ASSIGNMENT

Student Name:

Rizwan Wahid

Student ID:

15239

SUBMITED TO:

Engr. Nadeem Ullah

SUBJECT:

Water Demand Supply and Distribution

1.Hydrologic cycle

The hydrologic or Water cycle is the continuous movement of water between the earth and the atmosphere. Water reaches land as precipitation such as rain and snow. Then the water evaporates, condenses in the atmosphere to form clouds, and falls to the earth again as precipitation, continuing the cycle.

There are four main stages in the water cycle. They are evaporation, condensation, precipitation and collection. Let's look at each of these stages.

Evaporation:

This is when warmth from the sun causes water from oceans, lakes, streams, ice and soils to rise into the air and turn into water vapor. Water vapor droplets join to make clouds.

Condensation:

This is when water vapor in the air cools down and turns back into liquid water.

Precipitation:

This is when water (in the form of rain, snow, hail or sleet) falls from clouds in the sky.

Collection:

This is when water that falls from the clouds as rain, snow, hail or sleet, collects in the oceans, rivers, lakes, streams. Most will infiltrate (soak into) the ground and will collect.

Hydrological cycle is disturbed?

The science community now generally agrees that the Earth's climate is undergoing changes in response to natural variability, including solar variability, and increasing concentrations of greenhouse gases and aerosols. Furthermore, agreement is widespread that these changes may profoundly affect atmospheric water vapor concentrations, clouds, precipitation patterns, and runoff and stream flow patterns.

For example, as the lower atmosphere becomes warmer, evaporation rates will increase, resulting in an increase in the amount of moisture circulating throughout the troposphere (lower atmosphere). An observed consequence of higher water vapor concentrations is the increased frequency of intense precipitation events, mainly over land areas. Furthermore, because of warmer temperatures, more precipitation is falling as rain rather than snow.

In parts of the Northern Hemisphere, an earlier arrival of spring-like conditions is leading to earlier peaks in snowmelt and resulting river flows. Consequently, seasons with the highest water demand, typically summer and fall, are being impacted by a reduced availability of fresh water.

Warmer temperatures have led to increased drying of the land surface in some areas, with the effect of an increased incidence and severity of drought.

Reasons of Water Cycle Disturbance:

- Green House Gases Emission.
- Deforestation.
- Excess Use of Fossil Fuels.
- Urbanization.
- Industrialization.
- Land Use Change.
- Ecosystem Changes.
- Water Abstraction.

2.Rainwater Harvesting and Ground water Sustainability

Ground water sustainability:

Ground water sustainability is defined as the maintenance and protection of groundwater and related ecosystems to balance current and future environmental, economic and human (social) requirements.

Groundwater is the main source of drinking water for half of the world's population. Therefore, it is very important to conserve and manage this resource. Sustainable development and management of groundwater resource mean to the efficient management of the existing groundwater resources to meet the requirement of the present and future demand without affecting the risk associated with the damage to aquifer physical characteristics

Five Goals for Sustainable Groundwater Management.

1. Protection of groundwater supplies from depletion (Groundwater Quantity)
2. Protection of groundwater quality from contamination (Groundwater Quality)
3. Protection of ecosystem viability (Ecosystems)
4. Achievement of economic and social wellbeing (Socioeconomic)
5. Application of good governance (Governance).

Ground Water Sustainability:

• Identify sources of potable water
• Determine consumptive use requirements
• Evaluate sustainability of groundwater withdrawals
• Compliance with state permitting and sustainability requirements
• Identify ecosystems that depend on access to or discharge of groundwater
• Determine ecological water requirements
• Develop sustainability thresholds and triggers for management action

• Strategies for acquiring groundwater rights or other protective measures
• Delineate areas or activities that may affect groundwater discharge.
• Review, develop or run analytical and numerical models
• Estimate groundwater-level declines, stream flow depletions and the capture of aquifer discharge.

Rainwater Harvesting:
Rainwater harvesting is the process of collection of rainwater from surfaces on which rain falls, filtering it and storing it for multiple uses. Rainwater harvesting puts the supply of water back to normal levels. It is the collection and storage of water from surfaces that rain has fallen upon.
Rainwater harvesting is an innovative technique utilized to harvest rainwater from roofs and other above surfaces to be stored for later use. Rain harvested water can be used for garden and crop irrigation, watering livestock, laundry, and flushing toilets.
Rainwater harvesting systems are cost effective, provide high quality water, reduce dependence on wells. The surplus rainwater can also be used to recharge ground water aquifer through artificial recharge techniques. Following are the methods of Rainwater Harvesting which also impact the ground water sustainability.

Methods of Rainwater Harvesting:
Broadly there are two ways of harvesting rainwater
1)Surface runoff harvesting
2)Roof top rainwater harvesting.

1. Surface runoff harvesting:
In urban area rainwater flows away as surface runoff. This runoff could be caught and used for recharging aquifers by adopting appropriate methods.

Methods of Surface Runoff Harvesting.
- Surface spreading Method.
- Recharge Well Method
- Induced Recharge Method

2. Rooftop rainwater harvesting:
It is a system of catching rainwater where it falls. In rooftop harvesting, the roof becomes the catchments, and the rainwater is collected from the roof of the house/building. It can either be stored in a tank or diverted to artificial recharge system. This method is less expensive and very effective and if implemented properly helps in augmenting the groundwater level of the area.

Methods of Rooftop Rainwater Harvesting
Various methods of using roof top rainwater harvesting are illustrated in this section.
Storage of Direct Use.

- Recharging groundwater aquifers
- Recharging of bore wells
- Recharge pits
- Soak way or Recharge shafts
- Recharging of dug wells
- Recharge trenches
- Percolation tank.

3.Quality Parameters for Water supply Design System

A Water supply scheme includes huge and costly structures like dams, reservoirs, treatment works, penstocks etc which cannot be replaced or increased in their capacities, easily and conveniently It should be neither too long nor should it be too short. Normally 20-30 years is considered for distribution system.
Following are the Quality parameters considered in designing the water supply system for a community.

Essential Elements For Design Of Water Supply System Planning:

- Design period
- Economic aspects
- Design criteria
- Storage design
- Pumping station design
- Water Consumption.
- Peak Hourly Consumption

Quality Parameter for Design Water Supply System:
1. Water consumption rate (Per Capita Demand in liters per day)
2. Population to be served
Water Demand = Per capita demand x Population

Per Capita Demand (Rate Of Demand) (Q):
It is the annual average amount of daily water required by one person and includes the domestic use, industrial and commercial use, public use, wastes, thefts, etc.

Per capita Demand in liters/day/head =Total yearly water requirement of the city in Liters / 365xDesign population.

Q=V/365P

For an Average As per I.S recommendations the per capita demand may be taken as given in table below.

Use Consumption (Lpcd):

S. No	Purpose	Amount (LPCD)
1	Domestic use	135
2	Industrial use	50
3	Commercial use	20
4	Civic or public use	10
5	Waste/theft	55
6	Total Quantity	**270**

The above figure or 270 lpcd when multiplied by the population at the end of the design period shall give the total annual average water requirement of the city/day. When multiplied by 365 will give the volume of the yearly water requirement in liters.

Factors Affecting Per Capital Demand:

1. Size and type of city
2. Climatic conditions
3. Class of consumers
4. Quality of water
5. Pressure in the distribution system
6. Sewerage Facilities
7. System of supply
8. Policy of metering system
9. Cost of water.

Population Forecasting:

The design population is estimated with due to all factors governing the future growth and development of the project area in the industrial, commercial, educational, social and administrative spheres. Design of water supply and sanitation scheme is based on the projected population of a city or town and estimate the design period of the components of all structures of water supply and sanitation are depends on projection of

population. Changes in the population of the city over the years occur, and the system should be designed considering of the population at the end of the design period.

Factors Affecting Changes In Population:

- Increase due to births
- decrease due to deaths
- Increase/ decrease due to migration
- Increase due to annexation
- change (in education, politics, recreation and economic).
- increase in facilities of transport system.

Methods Of Population Forecasting:

- Arithmetic progressive method,
- Incremental increase method,
- Geometric progression method and
- Exponential growth rate methods.
- Comparative Graphical Method
- Simple Graphical Method