UNIT:II

**TOPIC: BASIN OR CATCHMENT HYDROLOGY: PRECIPITATION CHARACTERISTICS/TYPES AND PATTERN IN RELATION TO BASIN PHYSIOGRAPHIC UNITS****;1 CONCEPT OF BASIN RUNOFF;2 FACTORS AFFECTING BASIN RUNOFF, GEOLOGY AND SOILS; VEGETATION AND LAND USE, PHYSIOGRAPHIC CHARACTERISTICS, METEOROLOGICAL AGENTS AND CHANNEL AND FLOODPLAIN MORPHOLOGY.**

**Concept of Basin Runoff:**

Runoff is that portion of precipitation that flows over land surfaces toward larger bodies of water. Runoff can occur whenever rainfall satisfy the immediate demands of infiltration, evaporation, interception, surface storage and surface confinement. Thus, runoff can be expressed with the help of the following equation.

Precipitation– (infiltration + evapotranspiration+ interception + surface storage +surface confinement) = runoff

This can be illustrated by a hydrograph with a steady rainfall input:



**Factors Affecting Runoff:**

Geology: Infiltration rate vary with type of soil. So, runoff is great affected by soil type. Soil texture, or the percentage of sand, silt, and clay in a soil, is the major inherent factor affecting infiltration. Water moves more quickly through the large pores in sandy soil than it does through the small pores in clayey soil. Infiltration rate is high in areas having porous soil and thus reduce the volume of runoff. Broadly unfractured rocks cause almost complete run off with fractured rocks somewhat less and soil with lots elective vegetation also somewhat less but barren soils cause extraordinary runoff.

Catchments with average flow direction oriented toward the strike direction are characterized by large baseflows; Catchments with average flow direction oriented toward the opposite dip direction are steep, and this results in quick storm runoff generation; Catchments with average flow direction oriented toward the dip direction are gentle, and this results in delayed storm runoff generation.

**Vegetation and Land Use:**

Land use is a critical issue that affects primarily the hydrological cycle and the water balance of an ecosystem since the land cover influences potential evapotranspiration, infiltration, surface runoff and sediment yield in a watershed.

Land use and land management practices have great effect on the runoff yield. For example, an area with forest cover or thick layer of leaves and grasses contribute less runoff, because vegetation cover increase potential evaporation and results to the reduction of surface runoff.

Physiographic characteristics:

It includes both watershed and channel characteristics, which area as follows,

1. Size of Watershed: Size of watershed determines the quantity of rainfall received retained and disposed off [runoff]. Larger the watershed, larger be the channel and storage of water in basin.

A large watershed takes longer time for draining the runoff to outlet than smaller watershed and vise-versa.

2. Shape of Watershed: There are two shapes of river basins - fan shaped and a elongated linear or fern shaped basin. In the fan shaped basin and if the entire basin has had rainfall, the travel time for water from the distant areas to reach the outlet of the basin will be *nearly equal*, so the discharge at the outlet will have a higher peak discharge compared to the elongated linear basin. In the latter case, the discharges from different regions reach the outlet at different times and so the peak discharge at the outlet will have a lower peak discharge.



1.Fern shaped watershed 2. Fan shaped watershed

3. Topographic characteristics:

It includes those topographic features which affects the runoff. Undulate land has greater runoff than flat land because runoff water gets additional energy [velocity] due to slope and little time to infiltrate.

**4. Orientation of Watershed:**

This affects the evaporation and transpiration losses from the area. The north or south orientation, affects the time of melting of collected snow.

**5. Drainage Density:**

It is defined as the ratio of the total channel length [L] in the watershed to total watershed area [A]. Greater drainage density gives more runoff

**6. Meteorological agents:**

 It is associated with characteristics of which includes.

1.Types of Precipitation:

It has great effect on the runoff. For example. a precipitation which occurs in the form of rainfall starts immediately as surface runoff depending upon rainfall intensity while precipitation in the form of snow does not result in surface runoff.

ii. Rainfall Intensity:

If the rainfall intensity is greater than infiltration rate of soil then runoff starts immediately after rainfall. While in case of low rainfall intensity runoff starts later. Thus, high intensities of rainfall yield higher runoff.

iii. Duration of Rainfall:

It is directly related to the volume of runoff because infiltration rate of soil decreases with duration of rainfall. Therefore, medium intensity rainfall even results in considerable amount of runoff if duration is longer.

iv. Rainfall Distribution:

Runoff from a watershed depends very much on the distribution of rainfall. It is also expressed as “distribution coefficient” mean ratio of maximum rainfall at a point to the mean rainfall of watershed. Therefore

v. Direction of Prevailing Wind:

If the direction of prevailing wind is same as drainage system, it results in peak   low. A storm moving in the direction of stream slope produce a higher peak in shorter period of time than a storm moving in opposite direction

vi. Other Climate Factor:

Other factors such as temperature wind velocity, relative humidity, annual rainfall etc. affect the water losses from watershed area.

Compiled by:

Major Hariman Deka