Hydrograph Analysis

A hydrograph is a graph showing the water flow rate (discharge) of a river or channel over time. It plots discharge (m^3/s) on the y-axis against time on the x-axis.

A hydrograph shows the time distribution of total runoff at a specific point of measurement. It is generated from runoff resulting from either an isolated storm or a series of consecutive storms.

Isolated Storm: Results in a single-peaked hydrograph.

Complex/Consecutive Storms: Results in a multi-peaked hydrograph.

Theory Behind the Hydrograph

There are three essential components in a single-peaked hydrograph resulting from an isolated storm:

Rising Limb (AB)

Peak or Crest Segment (BPC)

Recession Limb (CD)

1. The Rising Limb (AB)

The rising limb, also known as the concentration curve, is the ascending portion of the hydrograph. it represents the increasing discharge due to a gradual increase in flow from the stream's catchment area.

Initial Stages: In the early stages of a storm, discharge rises slowly because of initial losses, such as water being intercepted by vegetation, filling depressions in the ground, or infiltrating the soil.

Shape: The initial curve is concave. As the storm continues, infiltration rates decrease and the ground becomes saturated, allowing more water from distant parts of the watershed to reach the outlet.

Influencing Factors: The shape is determined by both the basin characteristics (size, shape, slope) and the storm characteristics (duration and intensity).

2. The Peak or Crest Segment (BPC)

This is the most important part of the hydrograph as it contains the Peak Flow (P), which represents the maximum discharge rate.

Inflection Points: It stretches from inflection point B (on the rising limb) to inflection point C (on the recession limb).

Transition: Point 'B' indicates the transition of water from the catchment area entering the drainage channel.

Peak Arrival: The peak 'P' indicates that flow from all parts of the basin has arrived at the outlet. For large catchments, this peak actually occurs after the rainfall has stopped.

3. Lag Time (t_L)

Lag time is the time interval between the center of mass of the rainfall and the peak discharge.

Multiple Storms

If two storms occur close together, they may produce a single-peaked or multi-peaked hydrograph depending on the time gap.

Example: During the rainy season, if it rains for 2 hours in the morning, followed by a 2-hour gap, and then rains again for 1 hour, the resulting hydrograph will likely show multiple peaks.