VIVEKANANDA COLLEGE
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NAAC ACCREDITED 'A' GRADE

TOPIC:	**GROUNDWATER RECHARGE**
COURSE TITLE:	**ENVIRONMENTAL SCIENCE (HONS.)**
PAPER:	**CC – 3**
UNIT:	**3**
SEMESTER:	**2ND**
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NAME OF THE DEPARTMENT:	**ENVIRONMENTAL SCINECE**

Groundwater Recharge

In the earlier section we have dealt with the geological set up regarding the occurrence of groundwater below the Earth surface. Also we have discussed the way how the groundwater moves along within the geological reservoir called aquifers. Here, we are going to discuss how the underground water get replenished or being recharged either naturally or artificially from above the ground.

Natural recharge:

The natural recharging of groundwater happens either directly through percolation from the ground during rainfall and runoff or through the water bodies like ponds, lakes etc. Also some influent streams originating out of any water flow like river frequently recharge ground water.

The quality and composition of substratum, particularly the porosity and permeability of the soil or underground geological set up is the main limiting factor for natural recharge of groundwater. To explain, we can think of two surfaces, one with loam soil and grass cover and other with some concrete covered area or stony outcrops. Now, it is easily imperative that the first one will allow more water to percolate down than the later one, which will let the water flow as runoff. Hence, the former one is more capable of ground water recharge than the other.

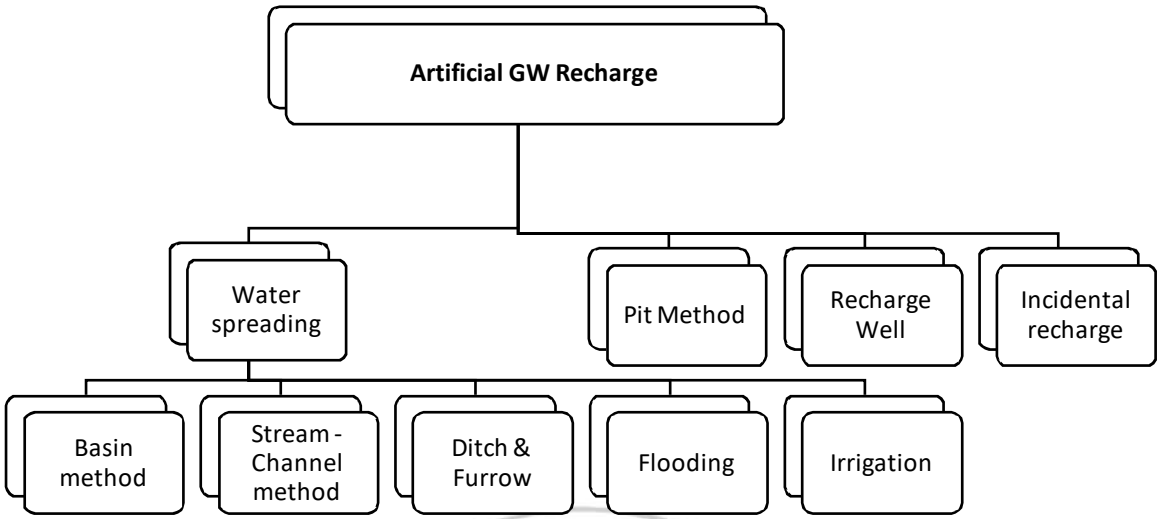
This is why, a sustainable landscaping always in favour of leaving open space with more vegetation cover than concretisation of the surface.

Artificial Recharge:

In the present day context due to fast infrastructure development the area under with vegetation cover is being shrinking and hence the possibilities of natural recharge are going down rapidly. Therefore to continue with the desired replenishment sometimes the aquifers are being artificially recharged. The artificial recharge projects are designed to serve a lot of purpose like,

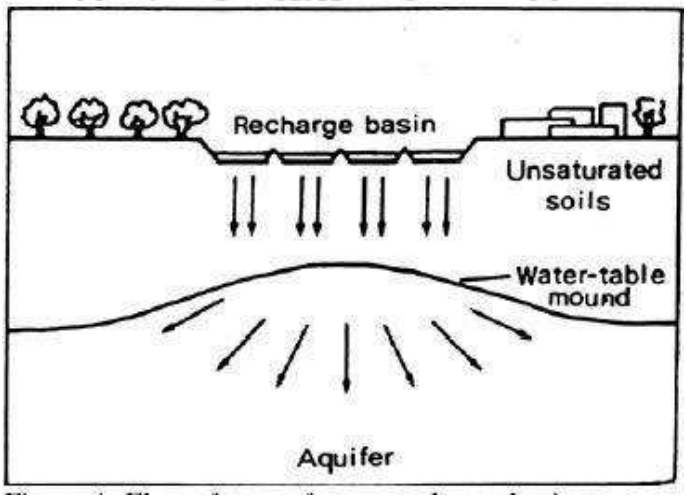
1. Maintain and augment the natural ground water as a resource
2. Combat adverse conditions like progressive lowering of groundwater level, unfavourable salt balance and saline intrusion.
3. Provide subsurface storage for local surface water.
4. Control or reduce land subsidence.
5. Provide treatment and storage for reclaimed wastewater for reuse.

The artificial recharge was first introduced in Europe and then adopted by other countries including India. There are variety of methods developed for the purpose, some of which have been discussed below.



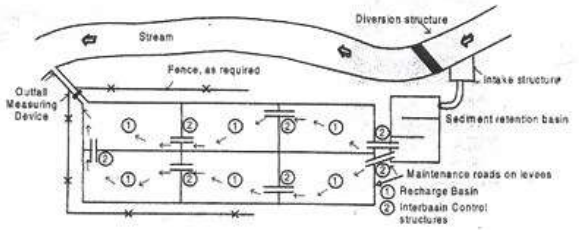
Water Spreading:

Water Spreading is the most used method of groundwater recharge, which can be done in different ways. It is basically the process of releasing water on the ground surface in order to increase the quantity of water infiltration into the ground leading to percolation to the water table. Although there are several factors on which the recharge efficiency depend, but most important among those are the contact time among water and soil surface. Therefore the spreading are planned accordingly so that the water be retained for a considerable time on the soil surface. The spreading method can be classified as *Basin, Stream Channel, Ditch and Furry, Flooding and Irrigation* methods.



Basin Method:

This is the most preferred and efficient method among all the water spreading methodologies. A study at *Califirnia* has estimated 58.4% water recharge by this method. In this method a low land or bowl type topography is formed by use of dike or excavation or the naturally low levees can be used for the purpose, where the water is released and kept for a period needed for proper percolation of the water. In case of multiple basins, the basins are linked with each other following a slop of land so that, there be a slow movement of water allowing the contact time.



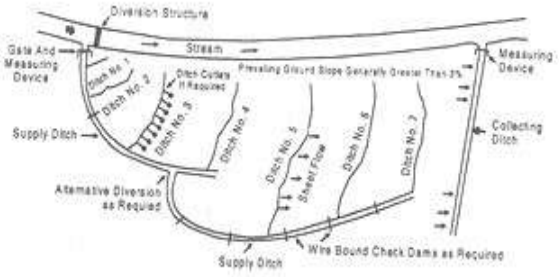
This is very useful in recharging water groundwater from a continuous runoff source.

Stream – Channel method:

In this type of water spreading methodology, the existing channels or streams are used with little modifications to enhance infiltration thorough higher retention and contact time. In this case generally the stream flows are improved by widening, levelling, scarifying or ditching to increase infiltration. Sometimes a few small dikes or weirs – known as check dams are used within the channel where the bed is little wider, to facilitate the spread of water through out the stream bottom. It is indeed a way of augmenting the percolation capacity of the existing channels beds to recharge ground water more efficiently.

Ditch and Furrow method:

In this method the runoff water is distributed among a series of flat bottomed ditch or shallow furrow to enhance the contact area. Depending upon the types of orientation, it can be called **Contour** – where the series of ditches follow the slope, **Tree shaped** – where the furrows are distributed in branches and smaller ditches and **Lateral** – where the furrows run laterally.



This method can be adopted within any existing landuse categories including agricultural lands, but get as low as 10% contact of the total gross area, hence becomes comparatively less efficient.

Flooding method:

In relatively flat terrain the water may be spread over a wide area either on the ground or through distribution channels, gullies etc. This allow the water to spread over and percolate down for further groundwater recharge.

Irrigation method:

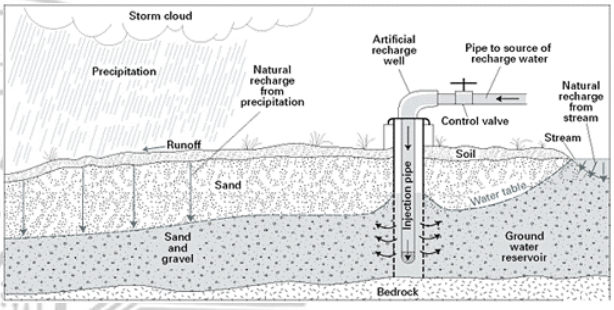
Sometime the irrigated lands are flooded with excess water or during the non-crop season to allow the water to percolate down. This is process basically highly effective for the recharge of shallow aquifers.

Pit Method:

In the areas of hard impermeable sub-surface strata like hard pans, clay layers etc. a pit can be excavated to open up the subsurface comparatively permeable layer through which water can percolate and reach the groundwater aquifer. In this method the water moves both downward and laterally into the soil. However, due to high cost of excavation, it is preferable to use abandoned pits of quarry or some other uses. Some precautions are needed to supply water with lower silt content to avoid the clogging of pores, which in turn may reduce the recharge efficiency.

Recharge Well method:

A recharge well may be defined as a well that admits water from the surface to the freshwater aquifers. Its flow is the reverse of a pumping well. When the water will be admitted to the well a cone of recharge will be formed which is similar in shape but in reverse in the pattern of that of a surrounding pumping well. It should be noted that, it needs some special constructions, instead of the fact that the flow is similar to that of a pumping well with only a reverse direction.



The recharge well is useful for recharging deep confined aquifer and for recharge in urban regions where the economy of the space is important. This procedure is highly efficient but need proper technological supports.

Incidental Recharge:

Various types of human activities like irrigation, sewer movement, canals, waste water treatment tank, landfill, septic tank etc. incidentally allow percolation of water into the subsurface. Very frequently, these types of percolated water mass reaches the groundwater aquifer and recharge the same. This type of unplanned recharge of ground water is known as incidental recharge. However, it must be noted that this procedure is useful mostly for shallow unconfined aquifer recharging and most importantly, it poses risks of groundwater pollution too.

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