SUBJECT: WATER DEMOND SUPPLY AND DISTRIBUTION CODE-562

Name Engr.khalid rashid reg no#14870

APRIL 18, 2020

SUBMITTED TO: SIR ENGR.NADEEM ULLAH SB

LECTURE IN IQRA NATIONAL UNIVERSITY PESHAWER

ANSWER NO#1

DESCRIPTION OF HYDRO LOGIC CYCLE

HYDROLOGICAL CYCLE:

It is a the sum of all processes in which water evaporate/ move from the ocean and land surface to atmosphere and from here the vapor convert to precipitation(liquid or solid) form and come back to surface of land or ocean is called hydrological cycle.

It is concerned with the origin, distribution, and properties of water on the globe.

Complex pathways:

Complex pathways include the passage of water from the gaseous envelope around the planet called the atmosphere, through the bodies of water on the surface of earth such as the oceans, glaciers and lakes, and at the same time (or more slowly) passing through the soil and rock layers underground. Later, the water is returned to the atmosphere.

Hydrological cycle includes the following processes

1. ***Evaporation:***

Evaporation occurs when water changes from liquid state to gaseous state.

- *Evaporation occurs on water surfaces like lakes, seas etc. Evaporated moisture is lifted into atmosphere.*
- *Evaporation is the primary pathway in which water moves from the liquid state back into the water cycle as atmospheric water vapor.*

Figure 1evaporation

2. ***Condensation:***

Condensation is the process by which water vapor changes into water.

- *Water vapor condenses to form dew, fog or clouds.*
- *Condensation takes place due to cooling of air.*

Figure 2:Condensation

*3. **Precipitation***

Precipitation is the process that occurs when water particles fall from the atmosphere and reach the ground.

- *Precipitated water may fall into water bodies or on land. It then goes to streams or penetrates into the soil.*
- *There are different types of precipitation including — rain, snow, hail, and sleet*

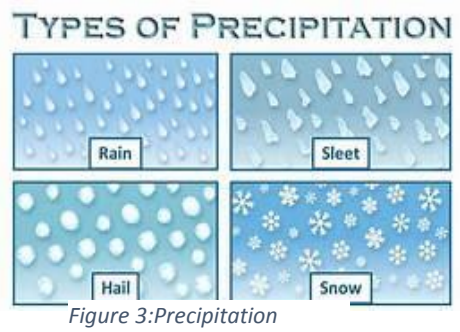

Figure 3:Precipitation

*4. **Interception***

Interception is the process of interrupting the movement of water in the chain of transportation events leading to streams.

- *When rain first begins some part of the rain does not reach the streams instead intercepted by the leaves, branches of plants and the forest floor.*

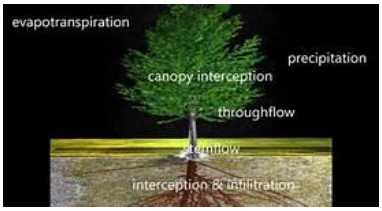

Figure 4:Interception

*5. **Infiltration***

Infiltration is the physical process involving 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.*

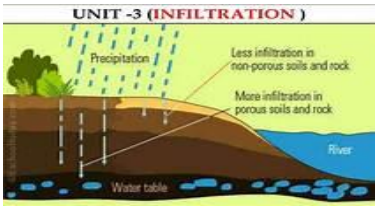

*Figure 5: **Infiltration***

*7. **Transpiration***

Transpiration is the process by which plants lose water out of their leaves.

- *Transpiration gives evaporation a bit of hand in getting the water vapor back up into the air.*

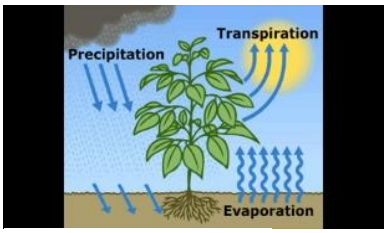

Figure 6:Transpiration

8. Runoff

Runoff is a flow from a drainage basin / catchment area in surface streams.

- *It generally consists of the flow that is unaffected by artificial diversions or storages.*

Figure 7:Runoff

9.storage

There are three basic water storage places:

1. in atmosphere 2. on earth's surface 3. in the ground

- *Surface storage places are: ocean, lake, reservoirs, glaciers.*
- *Underground storage occurs in soil, underground aquifers and in the cracks of rocks etc*

Fundamental characteristics:

A fundamental characteristic of the hydrologic cycle is that it has no beginning an it has no end. It can be studied by starting at any of the following processes: evaporation, condensation, precipitation, interception, infiltration, percolation, transpiration, runoff, and storage.

- ***"Now-a-days there is general discussion that Hydrological Cycle has been disturbed. Is this a myth or reality?"***

Now-a-days hydrological cycle has been disturbed by population growth, industrialization, urbanization, land-use changes and improved standards of living. In many countries resources are already fully committed and water will become a scarce commodity. All these above items disturb hydrological cycle.

- ***population growth****:due to population growth portable water withdrawal from well drinking and other usage and for industries usage which effect hydrological cycle. Because of population growth more water use as compare to water penetration into ground and other sources.*
- ***Industries:*** *industries produce* CO_2 *which go into air and warm atmosphere more rapidly. Where in hydrological cycle warm air come from ocean to land side and after rising it cool, and vapor convert to rain or snow and then come to land or sea surface in the form of precipitation but due to* CO_2" *atmosphere warm, and whole process disturb. According to environmental scientist now due to lock down all industries are closed and environment change/cool abruptly.*
- ***Agriculture:***

Most part of the water used for agriculture usage therefore it is more vulnerable to water shortage because higher priority given to portable water

- ***Land-use change:***

Due to population growth land use for houses ,industries, roads, markets, stores etc. where water don't able to penetrate in soil because of Bachuman/tarcsol or concrete pavements concrete sheet(building floors and roofs) on ground which as used for above structures and hydrological cycle disturb.

- ***Improved standards of living:***

Due to improved standards of living every new day people change vehicles, clothes ,shoes and other life related item, all these thing related to industries which are directly related to hydro logical cycle.

Figure 8: atmosphere warm due to CO2 gase

Conclusion:

From above discussion we conclude that main responsible for hydrological cycle disturbance is human. now-a-days as all industries closed, the ratio"CO2" decrease and temperature of atmosphere come down

and due to this change, hydrological cycle again start to come to normal condition but due to population growth and concrete sheets it is impossible to recur completely into normal state.

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

*"**Ground water sustainability"***

Groundwater sustainability can be best defined as "the development and use of groundwater in a manner that can be maintained for an indefinite time without causing unacceptable environmental or socioeconomic consequences"

Groundwater is the primary source of freshwater in streams, lakes, and wetlands, and maintains the pickled balance of inlets. When large amounts of groundwater are withdrawn from the aquifer system, the water table is locally depressed, which in turn reduces the amount of groundwater available to discharge to streams, wetlands, and estuaries. Large-scale sewering practices have also reduced groundwater levels and discharge to surface-receiving waters.

- ***Factors affecting groundwater supplies and use***

- *Methods that promote the wise use of groundwater supplies*
- *Need to determine strategies that promote groundwater sustainability*
- *Need for cooperative efforts to fill data gaps and undertake priority research*
- *Need for increased collaborative educational efforts*

It is important that we understand the factors that contribute to local, regional, or statewide groundwater shortages, the strategies that can be implemented to promote a sustainable groundwater supply, and what resources or tools are needed to implement these strategies successfully. In many parts of the country, surface water supplies are inadequate or unavailable, and groundwater is the only practical source of water supply. Groundwater feeds streams and rivers, especially during periods of drought or low flow. Approximately 40 percent of agricultural irrigation water is groundwater But the water shortages of recent drought years coupled with the increasing cases of surface and groundwater contamination warn us that we stand at a critical juncture regarding the availability of adequate water supplies. no state has met its groundwater data collection goals.

Microbial components are also available in ground water. There are different forms where ground water is stored and human can withdrawal from there namely aquifer, wells etc. Aquifers are divided into two types (confined and unconfined) depending on the position relative to surface and other permeable and impermeable layers. Man-made activities play a key role for depletion of natural composition of ground water through the disposal or dissemination of toxic chemicals and microbial matter at the land surface and into soils, or through waste water. In Pakistan, most of the population is dependent on groundwater as the only source of much clean drinking water supply than surface water. Continuous discharge of industrial effluents, domestic sewage use of fertilizers and pesticides, waste dump and over exploitation of the resource have badly impact on ground water sustainability (Harter T.). So, sustainable ground water

management is a burning challenge for the 21st century because it ensured livelihood security across the world. Agriculture dependent countries (viz. pakistan) are mostly relied on ground water.

- ***Impact of ground water depletion***

The most important impact of groundwater depletion is loss of base flow. If the base flow is reduced then there are different crucial additional impacts take place. These are:

• Increased magnitude and frequency of flood

• Loss of wetland and riparian vegetation

• Changes in channel morphology

• Accelerate erosion

• Increased frequency of drought

• Loss of biodiversity

Other impacts of ground water depletion are severe crisis of safe drinking water and irrigated water.

"Rainwater Harvesting"

Water is our most precious natural resource and something that most of us take for granted. We are now increasingly becoming aware of the importance of water to our survival and its limited supply. The harvesting of rainwater simply involves the collection of water from surfaces on which rain falls, and subsequently storing this water for later use. It is two types:

1) ***Rooftop rainwater harvesting:***

It is the system in which rainwater is collected from the roofs of the houses / buildings. It can either be stored in a tank or diverted into an artificial recharge system.

2) ***Surface Runoff rainwater:***

In urban areas rainwater flows away as surface overflow. This runoff can be caught and be used for recharging aquifers by adopting appropriate methods.

➢ *How can "Rainwater Harvesting" be linked to ground water sustainability?*

The collection of rainwater from the roofs of buildings can easily take place within our cities and towns. All that is necessary to capture this water is to direct the flow of rainwater from roof gutters to a rainwater storage tank. By doing this, water can be collected and used for various uses.in this way these store water use instead water drain out from well. When there is too much rain we can collect all the water at roof and via piping system it can be transferred to underground water after filtering so that it can be reused for household purposes.

Also we can send the rain water flowing on the streets to underground water after proper filter system so that it could be used in the dry seasons. In few places the underground water level goes down so much extent that wells, tube wells are dry in these places. Due to water withdrawal from well in this way rain water that lose can be use very properly and water which produce flood and then after flooding these water drop into river and river drop into sea which lose.in this above techniques underground water remain safe and it's level remain stable for long time .

There should be a provision of sending rain to go underground to increase underground water level so that it brings water level of wells and tube wells back to normal. There are many ways to send rain water to underground to increases the underground water level.

Most simple way to recharge is to dig a pit in the ground and make a filtering system so that clean rain water can reach underground and can be reused. Location of the pit should be on a clean ground surface so that polluted water doesn't go underground through the pit. The pit should be deep enough so that rain water would be reach the porous layer of soil as it allows the water to pass though it and get added to the underground water.

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

<u>The quality parameters that engineer must be consisted in designing water supply system for community:</u>

Selection Criteria of Water Sources

While selecting a water source for development, the engineer must consider three primary factors:

1. Water quantity

2. Water reliability

3. Water quality

1. Water quantity:

The source must be capable of supplying enough water for the rural community. If not, another resource or perhaps several sources will be required. Water Source Selection The process of choosing the most suitable source of water for development into a public water supply largely depends on the local conditions.

- ✓ ***Ground water***

Ground water as a source Generally for rural communities is the best option is exploring ground water resources. For rural water supplies simple prospecting methods will usually be adequate, whereas larger supplies, more extensive geo-hydrological investigations using special methods and techniques are likely to be needed. Dug wells can be appropriate for reaching ground water at medium depth. Tube wells are generally most suitable for drawing water from deeper water-bearing ground strata. Dug wells often are within the local construction capabilities, whereas the drilling of tube wells will require more sophisticated equipment and considerable expertise. In some cases, drilling may be the only option available.

- ✓ ***Surface water***

Surface water as a source If ground water is not available, or where the costs of digging a well or drilling a tube well would too high, it will be necessary to consider surface water from sources. Such as rivers, streams or lakes. Surface water will almost always require some treatment to render it safe for human consumption and use. The costs and difficulties associated with the treatment of water, particular the day to day problems of operation and maintenance of water treatment plants, need to be carefully considered.

- ✓ ***Rain water***

Rain water as a source Where the rainfall pattern permits rainwater harvesting, and storage during dry periods can be provided. Thus Rainwater harvesting may serve well for household and small scale rural community supplies. However this source should be considered where rainfall is heavy in storms of considerable intensity, with intervals during which there is practically no or very little rainfall

2. ***Water Reliability:***

The reliability of a water supply is one of the most important factors that the engineer considers when selecting a water source. A reliable water source is one that will supply the required amount of water for as long as needed. To determine the reliability of the water source, the engineer studies data, such as hydrological data, to determine the variations that maybe expected at the water source. Geological data should be studied since geological formations can limit the quantity and flow of water available. Also, legal advice may be necessary when selecting a water source since the laws regulating and controlling water rights may vary considerably from state to state and country to country. The stability and reliability of Water distribution systems (WDSs) is one of the important factors in ensuring public safety and the continuous operation of urban functions. Such functions include water supply, infrastructure construction and industrial development, etc. It is also the key field for infrastructure construction. The WDS is a large scale network system with complex topological structure. Its functions are designed to convey volumes of water to customers under adequate pressure. Nowadays, along with the increased population and population density, WDS is developing into wide-range supply which carries fluid under high or less pressure. A WDS can be represented as a spatially networks of multiple interconnected components. Pipes can be represented as links. Junctions, reservoirs and consumers can be represented as a collection of nodes. With the link-node representation of physical components in WDS, complex network analysis can be applied to evaluate the system reliability.

3. Water Quality:

The third primary factor the engineer must consider when selecting a water source is the quality of the water. Water supplies are generally exposed to pollution of some kind. Therefore, to ensure that water is potable, it must be tested to determine the existence of any impurities that could cause diseases, odor, foul taste, or bad color. In case of any impurities, the water will require treatment. In water treatment, the water is subjected to various filtration and sedimentation processes, and in nearly all cases is disinfected using chlorine or other disinfecting chemicals .Developing a water source includes all work that increases the quantity and improves the quality of the water or makes it more readily available for treatment and distribution. In developing a source, the engineer may use the construction of dams, diversion structures, digging or drilling of wells, and other improvements to increase the quantity and quality of the water. An examination of water quality is has basically a determination of the organisms, and the mineral and organic compounds contained in the water. The basic requirements for drinking water are that it should be:

a. Free from disease causing (Pathogenic) organisms

b. Fairly clear (low turbidity, little color)

c. Containing no compounds that cause an offensive taste or smell

d. Containing no compounds that have an adverse effect acute or in the long term, on human health e. Not of causing corrosion on encrustation of the water supply system, nor straining clothes others washed in it the results of the studies and research on drinking water quality are laid down in practical guidelines which usually take the form of a table giving number of selected water quality parameters, the highest desirable level and the maximum permissible level. Such values should not be taken as absolute standards but as indicative only. The most important parameter of drinking water quality is the bacteriological quality, i.e. the content of bacteria and viruses. It is not practicable to test the water

for all organisms that it might possibly contain. Therefore water is examined for a specific type of bacteria which originates in large numbers from human and animal excreta and whose presence in water is indicative of faucal contamination.

With best regards