Discipline: **MS Civil Engineering**	***Course Title:*** **Water Demand Supply and Distribution**	
Course Code: **CE- 562**	***Instructor Name:*** **Engr. Nadeem Ullah**	
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Question #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 #1:

Hydrological Cycle: The Hydrological Cycle or Water cycle describes the existence and movement of water on, in, and above the Earth. Earth's water is always in movement and is always changing states, from liquid to vapor to ice and back again. The Hydrological Cycle describes how water evaporates from the surface of the earth, rises into the atmosphere, cools and condenses into rain or snow in clouds, and falls again to the surface as precipitation. The water falling on land collects in rivers and lakes, soil, and porous layers of rock, and much of it flows back into the oceans, where it will once more evaporate. In the hydrologic cycle, water is transferred between the land surface, the ocean, and the atmosphere. ***Hydrological Cycle Process:***

Evaporation: The Hydrological Cycle starts with evaporation.

Condensation: As water vaporizes into water vapor, it rises up in the atmosphere.

Sublimation: The process of snow and ice changing into water.

Precipitation: Water falls back to the Earth.

Interception: precipitation that does not reach the soil, but is instead intercepted by the leaves, branches of plants and the forest floor.

Transpiration: Where liquid water is turned into water vapor by the plants.

Percolation: Rainfall seeps underground.

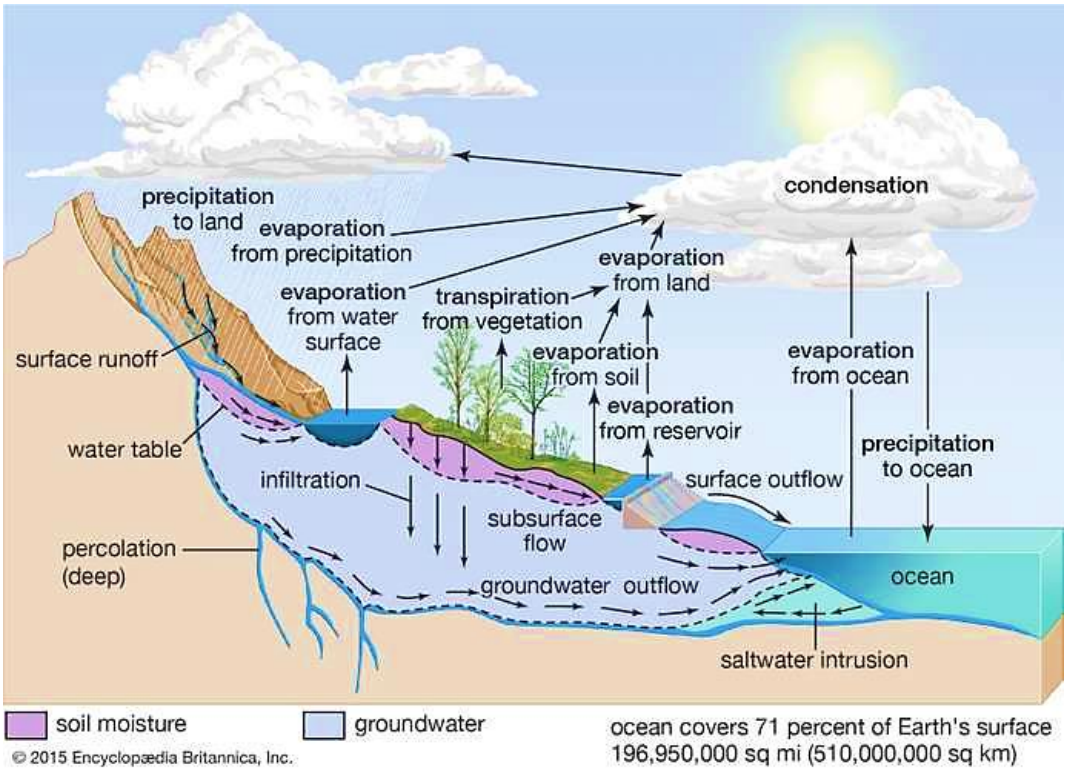
Runoff: Precipitation that didn't get (infiltrated) absorbed into the soil or did not evaporate.

Infiltration: the process by which precipitation or water soaks into subsurface soils and moves into rocks through cracks and pore spaces.

A number of human activities can impact on the Hydrological Cycle: damming rivers for hydroelectricity, using water for farming, ***deforestation*** and the ***burning of fossil fuels***. Now a days these activities are in high level and it's possible that hydrological cycle could be disturbed by these activities and one thing that should be noted that water in Hydrological Cycle is almost constant but it's quantity and movement in Hydrological Cycle could be disturbed by above mentioned human activities.

Climate change intensifies this cycle because as air temperatures increase, more water evaporates into the air. Warmer air can hold more water vapor, which can lead to more intense rainstorms, causing major problems like extreme flooding in coastal communities around the world.

The construction of a dams converts free flowing rivers into permanently flooded bodies of water.



All Process of Hydrological Cycle shown in above Image.

Question #2: Briefly describe "**Ground water Sustainability**"? How can "**Rainwater Harvesting**" be linked to ground water sustainability?

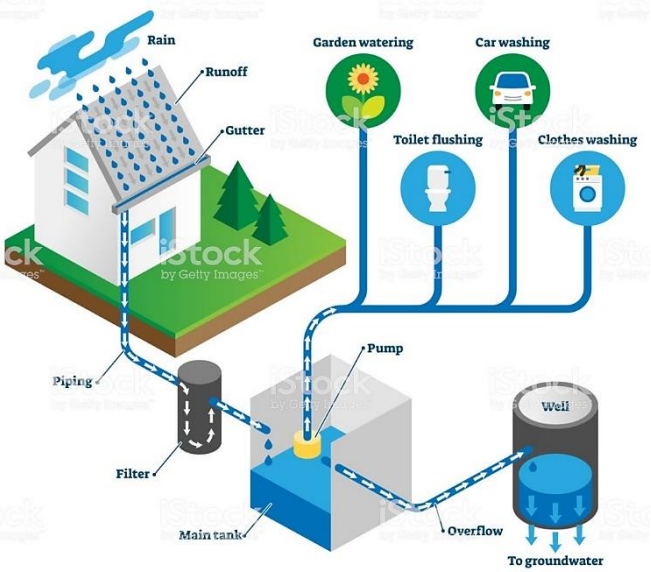
Answer #2:

Groundwater sustainability is the maintenance and protection of groundwater and related ecosystems to balance current and future environmental, economic and human (social) requirements. The main goals of groundwater sustainability are the Protection of groundwater from depletion and to protect its quality from contamination.

Rainwater harvesting essentially means collecting rainwater on the roofs of building and storing it underground for later use. The main ***link of rain water harvesting*** to ground water sustainability is, it does recharge ground water and arrest groundwater depletion; it also raises the declining water table and can help augment water supply.

Rainwater harvesting is a multipurpose way of supplying usable water to consumers during a crisis period, recharging the groundwater and finally reducing the runoff and water logging during the season of heavy rainfall. Traditional knowledge, skills, and materials can be used for this system.

Rain water harvesting link with groundwater sustainability



Question #3: What "Quality Parameters" should be considered in designing water supply system for a community?

Answer #3:

Quality Parameters: Water quality describes the condition of the water, including chemical, physical, and biological characteristics, usually with respect to its suitability for a particular purpose such as drinking or swimming. Below are the parameters to be tested for a community water supply system.

WATER TEMPERATURE: Temperature of a waterway is significant because it affects the amount of dissolved oxygen in the water. The amount of oxygen that will dissolve in water increases as temperature decreases.

DISSOLVED OXYGEN (DO): The amount of oxygen in water, to a degree, shows its overall health. That is, if oxygen levels are high, one can presume that pollution levels in the water is low. Conversely, if oxygen levels are low, one can presume there is a high oxygen demand and that the body of water is not of optimal health.

pH: pH is a measure of the acidity or alkalinity of water. It is usually measured by using a colorimetric test - litmus paper changes color with increased acidity or alkalinity. pH varies naturally within streams as a result of photosynthesis.

SALINITY: Salinity is a measure of the dissolved salts in the water. Salinity is usually highest during periods of low flows and increases as water levels decrease. Salinity is measured as either TDS (Total Dissolved Solids.

TURBIDITY: Turbidity is a measure of the ability of light to pass through water, that is, an estimate of suspended solids in the water. Turbidity is measured in Nephelometric Turbidity Units (NTU's).

HARDNESS: Hardness is a term used to express the properties of highly mineralized waters. The dissolved minerals in water cause problems such as scale deposits in hot water pipes and difficulty in producing lather with soap.

TASTE AND ODOR: Taste and odor in water can be caused by foreign matter such as organic materials, inorganic compounds, or dissolved gasses. These materials may come from natural, domestic, or agricultural sources.

FAECAL COLIFORMS: Faecal Coliforms are naturally occurring bacteria found in the intestines of all warm-blooded animals (including humans) and birds. The presence of Faecal Coliforms is an indicator of contamination by sewage waste.