

RUN-OFF CALCULATIONS

OPENSHAW COLLEGE, MANCHESTER

Runoff from Existing Impermeable Areas

The industry-standard Modified Rational Method has been used in the calculation of runoff rates from existing impermeable areas which are to be provided with a new drainage system to serve the increased impermeable catchment area,

It uses the following equation to calculate the peak rate of runoff generated by each catchment area of the development.

$$Q_p = 2.78 C_v C_R i A$$

Where:

C_v = Volumetric Runoff Coefficient

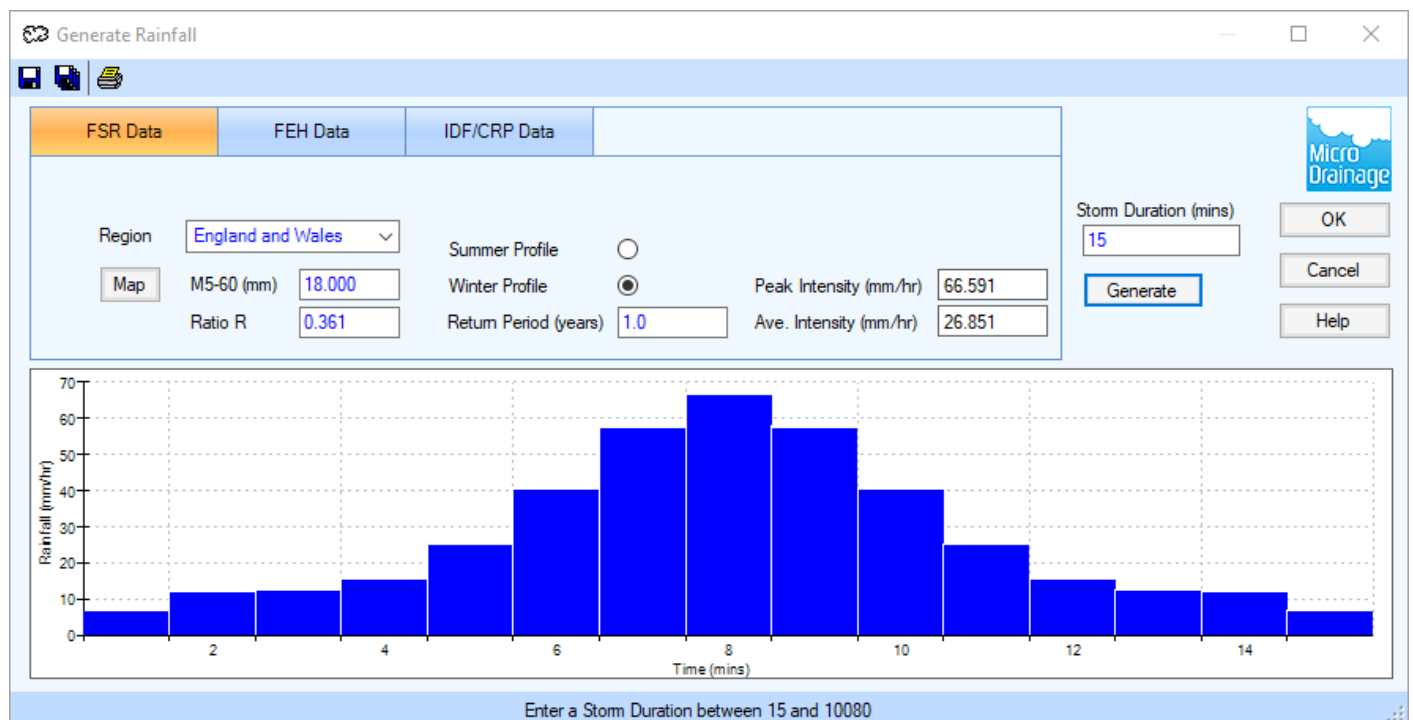
C_R = 1.3 (Routing Coefficient)

i = Rainfall Intensity (mm/h)

A = Area (ha)

2.78 = Coefficient which accounts for the differences in units used for the inputs and the outputs of the equation.

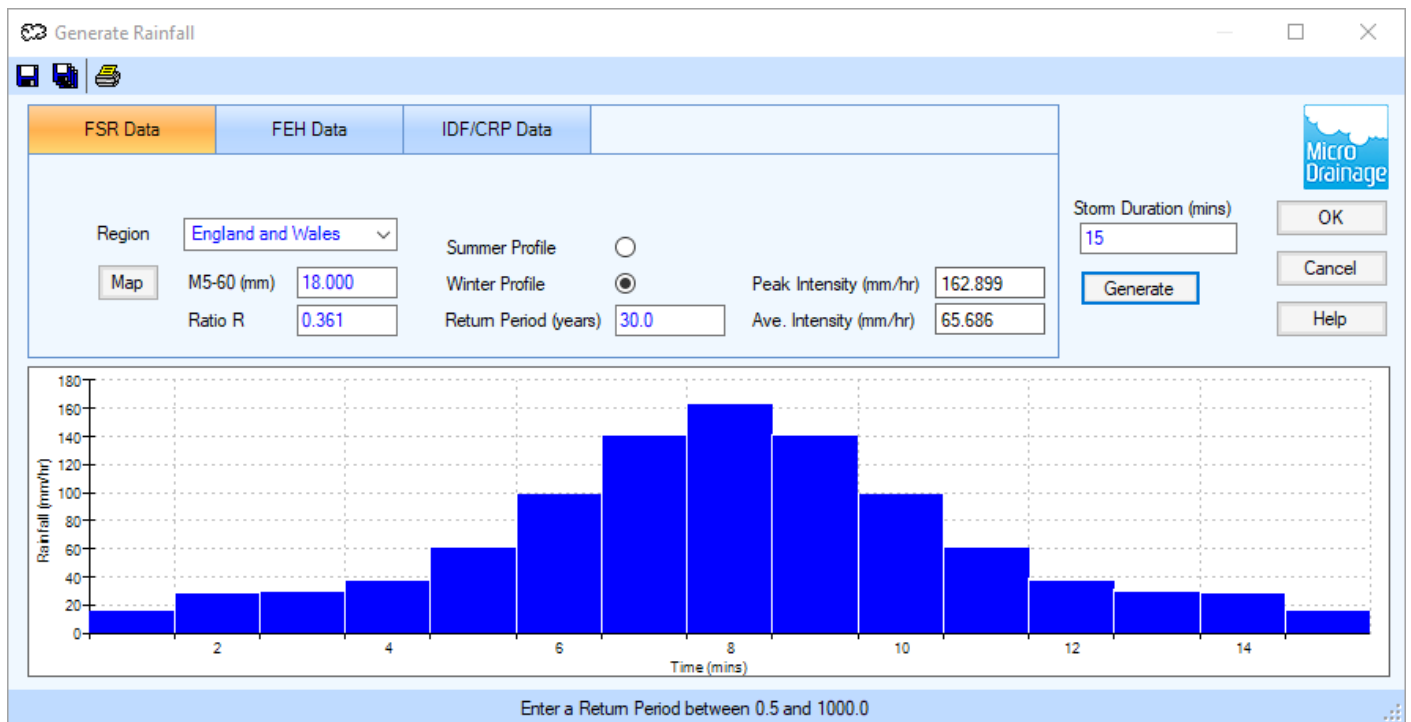
Rainfall intensity data has been obtained from the Microdrainage design software by Innovyze, peak rainfall intensities have been generated for a range of storm return periods for a 15-minute duration winter storm. Output from the software is shown below along with a table summarising the average rainfall intensity.



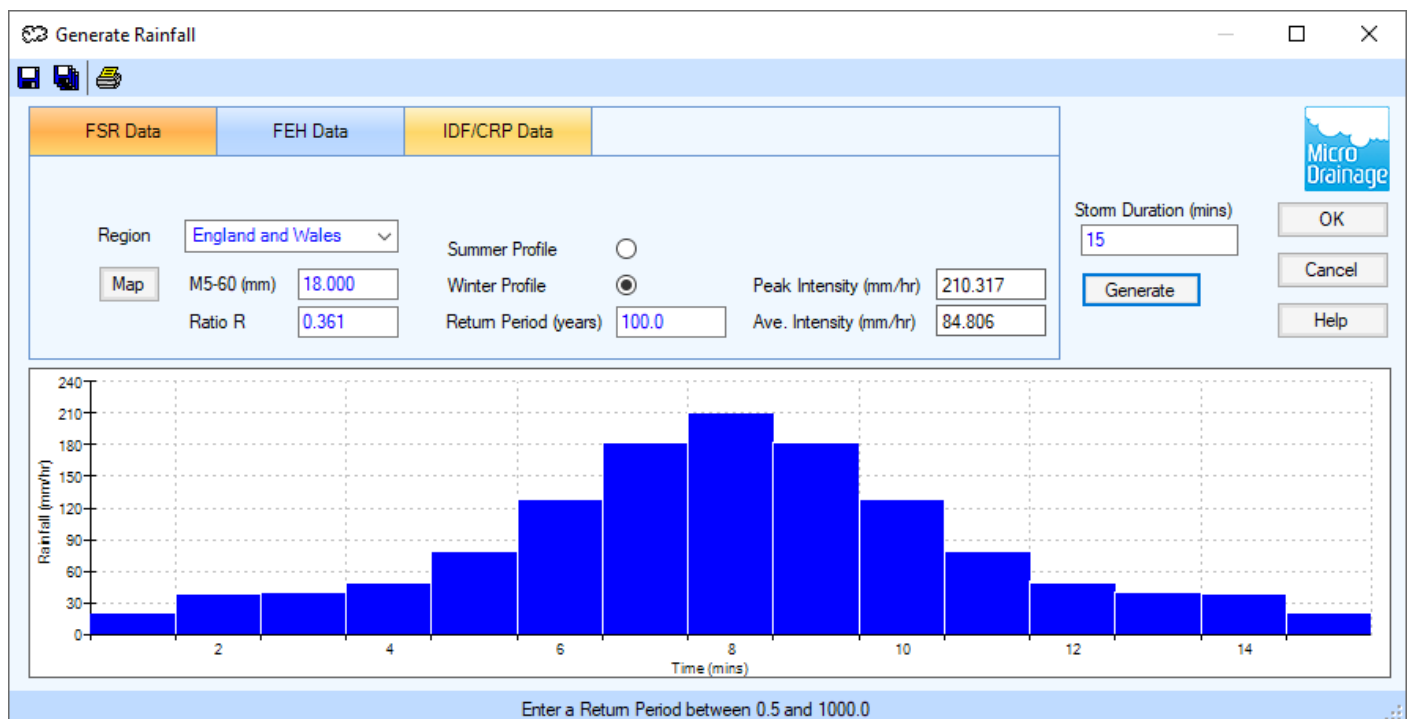
100% AEP Rainfall Event

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3.33% AEP Rainfall Event



1% AEP Rainfall Event

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Storm Return Period	Average Rainfall Intensity (i mm/hr) 15min Winter Profile
1 Year	26.85
30 Year	65.86
100 Year	84.80

A standard runoff coefficient of 0.9 was applied to each catchment assessed as impermeable. The variable C_v is a coefficient that describes the proportion of rainfall entering the surface water drainage system. C_R is a routing coefficient added to the Rational Method to represent runoff characteristics of a particular site or area in a more accurate manner.

The table below details the peak runoff rates generated by the existing development based on the assumption that the permeable areas do not contribute.

Catchment	Imp. Area (ha)	Perm. Area (ha)	Q_1 (l/s)	Q_{30} (l/s)	Q_{100} (l/s)
1A	0.135	0.036	11.79	28.92	37.24
1B	0.248	0.077	21.66	53.13	68.40
2A	0.871	0.212	76.07	186.58	240.24
TOTAL			109.51	268.63	345.88

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Proposed Restricted Discharge Rates

The Non-Technical Sustainable Drainage Technical Standards advise the following with respect to 'Peak Flow Control'.

S3 For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event

Based on the above, it is proposed to restrict discharge catchment to the 1 in 1 year and 1 in 100 year peak BROWNFIELD runoff rates with a 50% reduction applied in accordance with Manchester City Council planning policy.

This would ensure that surface water runoff from the proposed development would not exceed the existing scenario and a betterment would be provided for larger return periods.

The table below summarises the existing discharge rates with a 50% betterment applied.

Catchment	Gross Area (ha)	Q ₁ (l/s)	Q ₁₀₀ (l/s)
1A	0.171	5.90	18.62
1B	0.325	10.83	34.20
2A	1.083	38.00	120.12
TOTAL		54.73	172.94

Notwithstanding the above, United Utilities have advised during their consultation response that the maximum allowable discharge rate to the Clayton Lane sewer would be 120.0 l/s. This is 52.94 l/s less than the calculated peak Q₁₀₀ discharge (less 50%). To comply with this requirement, it is intended that Catchment 2A, which contains the sports pitch, will be reduced to a total maximum rate of 67.18 l/s.

The table below therefore summarises the indicative proposed restricted discharge rates for the development. These are subject to agreement with the LLFA and United Utilities and should not be recognised as final flow rates at this stage.

Catchment	Gross Area (ha)	Q ₁ (l/s)	Q ₁₀₀ (l/s)
1A	0.171	5.90	18.62
1B	0.325	10.83	34.20
2A	1.083	38.00	67.18
TOTAL		54.73	120.0