SJIF Impact Factor: 6.047 Volume: 6 | November - October 2019 -2020 ISSN(Print): 2250 – 2017

International Journal of Global Economic Light (JGEL)

Journal DOI : https://doi.org/10.36713/epra0003

ECONOMIC SUSTAINABILITY THROUGH ARTIFICIAL RECHARGE OF GROUND WATER

Dr. P.K.Verma

Dean, Student Welfare, Ranchi University, Ranchi, Jharkhand, India

Dr. Shweta Mishra

Jailhata, Daltonganj, Jharkhand, India

ABSTRACT

Water resources are an essential commodity for everyone as it is an important element for food security, economic prosperity and enhancing the quality of life of the people. The future food security of India depends upon the availability of irrigation water and the productivity of the consumed water. Over exploitation of ground water is leading to depletion of ground water irrigation resources, especially in high food production areas of the country. Arresting the depletion of ground water is of utmost importance for the sustainable food production and food security of India.

A large number of dams, barrages, hydro power structures, canal network, and other infra-structural facilities have come up all over the country in the last 50 years. A milestone in water resources development is creation of huge storage capacity because of which it has now become possible to provide assured irrigation in the command areas, to ensure supply of water to hydro- and thermal power plants, and also to meet demands from various other users.

KEYWORDS: *exploitation, irrigation water, thermal power plants, ground water, food production*

INTRODUCTION

Water resources are an essential commodity for everyone as it is an important element for food security, economic prosperity and enhancing the quality of life of the people. The future food security of India depends upon the availability of irrigation water and the productivity of the consumed water. Over exploitation of ground water is leading to depletion of ground water irrigation resources, especially in high food production areas of the country. Arresting the depletion of ground water is of utmost importance for the sustainable food production and food security of India.

A large number of dams, barrages, hydro power structures, canal network, and other infra-structural facilities have come up all over the country in the last 50 years. A milestone in water resources development is creation of huge storage capacity because of which it has now become possible to provide assured irrigation in the command areas, to ensure supply of water to hydro- and thermal power plants, and also to meet demands from various other users.

THE STUDY AREA

The State of Jharkhand covers a total area of about 79714 sq km has 24 districts and a population of about 26.9 million [Urban-5.9 million (21%), Rural 20.9 million (79%)]. The state has 152 towns and 32615 villages. The average rainfall here is about 1400mm. The study area forms a part of the hard rock terrain of the district of Palamu which covers an area of about 5246.8 square kms. and lies between 23°20' and 24°40' north latitude and 83°22' and 85°00' ea 84° 20'. The area is covered in the SOI topographic sheets no. 72D/4 and 73A/1. The study area covers around 500 hectares.

The district of Palamu is covered by three major geological formations viz, the Precambrian crystallines, the Vindhyans and the Gondwanas. Besides, the tertiary laterite and alluvium also cover part of the district. The study area is covered by Granitoid Gneiss as Precambrian Basement and Shales and Sandstones as a part of the representation of the Gondwanas. The Alluvium cover of considerable thickness occurs in the northern part of the district along the Sone and North Koel rivers. Ground water occurs mostly under phreatic condition in all the lithological units and locally under semiconfined and confined condition

The major watershed is of River Jinjoi which runs east to west and meets the Amanat near its confluence with the Koel. The study area suffers with mini, minor and major droughts on every 3rd, 7th and 13th year in spite of average to moderate rainfall. The area is economically backward with main occupation farming and literacy rate low.

The soil moisture status in the study region is highly suitable to support high water requiring crops during kharif season and highly to moderately suitable for less water requiring crops during rabi season.

The excessive indiscriminate exploitation of ground water had created a declining water table situation in the study area. This resulted in extra power consumption, affected the socio-economic conditions of the small farmers, destroyed the ecological balance and adversely affected the sustainable agricultural production and economy of the state. An attempt was made to analyse the problem of declining water table, possible factors responsible for this and to suggest suitable strategies for arresting declining water table for economical sustainability. The strategies included shift of cropping pattern and rainwater harvesting for artificial groundwater recharge.

ARTIFICIAL RECHARGE OF GROUND WATER

The increasing demand for water has increased awareness towards the use of artificial recharge to augment ground water supplies. It refers to the movement of water through man-made systems from the surface of the earth to underground water-bearing strata where it may be stored for future use. Stated simply, Artificial Recharge is a process by which excess surface water is directed into the ground – either by spreading on the surface, by using recharge wells, or by altering natural conditions to increase infiltration – to replenish an aquifer.

Prior to the experiments done in the area the villages were in badly shattered economic condition. In general the village presented the profile of poverty stricken, debt ridden society. Scarcity of water was the key to distress which limited the prospects of agriculture. The water table was below 20 m, most of the wells used to dry up during summers and the drinking water had to be fetched. The high rate of surface runoff, due to high degree of slope washed away the top fertile soil too. The Chakriya Vikas Pranali or the Cyclic system of Development was implemented in the area which is an innovative system developed at Society of Hill Resource Management School (SHRMS), Daltonganj by a team of multidisciplinary professionals for natural cycle of growth using land, water, plant, sun and human muscle power for creation of natural resources as sustainable base for sustainable growth. Here the benefit from one investment becomes the capital investment for the next, and thus the cycle moves on to provide economic and social benefits and make the community self reliant.

The areas for artificial recharge were selected on the basis of physiography, hydrogeology, pre and post monsoon groundwater levels, surplus source water availability, hydrometeorology and conventional practices etc. The methodology adopted for identification of recharge area involved depth to water level in the post monsoon period and the water level decadal trend. Superimposing these two, the areas for artificial recharge could be demarcated. The storage space available for artificial recharge was considered as a slice of unsaturated zone occurring 3m below ground level and the mean post monsoon depth to water level exceeding 7m.

The records show that the maximum rainfall occurred in the months of June to August in any year. Keeping these months in mind, the identification of the area was done for construction of Artificial Recharge projects and Pre monsoon and Post Monsoon data for 8 consecutive years was studied and finally recharge structures were recommended.

The favorable terrain conditions were high land areas with moderate slope, presence of weathered residuum (2m-15m thick) with vegetal cover and deep-seated interconnecting fractures. The confluence of 3rd order streams with 4th order streams was considered appropriate for construction of Artificial recharge structures.

Based on the field situation it was considered that storage will be through Percolation tanks, Nala bunds, Ponds, Boulder checks, Tie Ridges, Check dams, Contour ridges and Trenches and Recharge Pits.

The open well, pond and handpump data were collected from 70 available sources pre and post the artificial recharge structures and from the data it was apparent that in all cases the water table has increased ranging from 0.3 meter in case of ponds to 6-7 meter in case of handpumps. These ground data's not only showed a theoretical improvement due to vegetative cover but simultaneously it has improved the overall production of crops in the village.

The Tie ridges made among plants stored rain water insitu and improved soil fertility of the area. The overall water percolation had improved the soil and reduced the average temperature which was apparently felt on entering the plantation and comparing with outside plantation temperature.

From the analysis of survey data covering over 100 check dams, personal visits and interviews with more than 500 farmers, we concluded that Localized rainwater harvesting systems in the form of check dams in the area were an effective solution to the water crisis through their ability to channel rainfall runoff into the underground aquifer. This offered a decentralized system for decreasing the impact of drought and allowed the people's involvement in critical water management tasks with simple, local skill-based, cost-effective and environment-friendly technologies.

The Conservation and harvesting of surplus monsoon runoff was taking place in ground water reservoir which otherwise was going un-utilised outside the watershed/ basin.

Before Artificial Groundwater Recharge impact, the groundwater flow direction was from North to Southeast, but after Artificial Groundwater Recharge impact the flow direction spreads to all surrounding areas.

Some bore wells that were dry up previously were functioning for the irrigation uses. After the influence of Artificial Groundwater Recharge structures, all the defunct wells were functioning. Some parameters like fluoride were diluted due to Artificial Groundwater Recharge impact.

Part of the seepage from recharge structures was reaching the local groundwater system as artificial recharge. There was no ground water quality deterioration after Artificial Groundwater Recharge structures influence.

In the period of heavy rainy season, two tanks over flowed 4 months in non- Artificial Groundwater Recharge executed area, but in Artificial Groundwater Recharge executed area two tanks over flowed for 3 months only. The remaining tanks located in Artificial Groundwater Recharge executed areas with injection well, never overflowed during this heavy rainy season indicating that the rainwater immediately percolated into the aquifer system through the injection well.

CONCLUSION

The money available in village development funds after sharing of expected harvest will initiate secondary entrepreneurship to increase the socio economic condition and the system will complete its first cycle of operation. Self sprouting of CVP will initiate with village development fund and kalyan kosh from the village. The villagers have produced a number of seasonal crops in the water scarcity area and have received the benefit of production from the drought prone area. Due to improved soil water condition, the villagers have created their own water intervention channels in the area and are joining together for community effort for bigger interventions. The results have charged the people of the area with enthusiasm for their own development.

Thus the system development called Chakriya Vikas Pranali has inbuilt mechanism to improve the ground water for overall improvement of the society in which we live and which is ultimate of all our developmental programmes.

REFERENCES

1. *Aggarwal, R. 2007 Scope of Rainwater harvesting through Rooftop in Punjab. Paper presented in Conference on "Environmental and Livelihood Security Through Resource Management in Northern India" organized by Indian association of Soil and Water Conservationists, Dehradun at Chandigarh.*
2. *Singh, G. 1978 Ground water recharge from canals and other water conveyance systems, stream ûow and aquifer storage. Proc. Nat. Symp. Land and Water Manage. In the Indus Basin (India). Ludhiana: Punjab Agric. Univ. Vol. 1, pp. 79–86.*
3. *Muralidharan D and Athavale R.N, (1998), The Ground Water Recharge Movement in India by Ramaswamy Sakthivadivel, Pg 195*
4. *Verma P.K, Sinha S.P, (2000), Artificial Recharge of Ground Water in hard rock terrain through Chakriya Vikas Pranali-a case study of Palamu district in Bihar. Proc of Integrated water resource management for sustainable development, 2000.*
5. *Report of the Working Group on Sustainable Ground Water Management, Planning Commission, October 2011*
6. *Water Rights and Principles of Water Resource Management, Chhatrapati Singh, N.M. Tripathi, 1991*
7. *Ground Water Yearbook 2013-14, July 2014, Central Ground Water Board*