



Module 10 – (L38 – L40):

**“Water Conservation & Recycling”:
Water Conservation, Perspective on recycle and
reuse, Waste water reclamation .**

WATERSHED MANAGEMENT

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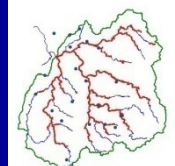
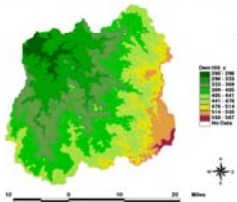
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Lecture No- **38** **Water Conservation**

L38– Water Conservation

- **Topics Covered**
- Water conservation, social, industrial, domestic, commercial & agricultural conservations, efficient water use, action plan, Water User's Association, Water Audit
- **Keywords:** Water conservation, efficient water use, water user's association, water audit

Digital Elevation Model Anas river watershed (Jhabsa, India)



Introduction – Water Conservation

- **Water conservation**- putting the available water resources for the best beneficial use with all the technologies at our command.
- **Water conservation**- refers to reducing the usage of water & recycling of waste water for different purposes such as cleaning, manufacturing, & agricultural irrigation
- **Water conservation**: 1.Any beneficial reduction in water loss , use & preservation of water quality. 2.A reduction in water use accomplished by implementation of water conservation or water efficiency measures; 3.Improved water management practices that reduce or enhance the beneficial use of water.

Introduction- Water Conservation

- A **water conservation measure** is an action, behavioral change, device, technology, or improved design or process implemented to reduce water loss, waste, or use.
- **Water efficiency** is a tool of water conservation that results in more efficient water use and thus reduces water demand.
- The **value and cost-effectiveness of a water efficiency** measure must be evaluated in relation to its effects on the use and cost of other natural resources

Water Conservation - Necessity

- **Water conservation**- to restore the fast deteriorating eco-system & to meet the inevitable emergency of shortage even for drinking & domestic water in the near future.
- **Water conservation** aims at matching demand & supply.
- Water resources - theoretically “renewable” through hydrological cycle.
- However, what is **renewable is only the quantity, but pollution, contamination**, climate change, temporal & seasonal variations have affected the water quality & reduced the amount of ‘usable water’.
- **Water conservation practices** especially in urban areas by industries, municipal uses & domestic uses can reduce the demand as much as by one third, in addition to minimizing pollution of surface & groundwater resources.

Water Conservation - Goals

- Sustainability. To ensure availability for future generations, withdrawal of fresh water from an ecosystem should not exceed its natural replacement rate.
- Energy conservation. Water pumping, delivery, & wastewater treatment facilities consume a significant amount of energy. About 15% of total electricity consumption is devoted to water management.
- Habitat conservation. Minimizing human water use helps to preserve fresh water habitats for local wildlife and migrating waterfowl, as well as reducing the need to build new dams and other water diversion infrastructures.
- **Reduce water consumption per capita**

Water Conservation – Social Aspects

- **Water conservation programs**- initiated at local level, by municipal water utilities or regional governments
- **Strategies**: public outreach campaigns, tiered water rates, restrictions on outdoor water use such as lawn watering & car washing
- **Fundamental conservation goal** is universal metering - water metering increases the efficiency of the entire water system.
- **Pay more means** – less wastage of water- water department would be able to monitor water usage by public, domestic and manufacturing services.
- **Water conservation efforts** - be primarily directed at farmers

Water Conservation – Domestic Aspects

- **Water saving for domestic purpose:**
- Low-flow shower heads
- Low-flush toilets and composting toilets.
- Dual flush toilets -use up to 67% less water than conventional toilets.
- Sea water or rain water can be used for flushing toilets.
- Faucet aerators- which break water flow into fine droplets to maintain "wetting effectiveness" while using less water
- Wastewater reuse or recycling systems
- Rainwater harvesting
- High-efficiency clothes washers
- Weather-based irrigation controllers
- using low flow taps in wash basins
- Automatic faucet is a water conservation faucet

Water Conservation – Commercial Aspects

- **Water saving for commercial purpose:**
 - Waterless urinals
 - Waterless car washes
 - Infrared or foot-operated taps, which can save water by using short bursts of water for rinsing in a kitchen or bathroom
 - Pressurized water brooms, which can be used instead of a hose to clean sidewalks
 - X-ray film processor re-circulation systems
 - Cooling tower conductivity controllers
 - Water-saving steam sterilizers, for hospitals
 - **Rain water harvesting.**

Water Conservation – Agricultural Aspects

- Water saving for agricultural purpose:
- For crop irrigation, optimal water efficiency means minimizing losses due to evaporation, runoff or subsurface drainage while maximizing production.
- Increase efficiency for existing system
- Reduce the flooding type system – go for sprinkler/ drip type systems
- Water efficient variety of crops
- Land preparation for efficient water use
- Use of soil moisture & rainfall sensors to optimize irrigation schedules
- Large gains in efficiency are possible through measurement & more effective management of the existing irrigation system

Efficient Water Use

Efficient water use means

- Reducing the demand by improving personal habits
- Reducing wastes
- Creating an adequate rate schedule
- Deriving benefits from technical developments as well as from water management techniques,
- Coordinating the management of hydraulic resources with that of the land and economical and social aspects;
- Promoting norms and regulations.

Types of Efficiencies

- Absolute efficiency - to use the least amount of water possible
- Economic efficiency- to derive maximum economical benefits
- Social efficiency- to fulfil the needs of the user community
- Ecological efficiency- to guarantee natural resources conservation
- Institutional efficiency- to qualify function of an institution regarding its water related tasks.



Efficient Water Use in Industry

- The **quality of water required depends** on the
 - Type of Industry
 - Its use within the processes
- **Industrial water** use can be grouped into three main categories:
 - Heat transfer
 - Power generation and
 - Use in industrial processes.
- **The main methods** for water efficiency in Industry are:
 - Recycling
 - Reuse
 - Reduction in consumption

Efficient Water Use in Industry

- Two basic activities are necessary in all three cases:
 - Measuring the amount and
 - Monitoring the quality of the water.
- **Metering** - most basic activity for any efficient-use program in industrial sector & practiced to get the consumption rate.
- **Recycling**, reuse or reduction at each stage in the industrial process is absolutely essential.
 - Recycling - to cool equipment that generates heat.
 - Recycling is also used in washing processes.
 - **In reuse system**, outflow from one process (treated or untreated), used in another requiring a different quality of water.

Efficient Water Use in Industry

- **Optimize processes**, improve operations or modify the equipment or the attitude of users.
- **Reuse in Industry to meet water shortages:**
 - First, practise as much conservation of water as possible.
 - Second, recycle only that fraction of wastewater which is in a relatively good condition and can be recycled back with little or no treatment.
 - Thirdly, arrange more 'reuse' after some treatment to make the industry's own wastewater fit for reuse.
 - Finally, if still more reuse is needed, get external source of wastewater.

Measures of Water Conservation in Industries

- Use of **pressure reducing orifices**- reduce the rate of flow;
- **Recycle** of steam condensates back to the boiler.
- Adoption of **counter-current washing** where washing is done in 3 or 4 successive compartments.
- Use of **closed-circuit cooling** systems wherever feasible so that re-circulating waters are not lost in evaporation.
- Adoption of **'dry' cleaning systems** wherever possible.
- **Recycling** of water used for conveying materials.
- Adopt modern **'cleaner' technologies**- use less water.
- **Separate drains** carrying wastewaters from different processes- to make recycle / reuse more feasible, & less cost.
- **Create and reward awareness** among workmen.

Action Plan for Water Conservation

- **Conservation of surface water resources** – create new storages and renovate existing tanks and water bodies.
- **Conservation of groundwater resources** – increase groundwater recharge and stop groundwater outflows by sub-surface dams, watershed management measures etc.
- **Rainwater harvesting** – collection & storage of rainwater at the surface or in sub-surface aquifers, before it is lost as surface runoff.
- **Protection of water quality** – from pollution is a vital aspect of water conservation.
- An **important component of water conservation** involves minimizing water losses, prevention of water wastage and increasing efficiency in water use.

Action Plan for Irrigation Sector

- **Performance improvement of irrigation system** and water utilization – proper and timely system maintenance;
 - rehabilitation and restoration of damaged / silted system;
 - reduce seepage losses by lining;
 - restoration / provision of appropriate control structures;
 - renovation and modernization of existing irrigation systems;
 - provision of adequate water measuring structure
- **Conjunctive use of surface and groundwater** –in the areas where there is threat of water logging.
- **Adopting efficient irrigation systems** such as sprinkler and drip irrigation, wherever suitable.

Action Plan for Irrigation Sector

- Preparation of a realistic and scientific system operation plan
 - based on availability of water and crop water requirement; minimize water logging and water loss.
- Scientific farming –
 - Revision of cropping pattern
 - Training of farmers on excess water use
 - Mixed cropping pattern
 - Rotational cropping
- Rationalization of water rate to make the system self-sustainable
- Formation of water user associations and transfer of management to them; promote multiple and efficient use of water.

Action Plan for Domestic Sector

- ***Domestic and Municipal Sector***
 - Measures towards reduction of conveyance losses;
 - management of supply through proper meter.
 - **Intermittent domestic water supply** to reduce wasteful usage.
 - **Realization of appropriate water charges** for sustainable supply and reduce wastage.
 - Creation of awareness to make attitudinal change.
 - Modification in design of accessories such as flushing system, taps etc.
 - **Possibility of recycling and reuse.**

Action Plan for Industrial Sector

- Modernising of industrial process to reduce water requirement.
- Setting-up of norms for water budgeting.
- Recycling water – especially re-circulating cooling system.
- Proper processing of effluents by industrial units to adhere to the norms for disposal.
- Rational pricing of industrial water requirement to ensure consciousness / action for adopting water saving technologies.

Water Conservation Possibilities

■ *Industrial Use:*

- Using fogging nozzle to cool product
- Installing in-line strainers on all spray headers; regular inspection of nozzles for clogging
- Adjusting pump cooling and water flushing to the minimum required level
- Determine whether discharge from any one operation can be substituted for the fresh water supply to another operation
- Choosing conveying system that use water more efficiently
- Handling waste materials in a dry mode wherever possible

Water Conservation Possibilities-Industrial

- Replacing high-volume hoses with high-pressure, low volume cleaning systems; equipping all hoses with spring loaded shutoff nozzles; instruct employees to use hoses only when necessary
- Replacing worn-out equipments with water-saving models
- Turning off all flows during shutdowns unless flows are essential for cleanup; adjusting flows in sprays and other lines to meet minimum requirements
- Sweeping and shovelling may be practiced instead of hosing down the floors, driveways, loading docks, parking areas etc; washing cars / trucks/ buses less often
- Avoiding runoff and making sure that sprinklers are used in gardens/ lawns

Water Conservation Possibilities- Domestic

- Timely detection and repair of all leaks
- Minimize use of water for all domestic uses such as bathing, brushing, shaving, washing etc. by various means
- Avoid water wastage in cooking, drinking, washing floors etc.
- Minimum use of water for watering of lawns and gardens
- Installation of high-pressure, low volume nozzles on spray washers
- Installation of float controlled valves on the make-up line;
- Washing vehicles less often
- Use of recycled water..

Water Conservation Possibilities- Domestic

- **In case of big establishments** like hotels, large offices and industrial complexes, community centres etc. dual piped water supply may be insisted upon. Under such arrangement, one supply may carry fresh water for drinking, bathing and other human consumptions whereas recycled water from second line may be utilized for flushing of human solid wastes.
- **Similarly, water harvesting through storing** of water runoff including rainwater harvesting in all new buildings on plots of 100 sq.m and above may be made mandatory

Water User's Association

- **Water User's Association** is an association of water users, generally prevalent in irrigation sector.
- **Involvement of farmers** in water management will facilitate equitable and judicious allocation of irrigation waters among farmers of head, middle and tail reaches and improve collection of water charges from users.
- With **improvement in collection** of water charges, irrigation projects may not languish for maintenance for want of funds and in this way overall efficiency of irrigation systems will improve.

Water User's Association

- In domestic sector, WUA help
 - In finding illegal tapping of water from supply lines,
 - In identifying leakages and losses and other illegal activities.
- In industrial sectors, WUA help
 - In identifying the cases of illegal discharge of industrial effluents to water bodies
 - In conservation of water.
- WUAs may be duly empowered through legalization to punish the errant water users.

Water Audit

- **Water audit determines** the amount of water lost from a distribution system due to leakage and other reasons such as theft, unauthorized or illegal withdrawals from the system and the cost of such losses to the utility.
- **Comprehensive water audit** gives a detailed profile of distribution system & water users, facilitating effective management of resources with improved reliability.
- **It helps** in correct diagnosis of the problem faced in order to suggest optimum solutions.
- **It is also an effective tool** for realistic understanding & assessment of the present performance level & efficiency of services & adaptability of the system for future expansion & rectification.

Water Audit

- **Elements of water audit** include a record of
 - The amount of water produced (total water supply),
 - Water delivered to metered users,
 - Water delivered to un-metered users,
 - Water loss and suggested measures to address water loss.
- **Water audit improves**
 - Knowledge & documentation of the distribution system,
 - Problem & risk areas and a better understanding of what is happening to the water after it leaves the source point.

Water Audit

A water audit report contain:

- Amount of water earmarked/ available to the service;
- Amount of water utilized, both through metered and un-metered supplies;
- Water loss and efficiency of the system along with reasons for such water losses
- Suggested measures to check water loss and improve efficiency.

An effective water audit report purposeful in

- Detection of leak in distribution system,
- Taking timely action for plugging such leaks
- Reducing conveyance losses of water and improving efficiency of the system.

Water audit of the system - undertaken at regular interval of time, at least on an annual basis.

Water Audit

- Water audit should be conducted categorically in two systems,
 - Resource audit or supply side audit
 - Consumption audit on demand side.

- All efforts should be made for improvement of
 - Water use efficiency and distribution system,
 - Efficient development and management of the source of water.

Concluding Remarks

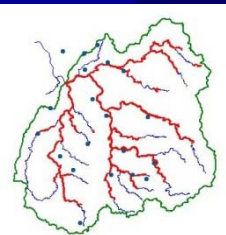
- Due to lack of **proper operation & maintenance**, there is huge loss of water -Improve operation & maintenance.
- For **developing water resources**, traditional water conservation methods to be adopted in conjunction with modern conservation technology.
- **Rain water harvesting, traditional** water storages, check dams & similar structures need to be adopted.
- **Building byelaws** should be suitably modified to introduce mandatory roof top rain water harvesting.
- In order to conserve water, **recycling of wastewater** may be incorporated wherever feasible
- Timely and need based irrigation
- **Strategic mass awareness campaign**

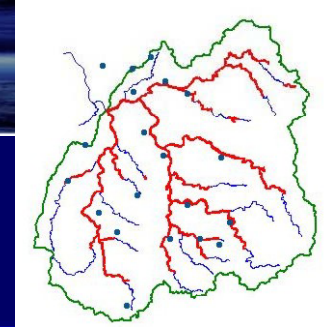
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- CWC, Report (2005), "General Guidelines for Water Audit and Water Conservation", Ministry of Water Resources, New Delhi.
- <http://wrmin.nic.in>
- www.epa.gov

Tutorials - Question!?.

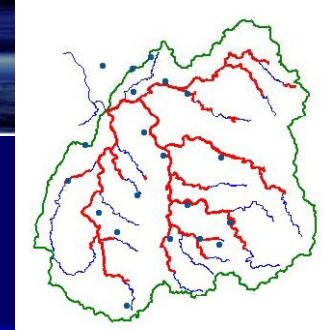
- Critically analyze and study various water conservation possibilities in India for various sectors such as: agriculture, domestic, industrial, commercial & ecology. (Ref: www.wrmin.nic.in)
- Why water conservation is important in sustainable development?.





Self Evaluation - Questions!.

- Discuss the importance of water conservation.
- What are the important goals of water conservation?
- What is efficient water use?. What are the different types of efficiencies?.
- What are the important measures of water conservation in Industry?.
- Discuss the water conservation possibilities for – Industry, Agriculture & domestic sectors.
- Describe “Water Audit” & its various features.



Assignment- Questions?.

- Illustrate the necessity of water conservation.
- Discuss importance of water conservation with reference to: social, domestic, commercial & agricultural aspects.
- Discuss the efficient water use in Industry.
- What are the possible action plans for water conservation: for irrigation, domestic & industrial uses.?
- What are the roles of “Water User’s Association”?

WATERSHED MANAGEMENT

THANK YOU

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