FEV (Flood-excess volume) is the volume of flood water we wish to mitigate. Thus, best case we want is to reduce it to 0. By following the FEV formula such as,

$$\mathrm{FEV} = \sum_{k=1}^{N_m} \left(Q(\bar{h}_k) - Q(h_T) \right) \Delta T$$

Or

$$\mathrm{FEV} = \int_a^b Q(h_m) - Q(h_T)\, dT$$

Where,

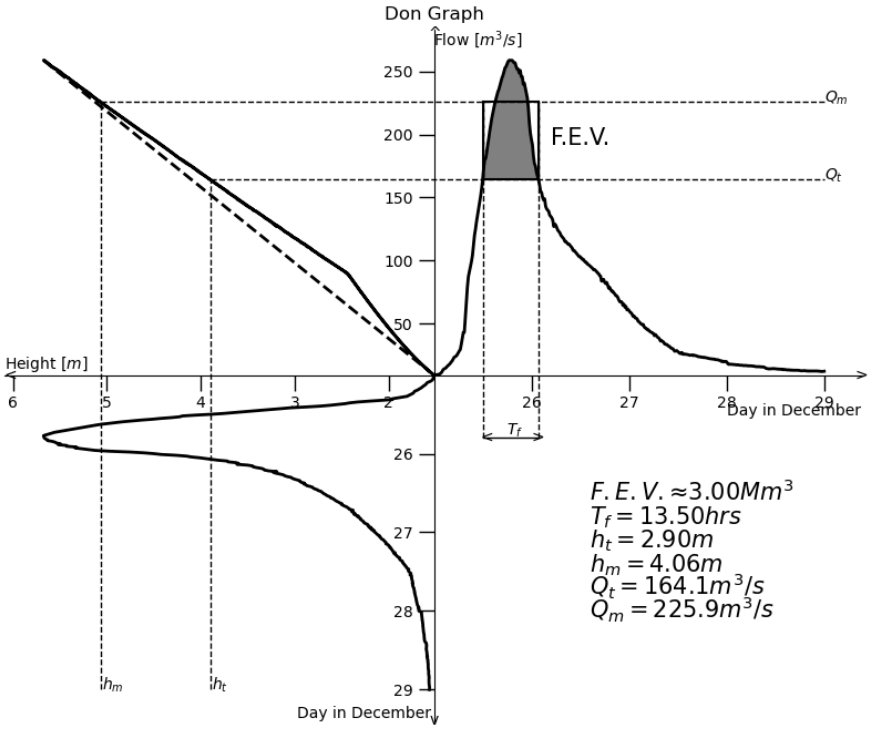
- a and b are the time of the flooding period measure in second.

- $Q(h_m)$ or Q_m is mean flow rate which we obtained from h_m via rating curve. We also can obtain h_m through estimation $h_m \approx \frac{(h_{max} - h_T)}{2}$.

- $Q(h_T)$ or Q_T is the threshold discharge level which we obtained from h_T via rating curve. Usually, h_T is given by government. This can be found through the moment when its start flooding.

- Moreover, the flow rate can be also estimated through linear interpolation if rating curve is not well known, $Q_m \approx \frac{h_m}{h_{max}} Q_{max}$ and $Q_T \approx \frac{h_T}{h_{max}} Q_{max}$.

When h_T is equal to h_{max}, the FEV equation will yield 0 based on the formula. This does indicate h_T has reached the maximum level of the river level which if we consider the above threshold will be equal to 0. Hence, for this case there is no flooding happen.



- The bottom-left panel describes the correlation between height vs time **(h_T, h_m).**
- The upper-left panel shows the rating curve **(Q_h).**
- The upper-right panel is the value that passed from the rating curve (for these graph combination) and state h = h(t) = h_t so that using this graph the flow rate Q(h) = Q(h_t) is in the time function. **(Q_T, Q_m).**

Our first FEV equation:

$$V_e \approx V_{e1} = T_f\left(\overline{Q}(h_k) - Q(h_T)\right)$$

Where,

$Q(h_T)$ = The threshold discharge level $(^{m^3}/_s)$

$\overline{Q}(h_k)$ = Mean flow rate usually data is given$(^{m^3}/_s)$

T_f = Flood duration (s)

Our Second FEV equation:

$$V_e \approx V_{e2} = \sum_{k=1}^{N_m}\left(Q(\bar{h}_k) - Q(h_T)\right)\Delta T$$

Where,

N_m = number of value in Q in certain duration

$Q(\bar{h}_k)$ = rating curve $(^{m^3}/_s)$

$Q(h_T)$ = The threshold discharge level $(^{m^3}/_s)$

ΔT = Time interval between measurement

Our Third FEV equation:

$$V_e \approx V_{e3} = T_f\frac{Q_{max}}{h_{max}}(h_m - h_T)$$

Where,

h_{max} = maximum water level

h_m = mean water level

h_T = water level for choosen flood threshold

Q_{max} = maximum flow rate

T_f = flood duration

Reference:

Bokhove, O., Kelmanson, M.A., Kent, T. (2018) “On using flood-excess volume in flood mitigation, exemplified for the River Aire Boxing Day Flood in 2015”. Available at: https://eartharxiv.org/stc7r/