

Sustainable Drainage Options Appraisal & Strategy

21 December 2025

MAC Developments & Construction Ltd

Land south of Lindley Wood, Fenn Lanes, Fenny Drayton, Nuneaton, CV13 6BJ

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1. Introduction

The following document is a Sustainable Drainage Options Appraisal & Strategy carried out by Oakshire Environmental, and includes details of the site, previous investigations, an evaluation of drainage options and an assessment of further investigations.

1.1 Project Overview

The client's proposed project involves the change of use of the site from residential to commercial storage on land south of Lindley Wood, Fenn Lanes, Fenny Drayton, Nuneaton CV13 6BJ. Oakshire Environmental have carried out a Sustainable Drainage Options Appraisal & Strategy, as described below.

1.2 Purpose of Investigation

The objectives of the Sustainable Drainage Options Appraisal & Strategy were to:

- Establish the context and setting of development at the site.
- Assess the nature of existing surface water management at the site.
- Calculate surface water storage volumes and runoff rates.
- Identify suitable sustainable drainage option(s).
- Outline a strategy for the implementation of suitable sustainable drainage option(s).
- Determine the requirement or scope of further investigations or maintenance at the site.

1.3 Scope of Work

- Desk studies will be carried out to establish the context and setting of development and the nature of existing surface water management at the site, through analysis of information obtained from sources including the Environment Agency, Local & National Authorities, Strategic Flood Risk Assessments and Digital Terrain Model (DTM) LiDAR topographical surveys.
- Quantitative surface water analysis will be conducted, to calculate runoff rates and storage volume requirements needed to meet Environment Agency, DEFRA and CIRIA guidance.
- Identify initial feasible options for sustainable drainage at the site, including assessment of potential constraints and generic objectives, based on the estimated cost, practicality and regulatory implications of their application.
- Conduct a detailed evaluation of sustainable drainage options, including development of site-specific objectives, in order to determine which option(s) are most appropriate for the site.
- Outline a strategy for the implementation of suitable sustainable drainage option(s).
- Supporting appendix includes photographs, maps and plans of the site.
- Options Appraisal has been carried out by professional Environmental Consultants, with BSc (Hons) in Environmental Science or above, in accordance with Environment Agency technical guidance.

1.4 Limitations

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This report excludes consideration of potential hazards arising from any activities at the site other than normal use and occupancy for the intended land uses. Hazards associated with any other activities have not been assessed and must be subject to a specific risk assessment by the parties responsible for those activities. Oakshire Environmental does not warrant or guarantee that the site is free of hazardous or potentially hazardous materials or conditions. It should be noted that this report has been produced for environmental purposes only.

2. Site

The following section provides a description of the site, location and previous investigations, utilising information obtained from the client and publicly available sources.

2.1 Site Description and Location

The site is located on a track off Fenn Lanes to the east of Fenny Drayton, Leicestershire, and covers an area of approximately 3.2ha. The site comprises a roughly rectangular vacant plot covered by hardcore, tarmac and concrete. A topographical survey shows that the northern western half of the site slopes from north to south while the south eastern half slopes very gradually from east to west.

The site is bordered by areas of woodland to the north west, south east and west and agricultural fields to the north east and south west.

There are several inspection chambers on the site, therefore, it is assumed that surface water from the site is currently drained to an existing sewer or watercourse to the south west of the site.

National Grid Reference: SP 36402 96871

2.2 Proposed Development

The proposed development involves the change of use of the land for the siting of 240 storage containers and an area for caravan storage at the south east.

The existing site is covered entirely by hardstanding which is to be retained and the storage containers will be situated on blocks.

3. Sustainable Drainage Options

A Sustainable Drainage Options Appraisal requires the initial identification of feasible options for sustainable drainage at a site, based on the costs involved and the practicality of their application. Some methods may not be appropriate to a particular site and some may not be cost effective. Other site specific constraints such as the available space can also determine the feasibility of a particular drainage option. The following section outlines objectives for the site, taking into account potential constraints, and includes a selection of feasible drainage options.

3.1 Feasible Drainage Options

The proposed development will result in no change to the impermeable surface cover across the site, however, sustainable drainage measures will be designed to ensure that the rate and volume of runoff from the site is reduced as far as reasonably practicable to reduce the flood risk off-site.

In accordance with the 'National standards for sustainable drainage systems', where the volume of runoff discharged from the development to surface waters or sewers for the 1% AEP, 6-hour rainfall event is greater than the volume of greenfield runoff for the same rainfall event, the peak allowable discharge rate from the development for the 1% AEP event shall be limited to the 50% AEP greenfield runoff rate or 3l/s/ha, whichever is the greater.

The 50% AEP greenfield runoff rate for the site is 13l/s while 3l/s/ha is 9.6l/s. It is not considered to be feasible to limit the runoff rate from the site to 13l/s due to the excessive storage volume required (2847m³), therefore, it is proposed to limit the runoff rate for the 1% AEP rainfall event, including an allowance for climate change, to 50% of the existing runoff rate for the same event (i.e. 521l/s). This will provide a 50% betterment to the existing runoff rate.

BGS mapping shows that the site is situated on mudstone bedrock with superficial deposits of diamicton and an infiltration test carried out on the site by PRP Environmental in 2021 concluded that soils can be classified as practically impermeable, therefore, infiltration SuDS will not be feasible at the site. The available space outside of the building footprint and proposed caravan storage area will preclude the use of above ground ponds or basins due to the land take these methods require and green roofs are not considered suitable for storage containers. The most suitable option is to provide attenuation storage and discharge surface water to the existing outlet at the south west.

These options will be subject to a more detailed evaluation in the following section.

1. *Pervious Paving*
2. *Attenuation Tank*

3.2 Detailed Evaluation of Drainage Options

Following the identification of feasible sustainable drainage options, a detailed evaluation of options, including development of site-specific objectives, is required to determine which option(s) are most appropriate for the site.

Table 1: Summary of Site-Specific Objectives

Mitigation Objective	Objective Type	Evaluation Criteria
Provide a reduction in the rate of runoff from the site	General/Technical	Peak discharge rate for the 1% AEP event will be limited to no more than 521l/s
Ensure that the implemented option can be maintained for the lifetime of the development	General/Technical	Allow maintenance of selected option for a minimum of 100 years
Enable development of a drainage strategy that meets regulatory requirements	Management	Drainage strategy to be agreed with Local Authority and carried out in accordance with relevant regulations
Enable development of a drainage strategy that meets the owner's requirements	Management	Drainage strategy to be agreed with site owner

3.3 Pervious Paving

Pervious paving could provide a means of significantly reducing the rate of runoff from the site, while also allowing the storage of surface water close to the surface.

A minimum infiltration rate of 2,500mm/h (7×10^{-4} m/s) is considered reasonable for a pavement surface to be considered pervious in respect to surface water management and most permeable paving designs can achieve infiltration rates of far more than this.

The external hardstanding areas will experience vehicular traffic including cars and light vans and will be classified as 'Traffic Category 4'. The structural requirements of pervious paving in Traffic Category 4 include sub-base thicknesses of at least 300mm.

Pervious paving also provides treatment of surface water to improve water quality through processes including the filtration of silt and the attached pollutants, biodegradation of organic pollutants (such as petrol and diesel within the pavement construction), adsorption of pollutants and the settlement and retention of solids.

Due to the low permeability ground conditions anticipated on the site, a 'Type C' system would be required in which all surface water stored within the paving sub base is discharged off-site.

Given that the site is currently covered entirely by hardstanding which is to remain in place as part of the proposed development, implementing pervious paving would require the excavation and off-site disposal of a large volume of material which is not likely to be practical or cost-effective.

3.4 Attenuation Tank

Alternatively, a geo-cellular attenuation tank could be installed beneath the proposed caravan storage area at the south east of the site. This would be constructed using plastic cellular crates that provide a high porosity to reduce the volume required to provide the necessary storage.

Stored water from the attenuation tank would then be discharged to an inspection chamber with a vortex flow control device before discharging to the existing network at a rate of 521l/s.

3.5 Swale

A more cost-effective alternative to an attenuation tank could be to install a large swale through the centre of the site.

This would require an amendment to the proposed site layout, however, there is ample space on the site to provide a swale if the layout is amended.

Calculations show that a storage volume of 925m³ would be required to limit the discharge rate for the 1% AEP event, with an allowance for climate change, to 50% of the existing 1% AEP runoff rate. This could be accommodated via a swale across the centre of the site with a length of 140m and a total width of at least 10.04m.

Stored water from the swale would then be discharged to an inspection chamber with a vortex flow control device before discharging to the existing network at a rate of 521l/s.

4. Recommendations

Following a detailed evaluation of feasible sustainable drainage options, the final option is selected, taking into account site-specific factors and the constraints outlined previously. The most appropriate sustainable drainage option at the site is considered to be via discharge to the existing network following storage within a swale. The details regarding this are outlined below.

4.1 Sustainable Drainage Strategy

A swale should be developed across the centre of the site from north east to south west. Given the potentially high sediment loads entering the swale and to provide further water quality treatment, this should be designed as a dry (or 'enhanced') swale.

The longitudinal slope of the swale should be between 0.5% and 6% and the side slopes should be a maximum of 1 in 3 (33%). Based on a topographical survey of the site, there appears to be a slope of approximately 1% across the proposed swale area.

Based on the storage requirements of the swale, it is recommended that a swale with a minimum length of 140m, a base width of 4.64m, a depth of 0.9m and side slopes of 1 in 3 should be constructed. This will result in a total width of 10.04m.

A minimum of 100mm of good-quality topsoil should be placed across the base and side slopes to support vegetation and a robust grass mix or native species suited to intermittent wetting and drying should be established to provide erosion protection and water quality improvement. Temporary erosion control measures such as biodegradable matting may be used until vegetation is established.

Where pedestrian or vehicular access is required across the swale, culverts should be constructed using reinforced concrete pipes or box culverts. The culverts should include headwalls and wing walls to prevent erosion and maintain structural stability. The swale profile should transition smoothly into the crossing structure, with erosion-resistant material (such as riprap) placed at the inlet and outlet to dissipate energy. For pedestrian paths, consider bridges or boardwalks supported on piles or beams spanning the swale without obstructing flow. All crossings must maintain the hydraulic continuity of the swale and allow for inspection and maintenance access.

An outlet pipe should be provided from the swale channel and should be situated slightly above the swale base to allow sediment deposition. A headwall with wing walls should be installed for stability and riprap, or similar erosion-resistant material, should be installed to dissipate energy. The outlet pipe will discharge to an inspection chamber containing a vortex flow control device that will limit the discharge rate to 521l/s. This inspection chamber will then connect to the existing sewer to the south west of the site. An overflow/bypass should also be incorporated to pass flows in excess of the swale storage capacity to the downstream drainage system.

4.2 Maintenance

Maintenance of the proposed swale will be the responsibility of the homeowner. The major maintenance requirement for dry swales is mowing and grass lengths should ideally be retained to between 75mm and 150mm across the surface, to assist in filtering pollutants and retaining sediments and to reduce the risk of flattening during runoff events, however, longer vegetation lengths, where appropriate, are not considered to pose a significant risk to functionality. Occasionally sediment will need to be removed (e.g. once deposits exceed 25mm in depth) and sediments excavated from swales that receiving runoff from residential or standard road and roof areas are generally not toxic or hazardous material and can, therefore, be safely disposed of by either land application or landfilling.

The following table provides guidance on the type of operational and maintenance requirements that are recommended and the frequency at which they should be carried out.

Table 2: Operation and maintenance requirements at the site

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris from swale	Monthly, or as required
	Cut grass in swale	Monthly (during growing season), or as required
	Manage other vegetation in swale and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockages and/or physical damage	Monthly
	Inspect swale surface for ponding, compaction, silt accumulation, record areas where water is ponding for >48 hours	Monthly, or when required
Remedial actions	Repair erosion or other damage to swale by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench or at top of filter media	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required
	Repair / rehabilitate inlets and outlets	As required
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect/check inlets and outlets to ensure that they are in good condition and operating as designed	Annually
	Monitor inspection chamber	Annually

5. Calculations

5.1 Greenfield Runoff Rate

The greenfield runoff rate for the site has been calculated using the uksuds tool from HR Wallingford.

Outputs are provided in the appendix.

5.2 Existing Runoff Rate

To calculate the existing runoff rate from the site, the industry-standard Modified Rational Method has been used which uses the following equation:

$$Q = 2.78CiA$$

Where:

Q = design event peak rate of runoff (l/s)

C = non-dimensional runoff coefficient which is dependent on the catchment characteristics

The runoff coefficient was split into two terms when the modified rational method was originally produced, however, the two coefficients are usually incorporated into a single term with a value of between 0.8 and 1.0 - depending on how effectively the catchment is drained and the level of impermeability. A runoff coefficient of 0.9 has been applied for the paved areas.

i = rainfall intensity for the design return period in (mm/hr) and for a duration equal to the "time of concentration" of the network

The rainfall intensity was calculated by obtaining hydrological data from the FEH Web Service and assuming a critical duration of 15 minutes as a conservative estimate.

A = total catchment area being drained (ha)

Applying this to the site, the existing runoff rates are as follows:

$$Q_{1\text{yr}} = 2.78 \times 0.9 \times 24.84 \times 3.2 = 198.9\text{l/s}$$

$$Q_{100\text{yr}} = 2.78 \times 0.9 \times 93.04 \times 3.2 = 744.9\text{l/s}$$

$$Q_{100\text{yr}+40\%cc} = 2.78 \times 0.9 \times 130.26 \times 3.2 = 1042.9\text{l/s}$$

A 50% betterment to the existing 1% AEP runoff rate, with an allowance for climate change, would result in a rate of 521l/s.

5.3 Storage Volume

The storage volume required to restrict the runoff rate for the 1% AEP rainfall event, including an allowance for climate change, was calculated using the uksuds tool from HR Wallingford. A climate change allowance of 40% was applied and hydrological data was obtained from the FEH Web Service. An urban creep allowance was not included as the site is already covered entirely by hardstanding.

It is not considered to be feasible to limit the runoff rate from the site to 13l/s due to the excessive storage volume required (2847m³), therefore, it is proposed to limit the runoff rate for the 1% AEP rainfall event, including an allowance for climate change, to 50% of the existing runoff rate for the same event (i.e. 521l/s). This will provide a 50% betterment to the existing runoff rate.

Calculations show that a storage volume of 925m³ would be required to limit the discharge rate for the 1% AEP event, with an allowance for climate change, to 50% of the existing 1% AEP runoff rate. This could be accommodated via a swale across the centre of the site with a length of 140m and a total width of at least 10.04m.

Outputs are shown in the appendix.

6. References

CIRIA, 2015. *The SuDS Manual*. ISBN: 978-0-86017-760-9.

Department for Communities and Local Government. *Technical Guidance to the National Planning Policy Framework*.

Department for Environment, Food & Rural Affairs, 2025. *National standards for sustainable drainage systems (SuDS)*. [online] Available at: <gov.uk/government/publications/national-standards-for-sustainable-drainage-systems/national-standards-for-sustainable-drainage-systems-suds>.

Environment Agency, 2025. *Flood risk and coastal change*. [online] Available at: <gov.uk/guidance/flood-risk-and-coastal-change>.

HR Wallingford, 2025. *Greenfield runoff rate estimation*. [online] Available at: <uksuds.com>.

HR Wallingford, 2025. *Surface water storage volume estimation*. [online] Available at: <uksuds.com>.

Ordnance Survey. [online] Available at: <ordnancesurvey.co.uk>.

UK Centre for Ecology & Hydrology. *Flood Estimation Handbook Web Service*. [online] Available at: <fehweb.ceh.ac.uk>.

Oakshire Environmental. Available at: <oakshireenvironmental.co.uk>

Appendix - Site Maps & Plans

Description

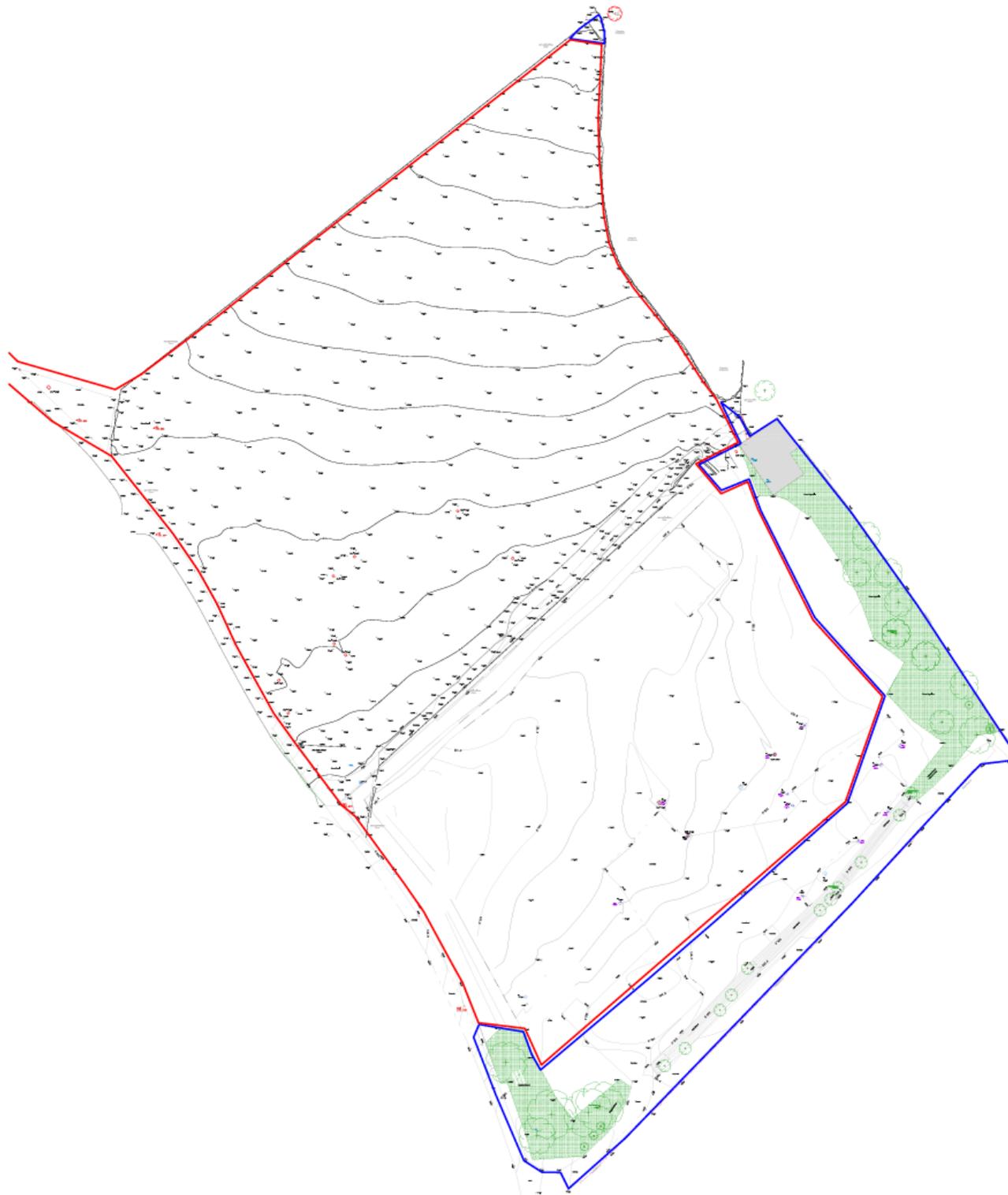
Topographical survey

Sources

Hayward Architects

Key

	Site boundary
	Land owned by the client
	North



Appendix - Site Maps & Plans

Description

Proposed site plan

Sources

Hayward Architects

Key

■ Site boundary

■ Land owned by the client

▲ North

	Quantity
40ft Containers	80
20ft Containers	80
10ft Containers	80
Total	240





Appendix - Indicative Drainage Layout

Description	
Indicative drainage layout (for illustrative purposes only – to be confirmed by engineer)	
Sources	
Hayward Architects Oakshire Environmental	
Key	
	Site boundary
	Swale (140m x 10.04m x 0.9m)
	Surface water pipe
	Inspection chamber w/ vortex flow control device (521l/s)
	Existing inspection chamber

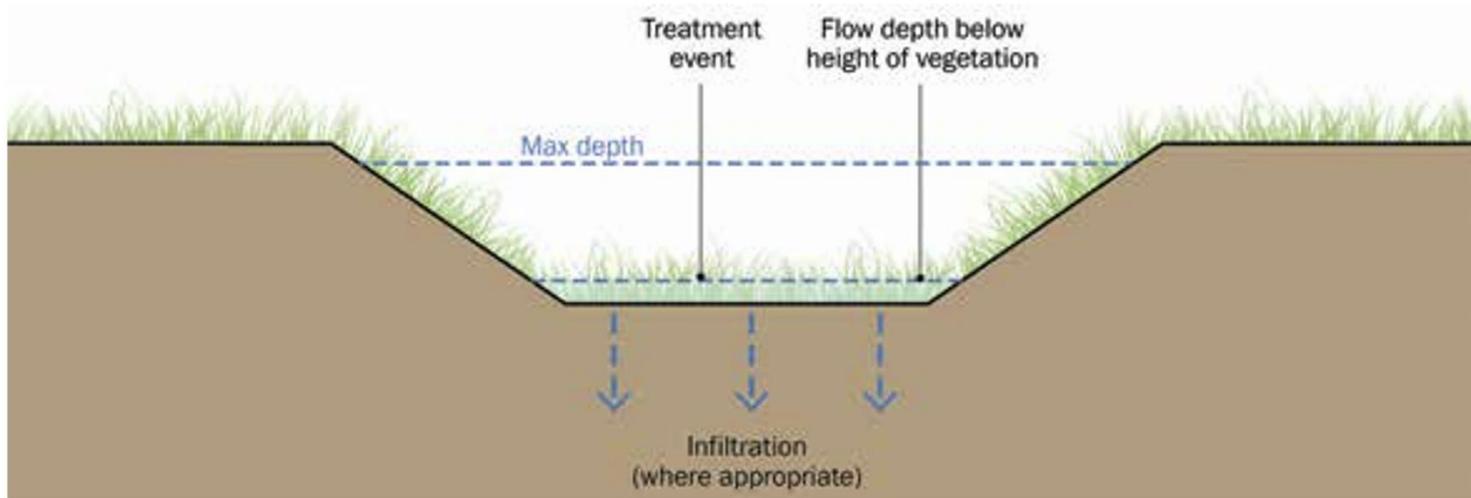
Appendix - Design Example

Description

Typical section for swale

Sources

CIRIA SuDS Manual 2015



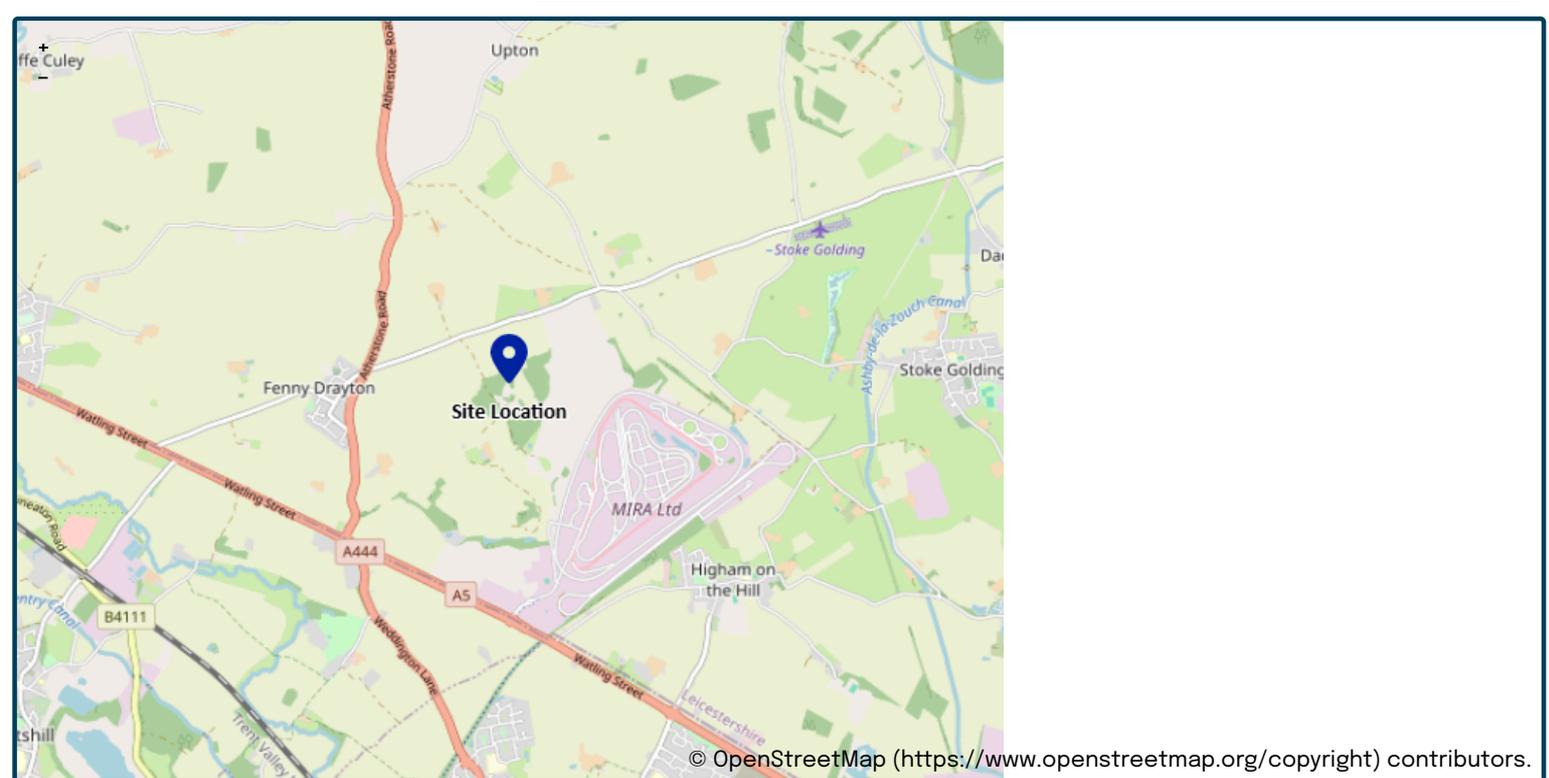
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015).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

Project details

Date	<input type="text" value="04/12/2025"/>
Calculated by	<input type="text" value="Oakshire Environmental"/>
Reference	<input type="text" value="Marrons"/>
Model version	<input type="text" value="2.2.2"/>

Location

Site name	<input type="text" value="Lindley Wood"/>
Site location	<input type="text" value="Fenny Drayton"/>



Site easting (British National Grid)	<input type="text" value="436407"/>
Site northing (British National Grid)	<input type="text" value="296848"/>

Site details

Total site area (ha)	<input type="text" value="3.2"/>	ha
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Greenfield runoff

Method

Method

FEH statistical (2025)

	<u>My value</u>	<u>Map value</u>
SAAR9120 (mm)	<input type="text" value="691"/>	<input type="text" value="mm"/>
BFIHOST19scaled	<input type="text" value="0.352"/>	
QMed-QBar conversion	<input type="text" value="1.124"/>	<input type="text" value="1.124"/>
QMed (l/s)	<input type="text" value="13"/>	<input type="text" value="l/s"/>
QBar (FEH statistical 2025) (l/s)	<input type="text" value="14.6"/>	<input type="text" value="l/s"/>

Growth curve factors

	<u>My value</u>	<u>Map value</u>
Hydrological region	<input type="text" value="4"/>	<input type="text" value="4"/>
1 year growth factor	<input type="text" value="0.83"/>	
2 year growth factor	<input type="text" value="0.89"/>	
10 year growth factor	<input type="text" value="1.49"/>	
30 year growth factor	<input type="text" value="2"/>	
100 year growth factor	<input type="text" value="2.57"/>	
200 year growth factor	<input type="text" value="3.04"/>	

Results

Method	<input type="text" value="FEH statistical (2025)"/>	
Flow rate 1 year (l/s)	<input type="text" value="12.1"/>	<input type="text" value="l/s"/>
Flow rate 2 year (l/s)	<input type="text" value="13.0"/>	<input type="text" value="l/s"/>
Flow rate 10 years (l/s)	<input type="text" value="21.8"/>	<input type="text" value="l/s"/>
Flow rate 30 years (l/s)	<input type="text" value="29.3"/>	<input type="text" value="l/s"/>
Flow rate 100 years (l/s)	<input type="text" value="37.6"/>	<input type="text" value="l/s"/>
Flow rate 200 years (l/s)	<input type="text" value="44.5"/>	<input type="text" value="l/s"/>

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent 'zero' figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (2.2.2) developed by HR Wallingford and available at [uksuds.com](https://www.uksuds.com/) (<https://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 [uksuds.com/terms-conditions](https://www.uksuds.com/terms-conditions) (<https://www.uksuds.com/terms-conditions>). The outputs from this tool have been used to estimate 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, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

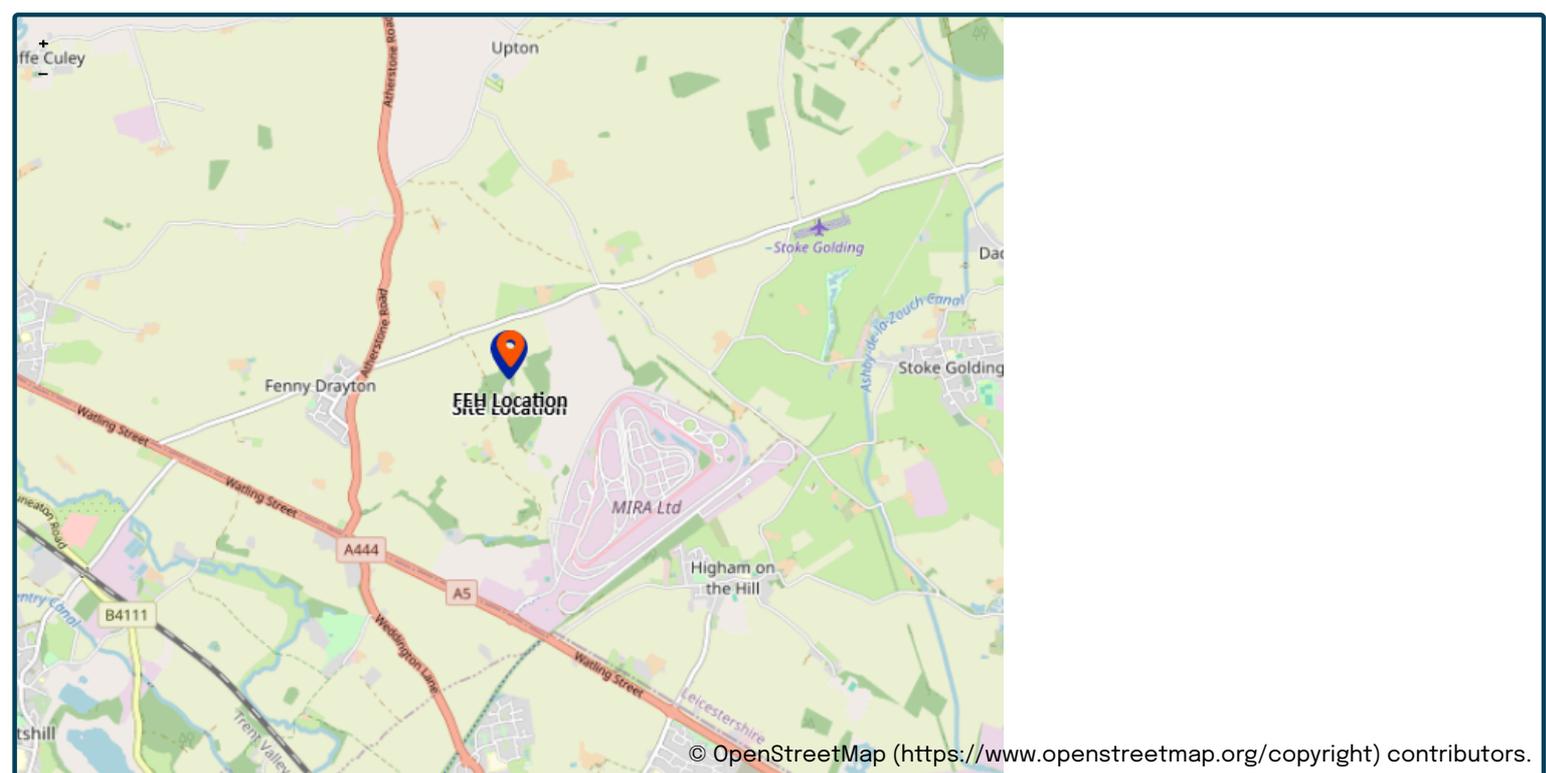
This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). It is recommended that the total storage volume for the site is distributed across the site using multiple SuDS and that hydraulic modelling software is used to undertake and finalise the detailed design of the drainage system.

Project details

Date	19/12/2025
Calculated by	Oakshire Environmental
Reference	Marrons
Model version	2.2.2

Location

Site name	Lindley Wood
Site location	Fenny Drayton



Site easting (British National Grid)	436403
Site northing (British National Grid)	296858

Site areas

Total site area (ha) ha

Roof area

Total roof area (ha) ha

Contributing roof area (ha) ha

Non-contributing roof area (ha) ha

Paved area

Total paved area (ha) ha

Contributing paved area (ha) ha

Non-contributing paved area (ha) ha

Grass / vegetated area

Total grass / vegetated area (ha) ha

Contributing grass / vegetated area (ha) ha

Non-contributing grass / vegetated area (ha) ha

Total area

Total contributing area (ha) ha

Contributing areas with urban creep allowance

Urban creep allowance factor

Storage design parameters

Storage base shape

Storage base length to width ratio

Storage design depth (m) m

Storage side slope (1 in x)

Storage voids ratio (%)

Storage volume design return period (years)

Discharge flow rate from the site

Method

Type of site

Specify the method

User specified discharge

Flow rate (user specified) (l/s) l/s

Final discharge rate

Runoff calculation method

Design flow rate (l/s) l/s

Blockage risk

Specify the method

Minimum discharge flow rate to prevent blockage

My value mm Calculated value

Design orifice diameter (mm)

Flow rate of orifice (l/s) l/s

Rainfall and runoff

Rainfall input type
FEH_Point_Rainfall_FEH22_AM_436409_296863.csv

Distance from FEH location to site (km) km

Climate change allowance factor

Model results

- **Maximum discharge flow rate:** 530.0 (l/s)
- **Outflow orifice diameter:** 562 (mm)
- **Storage base length:** 50 (m)
- **Storage base width:** 17 (m)
- **Storage base area:** 839 (m²)
- **Storage total volume:** 925 (m³)
- **Storage total water volume:** 925 (m³)
- **Storm return periods run:** 1, 2, 10, 30, 100, 200 (years)
- **Storm durations run:** 15, 30, 60, 120, 180, 240, 360, 540, 720, 900, 1080, 1440, 1800, 2160, 2880, 3600, 4320, 5040, 5760 (minutes)

Return Period (years)	Critical Duration (minutes)	Peak Flow Rate (l/s)	Max Depth (m)	Max water volume (m ³)	Max storage volume (m ³)
1	180	149.4	0.31	277	277
2	120	189.3	0.36	328	328
10	60	361.6	0.56	536	536
30	60	447.1	0.72	708	708
100	60	530.0	0.90	925	925
200	60	576.3	1.02	1072	1072

Please note runoff estimation and storage volume estimation are subject to uncertainty. Storage volume results are therefore reported to the nearest 1 m³ value, unless storage volumes are less than 10 m³, in which case, storage volumes are provided to 1 decimal place.

Disclaimer

This report was produced using the surface water storage volume design tool (2.2.2) developed by HR Wallingford and available at [uksuds.com](https://www.uksuds.com) (<https://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 [uksuds.com/terms-conditions](https://www.uksuds.com/terms-conditions) (<https://www.uksuds.com/terms-conditions>). The outputs from this tool have been used to estimate surface water storage volumes for the whole site based on a limiting discharge rate from the site. 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, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

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Appendix A - Rainfall Depths

Rainfall depths (mm) with climate change

Duration (minutes)	Duration (hours)	1 years	2 years	10 years	30 years	100 years	200 years
15	0.25	7.98	10.47	19.99	26.01	32.56	36.96
30	0.5	10.41	13.55	25.77	33.74	42.85	48.73
60	1	12.70	16.63	31.93	41.92	53.61	61.17
120	2	19.34	23.84	41.29	52.54	66.07	75.32
180	3	23.46	28.31	47.08	59.14	73.92	84.39
240	4	26.37	31.46	51.14	63.78	79.56	90.97
360	6	30.21	35.63	56.53	69.97	87.23	100.11
540	9	33.76	39.47	61.45	75.68	94.33	108.53
720	12	36.11	42.01	64.76	79.55	99.06	114.03
900	15	37.82	43.89	67.27	82.45	102.54	118.02
1080	18	39.21	45.42	69.33	84.83	105.34	121.11
1440	24	41.56	47.98	72.73	88.76	109.84	125.75
1800	30	43.48	50.11	75.66	92.12	113.50	129.35
2160	36	45.16	52.00	78.32	95.17	116.75	132.50
2880	48	48.21	55.43	83.16	100.72	122.53	138.03
3600	60	51.10	58.69	87.78	105.97	128.04	143.28
4320	72	53.85	61.80	92.22	110.99	133.32	148.27
5040	84	56.51	64.81	96.52	115.86	138.45	153.16
5760	96	59.13	67.76	100.73	120.65	143.50	158.00

Rainfall depths (mm) without climate change

Duration (minutes)	Duration (hours)	1 years	2 years	10 years	30 years	100 years	200 years
15	0.25	5.70	7.48	14.28	18.58	23.26	26.40
30	0.5	7.44	9.68	18.41	24.10	30.61	34.81
60	1	9.07	11.88	22.81	29.94	38.29	43.69
120	2	13.81	17.03	29.49	37.53	47.19	53.80
180	3	16.76	20.22	33.63	42.24	52.80	60.28
240	4	18.83	22.47	36.53	45.56	56.83	64.98
360	6	21.58	25.45	40.38	49.98	62.31	71.51
540	9	24.12	28.19	43.89	54.06	67.38	77.52
720	12	25.79	30.01	46.26	56.82	70.76	81.45
900	15	27.02	31.35	48.05	58.89	73.24	84.30
1080	18	28.01	32.44	49.52	60.59	75.24	86.51
1440	24	29.69	34.27	51.95	63.40	78.46	89.82
1800	30	31.05	35.79	54.04	65.80	81.07	92.39

Duration (minutes)	Duration (hours)	1 years	2 years	10 years	30 years	100 years	200 years
2160	36	32.26	37.14	55.94	67.98	83.39	94.64
2880	48	34.43	39.59	59.40	71.94	87.52	98.59
3600	60	36.50	41.92	62.70	75.69	91.46	102.34
4320	72	38.46	44.14	65.87	79.28	95.23	105.91
5040	84	40.37	46.29	68.94	82.76	98.89	109.40
5760	96	42.23	48.40	71.95	86.18	102.50	112.86