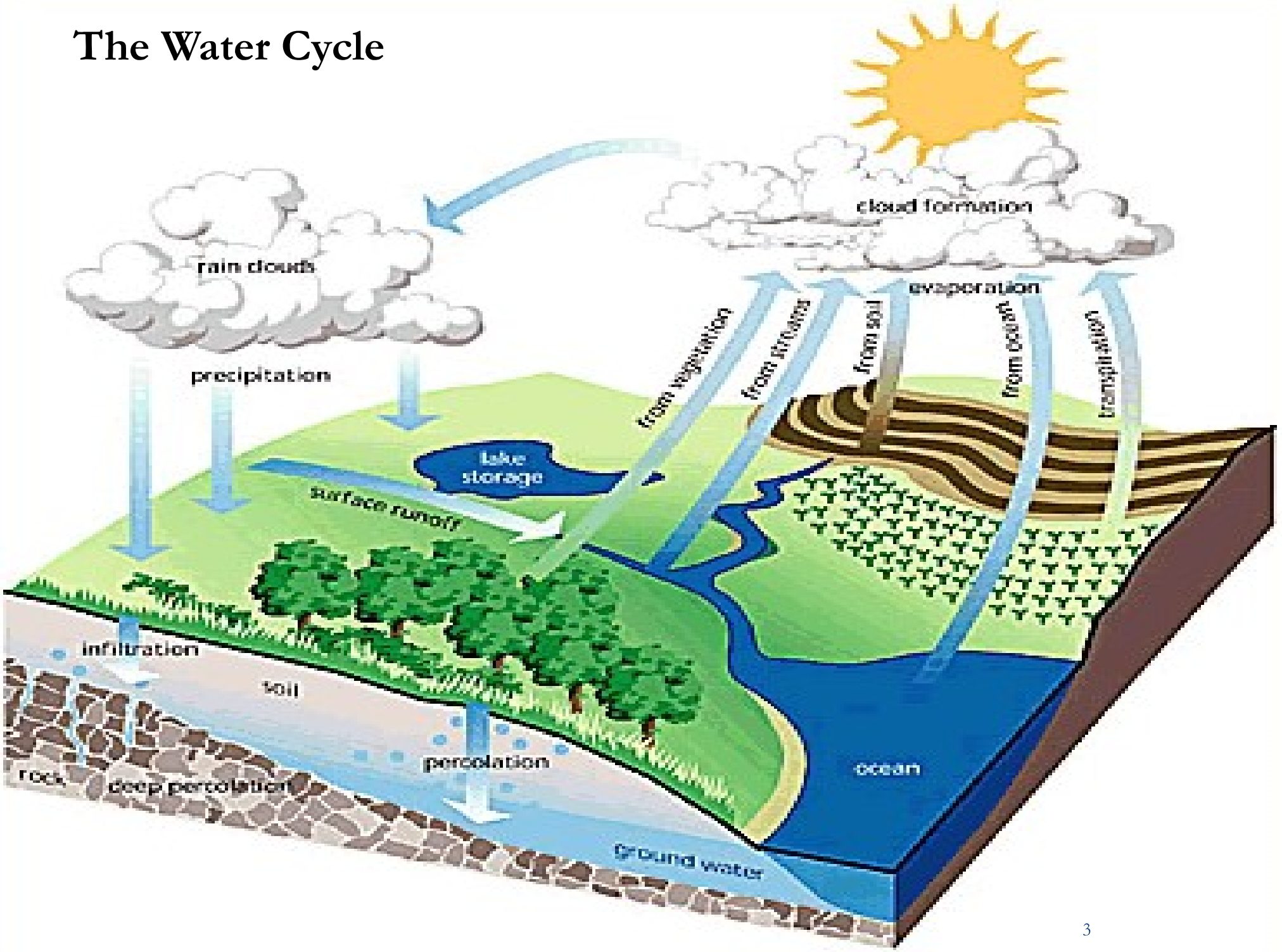
HYDROLOGY - BASIC CONCEPTS

Hydrology

* Hydrology is the science of the waters of the earth and its atmosphere. It deals with occurrence, circulation, distribution and movements of these waters over the globe and their interaction with the physical and biological environments.

The Water Cycle



Engineering Hydrology

* Engineering hydrology is the branch of hydrology which deals with estimation of water resources and related hydrologic quantities. It also investigates hydrologic problems such as floods and droughts, and develops strategies to mitigate them.

Floods & Droughts

Need for the Hydrologic Studies

* The need of the hydrologic studies arises from the following problems:
  * Uncertainty of precipitation and its seasonal occurrence
  * Seasonal flow of rivers, and
  * Population growth and rising standards of living

Continued….

Need for the Hydrologic Studies

* In many countries water is the main source of energy and the agriculture is an important sector for their economic growth. Although water is vital to life, but the precipitation which is the main source of water, is an uncertain phenomenon i. e. there might be plenty of rainfall when we do not need it and no rain when it is required. So we need to plan accordingly. It is necessary to store surplus water when and where available and to use it when and where required. Uncertainty of precipitation makes the study of various features of hydrology exceedingly important, which then will be helpful in better planning and development of water resources.

Continued….

Need for the Hydrologic Studies

* The flow in rivers varies from season to season. There are low flows during lean period and high flows during floods. The floods although bringing fertile silts, but are hazardous to human life and property. Flood mitigation is necessary to safeguard human life, livestock, cash crops and against spread of disease.
* The increased population and rising standards of living have greatly increased the demands of water. Hydrologic studies are of utmost importance for planning and development of water resources to meet these demands.

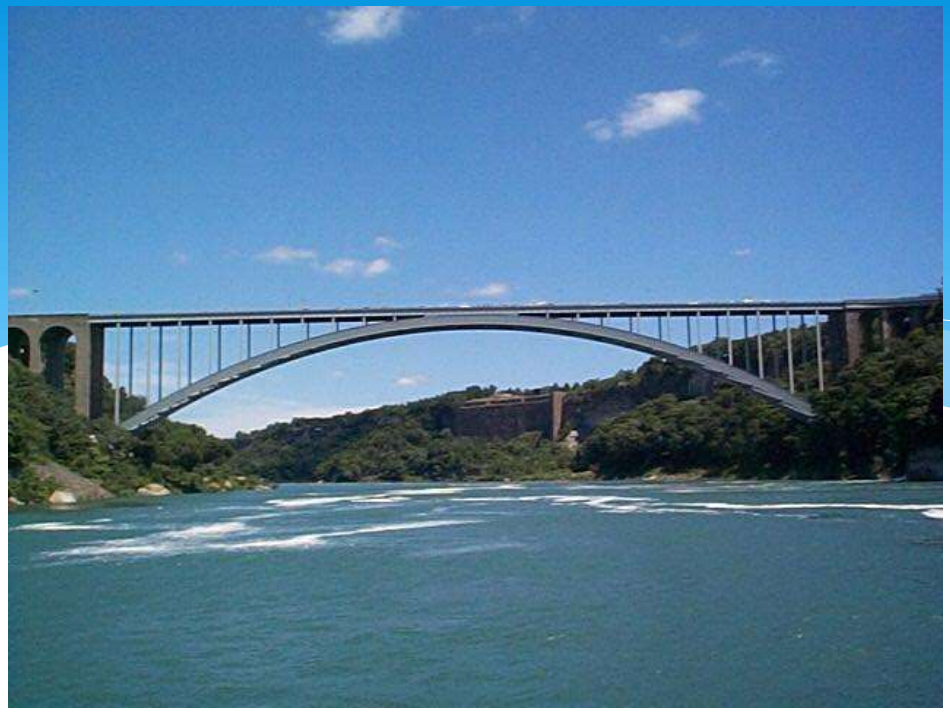
Importance of Hydrology in Civil Engineering

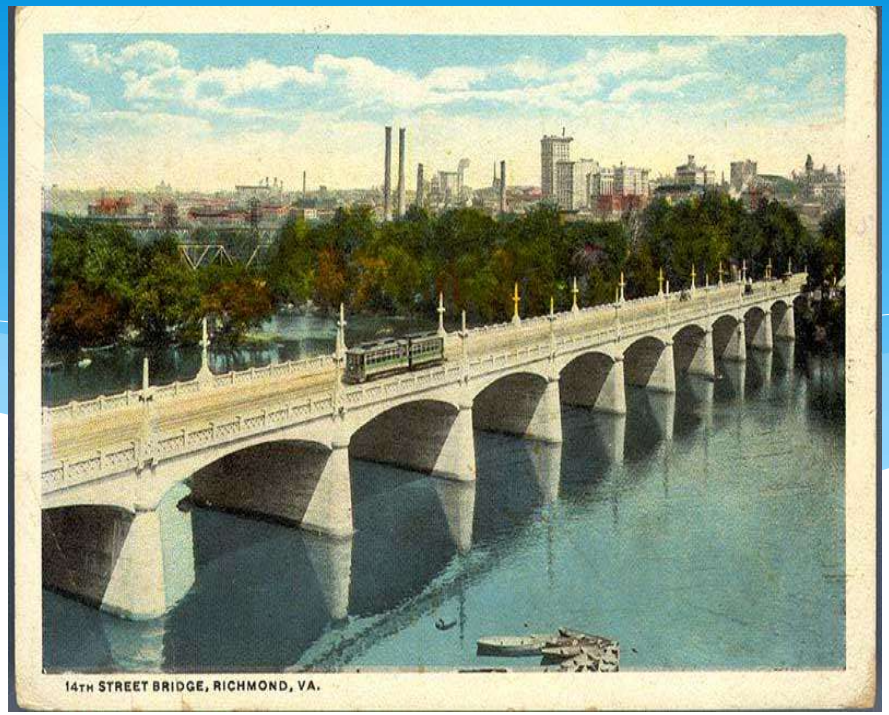
* Hydrology has an important role in the design and operation of water resources engineering projects like irrigation, flood control, water supply schemes, hydropower projects and navigation. Many important civil engineering projects have failed because of improper assessment of hydrologic aspects of the projects. Hydraulic structures which are very important civil engineering projects and cost millions of dollars may fail due to improper hydrologic design.

Continued….

Importance of Hydrology in Civil Engineering

* For example, a dam may fail due to inadequate spillway capacity. There may be reservoir operational problems due to lack of hydrologic data like probable inflows, evaporation and seepage. There might be failure of a bridge or a culvert if its maximum design flood is not estimated properly. Construction of a dam may cause problem for bridges upstream and downstream if proper hydrologic studies regarding floods and erosion downstream are not estimated and taken into account in design. Groundwater studies are important for installation of tube wells and irrigation projects. These are just a few examples which show the importance of hydrologic studies for civil engineering projects.




14TH STREET BRIDGE, RICHMOND, VA.

Major Aspects of Hydrology

* The main jobs of a hydrologist are collection and analysis of data, and making predictions out of this analysis.
  * Collection of Data
    * The hydrologic data comprises:
    * a. Rainfall Data
    * b. Snowfall and Snowmelt Data
    * c. Runoff Data (Catchment Runoff and Stream Flows), and
    * d. Groundwater Data

Continued….

Major Aspects of Hydrology

* Analysis of Data
  * Analysis of hydrologic data includes checking it for consistency and homogeneity as well as finding its various statistical parameters.
* Prediction
  * Prediction means finding design values and maximum possible floods and droughts. Various approaches for prediction of hydrologic values are:
    * Statistical Approach
    * Physical Approach
    * Deterministic Approach