



drainage strategy report

for the proposed demolition and replacement of the existing industrial unit with associated parking & landscaping.

project: 1 Arkwright Road

client: Studland Property Investments Ltd.

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References

- i. Geological Survey of Great Britain Solid Online Viewer
- ii. CIRIA Report C753 The SuDS Manual
- iii. Planning Practice Guidance – Flood Risk & Coastal Change
- iv. EA Guidance – Flood Risk Assessments: climate change allowances (April 2016)
- v. Local Authority Strategic Flood Risk Assessment (SFRA) Level 1
- vi. Sewerage Undertaker Drainage and Wastewater Management Plans (DWMPs)
- vii. Sewerage Undertaker Infrastructure Improvement Charges (2020-21)

Document Control

	Consultant	Date
Prepared By	rmh	07/10/24
Reviewed By	rmh	08/10/24

1. Introduction

BPS has produced this drainage strategy on behalf of Studland Property Investments Ltd. We accept no responsibility to any other party for the whole or part of its contents.

This drainage strategy has been prepared in compliance with the requirements set out in the National Planning Policy Framework (NPPF), the Planning Practice Guidance and CIRIA SuDS Manual.

This drainage strategy is intended to support a planning application at 1 Arkwright Road, Reading, RG2 0LU. The level of detail included is commensurate and subject to the nature of the proposals.

We confirm that BPS are an 'appropriately qualified professional' company with extensive knowledge and experience using SuDS based solutions and hydraulic calculations.

The information used to prepare the assessment is attached to the Appendices.

2. Development Description and Site Area

2.1. Existing Site

Existing Site Summary

Site Name	1 Arkwright Road,
Location	1 Arkwright Road, Reading, RG2 0LU
NGR (approx.)	E 471707 N 171503
Application Site Area (ha)	0.201
Est. Impermeable area (%)	92 (0.185ha)
Site Type	Brownfield – Used primarily for storage and distribution (Use Class B8), offices (Use Class E), toilets, kitchen, and reception.
Surrounding area	The site is in an urbanised setting in Reading, surrounded primarily by commercial and light industrial units and some residential properties. The area is well-connected, with local access roads and proximity to the A33. The terrain is generally flat, with no natural water features present. The nearest significant watercourse is the river Kennet, which is located 500m to the west.
Flood Zone Classification	Flood Zone 1
NPPF Vulnerability	Less Vulnerable
Geology	From the Geological Survey of Great Britain Solid Online Viewer, it can be seen that the underlying substrata here should be:- Bedrock Geology - Lambeth Group - Clay, silt and sand. Superficial deposits - None recorded This is likely to offer varied Infiltration for surface water. The infiltration rate will depend on the rock's homogeneity and whether any fractures or fissures are present.
Drainage	Foul water from the property discharges into the public sewer. Surface water from the property discharges into the public sewer. Drainage is managed by Thames Water, with limited SuDS implementation, relying heavily on sewer systems for runoff management.
See the aerial photograph below: -	



2.2. Development Proposals

The proposed development relates to a planning application to support the demolition and replacement of the existing industrial unit with associated parking and landscaping.

The proposed site plans are included for reference in the Appendix, the information given has been assessed to evaluate the drainage strategy, which includes the following: -

- 900m² Warehouse footprint
- 599m² Mezzanine (offices)
- Access & parking
- 25No parking bays.
- Cycle parking and bin store
- Biodiversity planting enhancements

The proposed levels are intended to follow the general lie of the existing land.

3. Sustainable Drainage Systems (SuDS) Assessment

3.1. Hierarchy

Appropriately designed SuDS can be used to attenuate runoff and improve the water quality passed on to watercourses or into the groundwater table.

The SuDS Hierarchy is set out as follows:

SuDS Drainage Hierarchy	Suitability	Comment
 Store rainwater for later use	✗	Not suitable for surface water attenuation. It can reduce the water demand, but it can provide no attenuation benefits if it is full before a storm event.
Infiltration techniques, such as porous surfaces and soakaways	✗	Due to the geology and expected contamination at the site, Infiltration is considered unsuitable.
Attenuate rainwater in ponds or open water features for a gradual release	✗	The site has insufficient green space to consider ponds for surface water attenuation.
Attenuate rainwater by storing it in tanks or sealed water features for a gradual release	✓	System 'C' geo-cellular storage systems to provide underground attenuation.
Discharge rainwater directly to a watercourse	✗	No watercourse was found within the vicinity of the site.
Discharge rainwater to a surface water sewer/drain	✓	Public surface water sewer has been located on site.
Discharge rainwater to the combined sewer.	—	
Discharge rainwater to the foul sewer.	—	

3.2. Management Train

SuDS management train (sometimes called the treatment train) sets out the order in which SuDS features should be delivered to best mimic natural drainage processes. So, it is an essential concept for SuDS designers to follow. The train is illustrated in the figure below:

1. **Prevention:** Good housekeeping and site design to reduce and manage run-off and pollution (e.g., land use planning, reduction of paved surfaces)
2. **Source control:** Run-off managed as close as possible to prevent pollution migration (e.g., using green roofs, rainwater harvesting, permeable paving, filter strips).
3. **Site control:** Run-off managed in a network across a site using a series of SuDS features in sequence. By providing several SuDS in a series, treatment is enhanced, slowing down water, sediment will settle out, and bypassing water through various features. The different treatment mechanisms used could be vegetation or gravel filtration.
4. **Regional control:** Downstream management of run-off for a whole site/catchment (e.g., retention ponds, wetlands).

3.3. Climate Change

With reference to 2016 EA guidance (ref. [iv]), SuDS components should be designed to accommodate and dispose of run-off from storms up to and including a 100-year critical storm event with an allowance for 45% climate change effects without flooding.

3.4. Component Suitability

A range of SuDS components can improve a development's environmental impact. Following the Management Train approach, various interconnected SuDS features through which surface water flows have been considered for development. Each feature reduces pollution, flow rates, and water volume and improves water quality.

SuDS Component Suitability:

Suitability of SuDS Components

SuDS Component	Description	Suitability
Green Roofs	An area of the roof that is partially or entirely covered with vegetation. Controls run-off close to the source. Provides storage and filters out pollutants. Also, it can provide visual benefits and ecological value.	✗
Soakaways	An excavation or trench filled with filter material. Can be a perforated storage structure backfilled with granular material. Allows water to soak away into the ground. Stores run-off filters out pollutants and recharges groundwater. The suitability and infiltration rate depends on the permeability of the surrounding soils.	✗
Rainwater Harvesting	System to collect water from impermeable surfaces for use in-potable water situations. Reduces the amount of portable water use.	✓
Permeable Pavements	Surfaces are allowing water to soak into the ground or a gravel-filled sub-base. Porous surface replaces traditional hard (impermeable) surfaces. Provides attenuation and can treat run-off and remove pollutants. Can be used in permeable and impermeable ground conditions. Can incorporate an outflow or overflow device to limit flows.	✓
Geocellular Systems	Modular plastic systems that can be used to create below ground store and allow the Infiltration of water. Incorporates an outflow or overflow device to limit flows.	✓
Channels and Rills	Open landscaped channels which can be vegetated, used to convey water from one SuDS component to another. Provides storage and filters out pollutants. Also, it can provide visual benefits and ecological value.	✗
Bioretention Systems	Depressions backfilled with sand/soil mixture and planted with vegetation. Water enters through a vegetated surface and then trickles via a filter layer entering a perforated pipe at the bottom before discharging downstream. Stores water and releases it gradually, some water improvement provided by a filter layer.	✓
Infiltration trench	Stone filled tranches that allow water to soak into the ground, and close to where it lands as possible. Controls the amount of run-off and provides storage. Needs permeable ground conditions.	✗
Filter Strips	A vegetated area of gently sloping ground is designed to drain water evenly off impermeable areas. Filtering out pollutants, sediment and other materials before run-off entering another SuDS component or watercourse.	✗
Filter Drains	Gravel filled trenches. Stores water and releases it gradually, filtering out pollutants. Can be used in permeable or impermeable conditions. Incorporates an outflow or overflow device to limit flows.	✗
Swales	Shallow vegetated swales that can run parallel to hard standings allowing run-off to trickle down the side slopes and into a base. Water is transported in a controlled manner to other SuDS components or a watercourse downstream. Treats and attenuate run-off. Can be used in permeable or impermeable ground conditions.	✗
Detention Basin	Shallow vegetated depressions to control the amount and rate of run-off and some water improvement. Stores water during large storms and releases it gradually.	✗
Retention Pond and Wetlands	Artificial depressions with an open water area and emergent aquatic vegetation around the edge. Stores water and releases it slowly allowing sediment to settle in the pond in a stilling/settlement area at the inlet, while the vegetation provides the biological treatment.	✗
Proprietary Treatment Systems	Manufactured products that remove specific pollutants from the water run-off.	✓

3.5. Water Quality Management

Pollution typically found in surface water run-off can be harmful to watercourses, groundwater, and coastal waters. Therefore, adequate treatment must be provided to remove pollutants.

CIRIA 753 SuDS Manual (ref. [ii]) has set out the quality management requirements for discharges receiving surface water and groundwater. Pollution hazards and SuDS mitigation components have been indexed. The approach is to deliver adequate treatment. Please refer to Tables 1 & 2 below.

The selected SuDS components should have a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index (for each contaminant type):

Total SuDS Mitigation Index (Table 1) ≥ Pollution Hazard Index Table 2)
(for each contaminant type) (for each contaminant type)

Table 1 - Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total Suspended Solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (e.g., cul de sacs, home zones and general access roads) and non-residential car parking with infrequent change (e.g., schools, offices), i.e., < 300 traffic movements/day	Low	0.5	0.4	0.05
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads /motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ¹	High	0.82	0.82	0.92

Summary of pollution hazard indices taken from Table 26.2 - CIRIA 753 SuDS Manual

Table 2 - Indicative SuDS mitigation indices for discharges to surface waters

Type of SuDS component	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Geocellular Tank	-	-	-
Filter Strip	0.4	0.4	0.5
Filter Drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention System	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8
Proprietary treatment systems	These must demonstrate that they can address each contaminant type to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

Summary of Indicative SuDS mitigation indices taken from Table 26.3 - CIRIA 753 SuDS Manual

The combined SuDS component mitigation summarised above should exceed the pollution hazard index for each catchment area. Therefore, it would be considered that sufficient pollution treatment has been provided in accordance with CIRIA 753 SuDS Manual.

After the first component (Source Control), a 50% reduction in the mitigation efficiency must be considered.

Additional measures have also been integrated to offer further pollutant reductions:

- Sump filter chambers are provided to each plot to capture roof runoff and retain silt, preventing ingress into the main sewer network.

For examples of recommended soils with good contaminant and attenuation potential, refer to Sniffer (2008a and 2008b), Scott Wilson (2010), or other appropriate guidance.

4. Drainage Strategy

Adequate control measures must be considered to mitigate the flood risk posed by the new development. This ensures surface water run-off generated is dealt with at the source, and the flood risk does not increase over the life of the development on or off-site. The post-development peak run-off rate must be no greater than the existing state.

4.1. Climate Change and Urban Creep Allowances

When estimating runoff rates for development sites during design events, it is essential to account for future climate change impacts on rainfall intensities.

Climate change should be applied to surface water drainage designs to address this, per Environment Agency (EA) guidance, reflecting the development's expected design life. This ensures that the system remains resilient and functional over time.

Urban Creep Factor (UCF) must also account for future increases in impermeable surfaces, such as patios, extensions, or driveways, that may be added without planning permission.

This incremental urbanisation can increase surface runoff, potentially compromising the drainage system's capacity and service levels. It is recommended that a 10% allowance for urban creep be applied if no specific value is provided by the drainage approval body or planning authority.

By integrating both climate change and urban creep allowances, the drainage system is designed to manage increased runoff efficiently, minimising flood risk in the catchment area and ensuring the long-term sustainability of the development.

4.2. Surface Water Strategy

The drainage should demonstrate that the surface water run-off generated for up to 100 years, including climate change allowance, will not exceed the run-off from the existing developed site following the corresponding rainfall event.

Additional run-off volumes from developments increase flood risk downstream of the site. The difference in run-off volume between the development state and the equivalent greenfield (or possibly pre-development state where this is considered acceptable) is termed the Long-Term Storage Volume.

CIRIA 753 SuDS Manual (ref. [iv]) guidance provides two design approaches for long-term storage and run-off mitigation: -

- Approach A
Where there is extra volume generated by the development that has to be discharged (because there are no opportunities for it to be infiltrated and/or used on site), this volume should be released at a very low rate (e.g., < 2 l/s/ha or as agreed with the local drainage approving body and/or environmental regulator). The 1:100-year greenfield allowable run-off rate was reduced to take account of this extra discharge (Kellagher, 2002).

- **Approach B**
An alternative approach to managing the extra run-off volumes from extreme events separately from the main drainage system is to release all run-off (above the 1-year event) from the site at a maximum rate of 2 l/s/ha or QBAR, whichever is the higher value (or as agreed with the drainage approving body and/or environmental regulator). This avoids the need to undertake more detailed calculations and modelling.

Given the expected on-site geology and the moderate to high risk of contaminated land (refer to the Groundsure Screening in the appendix), infiltration is unsuitable for managing surface water discharge. Additional on-site geological testing should be conducted to validate this assessment.

In accordance with Reading Borough Council's drainage policies, the surface water management strategy follows the sequential approach. Since infiltration is not feasible, the drainage system is designed to discharge via gravity into the public sewer, subject to the sewerage undertaker's approval.

The network should be engineered to ensure that the peak runoff rate post-development does not exceed and ideally improves upon the corresponding pre-development scenario across all events. This design will be applied to positivity-drained areas only during all rainfall events, including a 45% climate change allowance increase.

Estimated Brownfield Surface Water Discharge Rates Summary

	Site Area (ha)	Impermeable Area (ha)	QBAR	Discharge Rates (l/s)		
				2yr	30yr	100yr
Pre-development	0.201	0.185		6.0	18.9	24.8
Post-development		0.183		6.0*	18.7*	24.5*

*Includes 45% climate change allowance

Brownfield run-off rates are estimated using the Modified Rational Method (MRM), considering a 30-minute Time of Concentration & 1.0 Volumetric Runoff Coefficient (Cv)

The post-development peak volume of water run-off would be greater than the existing.

Excess water run-off must be temporarily stored during storm events when the development site's run-off rate exceeds the allowable discharge rate.

The preliminary estimate of storage volume requirements to safely accommodate storm flow without flooding on or off-site:-

- **1 in 2-year return period + 45%**
 - Peak flow - 6.0l/s
 - Required storage volume - 14m³-32m³
- **1 in 30-year return period + 45%**
 - 18.0l/s - Peak flow
 - 45m³-76m³ - Required storage volume
- **1 in 100-year return period + 45%**
 - 24.0l/s - Peak flow
 - 58m³-98m³ - Required storage volume

Flow controls have been considered to restrict storm discharge rates from the site. Following the current SUD's Guidance, a proposed minimum 20mm diameter flow control restriction has been adopted to prevent the risk of blockages and clogging.

The proposal is to accommodate the additional water volume within the SuDS Components outlined in Chapter 6 'SuDS assessment.' All SuDS components are to be impermeable systems with no Infiltration.

The preliminary calculations produced are included in the Appendix.

Pollution typically found in surface water run-off can harm watercourses, groundwater, and coastal waters. Therefore, adequate treatment must be provided to remove pollutants.

A bypass stormwater treatment system should be considered to provide water quality treatment. This is designed to effectively remove hydrocarbons, total suspended solids (TSS), and metals from surface water runoff, meeting the CIRIA SuDS Mitigation Index and ensuring compliance with sustainable drainage system (SuDS) requirements.

CIRIA Mitigation Index for Medium Pollution Hazard Level:

- Total Suspended Solids (TSS): 0.7
- Metals: 0.6
- Hydrocarbons: 0.7

The SPEL ESR Stormceptor 200 Series or an equivalent approved system is suitable for treating surface water runoff from various surfaces, effectively managing up to the 1 in 1-year storm event.

SPEL ESR Stormceptor - 215C1/ESR Specification:

- Treated Flow Rate: 15 l/s
- Maximum Flow Rate: 150 l/s
- Catchment Area: 2000 m²
- Oil Storage Capacity: 225 litres
- Silt Capacity: 1500 litres
- Mitigation Index:
 - Total Suspended Solids (TSS): 0.8
 - Metals: 0.6
 - Hydrocarbons: 0.9

Ensure the unit is installed in accordance with the manufacturer's guidelines to optimise performance. Regular inspection and maintenance are required to maintain efficiency. The coalescer inserts should be checked periodically, cleaned as necessary, and replaced if needed.

4.3. Exceedance

All storm events, including 100 years plus 45% CC, are safely accommodated without flooding on or off-site.

Exceedance of this event is to be considered carefully on-site; kerb lines and other hard landscaping structures should contain flood paths. The risk of adversely affecting the new properties is considered to be negligible.

All flow control devices must be fitted with an overflow to bypass the flow control during an exceedance event without on-site flooding.

4.4. Foul Water Strategy

The foul water drainage is to be designed in accordance with Part H1 and H2 of the Building Regulations and BS EN 752:2008

The proposed scheme is for all new foul drainage to discharge via gravity into the public sewer, subject to the sewerage undertaker's approval.

The sewerage undertaker must provide a foul drainage connection into the public sewer through their Infrastructure Charges Scheme.

4.5. On-site Construction

Both foul and surface water drainage systems shall be constructed strictly according to current Building Regulations.

The Contractor shall provide evidence, including photographs, to show that the drainage systems have been constructed as such. Records shall be incorporated within the Health & Safety File.

4.6. Maintenance and management

Both surface and foul water on-site networks are not adopted or transferable into public ownership.

A schedule of ongoing maintenance will be required, and the implementation of such would be the responsibility of a Management Company. We have formulated the following table identifying key areas to assist in developing the schedule. Recommendations and more detailed operations will need to be added via drainage product/equipment suppliers and specialists as and when these are chosen and implemented during construction.

Maintenance Schedule for Main Drainage

Activity	Indicative Frequency	Typical Tasks
Routine/regular maintenance	Monthly	- Litter picking. - Removal of any vegetation growth to permeable paving. - Verge grass cutting (seasonal).
	Every six months	- Carriageway sweeping. - Inspect watercourse, swale, ditch, culvert, road gullies and channels for damage or blockages. - Inspect flow control chambers and orifice plates for damage and blockages. - Bypass stormwater treatment system plant and equipment serviced and checked for defects.
Occasional maintenance	Annually	- Suction sweeps permeable paving. - Inspect and clean out silt traps. - CCTV inspection of cellular storage units. - Jet wash surface water drainage, including cellular storage units. - Inspect foul chambers and jet wash foul drainage system. - Inspection and maintenance of flow control units. - Vegetation management throughout all drainage components, including watercourse, pond, basin and culvert
Remedial Maintenance	As required	- Road resurfacing. - Reinstatement of damaged highway edgings/kerbs. - Inlet and outlet repairs. - Erosion repairs. - Clean up and reinstatement following pollution and/or flooding.

Ultimately, this information should be incorporated into the Health & Safety File and Site Maintenance Manual.

5. Conclusions

This report has assessed the proposed drainage strategy for the development. The SuDS components described in Section 6 are designed to meet preliminary surface water storage needs; using flow control measures will improve the post-development runoff rate compared to pre-development conditions.

The drainage strategy outlined remains indicative and requires further refinement into a detailed scheme. However, it demonstrates that effective surface water runoff management is achievable, adhering to current regulations and industry best practices.

By implementing the proposed strategies, the development will sustainably manage surface water runoff, ensuring compliance with regulatory standards while effectively mitigating impacts on the site and surrounding areas throughout the development's lifespan.