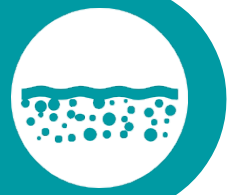


SuDSmart Plus



Sustainable Drainage Assessment

Site Address

7 Chapel Street
Levenshulme
Manchester
M19 3QB

Date

2023-06-01

Report Status

FINAL

Grid Reference

387489 , 394206

Site Area

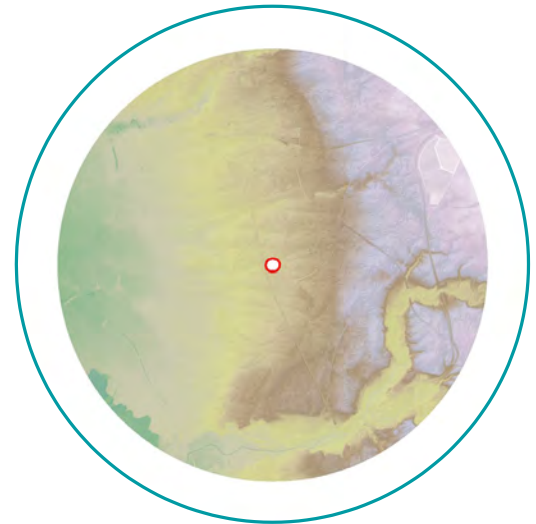
0.2 ha

Report Reference

79499R1

Report Prepared for

Burke Developments



Discharge to sewer

The proposed Sustainable Drainage Scheme (SuDS) strategy is comprised of rainwater harvesting butts, permeable paving and an attenuation tank for the management of surface water runoff.

Surface water will discharge to the nearby sewer network subject to confirmation from the utility provider and the incorporation of the identified SuDS.

Report Author

Rebecca Conway

Project Consultant

Report Checker

Andy Singleton

Associate

Report Reviewer

David South

Senior Consultant

GeoSmart Information Ltd
Suite 9-11, 1st Floor, Old Bank Buildings,
Bellstone, Shrewsbury, SY1 1HU
+44(0)1743 298 100
info@geosmartinfo.co.uk
www.geosmartinfo.co.uk

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
Discharge Location	What is the infiltration potential at the Site?	Low*
	What is the potential to discharge to surface water features?	Low
	What is the potential to discharge to sewers?	High
	What is the potential to discharge to highway drains?	Medium
Flooding	What is the river (fluvial) flood risk at the Site?	Very Low
	What is the surface water (pluvial) flood risk at the Site?	Very Low - High
	What is the groundwater flood risk at the Site?	Negligible
Pollution	Is the groundwater a protected resource?	No
	Is the surface water feature a protected resource?	N/A

* Whilst GeoSmart's SuDS Infiltration Potential (SD50) map indicates the Site has a Moderate potential for infiltration, nearby borehole records indicate that the underlying geology is comprised of clay, therefore the actual infiltration potential is considered to be Low.

Summary of existing and proposed development

The Site is currently used within an industrial capacity. At present the Site comprises of multiple workshop structures and a large yard area, surfaced in hard standing. Development proposals comprise the construction of nine (9) new residential dwellings with associated access, cycle storage and landscaping.

Summary of discharge routes

Whilst GeoSmart's SuDS Infiltration Potential (SD50) map indicates that the Site has a Moderate potential for infiltration, nearby borehole records indicate that the underlying shallow geology comprises of clay, therefore the actual infiltration potential is considered to be Low. Consequently, infiltration SuDS are not considered to be feasible.

Ordnance Survey (OS) mapping indicates that there are no surface water features within 100m of the Site, therefore discharge in this manner is not considered to be feasible.

The United Utilities asset location plan included in Appendix C confirms the Site is located adjacent to a combined sewer network. Due to the short distance to nearby sewers, discharging surface water runoff to the sewer network is considered to be feasible.

According to Google Streetview, highway gullies are located within Chapel Street, indicating the presence of a highway drainage network.

Runoff rate and attenuation requirements

Discharging off-Site requires 146.37 m³ 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 1 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 rainwater harvesting butts, permeable surfacing and an attenuation tank are proposed to attenuate a minimum of 149.65 m³ of surface water runoff. The SuDS features would provide some water quality benefits (interception and filtration) prior to discharging surface water to the nearby combined sewer network.

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 DEFRA's non-statutory technical standards (DEFRA, 2015).

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 buildings, where payments for the works will form part of the property deeds and / or rental agreements.

Recommendations / Next steps

The capacity of the public combined sewer network should be confirmed with the utility provider and permission to connect gained, as required.

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.

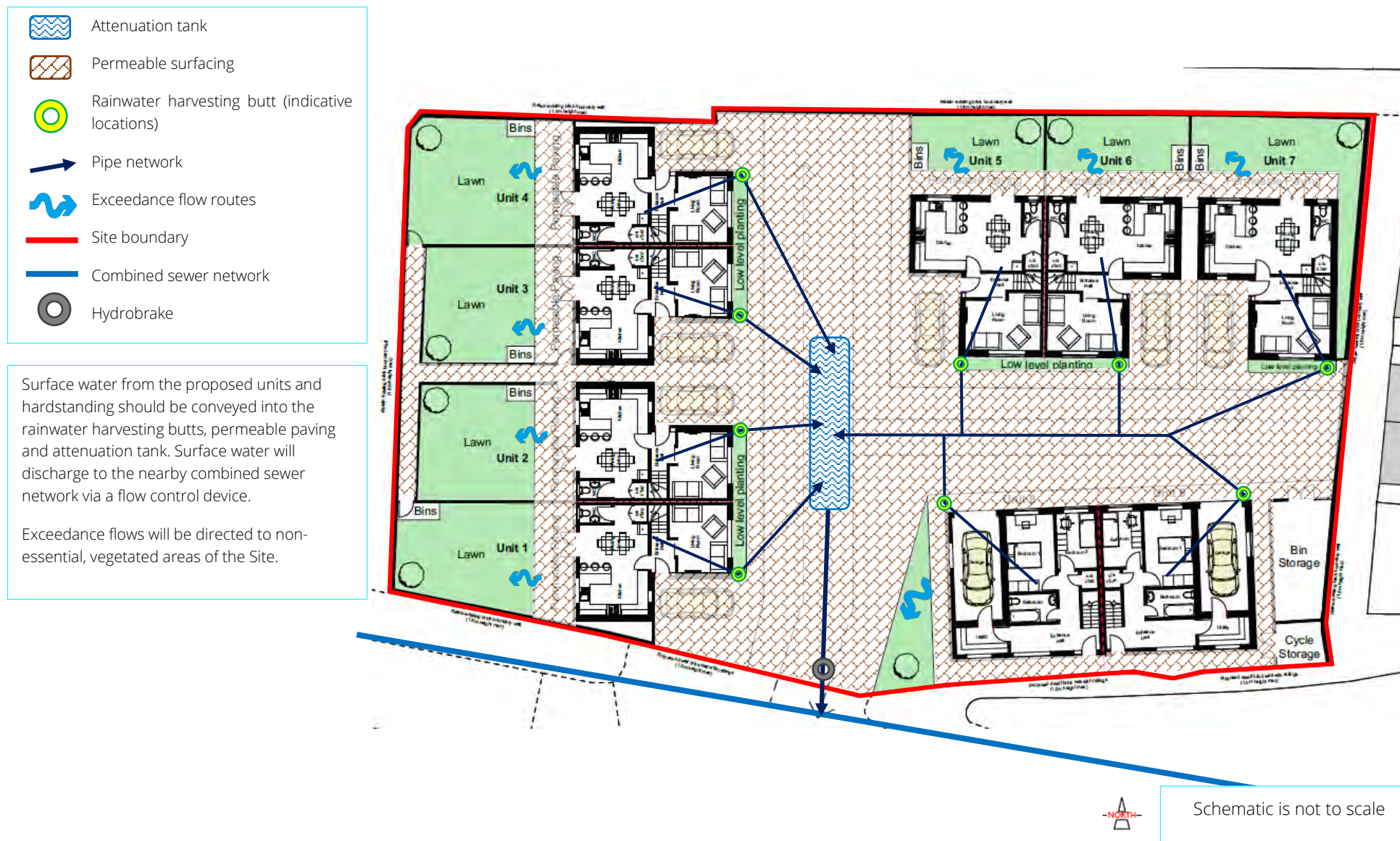
Table 1. Proposed SuDS type, features, discharge location and rate restriction

SuDS type	Source control (interception) and attenuation SuDS.
SuDS features	Rainwater harvesting butts, permeable paving and attenuation tank.
Discharge location	Public combined sewer network.
Discharge rate	1l/s (where discharge to sewer/surface water feature is proposed).

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

Rainwater harvesting	Rainwater harvesting butts should be established for each proposed property. 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 schematic.
Permeable paving	A 970 m ² area of permeable paving (underlain with a Type 3 aggregate material) within the proposed access road, patios and driveway areas to a depth of 0.4 m, with a 30% porosity, would result in c. 116.4 m ³ of attenuation.
Attenuation tank	An attenuation tank measuring 10m in length, 3.5m in width and 1m in depth, with a 95% void ratio, would result in 33.25 m ³ of attenuation.
Total Attenuation Provided	149.65 m ³
Total Attenuation Required	146.37 m ³
Freeboard Storage Provided	3.28 m ³

Figure 1. Proposed SuDS scheme



3 Site analysis

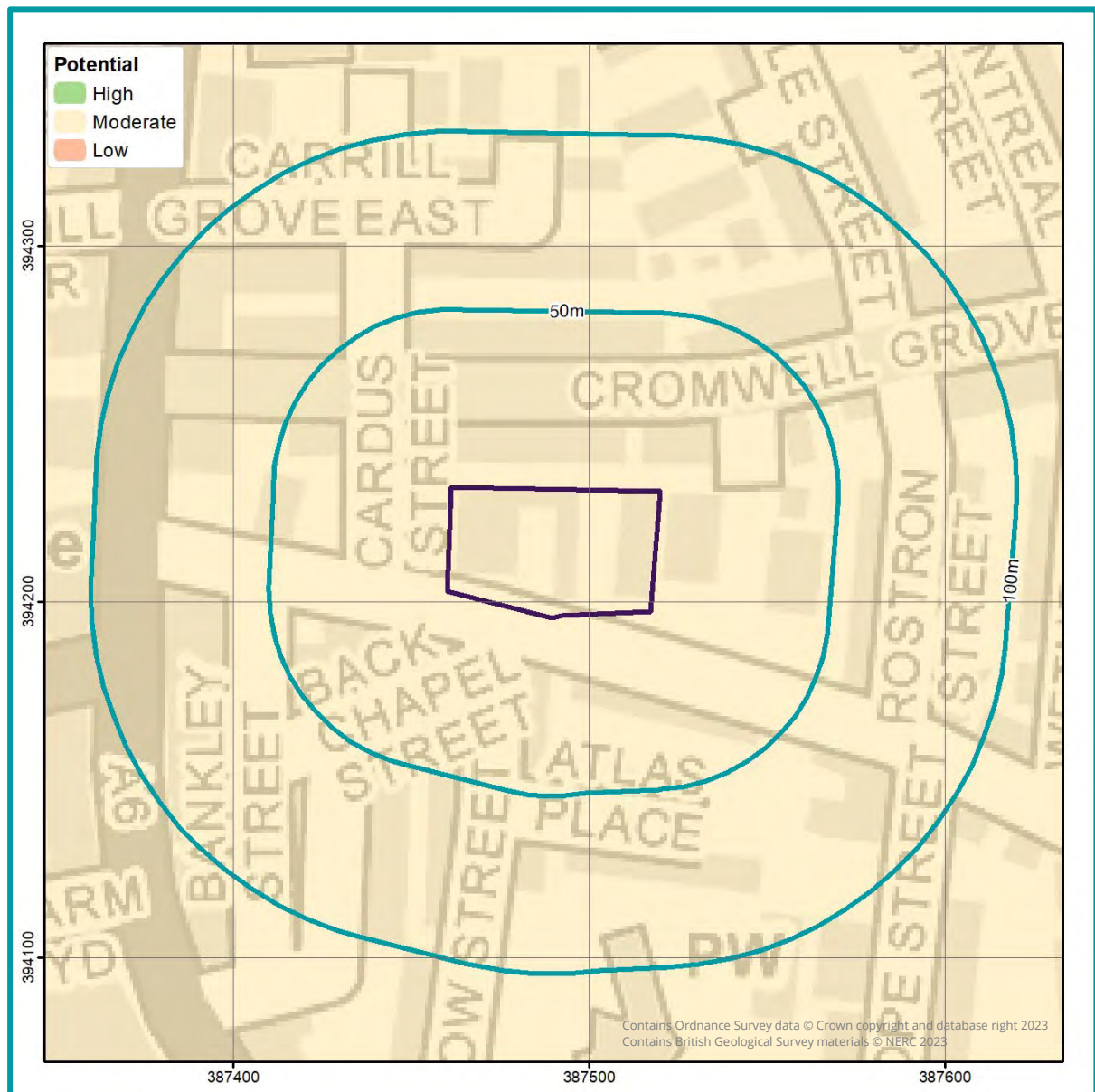


Site location

Figure 2. Aerial Imagery (Bluesky, 2023)



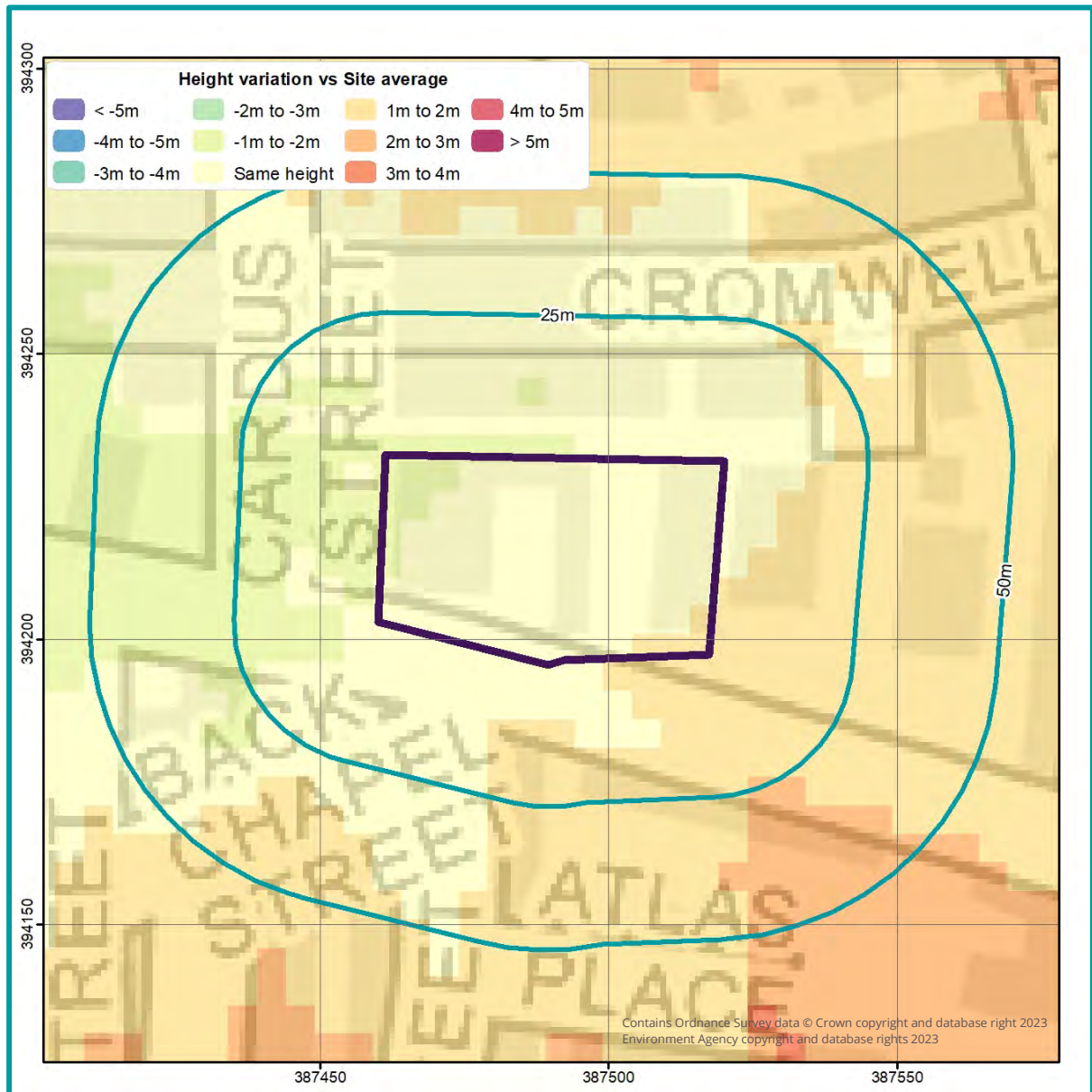
Figure 3. SuDS infiltration suitability (SD50) map (GeoSmart, 2023)



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.

The SD50 mapping indicates a Moderate potential for infiltration SuDS across the Site. It is likely that the underlying geology at the Site has moderate permeability and an infiltration SuDS scheme may be possible at the Site, subject to further assessment of the local hydrogeological characteristics (see Section 4).

Figure 4. Site topography (GeoSmart, 2023)



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 towards the west.

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

Figure 5. Source protection zone map (EA, 2023)

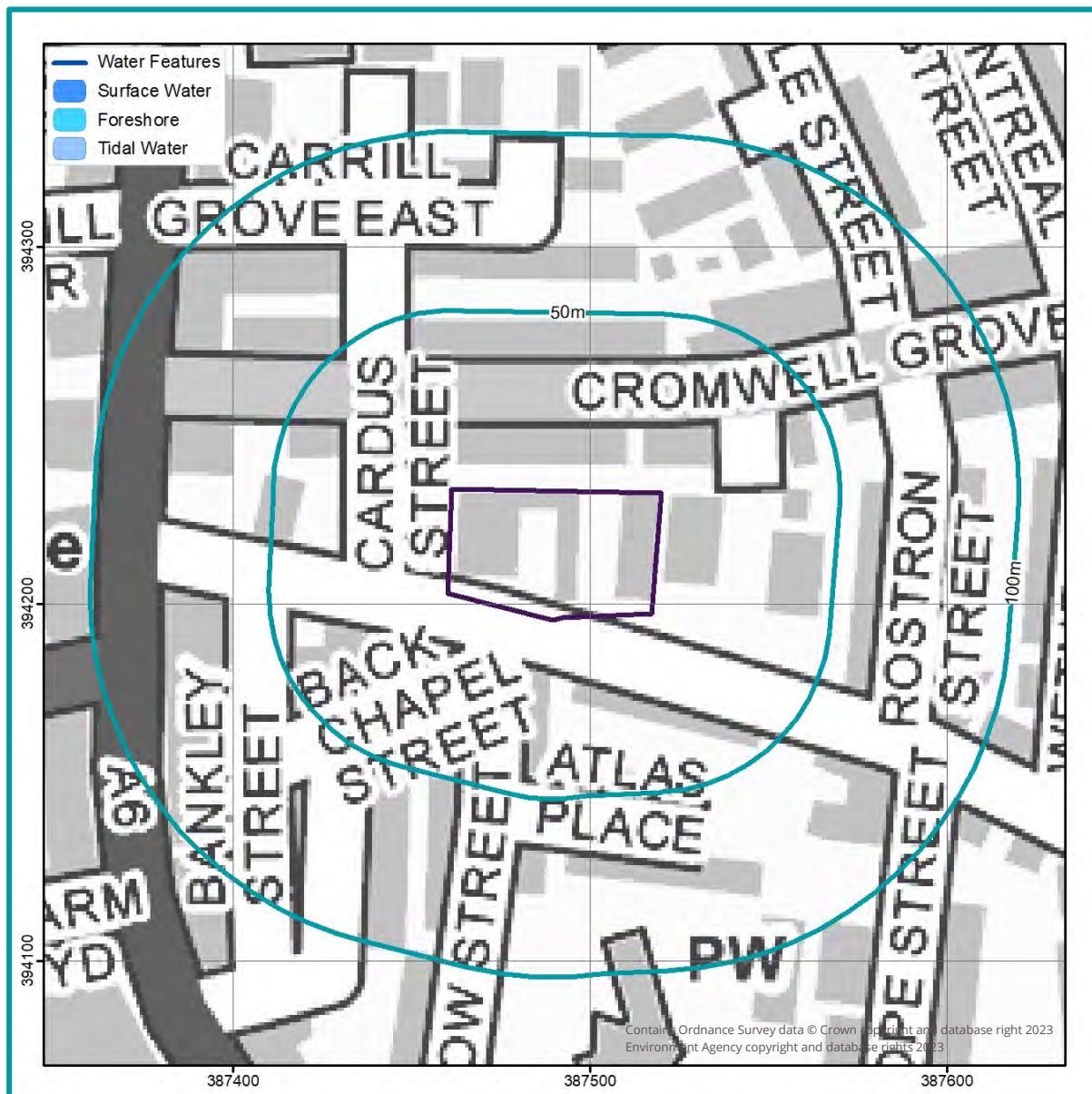


An assessment of the EA's groundwater Source Protection Zones (SPZs) has been undertaken within the vicinity of the Site and confirms the Site is not located within an SPZ.

Infiltration, if possible, would likely 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 any 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.

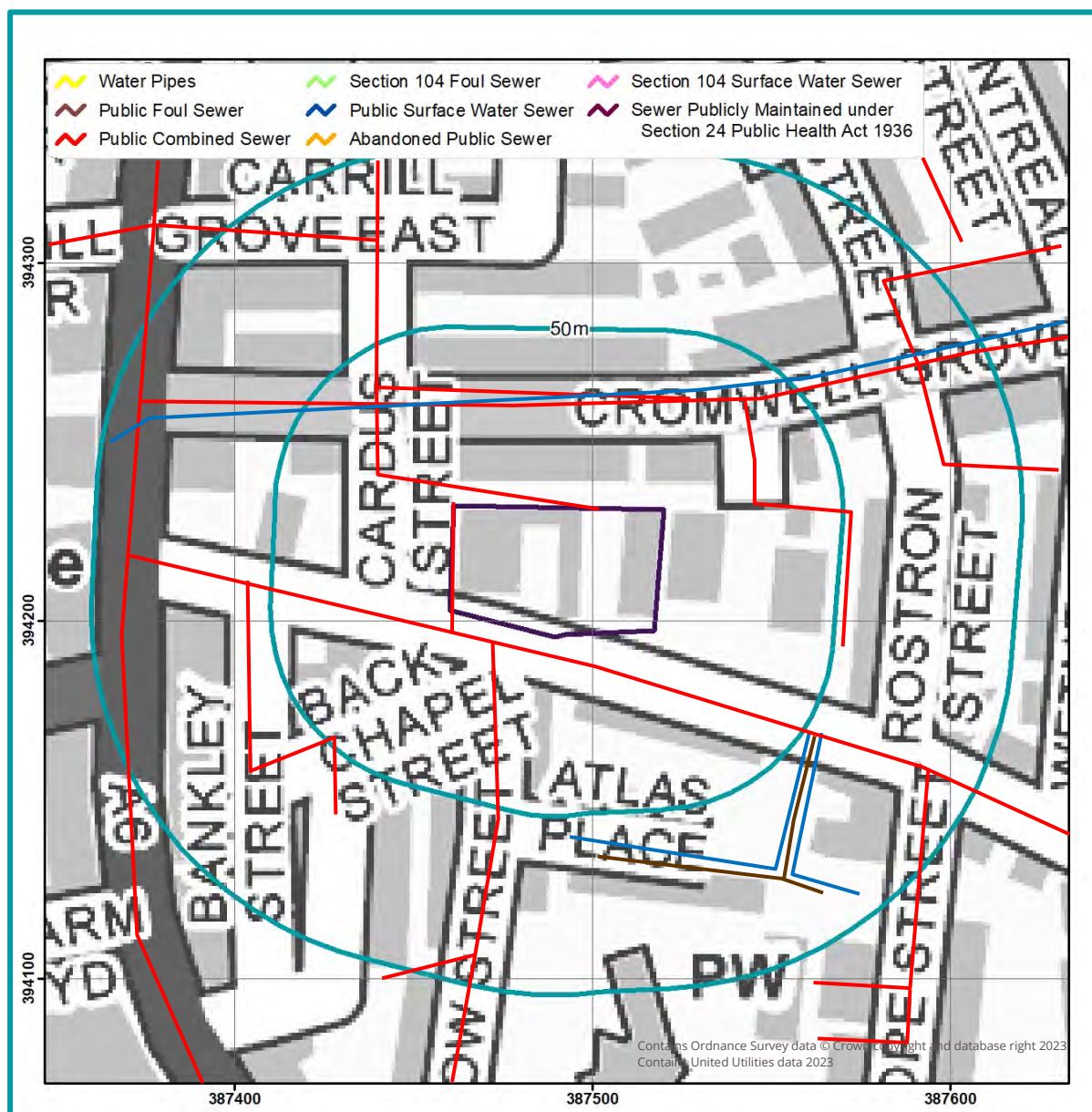
Figure 6. Surface water features map (EA, 2023)



OS mapping indicates that there are no surface water features within 100m of the Site's boundary. According to the EA'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 additional unmapped surface water features.

Figure 7. Sewer features map (OS & United Utilities, 2023)



GeoSmart has undertaken an assessment of the location of sewer features within the vicinity of the Site. There are public combined sewers, located adjacent to the north, south and west of the Site, therefore discharge to sewer is likely to be appropriate.

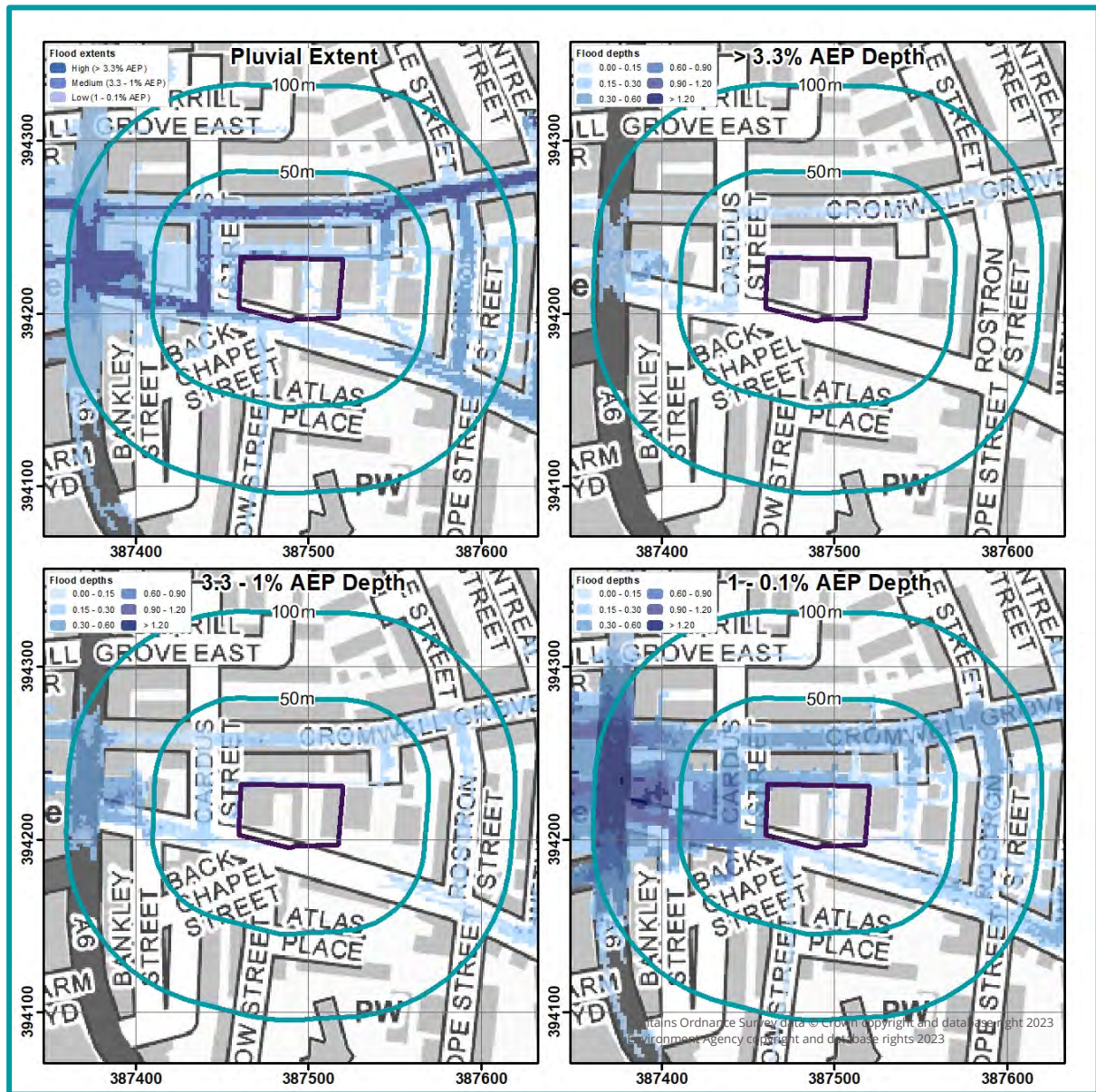
Further analysis of the connections and condition of the public surface water drainage system should be undertaken by carrying out a CCTV survey or by contacting the drainage provider or the Local Council to confirm the presence, location and condition of the sewer. Consultation with the drainage provider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

Figure 8. Risk of flooding from rivers & sea map (EA, 2023)



According to the EA's Risk of Flooding from Rivers and the Sea (RoFRS) map, the Site has a Very Low risk of flooding from fluvial or coastal flooding, with less than 0.1% annual probability of flooding, therefore the SuDs design is unlikely to be affected.

Figure 9. Risk of surface water flooding map (EA,2023)



GeoSmart has 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 that the Site is considered to be at Very Low - High risk of surface water flooding (albeit the majority of the Site area is at low risk).

The above map shows the extent and depth of flooding during a range of return periods. This confirms that there are very localised areas where flooding could occur from a 1 in 30 year event. Flooding in these areas may constrain certain types of SuDS features being used.

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, 2023)



GeoSmart has 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 Negligible risk of groundwater flooding during a 1% annual probability (1 in 100 year) event.

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 at 7 Chapel Street, Levenshulme, Manchester, M19 3QB (the Site). The Site is located in the centre of Levenshulme in a setting of commercial and residential use. The land slopes to the west from 53.07 mAOD to 51.67 mAOD (this is based on EA elevation data obtained for the Site to a 2 m resolution with a vertical accuracy of ± 0.15 m). Site plans and drawings are provided in Appendix A.

Development

The Site is currently used within an industrial capacity. At present the Site includes multiple workshop structures and a large yard area, comprised of hardstanding. Development proposals comprise the construction of nine (9) new residential dwellings with associated access, cycle storage and landscaping.

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)	Devensian Till (TILLD)	X*
Bedrock geology (Figure 12)	Chester Formation (sandstone) (CHES)	✓

*Whilst superficial Till deposits may potentially be permeable, nearby borehole records indicate that the underlying geology is comprised of clay and is therefore not considered to be permeable.

The BGS website was used to extract ground information from the nearest borehole record to the Site (ref: SJ89SE12). The boreholes is located c. 120m to the south west of the Site (note: this location is underlain by the same superficial deposits as mapped to be present below the study Site). The borehole records indicate that the underlying geology is comprised of 0.3m of Made Ground, overlying 14.94m of clay, at which point the borehole ended.

Whilst GeoSmart's SD50 mapping indicates that the Site has a moderate potential for infiltration, nearby borehole records suggest that the superficial Till deposits are comprised of clay and are therefore unlikely to be permeable. Consequently, the actual infiltration potential is considered to be Low and infiltration SuDS are not proposed.

Depth to groundwater

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

According to GeoSmart's Groundwater Flood Risk (GW5) map, shallow groundwater is unlikely to be an issue at the Site.

The nearest borehole record did not include reference to groundwater levels.

Infiltration features are not proposed at the Site, given the anticipated low permeability of the underlying geology.

Figure 11. Superficial Geology (BGS, 2023)

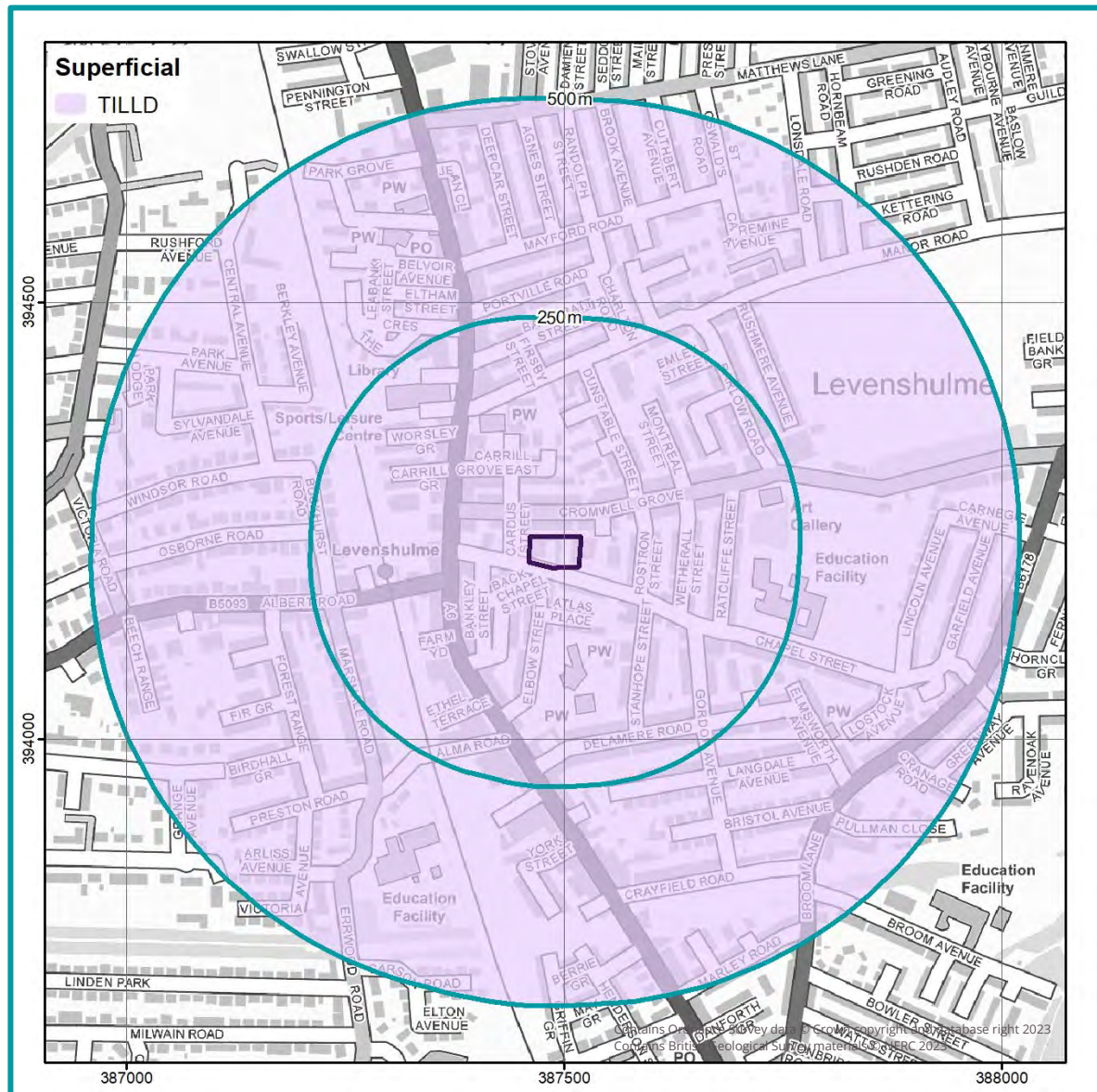


Figure 12. Bedrock Geology (BGS, 2023)



Ground conditions

Infiltration SuDS features are not proposed at the Site, therefore a detailed investigation into the ground conditions is not required.

Water quality

As infiltration SuDS are not proposed on-Site, an assessment of historical land uses is not required for the purpose of this sustainable drainage assessment.

5 National & local policy context



National Guidance

CIRIA SuDS Manual (C753) (2015)

A development should utilise sustainable drainage systems (SUDS) unless there are practical reasons for not doing so, and should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:

1. Use infiltration techniques, such as porous surfaces in non-clay areas,
2. attenuate rainwater in ponds or open water features for gradual release,
3. attenuate rainwater by storing in tanks or sealed water features for gradual release,
4. discharge rainwater direct to a watercourse,
5. discharge rainwater to a surface water sewer / drain,
6. discharge rainwater to the combined sewer.

Defra - Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems (2015)

Peak Flow control

For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.

For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.

Volume control

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. The runoff volume must be discharged at a rate that does not adversely affect flood risk.

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.

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 ($\geq 3.3\%$ AEP) and 1 in 100 (< 3.3 to 1% AEP) year event.

As the Site is located within the Upper Mersey Management Catchment the following climate change allowances are applicable.

Table 4. Peak rainfall intensity allowance within the Upper Mersey Management Catchment

Upper Mersey Management Catchment	3.3% annual exceedance rainfall event		1% annual exceedance rainfall event	
	Central allowance	Upper end allowance	Central allowance	Upper end allowance
2050s	20%	35%	25%	40%
2070s	30%	40%	30%	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 Policy

Manchester City Council – Core Strategy Development Plan Document (July 2012).

Policy EN 14 Flood Risk

All new development should minimise surface water run-off, including through Sustainable Drainage Systems (SUDS) and the appropriate use of Green Infrastructure. Developers should have regard to the surface water run-off rates in the SFRA User Guide. In CDAs, evidence to justify the surface water run-off approach / rates will be required.

JBA Consulting – Level 1 Strategic Flood Risk Assessment for Greater Manchester – Update: Appendix F1 (March, 2019).

For the GMCA area, LPAs will particularly encourage future development proposals to contribute to reducing the existing risk from surface water flooding and pollution in the locality of the development. This can be achieved through the incorporation of additional attenuation allowances to accommodate existing unattenuated impermeable development and climate change impacts. The extent and type of SuDS components are influenced by the specific characteristics of the site. There are a variety of SuDS components which are considered suitable that may be used independently or in combination (as part of the SuDS management train).

Rainwater harvesting

Given that development within the GMCA generally encompasses large impermeable areas including extensive roof areas, rainwater harvesting offers significant opportunities both for incorporation in new development and also retrofitting within existing development.

Infiltration systems

Dependent on the groundwater levels and the permeability of the soil these systems are useful for small urban catchments as is characterised by the drainage within GMCA areas. They can therefore potentially be used to intercept and infiltrate local surface flows. Infiltration systems can be compact and therefore are potentially suited for retrofitting in existing green space areas or other available areas within an area, however their suitability will require a consideration of the location of impermeable areas and flow routes. As the system facilitates discharge ultimately to groundwater it is critical to ensure runoff is suitably clean so that groundwater is not put at risk of contamination. They are subsequently best suited to deal with runoff from roofs. Retrofitting infiltration systems to existing sites and redirecting roof drainage from the existing drainage system to these areas components may provide the opportunity to reduce surface water flood risk and would be encouraged. New development will be expected to have considered infiltration as a means of managing both existing and post development surface water flood risk.

Pervious pavements

Pervious pavements can be used on most sites and will be particularly suitable where new and existing development includes extensive areas of carparking and hardstanding. Pervious pavements are an effective alternative to impermeable surfaces and therefore require no extra development space for their construction. As they only require a small head difference between the runoff level and the outfall, they are suitable for use on flat terrain. Whilst they generally tend to be used in areas with low traffic volumes and light traffic loading (such as car parks) they are capable of supporting heavy goods vehicles. Pervious pavements can be used in most ground conditions and by incorporating suitable lining systems they can be used in brownfield areas. Runoff contamination, groundwater levels and existing services will require consideration and the design will need to consider proximity to existing building foundations as is the case with infiltration systems. Given their suitability and benefits, the use of permeable pavements should therefore be integral to the design of new surfaces.

They can be combined with other SuDS solutions to effectively manage surface water. Retrofitting of pervious pavements to existing impermeable areas would also be encouraged.

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.

Table 5. Storage requirements at the proposed development Site (discharge runoff to combined sewer)

Attenuation scenario		Attenuation required (m ³)	Explanation	
Discharge runoff to combined sewer	1 in 30 year	61.01	Attenuation required to ensure surface water runoff is attenuated in all storm events up to and including the 1 in 30 year (6 hour, Critical Storm Duration) event*. Flooding of the Site of 30.13 m³ 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 55.23 m³ 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 40% allowance for climate change.
	1 in 100 year	91.14	Attenuation required to ensure surface water runoff is attenuated in all storm events up to and including the 1 in 100 year (8 hour, Critical Storm Duration) event*.	
	1 in 100 year including 45% CC	146.37	Attenuation required to ensure surface water runoff is attenuated in all storm events up to and including the 1 in 100 year (10 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.

Surface water runoff

A change in impermeable area on-Site will result in a change in 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 6. Change in impermeable area associated with the development

Total Site area	2000 m ²
Impermeable area (and as a percentage of the total area of the proposed development footprint of 2000 m ²)	
Pre-development	Post-development
2000 m ² (100%)	1630 m ² (82%)
Impermeable land use: Existing buildings and yard areas Permeable land use: None	New impermeable land use: Proposed dwellings, driveways and access road* New permeable land use: Landscaped areas

*Please note, whilst the access roads and driveways will be utilised for SuDS, for the calculations these areas will be classed as impermeable in order to assess the potential run-off volumes and rates for the Site post- development and the potential holding capability of the proposed SuDS features.

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"

(Defra, March 2015, 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 7. 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	1.25	N/A	N/A	N/A
6 hour 1 in 1 year	1.07	2.16	1.95	-0.21
6 hour 1 in 10 year	1.73	3.40	3.08	-0.32
6 hour 1 in 30 year	2.11	4.69	4.23	-0.46
6 hour 1 in 100 year	2.61	6.40	5.77	-0.63
6 hour 1 in 100 year + 20% CC	N/A	N/A	6.93	N/A
6 hour 1 in 100 year + 45% CC	N/A	N/A	8.37	N/A

¹ Assumes 100% runoff from impermeable surfaces. Assumes Greenfield runoff from permeable surfaces calculated using the loH124 method.

Relevant national, local and regional 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 1 l/s, without increasing the risk of any potential blockages occurring in the drainage network.

Total discharge volumes

The table below 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'. Total discharge volumes associated with the development.

Table 8. 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	23.18	N/A	N/A	N/A
6 hour 1 in 1 year	21.97	46.74	42.16	-4.58
6 hour 1 in 10 year	35.77	73.46	66.49	-6.97
6 hour 1 in 30 year	47.64	101.36	91.42	-9.94
6 hour 1 in 100 year	65.00	138.30	124.74	-13.56
6 hour 1 in 100 year + 20% CC	N/A	N/A	149.69	N/A
6 hour 1 in 100 year + 45% CC	N/A	N/A	180.87	N/A

² Assumes 100% runoff from impermeable surfaces. Assumes Greenfield runoff from permeable surfaces calculated using the loH124 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 1 l/s.

Table 9. 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	1	6	61.01
1 in 100 year	1	8	91.14
1 in 100 year including a 45% climate change	1	10	146.37

7 Runoff destination



Options for the destination for the runoff generated on-Site have been assessed in line with the prioritisation set out in the Building Regulations Part H document (HM Government, published in 2010 and updated in 2015) and Defra's Non-statutory Technical Standards for SuDS (2015).

Flow attenuation using infiltration SuDS (discharge to ground) is generally the preferred option. If discharge to ground is not available, runoff discharge to surface water is the other preferred method. Only if these two options are impractical should discharge to the sewer network be considered.

Discharge to ground

Whilst GeoSmart's SD50 mapping indicates that the Site has a moderate potential for infiltration SuDS, nearby borehole records indicate that the underlying superficial Till deposits are comprised largely of clay, therefore the actual infiltration potential is considered to be Low. Consequently, infiltration SuDS are not considered to be feasible.

Discharge to surface watercourse

OS mapping indicates that there are no surface water features within 100m of the Site's boundary. Therefore discharge in this manner is not considered to be feasible.

Discharge to sewer

Due to the unsuitability of other discharge locations, discharging surface water to the nearby combined sewer network is considered to be the most appropriate strategy. A United Utilities asset location plan confirms that a combined sewer network is located adjacent to the Site's northern, southern and western boundaries. Consultation with the local sewer undertaker should be undertaken to obtain permission to connect to the sewer network. Discharge would have to be controlled and on-Site attenuation would be required.

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 10. 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 of treatment stages suggested for the different runoff waters identified for the proposed development is highlighted in the table below.

Table 11. 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

Permeable surfacing would offer sufficient treatment stages (storage/attenuation, filtration through sub-base and filtration through the unsaturated soil zone).

9 Proposed SuDS strategy



Sustainable drainage systems

DEFRA's non-statutory requirements for SuDS require the below ground drainage systems to have the capacity to accommodate at least the 1 in 30 year event and to manage the 1 in 100 year event without flooding of on-site buildings and substations. All runoff should be managed on-Site though for the 1 in 100 year event, accounting for the maximum impacts of climate change to ensure flood risk is not increased to third-parties.

It is assumed that drainage from areas outside the development footprint will continue to use existing drainage arrangements.

A surface water drainage strategy (summarised in Section 2 of this report) includes the following SuDS features to intercept, attenuate and treat surface water runoff.

Primary SuDS Strategy:

Infiltration to ground is not achievable at the Site, and no surface water features have been identified or are available, therefore, surface water runoff will be managed within SuDS features and discharged to the public combined sewer network.

Table 12. Proposed SuDS type, features, discharge location and rate restriction

SuDS type	Source control (interception) and attenuation SuDS.
SuDS features	Rainwater harvesting butts, permeable paving and attenuation tank.
Discharge location	Public combined sewer network.
Discharge rate	1l/s (where discharge to sewer/surface water feature is proposed)

Table 13. Proposed SuDS sizing (dimensions) and attenuation volumes

Rainwater harvesting	Rainwater harvesting butts should be established for each proposed property. 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 schematic.
Permeable paving	A 970 m ² area of permeable paving (underlain with a Type 3 aggregate material) within the proposed access road, patios and driveway areas, to a depth of 0.4 m, with a 30% porosity, would result in c. 116.4 m ³ of attenuation.

Attenuation tank	An attenuation tank measuring 10m in length, 3.5m in width and 1m in depth, with a 95% void ratio, would result in 33.25 m ³ of attenuation.
Total Attenuation Provided	149.65 m ³
Total Attenuation Required	146.37 m ³
Freeboard Storage Provided	3.28 m ³

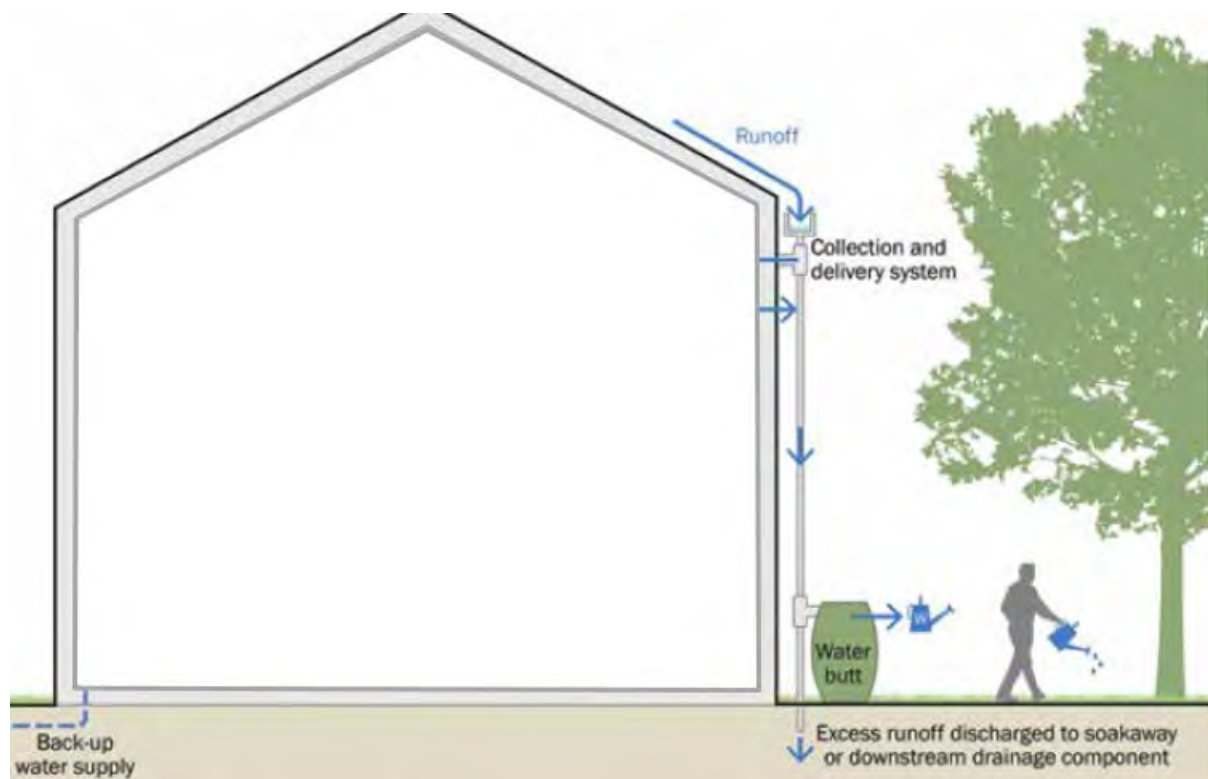
Rainwater harvesting

Rainwater harvesting butts are proposed for each on-Site dwelling. The run-off from the proposed development roofs should be led into rainwater harvesting butts via rainwater downpipes and guttering. Overflow from the butts should be discharged into the storage system provided by the permeable paving and attenuation tank.

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 devices 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 contaminants that collect on a residential roof.



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

Permeable paving

Permeable Paving is proposed for driveway areas, pathways and the access road on-Site to intercept runoff. Suitable aggregate materials (angular gravels with suitable grading as per CIRIA, 2015) will improve water quality due to their filtration capacity and usually work to a 30% porosity. A geotextile layer will be required for paving underlain by aggregate material to intercept silt/particles. Permeable pavements are multi-layered surfacing systems. The surface layer is constructed out of permeable material allowing infiltration of water through gaps along its surface. A geomembrane isolates stored water from the surrounding soil, especially in contaminated areas and a geotextile layer prevents clogging and damage to the geo-cellular modules.

The geotextile layer works to intercept silt/particles flowing through the system via direct rainfall, or through vehicle use deposited onto the car park area and into the permeable paving. The majority of silt would be trapped within the top 30mm of the joining material between the paving blocks. Rainfall flowing into the permeable paving directly from the development roof/rainwater butts would not contain enough volumes of silt and or particles to cause blockage so will be fed directly into underlying porous substrate via rainwater pipes. Downpipes from the development roofs/rainwater butts should extend through the paving for c.5 meters to divert roof run-off away from building foundations. Paving could also implement an impermeable liner close to the building or creating a separate compartment within the permeable sub-base close to the building to further divert attenuated water away from building foundations.

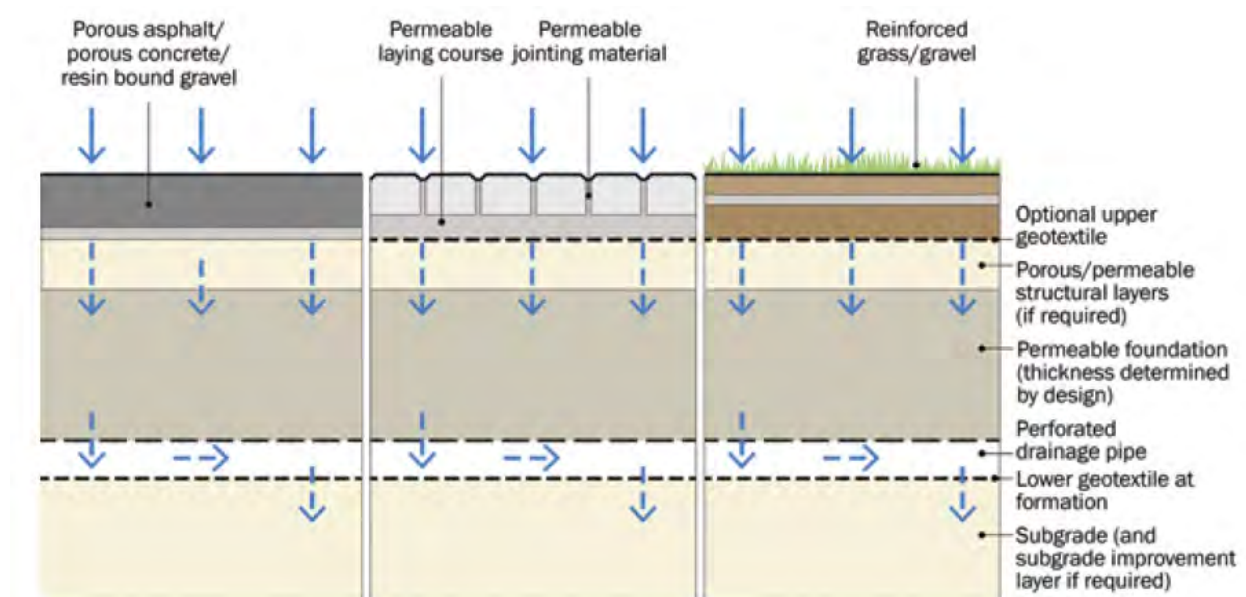


Figure 20.13 of the CIRIA SuDS Manual (C753) (2015)

Plastic geo-cellular systems could also be used, which can increase the void space and therefore storage but do not allow filtration unless they are combined with aggregate material and/or permeable geotextiles which could increase their storage potential by up to 20%. Geo-cellular modules also have the added advantage of reducing the amount of aggregate sub base required, thus keeping costs lower. Void systems, such as permavoids, have a void ratio of 95% (i.e. for every 1 m³ there is 0.95 m³ of space available for water storage), which has been factored into the storage capacity calculations.

Attenuation GRP Tanks

A Glass Reinforced Plastic (GRP) tank is proposed to provide the storage required. Attenuation GRP Tanks provide a below-ground void space for use of temporary storage via controlled release. They can also be modified to suit specific characteristics of a site. DEFRA, 2015 states that the run-off volume from the development to drain to any sewer or surface water body in the 1 in 100 year rainfall event must be constrained to a value as close as is reasonably practical to the greenfield runoff volume for the same event but should never exceed the runoff volume from the development prior to redevelopment from the Site. Issues with Attenuation GRP Tanks are the level of accessibility, lack of treatment performance and cost in comparison to surface systems.

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 valve is recommended for outflow pipes to reduce the risk of backflow from the channel/sewer 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. 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 14. SuDS operation and recommended maintenance requirements

Asset type	Maintenance schedule (and frequency)
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). • 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).

Asset type	Maintenance schedule (and frequency)
	• 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).
GRP Tanks / 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 15. 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?	
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 16. 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



This report assesses the feasibility of infiltration SuDS and alternative drainage strategies in support of the Site development process. From April 6th 2015 SuDS are regulated by Local Planning Authorities and will be required under law for major developments in all cases unless demonstrated to be inappropriate. What is considered appropriate in terms of costs and benefits by the Planning Authority will vary depending on local planning policy, and Site setting. The Lead Local Flood Authority will require information as a statutory consultee on major planning applications with surface water drainage implications. The National Planning Policy Framework requires that new developments in areas at risk of flooding should give priority to the use of SuDS and demonstrate that the proposed development does not increase flood risk downstream to third parties.

How was the suitability of SuDS estimated for the Site?

There are a range of SuDS options available to provide effective surface water management that intercept and store excess runoff. When considering these options, the destination of the runoff should be assessed using the order of preference outlined in the Building Regulations Part H document (HM Government, 2010) and Defra's National Standards for SuDS (2015):

1. Discharge to the ground;
2. Discharge to a surface water body;
3. Discharge to a surface water sewer;
4. Discharge to a local highway drain; and
5. Discharge to a combined sewer.

Data sets relating to each of the potential discharge options have been analysed to assess the feasibility of each option according to the hierarchy set out above. Hydrogeological characteristics for the Site are assessed in conjunction with the occurrence of SPZ's to assess infiltration suitability. The Site has been screened to determine whether flood risk from groundwater, surface water, fluvial or coastal sources may constrain SuDS. The distance to surface water bodies and sewers has been reviewed gauge whether these provide alternative options.

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 50m 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 50m 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, 2019). 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 Further information



The following table includes a list of additional products by GeoSmart:

Additional GeoSmart Products			
✓	Additional assessment: FloodSmart Report		The FloodSmart Report range provides clear and pragmatic advice regarding the nature and potential significance of flood hazards which may be present at a Site. Our consultants assess available data to determine the level of risk based on professional judgement and years of experience. Please contact info@geosmartinfo.co.uk for further information.
✓	Additional assessment: EnviroSmart Report		Provides a robust desk-based assessment of potential contaminated land issues, taking into account the regulatory perspective. Our EnviroSmart reports are designed to be the most cost effective solution for planning conditions. Each report is individually prepared by a highly experienced consultant conversant with Local Authority requirements. Ideal for pre-planning or for addressing planning conditions for small developments. Can also be used for land transactions. Please contact info@geosmartinfo.co.uk for further information.

14 References and glossary



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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 2023 BlueSky copyright and database rights 2023
Bedrock & Superficial Geology	Contains British Geological Survey materials © NERC 2023 Ordnance Survey data © Crown copyright and database right 2023
Flood Risk (RoFRS/Pluvial/Surface Water Features/SPZ)	Environment Agency copyright and database rights 2023 Ordnance Survey data © Crown copyright and database right 2023
Flood Risk (Groundwater) and SuDS infiltration suitability (SD50)	GeoSmart, BGS & OS GW5 (v2.4) Map (GeoSmart, 2023) Contains British Geological Survey materials © NERC 2023 Ordnance Survey data © Crown copyright and database right 2023
Sewer Location	Contains Ordnance Survey data © Crown copyright and database right 2023 Contains United Utilities Search data 2023
Topographic Data	OS LiDAR/EA Contains Ordnance Survey data © Crown copyright and database right 2023 Environment Agency copyright and database rights 2023

15 Appendices



Appendix A



Site plans



LOCATION PLAN

notes

This drawing is subject to a detailed building and site survey, therefore no guarantee of its accuracy can be given.
This drawing has been draughted in accordance with the clients design requirements.
All areas are approximate and are subject to a detailed building and site survey and further design development.
All dimensions should be checked prior to commencement of construction on site. Measurements should not be taken off the drawing.

All dimensions shown are in millimetres (mm).

PL0 Planning Issue

03.04.23

revisions



NADA Architects Ltd

169 Kingsway

Burnage

Manchester

M19 2ND

Mob: 07974 735527

E: ahmed@nadaarchitects.com

W: www.nadaarchitects.com

D - design

PL - planning

PT - pre-tender

T - tender

P - preliminary

C - construction

R - record

BURKE CONSTRUCTION LTD

NEW BUILD RESIDENTIAL
SITE @ 7 CHAPEL ST,
MANCHESTER, M19 3QB

LOCATION PLAN

scale	date	drawn	checked
1:1250 @ A3	03.04.23		AC
job no	(category) dwg no	revision	
23-1136	(01)001	PL0	
Drawing measurements shall not be obtained by scaling. Verify all dims prior to construction. Immediately report any discrepancies on this drawing to Architect. This drawing shall be read in conjunction with associated specifications and related consultant's documents.			



notes

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PL0 Planning Issue 03.04.23



revisions

NADA Architects Ltd
169 Kingsway
Burnage
Manchester
M19 2ND
Mob: 07974 735527
E: ahmed@nadaarchitects.com
W: www.nadaarchitects.com

D - design PL - planning PT - pre-tender
T - tender P - preliminary
C - construction R - record

BURKE CONSTRUCTION LTD

**NEW BUILD RESIDENTIAL
SITE @ 7 CHAPEL ST,
MANCHESTER, M19 3QB**

PROPOSED GA SITE PLAN

scale 1:500 @ A3 date 03.04.23 drawn checked AC

job no (category) dwg no revision

23-1136(03)001 **PL0**

Drawing measurements shall not be obtained by scaling. Verify all dims prior to construction. Immediately report any discrepancies on this drawing to Architect. This drawing shall be read in conjunction with associated specifications and related consultant's documents.

PLANNING

Appendix B



Rainfall runoff calculations

Greenfield Site Run-Off Calculations using the loH124 method

Greenfield peak run-off rate (QBAR):

Parameters	Input	Units	Comments
Area	50	ha	minimum 50ha
SAAR	875	mm	FEH CD ROM (NERC, 2009)
SPR	0.47	N/A	Soil run-off coefficient
Region	10	N/A	Region on Hydrological area map

QBAR

$$Q_{\text{BAR(rural)}} = 1.08 \text{AREA}^{0.89} \text{SAAR}^{1.17} \text{SPR}^{2.17}$$

Where:

$Q_{\text{BAR(rural)}}$	is the mean annual flood (a return period of 2.3 years) in l/s
AREA	is the area of the catchment in km ² (minimum of 0.5km ²)
SAAR	is the standard average rainfall for the period 1941 to 1970 in mm
SPR	is the soil run-off coefficient

$Q_{\text{BAR(rural)}}$ can be factored by the UK Flood Studies Report regional growth curves to produce peak flood flows for any return period.

$Q_{\text{BAR(rural)}}$	=	313.41	l/s for 50ha site
Divided by 50 to scale down	=	6.27	l/s/ha
Actual Area of the entire Site	=	0.20	ha

Return Periods (Growth curves obtained from DEFRA report)

Return Period		Growth Factor	Peak site run-off rate	
			l/s/ha	(l/s)
1	$Q_{\text{BAR(rural)}} \times$	0.85	5.33	1.066
2	$Q_{\text{BAR(rural)}} \times$	0.93	5.83	1.17
5	$Q_{\text{BAR(rural)}} \times$	1.19	7.46	1.49
10	$Q_{\text{BAR(rural)}} \times$	1.38	8.65	1.73
25	$Q_{\text{BAR(rural)}} \times$	1.64	10.28	2.06
30	$Q_{\text{BAR(rural)}} \times$	1.68	10.53	2.106
50	$Q_{\text{BAR(rural)}} \times$	1.85	11.60	2.32
100	$Q_{\text{BAR(rural)}} \times$	2.08	13.04	2.61
200	$Q_{\text{BAR(rural)}} \times$	2.32	14.54	2.91

Greenfield total run-off volume:

= actual area of the entire site x SPR x 6 hour rainfall depth

Return Period	6 hour rainfall (mm) from FEH CD-ROM	Area (ha)	SPR	Total run-off (m ³)
2.3 (QBAR)	24.66	0.20	0.47	23.2
1	23.37	0.20	0.47	22.0
10	38.05	0.20	0.47	35.8
30	50.68	0.20	0.47	47.6
100	69.15	0.20	0.47	65.0

Developed site run-off calculation sheet																				
1 in 1 year				1 in 30 year								1 in 100 year								
Proposed impermeable area		0.163 ha		Proposed impermeable area		0.163 ha						Proposed impermeable area		0.163 ha						
CC Factor		45%		CC Factor		45%						CC Factor		45%						
Total volume for surfaces during 6 hour event		38.09 m³		Total volume for surfaces during 6 hour event		82.61 m³						Total volume for surfaces during 6 hour event		112.71 m³						
Total volume for 6 hour event inc CC		55.23 m³		Total volume for 6 hour event inc CC		119.78 m³						Total volume for 6 hour event inc CC		163.44 m³						
Total volume for 6 hour event exc CC		38.09 m³		Total volume for 6 hour event exc CC		82.61 m³						Total volume for 6 hour event exc CC		112.71 m³						
Duration	Rainfall	Run-off rate	Run-off rate	Duration	Rainfall	Run-off volume	Run-off volume	Duration	Rainfall	Run-off volume	Run-off volume	Duration	Rainfall	Run-off volume	Run-off volume	Outflow at 1 l/s	Inflow from rain	Diff (storage required)	100yr Scenario	CC Scenario
	1 yr event	1 yr event	1 yr +cc event		30 yr event	30 yr event	30 yr +cc event		100 yr event	100 yr event	100 yr +cc event		100 yr event	100 yr event	100 yr +cc event					
hours	mm	m³	m³	hours	mm	m³	m³	hours	mm	m³	m³	hours	mm	m³	m³					
0.25	7.46	12.16	17.63	0.25	19.23	31.34	45.45	0.90	31.34	30.44		0.25	26.58	43.33	62.82	0.90	62.82	42.43	61.92	
0.5	9.66	15.75	22.83	0.5	25.33	41.29	59.87	1.80	41.29	39.49		0.5	35.26	57.47	83.34	1.80	83.34	55.67	81.54	
0.75	11.10	18.09	26.23	0.75	29.10	47.43	68.78	2.70	47.43	44.73		0.75	40.76	66.44	96.34	2.70	96.34	63.74	93.64	
1	12.10	19.72	28.60	1	31.90	52.00	75.40	3.60	52.00	48.40		1	44.76	72.96	105.79	3.60	105.79	69.36	102.19	
2	16.00	26.08	37.82	2	38.36	62.53	90.66	7.20	62.53	55.33		2	53.53	87.25	126.52	7.20	126.52	80.05	119.32	
3	18.49	30.14	43.70	3	42.60	69.44	100.69	10.80	69.44	58.64		3	59.08	96.30	139.64	10.80	139.64	85.50	128.84	
4	20.40	33.25	48.22	4	45.84	74.72	108.34	14.40	74.72	60.32		4	63.19	103.00	149.35	14.40	149.35	88.60	134.95	
5	21.99	35.84	51.97	5	48.45	78.97	114.51	18.00	78.97	60.97		5	66.43	108.28	157.01	18.00	157.01	90.28	139.01	
6	23.37	38.09	55.23	6	50.68	82.61	119.78	21.60	82.61	61.01		6	69.15	112.71	163.44	21.60	163.44	91.11	141.84	
8	25.68	41.86	60.69	8	54.42	88.70	128.62	28.80	88.70	59.90		8	73.58	119.94	173.91	28.80	173.91	91.14	145.11	
10	27.62	45.02	65.28	10	57.51	93.74	135.92	36.00	93.74	57.74		10	77.16	125.77	182.37	36.00	182.37	89.77	146.37	
12	29.30	47.76	69.25	12	60.16	98.06	142.19	43.20	98.06	54.86		12	80.17	130.68	189.48	43.20	189.48	87.48	146.28	
16	32.18	52.45	76.06	16	64.58	105.27	152.63	57.60	105.27	47.67		16	85.14	138.78	201.23	57.60	201.23	81.18	143.63	
20	34.59	56.38	81.75	20	68.24	111.23	161.29	72.00	111.23	39.23		20	89.20	145.40	210.82	72.00	210.82	73.40	138.82	
24	36.67	59.77	86.67	24	71.40	116.38	168.75	86.40	116.38	29.98		24	92.67	151.05	219.03	86.40	219.03	64.65	132.63	
28	38.53	62.80	91.07	28	74.16	120.88	175.28	100.80	120.88	20.08		28	95.70	155.99	226.19	100.80	226.19	55.19	125.39	
32	40.23	65.57	95.08	32	76.65	124.94	181.16	115.20	124.94	9.74		32	98.41	160.41	232.59	115.20	232.59	45.21	117.39	
36	41.80	68.13	98.79	36	78.93	128.66	186.55	129.60	128.66	-0.94		36	100.88	164.43	238.43	129.60	238.43	34.83	108.83	
40	43.27	70.53	102.27	40	81.05	132.11	191.56	144.00	132.11	-11.89		40	103.16	168.15	243.82	144.00	243.82	24.15	99.82	
44	44.66	72.80	105.55	44	83.02	135.32	196.22	158.40	135.32	-23.08		44	105.29	171.62	248.85	158.40	248.85	13.22	90.45	
48	45.97	74.93	108.65	48	84.87	138.34	200.59	172.80	138.34	-34.46		48	107.29	174.88	253.58	172.80	253.58	2.08	80.78	

Appendix C



United Utilities asset location search

GeoSmart Information

Suite 9-11, Old Bank Buildings
Bellstone,
Shropshire,
SY1 1HU

FAO:

How to contact us:

United Utilities Water Limited
Property Searches
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP

Telephone: 0370 7510101

E-mail: propertysearches@uuplc.co.uk

Your Ref: 79499
Our Ref: UUPS-ORD-490430
Date: 24/05/2023

Dear Sirs

Location: BELPER TOOLS 7 CHAPEL STREET, LEVENSHULME, MANCHESTER, M19 3QB

I acknowledge with thanks your request dated 23/05/2023 for information on the location of our services.

Please find enclosed plans showing the approximate position of United Utilities' apparatus known to be in the vicinity of this site.

The enclosed plans are being provided to you subject to the United Utilities terms and conditions for both the wastewater and water distribution plans which are shown attached.

If you are planning works anywhere in the North West, please read United Utilities' access statement before you start work to check how it will affect our network. <http://www.unitedutilities.com/work-near-asset.aspx>.

I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please [contact us](#).

Yours Faithfully,



Karen McCormack
Property Searches Manager

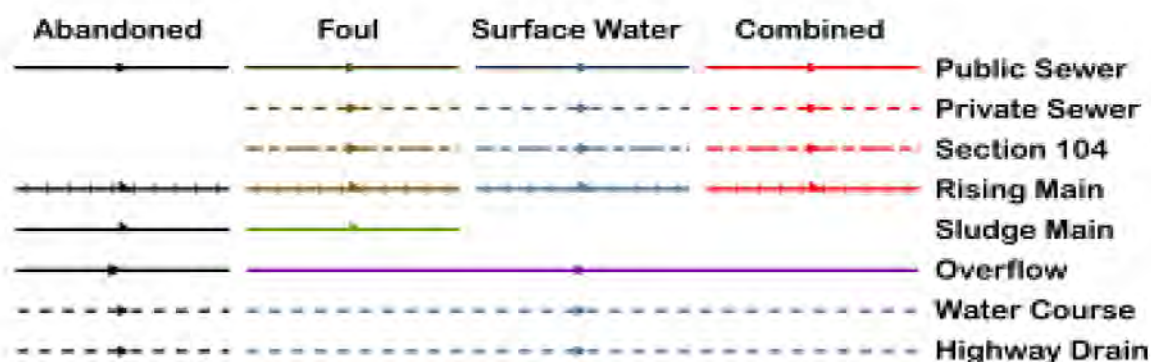
TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus) of United Utilities Water Limited "(UUWL)".

TERMS AND CONDITIONS:

- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
- This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.
- In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only. UUWL strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUWL apparatus. The exact location, positions and depths should be obtained by excavation trial holes.
- The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.
- The position and depth of UUWL apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.
- This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUWL apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.
- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.

Wastewater Symbolology



All point assets follow the standard colour convention: **red** – combined **brown** - foul
blue – surface water **purple** - overflow

- | | |
|------------------|--------------------------|
| Manhole | Side Entry Manhole |
| Head of System | Outfall |
| Extent of Survey | Screen Chamber |
| Rodding Eye | Inspection Chamber |
| Inlet | Bifurcation Chamber |
| Discharge Point | Lamp Hole |
| Vortex | T Junction / Saddle |
| Penstock | Catchpit |
| Washout Chamber | Valve Chamber |
| Valve | Vent Column |
| Air Valve | Vortex Chamber |
| Non Return Valve | Penstock Chamber |
| Soakaway | Network Storage Tank |
| Gully | Sewer Overflow |
| Cascade | Ww Treatment Works |
| Flow Meter | Ww Pumping Station |
| Hatch Box | Septic Tank |
| Oil Interceptor | Control Kiosk |
| Summit | |
| Drop Shaft | Change of Characteristic |
| Orifice Plate | |



Scale: 1:1250
Date: 24/05/2023

SEWER RECORDS



Water for the North West

Address or Site Reference: BELPER TOOLS 7 CHAPEL STREET,
LEVENSHULME, MANCHESTER, M19 3QB

Printed by: Property Searches

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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Further information

Information on confidence levels and ways to improve this report can be provided for any location on written request to info@geosmart.co.uk or via our website. Updates to our model are ongoing and additional information is being collated from several sources to improve the database and allow increased confidence in the findings. Further information on groundwater levels and flooding are being incorporated in the model to enable improved accuracy to be achieved in future versions of the map. Please contact us if you would like to join our User Group and help with feedback on infiltration SuDS and mapping suggestion.

Important consumer protection information

This search has been produced by GeoSmart Information Limited, Suite 9-11, 1st Floor, Old Bank Buildings, Bellstone, Shrewsbury, SY1 1HU.

Tel: 01743 298 100

Email: info@geosmartinfo.co.uk

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- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom.
- sets out minimum standards which firms compiling and selling search reports have to meet.
- promotes the best practice and quality standards within the industry for the benefit of consumers and property professionals.
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.
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- conduct business in an honest, fair and professional manner.
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- monitor their compliance with the Code.

Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award up to £5,000 to you if the Ombudsman finds that you have suffered actual financial loss and/or aggravation, distress or inconvenience as a result of your search provider failing to keep to the Code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs contact details:

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

You can get more information about the PCCB from www.propertycodes.org.uk.

Please ask your search provider if you would like a copy of the search code

Complaints procedure

GeoSmart Information Limited is registered with the Property Codes Compliance Board as a subscriber to the Search Code. A key commitment under the Code is that firms will handle any complaints both speedily and fairly. If you want to make a complaint, we will:

- Acknowledge it within 5 working days of receipt.
- Normally deal with it fully and provide a final response, in writing, within 20 working days of receipt.
- Keep you informed by letter, telephone or e-mail, as you prefer, if we need more time.
- Provide a final response, in writing, at the latest within 40 working days of receipt.
- Liaise, at your request, with anyone acting formally on your behalf.

If you are not satisfied with our final response, or if we exceed the response timescales, you may refer the complaint to The Property Ombudsman scheme (TPOs): Tel: 01722 333306, E-mail: admin@tpos.co.uk.

We will co-operate fully with the Ombudsman during an investigation and comply with his final decision. Complaints should be sent to:

Martin Lucass

Commercial Director

GeoSmart Information Limited

Suite 9-11, 1st Floor,

Old Bank Buildings,

Bellstone, Shrewsbury, SY1 1HU

Tel: 01743 298 100

martinlucass@geosmartinfo.co.uk

16 Terms and conditions, CDM regulations and data limitations



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<http://geosmartinfo.co.uk/data-limitations/>