

63781 - 57 River Road, Littlehampton
Drainage Assessment
August 2026

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1 Introduction

AKTII have been commissioned to undertake a foul and surface water drainage strategy in support of the proposed redevelopment of 57 River Road, Littlehampton on behalf of 'the Client', Brownfield Estates.

The site area is approximately 475 m² and consists of an auto repair unit as existing, which will be redeveloped to form 9 residential units as proposed.

The site is located at 57 River Road, Littlehampton and the Northings and Eastings for the development land are 102109, 502371 respectively.

The topography of the development land is broadly flat with the maximum level difference approximately 0.1 m. The average ground surface level on site is approximately 3.40 m AOD.

This report is intended to cover only the aspects of drainage design and provide the guidelines and parameters for the detailed design at later /more advanced stages of the project

This report has been prepared in accordance with the guidance contained in the National Policy Framework (NPPF) and the accompanying Planning Practice guidance and a more detailed explanation of the requirements nationally and locally are laid out in Section 2 of this report.

The following drainage report and strategy will need to be approved by the Lead Local Flood Authority (LLFA) to obtain planning approval and satisfy the relevant consultees (the local Water Authority and the Environment Agency, where relevant).

This report shall be read in conjunction with the separate Fire Risk Assessment (FRA).



Figure 1.1 Proposed North East Elevation



Figure 1.2 Proposed South West Elevation

1.1 Response to EA and Reasons for Refusal 4

1.1.1 Reason for Refusal 4

The proposal has not provided a drainage strategy which accords with the Standards set out in the National Standards for SuDS. It has failed to discharge in accordance with the hierarchy, intercept frequent storm events or provide water quality, amenity or biodiversity benefits. As a result, it is not possible to determine whether surface water runoff would be discharged in a sustainable manner or if it has taken account of climate change and existing water environment. Overall, it has not been demonstrated that the risk of surface water flooding would not increase on site or elsewhere. The proposal conflicts with Arun Local Plan policies W DM3, W SP1 and relevant paragraphs of the NPPF and NPPG.

At the time of the preparation of the Drainage Strategy Report (February 2025) for the LU/141/25/PL submission, the National Standards for SuDS had not yet been published - these were not released until 19th June 2025.

This updated Drainage Strategy now makes specific reference to the National SuDS Standards and the 7 Standards contained within.

The updated report again confirms that the proposals reduce the surface water runoff rate by between 85% and 89% ensuring that the surface water risk to and from the site is significantly reduced not just "not increased".

2 Executive Summary

	SCOPE
Purpose of the report	To highlight the drainage proposals for the site.
Current Site status	Location of Riverside Autos workshop and yard
Future Site end-use	Residential
Development Proposal	Demolish and rebuild
	SITE INFORMATION
National Grid Reference	502371 E, 102109 N
Site Area	Approximately 475 m2
Geology	The superficial geology map indicates that the Site is underlain by Raised Beach Deposits, 1 - Sand and gravel and the bedrock geology map indicates the Site is underlain by Lewes Nodular Chalk, Seaford Chalk, Newhaven Chalk, Culver Chalk and Portsdown Chalk Formations - Chalk.
Hydrogeology	The Environment Agency's new aquifer designation map indicates that the superficial Raised Beach Deposits are classified as a Secondary A Aquifer and the Lewes Nodular Chalk Formation is classified as a Principal Aquifer. The site is not located within an Environment Agency designated source protection zone (SPZ). The groundwater level will be confirmed during a site-specific ground investigation.
Hydrology	The nearest water feature is the River Arun.
	SURFACE WATER DRAINAGE DESIGN
Conceptual scheme design	Surface water from the roof areas will discharge to the public sewer at an attenuated rate of 1.7 litres/sec. Surface water from the car park areas will drain to the river Arun through conduits provided by the Environment Agency as part of their flood defence improvement works.
	FOUL WATER DRAINAGE DESIGN
Conceptual scheme design	Foul water will drain to the public sewer in River Road.

3 The Site

3.1 Site Location

The Site is located at River Road, Littlehampton and is bounded to the north east by River Road, to the north west by 47 River Road, to the south east by 49 River Road and to the south west by the River Arun.

The Site is located within Flood Zone 3a (land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year).

The site is located within the Littlehampton River Road Conservation Area and is listed as a Building of Special Interest.

The National Grid Reference for the site is TQ 02371 02109 and the nearest postcode is BN17 5DB.

Figures 3.1 to 3.3 below show the location of the proposed development.



Figure 3.1 Site Location (StreetMap)

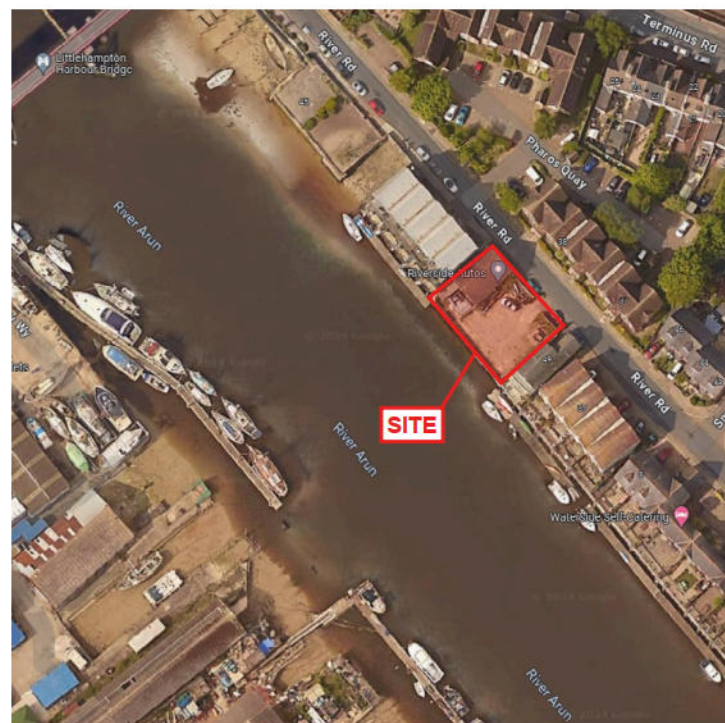


Figure 3.2 Site Location (Google Earth)

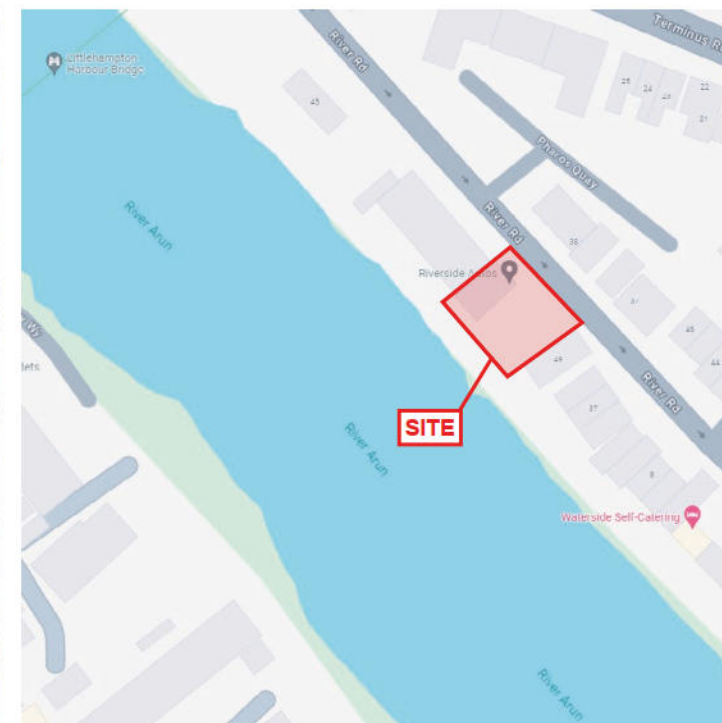


Figure 3.3 Site Location (Google Maps)

3.2 Site Description

The adjacent recently developed site, 47 River Road, is the first property on the eastern bank of Littlehampton's Arun riverside just after entering the town from the A258 across a bridge. It was developed originally in the early 19th Century as home to a small blacksmith's shop and warehouses and in recent years was used as a car repair workshop. The current site, 57 River Road, is a further workshop building associated with the garage and the yard area that serves it.

3.2.1 Topography

The site occupies an area of approximately 475 m² and is essentially flat with the maximum level difference approximately 0.1 m. The average ground surface level on site is approximately 3.40 m AOD. A site specific topographical survey for 55-57 River Road has been included in Appendix 1 for reference.



Figure 3.4 BGS Combined Geology Map

3.2.2 Geology

The following maps related to the Site's geology were received by Envirocheck:

- BGS Superficial Geology Map
- BGS Bedrock Geology Map
- BGS Combined Geology Map (Figure 3.4 below)

The superficial geology map indicates that the Site is underlain by Raised Beach Deposits, 1 - Sand and gravel and the bedrock geology map indicates the Site is underlain by Lewes Nodular Chalk, Seaford Chalk, Newhaven Chalk, Culver Chalk and Portsdown Chalk Formations - Chalk.

Published British Geological Survey maps and borehole records indicate that the geology underlying the Site comprises Made Ground, loose clayey to very clayey gravelly sand and structureless chalk.

The superficial Raised Beach Deposits are classified as a Secondary A Aquifer. Secondary A aquifers comprise permeable layers that can support local water supplies, and may form an important source of base flow to rivers

The Lewes Nodular Chalk Formation is classified as a Principal Aquifer, as per the Bedrock Aquifer map (Figure 3.5). Principal aquifers provide significant quantities of drinking water, and water for business needs. They may also support rivers, lakes and wetlands.

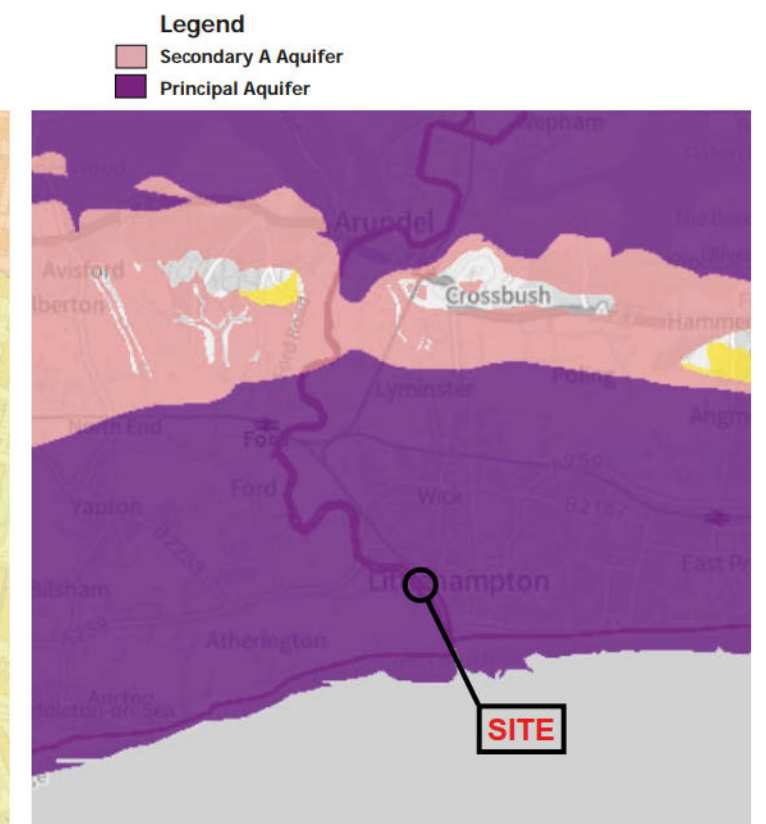


Figure 3.5 Bedrock Aquifer Map

3.2.3 Groundwater

The closest BGS borehole to the site is located within the existing yard area and recorded a groundwater level 4.25m below ground level (approximately -1.0m AOD).

3.2.4 Source Protection zones

The site is not located within a Source Protection Zone (Figure 3.6).

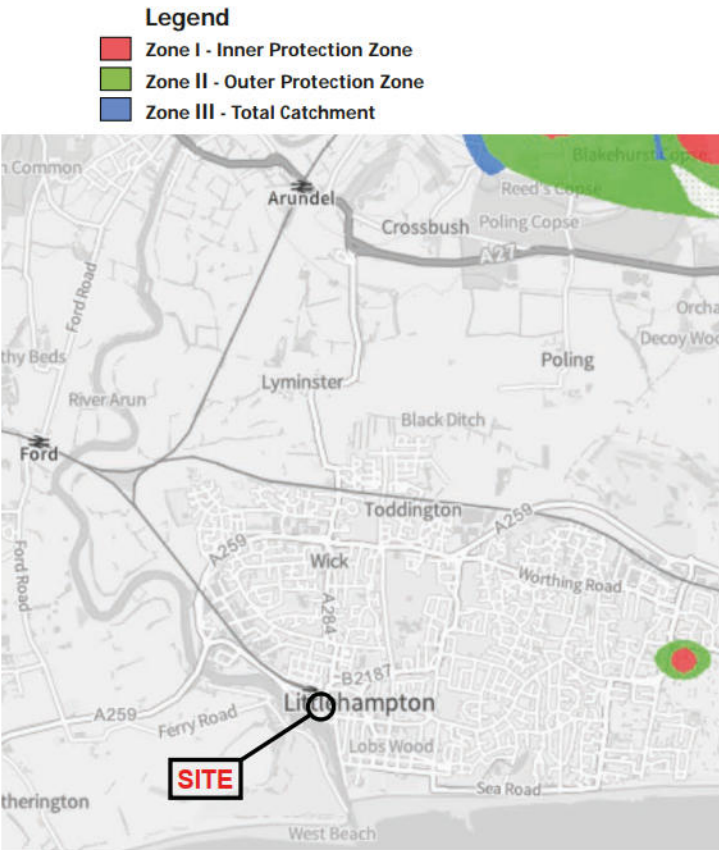


Figure 3.6 Source Protection Zone Map

3.3 Development Proposals

It is proposed to redevelop the site for residential purposes in a similar manner to the adjacent site 47 River Road which is owned by the same developer.

The ground floor level will consist of communal car parking, bicycle parking, bin store areas. Habitable residential space will be provided at upper ground floor and above.

Nine apartments are proposed with each apartment ranging from one to three bedrooms.

All habitable space has a finished floor level above 5.18m.

The proposed plans are shown in Figures 3.7 to 3.11 for reference.

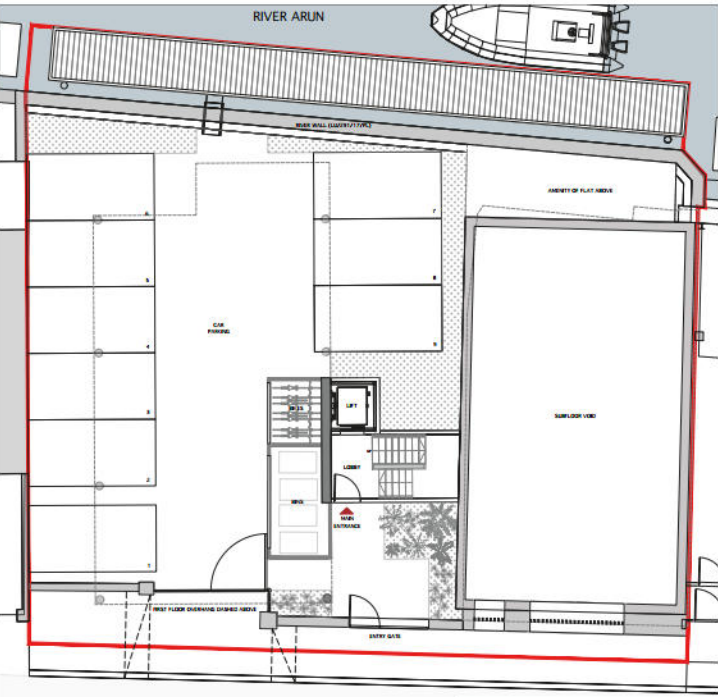


Figure 3.7 Proposals - Ground Floor

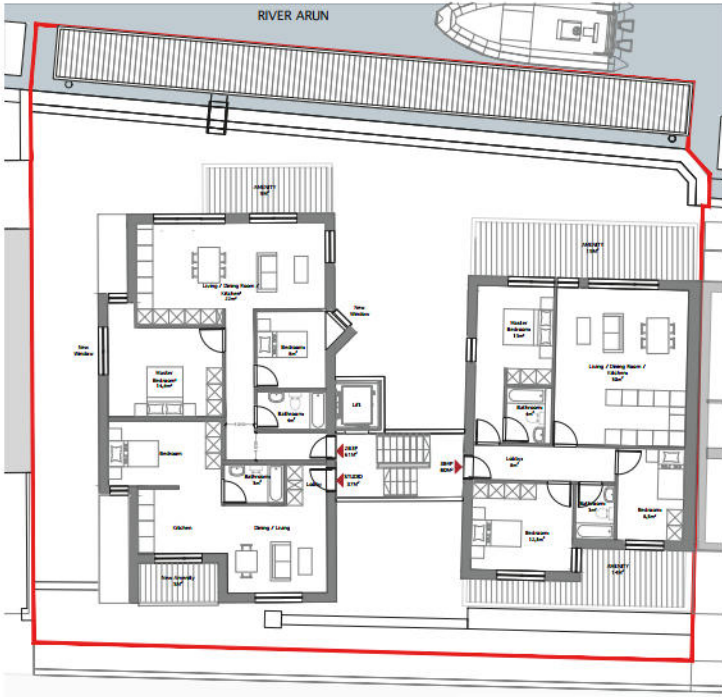


Figure 3.10 Proposals - Second Floor

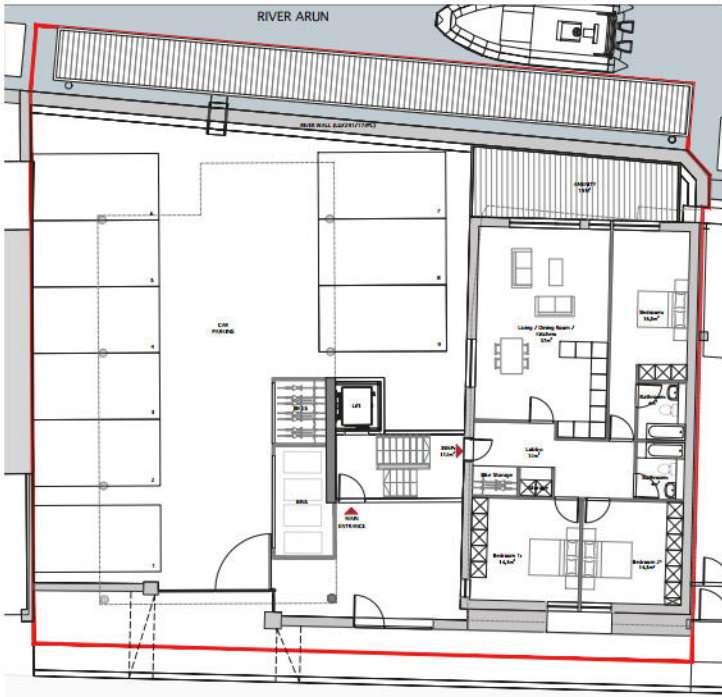


Figure 3.8 Proposals - Upper Ground Floor

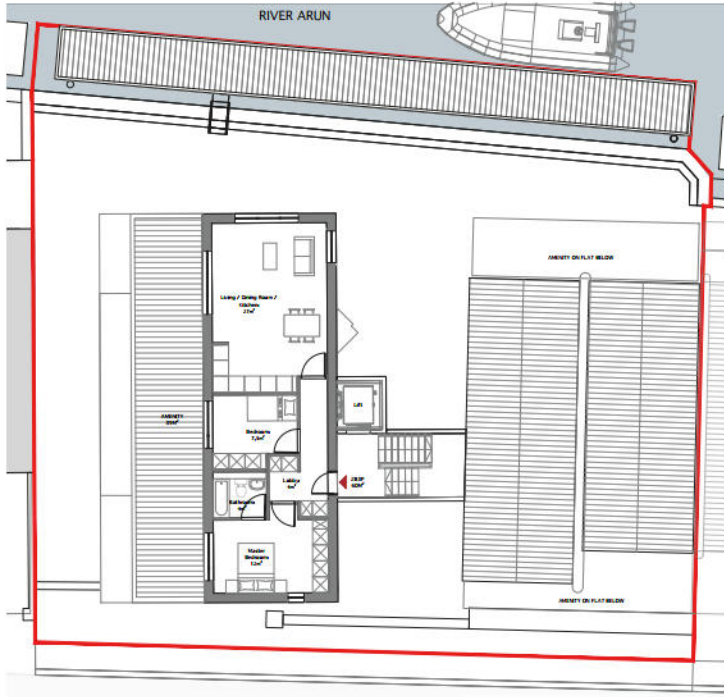


Figure 3.11 Proposals - Third Floor

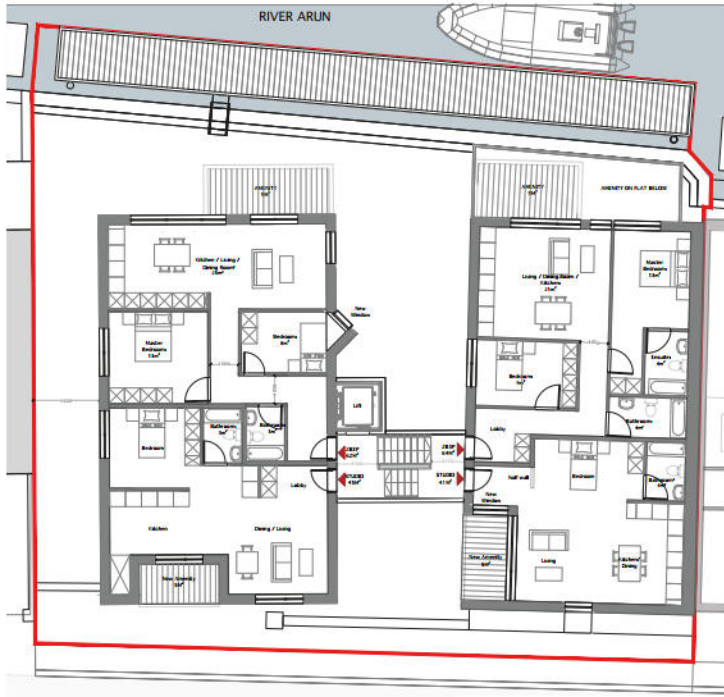


Figure 3.9 Proposals - First Floor

4 Design Standards

4.1 National Standards

The following guides and current British Standards will be used for the design of the drainage elements on this project:

- National standards for sustainable drainage systems (SuDS) 2025
- BS EN 752:2017 Drain and Sewer Systems Outside Buildings. Sewer System Management
- BS EN 12056 Gravity Drainage Systems Inside Buildings: Part 2
- Building Regulations 2010 Part H1 – Foul Water Drainage (2015 Edition)
- Building Regulations 2010 Part H2 – Wastewater Treatment Systems and Cesspools (2015 Edition)
- Building Regulations 2010 Part H3 – Rainwater Drainage (2015 Edition)
- Building Regulations 2010 Part H4 – Building Over Sewers (2015 Edition)
- Building Regulations 2010 Part H5 – Separate Systems of Drainage (2015 Edition)
- Building Regulations 2010 Part H6 – Solid Waste Storage (2015 Edition)
- Environment Agency “Control of Runoff from New Developments Interim Regional Guidance”
- National Planning Policy Framework Planning Practice Guidance
- National Planning Policy Framework Planning Practice Guidance

4.1.1 National Planning Policy Framework (NPPF)

The National Planning Policy Framework (NPPF) outlines the following requirements and goals in respect of flooding and surface water drainage design:

- The susceptibility of land to flooding is a material planning consideration;
- The Environment Agency has the lead role in providing advice on flood issues, at a strategic level and in relation to planning applications;
- Planning decisions should apply the precautionary principle to the issue of flood risk, using a risk-based search sequence to avoid inappropriate development on undeveloped and undefended flood plains etc;
- Developers should fund flood defences and warning measures required because of the development;
- Planning policies and decisions should recognise that the consideration of flood risk and its management needs to be applied on a whole-catchment basis and not only be restricted to flood plains.

With regard to the NPPF, those proposing particular developments are responsible for:

- Providing an assessment of whether any proposed development is likely to be affected by flooding and whether it will increase flood risk elsewhere and the measures proposed to deal with these effects and risks and;
- Satisfying the local planning authority that any flood risk to the development or additional risk arising from the proposal will be successfully managed with the minimum environmental effect thus ensuring the safe development and secure future occupancy of the site.

After this has been addressed, it is then the local planning authority's responsibility (advised as necessary by the Environment Agency on fluvial and tidal flood risk, and the LLFA on surface water flood risk) to determine an application for planning permission after taking into account all material considerations, including the issue of flood risk and how it might be managed or mitigated. Local planning authorities are required to adopt a risk-based approach to proposals for development in flood risk areas.

4.1.2 National standards for sustainable drainage systems (SuDS)

As part of the provisions of the Flood and Water Management Act, The Department for Environment, Food and Rural Affairs (Defra) released updated 'National Standards for Sustainable Drainage Systems (NSfS)' in June 2025. These standards:

- Provide guidance and supporting resources on sustainable drainage systems (SuDS) for designers, developers, local authorities, and related bodies.
- Apply to the design of surface water drainage for new developments on greenfield and brownfield sites, but not to retrofit projects, although they may be used as a starting point where constraints allow.
- Cover only largely uncontaminated rainwater runoff; higher-risk uses may require additional proprietary measures and may need Environment Agency permits.
- Are applicable to developments that include road drainage but they do not apply to the National Highways trunk road network, which is covered by the Design Manual for Roads and Bridges.

4.2 Local Standards

Arun District Council's SuDS general design guidance refers closely to the NSfS and The SuDS Manual:

General guidance note

- National Planning Policy requires Local Planning Authorities to ensure that flood risk is not increased due to development. To ensure that developments are adequately drained, we expect surface water drainage to be designed in accordance with The SuDS Manual C753 by CIRIA and the National Standards for Sustainable Drainage Systems (SuDS) - NSfS.
- It is expected that all surface water drainage designs submitted to support new planning applications comply with the NSfS. Where the scale and layout of a development have been decided by a full or reserved matters planning application prior to 19 June 2025, we will expect the design to attempt to meet the requirements of the NSfS. However, where this is demonstrated not to be possible, a departure from the standards may be suggested.
- Our consultations and checklists are designed to align with the NSfS as they are the most recently published national guidance. We recognise that there are some areas where the publication of these standards represents a change in expectation, however, many of the standards broadly reflect the guidance of The SuDS Manual.

Demonstrating compliance with the National Standards for SuDS

- It is expected that your drainage statement will include a short section which clearly refers to the NSfS and acknowledges full compliance with the standards, or where any departures from them are requested to be approved. However, it should be noted that such departures are rarely entertained by engineers. Each of the 7 standards should be referenced with a short statement which also directs the reader to where supporting evidence can be found.

5 Surface water drainage

5.1 Existing scheme

It is believed that until the recent upgrade of the flood wall along the edge of the site, all surface water from the existing building and yard area discharged directly to the public sewer in River Road without any form of attenuation. As part of the upgrade works, rainwater outlets with non-return valves were provided along the wall to allow part of the exisitng yard to drain to the river.

5.1.1 Site Characteristics

- Total site area = 475 m²
- Existing impermeable area = 475 m²
- Percentage Impermeable (PIMP) = 100%
- M5-60min = 19 mm
- Ratio r = 0.35
- IH 124 Soil Type = 2

Detailed calculations are contained in Appendix B for reference. The discharge rates and volumes are summarised below.

Return Period	Existing peak runoff rate ¹	Greenfield Run Off Rate ²	Existing Discharge Volume ³
1 year	5.4 litres/sec	0.08 litres/sec	1.11 m ³
30 year	11.2 litres/sec	0.22 litres/sec	2.31 m ³
100 year	14.5 litres/sec	0.29 litres/sec	3.00 m ³
100 year (+40%)	20.3 litres/sec	0.32 litres/sec	4.19 m ³

¹ The existing runoff rates were determined by the Wallingford Rational Method with a rainstorm of 15 minutes duration

² Calculated based on EA "Rainfall runoff management for developments"

³ Based on BS 8582 Section 9.8

5.2 Proposed scheme

The overall SuDS strategy for the site is to provide lined permeable paving within the car parking spaces long with soft landscaped / rain garden areas at ground level. A geocellular tank will also be provided below the car park to further reduce the discharge rate to XX litres/sec.

The following sections assess the proposed development against the requirements of each of the Standards contained in the 'National Standards for Sustainable Drainage Systems':

5.2.1 Standard 1: Runo Destinations

Requirements

- 1.1

A 'SuDS approach' shall be adopted to address the management of surface water by the development and where it should be discharged. Runo shall be treated as a resource and managed in a way that avoids negative impacts of the development on flood risk, the morphology and water quality of receiving waters and the associated ecology.
- 1.2

Runo from the development shall be discharged to the following final destinations, to the maximum extent practicable, in accordance with the below hierarchy:

Priority 1: Collected for non-potable use;

Priority 2: Infiltrated to ground;

Priority 3: Discharged to an above ground surface water body;

Priority 4: Discharged to a surface water sewer, or another piped surface water drainage system;

Priority 5: Discharged to a combined sewer;

where Priority 1 is the highest priority and Priority 5 is the lowest
- 1.3

To utilise a lesser priority final destination, appropriate evidence shall be provided that demonstrates all higher priority final destinations have been utilised to the maximum extent practicable. Higher cost alone shall not be a reason to utilise lower priority final destinations.
- 1.4

Where more than one final destination is utilised, each final destination's ability to accept runo shall be maximised in order of priority.
- 1.7

The runo from development shall not increase the risk of flooding elsewhere from any source

Element	Management stage	Water quantity	Water quality	Amenity & biodiversity	Proposed in scheme
Rainwater harvesting	Prevention	✓	✗	✗	✗
Green / brown / blue roof	Source control	✓	✓	✓	✗
Raingardens	Source control	✓	✓	✓	✗
Bio-retention	Source control	✓	✓	✓	✗
Permeable surfacing	Source control	✓	✓	✗	✗
Swales	Source control	✓	✓	✓	✗
Detention basin / ponds	Source control	✓	✓	✓	✗
Discharge to tidal river / dock / canals	Site control	✓	✗	✗	✓
Storage tanks / Geocellular storage	Site control	✓	✗	✗	✓
Oversized piping	Site control	✓	✗	✗	✗
Design for exceedance	Site control	✓	✗	✗	✗

Figure 5.1 Summary of proposed SuDS devices

Assessment

Priority 1 - Collection for non-potable use

The proposed development has approximately 305 m2 of roof area that could be collected in a rainwater harvesting and 170 m2 of parking area which is unsuitable for harvesting for non-potable uses without significant levels of treatment. The yield from this roof area would supply less than half of the demand of the development and would require a secondary non-potable water supply running throughout the development and therefore would not deliver efficient water savings.

Priority 2 - Infiltration

The underlying ground conditions do not permit infiltration to the ground. Due to the small scale of the development, It is not possible to locate any infiltration devices sufficiently distant from proposed or existing buildings and foundations to comply with the requirements of the Building Regulations (a minimum of 5 m from buildings/foundations, at least 2.5 m from boundaries, at least 5 m from a road and at least 10 m from a watercourse).

Priority 3

The recent upgrade to the River Arun flood defences in front of the development include a provision for some of the car parking area to drain directly to the river.

Priority 4

There are no surface water sewers in the vicinity of the site and so this is not possible. The nearest surface water sewer is located adjacent to Littlehampton Harbour Bridge approximately 100 m north west of the site which would require the surface water to be pumped in order to discharge to it. The Southern Water asset plan is contained in Appendix E for reference

Priority 5

The sewer serving the current development is combined and is the only available sewer in the vicinity of the site.

Range	Total potential change anticipated for 2010-2039	Total potential change anticipated for 2040-2059	Total potential change anticipated for 2060-2115
Upper end	10%	20%	40%
Central	5%	10%	20%

Figure 5.2 Peak rainfall intensity climate change allowance

5.2.2 Standard 2: Management of everyday rainfall (interception)

Requirements

- 2.1

Apply a 'SuDS approach' so that at least the first 5mm of rainfall for the majority of rainfall events does not result in runo from the Site to surface waters or piped drainage systems.
- 2.2

Evidence shall be provided that the approach to managing runo from 'everyday' rainfall has been developed alongside and in support of the management of runo quality (Standard 4) and the delivery of amenity and biodiversity benefits (Standards 5 and 6).

Assessment

It is not possible to provide green roofs as part of the development as the roofscape is to be pitched in keeping with the local area and character. However, it is possible to provide some areas of soft landscaping and planting to provide interception at ground level. Adjacent areas of paving will be directed to these soft landscaping areas where possible.

In addition, parking bays will be constructed as lined permeable paving which will also provide an element of interception.

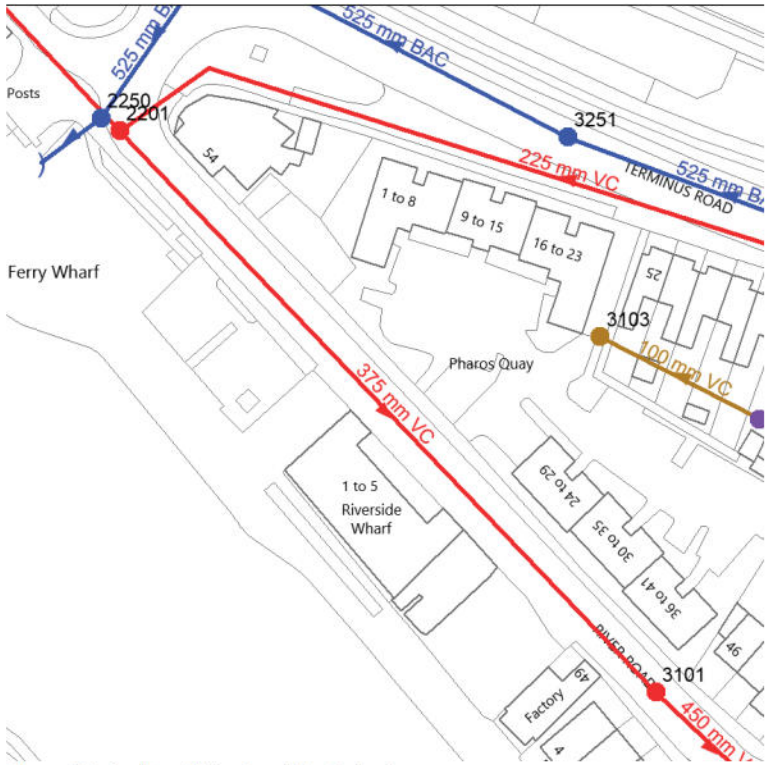


Figure 5.3 Southern Water Asset Map Extract

5.2.3 Standard 3: Management of extreme rainfall and flooding

Requirements

- 3.1

A 'SuDS approach' shall be adopted to address the management of development runo□ during extreme rainfall, including allowances for climate change and urban creep to:

 - protect people and property on the development from flooding of the surface water drainage system;
 - mitigate any increased flood risk to people and property adjacent to or downstream of the development;
 - protect the receiving water body from morphological damage or minimise the impact on sewer capacity;
- 3.2

When discharging to an infiltration feature, the system shall be appropriately sized to accommodate the design event based on ground conditions and contributing areas.
- 3.3

When discharging to an above ground surface water body, sewer or other piped drainage system, the surface water runo□ (rate and volume) for the 1% annual exceedance probability (AEP) event shall be controlled to ensure the runo□ from the development does not increase flood risk elsewhere.
- 3.4

When discharging to an above ground surface water body, sewer or other piped drainage system, the surface water runo□ rate for the 50% AEP event shall be controlled to ensure development runo□ from an event of this magnitude has no negative impact.
- 3.5

Any flooding from the surface water drainage system for events up to the 1% AEP event shall be managed within the development.
- 3.6

Any flooding from o□-site sources for the 1% AEP event should be managed on site or safely routed through the site, ensuring any downstream risks are not increased compared to the pre-development scenario.
- 3.7

The risks (both on and o□ the development) associated with flooding from the surface water drainage system for exceedance events greater than the 1% AEP event shall be appropriately managed.
- 3.8

The most up to date guidance on climate change allowances shall be used for the 3.3% AEP and 1% AEP design events unless stated otherwise. The Upper End Allowance shall be used for the relevant epoch based on the design lifetime of the proposed development.
- 3.9

Where runo□ from the development is to an above ground surface water body that can accommodate uncontrolled surface water discharges without any associated environmental impact, then requirements 3.3 and 3.4 of this standard may not need to apply, subject to written approval by the relevant risk management authority.

Note: examples include the sea, large tidal estuaries or another surface water body specifically identified in the relevant RBMP and flood risk management plan.

Assessment

Calculations have been run for the 1 in 1 year, (100% AEP) 1 in 2 year (50% AEP), 1 in 30 year (3.3% AEP) and 1 in 100 year (1% AEP) events and the current guidance of a 40% allowance for climate change has been applied to all storm events.

As the proposed development is 100% hardstanding it is not possible for urban creep to occur - the maximum possible hardstanding area on the site has already been reached.

The runo□ rate and volume from the proposed development has been controlled on site and therefore reduces the flood risk elsewhere. This applies at all storm return periods:

Return Period	Pre-development runo□ rate	Post-deveopment runo□ rate	Reduction
2 year	5.4 litres/sec	0.8 litres/sec	85 %
30 year	11.2 litres/sec	1.4 litres/sec	87 %
100 year	14.5 litres/sec	1.6 litres/sec	89 %

Detailed calculations are contained in Appendix B for reference These InfoDrainage results demonstrate that all water is contained within the proposed drainage system for every event up to and including the 1 in 100 year plus 40% climate change allowance event.

5.2.4 Standard 4: Water quality

Requirements

- 4.1

Apply a 'SuDS approach' that protects surface waters, groundwater and coastal waters by managing the quality of the surface water runo□ to adequately address water quality risks from the development.
- 4.2

The proposed SuDS management train(s) shall be based on a robust water quality risk assessment, appropriate to the pollution hazard and sensitivity of receiving waters, reflecting industry recognised guidance or other quantitative assessment as agreed with the approving body and permitting requirements.

Assessment

The Simple Index Method in CIRIA C753 has been applied across the entire Site, and this will be further augmented by aiming for the spatial allowances in Standard 2 where feasible. The risk of land use determines the indices required to be achieved:

- Residential roofs (CIRIA C753 Table 26.2 Risk Category: Very Low, Hazard Indices 0.2, 0.2, 0.05)
- Residential Car Parking (CIRIA C753 Table 26.2 Risk Category: Low, Hazard Indices 0.5, 0.4, 0.4). The Lined Permeable Paving provides Mitigation Indices of 0.7, 0.6, 0.7 which are greater than the Hazard Indices and is therefore su□cient.

Therefore, the proposed uses of the site along with the SuDS measures proposed will ensure that water leaving the site through the piped system to the sewer will be of good quality.

5.2.5 Standard 5: Amenity

Requirements

- 5.1

A 'SuDS approach' shall be adopted that maximises benefits for amenity through the creation of multi-functional places and landscapes.

Assessment

The scale and nature of the proposed development does not allow for the creation of multi-functional places and landscaping. Areas of private soft landscaping have been provided which will provide some amenity to wildlife and is all that is practicable within the constraints of the site.

5.2.6 Standard 6: Biodiversity

Requirements

- 6.1 A 'SuDS approach' shall be adopted to ensure the surface water drainage system maximises biodiversity benefits throughout the development lifecycle.
- 6.2 The surface water drainage system shall add biodiversity value by:
 - creating diverse, self-sustaining, resilient local ecosystems which contribute to net gains in biodiversity;
 - supporting and promoting natural local habitat and species, for example, through local nature recovery strategies (LNRS);
 - contributing to the delivery of local biodiversity strategies;
 - contributing to habitat connectivity;
- 6.3 Evidence of consideration and inclusion of biodiversity, proportionate to both the scale and ecological sensitivity of the site, shall be provided to the approving body.

Assessment

The scale and nature of the proposed development does not allow for the creation of significant areas of biodiversity. Areas of private soft landscaping have been provided which will provide some biodiversity and is all that is practicable within the constraints of the site.

5.2.7 Standard 7: Design of drainage for construction, operation, maintenance, decommissioning and structural integrity

Requirements

- 7.1 A 'SuDS approach' shall be adopted to ensure that surface water drainage systems are designed so they can be easily and safely constructed, operated and maintained taking account of the need to minimise negative impacts on natural resources and the environment.
- 7.2 The designer shall provide a management and maintenance plan that supports the design objectives detailed in standards 1 to 6 and ensures the performance of the surface water drainage system with regards to runoff destinations, everyday and extreme rainfall, water quality, amenity and biodiversity is maintained throughout the lifetime of the development.
- 7.3 Surface water drainage design shall examine for the likelihood and consequences of potential failure scenarios that may occur during the operation phase and safely manage the associated risks.
- 7.4 The surface water drainage system shall be designed to ensure structural integrity of all components under anticipated loading conditions for the design life of the development so that it does not affect the structural integrity of any existing or proposed components within, or adjacent to, the development.

Assessment

Operation and maintenance of the proposed SuDS devices is covered in Section 7 of this report.

6 Foul water drainage

6.1 Existing scheme

It is believed that all foul water from the existing building currently discharges directly to the public sewer in River Road.

As floor plans are not available for the existing building it has not been possible to accurately assess the current foul water discharge rate from the site. A rate of 5 litres/sec has been estimated based on the current use.

6.2 Proposed scheme

The proposed foul water discharge rate from the site has been calculated as **3.91 litres / sec** (detailed calculations are contained in Section B.2 of Appendix B for reference).

Although it has not been possible to make an assessment of the existing foul water flow, it is believed that it will be comparable to the proposed rates.

It is assumed that the new foul water drainage from ground floor level and above will be drained by gravity to the public sewer in River Road mimicking the existing situation.

7 Maintenance and operation

Before cleaning, final testing and immediately before handover the Contractor will:

- Lift covers to manholes, inspection chambers and access points. Remove mortar droppings, debris and loose wrappings.
- Thoroughly flush pipelines with water to remove silt and check for blockages. Rod pipelines between access points if there is any indication that they may be obstructed.
- Carry out a CCTV of the pipework to ensure that it is free of silt and blockages.

The End User shall then follow the "Waste Management, The Duty of Care - A Code of Practice (Revised 1996)" and shall ensure that their waste does not escape from their control and is transferred only to a registered waste carrier to be sent for recycling or disposal at a suitably licensed facility.

All waste arising from the maintenance of the drains and sewers shall be handled, stored and disposed of correctly to avoid pollution. Waste may be designated as hazardous / special waste and, as such, the End User shall ensure that they comply with the Hazardous Waste (England and Wales) Regulations 2005.

Reference shall be made to CIRIA publication C753 - The SuDS Manual by the Contractor and the End User. A suitable maintenance schedule must be developed, maintained, followed and updated as required to reflect observed performance. The following items are highlighted for guidance.

7.1 General drainage

The below ground drainage network has been designed in accordance with the requirements of the Building Regulations whilst acknowledging the need to limit the number of inspection chambers within "front of house" areas. To this end, all main runs have rodding eyes, manholes or inspection chambers at the head of the run and at all changes of direction to provide access to rod or jet the main pipework.

Where possible, connections from stacks or gullies have been made directly to these manholes or inspection chambers to allow the connection to be rodded or jetted from the downstream end. Where this is not possible, each stack has been detailed to have an access hatch provided just above floor level (see Figure 5.1) to allow the connection to be rodded or jetted from the upstream end. Similarly, the gullies have a rodding access provided within their body allowing the pipework to be rodded or jetted from the gully downstream.

Gullies and channels have been specified with silt buckets and silt trap manholes have been provided upstream of all tanks and infiltration structures to prevent the ingress of silts into the drainage network and impairing the performance of the system.

Maintenance schedule	Required action	Recorded frequency
Regular maintenance	Inspect and identify areas that are not operating correctly. If required, take remedial action.	Monthly for the first three months then six-monthly
	Remove sediment from pre-treatment structures (e.g. gullies, channels, silt traps).	Six-monthly or as required
Occasional maintenance	Debris removal from catchment surface where this may cause risks to performance.	Monthly
Remedial actions	Repair/rehabilitation of inlets, outlets, overflows and vents.	As required
Monitoring	Inspect all manholes, inspection chambers, inlets, outlets, overflows and vents to ensure they are in good condition and operating as designed.	Annually and after large storms

7.2 Attenuation tanks

By aligning AquaCell Plus units end-to-end,full length viewing channels have been created within the base of the attenuation tank allowing for CCTV inspection if required. CCTV inspection of the tank is recommended at six-monthly intervals and after every major storm. Should the CCTV reveal a build up of silt in the base of the tank these channels also allow for jetting of the tank structure to clear the system.

Silt traps prior to inlet pipework should be routinely inspected and cleaned out to minimise debris reaching the tank. It is important to prevent construction silt from entering the AquaCell structure.

The table below provides guidance on the type of operational and maintenance requirements that may be appropriate. The list of actions is not exhaustive and some actions may not always be required.

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
Remedial actions	Remove sediment from pre-treatment structures and/ or internal forebays	Annually, or as required
	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

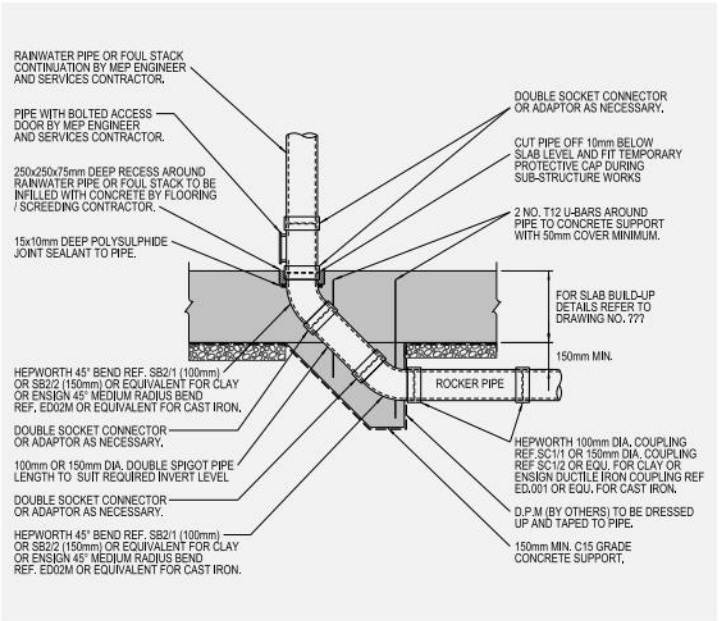


Figure 7.1 Rodding/jetting access detail

7.3 Pervious Pavements

Regular inspection and maintenance is important for the effective operation of pervious pavements. Maintenance responsibility for a pervious pavement and its surrounding area should be placed with an appropriate responsible organisation. Before handing over the pavement to the client, it should be inspected for clogging, litter, weeds and water ponding, and all failures should be rectified. After handover, the pavement should be inspected regularly, preferably during and after heavy rainfall to check effective operation and to identify any areas of ponding.

Pervious pavements need to be regularly cleaned of silt and other sediments to preserve their infiltration capacity. Extensive experience suggests that sweeping once per year should be sufficient to maintain an acceptable infiltration rate on most sites. However, in some instances, more or less sweeping may be required and the frequency should be adjusted to suit site specific circumstances and should be informed by inspection reports.

A brush and suction cleaner (which can be a lorry mounted device or a smaller precinct sweeper) should be used for regular sweeping. Care should be taken in adjusting vacuuming equipment to avoid removal of jointing material. Any lost material should be replaced. It is also possible to clean the surface using lightweight rotating brush cleaners combined with power spraying using hot water.

If the surface has clogged then a more specialist sweeper with water jetting and oscillating and rotating brushes may be required, especially for porous asphalt surfaces, to restore the surface infiltration rate to an acceptable level. The specialist equipment should be adjusted so that it does not strip binder from the aggregate in the asphalt.

The likely design life of grass reinforcement will be dictated by trafficking and is likely to be about 20 years if designed correctly. For concrete block permeable paving the design life should be no different from standard paving, assuming that an effective maintenance regime is in place to minimise risks of infiltration clogging. Porous asphalt will lose strength and begin to fatigue due to oxidation of the binder. This is likely to occur slightly faster in porous asphalt than normal asphalt, so the design life will be reduced slightly. Porous concrete should have a similar design life to a normal concrete slab.

The reconstruction of failed areas of concrete block pavement should be less costly and disruptive than the rehabilitation of continuous concrete or asphalt porous surfaces due to the reduced area that is likely to be affected. Materials removed from the voids or the layers below the surface may contain heavy metals and hydrocarbons and may need to be disposed of as controlled waste. Sediment testing should be carried out before disposal to confirm its classification and appropriate disposal methods.

Many of the specific maintenance activities for pervious pavements can be undertaken as part of a general site cleaning contract (many car parks or roads are swept to remove litter and for visual reasons to keep them tidy) and therefore, if litter management is already required at site, this should have marginal cost implications.

Generally, pervious pavements require less frequent gritting in winter to prevent ice formation. There is also less risk of ice formation after snow melt, as the melt water drains directly into the underlying subbase and does not have chance to refreeze. A slight frost may occur more frequently on the surface of pervious pavements compared to adjacent impermeable surfaces, but this is only likely to last for a few hours. It does not happen in all installations and, if necessary, this can be dealt with by application of salt. It is not likely to pose a hazard to vehicle movements.

The table below provides guidance on the type of operational and maintenance requirements that may be appropriate. The list of actions is not exhaustive and some actions may not always be required.

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 - pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	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 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth - if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually