Project name:	MODEL FARM (HILDERSLEY)
JN:	263987
Revision	2

Estimation of green runoff rates for the development site

Estimation of flows using ReFH2 software and catchment descriptors downloaded from FEH Web Service. It includes FEH13 rainfall DDF curves

Notes: a. ReFH2 does not produce results for non-integuer return periods, i.e. with decimal numbers, e.g. 2.33yr

b. ReFH2 offers the possibility of using plot scale equations to estimate flows as an alternative to "fluvial catchment" scale. Both are compared here

Location of catchment/site	and main catchment descripto	ors	ReFH2 software project file
Descriptor	Value Units	user Comment	<u>File:</u>
CATCHMENT	SO 61350 24200		ReFH2 ModelFarm catchment.rxml
AREA	0.57 km2		
BFIHOST	0.758	quite high, large component of baseflow	Location:
FARL	1	no attenuation	\\global\europe\Cardiff\Jobs\263000\263987-00\4 Internal Project Data\4-40 Calculations\Hydrology\
SAAR	696		
SPRHOST	12.01	low runoff potential	
URBEXT2000	0	completely rural	

Using Catchment equations

Definition of critical duration

Based on 100yr event	
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timestep (h):	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Return period event:	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Season:	Winter Winter	Winter	V	Vinter	Winter	Winter	Winter	Summer						
Event duration (h):	1.25	2.25	4.25	4.75	5.25	6.25	8.25	1.25	2.25	4.25	4.75	5.25	6.25	8.25
(as rural) Peak flow (m3/s):	0.18	0.22	0.24	0.24	0.24	0.24	0.22		0.38	0.4	0.4	0.4	0.39	

Following council officer's request, WINTER was adopted. A duration of 4.75h is still used

		WINI	IER				
				As-rural		comparis	0
	Urbanised	Urbanised		direct		n with	
	peak flow	direct runoff	As-rural peak	runnof	if scaled	Plot scale	
eturn period (yrs)	(m^3/s)	(ML)	flow (m^3/s)	(ML)	by area	Qp	
1	0.07	0.76	0.07	0.76	0.02	1.0	1 The ratios are very close to 1, indicating that the scaling by area is applicable and compares well with plot-scale calculation
2	0.08	0.87	0.08	0.87	0.02	1.0	0
30	0.17	2.00	0.17	2.00	0.05	0.9	9
100	0.24	2.78	0.24	2.78	0.06	0.9	8

Using Plot scale equations Blue line boundary for Site = 15.3ha

0.153 km2

development site area:

Definition of critical duration Based on 100vr event

basea on 200 ji evene									
timestep (h):	0.2	5	0.25		0.25	0.25	0.25	0.25	0.25
Return period event:	10	0	100		100	100	100	100	100
Season:	Winter	Winter		Winter		Winter	Winter	Winter	Winter
Event duration (h):	1.2	5	2.25		4.25	4.75	5.25	6.25	8.25
(as rural) Peak flow (m3/s):			0.0598	(0.0656	0.066	0.0661	0.0653	0.0608

0.25 0.25 0.25 0.25 0.25 0.25 0.25 100 100 100 100 100 100 100 Summer Summer Summer Summer Summer Summer
 1.25
 2.25
 4.25
 4.75
 5.25

 0.0926
 0.106
 0.11
 0.109
 0.109
4.75 5.25 6.25 8.25

The analysis of season and storm duration shows that Summer results in larger flows and critical duration is 4.251 WINTER

				As-rural
	Urbanised	Urbanised		direct
	peak flow	direct runoff	As-rural peak	runnof
Return period (yrs)	(m^3/s)	(ML)	flow (m^3/s)	(ML)
1	0.02	0.19	0.018	0.19
2	0.02	0.22	0.021	0.22
30	0.05	0.51	0.047	0.51
100	0.07	0.72	0.066	0.72

16/11/18 M. Piedra (Arup)

The flow estimates obtained using catchment scale equations can be used for the generation of design flows for the study plot by scaling by catchment area

Greenfield runoff rates

	Using catchment eqs. (A=0.57km2)	Using plot-scale eqs. (A=0.153km2)	
Return period (yrs)	As-rural peak runoff rate (l/s/ha)	As-rural peak runoff rate (I/s/ha)	very similar values, I propose using those from the entire catchment (0.57km2)
1	1.21	1.20	
2	1.37	1.37	
30	3.05	3.09	
100	4.22	4 29	

For full hydrograph time series see:

Files: ModelFarm ReFH2 outputs Catchment WINTER Duration4-75h.csv ModelFarm ReFH2 Qp Plot scale WINTER Duration4-25h.csv

Location: \\global\europe\Cardiff\Jobs\263000\263987-00\4 Internal Project Data\4-40 Calculations\Hydrology\

END of calculations

21/08/2019 M. Piedra (Arup)

Guidance on the ReFH2 software:

Note that plot scale, or "point", descriptors required for greenfield runoff equations are only available from the FEH Web Service. Load plot scale descriptors in the same way as you would a catchment descriptor XML file. As soon as you import your descriptors you will need to specify the area of your plot. (If you need to edit this value later, you can do so on the final modelling screen.)

Plot scale equations for greenfield runoff

ReFH2 includes alternative algorithms to estimate model parameters when calculating plot scale greenfield runding fates and volumes. If you are plot acate equations for panels, and though an enable quations for Tp and BL, although generally the catchment equations should be used (i.e. do not tick the plot scale checkbox). If you are loading a plot scale descriptor file Use plot scale equations will be automatically sected. See the BartH_Technical

On 21/08/19 Niall McAvoy passed on the following comments by the council officer: "Greenfield runoff rates have been calculated as 2.19 l/s/ha for the 2 year event and 4.99 l/s/ha for the 30 and 100 year events using the ReFH2 method. The flows are based on a summer storm which is inappropriate for a rural site, the calculation of equivalent flows in I/s (33.5 and 76.34) appears to assume the whole site drains to the attenuation pond whereas a reasonable proportion (estimated at ~20% following all development, and likely higher for Phase 1) would appear to drain directly to the wetland basin and railway culvert.

The applicant should provide equivalent greenfield discharge rates for the pond, based on a winter storm, for phase 1 and phase 2 drained areas, accounting for areas where runoff bypasses the pond.

Upon discussion with Niall, the green-ruoff rates were revised, using Winter season. It is noted that the only reference to season made in the ReFH2 Technical Guidance (http://files.hydrosolutions.co.uk/refh2/ReFH2_Technical_Report.pdf) is on Section 8.1, where it says that winter should be used except for very urbanised catchment

The ReFH2 software was run for the 0.57km2 catchment, using winter





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