Availability and Management of Groundwater Resources

Prof. Prasoon Kumar Singh
Department of Civil Engineering
Indian Institute of Technology (ISM), Dhanbad

Lecture - 54
Rainwater Harvesting and Artificial Groundwater Recharge (Contd.)

Welcome you all in the part 5 of the module 11 rainwater harvesting and artificial groundwater recharge. So, we have understood that the 2 different techniques are available through which we can augment the groundwater in the earth surface. So, first is the rainwater harvesting collection of the rain water at the rooftop catchment; area. And then with the filtrations and other applications it can be made available for different purposes and the areas which are having very less rainfall than what to do? In those areas generally we are preparing for the artificial groundwater recharge technique.

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So, this recharge technique artificial groundwater recharge can be technique can be followed on the earth's surface that is the surface techniques also and subsurface techniques also. So we have seen that some of the induced recharge method is also available through which in some impervious area we can send the groundwater. Because impervious area means the permeability is very poor in the area but forcefully, we can just move the water and keep it for the future uses in some structure.

So, here some structures may be created for the artificial recharge and rainwater harvesting this will be discussed in this lecture the fifth and last part of this lecture.

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The structures are recharge pit, recharge trench, recharge well, injection well, recharge shafts, ponds reservoir, farm bonds, surface storage and recharge through dug and defunct bore wells. So, in these structures whatever mentioned here is just what I have just discussed recharge pit, recharge trench, recharge well, ponds, farm bonds, surface storage and recharge through dug and defunct bore wells.

Generally, if the artificial technical technique will be followed definitely the level of the groundwater will move a little bit in the area it will just enhance in the area. So, water ground water storage capacity will increase in the area so these are the different means of the artificial recharge.

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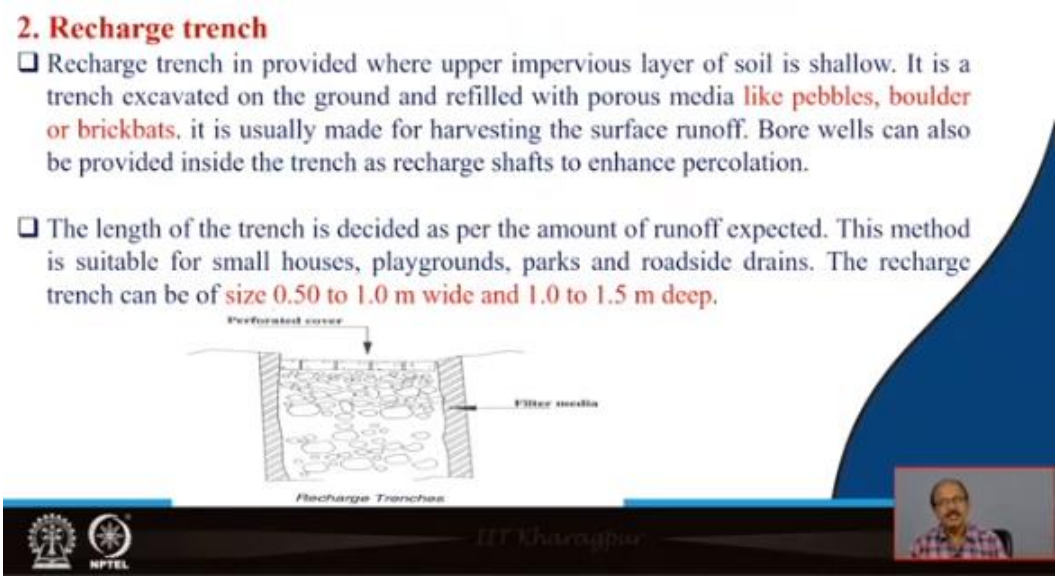
i. Recharge Pit

A recharge pit allows the rainwater to replenish groundwater by recharging the underground aquifers. It can be built to recharge a borewell or just to help the water infiltration in an area.

Now the first is the recharge pit so recharge pit you can see here also a recharge pit allows the rain water it allows the rain water to replenish the groundwater by recharging the underground aquifers. So, some pits are constructed in the earth's surface and through that pit the rain water is allowed to send down and this rain water will just recharge the underground aquifers it can be built to recharge a bore well as well.

If suppose a bore well is there so through those bore well also just, we can send the water the water will infiltrate in the area and it will just replenish the groundwater in the aquifer in the location. So, through recharge pit this is one of the important artificial recharge structures generally these are constructed and through it the groundwater level can be enhanced in the area. **(Refer Slide Time: 04:15)**



Second is the recharge trench is provided where impervious layer of soil is shallow. So, recharge trench generally it is provided where upper impervious layer of soil is shallow. So very little impervious layer of soil is remaining it is a trench excavated on the ground and refilled with porous media. So it is just a trench which is excavated on the ground and then refilled with porous media like pebbles, boulder or brickbats.

It is usually made for harvesting the surface runoff so recharge change is constructed for harvesting the surface runoff. Bore wells can also be provided inside the trench as any concept to enhance percolation. So, this bore well can also be used again with our steps to enhance the percolation of the water down to the aquifer. So, what we have seen that rainwater is enough then no problem but if the rain water is enough and the area are not receiving water.

Because of the poor infiltration and population processes then definitely the surface runoff will be generated and surface runoff will move to distant places and then it will reach to the certain stream. So, this surface runoff we can also harvest this surface runoff can be also harvested and the recharge trench is the good structure for harvesting of the surface runoff it is a test mode for harvesting the surface runoff.

The length of the trench is decided as per the amount of runoff expected so what is the amount of the runoff on this basis only the length of the trench is decided. This method is suitable for small houses, playgrounds, parks, roadside drains this method is suitable recharge trench method. The

recharge trench can be of size 0.50 to 1 meter wide and 1.0 1 to 1.5 meter deep. So, this may remain the parameters of the depth and breadth but it is a best for the surface runoff harvesting and is suitable for small houses, playground, parks and roadside drains etc. so this is second artificial recharge structure.

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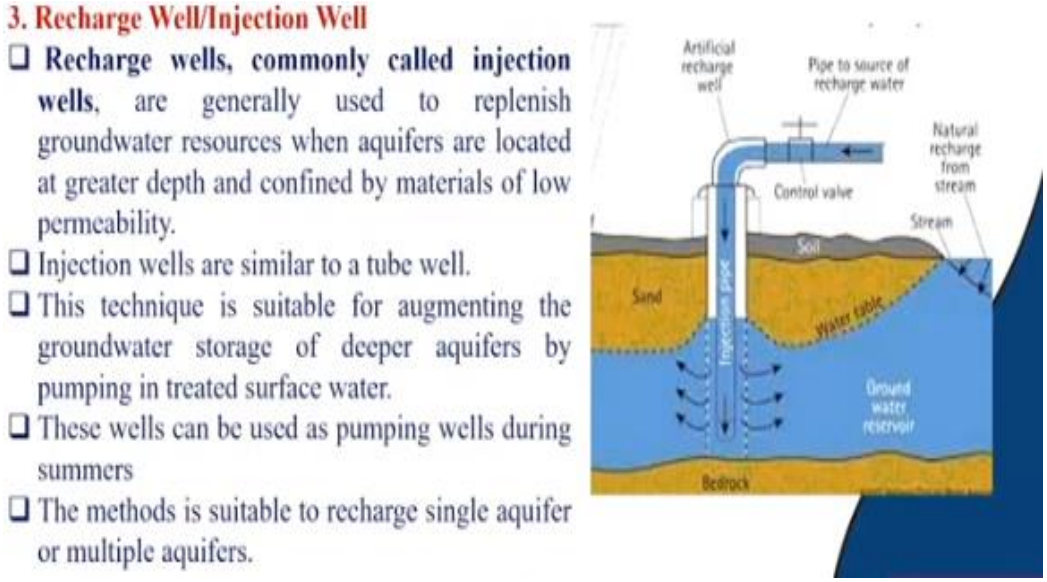

Now third recharge well injection well this recharge will commonly also be called as injection wells are used to replenish groundwater resources when aquifers are located at greater depth. The aquifers are located at greater depth and confined by materials aquifers are remaining in confined natures or the confined aquifers are there with low permeability; permeability is low. So, the 2 conditions are here the first is that the recharge well injection wall can be used in those areas to replenish aquifer.

When aquifers are located at greater depth and second the confine and this aquifer must be of low permeable nature. So, injection well it is similar to a tube well this technique is suitable for augmenting groundwater storage of deeper aquifers by pumping in treated soft water pumping in treated surface water. So, this technique is suitable for augmenting the groundwater storage of deeper aquifers how by pumping by pumping only and treated surface by surface treated surface water.

So, by treated surface water through pumping in deeper aquifers the augmentation of groundwater's storage take place is through the recharge well or injection wells. These wells can

be used as pumping wells during summers so from visuals during the summer period the water can be taken out so these wells can be used as pumping wells during the summers. And the methods is suitable to recharge single aquifer or multiple aquifer but the deeper aquifer the method is suitable to recharge the single aquifer or multiple aquifers but remains deep in condition.

So, in the diagram also we can see it is just like a pipe like structure and through it just the water is sending natural this water is coming injection pipe to the bedrock and from here it will be just water reservoir is just here just to the percolation it is reaching to the groundwater and enhancing the water table this you at the in the figure it is remaining here only so this is the condition of the recharge well injection well.

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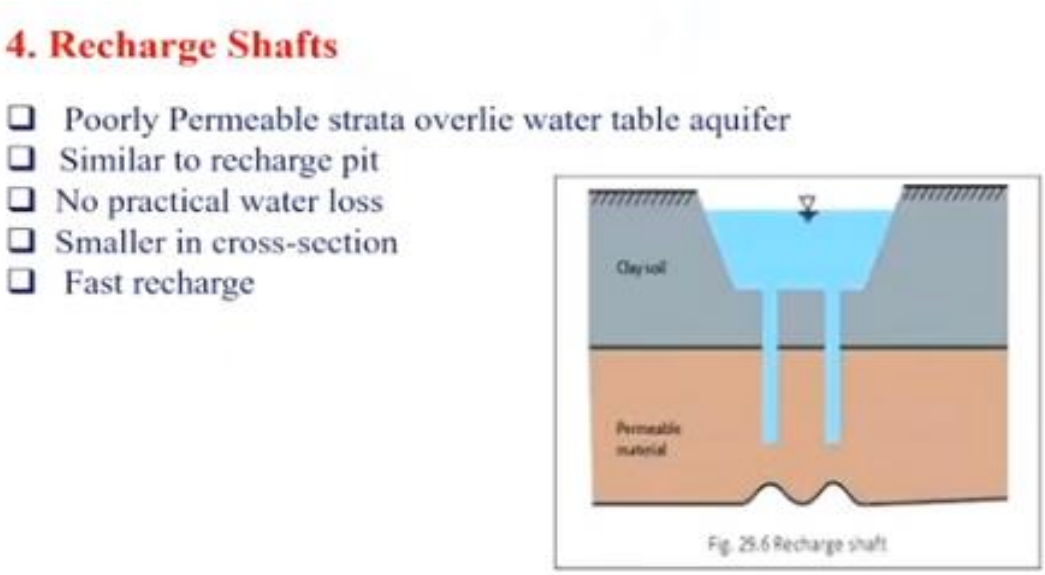

Now next structure is the recharge shafts so in this what is going doing that it is generally recharge that artificial structures are created where poorly permeable strata overlie water table aquifer. So, this is the permeable material water table aquifer means the permeable aquifer and over just above the permeable material which is the water table aquifer. Because this is unconfined it well lie the poorly permeable strata clay soil is clay is a very good porous but poorly permeable.

So, you in the diagram also the poorly permeable strata is here so in that case when the water table aquifer lie at depth and just above it the poorly permeable starter remains then in this condition only we are preferring for the recharge shaft method of the artificial recharge structure. Similar to recharge pit as we can construct the recharge shafts similar to the recharge speed no practical water

loss in this condition smaller in cross section this is very small in cross section also and the fast recharging can take place in such type of structure so this is a good structure where a water aquifer is having just poorly permeable starter above it.

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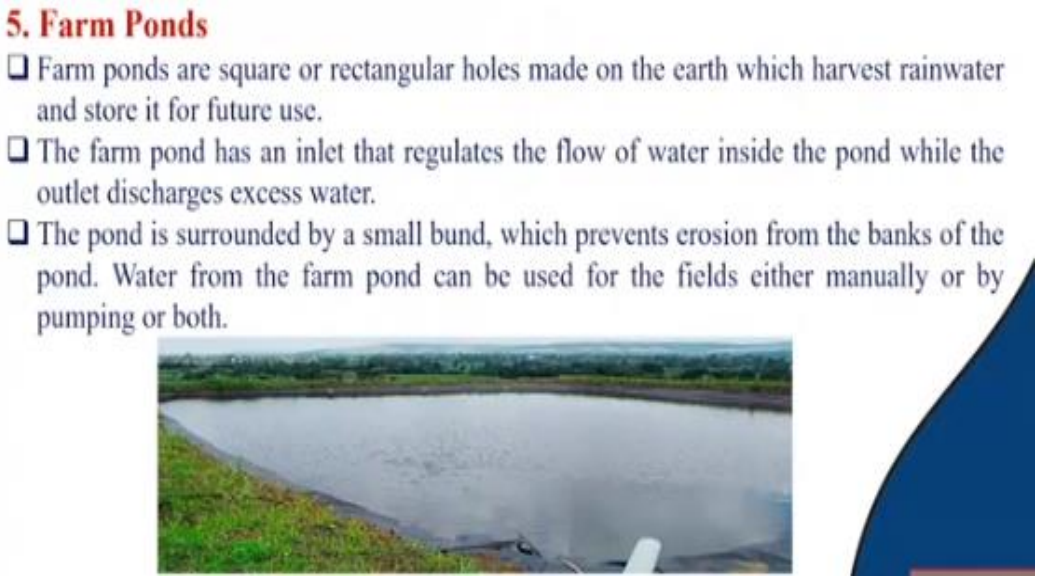

Now next are the farm ponds so this is also one of the good areas for recharging for making the artificial structure actually the farm ponds are square or rectangular holes made on the earth. This is just a hole in the form of in the shape of square rectangle on the earth surface which harvest rain water and store it for future use so we are storing the rain water for future use also. Farm pond has an inlet it has an inlet that regulates the flow of water inside the pond while the outlet discharges excess water this remains with the farm ponds.

The pond is surrounded by a small bund it is surrounded by small banks which prevents erosion from the banks of the pond so it is also necessary to stop the erosion so this pond is just surrounded by a small bund. So, we can see here also this is the farm pond and surrounded by a small bund. This brown portion is the one so this is just remaining the bunds and this bund is just preventing the erosion from the banks of the pond.

So, water from the farm pond can be used for fills either manually or by pumping or both so this is also one of the good artificial recharge structure artificial recharge structure.

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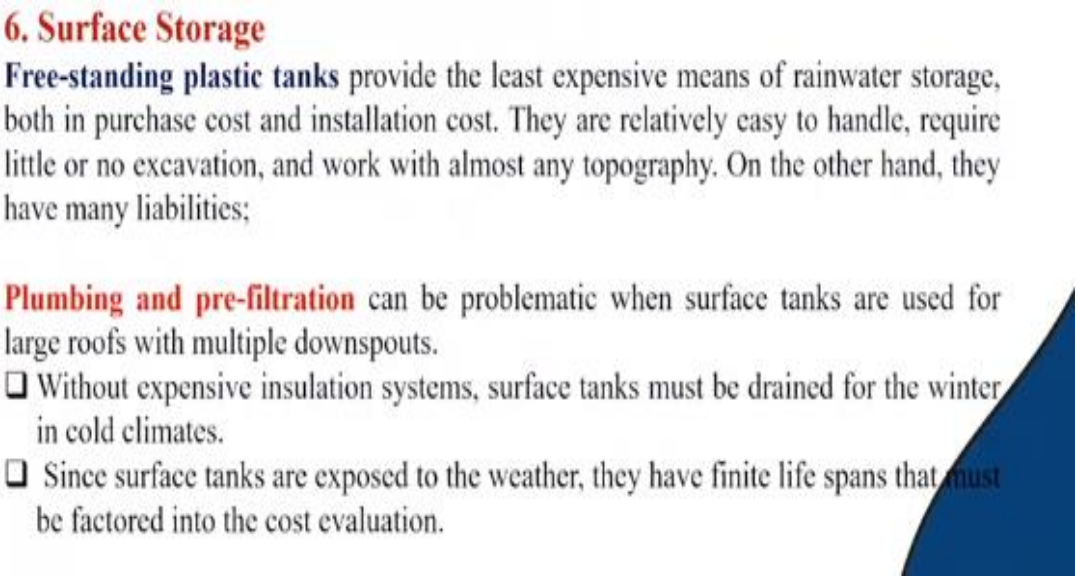

Now surface storage free standing plastic tanks 3 standing plastic tanks provide the least expensive means of rain water storage both in purchase cost and installation cost. So, plastic tanks are very much you know important and in level also they are relatively easy to handle require little or no excavation and work with almost any topography on the other hand they have many liabilities.

What plumbing and pre-filtration can be problematic when surface tanks are used for large groups with multiple down spouts? So, this plumbing and pre-filtration can be problematic when surface tanks are used for large roots without expensive insulation systems surface tanks must be drained for water in cold climates. And since surface tanks are exposed to the whether they have finite life spans that must be factored into the cost evaluation so this is the details about the surface storage artificial structure.

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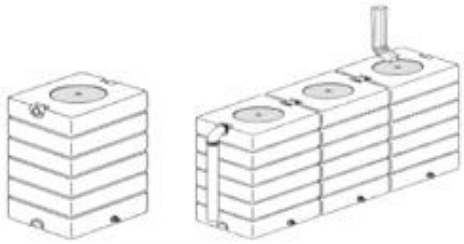
Large surface tanks are very difficult to conceal, although sometimes they can be incorporated as a dramatic building design element.

In general, surface storage makes the most sense for residential starter systems, for mild climates, for sites where excavation is difficult, or for interior use.



Rain box

Now in this also we can see that last surface tanks are very difficult to conceal large surface tanks are very difficult to conceal, although sometimes they can be incorporated as a dramatic building design element and sometimes it can be just accepted. In general surface storage makes the most sense for residential water system for mild climates for sites where excavation is difficult or interior for use.

So, generally the surface storage is very important in the residential starter systems where mild climates or the sites it is excavation is difficult or interior or for interior use. Generally, the surface storage structure is good for the artificial recharge.

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7. Recharge through Dug and defunct borewell

The defunct bore wells were drilled during different periods with different depth. Indiscriminate drilling around the area for agricultural purpose, deeper depth and failure of seasonal monsoon made the bore wells defunct.

With a complex hard rock structure in the Deccan Plateau and a depleting water table many borewells fail to strike water. Some go defunct when the water is extracted and the level falls below the borewells. These borewells have to be treated with great care else they can become the spots for accidents.

Now recharge through dug and defunct bore well so this is also one of the method the defunct bore wells generally we met the bore well rise at certain localities so the defunct bore well were drilled during different periods with different depths indiscriminate draining around the area for agriculture purpose, deeper depth and failure of personal monsoon made the bore wells defunct.

So, this may be the cause but generally the bore well are drilled for getting the water so by time it has become defunct because of the large agricultural uses or the deeper depth has gone or the failure of seasonal monsoon. So if the failure seasonal monsoon will fail definitely the recharge will fail and ultimately the bore well become defunct. So, within a complex hard rock structure in the Deccan plateau and a depleting water table many bore wells failed to strike water.

So, this is the hard rock areas in which complex rock structure is there and, in the areas, the many bore wells fail to strike water. Some go defunct when the water is extracted after few days or time in after the extraction of the water from the bore wells it again become defunct. And the levels fall below the bore wells and the level of water falls below the level of the bore wells. So, these bore wells have to be treated with great care as they can become the spots for accidents so these bore well will be treated and it can be used as a recharge structure for recharging the underlying aquifer.

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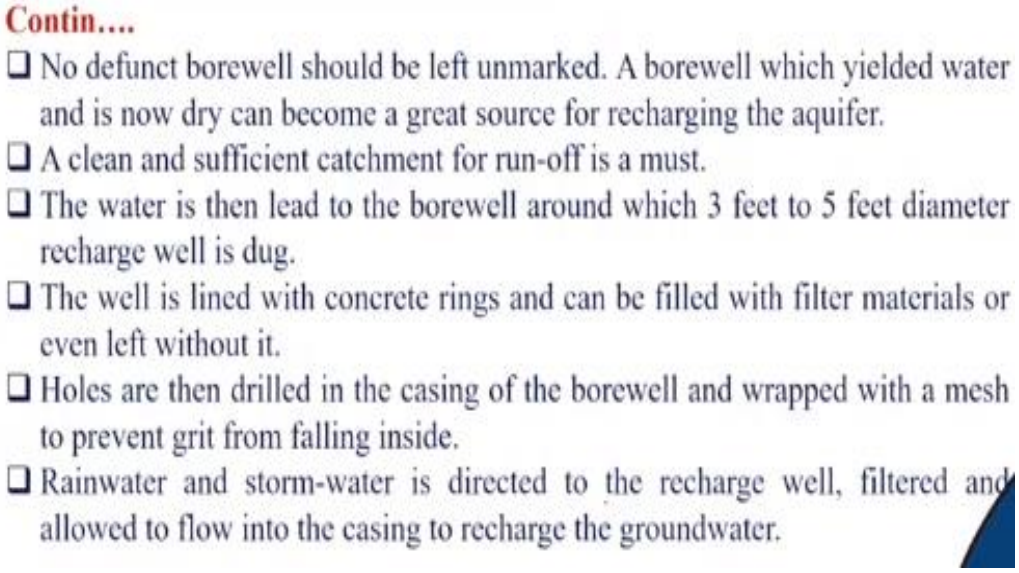

No defunct bore wells would be left and marked every defunct bore well should be marked a bore well which is that water and is now dry can become a great source for recharging that buffer this is very very important point that a bore well through which the people earlier the people were

getting water from the underground. But at the present time it has become dried so if we can by means of some artificial recharge method, we can send water in the column of the bore well to the underground surface definitely in a better way we are able to recharge the aquifer of the locality.

So, this is one of the very good techniques a clean and sufficient catchment for runoff is a must so catchment areas will be clean and then only the recharging will be good the use will be good. The water is then lead to the bore well around which 3 feet to 5 feet diameter recharge well is dug. The well is lined with concrete rings and the can be filled with water filter materials or even left without it.

Holes are then drilled in the casing of the bore well and wrapped with a mess to prevent grid from falling inside. Rain water and storm water is directly to the recharge well filtered and allowed to flow into the casing to recharge the ground water. So, rain water and storm water is directed to the recharge well both are coming to the recharge well filtered there and allowed to flow into the casing to recharge the groundwater and lying ground water.

So, these are the few structures of the artificial recharge through which the area which is receiving less rainfall we can just think we can just go the go the different scientific studies and then we can decide the different methods which is the best suitable method of the area and then we can improve the recharge of the underlying aquifer in those areas so this is all about the rain water harvesting and artificial recharge.

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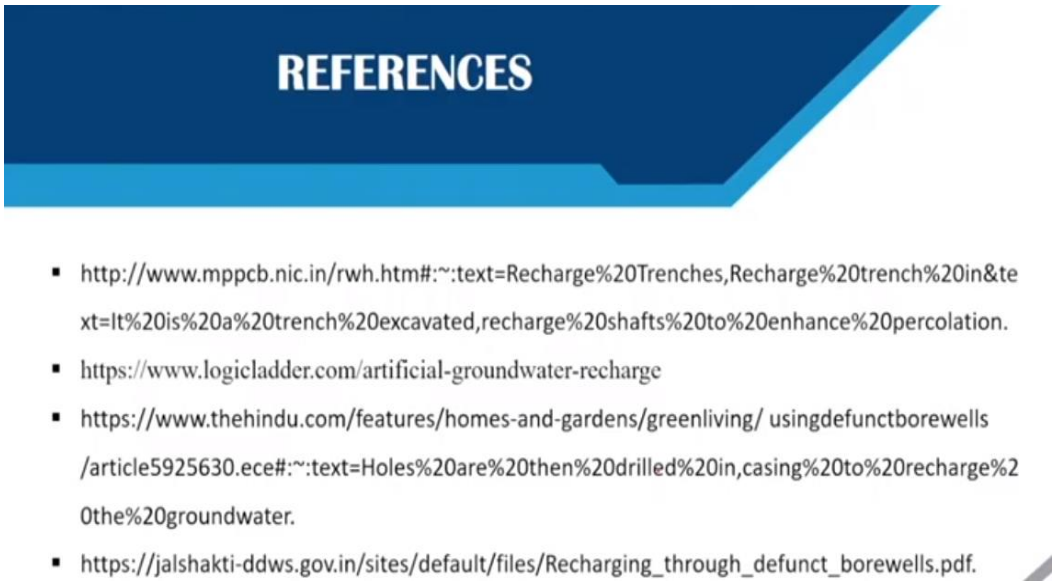

Now these are the some of the references you can also just go through it these references and try to discuss something more try to understand something more from other sources also. Because the course subject is very interesting your ability of ground water resources so in the area first, we have seen different techniques to which we can understand about the ability of the groundwater resources.

Suppose the ability of groundwater resource is not good suppose the rainfall pattern is erratic then what to do we can think further then we can think for the rainwater harvesting either the rooftop or rooftop rainwater harvesting or the surface water harvesting on the area which is having poor topography poor geology then what to do because infiltration is not good permeability is not good then what to do there we can go for the induced harvesting also.

And the area where little we are very erratic rainfall pattern is there, we can think for some artificial recharge structure also may be surface type or maybe subsurface type depends upon the different scientific study so this is whole about the topic. Now these references are mentioned here.

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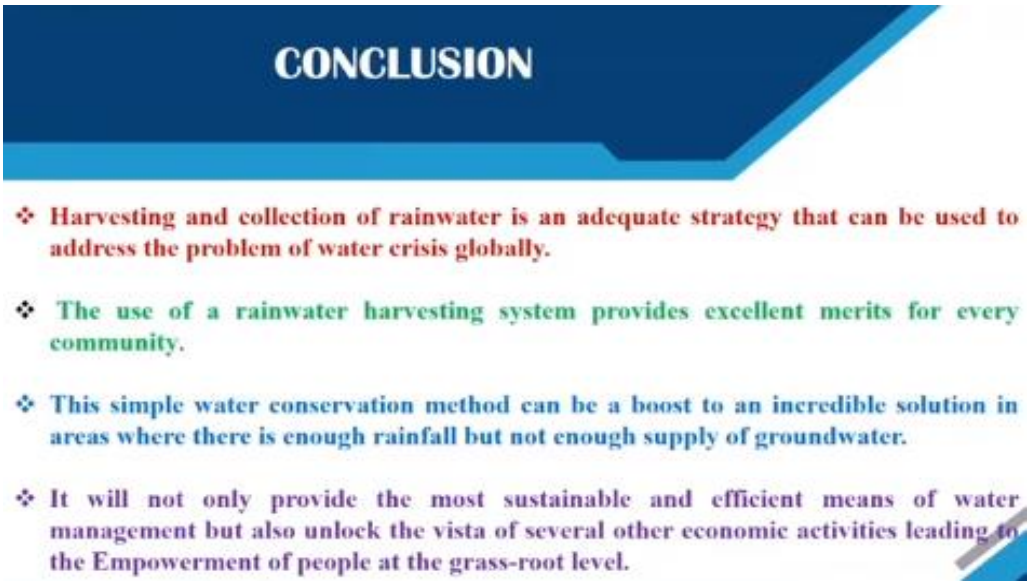

Now the conclusion of the topic is that harvesting and collection of rain water is an adequate strategy that can be used to address the problem of water crisis globally. So, this is a very important topic the use of rainwater harvesting system provides excellent merits for every community. This simple water conservation method can be a boost to an incredible solution in the area where there is enough rainfall but not enough supply of groundwater.

It will not only provide the most sustainable and efficient means of water management but also unlock the vista of several other economic activities leading to the empowerment of people at the grass-root level. So, you can see here this rainwater harvesting is not only providing the sustainable and efficient means of water management but also unlocking the several other economic activities because water is one of the important renewable resources leading to the empowerment of people at the grass-root level.

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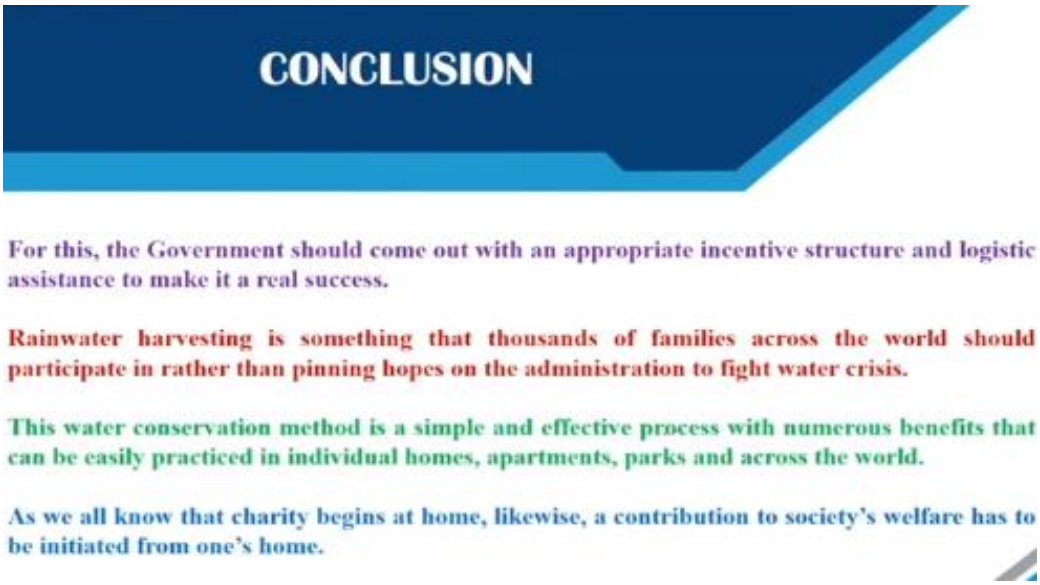

For this, the government should come out with the appropriate incentive structure and logistic resistance to make it a real success. Rain water harvesting is something that thousands of families across the world should participate in rather than winning hopes on the administration to fight water crisis. The water conservation method is simple and effective process with numerous benefits.

And can be easily practiced in individual homes, apartments, and park and across the world. As we all know that the charity begins at home likewise a contribution to society welfare has to be seated from one's home. So, in this way we have learnt the procedure of the artificial recharge and rainwater harvesting thank you very much to all.