FRA-Drainage Strategy & Pro-Forma
Sproughton

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Executive summary

Overview

Eight Versa has been appointed to carry out a Flood Risk Assessment , sustainable drainage systems (SuDS) strategy and Council's Drainage Pro-Forma for the proposed development at Sproughton, Courtenay Avenue, London, N6 4LR in the London Borough of Haringey. The total site area is approximately 4,800m^2 or 0.48ha. The site is currently occupied by a 2.5 storey detached dwelling. The proposal comprises demolition of the existing building and construction of three storey dwelling with associated parking and landscaping.

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 50m^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 971m^2, with attenuation storage of 61.2 m^3 in the sub-base.
- Intensive green roof with an area of approximately 160m^2.
- A bioretention system with an area of 20.0m^2, with attenuation storage of 3.6 m^3 in the sub-base
- Vegetated garden of about 0.213ha.
- Flow control device to limit rate of discharge from site.

Surface water on site is to discharge by infiltration, into the pond and through permeable pavements with overflow directed to grey water filtration system for household use and excess to the open water feature to the north east of the site. The existing site is assumed to discharge into the open water source north east to the site as well. The infiltration rate of the soil is to be confirmed via on site testing However, a default value has been used for the design at planning stage in accordance with the SuDS Manual.

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 , sustainable drainage systems (SuDS) strategy and Council's Drainage Pro-Forma for the proposed development at Sproughton, London, N6 4LR, in the London Borough of Haringey. 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 Sproughton is located in the London Borough of Haringey (N6 4LR). The total site area is approximately 4,800m^2 or 0.48ha. It is currently occupied by a 2.5 storey detached dwelling.

The proposal comprises demolition of the existing buildings and construction of a three storey dwelling.

Planning Context

National Planning Policy Framework (Ministry of Housing, Communities & Local Government, 2021)

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).

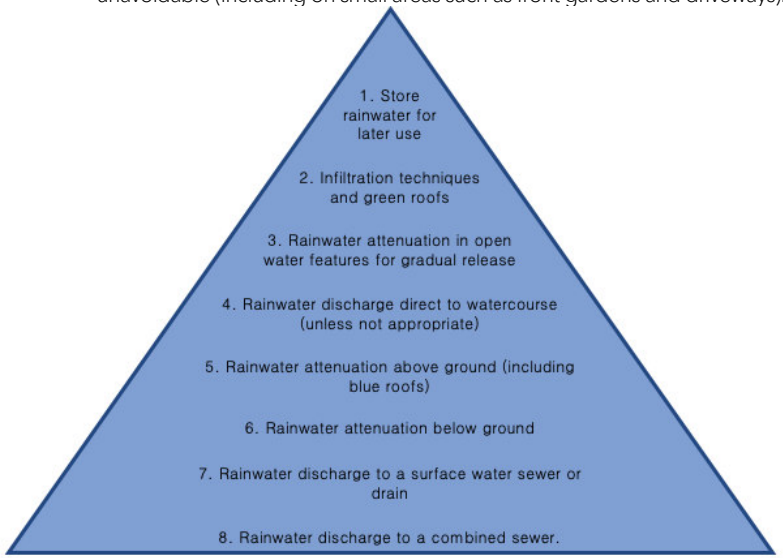

Figure 1: Sustainable drainage hierarchy.

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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.

Site Allocations DPD (London Borough of Haringey, 2017)
The Strategic Policies DPD (2013), as amended, sets out the long term vision of how Haringey, and the places within it, should develop by 2026 and sets out the Council's spatial strategy for achieving that vision. In particular, it identifies the broad locations for delivering housing and other strategic development needs such as employment, retail, infrastructure and other uses (see Table 3.1 and Appendix 2 and 4 of the Strategic Policies DPD). The Site Allocations development plan document (DPD) gives effect to the spatial strategy by allocating sufficient sites to accommodate the development needs of those parts of the borough outside the growth area of Tottenham, which is covered by the Tottenham Area Action Plan (AAP).

Haringey's Local Plan Strategic Policies 2013-2026 (London Borough of Haringey, 2017)
The Local Plan outlines how the Council will address local and strategic development needs including housing, employment, leisure, and retail provision. It goes beyond traditional land use planning and considers other plans and strategies that influence the use of land and the way that places around us look and work. The Local Plan covers the physical aspects of location and land use but also addresses other factors that make places attractive, sustainable and successful, such as social and economic matters. Preparation of these policies has been subject to a sustainability appraisal. This promotes sustainable strategies and policies through an assessment of their social, environmental and economic impacts.

Policy SP5 – Water Management and Flooding
The Council will require all development in Haringey to be water efficient during construction and operation and to reduce all forms of flood risk. All development shall:

- Improve the water environment, water quality and drainage systems.
- Minimise water use and illustrate how development would contribute to general and flash flooding.
- Take account of flood risk vulnerability classification as set out in paragraph 100 of the NPPF and will apply the NPPF Sequential Test and Exception Test.
- Implement measures to prevent (or mitigate as last resort) local surface water and downstream flooding.
- Implement Sustainable Drainage Systems from strategic to individual site level to improve water attenuation, quality and amenity.

Sustainable Design and Construction Supplementary Planning Document (London Borough of Haringey, 2013)
The Guidance will seek to contribute to achieving the vision in Haringey's Sustainable Community Strategy. The SPD will also play a key role in the implementation of the Council's Greenest Borough Strategy (2008-2018) and its priorities:

- Improving the urban environment.
- Protecting the natural environment.
- Managing environmental resources efficiently.
- Leading by example.
- Ensuring sustainable design and construction.
- Promoting sustainable travel.
- Raising awareness and involvement.

No flooding of property or off-site flows should occur as a result of a one in 100 year storm event (including an appropriate allowance for climate change). In principle, a well designed surface water drainage system should ensure that there is little or no residual risk of property flooding occurring during events well in excess of the return-period for which the sewer system itself is designed.

The design of drainage needs to be able to cope with the heaviest of storms expected over the buildings lifetime. Drainage techniques relying on water soaking into the soil underneath a site (known as infiltration systems) will NOT be effective in parts of the borough with clay soils as they become waterlogged easily. The use of soakaways or other infiltration methods on contaminated land carries groundwater pollution risks and may not work in areas with a high water table.

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Site Overview

Site Location

The development site at Sproughton is located in London in the London Borough of Haringey. The OS grid reference for the site is X (Eastings) 527003, Y (Northings) 188043and the postcode is N6 4LR. The site is currently occupied by a 2.5 storey detached dwelling and associated landscaping and parking areas (Appendix A). The proposal comprises demolition of the existing building and construction of a three storey dwelling with associated parking and landscaping. (Figure 2).

The total site area is approximately 4,800 m^2 or 0.48ha. The existing site may not be positively drained as there are no dedicated SuDS.

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

- Superficial geology – None recorded.
- Bedrock geology – London clay formation (clay, silt and sand).

Figure 2: Aerial map showing the location of the development site (Google Maps).

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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 topographical map in Figure 3 confirms that the site is sloping in the north-east direction. The difference between the ground level at the south west boundary (92.50mAOD) and the north east boundary (88.86mAOD) of the site is 3.19m.

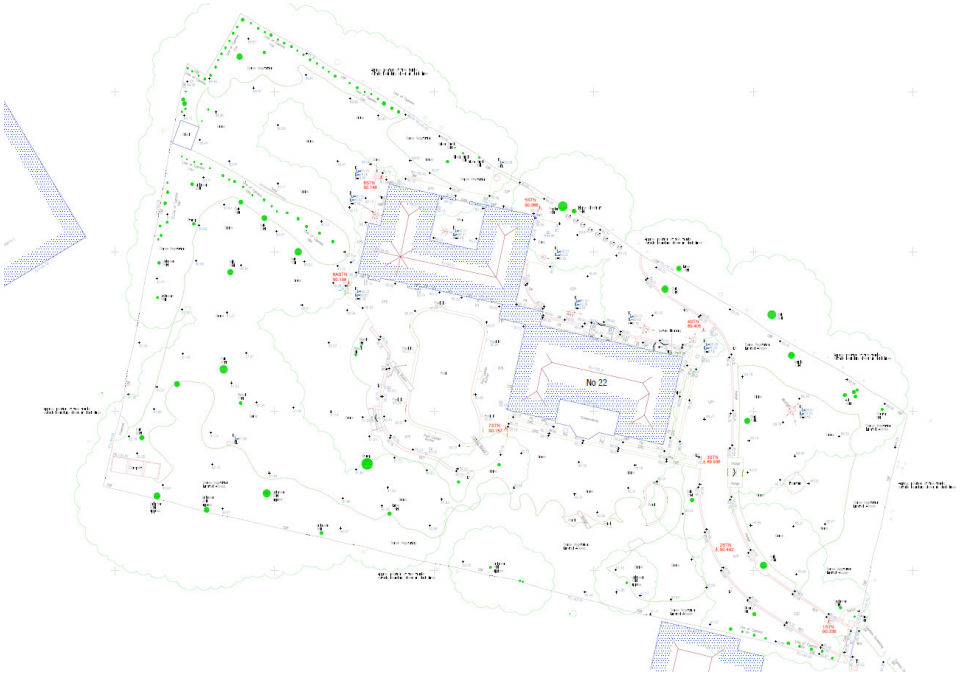

Figure 3: Topographical map of the site (Appendix B).

Development Proposals

The proposal comprises demolition of the existing buildings and construction of a three storey dwelling with associated parking and landscaping. Figure 4, Figure 5 and Figure 6 illustrate the proposed site plan, the proposed elevation and the proposed section, respectively. Additional drawings are found in Appendix C.

Figure 4: Proposed site landscape plan.

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Figure 5: Proposed front elevation of the development.

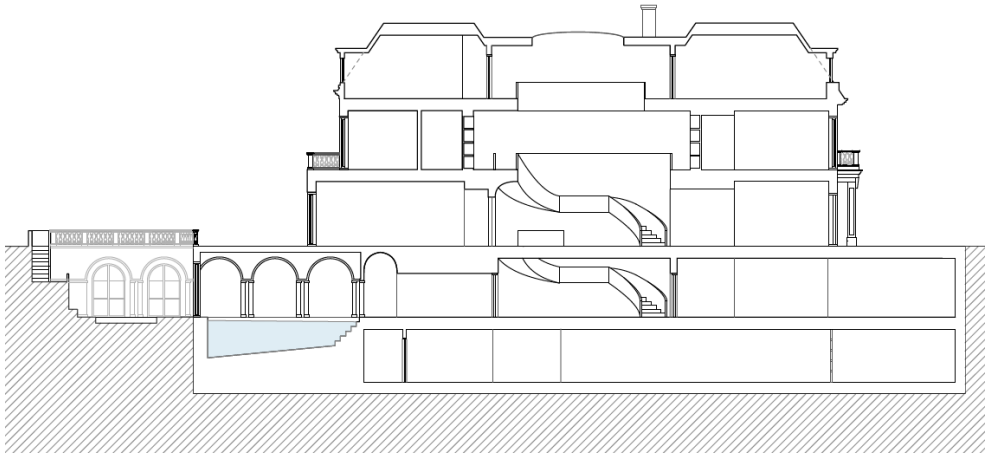

Figure 6: Proposed section of the development.

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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 7). 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.

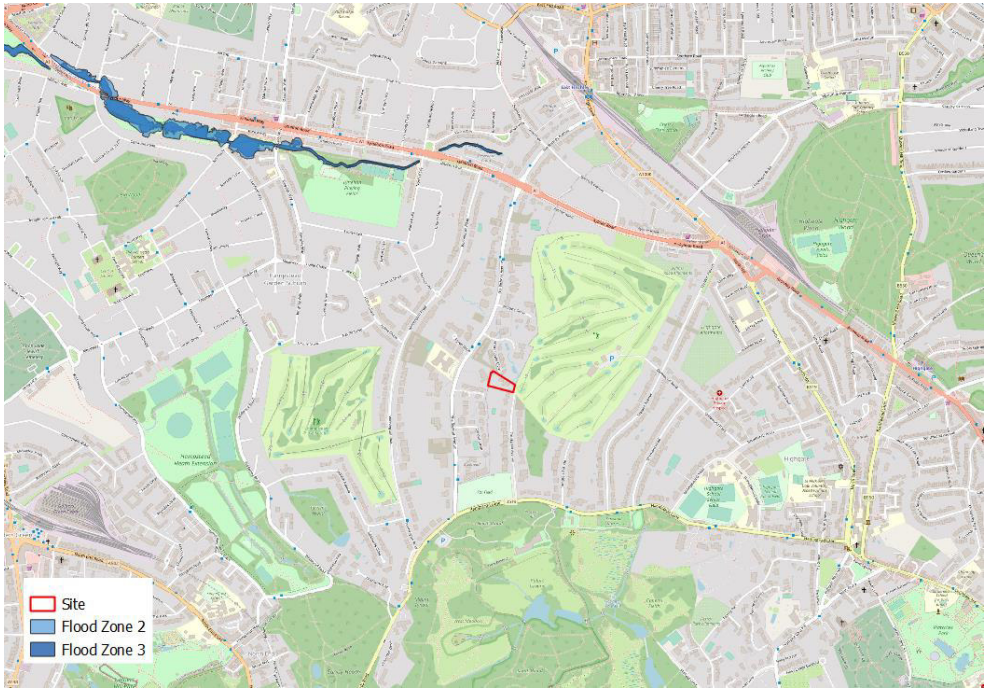

Figure 7: Environment Agency Flood Map (Environmental Agency).

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 8). Therefore, the SuDS design is unlikely to be affected.

Figure 8: EA's map illustrating risk of flooding from rivers and the sea (Environmental Agency).

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Surface Water (Pluvial)

In accordance with the EA's Risk of Flooding from Surface Water map, the development site is considered to be at low to medium risk of surface water flooding. Figure 9 illustrates the extent 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.

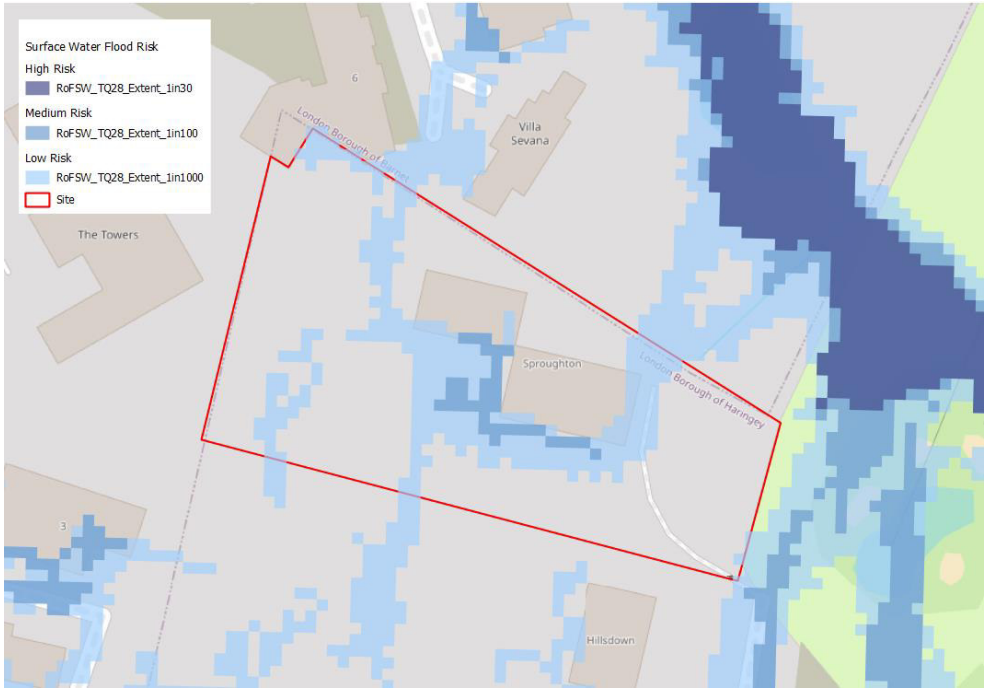

Figure 9: EA's map illustrating risk of flooding from surface water.

Groundwater

It was concluded in the North London SFRA that Haringey was at risk from fluvial, sewer and pluvial flooding but not groundwater or tidal flooding.

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) – low to medium risk.
- Groundwater – very 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 10). 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.

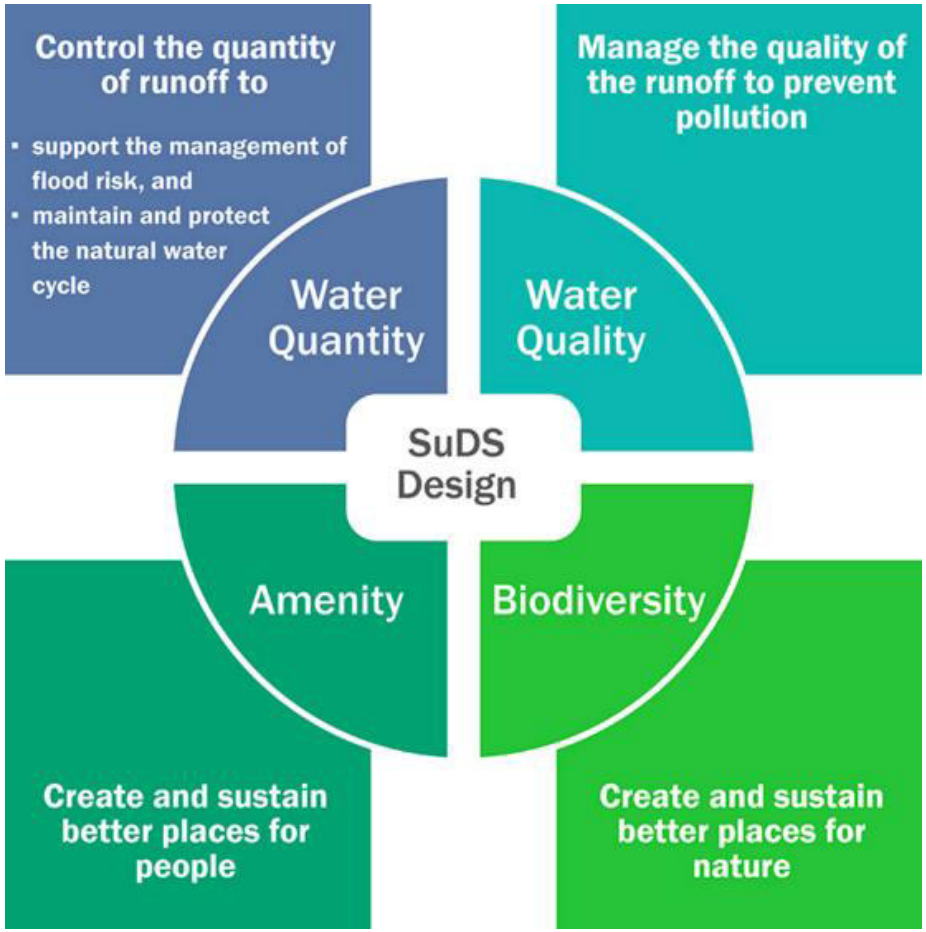

Figure 10: Multi-beneficial SuDS design principals (The SuDS Manual).

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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 11). 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.

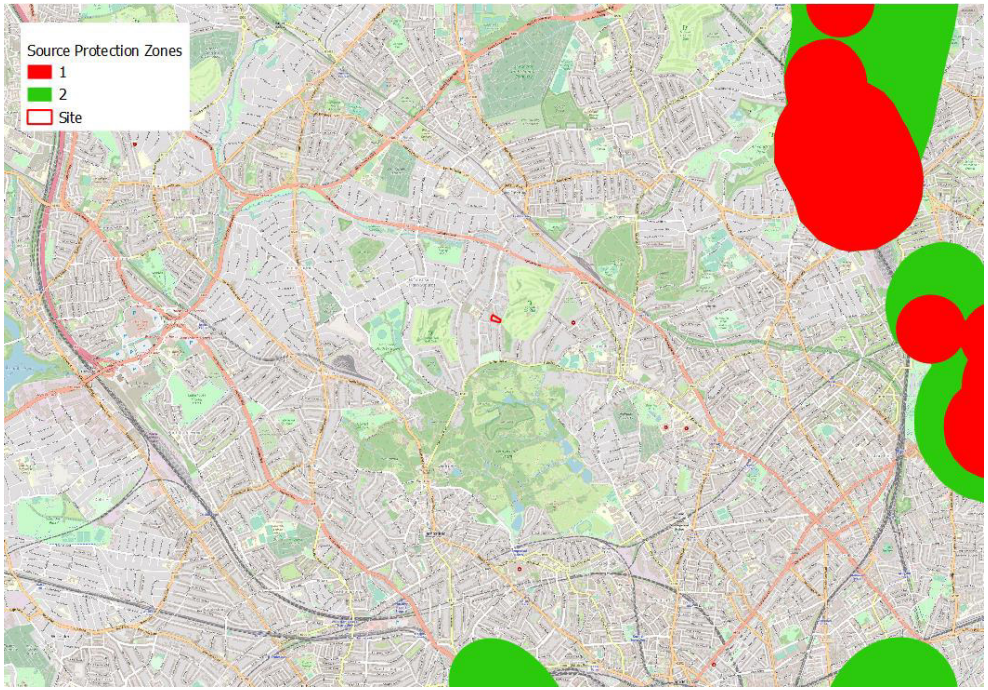

Figure 11: EA's Source Protection Zones map.

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Surface Water Features

The map in Figure 4 shows that there is a proposed pond on site. Moreover, there is an open source at the north east of the site with existing discharge from the site. Therefore, discharge to surface water is likely to be appropriate with the new proposed development in place as well.

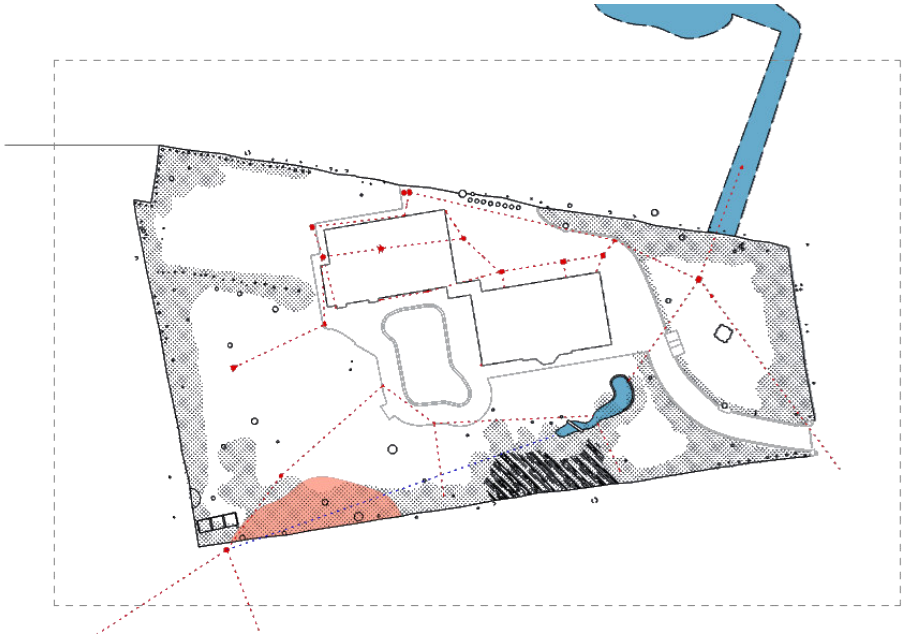

Figure 12: Existing drainage plan of the site.

Sewer Features

Existing drainage was provided and there is a public surface water sewer, located adjacent to the south west of the site, therefore discharge to sewer is likely to be appropriate (Figure 12) in the proposed case as well.

Further analysis of the connections and condition of the public surface water drainage system should be undertaken by carrying out a CCTV survey or by contacting the drainage provider or the Local Council to confirm the presence, location and condition of the sewer. Consultation with the drainage provider would also be required to determine that sufficient capacity is available to accept the proposed discharge, and to gain permission to connect if required.

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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	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓

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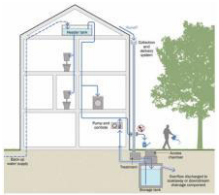
Rainwater Harvesting System

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:

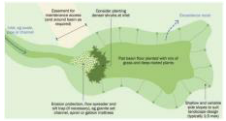
- Soakaway – sub-surface storage structure (typically rubble-filled voids beneath lawns) that stores runoff from a single house or development and allows for efficient infiltration into adjacent soil.
- infiltration trench – trench filled with permeable granular material, designed to promote infiltration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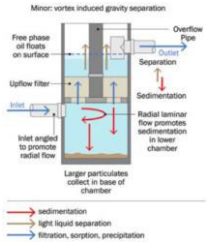
Proprietary Treatment System

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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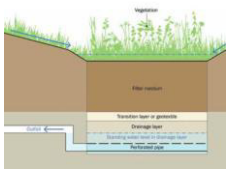
Bioretention System

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	Yes	Sufficient space for the demand.
Green roof	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓	17 out of 25	Yes	Suitable space available.
Infiltration system	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓	13 out of 25	Yes	Suitable space available.
Infiltration basin	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓	17 out of 25	No	Priority given to infiltration systems, bioretention systems and a pond.
Proprietary treatment system	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓	13 out of 25	No	Low pollution hazard.
Filter strip	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓	12 out of 25	No	Priority given to infiltration systems, bioretention systems and a pond.
Filter drain	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓	12 out of 25	No	Priority given to infiltration systems, bioretention systems and a pond.
Swale	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓	17 out of 25	No	Priority given to infiltration systems, bioretention systems and a pond.

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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	Yes	Sufficient 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	Priority given to infiltration systems, bioretention systems and a pond.
Pond/wetland	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	✓✓✓✓✓	15 out of 25	Yes	Suitable 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 13), a number of SuDS components have been recommended to be integrated in the site-wide SuDS design:

1. Store rainwater for later use –Proposed: rainwater harvesting systems for the development is proposed. Rainwater will be collected and used for watering gardens, with overflow directed to grey water filtration system for household use.
2. Infiltration techniques and green roofs – Proposed: Bioretention systems and green roof are proposed.
3. Rainwater attenuation in open water features for gradual release –Proposed: there is suitable space on the site for the implementation of a retention pond.
4. Discharge rainwater direct to a watercourse –Proposed: there is a water feature to the north east of the site available for discharge.
5. Rainwater attenuation above ground (including blue roofs) – Not proposed: Available roof space is allocated to green roofs.
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 –Not proposed: discharge to surface water sewer is not proposed.
8. Rainwater discharge to the combined sewer – Not proposed: discharge to the combined sewer is not proposed.

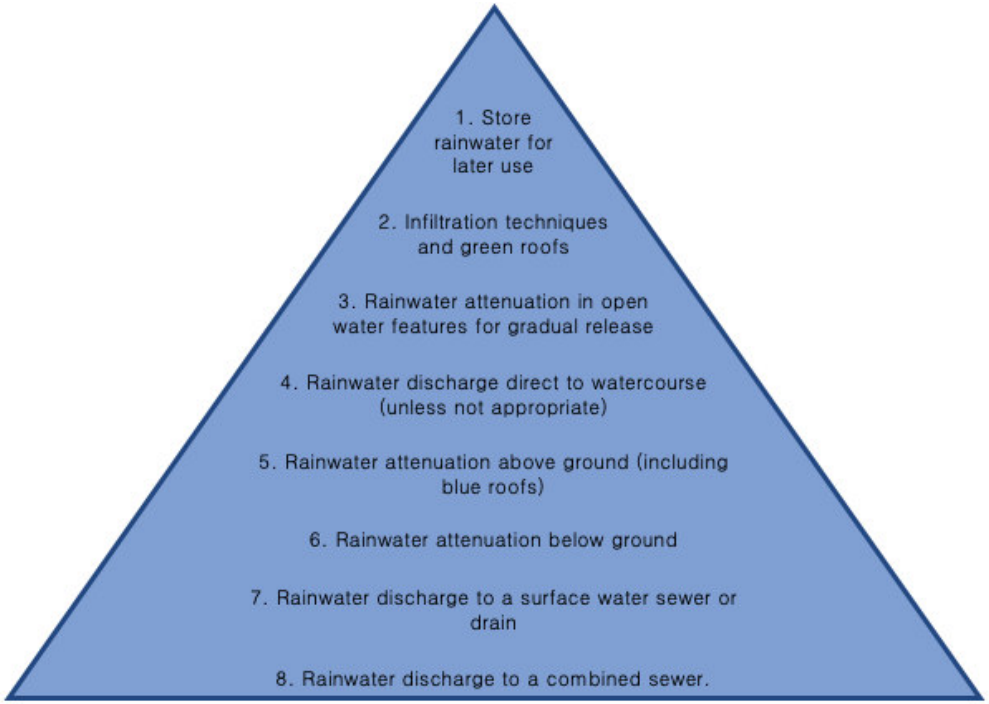

Figure 13: Sustainable drainage hierarchy.

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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. If there 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.

Run off rate calculation

The existing site area is approximately 0.48ha, with approximately 0.14ha of impermeable areas. This results in a total impermeable area of 0.225ha when applying a runoff coefficient of 1.0 for hardstanding and 0.25 for soft landscaping.

The proposed site area is approximately 0.48ha, with approximately 0.035ha of impermeable areas before permeable paving and green roof. This results in a total impermeable area of 0.14ha when applying a runoff coefficient of 1.0 for hardstanding and 0.25 for soft landscaping.

The run off 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 slightly clayey sand in 1×10^{-4} to 3×10^{-5}. For this design we have assumed an infiltration coefficient of 3×10^{-5} for design purposes. As noted, this is to be confirmed via intrusive testing on site, prior to construction.

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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 1).

From a UKSuDS Quick Storage Estimate the required attenuation volume is approximately 220m^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 220m^3 has been used for the development design. However, it is anticipated that this volume will reduce following on site infiltration testing and taking into account the permeable pavement design. Full calculations can be found in Appendix E.

Table 1: Greenfield, pre-development and post-development peak runoff rates.

eturn 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}	2.23	-	-	-
Q1 (1 in 1 year)	1.9	4	3	35%
Q30 (1 in 30 year)	5.1	9	6	35%
Q100 (1 in 100 year)	7.1	12	8	35%
Q100 (1 in 100 +40)	-	-	11	-

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Surface Water Drainage Model

Positively drained area

The total impermeable area of the proposed development is approximately 0.035ha, which covers the approximately 10% footprint of the site. The total impermeable area is taken as the positively drained area for the surface water run off rate calculation (Appendix F).

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 971m^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 61.2m^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').

Bioretention system

Bioretention system or Rain Gardens 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 20.0m^{2}m is proposed with a sub-base thickness of 600mm 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, as this would involve a review of site-specific contaminated land data. The attenuation storage is modelled as a Structure Type of Depth / Area / Inf Area with a porosity of 0.30 of total 3.6m^3 attenuation volume.

This bioretention system 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 bioretention system 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.

Green roof

A total surface area of green roofs of approximately 191m^2 is proposed for the development. In order to provide significant benefits for the development in terms of managing surface water runoff, biodiversity and amenity value, the green roofs should meet the following minimum criteria:

- Extensive sedum green roof-type system.
- Substrate depth should be maximised, within the limitations of the extensive green roof system. It is recommended that a minimum depth of substrate of 125mm should be used for the green roof areas. The system must be verified by a structural engineer with regards to the structural capacity of the building to withstand the imposed loads, including the saturated weight of the system.
- Substrate comprising commercial brick-base aggregate (or equivalent).
- Long-term plant coverage should be maximised through either of the seeded or 'biodiverse' roof types, to maximise the evapotranspiration performance of the green roof. It is acknowledged that the 'biodiverse' roof type would result in an initial lack of plant coverage but would be achieved once the indigenous plant species become established.

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Flow control

In order to target discharge rates (Table 1) 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').

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 calculations 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 the pond for temporary storage and gradual release with excess to the attenuation tank and with overflow to the grey water system and open water feature to the north east of the site.

Attenuation storage

It is estimated that a minimum storage volume of approximately 50m^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 G 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 owner, 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 owner 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 owner 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 owner.

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).

Pervious Paving (continued)

Maintenance schedule	Required action	Typical frequency
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.

Green Roofs

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspections and remedial works to control weeds and invasive plants	Monthly
Occasional maintenance	Replacement of vegetation may be required, depending on the type of green roof	Quarterly
Remedial actions	Structural rehabilitation or repair may be required if inspections reveal damage to the underlying structure	Annually (or as required)

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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.

Bioretention Systems

Maintenance schedule	Required action	Typical frequency
Regular inspections	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary	Quarterly
	Check operation of underdrains by inspection of flows at terrain	Annually
	Assess plants for disease infection, poor growth, invasive species etc and replace as necessary	Quarterly
	Inspect inlets and outlets for blockage	Quarterly
Regular maintenance	Remove litter and surface debris and weeds	Quarterly (or more frequently for tidiness or aesthetic reasons)
	Replace any plants, to maintain planting density	As required
	Remove sediment, litter and debris build-up from around inlets or from forebays	Quarterly to biannually
Occasional maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch	As required
Remedial actions	Remove and replace filter medium and vegetation above	As required but likely to be > 20 years

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Conclusions

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 50m^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 971m^2, with attenuation storage of 61.2 m^3 in the sub-base.
- Extensive green roof with an area of approximately 191m^2.
- A bioretention system with an area of 20.0m^2, with attenuation storage of 3.6 m^3 in the sub-base
- Vegetated garden of about 0.213ha.
- Flow control device to limit rate of discharge from site.

Surface water at the site is to discharge by infiltration, into the pond and through permeable pavements with overflow directed to grey water filtration system for household use and excess to the open water feature to the north east of the site. The existing site is assumed to discharge to an open water source north east to the site as well. The infiltration rate of the soils is to be confirmed via on site testing However, a default value has been used for the design at planning stage in accordance with the SuDS Manual.

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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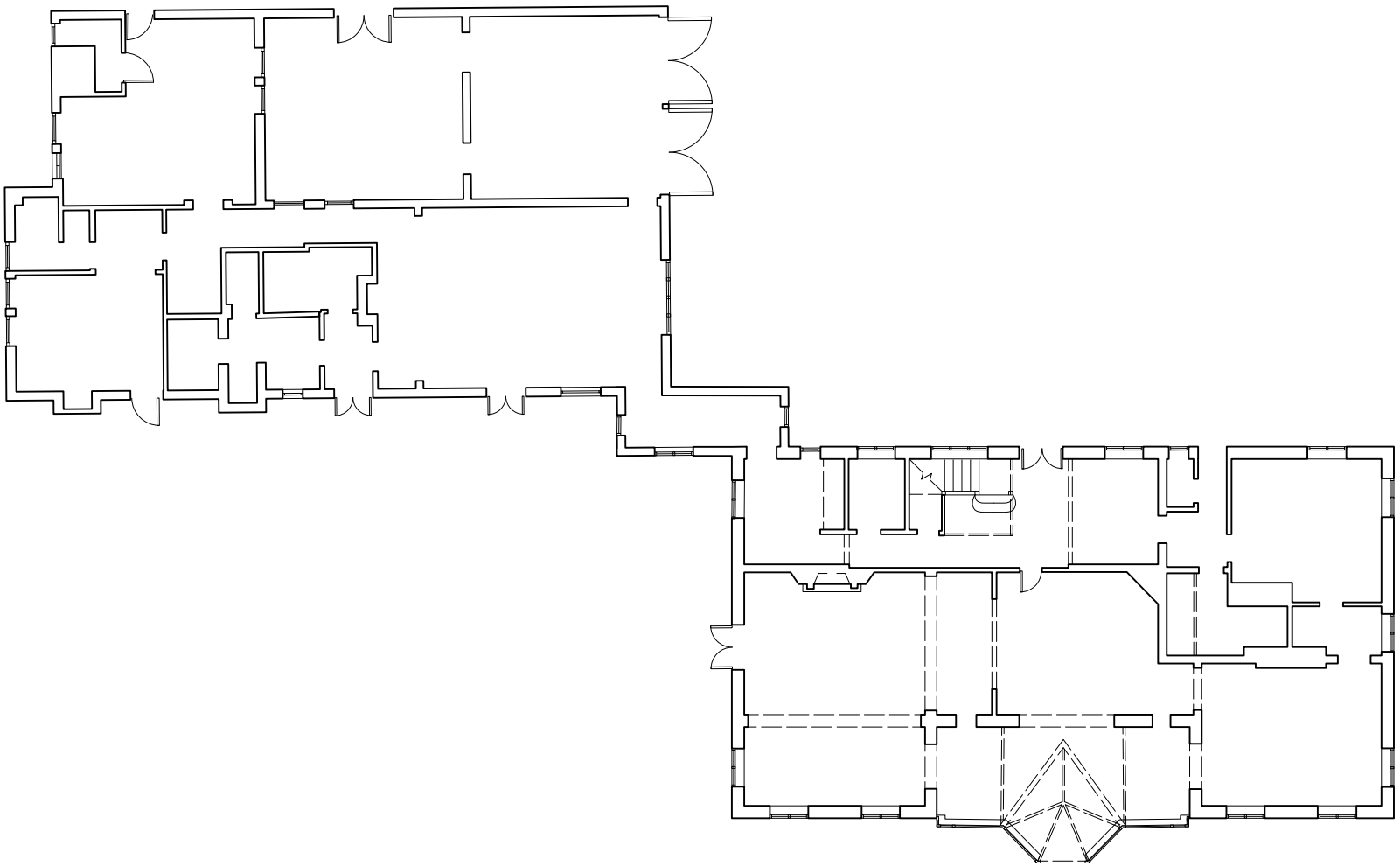
Appendix A: Existing Drawings



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PROJECT
Sproughton, 22 Courtenay Ave
N6 4LP, London

DRAWN BY
Brigitte Clements

DRAWING
18_N64_AA1
Existing Ground Floor

Scale
1:200 (A4)

DATE
16 November 2022

NORTH

2.5 5

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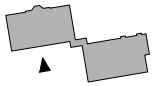
DRAWN BY
Brigitte Clements

DRAWING
18-N64_BB1
Elevation 1 (Existing)

Scale 1:100 (A4)

DATE
15 November 2022



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Appendix B: Topography

No 22
No 20
Conservatory
Pool
Courtenay Ave
1STN 90.336
2STN 90.442
3STN 89.936
4STN 89.405
5STN 90.066
6STN 90.146
6ASTN 90.198
7STN 90.187
Approx. position of tree trunks outside boundary shown in dash lines
Dense Vegetation
Dense Vegetation Limited Access
Grass
Shed
Compost
Meters Housing
Pond
Fountain
Hedge
Cypress Screening
Horse Chestnut 16H
Lime 18H
Oak 21H
Oak 20H
Maple 13H
Ash 18H
Conifer 8H
Silver Birch 10H
Poplar 30H
Beech 14H
Beech 5H
Lime 16H
Cherry 7H
Pine 7H
Unknown 10H
Unknown 20H approx.
Unknown 18H approx.
Line of Cypress 17H
Line of Cypress 18H
Line of Cypress 7H
Pool Loader Anchor
Diving Board
Boundary
Trench
Shrubs
Setts
Tmac
Hoarding
Gate (construction site)
Footway
Fence(s)
Road
Gate
Conc
CBF
CPS
CZP
FB
GU
IC
LP
RET
RWP
SW
UTL
BPav
Pipe
Stump
Oak 15H
Oak 16H
Oak 19H
Oak 15H
Unknown 18H
Unknown 20H
Unknown 20H approx.
Unknown 18H
Unknown 18H approx.
Beech 14H
Oak 20H
Oak 15H
Oak 15H
Oak 20H
Oak 15H
Oak 16H
Oak 19H
Oak 15H
Oak 20H
Oak 20H
Oak 15H
Oak 15H
Oak 15

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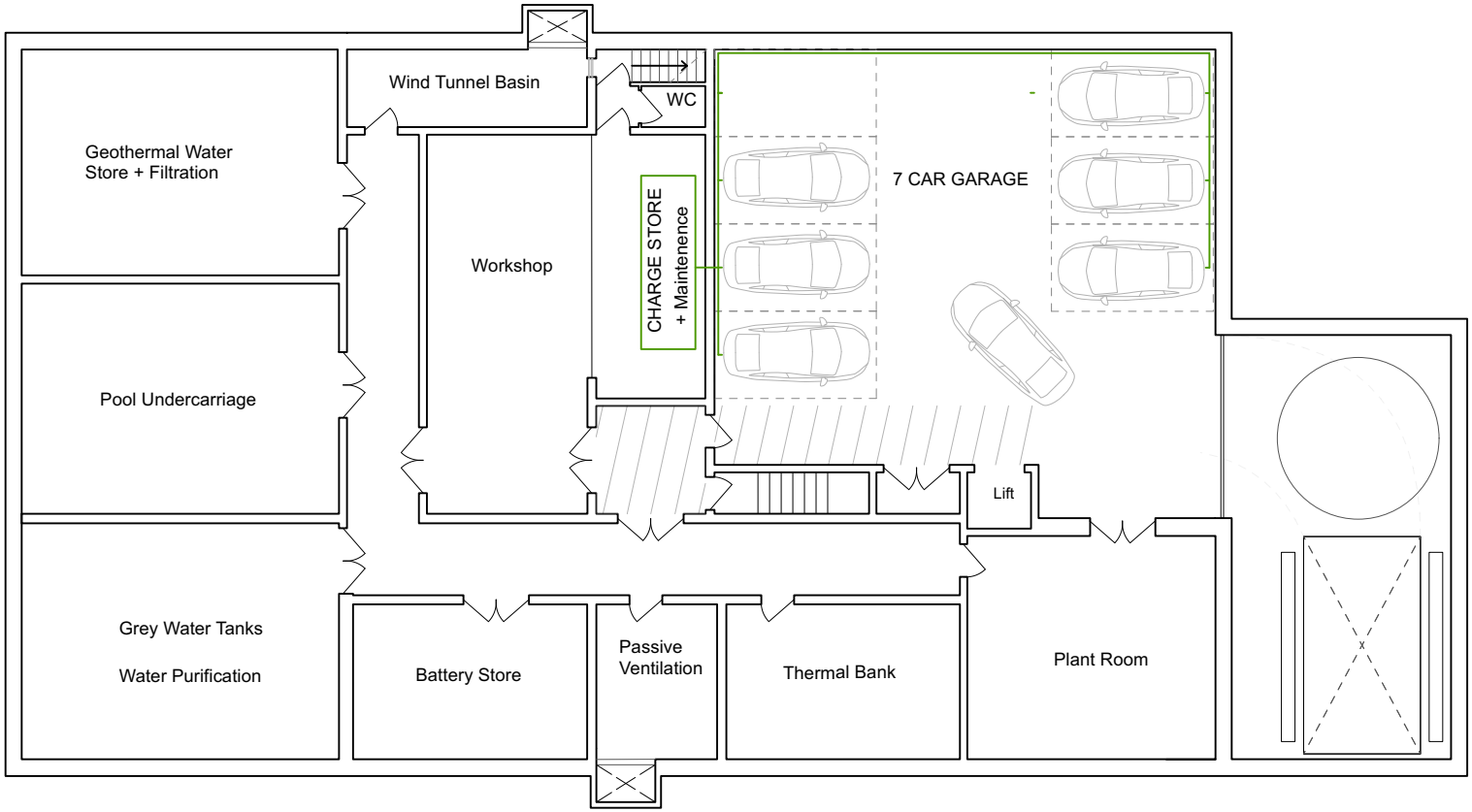
Appendix C: Proposed Drawings



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PROJECT
Sproughton, 22 Courtenay Ave
N6 4LP, London

DRAWN BY
Brigitte Clements

DRAWING
18_N64_A-02/1
Proposed -2 Basement

Scale
1:200 (A4)

DATE
24 November 2022

NORTH

2.5 5

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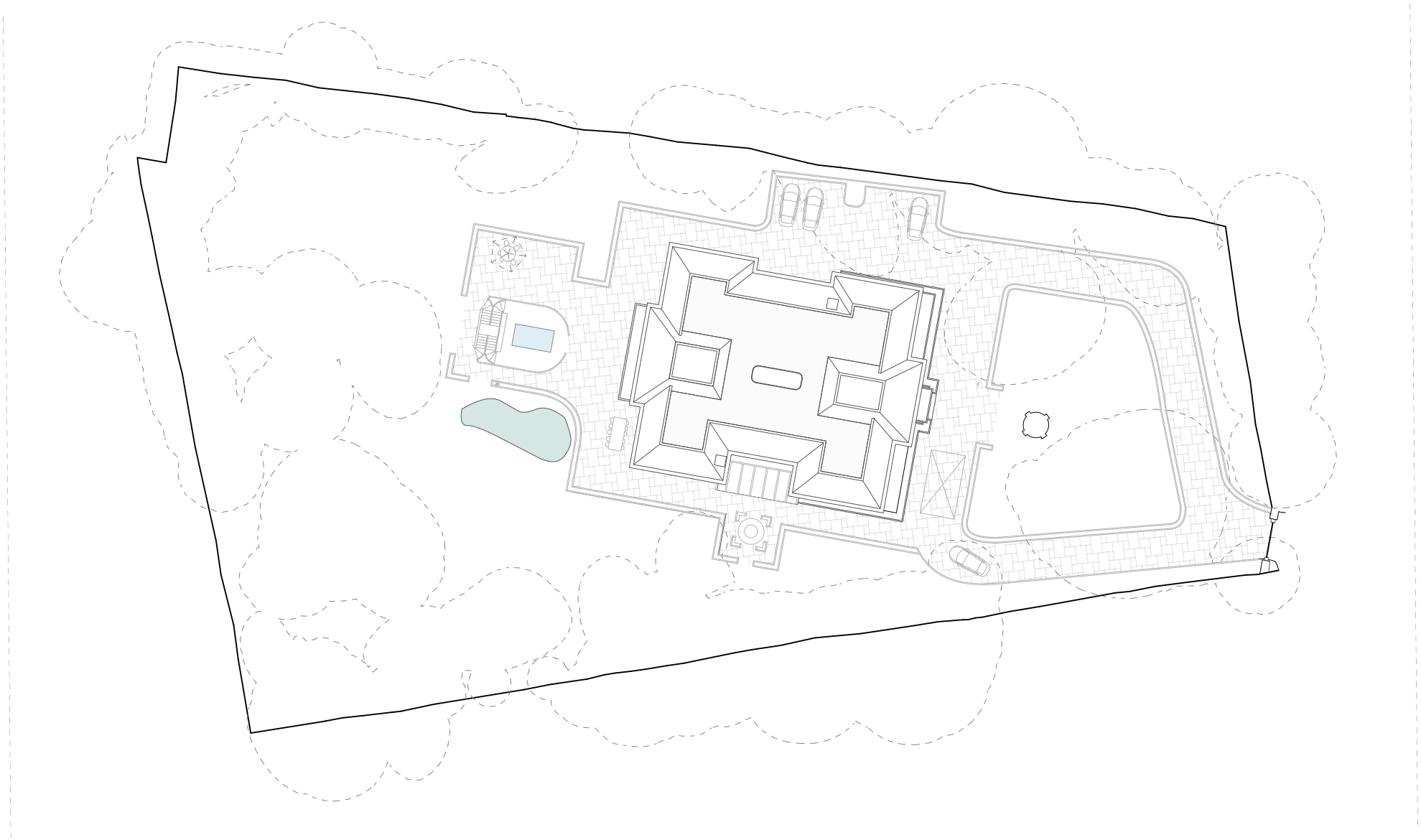

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PROJECT
Sproughton, 22 Courtenay Ave
N6 4LP, London

DRAWN BY
Brigitte Clements

DRAWING
18_N64_00_2/2
Proposed Site Plan

Scale
1:500 (A4)

DATE
24 November 2022

5 15 45m

NORTH

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Appendix D: Environment Agency Flood Map

Flood map for planning

Your reference	Location (easting/northing)	Created
<Unspecified>	**526989/188048**	**27 Apr 2023 16:39**

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 that 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)

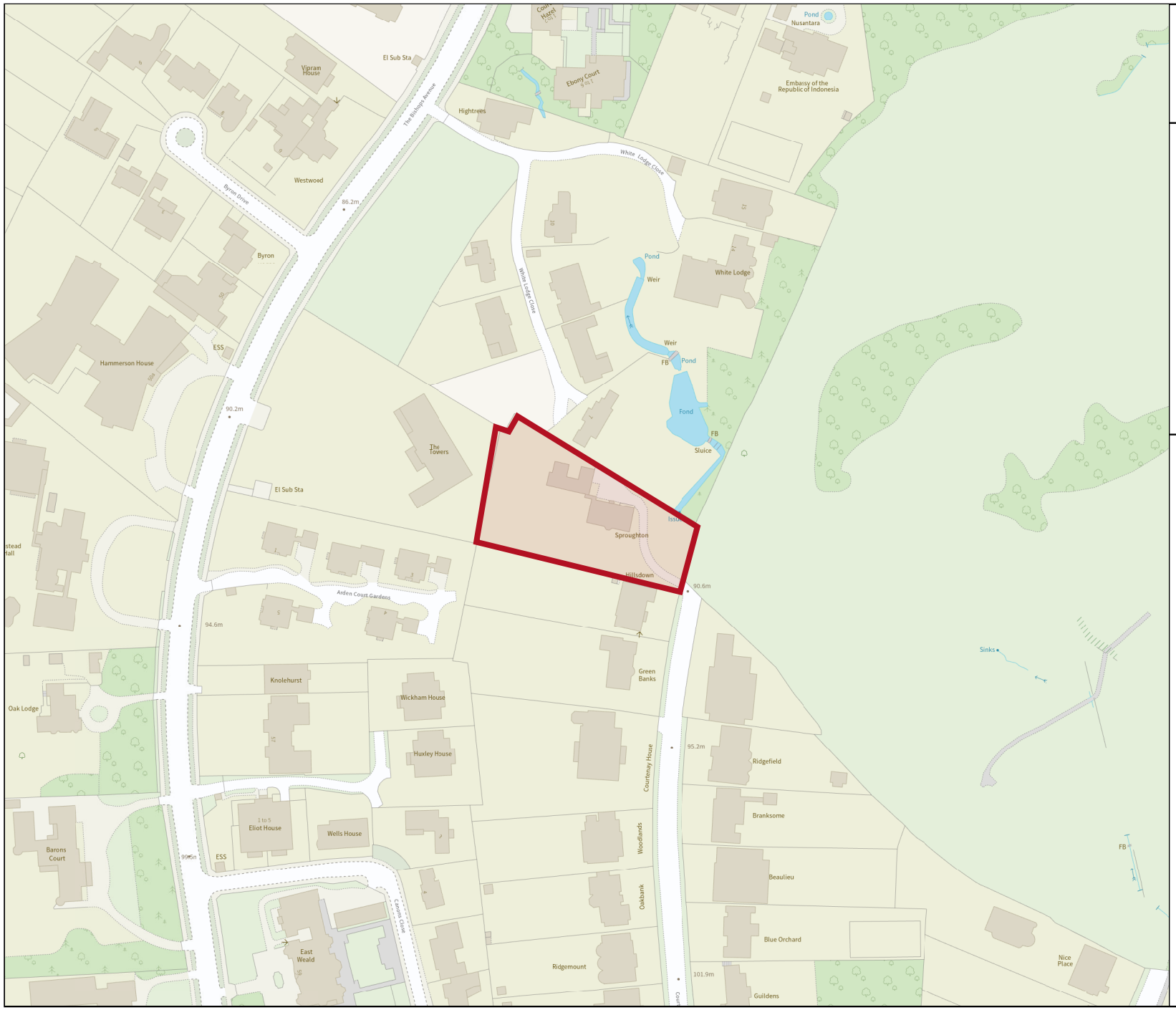
Notes

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.

Flood risk data is covered by the Open Government Licence **which** sets out the terms and conditions for using government data. https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2022 OS 100024198. https://flood-map-for-planning.service.gov.uk/os-terms



Environment Agency

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
526989/188048

Scale
1:2500

Created
27 Apr 2023 16:39

- 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: Surface Water run off rate calculations

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Nikita Vasilev
Site name:	Sproughton
Site location:	N6 4LR

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 not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	51.57693° N
Longitude:	0.16865° W
Reference:	4101126239
Date:	Jun 27 2023 15:25

Site characteristics

Total site area (ha):	0.48
Significant public open space (ha):	0.3
Area positively drained (ha):	0.18
Impermeable area (ha):	0.09
Percentage of drained area that is impermeable (%):	50
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.18
Net impermable area for storage volume design (ha):	0.1
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
SPR:	0.47	0.47

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	63
Rainfall 100 yrs 12 hrs:	--	97.79
FEH / FSR conversion factor:	1.27	1.27
SAAR (mm):	678	678
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 10 year:	1.62	1.62
Growth curve factor 30 year:	2.3	2.3

Design criteria

Climate change allowance factor:	1.4	Growth curve factor 100 years:	3.19	3.19
Urban creep allowance factor:	1.1	Q_{BAR} for total site area (l/s):	2.23	2.23
Volume control approach	Use long term storage	Q_{BAR} for net site area (l/s):	0.84	0.84
Interception rainfall depth (mm):	5			
Minimum flow rate (l/s):	2			

Site discharge rates

	Default	Edited
1 in 1 year (l/s):	2	2
1 in 30 years (l/s):	2	2
1 in 100 year (l/s):	2.7	2.7

Estimated storage volumes

	Default	Edited
Attenuation storage 1/100 years (m^3):	62	62
Long term storage 1/100 years (m^3):	0	0
Total storage 1/100 years (m^3):	62	62

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

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Appendix F: Preliminary SuDS Layout

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PROJECT
Sproughton, 22 Courtenay Ave
N6 4LP, London

DRAWN BY
Brigitte Clements

DRAWING
18_N64_00_2/4
Proposed Site Plan

Scale
1:500 (A4)

DATE
11 September 2023

5 15 45m

NORTH

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Existing

Grassland

Impermeable

0 10 20 m

Title: Existing Drainage

Project: Sproughton, London

Prepared by: Nikita Vasilev

Reference: 10393 - A01

Date: September 2023

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Sproughton Proposed

- Grassland
- Green Roof
- Impermeable
- Permeable paving
- Pond

0 10 20 m

Title: Existing Drainage

Project: Sproughton, London

Prepared by: Nikita Vasilev

Reference: 10393 - A01

Date: September 2023

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Appendix G: 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 G 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 owner, 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 owner 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 owner 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 owner.

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).

Pervious Paving (continued)

Maintenance schedule	Required action	Typical frequency
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.

Green Roofs

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspections and remedial works to control weeds and invasive plants	Monthly
Occasional maintenance	Replacement of vegetation may be required, depending on the type of green roof	Quarterly
Remedial actions	Structural rehabilitation or repair may be required if inspections reveal damage to the underlying structure	Annually (or as required)

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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.

Bioretention Systems

Maintenance schedule	Required action	Typical frequency
Regular inspections	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary	Quarterly
	Check operation of underdrains by inspection of flows at terrain	Annually
	Assess plants for disease infection, poor growth, invasive species etc and replace as necessary	Quarterly
	Inspect inlets and outlets for blockage	Quarterly
Regular maintenance	Remove litter and surface debris and weeds	Quarterly (or more frequently for tidiness or aesthetic reasons)
	Replace any plants, to maintain planting density	As required
	Remove sediment, litter and debris build-up from around inlets or from forebays	Quarterly to biannually
Occasional maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch	As required
Remedial actions	Remove and replace filter medium and vegetation above	As required but likely to be > 20 years

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Appendix H: SUDS Proforma

GREATER**LONDON**AUTHORITY

1. Project & Site Details	
Project / Site Name (including sub-catchment / stage / phase where appropriate)	Sproughton
Address & post code	Sproughton, Courtenay Avenue, London, N6 4LR
OS Grid ref. (Easting, Northing)	E 527003
	N 188043
LPA reference (if applicable)	
Brief description of proposed work	The proposal comprises demolition of the existing building and construction of a three storey dwelling with associated parking and landscaping.
Total site Area	4800 m^2
Total existing impervious area	1400 m^2
Total proposed impervious area	350 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	Open water feature
Designer Name	Nikita Vasilev
Designer Position	Sustainability consultant
Designer Company	Eigth Versa

2. Proposed Discharge Arrangements

2a. Infiltration Feasibility

Superficial geology classification	None recorded
Bedrock geology classification	London clay
Site infiltration rate	3x10^-5 m/s
Depth to groundwater level	None recorded m below ground level
Is infiltration feasible?	Yes

2b. Drainage Hierarchy

	Feasible (Y/N)	*Proposed (Y/N)*
1 store rainwater for later use	Y	Y
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	Y	Y
4 attenuate rainwater by storing in tanks or sealed water features for gradual release	Y	Y
5 discharge rainwater direct to a watercourse	Y	Y
6 discharge rainwater to a surface water sewer/drain	N	N
7 discharge rainwater to the combined sewer.	N	N

2c. Proposed Discharge Details

Proposed discharge location	orth east of the site to the open watercours
Has the owner/regulator of the discharge location been consulted?	No, existing connection

3. Drainage Strategy

3a. Discharge Rates & Required Storage				
	Greenfield (GF) runoff rate (l/s)	*Existing discharge rate (l/s)*	*Required storage for GF rate (m^3)*	*Proposed discharge rate (l/s)*
Qbar	2.23			
1 in 1	1.9	4		3
1 in 30	5.1	9		6
1 in 100	7.1	12		8
1 in 100 + CC			50	11
Climate change allowance used		40%		
3b. Principal Method of Flow Control		flow control device		

3c. Proposed SuDS Measures			
	Catchment area (m^2)	*Plan area (m^2)*	*Storage vol. (m^3)*
Rainwater harvesting	0		0
Infiltration systems	0		0
Green roofs	191	0	7
Blue roofs	0	0	0
Filter strips	0	0	0
Filter drains	0	0	0
Bioretention / tree pits	0	0	0
Pervious pavements	971	0	61
Swales	0	0	0
Basins/ponds	0	0	0
Attenuation tanks	0		50
Total	**1162**	**0**	**118**

4. Supporting Information

4a. Discharge & Drainage Strategy	*Page/section of drainage report*
Infiltration feasibility (2a) – geotechnical factual and interpretive reports, including infiltration results	p25
Drainage hierarchy (2b)	p25
Proposed discharge details (2c) – utility plans, correspondence / approval from owner/regulator of discharge location	Appendix C
Discharge rates & storage (3a) – detailed hydrologic and hydraulic calculations	p25
Proposed SuDS measures & specifications (3b)	p24

4b. Other Supporting Details	*Page/section of drainage report*
Detailed Development Layout	Appendix C
Detailed drainage design drawings, including exceedance flow routes	Appendix F
Detailed landscaping plans	Appendix F
Maintenance strategy	Appendix G
Demonstration of how the proposed SuDS measures improve:	
a) water quality of the runoff?	p25
b) biodiversity?	p25
c) amenity?	p25