Water Supply Engineering
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Module No # 10
Lecture No # 51
District Metered Area (DMA) for Zoning in Water Distribution Networks

Hi friends and welcome back so in the last class we discussed about the 24 7 supply system as one of the tools for the advanced water distribution networks designing okay. This class we are going to talk about the district metered area for zoning in the water distribution network.

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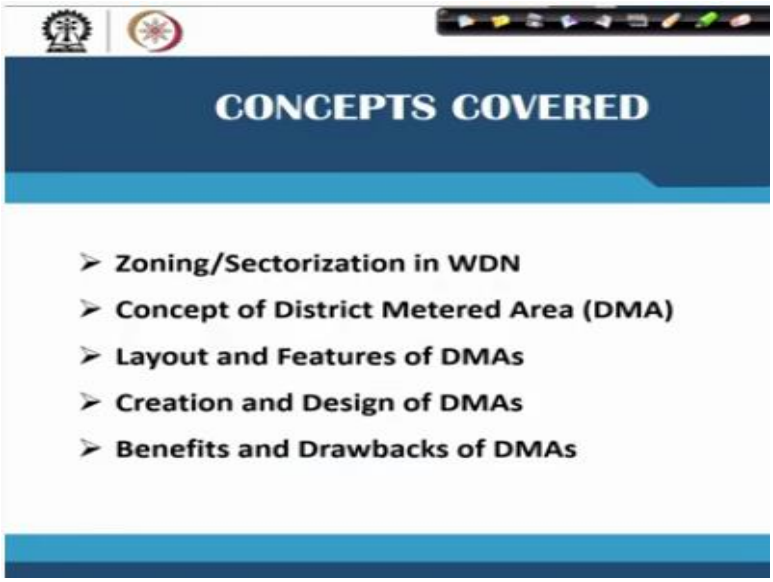

So what we are going to cover is the zoning or sectorization in the water distribution network we will be talking about the concept of district metered areas. Though we have a discussed this term in few times before but we will be talking about in more detail what exactly district meter areas are what are the layouts and features of the district metered area? How do we create a DMA or design concept for the DMA's? And then some of the benefits and drawbacks on the DMA's.

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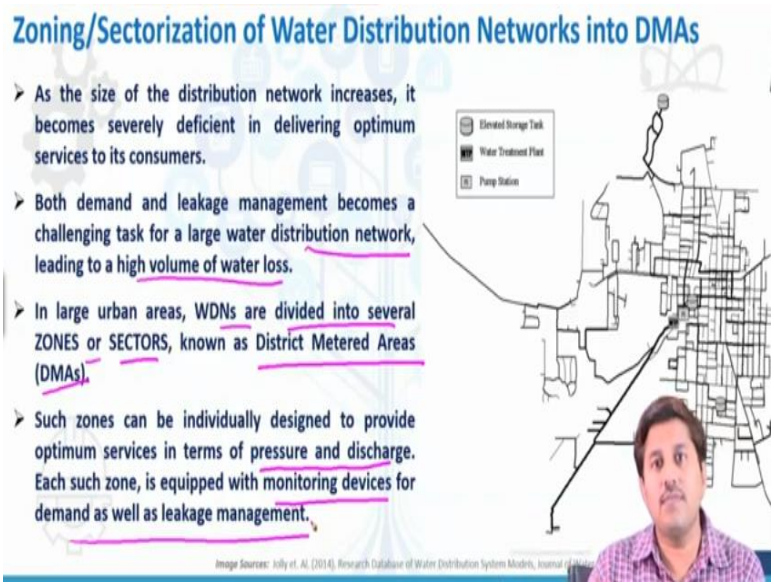

Now zoning and sectorization in water distribution networks is essential because as the size of distribution network increases it becomes severely deficient in developing the optimum services okay. There might be issues related to the pressure drop at some places there might be issues related to lesser flow. So variety of issues come both demand and leakage management becomes very challenging task with the large water distribution networks and this leads usually to the high volume of the water losses.

Now I have discussed in the previous week also the concept of DMA's is fact was first introduced with an idea of controlling the water losses because in a large network it is difficult to identify the losses it is difficult to the quantify and figure out how much loss is happening and where it is happening particularly the real losses are the physical losses. So the concept; of DMA's were; introduced so that in a smaller segregated areas the analysis can be done and the places of the leakage or points of the water leakages can be identified.

So in large urban areas generally this water distribution networks is divided into several zones or sectors and these are typically known as district metered areas or DMA's. Now these zones can be individually designed like can be individually designed to produced optimum service in terms of pressure as well as discharge. So we can take care of the services DMA wise in each DMA so each DMA means is have a inflow okay these are generally equipped with the monitoring devices for demand as well as leakage management.

So we will have probably a meter and we know how much water is going into the DMA how much is the demand within that DMA? What is the extent of leakages? How do we control that leakages so all that kind of exercise becomes easier in if we put zones into the water distribution network.

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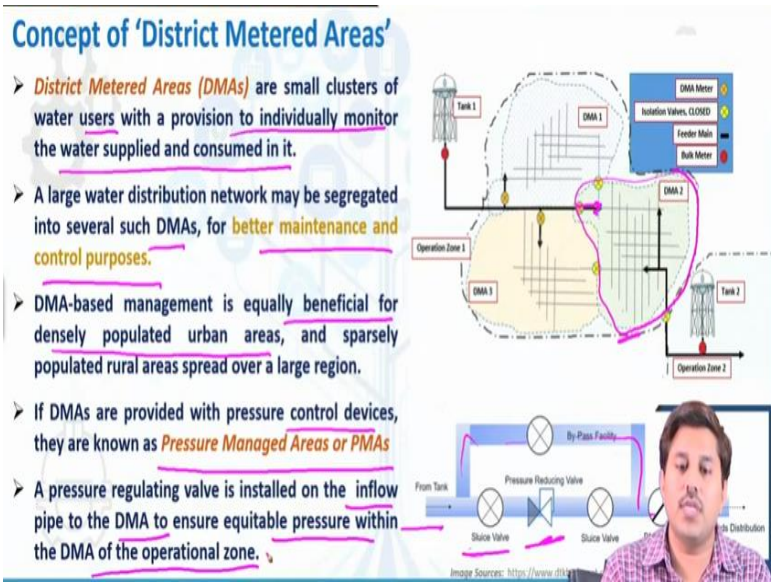

So this brings us to the concept of the district metered areas what we are referring as DMA's. Now these district metered areas are small cluster of water user with the provision of individually monitored the water supplied and consumed in it. So if you have 1 cluster so let us say this is a cluster so within the cluster how much water is being supplied and how much water is being consumed that is a monitored, tackled, handled separately right.

So that is that how many like there would be a number of households within a each DMA number of connection in fact that way because typically one households represents one connection and unless there are more connections at the same address. So generally how many number of connections are there in 1 DMA and how do we like regulate those connections in terms of supply in terms of demand in terms of the leakage or losses that is done on a DMA scale instead of large network scales okay.

So the large water distribution network may be segregated into several DMA's for better maintenance and the control purpose that is the major objective of the segregation of DMA's. This DMA base management is equally beneficial for densely populated urban areas so or for the

especially populated rural areas which are spread over a much larger region. So it does not matter that like we go like we install a DMA only where there is a huge cluster density at a smaller region.

So that the density is very high the density of connection or density of population is very high it is not only for those areas this can be adopted for rural areas also because then pipe length is longer and then all the number of connection might be smaller but then the pipe length and coverage are much longer. So again if you for a looped big looped network it becomes quite challenging to manage without such segregation.

Now this DMA's are provided with the pressure control devices generally known many times and then these are known as the pressure managed areas this could be like if you are getting water from a tank so you can have a PRV or bypass facility pressure is high passes through a switch valve and then through a pressure reducing this thing and then feed to a DMA. So then this is known as the pressure managed areas and if pressure is low it can be basically just directly going through the bypass.

So a pressure regulating value will typically installed the inflow pipe of the DMA to ensure that equitable pressure within the DMA of the operational zone so that DMA gets a like the pressure at a desired level at its inflow.

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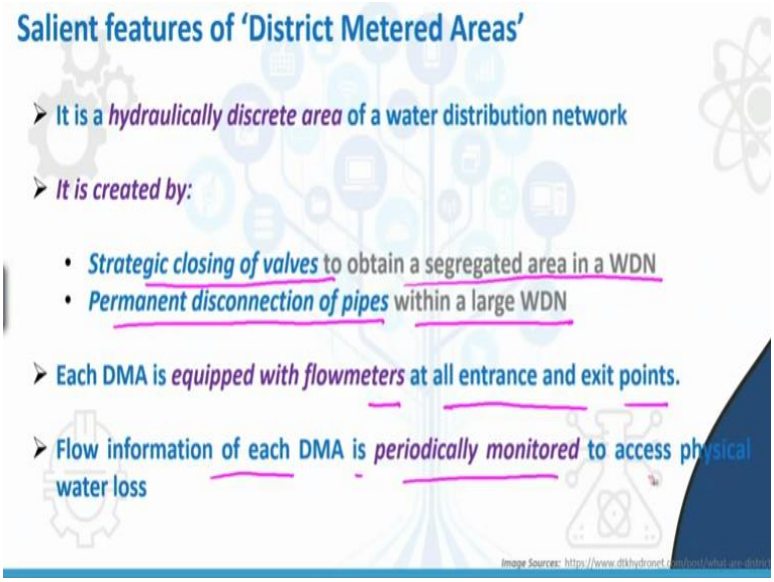

Now the basic features of a DMA include that it is a hydraulically means hydraulically discrete area so it is hydraulically separated area of a water distribution network. It is created by strategically closing of valves okay so many times like if it not there at the design is stage we can create it by strategically closing the valves to obtain a segregated area in a water distribution network and it can be created by permanent disconnection of pipe within a large water distribution networks.

Now each DMA is equipped with the flow meter at all entrance and exit points so that we can have in a contemn of the flow within a DMA and this flow information of each DMA is periodically monitored to a kind of access what is the level of the physical water losses happening in that particular DMA.

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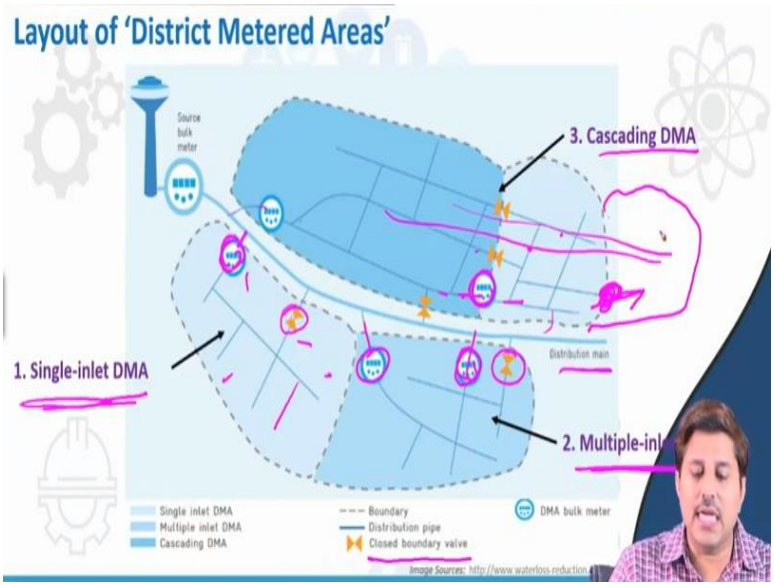

If you see these layout of this district metered areas is so there are 3 types of DMA there is a single inlet DMA so when there is a what like if you are say this is you distribution mains. So from the distribution main you have having just one single inlet you are having a monitoring system and then feeding a number of connections you might have a another inlet but or outlet were basically you can close this so this is basically a closed boundary valve.

This is a boundary valve which is closed so in that case you have just one single inlet valve coming in here okay this is just one distribution pipe which is coming into this DMA. So this is a single inlet DMA okay then there are multiple inlet DMA's may have more than 1 entry point so

you like you 1 entry point here and 1 entry point here in this particular DMA okay and this is a closed valve anyway. So what we see is that DMA is getting water from 2 sources so this is basically multiple inlet DMA.

Then there are cascading DMA okay so cascading DMA is where basically you are getting water in DMA and the another DMA is being fed from this DMA itself this is not having a separate entry directly into the DMA. There is no such entry here this DMA is basically getting water from another DMA. So it is basically this is in next step of this DMA and that is why it is known as basically the cascading DMA's.

So we have to 2 DMA's one after the other if you say have another boundary another DMA here which gets water from this particular DMA so this kind of setup's or this kind of systems are known as the cascading DMA's so these are the few different layouts of the DMA's okay.

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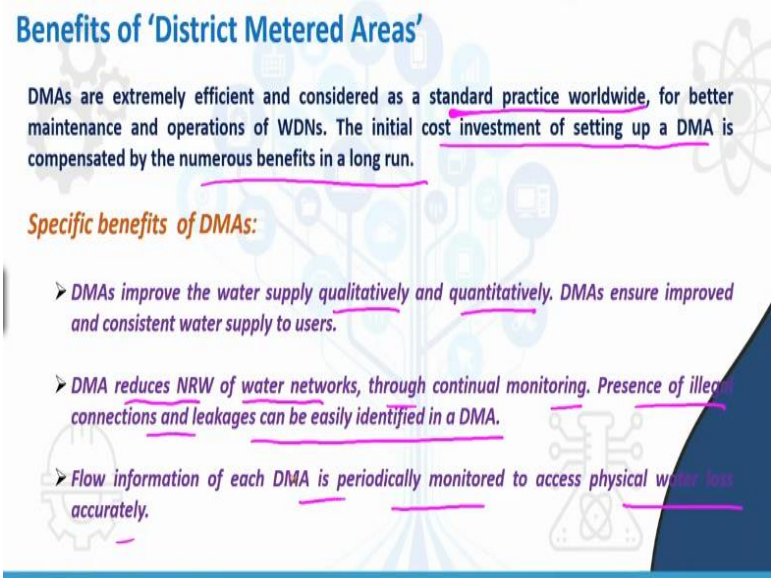

Now you see the benefits of going to the district metered areas is basically these are extremely efficient and considered as a standard practice worldwide. For better management of operation of the distribution network because we are able to isolate one section so as just we have been discussing again and again that managing very large distribution network is quite complex and challenging.

And once we segregating them into this smaller areas the leak detection the pressure regulation the Phloem observation the demand management everything becomes far more easier in a smaller set of network imagine a city having said 2 lakhs, 3 lakhs, 4 lakhs connections as opposed to a area have been just 3000 connections okay. So as opposed to 3 lakhs if you are just having 3000 connection 100 DMA's with 3000 connection so managing each individual DMA is you can do far more efficiently than that of managing all the like connections in just one big wide network okay.

So that is why this is being like a adopted as a standard practice worldwide everywhere people are like considering this as a better option for maintenance and operation of the DMA. There is an initial cost investment in setting up a DMA but again these benefits in a much longer run the specific benefits, are the water supply quantitatively and qualitatively improves under a DMA.

The DMA ensures the improved and consistent water supply to the user again I just we were discussing in the previous class as well that if you want to go for a continuous water supplies system or 24 water supply system which is regarded as the better system then intermittent system in systems of the quality of water supplied in terms of the network management okay or in terms of the loss detection.

So we have to go with by zoning the system into the several DMA's okay not this DMA reduces NRW of the water network NRW of losses physical losses in fact okay. Through continuous monitoring the presence of illegal connections and leakage can also be easily identified in the DMA's because we can oversee the demand in a much clear way that okay these many number of connections are there this is the demand and then how much extra water is getting lost okay.

So if there is not physical leakage we can actually try to detect the apparent losses as well within the DMA far more efficiently then that we do in a big wider network because tracing the illegal connections is such a wide network becomes far more challenging okay. The flow information in each DMA's is periodically monitor to access the basically physical water loss how much water is happening and what is the efficiency of the water which is being fed to the DMA's?

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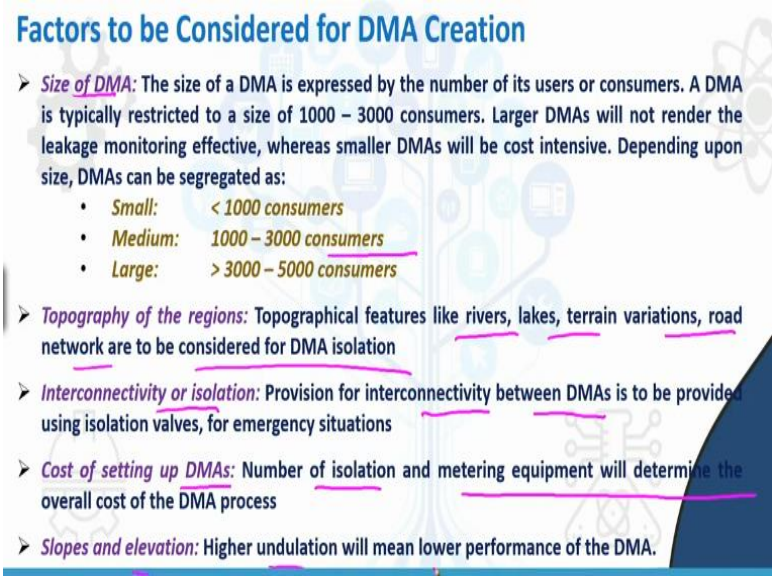

Now when we go for creation of DMA we need to consider several aspect several factors first thing is size of DMA what size we should chose for a DMA? Okay generally the size of DMA depends on the number of user or consumer so many number of connections we can give per DMA so typically 1000 to 3000 is taken as a like best range for isolating a DMA. DMA's generally of less than 1000 consumers are considered smaller DMA's.

DMA's is greater than 3000 is considered larger DMA's okay although there are DMA's with the more number of consumers okay. But generally like the best or medium or the appropriate size that is considered is the medium size which ranges between 1000 to 3000 consumers in a district metered network okay. Now then the topography of the reason so topographical features like if there are river, lake, terrain, variations, road, networks these should be considered in the DMA isolation so if we can isolate DMA's across boundaries of his street and this side that side it becomes far more easier or boundary of major roads rather than streets.

Then interconnectivity or isolation so we should have a provision of interconnection between the DMA's in case of emergency we can open the valve and connect 1 DMA to the other DMA like just we were seeing the example of the cascading systems. However we should have generally isolation was were in standard condition those valves should be closed and we can have DMA isolated from the much larger network because that is what is the purpose of doing this exercise the basic purpose of doing district meter areas exercise is that we monitor we observe we oversee we manage cluster of connection as an isolated area isolated region.

So we should have isolation values closed most of the time so that like it is slated but in case of emergency situations we should have a provision of the interconnection between the DMA's as well. Then we must look at the cost of the setting up of DMA's so how many number of isolation and metering equipment's are there will eventually going to determine the cost of the DMA creation processes okay. Then we should also see the slope and innovation so higher than the duration means the lower performance of the DMA.

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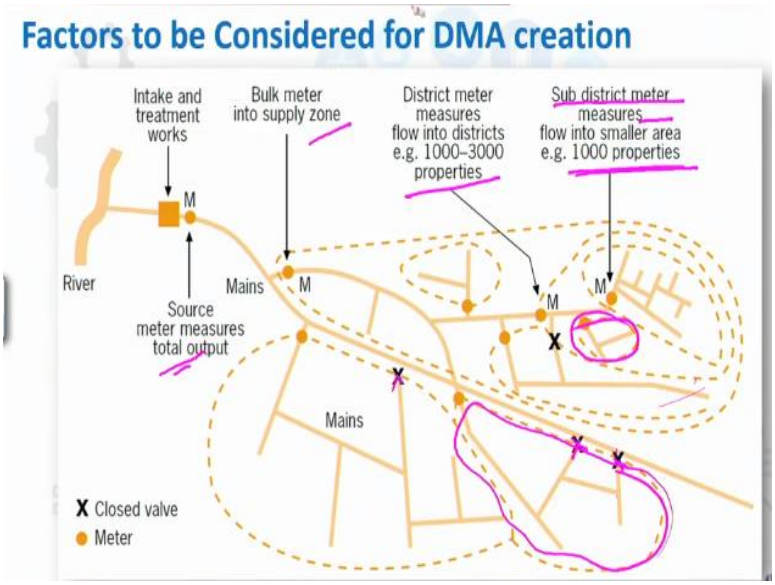

So if DMA's are generally flattered a I know that we usually will perform better in that sense. So this is basically an example that way if you say or having a river over here and then it is intake and this is going to be your mains. So we can isolate DMA's like using the valve so we have a say closed value wired meter here this becomes 1 DMA okay. We need to see the source meters of the total output we need to see the bulk meter into the zone which is going to get there.

And then let us say we have a again a big DMA and then there are several zones or several sub DMA's within that also it is possibility. So there might be possibility of having more sub district metered areas or sub DMA's within a much larger DMA okay when basically it is a smaller area less than the 1000 properties. The district metered areas measures generally between, the 1000 to 3000 properties so that is as just to be said.

So we can have segregating of DMA's like this can go to 1 network this can go to another network many times we have a smaller networks over there how we are closing the valves where we need to close the valves if there are 2 connections we can close these valves and separate isolate this as the 1 DMA. So this kind of things might be adopted while considering the creation of the DMA's.

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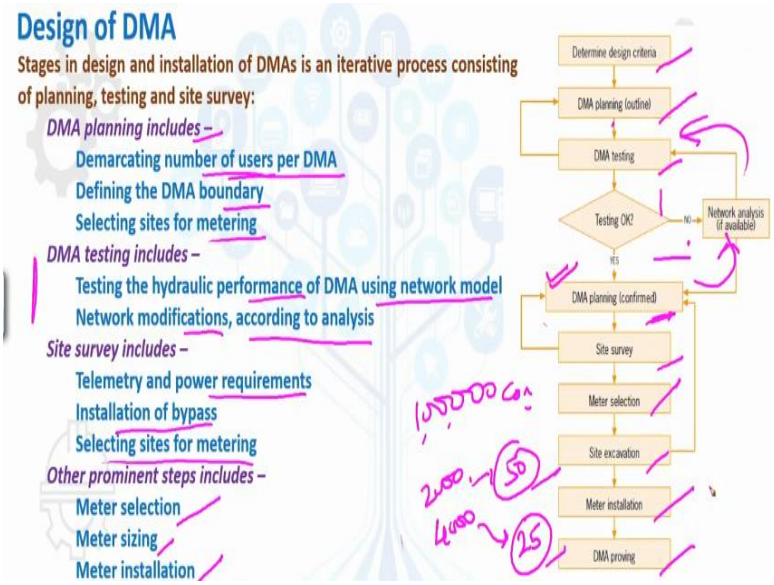

Now there are several stages when we go for designing of the DMA's of the setting up the DMA's okay these stages are basically used quite a few iterating processes and consists of planning, testing and site survey for the purpose of designing the DMA's. So, first stage is the planning where basically we see the like we demarcat the number of users per DMA. So if you are going to say have a city of say 1 lakh population okay so then we need to see how much population we are going miss 1 lakh connection in fact.

So how much connections we are going to attribute to per DMA and how many numbers of DMA's we are going to have in that case okay. So say if we attribute for say 2000 connections per DMA then that means we are going to end up with the 50 DMA okay or if we are going to have a say 4000 connection per DMA then we are going to have which is a bigger size DMA then we are going to just have 25 DMA's.

So how many DMA's we are going to have and how many number of users we are going to demarcate in each of the DMA. Now these numbers not necessarily to be fixed actually some

DMA may have a say 2000 connection some DMA may have 4000 connection some DMA may have 3000 connections 3500 or any number of connections is possible that way. Now defining the DMA boundary is another step then in a planning stage.

So once we set up okay let us say on an average these many number of connections we are going to have per DMA. So how we can basically define the boundaries with those many number of connections in the reason in the area for the different places and then we go on selecting site for the metering. So, if we have demarcated the reasons then where is going to be the input and where all we should put the meters that needs to be identified at the planning stage.

Then we move to the testing stage where basically we test the hydraulic performance of the DMA using network model so we use standard software tools we put the networks there network design there and test that under what pressure like if the pipe sizes are adequate under the design pressure if because we know that what pressure is to be operated what pressure the system is to be operated what has to be the delivery head.

So whether we are getting that adequate delivery head at the end consumer level or not how is the our age of like how is our the pipe component is strength of these are they were to able carry that flow are they be able to bare that pressure. So all these things we do and then if needed we go for network modifications according to the analysis so at some places let us say we need pressure reducing values in some places we need certain facet some places we need some values opening or closer valves.

So all those aspects are done during the testing state so during the testing stage we like with the network we simulate different conditions and see how this is going to work the in a best way and then we go to the next stage which is the site survey. The site survey includes the telemetry and the power requirement it includes the installation of bypass lines and selecting site for metering so where basically we are going to put the meter actually and then we go to the other prominent steps which is basically meter section, meter sizing, meter installation within the DMA.

So basically we will determine the design criteria first then we will go first the planning or outlining of the DMA then we go for the DMA testing following these steps if testing is okay we go to the next stage we confirm the planning if there is problem in the testing we go back and

basically then we go back at a planning stage. So we plan and then we test if in the test we find that our plan is okay so confirm plan and move ahead if in the test we find that no there are certain issues without plan.

So we go back to our planning stage do the required amendments in the planning and then again to go the testing. So we will again go to the testing and see if now it is okay we will move to the we will confirm that plan and move to the next stage however even if even now if it is not okay then we will again go back and do the relevant modifications that is needed okay. And then we will do the site survey again it can basically change the planning little bit based on the site survey.

Because once we plan initially we plan without like we plan as a like blank concept that okay this is what we are going to have we have very little we have the information about the site but not that great. Because we may plan say somewhere ESR we may plan somewhere a value somewhere in meter and but when we actually go to the site survey we might see that okay it is not possible or it is not feasible to put a ESR here then we need again go back and revise our plan okay so that possibility might also come out of the site survey.

Then we go for these meter selections the site excavation if it is needed to be done and then a meter installation and the we can provide the like provisions of the DMA. So we can that way isolate by closing of the by closing the selected value we isolate those specific sections of the DMA and then kind of consider that as an isolated part and work based on the like consider that as a DMA.

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Now what are the drawbacks and risks with DMA creations we have talked about what are the advantages with the DMA creations and how they kind of ease out the operation and maintenance of the network in a much smaller or segmented areas but in spite of this benefits the process of DMA creation is a much complex task and there are basically a few drawbacks also associated with these kind of DMA's.

So one is the cost of the DMA creation because if we want to go creating a DMA so we need to identify we need to basically put in some more pipelines at select places if you want to say convert an existing network into a DMA base segments or DMA based zone so we might need some additional valves isolation valve we might need meters. So there is going to be like required tools and those things monitoring equipment and that will basically enhance the cost of the process.

So initial stage the financial burden of DMA process may be very high and that is why like various water utilities does not even think of doing this because of the lack of the financial resources. So if utility does not have adequate financial resources at hand the creation of the DMA or generation like the creation of these segments becomes very challenging from them that is going to be the cost and then it is not just about the cost of physical entities are there but it also needs the human resources cost.

Because if you are having say network with a big wide network and you are basically somehow managing this network with say a team of 50 people or 20 people okay 50, 40 people and then if you end up creating a DMA's where you have given say 100 DMA so probably these 50 people would not be sufficient enough to control this 100 DMA's okay. Because we are putting more equipment's monitoring equipment in the setup so we need more human resource more skilled or trained manpower as well.

So even if let us say a resource financial resources are managed utilities many times see that okay who is going to operate how what is the modality of the operation of the DMA's okay. So many times they modality of the operation of the DMA's might also be a push back factor for going DM going for DMA creation. So it is just not the cost of the physical stuff it is basically overall cost okay.

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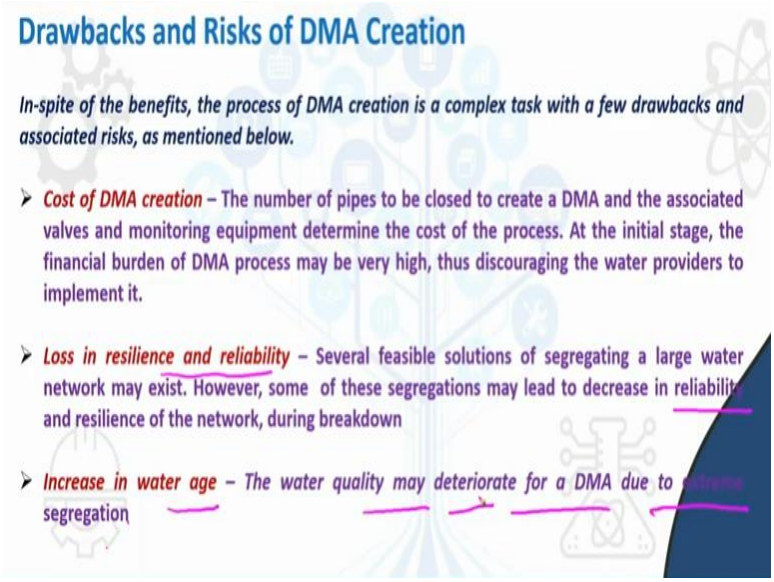

Then there is a some loss in the resilience and reliability when we go for the segregation of a large water network okay because we are going to cut off like many reasons value we are going to have various isolation valves and those things. So since we are doing the segregation so that might lead decrease in the reliability and the resilience of the network during the breakdown if there is a breakdown happens and say we want to water feed coming in from the different parts or different sized places that kind of reliability or resilience might be lost when we go on the segregation of the DMA's.

That this though this particular kind of drawback can be overcome by using the isolation valve which can be opened at the time of emergencies connecting the different DMA's as just we were discussing that is a good feature and to have in the DMA that we can actually have isolation valves they are. And once we need say more flows in case of emergencies we can open that isolation valve and channelize the flow through various other routes as well okay.

So but if we are going for a permanent closer as one option is permanent closer and segregation of the DMA's. So for permanent closer purpose again then there is problem because if a DMA has just a one single entry and there is all other like connections has been permanently closed then in case of emergencies of in case of higher needs that there might be a problem of channelizing more water through the single entry and that way we can see a kind of less reliable system with a DMA's.

But as we said that say this we can easily be overcome by having those provisions but keeping them closed so having isolation valve and those kind of thing keeping them closed. Then there is a increase in the water age so water quality may deteriorate for a DMA due to kind of extreme segregation if water is segregated at a very like at several levels.

So and in some part if water is say becomes stagnant for much longer period then there is a like the aged water may have see some deterioration in quality but again that is a very minor aspect otherwise generally because in a smoothly run DMA systems the less amount of water is being channelized almost equal to that of the demand which is being consumed easily so that way we will not see much of a problem in the management and maintenance of the system and the maintenance of the water quality as well okay.

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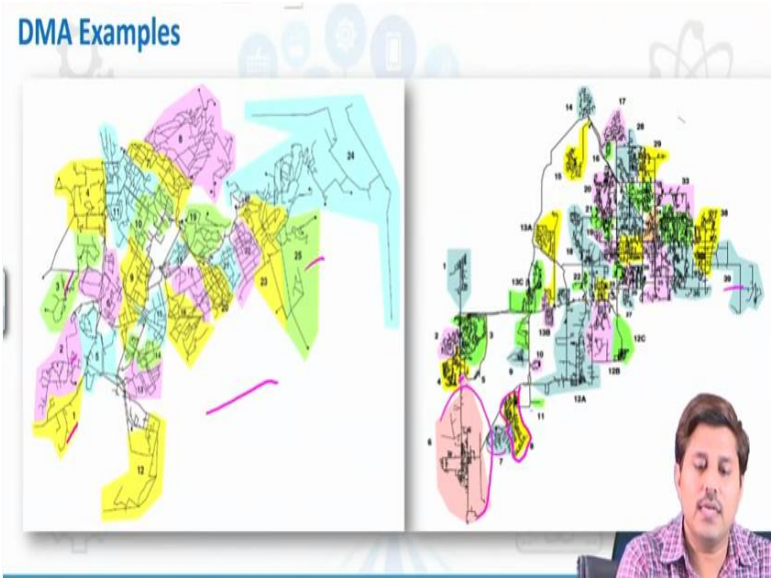

So that water quality can be kind of ensured if we stop large stagnation of the water for much larger periods. So these are couple of examples of the DMA's like we can see that these are in fact they are from the real networks. So we can see that there are several DMA's created around 25 DMA's here and this is again having some our 39, 40 DMA's in this particular network.

So one network how this as an been segregated so let us say we put this as a 1 DM may put this as a 1 DMA again based on the connection density you can see some maybe of small size some may be of big size so that way we can actually segregate a bigger network into the smaller DMA's. So with this we will conclude the discussion for now in the next class we will talk about using some software tools for the network designing which are also like the advanced tools available these days because earlier design used to be go like using the manual practice or various other calculation step lot of calculation steps.

But now there are easy tool available for designing and we will see some of those tools in the next class. So see you in the next class and thank you joining.