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GROUNDWATER SCENARIO OF AJMER DISTRICT, RAJASTHAN AN ENVIRONMENTAL ISSUE

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ABSTRACT

The district is situated between 250 38' & 260 58' North latitude and 730 54' & 750 22' East longitude covering geographical area of 8,481 sq km. Name of Ajmer is derived from Ajeymeru (the invincible hill). Ajmer is one of the Division which is further sub-divided into 4 sub-divisions namely Ajmer, Beawar, Kekri & Kishangarh and comprises of 6 tehsils & 8 blocks. Total number of villages in the district is 1022 (2001 census). Rural & Urban population of the district is 13,06,398 & 8,74,128 respectively. Decennial population growth rate of the district is 26.09% since 1991. The district is known for Khwaja Moinuddhin Chisti's Dargah and religious Pushkar town, where temple of Lord Bhrama, is situated. Systematic Hydrogeological survey in the district was carried out by Central Ground Water Board from 1970 to 1980. Reappraisal hydroeological survey of entire district was carried out during 2004-05. Under exploratory programme 45 exploratory boreholes, 2 observation boreholes and 1 slim hole have been drilled. Since 1969, monitoring of water level is being carried out four times a year from 38 National Hydrograph Network Stations.

Mean annual rainfall (1987-2006) of the district is 453.2 mm whereas normal rainfall (1901-70) is lower than average rainfall and placed at 433.8. Almost 95% of the total annual rainfall is received during the southwest monsoon, which enters the district in the last week of June and withdraws in the middle of September. Probability of average annual rainfall exceeding 300 mm is only 90%, except at Mangliawas. However, there is 10% probability that the average rainfall exceed 600 mm. Drought analysis based on agriculture criteria indicates that the district is prone to mild and normal type of droughts. Severe and very severe type of drought is very rare and occurred only twice during 1987 & 2002 (Srinagar); 1977 & 1987 (Todgarh); & 1991 & 1993 (Vijaynagar). January is the coldest month with mean maximum and minimum temperatures being lowest at 22.70 C & 7.60 C. Temperature in summer month, June, reaches up to 39.50 C. There is drop in temperature due to onset of monsoon and rises again in the month of September. Atmosphere is generally dry except during the monsoon period. The humidity is highest in August with mean daily relative humidity 80%. The annual potential evapotranspiration in the district is 1565.6 mm and is the highest in the month of May (243 mm).

INTRODUCTION

The distinguishing feature of the Ajmer district is Aravalli hill ranges, which divides plains of Marwar from the high table land of Mewar. Hill ranges runs parallel to each other giving rise to elongated valleys. Highest range is 970.3 mamsl at Bhutia Dungra. Sand dunes and cluster of sand mounds cover a large part of the Sarsuti valley and area around Picholian & Pushkar valley. These features are formed due to abrupt termination of a hill range or existence of wind gaps in the hills. Index map 5 The district falls in the Banas (64.88%), Luni (23.74%) & Shekhawati Basin. There is no important river in the district. Khari, Dai, Sarsuti or Saraswati, Sagarmati, Bara, Mashi and Roopnagar Rivers are ephemeral and flow only in response to precipitation. Banas River enters the district from the southeast near Khera & Jitpura villages and flows from south to north for about 3 km. It changes the direction and flows from southwest to northeast. Pushkar & Bud Pushkar are two natural lakes near the Ajmer city. The

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Pushkar Lake is nearly rectangular and about 500 x 600 m in dimension. The Budh Pushkar Lake has greatly dwindled in size due to heavy pumpage from the original size of 1.5 sq km to a few hundred sq m only.

Soils of the district are classified as follows: Sierozeme: This is arid soil, sandy loam to sandy clay, deep, brown and calcareous, found in the northern part in Silora block. Cultivation is limited due to climatic factors. Lithosols and Regosols of hills: This type of soil is found in the western part on the Aravalli hills and hill slopes. These are found at shallow depths with gravels near surface, reddish brown to grayish brown. Cultivation is limited due to limited root zone. Brown soils (Saline phase): These soils are pale brown to yellowish brown and are developed mainly from Proterozoic and Arachaen rocks and alluvium. These are associated with seasonal water table and saline. Cultivation is limited due to salinity. Alluvium: These are found in plains and derived from alluvium. The richest soil is obtained from the sand hills of Pushkar. These are non-calcareous, semi-consolidated to unconsolidated, brown, loamy sand to sandy loam and occupy gently sloping terrains in central and eastern part of the district. Total forest area is 54,737 ha (6.49 %) mainly. Cultivable area of the district is 6,49,149 ha (77.06%) whereas uncultivable area is 1,38,189 ha (16.40%). The major Kharif crops are bajra, jowar, pulses, maize and groundnut. Main Rabi crops are wheat, barley, gram and oilseeds. Cotton is an important cash crop that is grown in the district. Net area under irrigation is 92,807 ha (11.01% of the total geographical area). There is no major irrigation project, only 3 medium viz Lasariya & Narayan Sagar (Banas Basin) & Phool Sagar, Jaliya (Luni Basin) and 384 minor irrigation projects exists in the district whereas 3 minor irrigation projects are ongoing. Dug wells are the main source of irrigation (83.32%). Bore wells and tube wells are limited due to low discharge.

HYDROGEOLOGY

Major water bearing formations are alluvium, schist, gneiss, granites, limestone and phyllite of Bhilwara Supergroup & Delhi Supergroup. Ground water occurs under unconfined to semi-confined conditions in weathered and fractured part of the consolidated formation. These form generally poor aquifers compared to alluvium. Granite gneiss covers 4811 sq km (56.73%) and found in the eastern part falling in Kekri, Arain, Bhinia and parts of Masuda, Srinagar, Silora and Jawaja blocks. Quality of water varies from potable to brackish. Yield is generally poor and varies from 30 to 90 m3 /day

Schist is confined to 2,690 sq km (31.72%) in the western part of the district falling in parts of Pisangan, Srinagar, Silora, Masuda and Jawaja blocks. Open wells tapping schist yield 40 to 80 m3 /day whereas wells located along the intrusions of quartz vein and pegmatites yield 100 to 170 m3 /day

Alluvium covers only 494 sq km (5.83%) and found at isolated locations in eastern (Kekri block) & western part (Pisangan, Srinagar & Silora block) of the district. Thickness of alluvium near Srinagar is 20 m whereas in the Roopnagar valley it is quite thick and extends up to 40m. Yield of tube wells in alluvium varies from 50 to 150 m3 /day. Quartzite forms aquifer is different disconnected areas of limited extent in topographic lows in the western part of the district in the vicinity of Roopnagar, Kishangarh, Ajmer, Beawar and west of Nasirabad. Yield of wells tapping quartzite very from 40 to 100 m3 /day.

Limestone occurs between Bassi & Nand along Sasuti valley; confluence of Sasuti & Sagarmati Rivers in the north and Baktawarpura in the south. These do not form potential aquifer. Yield of wells at isolated location may goes up to 100 m3 /day. Depth of dug wells is below 50 m, generally restricted to weathered thickness. Nearly 90% wells are in the depth range of 10 to 25 mbgl. The yield of shallow wells varies from 20 to 30 m3 /day and it may go up to 150 m3 /day depending upon formation. Bore wells/ tube wells are generally 60 to 175 m deep. Depth to water level as recorded in 28 NHS (2006) ranges from 3.13 to 30.80 and 1.45 to 28.89 mbgl during pre-monsoon and post monsoon respectively.

GROUND WATER QUALITY

Ground water quality in shallow aquifer is deteriorated in northern part of Arian, southeastern part of Srinagar, southwest Bhinai and central part of Jawaja blocks where electrical conductance exceeds 3000 mmhos/cm at 250 C. Groundwater of electrical conductance less than 750 mmhos/cm at 250 C occurs in Kekri, Pisangan & southern part of Jawaja block. In rest of the area electrical conductance varies between 750 & 2000 mmhos/cm at 250 C. As compared to shallow aquifer, deeper aquifers are brackish to saline with electrical conductance ranges between 670 & 12320 mmhos/cm at 250 C. Groundwater is brackish (more than 3000 to 18030) at Bhilwara – Ajmer border along the Khari River. High conductivity in groundwater makes the area unfit for non-salt tolerance crops. Salt tolerant crops are suggested in these areas. Fluoride concentration in groundwater exceeding permissible limit (1.5 mg/l) has been reported from all the blocks. Higher values of fluoride have been observed at Goela (10.6), Bogla (7.56), Arian (5.54), Nasirabad (4.8), Bandanwara (4.43), Ludiana (3.85), Taragarh (2.85), Baglia (2.84), Kekri (2.28), Jawaja

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(2.04), Kishangarh (1.95) & Tabiji (1.65). Deeper aquifer has relatively better quality water in respect of fluoride contamination and varies from 1.0 to 7.96 mg/l. Higher concentration of Iron (permissible limit 1.0 mg/l) were observed in hydrograph stations at Bogla (16.5), Ghugra (8.05), Jawaja (6.08), Sanpla (1.14) & Ludiayan (1.09) in shallow aquifer.

GROUND WATER DEVELOPMENT

The ground water development in the district is being done by dug wells, bore wells and dug cum bore wells. Dug wells with horizontal boring are very common. Diameter of dug well varies from 1 m to 4 m with depth ranging from 5 m to 50 m. The present stage of ground water development in the district is 122.79%, which indicates that the scope of ground water development is already exhausted. Out of 8 blocks, 6 falls under "Over-exploited" category and 2 under "Critical" category. Gneiss, schist and alluvium form the aquifers in different parts of the district.

Alluvium area is restricted to riverbeds. Ground water occurs under unconfined to semi-confined conditions. Depth and diameter of the dug wells and bore wells depend on formation and geomorphology. However, general depth of dug well ranges from 5 to 25m, tube wells between 30 & 45m & bore wells between 65 & 175m.

Ajmer town falls in Pisangan block with total urban population 5,05,311 with 22% decadal growth since 1991. Most of the dug wells dried up during pre monsoon period. Water was previously supplied from Sagarmati and Sasuti River. Presently Leela Sewri, Ganhera & Budha Pushkar supplying water to Ajmer town. Most of the water supply to the town is being supplied from Bisalpur Project. Ajmer district has eight major towns namely Ajmer, Kishangarh, Beawar, Nasirabad, Kekri, Sarwar, Vijaynagar and Pushkar. The Vijaynagar town is covered under fluoride project and connected to Bisalpur dam recently. While Pushkar has its own source and Ganhera water is used for piped water supply system. Remaining all the towns of the district are covered by piped water supply schemes through Bisalpur Dam. All the schemes except for Nasirabad are maintained by the Public Health Engineering Department of the state. Water for Nasirabad town is supplied by the PHED in bulk quantities to the Cantonment Board for civilians and to MES for the Military requirement.

Due to scanty rainfall and poor hydrogeology of the area, yield from ground water sources has been negligible. During the period 1984-94, there has been acute water crisis in the area resulting in reduction in frequency of water supply to the urban towns of Ajmer, Beawar and Kishangarh to as low as once in 48 to 96 hours, for a duration of half to one hour only, in the various zones. In view of the unprecedented scarcity Bisalpur water supply project, for augmenting water supply to Ajmer, Kishangarh, Beawar, Kekri, Nasirabad and Sarwar towns, was sanctioned in the year 1987. The scheme envisaged construction of a dam across the seasonal river Banas, near village Bisalpur, approximately 120 kms south of Ajmer. The water stored during the monsoon season was purported to use for the requirement of water for the six urban towns of Ajmer district.

Pushkar Sarovar having storage capacity of 0.57 Mcm with full reservoir level of 6.7m is depleting its reservoir in the past few years. In addition to 950 m3 /day of water is being put into the Saraovar from Pushkar (720 m3 /day) and (230 m3 /day) from well field as a short-term measure. It is proposed to direct 1870 m3 /day of water from Leela Sewri and Ganhera well field, which is presently being supplied water to Ajmer City by PHED. Major part of the district (about 90%) is covered by hard formation where success failure ratio is 81:09. High yield i.e. more than 500 lpm was recorded in 7% (total 44 wells) of wells, yield between 250 & 500 lpm in 25% wells, between 100 & 250 lpm in 16% yield between 50 & 100 lpm in 20% whereas yield less than 50 lpm was registered in 23% of wells. About 9% wells have yielded negligible quantity of water

Stage of ground water development in the district is 122.79%, which indicate that the scope of ground water development is already exhausted in 6 blocks where 17 groundwater development has already exceeded 100% and categorized as "Over-exploited". Only 2 blocks fall under "Critical" category where ground water development is approaching 100%. Most of the boreholes have been drilled in the northern & western part of district falling in Silora, Srinagar & Pisangan blocks. There is no scope for further development in the over exploited blocks of the district for irrigation or industrial use. However, exploratory drilling can be taken up in Masuda and Kekri blocks and unexplored area for estimation of aquifer parameters.

WATER CONSERVATION AND ARTIFICIAL RECHARGE

Due to over development, further exploitation of precious resource must be checked. For sustainable development of ground water, artificial recharge measures to be employed to augment ground water and surface water resources. Exploratory drilling results show potential zone having inferior quality water, which can be blended with fresh water for irrigation use. Since the stage of ground water development has

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already crossed 100%, artificial recharge is the only solution to augment ground water through construction of bunds, anicuts, and rooftop harvesting structures. The area has undergone polyphase deformation in geological past, which has resulted in a complex structure (folded, faulted and jointed) that may not be conducive for such structures. Therefore, site of these structures should be selected carefully. Impact assessment of check dams revealed that increase in water level, cropping area, cropping intensity, crop production and labor employment observed in the project area. Erosion from nalah bank minimizes. Cropping pattern and cropping intensity changed. Harvested water provides supplementary irrigation during long dry spell. In view of the above, such artificial recharge programmes may be taken up in the district for further development of surface water and ground water resources to enhance agricultural production.

GROUND WATER RELATED ISSUES & PROBLEMS

Decline in Water level

Majority of blocks (6 out of 8 blocks) falls in over-exploited category whereas two blocks falls in Critical category, approaching to over exploited category. This has been resulted due to depletion in water level. Long term (1997-06) declining rate is more in urban areas falling in Pisangan (2.54 m/yr) and Srinagar block (1.02m/yr). Quality constraints Presence of fluoride in ground water is major problem in entire district. Situation is more pronounced in Vijaynagar & Masuda blocks where fluoride values exceed 10 mg/l. These blocks are now depended on water supply from Bisalpur dam. Fluoride is higher in shallower aquifer as compared to deeper aquifer.

Water scarcity

Almost entire district is facing problem of ground water scarcity, though water supply from Bisalpur dam solved drinking water problem to certain extent in urban areas. Over the greater part of the district occupied by hard formation the well yields are very poor. As such the depth of weathered zone is generally restricted up to 50m, which control the occurrence and movement of groundwater. Deep-seated fractures below 100m are very rare. This causes reduction in the well yield drastically during the summers creating acute water shortage of domestic water supply. However, in selective areas located on structural weak planes connected to some recharge source wells continue to yield moderate quantity of water. Deeper levels are either devoid of water or of poor quality of ground water (brackish to saline). Alluvium occurs at limited places along the major drainage/ valley fill and has shallow thickness. The well yield varies considerably year to year in different parts of the district and over the season. Thus the availability of surface as well as ground water is very scarce in low rainfall years & especially in summer months.

Mass awareness Programme (MAP)

A Mass Awareness Programme on "Ground Water Management in Pushkar Valley" was organized at Pushkar, Ajmer district on 14th February 2002. Dr D K Chaddha, Chairman, Central Ground Water Authority, New Delhi presided over the function. Shri Ramzan Khan, MLA, Pisangan (Ajmer district) & Shri Hira Singh, MLA, Raipur, (Pali district) were special guests on the occasion. Shri S S Chauhan, Member (ED & MM), Central Ground Water Board, Faridabad also graced the occasion as special guest. Shri Ram Singh Vishnoi, Minister for Public Health & Engineering Department also graced the occasion. During the programme, all the members and local people presented their views to check declining ground water levels in Pushkar Valley

Water Management Training Programme (WMTP)

A one day Training Programme on "Rainwater Harvesting for Artificial Recharge to Ground water" was organized at Ajmer on 13th December 2005. Prof M L Chhipa, Vice Chancellor, Maharshi Dayanand Saraswati University (MDSU), Ajmer was the Chief Guest during inaugural function. The function was presided over by Shri Mahaveer Singh, Collector, Ajmer. Prof A K Sinha, Department of Geology, University of Rajasthan and Prof K C Sharma, Head of Department, Environment Studies, MDSU, Ajmer were Special Guests. Shri A D Joseph, Regional Director, Central Ground Water Board, Western Region, Jaipur & other officers from CGWB imparted training. Lectures were also delivered by Prof A K Sinha and officers from various State Government Agencies including Ground Water Department, Irrigation Department and Public Health & Engineering Department, etc. Representative of non-government organization participated in the training. An exhibition was also organized during the training programme.

Areas Notified by CGWA

Pushkar valley, Ajmer district was Notified on 30th September 2003 for registration of groundwater abstraction structures. In response to this notification, 521 groundwater abstraction structures were registered with Central Ground Water Authority. It was again Notified on 5th December 2005 for groundwater

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regulation and management making it mandatory to seek permission for any structure propose to drill for groundwater abstraction. Advisory Council under the Chairmanship of District Collector is constituted to take up all the issues related to Notified area of Pushkar valley.

RECOMMENDATIONS

1. Ground water draft is very high in Pisangan, Srinagar, Jawaja, Bhinai & Silora blocks. Stage of ground water development in the district has reached 122% due to indiscriminate use. It has to be controlled by preventing further development.
2. Revival of traditional ground water storage system i.e. Baori, open wells, Tanka etc for rainwater conservation for use in day to day life will reduce ground water draft.
3. Awareness programmes and training on rainwater harvesting will be beneficial to check the decline in water level and justified use.
4. Taking advantage of uneven topography of the area, small check dams or earthen dams, upstream of irrigation commands, at suitable sites, may be constructed to store rainwater. This will increase recharge to ground water which ultimately result in increase of yield of wells.
5. An area of 547.37 sq km is occupied by forest. To protect the area from environmental degradation, extensive programme of aforestation and soil conservation measures may be taken up.
6. Modern agricultural management techniques have to be adopted for effective and optimum utilization of the water resources. Maintaining irrigation through minimum pumping hours as per minimum requirement of water by the crop and also selecting most suitable cost effective cropping pattern can achieve this.
7. Alluvial tracts along river channels of Banas, Kothari, Khari, Manusi and Chandrabhaga are most feasible locations where shallow wells can be constructed to harness the shallow water table aquifers being potentially recharged by the flash flood and surface runoff. These wells can be used for water supply, wherever feasible.
8. Surface runoff can be harnessed by constructing tanks at feasible sites in the area occupied by the hard rock terrain for supplementing irrigation potential to increase the agricultural production.
9. High water requirement crops be discouraged. Proper agriculture extension services should be provided to the farmers so that they can go for alternate low water requirement economical crops.

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