

**Watershed Management**  
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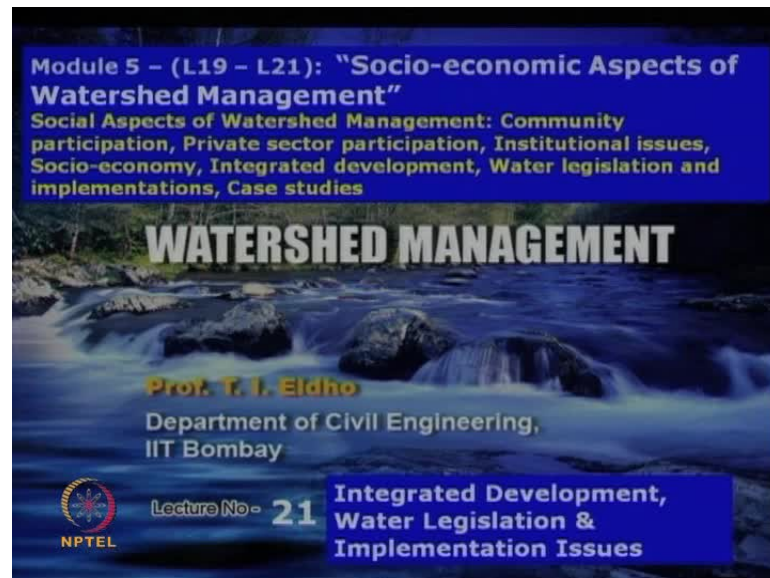
**Module No. # 5**

**Lecture No. # 21**

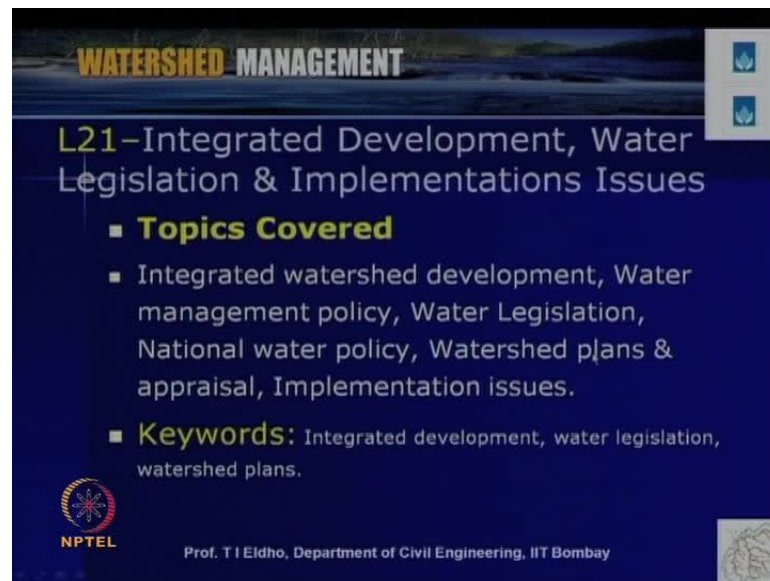
**Integrated Development, Water Legislation and Implementation Issues**

Namaste and welcome back to the video course on watershed management. In module number 5, on socio-economic aspects of watershed management, in lecture number 21, today we will discuss integrated development, water legislation and implementation issues.

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**WATERSHED MANAGEMENT**

**L21-Integrated Development, Water Legislation & Implementations Issues**

- **Topics Covered**
  - Integrated watershed development, Water management policy, Water Legislation, National water policy, Watershed plans & appraisal, Implementation issues.
- **Keywords:** Integrated development, water legislation, watershed plans.

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So, here, in this lecture, some of the topics covered include - Integrated watershed development, Water management policy, Water legislation, National water policy, Watershed plans and appraisal, and Implementation issues. Some of the key words for today's lecture include - Integrated development, water legislation and watershed plans.

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**WATERSHED MANAGEMENT**

**Integrated Watershed Development & Management (IWRDM)**

- **IWRDM** - effective means for conservation & development of land & water resources. It integrates the socio-cultural, economic, biophysical & technological aspects of development.
- Major concern of **IWRDM** is the improvement of the livelihoods of local communities on a sustainable basis. It requires balancing economic needs and expectations with environmental concerns - to avert degradation of the natural resource base, in particular soil and water components.
- **IWRDM & Community participation** - long term changes - better adoption

Sustainability, Efficient use of local resources, Indigenous knowledge

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So, as we discussed earlier, this integrated water resource development and management is one of the important topic now a days in the agenda of many of the countries all over the world.

So, it is not simply development of a watershed, but we have to see the overall development of the various resources within the watershed and the people and by giving emphasize on the social upliftment of the people. So, that is the essence of integrated watershed development and management.

So, that way, as we discussed earlier also IWRDM or Integrated Watershed Development and Management is an effective means for conservation and development of land water resources and other type of resources within the watershed, so, by giving an emphasis on the overall development of the people and overall the system, so, that way, IWRDM integrates the socio-cultural economic, biophysical and technological aspects of development within the watershed.

So, that way, it is not simply development of some system like check dam or **the say** some of the development of land or water, but it is in the holistic development within the watershed. So, the number of concerns as far as IWRDM or Integrated Watershed Development and Management is concerned. So, some of these are listed here - IWRDM the major concern is the improvement of the livelihoods of local communities on a sustainable basis.

So, we can see that most of the time the watershed will get deteriorated due to the human influence in a negative way. So, to make it in a positive way and then if sufficient livelihoods are available, for the, for the local people, then there will not be deterioration to the watershed and then appropriate development will takes place. So, that way, the IWRDM requires balancing economic needs and expectations with environmental concerns, so, so that we can avert degradation of the natural resource base in particular soil and water components.

So, that way, in an IWRDM framework, so, we have to see the overall development in an environmental friendly way, in an ecological friendly way and also so that the total development of the people of the flora and fauna and everything takes place.

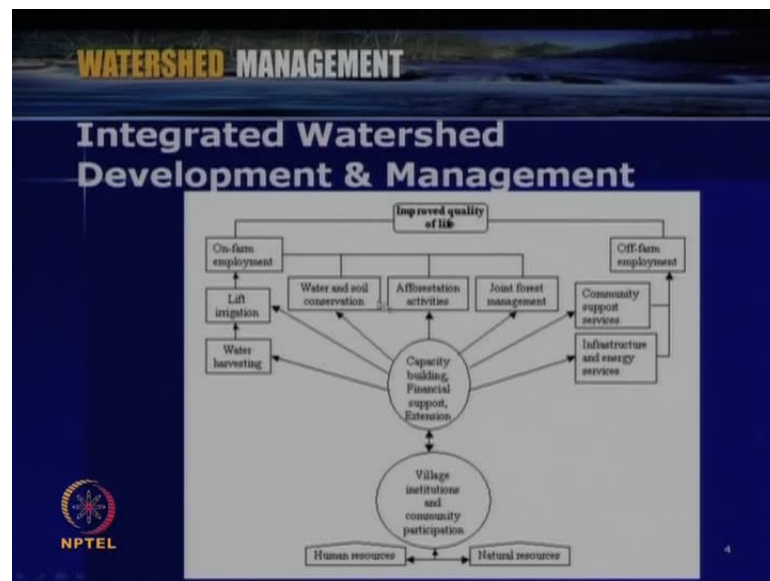
So, that way, of course, as we discussed in the previous lectures also, community participation is very important in the case of IWRDM, and so that say whenever some intervention takes place within the watershed say for few years, so the effects will be

long term and this long term sustainability should be there, and so, that way, things can be in a better we adopted.

So, IWRDM with community participation is the main emphasize of the development aspects as far as the development in a particular watershed is concerned. So, that way, the key words of IWRDM include sustainability efficient use of local resources and indigenous knowledge. So, whatever says the various things within a watershed varies from one watershed to another watershed.

So, as we discussed, there is no commonality between the various things within one watershed to another watershed. So, that way, we have to see that we use indigenous technologies; we use, we have meeting. When we are going for watershed management plans, we meet with the local needs and the aspirations of the people are met. So, that way, we have to plan the development as far as a watershed within the framework of integrated watershed development and management.

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So, as I mentioned also earlier, so finally what we are looking for improved quality of life of the people and then ecological improvement and environmental sustainability. When we consider the watershed development within the perspective of integrated water resource management or IWRDM, so, we can see that say the watershed which is the area. So, that way, the various natural resources like land, then water forest, etcetera.

So, these are all the natural resources, then human resources. So, human influence should be in a positive way. So, we are, when we develop say watershed development plans or watershed management projects, so, we have to see that all these influence are in a positive way. So, for me, human resources, we have to, and the natural resource come together, and then, that way, depending upon the area, depending upon the watershed, so, we have to see that various institutions and communities coming together for the development.

So, that way, we have to develop the village institutions, and so that, we can ensure community participation. And then, say within this perspective by considering the natural resources, human resources, and then the village institutions, we have to develop say capacity building to be taken place, and then, so that for all these things support like financial support, economical support and all other things should come from various sources from government and other agencies.

So, when we consider the developmental activities within a watershed, so like say water is concerned, we can go for water harvesting or development of the lift irrigation schemes. And then, land is concerned, land development for say better agriculture like water and soil conservation activities. Then the forest is concerned, we can go for a further afforestation activities.

And then, say we have to manage the forest in such a way that the forest, say various components within the forest is not degraded. So, that way, we have to look into joint forest management and then we have to see the community support services.

So, as I mentioned, it is a not only simply the area and resources but within, the, for the people. So, overall development should to should takes place. So, whatever like educational help or the medical or the other kinds of social activities all those community support services should be there.

And then infrastructure and energy services should also come into picture. So, like that, road development or the development of ponds, development of various say centers for leisure and other all other things should be developed and then energy needs of the people.

So, that is another important aspect within the perspective of watershed management, integrated watershed management development. So, there, if the sufficient energy sources are not there, then people will be going to the forest and collecting the wood. So, that way, the forest degradation will take place.

So all those things should come together, and then, say like once this say the various schemes are implemented, then there will be on-farm employment like agricultural activities will be enhanced and more activities will take place so that the employment opportunities will be improved, and then Off-farm employment like various other direct and indirect type of other employment will be developed within the area and then economical development will be taking place.

Since more income will be there to the people; more water will be available; more land will be developed for agricultural activities. So, overall the economical development will be taking place, and then, once the economical development takes place, people will be say families will send their children to the school and women will get sufficient time for all other activities since they do not have to take water from faraway places for their daily needs.

So, that way, when we look into all these things, when taking place within the perspective of integrated watershed development and management, so final output will be improved quality of life and social upliftment within the watershed in a very environmental friendly way and with a very positive ecological development will take place.

So, this is a typical frame work for IWRDM or Integrated Watershed Development and Management which we can practice in many areas and in many successful cases, if we analyze what has happened. So that we can see that most of the time, the implementation agencies are taking the IWRDM or Integrated Watershed Development Management perspective is taken care and then the projects are were in a success.



So, this shows how effective people participation can take place within the perspective of integrated water resource development and management and so that the projects will be a success. So, that way, we have to coordinate a bit. So, we have to first organize various committees, various groups within the watershed and then the organizer has to play a role of liaising between these committees or groups to implement various schemes, watershed development schemes and then maintain it and then sustain it.

So, that way, when we are developing a watershed or water management policy, we have to look into various aspects like a supply side management.

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The slide is titled "WATERSHED MANAGEMENT" and "Water Management Policy". It features a small video inset of a man in the top right corner. The main content includes a bulleted list of management aspects and three numbered boxes at the bottom.

- Supply side management – includes technical measures
- Demand side management – includes technical, financial and policy based measures .
- Focus on policy based measures for water resources management
- Integrated water Resources Management Covers everything

1. **Enabling Environment**  
- Policies  
- legislation and  
- incentives

2. **Institutional Rules**  
Organizational  
Frame work &  
institutional  
capacity

3. **Management Instruments**

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So, that way, how much water can be supplied? Say for example, if we consider water as a resource or we can consider any other type of resource so that we have to consider various technical measures how much water can be obtained, say once a check dam is made or once a bore hole or bore well is initiated, so, that way, we have to see, and then, demand side management like a, the, say how much water is required for domestic needs agriculture purposes or various other means, and then, we have to see the various financial aspects and various policy based measures, we have look into, when we look into the overall water management policies, and then, most of time we have to focus on policy based measures for water resource management.



So, we should have a clear cut policy either on the side of say supply side or demand side, and then, we have to integrate between the supply side and demand side so that sufficient water is available. Say for example, if we consider water as a resource, sufficient water is available so that we can frame appropriate water management policy.

So, that way, when we look into this water management policy, so, this we have to do in a series of three steps: like in the first step, we have to enable the environment. So, we have to, we should have appropriate policies to be framed and then has appropriate legislation to be passed by either assembly or parliament, and then, assigning say to implement various schemes may be we have to the government has to give certain incentives to the stake holders,

And then comes the institutional rules. So, say everything should be done in a organized way. So, we have to see organizational framework and then institutional capacity building within the watershed and then by considering the stake holders within the watershed, and then we have to see the management instruments like how to get these appropriate fund for that particular scheme or how to implement the particular watershed project scheme and how we can go ahead with the appropriate implementation and getting the benefits out of that and then managing the overall system.

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The slide features a dark blue background with a light blue header area. The title 'WATERSHED MANAGEMENT' is in yellow, and 'National Water Resources Policies' is in white. A bulleted list follows, with a sub-section highlighted in yellow. The NPTEL logo is in the bottom left, and the presenter's name and affiliation are at the bottom center. A small number '7' is in the bottom right corner.

**WATERSHED MANAGEMENT**

**National Water Resources Policies**

- National Water Resources Policy sets goals & objectives for management of water resources at national scale
- Includes policies for: Regions; Catchments; Shared or trans-boundary water resources within IWRM frame work; Inter-basin transfers

**A national policy may include following matters**

- Jurisdiction and delegation
- The extent to which water management is decentralised or consolidated
- The use of economic incentives
- Capacity building to meet institutional challenges
- Monitoring & control to reduce ecosystem degradation

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So, that way, we have to see when we develop, say for example, water as a resource when we develop water management policy says for a particular area. So, we can see that if you go through say most of the say country level water policies, most of the nations, they will have their own type of policies which will be suited for various requirements of the people.

So, National Water Resource Policies say play a major role in the implementation of either water shed schemes or water development schemes and then also related to agricultural aspects. So, that way, National Water Resource Policy sets goals and objectives for management of water resource at national scale and this policies include, say whatever to be covered specific regions, say like where drought prone area or humid regions or like that as per the requirement.

Then catchments, then shared or trans-boundary water resources within integrated water resource management framework, and then, Inter-basin transfers. So, you can see that say for example, major rivers are concerned. These rivers will be passing through one state to another state. So, as for example, India is concerned, water is a state subject. So, that way, we have to see the government of India or the central government has to should have appropriate policies or they have to set certain norms and regulations so that water sharing is taking place between states or even when the river is passing from one country to another country. Say for example, river Ganges from, it goes from India to Bangladesh.

So, we have to see that there are no conflicts between the countries or between the states, and then, the water should be shared in a very environmentally friendly way and then also in an appropriate way. So, that way, the, either the Trans boundary water resource or inter basin transfers, all these aspects we have to consider when we frame the national water resource policies.

So, a national policy may include following themes like what will be the jurisdiction and delegation. So, what will be the role of, say federal government or central government; then what will be the roles of the state governments or district level to the panchayat level or grass wood level.

Then the extent to which water management is decentralized or consolidated. So, whether we have to deal the water as a resource in a centralized way or decentralized way, and then what is the, up to what level we have to decentralized, and then, the use of economic incentives, say for example, to include, to implement various watershed development schemes, say Government of India or the central government may have to give various incentives to the states or to the district level or to the watershed level. So, that we have to see the economic incentives what can be given.

Then capacity building to meet institutional challenges, so, that is also important. So, the, how we can develop the capacity of the stake holders and then how the various committees can be formed and then how they can come together for to meet the institutional challenges, and then, monitoring and control to reduce ecosystem degradation. So, once various projects are implemented or for the given system, we have to we should have appropriate monitoring system. So that, say make sure that there is no ecosystem degradation takes place, but we have to improve the system, and so, monitoring, constant monitoring and controlling is essential.

These are some of the important themes which should be included in any of the national water policy when we consider water as a resource, and then, within the perspective of integrated water resource development and management.

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**WATERSHED MANAGEMENT**

## Integrated Water Policy

Major points for effective integrated policy making are:

- Clarified roles & goals of government and stakeholders
- Government- as regulator, as organiser of the participatory process and as a last resort adjudicator in cases of conflict
- Identification of key water resources issues
- Water is a social and economic good means designing policies to allocate resources
- Make explicit in the policy the links between land use and other economic activities
- Take into account trade-offs between short term costs and long term gains.

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So, that way, when we deal with the water, we have to see the policy as integrated water policy. So, we have to see various aspects of the development of the water resource, and then, it sharing and then looking after so that there is no degradation taking place to the ecosystem.

So, some of the important points to be considered for effective integrated policy making are - we have to clarify the roles and goals of government and stake holders. So, central government or state governments, so what will be their roles, how to say play their each ministries or each department roles, and then, how each department should collaborate with stake holders, and then, the second important point is government as regulator and then as organizer of the participatory process.

So, say we have to consider the needs of the people and then how it can be particular schemes can be implemented, and as a last resort adjudicator in case of conflict, say for example, if a conflict takes place from one state to another state, when a river passes from one state to another state, say for example, between Tamil Nadu Kerala or Karnataka-Tamil Nadu for Cauvery issues, so then, the government of India or the central government should have a policy how to deal with that kind of conflicts.

Then, identification of key water resource issues: so, the government policy should specifically say how to deal with the drought area or the how to deal with the flooding. All those things there should be appropriate policies related to water.

Then, water is a social and economic good. So, we have to see that it is water is not only as a social good as people needs all the ecosystem people everybody needs water. So, it is a social good, but it is also an economic good since we have to invest lot of money to develop appropriate system. So, that way, we have to see, we have to develop appropriate policies or we have to design policies to allocate resources in an effective way so that by considering water social and economic good. Then make explicit in the policy, the links between land use and other economic activities. So, that is also essential when we deal with the development of water policies.

Then take into account tradeoffs between short term costs and then long term gains. So, for example, when we are going to develop a dam or when we construct a dam, so, it is a say the say 500 crores or 1000 crores of rupees to be spent. It is a short term costs but the gains will be long term.

So, we should appropriate policies to look after, say what will be the tradeoff between the short term costs and then long term gains, and then also we have to see the environmental impact of various schemes. So, that way, when we develop a water policy, we have to develop by considering all these aspects in an integrated way.

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The slide is titled "WATERSHED MANAGEMENT" and "Water Rights". It features a small video inset of Prof. T I Eldho in the top right corner. The main content is a list of bullet points under the heading "Right to use water". The slide also includes the NPTEL logo in the bottom left and the professor's name and affiliation in the bottom center.

- **Right to use water**
  - Good water law must be flexible enough to permit reform in response to technological change and socio-economic need
  - The **tenets of effective and beneficial use** are:
    - ✓ Water must not to be obtained for speculation or let run to waste
    - ✓ The end use must be a socially acceptable use
    - ✓ Water is not to be misused
    - ✓ The use must be reasonable as compared with other uses

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So, now, let us look into while developing the water policy, we have to see the water rights. So, what are the rights of the individuals or the people or the states or as the federal government, so, what are the rights or say one catchment to another catchment what will be the rights. So, all those things we have to define appropriately.

So, say first aspect is right to use water and good water law must be flexible enough to permit reform in response to technological change and a socio economic need. So, that is very important. We have to see what kind of say technological development takes place accordingly various aspects should be changed, and then socio-economical needs should be the most important aspect in the development of this type of policies.

The tenets of effective and beneficial use are water must not be obtained for speculation or let run to waste. So, available water should be used in a very effective way. So, water should not be wasted and then should not be put for speculation between various agencies, and the end use must be a socially acceptable use. So, whatever use, it is going to put water is to put. So, that way, we have to see it is a social acceptable use.

Then water is not to be misused. So, say for example, like a some farmers so much of groundwater so that others will not get and then they may try to sell. So, that kind of misuse should not takes place.

And the use must be reasonable as compared with other uses. So, if for agriculture purpose or any other purpose, so the use of the water for by the individual or stake holder should be in a reasonable way. So, these are some of the important aspects. When we have to develop a water shed water policy, the various rights what is to be considered.

So, now, let us look further aspects, further characteristics and other things which you have we considered when we develop legislation for water or water quality.

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The slide is titled "WATERSHED MANAGEMENT" at the top. Below that, the main heading is "Legislation for water quality". Under this heading, there is a section titled "Characteristics" which lists several bullet points. The first bullet point states that measures to protect water quality must be encoded in legislation, which can be preventive or corrective. The second bullet point describes preventive measures, including effluent and discharge regulations, technical standards, and requirements for treating polluted effluents, along with economic instruments and quality standards for receiving waters. The third bullet point notes that legislation sets out the principles for pollution control. The fourth bullet point describes corrective measures, such as cease and desist orders, compensation for damage and economic losses, and abatement and remediation requirements. The fifth bullet point states that the polluter pays principle allocates responsibility for damage costs. In the bottom left corner, there is the NPTEL logo. In the bottom center, it says "Prof. T I Eldho, Department of Civil Engineering, IIT Bombay". In the bottom right corner, the number "10" is displayed.

So, some of the important characteristics to be considered are - the measures to protect the quality of water resources; so, that aspect should be there in the legislation. So, this can be preventive or in a corrective way. So, preventive measures include effluent and discharge regulations say as far as water quality is concerned. Then technical standards and requirements for treating polluted effluents, economic instruments as well as quality standards for receiving waters.

Then the legislations sets out the principles upon which pollution control is based, and then, if you consider corrective measures, that may include cease and desist orders, then compensation for damage and economic losses, and then, abatement and remediation requirements. So, even if pollution takes place, that should be reduced and then we have to see that the polluted thing should be remediated.

So, most of the time when we put such laws, say it should be in such a way that the polluter pays principle should be put so that the polluter should have a responsibility to pay for the damages cost or to remediate what has created. So, especially water quality issues are concerned, the legislation what should be formed by the governments should have all these characteristics like a either preventive way or corrective way or there should be preventive measures and corrective measures and then most of the time the best policy will be polluter pays principle should be applied as far as the legislation for water quality is concerned.

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**WATERSHED MANAGEMENT**

Reform of existing legislation for strong IWRM frame work

- Enabling institutional framework, including the legal roles and responsibilities of institutions and their inter-relationship
- Mechanisms for stakeholders to participate in water resources management
- Conflict resolution mechanisms
- Provision of water for basic human needs, and standards of service
- Tariff and water pricing systems
- Clear mechanisms for transfer of water rights to minimise conflicts and risk of social unrest

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Enabling institutional framework including the legal roles and responsibilities of institutions and their inter-relationship. So, that aspect we have to see, and then, mechanisms for stake holders to say participate in water resource management, then conflict resolution mechanisms, then provision of water for basic human needs and standards of service, then tariff and water pricing systems, then clear mechanism for transfer of water rights to minimize conflicts and risk of social unrest.

So, say we can see that say already in say most of the countries, there are number of legislation as far as water is concerned so called water legislation either say water quantity concerned or quality is concerned.

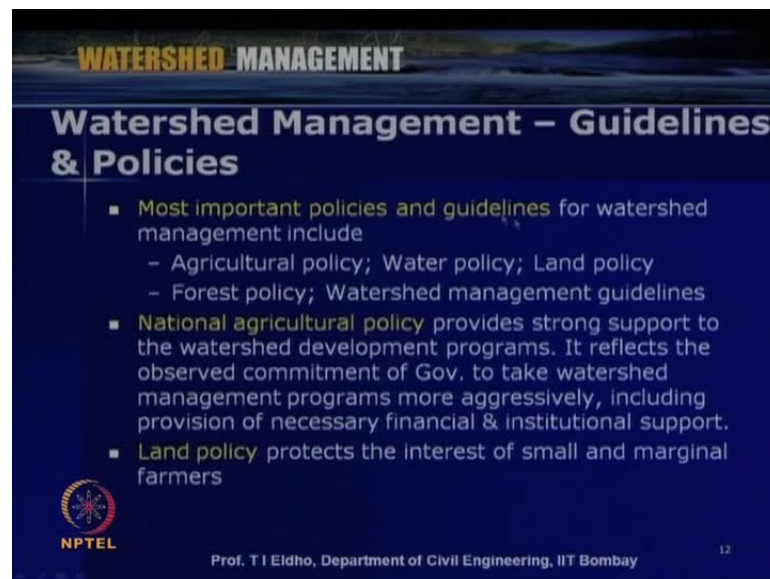


So, within the framework, when we are discussing about integrated water resource management by considering all the socio-economical aspects of the people within the watershed or within the area. So then, say we have to see that we have to modify or we have to reform the existing legislation.

So that now the emphasis should be enable institution framework, say if it is not existing within the water legislation, and then, say we have to see that the mechanisms for stake holders to participate in various water related issues or water resource development and management. So, that is the now the trend now a days.

And then if any conflicts take place between the states or between the catchments or between the stake holders, then there should be some mechanist to sort out this kinds of conflicts, and then also as water is an economic good, we have to see that say appropriate tariff and water pricing are implemented. So, all these aspects we have to see as far as reforms for existing legislation or when we go for new legislation also.

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The slide is titled "Watershed Management – Guidelines & Policies" and is part of a presentation on "Watershed Management". It lists three key points:

- Most important policies and guidelines for watershed management include
  - Agricultural policy; Water policy; Land policy
  - Forest policy; Watershed management guidelines
- National agricultural policy provides strong support to the watershed development programs. It reflects the observed commitment of Gov. to take watershed management programs more aggressively, including provision of necessary financial & institutional support.
- Land policy protects the interest of small and marginal farmers

The slide also features the NPTEL logo in the bottom left corner and the text "Prof. T I Eldho, Department of Civil Engineering, IIT Bombay" in the bottom right corner, along with the number "12".

So, some of the guidelines and policies while making the water legislation listed here. So, most important policy and guidelines for watershed management include – so, as water say watershed is concerned, we have to see various resource, land, then water, then agricultural or forest management all these aspects we have to consider.

So, that way, so it is the watershed management policies should include first of all agricultural policy. Then agricultural policy means there should be a national agricultural policy which provides strong support to the watershed development programs and it should reflect the observed commitments of government to take watershed management programs more aggressively including provision of necessary financial and institutional support. So, this should be very essential within the framework of IWRM or Integrated Water Resource Management. So, that way, the appropriate framework should be set for agricultural policy.

Then second one is water policy which we have already discussed in the last few slide. So, we should appropriate water policies by considering the quantity issues, quality issues, conflict resolution or the appropriate sharing. So, water policy should be appropriately should be done, and then, land policy – so, land policy generally protects the interest of small and marginal farmers.

So, you can see that in many countries, most of time the land policy is always favoring the rich farmers or the farmers who have got so much of land, and small farmers or marginal farmers are always marginalized in many way, so but we have to say for overall development, social upliftment socio-economical development, we have to see that the interest of small and marginal farmers, we have to consider, and that way, one important aspect to be considered is land policy.

And then forest policy. Forest policy means we have to see that the existing forest is not degraded and further afforestation should takes place and a minimum area should be kept for forest development and management as the forest development may influence overall development and management for the area.

Then of course watershed management guidelines, so which way to manage various resources within the watershed, and then, how to say collaborate between the stake holders or how to take the help of the community as far as watershed. So, all these issues we have to consider when we develop guidelines and policies for watershed management.

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**WATERSHED MANAGEMENT**

### WM - Guidelines & Policies

- **Water policy** identifies water management as one of the most crucial elements in development planning of country.
- **Water policy** states that the watershed management through soil erosion, catchment area treatment, preservation of forests and increasing forest cover & construction of check dams should be promoted.
- **Environmental laws** often dictate the planning and actions that agencies take to manage watersheds.
- **Some laws require** that planning be done, others can be used to make a plan legally enforceable & others set out the ground rules for what can & cannot be done in development & planning.
- **Most countries & states** have their own laws regarding watershed management.

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As I mentioned already, water policy identifies water management as one of the most crucial developments in development planning of a country. Water policy states that watershed management through soil erosion, catchment area, treatment preservation of forests and increasing forest cover and construction of check dams should be promoted.

So, within the watershed policy, there should be say policy or guidelines for watershed development, prevention of soil erosion, then catchment area treatments and then development of various rain water harvesting schemes, etcetera, and then also say environmental issues are very important. So, environment laws should be framed within the watershed management guidelines and policies itself.

So, environmental laws often dictate the planning and actions that agencies take to manage the watershed. Then some laws are required that planning to be done. Others can be used to make a plan legally enforceable and others set out the ground rules for what can and cannot be done in development and planning.

So, there should be certain rules and regulations or policy guidelines so that what can be done and what cannot be done. So, all these things should be appropriately defined when we develop guidelines and policies for watershed management. So, otherwise, there will be always problems or conflicts between the stakeholders or between one watershed to

another watershed or one say the upstream river basin holders to the downstream river basin holders.

So, in most of the countries and states, say they have developed their own rules and regulations or laws regarding watershed management. So, government of India also has made appropriate rules and regulations and then this has come under the umbrella of national water policy which we will be discussing say after few slides.

So, now, say as far as the policies and guidelines are concerned, the financial aspect is plays a major role and then appropriate investment plans or investment policies also should be say made as far as watershed management plans are concerned.

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**WATERSHED MANAGEMENT**

### Financing & Investment Policies

- Gov. have a responsibility for investment policies that affect the water sector.
- Macroeconomic policies: Trade policies affect the pace and type of development in the water sector
- Tax incentives might result in the growth of water-intensive industries
- Public investment: Investment in many sectors may affect demand for water, such as housing, new town & industry development, transport, power & energy, agriculture & tourism
- Public & private investment in the water sector itself: Water sector needs potentially very large financial needs for irrigation, water supply, waste water treatment, flood and environmental protection

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So, government have a responsibility for investment policies that affect the water sector. So, it can be either as a development of dams or development of wells or various watershed development schemes, then macroeconomic policies like trade policies affect the pace and type of development in the water sector.

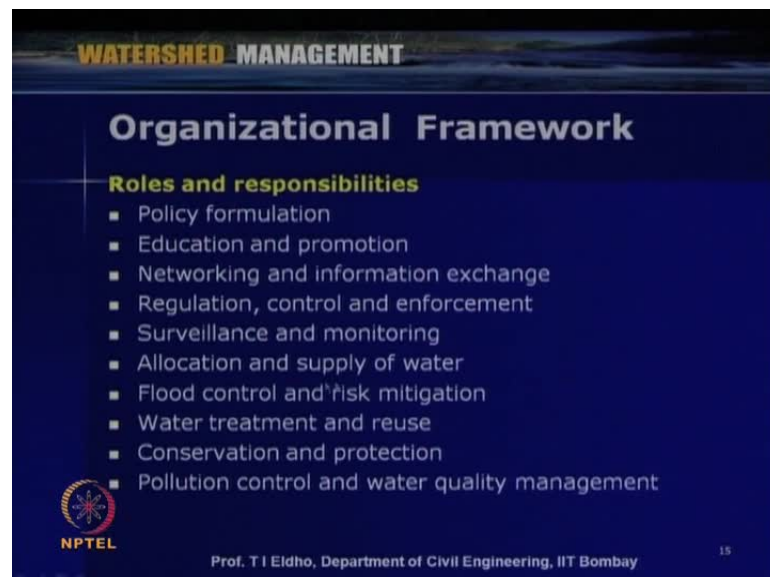
So, government has to see appropriate macroeconomic policies are developed, and then, tax incentives might result in the growth of water-intensive industries. So, industries are concerned, say if availability of water free water or tax incentives if the appropriate waters development schemes is done. So, that way, industries may come forward to implement those schemes.

Then public investment – so, how the various schemes can attract public investment like investment many sectors may affect demand for water such as housing, new town, industry development, transport, power and energy, agriculture and tourism. So, that way we have to see.

Then public and private investment in the water sector itself – so, water sector needs potentially very large financial needs for irrigation, water supply, waste water treatments, flood and environment protection. So, as government cannot spend all the money or all investment cannot be done alone.

So, government has to see public private partnership takes place. So, p p p, - public private partnership – so, that is needed in the water sector also whether for the development of new reservoirs or dams or the watershed development schemes or water transfer from one basin to another basin. So, that way, public private partnership and then private investment government should welcome in an appropriate way so that sufficient investment can be done in the water sector.

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**WATERSHED MANAGEMENT**

## Organizational Framework

**Roles and responsibilities**

- Policy formulation
- Education and promotion
- Networking and information exchange
- Regulation, control and enforcement
- Surveillance and monitoring
- Allocation and supply of water
- Flood control and risk mitigation
- Water treatment and reuse
- Conservation and protection
- Pollution control and water quality management

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So, when we discuss all these water policies or guidelines and then within the organization framework, we have to see what are the important roles and responsibilities. So, here some of the important points are listed - so, like first we have to develop a policy; so, policy formulation is important.

So, the policy formulation can be either through ministries like water resource ministry or agricultural ministry for the center or state. Then education and promotion – so, whatever schemes have been developed, the government has to see that all the stake holders know about that and should be promoted.

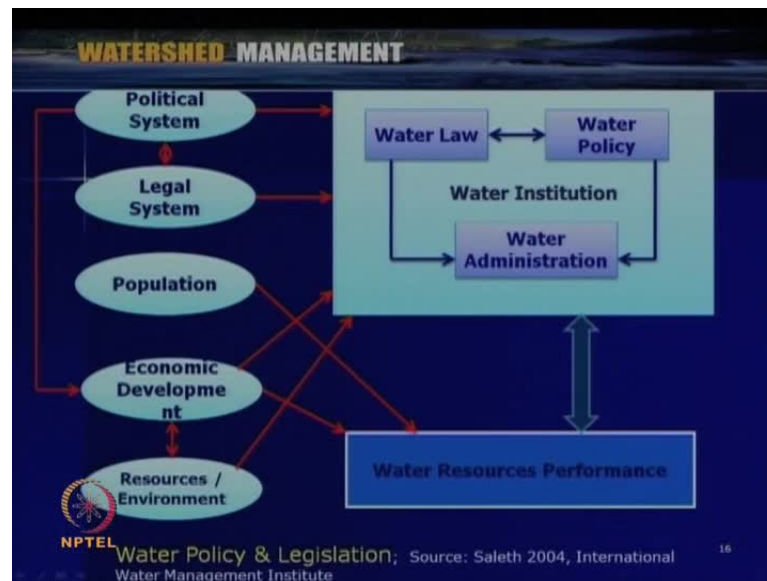
Then networking and information exchange – so, between the watersheds, so from people to people that should takes place. Then regulation control and enforcement – so, appropriate rules and regulations should be put, and then, control measures should be developed and then surveillance and monitoring – so, say as far as watershed development schemes say whether any deterioration is taking place, all the developments are in a positive way. So, that way, we have to see the appropriate monitoring to be done.

Then allocation and supply of water – so, once scheme is developed, we have to see that it is appropriately allocated for various needs, and so that the stake holders equity will be there between the stake holders. Then flood control and risk mitigation – so, many areas say there will be flood problem, and some other areas, there may be drought problem. So, in all these say the framework should be there to deal with, say wherever flood problems are there, how to deal with that flood control.

So, some of the measures some of the projects may be for flood control, and some schemes may be for drought mitigation. So, that way, we have to see the risk associated with either drought or floods. Then water treatment and reuse – so, as water as a resource, say when people use, it become say polluted. So, that way, appropriate treatment should be given and then reuse; we have to always encourage. So that water recycling and reuse also play major role so that sufficient water is available locally in the area itself.

Then conservation and protection – so, water conservation projects or water resource protection should be we have to emphasize on this. Then pollution control and water quality management – so, we can see that due to the industrial revolution for last few decades including ground water most of the resources have been polluted. So, we have to see that appropriate measures or pollution control and water quality management, framework, appropriate policies are made and this legislation are carried out so that appropriate level all these aspects can be done within the integrated water resource management framework.

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So, here, this flowchart, so here I have put a when we develop water policy and legislation, so there should be say we have to consider various aspects which will be coming say like a the environment or the resources, then economic development, then population, and so appropriate policies or legal framework should be made. So that the political system, say existing within the country, they have to deal with the economic development or the legal framework.

So, they have to make appropriate water laws and water policies. So, say on a watershed scale basis appropriate water institution should be formed and then appropriate way the water administration can be carried out.

So, finally, there should be better performance as far as water resource is concerned. So that the socio-economic development or upliftment should takes place and sufficient quantity of water should be available; water quality should be good and there should not be any pollution for the existing resources.

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The slide is titled "WATERSHED MANAGEMENT" at the top. Below that, the main heading is "Water Legislations in India". The content is organized into a bulleted list:

- **Water in Indian constitution**
  - "Water" in entry 56 of union list and entry 17 of state list.
  - Article 246 & Art 262, empowers parliament to make law regarding development and management of inter-state rivers.
  - " Art 262, specifies that parliament may by law provide that neither the supreme court or any other court shall exercise jurisdiction with respect of inter-state river disputes , .....Interpretation
    - Tribunals set up under inter-state River Dispute Act -1956, though can announce award , but it can not be 1) liable to follow for parties , 2) can not be adjudicated to any court

At the bottom left, there is a logo for "RIIAPTEL" and "Government of India". At the bottom right, the text reads "www.wrmin.nic.in" and "Prof. T I Eldho, Department of CIVIL Engineering, IIT Bombay". A small number "17" is visible in the bottom right corner.

So, that way, appropriate water policy and legislation should be carried out. So, now, whatever, we have, we have discussed is forming the appropriate guidelines or policies as far as water legislation is concerned within the framework of integrated water resource management.

So now, let us look some of the water legislation as a typical example. Let us consider India. So, India is concerned, number of water legislations are there have been made in the last few decades. So, here, water in Indian constitution, water in a entry of 56 of union list and entry 17 of state list water is a major theme. Article 246 and Article 262 empowers parliament to make law regarding development and management of say interstate rivers.

So, as I mentioned earlier, water is a state subject but central government has a advisory role, and then, wherever conflicts takes place, government of India can interfere in a positive way. So, article 262 specifies that parliament may by law provide that neither the Supreme Court nor any other court shall exercise jurisdiction with respect of interstate river disputes.

So, generally, when this kinds of dispute comes, government of India forms appropriate tribunals and this tribunals have the full power to take appropriate action by considering



the view points of the various states or various parties, so that, and most of this the ruling by this tribunals cannot be questioned in courts.

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Component of water regulation	Applicable regulatory framework
Ownership of Water	Government of India Act: The Easement Act 1882- private right to groundwater since it is viewed as an attachment to
Drawl of water	State subject : few states has enacted and implemented water resource legislation
Usage of water	Government of India Act: Water (Prevention and Control of Pollution) Cess Act, 1977, 1990 and 2003 and rules thereof for providing for the collection of cess on water consumed on bulk
Wastewater Disposal	Government of India Act : Water (Prevention and Control of Pollution )Act , 1974 and 1998 , and rules thereof which provide norms for wastewater disposal and prevention and control of water pollution.

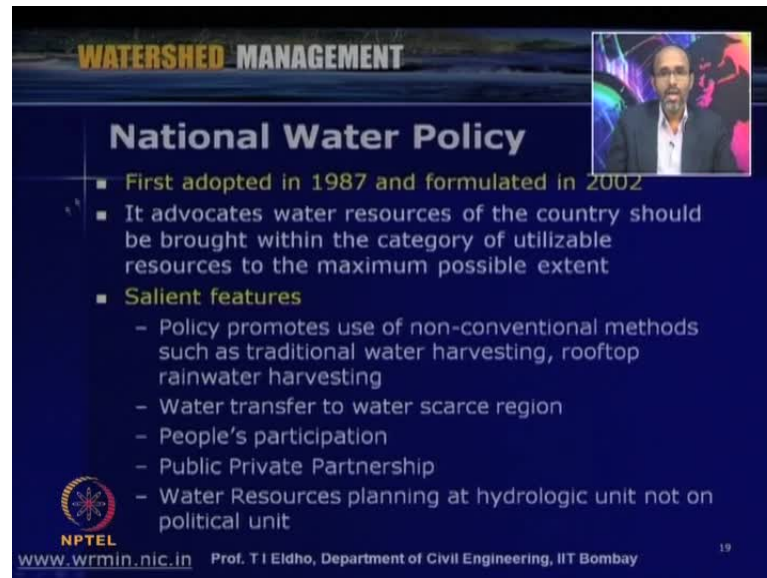
So, that way, this water tribunals play major role whenever conflicts arises. So then, say various legislations in India is concerned, there are legislation for ownership of water; then withdrawal of water; then usage of water or in then water quality issues are concerned or waste water disposal is also concerned.

So, in constitution of India, surface water and ground water is not defined separately but water as a single resource is concerned considered. So, ownership of water, say for example, even in 19th century itself, the easement act 1882 says about the ownership of water, and then, withdrawal of water is concerned, it is actually state subject but as per the framework put by the parliament, some of the states have enacted and implemented water resource legislation.

Then usage is concerned, government of India act like water prevention and control of pollution the various acts in 77 1990 2003 rules. Thereof for providing for the collection of Cess on water consumed on bulk, Bulk water tariff schemes some guidelines are already given, and then, waste water disposal or water quality is concerned also government of India act water prevention and control pollution act of 1974 1998 define various norms as far as how to deal with waste water and then how to keep the water

quality, and then, what way to deal with various say cases of water pollution by industries or by any other agencies. So, that way, well framed rules and regulations are available in India as so called water legislations.

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**WATERSHED MANAGEMENT**

### National Water Policy

- First adopted in 1987 and formulated in 2002
- It advocates water resources of the country should be brought within the category of utilizable resources to the maximum possible extent
- Salient features
  - Policy promotes use of non-conventional methods such as traditional water harvesting, rooftop rainwater harvesting
  - Water transfer to water scarce region
  - People's participation
  - Public Private Partnership
  - Water Resources planning at hydrologic unit not on political unit

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So then, as I mentioned, say by considering the various aspects, a national water policy has been framed in India and first adopted in 1987 and then further formulated in 2002. So, national water policy is important by considering the various issues, say on a river basin scale or watershed scale or by considering the various needs like agricultural uses or the domestic uses or industrial use.

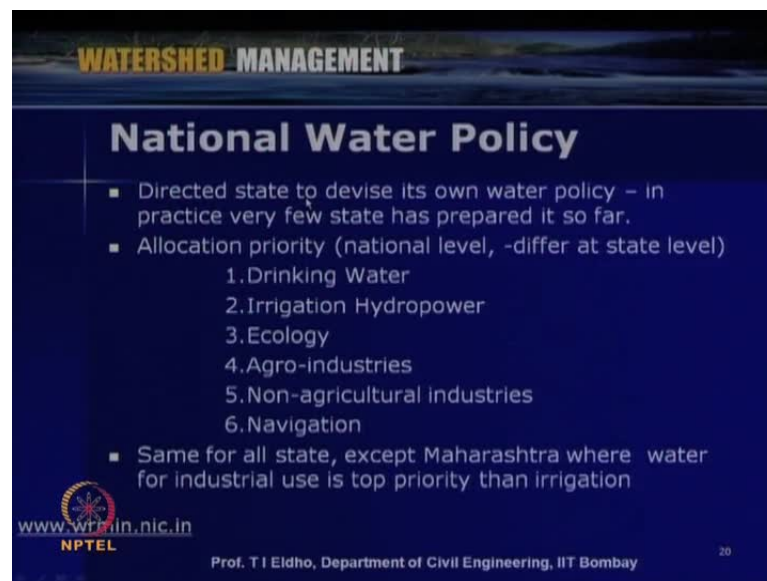
So, this national water policy advocates water resource of the country should be brought within the category of utilizable resource to the maximum possible extent. So, some of the salient features of this national water policy of government of India include: policy promotes use of non-conventional methods such as traditional water harvesting, rooftop rainwater harvesting, etcetera.

Then water transfers to water scarce region through inter basin transfer or other means. Then the national water policy encourages people participation in all the schemes. Then public private partnership is always encouraged; then water resource planning at hydrologic unit not on political unit. So, water is concerned, as a resource should be

developed and planned and managed not on a state or district level but watersheds bill level or river basin level.

So, all this national water policy can be obtained in a triple w wrmin dot nic dot in the ministry of water resource website. So then, further this national water policy directs states to devise its own water policy.

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**WATERSHED MANAGEMENT**

## National Water Policy

- Directed state to devise its own water policy – in practice very few state has prepared it so far.
- Allocation priority (national level, -differ at state level)
  1. Drinking Water
  2. Irrigation Hydropower
  3. Ecology
  4. Agro-industries
  5. Non-agricultural industries
  6. Navigation
- Same for all state, except Maharashtra where water for industrial use is top priority than irrigation

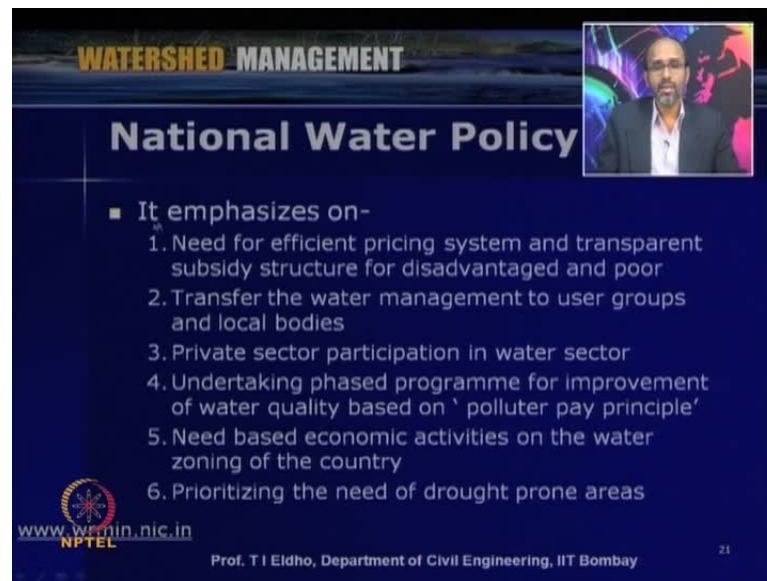
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So, national water policy, the frameworks are given and based upon that each state can formulate its own policy so that can be practiced in an effective way. So, as far as water allocation is concerned, say national water policy say give the allocation priorities like first should be for drinking water; second should be for irrigation hydropower; then third should be for ecological, and fourth for agro-industries; then fifth for non-agricultural industries and sixth for navigation.

So, most of the states this based upon national water policy, they have the states have made their own policies and most of the time this priorities are kept on the same way. Other with few exceptions like state of Maharashtra.

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**WATERSHED MANAGEMENT**

## National Water Policy

- It emphasizes on-
  1. Need for efficient pricing system and transparent subsidy structure for disadvantaged and poor
  2. Transfer the water management to user groups and local bodies
  3. Private sector participation in water sector
  4. Undertaking phased programme for improvement of water quality based on 'polluter pay principle'
  5. Need based economic activities on the water zoning of the country
  6. Prioritizing the need of drought prone areas

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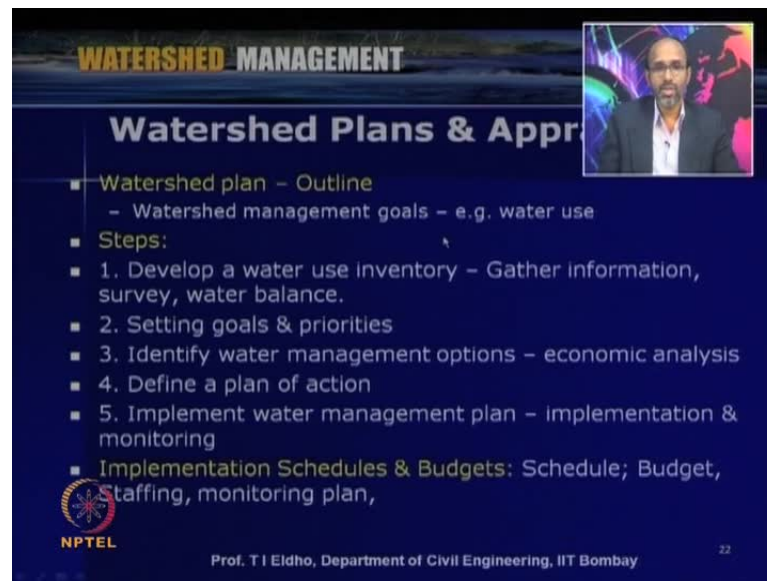
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Then some of the major emphasize on this water national water policies include the need for efficient pricing system and transparent subsidy structure for disadvantaged and poor. So, even though water is a socio-economic socio good, it is also an economical good. So, appropriate pricing should be there, but of course, we have to see sufficient water is available to the disadvantaged and poor people.

Then transfer the water management to user groups and local bodies; then private sector participation in water sector; then undertaking a phased program for improvement of water quality based on polluter pay principle. As I already mentioned, this is one of the important principle which is adopted polluter should pay for the remediation or to recovery.

Then need based economic activities on the water zoning of the country; then prioritizing the need of drought prone areas. So, all those issues, sufficient emphasize is given, and that way, this is a good document say government of India national water policy and many of the states have made their own state policy also.

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The slide is titled "Watershed Management" and "Watershed Plans & Appraisal". It features a video inset of Prof. T I Eldho in the top right corner. The main content is a bulleted list:

- **Watershed plan – Outline**
  - Watershed management goals – e.g. water use
- **Steps:**
  1. Develop a water use inventory – Gather information, survey, water balance.
  2. Setting goals & priorities
  3. Identify water management options – economic analysis
  4. Define a plan of action
  5. Implement water management plan – implementation & monitoring
- **Implementation Schedules & Budgets:** Schedule; Budget, Staffing, monitoring plan,

The slide also includes the NPTEL logo and the text "Prof. T I Eldho, Department of Civil Engineering, IIT Bombay" at the bottom.

So then, now, let us come back to say once the say coming back to watershed management and plans, so we have to formulate appropriate watershed plans and then we have to put it in a appropriate format, and then, while implementing, we have apprise various project schemes in an appropriate way. So, that way, here, let us discuss few of the important steps to consider watershed plans and appraisal.

So, for example, when we consider water as a resource within the watershed, some of the important steps to consider when we go for watershed plans and appraisal include. Develop a water use inventory. So, there we have to gather the all the information from the people; so, through surveys recognizing survey, then available water sources like a ponds lakes, then river system or the wells.

Then water balance study - we have to carry out how much water is the needed for the people or for the eco system and how much is excess or how much is the deficit. Then setting goals and priorities – so, we have to set. Say for the future, what should be the goals or what should be the project to be implemented and what are the priorities that all should be set.

Then identify water management option – so, appropriate alternatives can be formed and then economic analysis can be carried out and define a plan of action. Then implement

water management plan implementation and monitoring; then implementation schedules and budgets.

So, we have to see that appropriate schedule is made; then budget provisions are obtained, and then, appropriate committees or staffs are available, and then we have to also should have monitoring plan. So, when we consider in a holistic way the various watershed management plans and appraisals.

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**WATERSHED MANAGEMENT**

### Watershed Plan Implementation

- **Classifying critical watersheds** to establish priorities for conservation and management strategies.
- **Identifying critical threats**, such as surface & groundwater pollution, to a watershed's integrity in order to protect its resources and value to society.
- **Making watershed management recommendations** to ensure sustainable, clean water flow & maintenance of aquatic resources.
- **Identifying system-wide** controlling processes & mechanisms to distinguish environmental indicators for ecosystem health evaluation.
- **Recommending land-use impact mitigation**, habitat restoration programs, & other remediation techniques in watershed disputes.

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So then, now, we let us see some of the implementation issues as far as watershed plans are concerned. So, classifying critical watersheds here, say we can classify and then we can establish priorities for conservation and management strategies. Then we can identify critical threats, say for example, if it is as far as forest is concerned or surface water is concerned or ground water is concerned, the quantity or quality or pollution issues. Then making watershed management recommendations to ensure sustainability; then clean water availability, and identifying system wide controlling processes and mechanisms to distinguish environmental indicators. Then recommending land use impact mitigation habitat restoration programs, etcetera.

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**WATERSHED MANAGEMENT**

### Implementation Issues

- Analyzing socio-economic value of watersheds & their environmental services for policy development & management planning.
- Ensuring technical assistance in the design and installation of management measures
- Providing training and follow-up support to landowners and other responsible parties in operation & maintenance.
- Managing the funding mechanisms and tracking expenditures for each action and for the project as a whole
- Conducting the land treatment and water quality monitoring activities and interpreting and reporting the data
- Measuring progress against schedules and milestones
- Communicating status and results to stakeholders and public

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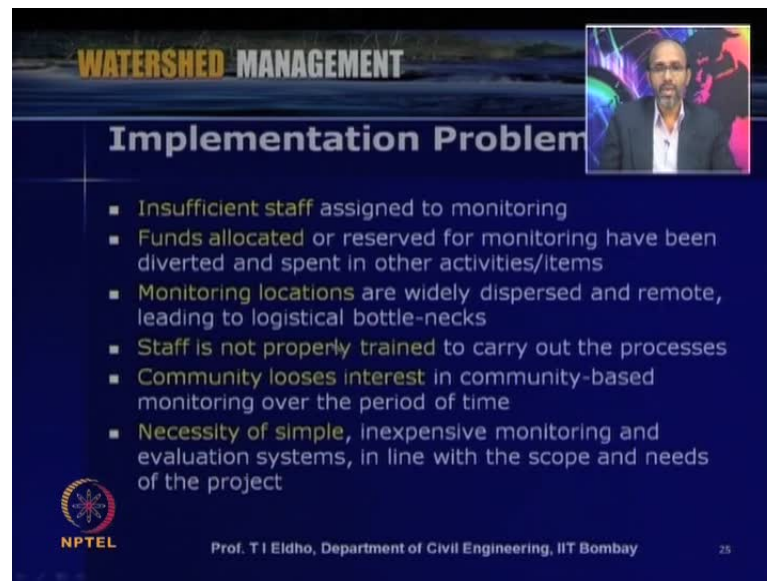
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So, these are some of the aspects. When we go for watershed management plans and implementation, these are some of the issues which we have to consider. Then some of the importantly implement issues include we have to analyze socio economic and economic value of the various schemes; then we have to ensure technical assistance in the design and installation of management measures; then we have to provide training and follow up support to stake holders.

Then we have to managing the funding mechanisms and we have to track the expenditures; then we have to conduct the land treatment and water quality monitoring activities.

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The slide features a dark blue background with a landscape image at the top. The title 'WATERSHED MANAGEMENT' is in yellow and white, and 'Implementation Problem' is in white. A small video inset shows a man speaking. The main content is a bulleted list of seven implementation problems. The NPTEL logo is in the bottom left, and the speaker's name and affiliation are at the bottom center. A small number '25' is in the bottom right corner.

- Insufficient staff assigned to monitoring
- Funds allocated or reserved for monitoring have been diverted and spent in other activities/items
- Monitoring locations are widely dispersed and remote, leading to logistical bottle-necks
- Staff is not properly trained to carry out the processes
- Community loses interest in community-based monitoring over the period of time
- Necessity of simple, inexpensive monitoring and evaluation systems, in line with the scope and needs of the project

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Then various measures and schedules and milestone we can make for the implementation of the plans and we can see that these are all met. Then we can communicate all these aspects from between the stakeholders and then funding agencies or the various government agencies.

So, some of the implementations problems here I have listed like when we implement watershed management plans, so, what are the implementation problems like say insufficient staff assigned to monitoring. So, most of the time, due to lack of funds sufficient staff will not be there, and funds allocated may be diverted for other purposes. Then monitoring locations are widely dispersed and remote leading to logistical bottle necks.

So, mainly when we deal with river basins or watershed large area we have to deal. So, that way, monitoring locations will be far away. So, it is always a problem. Then staff is not properly trained. So, local people are if they are not properly trained to carry out appropriate work in an appropriate way, then always problem. Then community loses interest so that there is no community participation.

Then, so, all the schemes should be simple, there should not be any complexities, and then, in a very efficient way, distribution inexpensive monitoring should be are required.



Then appropriate evaluation system should be formulated. So, these are some of the problems when we deal with a watershed management plans appraisal and implementations are concerned.

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**WATERSHED MANAGEMENT**

Case Study: Co-Management of Electricity & Groundwater : Gujarat's Jyotirgram Yojana

- **The policy Decision-** 1980 shift of tariff regime to flat tariff based on HP
- **Implications**
  - Very sharp Increase in electricity tube wells
  - Rampant corruption in terms of billing and meter reading
  - Flat based tariff system under subsidy regime has brought zero marginal cost of pumping, resulting –
    - Excessive withdrawal of groundwater by farmer
    - Selling of water to those who can not afford the infrastructure , resulting in development of informal groundwater market in state.

Shah, Sharma, 2007: [www.iwmi.cgiar.org](http://www.iwmi.cgiar.org)  
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So, now, before closing this lecture, let us look into the importance of development of appropriate policies and legislation as far as the either water management or energy management is concerned. So, let us consider a case study cooperative management of electricity and ground water. This case study is Gujarat Jyotirgram Yojana or Jyotirgram scheme.

So, actually, in 1980s, say the state governments made a regulation. There was a shift of tariff regime to flat tariff based on horse power or how much energy is used. So, for various uses like especially for irrigation purpose, people pump water from the ground water using from the bore wells.

So, there is a simple flat tariff has been implemented. So, some of the implications were very sharp increase in electricity to say while pumping water from tube wells. Rampant corruption in terms of building and meter reading. Then, flat based tariff system under subsidy regime.

Then, so, excessive withdrawals of ground water – so, groundwater level got down drastically. Then some of the rich farmers started to sell even water to the poor people, so, resulting in development of informal groundwater markets in the state.

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**WATERSHED MANAGEMENT**

### Case study: Situation in Gujarat

Returning to volumetric tariff system was not easy, since farmers lobby is very strong in state

- GEB suffered heavy loss due to power supply to agriculture consumer, resulting into gradual reduction in power supply.
- Farmers found alternative of using capacitor to cover single phase to 3 phase power, getting 18-20 hr of electricity.

This heavy theft of electricity has led to –

- Huge financial loss to utility
- Excessive withdrawal of groundwater- in north Gujarat, farmers have gone down to 1000 ft for drawing water
- Construction of groundwater well was expensive – require more than Rs 12 lakh to drill bore well

Practices such as cooperative bore well drilling, sharecropping and selling groundwater was exercised in the region

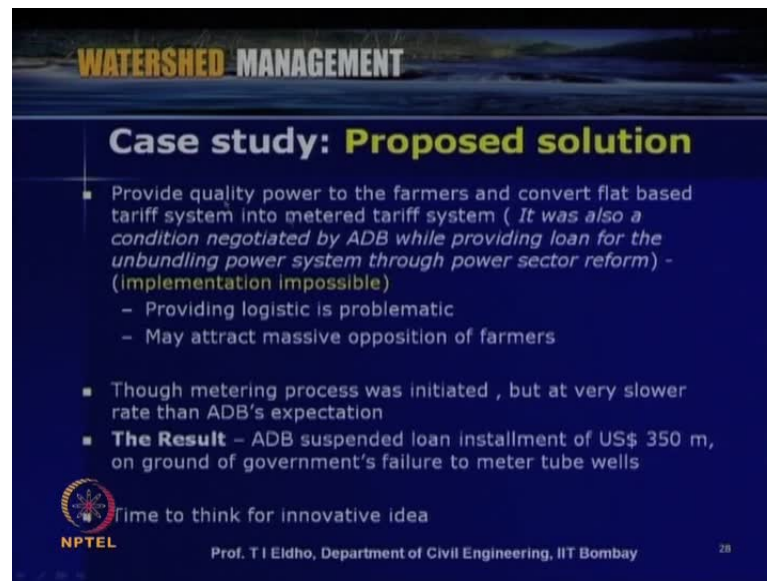
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Shah & Verma, 2007: [www.iwmi.cgiar.org](http://www.iwmi.cgiar.org)

So, say the situation say has been very difficult situation in 1980s and 90s. So, returning, so again once this problem were understood, we are going back to volumetric tariff system was not so easy since it was popular amongst the farmers, since farmers lobby was also is also very strong in the state.

So, Gujarat electricity boards suffered heavy loss due to power supply to agriculture consumers, so, resulting gradual reduction in power supply. So, farmers found alternatives of using capacitor to cover single phase to 3 phase power so that they can take more power, but flat only a small amount to be paid, so, getting 18-20 hours of electricity.

So, this heavy theft of electricity has led to huge financial loss to the utility and excessive withdrawal of groundwater. Then construction of groundwater wells. Many wells were come up and then practice such as cooperative bore well drilling all those were to taken place in 1980s and 1990s.


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**WATERSHED MANAGEMENT**

**Case study: Proposed solution**

- Provide quality power to the farmers and convert flat based tariff system into metered tariff system ( *It was also a condition negotiated by ADB while providing loan for the unbundling power system through power sector reform* ) - (Implementation impossible)
  - Providing logistic is problematic
  - May attract massive opposition of farmers
- Though metering process was initiated , but at very slower rate than ADB's expectation
- **The Result** - ADB suspended loan installment of US\$ 350 m, on ground of government's failure to meter tube wells

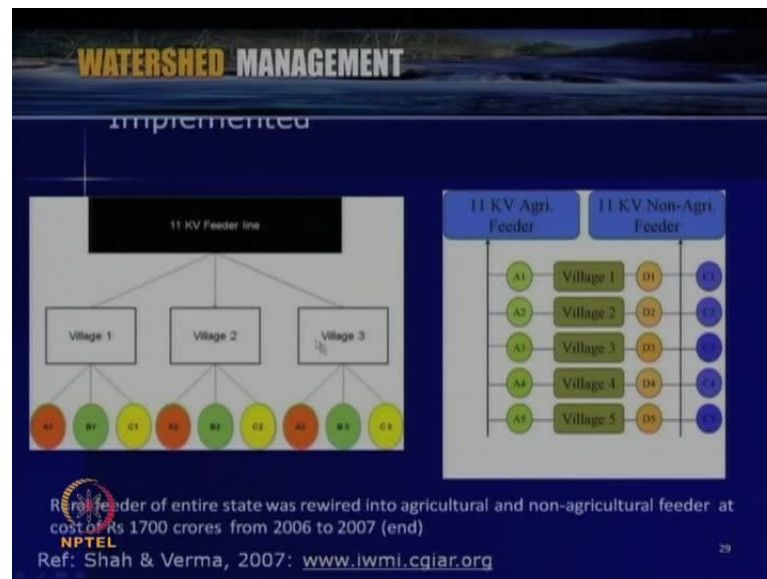
 Time to think for innovative idea

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Then say after studying all these things, a scheme was formulated called Jyotirgram Yojana or Jyotirgram scheme. So, the solution was provide quality power to the farmers and convert flat based tariff system into meter tariff system. So, this was also requirement of the funding agency so called Asian development bank. So, providing say logistic is always problematic to implement this scheme may attract massive opposition of farmers.

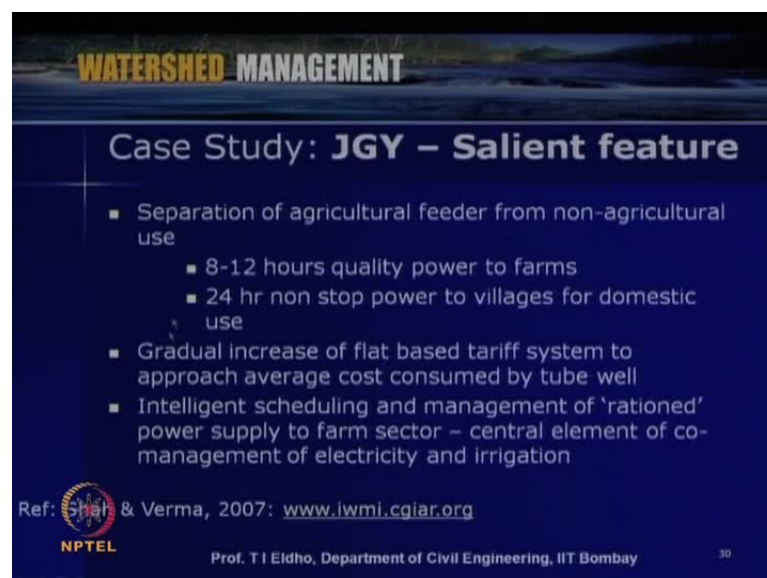
So, though metering process was initiated, but at very slower rate, then ADB's expectation. So, the result was ADB suspended or Asian development was suspended loan installment to the state government.

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So then, the scheme was implemented. Earlier a flat regime of supply to villages through single feeder line, but then a scheme was say separate say agricultural feeder and non-agricultural feeder has been implemented. Within the state rural feeder of entire state was rewired into agricultural and non-agricultural feeder at a cost of rupees 1700 crores from 2006 to 2007.

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So, that way, so the separation of agricultural feeder from non-agricultural use has been made. So, 8 to 12 hours of quality power to farms; 24 hour nonstop power to villages for

domestic use. Then gradual increase of a flat based tariff system approach average cost consumed by tube well. Then intelligent scheduling and management of rationed power supply to farm sector has been implemented. So, these details are available in this reference.

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**WATERSHED MANAGEMENT**

**Comparison Before and after JGY**

Ref: Shah & Verma, 2007: [www.iwmi.cgiar.org](http://www.iwmi.cgiar.org)

Before	After
<ul style="list-style-type: none"> <li>Tube wells get 12-13 hours of 3-phase power supply of variable voltage, with frequent tripping, at unknown times mostly during nights</li> </ul>	<ul style="list-style-type: none"> <li>Farmers get 8 hours/day of high voltage uninterrupted power at fixed schedules; night in one week, day-time the next</li> </ul>
<ul style="list-style-type: none"> <li>Flat tariff: Rs 350-500/hp/year</li> </ul>	<ul style="list-style-type: none"> <li>Flat tariff Rs 850/hp/year</li> </ul>
<ul style="list-style-type: none"> <li>Massive use of capacitors to convert 1 and 2 phase power to run tube wells</li> </ul>	<ul style="list-style-type: none"> <li>Capacitors out; Impossible</li> </ul>
<ul style="list-style-type: none"> <li>Non-farm users de-electrified because of capacitors</li> </ul>	<ul style="list-style-type: none"> <li>Non-farm users get 24-hour non-stop single phase power</li> </ul>
<ul style="list-style-type: none"> <li>Motor burn-out and rewinding the most important part of maintenance cost</li> </ul>	<ul style="list-style-type: none"> <li>Motor burn out at the minimum</li> </ul>
<ul style="list-style-type: none"> <li>Electricity connections not available.</li> </ul>	<ul style="list-style-type: none"> <li>New connections allowed at high costs; now rationed;</li> </ul>

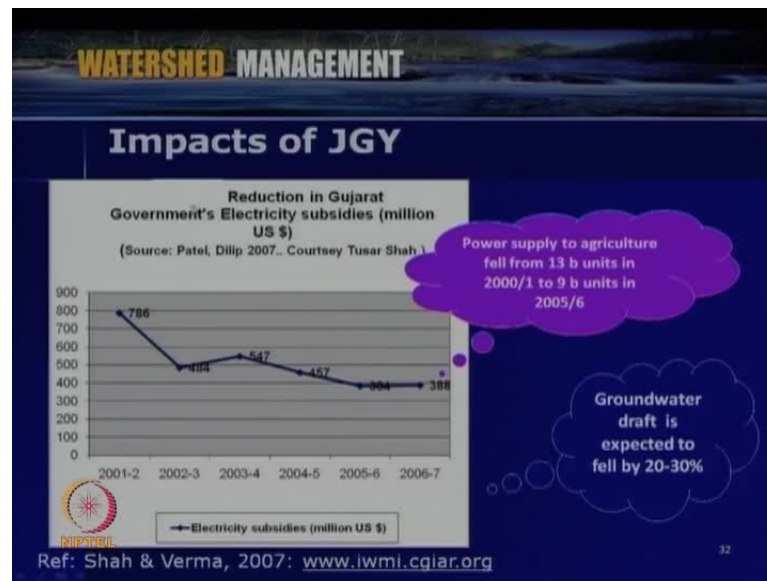
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So, comparison between before and after the Jyothirgram Yojana or Jyothirgram scheme before the tube wells get 12 to 13 hours of 3 phase power, but after farmers get 8 hours per day high voltage uninterrupted power supply. Then flat tariff rupees 350 to 500 per year, but now, flat tariff is rupees 850 per connection per year.

Then massive use of capacitors to convert before but afterwards capacitors out since it was not possible to put. Then non-farm users de-electrified because of capacitors. Now, non-farm users get 24 hour nonstop single phase power. Then most motor burnt-out and rewinding these all kinds of expenses took place earlier and after the implementation motor burn out at the minimum. Now, new connections are not available earlier. Then after this scheme was implemented, new connections were possible but in the restricted way.

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Gujarat electricity board saved a lot of money you can see that the electricity subsidies has been reduced from about 786 million dollars to 388 million dollars from say 2001 to 2007. So, the outcome was power supply to agriculture fell from 13 billion units in 2001 to 9 billion units in 2005-6 and ground water draft is expected to fell only very slowly; so, ground water recovery also took place.

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**WATERSHED MANAGEMENT**

### Case Study: Lessons Lear

- Policy based measures under demand side management really play greater role.
- Groundwater withdrawal could be curbed in the depleted areas with the help of policy based innovative solution like JGY
- Subsidy restructuring is big issues, especially for states where groundwater depletion is fast and farm power is free (eg. Punjab and Tamil Nadu)
- JGS significantly reduced the misery of the agrarian poor by adjusting the schedule of power supply to match peak irrigation periods.

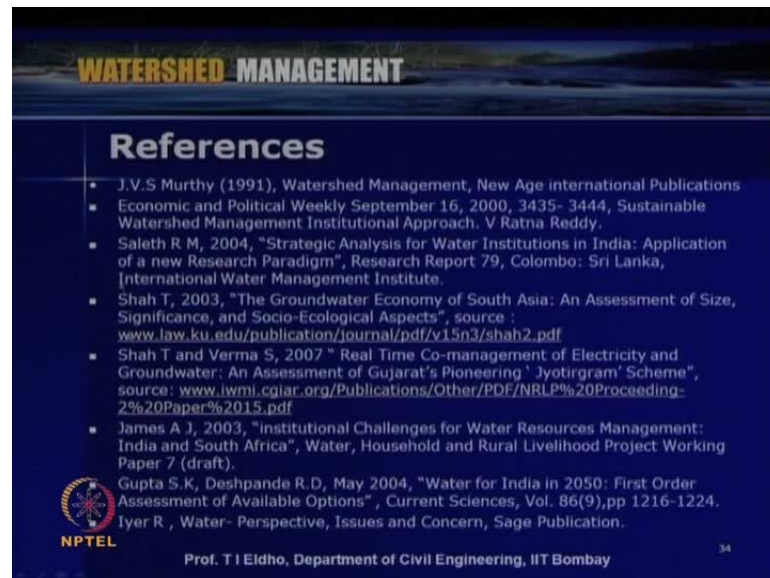
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So, that were the outcome of this, and some of the lessons learnt: policy based measures under demand side management. Then groundwater withdrawal could be curbed in the

depleted areas with the help of policy based innovative solution like Jyothirgram Yojana. Subsidy restructuring is big issue. So, appropriate scheme to be developed and these kinds of schemes reduce the misery of the poor people. So, they get sufficient electricity and sufficient power supply to match peak irrigation periods compared to earlier scheme.

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**WATERSHED MANAGEMENT**

### References

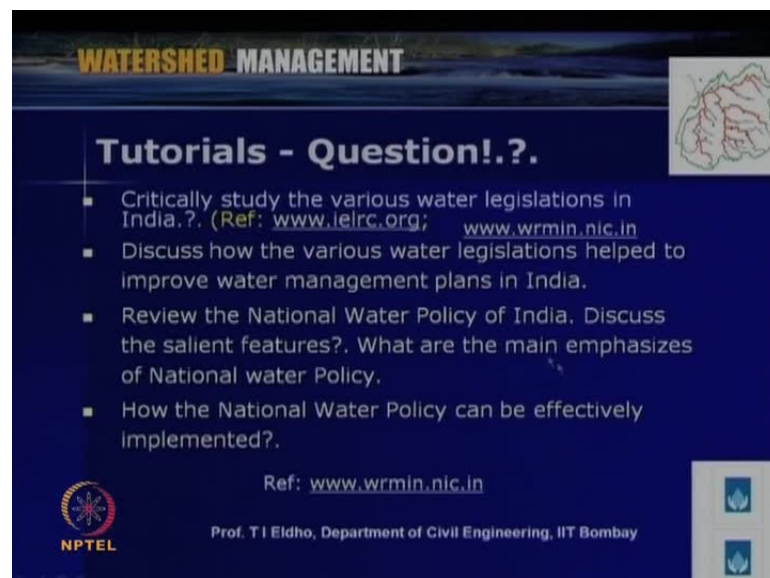
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**WATERSHED MANAGEMENT**

### Tutorials - Question!?.

- Critically study the various water legislations in India.?. (Ref: [www.ielrc.org](http://www.ielrc.org); [www.wrmin.nic.in](http://www.wrmin.nic.in))
- Discuss how the various water legislations helped to improve water management plans in India.
- Review the National Water Policy of India. Discuss the salient features?. What are the main emphasizes of National water Policy.
- How the National Water Policy can be effectively implemented?.

Ref: [www.wrmin.nic.in](http://www.wrmin.nic.in)

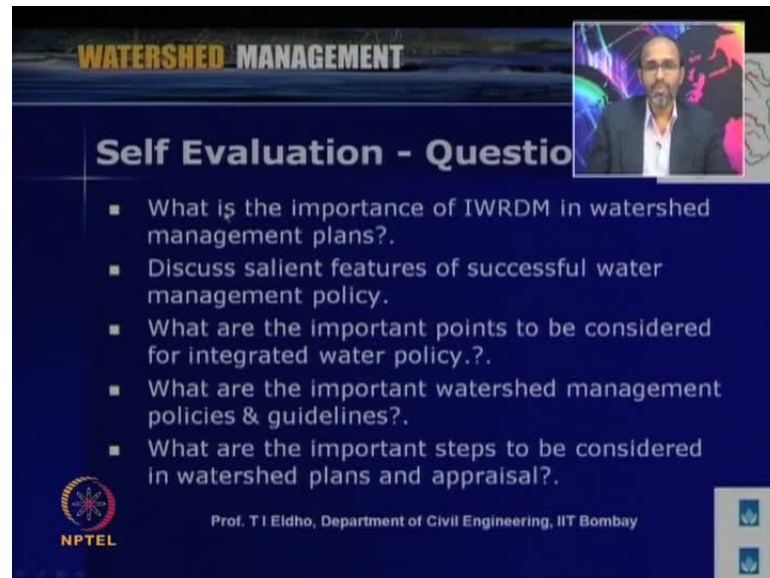
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So, these are some of the important references for today's lecture. So, before closing for today's lecture, some of the say tutorial questions - say critically study the various water legislation in India; the references are given here. Discuss how the various water

legislations helped to improve water management plans in India. Review the national water policy of India. Then, how the national water policy can be effectively implemented in India?

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**WATERSHED MANAGEMENT**

**Self Evaluation - Questions**

- What is the importance of IWRDM in watershed management plans?.
- Discuss salient features of successful water management policy.
- What are the important points to be considered for integrated water policy?.
- What are the important watershed management policies & guidelines?.
- What are the important steps to be considered in watershed plans and appraisal?.

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Then few self-evaluation questions - what is the importance of IWRDM in watershed management plans? Then, discuss salient features of successful water management policy. What are the important points to be considered for integrated water policy? What are the important watershed management policies and guidelines? Then, what are the important steps to be considered in watershed plans and appraisal?



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**WATERSHED MANAGEMENT**

### Assignment- Questions?.

- How a typical IWRDM scheme can be implemented in a watershed?.
- What are the basic requirements of National Water Policy?.
- Illustrate important features of good water legislation.
- Discuss the various organization framework for water legislation.
- What are the important watershed implementation issues?.

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Then some assignment questions - how a typical IWRDM scheme can be implemented in a watershed? What are the basic requirements of national water policy? Illustrate important features of good water legislation. Discuss various organization frameworks for water legislation. What are the important watershed implementation issues?

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**WATERSHED MANAGEMENT**

### Unsolved Problem!.

- Develop an IWRDM scheme for your watershed area. Study the various IWRDM related issues in your watershed area.
- Develop appropriate schemes for IWRDM plan in your study area.
- How you can implement the IWRDM plan?..
- What are the main implementation issues?.
- How to monitor the implemented plans?.

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So, one unsolved problem - develop an IWRDM scheme for your watershed area. Study the various IWRDM related issues in your watershed area. Then develop appropriate schemes for integrated water resource development plan in your study area, and then,

how you can implement the IWRDM plan? What are the main implementation issues in your area? How to monitor the implemented plans? So, this, say you can develop a particular scheme for your study area.

So, in these last few lectures, we discussed about the socio-economical aspects of watershed development plans or watershed management, then integrated development, and then, water legislation and policies and implementation issues. So, with this, today's lecture this module number 5 on socio-economical aspects of watershed management is over. So, we will go to the next module in the next lecture. Thank you.