FEH Book Statistical Procedures for flood frequency estimation. Tributary of the River Wye, Macclesfield Road, Buxton

Book 3. Para 3.3 Estimation of $QMED_{rural}$

$$QMEDrural = 1.172AREA^{AE}\left(\frac{SAAR}{1000}\right)^{1.560}FARL^{2.642}\left(\frac{SPRHOST}{100}\right)^{1.211}0.0198^{RESHOST}$$

For River Roche the following catchment parameters have been obtained from the FEH CD Rom 2.

AREA 1.36km^2, SAAR 1336, FARL 1.0, SPRHOST 11.34, BFIHOST 0.702, URBEXT 1990 0.1121.

$$AE = 1 - 0.0015.\ln\left(\frac{AREA}{0.5}\right)$$

$$AE = 1 - 0.0015\ln(2.72) = 0.9985$$

$$RESHOST = BFIHOST + 1.30\left(\frac{SPRHOST}{100}\right) - 0.987$$

$$RESHOST = 0.702 + 1.3\left(\frac{11.34}{100}\right) - 0.987 \quad = -0.1376$$

$QMED_{rural}$ = 1.172 x 1.36 x 1.57 x 1.0 x 0.0716 x 1.715 = 0.317m^3/s.

Site is in growth area 10, from growth curve growth factor is about 2.1

$Qrural_{100}$ = 2.1 x 0.317m^3/s = 0.664m^3/s.

Adjusting for urbanisation.

$Qrural_T = QMED_{rural}\ xrural_T$ Para 9.1

$QMED = UAF\ QMED_{rural}$ Para 9.2

where $UAF = PRUAF\ (1 + URBEXT)^{0.83}$ Para 9.3 and

$$PRAUF = 1 + 0.615\ URBEXT\ \left(\frac{70}{SPRHOST} - 1\right) \text{ Para 9.4}$$

PRAUF = 1 + 0.615 x 0.1121 x 5.17 = 1.356

UAF = 1.356 x $(1 + URBEXT)^{0.83}$ = 1.356 x 1.092 = 1.481

QMED = 1.481 x 0.317 = 0.455m^3/s

Q_{100} = 2.1 x 0.455 = 0.955m^3/s add 20% for the effects of global warming = 1.145m^3/s

1.1 The FEH rainfall-runoff method estimates a flood peak of 2.61m^3/s that rises to 3.13m^3/s when a 20% increase is added to allow for the effects of global warming.

1.2 In FEH Book 4, Para 3.4.2 states that 'A comparison of peak flows obtained from the two methods concluded that, subject to an assumed use of identical run off coefficients for small lowland catchments, the rational method yield flood peaks typically twice as large as those from the FRS rainfall runoff method, but the two methods tend to a greater similarity for larger and steeper catchments'.

1.3 The ReFH rainfall-runoff method estimates a peak flood of 2.7m3/s that rises to 3.24m3/s when increased by 20 % to allow for the effects of global warming.

1.4 The factorial standard error associated with Equation 3.2 is 1.549 thus the estimate lies between 0.65 $QMED_{rural}$ and 1.55 $QMED_{rural}$

1.5 That is the estimate of 1.146m^3/s could vary between 0.745m^3/s and 1.78m^3/s.

1.6 Therefore we have 2 estimates of the Q_{100} (cc) flood peak.

a) 1.146m^3/s from the statistical method. Plus or minus the factorial standard error. That is between 0.745m^3/s and 1.78m^3/s from the statistical procedure.

b) 3.24m3/s from the ReFH/FEH method.

1.7 Therefore it would appear that we should be using a flood peak that is in the range 1.78m^3/s as a minimum and 3.24m^3/s as an absolute maximum.

1.8 If we consider the catchment as an urban drainage catchment of 1.36km2 with an impermeability factor of 40%, that is almost wholly urbanised. And a 1 in 100 year, 1.67 hour storm with a rainfall intensity of 25mm/hr. We generate a flow of 3.68m^3/second. Add 20% for the effects of global warming = 4.42m^3/s.

Therefore to estimate the boundaries of the existing flood plain I have used the 4.42m^3/s flood flow, and to estimate the flood level that dictates the finished floor levels I have used the blocked culvert scenario. These figures are probably the worst case scenario from a catchment of only 1.36 hectares.

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