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Ground Water Conservation by Artificial Recharge Techniques and Development of Watershed

Athira K Raman[1], Muhammad Fayis T[2]

[1]*M Tech Student, Environmental Engineering, MDIT Engineering College, Kerala, India*
[2]*Assistant Professor Department of Civil Engineering, MDIT Engineering College, Kerala, India*

Abstract – *This paper aims at the Watershed development at the place Eranholi, which is facing a rapid decrease in ground water levels that is leading to the scarcity of water with in the area. It was noted from the residents that, at times the channel surrounding the spot had water flowing through it, there existed much more water levels in the wells nearby. So, the project aims at an inventive method of conservation, replenishing and rejuvenating of water source in the above-mentioned area through scientific and technical practices and designs that will ultimately eradicate the problem suffered with in the area. The solutions proposed in the area includes the design of the channel, check dam as Vented cross bars, and Stream bank stabilization techniques. Soil and water conservation measures have an important role in the present scenario as top soil is replenishing at an alarming rate and the level of water table is declining*.

Key Words: **Watershed, Check dam, Vented cross bars, stream bank Stabilization, and Channel design.**

1. INTRODUCTION

Recharging of ground water is a thriving process in order to meet the water demand and water scarcity. Since the ground water is polluted now a days and also it is not able to provide amble amount of water. We can recharge the ground water naturally as well as artificially. Infiltration process helps the water to recharge naturally in which water move downwards from surface to aquifer bed. Since the water demand increases, the need for use of artificial recharge to nourish ground water supplies also increases. Artificial recharge of ground water can be defined as the method by which surplus amount of surface water is enrooted towards the ground by means of recharge wells or by adjusting natural conditions to improve the infiltration process. It can also be explained as the water movement through man made systems from the exterior of the earth to underground water-bearing strata where it may be stored for subsequent use. The choice of a particular method is reigned by local topographical, geological and soil conditions and also the quantity and quality of water present for recharge and also the technical feasibility and social adequacy of some schemes. A watershed can be explained as a geo hydrological unit in which water from all over the area flows under gravity to a common vent. Each stream consists of its own watershed. Topography is the keystone affecting this area of land.

1.1 Objectives

1. To propose inventive methods of conservation, replenishment and rejuvenation of the water sources in the Eranholi Gram Panchayath. To mitigate the intermittent problem of drought and acute water scarcity during summer.

2. To raise the water level in the water sources and an increment in the total volume of ground water reservoir. To carry out level surveying across the bed of the channel, and to do profile leveling from the calculated RLs

3. The design of the channel as a stable unlined regime channel as per standards. To propose stream bank stabilization by bank protection wall designs as per standards and use of coir geotextiles

4. To determine the soil properties (infiltration, porosity) for effective and efficient selection and proposal of recharge schemes. To propose designs of check dams as vented cross bars along the channel as a part of water recharge, as per Indian standards.

5. To provide guidelines for impact assessment, monitoring and maintenance of the project, once it is implemented. A socially aware society about the importance of ground water conservation and recharging.

1.2 Scope of the study

A healthy watershed is essential to the development and survival of a community and successful functioning of the ecosystem. The significance of the project prioritizes areas of restoration of a stream, proposals for artificial recharge of ground water that can enhance the ground water reservoir of the area and to mitigate the declining water levels in the water sources of the area and the shortage of ground water availability. The primary objective of this project is to preserve or enhance ground water resources in the selected watershed area. Due to rapid development and growth of population in the recent past, the areas for natural infiltration are declining to high level. Therefore, the significance of artificial recharge is very serious in the world today to eradicate or mitigate the current problems relating to water shortage, poor quality of water, dried up lands and the drought like conditions facing by the world today.

2. METHODOLOGY

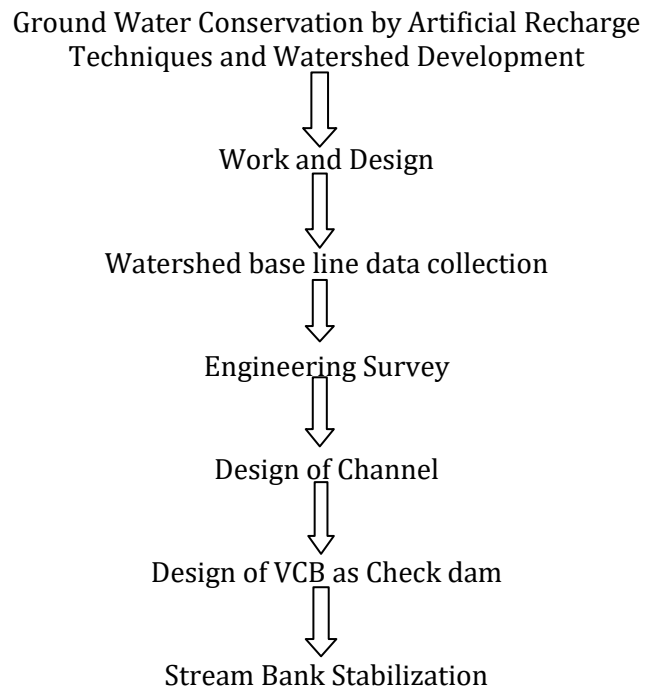

Fig-1 Steps for Artificial Recharge and Watershed Development

2.1 Advantages of Artificial Recharge

The benefits of artificial recharge can be both substantial and unsubstantial. The important advantages of artificial recharge are,

• Subsurface storage space is available free of cost and inundation is avoided. Evaporation losses are negligible.

• Quality improvement by infiltration through the permeable media. Biological purity is very high.

• It has no adverse social impacts such as displacement of population, loss of scarce agricultural land etc. Temperature variations are minimum.

2.2 Types of Artificial Recharge Techniques And Designs

A wide spectrum of techniques is used to recharge ground water reservoirs. Artificial recharge techniques can be broadly categorized as given below.

Direct Methods

- Surface Spreading Techniques
- Runoff Conservation Structure:
- Bench Terracing
- Contour Bunds
- Gully Plugs. Nala Bunds, Check Dams
- Percolation Ponds
- Flooding;
- Ditch And Furrows;
- Recharge Basins; And
- Stream Modification/Augmentation.

- Sub-Surface Techniques
- Injection Wells (Recharge Wells).
- Gravity Head Recharge Wells (Dug Well/Bore Well/Tube Well Recharge),
- Recharge Pits And Shafts.

- Indirect Methods
- Induced Recharge From Surface Water Sources,
- Aquifer Modification:

2.3 ENGINEERING SURVEY

- **Profile Levelling**

Profile leveling can be defined as the method of determining the elevations of series of points which is measured at intervals along a line such as the center line of a proposed road or center line of a natural feature like stream bed. It is also known as longitudinal leveling or sectioning. Profile leveling is one of the most common applications of running levels and vertical distance measurement for the surveyor. The results are plotted in the form of a profile, which is a drawing that shows a vertical cross section. Profiles are required for the design and construction of roads, curbs, sidewalks, pipelines etc. That is profile leveling refers to the process of determining the elevation of points on the ground at mostly uniform intervals along continuous line. The line of section may be single straight line or may consist of a series of straight lines changing direction, or connected by curves. From the benchmark or end on the benchmark, the leveling operations always start. If the permanent benchmark is not near the line of the section, flying levels may be run from the permanent benchmark to establish a benchmark near the line of section.

2.4 Design

- Unlined Open Channel

The design of a channel consist of the selection of a channel's alignment, shape, size and bottom slope. The design capacity of an irrigation channel consist of determination of the cross-sectional areas, depth, width, side slopes and longitudinal slopes. Regime Theory by Lacey is used for the design of an unlined open channel. Lacey defined a regime channel as a channel carrying a constant discharge under uniform flow in an unlimited incoherent alluvium having the same characteristics as that transported without changing the bottom slope, shape or size of the cross section for a period of time. The Regime theory is purely empirical in nature.

- Side Protection Walls

Retaining wall is a structure used for maintaining the ground surfaces at different elevations on either sides. A retaining wall that retains soil on the backside and water on the front side is called a seawall or bulkhead.

- Coir Boovasthra for Bank Stabilization

Coir geo textiles or Coir Bhoovastra are permeable fabrics capable to control soil erosion. It protects the earth and promotes vegetation retaining precious top soil. It is available in woven and non-woven forms. Coir Bhoovastra is made from natural fiber, 100% organic and renewable, good durability, Biodegradable, Naturally resistant to rot, and moisture, Needs no chemical treatment, High tensile strength and modulus, Good dimensional stability Anti-slip nature, Available in India in abundance at low price.

- Vented Cross Bars

Vented Cross Bars are generally designed in discharge areas where direct irrigation is not feasible from streams. Vented Cross Bars are mainly constructed across the streams with RCC on an average height of 2.5m above bed, with vents and provision of wooden or sheet shutters to discharge the flood water and silt load carried during monsoon season. Protection work upstream of the VCB along the canals are also given to protect earthern canals. Bligh's theory for the design of Hydraulic structures are used for the design of VCB.

3. CONCLUSIONS

Various Artificial recharge schemes and studied and the most suitable methods for the area is designed, analyzed and estimated. . The design of the channel as a stable unlined trapezoidal regime channel was done using Lacey's Theory (IS 7112:2002). The plan and elevation of the same is drawn. Check dams are proposed as a method of Artificial Recharge to ground water. Check dam designed here is Vented Cross Bars (VCB) with two vents with wooden shutters as per IS 6966 Part one And IS 15792:2008. These shutters will help in resisting flood and salt water ingression. Three VCBs are proposed along the length of the channel, with regard to the RL of channel bed. Stream bank stabilization is ensured by providing DR protection wall and coir geotextiles. DR wall is designed and checked for stability as per IS 456:2000. Coir geotextiles are chosen and calculated as per IS12503 Part Two. The total cost estimate of the project is calculated as Rs 1, 40,00,000/-. The project can be further extended with an efficient rain water harvesting method, to be implemented to each house to utilize rainwater effectively. Also an efficient water treatment plant to treat waste water, which in turn can be used for recharging will ensure source water for recharge throughout the year, also, becomes a good method of disposal of waste water.

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BIOGRAPHIES

ATHIRA K RAMAN received the B.Tech degree from APJ Abdul Kalam Technological University India, in 2019 in Civil Engineering. She is currently a final year M.Tech student of APJ Abdul Kalam Technological University.