GeoSmart Information

SuDSmart Plus

Sustainable Drainage Assessment

Site Address

44 Pagham Road
Bognor Regis
PO21 4NP

Grid Reference

488865, 097801

Report Prepared for

Nova Build (Sussex) Ltd
Dell Quay Yacht Yard
Chichester
PO20 7EE

Date

16/12/2025

Report Status

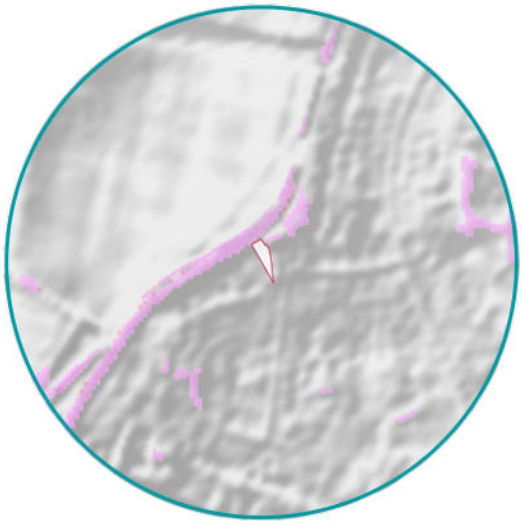
FINAL

Site Area

510 m^2

Report Reference

87325.01R2



Infiltrate to ground

The proposed Sustainable Drainage Scheme (SuDS) strategy is comprised of rainwater harvesting, permeable paving and a soakaway to attenuate surface water runoff during the 1 in 100 plus 45% climate change event.

Surface water is proposed to infiltrate to ground via a soakaway in the rear garden, following confirmation of the infiltration rate and the depth to groundwater in accordance with BRE365.

Where infiltration is not feasible, surface water will discharge via a new connection to the minor watercourse c. 15m north of the Site subject to permission from the LLFA and Environment Agency where applicable.

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1 Executive summary

This report assesses the feasibility of a range of Sustainable Drainage Scheme (SuDS) options in support of the Site development process. A SuDS strategy is proposed to ensure surface water runoff can be managed effectively over the lifetime of the development.

SuDS suitability

Risk	Issue	Result
Runoff destination feasibility	Priority 1: rainwater collected for non-potable use	Yes
	Priority 2: infiltration to ground	Moderate
	Priority 3: discharge to an above ground surface water body	High
	Priority 4: discharge to surface water sewer	Low
	Priority 5: discharge to combined sewer	Low
Flooding	What is the river (fluvial) and/or tidal flood risk at the Site?	Very Low
	What is the surface water (pluvial) flood risk at the Site?	Very Low to Low
	What is the groundwater flood risk at the Site?	Low
Pollution	Is the groundwater a protected resource?	No
	Is the surface water feature a protected resource?	No

Summary of existing and proposed development

The Site is currently in use as a detached residential dwelling with associated access and landscaping. Development proposals comprise the demolition of the existing garage and the construction of a new 4-bedroom property in its place. Site plans and drawings are provided in Appendix A.

National Standard 1: Runoff Destinations

Priority 1: collection for non-potable use

In line with DEFRA's national guidance, the potential for the collection of rainwater for non-potable use across the proposed development has been considered.

Rainwater harvesting butts are proposed at the base of the downpipes of the development in order to provide rainwater re-use potential at the Site, as well as to provide biodiversity

and amenity benefits. Captured water will be used to water vegetation and ensure their long-term viability as sustainable amenity features.

Priority 2: infiltration to ground

GeoSmart's SuDS Infiltration Potential (SD50) map indicates that the Site has a Moderate potential for infiltration, primarily due to the anticipated modest permeability of the underlying geology. Infiltration to ground therefore has the potential to be feasible subject to further investigation.

Priority 3: discharge to above ground surface water body

Ordnance Survey (OS) mapping indicates that a surface water feature is located c. 15 m to the north . Discharging surface water runoff to this feature would require drainage pipework to cross third-party land and therefore should be considered where infiltration is deemed unfeasible.

Priority 4: discharge to surface water sewer

The asset location plan included in Appendix C confirms that there are no public surface water sewers within the vicinity of the Site that could feasibly be discharged to. As such, discharge to surface water sewer is not considered to be feasible.

Priority 5: discharge to combined sewer

The asset location plan included in Appendix C confirms that there are no public combined sewers within the vicinity of the Site that could feasibly be discharged to. As such, discharge to combined sewer is not considered to be feasible.

Runoff rate and attenuation requirements

Discharging via infiltration requires 8.54 m^3 of attenuation to be provided to ensure there is no flooding as a result of the development in all storm events up to and including the 1 in 100 year including a 45% allowance for climate change. This volume has been calculated using Causeway Flow v.10.7 based on an assumed infiltration rate of 1 x 10^{-5} m/s taken from Table 25.1 of the CIRIA SuDS (C753) (2015) as the worst-case scenario for 'slightly silty slightly clayey sand' soil type. This is subject to the results of infiltration testing and would ensure runoff is not increased above the greenfield scenario.

Discharging off-Site requires 4.93 m^3 of attenuation to be provided to ensure there is no flooding within the development in all storm events up to and including the 1 in 100 year including a 45% allowance for climate change. This volume is subject to the discharge rate being restricted to 2 l/s (as close to the Greenfield 1 in 1 year rate as possible, without increasing the potential for blockages).

Proposed SuDS strategy

SuDS features comprised of permeable paving, a soakaway and rainwater harvesting are proposed to attenuate a minimum of 9.12 m^3 of surface water runoff. The SuDS features

would provide some water quality benefits (interception and filtration) prior to infiltration to ground.

The proposed SuDS strategy would ensure surface water runoff is stored on-Site in SuDS features for the 1 in 100 year event including a 45% allowance for climate change and will not cause flooding to the proposed development in accordance with DEFRAs non-statutory technical standards (DEFRA, 2025).

SuDS & drainage network maintenance

The management and maintenance of the SuDS features, in line with the details and schedules outlined in Section 10 of this report, will be undertaken by contractors appointed by the owners and occupiers of the new residential building, where payments for the works will form part of the property deeds and / or rental agreements.

Recommendations / Next steps

A site investigation is required to confirm the infiltration capacity of the ground in line with BRE 365 guidelines to confirm the infiltration rate and the groundwater level.

Where infiltration is not feasible, an investigation is required to confirm the capacity of surface water bodies to accept surface water runoff and whether sewers within the immediate vicinity of the Site could be used within the SuDS design.

2 Proposed SuDS strategy

The most suitable SuDS options are outlined below and a SuDS strategy schematic is shown overleaf. Supporting information is provided in subsequent sections.

Table 1. Proposed SuDS type, features, discharge location and rate restriction

SuDS type	Source control (interception) and infiltration SuDS.
SuDS features	Rainwater harvesting, permeable paving and a soakaway
Discharge location	Infiltration to ground
Infiltration rate	1 x 10^{-5} m/s (worst case infiltration rate taken from Table 25.1 of the CIRIA SuDS manual C753).

Table 2. Proposed SuDS sizing (dimensions) and attenuation volumes

Rainwater harvesting	Rainwater harvesting butts should be established for the proposed development. In terms of attenuation storage within this SuDS scheme, the volume of run-off which could be attenuated by rainwater harvesting has not been considered within the Preliminary SuDS strategy.
Permeable paving	A 30 m^2 area of permeable paving is proposed as part of the parking areas in the north of the Site. These areas will effectively drain themselves and their attenuation has not been considered within the primary SuDS schematic.
Soakaway	A soakaway located in the rear garden with dimensions 4m x 6m x 0.4m and a void ratio of 95% will attenuate a minimum of 9.12m^3 prior to infiltrating to ground. It should be noted that the soakaway has been designed as shallow as possible to reduce the risk of groundwater interacting with the proposed soakaway, subject to confirmation via winter groundwater monitoring.
Total attenuation provided	9.12 m^3
Total attenuation required	8.54 m^3
Freeboard storage provided	0.58 m^3

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Figure 1. Proposed SuDS scheme

- Soakaway
- Permeable paving
- Rainwater harvesting butt
- Surface water drainage network
- Exceedance flow routes
- Site boundary
- Wider ownership boundary

Surface water from the proposed dwellings should be conveyed into the rainwater harvesting feature, where overflows are directed to the soakaway located in the rear garden for infiltration to ground, following site investigation in line with BRE365.

Permeable paving in the north of the Site will effectively drain itself and thus has been excluded from attenuation calculations.

Exceedance flows are directed towards non-essential, landscaped areas on Site.

Schematic is not to scale

[redacted]

[redacted]

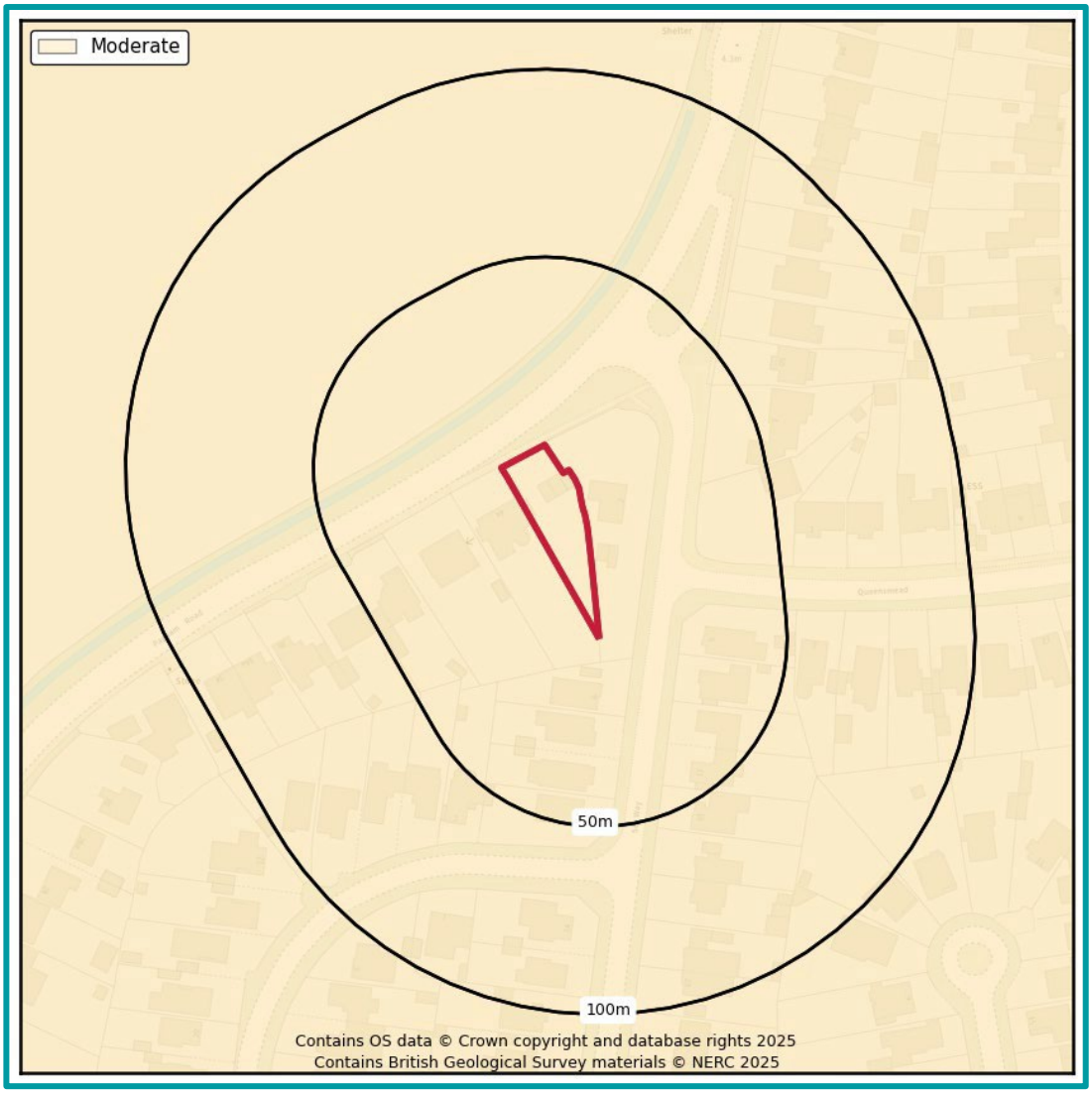
[redacted]

3 Site analysis

Site location

Figure 2. Aerial Imagery (Bluesky, 2025)

Figure 3. SuDS infiltration suitability (SD50) map (GeoSmart, 2025)

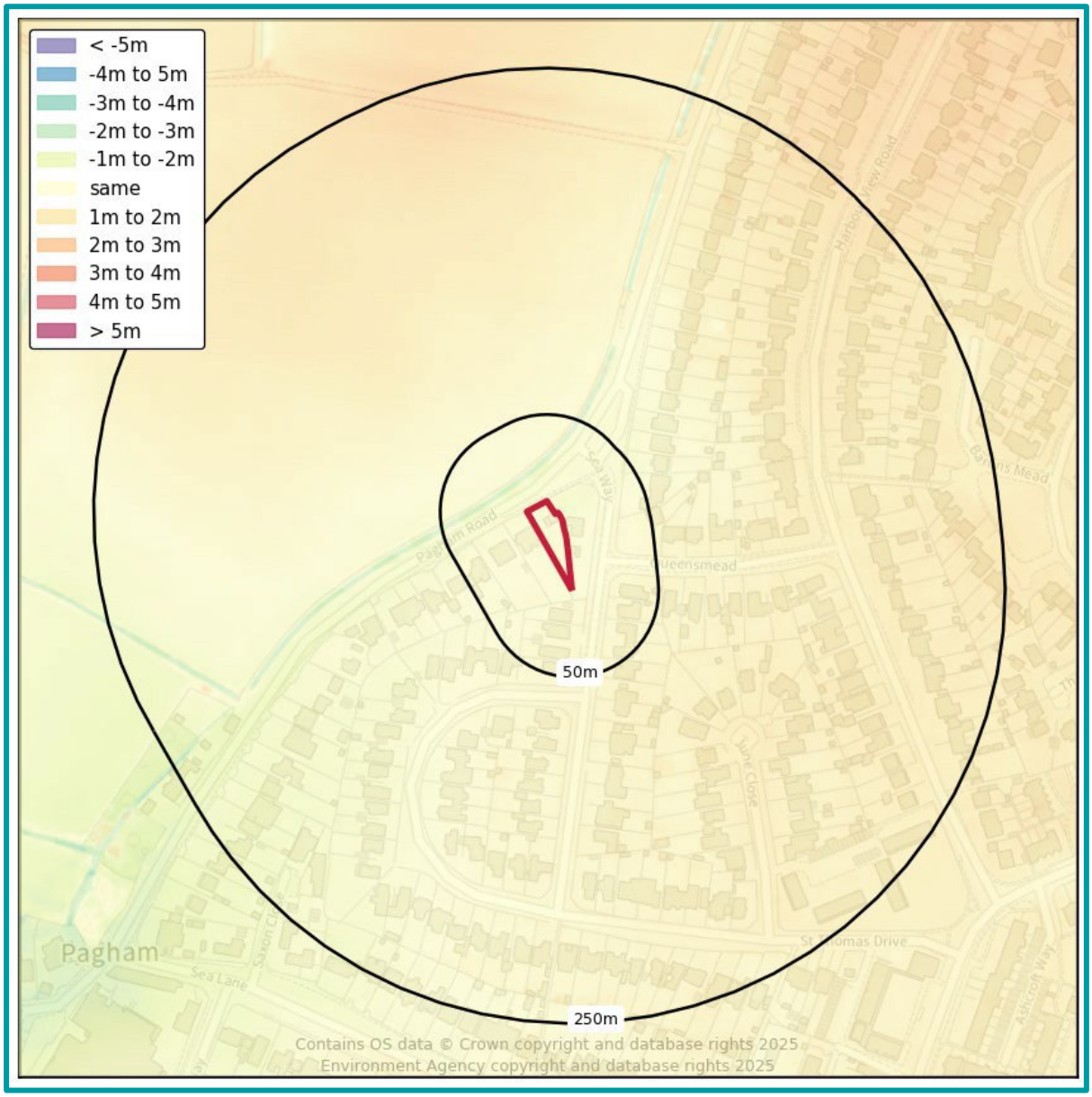


The GeoSmart SuDS Infiltration Suitability Map (SD50) screens the potential for infiltration drainage at the Site and indicates where further assessment is recommended. The map combines information on the thickness and permeability of the underlying material and the depth to the high groundwater table. It supports conceptual Site drainage design and the planning of further Site investigation.

There is a Moderate potential for infiltration SuDS across the Site. It is likely that the underlying geology at the Site has variable permeability and an infiltration SuDS scheme should be possible at the Site.

There is insufficient information to confirm the depth to groundwater at the Site and as such a Site Investigation is recommended to confirm the infiltration capacity and the depth to groundwater. Various options can be considered for infiltration SuDS and these include infiltration trenches, soakaways, swales and permeable pavements.

Figure 4. Site topography (GeoSmart, 2025)

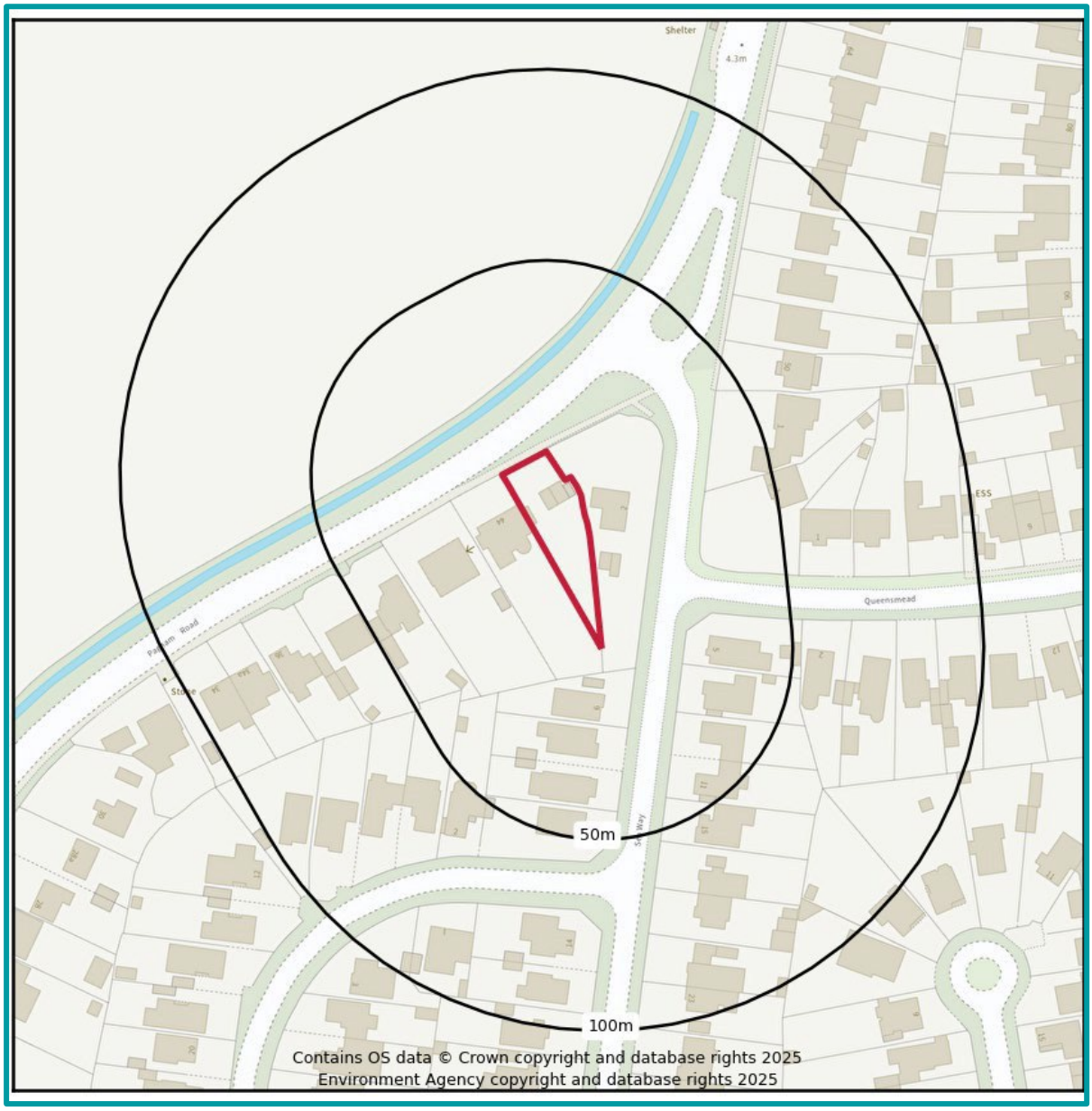


An assessment of the topography at the Site has been undertaken using LiDAR DTM5 elevation data to identify the general slope and any localised depressions. The mapping shows a comparison between average ground levels on the Site with ground levels in the surrounding area. The mapping confirms the overall Site is on a gradual slope, falling to the northwest towards a nearby watercourse.

Further analysis could be undertaken by visiting the Site or by collecting additional topographic survey to provide further confirmation of ground levels.

[redacted]

Figure 5. Source protection zone map (EA, 2025)

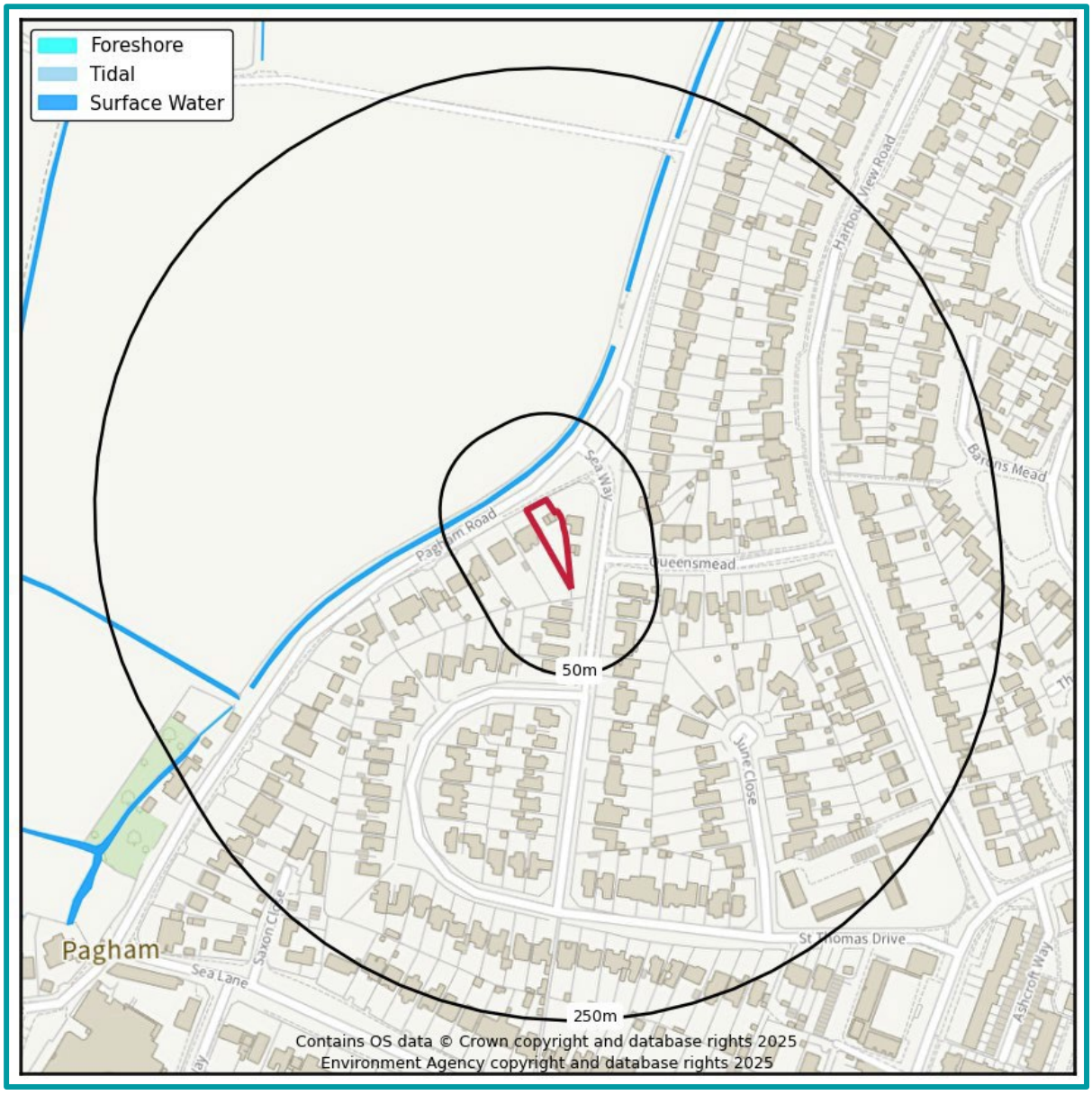


An assessment of the EA's groundwater Source Protection Zones (SPZs) has been undertaken within the vicinity of the Site and confirms the Site is not located within an SPZ.

Infiltration, if possible, is likely to be acceptable providing 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. If hazards are identified, it is recommended that the Local Authority and the Environment Agency are contacted to confirm the susceptibility of any SPZs within the wider area.

Figure 6. Surface water features map (EA, 2025)



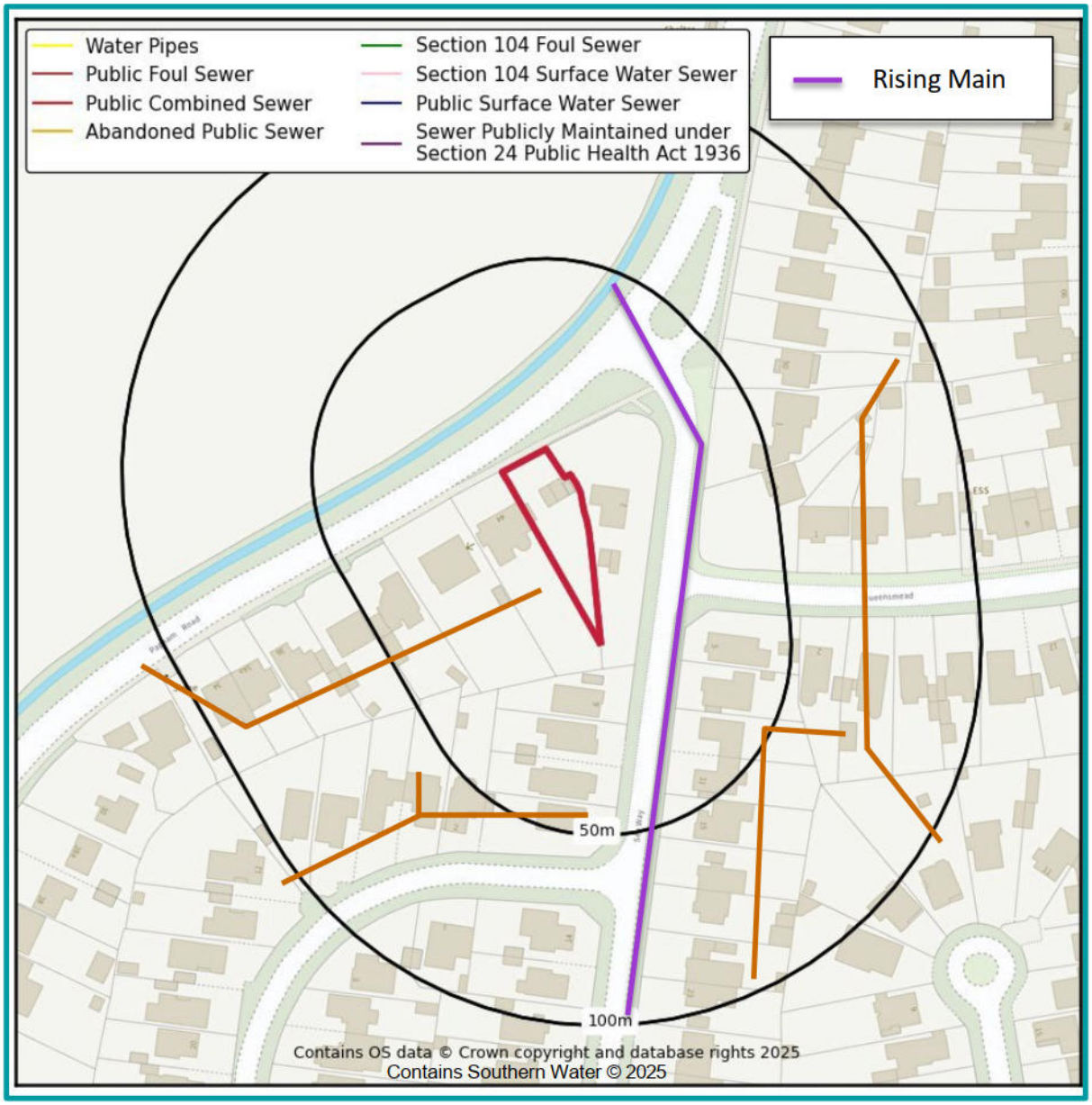
OS mapping indicates a surface water feature (a minor unnamed watercourse) is located c. 15 m north of the Site. The feature is located within close proximity to the Site however would require drainage pipework to cross third-party land. Given the close proximity, discharge into this feature has the potential to be feasible but should be carefully considered.

According to DEFRA's Magic Map, the Site is not within 250m of a SSSI or SPA.

Further analysis could be undertaken by visiting the Site or by contacting the Local Council and the Environment Agency (EA) to confirm the presence, location and condition of any mapped or additional unmapped surface water features.

[redacted]

Figure 7. Sewer features map (OS & Southern Water, 2025)

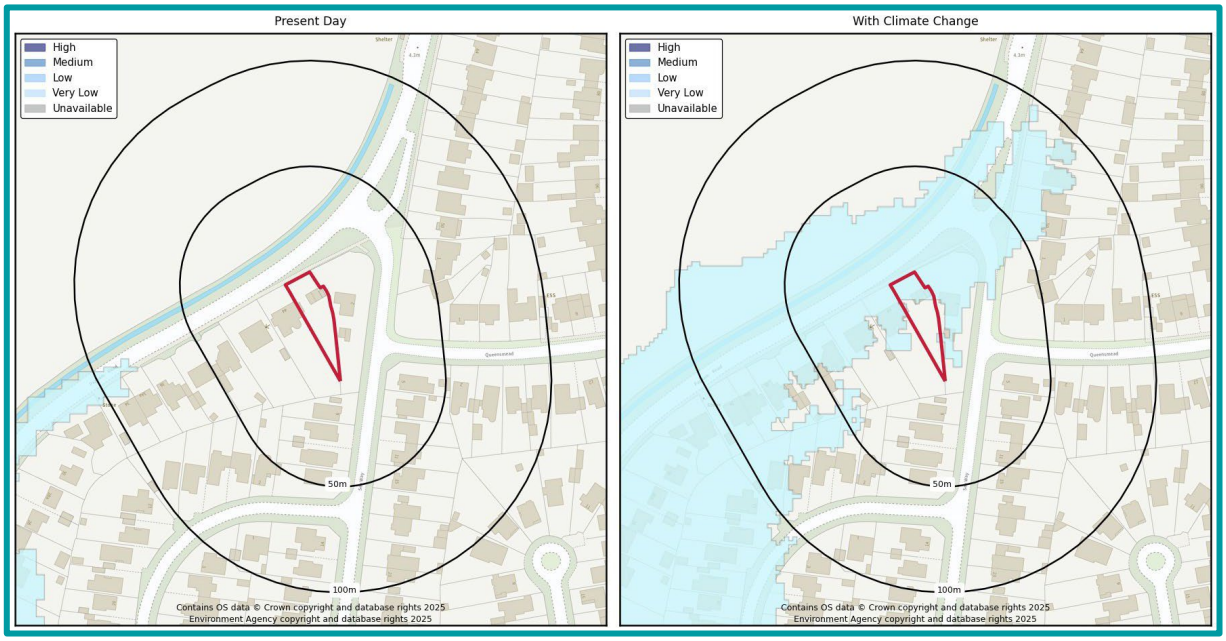


GeoSmart has undertaken an assessment of the location of sewer features within the vicinity of the Site. According to the asset location plan undertaken at the Site (Appendix C), there are no public surface water sewer or combined sewers located within the vicinity of the Site. A foul sewer is located adjacent to the Site boundary but is unlikely to be acceptable in line with national and local policy.

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.

[redacted]

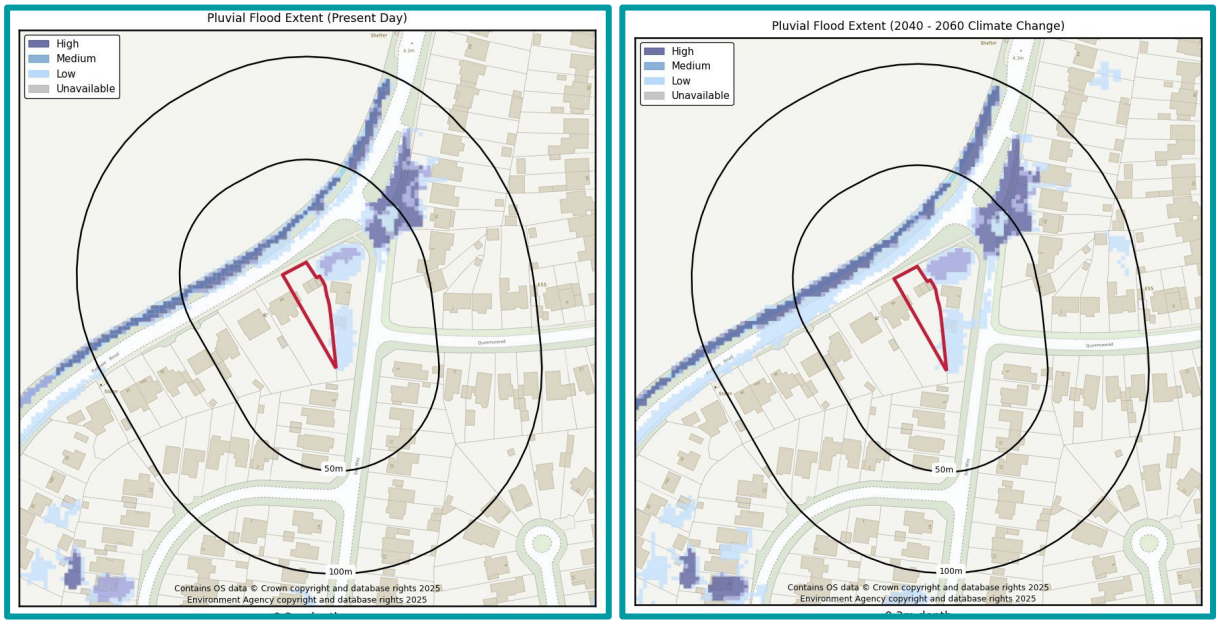
Figure 8. Risk of flooding from rivers & sea map (EA, 2025)



According to the EA's Risk of Flooding from Rivers and the Sea (RoFRS) map, the site is shown to be outside all modelled areas of flood risk in the present-day scenario, with an annual probability of flooding of less than 0.1%. Taking into account the effect of climate change (2036 – 2069), the Site is mapped as at Very Low risk of flooding.

[redacted]

Figure 9. Risk of surface water flooding map (EA,2025)

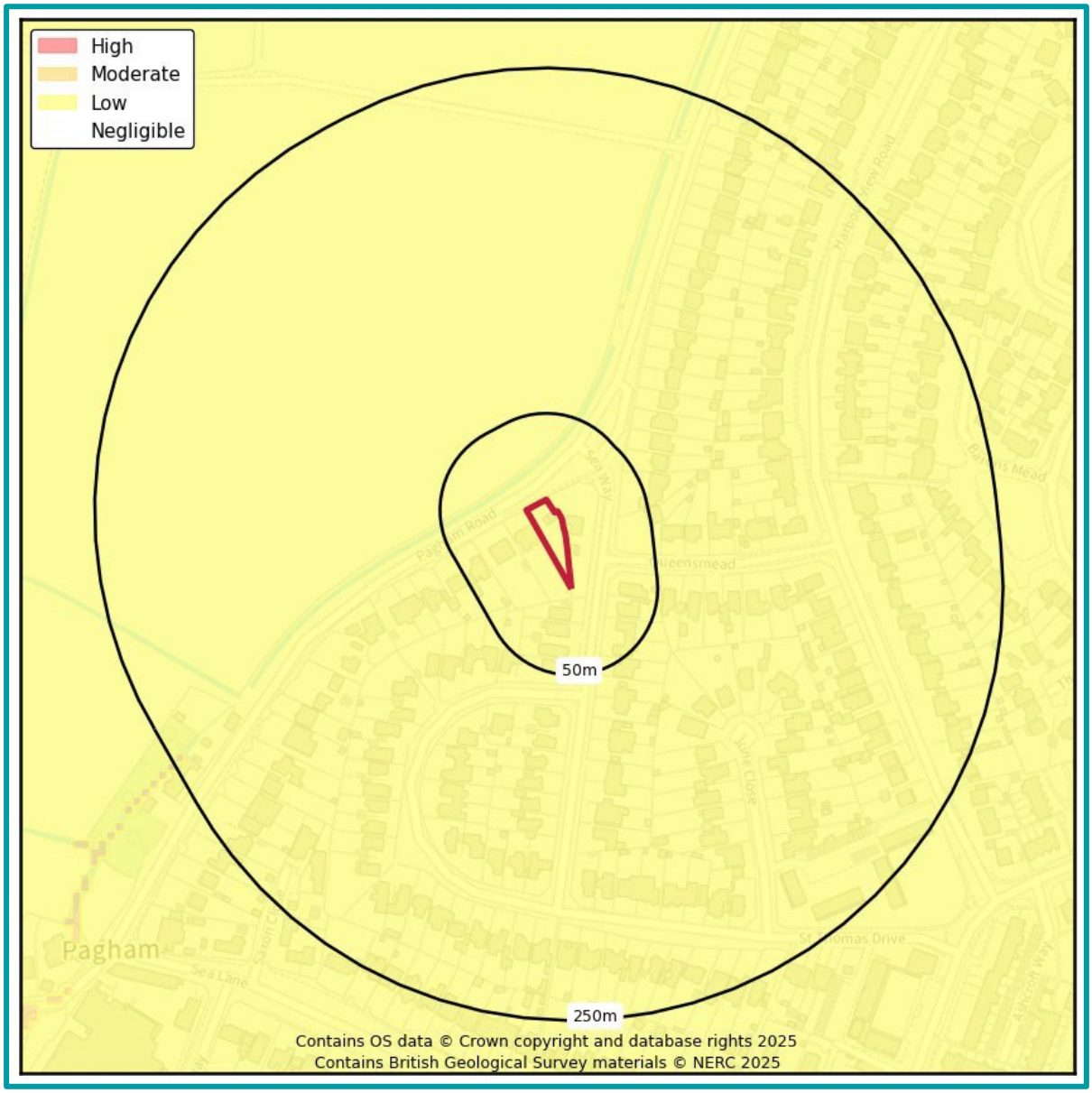


GeoSmart have undertaken an assessment of the risk of flooding from surface water (pluvial) sources within the vicinity of the Site using the EA's Risk of Flooding from Surface Water (RoFSW) mapping. The EA's mapping confirms the Site is considered to be at Very Low to Low risk of surface water flooding during a present day and future climate change (2050s epoch) event.

The above map shows the extent and depth of flooding during the >3.3% annual probability (AEP) (1 in 30 year – High risk), 3.3 – 1% AEP (1 in 100 year – Medium risk) and 1 – 0.1% AEP (1 in 1000 year – Low risk) events. This confirms there are areas where flooding could occur in a 1 in 1000 year event. Given the limited extent and depth of flooding, this is not deemed a significant constraint the use of SuDS in this area.

Further analysis could be undertaken by visiting the Site or by contacting the Local Council and the Environment Agency to confirm the pluvial flood risk, flood depths and velocities where applicable.

Figure 10. Groundwater flood risk (GW5) map (GeoSmart, 2025)



GeoSmart have undertaken an assessment of the risk of flooding from groundwater within the vicinity of the Site. GeoSmart's Groundwater Flood Risk Screening (GW5) map confirms the Site has a Low risk of groundwater flooding during a 1% annual probability (1 in 100 year) event.

The use of SuDS features may be constrained in areas where there is a High or Moderate risk of groundwater emergence.

[redacted]

4 Site context

Site information

The purpose of this report is to assess the potential for disposing of surface water through a Sustainable Drainage System (SuDS) for the site of 44 Pagham Road (the Site). The Site is located in a setting of residential use.

The land slopes to the north from 4.50 mAOD to 4.06 mAOD. This is based on EA elevation data obtained for the Site to a 1 m resolution with a vertical accuracy of ±150 mm.

Development

The Site is currently in use as a detached residential dwelling with associated access and landscaping. Development proposals comprise the demolition of the existing garage and the construction of a new 4-bedroom property in its place. Site plans and drawings are provided in Appendix A.

Geology, permeability and thickness

British Geological Survey (BGS) national superficial and bedrock geology mapping confirms the geological formations underlying the Site and each formation may have a range of permeability.

Table 3. Site Geology

Geology present on-Site		Potentially permeable?
Superficial geology (Figure 11)	River terrace deposits (RTDU) – sand silt and clay	✓
Bedrock geology (Figure 12)	London Clay (LC)	X

The BGS website was used to extract ground information from the nearest borehole records to the Site however there are no relevant boreholes within 500m of the Site to confirm the underlying geology or depth to groundwater.

Figure 11. Superficial Geology (BGS, 2025)

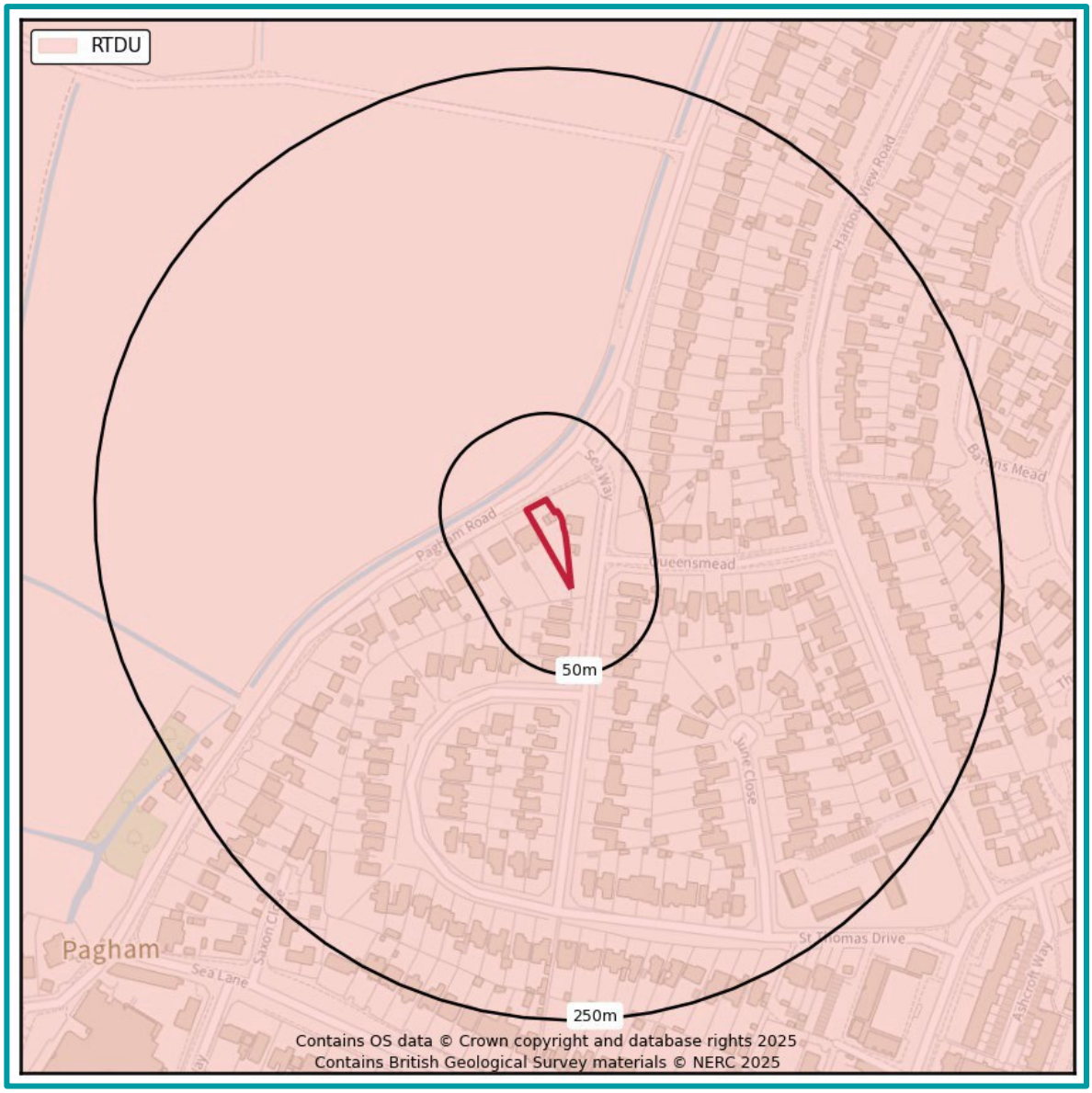
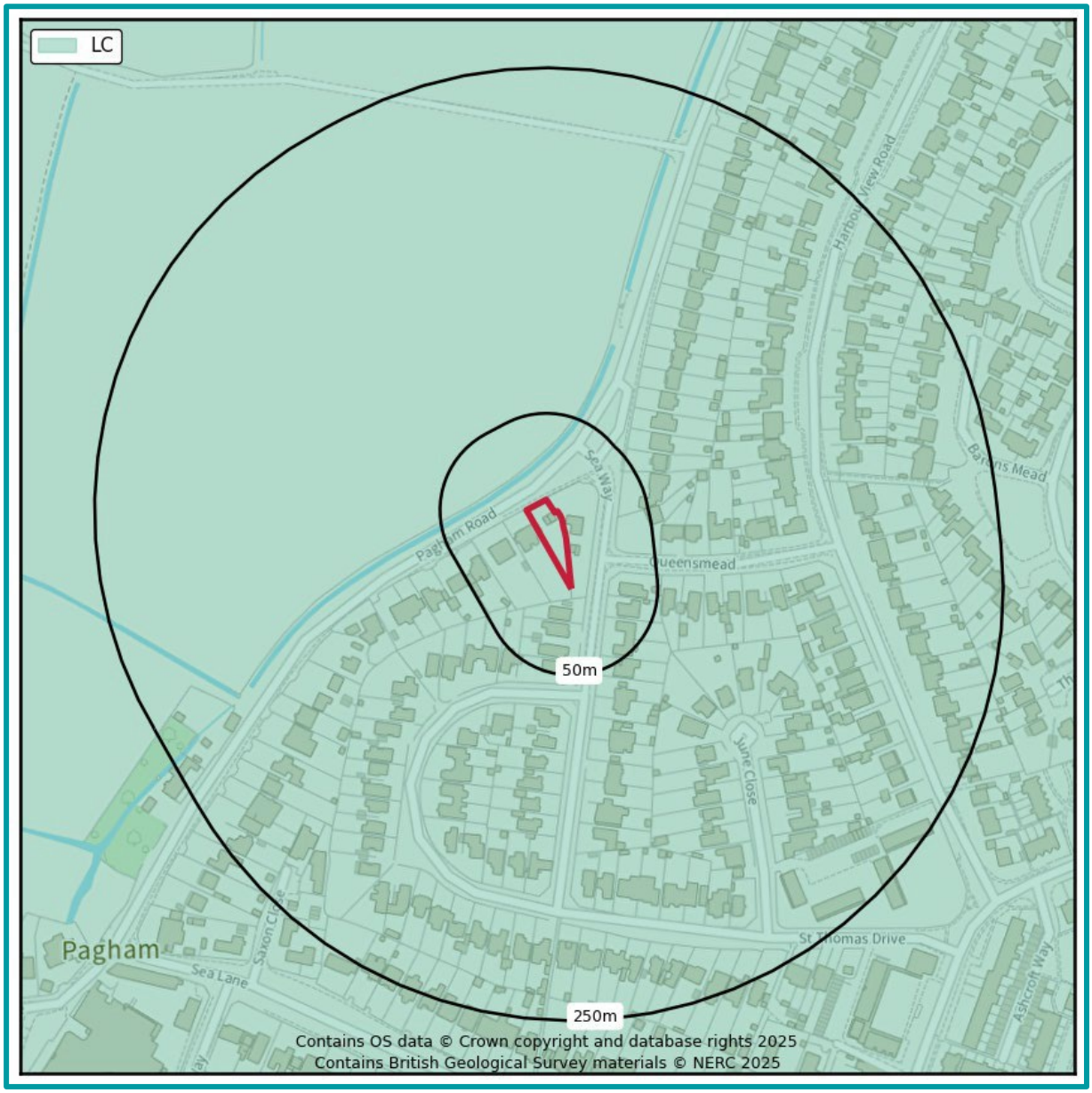


Figure 12. Bedrock Geology (BGS, 2025)



Depth to groundwater

The SuDS system should be designed to operate in periods of extreme groundwater levels.

Relevant borehole/trial pit records were not available within the vicinity of the Site to confirm the groundwater level however given the Site is in close proximity to a watercourse, is underlain by permeable superficial deposits above low permeability bedrock there is potential for a shallow “perched” water table beneath the Site which could constrain the use of infiltration SuDS, which is likely to be in hydraulic continuity with the minor watercourse during flooding events.

[redacted]

GeoSmart's GW5 map identifies the Site as at Low risk during a 1 in 100-year event, however, the risk of flooding is higher for buried services, and the use of infiltration features should be carefully considered following infiltration testing and groundwater monitoring.

The soil infiltration coefficient must be sufficient to accommodate the constraints on the dimensions of the soakaway and its emptying time.

Ground conditions

A Site-specific review of underlying ground conditions is recommended to ensure focused infiltration does not cause ground instability as a result of landslide or collapse associated with dissolution or shallow mining. Hazards that should be considered include soluble rocks, landslides, compressible ground, collapsible ground, shrink-swell clays, running sand and shallow mining.

Soakaways should be a minimum of 5m away from the foundations of a building and local guidance may recommend a greater distance, such as 10m on some areas of the Chalk. A detailed ground assessment is recommended: on steep slopes where infiltrating water would produce saturation and instability downslope; or within layered geology, where infiltrating water would produce springs down gradient.

Water quality

The Site does not lie within an SPZ. The infiltrated water quality should be of sufficient quality that it does not give rise to pollution of the underlying groundwater. Further consultation with the water company is unlikely to be required.

5 National & local policy context

National Guidance

DEFRA - National standards for sustainable drainage systems (SuDS) (2025)

Standard 1: runoff destinations

A 'SuDS approach' shall be adopted to address the management of surface water by the development and where it should be discharged. Runoff 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.

Runoff 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

Note 1: priority 1 is the highest priority and priority 5 is the lowest.

Note 2: for the purposes of this standard, a combined sewer is a sewer intended to receive both foul sewage and surface runoff and does not include a sewer intended to receive only foul sewage, even if it has the capacity to accommodate additional flows or has an element of surface water in it already.

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.

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

Standard 2: management of everyday rainfall (interception)

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

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

Standard 3: management of extreme rainfall and flooding

A 'SuDS approach' shall be adopted to address the management of development runoff 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

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

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

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

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

Any flooding from off-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.

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

Standard 4: water quality

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

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.

Standard 5: amenity

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

Standard 6: biodiversity

A 'SuDS approach' shall be adopted to ensure the surface water drainage system maximises biodiversity benefits throughout the development lifecycle.

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

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

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.

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.

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.

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.

Urban Creep

Within developments an urban creep uplift factor shall be applied by adding a percentage increase to the calculated area of the impermeable area within the property curtilages. This shall be 10% for all developments unless there are no external private permeable spaces, for example, flats and apartments, when it shall be 0%.

Ministry of Housing, Communities & Local Government – National Planning Practice Guidance: Flood risk assessments: climate change allowances (2022)

The Peak rainfall intensity allowances section provides advice on the increased rainfall effects on river levels and land and urban drainage systems. As of May 2022, the applicable climate

change allowance is defined by specific Management Catchment for the 1 in 30 (≥ 3.3% AEP) and 1 in 100 (< 3.3 to 1% AEP) year event.

As the Site is located within the Arun and Western Streams Management Catchment the following climate change allowances are applicable.

Table 4. Arun and Western Streams Management Catchment peak rainfall allowances

Arun and Western Streams Management Catchment	3.3% Annual exceedance rainfall event		1% Annual exceedance rainfall event	
	2050s	2070s	2050s	2070s
Central	20%	25%	20%	25%
Upper end	35%	40%	45%	45%

The drainage system should be designed to make sure there is no increase in the rate of runoff discharged from the Site for the upper end allowance.

Where on-Site flooding for the upper end allowance presents a significant flood hazard (for example, depths and velocities of surface water runoff cause a significant danger to people), you will need to take further mitigation measures to protect people and property (for example, raising finished floor levels). As a minimum, there should be no significant flood hazard to people from on-Site flooding for the central allowance.

Local Guidance

Arun District Council – Surface Water Drainage Design Guidance (2025)

Any infiltration drainage design must be supported by adequate winter groundwater monitoring data to determine the highest winter groundwater table. Residential developments of five properties or more will require groundwater monitoring to be carried out between October and March inclusive. The extent of monitoring required for smaller developments will be subject to agreement with our engineers but will need to capture likely peak groundwater levels during the winter period. This is likely to be during January or February but is dependent on certain factors, including the weather up to that point.

A freeboard of at least 1m should be provided between the base of an infiltration structure and the highest recorded groundwater level identified in that location.

Suitable water treatment is required upstream to the point of discharge in all circumstances to minimise any groundwater pollution risk or detriment to the drainage network.

Infiltration rates for soakage structures are to be based on infiltration tests undertaken at an agreed time during the winter period and at the location and depth of the proposed structures. The infiltration test depth is also dependent on the peak groundwater levels recorded at that location, ensuring that the test depth does not exceed the depth to the peak

groundwater level recorded. The infiltration tests must be carried out in accordance with BRE 365, CIRIA R156 or a similar approved method.

For the design, the infiltration rate must be applied to the sides of the infiltration structure only and the rate for the base must be zero, unless otherwise agreed. For infiltration basins or permeable pavements, the percolation rate is generally applied to the base only.

All design storms must include a climate change allowance, as per the climate change allowances website, on stored volumes or rainfall intensity. All major applications must also include a 10% allowance for urban creep applied to the design. Infiltration structures must cater for the critical 1 in 10 year storm event, (plus 40%) between the invert of the entry pipe to the soakaway and the base of the structure. The design must also have provision to ensure that there is capacity in the system to contain the critical 1 in 100 year storm event (plus 45%) on site.

The infiltration design should also drain 50% of its total volume in 24 hours or less for the 1 in 10 (plus 40%) critical storm event and also the 1 in 100 year (plus 45%) critical storm event if possible, to provide spare capacity for subsequent storms.

Discharge to a watercourse or surface water sewer must be restricted to the estimated mean greenfield runoff rate (Q_{bar}) or 2 l/s/ha, depending on which is higher, for all design storm events. Where a higher discharge rate is proposed this must be justified and agreed with us. The calculations must be based on the positively drained area, rather than the entire greenfield site area. Runoff rates can be derived from IH124 or a similar approved method.

For brownfield sites, the same criteria applies. If it is deemed that this is not achievable, evidence must be provided and flow should be restricted to as close to Q_{bar} as possible. Betterment must be achieved. The level of betterment that is provided must be agreed if the proposed runoff rate is higher than Q_{bar}.

Satisfactory blockage mitigation measures must be specified where flow rates are restricted below 2l/s.

The storage design must include a climate change allowance, as specified in the 'Infiltration Drainage Design' above.

Any storage design must be submitted with winter groundwater monitoring data and where applicable, floatation calculations, to ensure there will be no detrimental effect on the structure or storage.

[redacted]

6 Storage, volume and peak flow rate

Suggested minimum and aspirational storage requirements for an infiltration or attenuation SuDS scheme for the development footprint are set out below, with more detail provided in subsequent sections. Storage volumes may be reduced (but not below the minimum level) if the design incorporates off-Site discharge.

Table 1. Primary strategy - Storage requirements for the proposed development (discharge of runoff via infiltration)

Attenuation scenario	Attenuation required (m^3)	Explanation
1 in 100 year including 45% CC	8.54*	Attenuation required to ensure surface water runoff is attenuated in all storm events up to and including the 1 in 100 year event including a 45% allowance for climate change. Calculations are based on an assumed infiltration rate of 1x 10^{-5} m/s (0.036 m/hr) (the worst-case infiltration rate for 'slightly silty, slightly clayey sand' soil types, taken from Table 25.1 of the CIRIA SuDS manual (C753) (2015) – to be confirmed via infiltration testing).

*Subject to confirmation through infiltration testing.

[redacted]

Table 2. Storage requirements at the proposed development Site (Discharge runoff to watercourse

Attenuation scenario		Attenuation required (m^3)	Explanation	
Discharge runoff to watercourse	1 in 30 year	1.75	Attenuation required to ensure surface water runoff is attenuated in all storm events up to and including the 1 in 30 year (0.25 hour, Critical Storm Duration) event*. Flooding of the Site of 0.89 m^3 should be contained within permeable landscaped areas within the Site to ensure no flooding of internal areas during the 1 in 100 year storm event.	A further 2.30 m^3 should be managed within overland flow routes to ensure there is no increase in flood risk in all events up to the 1 in 100 year including 45% allowance for climate change.
	1 in 100 year	2.64	Attenuation required to ensure surface water runoff is attenuated in all storm events up to and including the 1 in 100 year (0.25 hour, Critical Storm Duration) event*.	
	1 in 100 year including 45% CC	4.93	Attenuation required to ensure surface water runoff is attenuated in all storm events up to and including the 1 in 100 year (0.50 hour, Critical Storm Duration) event including a 45% allowance for climate change*.	

*See Appendix B for associated runoff and discharge calculations. Discharge rates all restricted as close as possible to greenfield rates in their respective events.

[redacted]

Surface water runoff

An increase in impermeable area on-Site will result in greater rainfall runoff. Reduction in runoff will help mitigate flood risk both on and off-Site. Further information on the surface water runoff calculations is provided in Section 12 'Background Information'.

Guidance

The Non-Statutory Technical Guidance for SuDS (Defra, March 2015) states:

"Where reasonably practicable, for Greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the Greenfield runoff volume for the same event. Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the Greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event."

Table 3. Change in impermeable area associated with the development

Total Site area	510 m^2
Impermeable area (and as a percentage of the total area of the proposed development footprint of 510 m^2)	
Pre-development	Post-development
145 m^2 (17%)	176 m^2 (21%)*
Impermeable land use: Commercial office, car park Permeable land use: landscaped areas	New impermeable land use: 130 m^2 new residential dwelling New permeable land use: landscaped areas, permeable parking areas**

*Please note this includes an additional 10% increase in impermeable areas in line with urban creep policy in line with the new non-statutory SuDS standards (2025). **Whilst these areas will be utilised for SuDS they have been classified as impermeable to assess the total runoff from the Site during the secondary strategy only (see associated calculations in Appendix B). In the primary strategy, these areas will drain themselves.

Guidance

"The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event' and 'flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development"

[redacted]

(Defra, June 2025, non-statutory guidance).

Peak discharge rates

The table below presents peak discharge rates for a range of storm events used to assess the impact of the proposed development and select the maximum permitted discharge rate. Further information on the calculation and control of peak discharge rates is provided in Section 12 'Background Information'.

Table 4. Peak discharge rates associated with the development

Rainfall event	Greenfield runoff rates (l/s)	Existing runoff rates[1] (l/s)	Potential runoff rates without attenuation (l/s)	Potential minus existing (l/s)
QBAR	0.15	N/A	N/A	N/A
6 hour 1 in 1 year	0.13	0.33	0.35	0.02
6 hour 1 in 10 year	0.25	0.52	0.55	0.04
6 hour 1 in 30 year	0.35	0.65	0.70	0.05
6 hour 1 in 100 year	0.49	0.81	0.87	0.06
6 hour 1 in 100 year + 20% CC	N/A	N/A	1.04	0.23
6 hour 1 in 100 year + 45% CC	N/A	N/A	1.26	0.45

[1] Assumes 100% runoff from impermeable surfaces. Assumes Greenfield runoff from permeable surfaces calculated using the IoH124 method.

Relevant national, regional and local planning policy has been consulted in Section 5 to determine restrictions on runoff from previously developed and greenfield sites. In some cases, greenfield rates may be requested, but in practice it is difficult to restrict discharge rates at any one control point to less than 2 l/s, without increasing the risk of any potential blockages occurring in the drainage network.

Total discharge volumes

The table overleaf presents discharge volumes for a range of storm events used to assess the impact of the proposed development and calculate the required storage volumes. Further information on the calculation of total discharge volumes is provided in Section 11 'Methodology and Limitations'.

Table 5. Total discharge volumes associated with the development

Rainfall event	Greenfield runoff volume (m^3)	Existing runoff volume[2] (m^3)	Potential runoff volume without attenuation (m^3)	Potential minus existing (m^3)
QBAR	5.11	N/A	N/A	N/A
6 hour 1 in 1 year	4.83	7.16	7.66	0.50
6 hour 1 in 10 year	7.66	11.20	11.96	0.76
6 hour 1 in 30 year	9.53	14.14	15.13	0.99
6 hour 1 in 100 year	11.83	17.55	18.77	1.22
6 hour 1 in 100 year + 20% CC	N/A	N/A	22.53	4.98
6 hour 1 in 100 year + 45% CC	N/A	N/A	27.22	9.67

[2] Assumes 100% runoff from impermeable surfaces. Assumes Greenfield runoff from permeable surfaces calculated using the IoH124 method.

Critical storm duration and volume requirements

Storage volumes for a range of return periods including the 1 in 30 year, 1 in 100 year and 1 in 100 year plus climate change (45%) events have been calculated to assess the impact of the proposed development. The required storage volumes for attenuation features have been calculated for the critical storm durations, limited to a maximum discharge rate of 2 l/s.

Table 6. Critical Storm Duration and Attenuation volume requirements

Return Period	Runoff rate restriction (l/s)	Critical Storm Duration (hr)	Attenuation volume required (m^3)
1 in 30 year	2	0.25	1.75
1 in 100 year	2	0.25	2.64
1 in 100 year including a 45% climate change	2	0.50	4.93

[redacted]

7 Runoff destination

National Standard 1: runoff destinations

Options for the destination for the runoff generated on-Site have been assessed in line with the prioritisation set out in DEFRA's national standards for sustainable drainage systems (2025).

Priority 1: Collection for non-potable use

An assessment of the potential for rainwater collection and re-use across the proposed development has been undertaken, which confirms that there is the potential for the provision of rainwater harvesting measures at the Site. Captured water could be used to water vegetation in order to provide additional amenity and biodiversity benefits.

Priority 2: Discharge to ground

There are no known issues identified relating to Site contamination or the presence of a SPZ.

According to GeoSmart's SD50 screening data, the Site has Moderate potential for infiltration. Based on the available hydrogeological information (Section 5) the permeability of the underlying strata cannot be reliably quantified using the available geological information, however, shallow groundwater may be a concern at the Site.

A site investigation comprising trial pits is recommended to confirm the depth to groundwater and allow infiltration tests to be undertaken to confirm the feasibility of an infiltration SuDS scheme.

Priority 3: Discharge to above ground surface water body

According to OS mapping, a surface water feature is located c. 15 m to the north of the Site boundary. The feature is located within close proximity to the Site however would require drainage pipework to cross third-party rural land; as such, discharge of runoff to this feature is considered to be feasible.

If Site investigation proves on-Site infiltration is not possible, then off-Site discharge with flow attenuation and storage may be a suitable alternative option.

Access would need to be arranged, and the outfall would be subject to river level and flood conditions. A flow control device would be required to limit peak discharge rates to the maximum selected rate as indicated in Section 7, along with the appropriate attenuation storage volume.

Priority 4: Discharge to surface water sewer

According to the Southern Water asset location plan obtained for the Site (Appendix C), there are no public surface water sewers within the vicinity of the Site.

Priority 5: Discharge to combined sewer

According to the Southern Water asset location plan obtained for the Site (Appendix C), there are no public combined sewers within the vicinity of the Site.

8 Water quality

A key requirement of any SuDS system is that it protects the receiving water body from the risk of pollution. This can be effectively managed by an appropriate "train" or sequence of SuDS components that are connected in series. The frequent and short duration rainfall events are those that are most loaded with potential contaminants (silts, fines, heavy metals and various organic and inorganic contaminants). Therefore, the first 5-10 mm of rainfall (first flush) should be adequately treated with SuDS.

The minimum number of treatment stages will depend on the sensitivity of the receiving water body and the potential hazard associated with the proposed development SuDS Manual (CIRIA, 2015). The proposed development is a combination of Very Low (roof water) to Low hazard (runoff from car parking and road). The Site does not lie within an SPZ and therefore additional treatment stages are not required.

Table 7. Level of hazard

Hazard	Source of hazard
Very Low	Residential roof drainage
Low	Residential, amenity uses including low usage car parking spaces and roads, other roof drainage.
Medium	Commercial, industrial uses including car parking spaces and roads (excluding low usage roads, trunk roads and motorways).
High	Areas used for handling and storage of chemicals and fuels, handling of storage and waste (incl. scrap-yards).

The recommended minimum number treatment stages suggested for the different runoff waters identified for the proposed development is highlighted in the table below.

Table 8. Minimum number of treatment stages for runoff

		Sensitivity of the receiving water body		
		Low	Medium	High
Hazard	Low	1	1	1
	Med	2	2	2
	High	3	3	3

9 Proposed SuDS strategy

Primary SuDS Strategy:

If Ground conditions at the Site are conducive to infiltration, surface water runoff will be managed within SuDS features and infiltrated to ground.

Table 9. Proposed SuDS type, features, discharge location and rate restriction

SuDS type	Source control (interception) and infiltration SuDS.
SuDS features	Rainwater harvesting, permeable paving and a soakaway
Discharge location	Infiltration to ground
Infiltration rate	1 x 10^{-5} m/s (worst case infiltration rate taken from Table 25.1 of the CIRIA SuDS manual C753).

Table 10. Proposed SuDS sizing (dimensions) and attenuation volumes

Rainwater harvesting	Rainwater harvesting butts should be established for the proposed development. In terms of attenuation storage within this SuDS scheme, the volume of run-off which could be attenuated by rainwater harvesting has not been considered within the Preliminary SuDS strategy.
Permeable paving	A 30 m^2 area of permeable paving is proposed as part of the parking areas in the north of the Site. These areas will effectively drain themselves and their attenuation has not been considered within the primary SuDS schematic.
Soakaway	A soakaway located in the rear garden with dimensions 4m x 6m x 0.4m and a void ratio of 95% will attenuate a minimum of 9.12m^3 prior to infiltrating to ground. It should be noted that the soakaway has been designed as shallow as possible to reduce the risk of groundwater interacting with the proposed soakaway, subject to confirmation via winter groundwater monitoring.
Total attenuation provided	9.12 m^3
Total attenuation required	8.54 m^3

[redacted]

Soakaways

Soakaways are square or circular excavations either filled with rubble or lined with brickwork, pre-cast concrete or polyethylene rings/perforated storage structures surrounded by granular backfill. The supporting structure and backfill can be substituted by modular or geocellular units. The base of the infiltration features should lie at an elevation at least 1 m above the highest winter groundwater levels, to ensure there is sufficient space for surface water to discharge. Soakaway excavation should be outside of the root zone of any protected trees and dimensions will depend on the depth to the sand layer where the soakaway is eventually situated.

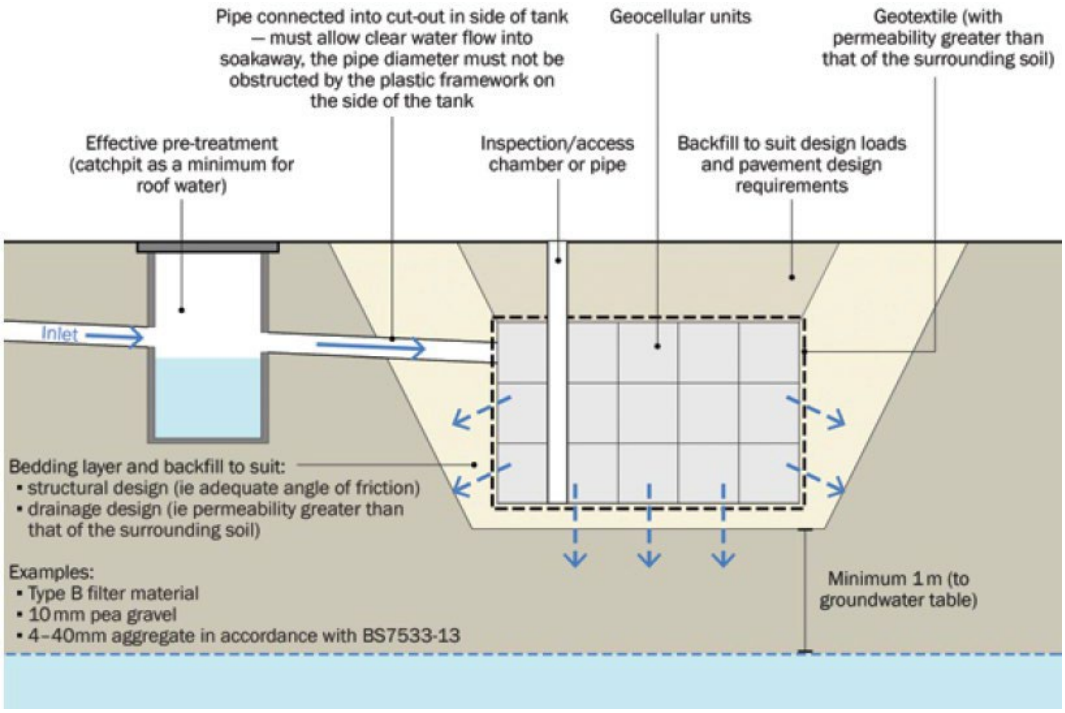


Figure 13.1 of the CIRIA SuDS Manual (C753) (2015)

Secondary SuDS Strategy:

If Infiltration to ground is not achievable at the Site, therefore surface water runoff will be managed within SuDS features and discharged to the water feature identified.

Table 11. Proposed SuDS type, features, discharge location and rate restriction

SuDS type	Source control (interception) and attenuation SuDS.
SuDS features	Rainwater harvesting and lined permeable paving (geo-cellular)
Discharge location	Surface water feature
Discharge rate	2 l/s

Table 12. Proposed SuDS sizing (dimensions) and attenuation volumes

Rainwater Harvesting	Rainwater harvesting butts should be established for the proposed development. In terms of attenuation storage within this SuDS scheme, the volume of run-off which could be attenuated by rainwater harvesting has not been considered within the Preliminary SuDS strategy.
Lined permeable paving	A 30 m^2 area of permeable paving (underlain with a geocellular crates) within the proposed driveway areas to a depth of 0.30 m, with a 95% porosity would result in c. 8.55 m^3 attenuation.
Total Attenuation Provided	8.55 m^3
Total Attenuation Required	4.93 m^3
Freeboard Storage Provided	3.62 m^3

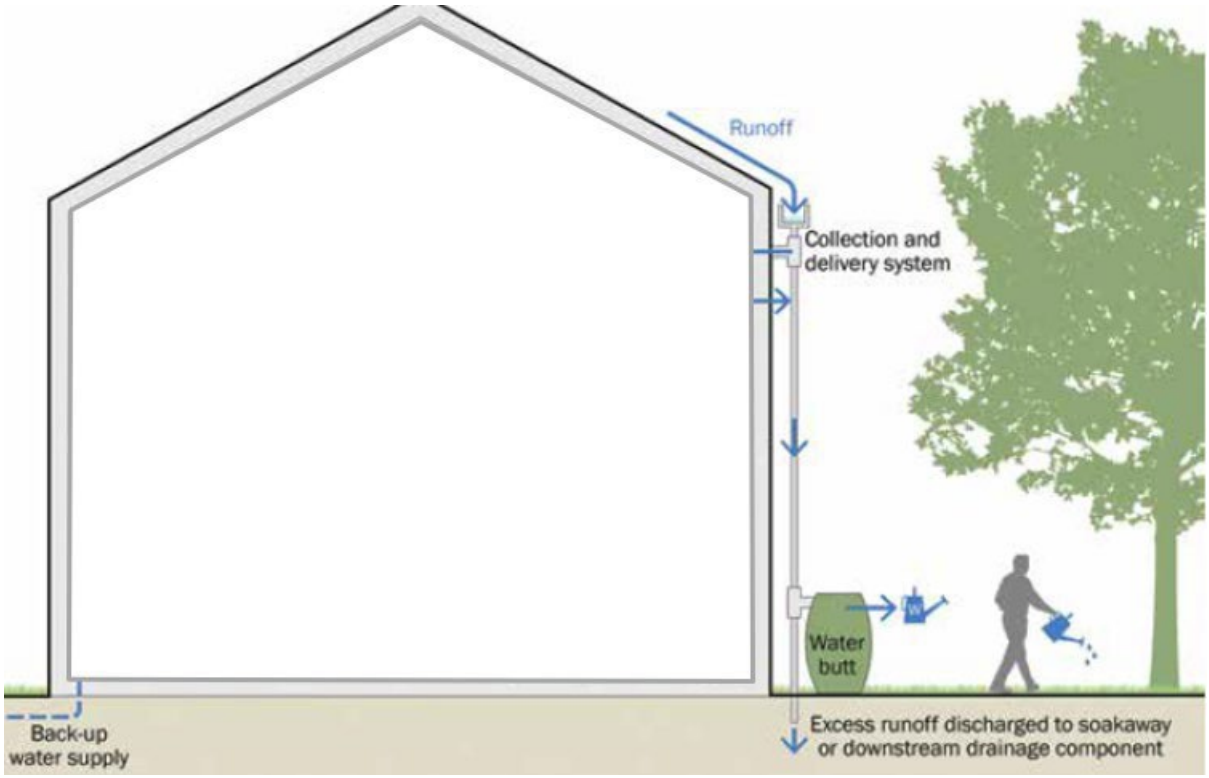
Rainwater harvesting

A rainwater harvesting butt is proposed. The run-off from the proposed development roof should be led into rainwater harvesting butts via rainwater downpipes and guttering to catch run-off from the extension roof. Overflow from the butts should be discharged into the storage system provided by the permeable paving.

Due to the relatively insignificant amounts of attenuation provided by rainwater harvesting tanks in this instance and the requirement to retain water for non-potable uses such garden maintenance, the volume of run-off which could be attenuated by rainwater harvesting has not been considered within the report.

As there is an issue with the storage capability of rainwater harvesting tanks, this method should have a fixed attenuation volume and a controlled outlet to discharge into the proposed SuDS feature. An overflow system will be required for implementation on the Site due to exceedance events (where the pumps fail or there is a blockage within the system / or the number of residents and subsequent water usage is reduced).

Roof run-off is generally less polluted than run-off from road surfaces but can still generate pollutants such as sediments. Pollutants would be captured by the collection and filtration system and, by reducing the volume of run-off generated from the Site. Primary screening devices are used to prevent leaves and other debris from entering the butt and first flush devises can be designed to divert the first part of the rainfall away from the main storage tank and can pick up most of the dirt, debris and contaminates that collect on a residential roof.



Modified from Figure 11.3 of the CIRIA SuDS Manual (C753) (2015)

[redacted]

Permeable paving

Lined permeable paving is proposed for driveway areas to intercept runoff. The permeable paving would use plastic geo-cellular systems, which would provide increased void space and therefore storage. Void systems, such as permavoids, have a void ratio of 95% (i.e. for every 1 m^3 there is 0.95 m^3 of space available for water storage), which has been factored into the storage capacity calculations. Paving could also implement an impermeable liner close to the building or create a separate compartment within the permeable sub-base close to the building to further divert attenuated water away from building foundations.

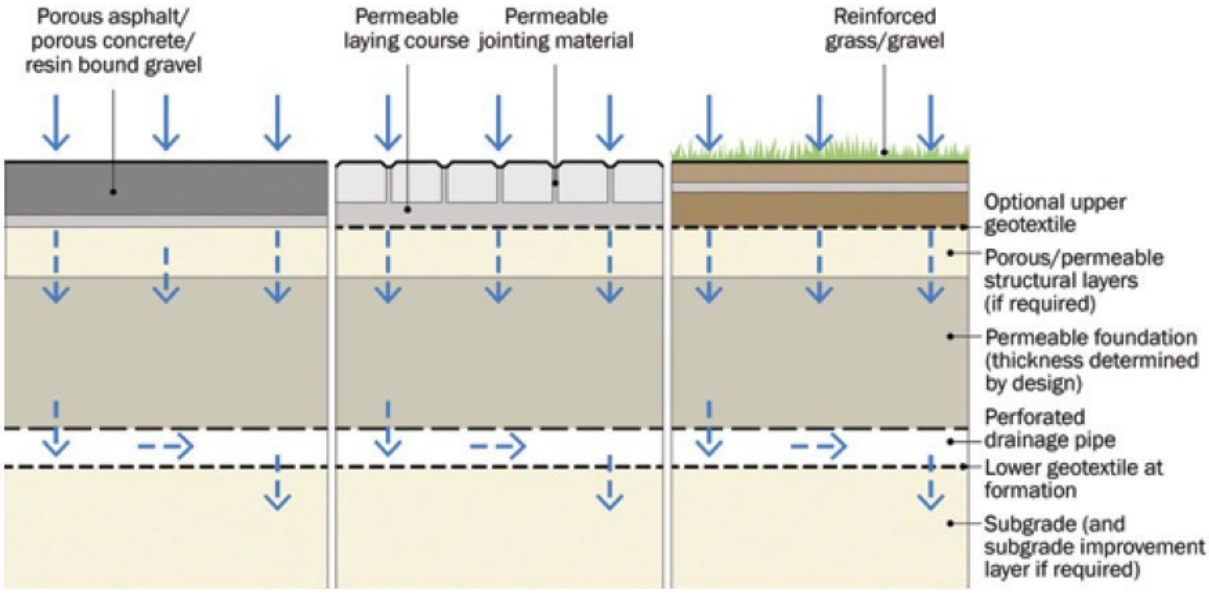


Figure 20.13 of the CIRIA SuDS Manual (C753) (2015)

Flow control devices and systems

Hydrobrake Flow control systems can be used to reduce the runoff rate from the Site. These are usually a device used for controlling water flow into a connecting feature, such as a sewer, to a specific attenuation performance. The design consists of an intake, a volute and an outlet and the configuration is critical to ensure discharge control. For drainage areas which are less than 3 ha, outlet throttle diameters would have to be small (<150mm diameter) to achieve outflow rates which could result in blockage. For most SuDS features, a flow control device will comprise a fixed orifice or a throttle such as a short pipe.

A Vortex Control is usually a self-activating vortex flow device which directs water into a volute to form a vortex. For the Site, rainwater down pipes from the development roof should drain directly into the attenuation feature to reduce infill from potential flood water.

Drainage protection devices

A non-return flap value is recommended for outflow pipes to reduce the risk of backflow from the channel during a large-scale rainfall event.

Exceedance Flows

Exceedance flow routes are included within the proposed SuDS drainage layout. Where possible, exceedance flows should be directed away from buildings and into non-essential areas of the Site such as the car park. The SuDS system recommended for the Site should provide enough storage that this method would only be utilised during a worst case scenario.

10 SuDS maintenance

Regular maintenance is essential to ensure effective operation of the SuDS features over the intended lifespan of the proposed development. The SuDS Manual (C753) (CIRIA, 2015) provides a maintenance schedule for SuDS with details of the necessary required actions as shown in the Table below.

Table 13. SuDS operation and recommended maintenance requirements

Asset type	Maintenance schedule (and frequency)
Soakaways	Regular maintenance: • Remove sediment and debris from pretreatment and inspection chamber. Clean gutters, filters, downpipes. Trim roots prevent blockages (annually). • Reconstruct/ clean if performance deteriorates, replace clogged geotextile (as required) Monitoring: • Inspect inlets/outlets, silt traps – note rate of accumulation (monthly). Check water levels and emptying time (annually).
Permeable pavements	Regular maintenance: • Brushing and vacuuming (three times per year). • Trimming any roots and surrounding grass and weeds that may be causing blockages (annually or as required). Monitoring: • Initial inspection (monthly). • Inspect for poor performance and inspection chambers (annually).
Hydro-Brake Flow Control	Low amounts of maintenance required as there are no moving parts within the Hydro-Brake® Flow Control. • Initial monthly inspection at the manhole once the construction phase is over. If blockages occur they normally do so at the intake. Hydro-Brake® Flow Controls are fitted with a pivoting by-pass door, which allows the manhole chamber to be drained down should blockages occur. Inspection should be undertaken annually or when a storm event occurs.
Underground drainage pipe network	Regular maintenance: • Remove sediment and debris from pre-treatment devices and floor of inspection tube or chamber (annually). • Cleaning of gutters and any filters on downpipes (annually).

[redacted]

Asset type	Maintenance schedule (and frequency)
	• Trimming any roots that may be causing blockages (annually or as required). Monitoring: • Inspect silt traps and note rate of sediment accumulation (monthly in the first year and then annually).
Rainwater Harvesting	Regular maintenance: • Inspection of tank for debris and sediment build up (annually and following poor performance). • Inspection of inlets, outlets, overflow areas, pumps and filters (annually and following poor performance). • Cleaning of tank, inlets, outlets, gutters, roof drain filters and withdrawal devices (annually or as required). Remedial actions: • Repair or overflow erosion damage or damage to tank and associated components (as required)
Geo-cellular storage	Regular maintenance: • Remove litter and debris from inlets and outlets (monthly). • Trimming any roots and surrounding grass blockages (as required). Monitoring: • Inspect inlets, outlets and overflows for blockages (monthly or after a heavy storm). • Inspect inlets and outlets for silt accumulation (half yearly). • Inspect infiltration surfaces for compaction and ponding (monthly).

Client checklist

A drainage strategy has been recommended as suitable on the basis of the information provided. Prior to installation of the Site drainage system it is recommended that the client carries out the following checks to confirm the development proposals. GeoSmart would be able to support with any updates required to the drainage scheme, please contact us and we would be happy to provide you with a proposal to undertake the work.

Table 14. Potential SuDS limitations

Conditions in Non-Statutory Technical Standards (Defra, 2015), limitations to infiltration SuDS	Do these conditions arise at the Site?
Is the surface runoff greater than the rate at which water can infiltrate into the ground?	

[redacted]

Conditions in Non-Statutory Technical Standards (Defra, 2015), limitations to infiltration SuDS	Do these conditions arise at the Site?
Is there an unacceptable risk of ground instability?	
Is there an unacceptable risk of mobilising contaminants?	
Is there an unacceptable risk of pollution to groundwater?	
Is there an unacceptable risk of groundwater flooding?	
Is the infiltration system going to create a high risk of groundwater leakage to the combined sewer?	

Table 15. SuDS design considerations

Confirm that potential flooding on-Site in excess of the design storm event and exceedance flow routes have been considered.	
Review options for the control of discharge rates (e.g. hydrobrake).	
Confirm the owners/adopters of the drainage system. Consider management options for multiple owners.	
Is there an unacceptable risk of pollution to groundwater?	
Review access and way leave requirements.	
Review maintenance requirements.	

Health and safety considerations for SuDS

GeoSmart reports may include outline strategies or designs to support with development plans. Any drawings or advice provided do not comprise any form of detailed design. Implementation of any conceptual scheme options may constitute 'Construction Work' as defined by CDM Regulations (2015).

The CDM Regulations place specific Health and Safety duties on those commissioning, planning and undertaking construction works. If you are uncertain what this means you should seek the advice of your architect, builder or other competent professional.

GeoSmart does not provide health and safety advisory services but we are required to advise you of your general responsibilities under CDM (visit http://geosmartinfo.co.uk/knowledge-hub/cdm-2015/ for more information).

Please remember that detailed design work should be undertaken by a competent professional who might be your engineer, architect, builder or another competent party.

11 Methodology and limitations of study

GeoSmart SuDS Infiltration Suitability Map (SD50)

The GeoSmart SuDS Infiltration Suitability Map (SD50) screens the suitability for infiltration drainage in different parts of the Site and indicates where further assessment is recommended. In producing the SuDS Infiltration Suitability Map (SD50), GeoSmart used data from the British Geological Survey on groundwater levels, geology and permeability to screen for areas where infiltration SuDS may be suitable. The map classifies areas into 3 categories of High, Medium and Low suitability for infiltration SuDS. This can then be used in conjunction with additional data on Site constraints to give recommendations for SuDS design and further investigation.

The primary constraint on infiltration potential is the minimum permeability of the underlying material and in some cases the range in permeability may be considerable, ranging down to low. The map classifies these areas as moderate infiltration suitability requiring further investigation. In cases where the thickness of the receiving permeable horizon is less than 1.5 meters then additional Site investigation is recommended. If the Site is at risk of groundwater flooding for up to the 1% annual occurrence the map classifies these areas as moderate infiltration suitability requiring further investigation.

The GeoSmart SuDS Infiltration Suitability Map (SD50) is a national screening tool for infiltration SuDS techniques but a Site specific assessment should be used before final detailed design is undertaken. Further information on the GeoSmart SuDS Infiltration Suitability Map (SD50) is available at geosmartinfo.co.uk

How is the suitability to discharge to sewers and watercourses calculated?

The suitability to discharge to discharge to sewers and watercourses has been calculated using the distance from the Site to both. For example, where the Site is within 50 m of a surface water body. Discharge to surface water is potentially appropriate subject to land access arrangements and a feasibility assessment. Where the Site is within 50 m of a sewer, discharge to sewer is potentially appropriate subject to land access arrangements and a feasibility assessment. The utility company should be contacted to agree connection feasibility and sewer capacity.

Further information relating to sewers available in the area can be found in Appendix C.

What is a Source Protection Zone?

The Environment Agency have defined Source Protection Zones (SPZs) for 2000 groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the

area. The closer the activity, the greater the risk. The maps show three main zones (inner, outer and total catchment) and a fourth zone of special interest, which is occasionally applied. The zones are used to set up pollution prevention measures in areas which are at a higher risk. The shape and size of a zone depends on the condition of the ground, how the groundwater is removed, and other environmental factors. Inner zone (Zone 1) is defined as the 50 day travel time from any point below the water table to the source (minimum radius of 50 metres). Outer zone (Zone 2) is defined by a 400 day travel time. Total catchment (Zone 3) is defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source.

How was surface water runoff estimated from the Site?

In accordance with The SuDS Manual (C753) (CIRIA, 2015), the Greenfield runoff from the Site has been calculated using the IoH124 method and is assumed representative of the runoff generated on the undeveloped surfaces that are affected by the proposed development. The method used for calculating the runoff complies with the NPPF (MHCLG, 2024). For the impermeable surfaces, it has been assumed that 100% runoff will occur (calculations provided in Appendix B). Rainfall data is derived from the Flood Estimation Handbook (FEH), developed by NERC (2009). Only areas affected by the proposed development are considered in the flow and volume calculations. Permeable areas that remain unchanged are not included in the calculations as it is assumed these will not be actively drained and attenuated.

What is the peak discharge rate?

An estimation of peak runoff flow rate and volume is required to calculate infiltration, storage and discharge requirements. The peak discharge rate is the maximum flow rate at which surface water runoff leaves the Site during a particular storm event, without considering the impact of any mitigation such as storage, infiltration or flow control. Proposed discharge rates (with mitigation) should be no greater than existing rates for all corresponding storm events. If all drainage is to infiltration there will be no discharge off-Site. Discharging all flow from Site at the existing 1 in 100 event would increase flood risk during smaller events. Flow restriction is generally required to limit the final discharge from Site during all events as a basic minimum to the green field QBAR rate. A more complex flow restriction which varies the final discharge rate from the Site depending on the storm event will reduce the volume of storage required on-Site. Drainage to infiltration SuDS is subtracted from the total discharge off-Site to achieve a beneficial net affect.

What is the total discharge volume?

The total discharge volume is calculated on the basis of the surface water runoff that has the potential to leave the Site as a result of the assumed 6 hour duration design storm event. The runoff is related to the underlying soil conditions, impermeable cover, rainfall intensity and duration of the storm event. The total volume generated by the current Site is compared to

the potential total volume from the developed Site (not taking into consideration any mitigation). The difference provides the minimum total volume that will need to be stored and infiltrated on-Site or released at a controlled rate. Guidance indicates that the total discharge volume should never exceed the runoff volume from the development Site prior to redevelopment for that event and should be as close as is reasonably practicable to the Greenfield runoff volume.

12 Background SuDS information

SuDS control surface water runoff close to where it falls. SuDS are designed to replicate, as closely as possible, the natural drainage from the Site before development to ensure that the flood risk downstream does not increase as a result of the Site being developed, and that the Site will have satisfactory drainage under current and likely future climatic conditions. SuDS provide opportunities to reduce the causes and impacts of flooding; remove pollutants from urban runoff at source; and combine water management with green space with benefits for amenity, recreation and wildlife. Government planning policy and planning decisions now include a presumption in favour of SuDS being used for all development Sites, unless they can be shown to be inappropriate.

For general information on SuDS see our website: http://geosmartinfo.co.uk/

Infiltration SuDS

Government policy for England is to introduce sustainable drainage systems (SuDS) via conditions in planning approvals. Guidance indicates that capturing rainfall runoff on-Site and infiltrating it into the ground (infiltration SuDS) is the preferred method for managing surface water without increasing flood risk downstream.

The greatest benefit to general flood risk is if all runoff is infiltrated on-Site, however, this may not be feasible due to physical and economic constraints in which case infiltration may be considered as a part of an integrated drainage solution. The final design capacity for an infiltration SuDS system depends on the Site constraints and the requirements of the individual Planning Authority and the Lead Local Flood Authority.

The capacity of the ground to receive infiltration depends on the nature, thickness and permeability of the underlying material and the depth to the high groundwater table. The final proportion of the Site drained by infiltration will depend on topography, outfall levels and a suitable drainage gradient. It is important to note that, even if the whole Site cannot be drained by infiltration, the use of partial infiltration is encouraged, with the remainder of runoff discharged via other SuDS systems.

Types of infiltration SuDS

Infiltration components include infiltration trenches, soakaways, swales and infiltration basins without outlets, rain gardens and permeable pavements. These are used to capture surface water runoff and allow it to infiltrate (soak) and filter through to the subsoil layer, before returning it to the water table below.

An infiltration trench is usually filled with permeable granular material and is designed to promote infiltration of surface water to the ground. An infiltration basin is a dry basin or depression designed to promote infiltration of surface water runoff into the ground. Soakaways are the most common type of infiltration device in the UK where drainage is often connected to over-sized square or rectangular, rubble-filled voids sited beneath lawns.

According to the guidance in Building Research Establishment (BRE) Digest 365 (2016) a soakaway must be able to discharge 50% of the runoff generated during a 1 in 10 year storm event within 24 hours in readiness for subsequent storm flow. This is the basic threshold criteria for a soakaway design and the internal surface area of the proposed soakaway design options should be calculated on this basis by taking into account the soil infiltration rate for the Site.

Developers need to ensure their design takes account of the construction, operation and maintenance requirements of both surface and subsurface components, allowing for any machinery access required.

SuDS maintenance and adoption

Regular maintenance is essential to ensure effective operation of the soakaway(s) over the intended lifespan of the proposed development. A maintenance schedule for SuDs is required. Sewerage undertakers or Local Authorities may adopt SuDS and will require maintenance issues to be dealt with in accordance with their Management Plan. If the SuDS will not be adopted other provision is required with associated financial implications. Maintenance is a long-term obligation requiring the upkeep of all elements of the SuDS, including mechanical components (e.g. pumps), as well as inspections, regular maintenance and repair.

Additional background SuDS information can be found on our website: http://geosmartinfo.co.uk/

13 References and glossary

British Geological Survey (BGS). (2025). BGS Onshore GeoIndex. Based on British Geological Survey materials © NERC 2024. Accessed from: https://mapapps2.bgs.ac.uk/geoindex/home.html on 25/09/2025

Building Research Establishment (BRE) (2016). Digest 365, Soakaway design.

CEH (2025) Online FEH web service Depth/duration/frequency modelling using the FEH 2022 models. Accessed from: https://fehweb.ceh.ac.uk/ on 25/09/2025

CIRIA (2015) The SuDS manual (C753).

Department for Environment, Food and Rural Affairs (2015). Non-statutory technical standards for SuDS (March 2015).

Environment Agency [EA] (2025). MagicMap. Accessed from: http://magic.defra.gov.uk/MagicMap.html on 25/09/2025

GeoSmart (2024) GeoSmart GW5 Version 2.4.

HM Government (2010). The building regulations 2010 Part H drainage and waste disposal (2015 edition).

LASOO (2015) Practice Guidance, Local Authority SuDS Officer Organisation.

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

Ministry of Housing, Communities & Local Government. (2025). National Planning Policy Guidance (NPPG).

Arun District Council (2025). Surface Water Drainage. Accessed from: https://www.arun.gov.uk/surfacewater/ on 26/09/2025

Southern Water (2025). Asset Location Plan. Ref: 1890106 - 1

Glossary

General terms

Attenuation	Reduction of peak flow and increased duration of a flow event.
Combined sewer	A sewer designed to carry foul sewage and surface water in the same pipe.
Detention basin	A vegetated depression, normally is dry except after storm events, constructed to store water temporarily to attenuate flows. May allow infiltration of water to the ground.
Evapotranspiration	The process by which the Earth's surface or soil loses moisture by evaporation of water and by uptake and then transpiration from plants.
FEH	Flood Estimation Handbook, produced by Centre for Ecology and Hydrology, Wallingford (formerly the Institute of Hydrology).
Filter drain or trench	A linear drain consisting of a trench filled with a permeable material, often with a perforated pipe in the base of the trench to assist drainage, to store and conduct water, but may also be designed to permit infiltration.
First flush	The initial runoff from a site or catchment following the start of a rainfall event. As runoff travels over a catchment it will collect or dissolve pollutants, and the "first flush" portion of the flow may be the most contaminated as a result. This is especially the case for intense storms and in small or more uniform catchments. In larger or more complex catchments pollution.
Flood plain	Land adjacent to a watercourse that would be subject to repeated flooding under natural conditions (see Environment Agency's Policy and practice for the protection of flood plains for a fuller definition).
Greenfield runoff	This is the surface water runoff regime from a site before development, or the existing site conditions for brownfield redevelopment sites.
Impermeable surface	An artificial non-porous surface that generates a surface water runoff after rainfall.
Permeability	A measure of the ease with which a fluid can flow through a porous medium. It depends on the physical properties of the medium, for example grain size, porosity and pore shape.

Runoff	Water flow over the ground surface to the drainage system. This occurs if the ground is impermeable, is saturated or if rainfall is particularly intense.
Sewerage undertaker	This is a collective term relating to the statutory undertaking of water companies that are responsible for sewerage and sewage disposal including surface water from roofs and yards of premises.
Soakaway	A subsurface structure into which surface water is conveyed to allow infiltration into the ground.
Treatment	Improving the quality of water by physical, chemical and/or biological means.

The terms included in this glossary have been taken from CIRIA (2015) guidance.

Data Sources

Aerial Photography	Contains Ordnance Survey data © Crown copyright and database right 2025 BlueSky copyright and database rights 2025
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Flood Risk (Groundwater) and SuDS infiltration suitability (SD50)	GeoSmart, BGS & OS GW5 (v2.4) Map (GeoSmart, 2025) Contains British Geological Survey materials © NERC 2025 Ordnance Survey data © Crown copyright and database right 2025
Sewer Location	Contains Ordnance Survey data © Crown copyright and database right 2024 Contains Southern Water Search data 2025
Topographic Data	OS LiDAR/EA Contains Ordnance Survey data © Crown copyright and database right 2025 Environment Agency copyright and database rights 2025

14 Appendices

GeoSmart Information

Appendix A

Site plans

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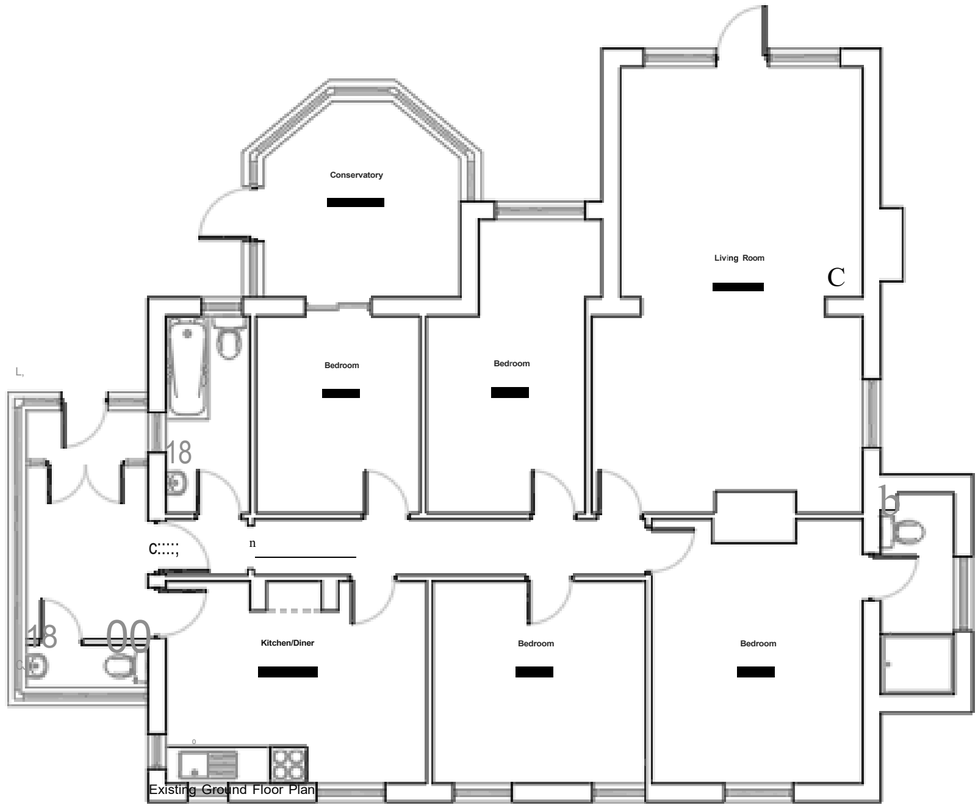
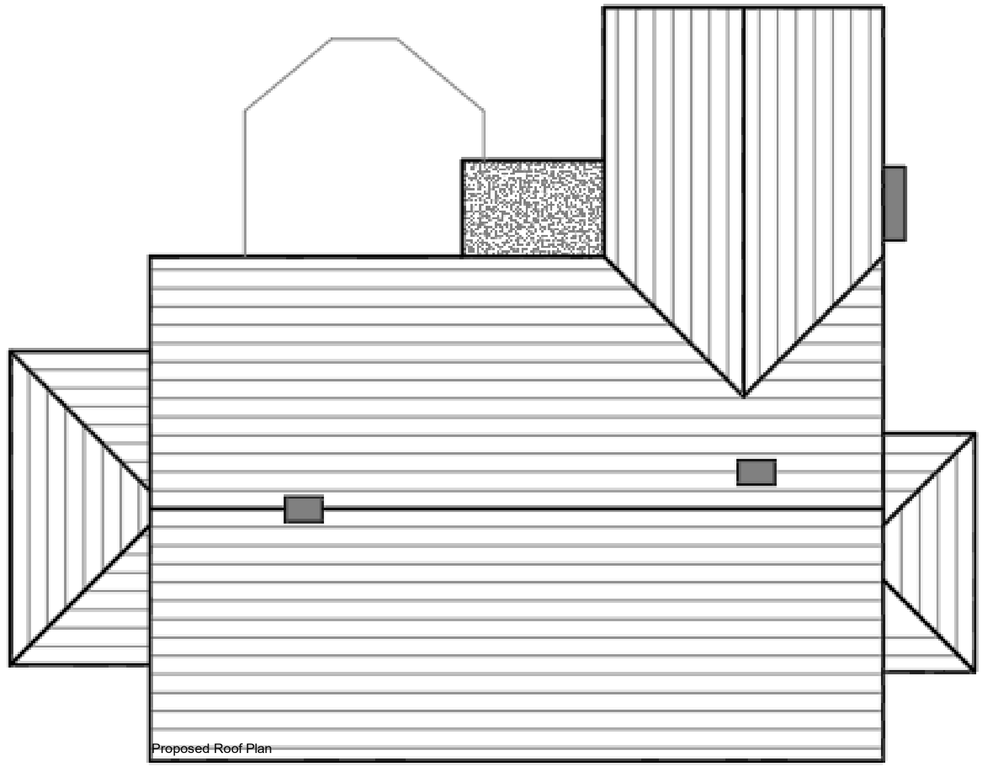


Existing Ground Floor Plan

Existing Ground Floor Plan



Proposed Roof Plan

Proposed Roof Plan

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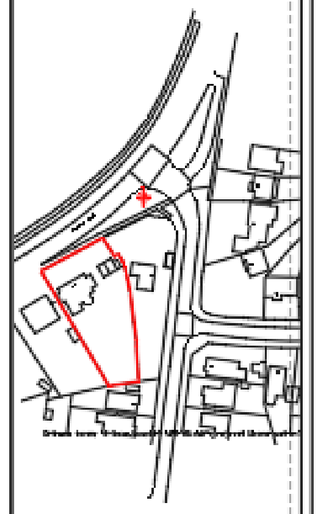

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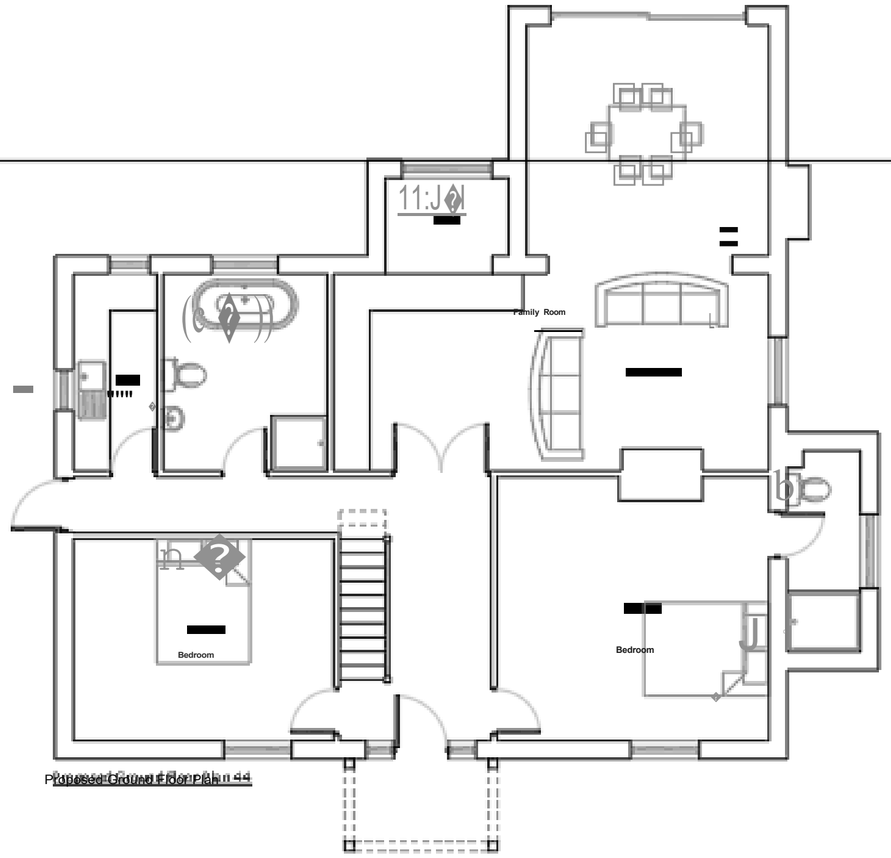
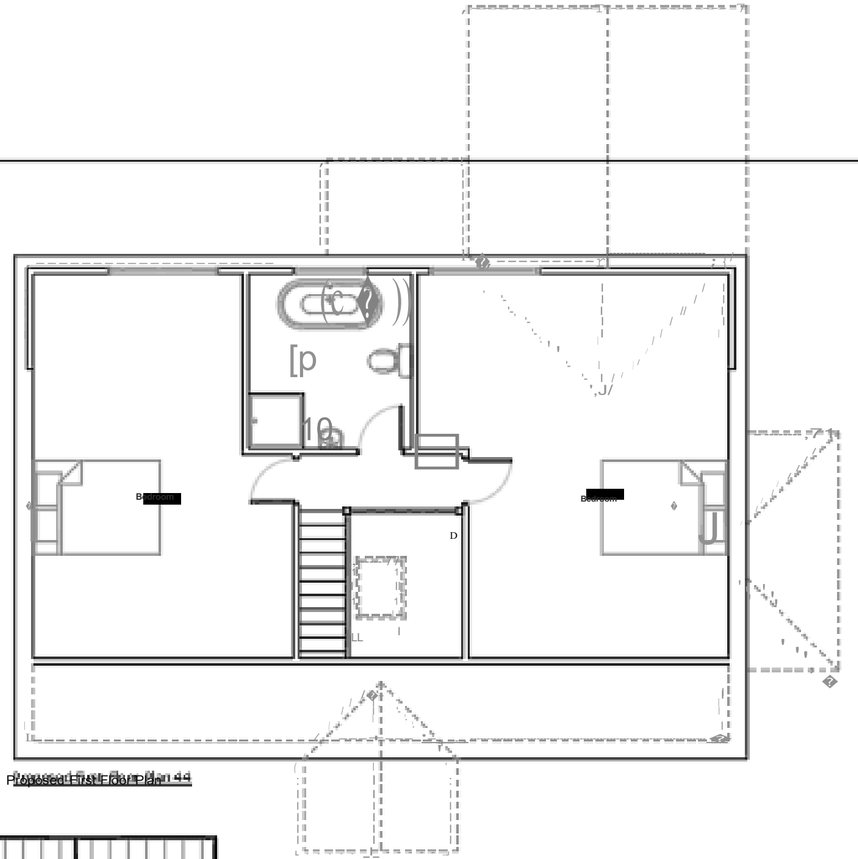
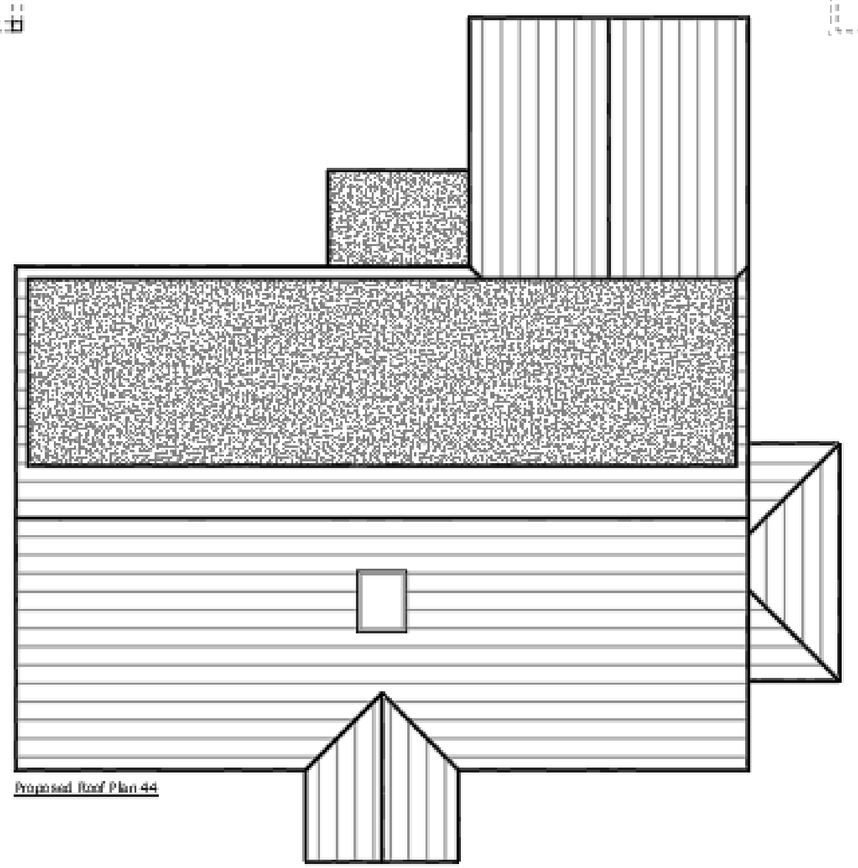


Proposed Ground Floor Plan 44



Proposed First Floor Plan 44



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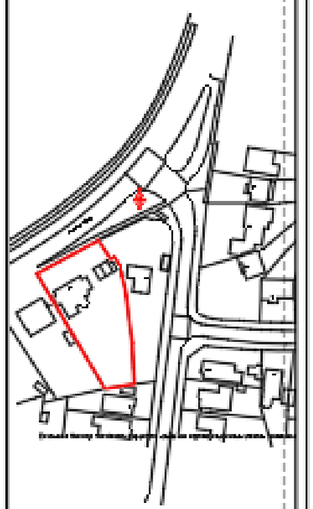

No.	Revision/Issue	Date

Proposed 4 Bed Chalet Bungalow

September 2025

1:50

Proposed 4 Bed Chalet Bungalow

Date
September 2025

Scale
1:200 1:1250

Revision/Issue

QUEENSME

PAGHAM ROAD

50

1

3

1

2

5

2

44A

44

6

GeoSmart Information

Appendix B

Rainfall runoff calculations

[redacted]

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Depth (m)
Impermeable	0.013	5.00	10.000	1.000

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	0.750	Drain Down Time (mins)	240	Check Discharge Volume	x
Winter CV	0.840	Additional Storage (m³/ha)	20.0		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	0	0	0
100	45	10	0

Node Impermeable Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.03600	Invert Level (m)	9.000	Depth (m)	0.400
Side Inf Coefficient (m/hr)	0.03600	Time to half empty (mins)	543	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	4.000	Number Required	1
Porosity	0.95	Pit Length (m)	6.000		

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	Impermeable	248	9.068	0.068	0.3	1.5566	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
360 minute winter	Impermeable	Infiltration	0.1

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	Impermeable	224	9.166	0.166	0.9	3.8279	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
240 minute winter	Impermeable	Infiltration	0.1

Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	Impermeable	180	9.211	0.211	1.4	4.8684	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
180 minute winter	Impermeable	Infiltration	0.1

Results for 100 year +45% CC +10% A Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	Impermeable	344	9.370	0.370	1.3	8.5400	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
360 minute winter	Impermeable	Infiltration	0.2

GeoSmart Information

Appendix C

Southern Water Asset Location Plan

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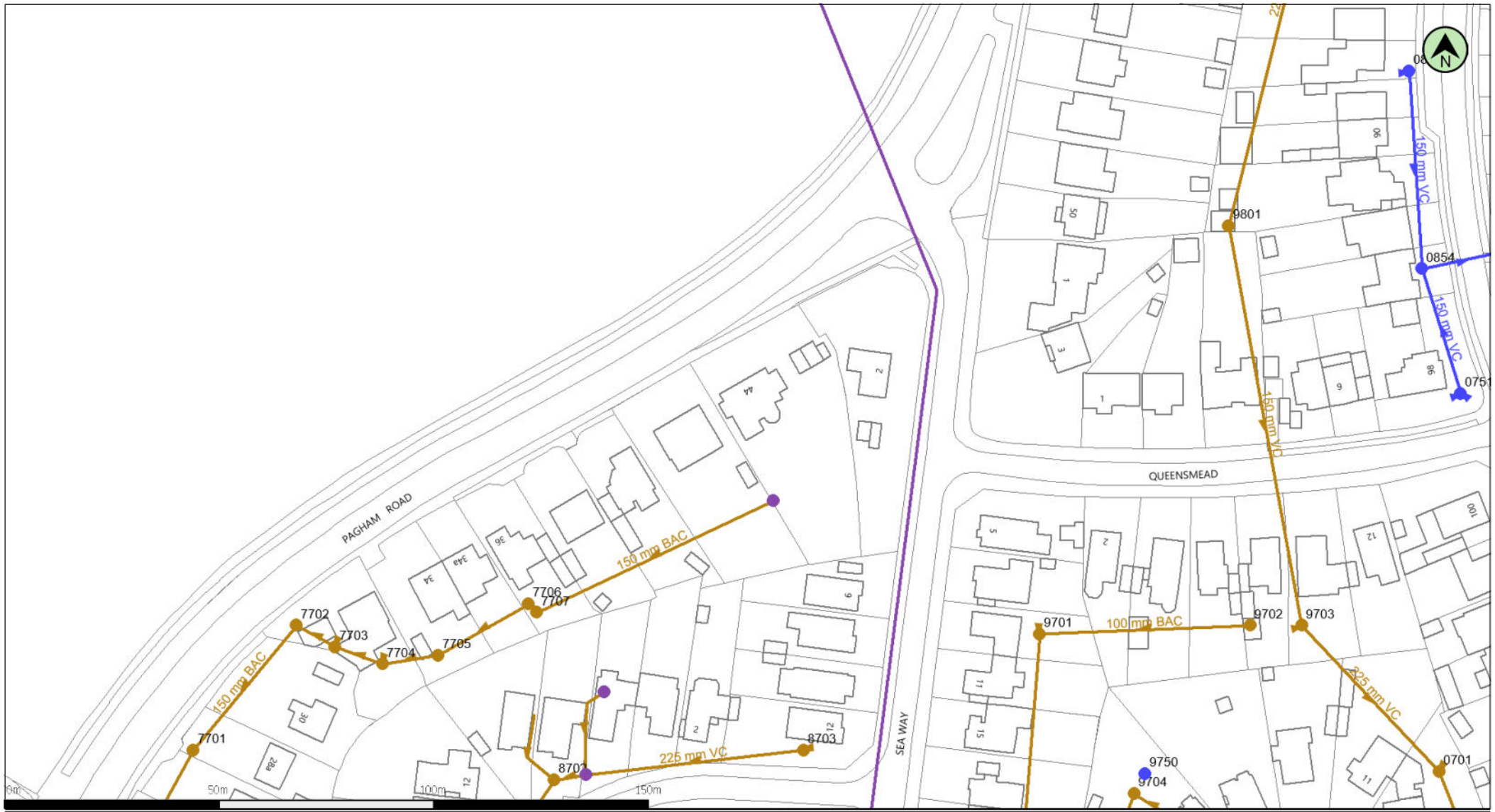


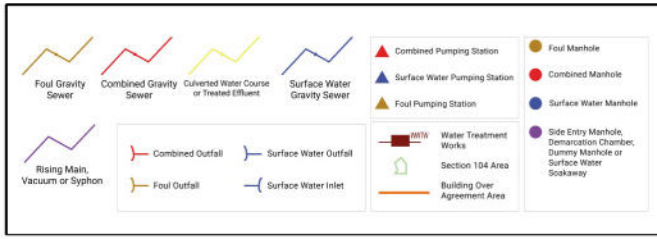
Date: 25/09/25 | Scale: 1:1250 | Map Centre: 488848,97794 | Data updated: 21/08/25 | Our Ref: 1890106 - 1

Wastewater Plan A4
Powered by digdat

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2025 Ordnance Survey AC0000808122 .This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.



davidsouth@geosmartinfo.co.uk

87325

WATER for LIFE from Southern Water.

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
0701	F	4.93	2.52	-
7701	F	0.00	2.53	-
7702	F	3.89	2.78	-
7703	F	3.90	2.82	-
7704	F	3.95	2.87	-
7705	F	4.05	2.93	-
7706	F	4.24	3.06	-
7707	F	0.00	3.20	-
8702	F	4.33	3.10	-
8703	F	4.48	0.00	-
9701	F	4.58	3.36	-
9702	F	0.00	3.59	-
9703	F	4.74	2.66	-
9704	F	0.00	0.00	-
9801	F	0.00	3.12	-
0751	S	4.93	3.89	-
0853	S	5.16	4.21	-
0854	S	4.99	3.73	-
9750	S	0.00	0.00	-

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

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Tel: 01743 298 100

Email: info@geosmartinfo.co.uk

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The Property Ombudsman scheme

Milford House

43-55 Milford Street

Salisbury

Wiltshire SP1 2BP

Tel: 01722 333306

Fax: 01722 332296

Email: admin@tpos.co.uk

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- Provide a final response, in writing, at the latest within 40 working days of receipt.
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E-mail: [redacted]

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Liz Lloyd

Finance Manager

GeoSmart Information Limited

Suite 9-11, 1st Floor,

Old Bank Buildings,

Bellstone, Shrewsbury, SY1 1HU

[redacted]

[redacted]

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