FAO James Weir
Planning Department
Renfrewshire Council
Renfrewshire House
Cotton Street
Paisley
PA1 1AN

By email: james.weir@Renfrewshire.gov.uk

30th September 2021

Your Reference: 21/0034/PP
Our Reference: 3547/SuDS

Dear Mr Weir,

Drainage Design for the construction and operation of Neilston Greener Grid Park at Land off Gleniffer Road, Renfrewshire

In accordance with Renfrewshire Council, Drainage Assessment: Notes for Guidance[1] an outline Sustainable Drainage System (SuDS) has been designed to serve the proposed Greener Grid Park on land off Gleniffer Road, Renfrewshire.

As outlined in the application the Development involves the installation of a battery storage facility which includes the impermeable elements totalling 0.95 ha and the initial design utilised attenuation structures which infiltrated to ground.

The greenfield run-off rate (Q_{BAR}) was calculated at 136.4 l/s using the Flood Estimation Handbook (FEH) rainfall data and ICP SuDS method using Micro Drainage software.

Following consultation, it has been suggested that the SuDS should discharge to the adjacent wetlands to the west of the Site rather than utilise infiltration.

The wetland to the west is a designated Site of Importance for Nature conservation (SINC) and will require a 30 m buffer from development infrastructure as advised during consultation. As such no development infrastructure, including the SuDS infrastructure, is to be located within 30 m of the SINC wetland (see Figure 1).

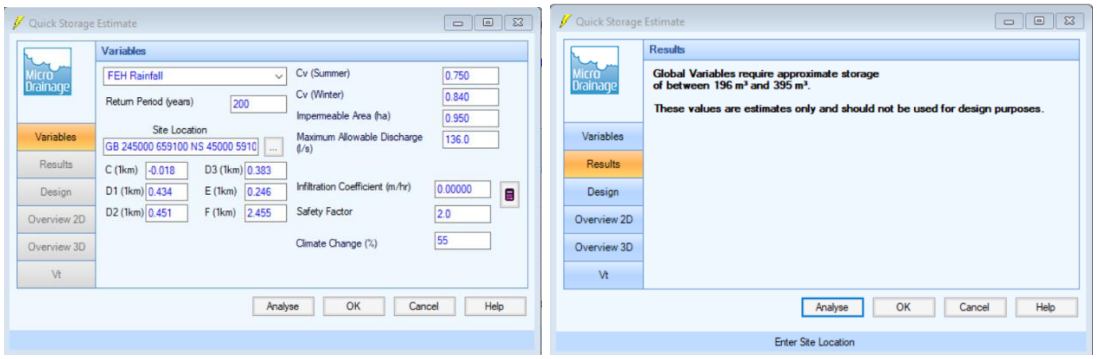
Disposal via Attenuated Release to Wetlands

Adequately sized structures are considered practicable within the proposed construction phase to attenuate surface water run-off for the 1:200 year event, plus a 55 % allowance for climate change.

The overall storage volume required to attenuate surface water flows for the 1:200 year (+55 %) event are shown in Plate 1, based on the areas of hardstanding outlined in Table 1 of the Outline Sustainable Drainage Strategy (Arcus 2021).

[1] Renfrewshire Council, Drainage Assessment: Notes for Guidance. [Online]. Available at: http://www.renfrewshire.gov.uk/media/1097/Drainage-assessment-guidance/pdf/Drainage_assessment_guidance.pdf?m=1455808042243

Plate 1: Micro Drainage Storage Calculations



As such, a detention basin will be used to attenuate flows and discharge at greenfield rates via an orifice plate or similar flow restriction device, with a depth of 0.5 m and an area of 585 m² as shown in Plate 2. Further details are provided in the Micro Drainage outputs in Appendix 2.

Plate 2: Attenuation Basin Dimensions

Estimation Pond Area / Volume Calculation (based on rectangular pond)

Base width	12	m	
Base length	36	m	
Ratio (L to W)	3		SuDS for Road 1.5:1 to 4:1, Sewers for Scotland Minimum 3:5
Side slope (1 in)	3		
Increment	0.1	m	

Depth	Area	Volume	Length	Width	
0	432	0	36	12	Invert Level of Oriface In Outlet Chamber
0.1	461.16	44.658	36.6	12.6	
0.2	491.04	92.268	37.2	13.2	
0.3	521.64	142.902	37.8	13.8	
0.4	552.96	196.632	38.4	14.4	
0.5	585	253.53	39	15	

The detention basin will be located in the south western section of the Site and will be served by filter drains and standard catch pits.

The Simple Index Approach (SIA) Tool

The Site will not be occupied by personnel and it is anticipated that occasional maintenance visits will be required, which will limit vehicle movements. This will involve significantly less than 300 traffic movements per day. Table 26.2 *Pollution hazard indices for different land use classifications* of the SuDS Manual identifies that the Development has a Pollution Hazard Level of Low, taken from the 'Low Traffic Roads *e.g. residential roads and general access roads, < 300 traffic movements/day'* scenario.

A SIA has been developed on behalf of Construction Indsutry Research and Information Association (CIRIA) to support the implementation of the water quality management design methods set out in the SuDS Manual, with appropriate cross referencing to the relevant 'Design Conditions' in the tool.

The SIA outputs are shown in Appendix 2 and as shown in Table 1, demonstrate that the combined Pollution Mitigation Indices for the run-off area are adequately met by the installation of permeable hardcore layer and a pond.

Table 1: SIA Outputs for Low Pollution Hazard Level Scenario

	Total Suspended Solids	**Metals**	**Hydrocarbons**
Pollution Hazard Indices	0.5	0.4	0.4

Pond / basin treatment indices	0.7	0.7	0.5

As such, the treatment of the surface water run-off, in the absence of significant spillages of hydrocarbons or other pollutants, will adequately meet the minimum requirements of the pollution mitigation indices outlined in the SIA Tool.

Responsibilities and Long-Term Management

It will be the responsibility of the site operator to maintain effective drainage measures and rectify drainage measures that are not functioning adequately. A nominated person will also have responsibility for reporting on the functionality of drainage measures.

Where impermeable areas remain through the lifetime of the Development, the SuDS measures serving these areas will be checked on a regular basis. Should drainage measures require dredging or unblocking, this will be undertaken as soon as practicable by a local contractor engaged by the site operator.

It is not anticipated that the Council will adopt the new drainage network. Therefore, it will be the responsibility of the site operator to maintain effective drainage measures and rectify drainage measures that are not functioning adequately. A nominated person from a management company will also have responsibility for reporting on the functionality of drainage measures. This should be secured through an appropriately worded planning condition.

An outline management / maintenance plan is provided in Table 1 and is based on the SuDS Manual.

Long-term Maintenance Schedule for the Detention Basin (based on Table 22.1 - Operation and maintenance requirements for detention basins of the SuDS Manual)

Maintenance Schedule	**Required Action**	**Frequency**
Regular Maintenance	Litter removal	A required
	Cut grass – for spillways and access routes (within the approved Applicant ownership agreement extents)	Monthly (during growing season), or as required
	Grass cutting – meadow grass in and around basin	Half yearly (spring, before nesting season, and autumn)
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect banksides, structures, pipework etc. for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (as set out in Chapter 23)
Occasional	Reseed areas of poor vegetation growth	As required

Maintenance	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial Actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

An outline management / maintenance plan for the filter drains is provided in Table 2 and is based on Table 16.1 of the SuDS Manual.

Table 2: Outline maintenance plan for filter drains

Maintenance schedule	**Required Action**	**Typical Frequency**
Regular maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly, or as required
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from pre-treatment devices	Six monthly, or as required
Occasional maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (e.g. NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear perforated pipework of blockages	As required

Sergeantlaw Moss Peatland Restoration

In September 2021, NatureScot published the Peatland Restoration Feasibility Assessment Report for the Sergeantlaw Moss, which includes an assessment of the potential impacts of the Development.

Notably within this report was a recommendation that *"a minimum 30m hydrological protection / buffer zone is established between the edge of Sergeantlaw Moss and any development"*, as shown in figure 1 below.

Figure 1: Sergeantlaw Moss and Development

The Applicant has incorporated the 30m buffer prescribed in the NatureScot Report, and this is demonstrated in the revised layout within Appendix 1.

Timescales

Drainage measures outlined within this report should be implemented as soon as practical by the Developer's Contractor but in any event before the construction of any impermeable surfaces which are proposed to drain into the approved drainage system. Measures such as drainage pipes should be installed at the same time as the excavations, or as soon as practicable thereafter.

I trust that the above design provides sufficient information to condition the drainage scheme to serve the Development. Should you require any further information please contact me on the details below.

Yours sincerely,

[redacted]

Liam Nevins BSc (hons) MCIWEM C.WEM

Associate Director

Encs
Appendix 1 - Drainage Drawing 3547-DR-HYDR-0001
Appendix 2 - Micro Drainage outputs and drainage schematic

APPENDIX 1

KEY:

- SITE BOUNDARY
- 2.4m HIGH PALISADE FENCE
- 3.4m HIGH PALISADE FENCE
- BATTERY (12.9m x 2.44m x 2.59m)
- INVERTER (6.1m x 2.44m x 2.59m)
- TRANSFORMERS WITH 7.0M HIGH CONNECTING BUS BARS
- LV SWITCH HOUSE (7.5m x 9.1m)
- FIRE WALL (46.7m x 0.5m x 14.0m)
- BUILDING (20.7m x 36.7m x 10.0m TO ROOF PITCH)
- E-HOUSE (ENCLOSED IN BUILDING 20.7m x 38.6m x 10.0m TO ROOF PITCH)
- ENERGY MANAGEMENT SYSTEM (ENCLOSED IN BUILDING 20.7m x 36.7m x 10.0m TO ROOF PITCH)
- COOLER (11.3m x 2.4m x 2.5m)
- PROPOSED ROADS
- SWITCHGEAR CONTAINER (12.2m x 2.44m x 3.0m)
- EMERGENCY BACK UP DIESEL GENERATOR (6.1m x 3.6m x 2.9m)
- COMMS HOUSE (12.19m x 2.44m x 2.59m)
- DISCONNECTOR (2.2m x 4.5m)
- 6m SECURITY COLUMN
- 4m HIGH WALL
- WW2 BUILDING 5m BUFFER
- ATTENUATION BASIN

Project Title: NEILSTON BATTERY STORAGE SITE

Client: Statkraft

Drawing Title: PROPOSED OUTLINE DRAINAGE LAYOUT

Purpose of issue: PLANNING

Designed	Drawn	Checked	Approved
LN	RD	MG	MG

Arcus Internal Project No.: 3547

Scale @ A3: 1:2500

Date: 29/09/21

Drawing Number: 3547-DR-HYDR-0001

Rev: 1

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ARCUS

Plot Date : 29 September 2021 16:25:27
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APPENDIX 2

Summary of Results for 200 year Return Period (+55%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	1.077	0.377	122.4	184.0	Flood Risk
30 min Summer	1.118	0.418	126.9	206.4	Flood Risk
60 min Summer	1.117	0.417	126.8	205.8	Flood Risk
120 min Summer	1.083	0.383	123.0	187.2	Flood Risk
180 min Summer	1.042	0.342	118.3	165.1	Flood Risk
240 min Summer	1.002	0.302	113.4	143.7	Flood Risk
360 min Summer	0.933	0.233	104.6	108.5	Flood Risk
480 min Summer	0.879	0.179	97.1	81.8	O K
600 min Summer	0.837	0.137	90.9	61.9	O K
720 min Summer	0.806	0.106	85.9	47.3	O K
960 min Summer	0.768	0.068	75.1	29.8	O K
1440 min Summer	0.720	0.020	61.1	8.6	O K
2160 min Summer	0.700	0.000	49.1	0.0	O K
2880 min Summer	0.700	0.000	40.8	0.0	O K
4320 min Summer	0.700	0.000	30.6	0.0	O K
5760 min Summer	0.700	0.000	24.9	0.0	O K
7200 min Summer	0.700	0.000	21.2	0.0	O K
8640 min Summer	0.700	0.000	18.6	0.0	O K
10080 min Summer	0.700	0.000	16.7	0.0	O K
15 min Winter	1.129	0.429	128.1	212.6	Flood Risk
30 min Winter	1.175	0.475	133.1	238.9	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	166.137	0.0	294.6	21
30 min Summer	105.048	0.0	374.6	30
60 min Summer	66.422	0.0	473.9	46
120 min Summer	41.998	0.0	597.2	80
180 min Summer	32.120	0.0	684.6	112
240 min Summer	26.555	0.0	758.1	144
360 min Summer	20.310	0.0	867.6	204
480 min Summer	16.791	0.0	957.8	264
600 min Summer	14.487	0.0	1031.9	324
720 min Summer	12.842	0.0	1097.8	382
960 min Summer	10.669	0.0	1215.7	502
1440 min Summer	8.216	0.0	1404.8	740
2160 min Summer	6.327	0.0	1622.9	0
2880 min Summer	5.257	0.0	1797.7	0
4320 min Summer	3.938	0.0	2020.1	0
5760 min Summer	3.208	0.0	2194.4	0
7200 min Summer	2.737	0.0	2339.9	0
8640 min Summer	2.403	0.0	2465.9	0
10080 min Summer	2.154	0.0	2577.7	0
15 min Winter	166.137	0.0	330.1	21
30 min Winter	105.048	0.0	417.3	31

Summary of Results for 200 year Return Period (+55%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	1.165	0.465	132.0	233.3	Flood Risk
120 min Winter	1.100	0.400	124.9	196.4	Flood Risk
180 min Winter	1.031	0.331	116.9	158.8	Flood Risk
240 min Winter	0.969	0.269	109.3	126.8	Flood Risk
360 min Winter	0.874	0.174	96.4	79.4	O K
480 min Winter	0.810	0.110	86.7	49.3	O K
600 min Winter	0.774	0.074	77.0	32.9	O K
720 min Winter	0.748	0.048	69.2	21.0	O K
960 min Winter	0.711	0.011	58.6	5.0	O K
1440 min Winter	0.700	0.000	46.1	0.0	O K
2160 min Winter	0.700	0.000	35.5	0.0	O K
2880 min Winter	0.700	0.000	29.5	0.0	O K
4320 min Winter	0.700	0.000	22.1	0.0	O K
5760 min Winter	0.700	0.000	18.0	0.0	O K
7200 min Winter	0.700	0.000	15.3	0.0	O K
8640 min Winter	0.700	0.000	13.5	0.0	O K
10080 min Winter	0.700	0.000	12.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	66.422	0.0	526.8	50
120 min Winter	41.998	0.0	672.6	84
180 min Winter	32.120	0.0	767.2	118
240 min Winter	26.555	0.0	846.3	150
360 min Winter	20.310	0.0	971.7	210
480 min Winter	16.791	0.0	1072.4	266
600 min Winter	14.487	0.0	1155.8	326
720 min Winter	12.842	0.0	1229.4	386
960 min Winter	10.669	0.0	1362.2	504
1440 min Winter	8.216	0.0	1573.5	0
2160 min Winter	6.327	0.0	1817.6	0
2880 min Winter	5.257	0.0	2013.5	0
4320 min Winter	3.938	0.0	2262.6	0
5760 min Winter	3.208	0.0	2457.8	0
7200 min Winter	2.737	0.0	2620.7	0
8640 min Winter	2.403	0.0	2761.8	0
10080 min Winter	2.154	0.0	2887.1	0

Rainfall Details

Rainfall Model	FEH
Return Period (years)	200
Site Location	GB 245000 659100 NS 45000 59100
C (1km)	-0.018
D1 (1km)	0.434
D2 (1km)	0.451
D3 (1km)	0.383
E (1km)	0.246
F (1km)	2.455
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+55

Time Area Diagram

Total Area (ha) 0.950

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.317	4	8	0.317	8	12	0.317

Model Details

Storage is Online Cover Level (m) 1.200

Tank or Pond Structure

Invert Level (m) 0.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	432.0	0.500	585.0

Orifice Outflow Control

Diameter (m) 0.283 Discharge Coefficient 0.600 Invert Level (m) 0.400

Source Control - [3547_Pond_v1.SRCX] - [3D Animation]

File Edit View Analyse Cascade Window Help

Design Guide

Quick Storage Estimate

Quick Design: Infiltration

Detailed Design

Cascade

Total Vol (m³) = 173.4

60 min Winter

Max Water Level 1.147m

INFLOW 147.2 l/s

OUTFLOW 129.9 l/s

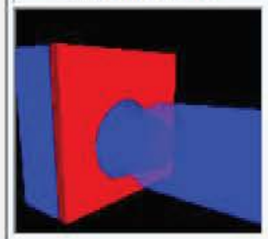
Video Controls

48 minutes

1x

19

Outflow Water Level



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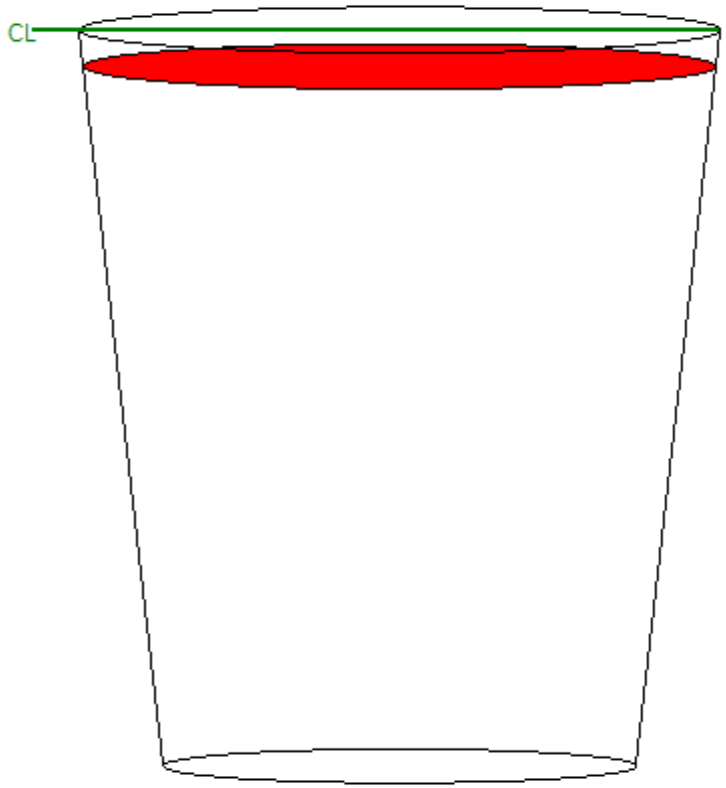
XP Solutions	Source Control 2015.1	



Invert Level of Structure (m): 0.700

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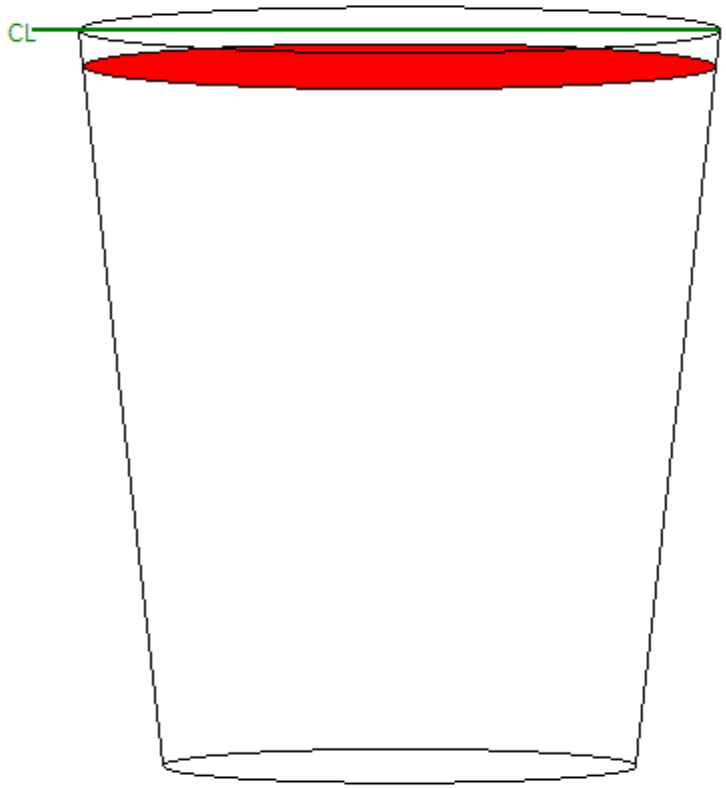

Invert Level of Structure (m): 0.700

SIMPLE INDEX APPROACH: SUMMARY TABLE

SUMMARY TABLE		DESIGN CONDITIONS			
		1	2	3	4
Land Use Type	Other	Where indices are approved by the environmental regulator as part of the required risk assessment process, these should be entered in the 'User Defined Indices' row below. If indices are not considered appropriate, the risk assessment should use alternative measures of pollution hazard for the site.	In Scotland and Northern Ireland, the environmental regulator should be consulted as part of the licensing process required for High Risk sites. In England and Wales, the environmental regulator should be consulted prior to design (for pre-permitting advice) to determine the most appropriate design approach and requirements for risk assessment.		
Pollution Hazard Level					
Pollution Hazard Indices					
TSS	0.5				
Metals	0.4				
Hydrocarbons	0.4				
SuDS components proposed		SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B	Ponds/wetlands should be preceded by an upstream component(s) that trap(s) silt, or designed specifically to retain sediment in a separate zone, easily accessible for maintenance, such that the sediment will not be re-suspended in subsequent events		
Component 1	Pond or wetland				
Component 2	None				
Component 3	None				
SuDS Pollution Mitigation Indices					
TSS	0.7				
Metals	0.7				
Hydrocarbons	0.5				
Groundwater protection type	None				
Groundwater protection Pollution Mitigation Indices					
TSS	0				
Metals	0				
Hydrocarbons	0				
Combined Pollution Mitigation Indices					
TSS	0.7				
Metals	0.7	**Note: In order to meet both Water Quality criteria set out in the SuDS Manual (Chapter 4), Interception should be delivered for all impermeable areas wherever possible. Interception delivery and treatment may be met by the same components, but Interception requires separate evaluation.**	Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see Chapter 7 The SuDS design process). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England		
Hydrocarbons	0.5				
Acceptability of Pollution Mitigation					
TSS	Sufficient				
Metals	Sufficient				
Hydrocarbons	Sufficient				