

# Simplified Modified Rational Method

The **Simplified Modified Rational Method** is a runoff method common to the USA, used to generate flows in place of a full hyetograph. This method benefits from easy confirmation of results by hand. This method should not be confused with the UK based Modified Rational Method used to generate peak flows during the [Network Design](#).

Due to its static nature, this runoff method does not require dynamic rainfall, and a single or multiple IDF Table can be used. Most design storms can be used as well, as they hold or can generate IDF tables internally. User Defined rainfall or non-IDF deriving rainfall types (e.g. SCS, Long Term or Observed) cannot be used for static analysis.

In order to perform a sizing analysis using the Simplified Modified Rational Method, two conditions must be met:

- Each inflow in the phases to be analysed must be using the Simplified Modified Rational runoff method.
- The Analysis Criteria must be set to use Static method, and a suitable rainfall selected.

This method assumes that the rainfall intensity averaging period is equal to the actual storm duration. This means that the rainfall and runoff that occur before and after the rainfall averaging period are not accounted for. Therefore, the Modified Rational Method may underestimate the required storage volume for any given storm event.



The Simplified Modified Rational Method should normally be used in homogeneous drainage areas of less than 20 acres, with a Time of Concentration of less than 20 minutes.



This method may not be available for your region. For more information, refer to the [Regionalisation](#) topic.

## Calculations

Calculations are outlined in more detail in the Norfolk, Virginia Engineering Calculations document (pages 5-12 to 5-17).

The method involves the use of the standard rational method equation to generate a peak flow that is then converted into an inflow hydrograph using the following formula:

$$Q = CfCIA$$

where:

Q = Flow

Cf = Runoff Coefficient (Adjustment) Factor - Accounts for reduction of infiltration and other losses during high intensity storms

C = Runoff Coefficient

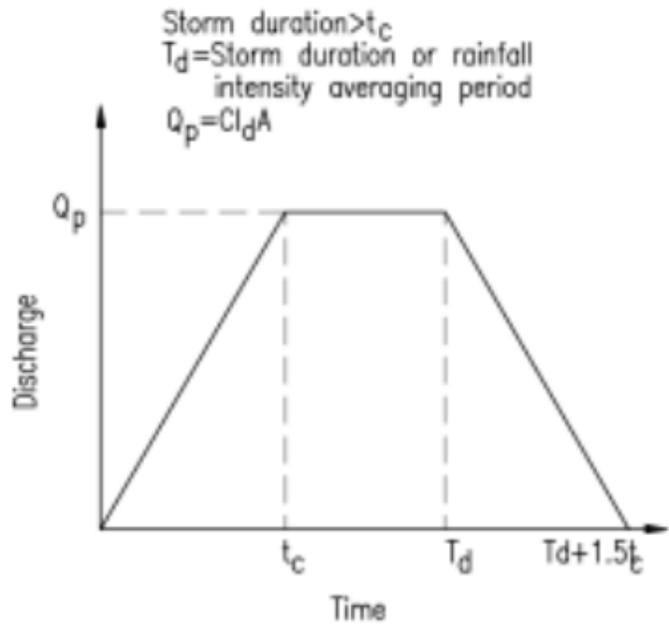
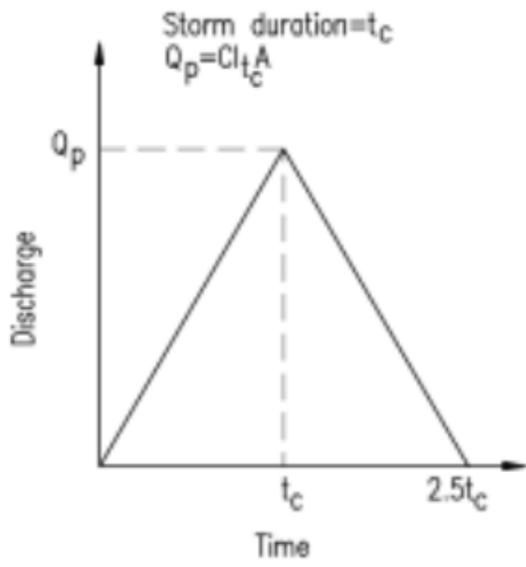
I = Rainfall Intensity – Selected from an IDF table based on the duration

A = Area

The hydrograph is then created using some additional parameter to describe the shape of the curve. These are:

- **Duration of Peak, or rainfall averaging period,  $T_d$**  – The duration to run the storm for before the start of the recession (drain down) limb. This must be greater than or equal to the time of concentration. Where equal the curve is a triangular hydrograph.
- **Recession Limb Multiplier** - The time taken to drop back from the peak to zero after the duration of the event. This defaults to 1 to give a triangular curve, but may be increased to give a longer drain down. A value of 1.5 is commonly used as it better reflects the SCS runoff.

The graph starts at 0, 0 and then builds up to the peak flow for the  $T_c$  value. It will then remain at that flow rate until  $T_d$ , at which point it will drop back to zero based on the recession multiplier \*  $T_c$ .



Images taken from the Norfolk, Virginia Engineering Calculations, Figure 5-5