Remote Sensing and GIS for Rural Development
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Week - 06
Lecture - 05
Extracting polygon features from georeferenced data and seeing a timelapse on Google Earth

Hello everyone. Welcome to Remote Sensing and GIS for Rural Development. This is week 6, lecture 5. We are wrapping up week 6, which is half of the NPTEL course. I hope you are enjoying learning GIS techniques that can be applied for rural development as much as I enjoy teaching. In this week very specifically we had looked at certain aspects in the data acquisition or data mining we call.

How do you convert paper data into GIS data or a scanned image into GIS data? This helps tremendously because a lot of data are from the past and they have a lot of value and information still in it, especially to create a time lapse image or a time series of data, so it is important to hold these data in GIS formats or digital formats so that we can compare readily.

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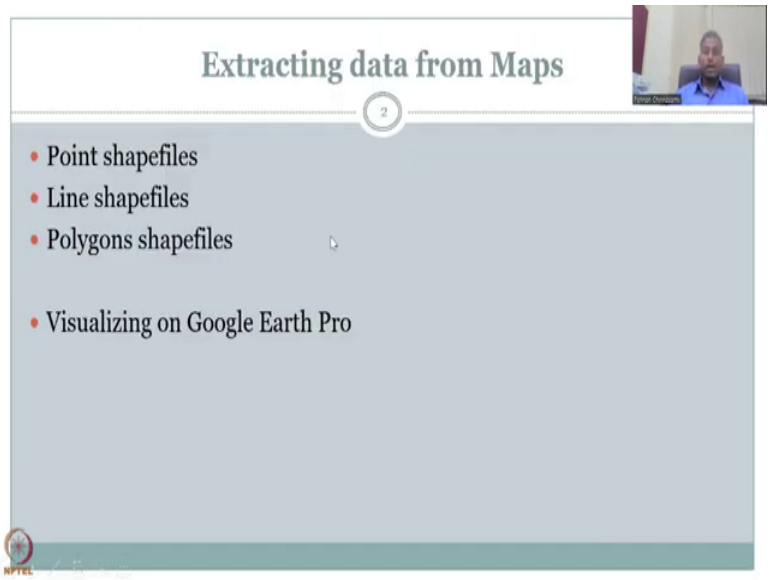

So let us dig into the last week 6, lecture 5, which is the closing lecture for week 6. The midweek and we have been looking at extracting data from maps. I hope the hands-on tutorial that I showcased live in the last two classes were helpful to redo that in your own system. We will also be sharing this data with you through the forum, so that you can also try these examples, but I prefer you to find the data from the links that I gave.

Because then even if the data is not new or outdated, then you can eventually find the link and download by yourself. We want you to create capacity by teaching and learning by doing, rather than providing it readily available. Extracting data from maps, we have looked at point shapefiles and line shapefiles. Now we are going to look at polygon shapefiles.

It is of similar process, but then the last part where we take all of this back into the GIS Earth Engine or Google Earth platform is where you will see wonderful images on how this image that we took from a paper map can be converted into a Google Earth, a real life image that has been taken from satellites. So let us move on. We will complete the last part which is polygon shapefiles and then we will jump into visualizing and Google Earth Pro.

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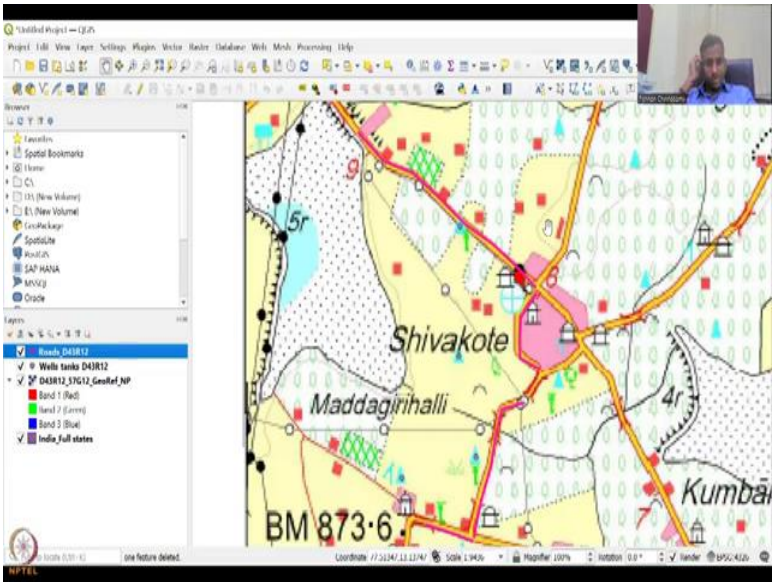

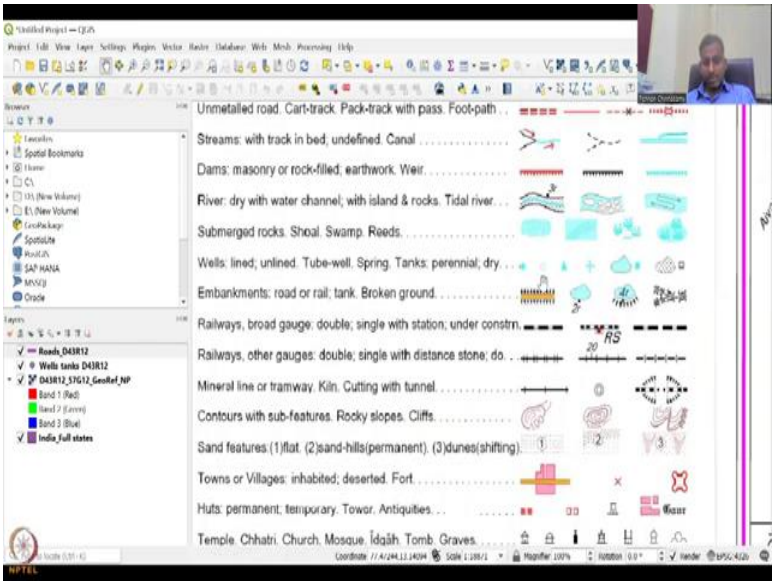

So let me share the new map that we downloaded and used. So this is the same map that we have already done the point and the roads, which is lines from the D43R12 sheet and we also made sure that it is following on the Indian boundaries, it is not coming out of Indian boundaries. So you see the poly points and then lines and then now we are going to do the polygon. So for the polygon we will do two polygons.

One in the Shivakote area, so we will see what the water body means. If you go to the left side you could see that a water body is given as a blue color, this one, it is a well lined, spring, tanks, perennial and dry. So you have a tank, which is, which could be perennial or dry. Dry is dotted. So here you have some part of the tank as dotted, whereas some part is perennial. So we will map this and then the bigger Yelahanka lake in this tutorial today.

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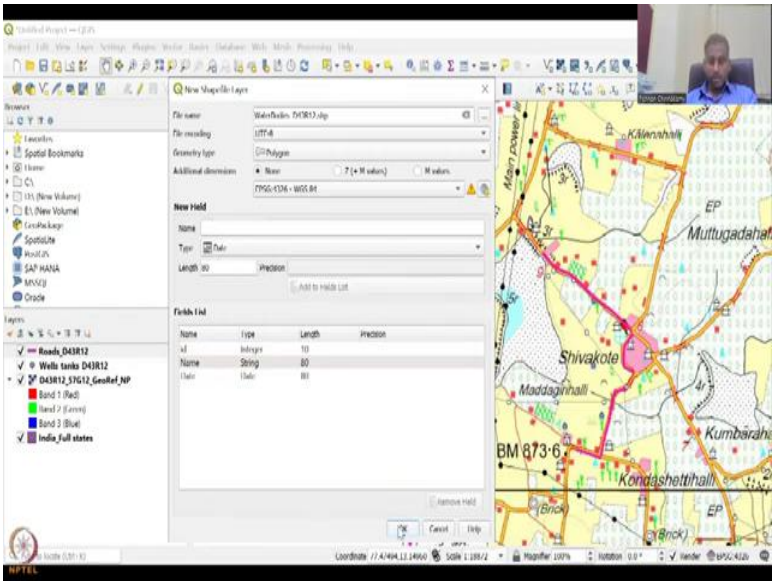

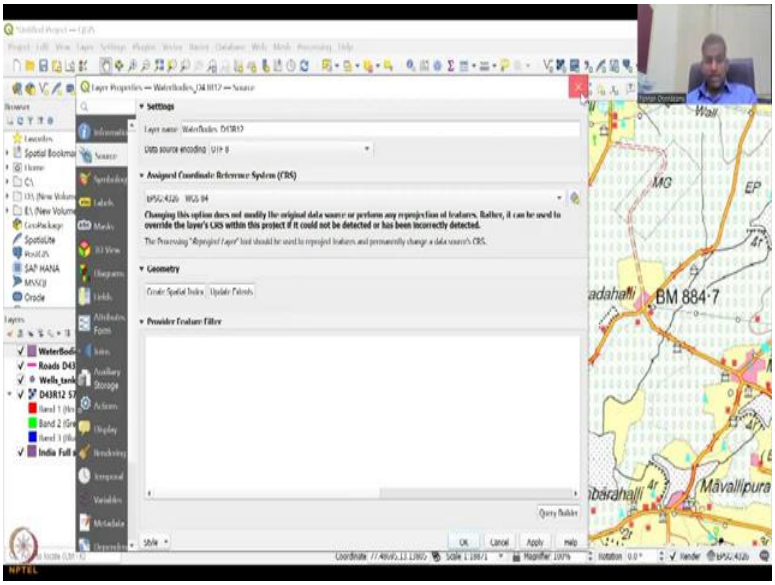
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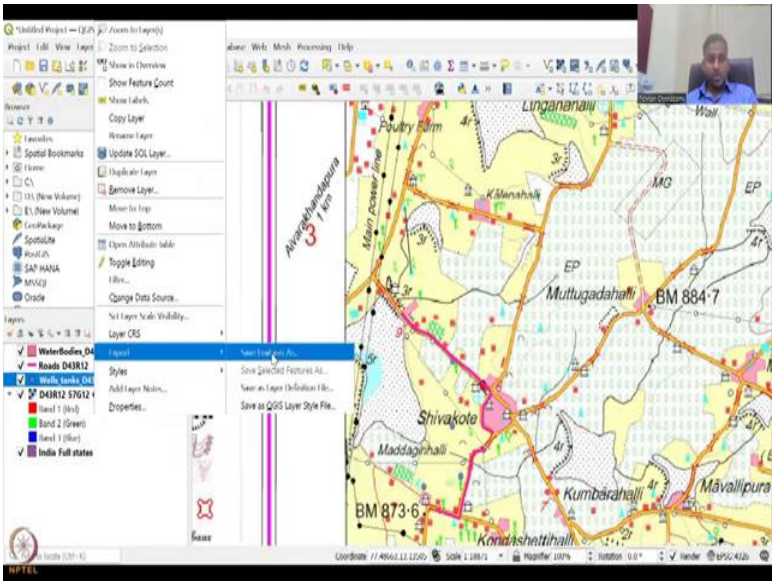
Settings
Layer name: WaterBodies_D43R12
Data source encoding: UTF-8
Assigned Coordinate Reference System (CRS)
EPSG:4326 - WGS 84
Changing this option does not modify the original data source or perform any reprojection of features. Rather, it can be used to override the layer's CRS within this project if it could not be detected or has been incorrectly detected.
The Processing "Reproject Layer" tool should be used to reproject features and permanently change a data source's CRS.
Geometry
Create Spatial Index
Update Extents
Provider Feature Filter
Query Builder
OK
Cancel
Apply
Help
BM 884·7
Māvallipura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Zoom to Selection
Show in Overview
Show Feature Count
Show Labels
Copy Layer
Rename Layer
Update SQL Layer...
Duplicate Layer
Remove Layer...
Move to Top
Move to Bottom
Open Attribute Table
Toggle Editing
Filter...
Change Data Source...
Set Layer Scale Visibility...
Layer CRS
Export
Styles
Add Layer Notes...
Properties...
Save Selected Features As...
Save as Layer Definition File...
Save as QGIS Layer Style File...
Poultry Farm
Kilenahalli
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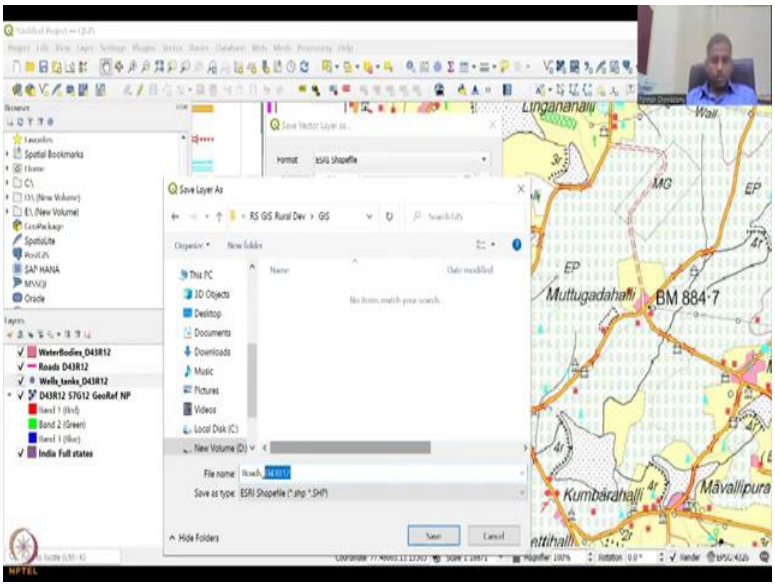
Shivakote
Maddaginhalli
Kumbārahalli
BM 873·6
Māvallipura
Kondashettihalli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Format
ESRI Shapefile
Save Layer As
RS GIS Rural Dev › GIS
Organize
New folder
This PC
3D Objects
Desktop
Documents
Downloads
Music
Pictures
Videos
Local Disk (C:)
New Volume (D:)
File name:
Roads_D43R12
Save as type: ESRI Shapefile (*.shp *.SHP)
Hide Folders
Save
Cancel
WaterBodies_D43R12
Roads D43R12
Wells_tanks_D43R12
D43R12 57G12 GeoRef NP
India Full states
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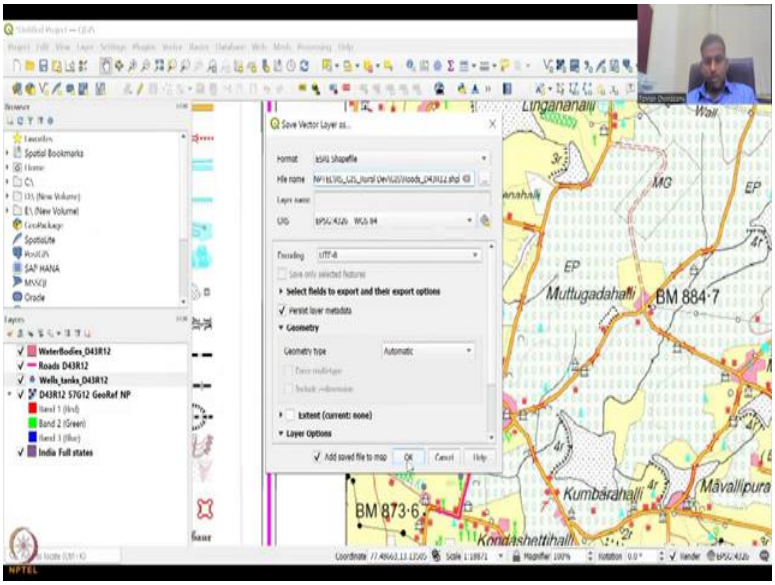

So let us get started. As we have done previously, we have to create a new shapefile to incorporate the polygons from the paper map. So let us do this, it is a little bit of drawing exercise, but I hope you are enjoying it with me. Let us say we have labelled as roads and wells, now say water bodies. D43R12 is the sheet number. The geometry type will be polygon and there is no additional values, the dimensions are the same and you have the coordinate system which is already WGS84.

Let us now create the fields. The ID is already created, the first field is exactly the name, name of the water body and that could be text data, and I am just going to add field. If you forget to add I have showed you how we could add later once the shapefile is created. One more thing we could add is the date, date of checking of the lake or the water body and that could be a date format.

It is 80 and the date formats can be different numbers dash, how you would like to be. We will see how the default works. Let us say date, there is no precision for it, we do add to the list. Now we have created three ID, name and date. Let us say and let us start drawing. So now the water body shapefile has been created. We have, we can look at the properties to see the source and you could see that the layer name is there.

But we still need to incorporate it into the GIS folder that we want. As I said you could always create a shapefile on the fly. So you can create a shapefile, but it is better to store it. So, I purposely did not store it because we were trying these GIS files but let us store it now. So the wells and tanks I have to right click, export, save feature as ESRI shapefile, file name is the same, we are going to just say roads dash D43R12.

And then where do you want to store it, you can click here and I am going to go to my rural folder GIS and then put it here. So this is where I would like to store it. So you can type it again, D43R12, so I am just going to copy it, so that we can do it the rest also and we say okay. Same thing, let us do it for the other two.

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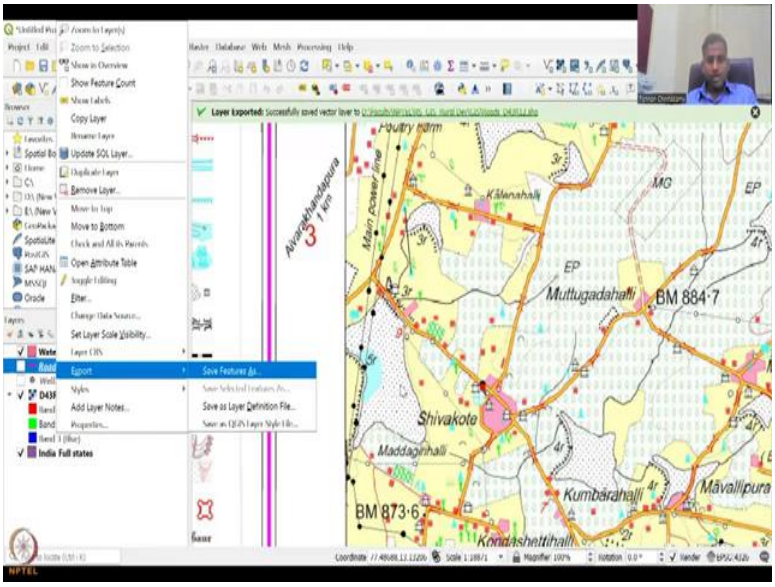

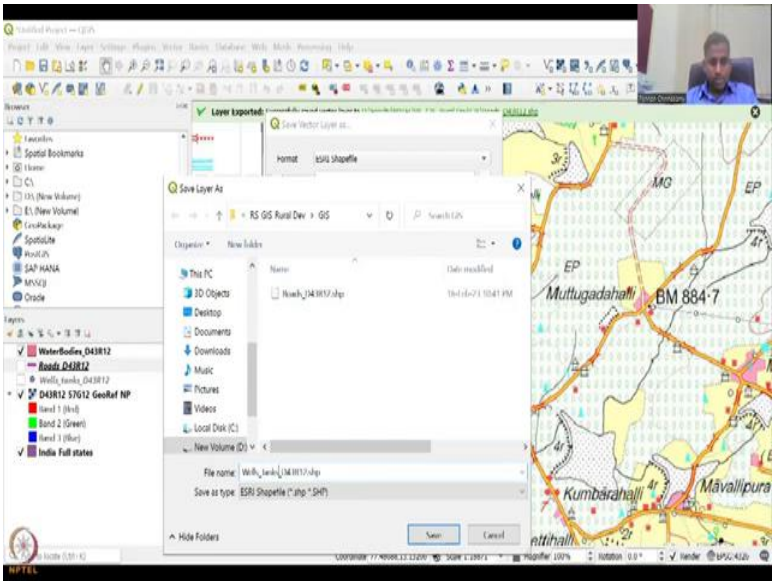

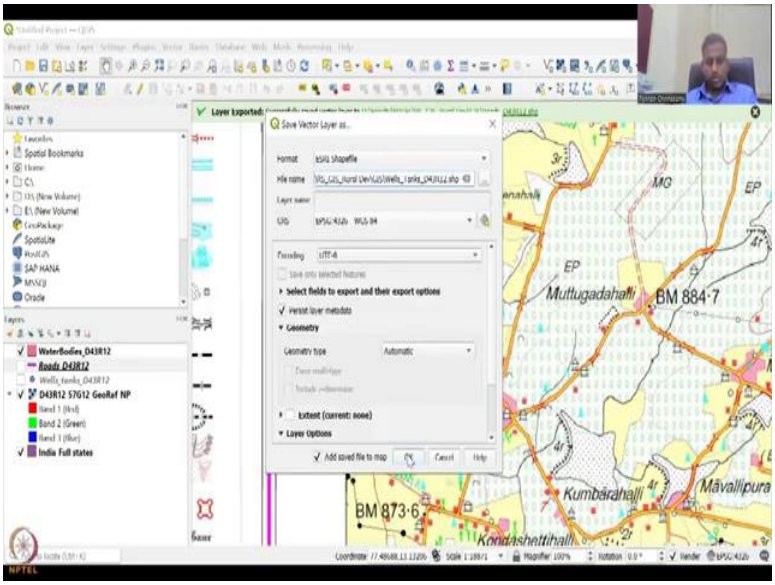
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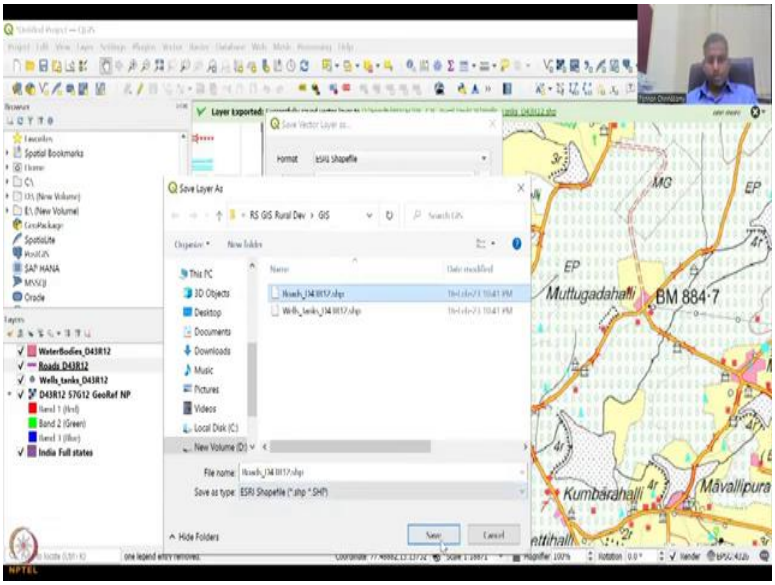
Format
ESRI Shapefile
File name
Layer name
CRS
Encoding
UTF-8
Select fields to export and their export options
Persist layer metadata
Geometry
Geometry type
Automatic
Extent (current: none)
Layer Options
Add saved file to map
OK
Cancel
Help
WaterBodies_D43R12
Roads D43R12
Wells_tanks_D43R12
D43R12 57G12 GeoRef NP
Band 1 (Red)
Band 2 (Green)
Band 3 (Blue)
India Full states
Muttugadahalli
BM 884·7
BM 873·6
Kumbārahalli
Māvallipura
Kondashettihalli
MG
EP
NPTEL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RS GIS Rural Dev › GIS
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This PC
3D Objects
Desktop
Documents
Downloads
Music
Pictures
Videos
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New Volume (D:)
File name:
Save as type: ESRI Shapefile (*.shp *.SHP)
Hide Folders
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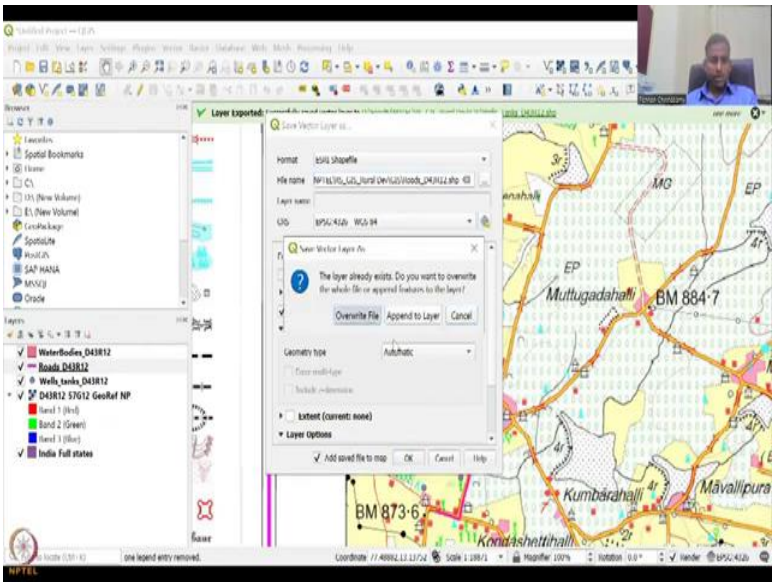
Kumbārahalli
Māvallipura
NPTEL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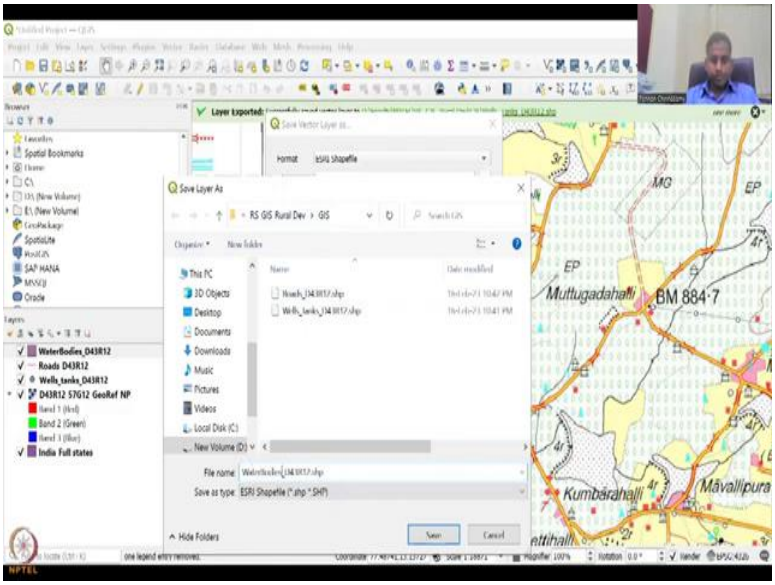
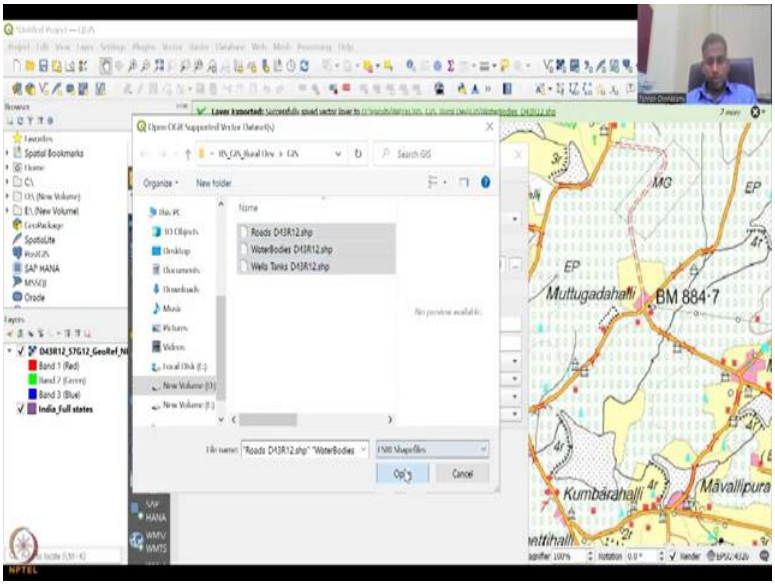

Save Layer As
RS GIS Rural Dev › GIS
Roads D43R12
Wells_tanks D43R12
D43R12 57G12 GeoRef NP
India Full states
Muttugadahalli
BM 884·7
Kumbārahalli
Māvallipura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WaterBodies D43R12.shp
Wells Tanks D43R12.shp
Open
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Muttugadahalli
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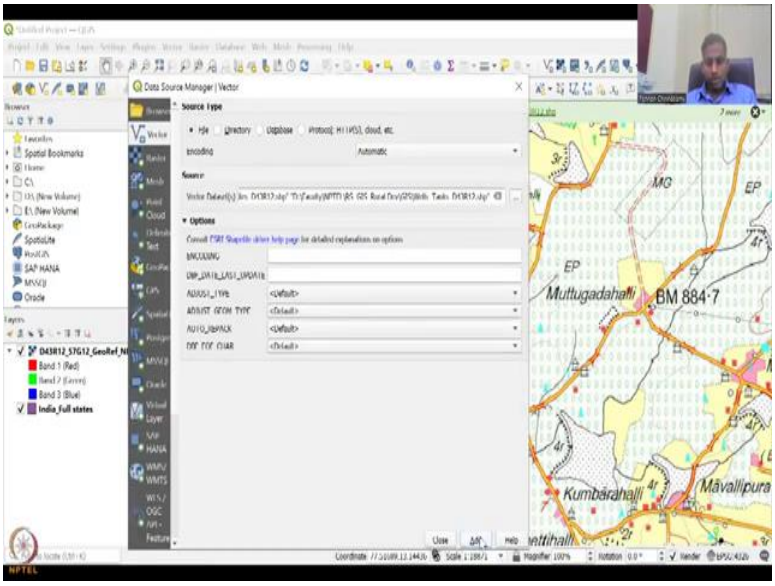
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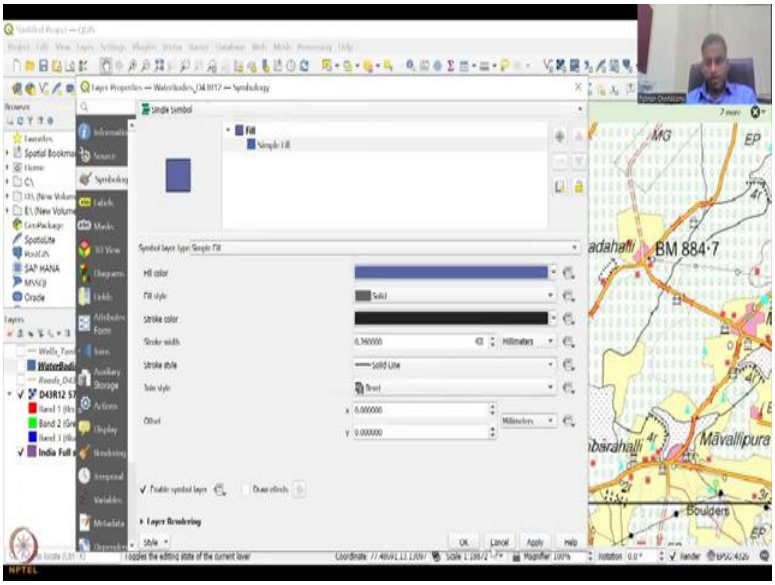

We are going to do export, save feature as, I am going to go here, roads, instead of roads I will put wells underscore tanks and I am going to store it. And then it has already added it also that is fine. So wells and tanks we should, we can remove this for now, remove the legend, let us save feature as, go back here, I am going to go to roads yep roads, we are going to replace it, override filed.

We have overwritten the file, and we have wells roads roads. We remove one of the roads because we do not need it. Instead of temporary file and the water bodies, the last one. Export, save feature as go here, again I do not want roads and stuff that is water bodies. Let us just go. We will now remove the duplicate. So just to show you I am going to take everything out and then I am going to add them from here.

Because we have exported them into the file. So let me add it. Now you can see it, choose from my directory all of the three, opening, clicking add, we have it now. Good. So what has happened is we have all the files that we needed and now we are going to add data for the water body. So for now we have, you can open the attribute table, there is different files that have been, we have made, but we will just remove it for now.

Because we are going to show it in the Google Earth. So this water body has to be in blue color, so just as a symbology let us change it to blue, because water body is blue, apply, ok, apply, ok. Good.

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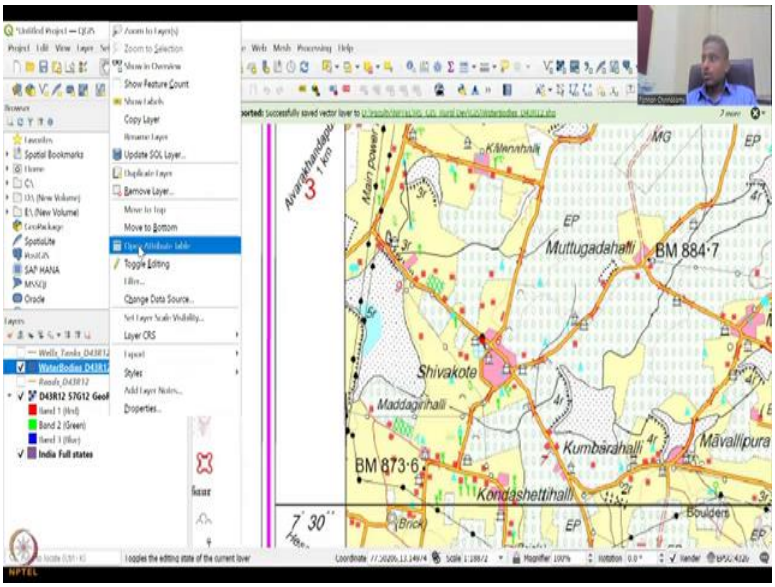

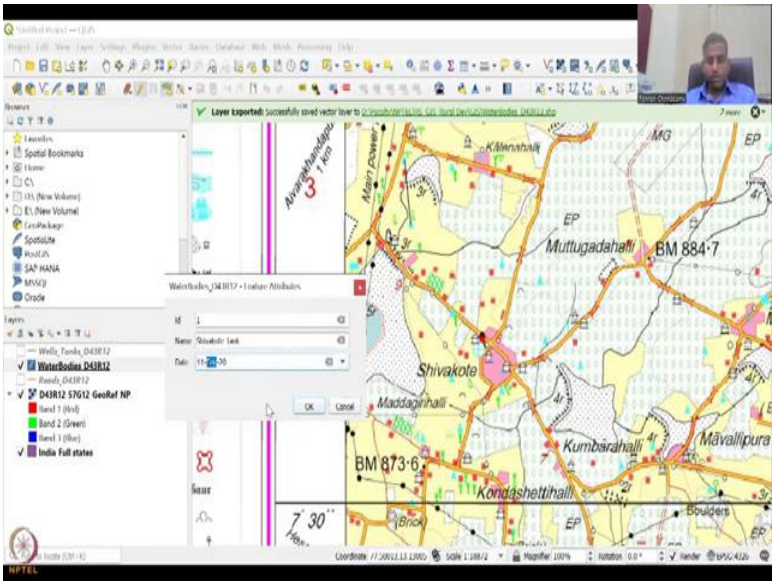

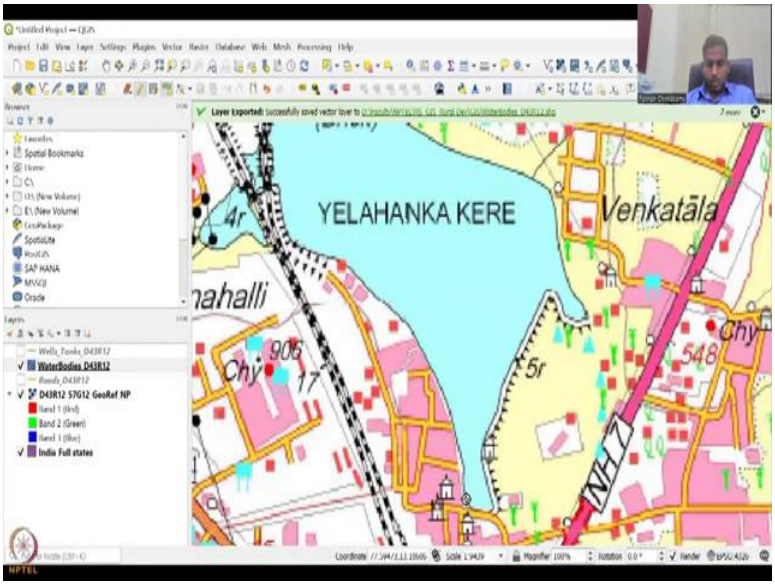
YELAHANKA KERE
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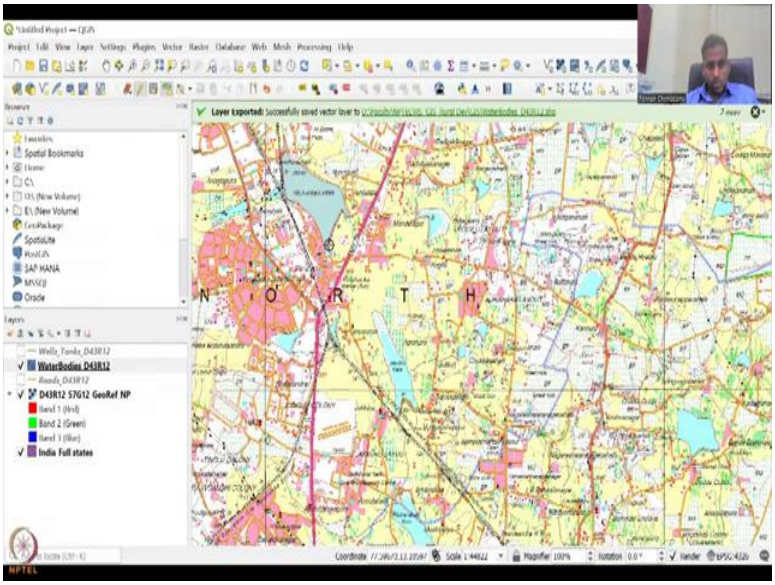
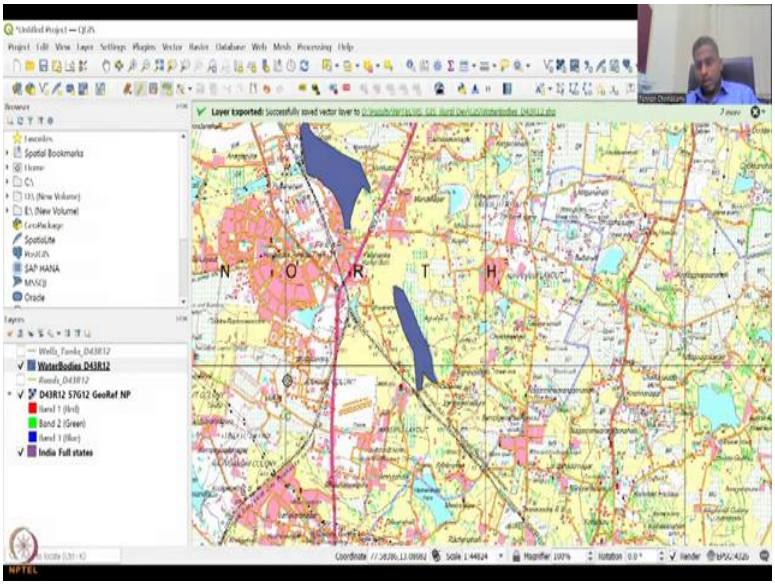

N O R T H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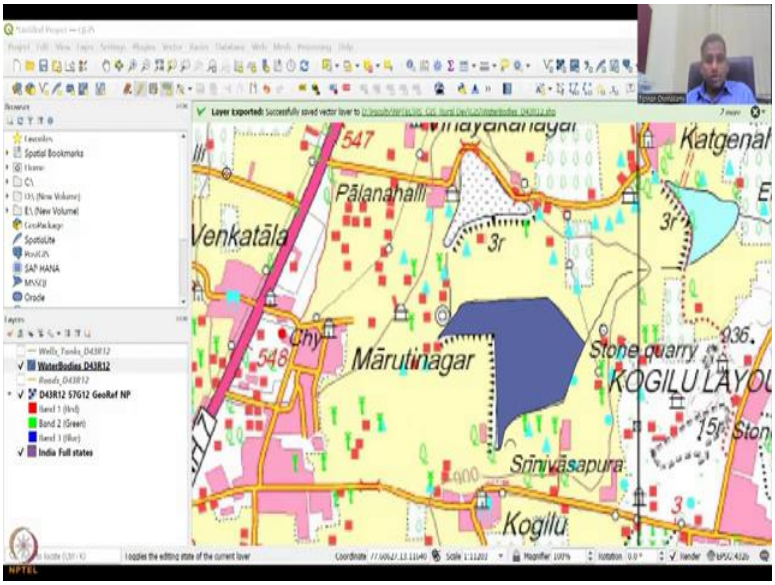

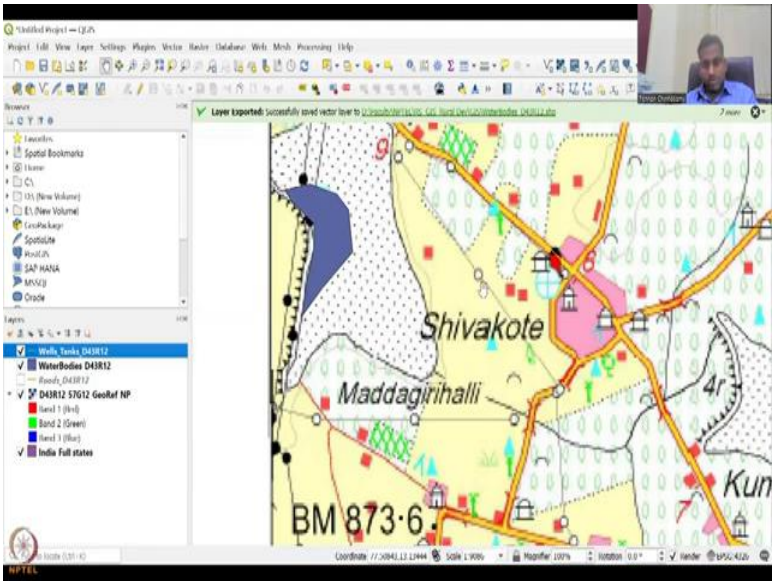

So if you open the attribute table you will find there is no attributes, correct. Why is this? Because we have not added yet. We just created the water body. So now we are going to add it. So let us add the water body that we have created. So I am going to just make it, so that you can see this table. I hope you can see my screen, if not let me open it again.

Yes, now you can see it. So I will keep it here as I said we will do two water bodies. So the first water body is we are going to first toggle it. Once you toggle it, this polygon, new polygon comes, it is a green and a plus sign. So you are going to add a new polygon. So I am going to click it.

And now let us make only this water body. I do not want the perennial or the dry part, I just want the water body part. Good and then right click, ID is 1, and this is Shivakote tank, date

is, you can say once you click the date it automatically picks a date. Let us say 16 Feb, ‘20. Just a date for our analysis. And we, as I said, promised, let us go to the lake. While we were doing the work we said we wanted this lake, which is a big lake.

And let us see how it has changed over time for which we need the boundary and that is what we are going to extract now. So I am going to do another one, and so I am going to, you can zoom in and click as clean as possible and there are multiple tools in GIS to calculate this area. So once you have the location and the shape, it is easy for 12, get the area using formulas and other aspects.

And there is always a way to, you can, a way to change and edit the vertex if you have issues. This is number 2 and as I said this is Yelahanka lake and then let us say 21, 12 Feb, ’21. We have it. You can always edit it but let us not edit it for now and then this is a Jakkur lake, because now we are going to see the whole body and let us see how it has changed. I have personally visited this lake, so I think I will be able to see the changes in this lake.

And all these are part of rural area in the past and now they have become very urban. So three water bodies are good and then, because this is a Bengaluru and people know that it is a land of lakes. However, because of urbanization and a lot of drainage was created to drain these lakes and then plots were built. For example, Hesaraghatta plot is there, which is basically on a lake which was just drained away and the land was reclaimed for water bodies.

Let us take one more, I might take something in this area, so that we can easily look at it in the map. This water body does not have a name, so we will not take it. Let us take a forest, a reserve forest just for the sake of it, because just not water bodies, we have named water bodies in the file, so we will not taking that. So we can we can take this, Kempanahalli or these small, small water bodies are also.

So let me with the hand bring it here and this one is what we are going to look at and again this one, as many as you want you can click in terms of the points, so do not feel shy to click more if you need more and then as the name suggested this is Marutinagar and let us say it has been taken in 2023. So now we have four water bodies, correct. Open S4 and then we will close the toggle save the edits, close it.

Now we have four water bodies, four points and four roads. So this is how you could extract data from your scanned image. Now we have shapefiles that can actually go ahead and look

at the region that we are looking at. So you have these roads, it is very tiny, you cannot see it, so let me go to the properties and change the line and color.

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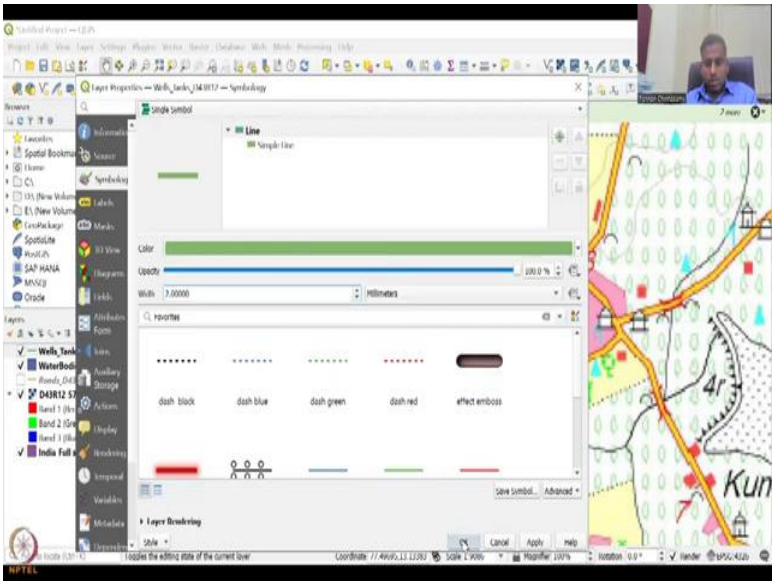

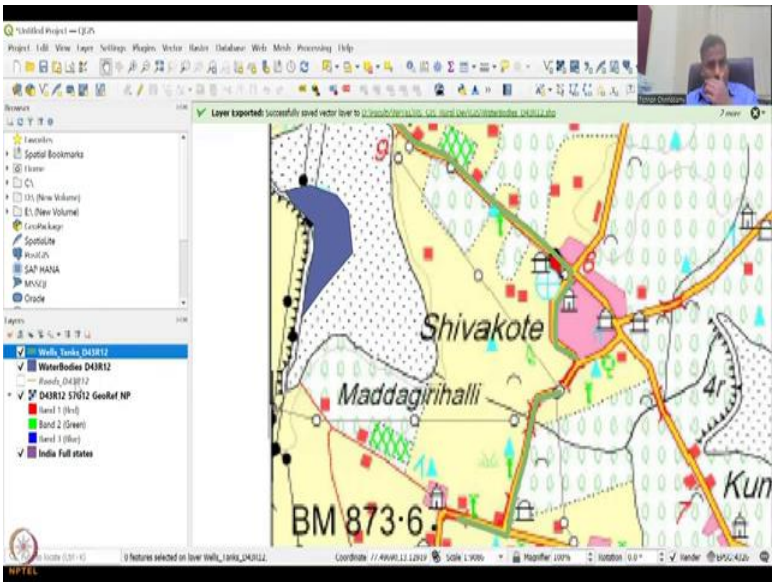

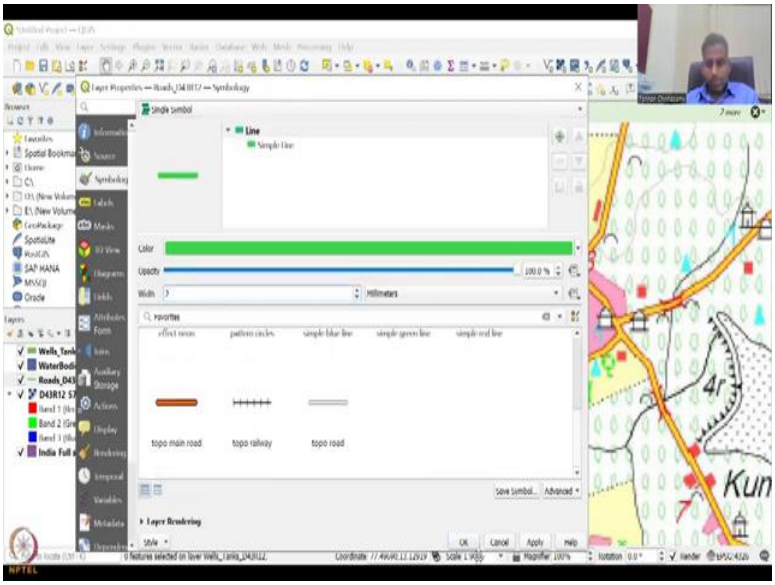

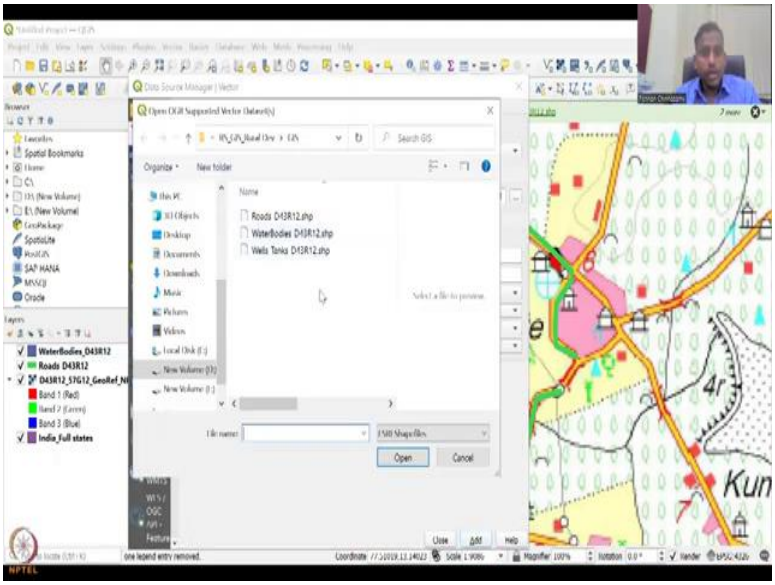

So as I said let us do 2, and then you can see the road now coming up, so these are the roads 1, 2, 3, 4 and then you have open attribute table, the first one is selected. Let us clear all the selections, so that you can see all the green lines are there and then water bodies are there, wells and tanks are there. So you have, instead of wells and tanks I think it has to be roads. Again properties, let us make the line bigger, the roads, 2, apply, we have roads.

Yes, so we have the water bodies and then we have the roads. The wells layer is also there but let us look at these two in the Google Earth profile. So before that what we can do is we can look at one more thing that I always wanted to do is look at this map in Google Earth engine to see if, or Google Earth Pro to see if the map has loaded properly.

So for that let us first take all these points of interest out and we are going to look at the roads and water bodies. The point I am removing because if you zoom in too much in the point you cannot see the well because the satellite image is not going to be there, but at least right now we do have three shapefiles created, point, polygon and line.

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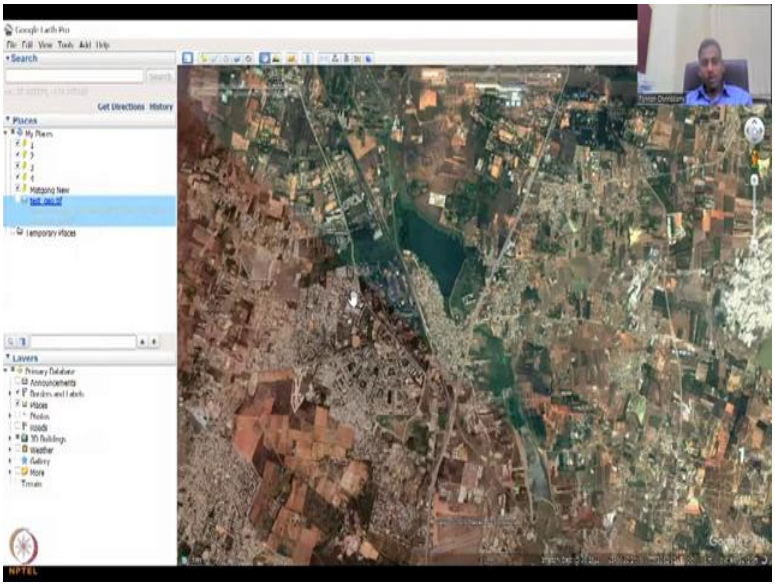
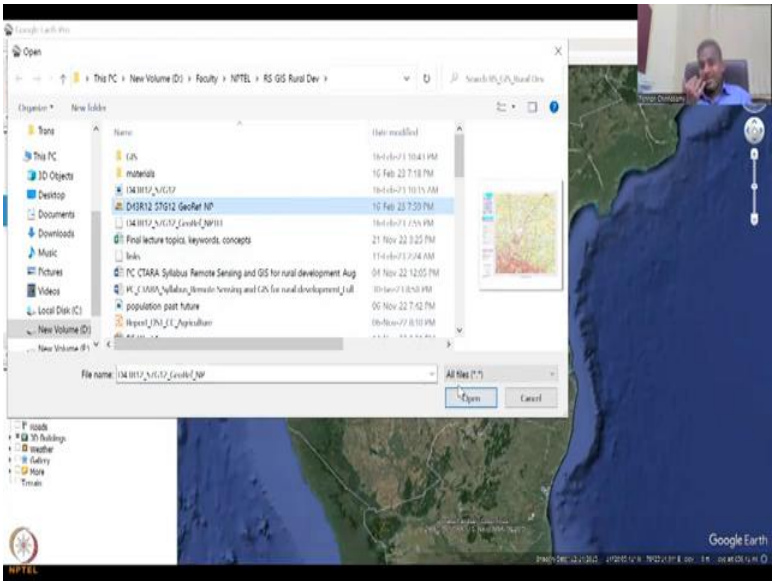
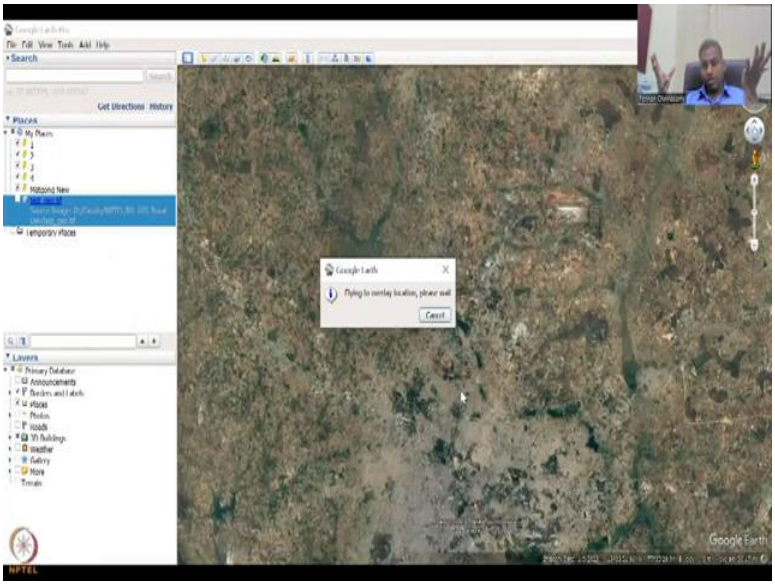
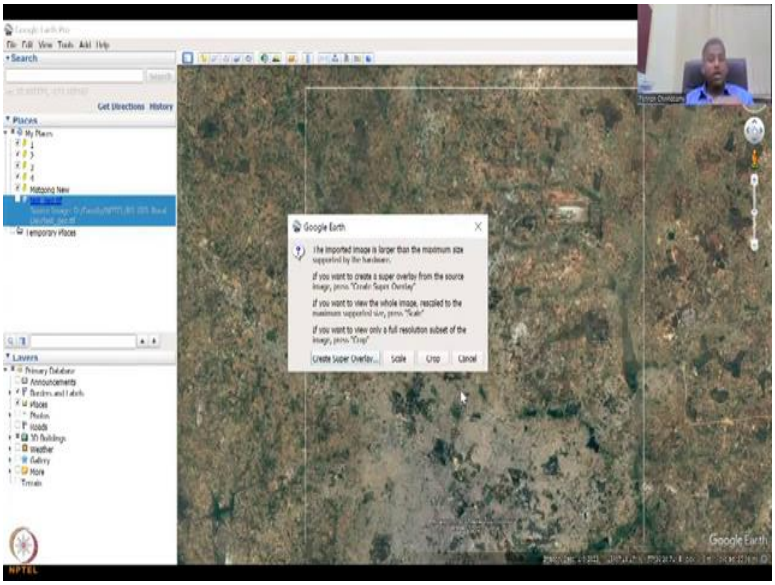
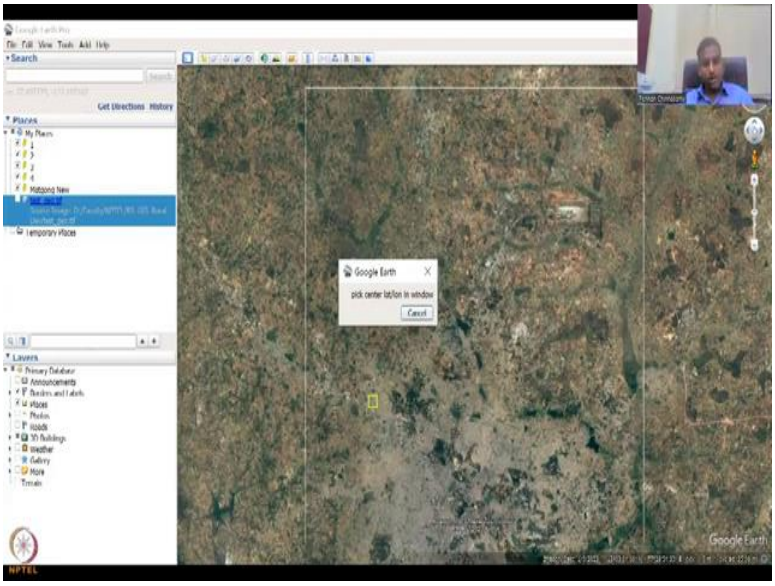





Google Earth
Flying to overlay location, please wait
Cancel
Google Earth


Google Earth
The imported image is larger than the maximum size supported by the hardware.
If you want to create a super overlay from the source image, press "Create Super Overlay"
If you want to view the whole image, rescaled to the maximum supported size, press "Scale"
If you want to view only a full resolution subset of the image, press "Crop"
Create Super Overlay...
Scale
Crop
Cancel
Google Earth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pick center lat/lon in window
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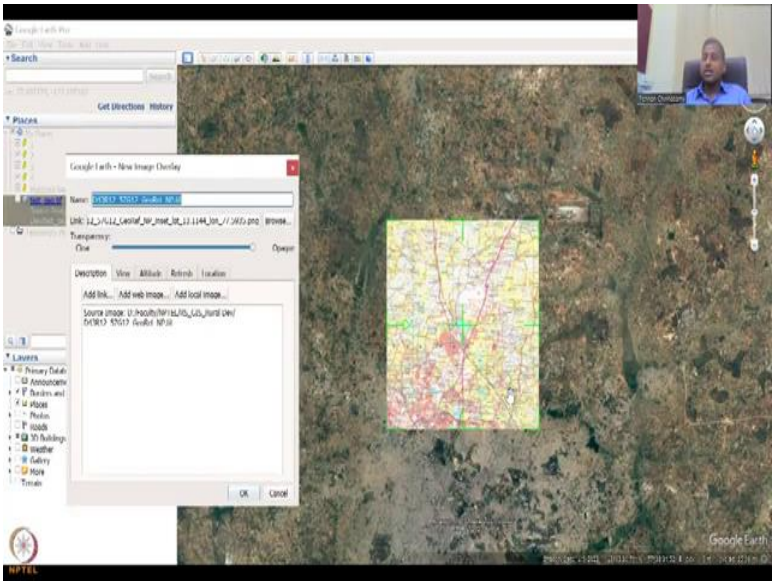
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Get Directions
History
Places
Google Earth - New Image Overlay
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OK
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Layers
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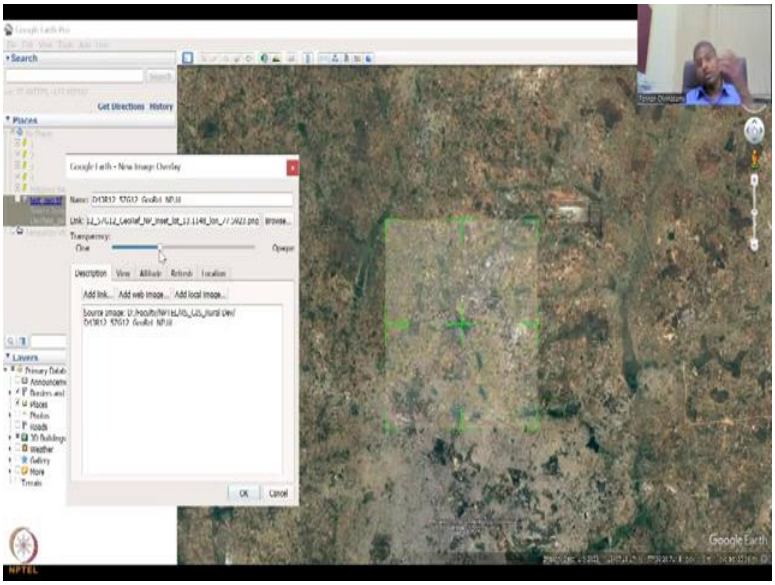
NPTEL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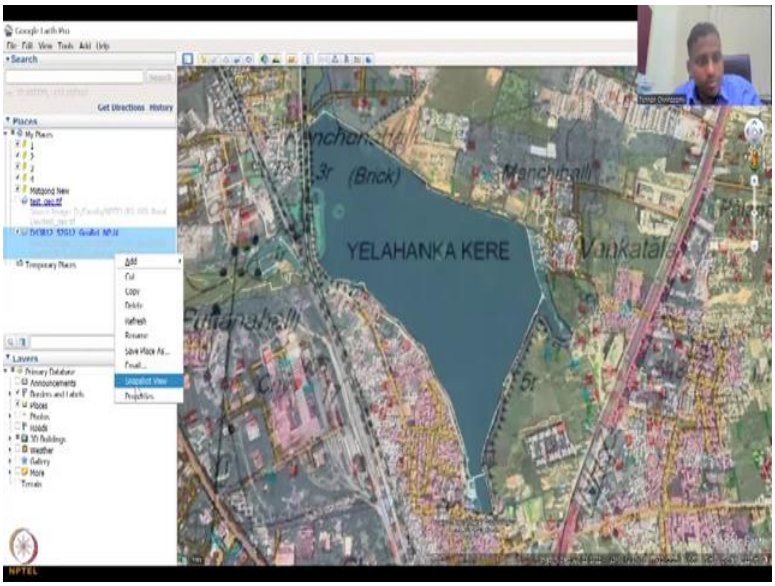
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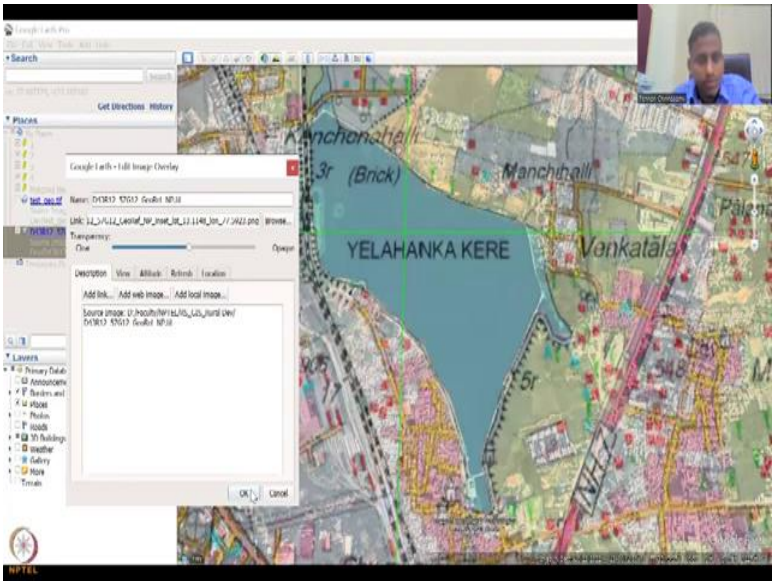
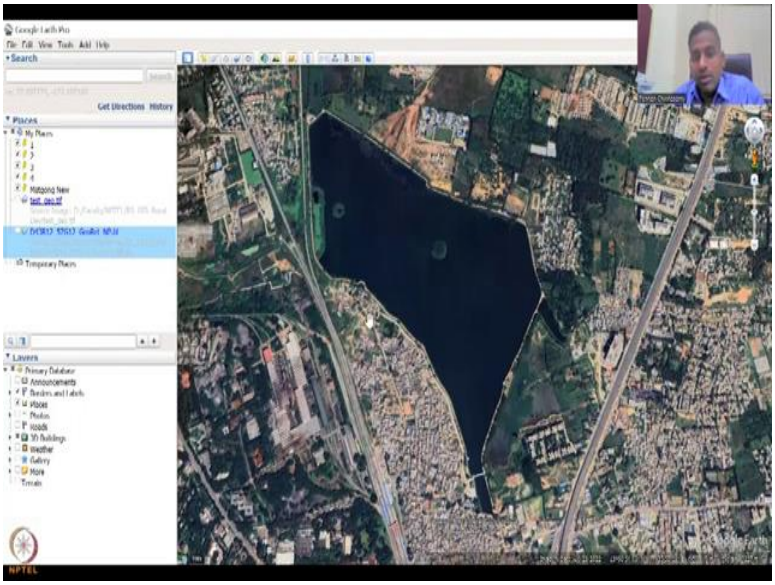
Properties
Layers
YELAHANKA KERE
(Brnck)
Google Earth
NPTEL


Manchenahalli
3r (Brick)
Manchahalli
YELAHANKA KERE
Venkatala
5r
NH7
NPTEL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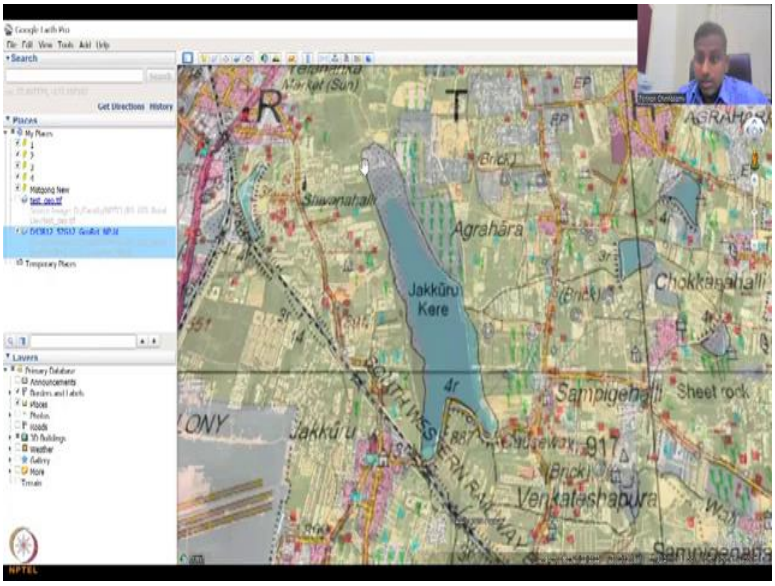

Agrahāra
Jakkūru Kere
Chokkanahalli
Sampigehalli
Sheet rock
Jakkūru
Venkatashapura
NPTEL

So now I am going to open the Google Earth Pro, let me share my Google Earth Pro, let me have it here. So this is my Google Earth Pro. I have zoomed in just to that area of Karnataka, just to make sure that our Map works. So now what I am going to do is we are going to add the first scanned image that we created. So this is a scanned image that we created, I am going to add it.

I hope you remember, this is week 6, lecture 3, 4. We have scanned the map and I am going to add it. So once you add on Google Earth Pros let us see what happens. It is saying that I am flying to the overlay area, location, however, there is a pop-up which comes, which says the image is too big. I cannot import such a big image because of the hardware that my system has.

It says the import image is larger than the maximum size supported by the hardware. If you want to create a super overlay from resource image, press 'Create Super Overlay,' for which you need a lot of libraries. Let us not do that. If you want to view the whole image rescale to maximum supported size, you can say 'scale'. Scale will, what the scale will do is it will downscale the image and then show at that particular location.

However, as I said we do not want that to, because we want a zoomed high resolution from the paper image. The last one is, if you want to view only a full resolution subset of the image, press 'Crop.' Crop means a part of the image comes in, not the full image. So let us do the crop. And then it asked me where do you want to crop it? So if you pick a centre of the image then it crops as per the hardware.

So as I said we want to look at this lake, so I am just going to click that lake and the image is coming, loading up. So once the image loads up, you can see the image has loaded up, but the entire image is not there because it has been cropped. You can actually drag and pull this but this is the maximum you can go, so in terms of the cropping. If you do this type of cropping then the map is moved.

So do not, let us cancel and then redo this again, because we should not be pulling and pushing the data, because then it will get distorted. So now again as I say it is overlying to the location and I am going to pick only the image that is crop, which is centre of the location, let us place it on the centre of the lake. You can see that this image is very recent, 2023 Airbus, Maxer Technologies using Airbus payload.

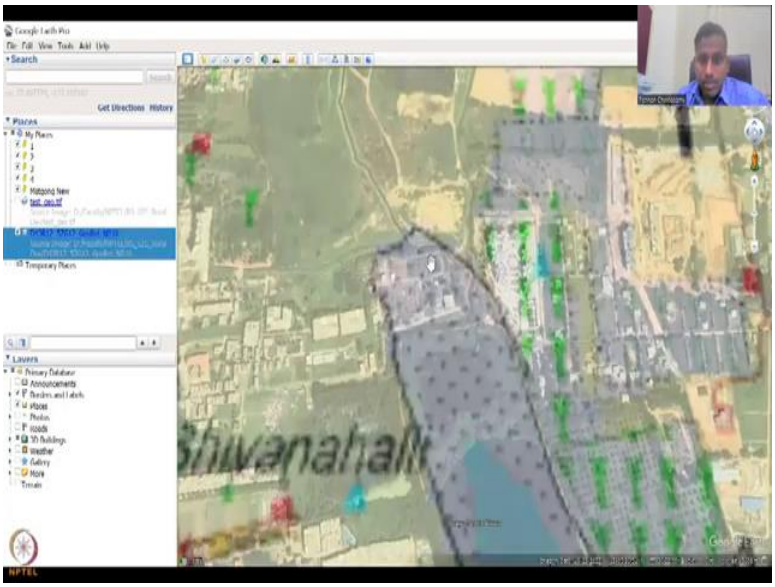
And you can see that this has been done. The same file name can be there, it is fine. The opaque city is, if you decrease the opacity, then the map is transparent, so if you see that now the map is blocking the satellite image, but if you go down the map is gone because it is very very slightly seen. So somewhere in the mid middle is fine, like this is fine because you can see both the map and the satellite image.

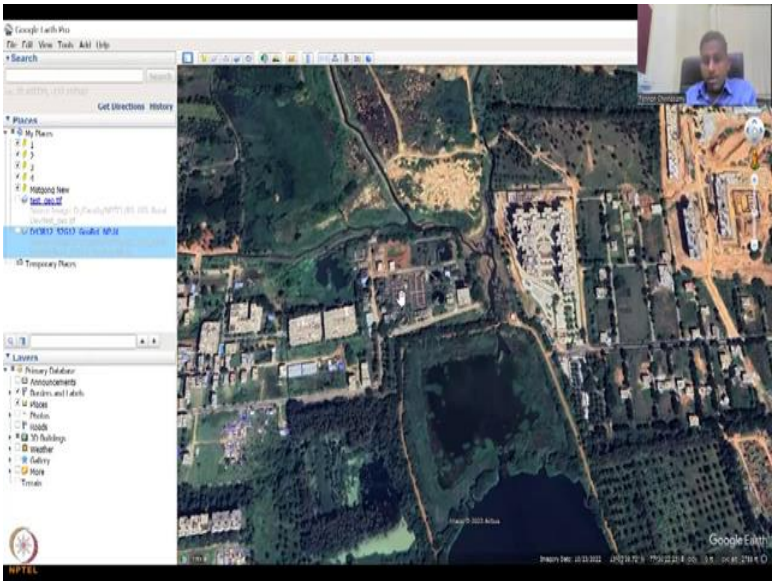
Now I am going to click ok. So once I have clicked ok, a beautiful thing that can happen is you can zoom in. See now if you zoom in you could clearly see that the lake, which is on this lake which is a satellite image coincides with the lake from the map. So the map is 2011, and this is 2023, so you could see that some parts of over the 10, 11, 12 years, the map says that the boundaries have been preserved.

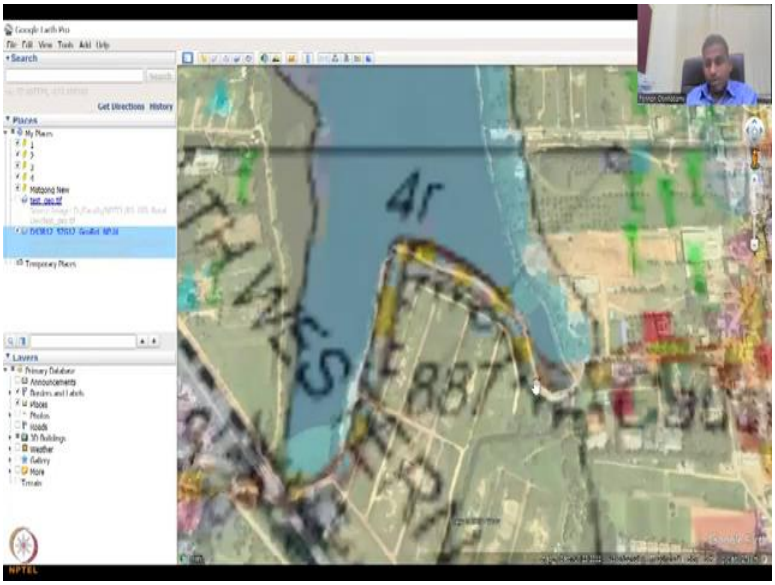
You could see that the map boundary, let me, maybe we could just more increase the opacity, so that we can see the boundary. Yeah, you see the blue color from the map boundary is almost the same, so maybe they have bunded it, no more, so these are all buildings, so no more, you can toggle on and off, so no more construction can happen, all of this is taken care of. What has happened is the sides have been highly polluted and you can see that there is a lot of covered water bodies are there, which were not there in the previous lake,

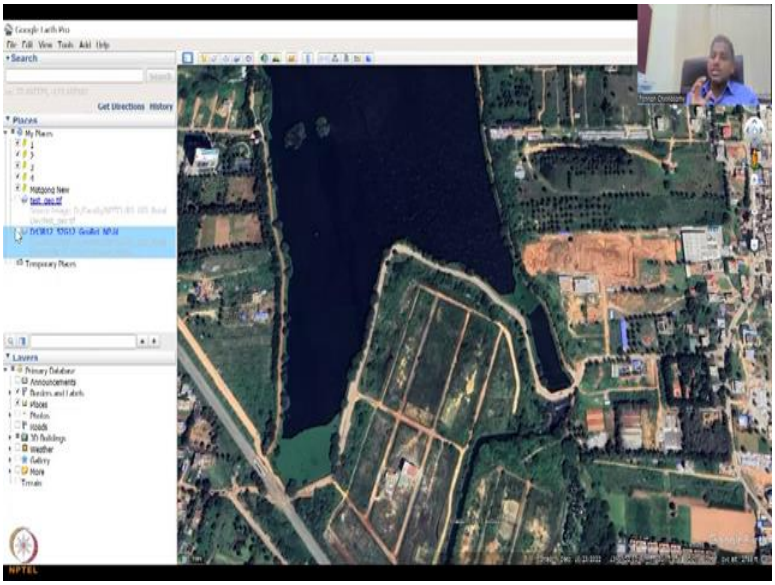
It is a full clean lake boundary, but again as I said it is gone. So now what we will do is we will see one lake of the other, we also said this Jakkur lake as I said, let us look at Jakkur lake, so the paper map shows that the water boundary is here and this part is dry and this is perennial. Let us see if that coincides with the map. If you take off that you can see that part of this area, this area has already been taken over.

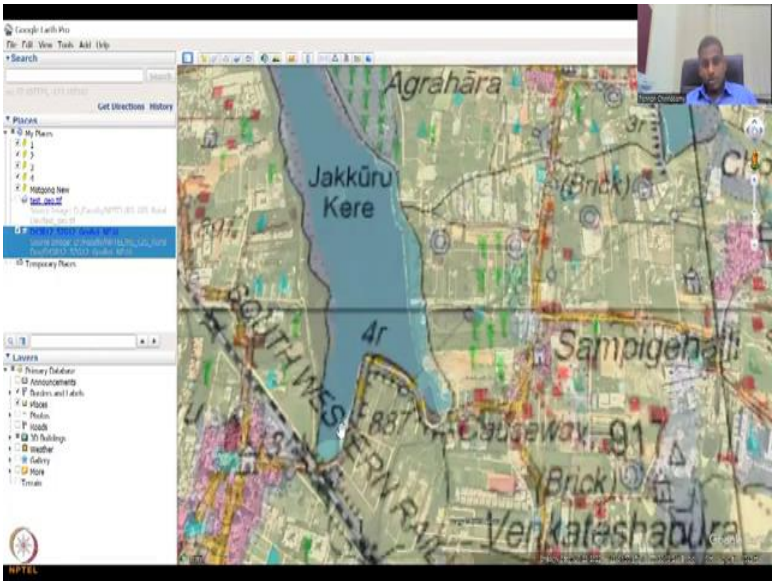
(Refer Slide Time: 23:51)






4r



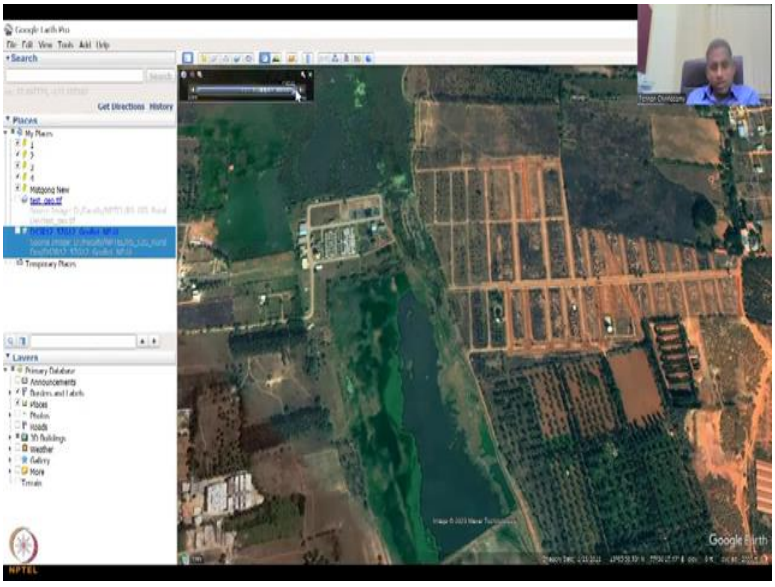

Agrahāra
Jakkūru
Kere
(Brick)
4r
Sampigehalli
Brick)
Venkateshapura

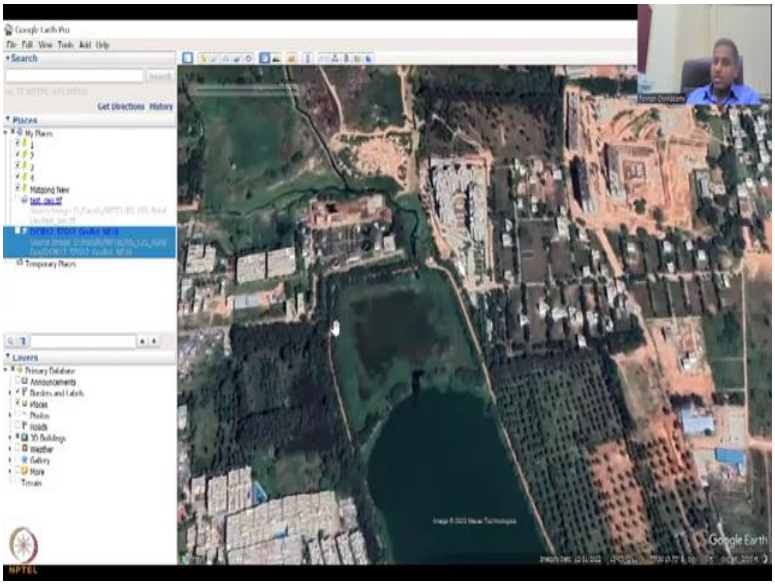
You can see here, so this dotted was initially a lake, dry part of the lake, but now it has been used for water treatment plants and other things that you can see. Some buildings are there, how some houses are there, so you know what is happening. So this entire thing was the lake, but now it has been taken away. So this is the Jakkur, very famous Jakkur lake, you can see this part also it is mapped pretty well.

So this map and this map coincides. See how we have imported a paper map into a satellite map and because we accurately made sure lat longs are all captured, the six points that we used are all correctly captured. Both the boundaries are correctly merging, this boundary what you see now is a satellite boundary. There is a lot of information here, but, and no distortion because this is a satellite image. The boundary is what we see as the line.

The line is the boundary and if you overlay this part you could see that, so some part of the water body has been taken away and some part has been expanded. So right here you could see that the boundary is almost on target except for this part. So this part the boundary comes up here, whereas, here itself they have closed. So they have closed it here and this part has been taken away.

(Refer Slide Time: 25:21)

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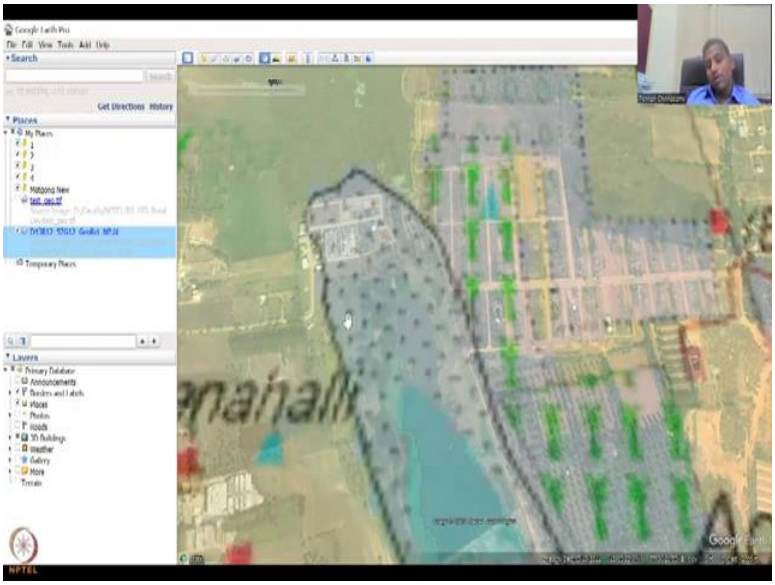
NPTEL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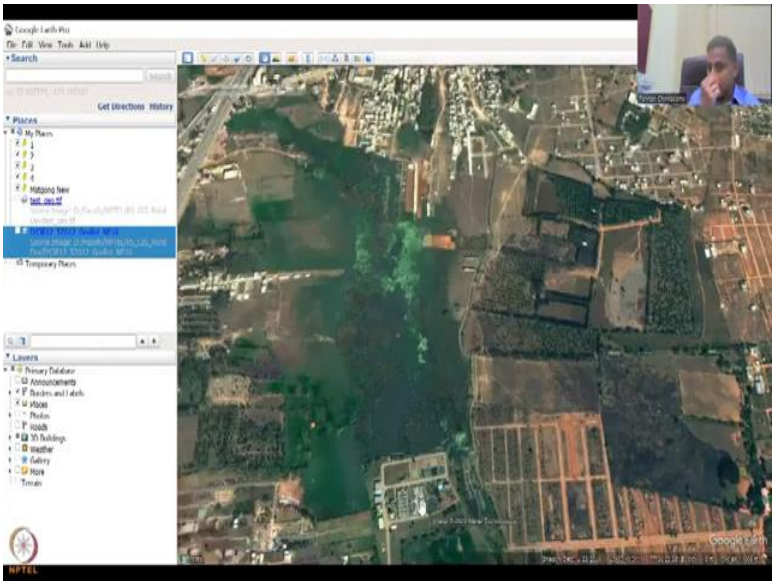
Google Earth
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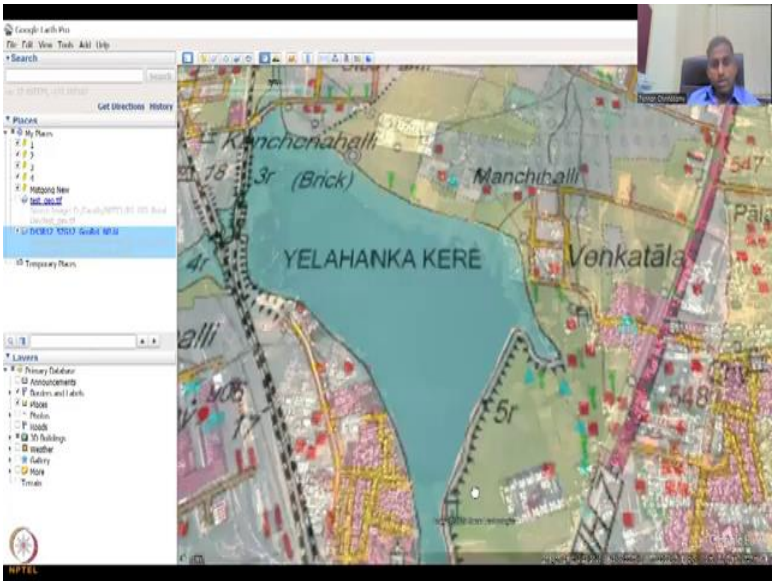
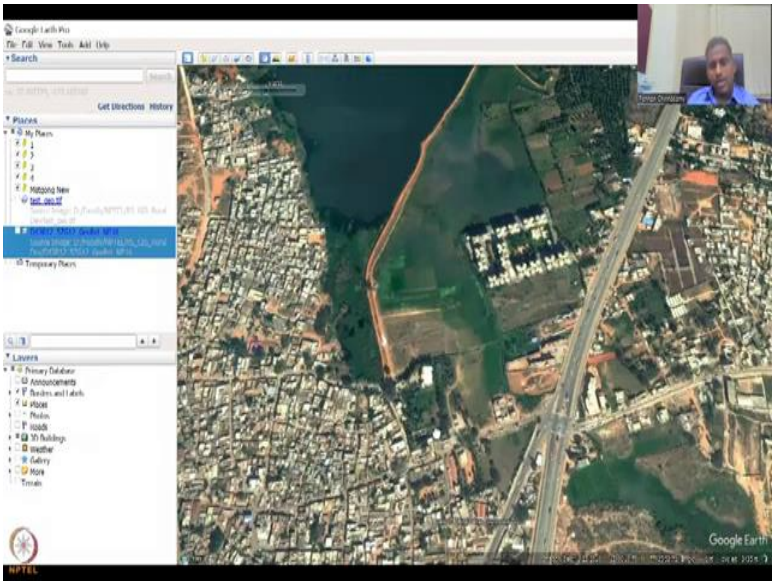

Manchihalli
(Brick)
YELAHANKA KERE
Venkatāla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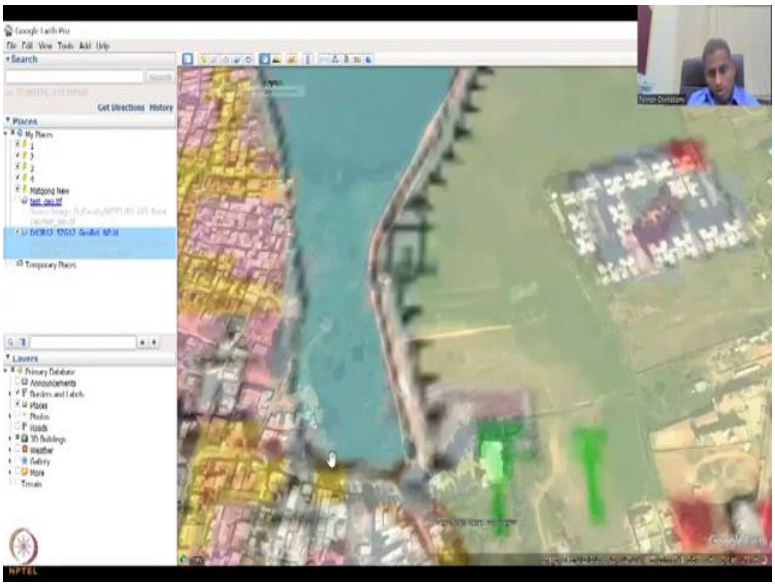
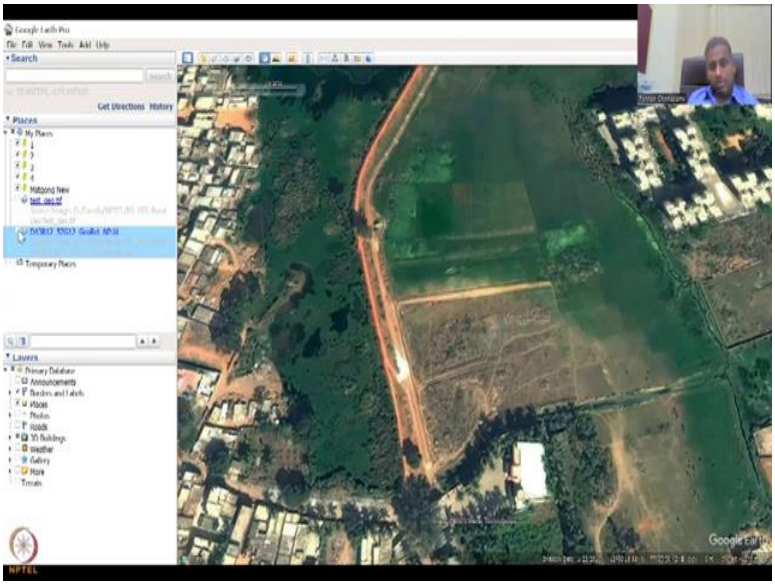
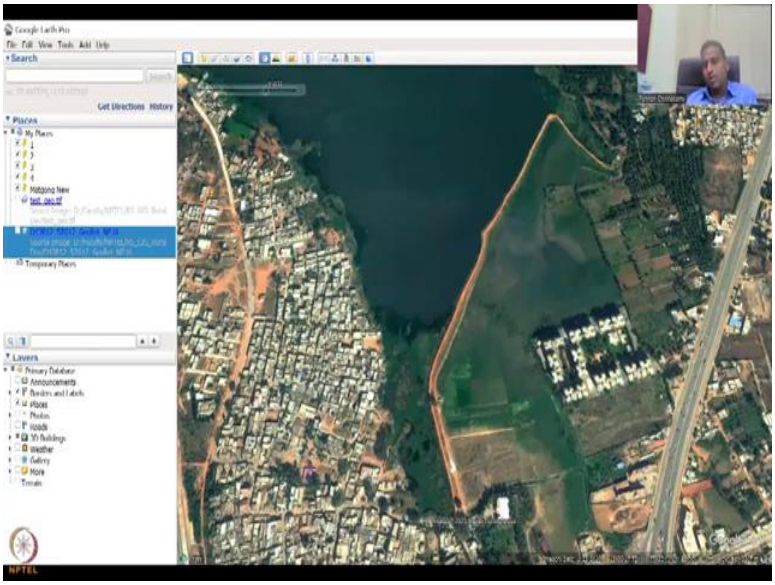
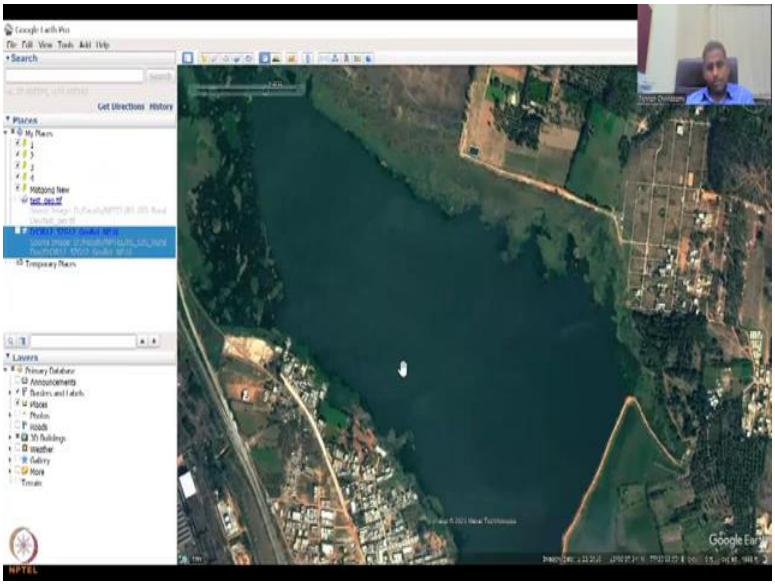








So let us look at this image in a time lapse. So I am going to click the time button, and we can go back to let us say 2011. And now you could see that this part is not as populated as initially, so initially in 2023, you can see that a lot of construction has happened here, whereas in 27; you will not have high resolution so you will not see anything, but let us wait, maybe the computer, the Internet takes time to load.

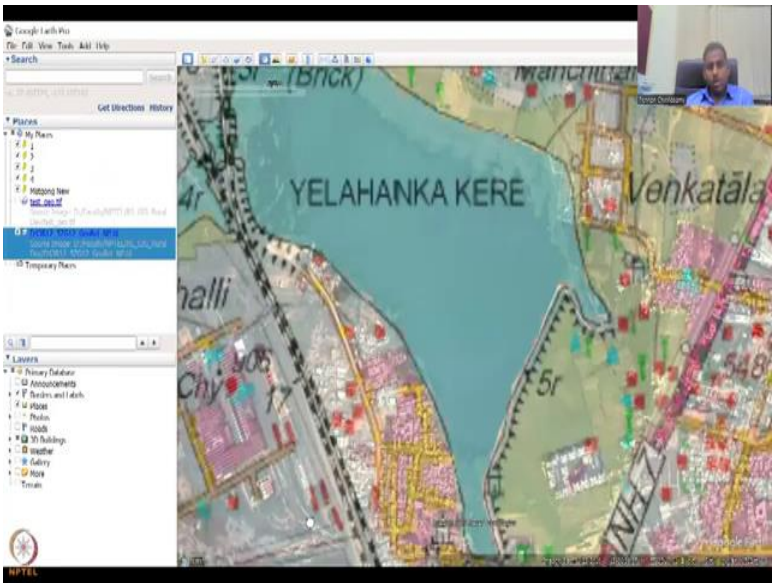
Yeah, it does not load because there is no image or the image is, so like this also you will see which means only part of the image is there and click on the best available resolution, so this is the best available resolution. Now, I am going to click on our paper map. If I click on the paper map again I am saying that the entire body should have been there, however, only part of the body is there because it has been used.

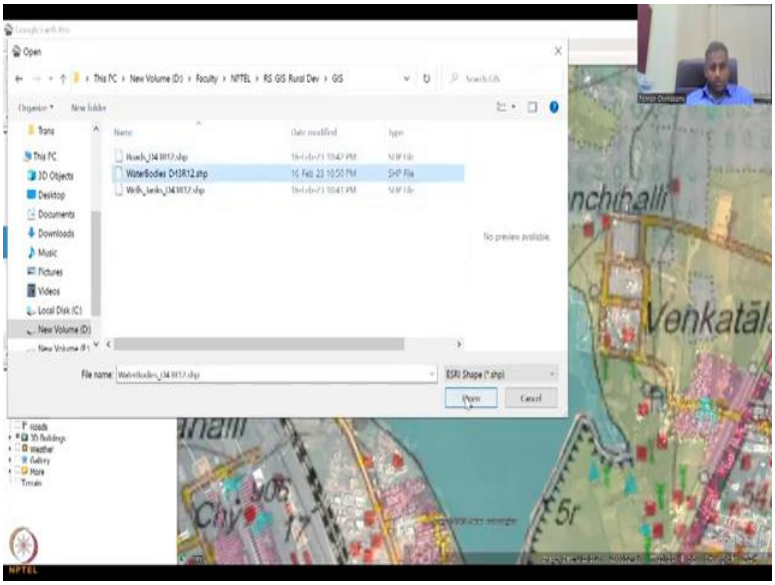
So on paper what happens is exactly the government officials know that this is part of the lake, however, it has been taken up by some construction activities. So these construction activities are there and it could be a water treatment plant. As I said it is a water treatment plant, which is for the public water supply schemes, so they can use it. So that is what we could see. Again we will go back to Yelahanka lake.

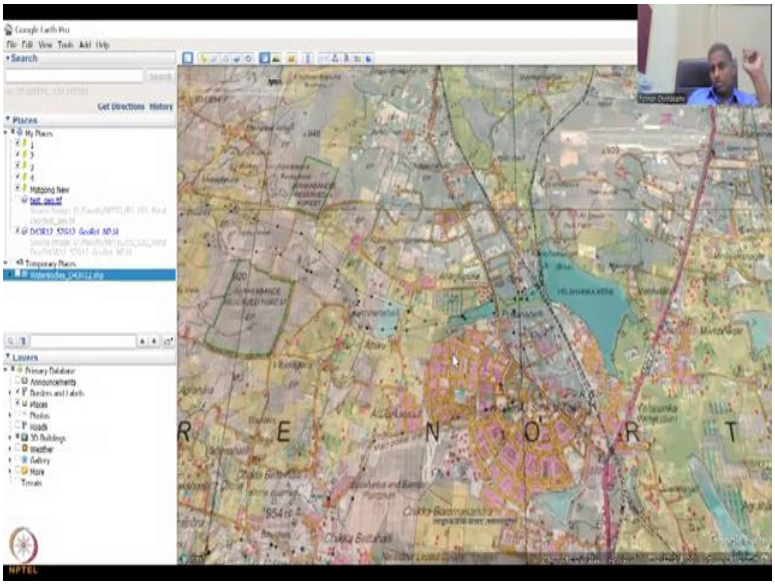
And you could see that the lake boundary goes up to here on the paper, whereas on the image it stops here. There is some very slight level of boundaries taken for construction and other purposes. Same way here the boundary closes along the black line and you can see perfectly it is closing. You can see how perfectly this road and the black line from the map are coinciding. Basically telling that this part, the water body part has been mapped perfectly.

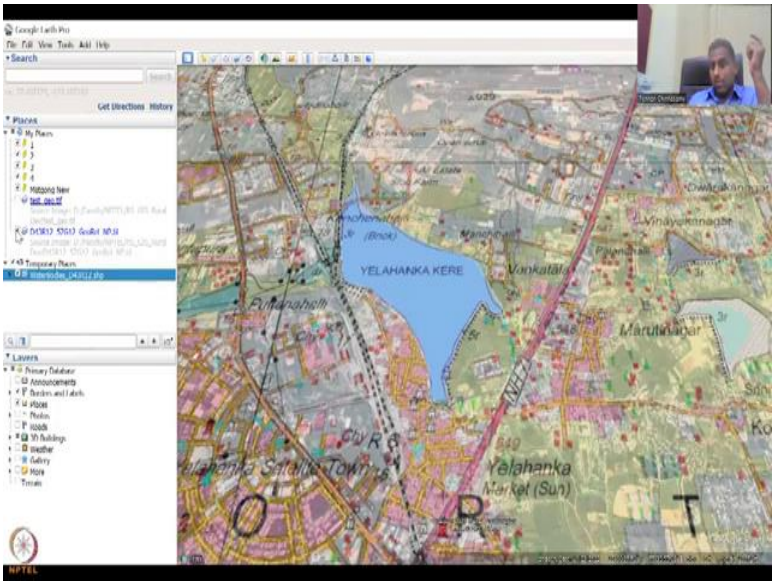
Again the paper drawing also may have some distortion, so some part of the map maybe not correctly done. So all the boundaries have been mapped well and good.

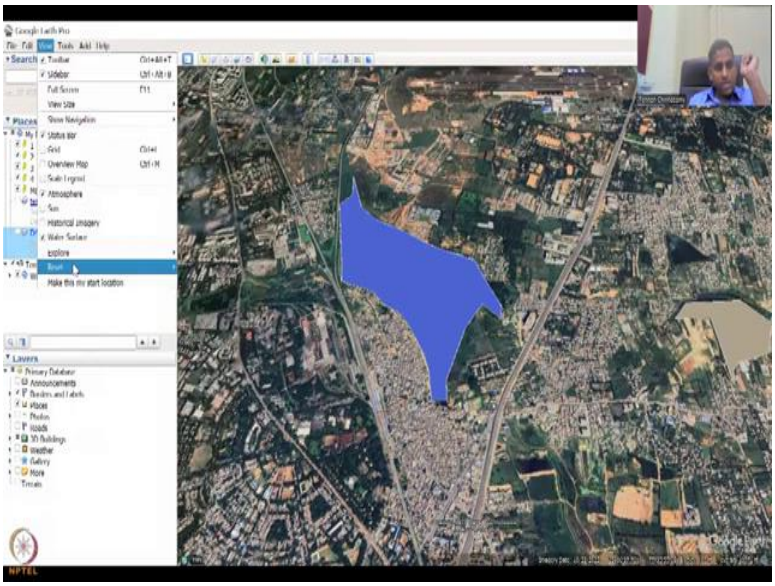
(Refer Slide Time: 27:46)

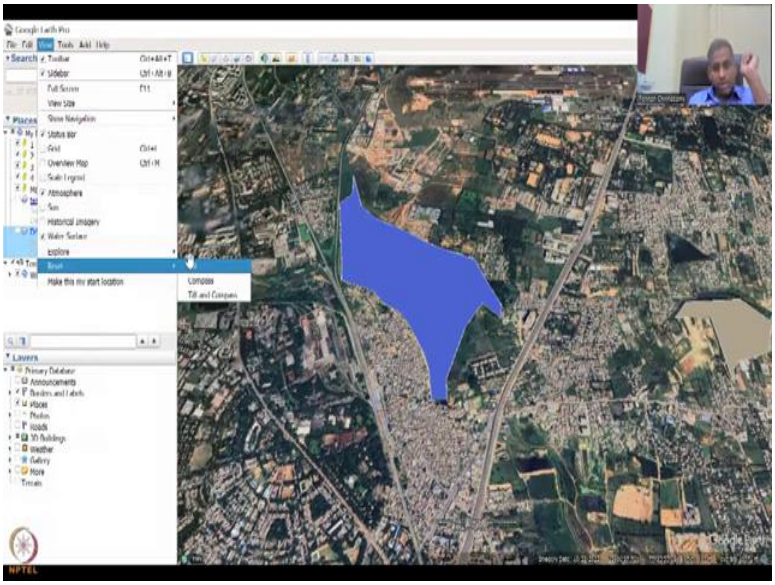


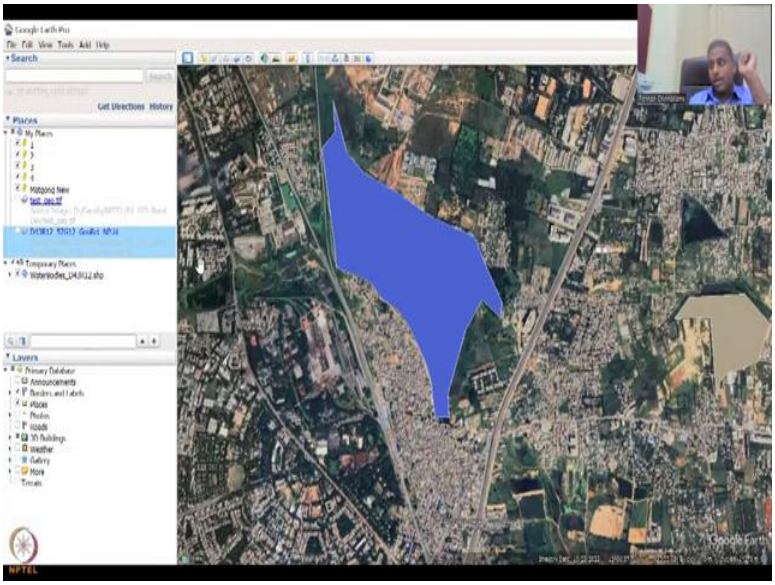


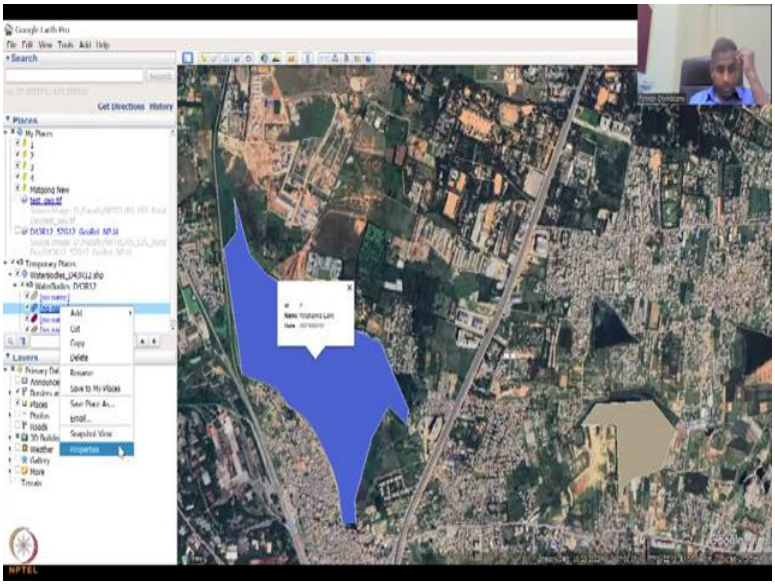

R E N O R T

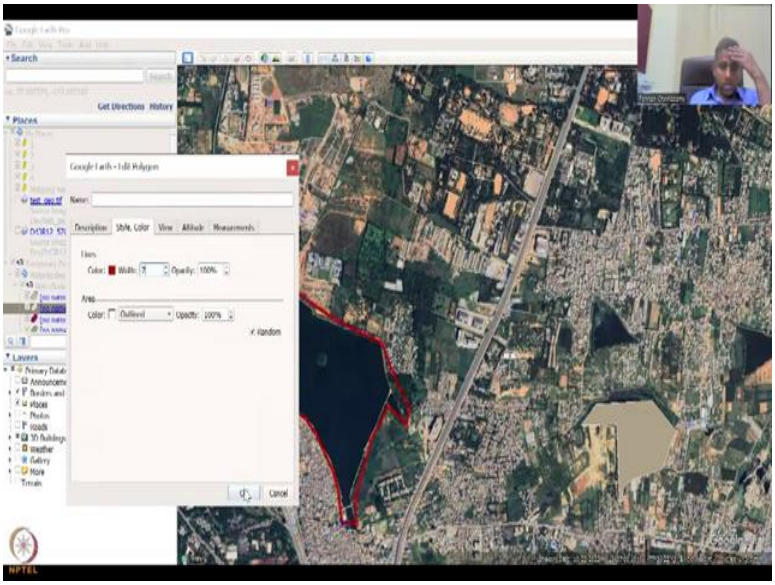

YELAHANKA KERE
Yelahanka
Market (Sun)
O R T







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Get Directions
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Google Earth - Edit Polygon
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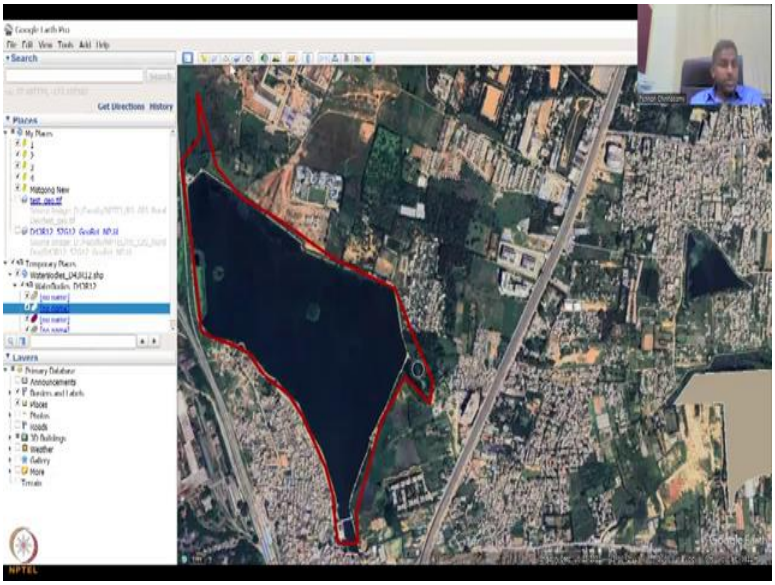
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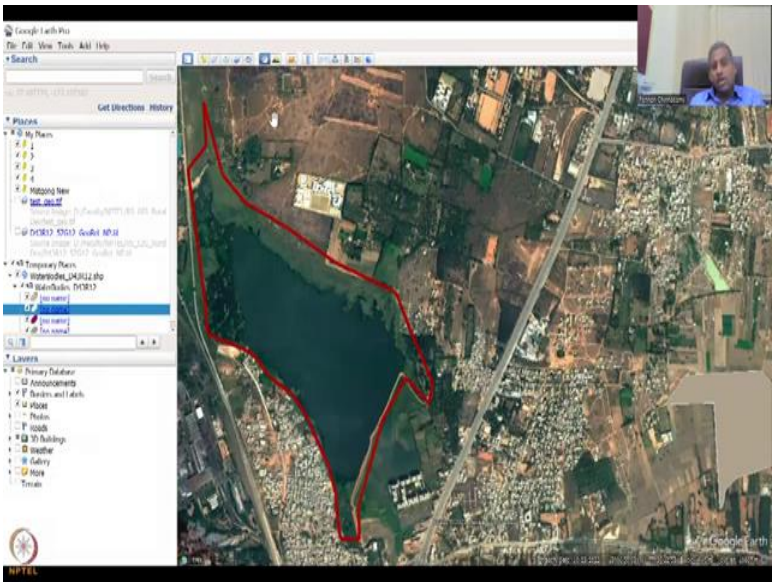
NPTEL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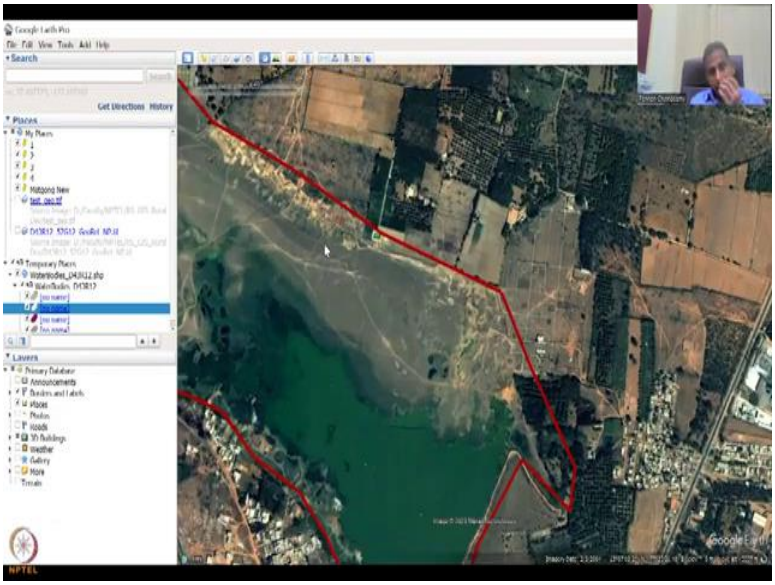

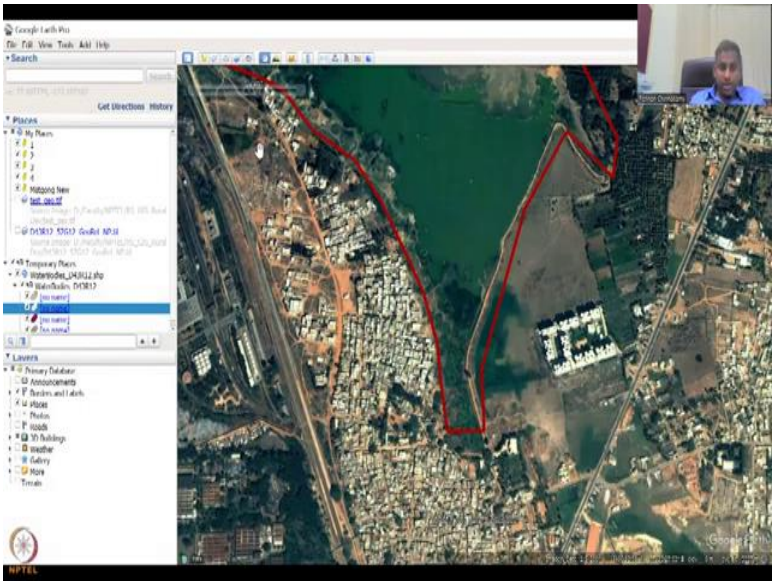

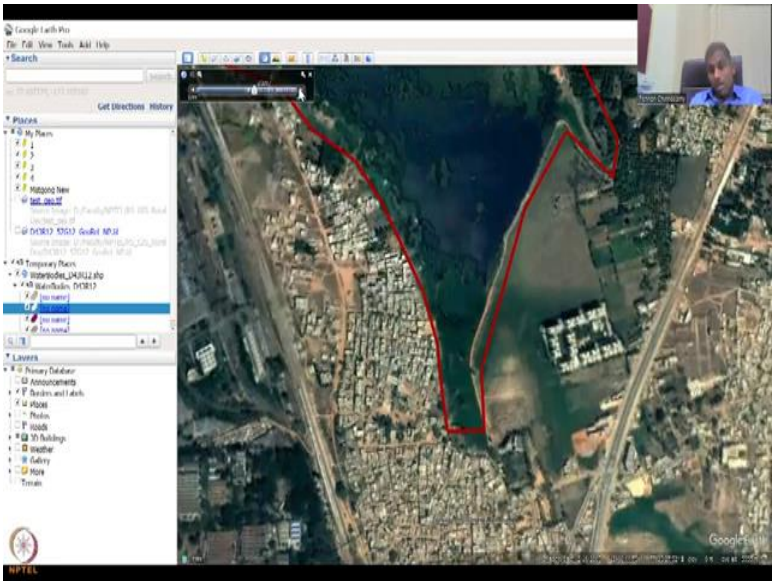

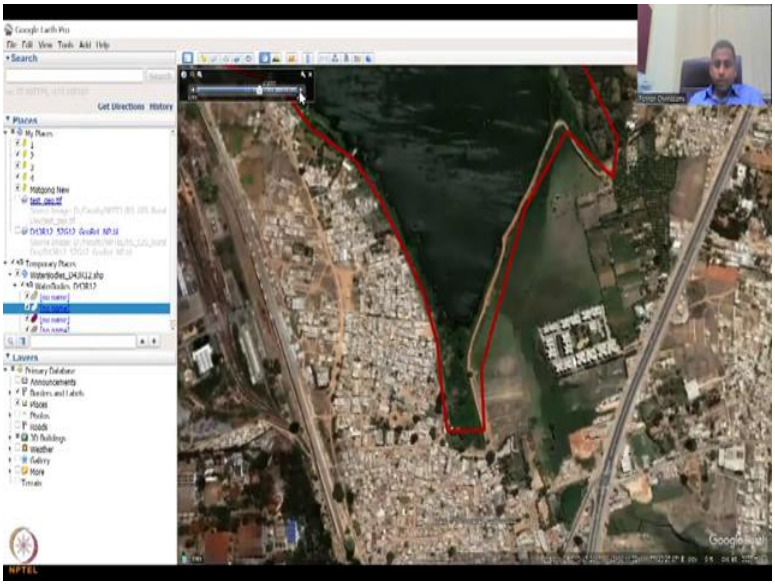

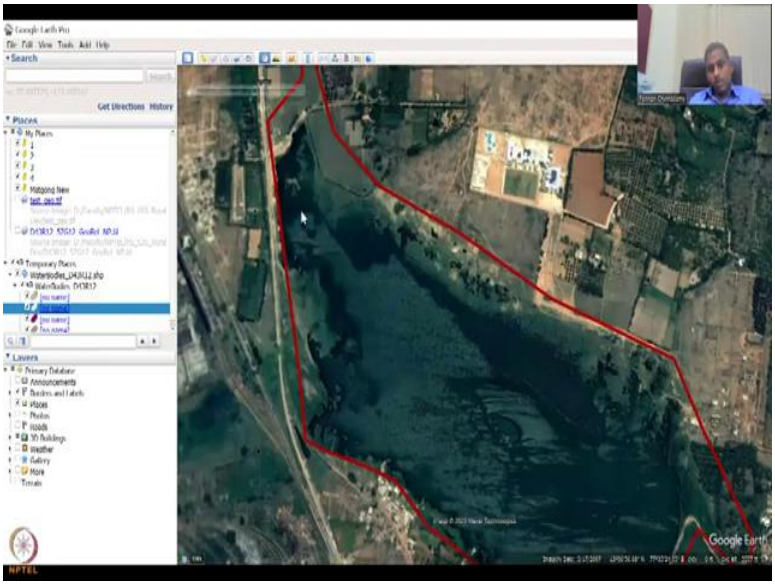

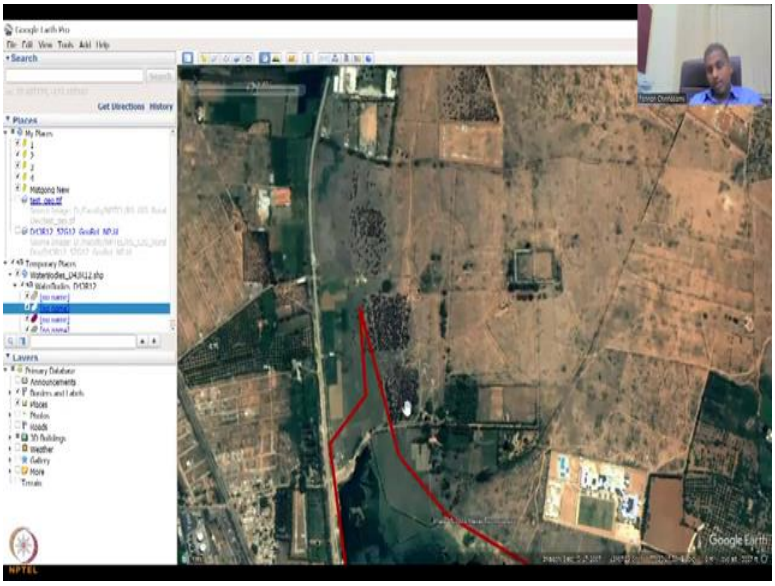

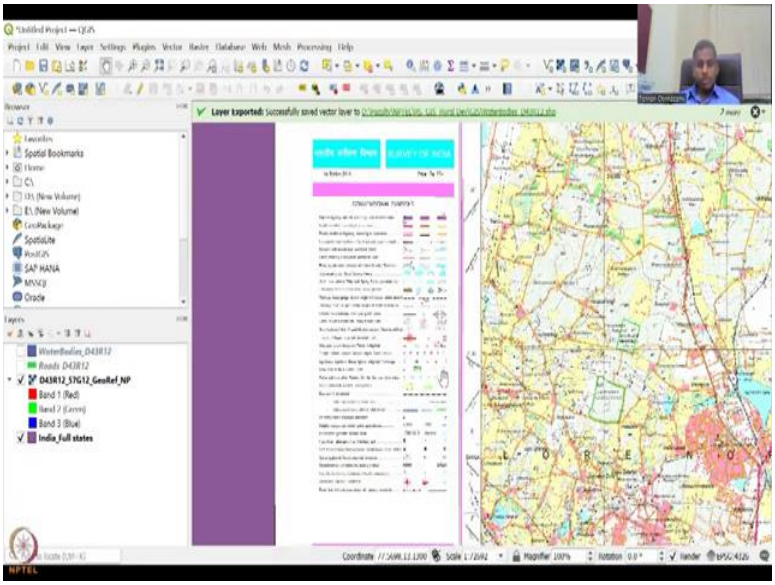
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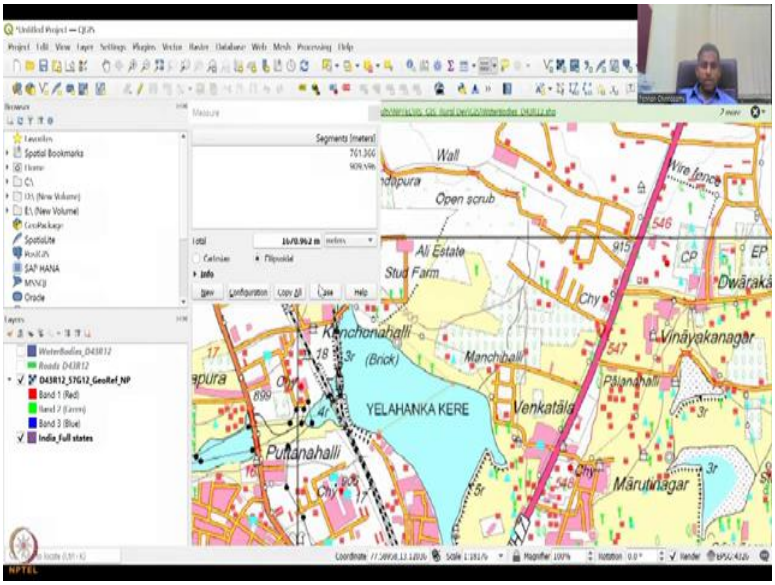
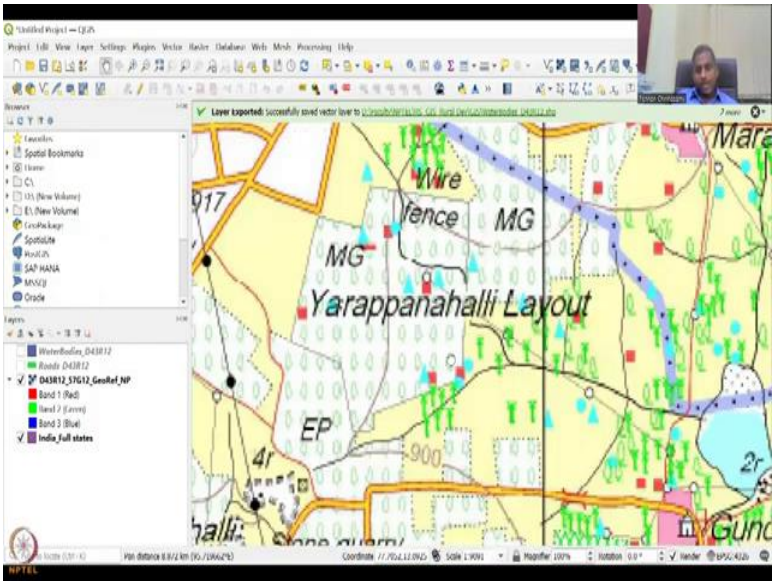
Band 1 (Red)
Band 2 (Green)
Band 3 (Blue)
India_Full states
NPTEL


Wall
Wire fence
Open scrub
Ali Estate
Stud Farm
Kenchanahalli
(Brick)
Manchihalli
YELAHANKA KERE
Venkatala
Puttanahalli
Vinayakanagar
Dwaraka
Marutinagar
NPTEL


Wire fence
MG
Yarappanahalli Layout
EP
4r
2r
NPTEL

Now we can also open the shapefiles that we had, let me just open as ESRI shapefiles and as I said let us do the water bodies. And when you add it, it will ask 'Do you want to apply a style compared to the features you ingested?' You will say 'No'. We do not want a style in the template, but we just want the entire map. So once you click it, now you see that the four water bodies that we linked, 1, 2, 3, 4 are there.

But other two may be cropped, because we went outside the boundary, that is fine, but now I can remove this, the map that we made, because the map we made is covering the entire area, but of the map I am only interested in the water body, so the water body is being taken now. Sometimes you have a tilt, so go and reset the tilt, it will turn back up again. And you could see that the water body is there.

Correct, you could make the water body again, properties, you can type in the name, style and color is there, if you want different colors you can do different colors. You can just say outline is fine, and then the outline color could be red, just for our sake and then the width could be a little more thicker, say this is 7 and that is it. So in this part you could see that the lake boundary of Yelahanka was captured.

It was captured to a particular extent and you could see that some part of the lake, maybe the clicking would have been off or the paper had more land, whereas in the reality it is not as big, because some land has been taken away for construction purposes. One way of checking it as I said is running a time lapse of this data and you could see here, if I go to 2000 to 2004 you could see that part of the lake is dry.

Most of the lake is dry and this construction has already been happening on the lake boundaries, whereas on this side they were respecting the boundaries. If you see the line was clear and only behind the line the houses are there, but as time progresses, as time progresses slowly the houses are coming near the boundary of the lake and then slowly encroachments can happen or the government would have said, "Okay, you can build some protection against it." So right now there is no breach.

You can see there is no breach happening on this side but more and more houses come up which demand water supply from the lake. Yes, so you could see here one or two just coming up which was not there in the previous images. So then you have all these water bodies and the road which was there, but I just went above it to show that water flows until here, so that should also be taken as the lake area.

So this is how you could import an image into GIS and then from the image which is old dated, outdated, maybe it is a sensitive data that was shared by a government agency, you could run it in the GIS software, let me show you and then we will pick out the data from it, so will be a lot of more data see, a lot of legends is given, so you could easily see, zoom in to as much as possible and then see how these maps were created.

The size is not as big an issue here because houses will not have a size, the lake may have a size. You can use the scale here to say, what is the perimeter, what is the width, etcetera but you cannot, let me just do a line measure and then I want it in kilometres, let us select kilometres and then let us say new, and we are just going to go from one point to the other.

So it is 0.64 kilometres wide and it is not the same with, because there are multiple widths on the thing. I am just going to close and then we will use this to zoom out and zoom in. So there is a lot of data in this, trees have been marked, wells, lakes, etcetera have been marked, Bengaluru as I said.

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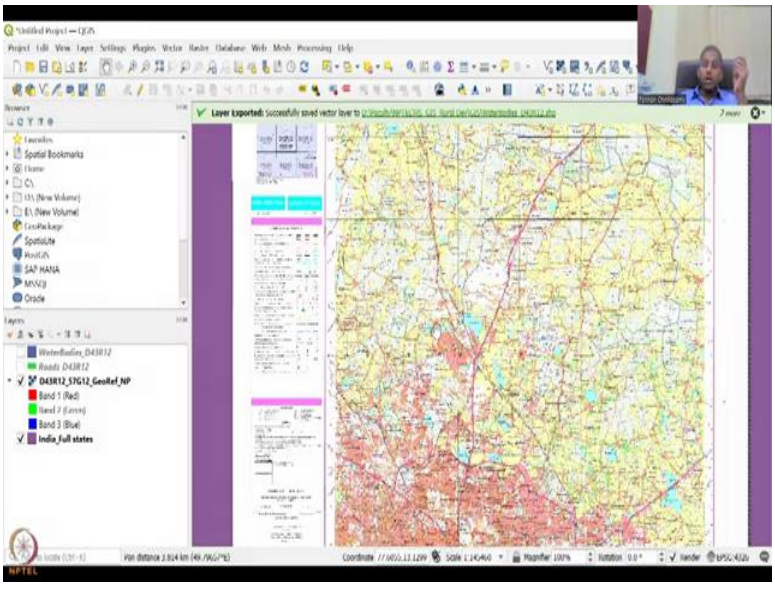

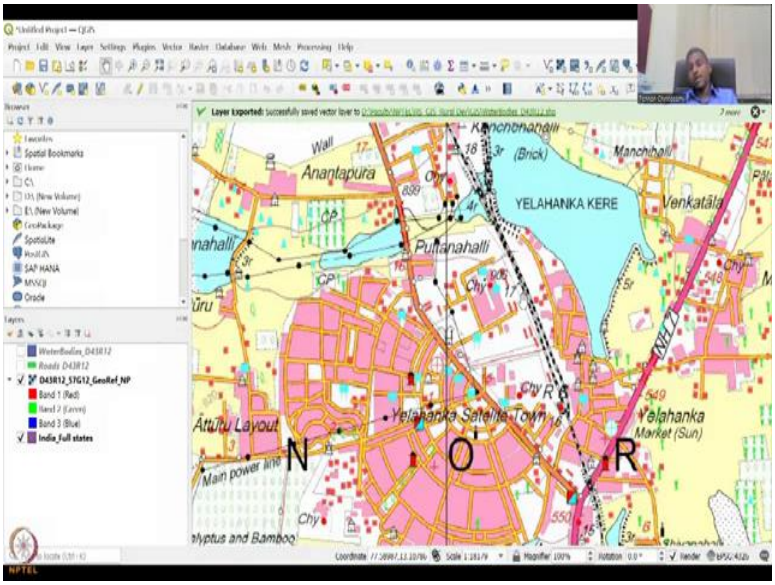

So now if you import an image from 1800s, from the British time, 1870 there is one dataset I used. Then you could clearly see that how the land, how the water bodies have changed from 1870s, 1890s, till 2022, with expansion, with increase in population and people migration from rural villages, there is a need for land and water resources, but it should be sustainable. That is what is needed.

And here what you could see is sometimes if the data is not there, you could use these kind of data. This is the same method you will be using for satellite imagery and imagery is that you can capture using phones, drones and unmanned vehicles or airplanes. All these data will contribute to rural development in mapping structures, mapping road connectivities and also mapping access to water.

So for example, that there is a housing settlement in this map area and you have a water body where maybe if it is a village people would go there and access water for their domestic supply. So they would walk and if it is too far then they would eventually lose livelihood options or education options, so all of this can be mapped.

And again this is a static map, it is a 2011 map, it does not change. Whereas your GIS map can be updated as and when the data comes in.

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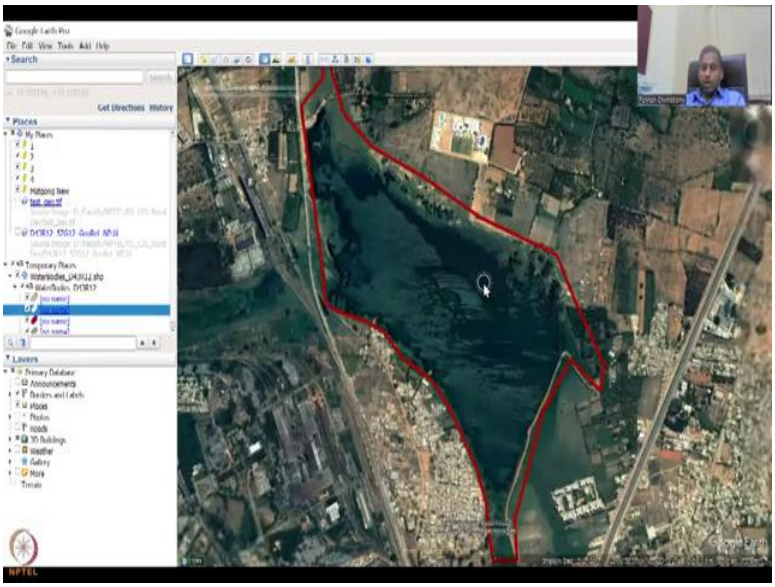

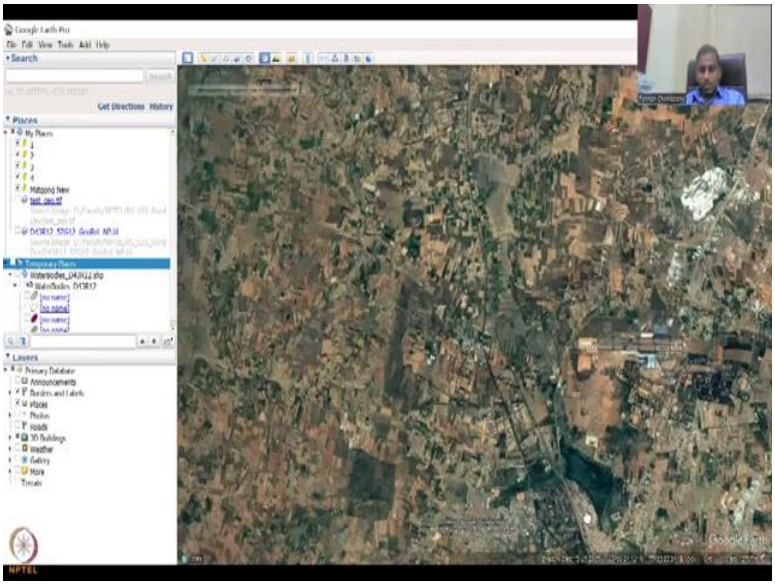

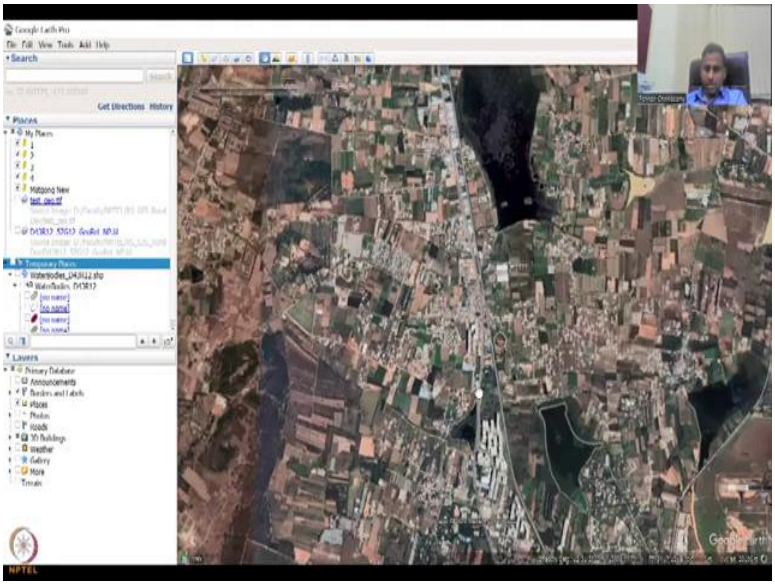

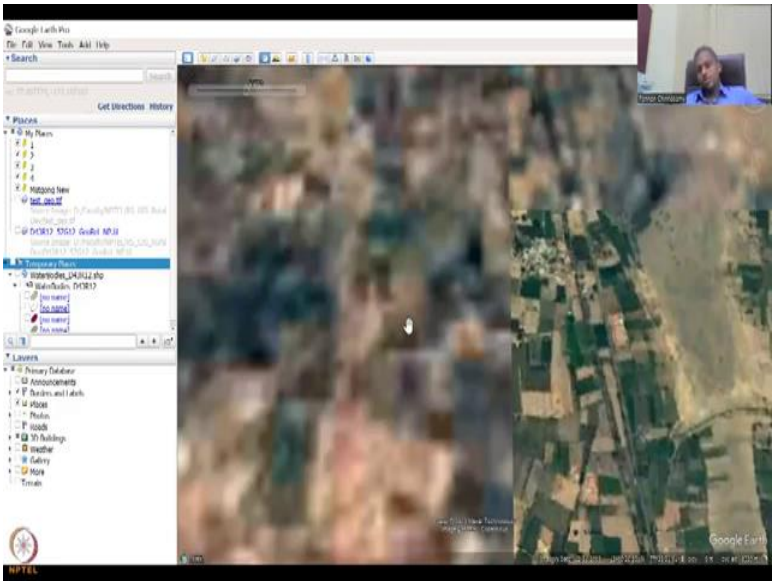

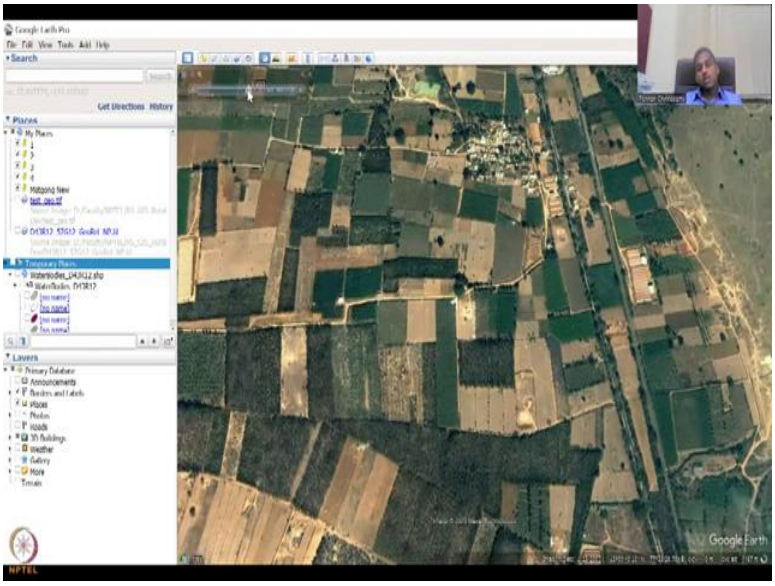

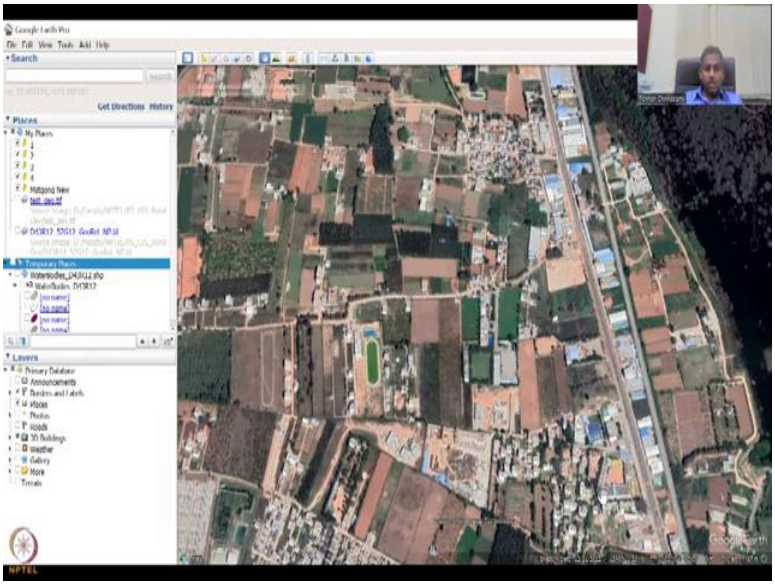

So here you could see that this is a time lapse image, let us quickly see a time lapse image of this area okay to see how the population was before and now. So these are all agricultural lands. If you see now you will see agriculture land is gone. Yeah, let us focus here, and then I am going back as much as possible wherever the data takes me. 1985 is the latest satellite data you have, but again you will have issues like this.

The resolution is not good. However, this part is good, so this is 2004. These parcels of land is nothing but agricultural land. So now if I increase, so it does take time a little bit, the source of the data comes here. We will have a session on Google Earth Pro and you can see here that it is still circling. So in 2005 all this land was agriculture. But now in 2023 you could see how ground has been built.

A lot of land has been cleared and you could see that these things are populating. These are not sustainable in a longer run, because the food security could be breached. All these land which were initially agricultural land has now become urban land, thereby demanding more power supply, water supply and other accessories, their needs. With this I will conclude to today's lecture and also week 6. We will re-share the final slide to close.

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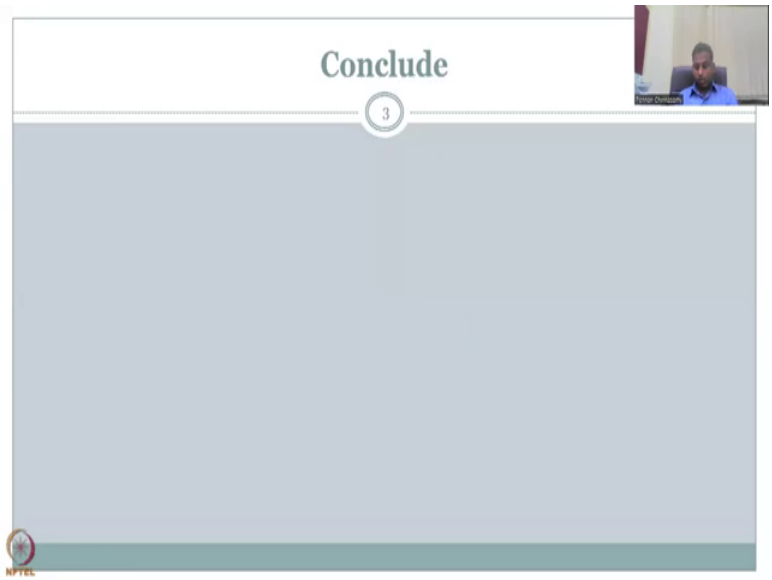

So we will conclude here with week 6 lecture. In the week 6, it has been very important because we have looked into how to look at new data and other data sources, the other data sources include satellite and other imagery that were not initially available for the public, because these satellite data or the map data were in papers. And people were storing it in papers because that is how the map was created.

And it was large maps which cannot be scaled down to a computer. But now since the globe can be scaled down into your computer using your GIS software, it is definitely possible to put the map which is much smaller than the globe. So all this we have discussed in detail, I really hope that you can go to your nearby panchayat office, government office and ask for paper maps.

And if they say you cannot take it out, you can still take a snapshot using your phone and the same method you can use. Make sure you do not zoom in zoom out and have angles when you take. Just keep it, keep the map under the table, on the table and then keep it very focused to your phone and take an image that is what a scanner does. A scan is it does not disturbs the image and it scans the map.

So same way scan the map, take the image convert the image into a GIS image in, by using GIS georeferencing tool. Make sure you take points that are allowing you to anchor it. So suppose you have a map which does not have an anchor points, what do you do is you take

the anchor points from a Google Earth engine. So that part we will cover in the next lecture. I will close today's lecture with this slide. Thank you.