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GROUNDWATER MANAGEMENT IS THE NEED OF TIME IN THE SOUTH WESTERN REGION OF RAJASTHAN

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ABSTRACT

Sustainable groundwater resource management is need of the time and this aspect become crucial in the western desertic terrain of Rajasthan which witness scarcity of rainfall. The success of any physical activity being planned for groundwater depends upon the availability of runoff in the area, direction of flow of groundwater and the physical characteristics of the aquifer rocks. The role and importance of groundwater in the natural water cycle has become now more recognized with the increasing dependency of many human activities on it. With increasing human interference with the water cycle, the groundwater is at risk. The groundwater resources are also facing threat due to climate variability and changes. The effect of the implication is from local to global level.

The South-western region of Rajasthan which is the research study area is largely represented by semi- desertic to desertic terrain and therefore there is a water scarcity in the region. This region witnesses least groundwater recharge hence there is a need for sustainable management of available water resources.

The concluding observations and the suggestions given in the papar will go a long way in increasing the potable groundwater potential of the studied six districts of Rajasthan on one

hand and on the other hand it will keep sound health of the local population. It is high time to conserve the rainwater in the artificial water conservation structures as it is safe for drinking, however groundwater augmentation structures are recommended in the Malani Igneous Suite rocks mainly in granites and rhyolites which have been proved as fair aquifers in the region though their yielding capacity is limited. Tubewells for irrigation may be restricted particularly in over exploited groundwater blocks.

INTRODUCTION:

Groundwater is the water to be found beneath Earth's surface in earth pore spaces and in the fractures of rock formations. A unit of rock or an unconsolidated deposit is called an aquifer when it can yield a particular quantity of water. Groundwater is the primary resource of potable water supply in rural India. It is not readily available in most parts of India due to hard rock shield which covers 70% of the country. Central and Southern part of the country consists of a peninsular portion where surface water is sparse or seasonal and the groundwater is deep. The similar situation prevails in Malani terrains of western Rajasthan.

The population growth of the state is among the highest in the country. Demand for water from uses such as industry, tourism and amusement as well as sanitation and environmental purposes has been growing. Nearly one-third of the RajasthanState is arid and another 30 per cent semi-arid, which implies that nearly two third of the State suffers from recurrent water scarcity. Monsoon rain is also lesser in Rajasthan due to parallel alignment of Aravalli hills with Arabian monsoon direction.

Almost south-western region of the state is facing groundwater scarceness. However, there are large areas in danger for quality and depleted water table. Major issues in the study area (covering districts of Barmer, Jaisalmer, Jalore, Jodhpur, Pali & Sirohi) are as follows:

MAJOR POLLUTANTS AFFECTING POTABLE WATER

EC Variation: It has been analysed that EC values remained anomalous in the study area when studied between the periods from the year 2011 and 2014 . The permissible EC values in potable water is up to low 2000 µS/cm while they are analysed 15400 µS/cm in Patodi village in Balotra block of Barmer district in year 2011. Again in this block at Thob village EC value of

11200 µS/cm observed in year 2014. These values are increasing year after year due to less rain. (Table1.1).

Table- 1.1 EC variation in few selected villages of Balotra block of Barmer district of Rajasthan (Between the period of 2011 to 2014)

S.no.	Well Location	Pre-monsoon E.C. (µS/cm) 2011	Post-monsoon E.C. (µS/cm) 2011	Pre-monsoon E.C. (µS/cm) 2014	Post-monsoon E.C. (µS/cm) 2014	Pre-monsoon 2011, $NO3^{-1}$ (mg/L)	Post-monsoon 2011 NO_3^{-1} (mg/L)	Pre-monsoon 2014, NO_3^{-1} (mg/L)	Post-monsoon 2014 NO_3^{-1} (mg/L)
1	Balotra	4000	4900	10500	2100	80	50	11.0	16
2	Barnawa	7800	7000	4900	2600	264	150	122.0	100
3	Charlai	4500	3900	4950	4000	140	80	100.0	80.5
4	Kalyanpur	6000	2300	5350	2350	37	50	166.0	120
5	Patau	4800	5300	450	3700	33	90	02.0	42
6	Khattu	4200	4700	3900	3300	175	45	50.0	112
7	Nagona	4500	6000	4800	700	30	42	116.0	1.5
8	Patodi	**15400**	15000	2730	1500	**880**	**250**	102.0	75
9	Thob	6600	13500	**11200**	5000	250	190	80.0	48
10	Thumbli	5300	5900	5670	3600	126	50	111.0	65
11	Variya	2100	3000	2100	1300	29	45	29.0	15

Source: SenHemant, (2017) Ph.D.Thesis

High Flouride Contamination: The high fluoride contamination beyond 1.5ppm of fluoride is observed in almost all the six districts. The flurosis disease is wide spread amongst the local residents like pain in joints & yellowness in teeth etc.. In Barmer, Sirohi, Jaisalmer and Jalore districts situation is alarming and be tracked by a firm hand. The anamolous values of flouride have been observed in groundwater sources in most of districts. Rajasthan is the only State in India where in almost all the district, the distribution of high fluoride in groundwater have been reported.

Nitrate Pollution: 45mg/L is upper normal limit of nitrate concentration in potable water but in the study area, maximum value of 880 mg/L is observed in the groundwater of village in Patodi (2011) in Balotra block of Barmer district which is alarming.

Salinity: High salinity in potable water sources of Jalore, Barmer and Jaisalmer have been noticed. The desalination process is costly and therefore it is need of the time to provide safe drinking water to the people in high salinity villages through conserve of rain water.

Groundwater Depletion Hazard: Comparison of pre monsoon water level between 2011 & 2014 shows that 70% of wells (total wells reported 66 Nos.) registered decline in water level. The long term depleting nature of water level causes reduction in storage, which leads to water scarcity. Villages located in such areas have the basic problem of drinking water requirement and the situation becomes very critical in summers and in drought years. It calls for technical assessment of this crucial situation.

NEED OF EFFECTIVE GROUNDWATER MANAGEMENT

Water management requires a holistic view in meeting ever growing demand in developing countries like India. Uncertainty associated with the availability of water, extreme weather conditions, climate change, deteriorating quality of water, limited infrastructure and ever increasing demand pose a great challenge to the water managers and decision makers.

The groundwater scarcity particularly in arid and semi-arid regions has been given special attention and is much more in hard rock regions. The complexity of the aquifer system in hard rock terrain adds to the problem to tackle in a different way. In spite of fair amount of

research for igneous rocks, it is still needed to understand the behavior of such complex system of particular region, precisely.

As the study area comprises mainly of rhyolite and granites, the main challenge on water sector is in hard rock areas involving the problems of water conservation and its management inclusive of planning of the water resources. Therefore, the present research is focused on impact of groundwater augmentation structures, quality of groundwater with type of rocks exposed.

The **challenges of water sector** are many facets. Following are some of the important issues which have to be addressed in the strategic planning in water sector:

- Growing imbalance between demand and supply of water.
- Lack of ownership among the stakeholders;
- Low water charges;
- Groundwater over exploitation; and
- Lack of consensusness among stake holders on water sector reforms;

The above background leads to the following priorities and activities for water resources development and management:

- Minimizing adverse impacts of water resources development on the natural environment and on population affected by project implementation works;
- Institutional reforms;
- Water charges rationalization; and
- Water resources information systems and awareness campaign.

VISION FOR SUSTAINABLE GROUNDWATER MANAGEMENT:

Sustainable groundwater resource management is need of the time and this aspect become beneficial in the western desertic terrain of Rajasthan which witness scanty rainfall. The success of any physical activity being planned depends upon the availability of runoff in the area, direction of the flow and the physical characteristics of the aquifer rocks. The groundwater resources also facing threat due to climate variability and changes. The manifestation of the

implications is from local to global level. Thus governmental policies should be so planned to use every drop of groundwater in a sustainable manner.

The State Water Policy should focus on paradigm shift from engineering bases solutions to community based management system. Thus the role of water user associations and NGOs assumes greater importance in future water management. The focused attention in theperiodical V^{th} year Plans should be on harnessing the remaining surface water, reducing gap between irrigation potential created & utilized, strengthening Water User Associations and water harvesting, improve irrigation efficiency with shift from surface irrigation to adoption of drip & sprinkler irrigation system and from traditional cropping pattern to new less water requiring crops.

From the above discussion, following conclusions and suggestions have been drawn which we will helpful for planners and policy makers to formulate future strategies for integrated development of all the six districts covered under the research study particularly in accelerating groundwater potential and supply of safe drinking water to the inhabitants.

CONCLUDING OBSERVATIONS

Living on earth is possible because of its vast water resources. As human activities expand, this generous gift of nature is predicated to become scarce. The fast growth in population and the corresponding expansion in the requirement for domestic, industrial and agricultural needs necessitate the conservation and judicious use of water and leave what we inherited to the future generations.

The groundwater quality is dependent upon the factors such as: rainfall problem, depth of water table, distance from the source of contaminants, human interference, industrial, agricultural and domestic effluents and soil properties like texture, structure and infiltration rate. Determination of groundwater quality will allow one to take the most feasible remedial action necessary to restore an aquifer to some predetermined level of quality in order to provide treatment for the contaminated water before use.

Availability of safe and potable drinking water still remains a distant dream for a significant percentage of population residing in rural areas of 18 Western and North Western districts of Rajasthan, where main source of drinking water is groundwater which is available

through open wells, tube wells, hand pumps etc. The scanty rainfall has put almost a halt on proper recharge of groundwater on one hand and on the other, groundwater sources are being contaminated due to concentration of various contaminants being leached by weathering through rocks, agricultural, industrial and human activities. Such an adverse situation is alarming and calls for remedial action.

The study area districts display almost a desertic to semi- desertic terrain where water scarcity is always exist due to least precipitation and rainfall. Author therefore came to following **major conclusions** which may be of great significance in this region in future:

1. For the forgoing description it is clearly evident that the six districts of the study area represents a desert terrain and most part is covered by wind blown sand and the alluvium. These are scanty outcrops of rocks of varied age group. The Malani Igneous Suite of Rocks appear a few potential aquifer rocks in the region if water holding structures are constructed in igneous terrain. Scanty vegetation does not support adequate rainfall hence annual groundwater recharge is meager. Water scarcity is seen all around the study area. Groundwater is the major source of potable water which is too contaminated with high fluoride, nitrate, salinity etc. The groundwater augmentation structures are less in number as rock exposures are less in this region.

2. In the entire study area, the main litho units of Malani Igneous Suite like granite and rhyolite are proved as good aquifers. In these rocks, water retention during pre- monsoon period was observed as significantly high and therefore the future groundwater augmentation structures should be planned in these category of rocks;

3. On the contrary in the younger alluvium of the study area, wells so drilled remained dry during pre-monsoon period. Moreover in the subsequent years of construction of wells the situation remained worse and most of the wells witnessed completely dryness;

4. Even in the river beds, the situation observed is slightly improved and in the groundwater augmentation structure so constructed in river beds retained least water during pre-monsoon period; and

5. The entire study area is almost a desertic terrain with least exposures of rocks. Majority of the rocks in the entire study area are represented by Malani Groups of rocks predominantly by granites and rhyolites. The State Watershed Department have

constructed hundreds of groundwater augmentation structures constructed in different parts of the study area in different litho- units and it has been observed that their efforts declared successful in the igneous rocks like granite and rhyolite too. These rocks are providing water to the local population and the cattle on one hand and on the other are recharging the nearby dug wells and the tubewells.

6. From the above discussion, it is quite clear that in all the six districts of the study area, potable groundwater sources contain number of pollutants like nitrate, fluoride which are affecting human health. Therefore, local population is in urgent need of pipe water supply to fulfill their drinking water needs. High fluoride content also affect the health of cattle therefore alternative surface water sources be constructed to provide safe water even to the local cattle population.

SUGGESTIONS

Suggestion have been made at certain places wherever they sprung logically from the findings; nevertheless in order that they reflect an overall picture of the findings, it is desirable to put forth all the suggestions in a compact form to understand their underlying interdependence and importance of policy measures that follow:

1 It is high time to review and rethink about our strategies and stop this maid race of overexploitation of groundwater at the cost of local residents who, in fact are in need of safe drinking water for cooking and drinking and therefore strict laws be framed to check the over exploitation of groundwater and thereby keeping a balance between annual recharge and usage of groundwater in a systematic way;

2 Central and State government should provide tap water to the local population having high fluoride containing groundwater sources. As surface water does not contain fluoride, it may be supplied in flourosis endemic areas to the local population by laying pipelines. Although it is a costly affair but should be implemented to keep health of the people in a phased manner;

3 Although about fifty lakh people in India are reportedly suffering from flourosis, yet in order to identify the exact magnitude of the problem, detailed water quality analysis of all the drinking water sources be undertaken every year by both Central and State government concerned departments.

4 Practically, little attempt has been made till date to investigate in detail the physio-chemical processes that alter the water quality in different region of India because of its high expensive nature. It is need of the time.

5. Assessment of water sources availability in space and time forms a crucial part of the planning process for rural water supply programmes. Systematic research is needed on dynamics of groundwater, its depth variation, relative importance of rainfall pattern etc. Iso-concentration maps of contaminated levels in groundwater should be prepared for all the tehsils, towns, cities and district headquarters and be revised from time to time in relation to the changes in land use patterns.

6 All the information about the hydrological variation of the aquifer, i.e. the location depth and area of the aquifer, its geological and mineralogical characteristics, groundwater occurrence, its levels and seasonal fluctuations recharge characteristics, hydraulic gradient, transmissivity, velocity and direction of groundwater flow should be assembled. Water table positions in both recharge areas as well as in discharge areas should be measured by both Central as well as State Groundwater Department/Board.

7 The groundwater of the study area has been least protected and highly exposed. There is strong need of district level monitoring to tackle the problem with a firm hand. Any default against existing environmental protection acts and rules be considered a cognizable offence. District administration should arrange for a counter check verification of pollutants in potable groundwater sources of all the six districts covered under this research study. Prescribed safe limits should be seriously adhered too.

8 The statutory provisions made under various acts for proper and limited use of groundwater, digging of wells and tubewells etc should be strictly adhered and defaulters should be severally penalized. Surprise inspections should be executed with adequate power so that defaulters are penalized at the spot.

9 As the study area has limited outcrops, the potential aquifers of the area be assessed and in potential rocks, future groundwater augmentation structures, be constructed for prolonged retention of groundwater and for greater recharge of aquifers.

10. Under mentioned few more suggestions which are useful to overcome shortfall of water are:.

a. Retention of Rainfall where it Falls: Rainy season is mostly 60 days in a year in southwestern part of the Rajasthan state hence the most obvious concentration of effort should be directed towards retaining the rainfall where it fell through construction of *khadins*, *anicuts* and ponds.

b. Linking of Major Rivers of India : The Central Government appears to be quite serious about implementing the river linking project. Hard rock and salty water terrain should be linked with this project in first priority, so as to provide safe potable water.

c. Prevent wastage of water: We must keep two outlet in bathrooms one for soapy water and other for soap free water. Soap free water may be used either for livestock or for lawns and percolation tanks. Even we can have two separate bathrooms. Similarly we can have separate washbasins, one for soap free water which may also be linked to lawns. In Peoples should make habit of taking bath without soap at least five days in a week in winter season and as per need in the other seasons. Also stop washing cloth without getting real dirt.

d. Forced changes in food habits: Peoples may be appreciated to continue with their traditional food habits. At present maize, bajra and jwar eating peoples started taking wheat and wheat eating added rice in their food menu. Wheat and rice crops require more water for their growth than maize, bajra and jwar.

The above conclusion and suggestions will go a long way in increasing the potable groundwater potential of the studied six districts of Rajasthan on one hand and on the other hand it will keep sound health of the local population. It is high time to conserve the rainwater in the artificial water conservation structures as it is safe for drinking, however groundwater augmentation structures are recommended in the Malani Igneous Suite rocks mainly in granites and rhyolites which have been proved as fair aquifers in the region though their yielding capacity is limited. Tubewells for irrigation may be restricted particularly in over exploited groundwater blocks.

It is for us to manage water resources wisely and well. Government should promote rainwater harvesting which is more urgent. Educating the public and making it aware of the real issues involved is the need of the time. Therefore there is need of effective groundwater management in the six facilitate in providing safe potable water to the local population and on one hard and on the other will give a way to retain the precious water for agriculture and industrial purposes

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