International Journal of ChemTech Research
CODEN(USA): IJCRGG ISSN : 0974-4290
Vol. 3, No.3, pp 1050-1053, July-Sept 2011

Selective Techniques in Artificial Ground Water Recharge through Dug well and Injection well methods

S. Ravichandran[1]*, S.Sathish Kumar[1] and Leena Singh[2]

[1]Department of Chemistry, Vel Tech Dr.RR & Dr.SR Technical University, Avadi, Chennai-600 062,India.

[2]Galgotia's College of Engineering and Technology, Greater Noida, New Delhi – 201 306,India.

Corres.author: ravichanduru@yahoo.com

Abstract: Ground water recharge is the process by which water percolates down to the soil and reaches the water table, either by natural or artificial methods. Ground water plays a crucial role in the country in increasing food and agricultural production, providing drinking water and facilitating industrial development. Ground water meets nearly 55% of irrigation, 85% of rural and 50% urban and industrial water needs. In most of the states the ground water extraction has exceeded annual recharge and water table has gone down. The growing needs of population and urbanisation have generated an urgency to evolve innovative methods for holding up of the ground water resources through appropriate recharge activities. In order to improve the ground water situation it is necessary to artificially recharge the depleted ground water aquifers. In this paper, selective techniques of estimating artificial ground water recharge are outlined which can be adopted to improve the ground water recharge.
Key words: Artifical water recharge,Dug well, Injection well.

Introduction

Water is indispensable to all life on earth. However, fresh water is constantly formed newly through a phenomenon known as hydrological cycle. Ground water recharge may be explained as the process where by the amount of water present in or flowing through he interstices of the sub-soil increases by natural or artificial means. Rainfall is the main source of both types of recharge. Other sources include recharge from rivers, streams, irrigation water etc. The amount of moisture that will eventually reach the water table is defined as natural ground water recharge[1-3]. As the rainfall occurrence in different parts of India is limited to a period ranging from about 10 to100 days. The natural recharge to ground water reservoir is restricted to this period only and is not enough to keep pace with the excessive continued exploitation. Since large volume of rainfall flows out in to the sea or gets evaporated, artificial recharge has been advocated to supplement the natural recharge. Artificial Recharge is the process by which the ground water reservoir is augmented through increased infiltration by using artificial structures.

Sources of water for recharge

Before undertaking a recharge scheme, it is important to first assess the availability of

adequate water for recharge. Following are the main sources, which need to be identified and assessed for adequacy:

• Large roof areas from where rainwater can be collected and diverted for recharge
• Natural streams from which surplus water can be diverted for recharge
• Properly treated municipal and industrial wastewaters.

Advantages of artificial recharge

Artificial recharge has several potential advantages:

- No large storage structures needed to store water. Structures required are small and cost-effective.
- Enhance the dependable yield of wells and hand pumps.
- Negligible losses as compared to losses in surface storages.
- Improved water quality due to dilution of harmful chemicals/ salts.
- No displacement of local population.
- Reduction in cost of energy for lifting water especially where rise in ground water level is substantial.
- Utilizes the surplus surface runoff which otherwise drains off.
- Very few special tools are needed to dig drainage wells.
- The technology is appropriate and generally well understood by both the technicians and the general population.
- Recharge methods are environmentally attractive, particularly in arid regions.
- Most aquifer recharge systems are easy to operate.

Recharge of Dug well method.

In alluvial as well as hard rock areas, there are thousands of dug wells, which have either gone dry, or the water levels have declined considerably. These dug wells can be used as structures to recharge the ground water[4] reservoir (Figure 1). Storm water, tank water, canal water etc. can be diverted into these structures to directly recharge the dried aquifer. By doing so the soil moisture losses during the normal process of artificial recharge, are reduced. There charge water is guided through a pipe to the bottom of well, below the water level to avoid scouring of bottom and entrapment of air bubbles in the aquifer. The quality of source water including the silt content should be such that the quality of ground water reservoir is not deteriorated. Schematic diagrams of dug well recharge is given in Figure 1. In urban and rural areas, the roof top rainwater can be conserved and used for recharge of ground water. This approach requires connecting the outlet pipe from rooftop to divert the water to either existing wells/tubewells/borewells or specially designed wells. The urban housing complexes or institutional buildings having large roof areas can be utilised for harvesting roof top rainwater for recharge purposes (Figure 1).

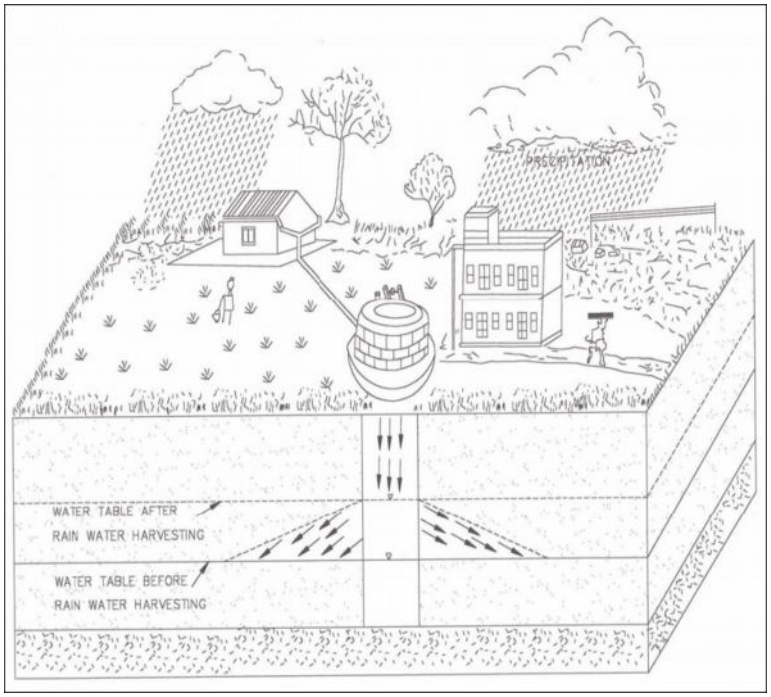

Fig. 1 : Dug Wells through Roof Top Rain Water Harvesting

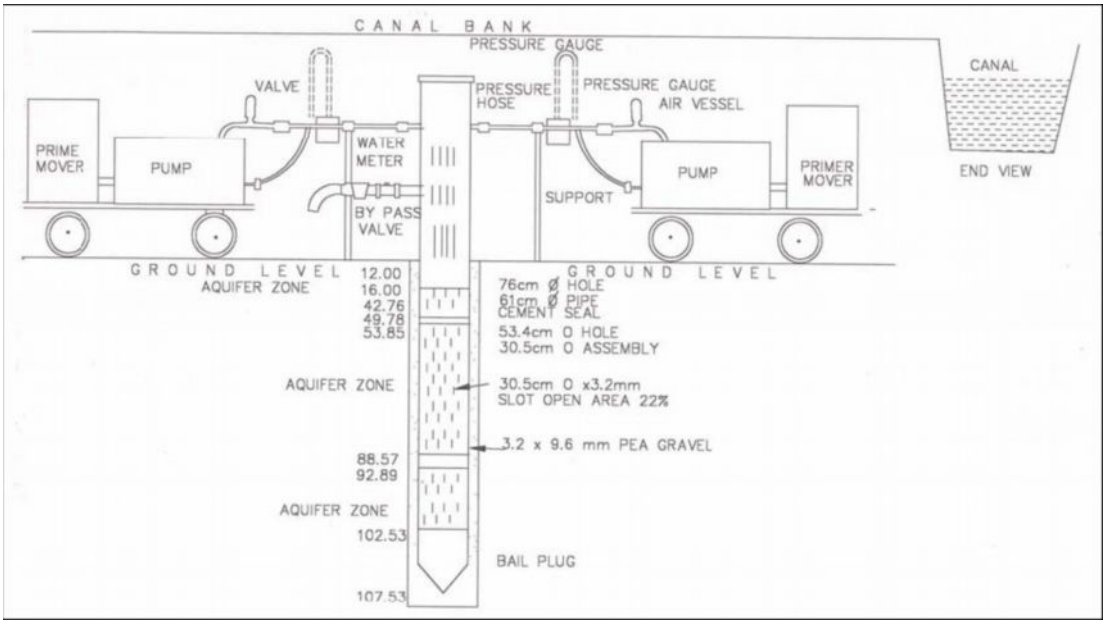

Fig. 2 : Artificial Recharge through Injection Well

Artifical recharge through Injection well method

Injection wells are structures similar to a tube well but with the purpose of augmenting the ground water storage of a confined aquifer by pumping in treated surface water under pressure (Figure 2). The injection wells are advantageous when land is scarce. Water is led directly into the depleted aquifers by providing access, such as tube well or shaft or connector wells. Recharge by injection is the only method for artificial recharge of confined aquifers or deep-seated aquifers with poorly permeable overburden. The recharge is instantaneous and there are no transit and evaporation losses. Injection method is also very effective in case of highly fractured hard rocks and karstic limestones but very high permeability is not suitable, as they do not allow the water to be retained for long periods for use during dry season. However, it is necessary to ensure purity of the source water as well as its compatibility with aquifer to prevent frequent clogging of injection structures, by bacterial growth, chemical precipitation or deposition of silt. Dual-purpose injection wells i.e. injection cum pumping wells are more efficient. Connector injection well where saturated shallow aquifer and over-exploited confined aquifers are tapped in a single well, allows freefall of water from shallow aquifer into the deeper aquifer, thereby reducing cost of injection. Injection method[5-8] is also used as a "Pressure Barrier Technique" to arrest or reverse saline water ingression.

Conclusion

The present techniques are easy, cost-effective and sustainable in the long term. Many of these can be adopted by the individuals, rural and urban communities with locally available materials and manpower. Though ground water recharge scheme either naturally or artificially may not be the final answer, but they do call for the community effort and create the spirit of cooperation needed to subsequently manage sustain ably ground water as a community resource.

Acknowledgements

Dr.SR and SS thank the Chancellor, Director, Principal and Dean(S&H) of Vel Tech University, Chennai for their constant support and encouragement. Dr.Leena thanks the Vice Chancellor, Director, Head (ASH) and Dean of Galgotia's College of Engineering and Technology, Greater Noida for their constant support and encouragement.

References

1. C.P.Kumar, "Estimation of Natural Ground Water Recharge". ISH Journal of Hydraulic Engineering, 3(1), 61 (1977).
2. S. Chandra, "Estimation and measurement of recharge to ground water for rainfall, irrigation and influent seepage" - International seminar on development and management of ground water resources, November 5-20 (1979).
3. M.A.Sophocleous, "Combining the soil water balance and water-level fluctuation methods to estimate natural ground water recharge - practical aspects". Journal of hydrology, 124, 229 (1991).
4. C.W.Thornthwaite, "An approach towards a rational classification of climate". Geogr. Rev.; 38(1), 55 (1948).
5. M.Van Genuchten, "A closed-form equation for predicting the hydraulic conductivity of unsaturated soils". Soil Sci. Soc. Am J., 44, 892 (1980).
6. Http:\\ megphed.gov.in\knowledge\Rainwater Harvest\Chapter9.pdf.
7. Leena Singh, S.Ravichandran, Int. J. Chem. Tech. Res., 3(1), 435 (2011).
8. M.P.O'Hare, D.M.Fairchild, P.A.Hajali, L.W. Canter, Artificial Recharge Of Groundwater (1986).

*****