FRA & SuDS Strategy
The Dower House

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Executive summary

Overview

Eight Versa has been appointed to carry out a Flood Risk Assessment (FRA) report and sustainable drainage systems (SuDS) strategy for the proposed development at The Dower House, 393 High Street, Harlington, UB3 5LF in the London Borough of Hillingdon. The total site area is approximately 5,900m^2 or 0.59ha. The site comprises Dower House in the west with an area of vegetation and woodland in the middle and east. The proposal consists of the clearance of vegetation within the central parts of the assessment site, the renovation of Dower House and construction of up to 5 No. 3 bed dwellings and 12 No. 2 bed dwellings with associated access road, refuse area, parking and communal woodland area (in the eastern end of the assessment site).

Flood risk

The site is located within the Environmental Agency's Flood Zone 1 and the overall risk of flooding to the site is considered to be high. The risk from the assessed sources of flooding is as follows:

- Rivers and the sea – very low risk.
- Pluvial (surface water) – high to low risk.
- Groundwater – low risk.
- Artificial water sources (reservoirs and canals) - negligible risk.
- Artificial water sources (sewers) – low risk.

The flood risk assessment has identified high risk from surface water flooding, while all other sources present only a low risk. Mitigation and resilience measures should therefore be directed primarily towards surface water flooding.

The following mitigation measures are recommended to maintain safety over the lifetime of the development:

- Use of waterproof construction methods to prevent water ingress at ground level during flood events.
- Incorporation of resilient and resistant design features, such as:
  - positioning electrical and mechanical equipment above predicted flood levels,
  - installing flood-resistant doors and barriers to restrict water entry.
- A SuDS strategy should be developed for controlled discharge to the public sewer (to achieve a 50% betterment against the pre-development runoff rates).
- A Flood Response and Evacuation Plan is required for the site, detailing how flood warning will be provided, safe evacuation routes, access strategy for emergency services and emergency plan for flooding.

Sustainable Drainage Systems

A SuDS strategy has been proposed for the development in accordance with all relevant best-practice guidance and the principles of the sustainable drainage hierarchy, along with local planning policy requirements. The suitability of specific SuDS components has been evaluated based on the site and development proposals. The following SuDS components and features are proposed as part of a surface water drainage strategy for the site, specifically:

- An attenuation storage tank with a volume of 137m^3 for controlled discharge rate (to achieve greater than 50% betterment against the pre-development runoff rates).
- Pervious paving with a surface area of approximately 1,113m^2, with attenuation storage of 70 m^3 in the sub-base.
- Soft landscaping of about 2,597m^2.
- Flow control device to limit rate of discharge from site.

Preliminary hydraulic calculation of the proposed development site has been undertaken based on a notional surface water drainage network, using surface water storage volume estimation tool. The preliminary calculation demonstrates that no attenuation storage is required in order to achieve the targeted discharge rates, whilst mitigating flood risk to the site and surrounding area, as almost 30% of the site is permeable. Targeted discharge rates are subject to change, following the review and verification by a structural/drainage engineer during the detailed design stages.

The proposed SuDS components will allow the development to meet surface water management requirements for water quantity, whilst also providing a range of additional benefits for biodiversity and ecological value, amenity value, and health and wellbeing of residents.

An outline management plan has been developed for the proposed SuDS components, providing indicative schedules of monitoring, management and maintenance activities to be implemented after handover of the development. Note that a detailed management plan will be developed during the detailed design stages and can be secured by planning conditions. Where applicable, guidance on management and maintenance from system manufacturer's must be adhered to.

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Introduction

Eight Versa has been appointed to develop a Flood Risk Assessment (FRA) report and a Sustainable Drainage Systems (SuDS) strategy for the proposed development at The Dower House, Harlington, UB3 5LF, in the London Borough of Hillingdon. The report will evaluate the suitability of the development site for incorporation of SuDS within the development proposal. Specific SuDS components will be recommended based on their suitability to manage surface water runoff within the constraints of the development.

About the Scheme

The development site at The Dower House is located in the London Borough of Hillingdon (UB3 5LF). The total site area is approximately 5,900m^2 or 0.59ha. The site comprises Dower House in the west with an area of vegetation and woodland in the middle and east.

The proposal consists of the clearance of vegetation within the central parts of the assessment site, the renovation of Dower House and construction of up to 5 No. 3 bed dwellings and 12 No. 2 bed dwellings with associated access road, refuse area, parking and communal woodland area (in the eastern end of the assessment site).

Planning Context

National Planning Policy Framework (Ministry of Housing, Communities & Local Government, 2024)

The National Planning Policy Framework (NPPF) requires that all local planning authorities ensure that proposed developments do not increase the potential for flood risk on a site. The NPPF not only requires that flood risk is minimised, but that the development is appropriately flood resilient, giving priority to the use of sustainable drainage systems (SuDS).

As a result of this, all new developments should utilise SuDS unless there are practical reasons for not doing so. The proposed site should ensure runoff rates are sufficiently managed and not increased as a result of the development, with the aim of achieving greenfield runoff rates where feasible.

The London Plan (Mayor of London, 2021)

The London Plan is the spatial development strategy, developed by the Mayor of London and the Greater London Authority (GLA), for the 32 London boroughs and the City of London. Policy SI 13 relates to SuDS, as referenced below:

- Development proposals should aim to achieve greenfield runoff rates and manage surface water runoff as close to its source as possible, in accordance with the sustainable drainage hierarchy (Figure 1).
- There should be a preference for 'green' over 'grey' features and the delivery of multi-benefits from SuDS features.
- Proposals for impermeable paving should be refused, unless they can be shown to be unavoidable (including on small areas such as front gardens and driveways).

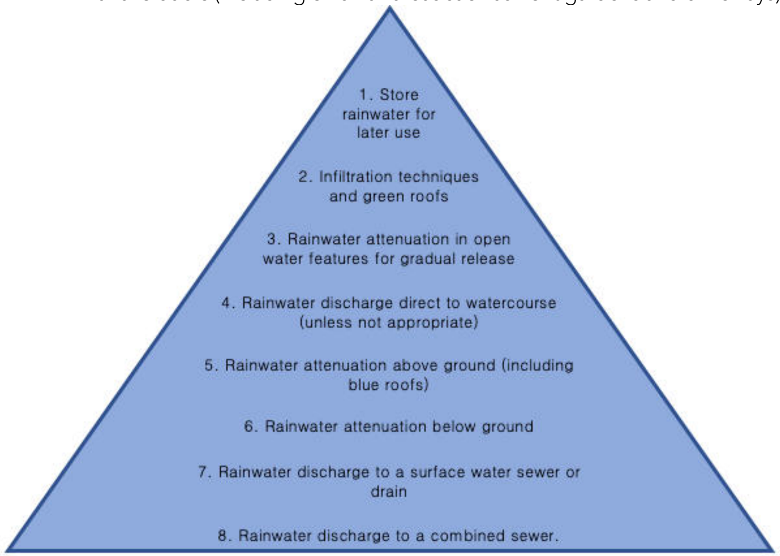

Figure 1: Sustainable drainage hierarchy.

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Sustainable Design and Construction: Supplementary Planning Guidance (Mayor of London, 2014)
This GLA document provides guidance to London boroughs and developers on design and construction measures that may be implemented to meet London Plan requirements, including guidance on the following:

- Specific conditions and consideration on flood risk to basements, along with recommended mitigation measures.
- Climate change resilience, including increased rainfall intensities and rising sea levels.
- Major developments for pre-developed sites must achieve at least 50% attenuation of pre-development surface water runoff at peak times.
- There may be situations where it is not appropriate to discharge at greenfield runoff rates (i.e. where the calculated greenfield runoff rate is extremely low and the final outfall of a piped system would be prone to blockage); in this instance an appropriate minimum discharge rate would be 5 l/s per outfall.
- Site conditions that should be considered when assessing the suitability of SuDS include potential contaminants, catchment area, local hydrology and development type.
- Infiltration SuDS proposals should consider soil permeability, ground stability, depth to water table, soil attenuation, potential contaminants and local hydrology.

Local Plan (London Borough of Hillingdon, 2012)
It sets out policies and guidance for the development of the borough. The following policies relate to FRA and SuDS:

Policy EM6: Flood Risk Management
The Council will require new development to be directed away from Flood Zones 2 and 3 in accordance with the principles of the National Planning Policy Framework (NPPF).

The subsequent Hillingdon Local Plan: Part 2 - Site Specific Allocations LDD will be subjected to the Sequential Test in accordance with the NPPF. Sites will only be allocated within Flood Zones 2 or 3 where there are overriding issues that outweigh flood risk. In these instances, policy criteria will be set requiring future applicants of these sites to demonstrate that flood risk can be suitably mitigated.

The Council will require all development across the borough to use sustainable urban drainage systems (SUDS) unless demonstrated that it is not viable. The Council will encourage SUDS to be linked to water efficiency methods. The Council may require developer contributions to guarantee the long term maintenance and performance of SUDS is to an appropriate standard.

Sustainable Drainage – Design & Evaluation GUide (London Borough of Hillingdon, 2018)
This guide promotes the idea of integrating SuDS into the fabric of development using the available landscape spaces as well as the construction profile of buildings. This approach provides more interesting surroundings, cost benefits, and simplified future maintenance.

London Borough of Hillingdon Flood Risk Management Strategy (London Borough of Hillingdon, 2024)
As the Lead Local Flood Authority, the Council is committed to being at the forefront of the action to protect our residents and businesses. This Local Flood Risk Management Strategy is a requirement of the Flood and Water Management Act 2010 and sets out our approach to managing flood risk. We have already taken measures to reduce flood risk across the borough and these are set out in the Strategy, but we also commit to further actions and objectives to respond more aggressively to the increasing risk of flooding.

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Site Overview

Site Location

The development site at The Dower House is located in Harlington in the London Borough of Hillingdon. The OS grid reference for the site is X (Eastings) 508909, Y (Northings) 177333 and the postcode is UB3 5LF. The site comprises Dower House in the west with an area of vegetation and woodland in the middle and east. The proposal consists of the clearance of vegetation within the central parts of the assessment site, the renovation of Dower House and construction of up to 5 No. 3 bed dwellings and 12 No. 2 bed dwellings with associated access road, refuse area, parking and communal woodland area (in the eastern end of the assessment site).(Figure 2).

The total site area is approximately 5,900m^2 or 0.59ha. The existing site may not be positively drained as there are no dedicated SuDS. However, the site seems to be connected to the public surface water sewer (Figure 12).

The underlying geological characteristics of the surrounding area have been determined using the British Geological Survey's 'Geology of Britain Viewer':

- Superficial geology – Langley Silt Member - Clay and silt.
- Bedrock geology – London clay formation (clay, silt and sand).

Figure 2: Aerial map showing the location of the development site.

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Development Site

Site Topography

An assessment of the topography at the site has been undertaken using LiDAR DTM5 elevation data to identify the general slope and any localized depressions. The mapping shows a comparison between average ground levels on the site with ground levels in the surrounding area. The mapping in Figure 3 confirms that the site is generally flat.

Figure 3: Topographical plan of the development site.

Development Proposals

The proposal consists of the clearance of vegetation within the central parts of the assessment site, the renovation of Dower House and construction of up to 5 No. 3 bed dwellings and 12 No. 2 bed dwellings with associated access road, refuse area, parking and communal woodland area (in the eastern end of the assessment site).Figure 4 and Figure 5 illustrate the proposed ground floor plan, and the proposed elevation respectively. Additional drawings are found in Appendix C.

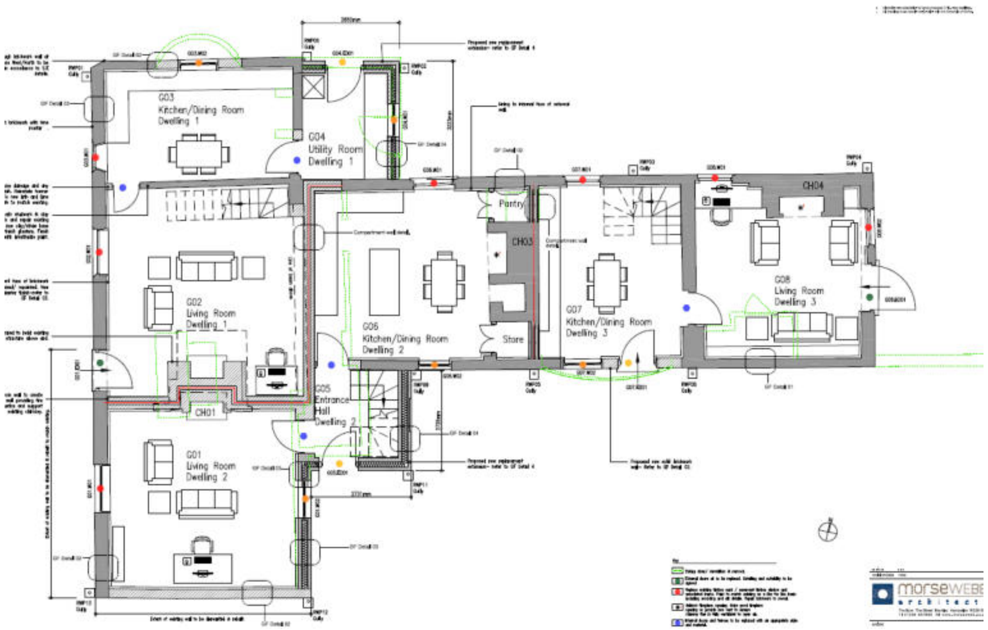

Figure 4: Proposed ground floor plan.

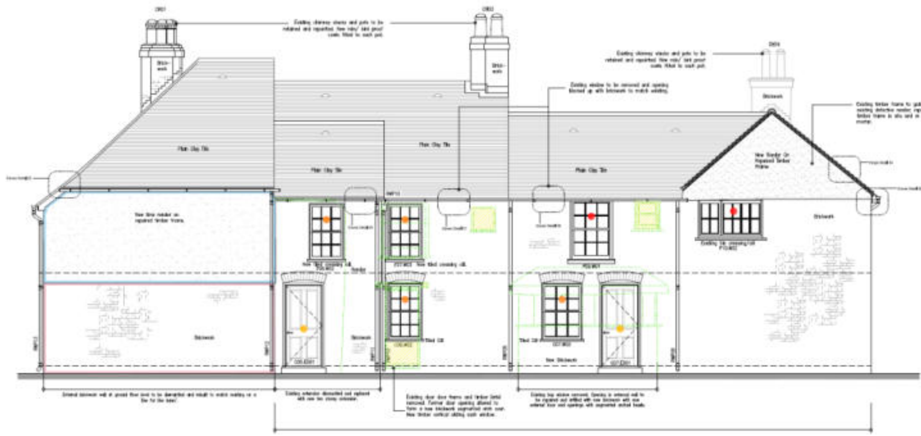

Figure 5: Proposed south elevation of the development.

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Flood Risk

Annual Probability of Flooding

The Environment Agency's (EA's) Flood Map for Planning confirms that the site is in Flood Zone 1; 'an area with a low probability of flooding' (Figure 6). Flood Zone 1 comprises areas assessed as having a 1% (1 in 100 years) Annual Exceedance Probability (AEP) or less annual probability of flooding from rivers and the sea. As the development site is less than 1 hectare and is located in Flood Zone 1, a site-specific flood risk assessment (FRA) is not required, provided the site is not affected by other sources of flooding. The full Environment Agency Flood Map for Planning report is given in Appendix D.

Figure 6: Approximate location of the development site in Flood Zone 1 as per the EA flood map.

Flood Risk from Rivers and Sea

According to the EA's Risk of Flooding from Rivers and the Sea (RoFRS) map, the site has a very low risk of flooding from fluvial or coastal flooding, with less than 0.1% annual probability of flooding (Figure 7). Therefore, the SuDS design is unlikely to be affected.

Figure 7: EA's map illustrating risk of flooding from rivers and the sea.

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Historic flood map

The PFRA provides a summary of the past flooding recorded in London Borough of Hillingdon, and known to be from fluvial, surface water, sewer or groundwater sources (Appendix E). However, the development site does not have any record of flooding, as illustrated in Figure 8.

Figure 8: EA's historic flood map.

Surface Water (Pluvial)

In accordance with the EA's Risk of Flooding from Surface Water mapping tool, the development site is considered to be at high to low risk of surface water flooding. Figure 9 illustrates the extent and depth of flooding during the >3.3% (High – 1 in 30 year), 3.3 – 1% (Medium – 1 in 100 year) and 1 – 0.1% (Low – 1 in 1000 year) annual probability events.

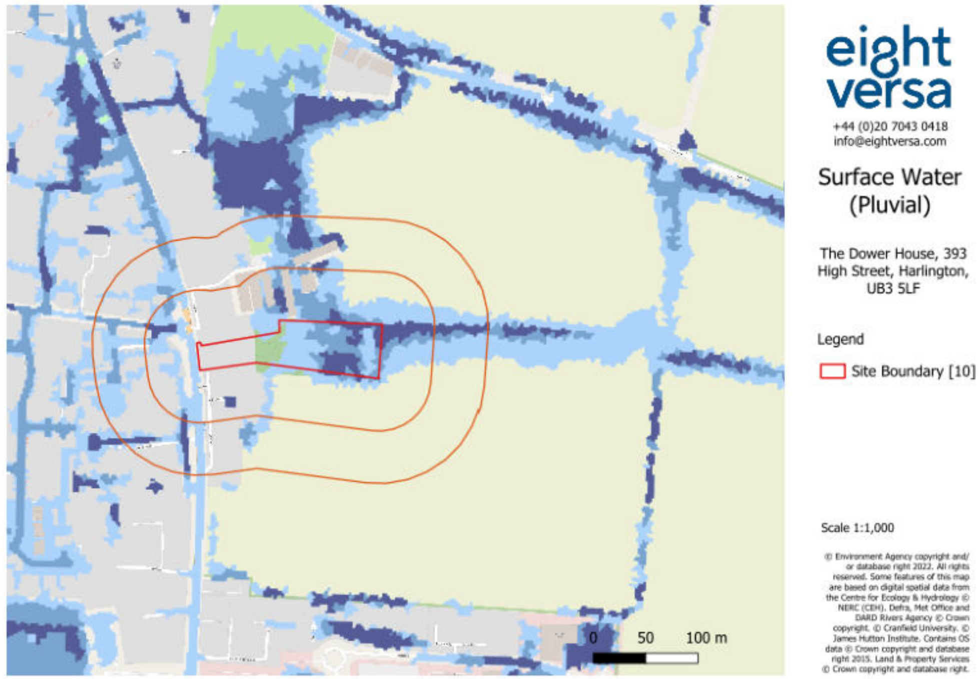

Figure 9: EA's map illustrating risk of flooding from surface water.

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Groundwater

Groundwater Flood Risk map (Figure 10) confirms that the site has a low risk of groundwater flooding during a 1% annual probability (1 in 100 year) event. Further investigation may be required, including surveying of ground conditions at the site, to confirm the site-specific geological and groundwater conditions with respect to groundwater flood risk. However, the Historic Flood Map shows no records of flooding at the site (Appendix E).

Figure 10: Groundwater Flood Risk map.

Artificial Water Sources

Reservoirs and canals

In accordance with the EA's Risk of Flooding from Reservoirs mapping tool, the site is at negligible risk of flooding from any reservoirs (Figure 11). Additionally, the Historic Flood Map shows no records of flooding at the site (Appendix E).

Figure 11: EA's map illustrating flood risk from reservoir.

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Sewers

Sewer Flooding records map within the SFRA report (Appendix E) includes a record of historical sewer flooding incidents. The site is not located in an area that is susceptible to sewer flooding, as a result of overloaded sewers. It should be noted that due to data protection regulations, data on historical sewer flooding incidents cannot be obtained at the address-level. The development site is, therefore, considered to be at low risk of sewer flooding.

Figure 12: SFRA map of sewer flooding records in relation to the development.

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Vulnerability Policy

National and local planning policy requires that all developments should consider the vulnerability of building users when carrying out flood risk assessments, in accordance with current Environment Agency guidance and the National Planning Policy Framework (NPFF) 2021.The development proposals are for dwellings, which fall into the vulnerability classifications of 'more vulnerable'.

The Sequential Test

Planning policy and the NPFF typically requires that new developments must undertake a sequential test, if they are located in Flood Zone 2 or 3, CDA or if a sequential test has not already been carried out for a development of the same type at the development site. However, a development is not required to undertake a sequential test if one has already been carried out for the same type of development at the site; the development is a minor development; the development involves the change of use; or is located in Flood Zone 1 (provided there are no other flooding issues in the area).

The development is a major development and located in Flood Zone 1, therefore a sequential test is not required for this development.

The Exception Test

Planning policy requires that new developments must undertake an exception test, if they meet the specific flood risk vulnerability and Flood Zone classifications, as outlined in Table 1. It helps to confirm that the site and its users are safe if the site is at risk of flooding.

According to Table 1, an exception test is not required as the development is classified as 'more vulnerable' and is in Flood Zone 1. Moreover, the site is not within a CDA, therefore an exception test is not required for this development.

Table 1: Flood risk vulnerability and Flood Zone 'compatibility' for the exception test.

Flood Zones	Flood risk vulnerability classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Flood Zone 1	✓	✓	✓	✓	✓
Flood Zone 2	✓	Exception test required	✓	✓	✓
Flood Zone 3a	Exception test required	✗	Exception test required	✓	✓
Flood Zone 3b	Exception test required	✗	✗	✗	✓

✓ Development permitted

✗ Development not permitted

Flood Risk Conclusions

The risk of flooding to the development site, from specific common sources of flooding, has been assessed. The risk from the respective sources of flooding is as follows:

- Rivers and the sea – very low risk.
- Pluvial (surface water) – high to low risk.
- Groundwater – low risk.
- Artificial water sources (reservoirs and canals) - negligible risk.
- Artificial water sources (sewers) – low risk.

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SuDS Overview

Introduction to SuDS

Sustainable drainage systems (SuDS) are drainage systems designed to maximise the opportunities and benefits that can be secured from surface water management. SuDS are considered to be environmentally beneficial due to their ability to manage water and flood risk within the urban and built up environment and take account of water quality by minimising water pollution, whilst also providing the opportunities for improvements in biodiversity and amenity space for the local community.

SuDS are able to replicate the natural environment, capturing rainfall and slowing down water at its source, whilst having the ability to allow water to infiltrate and provide water storage, to slow down runoff into streams and rivers.

The SuDS Manual highlights the importance of SuDS design providing a number of benefits to the sustainability of the site (Figure 13). In addition to slowing down water runoff and reducing flood risk, SuDS can also protect the ecology and natural hydrological systems on and surrounding the site; prevent water pollution to allow the system to be resilient for future change; create biodiverse green spaces to contribute to habitat connectivity and supporting local biodiversity; and provide a social place for the local community that can enhance the visual character of a space in a safe environment.

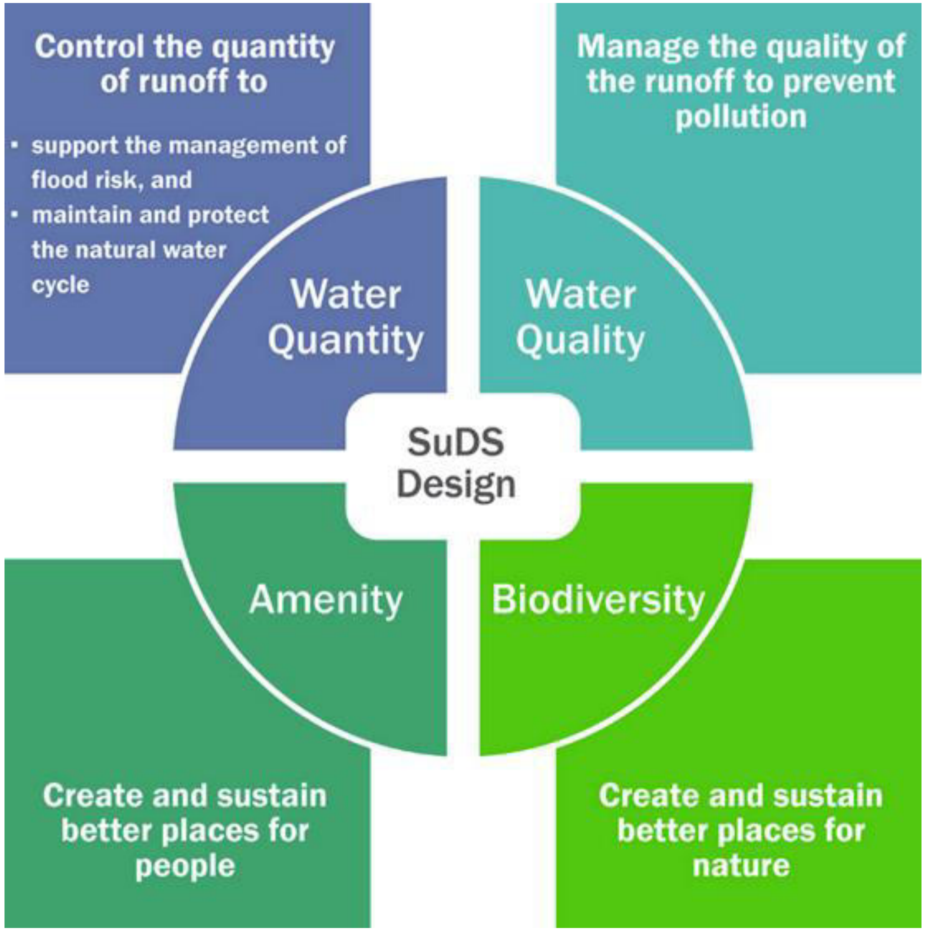

Figure 13: Multi-beneficial SuDS design principals (The SuDS Manual).

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SuDS Guidance and Principles
The SuDS Manual is a published guidance by CIRIA, written by a series of experts, and based on existing guidance and research in the UK and internationally. The CIRIA guidelines within the SuDS Manual and UKSuDS tools have been used as guidelines for the evaluation of SuDS suitability and to develop a SuDS strategy for the development.

To comply with current best practice, the drainage system should:

1. Manage runoff at or close to its source;
2. Manage runoff at the surface;
3. Be integrated with public open space areas and contribute towards meeting the objectives of the urban plan;
4. Be cost-effective to operate and maintain.

The drainage system should endeavour to ensure that, for any particular site:

1. Natural hydrological processes are protected through maintaining interception of an initial depth of rainfall and prioritising infiltration, where appropriate;
2. Flood risk is managed through the control of runoff peak flow rates and volumes discharged from the site;
3. Stormwater runoff is treated to prevent detrimental impacts to the receiving water body as a result of urban contaminants.

In addition, it is desirable to maximise the amenity and ecological benefits associated with the drainage system where there are appropriate opportunities. Many SuDS components are green infrastructure features and can provide health benefits and reduce the vulnerability of developments to the impacts of climate change.

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SuDS: Site Evaluation

Source Protection Zones

An assessment of the EA's groundwater Source Protection Zones (SPZs) within the vicinity of the development site has been undertaken (Figure 14). The site is not within a SPZ, therefore, if suitable, infiltration is likely to be acceptable, provided risk screening identifies suitable mitigation measures, if required, to prevent an impact on water quality from the proposed or historical land use and contaminated land. If further analysis is required, this would involve a review of site-specific contaminated land data.

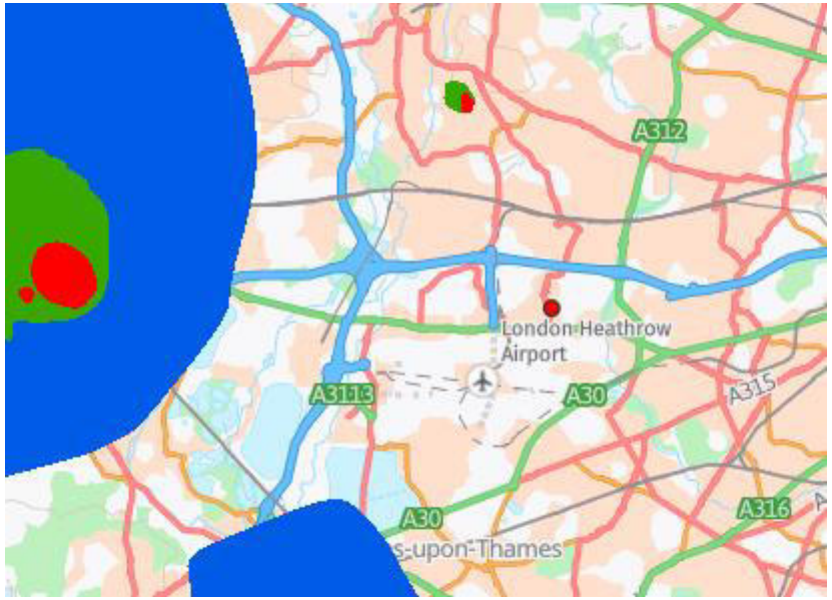

Figure 14: EA's Source Protection Zones map.

Surface Water Features

The map in Figure 15 shows that there is no surface water feature within 100m of the site. Therefore, discharge to surface water is unlikely to be appropriate.

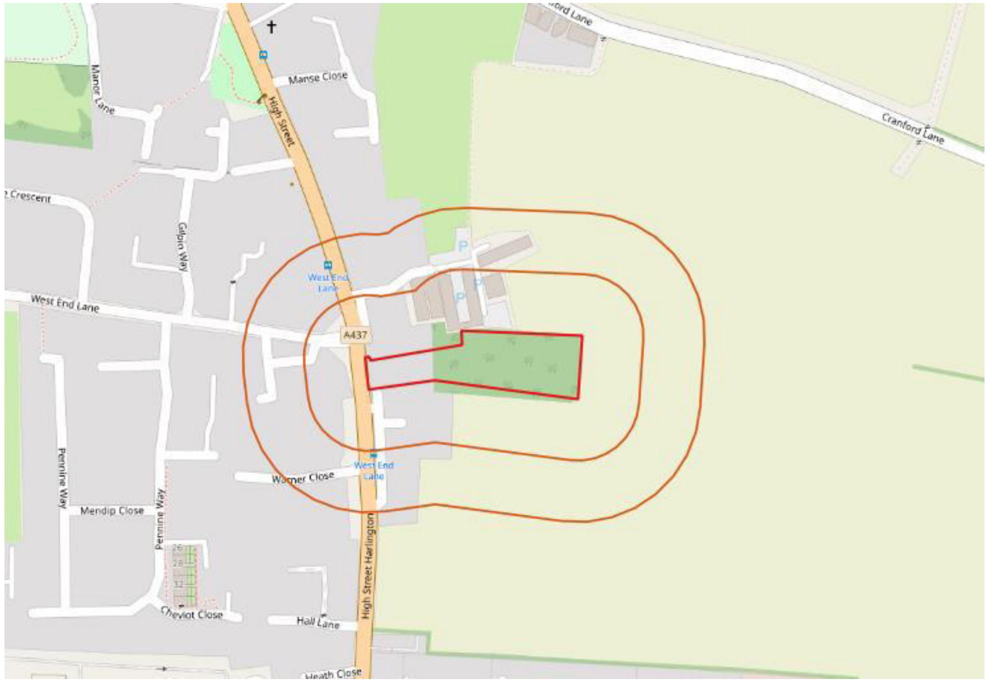

Figure 15: Surface water features map.

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Component Evaluation

SuDS Component Feasibility
The site conditions and development proposals have been assessed for their suitability for different SuDS components. The following SuDS components are considered for the proposed development and are recommended based on their feasibility for the site.

Each SuDS component has been assessed under three broader categories. There are key criteria for each category on which the SuDS component is evaluated. The key criteria have been given a weighting based on a tick-system, an example representation of this is shown below:

✓✓✓✓✓ = 3 scored out of a possible 5

The weighting of each of the criteria within the categories is shown below:

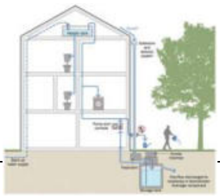
- Local area and site impact (maximum score of 10):
  - Local planning policy priority = ✓✓
  - Space required for component = ✓✓✓
  - Applicability with development design = ✓✓
  - Compatibility with geological conditions and flood risk = ✓✓✓
- Multi-beneficial design principles (maximum score of 10):
  - Water quantity = ✓✓✓✓
  - Water quality = ✓✓
  - Amenity = ✓✓
  - Biodiversity = ✓✓
- Capital cost, operation and maintenance (maximum score of 5):
  - Capital cost of component = ✓✓
  - Regular maintenance requirements = ✓✓
  - Impact of remedial actions = ✓

Key comments on each of the criteria and the corresponding score will be provided in a table (example below) for each of the SuDS components. The score for each of the criteria will be summed and each of the technologies will then be ranked. The assessment of each technology is undertaken on the following pages.

SuDS component	Local area and site impact	Multi-beneficial design principles	Capital cost, operation and maintenance
Example component	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓

Rainwater Harvesting System

A rainwater harvesting system collects and stores rainwater for use in a development. Systems range from small-scale rainwater storage butts for irrigation, to large-scale systems to serve non-potable (and in some cases, potable) uses within a building. Rainwater harvesting systems intercept surface water from roofs and can be designed to reduce the runoff volume of a development, via recycling and reuse to meet water demand on-site.

SuDS component	Local area and site impact	Multi-beneficial design principles	Capital cost, operation and maintenance
Rainwater harvesting system 	✓✓✓✓✓ ✓✓✓✓ Policy priority. Space required for storage tank(s). Residential use likely to meet demand. Ground/flood compatible.	✓✓✓✓✓ ✓✓✓✓✓ Control runoff volumes from roofs. Treatment for internal non-potable use. No direct amenity or biodiversity benefits.	✓✓✓✓✓ Relatively high capital cost. Regular maintenance and inspection required.

Green Roof

A green roof is a roof of a building that is covered with a growing medium and vegetation, planted over a waterproofing membrane. Green roofs intercept rainfall and may facilitate flow control, attenuation and treatment of surface water. Green roofs may be particularly beneficial in high-density, urbanised areas, where there are otherwise limited opportunities for incorporating SuDS in landscaping. Green roofs provide additional benefits for biodiversity and reducing the urban heat island effect.

SuDS component	Local area and site impact	Multi-beneficial design principles	Capital cost, operation and maintenance
Green roof 	✓✓✓✓✓ ✓✓✓✓✓ Policy priority. Some roof areas may be feasible. Pitched roofs and solar PV panels proposed so traditional system types not viable. Ground/flood compatible.	✓✓✓✓✓ ✓✓✓✓✓ Runoff rate/volume control only for small rainfall events. Limited treatment functions provided. Amenity benefits provided if visible. Significant biodiversity benefits provided.	✓✓✓✓✓ Relatively low capital cost. Regular maintenance and inspection required.

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Infiltration System

Infiltration system types include:

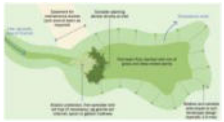
- Soakaway – sub-surface storage structure (typically rubble-filled voids beneath lawns) that stores runoff from a single house or development and allows for efficient infiltration into adjacent soil.
- infiltration trench – trench filled with permeable granular material, designed to promote infiltration of water to the ground.

Infiltration systems should be located at least 5m from all buildings and roads and at least 3m from the site boundary. The viability of infiltration should be validated with site investigations confirming groundwater levels (which should remain a minimum of 1m below the base of any infiltration systems) and infiltration rates (in accordance with BRE Digest 365).

SuDS component	Local area and site impact	Multi-beneficial design principles	Capital cost, operation and maintenance
Infiltration system 	✓✓✓✓✓ ✓✓✓✓✓ Policy priority. Must be 5m from buildings/roads. Infiltration capacity and ground water levels must be verified.	✓✓✓✓✓ ✓✓✓✓✓ Excellent runoff rate/ volume control. Limited treatment functions provided. No direct amenity or biodiversity benefits.	✓✓✓✓✓ Relatively low capital cost. Regular maintenance and inspection required. Pre-treatment sediment removal required.

Infiltration Basin

An infiltration basin is a vegetated basin or depression, which is designed to promote infiltration and is typically dry, except in periods of heavy rainfall.

SuDS component	Local area and site impact	Multi-beneficial design principles	Capital cost, operation and maintenance
Infiltration basin 	✓✓✓✓✓ ✓✓✓✓✓ Policy priority. Significant space requirement. Infiltration capacity and ground water levels must be verified.	✓✓✓✓✓ ✓✓✓✓✓ Excellent runoff rate/ volume control. Limited treatment functions provided. Good amenity benefits. Good biodiversity benefits.	✓✓✓✓✓ Relatively low capital cost. Regular maintenance and inspection required.

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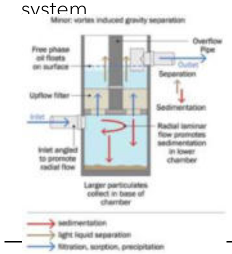
Proprietary Treatment System

A proprietary treatment system is a manufactured product that removes specified pollutants from surface water runoff. They are often useful where site constraints preclude the use of other methods. System types include:

- Treatment channels.
- Hydrodynamic or vortex separators.
- Proprietary filtration systems.
- Oil separators.
- Multi-process systems.

SuDS component	Local area and site impact	Multi-beneficial design principles	Capital cost, operation and maintenance
Proprietary treatment system 	✓✓✓✓✓ ✓✓✓✓✓ Small space requirement. Ground/flood compatible.	✓✓✓✓✓ ✓✓✓✓✓ Treatment functions provided. May be combined with flow rate control. No direct amenity or biodiversity benefits.	✓✓✓✓✓ Moderate capital cost. Regular maintenance and inspection required. Pre-treatment may be required.

Filter strip

Filter strips are gently sloping, vegetated strips of land that that treat runoff by filtering and promoting the settlement of pollutants, commonly installed in proximity to impermeable surfaces (for instance roads and car parks). They may be used as a pre-treatment component before swales, bioretention systems and trenches or a treatment component (where the flow path length across the strip is sufficient).

SuDS component	Local area and site impact	Multi-beneficial design principles	Capital cost, operation and maintenance
Filter strip 	✓✓✓✓✓ ✓✓✓✓✓ Significant space requirement. Best-suited for use adjacent to large impermeable surfaces.	✓✓✓✓✓ ✓✓✓✓✓ Limited runoff rate/volume control. Moderate treatment functions provided. Moderate amenity benefits. Moderate biodiversity benefits.	✓✓✓✓✓ Relatively low capital cost. Infrequent maintenance and inspection required. May provide pre-treatment function.

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Filter Drain

Filter drains are shallow trenches, filled with stone or gravel, and constructed slightly below the adjacent ground surface. Filter drains are typically most effective when installed alongside impermeable areas such as roads and car parks, to attenuate water runoff in a storm event, whilst also providing a treatment function.

SuDS component	Local area and site impact	Multi-beneficial design principles	Capital cost, operation and maintenance
Filter drain	✓✓✓✓✓ ✓✓✓✓✓ Best-suited for use adjacent to large impermeable surfaces. Compatible with contaminated land/ high groundwater levels.	✓✓✓✓✓ ✓✓✓✓✓ Limited runoff rate/volume control. Good treatment functions provided. No direct amenity or biodiversity benefits.	✓✓✓✓✓ Relatively low capital cost. Regular maintenance and inspection required. Risk of blockages/ pollutant build up.

Swale

Swales are linear vegetated drainage features that convey and attenuation surface water, along with in some instances facilitating infiltration and providing pollutant control by allowing settlement. Swales intercept rainfall and may facilitate flow control and volume reduction (via infiltration, where viable), along with conveying water to the on-site drainage network. Check dams and berms can also be installed along a swale to incorporate attenuation storage and promote settling and infiltration.

SuDS component	Local area and site impact	Multi-beneficial design principles	Capital cost, operation and maintenance
Swale 	✓✓✓✓✓ ✓✓✓✓✓ Moderate space requirement. Compatible with contaminated land/ high groundwater levels (if lined).	✓✓✓✓✓ ✓✓✓✓✓ Good runoff rate/volume control. Moderate treatment functions provided. Good amenity benefits. Good biodiversity benefits.	✓✓✓✓✓ Relatively low capital cost. Regular maintenance and inspection required. Inlets, culverts and outlets need to be cleared.

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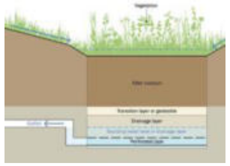
Bioretention System

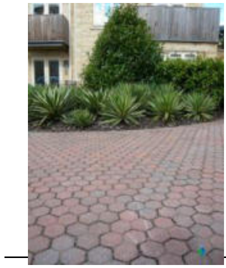
Bioretention systems are shallow vegetated landscaped depressions, which are typically under drained and constructed with engineered soils. Bioretention systems are typically referred to as rain gardens, when constructed on a small scale, without engineered soils. Bioretention systems intercept rainwater (typically at least the first 5mm) and facilitate flow control and volume reduction (via infiltration, where viable) from frequent and smaller rainfall events, along with filtering sediment and pollutants from surface water. Plant species that are tolerant to inundations should be selected to optimise performance of the system.

SuDS component	Local area and site impact	Multi-beneficial design principles	Capital cost, operation and maintenance
Bioretention system 	✓✓✓✓✓ ✓✓✓✓✓ Small space requirement. Compatible with contaminated land/ high groundwater levels (if lined).	✓✓✓✓✓ ✓✓✓✓✓ Moderate runoff rate/volume control. Good treatment functions provided. Good amenity benefits. Moderate biodiversity benefits.	✓✓✓✓✓ Relatively low capital cost. Regular maintenance and inspection required.

Pervious Paving

Pervious paving may be used for the construction of otherwise impermeable surfaces (i.e. roads (typically with speeds less than 30 mph), car parks, patios and pedestrian pathways), with materials that allow infiltration to a subsurface medium, from where water may be infiltrated to the ground or piped to the surface water drainage network. Pervious paving includes:

- Porous paving – paving that infiltrates water across the entire surface.
- Permeable paving – paving that infiltrates water through the gaps between solid blocks.

SuDS component	Local area and site impact	Multi-beneficial design principles	Capital cost, operation and maintenance
Pervious paving 	✓✓✓✓✓ ✓✓✓✓✓ Compatible with hard landscaping proposals. Compatible with contaminated land/ high groundwater levels (if lined).	✓✓✓✓✓ ✓✓✓✓✓ Good runoff rate/volume control. Good treatment functions provided. Low direct amenity or biodiversity benefits.	✓✓✓✓✓ Relatively low capital cost. Regular maintenance and inspection required. Risk of clogging with poor maintenance.

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Attenuation Storage

Attenuation storage may be provided to temporarily store runoff volumes prior to discharge from the site. An attenuation storage structure may be located under external landscaping areas, or within a proposed building. Runoff from the roof and any other impermeable surfaces may be collected and stored in the structure. Types of storage structure include:

- Geocellular storage structure (typically modular plastic units).
- Oversized concrete, plastic or corrugated steel pipes.
- Precast or in situ concrete panel structures and tanks.
- Glass-reinforced plastic (GRP) tanks.

SuDS component	Local area and site impact	Multi-beneficial design principles	Capital cost, operation and maintenance
Attenuation storage 	✓✓✓✓✓ ✓✓✓✓✓ Large sub-surface space required (compatible beneath landscaping). May be compatible with high groundwater levels.	✓✓✓✓✓ ✓✓✓✓✓ Excellent runoff rate/volume control. No direct treatment functions provided. No direct amenity or biodiversity benefits.	✓✓✓✓✓ Relatively high capital cost. Regular maintenance and inspection required. Accessibility and maintainability key.

Detention Basin

A detention basin is a surface storage basin or depression, that provides flow control through attenuation of surface water runoff. Detention basins are normally dry and in certain situations the land may also function as a recreational facility. However, basins can also be mixed, including both a permanently wet area for wildlife or treatment of the runoff and an area that is usually dry to cater for flood attenuation. They also facilitate some settling of particulate pollutants.

SuDS component	Local area and site impact	Multi-beneficial design principles	Capital cost, operation and maintenance
Detention basin 	✓✓✓✓✓ ✓✓✓✓✓ Large space required. May be compatible with high and vulnerable groundwater (if lined).	✓✓✓✓✓ ✓✓✓✓✓ Moderate runoff rate/volume control. Moderate treatment functions provided. Good amenity benefits. Moderate biodiversity benefits.	✓✓✓✓✓ Relatively low capital cost. Limited maintenance and inspection required.

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Pond / Wetland

Ponds and wetlands can provide attenuation storage and treatment functions for surface water, at varying scales, along with promoting the ecological benefits of SuDS. A pond can perform the role of a retention pond or a detention pond. Wetlands comprise shallow ponds and marshy areas, covered almost entirely in aquatic vegetation. Wetlands detain flows for an extended period to allow sediments to settle, and to remove contaminates by facilitating adhesion to vegetation and aerobic decomposition. They also provide significant ecological benefits.

SuDS component	Local area and site impact	Multi-beneficial design principles	Capital cost, operation and maintenance
Pond/wetland 	✓✓✓✓✓ ✓✓✓✓✓ Policy priority when aligned with biodiversity objectives. Large space required. May be compatible with high and vulnerable groundwater (if lined).	✓✓✓✓✓ ✓✓✓✓✓ Good runoff rate/volume control. Good treatment functions provided. Excellent amenity benefits. Excellent biodiversity benefits.	✓✓✓✓✓ Relatively high capital cost due to large size. Moderate maintenance and inspection required. Vegetation management required.

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SuDS Component Evaluation

SuDS component	Local area and site impact	Multi-beneficial design principles	Capital cost, operation and maintenance	Total score	Proposed	Rationale
Rainwater harvesting system	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓	12 out of 25	No	Insufficient space for the demand.
Green roof	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓	17 out of 25	No	No suitable space available.
Infiltration system	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓	13 out of 25	No	No suitable space available.
Infiltration basin	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓	17 out of 25	No	No suitable space available.
Proprietary treatment system	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓	13 out of 25	No	Low pollution hazard.
Filter strip	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓	12 out of 25	No	Insufficient space.
Filter drain	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓	12 out of 25	No	Insufficient space.
Swale	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓	17 out of 25	No	Insufficient space.

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SuDS Component Evaluation

SuDS component	Local area and site impact	Multi-beneficial design principles	Capital cost, operation and maintenance	Total score	Proposed	Rationale
Bioretention system	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓	17 out of 25	No	Insufficient space.
Pervious paving	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓	16 out of 25	Yes	Suitable paving areas proposed.
Attenuation storage	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓	12 out of 25	Yes	Suitable space.
Detention basin	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓	14 out of 25	No	Insufficient space.
Pond/wetland	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓	15 out of 25	No	Insufficient space.

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SuDS Proposals

The suitability of specific SuDS components for the site has been evaluated. Based on this evaluation, and the sustainable drainage hierarchy (Figure 16), a number of SuDS components have been recommended to be integrated in the site-wide SuDS design:

1. Store rainwater for later use – Not proposed: rainwater harvesting systems for the development is not proposed. There is insufficient space on site to meet the demands of the development.
2. Infiltration techniques and green roofs – Not proposed: No suitable space.
3. Rainwater attenuation in open water features for gradual release – Not proposed: there are no suitable space on the site for the implementation of a retention pond.
4. Discharge rainwater direct to a watercourse –Not proposed: there are no water features within 100m of the site.
5. Rainwater attenuation above ground (including blue roofs) – Not proposed: No suitable space.
6. Rainwater attenuation below ground (tanks or sealed water features for gradual release) – Proposed: there is sufficient space.
7. Rainwater discharge to a surface water sewer or drain –Proposed: discharge to surface water sewer is proposed
8. Rainwater discharge to the combined sewer – Not proposed: discharge to the combined sewer is not proposed.

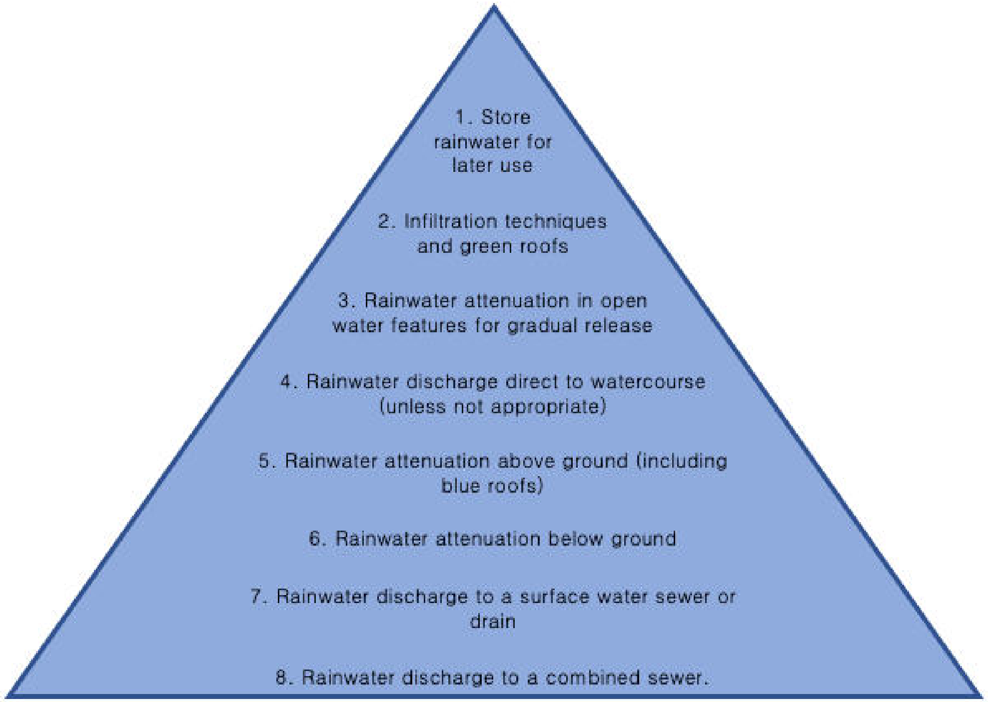

Figure 16: Sustainable drainage hierarchy.

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Hydraulic Design Criteria

In accordance with local planning policy, the hydraulic design of the scheme will meet the following design principles:

Flood risk
The surface water drainage network will be designed so that flooding does not occur on any part of the site for a 1 in 30 year rainfall event (aside from areas specifically design to hold or convey water) and flooding does not occur in any part of a building for a 1 in 100 year event (with 40% climate change allowance).

Peak runoff flow control
The peak runoff rate for the 1 in 1 year, 1 in 30 year and 1 in 100 year rainfall events for the post-developed site will not exceed the pre-developed runoff rates from the site for the same rainfall events. A 50% betterment of the pre-developed runoff rates and rates as close as practicably possible to the greenfield runoff rates will be targeted.

Runoff volume control
The runoff volume for the 1 in 100 year (6 hour duration) rainfall event for the post-developed site will not exceed the pre-developed site runoff volume for the same event.

Water quality
All appropriate best-practice guidance for runoff pollution control will be following, to ensure that the water quality of any receiving water body will not be adversely affected by the development. are car parking areas proposed for the development, there is a potential pollution hazard.

Highway drainage
There will be no SuDS features proposed within existing highways or new proposed highways for adoption.

Climate change
The effects of climate change will be accounted for in calculations, with an allowance of 40% made for increased rainfall intensities for the 1 in 100 year rainfall event, in accordance with the latest guidance provided by the Environment Agency.

Urban creep
The potential future expansion within the development will be accounted for by making an allowance for urban creep of 10% within calculations.

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Run off rate calculation

The existing site area is approximately 0.59ha, with approximately 0.049ha of impermeable areas. The proposed site area is approximately 0.59ha, with approximately 0.223ha of impermeable areas.

The runoff rates were determined by the Wallingford Rational Method with a rainstorm of 6 hours duration. Greenfield run off rate is calculated based on IH 124 and 'Rainfall runoff management for developments.

The infiltration rate of the soils is to be determined via on site testing to BRE 365. However, for this initial stage design purpose an estimation of the infiltration rate has been made. Table 25.1 in CIRIA C753, The SuDS Manual, the typical infiltration coefficient for silty clay in 1 x 10-5 to 1 x 10-6. For this design we have assumed an infiltration coefficient of 1 x 10-6 for design purposes. As noted, this is to be confirmed via intrusive testing on site, prior to construction.

In accordance with local planning policy, for previously developed sites, the peak runoff rate for the 1 in 1 year, 1 in 30 year and 1 in 100 year rainfall events for the post-developed site must not exceed the pre-development runoff rates from the site for the same rainfall events and should be as close as reasonably practicable to greenfield runoff rates (Table 2).

From a UKSuDS Quick Storage Estimate the required attenuation volume is approximately 207m^3 without taking into account permeable pavements for the 1 in 100-year event. This Quick Storage Estimate tool includes an allowance for Climate Change of 40%. An attenuation volume of 207m^3 has been used for the development design. Full calculations can be found in Appendix E.

Table 2: Greenfield, pre-development and post-development peak runoff rates.

Return period	Greenfield peak runoff rates (l/s)	Pre-development peak runoff rates (l/s)	Post-development proposed discharge rates (l/s)	Betterment from pre-development peak runoff rates (l/s)
Q_{BAR}	0.75	-	-	-
Q1 (1 in 1 year)	1.4	10.6	1.0	90%
Q30 (1 in 30 year)	3.7	34.1	1.6	95%
Q100 (1 in 100 year)	5.2	36.8	1.8	95%
Q100 (1 in 100 +40)	-	-	2	-

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Surface Water Drainage Model

Positively drained area

The total impermeable area of the proposed development is approximately 0.2234ha, which covers the approximately 40% footprint of the site. The total impermeable area is taken as the positively drained area for the surface water drainage model (Appendix G).

Drains, manholes and pipes

All drains, manholes and pipes will be designed in accordance with Building Regulations Part H and Sewers for Adoption 7th Edition. A notional series of drains, manholes and pipes has been developed to evaluate the surface water drainage potential for the proposed site.

Attenuation storage in the sub-base of the pervious paving

Pervious paving with storage in the sub base allows for temporary storage of surface water runoff, prior to discharge from the site at the allowable discharge rates. A surface area of approximately 1,113m^2 is proposed with a sub-base thickness of 210mm for attenuation storage based on 1 in 100 year event plus 40% climate change, subject to verification of ground suitability and system specification by a structural or drainage engineer. The attenuation storage is modelled as a Structure Type of Depth / Area / Inf Area with a porosity of 0.30 of total 70m^3 attenuation volume.

TS^{3}e system, would additionally, consist of an impermeable geo-membrane to prevent possible contamination of the drained water from the surrounding soils, this would involve a review of site-specific contaminated land data. Regular inspection for surface ponding, sediment build up, pollution and vegetation health with remediation taken as required.

The pervious pavements should be designed and constructed in accordance with the SuDS Manual (Chapter 20 'Pervious pavements').

Exceedance and overland flows

The surface water drainage network has been designed to safely contain volumes of surface water up to the 1 in 100 year (with 40% climate change) event. The preliminary hydraulic modelling estimates that the 1 in 100 year event will be contained within the surface water drainage network. However, it is proposed that any exceedance flow is channelled to greenspace of the site for temporary storage and gradual release.

Flow control

In order to target discharge rates (Table 2) from the site that are in accordance with local planning policy, a flow control device should be installed prior to the point of connection with the local surface water sewer. The actual flow rate(s) and variability of flow rates between each simulated rainfall event will be confirmed at the detailed design stages with the specification of a suitable flow control product. Key considerations include:

- Flow control devices may be static (such as fixed orifice plates or vortex flow controls) or variable (such as pistons or slide valves).
- Static controls should have a minimum opening size of 100mm chamber, or equivalent.
- Variable controls may have a smaller opening provided they have a self-cleansing mechanism.
- Static controls typically have less onerous maintenance requirements than variable controls, but variable controls typically can achieve greater variability of flow rates than static controls.
- A bypass should be included with a surface operated penstock or valve; and access should be provided to the upstream and downstream sections of a flow control device to allow maintenance.

Note that the flow control function may be performed by the pumping system, installed further upstream (provided no additional runoff enters the drainage network after the flow control provided by the pumping system).

Flow controls devices should be designed and constructed in accordance with the SuDS Manual (Chapter 28 'Inlets, Outlets and Flow Control Systems').

Attenuation storage

It is estimated that a minimum storage volume of approximately 137m^3 would be required to temporarily store surface water runoff, prior to discharge from site at the allowable discharge rates. The storage structure may be a plastic tank. This attenuation storage structure should be installed after the entry point for runoff from all positively drained areas, but prior to the flow control device, limiting the final discharge rates from the site.

The design of attenuation storage structures and associated infrastructure should seek to prevent a build-up of silt and other debris contained in surface water runoff (e.g. by use of benching and low-flow channels) and should be designed to allow access for regular maintenance. Attenuation storage should be designed and constructed in accordance with the SuDS Manual (Chapter 21 'Attenuation Storage Tanks').

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Management Plan

Outline SuDS Management Plan

To ensure that SuDS features and components work effectively, it is essential that they are adequately maintained and working to their expected capacity. A detailed site-specific SuDS management plan will be produced for the development, including responsibilities and a programme of maintenance works and inspections. An outline management plan for the proposed SuDS components is provided below. A template SuDS inspection and maintenance checklist form, which may be used to record the site inspections and management and maintenance actions undertaken, is provided in Appendix H to this report.

Management and maintenance of all surface water drainage and SuDS components within the curtilages of the properties will be the responsibility of the respective property owners, for the lifetime of the development. All surface water drainage and SuDS components outside of the property curtilages, but within the curtilages of the overall development site, will be the shared responsibility of the respective property owners and will be managed and maintained via a management agreement or similar contractual arrangement, for the lifetime of the development.

To ensure that the maintenance requirements and responsibilities for the proposed SuDS components are met, information will be made available to the first owners of each property in a clear and concise format to clarify their requirements. The developer shall be responsible for providing a framework management agreement for SuDS outside of the property curtilages, for the future property owners.

Management and maintenance requirements should be determined in accordance with all best-practice guidance and the SuDS Manual (Chapter 32: Operation and Maintenance), including:

a) Regular maintenance activities.
b) Occasional maintenance activities.
c) Remedial maintenance requirements.
d) Ongoing monitoring requirements.

All management, monitoring and maintenance activities should follow guidance from the SuDS system manufacturer, where applicable.

Drains, Manholes and Pipes

All drains, manholes and pipes should be constructed, operated and maintained in accordance with Building Regulations Part H, Sewers for Adoption 7th Edition and BS EN 752:2017 'Drain and sewer systems outside buildings'.

Pumping System and Rising Mains

The surface water pumping station system be constructed, operated and maintained in accordance with Building Regulations Part H, Sewers for Adoption 7th Edition and BS EN 16932-1:2018 'Drain and sewer systems outside buildings – Pumping systems'.

Flow Control Devices

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspection of the device and filter for debris and sediment build-up.	Annually (and following poor performance).
	Cleaning of device inlet/outlet, chamber and sump.	Annually (and following poor performance).
Occasional maintenance	Cleaning and/or replacement of any filters.	Three monthly (or as required).
Remedial actions	Repair of flow control device.	As required.
Monitoring	Visual inspection within chamber to ensure that the device is in good condition and operating as designed.	Annually.
	Survey from inside of chamber for sediment build-up and remove if necessary.	Every 5 years, or as required.

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Pervious Paving

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 of clogging or manufacturer's recommendations).
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.	As required – once per year on less frequently used pavements.
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm 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.	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, 48 hours after large storms in first six months.
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually.
	Regular inspection for surface ponding and pollution.	As required.
	Monitor inspection chambers.	Annually.

Attenuation Storage

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually.
	Remove debris from the catchment surface (where it may cause risks to performance).	Monthly.
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually.
	Remove sediment from pre-treatment structures and/ or internal forebays.	Annually, or as required.
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents.	As required.
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually.
	Survey inside of tank for sediment build-up and remove if necessary.	Every 5 years, or as required.

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Conclusions

Flood Risk

The site is located in Flood Zone 1 and the overall risk of flooding to the site is considered to be high. The risk from the assessed sources of flooding is as follows:

- Rivers and the sea – very low risk.
- Pluvial (surface water) – high to low risk.
- Groundwater – low risk.
- Artificial water sources (reservoirs and canals) - negligible risk.
- Artificial water sources (sewers) – low risk.

The flood risk assessment has identified high risk from surface water flooding, while all other sources present only a low risk. Mitigation and resilience measures should therefore be directed primarily towards surface water flooding.

The following mitigation measures are recommended to maintain safety over the lifetime of the development:

- Use of waterproof construction methods to prevent water ingress at ground level during flood events.
- Incorporation of resilient and resistant design features, such as:
  - positioning electrical and mechanical equipment above predicted flood levels,
  - installing flood-resistant doors and barriers to restrict water entry.
- A SuDS strategy should be developed for controlled discharge to the public sewer (to achieve a 50% betterment against the pre-development runoff rates).
- A Flood Response and Evacuation Plan is required for the site, detailing how flood warning will be provided, safe evacuation routes, access strategy for emergency services and emergency plan for flooding.

Sustainable Drainage Systems

A SuDS strategy has been proposed for the development in accordance with all relevant best-practice guidance and the principles of the sustainable drainage hierarchy, along with local planning policy requirements. The suitability of specific SuDS components has been evaluated based on the site and development proposals. The following SuDS components and features are proposed as part of a surface water drainage strategy for the site, specifically:

- An attenuation storage tank with a volume of 137m^3 for controlled discharge rate (to achieve greater than 50% betterment against the pre-development runoff rates).
- Pervious paving with a surface area of approximately 1,113m^2, with attenuation storage of 70 m^3 in the sub-base.
- Soft landscaping of about 2,597m^2.
- Flow control device to limit rate of discharge from site.

Preliminary hydraulic calculation of the proposed development site has been undertaken based on a notional surface water drainage network, using surface water storage volume estimation tool. The preliminary calculation demonstrates that no attenuation storage is required in order to achieve the targeted discharge rates, whilst mitigating flood risk to the site and surrounding area, as almost 30% of the site is permeable. Targeted discharge rates are subject to change, following the review and verification by a structural/drainage engineer during the detailed design stages.

The proposed SuDS components will allow the development to meet surface water management requirements for water quantity, whilst also providing a range of additional benefits for biodiversity and ecological value, amenity value, and health and wellbeing of residents.

An outline management plan has been developed for the proposed SuDS components, providing indicative schedules of monitoring, management and maintenance activities to be implemented after handover of the development. Note that a detailed management plan will be developed during the detailed design stages and can be secured by planning conditions. Where applicable, guidance on management and maintenance from system manufacturer's must be adhered to.

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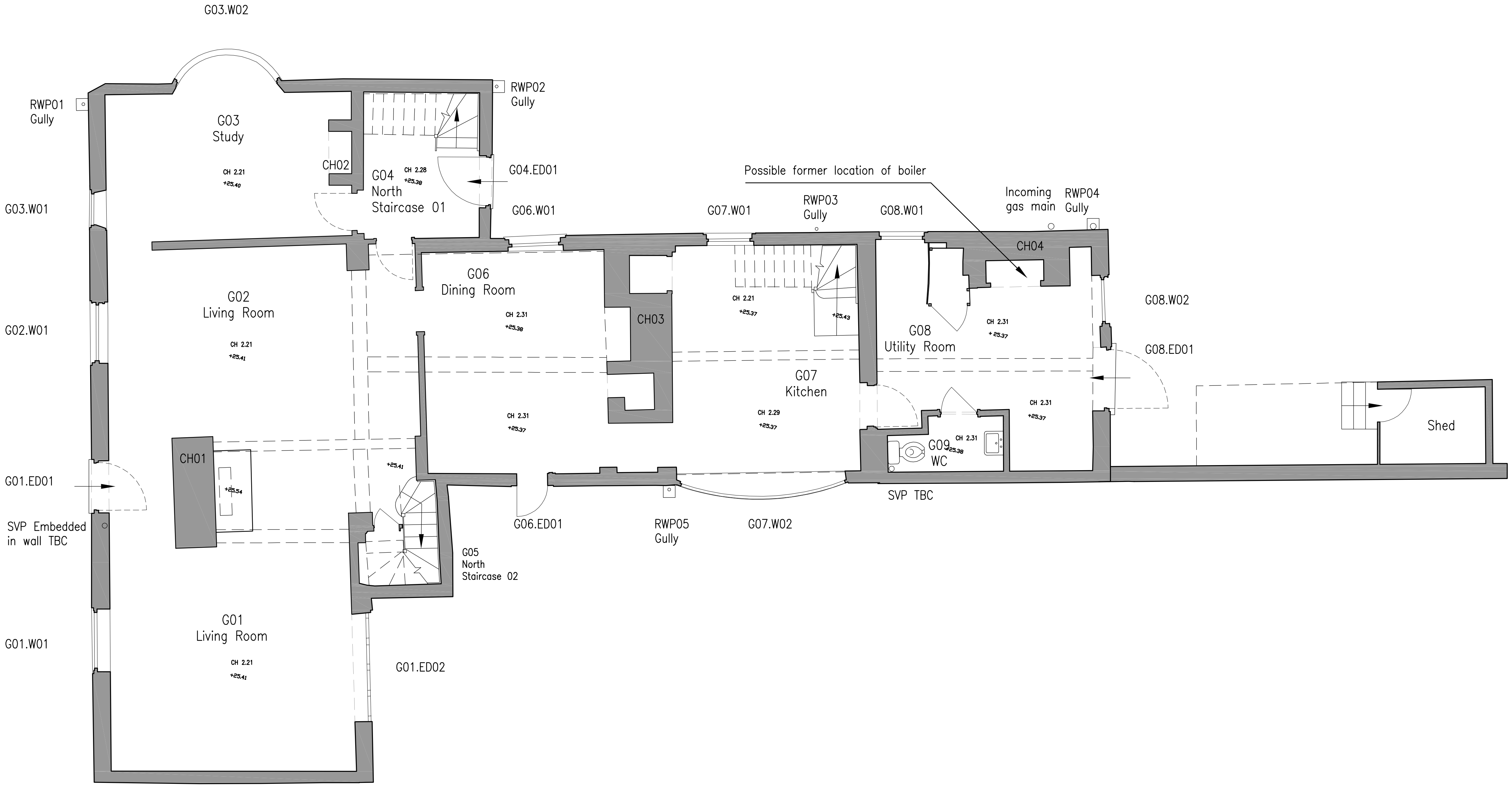
Appendix A: Existing Drawings



01 GROUND FLOOR PLAN AS EXISTING
1:100

revision/date	note
. . ./. . .	. . .

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project
Dower House Harlington
Dower House

title
Ground Floor Plan As Existing

scale	status	
1:100@A3	PRELIMINARY	
job no.	dwg no.	status/revision
748	D-010	PR00

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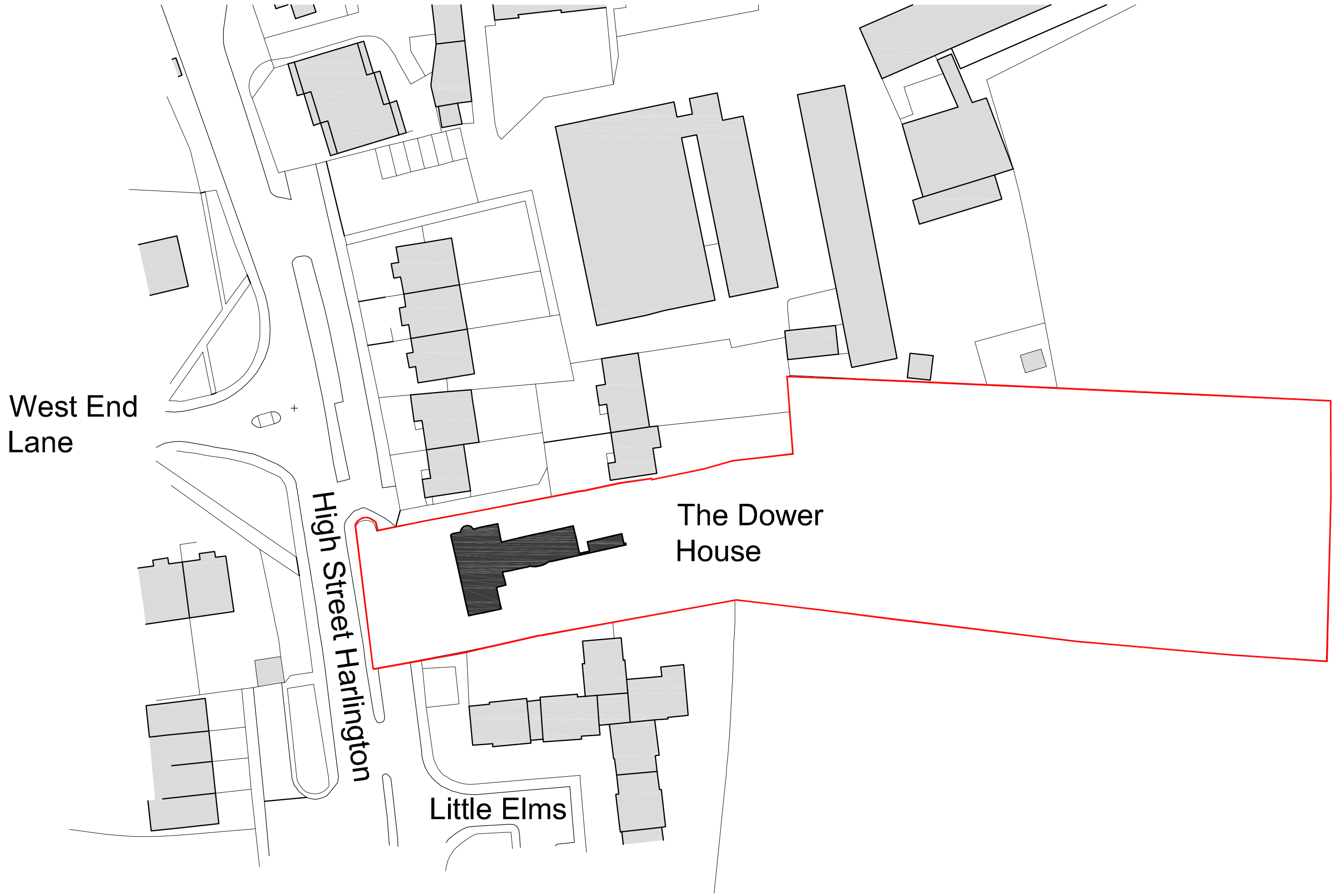
Appendix B: Topography



01 LOCATION PLAN
1:1250

Scale Bar. 1:1250

0 10m 25m 50m 100m

N

revision/date	note
. . /. . .	. . .

morseWEBB architects
The Byre The Street Bramley Hampshire RG26 5DE
T: 01256 587888 W: www.morsewebb.co.uk

project
Dower House
Harlington High Street

title
Location Plan

scale	status	
1:1250 @A4	PLANNING	
job no.	dwg no.	status/revision
748	001	PL00

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Appendix C: Proposed Drawings

NOTE: This drawing is the copyright of UBU Design LTD, all rights reserved.

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LEGEND

- Hedge planting
- Pedestrian macadam surfacing
- Parking Bays Tobermore - Fusion Block Paving or similar equivalent Colour: Sandstone
- Marshalls Vehicular tarmac surfacing Colour: buff quartzite
- Grass areas
- Planting bed
- Marshalls Yorkstone Paving
- Stone Setts
- Proposed Trees
- Hedge
- F1 - Existing brick wall
- F2 - 1.8m high close board fence
- F3 - Proposed brick wall
- F4 - Proposed post and rail timber fencing
- Gate Type 5 1500 x 1800 high single
- Gate Type 6 3000 x 1800 high double
- Gate Type 8 1100 x 1200 high single
- Existing gates double vehicular
- Tree to be removed
- +76.09 Proposed Levels
- Existing tree
- Walled Garden Fruit Trees
- FK 915 x 150 x 63mm Marshalls Drivesett Argent Edging precast concrete flash kerbs - 0mm upstand - colour light
- K 915 x 150 x 63mm Marshalls Drivesett Argent Edging precast concrete road kerbs - 125mm upstand - colour light
- BNG area
- Wildflower

REV	DATE	COMMENTS	DRN	CHK	APP
P01	27/11/23	Bin enclosure moved, wildflower added, general updates	KK	MJ	

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studio@ubu-design.co.uk
www.ubu-design.co.uk

PROJECT: Dower House, Harlington

TITLE: HARD LANDSCAPE PLAN

CLIENT: KOMFORT SERVICES

SCALE: 1:250@A1

DATE: 17/11/2023

JOB NO: 3071

DWG NO: DOWE-UBU-XX-XX-D-L-1000

STATUS: PLANNING

REV: P01

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Appendix D: Environment Agency Flood Map

Environment Agency

Flood map for planning

Your reference	Location (easting/northing)	Created
Unspecified	**508917/177329**	**7 October 2025 19:33**

Your selected location is in flood zone 1, an area with a low probability of flooding.

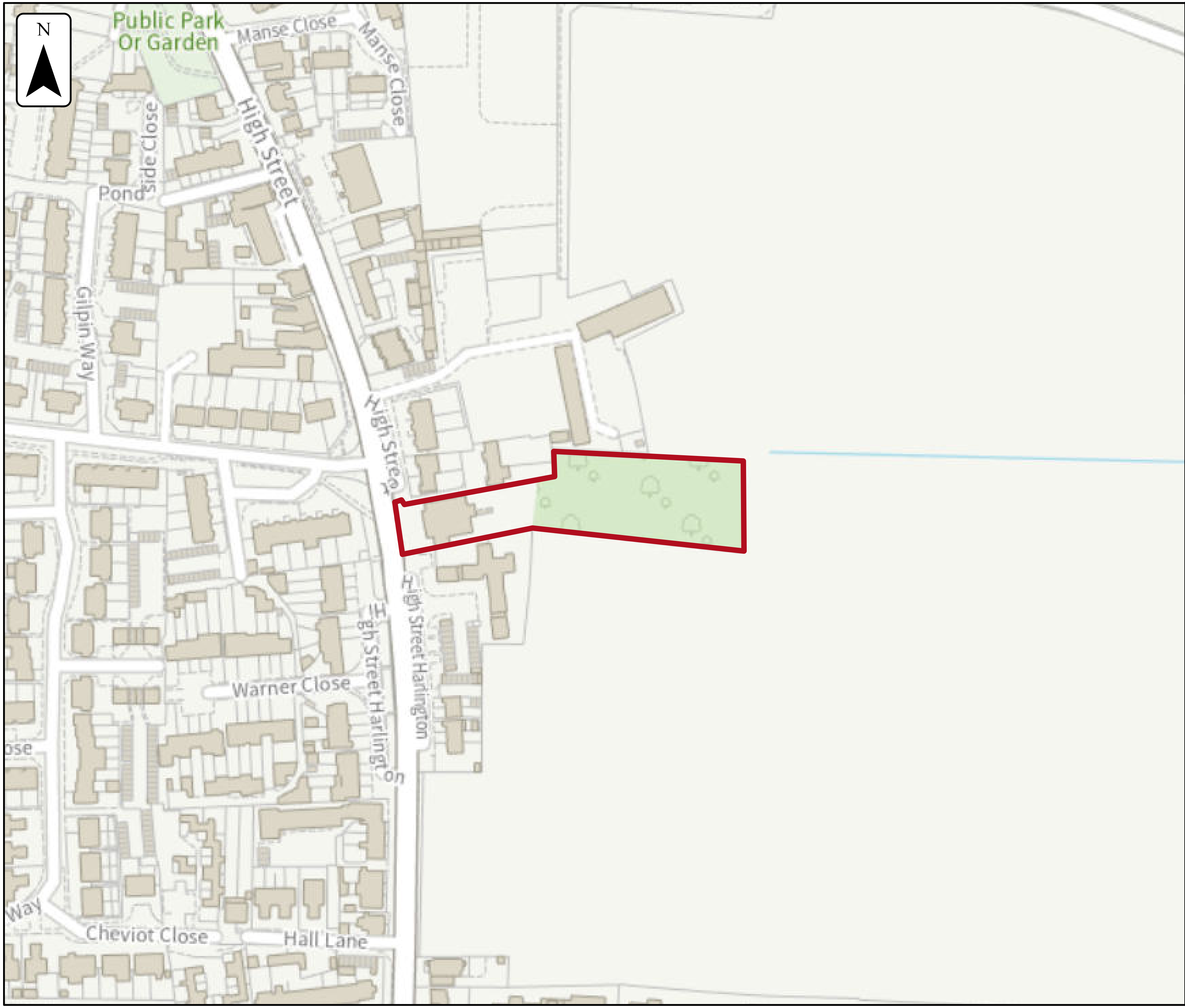
You will need to do a flood risk assessment if your site is **any of the following**:

- bigger than 1 hectare (ha)
- in an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.



Environment Agency

Flood map for planning

Your reference
Unspecified

Location (easting/northing)
508917/177329

Scale
1:2,500

Created
7 Oct 2025 19:33

Selected area

Flood zone 3

Flood zone 2

Flood zone 1

Flood defence

Main river

Water storage area

0 20 40 60m

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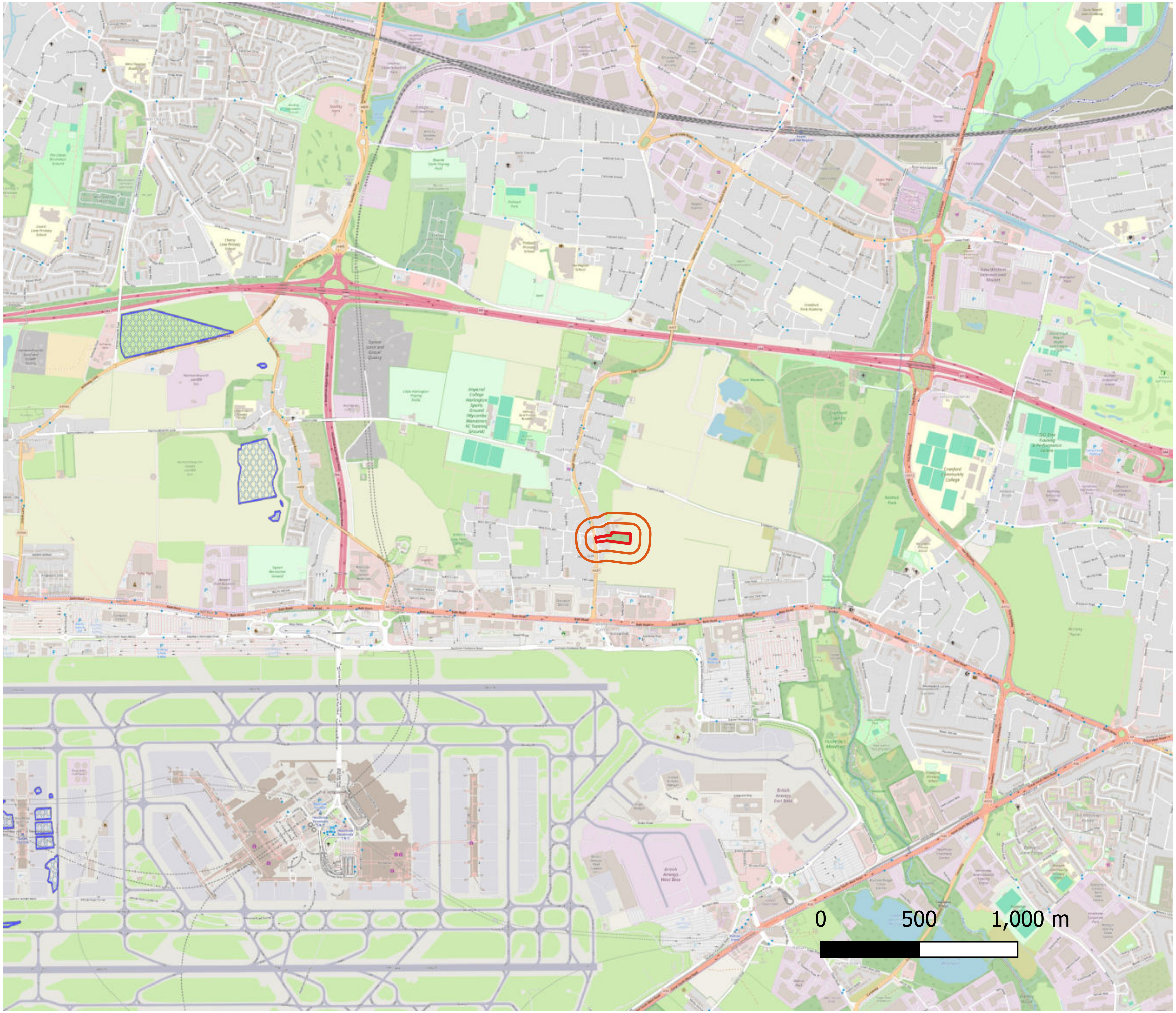
Appendix E: PFRA Maps



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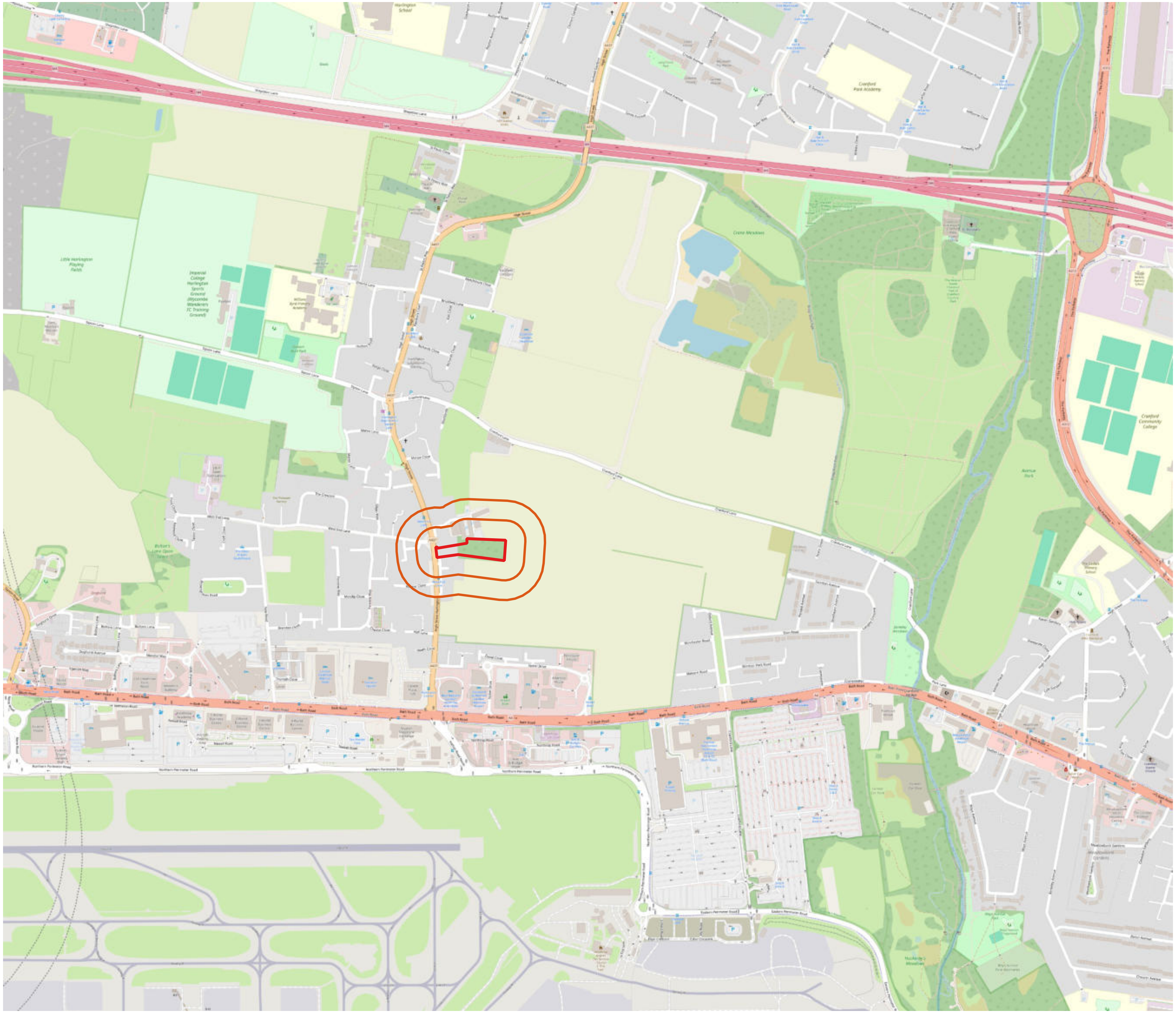
Historic flood map

The Dower House, 393 High Street, Harlington, UB3 5LF

Legend

Site Boundary [10]

Historic Flood Map



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Flood Risk from Rivers and Sea

The Dower House, 393 High Street, Harlington, UB3 5LF

Legend

Site Boundary [10]

Historic Flood Map

OpenStreetMap

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Appendix F: Runoff calculations

Greenfield runoff rate estimation tool

www.uksuds.com | Greenfield runoff rate estimation tool (https://www.uksuds.com/)

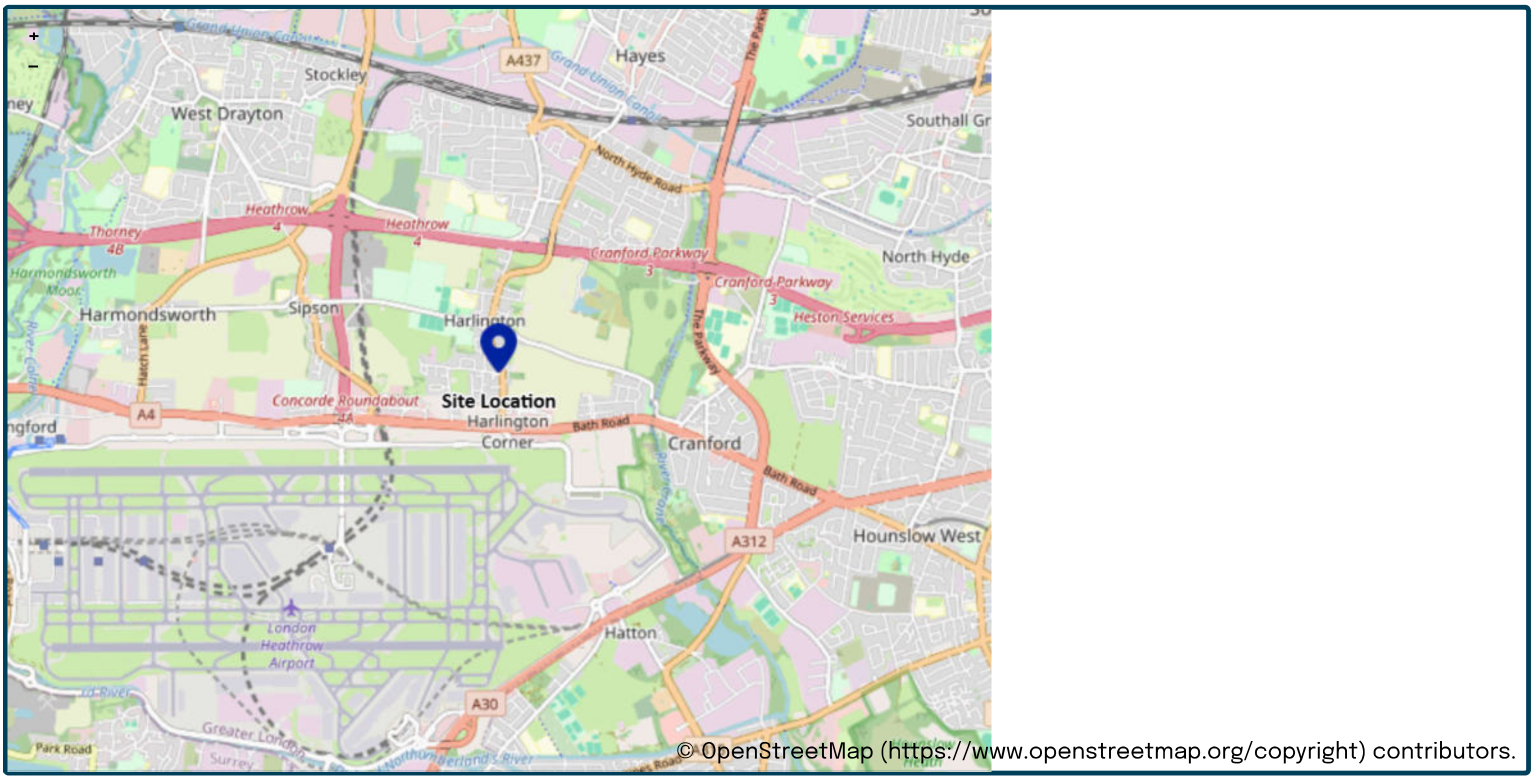
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). 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	30/09/2025
Calculated by	Nikita Vasilev
Reference	11726
Model version	2.1.2

Location

Site name	The Dower House
Site location	UB3 5LF



Site easting (British National Grid)	508796
Site northing (British National Grid)	177178

Site details

Total site area (ha)	0.59 ha

Greenfield runoff

Method

Method	FEH statistical

FEH statistical

	My value		Map value
SAAR (mm)	611 mm		611
BFIHOST	0.43		
QMed-QBar conversion	1.136		1.136
QMed (l/s)	1.43 l/s		
QBar (FEH statistical) (l/s)	1.63 l/s		

Growth curve factors

	My value		Map value
Hydrological region	6		6
1 year growth factor	0.85		
2 year growth factor	0.88		
10 year growth factor	1.62		
30 year growth factor	2.3		
100 year growth factor	3.19		
200 year growth factor	3.74		

Results

Method	FEH statistical
Flow rate 1 year (l/s)	1.4 l/s
Flow rate 2 year (l/s)	1.4 l/s
Flow rate 10 years (l/s)	2.6 l/s
Flow rate 30 years (l/s)	3.7 l/s
Flow rate 100 years (l/s)	5.2 l/s
Flow rate 200 years (l/s)	6.1 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

Surface water storage volume design tool

www.uksuds.com | Surface water storage volume design tool (https://www.uksuds.com/)

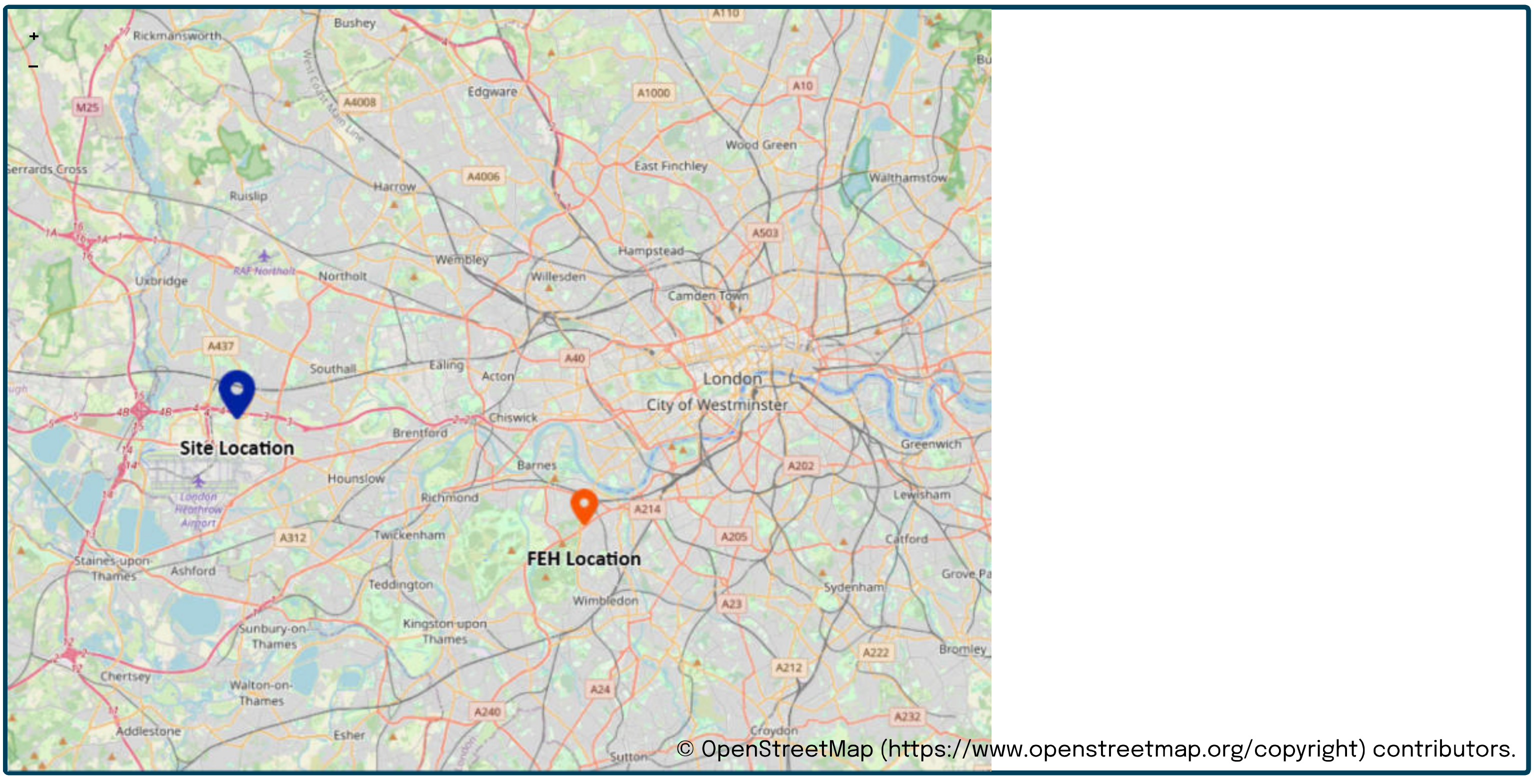
This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). 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	30/09/2025
Calculated by	Nikita Vasilev
Reference	11726
Model version	2.1.2

Location

Site name	The Dower House
Site location	UB3 5LF



Site easting (British National Grid)	508796
Site northing (British National Grid)	177178

Site areas

Total site area (ha)	0.5944	ha

Roof area

Total roof area (ha)	0.0180	ha
Contributing roof area (ha)	0.0180	ha
Non-contributing roof area (ha)	0	ha

Paved area

Total paved area (ha)	0.0310	ha
Contributing paved area (ha)	0.0310	ha
Non-contributing paved area (ha)	0	ha

Grass / vegetated area

Total grass / vegetated area (ha)	0.5454	ha
Contributing grass / vegetated area (ha)	0	ha
Non-contributing grass / vegetated area (ha)	0.5454	ha

Total area

Total contributing area (ha)	0.049	ha

Contributing areas with urban creep allowance

Urban creep allowance factor	+5%	
Contributing roof area (adjusted for urban creep) (ha)	0.018	ha
Contributing paved area (adjusted for urban creep) (ha)	0.031	ha
Contributing grass / vegetated area (adjusted for urban creep) (ha)	0	ha

Storage design parameters

Storage base shape	Rectangular / square	
Storage base length to width ratio	3:1	
Storage design depth (m)	1	m
Storage side slope (1 in x)	1 in 3	
Storage voids ratio (%)	100% (all voids)	
Storage volume design return period (years)	1:100 years	

Discharge flow rate from the site

Method

Type of site	Previously developed
Specify the method	FEH statistical + relaxation

FEH statistical

	My value	Map/default value
SAAR (mm)	611 mm	611
BFIHOST	0.43	
QMed (l/s)	1.44 l/s	
QMed-QBar conversion	1.136	1.136
Total area for greenfield runoff calculation (ha)	0.5944 ha	0.5944
QBar (l/s)	1.64 l/s	
Hydrological region	6	6
Return period (years)	Qbar (1:2.3 years)	
Growth curve factor	1	
Flow rate (FEH statistical) (l/s)	1.64 l/s	
Relaxation factor	1x	

Final discharge rate

Runoff calculation method	FEH statistical + relaxation
Design flow rate (l/s)	1.64 l/s

Blockage risk

Specify the method	Orifice diameter
Minimum orifice diameter to prevent blockage (mm)	1500 mm

	My value	Calculated value
Design orifice diameter (mm)	150 mm	1500
Flow rate of orifice (l/s)	45.25 l/s	

Rainfall and runoff

Rainfall input type	FEH22 CSV file FEH_Point_Rainfall_FEH22_1 year return period.csv
Distance from FEH location to site (km)	15.8 km
Climate change allowance factor	120%
Specify the runoff method from grass / vegetated areas	Fixed percentage - based on rainfall event depth and SPR

	My value	Map value
How should SPR be derived?	WRAP soil type	

WRAP soil type | 2 | 2

SPR | 0.3

Model results

- **Maximum discharge flow rate:** 36.8 (l/s)
- **Outflow orifice diameter:** 150 (mm)
- **Storage base length:** 0.0 (m)
- **Storage base width:** 0.0 (m)
- **Storage base area:** 0.0 (m^2)
- **Storage total volume:** 1.7 (m^3)
- **Storage total water volume:** 1.7 (m^3)
- **Storage 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)
- The storm duration requiring the most storage may not have been run. Check whether any other storm durations may result in greater required storage.

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	NaN	10.6	0.00	0.0	0.0
2	NaN	16.3	0.00	0.0	0.0
10	NaN	31.1	0.00	0.0	0.0
30	15	34.1	0.36	0.6	0.6
100	15	36.8	0.52	1.7	1.7
200	15	38.3	0.60	2.6	2.6

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.

Surface water storage volume design tool

www.uksuds.com | Surface water storage volume design tool (https://www.uksuds.com/)

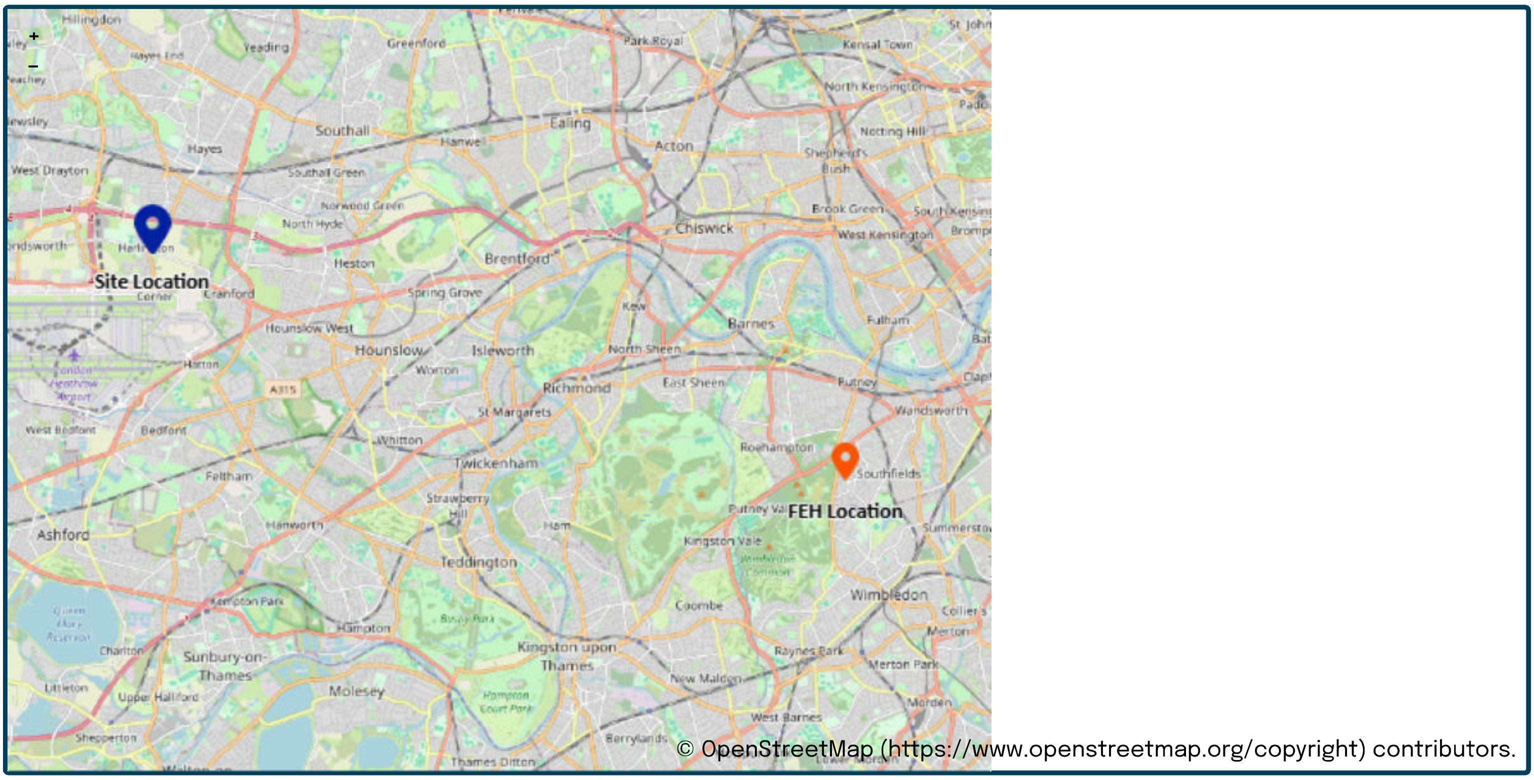
This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). 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	30/09/2025
Calculated by	Nikita Vasilev
Reference	11726
Model version	2.1.2

Location

Site name	The Dower House
Site location	UB3 5LF



Site easting (British National Grid)	508796
Site northing (British National Grid)	177178

Site areas

Total site area (ha)	0.59 ha

Roof area

Total roof area (ha)	0.1371 ha
Contributing roof area (ha)	0.1371 ha
Non-contributing roof area (ha)	0 ha

Paved area

Total paved area (ha)	0.0863 ha
Contributing paved area (ha)	0.0863 ha
Non-contributing paved area (ha)	0 ha

Grass / vegetated area

Total grass / vegetated area (ha)	0.2597 ha
Contributing grass / vegetated area (ha)	0 ha
Non-contributing grass / vegetated area (ha)	0.2597 ha

Total area

Total contributing area (ha)	0.2234 ha

Contributing areas with urban creep allowance

Urban creep allowance factor	+5%
Contributing roof area (adjusted for urban creep) (ha)	0.1371 ha
Contributing paved area (adjusted for urban creep) (ha)	0.0863 ha
Contributing grass / vegetated area (adjusted for urban creep) (ha)	0 ha

Storage design parameters

Storage base shape	Rectangular / square
Storage base length to width ratio	3:1
Storage design depth (m)	1 m
Storage side slope (1 in x)	1 in 3
Storage voids ratio (%)	100% (all voids)
Storage volume design return period (years)	1:100 years

Discharge flow rate from the site

Method

Type of site	Previously developed
Specify the method	IH124 + relaxation

IH124

	My value		Map/default value
SAAR (mm)	611	mm	611
How should SPR be derived?	WRAP soil type		
WRAP soil type	2		2
SPR	0.3		
Total area for greenfield runoff calculation (ha)	0.4831	ha	0.4831
QBar (l/s)	0.75	l/s	
Hydrological region	6		6
Return period (years)	Qbar (1:2.3 years)		
Growth curve factor	1		
Flow rate (IH124) (l/s)	0.75	l/s	
Relaxation factor	1x		

Final discharge rate

Runoff calculation method	IH124 + relaxation	
Design flow rate (l/s)	0.75	l/s

Blockage risk

Specify the method	Flow rate
Minimum discharge flow rate to prevent blockage	2l/s

	My value		Calculated value
Design orifice diameter (mm)	31	mm	31
Flow rate of orifice (l/s)	1.99	l/s	

Rainfall and runoff

Rainfall input type	FEH22 CSV file	
	FEH_Point_Rainfall_FEH22_1 year return period.csv	
Distance from FEH location to site (km)	15.8	km
Climate change allowance factor	140%	
Specify the runoff method from grass / vegetated areas	Fixed percentage - based on rainfall event depth and SPR	

	My value	Map value
How should SPR be derived?	WRAP soil type	

WRAP soil type	2	2
SPR	0.3	

Model results

- **Maximum discharge flow rate:** 2.0 (l/s)
- **Outflow orifice diameter:** 31 (mm)
- **Storage base length:** 19 (m)
- **Storage base width:** 6.3 (m)
- **Storage base area:** 120 (m^2)
- **Storage total volume:** 207 (m^3)
- **Storage total water volume:** 207 (m^3)
- **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	540	1.2	0.37	56	56
2	540	1.4	0.47	75	75
10	540	1.6	0.68	121	121
30	540	1.8	0.82	155	155
100	540	2.0	1.00	207	207
200	720	2.1	1.15	256	256

Please note runoff estimation and storage volume estimation are subject to uncertainty. Storage volume results are therefore reported to the nearest 1 m^3 value, unless storage volumes are less than 10 m^3, in which case, storage volumes are provided to 1 decimal place.

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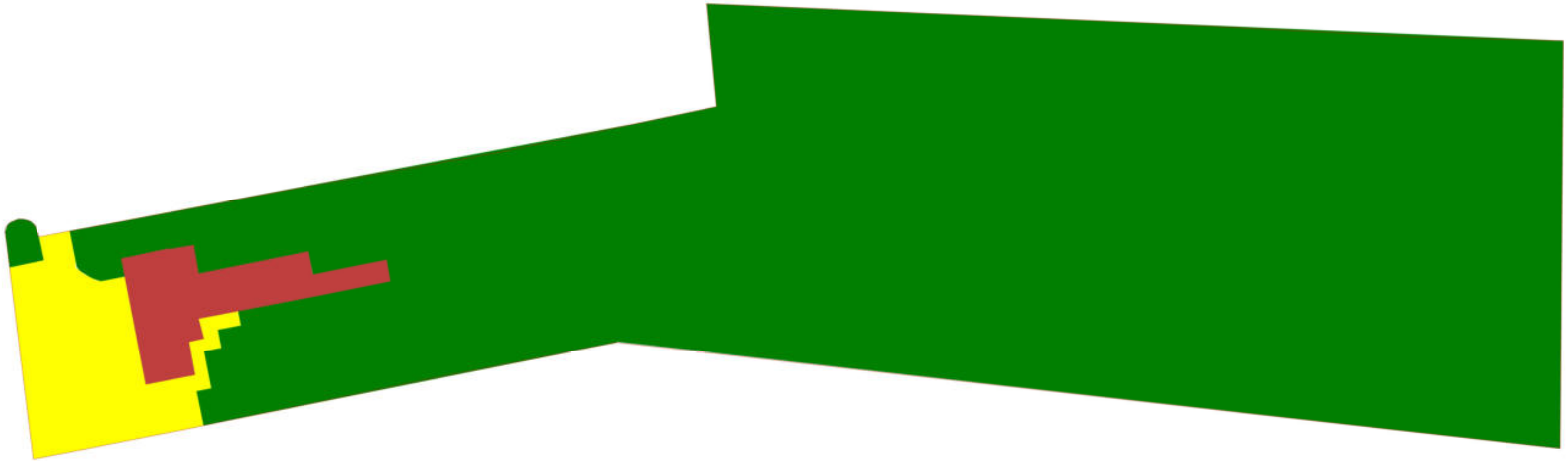
Appendix G: Preliminary SuDS Layout



Legend

Site boundary

Buildings (impermeable) - c. 180m2 total

Hardstanding (impermeable) - c. 310m2 total

Landscape (permeable) - c. 5,454m2 total

Notes

This drawing shows measured areas of the existing site, as shown in the topographical plan. This drawing should be read in conjunction with the Eight Versa SuDS Strategy report.

Where areas are not shown on the topographical plan, aerial imagery has been used to estimate the areas relevant to this plan. This drawing is not to scale.

Project name

The Dower House

Drawing name

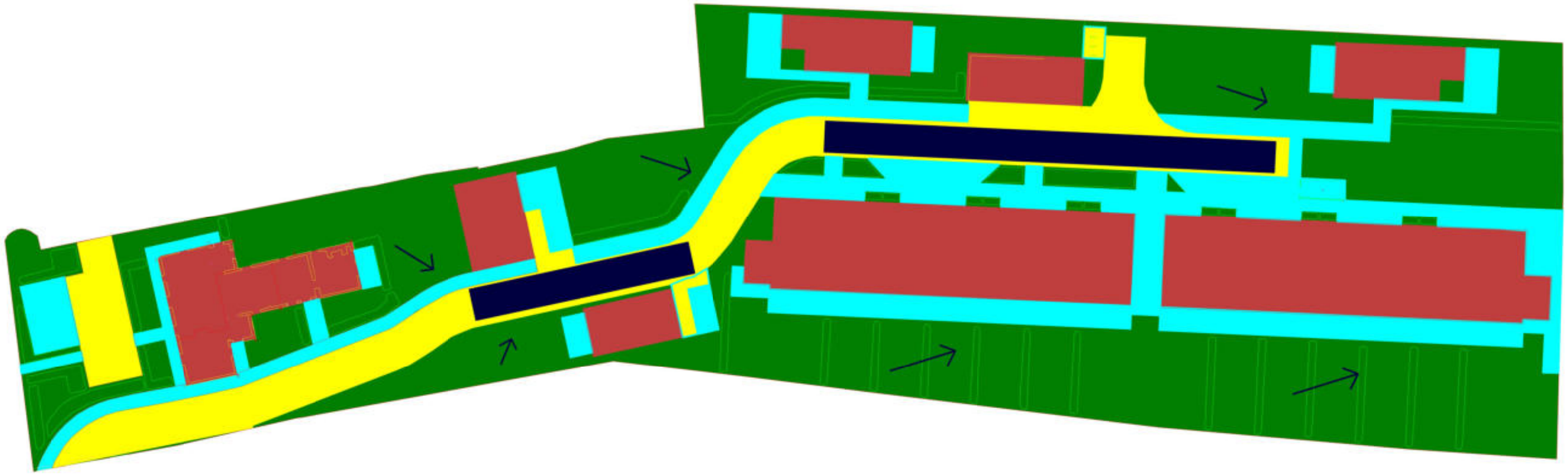
Existing - Areas

Date

07/10/2025

Drawing number

11726_A_01



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Legend

Site boundary

Buildings (impermeable) - c. 1,371m2 total

Hardstanding (permeable) - c. 1,113m2 total

Landscape (permeable) - c. 2,597m2 total

Hardstanding (impermeable) - c. 863m2 total

Exceedance and overland flow routes

Notes

This drawing shows measured areas of the proposed development site, as shown in architect drawings. This drawing should be read in conjunction with the Eight Versa SuDS Strategy report.

The areas on the site are subject to change during the detailed design stages and should be reviewed by the design team.This drawing is not to scale.

Project name

The Dower House

Drawing name

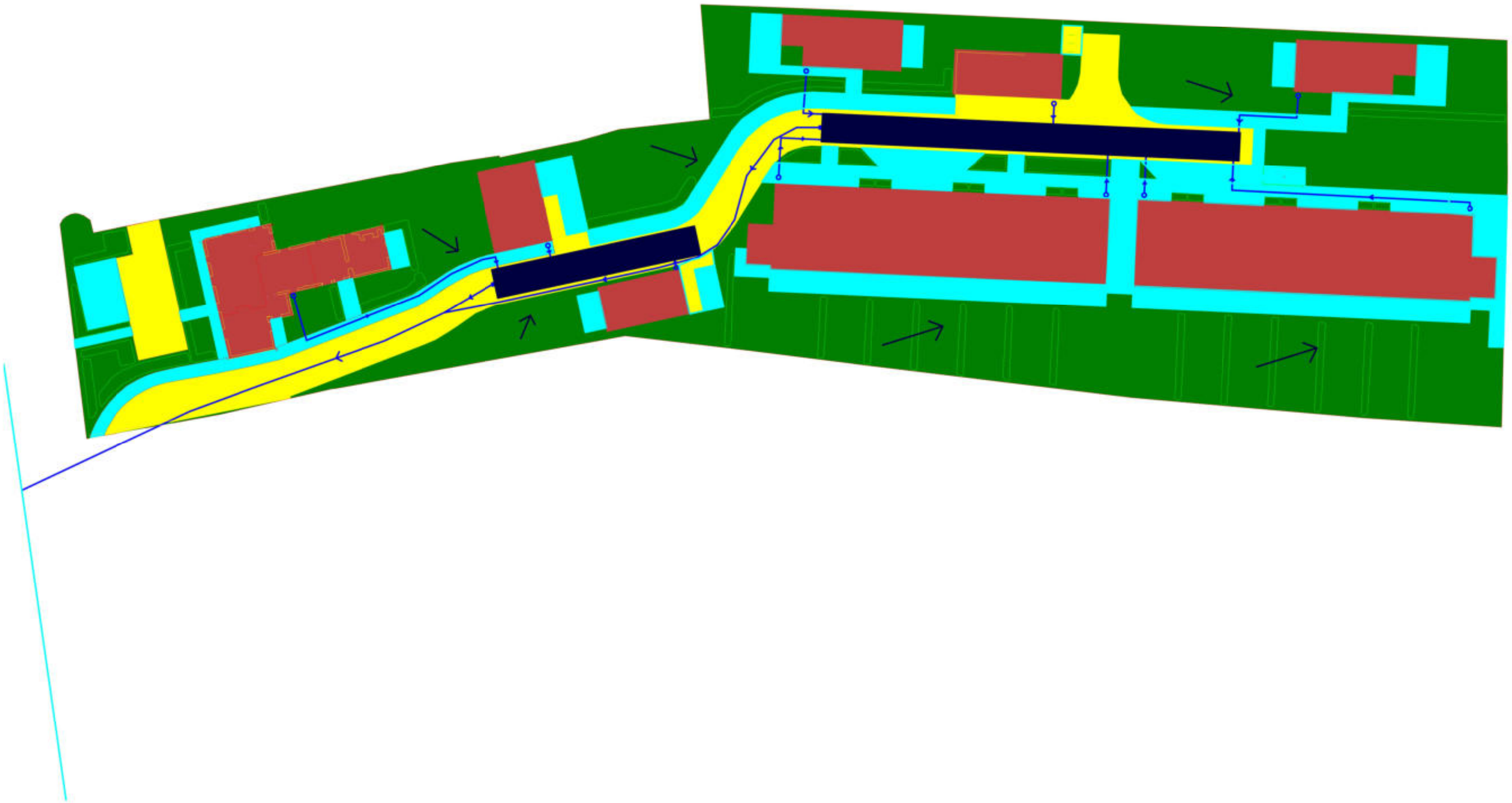
Proposed - Areas

Date

07/10/2025

Drawing number

11726_A_02



Legend

- Site boundary
- Approximate location of existing surface water sewer
- Sub-surface geocellular attenuation storage
- Proposed notional pumped flow control device
- Proposed notional surface water drainage network
- Proposed notional drainage junctions, inspection chambers, manholes
- Exceedance and overland flow routes

Notes

This drawing shows potential locations of sustainable drainage systems (SuDS) components and a preliminary notional surface water drainage network layout. This drawing should be read in conjunction with the Eight Versa SuDS Strategy report.

The locations and arrangements of SuDS components in this drawing are indicative and should be subject to a detailed review of feasibility by a structural or drainage engineer during the detailed design stages. This drawing is not to scale.

Project name

The Dower House

Drawing name

Proposed - Preliminary SuDS Layout

Date

07/10/2025

Drawing number

11726_A_03

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Appendix H: Management Plan

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Management Plan

Outline SuDS Management Plan

To ensure that SuDS features and components work effectively, it is essential that they are adequately maintained and working to their expected capacity. A detailed site-specific SuDS management plan will be produced for the development, including responsibilities and a programme of maintenance works and inspections. An outline management plan for the proposed SuDS components is provided below. A template SuDS inspection and maintenance checklist form, which may be used to record the site inspections and management and maintenance actions undertaken, is provided in Appendix H to this report.

Management and maintenance of all surface water drainage and SuDS components within the curtilages of the properties will be the responsibility of the respective property owners, for the lifetime of the development. All surface water drainage and SuDS components outside of the property curtilages, but within the curtilages of the overall development site, will be the shared responsibility of the respective property owners and will be managed and maintained via a management agreement or similar contractual arrangement, for the lifetime of the development.

To ensure that the maintenance requirements and responsibilities for the proposed SuDS components are met, information will be made available to the first owners of each property in a clear and concise format to clarify their requirements. The developer shall be responsible for providing a framework management agreement for SuDS outside of the property curtilages, for the future property owners.

Management and maintenance requirements should be determined in accordance with all best-practice guidance and the SuDS Manual (Chapter 32: Operation and Maintenance), including:

a) Regular maintenance activities.
b) Occasional maintenance activities.
c) Remedial maintenance requirements.
d) Ongoing monitoring requirements.

All management, monitoring and maintenance activities should follow guidance from the SuDS system manufacturer, where applicable.

Drains, Manholes and Pipes

All drains, manholes and pipes should be constructed, operated and maintained in accordance with Building Regulations Part H, Sewers for Adoption 7th Edition and BS EN 752:2017 'Drain and sewer systems outside buildings'.

Pumping System and Rising Mains

The surface water pumping station system be constructed, operated and maintained in accordance with Building Regulations Part H, Sewers for Adoption 7th Edition and BS EN 16932-1:2018 'Drain and sewer systems outside buildings – Pumping systems'.

Flow Control Devices

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspection of the device and filter for debris and sediment build-up.	Annually (and following poor performance).
	Cleaning of device inlet/outlet, chamber and sump.	Annually (and following poor performance).
Occasional maintenance	Cleaning and/or replacement of any filters.	Three monthly (or as required).
Remedial actions	Repair of flow control device.	As required.
Monitoring	Visual inspection within chamber to ensure that the device is in good condition and operating as designed.	Annually.
	Survey from inside of chamber for sediment build-up and remove if necessary.	Every 5 years, or as required.

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Pervious Paving

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 of clogging or manufacturer's recommendations).
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.	As required – once per year on less frequently used pavements.
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm 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.	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, 48 hours after large storms in first six months.
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually.
	Regular inspection for surface ponding and pollution.	As required.
	Monitor inspection chambers.	Annually.

Attenuation Storage

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually.
	Remove debris from the catchment surface (where it may cause risks to performance).	Monthly.
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually.
	Remove sediment from pre-treatment structures and/ or internal forebays.	Annually, or as required.
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents.	As required.
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually.
	Survey inside of tank for sediment build-up and remove if necessary.	Every 5 years, or as required.

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Appendix I: SUDS Proforma

GREATERLONDONAUTHORITY

1. Project & Site Details

Project / Site Name (including sub-catchment / stage / phase where appropriate)	The Dower House
Address & post code	The Dower House, 393 High Street, Harlington, UB3 5LF
OS Grid ref. (Easting, Northing)	E 508909
	N 177333
LPA reference (if applicable)	
Brief description of proposed work	The proposal consists of the clearance of vegetation within the central parts of the assessment site, the renovation of Dower House and construction of up to 5 No. 3 bed dwellings and 12 No. 2 bed dwellings with associated access road, refuse area, parking and communal woodland area (in
Total site Area	5900 m^2
Total existing impervious area	490 m^2
Total proposed impervious area	2230 m^2
Is the site in a surface water flood risk catchment (ref. local Surface Water Management Plan)?	no
Existing drainage connection type and location	assumed surface water sewer to the west of the site
Designer Name	Nikita Vasilev
Designer Position	Senior Environmental Engineer
Designer Company	Eight Versa

2. Proposed Discharge Arrangements

2a. Infiltration Feasibility

Superficial geology classification	Langley Silt Member - Clay and silt.
Bedrock geology classification	– London clay formation (clay, silt and sand
Site infiltration rate	- m/s
Depth to groundwater level	- m below ground level
Is infiltration feasible?	Yes

2b. Drainage Hierarchy

	Feasible (Y/N)	*Proposed (Y/N)*
1 store rainwater for later use	N	N
2 use infiltration techniques, such as porous surfaces in non-clay areas	Y	Y
3 attenuate rainwater in ponds or open water features for gradual release	N	N
4 attenuate rainwater by storing in tanks or sealed water features for gradual release	Y	Y
5 discharge rainwater direct to a watercourse	N	N
6 discharge rainwater to a surface water sewer/drain	Y	Y
7 discharge rainwater to the combined sewer.	N	N

2c. Proposed Discharge Details

Proposed discharge location	To the west of the site
Has the owner/regulator of the discharge location been consulted?	No

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3. Drainage Strategy

3a. Discharge Rates & Required Storage				
	Greenfield (GF) runoff rate (l/s)	*Existing discharge rate (l/s)*	*Required storage for GF rate (m³)*	*Proposed discharge rate (l/s)*
Qbar	0.75			
1 in 1	1.4	10.6		1
1 in 30	3.7	34.1		1.6
1 in 100	5.2	36.8		1.8
1 in 100 + CC			207	2
Climate change allowance used		40%		
3b. Principal Method of Flow Control		Orifice		

3c. Proposed SuDS Measures	*Catchment area (m²)*	*Plan area (m²)*	*Storage vol. (m³)*
Rainwater harvesting	0		0
Infiltration systems	0		0
Green roofs	0	0	0
Blue roofs	0	0	0
Filter strips	0	0	0
Filter drains	0	0	0
Bioretention / tree pits	0	0	0
Pervious pavements	1113	0	70
Swales	0	0	0
Basins/ponds	0	0	0
Attenuation tanks	0		137
Total	1113	0	207

4. Supporting Information

4a. Discharge & Drainage Strategy	*Page/section of drainage report*
Infiltration feasibility (2a) – geotechnical factual and interpretive reports, including infiltration results	p28
Drainage hierarchy (2b)	p26
Proposed discharge details (2c) – utility plans, correspondence / approval from owner/regulator of discharge location	app G
Discharge rates & storage (3a) – detailed hydrologic and hydraulic calculations	p28
Proposed SuDS measures & specifications (3b)	p29

4b. Other Supporting Details	*Page/section of drainage report*
Detailed Development Layout	app C
Detailed drainage design drawings, including exceedance flow routes	app G
Detailed landscaping plans	app C
Maintenance strategy	p30
Demonstration of how the proposed SuDS measures improve:	
a) water quality of the runoff?	p27
b) biodiversity?	p27
c) amenity?	p27