Mid Term Assignment

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Q1. 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.

Hydrological Cycle

Hydrological cycle refers to the movement of water of oceans, atmosphere and lands in a series of continuous interchanges of both geographic position and physical state.

Generally the Hydrological cycle involves following processes.

- Evaporation
- Condensation
- Precipitation
- Interception
- Infiltration
- Percolation
- Transpiration
- Runoff and Storage

The complete water cycle involves many, many things; however, the two most important components are evaporation and condensation. To get precipitation, you have to have condensation and in order to get water vapor into the atmosphere, there has to be evaporation (from wet soil, lakes, rivers, oceans, and even transpiration from vegetation) and sublimation from ice/snow. The moisture gets condensed at higher levels and falls to the earth as precipitation in the form of rain, snow, hail, dew, sleet, frost etc.

Since the total amount of moisture in this entire system remains constant, a balance is required between evapotranspiration and precipitation. The hydrological cycle maintains this balance. The study of the hydrological cycle actually involves the study of the flow of moisture from one store to another and from one form to another.

Hydrological cycle is disturbed or not

To deal with this we have to evaluate two things in general. Firstly we have to check the intensity of factors that affect H-Cycle and secondly to check the impacts of these factors on our globe. Science has shown that climate change touches every corner of our planet’s ecosystem, and the water cycle is no exception. Because the processes involved are highly dependent on temperature, changes in one have consequences on the other. Due to industrialization and population growth temperature of the globe is increased to worst extreme. This high temperature evaporates more water into the air. Warmer air can hold more water vapor, which can lead to more intense rainstorms, causing major problems like extreme flooding. Not only this but as temperatures rise, evaporation increases and soils dried out so at one side is flooding and at the other side is drought.

Deforestation is another cruel factor in this regard. Rain forests store vast quantities of water, and when those trees are cut down, the water they store is lost and transpiration component of water cycle is disturbed, deforestation results in the water not being able to be released back into the atmosphere, affecting the balance of the water cycle. This results in Desertification, leading to dry climates, which affects livings conditions. The hydrologic cycle is altered by not only direct physical alteration, but also anthropogenic climate change; the most obvious symptom is the global redistribution of precipitation and the resulting change in surface water Also the growing population, damming, discharge and recharge gap of water resources, polluting the rivers etc. are among numerous factors. But the natural system have also bounced back response due to inertia and this is called impacts of those factors that disturb H-Cycle. The impact of this are heat waves, timing and volume of snow and ice melt in mountainous and polar regions, extreme flooding due to melting of glaciers and many other emerging impacts are alarming us about our future.

So by seeing the scenario it is cleared that timing and volume of water cycle components is changed significantly in decades.

Q2. Briefly describe "**Ground water Sustainability"**? How can **"Rainwater Harvesting"** be linked to ground water sustainability?

Ground water Sustainability

Ground-water sustainability may be defined as development and use of ground water in a manner that can be maintained for an indefinite time without causing unacceptable environmental, economic, or social consequences.

Perhaps the most important attribute of the concept of ground-water sustainability is that it makes a long-term perspective to management of ground-water resources.

To address this first it should be clear that ground water is neither a nonrenewable resource nor is it completely renewable. Recharge of ground water from precipitation continually replenishes the groundwater resource but may do so at much smaller rates than the rates of ground-water withdrawals. Second, ground-water development may take place over many years; thus, the effects of both current and future development must be considered in any water-management strategy. Third, the effects of ground-water pumping tend to manifest themselves slowly over time. Three terms that have long been associated with ground-water sustainability need special mention; namely, safe yield, ground-water mining, and overdraft. The term "safe yield" commonly is used in efforts to quantify sustainable groundwater development. The term "groundwater mining" typically refers to a prolonged and progressive decrease in the amount of water stored in a ground-water system, as may occur, for example, in heavily pumped aquifers in arid and semiarid regions and the term "overdraft" refers to withdrawals of ground water from an aquifer at rates considered to be excessive and therefore carries the value judgment of overdevelopment.

Rainwater Harvesting

Rainwater harvesting is a technique of collection and storage of rain water in to natural reservoirs or tanks, or the infiltration of surface water into subsurface aquifers (before it is lost as surface runoff).

Link between Ground water Sustainability and Rainwater harvesting

This technique is a successful step toward sustainable world and there is very dominant and direct link between the Ground water Sustainability and Rainwater harvesting. Rainwater effect the groundwater sustainability in various aspects.

In developing countries almost 45% water for domestic purpose is extracted from ground sources and also due to increase in population and industrialization of these developing countries the use of groundwater increase drastically leading to the constant depletion of groundwater levels. So it is imperative to take serious measurement to meet the domestic need of dwellers.

For this purpose rainwater harvesting provides a good supplement to other water sources and is reliable solution for augmenting groundwater level to attain self-sufficiency. The rain water is channeled by pits, trenches or dug wells to recharge groundwater sources thus it can mitigate the water crisis problem and reduce the burden on traditional water sources.

The other advantage of rainwater harvesting is that although groundwater is free from pathogens but is somehow polluted by inorganic chemicals, so rainwater is used to dilute the groundwater to bring these chemicals into acceptable proportion.

So in this perspective we can say that rainwater harvesting plays an important role in developing sustainable Future

Q3. What "Quality Parameters" should be considered in designing water supply system for a community?

Water quality

Water quality describes the condition of the water, including chemical, physical, and biological characteristics, usually with respect to its suitability for a particular purpose.

Water quality Parameters

A wide range of water quality parameters or standards are there in order to quantify the quality measures. These quality parameters are classified into 3 categories as under:

- Physical properties
- Chemical composition
- Biological properties

Here we will discuss that particular parameters that are used to evaluate the quality of water for a community.

Parameters for physical properties

Turbidity

Turbidity is the measure of resistance to the passage of light through water. Water is said to be turbid if it contain visible material in suspension. It is measured in PPM on silica scale. Maximum permissible turbidity for domestic supply is 5 to 10 PPM.

Temperature

Temperature is measured by ordinary thermometer in order to determine the density, viscosity, vapour pressure of water. Maximum permissible temperature of water for domestic use is 10^0C to 15^0C.

Taste and Odour

Taste and odour of water is due to the presence of dead or live micro-organisms or dissolved gases like CO_2 or Methane or due to the mineral substance. It change with temperature. The water odour is tested at 20^0C to 25^0C by an apparatus Osmoscope which is graduated with PO Values from 0-5 indicating 5 as extremely strong odour.

Color

Color of water is due to suspended particles and organic matters. It also indicates the source of water. Color of water is expressed in platinum cobalt scale. Maximum permissible color of domestic supply is 10-20PPM.

Parameters for chemical properties

PH Value

This value indicates the hydrogen ion concentration in water.PH value of water for public supplies is limited to 6.5-8. If PH value is equal to 7 then it is neutral. If the value is less than 7 then it will be acidic and PH greater than 7 means it represent alkaline water.

Chlorine Content

Chlorine remains as residual in treated water for the sake of safety against photogenic bacteria. The maximum permissible chlorine content for public supplies is 0.2 PPM.

Hardness

It is caused due to the presence of bicarbonates, sulphate, chloride and nitrates of calcium and magnesium. The hardness of water prevents the lathering of soap and forms boiler scale. Maximum permissible Hardness of water for drinking purpose should niot exceed 100 PPM.

Copper

The presence of copper indicates pollution. The copper content in water for domestic purpose should not be more than 3PPM. Small quantity is desirable from health point of view

Alkalinity

Determined by measuring the amount of acid needed to lower the pH in a water sample to a specific endpoint; the results are usually reported in standardized units as milligrams CaCO3 per liter.

Total Solids

Total solids include chlorides nitrates and other compounds which cause hardness of water. Maximum permissible total solids for domestic supply is 500PPM.

Other Minerals

Iron and Manganese less than 0.3 PPM, Arsenic less than 0.05 PPM and Fluorine should be 1.5 PPM is good for domestic supply

Parameters for biological properties

Total Count of Bacteria Test

Total numbers of bacteria in milliliter of water is calculated. Total count of bacteria per cubic cm for domestic purpose varies from 0-100

Biochemical Oxygen Demand (BOD)

Milligrams of dissolved oxygen consumed per liter at a temperature of 20C for 5 days. It is needed by aerobic bacteria in a water sample to break down organic material.

Chemical Oxygen Demand (COD)

Mass of oxygen consumed per liter of solution usually expressed in Mg/L. It is amount of oxygen used to regenerate all pollution in a chemical way by adding oxidizing agents like Potassium Permanganate.