



SUBJECT: WATER DEMAND AND SUPPLY CODE 652

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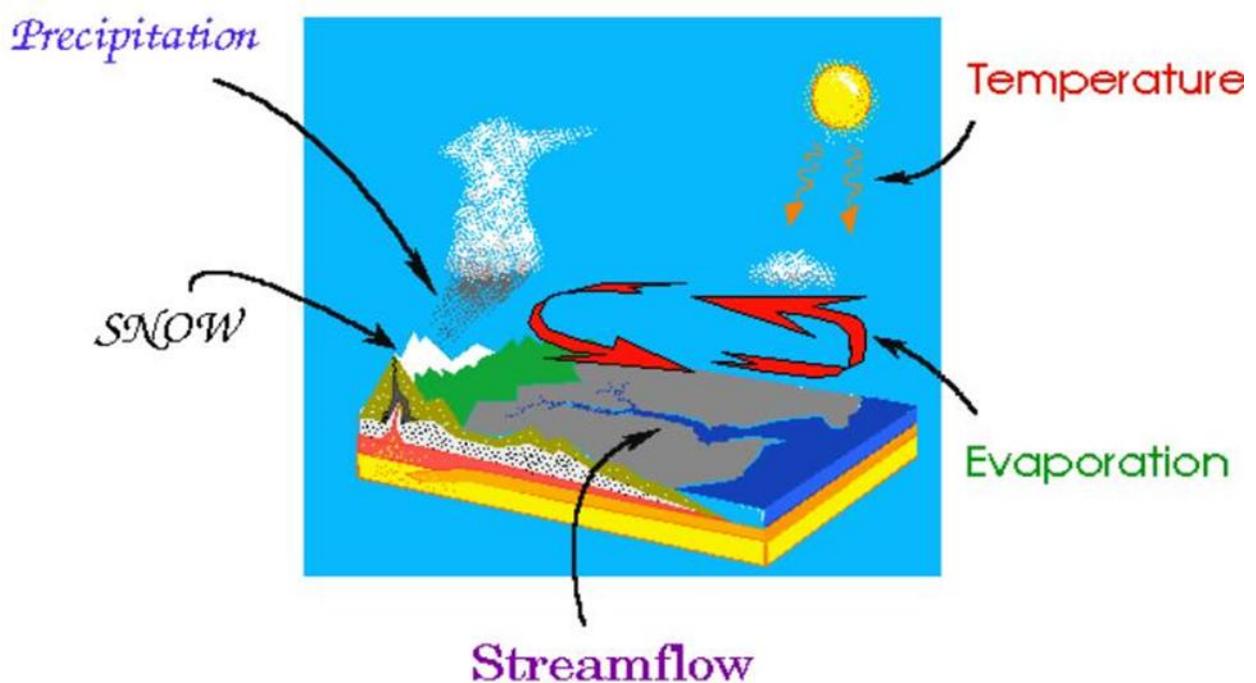
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SUBMITTED TO: SIR ENGR.NADEEM ULLAH SB
Lecture in IQRA NATIONAL UNIVERSITY PESHAWER

Q.1: What is “Hydrological cycle”. Now a days, there is general discussion that hydrological cycle has been disturbed. Is this a myth or reality? Briefly explain.

Answer: Hydrological cycle is also known as Water cycle. In Hydrological cycle, containing various processes, water moves from the earth, plants and ocean surface to the atmosphere and back in the form of precipitation. Total quantity of water within the cycle remains essentially constant but still proportions of water in various forms like drinking waters, saline water etc. get changed due to changes in water cycle as a result of the various activities of the human in his daily life. These activities will be discussed later on.

The cycle includes the following processes.



1. **Evaporation:**

In this process the water moves from liquid state into the gaseous state as atmospheric water vapor.

2. **Condensation:**

In this process atmospheric water vapor changes into water due to cooling of air.

3. **Precipitation:**

When water falls from atmosphere in the form of rain, snow, hail and sleet to the ground and water bodies.

4. **Interception:**

In this process some part of rain does not reach the streams but is instead intercepted by the leaves, branches of plants, other greenery on the land etc.

5. **Infiltration:**

This process involves movement of water through the boundary area where atmosphere interfaces with the soil. Infiltrated water and water stored in the soil, can become subsurface runoff.

6. **Transpiration:**

In this process the leaves of plants lose water in the atmosphere.

7. **Runoff:**

It is the flow from a drainage basin/catchment are in surface streams, unaffected by artificial diversions or storages.

8. **Storage:**

- a. It may be in atmosphere
- b. On earth surface
- c. In the ground

The cycle has been disturbed and is a reality.

This has been done due to:

Deforestation, abnormal increase in population, industrial development, salinity of agricultural lands due to excessive irrigation, improved standards of life, greenhouse effect due to the release CFCs in the atmosphere by the humans. The greenhouse gases trap heat from escaping to the space resulting in global warming.

The overall effect of this menace is as follows:

1. Ground temperature is increasing day by day.
2. Sea level is going up.
3. Excessive rains in some parts of the world whereas drought in other parts of the world.
4. Water logging and salinity of agricultural land etc.
5. Acid rains in various parts of the world.
6. Expansion of deserts.

Keeping in view the above alarming situation based on facts, the whole world should take the problem seriously and look for practical solutions to reduce the global

warming and adopt practices like excessive plantation, recycle more, turn off electronic devices, adjusting thermostats, economic use of water, lining of sides and beds of canals, planning and management of water supply. By adopting the aforementioned proposals the change in the water cycle/climatic changes can be controlled effectively making this world a better place for the humans and other creatures.

Q.2: Briefly describe “Ground. Water sustainability? How can rain water harvesting” be linked to Ground Water sustainability?

Answer: Ground Water sustainability:

It is the development and use of Ground Water resources to meet current and future beneficial uses without causing unwanted environmental or socio economic consequences.

Ground water is a valuable sustainable source of drinking water gifted by the nature to the humans. It should be used with maximum care so that the resource can sustain for appreciable amount of time. This is the water that seeps through the soil and gets accumulated above the non-porous rocks deep underground.

The reserves of the ground water are called aquifers and may be used for various purposes like drinking, industrial use, irrigation purposes etc. Changes in ground water availability and quality badly affect human health, lively hoods, food security and economic development. If humans fail to manage this precious asset it'll bring long lasting effects on the human life. Good management of ground water is pumping to sustainable levels, control of unwanted discharge to ground water and in some areas the aquifers be recharged periodically.

When large amounts of ground water are withdrawn from the aquifer local water table gets depressed, which in turn reduces the amount of ground water available to discharge to streams, wet lands and estuaries. If the withdrawal is continued beyond some level the ground in the area may also get subsided.

Impact of ground water depletion will be:

1. Reduction in surface water supplies.
2. Lowering of water table.
3. High cost of water pumping.
4. Land subsidence.
5. Water quality concerns.
6. Loss of wet land and riparian vegetation.
7. Acute crisis of drinking water and irrigated water.

In subcontinent during monsoon season there are a lot of rains resulting in surface runoff which ultimately makes its way to sea without being beneficially used. Therefore, by Rain Harvesting Technique, ground water sustainability can be achieved.

This is a technique of collection and storage of rain water into natural reservoirs or tanks, or the infiltration of surface water into underground aquifer before it is lost as surface runoff.

There are 2-methods of this technique:

1. Roof top rainwater harvesting.
2. Surface runoff rainwater.



1. In this system, rainwater from the roofs of the houses/ buildings is collected to be stored in a tank or diverted into an artificial recharge system.
2. In urban areas, rainwater flows away as surface over flow / sheet flow. This water can be caught and used for recharging aquifers by adopting appropriate methods.

The technique is employed to overcome shortage of ground water due to population increase, industrialization, urbanization, uneconomical use of water and less percolation due to increased paved surfaces. The rain water harvesting is linked with ground water sustainability having the following impacts on ground water.

1. Water table will be raised.
2. Cost of water pumping will be reduced.
3. Quality of ground water will be improved through dilution.
4. The salinity will be controlled.
5. The underground erosion will be stopped.

Q.3 what quality parameters should be considered in designing H₂O supply for a community?

Answer: Human life is dependent on various factors of which water is of prime importance. Water is used by humans for various purposes like drinking, domestic use, industrial use, irrigation and power generation. The selection of a source of water for community is based on the following three important factors.

1. Water Quantity
2. Reliability of Water
3. Quality of Water

1. Quantity of Water:

The source of water should have enough quantity to serve all the needs of the community. However, the quality of water should be ensured at minimum cost. For this purpose various types of sources may be selected like groundwater, surface water with appropriate disinfection wherever required.

2. Reliability of Water:

Such a source be selected which is most reliable. A reliable source is the one that will supply the required amount of water for as long as needed. For this purpose hydrological and geological data of the area may be collected and properly analyzed before selection of the source.

3. Quality of Water:

This is the most important aspect which is to be discussed in detail.

Water supplies are generally exposed to some kind of pollution. Therefore, before use, it should be tested to determine the existence of any impurity that could cause a disease, odor, taste, color etc. In water treatment, the water is passed through various processes like filtration, sedimentation and disinfection. Developing a water source includes all work that increases the quantity and quality of water. For developing a source, a dam or a barrage may be constructed or even wells can be dug or surface water may be selected.

To ensure quality of water, we have to detect the presence of organisms, unwanted minerals and organic compounds in the water. The basic requirements to ensure the quality of water, the following parameters are to be taken in account.

1. Physical
2. Chemical
3. Biological
4. Radiological

1. **Physical:**

Characteristics of water that can be determined by the senses of touch, sight, smell and taste are called physical parameters. Physical indicators are as follows

- a) Water Temperature
- b) Total dissolved solids
- c) Total suspended solids
- d) Turbidity
- e) Electrical Conductance
- f) Odor
- g) Taste

2. **Chemical Parameters:**

The chemical properties of water include;

- a) PH
- b) Biochemical Oxygen Demand
- c) Chemical Oxygen Demand
- d) Dissolved Oxygen
- e) Total hardness
- f) Heavy metals
- g) Nitrates
- h) Ortho phosphates
- i) Pesticides

3. Biological Parameters:

Drinking water should not contain any microorganism known as pathogenes capable of causing disease or any bacteria indicative faecal pollution. The presence of living organisms in water are the basis of biological/bacteriological parameters which are as follows:

- a) Bacteria
- b) Algae
- c) Viruses
- d) Protozoa

Guidelines values for bacteriological quality is given below

All Water intended for drinking	
E. Coli or thermotolerant coliform bacteria	Must not be detectable in any 100-ml Sample
Treated Water entering the distribution system	
E. Coli or thermotolerant coliform bacteria	Must not be detectable in any 100-ml Sample
Total coliform bacteria	Must not be detectable in any 100-ml Sample
Treated water in the distribution system	
E. Coli or thermotolerant coliform bacteria	Must not be detectable in any 100-ml Sample
Total coliform bacteria	In the case of large supplies, where sufficient samples are examined, must not be present in 95%of samples taken throughout any 12 month period

4. Radiological Parameters:

Water from nuclear plants, industries or medical research using radioactive chemicals and mining of uranium ores or other radioactive materials are potential sources of water contamination.

Conclusion:

Keeping in view all the above facts while designing water supply for a community, the following quality parameters should be strictly considered;

- a) The water should be free from pathogenic organisms causing various diseases
- b) Water should be fairly clear (low turbidity, little color)

- c) The water should contain no compound that cause an offensive taste/smell
- d) The water should not contain any compound that may casue a long term effect on human health
- e) The water should not contain any compound that could corrode the supply system
- f) The water should not have staining effect on clothes while washing
- g) Water should be free from bacteria originating from human and animal excreta.