

Appendix F

Drainage Calculations

Purpose

To estimate the indicative (1-hr) change in runoff rate on a site caused by the proposed development. Note that proposed / indicative runoff rates are outline only and rely on the routing equation within the Modified Rational and Wallingford methods; actual runoff rates may differ significantly dependant on the nature of the surface water drainage network proposed and should be determined using hydraulic modelling.

Existing Site	A1	A2	A3	A4	Effective Area
Roof					0 m ²
Bitmac / Paved / Hardstanding					0 m ²
					0 m ²

Proposed Site	A1	A2	A3	%-Runoff	Effective Area
Roof				95%	0 m ²
Bitmac / Paved / Hardstanding	128214			65%	83339 m ²
					83339 m ²

Site Details

Total Development Area	12.82	Ha	
SAAR	1391	mm	From FEH3
SAAR4170	1248	mm	From FEH3
UCWI	115	mm	
IOH124 region	1		from map ->
SOIL	5		From WRAP maps
SOIL	0.50		
DEEPSTOR	0.37		



Modified Rational Method (MRM):

	<u>Existing</u>		<u>Proposed</u>		
Length (m)	3700	m	3700	m	From Site Maps
Impermeable Area (ha)	0.000	Ha	8.334	Ha	
Max Height	337	mAOD	337	mAOD	From Survey
Min Height	191	mAOD	191	mAOD	From Survey
DeltaH	146.000		146.000		
Slope (%)	3.95		3.95		
Te (mins)	15.23		15.23		
ARF	0.000		0.973		

	Existing Site		Proposed Site	
PIMP	0.000	%	100.000	%
Percentage Runoff PR	0.50	%	83.64	%
Cv	0.00		0.84	
Cr	1.3		1.3	

Institute of Hydrology Report 124 (IoH 124) "Flood Estimation on Small Catchments" method

	<u>Existing</u>		<u>Proposed</u>	
Remaining Greenfield Area	12.82	Ha	0.00	Ha
% Greenfield	100.00	%	0.00	%

Existing Site - Peak (1-hr) Runoff Rates

Return Period	Permeable Runoff (IOH124) (lps)	Impermeable Runoff (MRM) (lps)	Total Runoff (lps)
1 in 2 year (1hr)	132	0	132
1 in 30 year (1hr)	229	0	229
1 in 100 year (1hr)	272	0	272

Proposed Site - Peak (1-hr) Runoff Rates

Return Period	Permeable Runoff (IOH124) (lps)	Impermeable Runoff (MRM) (lps)	Total Runoff (lps)
1 in 2 year (1hr)	0	259	259
1 in 30 year (1hr)	0	739	739
1 in 100 year (1hr)	0	1003	1003

Summary - Peak (1-hr) Runoff Rates

Return Period	Existing Site (lps)	Proposed Site (lps)	Increase (lps)	Increase (%)
1 in 2 year (1hr)	132	259	128	97%
1 in 30 year (1hr)	229	739	510	223%
1 in 100 year (1hr)	272	1003	730	268%

By	Checked	Revision	Reason for Change	Date
DKS	DKS	Original		09/11/2021

CRM Stormflow Stormwater Management Software

Client:	RES
Project:	M01616-23
Location:	Unshinagh Wind Farm, Carnlough
Catchment:	Whole Catchment

Catchment Details:			
Buildings	0	m ²	x 95 %
Dense surfacing	128214	m ²	x 65 %
Effective Area	83339.1	m ²	

Storage Details:	
Volume	3020 Cu.m
Porosity	100 %
Area Increase	0 %

Rainfall Details - FEH Method:			
Return Period	100	years	
Climate Change Factor	20	%	
c	-0.022	d1	0.467
d2	0.605	d3	0.233
e	0.256	f	2.198
	mm	mm/h	storage (m ³)
30 min	27.2	54.5	2039.128
45 min	31.6	42.1	2286.783
60 min	35.1	35.1	2463.698
2 hours	45.2	22.6	2846.887
6 hours	67.6	11.3	2867.638
24 hours	123.5	5.1	0.000

Outflow Details:	
Infiltration rate	0 m/hr
Attenuation Control	Fixed Outflow
Control Diameter	- mm
Discharge rate	128 l/s

Results:	
Outcome:	Pass
Critical Storm Duration	3.78 hrs
Hmax	0.998 m
Time to half empty	3.3 hrs

Table Error! No text of specified style in document.-1 Attenuation Requirements

Catchment	Comment	Drainage area (m ²)	Attenuation storage required (m ³)	Allowable run-off rate (l/s)
1	Discharge overland	5319	130	5.3
2	Discharge to Drain / Watercourse	2969	72	3
3	Discharge to Drain / Watercourse	5844	142	5.8
4	Discharge to Drain / Watercourse	4545	111	4.5
5	Discharge to Drain / Watercourse	630	15	0.6
6	Discharge overland	7052	172	7.1
7	Discharge to Drain / Watercourse	6448	157	6.4
8	Discharge to Drain / Watercourse	5515	134	5.5
9	Discharge to Drain / Watercourse	541	13	0.5
10	Discharge to Drain / Watercourse	563	14	0.6
12	Discharge to Drain / Watercourse	1780	43	1.8
13	Discharge overland	1672	41	1.7
14	Discharge to Drain / Watercourse	272	7	0.3
15	Discharge to Drain / Watercourse	5119	125	5.1
16	Discharge to Drain / Watercourse	5900	144	5.9
17	Discharge to Drain / Watercourse	6935	169	6.9
18	Discharge to Drain / Watercourse	5627	137	5.6
19	Discharge to Drain / Watercourse	2002	49	2
20	Discharge to Drain / Watercourse	13755	335	13.8
21	Discharge to Drain / Watercourse	1154	28	1.2
22	Discharge to Drain / Watercourse	3343	81	3.3
23	Discharge to Drain / Watercourse	1167	28	1.2
24	Discharge to Drain / Watercourse	873	21	0.9
25	Discharge to Drain / Watercourse	829	20	0.8
26	Discharge to Drain / Watercourse	583	14	0.6
27	Discharge to Drain / Watercourse	2601	63	2.6
28	Discharge to Watercourse via offsite outfall	4281	104	4.3
29	Discharge to Drain / Watercourse	5795	141	5.8
30	Discharge overland	1284	31	1.3
31	Discharge to Drain / Watercourse	5361	131	5.4
32	Discharge to Drain / Watercourse	1770	43	1.8
33	Discharge to Drain / Watercourse	4451	108	4.5
34	Discharge to Drain / Watercourse	484	12	0.5
35	Discharge to Drain / Watercourse	482	12	0.5
36	Discharge to Drain / Watercourse	1041	25	1
37	Discharge to Drain / Watercourse	5455	133	5.5
38	Discharge to Drain / Watercourse	4511	110	4.5
TOTAL		127953 sq m	3115 cu.m	128 lps (equivalent to 10 lp/Ha)