from north to south direction.

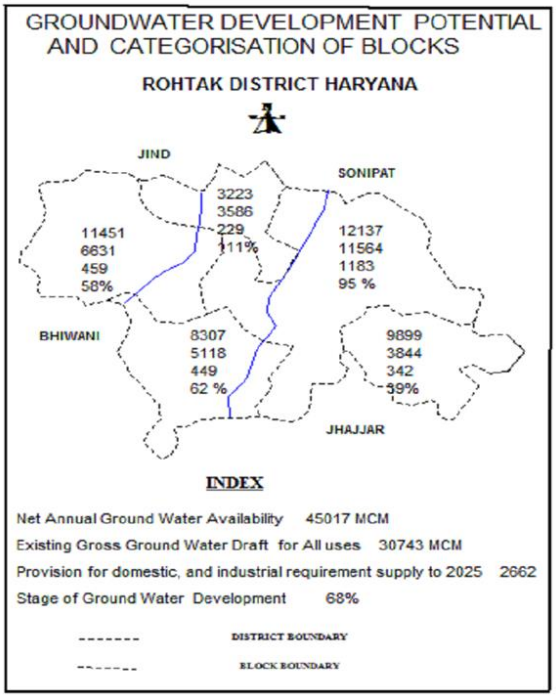
2. Ground water Resources

The blockwise ground water resource potential in the district has been assessed as per GEC-97. The stage of ground water development ranges between 39% (block Sampla) to 111% (block-Lakhan Majra). The total replenish able ground water resource in the district is 450.17 mcm, while the existing ground water draft is 307.43mcm. Ground water availability for future irrigation development is 139.09 mcm. The stage of ground water development in the district is 68%

GROUND WATER RESOURCES OF ROHTAK DISTRICT ,HARYANA.

Assessment Unit / Block	Net Annual Ground water Availability (Ham)	Existing Gross Ground water Draft for Irrigation (Ham)	Existing Gross GW Draft for Domestic & Industrial water supply (Ham)	Existing Gross Groundwater Draft for all uses (Ham)	Allocation Domestic industrial upto next 25 years (Ham)	Net GW availability for future irrigation development (Ham)	Stage of Groundwater Development	Category of the Block
Rohtak	12137	10789	775	11564	1183	165	95%	Semi Critical
Kalanaur	8307	4715	403	5118	449	3143	62%	Safe
LakhanMajra	3223	3357	229	3586	229	-363	111%	Semi-Critical
Meham	11451	6053	578	6631	459	4939	58%	Safe
Sampla	9899	3522	312	3844	342	6025	39%	Safe
Total	45017	28446	2297	30743	2662	13909	68%	Safe

Source: CGWB



Source: CGWB

3. Ground Water Equality

The ground water quality of the district is alkaline in nature and varies from fresh to saline. EC ranges from 565 to 12300 Micromhos /cm at 25^{0}C. 60% of the collected samples in the district have EC less than 3000 Micromhos /cm at 25^{0}C but at few places such as Madina, Sampla, Kansla&Rukhi it is 5755, 12300, 3450 & 5200 respectively.

Constituents: Concentration
EC Micromhos /cm at 25^{0}C: 565-12300
Cl: 14-4252
NO_3: 0.17 - 414
F: 0.16 – 1.86
Fe: nil-7.0
As: 0.0005-0.039

Type of Water

The shallow ground water is $NaHCO^3$ type and mixed facies.

Suitability of Water

Domestic

Salinity, Nitrate, Chloride, Flouride are the parameters which are considered for drinking water purposes. Nitrate concentrations of the district are within permissible limits except at few places such as Nidhan, Kalanaur, Madina, Bhalandpur, Kansla and Rukhi it is 47, 57, 414, 55, 218 & 156 mg/l respectively. 56% of groundwater samples collected from the district have groundwater suitable for drinking purposes.

Irrigation

The shallow ground water to a depth of 20m is by and large fresh and fit for irrigation. The deep ground water is saline and salinity increases with depth and that water is not fit for irrigation. USSL diagram indicates that most of the groundwater samples collected in the district fall under high to very high

salinity class (C3S4) and not fit for irrigation purposes. The SAR values are within the limits. Use of such type of water for irrigation may lead to salinity hazards but may not cause sodium hazards. However, such type of water can be used for irrigating salt tolerant crops grown on soils with adequate permeability and only after addition of appropriate amounts of gypsum.

4. Status of Ground Water Development

The drinking water supply is mainly canal water based in the district. The short fall in water supply to the towns, cities and villages is met with the installation of hand pumps by the public individually as spot and convenient source of water. There are 16995 minor irrigation units with the depth ranging from 15m to 20m. Most of these shallow tube wells are cavity type and either run by diesel engines or electric motors.

5. Geophysical Studies

CGWB has carried out geophysical studies in Rohtak district to delineate the fresh and saline aquifers. The findings of surface geophysical studies in Rohtak district shows that ground water is saline at all levels in major part of the area and is saline below 20m in most of the area over the district. However, in the vicinity of the canals, fresh to marginally saline water is expected and the results indicate deterioration of ground water quality away from the canals. The areas where granular zones with fresh to marginally saline water has been inferred at shallow depth within 10 m are Bohar, Rohtak city, Kansala, Pakasma, Morkheri, Lahli (Near canal), Tatauli, Bahu Jamalpur, Kharkhora Kiloi. Around 12 to 25 m thickness of granular zones bearing fresh to marginally saline water is expected in Rohtak city, Bahu Jamalpur and Kharkhora. In order to prevent deterioration of ground water quality in affected areas due to water logging preventive measures are suggested to be taken.

Resistivity upto 50 ohm m corresponds to the top soil with clay. Thickness of this layer is within 10 m in general. 15 ohm m to 30 ohm m resistivity corresponds to the granular zones bearing fresh to marginally saline quality of ground water. This zone consists of sand and kankar. Less than 15 ohm m resistivity for the bottom horizon corresponds to the formation consisting of clay, sand and kankar bearing saline to brackish quality of ground water. Major part of Rohtak area is water logged, which is the main reason for deterioration of quality of ground water. The other reasons for water logging are dense canal network, seepage through canals, floods, absence of proper drainage system, improper management of water and presence of impermeable clay layer.

VII. GROUND WATER MANAGEMENT STRATEGY

Ground Water Development

The hydrogeological data generated through exploratory test drilling has provided vital information regarding identification of aquifer systems, demarcation of their vertical and lateral extent, delineation of potential aquifer characteristics. However these studies have proved that the district area is by and large saline and salinity increases with depth, thus the area is not fit for deep ground water exploitation. The shallow ground water can extensively be exploited through shallow tube wells(Cavity Type) and the yield of these 15 m to 20 m deep tube wells varie s from 480-600 lpm. PVC pipes are commonly used for constructing these tube wells. Drilling technique used for boring the shallow wells is locally developed.

VIII. GROUND WATER RELATED ISSUES & PROBLEMS

1. Water Logging

The phenomenon of water logging is associated with clayey formation, which causes rise of water levels and salinity in the area. The canal net work in the district is dense, which is another cause of water logging. Water logged areas vary from pre monsoon to post monsoon period. The water logged areas of the district is however reducing year after year due to manifold increase in exploitation of shallow ground water mainly through cavity type shallow tube wells. Thus there has been a check on the rise of water level in the district despite salinity, the main cause of rising trend of water levels.

2. Salinity

The twin problem of water logging and salinity is associated with clay formation at shallow depth, which results in increased evaporation and evapotranspiration from shallow water table. The improper management of ground water by users in the area has also contributed to ground water salinity. This has also damaged surface soils in the area and aggravated the problem of ground water salinity. In absence of natural drainage the rain water accumulates in the natural depressions and artificial drains. This undrained flood water creates ponds and marshes. There however a good network of artificial drains keeps proper balance between soil moisture and air to a considerable extent, and has been very helpful in removing excess water and salt from the soils.

3. Fluoride

High fluoride (F) content, more than the permissible limit of 1.5mg/l, is present in some areas (0.16-1.86mg/l) in shallow ground water of the district, thus making the water harmful (unfit)for human consumption.

IX. RECOMMENDATIONS

- There is a rise in water level along canals due to seepage which creates water-logging conditions. Water logging can be checked by adopting suitable measures to reduce the recharge and increase discharge from the phreatic aquifer. In the problematic areas construction of surface drains, lining of canals and water courses, village ponds, optimum use of irrigation water, a forestation along canals, drains, rails and roads, and pumpage of ground water to drains and canals are some of the remedial measures suggested.
- Fluoride concentration in groundwater can be mapped and the public be educated about its harmful effect on human body. Small defluoridation plants can be used and mixing of water can be practiced.
- PVC pipe assembly may be used in case of shallow tubewells.
- In the vicinity of the canals, fresh to marginally saline water is expected and the results indicate deterioration of ground water quality away from the canals. Around 12 to 25 m thickness of granular zones bearing fresh to marginally saline water is expected in Rohtak, Bahu Jamalpur & Kharkhora. Areas having granular zone with thickness of 12.0 and 25.0 m can be used for construction of 20 to 30 m deep shallow tubewells. In other areas where fresh to marginally saline water is expected within 10 m depth, shallow ground water structures in the form of dugwells or handpumps can be constructed to maintain balance in the use of canal water & ground water.
- In order to prevent deterioration of ground water quality in affected areas due to water logging some preventive measures are to be taken, such as

lining of unlined canals & repairs of broken linings etc. Proper drainage system to avoid accumulation of flood water may be helpful in this direction.

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