Ground Water Hydrology
Prof. Dr.Venkappayya R Desai
Department of Civil Engineering
Indian Institute of Technology – Kharaghpur

Module No # 04
Lecture No # 19
Concept and methods of Artificial Ground Water Recharge (Contd.); Recharge Mounds and induced recharge

Welcome to this lecture number 19 so in this lecture we will continue with what we started in the previous lecture that is lecture number 18 which is the methods and concepts of artificial ground water recharge and after completing this we will move on to recharge mounts and induce recharge. So first we will continue with this concept of artificial ground water recharge.

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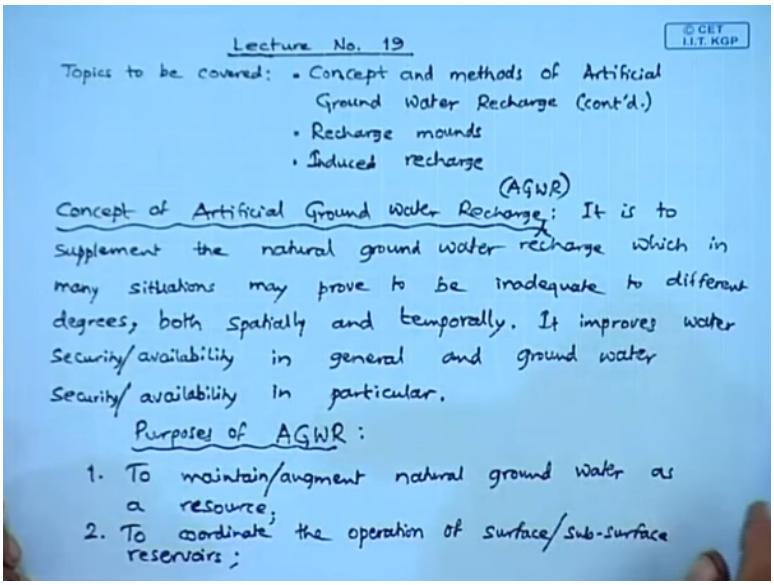

And here so the so basically this artificial ground water recharge is necessary to supplement this the concept of artificial ground water recharge so here it is to supplement the natural ground water recharge which in many cases many situations may prove to be inadequate to different degrees. So it is just like say for example the natural lighting which is am just giving an analogy the natural lighting is always from a dawn to dusk by the human activity has developed or extended to such as level.

So that even once the sun has set that means the dusk has the set in so still the human beings the human society and we want to do more work and we want to engage our self in more activities.

So in such cases so we need to go for artificial lighting so this is a temporary basis and specially also. So even in the broad day light so some areas so they may have insufficient lighting.

So in that case we may have to this is take the help of artificial lighting so similarly so this there is always this inadequate in different degrees both spatially and temporally. That means both space wise as well as time wise so this natural ground water recharge may prove to be inadequate so this it may be slightly inadequate or it may be significantly inadequate or it may be totally inadequate.

So it all depends upon the actual situations and so therefore so this ground water recharge and obviously so this common sense say that so in areas where there is a water logging that means excessive this natural ground water recharge so then there is no question of this necessity of this artificial ground water recharge. So with this concept and then so there are many formula to estimate the natural ground water recharge and so.

And of course once they estimate the natural ground water recharge so we may find the amount of volume of water which has a gone into that is the sub surface spaces which may be aquifer or it may be even wells or it may be any other storage sub surfaces. So in that case we have to adopt this artificial ground water surface and there by so improve our water security. So this so this it improves that is water security stroke availability in general.

And ground water security stroke availability in particular okay and so the now let us briefly discuss about this purposes this artificial ground water recharge. So let me abbreviate this as AGWR. So purposes of artificial ground water recharge so the following are the main purposes of artificial ground water recharge the first one is to maintain or augment. So this is the main important this one natural ground water as a resource.

And this resource it is a economical resource as well as overall resource because there are certain parameters which cannot be quantified economically so like say such as the intangible benefits. So when this artificial ground water recharge is adopted or is employed so then it will also result in other intangible benefits like improvement in flora fauna and other things. So which all of which may not be may not be quantified.

So second purpose is to co-ordinate the operation of surface stroke sub surface reservoirs okay. So this is the second purposed of artificial ground water recharge.

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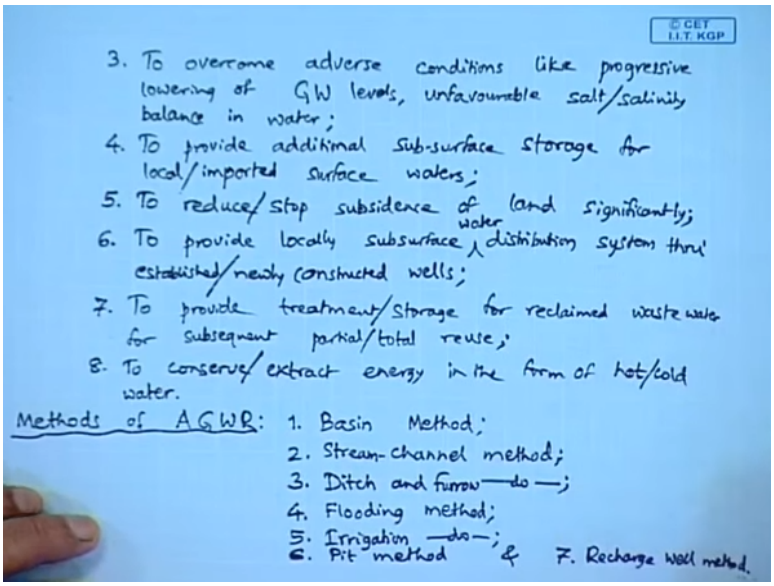

And then thirdly the third purpose of artificial ground water recharge is to that is to overcome adverse conditions like progressive lowering of ground water level unfavorable or undesirable salt or salinity balance in water. So it includes salt water inclusion also or salinity intuition also or say brackish water intuition. So this is the third purpose and the next one is to provide additional sub surface storage for local or imported surface water.

So once we have this once we employ this artificial ground water recharge so then it provides the additional storage addition reservoir sub surface reservoir which can be used for so which can be with used locally or which can be it can be transported over a short or medium or long distance so to meet the appropriate water use. So next is this is to reduce or stop completely stop subsidence of land significantly.

See here once this artificial ground water recharge is adopted it will improve the soil balance that is the moisture content in the soil so there by will improve the strength in the soil. So it will be less susceptible for erosion. So therefore not only in this one and also what happens is it will be it will be less susceptible for subsidence and like the foundation at all so it is the foundation that is a settlement of foundations okay.

So unequal settlement or it can be totally that is almost it is a total settlement in all the areas so such which results in the land subsidence so that can be reduced or stopped completed that is this one. So the next purpose is to provide locally subsurface distribution system so this is subsurface water distribution sub surface water means basically ground water distribution system through established or newly constructed wells.

So here so we will ensure so there is adequate supply of subsurface water and the additional adequate supply of sub-surface water which can be harnessed through whether this already established wells or existing wells or the newly constructed well. So and then so this is the fixed purpose and then next is to provide treatment stroke storage for a reclaimed wastewater for subsequent partial or total reuse.

It is said that the solutions to pollution is a dilution so therefore so this waste water when it is reclaimed so there the artificially recharged groundwater what it does is it will ensure that the that is the are the reclaimed further diluted and so thereby the concentration of the pollutions in the wastewater is further minimized and many times it may be within the permissible limits or it may be even almost very much below the permissible limits.

So in this case it can be used either for partial reuse or total reuse so here in this case a can give an example of this new water. So basically in Singapore where in so some fraction may be 5 % or say 10 % of the water is being supplied is added with such treated reclaimed wastewater and then so that is this 1 and then lastly the to conserve or extract energy in the form of hot or cold water.

So here we know that the there is always an optimum depth below the ground where the temperature variation is minimum. And we can use this utilize this fact to our advantage and then so we can create a reservoir through this artificial ground water recharge which as you can create a reservoir. So which may be of great help as especially in winters and which is also known as a passive air conditioning technology and so or in summer when it is too hot so that time so it may provide a it may be able to provide water which is significantly colder than the extreme summer temperature.

So all this can be so that can be this one we can utilize that is the ground as a reservoir wherein so this temperature can be is when temperature variation can be reduced. So these are purposes and so and based on this purposes the concept of artificially ground water recharge is hinged upon. So now we will go to methods of artificial ground water recharge methods of AGWR.

So that is artificial ground water recharge so there are various methods for this artificial ground water recharge. So let us list these methods and then briefly discuss one by one the first one is basin method. So this is followed by stream channel method and then the third method is ditch and furrow method then there is a flooding method fifth one is the irrigation method and the next one am writing here that is the pit method.

Then lastly this is a let me write here only the recharge well method so these are the seven methods of which are generally used for artificial ground water recharge. So now we will briefly discuss these methods and these are methods are the names of these methods the titles of artificial ground water recharge which are self-explanatory. Now first let us go to this basin method.

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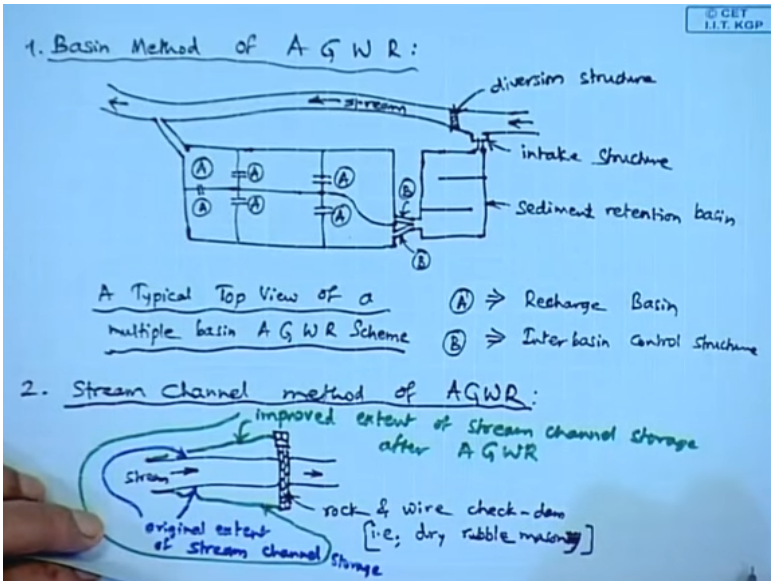

Basin method of artificial ground water recharge I am extensively using the abbreviation AGWR which is artificial ground water recharge here this case say basically what is done is see whenever there is excess supply of surface water. So this surface water is stored in a basin which is in the vicinity of the stream or a water body and in this case for example say suppose this is a

there a stream say suppose there is a stream and let us consider the for a let us say the flow is from right to left in the stream.

And here what this basin method does is so an addition basin is created and so this is the stream or river and then this is the diversion structure. So it can be a small bare or barrage and here so this is a so this is the intake structure and here this is a sediment retention basin or which is simply known as sedimentation basin and followed by so this is a so these are that is denote this as B and here so that is like this.

So this is a these are A so here this A represents a recharge basin and this B represents that is inter basin control structure control or regulating structure. So this is the typical plan or say top view of a multiple basin artificial ground water recharge scheme. So it will be like this so basically so here what happens is so they this is a it is in a same direction.

So initially there is an in diverge structure which will create to log the head and then so the water is diverted through in take structure and then from intake structure it passes through the sediment retention or sedimentation basin and then so there is a intubation control structure. So here by closing this bottom one that is the below one we can ensure that so these top three recharge basins can be recharge and similarly if we close the top one.

So this one we can ensure that so there is recharge only in this bottom three recharge basins. So this this is the basin method so in which the area which is in and around the water bodies such as stream okay. Where in this feasible topographically as well can be employed and so here this will induce. So because of this large area to the basins o the flow velocity of water is significantly reduced and then so therefore it will result in this it will induce artificially ground water recharge by significantly through infiltration.

So initially the top wafer that is the unconfined aquifer is getting recharged and then again this subsequently it also results in the recharge of lower aquifer of course and if you want to further increase this one. So then obviously we have to use appropriate technique so that it can be done. So this is the basin methods which is the first method of artificial water recharge.

So now let us go on to second method which is the stream channel method and of course in this case the so here let me so the second is the stream channel method of AGWR. Now here what is done is as suppose this it he top view of a stream in this case a check dam may be constructed along the so this could be so this is a stream and then this is a so this is a rock and wire check dam.

So this is basically here you can say so that it is a dry rubble masonry so here what happens is this dry rubble masonry which is which is which forms what is known as the check dam so is constructed across the length of a stream or river and what it does is so initially it will the all the fine art sediment particles which otherwise would have flown along with the stream water so these are trapped so their velocity is significantly reduced and then this final sediment particles.

So they basically get deposited in the that is the intermolecular spaces or say it is in the inter surface of the this dry rubble masonry and then what happen is so this is a initially till start as a soil conservation measure and then it also conserves water and then eventually it will conserve vegetation also so which are the three important parameters to be conserved in integrated watershed management.

So therefore so the stream channel method in this what happen is so this is suppose this is the here let me show this is the this is the original extent of stream channel and then the improved extent because of this construction of this dry rubble masonry and all. So what happens is so this will be in additional storage of water. So this is the now here so this is the improved extent of stream channel storage after this artificial ground water recharge here.

So this is the original extent of stream channel so this is original extent of stream channel storage okay. So this is the second method of artificial ground water recharge which is the stream channel method. And now let us go to the third method that is the ditch and furrow method.

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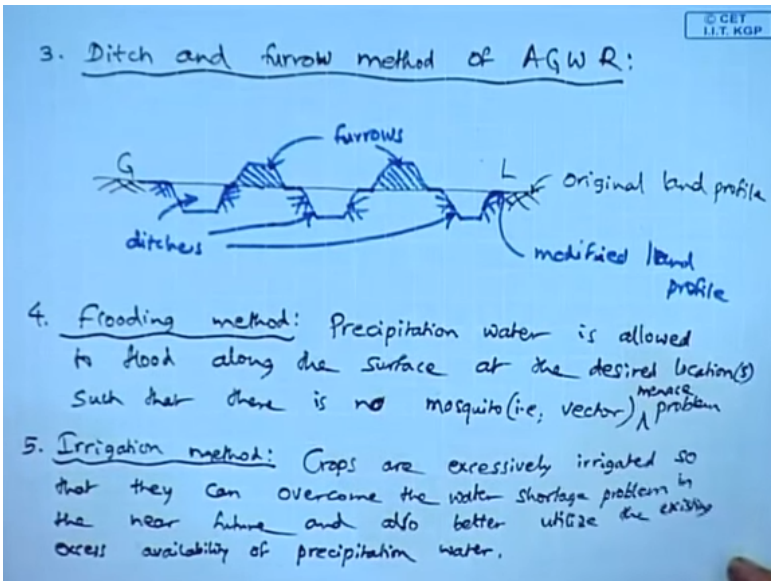

So this is the third is the ditch and furrow method of AGWR so in this what is done is so this is the Ditches and furrows are created so that say this is the suppose this is the original land profile. So this is the so here this so we are certain furrows so these are the furrows and then this is may be some ditches also okay these are the ditches this this as well as this and then this are the furrows there are basically the are then this one or they may also have so these are the furrows.

So the new so this is the modified land profile so by creating this ditches and furrows so we are going to increase the water retaining capacity or water with holding capacity and which will eventually result in artificial ground water recharge. So this is the third method and so the fourth one is a the flooding method so here it is a self-explanatory so in this case is simply water is allowed to flood so the precipitation water allowed to flood along the surface at the desired location or locations such that there is no mosquito.

So that means this also known as vector problem mosquito menace problem so by doing this so that is a we may adopt various method so that flooding is there but at the same time so there is now growth of mosquitoes and undesirable organisms and so therefore so this is one this is a the water is allowed to flood so then it automatically it will recharge that will flow by gravity in the vertically downwards direction and then there by this artificial ground water recharge is achieved.

So next is that is the irrigation method so here also it is self-explanatory in this case so what is done is that is so this is crops are excessively irrigated. So that they can overcome these crops are so that they can overcome the water shortage problem in the near future and also better utilize the existing excess availability of precipitation water or say rain water or precipitation water.

So this is the irrigation method and of course once the excess water is allowed and then so this we may reduce the irrigation trick near the frequency and then we may even go for this deficit irrigation. So that even if there is a slight delay in the monsoon or this one so they is the plants are self-sufficient to overcome this situation because of the that is already achieved this one that is that what I should say the already achieved it water availability.

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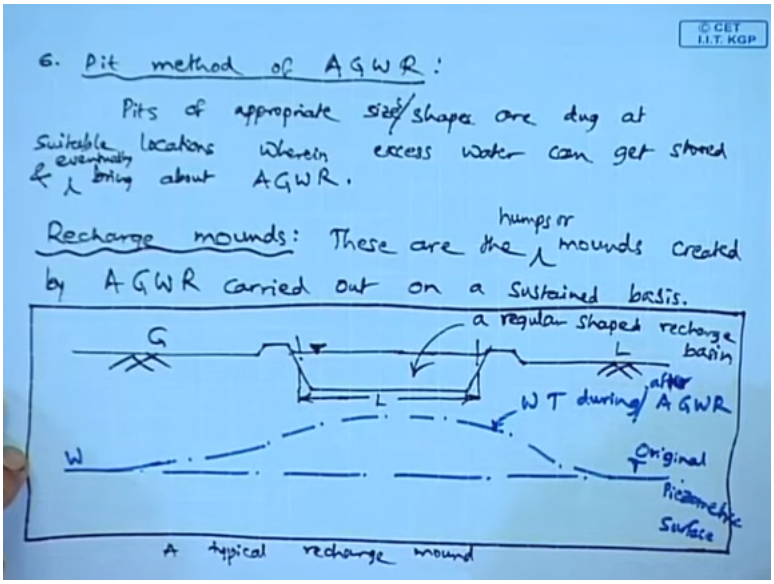

So this is the fifth one and then lastly so there is PIT method so this is PIT method is also so that is the sixth one is the PIT method of AGWR so this is self-explanatory. So this PITS of appropriate sizes size stroke shape are dug at suitable locations where in excess water can get stored and bring about and say eventually bring about artificial ground water recharge so the this the PIT method okay.

So these are the six methods of artificial ground water recharge and of course these are not exclusive so we may adopt any new method which may be this artificial ground water recharge. So to give one simple example so I can mention so that as so this the terminology of rainwater

harvest is very popular these days and of course these rainwater have harvesting is essentially it is also one form of artificial ground water recharge.

And in this case I am I would like to bring it to the notice of this one the fact that a village lady it is in an interior costly at the rather in coastal Karnataka near the town of Mangalore. So she uses her old saris and so this she spreads this old saris around this one and then so the coastal area which is having a relatively large amount of humidity so this water the humid water it gets this one and then eventually so there will be condensation of this humid water and then.

So she gets may be some amount of may be few liters depending upon the size of her saree and all that as well as thickness of as well as material. So she gets this one so like that so they this she bring about see and that is harvest or the locally available will axis excess moisture and okay. And with this the complete this one and now we will go to what are known as recharge mounts.

So these recharge mounts are essentially the mounts are humps which are created by artificial ground water recharge. So these are here you can write down so these are the mounts the humps or mounts so these are the humps or mounts created by this artificial ground water recharge carried out on a sustained basis and here let me draw the a typical this one the cross section as well as and in this say for example say suppose this is the so this is the ground surface.

And here suppose this is the square which has basin and here this is a here this is a regular so in which most of the cases in which may be recharge basin square and here what happens is so what happen say suppose so this is the here you can say the average length of this one A the regular shape recharge basin. So let me just differentiate so here what happens so this is the initial water table.

So this is the original water table or piezometric surface let me write this as and then because of this storage of this water in this recharge basin. So here what happens is so it will form a mount here okay so this is the water table during or during stroke after artificial ground water recharge so therefore this is the recharge mount is created here because of this the recharge in a regular shape basin.

Then so this is a so this is a typical recharge mount then we will go for this is a the induce recharge in this case anyway we will stop here and we will continue with the induced recharge in the next lecture and so this one okay so thank you