

## **QUESTION NO. 1**

### **1. WHAT IS HYDROLOGICAL CYCLE?**

In water cycle or hydrological cycle, water evaporates from the oceans and land surface to become water vapour that is carried over the earth by atmospheric circulation. The water vapour condensed and precipitated on the land surface and oceans. The precipitated water may be intercepted by vegetation, become overland flow over the ground surface, infiltrate into the ground. Flow through the soil as sub surface flow, or discharge as surface run off. Evaporation from the land surface comprises evaporation directly from soil and vegetation surfaces, and transpirations through plant leaves, collectively this process is called evapotranspiration. Infiltrated water may percolate deeper to recharge ground water and later become spring flow or seepage into streams to also become stream flow.

Hydrological cycle has been disturbed by manmade activities and disruptions in nature by pollution, urbanization, misusing natural resources specifically fresh water and many other reasons. This is the reality that Hydrologic cycle has been disturbed these days and it can be justified scientifically by the following factors.

#### **i. CONSTRUCTION OF DAMS FOR HYDROELECTRICITY:**

Now a days huge reservoir are built by constructing dams across rivers which stores the fresh water on upstream side while making the downstream side arid which ultimately affects adversely the downstream forest, vegetation and aquatic life and may cause serious change in local environment. Overall, impact of dam and reservoir construction may cause disturbance in hydrological cycle.

#### **ii. IRRIGATION:**

As the human population increases day by day and more food grains are required which ultimately demands more agriculture. For this purpose we need more irrigation and divert water from its natural sources towards fields where we made its runoff. Beside this, we also use many kinds of pesticides, chemicals and fertilizers which may pollute the surface and ground water may cause a serious harm when water evaporates in atmosphere or infiltrate in ground. This may disturb the hydrological cycle.

#### **iii. DEFORESTATION:**

The removal of trees and plants is having a major impact on the hydrological cycle, as local and global climates change. Normally trees releases water vapors when they transpire, producing a localized humidity. This water vapor then evaporates into the atmosphere where it accumulates before precipitating back to the

earth as rain. If we cut the trees, the evapotranspiration process will be disturbed which is the important sub process of hydrological cycle. Besides this, less vegetation may encourage excess run off on earth surface which is another serious issue for reservoirs in shape of silting and removal of fertile super layers from the fertile land.

iv. **GREEN HOUSE EFFECTS:**

Green house is a natural phenomenon of earth's atmospheric trapping a range of gases, which in turn capture infrared radiation to keep earth temperature controlled. Human activities such as burning of fossils fuels in automobiles and rapid industrialization which causes emission of toxic gases, has raised the earth temperature and damaged ozone which causes more evaporation and melting ice (snow covers), which has badly disturbed the hydrological cycle.

## **QUESTION NO. 2**

### **1. WHAT IS GROUND WATER?**

Ground water is one of the major parts of the earth's water circulatory system known as hydrologic cycle. Water bearing formations of the earth acts as conduits or pathways for transmission of water from one part to another subject to observance of the hydraulic gradient. Water travels slowly in geological formations in earth from its surface as a result of precipitation (rainfall & snowfall), bodies of surface water (lakes, rivers & reservoirs) while it returns the earth's surface by action of natural flow (springs, artesian flow), evaporation or human efforts (pump age from tube wells)

### **2. WHAT IS GROUND WATER SUSTAINABILITY?**

Ground water is an important source of water supply and its use in municipalities, irrigation and industries continues to increase on daily basis. Ground water represents 99% of the earth's liquid fresh. Withdrawal of ground water by pumping for the above mentioned purposes have caused its shortage in those areas where its yield is in excessive quantity. It is important to carry out the accurate estimation of the available sub surface water resources and proper planning may be done to ensure its continued availability in future. Ground water sustainability is the concept of utilization of fresh water for drinking, irrigation, industries & other beneficial purposes without causing unacceptable environmental or socioeconomic consequences. In this regard a very simple approach of **water budget** may be employed to improve the ground water sustainability by analysing the inflow & outflow of fresh water & to devise models to

introduce the artificial recharge technique to the ground in addition to maintain the natural recharge system for better future preservations of natural resources.

### **3. LINKAGE OF RAIN WATER HARVESTING TO GROUND WATER SUSTAINABILITY:**

Practically all ground water originates as surface water. A principal source of natural water recharge includes precipitation, snow flow, lakes and reservoirs. The way in which we are getting withdrawal (yield) of fresh water from ground water source, the natural recharge system is getting disturbed because of unbalancing of water budget, as the rate of inflow is much lesser than that of outflow from ground water source. Now, keeping in view of the sustainability of ground water, we should employed the concept of artificial recharge in the shape of various techniques such as by construction of check dams, injection wells, afforestation on barren lands to trap maximum run off and the most feasible & economical way is the rain water harvesting by using roof top run off for storage & injecting in deep wells driven in ground up to the aquifer to recharge the ground water. Rain water may be used directly for drinking, irrigation & other purposes which ultimately reduces the unnecessary withdrawal of ground water hence we can ensure Ground Water Sustainability.

#### **QUESTION NO. 3**

#### **WHAT “QUALITY PARAMETER” SHOULD BE CONSIDERED IN DESIGNING WATER SUPPLY SYSTEM FOR A COMMUNITY?**

A water supply system provides safe water to the general public & inhabitants of area which is used for drinking and domestic purpose. Mostly ground water is used due to its nature that it is fresh and needs no treatment but sometimes surface water also used after proper treatment.

While designing a water supply system, the most important and primary objective is to select a fresh water source that may be free from pathogenic bacteria or to treat water properly as per approved guide lines of WHO/EPA. During design phase some quality parameters are considered to be checked before provision of drinking water to general public in order to ensure its safety.

According to Environmental Protection Agency (EPA) of USA, there are 101 parameters to measure the quality of water. Out of 101 parameters, 15 are considered as Secondary Parameters. The primary parameters are six (06) which are called “Nuisance Impurities” and are listed below.

- i. PH
- ii. Total Dissolved Solids (TDS)
- iii. Hardness
- iv. Suspended Solids (SS)

- v. Odour & Taste
- vi. Floride

They are established as guidelines to assist the public water systems in managing drinking water. These contaminations are not considered to present in water due to a serious risk to human life. The secondary parameters include the following.

- i. Temperature
- ii. Conductivity
- iii. Iron
- iv. Aluminium
- v. Sulphates
- vi. Silver
- vii. Zinc & Manganese
- viii. Foaming agents

It is concluded that the above mentioned quality parameters shall be checked before finalization and designing water supply system in order to ensure provision of safe drinking water to the inhabitants.