Geoenvironmental Engineering (Environmental Geotechnology):
Landfills, Slurry Ponds & Contaminated Sites
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Lecture - 27
Site Selection for Landfills

Good day and welcome back to this class. Today, we will discuss site selection. Nobody, wants a landfill in his backyard. If I come to your house and say next to it, I will want to make garbage dump, so will you agree? No, I even not agree. Because you will say I will get the bad smell from this all the time and flies and all kinds of pastes, infections, hazardous fumes. So, nobody wants a landfill nearest his or her area, it is called the nimbi effect not in my backyard.

So, the biggest problem is to find sites which are acceptable to people for making landfills. And the current state of the art in India is that if you have an old waste dump, where people are already used to the fact that waste comes then and site adjacent to it or re-managing the same site to create a larger land fill is very easy. But you go to a pristine new site where people are closed by then it is very difficult to acquire that land and allow the local population will not allow you to make the landfill.

However, if you have degraded land something, which was polluted by an industry in the past or something which has no use saline there is no agriculture you cannot make any industry on it then degraded land can also be degraded remote land can also be used for landfill sites. So, site selection is a process which first allows you to identify which sites can probably be used for putting a waste and then amongst the site which site is the best or which site is the one which you should adopt.

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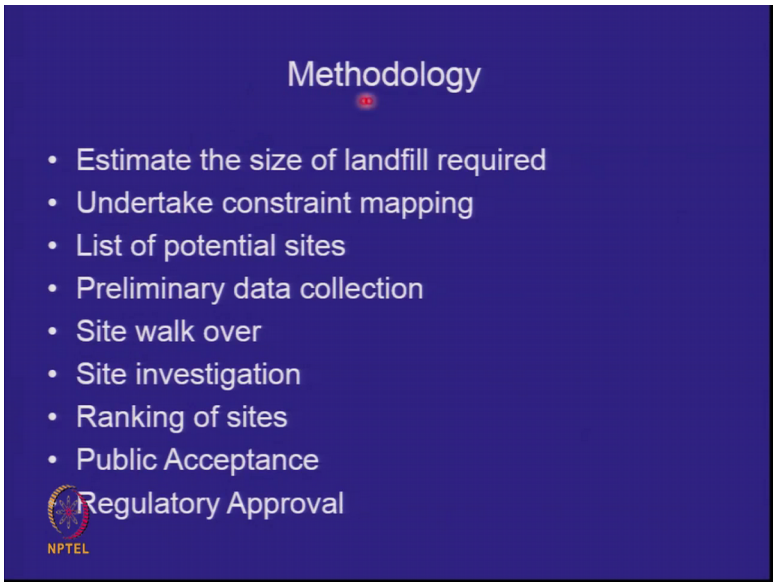

So, site selection involves the following steps, you should have an idea of the size of the landfill that you need remember you are going to have a landfill for 15 years, 25 years. So, what is the size what kind of area are you looking for, what is the quantity of waste we already done this. Then around the city or the urban center, where you are going to make the landfill do constraint mapping.

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What is constraint mapping? Constraint mapping is these are all constraints. If you have a pond or lake you have landfill if you have a river you cannot landfill 100 meters, if you

have a high way you cannot have a landfill 500 meters. So, if you know all these locations around your urban center then you can make this huge circle saying these are the buffer zones, I cannot put a landfill here. So, undertake constraint mapping. After the constraint mapping is done, there will be some sites which will emerge whether these are available or not, but there will be some sites which will emerge. So, they become the potential sites.

So, we get a list of potential sites you may get two three you may get five if you are very lucky you may get one if you unlucky you may get none. If you are if you are living in a place like Delhi where every place is populated there is a community or habitat you start making circles of 500 meters around the habituated area you cannot have any landfill site left. If you got sites then you will do preliminary data collection, you will do preliminary data collection, you will do site walk over each of these sites, you will do a site investigation to get some additional data.

Then you will do ranking of the sites. And the site which is coarse the best marks in terms of acceptability should be adopted. You will have to go for a public consulted process which is the one which has a big issue because the moment you do a public consultation, you are involving the local people about its the landfill, and public acceptance is a major issue. And then you have to get your regulatory approval. So, this is a locational criteria which we had discussed in the beginning. This is of course, changing from time to time. The new rules I will tell you the 2016 rules have a slightly different criteria, but this is a good one, this is this is a good one to follow.

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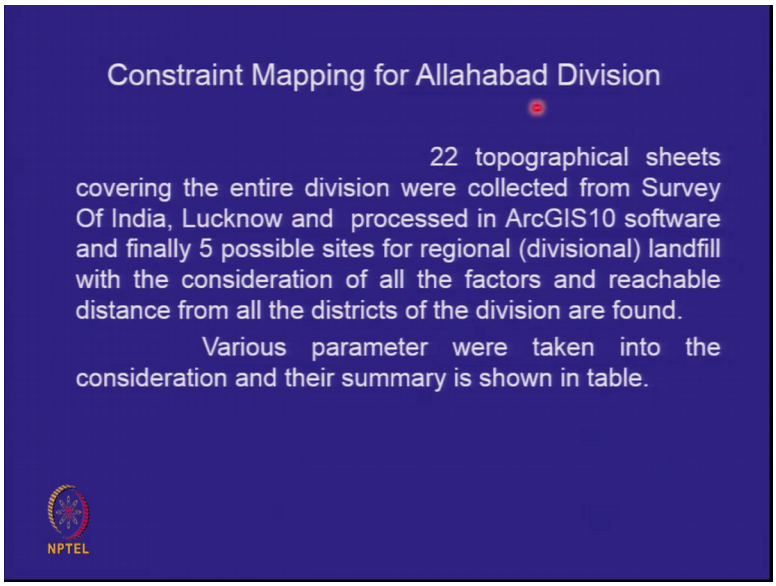

Now, I am going to show you work which is done by Mohith in his M. Tech. He did constraint mapping for a landfill for Allahabad division, not Allahabad city, not Allahabad district, by understand division comprises of three four districts. So, the concept was they nobody was willing to give land for a landfill. So, they said ok everything will be far off from the city, can we have one site where the waste from all this four districts can come that is the concept of a regional landfill. Do not keep it close to your city, do not try and reduce transportation costs, but make a huge dump somewhere remote where waste from different districts and cities can reach. So, this is an exercise which they did for the and he did the use the GIS software and they were able to identify five possible sites for the Allahabad division.

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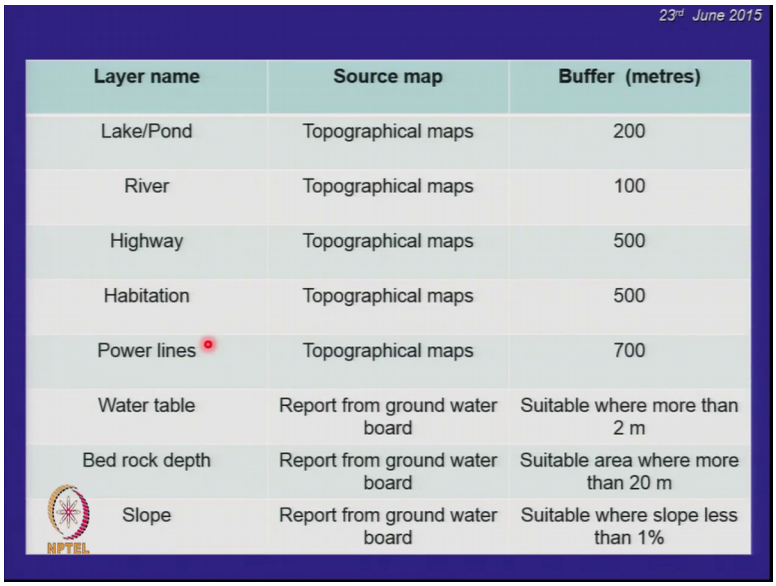

So, what did I do? There are constrained mapping criteria was different, we have different, but more or less if for example, they have added power lines. If you have a transmission line, you have to be 700 meters away from the transition line. This is not in our.

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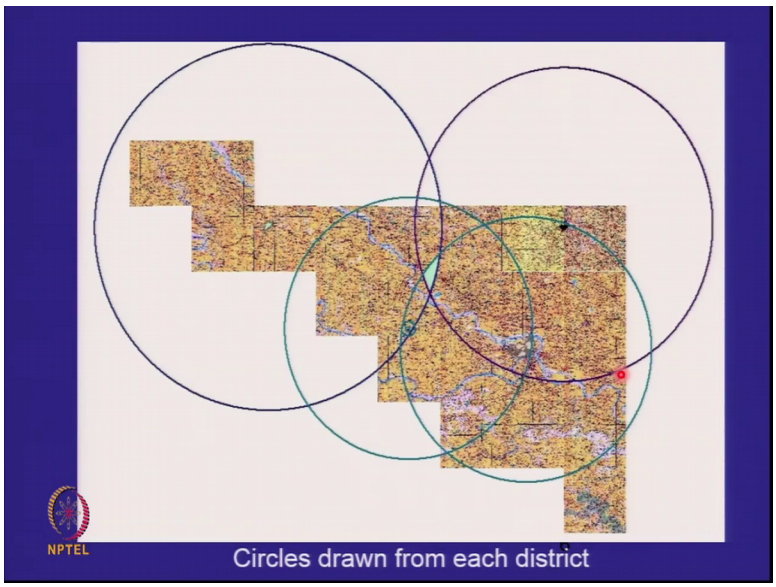

Using this criteria and using the distance approach, they actually got this topographical maps with population density for this entire division. They have many at the center of all the circles are the major cities, and these circles represent the maximum distance to

which the waste will be sent from the cities. So, by overlapping this circles, you have got four circles here. Can you see that? They are able to identify a region where everybody can send their waste. And what is the diameter of this circle?

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50 to 55 kilometers was the diameter of the circle. So, everybody was willing to send their waste from the center till about 30 kilometers away.

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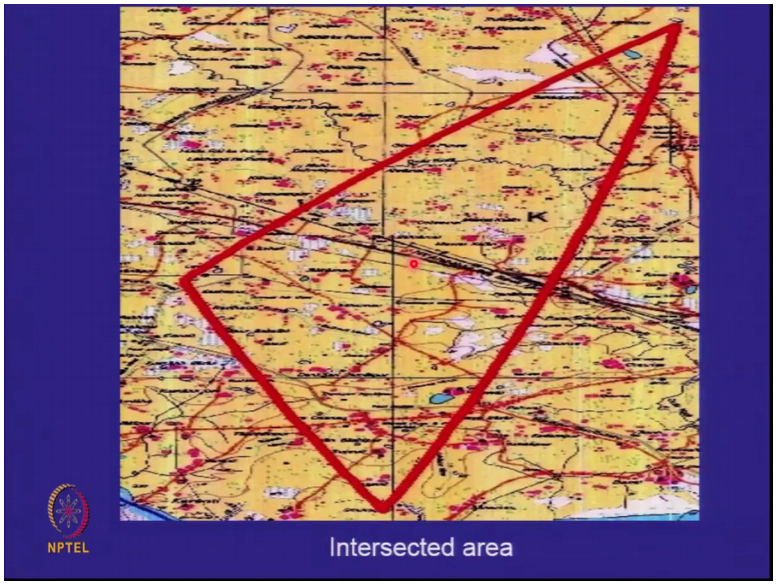

Let us look at this area now a little bit closely. When you look at that triangular area, and this diagram is not very clear, but there are some railway lines, there are some roads, there are some rivers, there are some water bodies, there are some transmission lines those are the ones which will require constraint mapping and also there is habitation. So, several of these dots which you can see indicate the population in that area. So, for each of this, so for example, if we have a road what is the constraint for the road how near can we be 500 meters if you have highway. So, if there is a highway which is going through you are going to lose 500 meters of either side.

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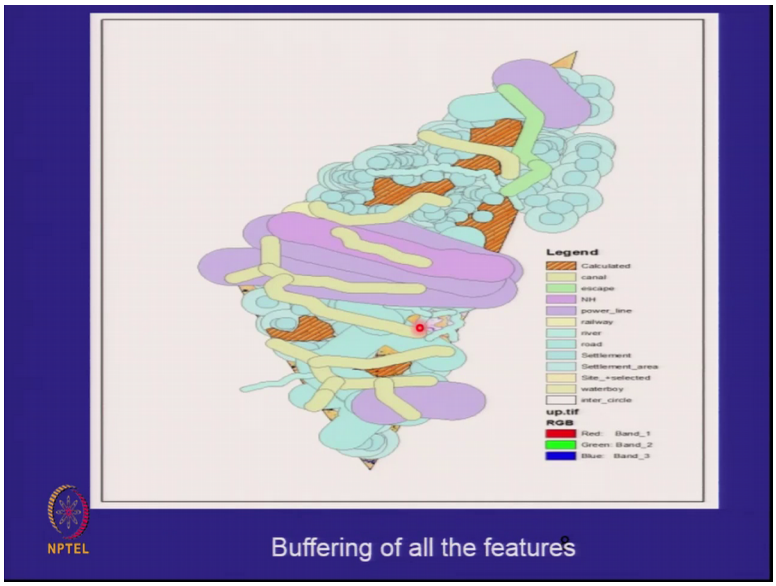

So, when they put all the constraints, there was transmission line, there was road. So, all these colors are the constraint mapping. River, road and all that remains as the brown portions. So, the constraint mapping throws up areas, which are not coming under any buffer zone of any of the things river, pond, transmission line, road habitation those are your five areas in that triangle which was acceptable to everybody.

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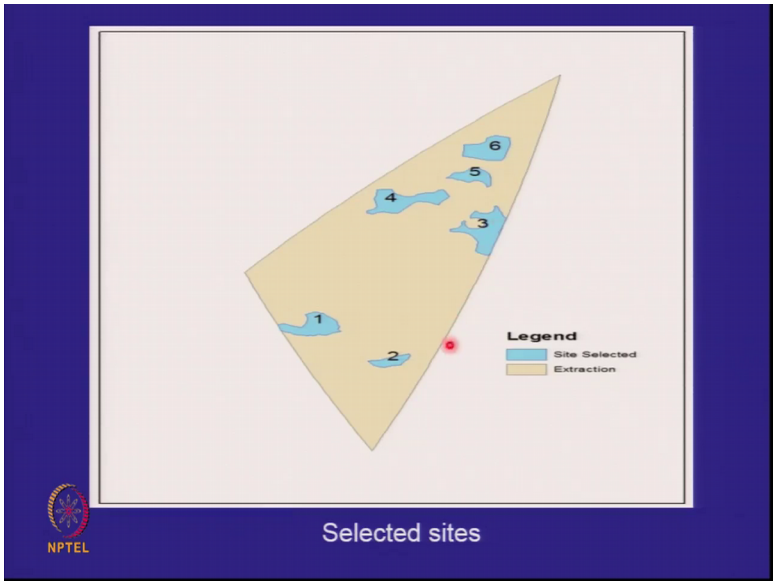

So, now we have to find out which site to select. So, they went ahead and looked at the areas which are available.

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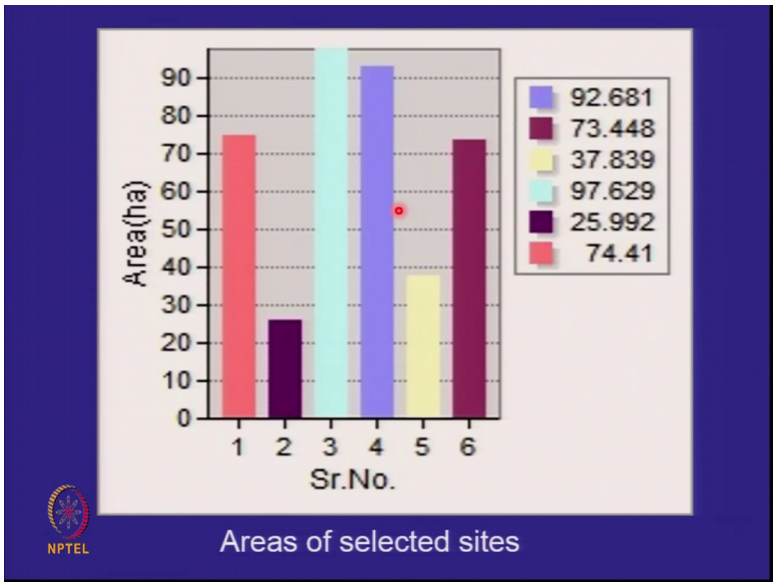

And you can see that site three had probably the maximum area I followed by site four and. So, now, I have five sites I mean this is 5 or 6, 6 sites sorry and if I have to select within the sites I have to do a site ranking.

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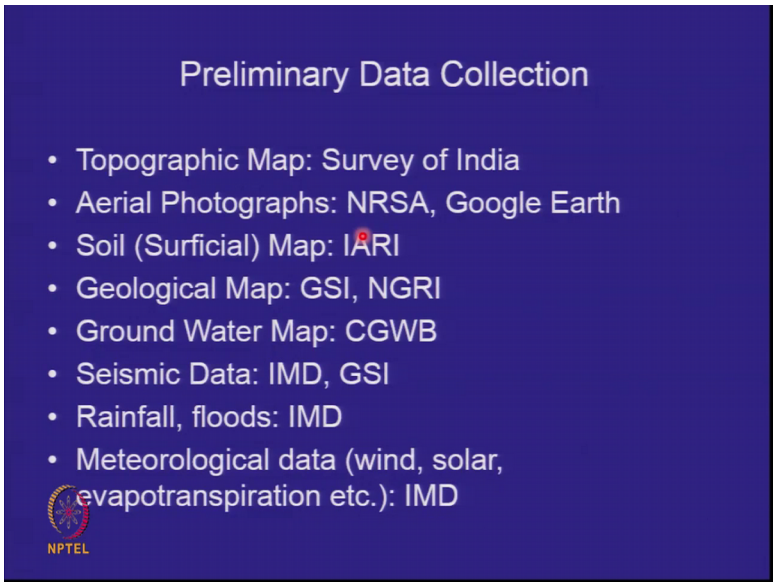

So, I go to each of the site and start doing data collection, so that I can then do site ranking. So, I need the topographic maps, I will have some I will not a very fine contour interval maps, but I left some quotes topographical map from the survey of India. I can get aerial photography from the national remote sensing agency or even now Google

earth will give you some kinds of maps. We have soil maps of India, you would have heard about it, but is geotechnical engineer I have never use the soil map. Why, because the soil map is actually prepared for agricultural purposes, it is a surface soil map. So, somebody says of this is the soil in this area, we should go 20 meters below that is not the soil in that area, but if you want to grow a crop on it when you can say yes, yes on the surface on the top few inches of or the top one meter you will have that soil. So, you can go and get an idea of the soil from the soil maps, get the geological maps from in the geological survey of India.

Ground water maps it actually gets an idea where the ground water table is. Seismic zone one, two, three, four, you will get from IMD or even the code. You need rainfall data is it higher rainfall, is it flood floods, is it low lyings. So, you get you can get that from the indian meteorological department or I think floods will also come from central water commission. You may have some data with the central water commission about the floods. And wind, solar data, evapotranspiration from IMD.

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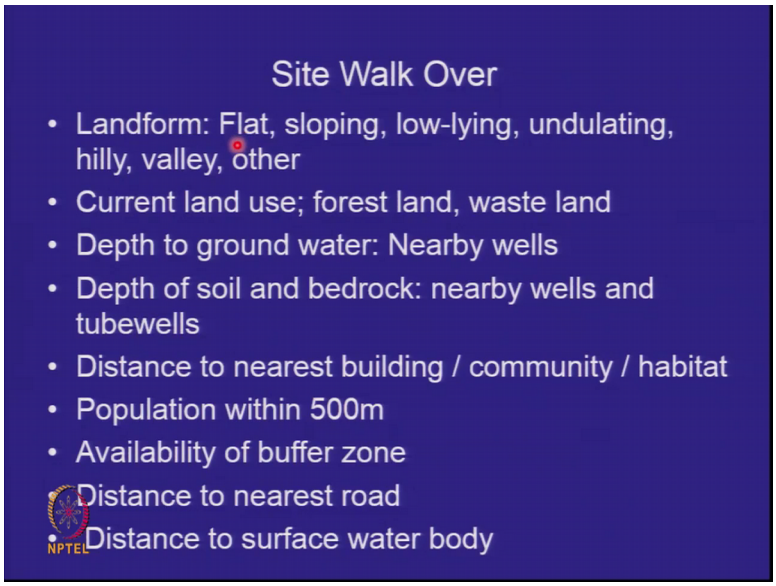

You get this data for all the file sites and then do a site walk over and when you go to the site what you want to go and see there first, is it a flat ground, is it slopping, is it low line, is it undulating, is it hilly, is it a valley or any other. So, once you will go to a site you will get that immediate feeling then on your site walk over with the topographical map, you can say ok, this is what it looks like. See site walking is ground trothing some

other maps which you will see may have been old even the Google earth photograph sometimes is how many how many months old. If you go to Google earth do not think you are seen today's photograph.

Do you seen today's photograph on Google? No, when you see terrain, it will be several months or couple of years old. If you are the professional user, you will be able to you pay and get the latest photographs for that area. Look at the current land use, is it if it was immigrated crop land it will go away in the buffer, but is it forest land, is it waste land what kind of land is it. The simplest to do is to find about the ground water table is there a well nearby, and look at that water depth. And depth of bedrock comes from tube wells. Sometimes your well may not be reaching the bedrock, but a tube well is taking out water from say 150 meters, you would normally tell you that 150 meters (Refer Time: 12:11). Are we taking out the water from a weathered rock or are we taking out the water from soil. So, you will get information on bedrock.

How close is the nearest building where is there a village near by habitat, what kind of population is there in the 500 meter diameter buffer zone. Is there availability or people are there is no buffer zone, actually it should not show up because of you are done constrain mapping, but still you would like to somebody might have taken the census of that area 5 years ago, you would like to have a current situation. Distance to the nearby road, distance to the nearby river or a lake or a pond, this is all from site walk over.

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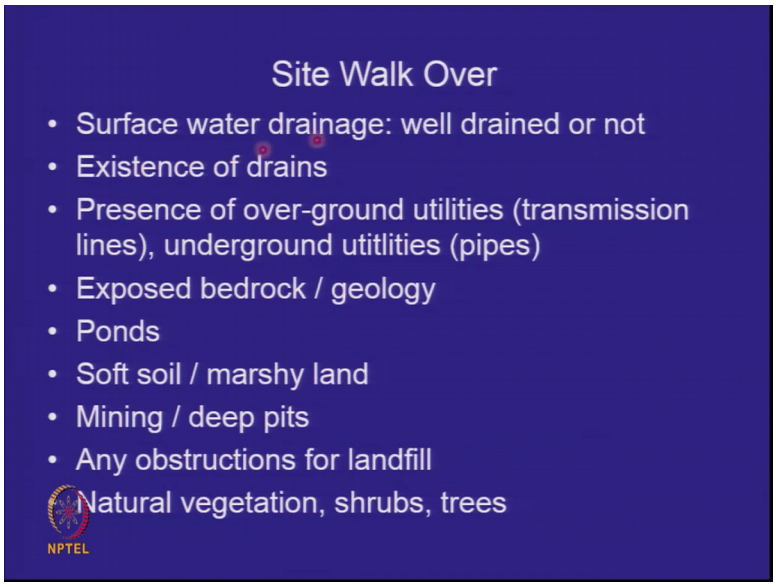

Surface water drainage, is it well rain site or is there water logging, you can find out. Are any drains [FL] drains passing through that area, the moment you have drain there is the constraint, the moment you have a transmission line tower, there is a constraint. The moment you have underground utilities some pipe is passing. You will not be able to put your landfill on that pipe. So, if it is a underground sewer line, you will not be allowed; water main for a city you will not be allowed. So, identify all this. If the bedrock is exposed have a look at it; if there are some ponds report it, is it marshy land, is it white laying empty that nobody is using it. Marshy land normal is water table is high. So, you will have those issues with that are there any mining or deepest any abstractions and what is the natural vegetation is it aided, is it shrubbery or is it densely vegetative, all this comes from the site walk over.

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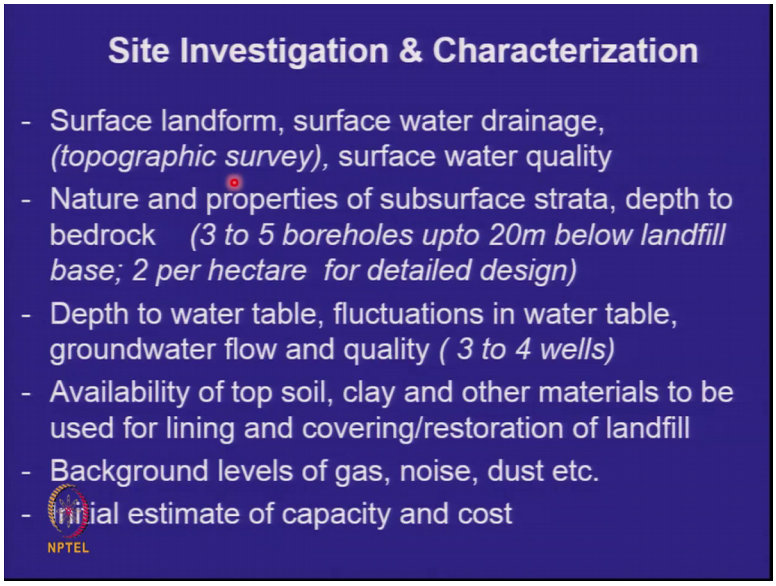

In addition to that you have to do some site investigation. Now, you have the topographical map from the survey of India, but the contour interval, I do not know what contour intervals did you get for the Allahabad division do you recall. Eventually for design you are going to need topographical map with contour intervals of 1 meter or half a meter right and that is not what is going to be available to you from the survey of India it will be 10 meter or more. So, do your topographical survey, at least drill 3 to 5 bore holes to understand what is below, standing on the top you cannot predict what is below this 3 to 5 bore wells is only for the site selection. If you are going to do design, you will

have to do 2 bore holes per hectare, so typically a landfill may require 10 to 15 boreholes for a detailed design.

For depth to water table and fluctuations look at 3 to 4 wells, if two are already available look at the groundwater fluctuations. Check about the availability of clay and other materials. Look at the background level of gas, noise, dust you are also going to look at the background levels of surface water quality at background levels of groundwater quality. If the ground water is already saline then your site is better for you to use because you are not putting a landfill on top of a drinking water source. So, you have to get this data. And get an idea all land fill size is not be the same the land available will have different shapes different sizes. So, look at the costs and the capacities that can be accommodated. With this you can go ahead for site selection.

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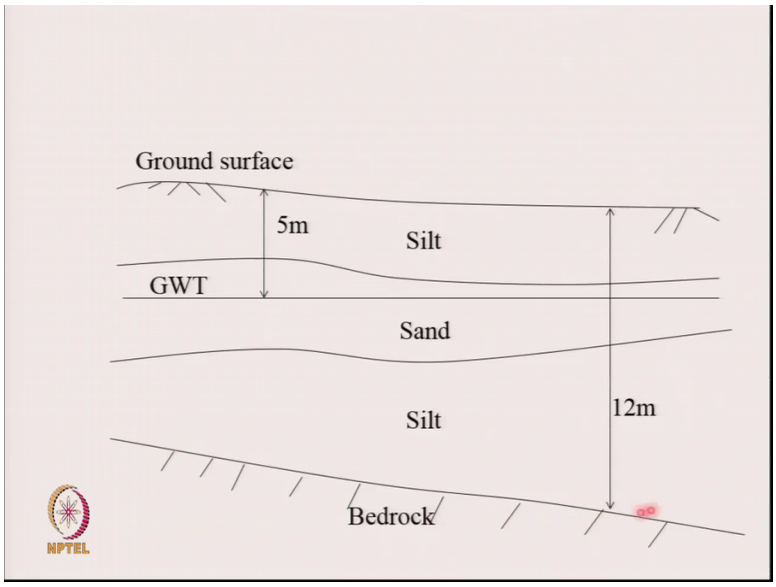

So, after you have done your site investigation, you will now have an idea what is below. Before that you have an idea what is on the top; and at least you should be able to say that there are two or three types of soils is clays, is there silt sand is there bedrock Is there ground water table you should be able to see all that that is about it. Once you are able to have that sub surface information with you your site selection is so much easier. Now, we have to have a methodology of ranking these five sites, which we talked about. The Central Pollution Control Board in 2003, has come up some guidelines and this is

one of the site ranking methodology if you go and look at literature, you will find other site ranking methodologies as well.

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So, the Central Pollution Control Board says that there are 32 factors or attributes which are to be taken into account for ranking a site; 32 that is not small. And these are grouped into 7 categories. And you know let say cost is the category, environmental impact is a category, distance is a category, so you have got seven categories and all those categories are given weightage in a scale of 1000. So, you may give more weightage to cost, somebody else may give more weightage to environment. So, a group of experts, this is not done on webs and fences. So, by using the opinion of a group of experts you come out of this weightage we will look at these seven categories, but this 1000 may be divided up if everything goes equal then it will be 1000 divided by 7, but everything is not equal in this category. So, different weightage are arrives.

Within the category now you have this 32 factors or attributes in 7 category, so obviously, each category has 5, 6 attributes to each attribute you have to give a weightage. So, suppose one category had 200 points as the weightage and within that there were 5 attributes. So, you would have a tendency to the 42 each unless again the group of experts give you a separate weightage. So, once you have got the attribute, once you got the weightage, the most important thing is a sensitivity index.

So, in this methodology we use a sensitivity index between 0 to 1. If you have perfect permeability soil sensitivity for ground water contamination is 0; if you have horrible gravel very high permeability soil sensitivity for ground water contamination is 1. So, it is a scale of 0 to 1. If you know the permeability is you can give the sensitivity indexes between zero to one this is what CPCB has developed you may or may not agree with that you can do a critical analysis of it, but we will go through it. Now, once you have given the sensitivity for that site you multiply it with the weight and then add everything. I will just quickly look at it in the next slides.

So, you have an attribute, the attribute has a weight, it has a site sensitivity depending on the data coming in from that site. You multiply that sensitivity with that weight for that site. And for all the 32, you do this and you add them and you will get a score you will get a score between 0 and 1000. The ideal perfect dream site is 0; and the most horrible site is 1000, because the worst case scenario is 1 site sensitivity index.

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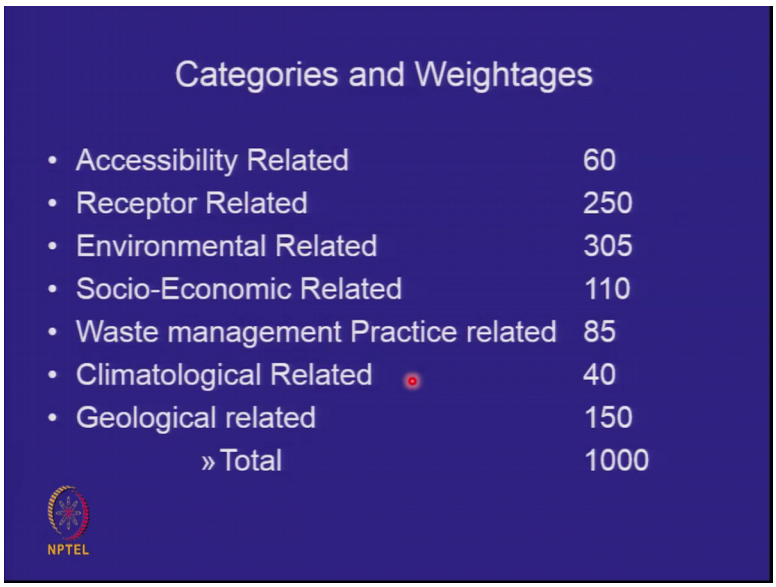

So, here are the categories and the weights which have been adopted by the Central Pollution Control Board something related to accessibility. Receptor who will receive, environmental aspects, ground water, surface water. Socioeconomic aspects, waste management large capacity less capacity climatology high rainfall low rainfall. If there is zero rainfall then the sensitivity index will be 0; if you have Cherrapunji sensitivity index

will be one and geology related or some surface related what we call geo technical, but what they call geology we add this will come to 100.

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Final Score for Kannahali Site

Attribute	Attribute measurement	Sensitivity index	Weightage	Attribute score
Accessibility Related				
Type of road	State highway	0.35	25	8.75
Distance from collection point	25km	0.75	35	26.25
Total			60	35
Receptor Related				
Population within 500 meters	100	0.25	50	12.5
Distance nearest to drinking water source	200 m	1	55	55
Use of site nearby residents	Not used	0	25	0
Distance to nearest building	100	1	15	15
Land use / Zoning	Completely remote	0	35	0
Decrease in property value with respect to distance	No decrease in property value	0	15	0
Public utility facility within 2 kms	No public utility	0.15	25	0
Public acceptability	No complains		30	4.5
Total			250	87

within the for example, I talked about accessibility related 60 marks there were two attributes; type of road passing nearby and distance from the collection point. So, these are accessibility. So, these are the weightage, this is 60. Receptor related, population, drinking water, nearest building, land use, property value, public utility, public acceptability, this is 250 and these are the breakups which are given.

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Attribute	Attribute measurement	Sensitivity index	Weightage	Attribute score
ENVIRONMENTAL RELATED				
Critical environment	Not a critical environment	0.15	45	6.75
Distance to nearest surface water	1.5 km	0.5	55	27.5
Depth to ground water	5 m	0.75	65	48.75
Contamination	No contamination	1	35	35
Water quality	Potable	0.75	40	30
Air quality	Confirming to residential standards	1	35	35
Soil quality	Average	0.75	30	22.50
Total			305	205.50
SOCIO-ECONOMIC RELATED				
Health	Moderate	0.25	40	10
Job opportunities	Low	0.5	20	10
Odour	Moderate	0.35	30	10.5
Vision	Site partly seen (25%)	0.3	20	6
Total			110	36.5

Environmental related is it critical habitat, distance of surface water, not drinking water surface water, distance to river, distance to groundwater, contamination possibility, quality of water, quality of air, quality of soil. If that is already degraded then the impact is less if everything is pristine and you are going to a very nice sanctuary then obviously, your impact is going to be much higher. But if you go to a place where the air is already degraded like Delhi then you are making a lesser impact I mean that is not an example to take. Then socio economic related health will this whole waste to energy waste to land filling (Refer Time: 21:53)), jobs will the odor have issues with the local population you know, odor can lead to headaches it can lead to depression is the visibility of the that is it going to be an issue so 110.

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Attribute	Attribute measurement	Sensitivity index	Weightage	Attribute score
WASTE MANAGEMENT PRACTICE RELATED				
Waste quantity/day	1197 T/d	0.6	45	27
Life of site	21 months	0.8	40	32
Total			85	59
CLIMATOLOGICAL RELATED				
Precipitation effectiveness index	31 to 63	0.5	25	12.5
Climatic features contributing to air pollution	No problem	0	15	0
Total			40	12.5

Waste management related what will be the life of the site right and what is the waste quantity per day it will accommodate 85. Climatology, how much precipitation, precipitation effectiveness index is the ratio of precipitation to operation. In aided climate, it will be very low; in wet climate, it will be very high. Climate factors contributing to air pollution it is 15. And finally, the subsoil where we (Refer Time: 22:46) come in the soil permeability, the depth to bedrock, erosion characteristics of rock is it weathered or a massive depth of soil layer, what is the slope of the ground what is the seismicity of the area 150. So, if I want to go back and see which is the most important category here which is the most important category here which is the most important category environmental and receptor these two guys get the highest marks.

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SITE SENSITIVITY INDEX

S.No.	Attribute	0.0-0.25	0.25-0.5	0.5-0.75	0.75-1.0
	ACCESSIBILITY RELATED				
1.	Type of Road	National Highway	State Highway	Local road	No road
2.	Distance from collection area	< 10 km	10-20 km	20-25 km	>25 km
	Receptor Related				
3.	Population within 500 m	0 to 100	100-250	250-1000	>1000
4.	Distance nearest to drinking water source	>5000 m	2500-5000 m	1000-2500 m	<1000 m
5.	Use of site nearby residents	Not used	Occasional	Moderate	Regular
6.	Distance to nearest building	>3000 m	1500-3000 m	500-1500 m	<500 m
7.	Land use / Zoning	Completely remote	Agricultural	Commercial or industrial	Residential
8.	Decrease in property value with distance	>5000 m	2500-5000 m	1000-2500 m	<1000 m
9.	Public utility facility within 2 kms	Commercial area	National heritage	Hospital	Air port
10.	Public acceptability	Fully accepted	Acceptance (suggestions)	Acceptance with changes	Non acceptance

So, important is the development of size sensitivity index. You can develop your own with your own group of experts both the weightages. But here for example, here are the indices from 0 to 1. If a national highway is available close by if there is no road that is the difference; if the distance from the city boundary or the collections city centre of the collection area has less than 10 kilometer it is a good site; but if it is greater than 25 kilometers, it is the bad site. So, like this population within 500 meters very less 0 to 100 people, but more than 1000 people. So, this is the low and. So, suppose I have 50, I will give 0.1 to 5 got it. So, like this we are able to using this use of site by nearby residents not used somebody is regularly coming and doing yoga there. So, you know that is an issue.

Distance to the nearest building 3 kilo meters less than 500. Land use completely remote degraded not being used residential. Decrease in property value with distance. So, how does the decrease in property value take place. And public utility of the site is there a commercial area; worst is airport you have gone airport site is out. Public acceptability non acceptance is most often nowadays, but acceptance with changes are fully accepted like that the indices have been made for everything.

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S.No.	Attribute	0.0-0.25	0.25-0.5	0.5-0.75	0.75-1.0
ENVIRONMENTAL RELATED					
11.	Critical environment	Not a critical environment	Pristine natural area	Wetlands, flood plains, preserved areas	Major habitat of endangered or threatened species
12.	Distance to nearest surface water	>8000 m	1500-8000 m	500-1500 m	<500 m
13.	Depth to ground water	>30 m	15-30 m	5-15 m	<5 m
14.	Contamination	Air, Water or food contamination	Biota-contamination	Soil contamination only	No contamination
15.	Water quality	Highly polluted	Polluted	Potable	Confirming to standards
16.	Air quality	Highly polluted	Polluted	Confirming to industrial standards	Conforming to residential standards
17.	Soil quality	Highly contaminated	Contaminated	Average	No contamination

Distance to nearest surface water if its 9 kilo meters away fine if it is less than 500 your landfill site is got the buffer, but it still is close to a river, so that will give better high index. So, like that.

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S.No.	Attribute	0.0-0.25	0.25-0.5	0.5-0.75	0.75-1.0
Geological Related					
26.	Soil permeability	$<1x10^{-7}$cm/sec	$1x10^{-5}$cm/sec to $1x10^{-7}$ cm/sec.	$1x10^{-3}$cm/sec to $1x10^{-5}$ cm/sec.	$>1x10^{-3}$ cm/sec.
27.	Depth to bed rock	>20 m	10 to 20 m	3 to 10 m	<3 m
28.	Susceptibility to erosion and run-off	Not susceptible	Potential	Moderate	Severe
29.	Physical characteristics of rock	Massive	weathered		Highly weathered
30.	Depth of soil layer	>5 m	2-5 m	1-2 m	<1 m
31.	Slope pattern	< 1 %	1-2 %	2-5 %	>10 %
32.	Seismicity	Zone I	Zone II	Zone III	Zone IV & V

So, for each one of them for example, if the soil permeability is less than 10 to the power of minus 7 centimeters per second good site; it is like a clay back here, but if it is greater than 10 to the power of minus 3 bad site its soil. Also you know if the rock is massive it is good if the rock is weathered not good like that. If it is high slope may be there are

slope stability issues or maybe the leachate can come out and run down the slope for very large distances is the two issues. And of course, low seismicity areas is fine, high seismicity areas are not fine.

So, let us take a case study to understand how this is applied Now for each site, this is for a Bangalore site. So, we are away from the Allahabad selections this is one site only I am doing in Bangalore, I need this measurement right. What is the type of road nearby a state highway. What is the distance from the collection point 25 kilometers this is for that particular site, what is the population within 500 meters 100. Distance to the nearest drinking water source 200. Site not used by residence 100 meters away. Remote no decrease in property value no public utility and there are no complaints from the public. So, like that this data has been collected, it is not a critical in manner environment distance to the nearest river or a pond or a lake is 1.5 kilometers; depth to ground water is 5 meters and so on and so forth.

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Attribute	Attribute measurement	Sensitivity index	Weightage	Attribute score
GEOLOGICAL RELATED				
Soil permeability	1x 10-4 to 1x10-5	0.5	35	17.5
Depth to bed rock	10-40 m	0.3	20	6
Susceptibility to erosion and run-off	Not susceptible	0	15	0
Physical characteristics of rock	Weathered	0.3	15	4.5
Depth of soil layer	0.3-3 m	0.75	30	22.5
Slope pattern	2%	0.25	15	3.75
Seismicity	Zone I	0	20	0
Total			150	54.25
Grand Total			**1000**	**489.75**

The effect of the site on health is estimated is moderate, job opportunities will be not very high, odor will be moderate, visibility partly seen site. Precipitation index of Bangalore and climatic features no problem. So, like this the permeability is 10 to the power of minus 4 to 10 to the power of minus 5, depth to bedrock 40 meters weathered rock two percent zone one. So, these are the weightages. Now, let us see with this data this is the first time I am bring in that first slide. Let us look at 25 kilometers what

sensitivity would you give to it and let us look at the sensitivities recommended by Central Pollution Control Board. So, about 25 kilometers what is the site sensitivity index which will adopt please tell me.

Student: (Refer Time: 28:22)

0.75 because this correspond to this and this corresponds to this, hopefully they will adopt that. How much was the population within 500 meters, 100. How much would you adopt, 0.25. And let me go to distance to nearest drinking water source 200 meters and here it says he is talking a 5 kilometer. So, hour will fall here, so one. So, let us see 25 kilometers 0.7, 500 people within 500 meters 0.25, 200 meters 1. So, now you will multiply this sensitivity index with this weightage to get this value. So, if it was the worst site it would have been 60 and if it was the best site it would have been 0. For this site if I add these two up, I get 35. Similarly, if I add this up I get 87 out of 250. So, use zoning completely remote zero, no decrease zero. So, like that I got the values and I multiply it.

Environmental related, you got these values; and in social economic repeated I got these values. So, when I got 205 out of 305, and then I got 36.5 out of 110, 21 months even that is very low by our standards, but must be in a small site which has to be developed we have talked about how much is should be the minimum life.

Student: (Refer Time: 30:31)

How much should be the minimum life of a landfill?

Student: (Refer Time: 30:34)

10 years is how many months 120. So, this is less than the critical size that you have developed it in any case. So, you are getting the values for each one of them; and in the end, when you add up all the score, when you add up all the score, you get 489.75 that is bang in the middle of the 0 to 1000 scale, we have 0 to 1000 scale. So, do you think the site is acceptable or not acceptable? Please note that these are relative ranking indices, these are relative indices. So, if you have three sites then quite clearly the site with the lower score is better and the site with the highest score is not better.

However, if you have treating this as an absolute value, then we have to answer the question do we accept this site or do we not accept this site. So, typically if you have to divide the 0 to 1000 scale you would have said not acceptable, acceptable, in between. So, suppose I want to adopt the 0 to 1000 scale into three not acceptable, acceptable, in between. So, how do you make the grouping, you could do a linear grouping 1000 divided by 3, 0 to 333, acceptable 330 to 666 in between you take the call, and 666 to 1000 not acceptable. So, you need a scale, but remember site ranking methodologies are for relative comparisons, the absolute scales to stand the with stand scrutiny are difficult; however, at least in that document of the Central Pollution Control Board this is what is listed.

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Less than 300 preferred sites take it. 300 to 750 a huge range, moderate left to you to decide if you have a better site go for it, if you do not perhaps you have to accept this. And greater than 750 undesirable. Therefore, it would be a moderately acceptable site compare it with two other sites and take your decision. I would like to say that we have all talked of educational criteria and we had these municipal solid waste management rules, which was revised in 2016 towards the end of last year.

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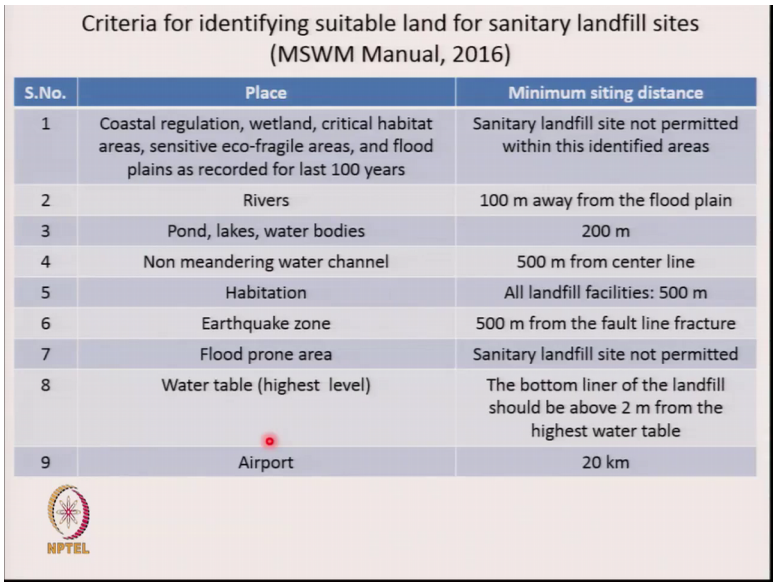

So, now this is yet another table about the constraint mapping; not permitted coastal regulation zone, wetland, critical habitat, sensitive zones in the flood plain. In our table, it was said in floodplain please put an embankment all around, but it is is not permitted. I do not know how it will work because indogangetic plain is a huge flood plain you cannot say that do not make a landfill there, you might want to put a protective on that. So, that the flood does not come inside, but that something at the moment it is not allowed. Rivers 100 meters, ponds lakes and water bodies 200, and others non meandering 500, habitation 500, earthquake 500, flood prone not permitted, water table 2 meters below. Airport still 20 kilometers because always the problem of bird hit, if you have a landfill there will be birds if you have a birds then they will be able to damage the aircraft. So, with this we have now understood the site methodology. Any questions on the topic of site selection? Then we will continue from here in the next class, all the best.