DEPARTMENT OF CIVIL ENGINEERING

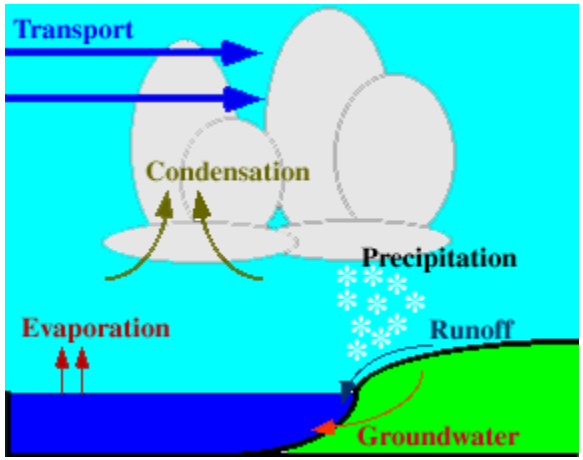
Mid Assignment / Quiz (Spring 2020) **Subject: Water supply and demand**
Name: Murtaza Kamal
Semester: M.S (Civil Engineering) **Roll No./ ID: 14436 MS (CE)**

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.

Ans.

The hydrologic cycle begins with the evaporation of water from the surface of the ocean. As moist air is lifted, it cools and water vapor condenses to form clouds. Moisture is transported around the globe until it returns to the surface as precipitation. Once the water reaches the ground, one of two processes may occur; 1) some of the water may evaporate back into the atmosphere or 2) the water may penetrate the surface and become groundwater. Groundwater either seeps its way to into the oceans, rivers, and streams, or is released back into the atmosphere through transpiration. The balance of water that remains on the earth's surface is runoff, which empties into lakes, rivers and streams and is carried back to the oceans, where the cycle begins again.

Lake effect snowfall is good example of the hydrologic cycle at work. Below is a vertical cross-section summarizing the processes of the hydrologic cycle that contribute to the production of lake effect snow. The cycle begins as cold winds (horizontal blue arrows) blow across a large lake, a phenomenon that occurs frequently in the late fall and winter months around the Great Lakes.



Evaporation of warm surface water increases the amount of moisture in the colder, drier air flowing immediately above the lake surface. With continued evaporation, water vapor in the cold air condenses to form ice-crystal clouds, which are transported toward shore.

By the time these clouds reach the shoreline, they are filled with snowflakes too large to remain suspended in the air and consequently, they fall along the shoreline as precipitation. The intensity of lake effect snowfall can be enhanced by additional lifting due to the

topographical features (hills) along the shoreline. Once the snow begins to melt, the water is either absorbed by the ground and becomes groundwater, or goes returns back to the lake as runoff.
Lake effect snow events can produce tremendous amounts of snow. One such event was the Cleveland, Ohio Veteran's Day Snowstorm from November of 1996, where local storm snowfall totals exceeded 50 inches over two to three days.

Keeping in view the above discussion to me it seems a myth that hydrological cycle is disturbed and can be changed as it's a natural phenomenon.

Que 2. Briefly describe "**Ground water Sustainability"**? How can **"Rainwater Harvesting"** be linked to ground water sustainability?
Ans 2
Groundwater is the water found under ground in the cracks and spaces in soil, sand and rock. It is stored in and moves slowly through geologic formations of soils, sand and rocks called aquifers. It is one of the Nation's most important natural resources. It plays a major role in ensuring livelihood security across the world, especially in economies that depend on agriculture. Ground water contains mineral ions which slowly dissolve from soil particles, sediments, and rocks named as dissolved solids. Continuous discharge of industrial effluents, domestic sewage uses of fertilizers and pesticides, waste dump and over exploitation of the resource have badly impact on ground water sustainability. Though over utilization of ground water is the key factor for ground water depletion but there are other factors which have negative impact on ground water sustainability. The most important impact of groundwater depletion is loss of base flow; other impacts being severe crisis of safe drinking water and irrigated water. Lastly it is to be mentioned that protection of the water resource from depletion is not possible unless the users agree to cooperate and manage the resource themselves in a sustainable manner. Moreover, the state also needs to play a key role of facilitating and fostering community action for sustainable management.

Q3. What **"Quality Parameters"** should be considered in designing water supply system for a community?
Ans WATER QUALITY PARAMETERS
Importance of Water:
Water is an essential commodity to all life
Without water, there can be no life.

Every living thing--plants, animals, and people--must have water to live.
Water is used in almost all activities of life support systems
Water is a major abiotic factor in the environment
Natural water
The endless circulation of water between atmosphere, lithosphere, hydrosphere and biosphere is known as hydrologic cycle.
We get water from Precipitation of water vapor in the atmosphere
World's Water Distribution:
Earth has tremendous amount of water
Three fourth's of the earth surface is covered by water
97% of World's water is in the seas and oceans. This water is saline.
Only 3% is present on the continents.
This water is fresh.
The distribution of water over land is uneven Water is everywhere:
Water is a common substance.
It fills the oceans, rivers, and lakes.
It is in the ground and also in the air we breathe.
Water is used for drinking, all domestic purposes, agriculture, industrial applications, cleaning and recreation
Quality determines its Usage:
Water has its own taste, color, smell and constituents.
Not all water can be used for all purposes.
Eg. Sea water can not be used by us for drinking.
The suitability of water for different purposes is determined by its quality parameters.
Quantity and quality:
On an average, each person in a developed country uses about 260 litres of water a day in the home.
The Quality of water is equally important than quantity.
Even if present in huge amounts, we can not use salt water in many life support activities.
Characteristics of
Water:
Water is a good solvent
Water never occurs in its pure form
All waters contain some dissolved substances
The quality of water is determined by these substances.
It has the ability to dissolve many inorganic and organic substances.
Water Quality Parameters:
Water has its own Physical properties

Chemical composition and
Biological Properties
Physical Properties:
Temperature
Colour
Odor
Turbidity
Electrical Conductivity
Temperature (T) of Water:
Essential for all environmental studies
Controls many ecological processes including chemical reactions.
T of surface water varies from space and time
T of groundwater varies not only
with reference to space and time
but also with reference to depth.
Temperature of Water:
Measured using Thermometers
It ranges from 0 to 100 degree Celsius
Unit of measurement is degree
Celsius
The temperature of Surface water is influenced by the atmospheric conditions
The temperature of groundwater is controlled by the thermal characteristics of bedrocks and the depth.
Color of water:
The color of water is due to the suspended particles and organic matter
Ranges form light to dark brown
Brownish color in water comes due to the presence of iron
Greenish color in pond water is seen due to the presence of organic substances including al Odor:

Pure water is odorless

When water dissolves other substances, the odor is determined by them

Mostly decayed organic substances give fouling smell

Inorganic substances give earthy smell

Turbidity:

Muddiness in water
Comes due to suspended particles from clay, silt and organic matter

Controls the transparency of water
Transparency is measured using
Secchi Disc

Water Turbidity is measured using Nephelometer

Electrical Conductivity(EC):

Ability of a substance to conduct an electrical current.

The presence of charged ionic species makes water conductive.
It is measured using EC meters.
Directly related to temperature of water.

Unit of measurement is mmhos/cm at std temperatures. Ranges from 100-1,00,000

Pure water is less conductive

Chemical properties:

pH

Total Dissolved Solids(TDS) Major ions

Minor or trace elements

Hardness

Salinity

Alkalinity

pH of water:

Refers to the effective concentration of hydrogen ions in water

It ranges from 0 to 14. Measured using pH meters

Water is said to be acidic(less than 7)

or alkaline (above 7) depending on the relative concentration of hydrogen ions from the neutral value which is 7.

Total Dissolved Solids(TDS):

Concentration of non -volatile substances present in colloidal or molecular state

Total of all ions present in water, expressed in ppm or mg/L

Increases due to dissolution of more mineral substances by water on its path

TDS determines the suitability of water for our use and consumption.

Quality of Water :

Total dissolved solids(ppm)

< 1000	fresh water
1000-10,000	brackish water
10,000 to 1,00,000	saline
> 1,00,000	hypersaline or brine

Classification of Dissolved constituents:

Basis of concentrations-mg/L

Charges(positive or negative)

Level of Toxicity (toxic or non-toxic)

Based on Concentrations:

Major ions(> 10 mg/L)

Mostly Bicarbonate, calcium, Magnesium, Chloride, sodium, sulphate and silicon

Minor ions (0.1-10 mg/L)

Mostly Carbonate, fluoride, nitrate, potassium, iron, strontium, boron.

Trace elements(< 0.1 mg/L)

Mostly Aluminium, Arsenic, Barium, Bromide, Cadmium, Chromium, Cobalt, Copper, Lead, Zinc, Nickel, Phosphate, Silver, Tin and Vanadium.

Based on ionic Charges:

Major ions

Positively charged = Cations Negatively charged = anions

Major Cations in water:

Calcium

Magnesium

Sodium

Potassium

(Source: lithosphere)

Major Anions in Water:

Bicarbonate

Carbonate

Chloride

Sulphate

Nitrate

Phosphate

Trace elements in water:

Play a significant role in the use of water

Some are essential elements for health & growth

Some are injurious to health and toxic also.

Deficiency or excess intake of some of these elements may cause serious health problems to life.

Hardness:

Hardness of water is defined as its content of metallic ions which react with sodium soaps to produce a residue
Expressed as total concentration of

Calcium and Magnesium in ppm. Total hardness= 2.5 Ca + 4.1 Mg. Softwater (Temporary)

Hardwater (permanent).

Salinity of Water:

Comes due to sodium and chloride

Sea water contains 35,000 ppm or mg/L of dissolved salts

Alkalinity of water:

Combined effect of Bicarbonates and Carbonates with calcium ions

It has a direct relationships with pH.

Carbonates will be noticeable for water having a pH of more than 8.2

Biological Properties:

Dissolved Oxygen (DO)

Biochemical Oxygen

Demand(BOD)

Chemical oxygen

Demand(COD)

Microorganisms-Bacterial counts

Dissolved Oxygen(DO):

Is related to the solubility of air in water at 0 deg. C

Solubility of oxygen in water decreases with high temperatures

Important property for aquatic organisms

Surface water bodies should have enough

DO

If DO depletes, it will be difficult to many aquatic organisms for their survival.

Biochemical Oxygen Demand(BOD):

Is a measure of the biodegradable material

It is determined by incubating a water sample and measuring the decrease in dissolved oxygen as bacteria decompose these materials.

Chemical Oxygen Demand(COD):

Is determined by chemical oxidation of water with dichromate

Water Quality Parameters:

Limits the suitability of water for different purposes

Drinking

Domestic consumption

Agriculture

Industrial Processes

Cleaning and Recreation.

Water Quality Standards

Permissible limits

United States Public Health Drinking

Water Standards(USPH)

Indian Standards Institution (ISI)

World Health Organization (WHO)

Below are Given Standards for Basic Drinking Water Parameters as per WHO

W.H.O. DRINKING WATER STANDARDS

PARAMETER	UNIT	LIMIT
Aluminium	mg Al/l	0.2
Arsenic	mg As/l	0.05
Barium	mg Ba/l	0.05

Berylium	ug Be/l	0.2
Cadmium	ug Cd/l	5.0
Calcium	mg Ca/l	200.0
Chromium	mg Cr/l	0.05
Copper	mg Cu/l	1.0
Iron Total	mg Fe/l	0.3
Lead	mg Pb/l	0.01
Magnesium	mg Mg/l	150.0
Manganese	mg Mn/l	0.1
Mercury	ug Hg/l	1.0
Selenium	mg Se/l	0.01
Sodium	mg Na/l	200.0
Zinc	mg Zn/l	5.0
Chlorides	mg Cl/l	250.0
Cyanide	mg Cn/l	0.1
Fluorides	mg F/l	1.5
Nitrates	mg NO_3/l	10.0
Nitrites	mg NO_2/l	-
Sulphates	mg SO_4/l	400.0
Suphides	mg H_2S/l	0
TOTAL "drins"	ug/l	0.03
TOTAL "ddt"	ug/l	1.0
Hydrocarbons	mg/l	0.1
Anionic Detergents	mg/l	0
pH		9.2
Total dissolved solids	mg/l	1500
Total hardness	mg/l	500
Alkalinity	mg/l	500
MICROBIOLOGICAL PARAMETERS		
Total Bacteria	Count/ml	100
Coliform	Count/100ml	0
E. Coli	Count/100ml	0
Salmonella	Count/100ml	0