SUDS REPORT FOR BATTLERS GREEN FARM, COMMON LANE, RADLETT, WD7 8PH

DOCUMENT NUMBER.: C2486-R1-REV-B

PREPARED BY

Nimbus
ENGINEERING CONSULTANTS

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1. INTRODUCTION

1.1 Appointment

Nimbus Engineering have been appointed by CAF Construction Ltd, to provide a solution on the management of Surface Water run-off and to ensure that there is no risk of flooding caused by the proposed development at Battlers Green Farm, Common Lane, Radlett, WD7 8PH.

Hertfordshire County Council have imposed the following planning condition, relating to surface water:

3.No development shall take place before a scheme for the on-site storage and regulated discharge of surface water run-off has been submitted to, and approved in writing by, the Local Planning Authority. The development shall be carried out in accordance with the approved scheme.

Reason: To ensure the proposed development does not overload the existing drainage system resulting in flooding and/or surcharging. To comply with Policy CS16 of the Hertsmere Core Strategy 2013

1.2 Objectives

This report will address the concerns raised by the Borough and provide details on a suitable Sustainable Urban Drainage System (SuDS) in order to reduce the surface water run-off leaving the site and show that the proposed development will not increase Flood Risk at the site or elsewhere.

1.3 Limitations

The general limitations of this report are:

- A number of data and information sources have been used to prepare this report. Whilst Nimbus Engineering believes them to be trustworthy, Nimbus Engineering is unable to guarantee the accuracy of data and information that has been provided by others;

- This report has been prepared using the best data and information that was available at the time of writing. There is the potential for further information or data to become available, leading to changes in the conclusions drawn by this report, for which Nimbus Engineering cannot be held responsible.

2. SUSTAINABLE URBAN DRAINAGE SYSTEMS

Surface water arising from a developed site should, as far as is practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account.

Reducing the rate of surface water discharge from urban sites is one of the most effective ways of reducing and managing flood risk.

Traditional piped surface water systems work by removing surface water from our developments as quickly as possible, however this can cause various adverse impacts:

- Increased downstream flooding, and sudden rises in flow rates and water levels in local water courses.

- Reduction in groundwater levels and dry weather flows in watercourses.

- Reduce amenity and adversely affect biodiversity due to the surface water run-off containing contaminants such as oil, organic matter and toxic materials.

SuDS are defined as a sequence of management principles and control structures designed to drain surface water in a more sustainable fashion than conventional piped drainage techniques. SuDS should utilise the natural landscape of an area which as well as slowing down the rate of runoff provides a number of environmental, ecological and social benefits.

These include:

Protection and enhancement of water quality. As well as providing on-site attenuation, SuDS treat the water, resulting in an improved quality of water leaving the site. This is achieved when the water passes through fine soils and the roots of specially selected plants. Pollutants washed off the hard landscaping by rainfall will be safely removed before the water reaches the natural receiving water course.

- A sympathetic approach to the environmental setting by providing opportunities to create habitats for flora and fauna in urban watercourses and open spaces.

- Meeting the amenity and social needs of the local community and residents in the creation of attractive green spaces.

The various types of SuDS include:

Permeable paving	
Soakaways;	
Swales and basins;	

Bioretention/ rain gardens;	
Green roofs and rainwater re-use;	

Preferably a combination of these techniques should be used as part of the surface water management train, and it is important for all stakeholders, such as developers, architects, landscape architects and engineers to work in order to determine a feasible solution.

3. PROPOSED SOLUTION

The total site area is 2076m^2, with the impermeable areas at the existing site being 2076 m^2. Following the development at this site, the impermeable areas will have decreased to 717 m^2. There are hard surfaces which will be flat and formed of porous surfacing, and therefore these will not contribute to the calculations.

Pre and post development peak flow rate of run off were carried out using these pre and post development impermeable area figures in order to determine a suitable surface water management solution, as requested by the Hertfordshire County Council. All surface water calculations are included in Appendix A.

In order to ensure that the SuDS management train has been considered fully, all hardstanding areas will be formed of permeable surfacing underlain by a hydrocarbon removing geotextile membrane at the road and car parking areas, in order to deal with as much of the surface water run off at source, with the surface water run off from all sloped area to be caught by slot drains.

The surface water run off from the roof, and the overflows from the above will then be conveyed into a gravel trench soakaway, which has been sized for a 1 in 100 year plus 40% climate change storm event. The client undertook a BRE365 Percolation test at the site, and this showed that infiltration is feasible, and the results of these tests can be found in Appendix B, with the BRE365 Gravel Trench soakaway calculations included in Appendix A.

We believe the Sustainable Urban Drainage System hierarchy has been considered fully with respect to the type of development, the proposals will reduce flood risk at the site and elsewhere. The proposed SuDS layout and details are shown on drawing number C2486-01, and C2486-02 which can be found in Appendix C. All surface water run off calculations have been provided in Appendix A.

The timetable of works is to complete all drainage prior to occupation of buildings, and maintenance requirements are also included in this report, therefore it is considered that all requirements of the planning condition have been met, and therefore can be discharged.

4. TIMESCALE AND MAINTENANCE OF WORKS

All drainage works shall be completed prior to first occupation and there shall be no adoption of any of the drainage works within the site. The owners of the site will be responsible in overseeing the long term, maintenance of all communal drains. The following outline maintenance strategy sets out recommended timescales for maintenance of the proposed drainage works, in line with CIRIA SuDS Design Guide:

- Regular inspection will comprise the inspection and cleaning of catchment, gutters, filters and tanks to reduce the likelihood of contamination, this is recommended to be carried out every 3 to 6 months.

- Periodic inspections & removal of debris or other items that represent blockage risks particularly in the catchpit chamber upstream of the gravel soakaway.

- Jet washing of permeable surfaces should be undertaken every 3 to 6 months in order to ensure that the system works properly

Table 1: Operation and maintenance requirements for pervious pavements.

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations or clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this is the most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving.	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material.	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48hr after large storms in six months
	Inspect slit accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Table 2: Operation and maintenance requirements for soakaways.

Maintenance schedule	Required action	Typical frequency
Regular Maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of crate cells	Annually
	Cleaning of gutters and any filters on downpipes	Annually (or as required based on inspections)
	Trimming any roots that may be causing blockages	Annually (or as required)
Occasional Maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube or chamber and inside of inside of crate cells	As required, based on inspections
Remedial Actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway)	As required
Monitoring	Inspect silt traps and note rare of sediment accumulation	Monthly in the first year and then annually
	Check soakaway to ensure emptying is occurring	Annually

5. CONCLUSIONS

The purpose of this report and associated drawings, is to satisfy the planning condition relating to surface water flows arising due to the development at this site.

This proposed development will greatly reduce the surface water run off leaving the site, and therefore reduce flood risk at the site and elsewhere.

The timetable of works is to complete all drainage prior to occupation of dwellings, and maintenance requirements are also included in this report, therefore it is considered that all requirements of the planning condition have been met, and therefore can be discharged.

APPENDIX A – SURFACE WATER RUN OFF CALCULATIONS

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MasterDrain
SW 16.02

Job No.	C2486
Sheet no.	1
Date	11/05/21
Project	Battlers Green Farm, Common Lane, Radlett, WD7 8PH
Title	BRE365 Gravel Trench Soakaway Calcs

By	Checked	Reviewed
S.L		

Rectangular pit design data:-

Pit length	= 9 m	Pit width	= 5 m
Depth below invert	= 2.5 m	Percentage voids	= 30.0%
Imperm. area	= 717 m²	Infilt. factor	= 0.000062 m/s
Return period	= 100 yrs	Climate change	= 40%

Calculations :-

Surface area of soakaway to 50% storage depth (not inc. base):-

a_{s50} = 2 x (length + width) x depth/2 = 35.0 m²

Outflow factor : O = a_{s50} x Infiltration rate = 0.00217 m/s

Soakaway storage volume : S_{actual} = length x width x depth x %voids/100 = 33.8 m³

Duration	Rainfall mm/hr	Inflow m³	Depth (hmax) m	Outflow m³	Storage m³
5 mins	236.3	14.1	0.99	0.65	13.41
10 mins	175.4	20.9	1.45	1.30	19.58
15 mins	140.5	25.2	1.72	1.95	23.24
30 mins	91.5	32.8	2.14	3.91	28.90
1 hrs	56.7	40.7	2.43	7.81	32.85
2 hrs	34.0	48.7	2.45	15.62	33.09
4 hrs	19.8	56.8	1.89	31.25	25.52
6 hrs	14.3	61.6	1.09	46.87	14.68
10 hrs	9.5	68.1	0.00	78.12	0.00
24 hrs	4.7	80.6	0.00	187.49	0.00

Actual volume : S_{actual} = 33.750 m³

Required volume : $S_{reqd.}$ = 33.090 m³

Soakaway volume storage OK.

Minimum required a_{s50} : 34.32 m²

Actual a_{s50} : 35.00 m²

Minimum depth required: 2.45 m

Time to maximum 2 hrs

Emptying time to 50% volume = t_{s50} = S_{reqd} x 0.5 / (a_{s50} x Infiltration rate) = 02:07 (hr:min))

Soakaway emptying time is OK.

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Job No.	C2486
Sheet no.	2
Date	11/05/21

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Project	Battlers Green Farm, Common Lane, Radlett, WD7 8PH	By	S.L
Title	BRE365 Gravel Trench Soakaway Calcs	Checked	
		Reviewed	

Location hydrological data (FSR):-

Location	= RADLETT	Grid reference	= TL1600
M5-60 (mm)	= 20	r	= 0.42
Soil index	= 0.30	SAAR (mm/yr)	= 690
WRAP	= 2	Area = England and Wales	

Soil classification for WRAP type 2
i) Very permeable soils with shallow ground water;
ii) Permeable soils over rock or fragipan, commonly on slopes in western Britain associated with smaller areas of less permeable wet soils;
iii) Moderately permeable soils, some with slowly permeable subsoils.

N.B. The rainfall rates are calculated using the location specific values above in accordance with the Wallingford procedure.

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Job No.	C2486
Sheet no.	1
Date	07/04/21

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HY 10.01

Project	Battlers Green Farm	By	S.L
Title	Pre & post SW run off calcs	Checked	
		Reviewed	

Data:-

Hydrology (FSR):-

Location = RADLETT		WRAP	= 2
Long reference =	516200	Grid reference	= TL1600
M5-60 (mm)	= 20	SAAR (mm/yr)	= 690
r	= 0.42	Soil	=0.30
Hyd. area	= 6	Hyd. zone	= 8
Hydrograph	= Winter	Area = England & Wales	

Site values used in design:-

Total site area	= 0.2076 ha	Climate change factor	= 40%
Pre-dev area drained	= 0.2076 ha	Post-dev area drained	= 0.0717 ha
Imperm runoff factor	= 100%	Perm runoff factor	= 20%

Pre-development

Area to soakaways	= 0.0000 ha	Area to other SUDS	= 0.0000 ha
Perv. area to SUDS	= 0.0000 ha	Pre-dev flow to drain	= 0.00 l/s

Post-development

Area to soakaways	= 0.0000 ha	Area to other SUDS	= 0.0000 ha
Perv. area to SUDS	= 0.0000 ha	Post-dev flow to drain	= 0.00 l/s

Calculations:-

Revised Post-dev Imperm. area = 0.072 ha
Equiv. Post-dev Imperm. area = 0.072 ha
Equiv. Post-dev Perm. area = 0.027 ha
Total Pre-dev equiv. area ha = 0.208 ha
Total Post-dev equiv. area ha = 0.099 ha
100 yr 6 hour mean intensity = 10.22mm/hr

Results:-

Pre-dev peakflow runoff (l/s) (m^3/s)

R.P.	15	30	60	120	240	360	480	600	Max	CCF	Final	R.P.
1	45.7	30.1	18.5	11.4	7.0	5.3	4.2	3.6	45.7	N/A	45.7	1
30	111.4	72.0	44.4	26.6	15.6	11.3	9.1	7.6	111.4	N/A	111.4	30
100	144.7	94.2	58.4	35.0	20.4	14.7	11.7	9.8	144.7	N/A	144.7	100

Post-dev peakflow runoff (l/s)

R.P.	15	30	60	120	240	360	480	600	Max	CCF	Final	R.P.
1	21.8	14.3	8.8	5.4	3.3	2.5	2.0	1.7	21.8	40	30.5	1
30	53.1	34.3	21.2	12.7	7.4	5.4	4.3	3.6	53.1	40	74.3	30
100	68.9	44.9	27.8	16.7	9.7	7.0	5.6	4.7	68.9	40	96.5	100

100 year 6 hour (x Climate Change Factor) storm gives:-
Pre-dev runoff volume m^3 = 127.3m^3
Post-dev rainfall volume = 84.9m^3
Post-dev volume m^3 (excess above SUDS) = 84.9m^3
100 yr 6 hour mean intensity = 10.22mm/hr
Pre-dev volume to drain at 0 l/s = 0.0 m^3
Post-dev volume to drain at 0 l/s = 0.0 m^3
Post-dev storage volume = 84.9m^3
Post-dev 5mm imperm volume = 3.6 m^3
Post-dev 5mm perm volume = 6.8 m^3

$Q_{BAR(rural)}$ = 0.372 l/s or 1.792 l/s/ha or 0.000 cumecs - from IoH 124.

The rainfall rates are calculated using the location specific values above in accordance with the Wallingford procedure.

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Data summary.

Use the data below for the SUR1 form

Site areas:-

Total site area	=	0.2076 ha ;2076.0 m² [3A]
Pre-development impermeable area	=	0.2076 ha [3B]
Pre-development permeable area	=	0.0000 ha
Post-development impermeable area	=	0.0717 ha [3C]
Post-development permeable area	=	0.1359 ha

Peak runoff:-

Pre-development 1 year storm (15min)	=	45.7 l/s [6A]
Pre-development 100 year storm (15min)	=	144.7 l/s [6C]
Post-development 1 year storm (15min)	=	21.8 l/s [6B]
Post-development 100 year storm (15min)	=	68.93 l/s [6D]

Greenfield runoff:-

$Q_{BAR(rural)}$ = 0.372 l/s or 1.792 l/s/ha or 0.000 cumecs - from IoH 124.

Climate change factor:-

CCF = 40%

Volumes:-

Pre-development 100 yr/6hr storm [12A]= 178.2m³
Post-development 100 yr/6hr storm (add. volume with no SUDS) [12B]= 84.9m³
Post-development 100 yr/6hr storm (add. volume with SUDS) = 84.9m³
Post-development add. predicted volume (No SUDS) [12C] = -93.3m³

You may also require

Data relating to the infiltration test calculations (if applicable)
Evidence to show runoff reduction (if applicable)
Information on calculation methods (if applicable see next sheet)

Note

Numbers in square brackets relate to the
Nov. 2010 v1.1 / issued 11/02/10 copy of SUR1

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Definitions and methods

Hydrology

The hydrological constants are derived from the Wallingford maps. They are used to calculate location specific rainfall figures.

Site values and factors

Areas of the site should be entered in hectares (10000 m²). If the Pre-development site is a green field, this box is blank.
Climate Change Factor is initially set at 20% - this may be changed as required.
Greenfield runoff is calculated using the method described in IoH 124.
Runoff factors

The impermeable runoff factor is initially set at 98%
The permeable runoff factor is initially set at 20%

Note: the CCF and the runoff factors may be changed by the user to suit the development
The areas draining to soakaways and other SUDS are entered in the appropriate box (in hectares)

Calculations

The post-development area is reduced by subtracting the areas that drain to soakaways or other SUDS, to give a revised figure.
All areas are then multiplied by the appropriate runoff factor to give an equivalent area with 100% runoff.
These are then summated.
This gives a total pre-development equivalent area, and a similar figure for the post-development area.
The 'Post-dev volume to drain (no SUDS)' gives the total runoff to drain if no SUDS were used.

Results

The pre- and post-development areas are subjected to 1,30 and 100 year return period storms with a duration of 15 to 600 minutes.
The Revised Post-dev Imperm. area is the area (in ha) that is not going to SUDS x impervious runoff factor.
The runoff rates are calculated for the chosen hydrograph (Summer or Winter) as l/s. Figures in red indicate m³/s
The peak value is measured, multiplied by the CCF and the total maximum rate is shown.
The pre- and post-development volumes for a 100 year / 6 hour storm are calculated from the area under the hydrograph curve.
Post-dev volume (i.e. excess above SUDS) is that volume produced by the drained area that does not go to SUDS.
Qbar(rural) is calculated in accordance with the procedure laid down in IoH 124

APPENDIX B – BRE365 PERCOLATION TEST RESULTS

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CHECK SHEET

1. Please specify the size of the soakaway that you are proposing to use:

   5 **Width (m)** 9 **Length (m)** 2.5 **Depth (m)**

2. Please specify the area that is to be drained to the soakaway:

   717 **m²**

3. Please specify the size of the trial pit:

   1.8 **Width (m)** 2.1 **Length (m)** 2.5 **Depth (m)**

4. Please specify the proposed invert level of the drain:

   2.6 **m**

5. Below is a table for you to input the data (times) gathered from the Soil Infiltration Rate tests:

Test carried on 5th May 2021

Test Number	75%	25%	25% - 75%
1 08:00 am	52 min	135 min	83 min
2 11:15 am	49 min	137 min	88 min
3 14:28 pm	54 min	148 min	94 min

Key: 75% - The time taken in minutes for the water level to fall to 75% full. 25% - The time taken in minutes for the water level to fall to 25% full. 25% - 75% - The 25% time minus the 75% time. (This will give the time for the water level to fall from 75% full to 25% full.)

Name: Cosmin Florin

Signature:

Date: 6th May 2021

APPENDIX C – DRAWINGS