



**Southern Water
Integrated Constructed Wetland
Technical Note: Greenfield Runoff Rates**

May 2024



1. INTRODUCTION

Greenfield runoff-rates have been calculated for a site proposed for a wetland treatment facility adjacent to Staplefield WTW. An assessment of the impact on greenfield runoff rates post-development has also been made.

2. EXISTING GREENFIELD RUNOFF-RATES

Staplefield Greenfield runoff rates have been calculated using three methods:

- 1) IoH124 report
- 2) FEH method
- 3) ReFH2 rainfall runoff (plot scale equations using FEH22 rainfall)

Methods 1 and 2 have been carried out using the tool provided by the UK SUDS website: <https://www.uksuds.com/>. The *pro forma* are included in Appendix A. The greenfield runoff rates are calculated for the entire site area (3.13 ha) and can then be calculated for each component of the site (wetland treatment cell, flood mitigation pond, gravelled areas) on a *pro rata* by area basis if required (refer to Appendix B). The site layout is provided in Dwg. no. 23539_4_13 SURFACE WATER MANAGEMENT; refer to Appendix C. The ReFH2 method uses plot scale calculations using catchment descriptors from a small nearby catchment imported into the ReFH2.3 software and then similarly calculated on a *pro rata* by area basis. The greenfield runoff rates for the whole site are presented in Table 1 below for different events and are attributable to the existing site, which is an agricultural field. The QBAR event is included, which is the mean annual maximum flow rate.


Table 1: Greenfield runoff rates

Return Period [years]	IoH124	FEH	ReFH2
	l/s	l/s	l/s
1	15.9	21.1	18.5
QBAR	18.7	24.9	21.0
30	43.1	57.2	44.4
100	59.8	79.3	56.2

3. POST-DEVELOPMENT RUNOFF-RATES

The agricultural field drains southwards into the River Ouse. The creation of a treatment wetland will effectively create attenuation ponds into which the majority of the rainfall across the site will end up, either directly or through runoff. The treatment wetland has a minimum travel time of 2 days and is designed not to exceed the current discharge permit of 4 l/s, which is substantially lower than the existing greenfield runoff rates shown in Table 1 above. The flood mitigation area will provide over 4000 m³ of storage, which will also slow the rate of flow into the Ouse. Around 20% of the site will continue to drain without attenuation into the River Ouse, the majority of which will be grassed, with a small proportion gravelled. Gravelled areas will be permeable, which will continue to allow infiltration, so its impact on runoff rates will be small. The runoff rates to the River Ouse will therefore not increase in comparison to existing greenfield runoff rates once the treatment wetland is constructed.

APPENDIX A.1: UK SuDS IoH124



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Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Timothy Paddison
Site name:	Stapleford
Site location:	Cuckfield Road

Latitude:	51.03170° N
Longitude:	0.17567° W
Reference:	808248419
Date:	Dec 01 2023 15:29

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 3.1345

Methodology

Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	840	840
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is $SPR/SPRHOST \leq 0.3$?


Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited

Q _{BAR} (l/s):	18.73	18.73
1 in 1 year (l/s):	15.92	15.92
1 in 30 years (l/s):	43.08	43.08
1 in 100 year (l/s):	59.75	59.75
1 in 200 years (l/s):	70.05	70.05

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

APPENDIX A.2: UK SuDS FEH



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Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Timothy Paddison
Site name:	Stapleford
Site location:	Cuckfield Road

Latitude:	51.03170° N
Longitude:	0.17567° W
Reference:	2485487649
Date:	Dec 01 2023 16:04

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Runoff estimation approach: FEH Statistical

Site characteristics

Total site area (ha):

Methodology

Q _{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Specify BFI manually
HOST class:	28
BFI / BFIHOST:	0.337
Q _{MED} (l/s):	16.77
Q _{BAR} / Q _{MED} factor:	1.14

Hydrological characteristics

	Default	Edited
SAAR (mm):	840	840
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
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Q _{BAR} (l/s):	19.06	24.85
1 in 1 year (l/s):	16.2	21.12
1 in 30 years (l/s):	43.83	57.16
1 in 100 year (l/s):	60.79	79.28
1 in 200 years (l/s):	71.27	92.94

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Appendix B: Staplefield WTW Components

SUDS Tool – IoH124

		<i>Area (ha) =</i>								
		<i>0.0482</i>	<i>0.5399</i>	<i>0.4418</i>	<i>0.2585</i>	<i>1.3108</i>	<i>0.2555</i>	<i>0.1852</i>	<i>0.093</i>	
Event (1 in x years)	Site Area		Cell 1	Cell 2	Cell 3	Cell 4	Grassed	Gravel to treatment	Gravel to grass	Flood Mitigation
	l/s	l/s/ha	l/s	l/s	l/s	l/s	l/s	l/s	l/s	l/s
1	15.92	5.1	0.24	2.74	2.24	1.31	6.66	1.30	0.94	0.47
QBAR	18.73	6.0	0.29	3.23	2.64	1.54	7.83	1.53	1.11	0.56
30	43.08	13.7	0.66	7.42	6.07	3.55	18.02	3.51	2.55	1.28
100	59.75	19.1	0.92	10.29	8.42	4.93	24.99	4.87	3.53	1.77
200	70.05	22.3	1.08	12.07	9.87	5.78	29.29	5.71	4.14	2.08

SUDS Tool – FEH method

		<i>Area (ha) =</i>								
		<i>0.0482</i>	<i>0.5399</i>	<i>0.4418</i>	<i>0.2585</i>	<i>1.3108</i>	<i>0.2555</i>	<i>0.1852</i>	<i>0.093</i>	
Event (1 in x years)	Site Area		Cell 1	Cell 2	Cell 3	Cell 4	Grassed	Gravel to treatment	Gravel to grass	Flood Mitigation
	l/s	l/s/ha	l/s	l/s	l/s	l/s	l/s	l/s	l/s	l/s
1	21.12	6.7	0.32	3.64	2.98	1.74	8.83	1.72	1.25	0.63
QBAR	24.85	7.9	0.38	4.28	3.50	2.05	10.39	2.03	1.47	0.74
30	57.16	18.2	0.88	9.85	8.06	4.71	23.90	4.66	3.38	1.70
100	79.28	25.3	1.22	13.66	11.17	6.54	33.15	6.46	4.68	2.35
200	92.94	29.7	1.43	16.01	13.10	7.66	38.87	7.58	5.49	2.76

ReFH2 – plot scale equations

Event (1 in x years)	Area (ha) =		0.0482	0.5399	0.4418	0.2585	1.3108	0.2555	0.1852	0.093
	Site Area		Cell 1	Cell 2	Cell 3	Cell 4	Grassed	Gravel to treatment	Gravel to grass	Flood Mitigation
	l/s	l/s/ha	l/s	l/s	l/s	l/s	l/s	l/s	l/s	l/s
1	530	5.9	0.28	3.19	2.61	1.53	7.74	1.51	1.09	0.55
QBAR	601	6.7	0.32	3.62	2.96	1.73	8.78	1.71	1.24	0.62
30	1270	14.2	0.68	7.64	6.25	3.66	18.55	3.62	2.62	1.32
100	1610	17.9	0.86	9.69	7.93	4.64	23.51	4.58	3.32	1.67
200	1840	20.5	0.99	11.07	9.06	5.30	26.87	5.24	3.80	1.91

*Runoff rates calculated from nearest small catchments, which has a site area of 89.75ha.

Appendix C: Site Layout

