

SuDSmart Pro



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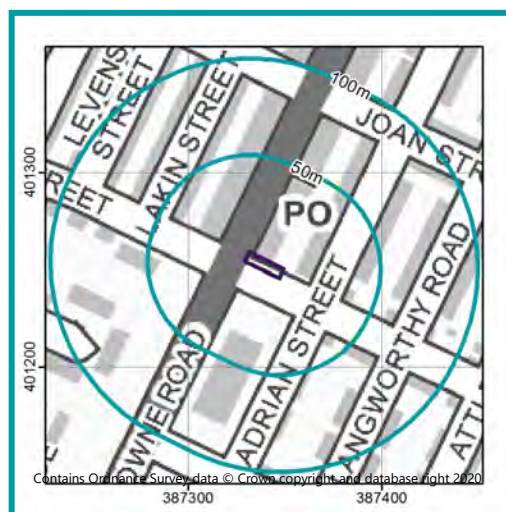
Report prepared for: Mr W Chaudry

Site address: Land adjacent to 174 Lightbowne Road, Manchester, Lancashire M40 5EE

Overview: The proposed Sustainable Drainage System (SuDS) for the development is comprised of lined permeable surfacing and rain gardens to attenuate up to 2.3 m³ of surface water runoff.

Surface water will be discharged to the public combined sewer at a restricted rate of 1 l/s.

The proposed strategy has been produced in accordance with DEFRA's non-statutory technical standards S4, S5 and S6 (DEFRA, 2015). Surface water runoff will be managed effectively in all events up to and including the 1% AEP event plus a 40% allowance for climate change.



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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 is managed effectively over the lifetime of the proposed development.

SuDS suitability

Risk	Issue	Result
SuDS suitability	What is the infiltration potential at the Site?	Moderate
	What is the potential to discharge to surface water features?	Low
	What is the potential to discharge to sewers?	High
Flooding	What is the fluvial flood risk at the Site?	Negligible
	What is the pluvial flood risk at the Site?	Very Low
	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

The Site is currently used within a greenfield capacity, although there was once an end of terrace house on the Site. Development proposals comprise the construction of 1 No. 3 bed end-terraced house with garden.

SuDS strategy summary

According to GeoSmart's SuDS Infiltration Potential (SD50) map, the Site has a Moderate potential for infiltration, primarily due to the underlying sandstone geology. Although Infiltration to ground could be feasible, due to spatial constraints it is not proposed as the surface water drainage strategy for this proposed development.

There is no surface watercourse/feature within close proximity to the Site. Therefore, surface water has been discounted as a discharge location.

The Site is located within 10 m of the public combined sewer network, within both Lighbowne Road and Egbert Street. It is proposed that discharge to the public combined sewer within Egbert Street would be the optimum discharge solution for the proposed development.

Runoff rate and attenuation requirements

SuDS features comprised of lined permeable surfacing is proposed to attenuate a minimum of 2.3 m³ of surface water runoff before discharging offsite to the public combined sewer at a restricted rate of 1 l/s. A sediment trap is proposed to reduce the risk of blockage.

The proposed SuDS strategy would ensure surface water runoff is stored on Site in SuDS features for the 1 in 100 year event and will not cause flooding to the proposed development as preferred by DEFRA non-statutory guidance (DEFRA, 2015).

SuDS & drainage network maintenance

The management and maintenance of the SuDS features, in line with the details and schedules outlined in Section 17 of this report, will be undertaken.

Next steps

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

Environmental and ecological considerations:

The Site is not located within a Special Protection Area (SPA) or a Site of Special Scientific Interest (SSSI).

CDM considerations:

If your development is defined as 'Construction Work' under CDM 2015, you or the organisation that is having the work carried out will be defined as 'the Client' and have specific duties under the Regulations. A full list of CDM considerations and our Terms and Conditions can be found on our website, the links can be found in Section 22 at the back of this report.

2. Proposed SuDS strategy

The most suitable SuDS options are indicated below, including a SuDS strategy schematic overleaf with further supporting information provided in subsequent sections. A combination of SuDS features are proposed including those shown below.

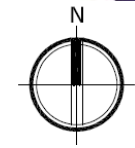
Table 1: Proposed SuDS type, features, discharge location and rate restriction

SuDS type	Source control (interception) and attenuation SuDS.
SuDS features	Lined permeable surfacing.
Discharge location	Public combined sewer network.
Discharge rate	1 l/s (where discharge to sewer/surface water feature is proposed).

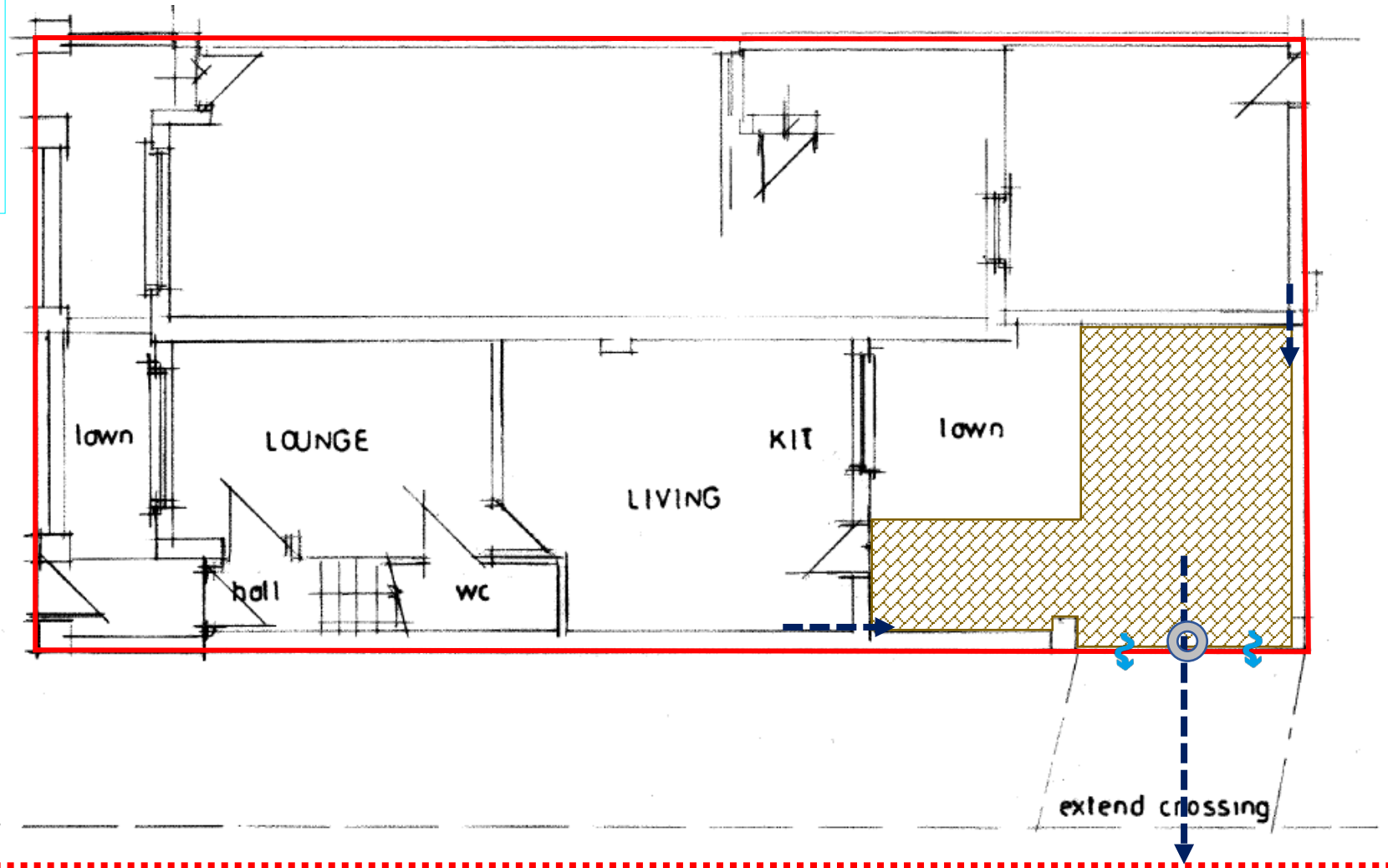
Table 2: Proposed SuDS sizing (dimensions) and attenuation volumes

Lined permeable surfacing	A 29 m ² area of lined permeable surfacing (underlain with a Type 3 aggregate material) within the proposed driveway area to a depth of 0.3 m, with a 30% porosity.
Total Attenuation Provided	2.6 m³
Total Attenuation Required	2.3 m³
Freeboard	0.3 m³

2. Proposed SuDS scheme layout



-  Lined permeable surfacing
-  Drainage network
-  Hydro-brake
-  Public combined sewer
-  Exceedance flow routes
-  Site boundary



3. Site location

Grid reference:
387339, 401255

Site area:
100 m²

Current use:
Greenfield

Proposed use:
Residential

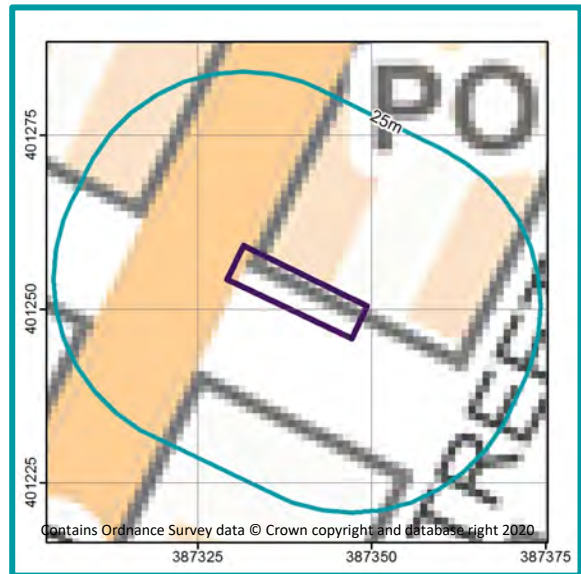
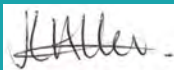
Report author:
Jennifer Allen – Project Consultant

Report checker

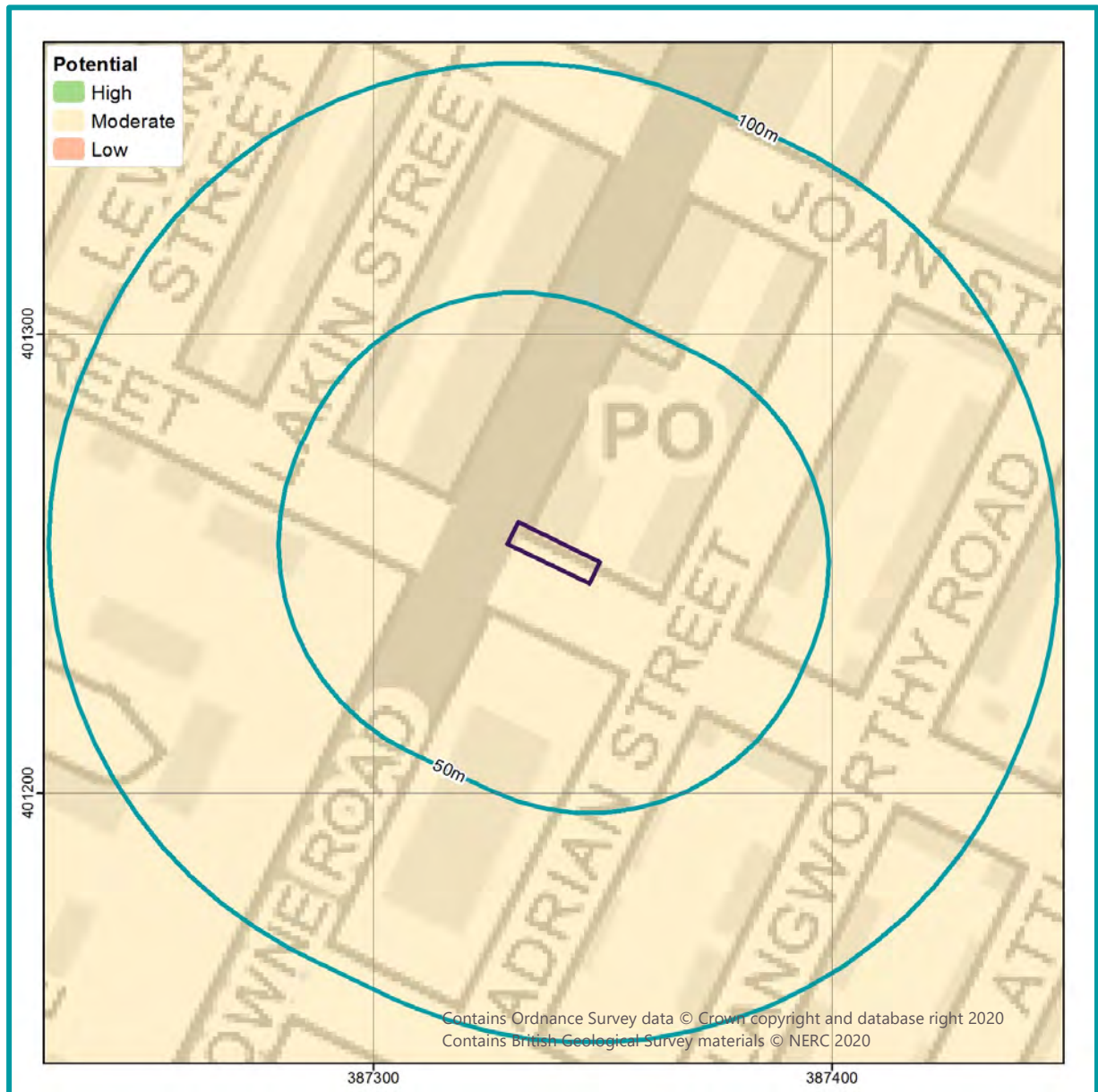
Alan White - Principal Consultant

Report reviewer:

Bob Sargent - Principal Hydrologist



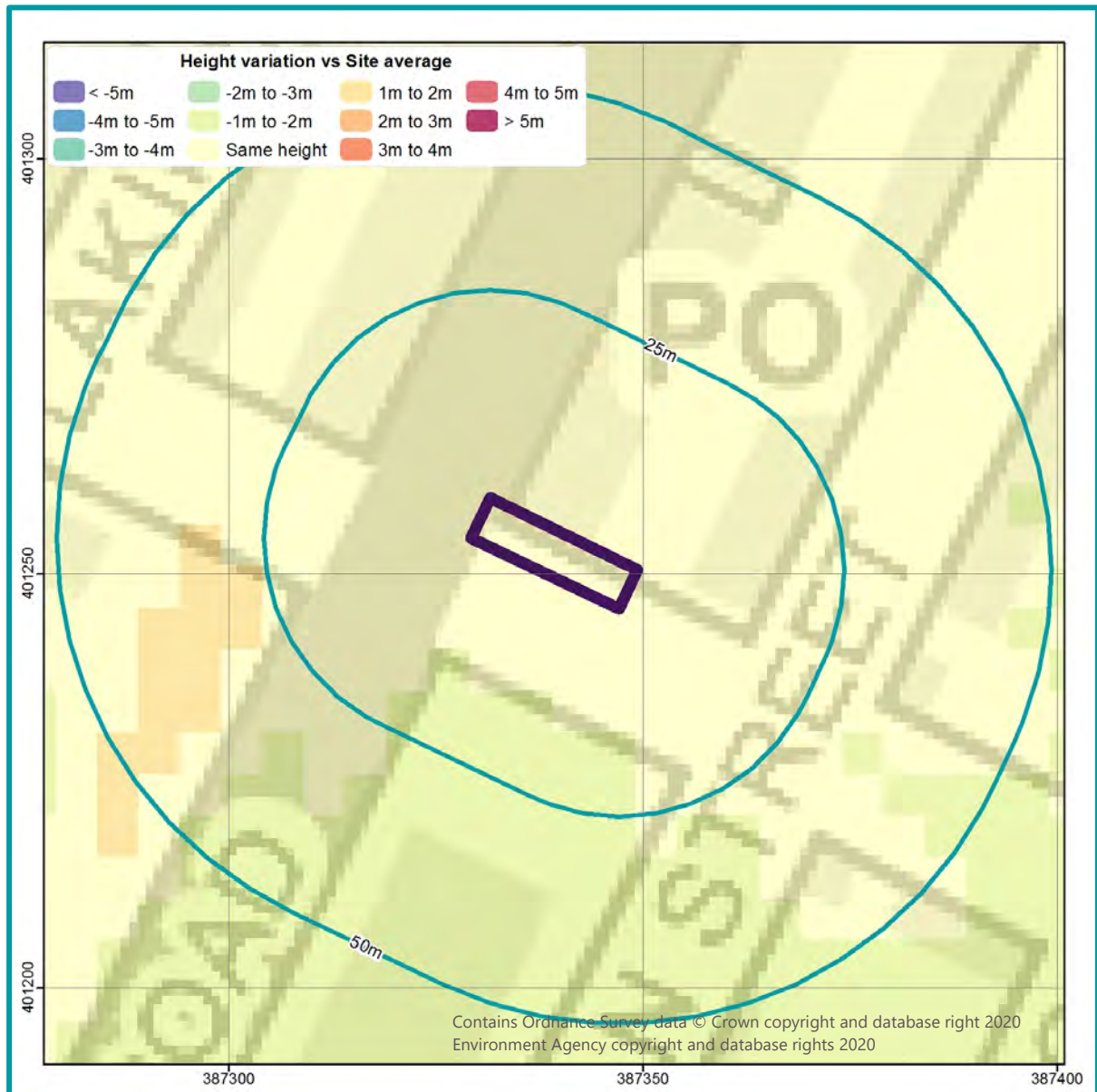
4. SuDS infiltration suitability (SD50) map



GeoSmart's SuDS Infiltration Suitability (SD50) Map 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.

According to the SD50 map, the Site has a Moderate potential for infiltration. Although infiltration to ground of surface water runoff may be feasible at the Site, following infiltration testing, spatial constraints at the Site would mean that infiltration SuDS features could not be located at least 5 m from building foundations or 2 m from a Site boundary.

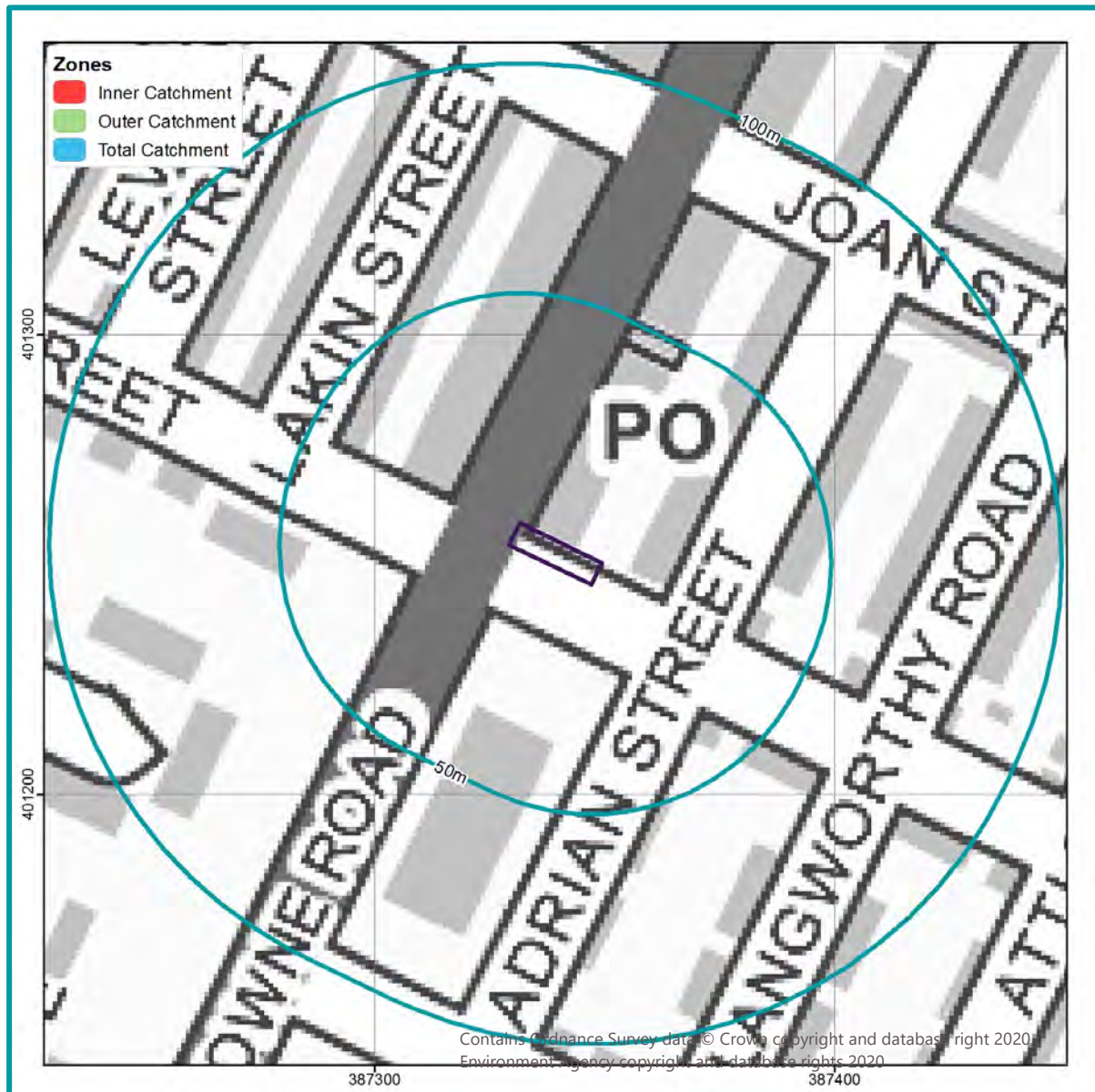
5. Site topography



GeoSmart have undertaken an assessment of the topography at the Site and within its vicinity, using LiDAR ground elevation data from the Environment Agency (EA). The mapping shows a comparison between average ground levels on the Site with ground levels in the surrounding area.

According to the EA's LiDAR data, ground levels at the Site are relatively flat between 86.9 and 87.2 m Above Ordnance Datum (AOD).

6. Source protection zone map



GeoSmart have undertaken an assessment of the EA groundwater Source Protection Zones (SPZ) within the vicinity of the Site.

The Site is not located within an SPZ or Special Protection Area (SPA), therefore, if applicable, infiltration to the ground is likely to be acceptable providing suitable mitigation measures are in place if required to prevent an impact on water quality from the proposed or historical land use.

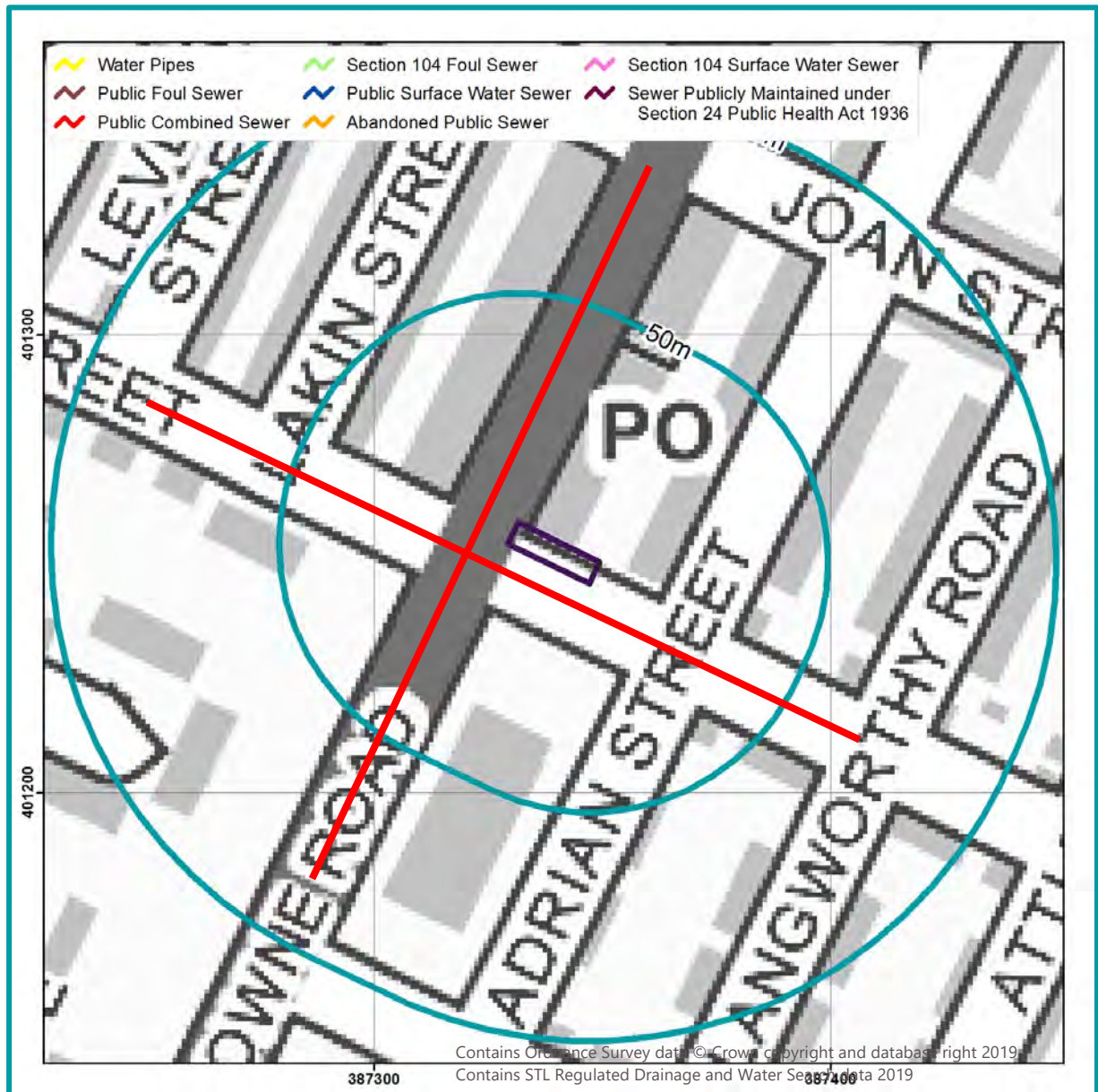
If hazards are identified, further consideration of the potential for any drainage system to cause pollution of groundwater is recommended. It is also recommended that the Local Authority and the EA are contacted to confirm the susceptibility of controlled water within the wider area.

7. Surface water features map



GeoSmart have undertaken an assessment of the location of surface water features within the vicinity of the Site. There are no surface watercourses/features within close proximity to the Site which can be used for discharge.

8. Sewer features map

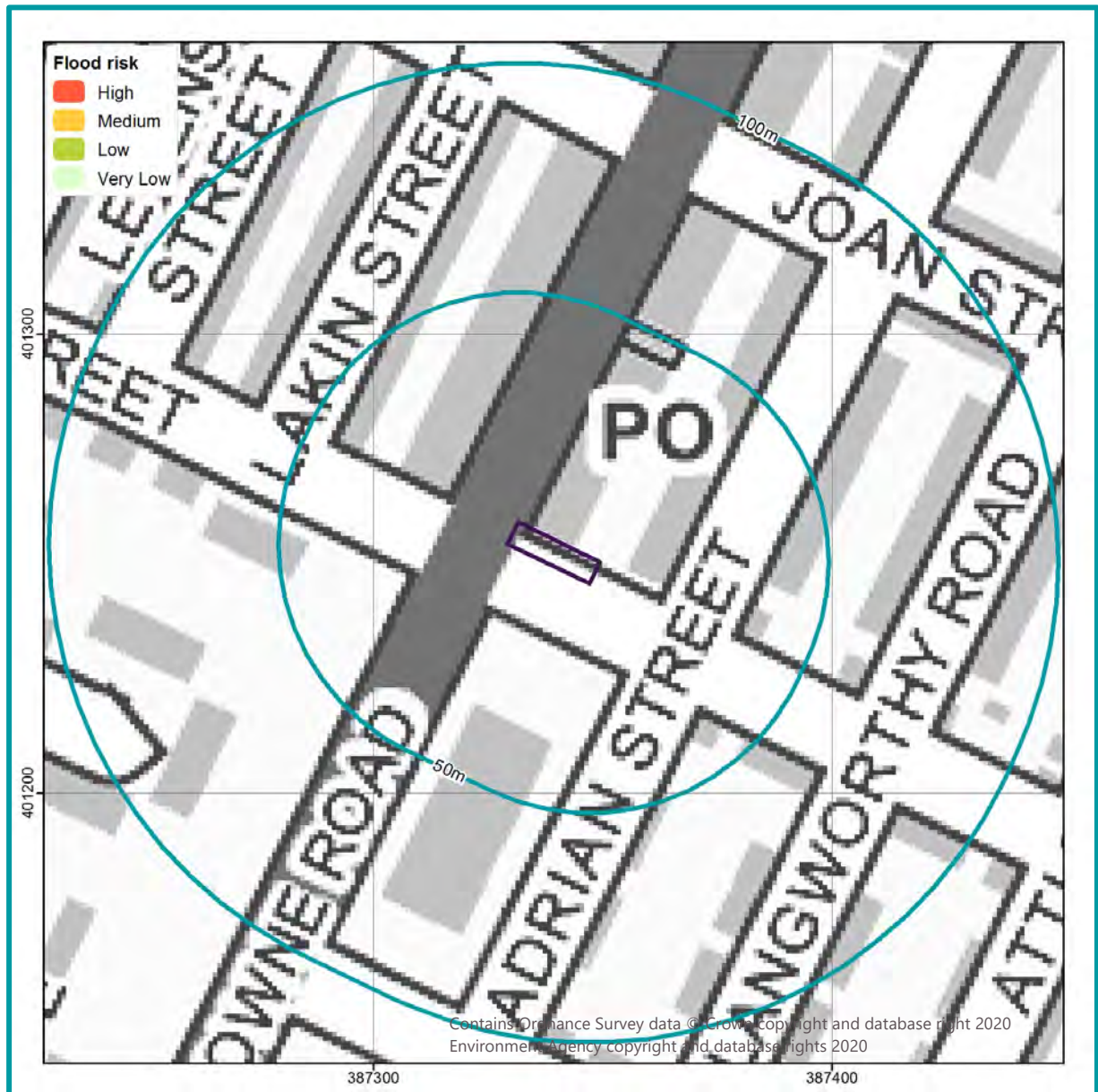


GeoSmart have undertaken an assessment of the location of sewer features within the vicinity of the Site. According to United Utilities sewer records (Appendix C), there is a public combined sewer within Egbert Street and Lightbowne Road.

Further analysis of the connections and condition of the public combined 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 these sewers.

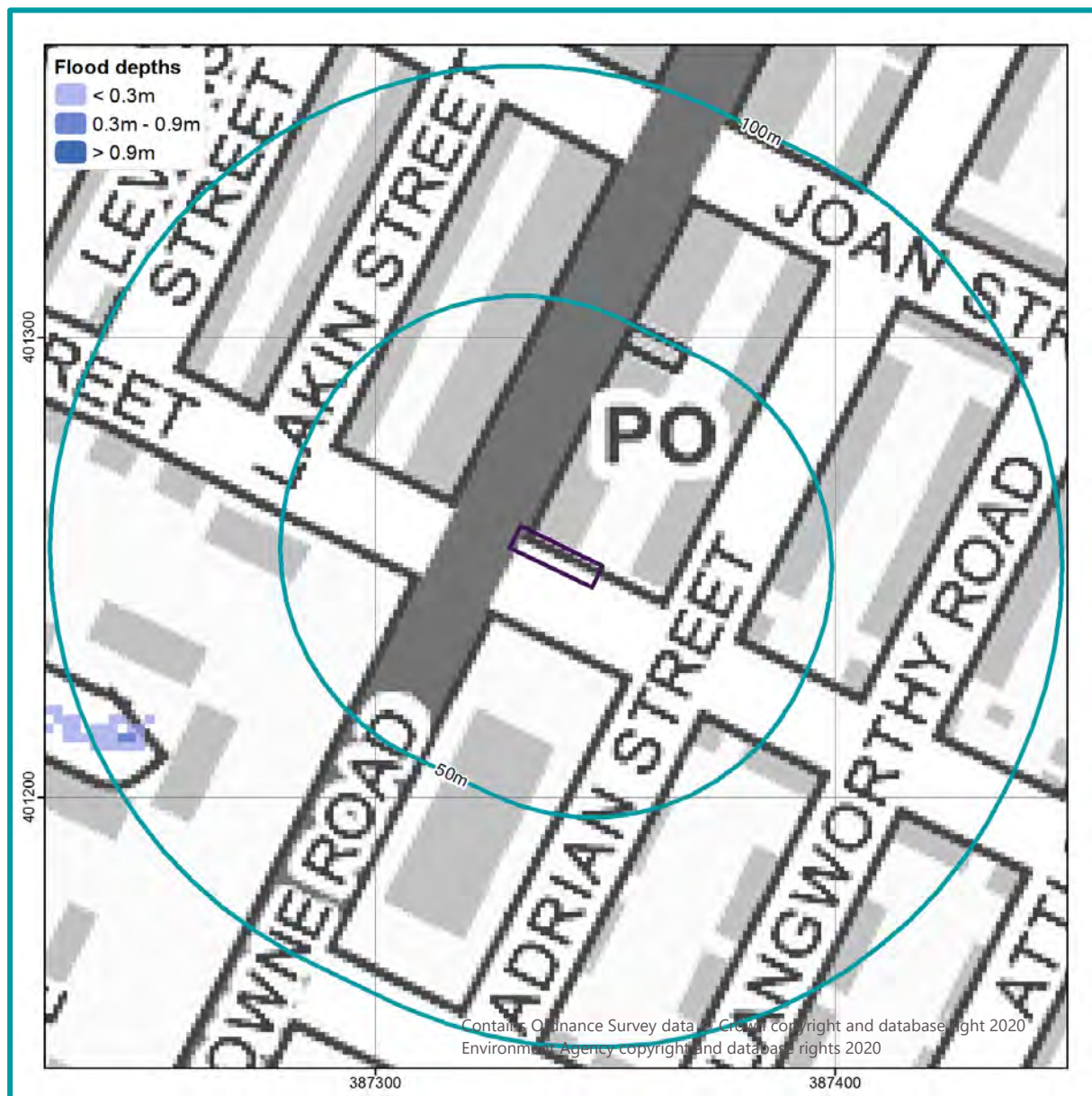
Consultation with the drainage provider would also be required to determine that sufficient capacity is available to accept the proposed discharge, and to gain permission to connect if required.

9. Risk of flooding from rivers & sea map



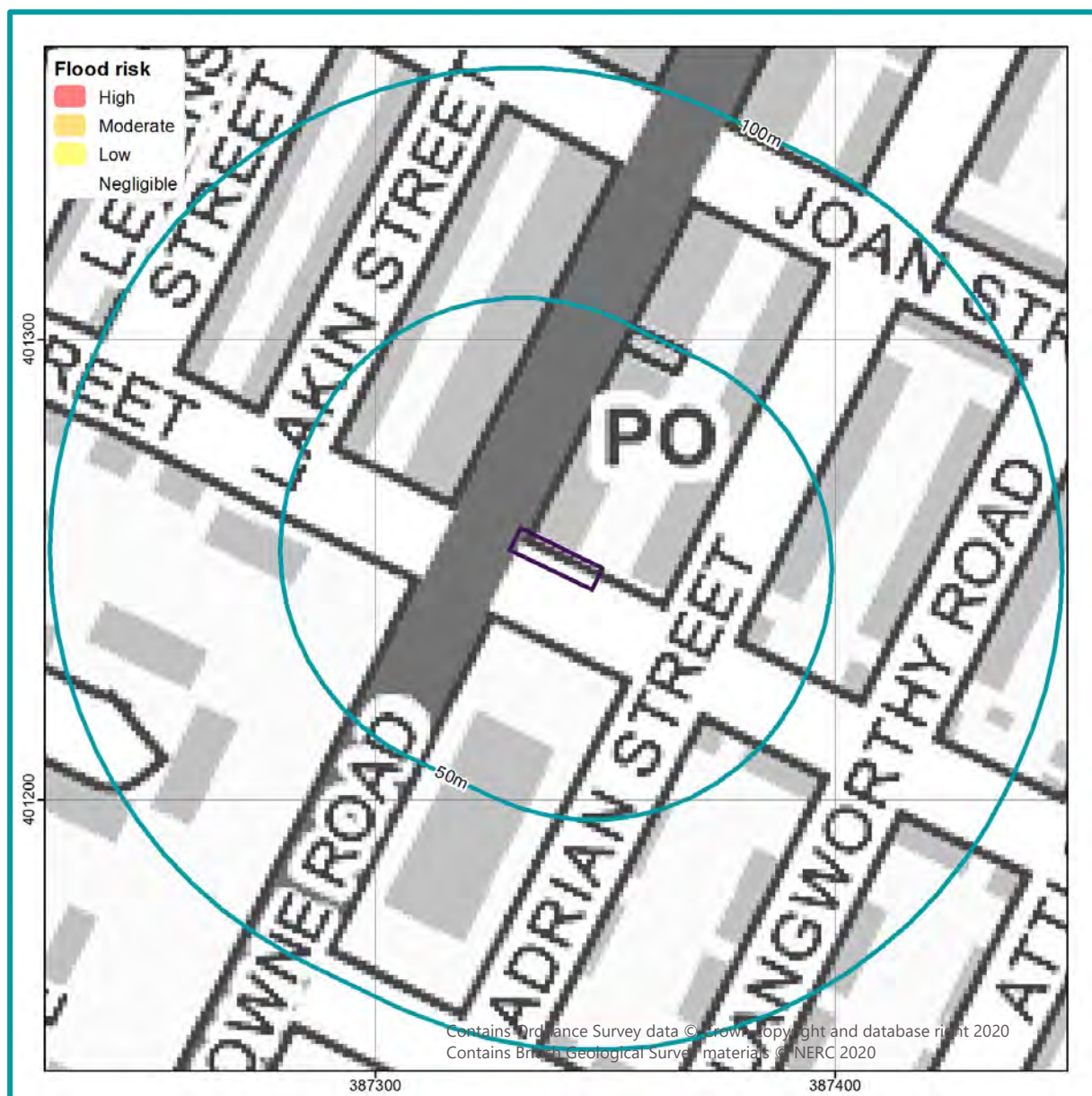
GeoSmart have undertaken an assessment of the Risk of Flooding from the Rivers and the Sea (RoFRS) within the vicinity of the Site. According to the EA's RoFRS mapping, the Site has a Negligible risk of fluvial or coastal flooding.

10. Risk of surface water flooding map



GeoSmart have undertaken an assessment of the Risk of Flooding from Surface Water (RoFSW) (pluvial) sources within the vicinity of the Site. According to the EA's RoFSW According to the EA's pluvial flood risk map for a 1 in 100 year (Medium risk) event, the Site is not at risk of flooding.

11. Groundwater flood risk (GW5) map



GeoSmart have undertaken an assessment of the risk of flooding from groundwater sources within the vicinity of the Site. According to the GW5 map, the Site has a Negligible risk of groundwater flooding with a minimum 1% annual probability of flooding from groundwater according to the GeoSmart GW5 map.

Therefore, SuDS design is unlikely to be affected by flooding through the underlying geology. It is necessary that any SuDS are designed to operate in times when groundwater levels are high.

12. Site context



Site information

The purpose of this report is to assess the potential for disposing of surface water through a Sustainable Drainage Scheme (SuDS) for the proposed residential development on Land adjacent to 174 Lightbowne Road, Manchester, Lancashire M40 5EE (the Site). The Site is located at the junction of Lightbowne Road and Egbert Street in the Harpurhey area of North East Manchester in a setting of commercial and residential use at National Grid Reference SD 87339 01254. Site plans and drawings are provided in Appendix A.

The basemap used is the OS Street View 1:10,000 scale, however the Site boundary has been drawn using BlueSky aerial imagery to ensure the correct extent and proportion of the Site is analysed.



Development

The Site is currently used within a greenfield capacity, although there was once an end of terrace house on the Site. Development proposals comprise the construction of 1 No. 3 bed end-terraced house with garden.



Geology, permeability and thickness

British Geological Survey (BGS) national superficial and bedrock geology mapping confirms a number of different formations underlie the site and each formation may have a range of permeability.

Table 3: Site Geology

Geology present on site		Potentially permeable?
Superficial geology	Till, Devensian - Diamicton	✓
Bedrock geology	Collyhurst Sandstone Formation	✓

A nearby borehole record (ref: SD80SE47) was obtained from the BGS website, this is located approximately 35 m to the north west of the Site at an elevation of 87 mAOD.

The borehole record confirms the underlying geology is comprised of:

- Made ground to a depth of 0.61 m below ground level (bgl); underlain by
- Various forms of clay to a depth of 26.5 m bgl; underlain by
- Hard brown sand to a depth of 27.7 mAOD (end of borehole).

Although the permeability of the underlying geology is potentially Moderate, spatial constraints at the Site would not support an infiltration SuDS feature.



Depth to groundwater

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

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

Guidance

'It is essential that the consideration of sustainable drainage takes place at the land acquisition due diligence stage'

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



Ground conditions

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



Water quality

The Site does not lie within a SPZ. In this case an assessment of the quality of infiltrating runoff and the possibilities for pre-treatment is not required.

The influence of surface runoff on water quality will depend on whether there is a source of contamination on Site and the sensitivity of the receiving environment. The intervening pathway from source to receptor including mitigation and natural attenuation will determine the final impact.

13. National & local policy context

National Guidance

CIRIA SuDS Manual (C753) (2015)

A development should utilise sustainable urban drainage systems (SUDS) unless there are practical reasons for not doing so, and should aim to achieve greenfield runoff rates and ensure that surface water runoff 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.

Local Guidance

Manchester City Council

New developments will no longer automatically be allowed to connect to surface water or combined public sewers. In order to manage surface water, developers are encouraged to implement sustainable drainage into new development.

We ensure that surface water drainage proposals on new developments meet the criteria laid down in guidance from Government, the Environment Agency, DEFRA and Greater Manchester policies.

14. Storage, volume and peak flow rate

Suggested minimum 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 4: Storage requirements at the proposed development Site.

Attenuation scenario		Attenuation required (m ³)	Explanation	
Discharge runoff to public combined sewer	1 in 30 year	0.7	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 (15 mins), Critical Storm Duration) event*. Flooding of the Site of 0.6 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 0.9 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
	1 in 100 year	1.3	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*.	including 40% allowance for climate change.
	1 in 100 year including 40% CC	2.3	Attenuation required to ensure surface water runoff is attenuated in all storm events up to and including the 1 in 100 year (0.5 hour (30 mins), Critical Storm Duration) event including a 40% allowance for climate change*.	

*See Appendix B and Table 2 for associated runoff and discharge calculations. Discharge rates all restricted to greenfield rates in their respective events.

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).

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 19 'Background Information'.

Table 5: Change in impermeable area associated with the development

Total site area	100 m ²
Impermeable area	
Pre-development	Post-development
0 m ² (0%)	85 m ² (85%)
Permeable Land use: Greenfield	New impermeable land use: 56 m ² building footprint and 29 m ² of permeable surface* New permeable land use: 15 m ² of Landscaped area

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

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 19 'Background Information'.

Table 6: 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	0.07	N/A	N/A	N/A
6 hour 1 in 1 year	0.06	0.06	0.11	0.05
6 hour 1 in 10 year	0.09	0.10	0.18	0.09
6 hour 1 in 30 year	0.12	0.12	0.24	0.12
6 hour 1 in 100 year	0.14	0.15	0.30	0.15
6 hour 1 in 100 year + 20% CC	N/A	N/A	0.36	0.21
6 hour 1 in 100 year + 40% CC	N/A	N/A	0.42	0.27

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

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 18 'Methodology and Limitations'.

Table 7: 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	1.19	N/A	N/A	N/A
6 hour 1 in 1 year	1.13	1.13	2.21	1.08
6 hour 1 in 10 year	1.84	1.84	3.48	1.64
6 hour 1 in 30 year	2.46	2.46	4.81	2.35
6 hour 1 in 100 year	3.33	3.33	6.53	3.20
6 hour 1 in 100 year + 20% CC	N/A	N/A	7.84	4.50
6 hour 1 in 100 year + 40% CC	N/A	N/A	9.14	5.81

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 (40%) 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. A sediment trap is proposed to ensure that the risk of blockage is reduced.

Table 8: 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	0.25	0.7
1 in 100 year	1	0.25	1.3
1 in 100 year plus 40% climate change	1	0.5	2.3

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."

15. 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, 2010) and Defra's Non-statutory technical standards for the design, maintenance and operation of sustainable drainage systems (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

As discussed in Section 4 the Site has Moderate potential for infiltration, with potentially permeable underlying Till and sandstone bedrock. However, infiltration SuDS features are not feasible at the Site due to spatial constraints not allowing for a 5 m buffer from building foundations.

Discharge to surface watercourse

There are no surface watercourses/features within close proximity to the Site which could be used for surface water discharge.

Discharge to sewer

Discharge to the public combined sewer, within Egbert Street is likely to be the optimum sustainable drainage option for the new development area. If required consultation with the local sewer undertaker, United Utilities, should be undertaken to confirm connection.

16. Sustainable drainage systems

It is recommended the drainage system has the capacity to accommodate the 1 in 100 year event before flooding occurs. Drainage from areas outside the development footprint will continue to use the 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:

The proposed SuDS strategy will restrict the off-Site discharge rate (from the proposed development) to 1 l/s, this is as close to the greenfield runoff rate which can be achieved, without increasing blockage risks within the drainage network. A sediment trap is also proposed to further reduce the blockage risk. A maximum volume of runoff of up to 2.3 m³ will be stored in SuDS features, in all events up to and including the 1 in 100 year (0.5 hour Critical Storm Duration) event, including a 40% allowance for climate change. This would be in line with Defra - Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems (2015).

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

SuDS type	Source control (interception) and attenuation SuDS.
SuDS features	Lined permeable surfacing.
Discharge location	Public combined sewer network.
Discharge rate	1 l/s (where discharge to sewer/surface water feature is proposed).

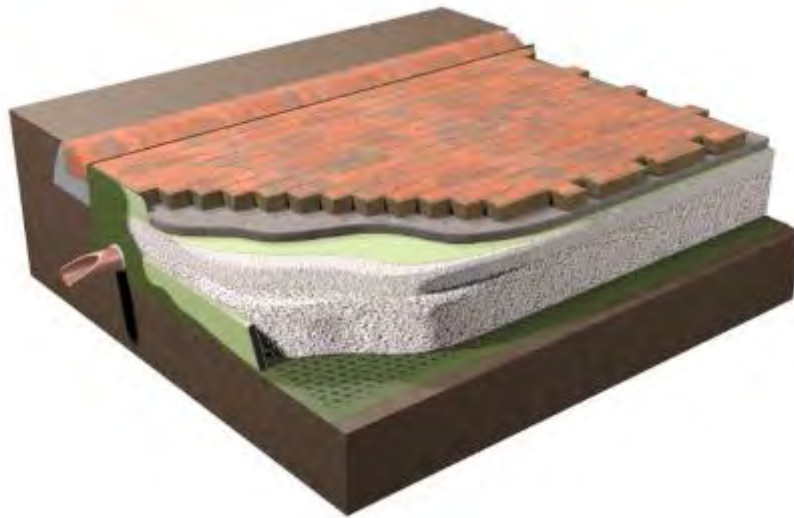
Table 12: Proposed SuDS sizing (dimensions) and attenuation volumes

Lined permeable surfacing	A 29 m ² area of lined permeable surfacing (underlain with a Type 3 aggregate material) within the proposed driveway area to a depth of 0.3 m, with a 30% porosity.
Total Attenuation Provided	1.7 m ³
Total Attenuation Required	2.3 m ³
Freeboard	0.3 m ³

Lined permeable surfacing is proposed for the driveway area 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 the surface underlain by aggregate material to intercept silt/particles. Permeable surfaces are multi-layered surfacing systems. The surface layer is constructed out of permeable material allowing infiltration of water through gaps along its surface. An impermeable membrane 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 driveway and into the permeable surface. The majority of silt would be trapped within the top 30 mm of the joining material between the surfacing. Rainfall flowing into the surface directly from the development roof would not contain enough volumes of silt and or particles to cause blockage.



Where possible, **exceedance flows** should be directed away from the building and into the highway, where raised kerbs allow for additional storage. 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.

Hydrobrake Flow control systems are required to reduce the runoff 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 (<150 mm 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.

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

Additional recommendations

Additional SuDS options that may be considered for the site are as follows:

- Rainwater harvesting can collect runoff from the roofs for use in non-potable situations, using water butts for example.
- Having part/all of the roof as a green roof covered in vegetation intercepts up to 30 mm of rain before any runoff is generated from the structure.

SuDS maintenance

Regular maintenance is essential to ensure effective operation of the proposed SuDS feature(s) 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)
Permeable surfaces and silt trap	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.

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 National 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 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 Pro 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.

17. 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 Non-statutory technical standards for the design, maintenance and operation of sustainable drainage systems (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 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 and Section 8 of this report.

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 (DGLC, 2014). For the impermeable surfaces, it has been assumed that 100% runoff will occur (calculations provided in Appendix A). Rainfall data is derived from the Flood Estimation Handbook Web Service (FEH), developed by NERC (2020). 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.

18. 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 web site: <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 SuDS features 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/>

19. References and glossary

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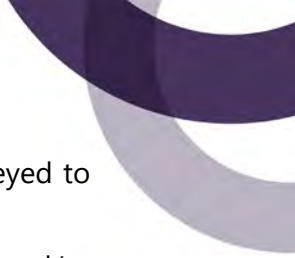
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Glossary³

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.

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

20. Further information

Disclaimer

This report has been prepared by GeoSmart in its professional capacity as soil and groundwater specialists, with reasonable skill, care and diligence within the agreed scope and terms of contract and taking account of the manpower and resources devoted to it by agreement with its client, and is provided by GeoSmart solely for the internal use of its client.

The advice and opinions in this report should be read and relied on only in the context of the report as a whole, taking account of the terms of reference agreed with the client. The findings are based on the information made available to GeoSmart at the date of the report (and will have been assumed to be correct) and on current UK standards, codes, technology and practices as at that time. They do not purport to include any manner of legal advice or opinion. New information or changes in conditions and regulatory requirements may occur in future, which will change the conclusions presented here.

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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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- 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,
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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 compensation of up to £5,000 to you if he finds that you have suffered actual loss 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

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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:

Alan White

Operations Manager

GeoSmart Information Limited

Suite 9-11, 1st Floor,

Old Bank Buildings,

Bellstone,

Shrewsbury,

SY1 1HU

Tel: 01743 298 100

alanwhite@geosmartinfo.co.uk

21. Terms and conditions, CDM regulations and data limitations

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CDM regulations can be found on our website:

<http://geosmartinfo.co.uk/knowledge-hub/cdm-2015/>

Data use and limitations can be found on our website:

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

22. Appendices

Appendix A

Site plans



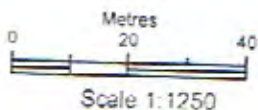
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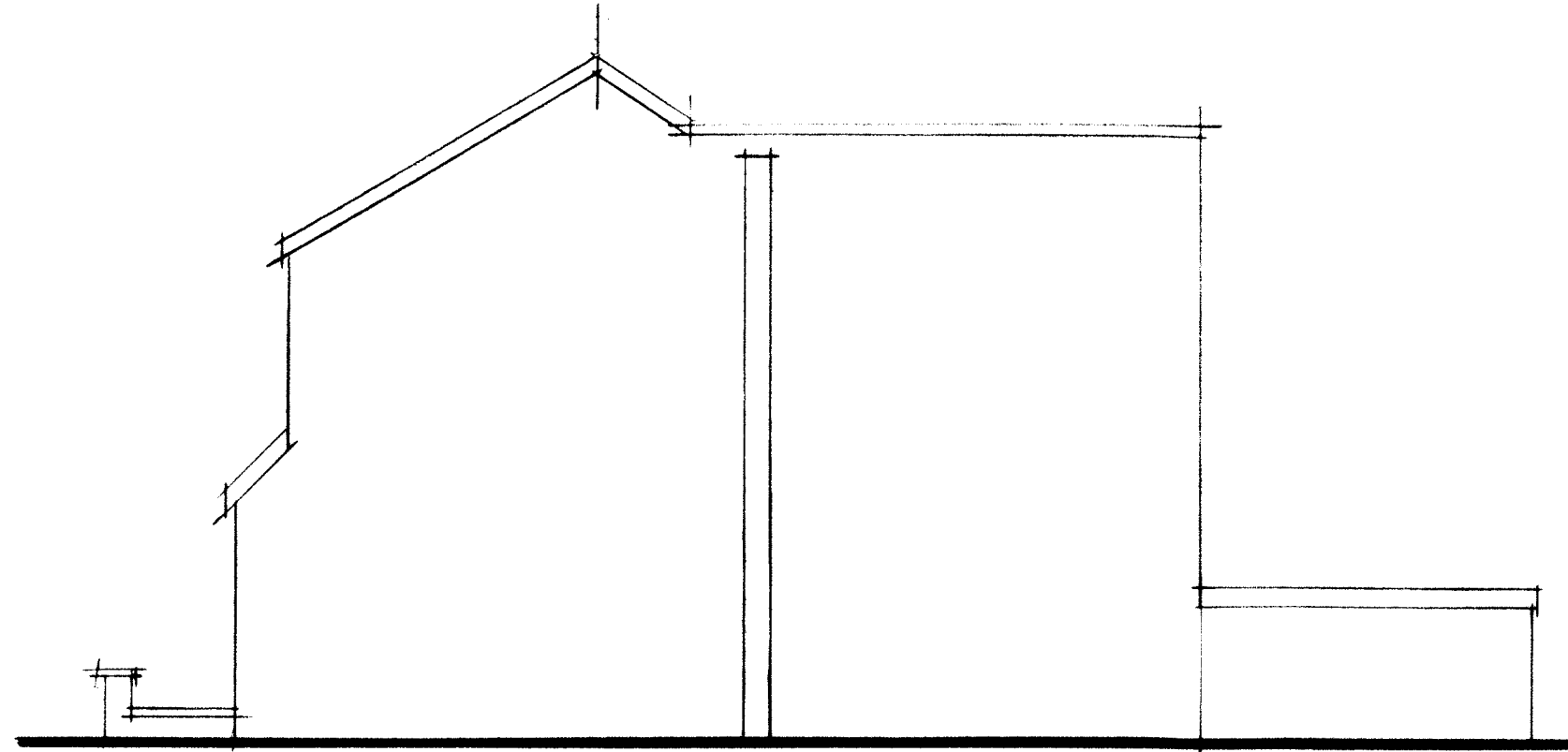
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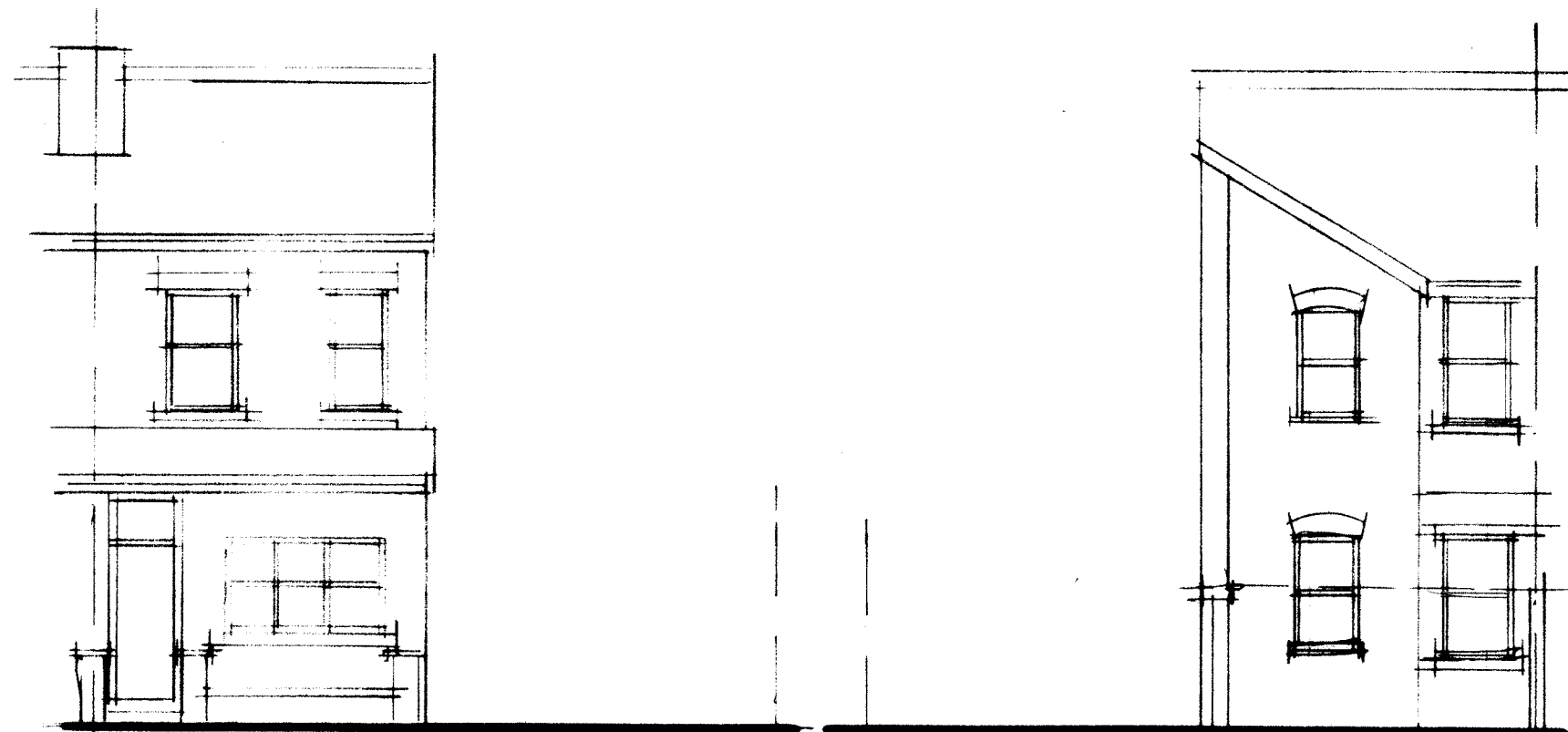
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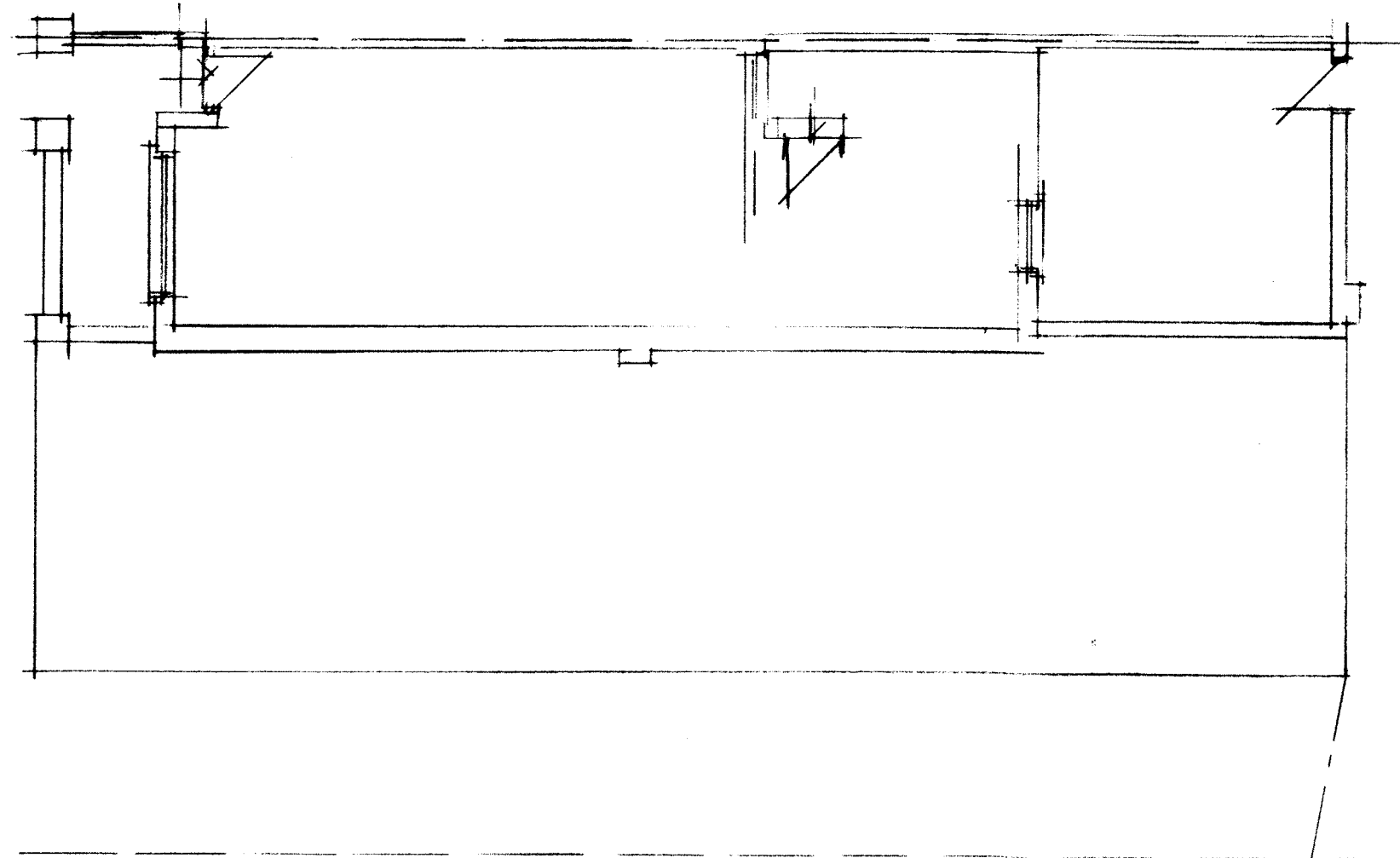


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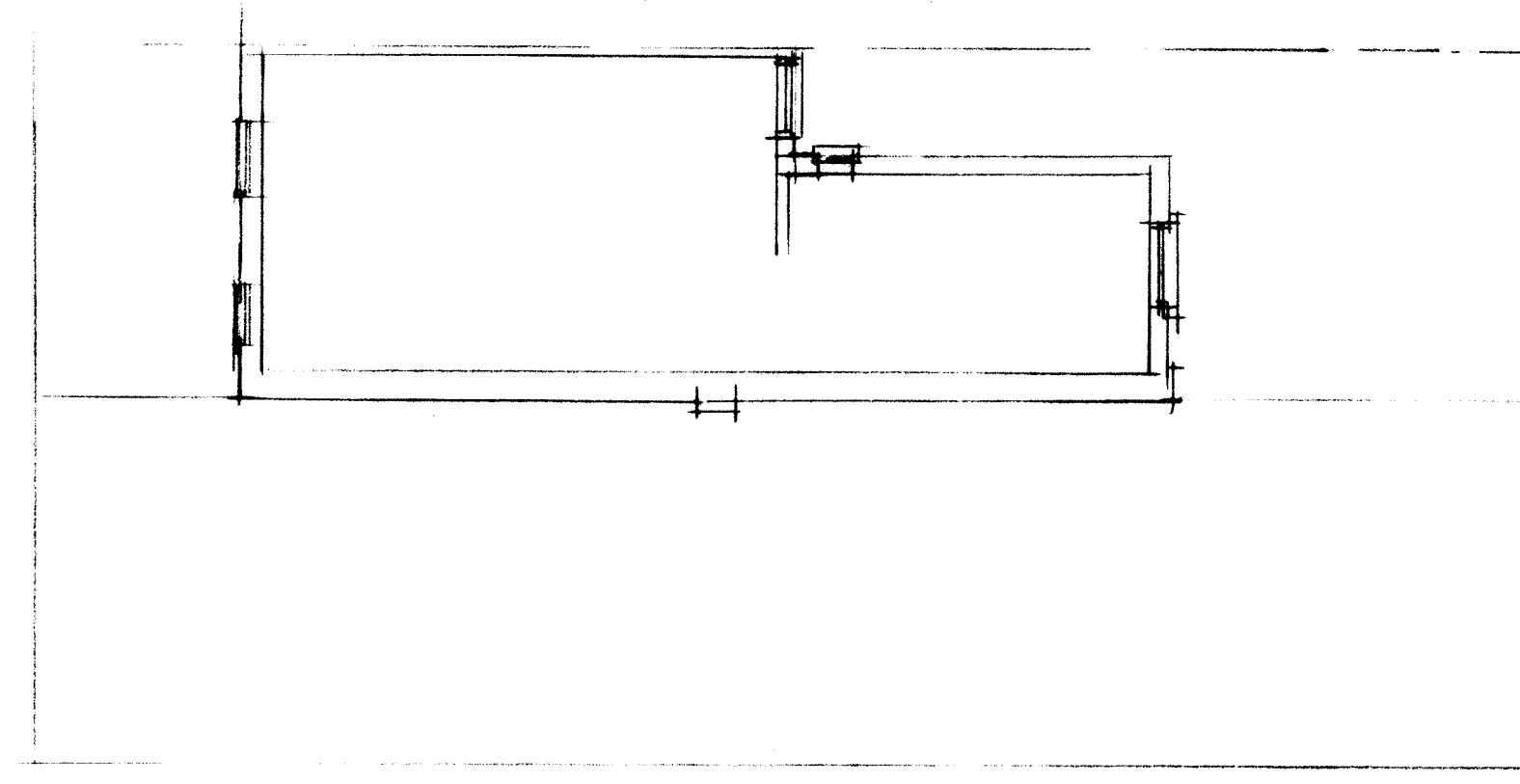


front

rear



GROUND FLOOR PLAN



FIRST FLOOR PLAN

CLIENT
MR W CHOUDRY
94 EAST ROAD
MANCHESTER M12 5QA

JOB TITLE
PROPOSED HOUSE adj
174 LIGHTBOWNE ROAD
MANCHESTER M40 5EE

DRG. TITLE
PLAN & ELEVATIONS
AS EXISTING

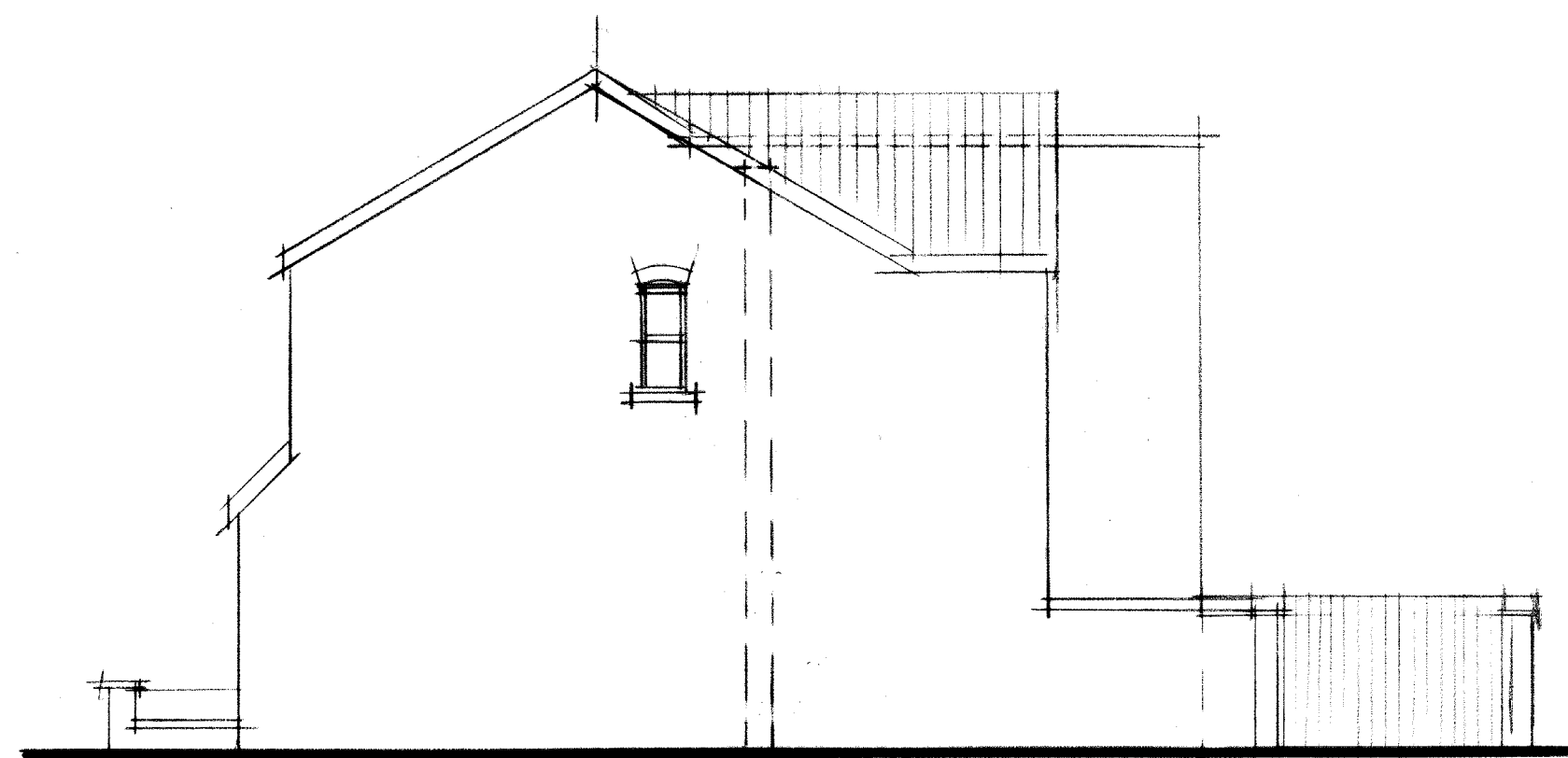
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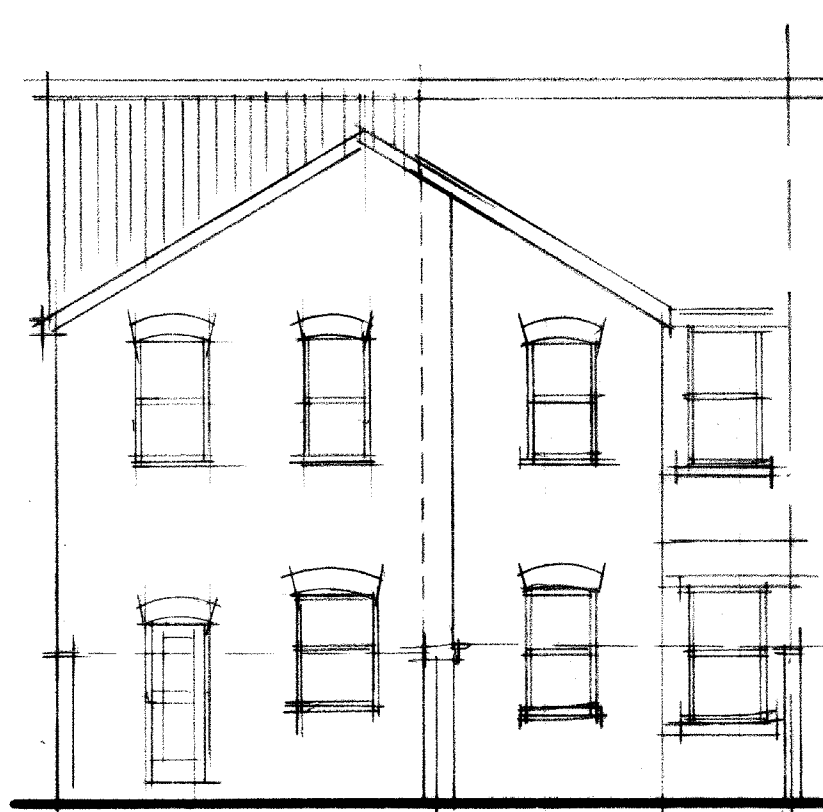
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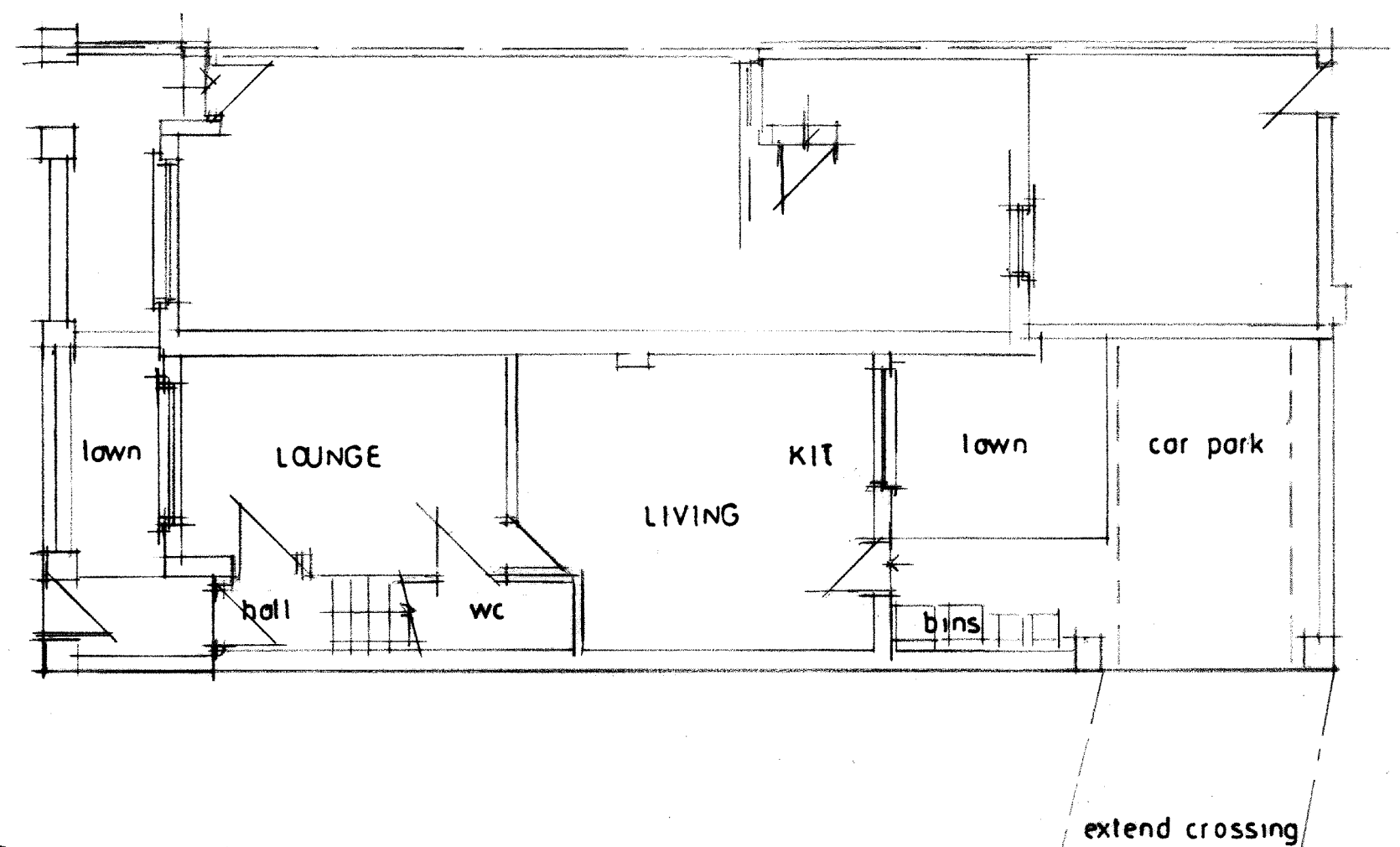
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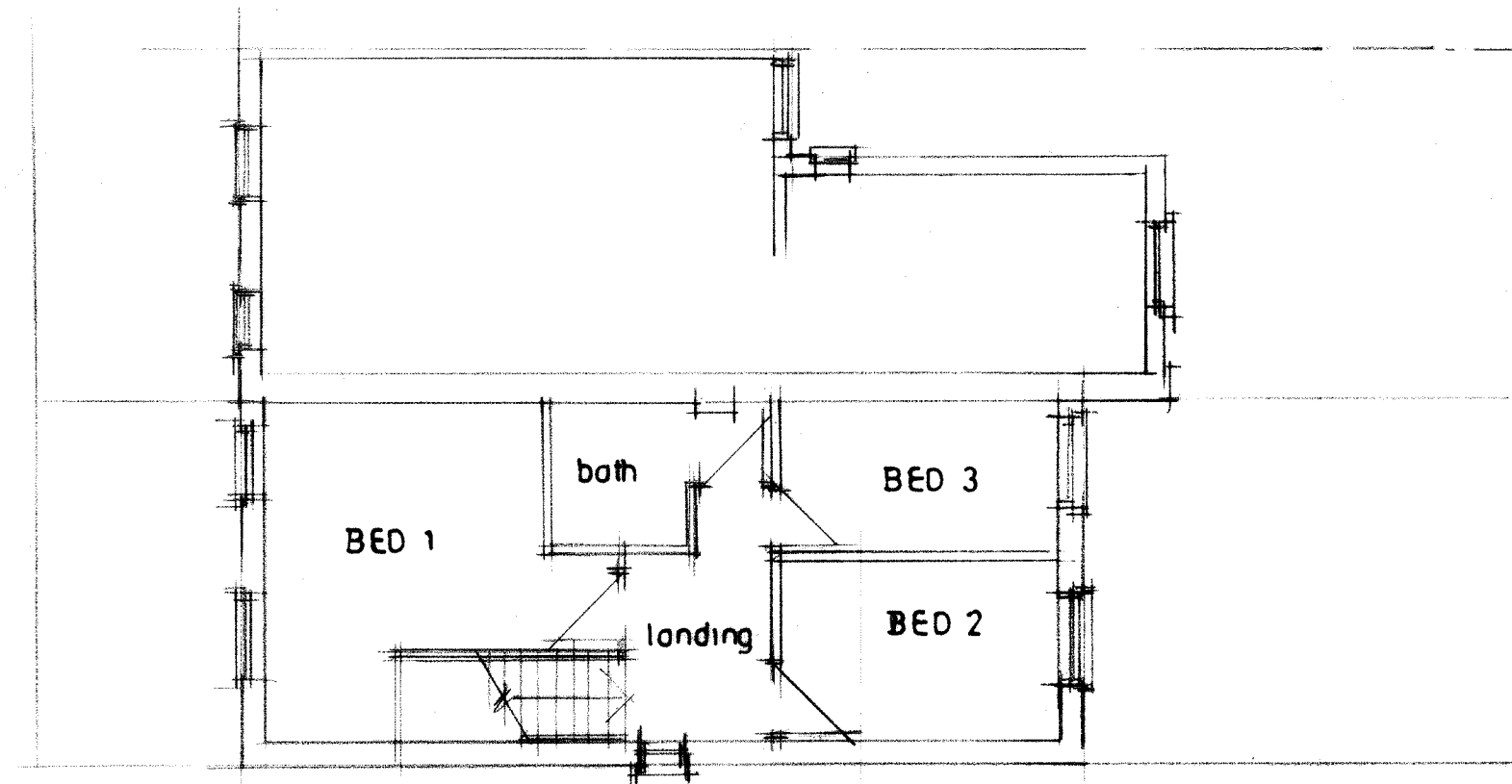
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GROUND FLOOR PLAN



FIRST FLOOR PLAN

CLIENT
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94 EAST ROAD
MANCHESTER M12 5QA

JOB TITLE
PROPOSED HOUSE adj
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REVISION								
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APPROVED								
SCALE		1:100 at A2						
DRAWING NUMBER		2080/90/02						

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	mimimum 50ha
SAAR	945	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.

$Q_{\text{BAR(rural)}}$	=	342.94	l/s for 50ha site
Divided by 50 to scale down	=	6.86	l/s/ha
Actual Area of the entire Site	=	0.01	ha

Return Periods (Growth curves obtained from DEFRA report)

			Peak site run-off rate	
Return Period	Growth Factor		l/s/ha	(l/s)
1	$Q_{\text{BAR(rural)}} \times 0.85$		5.83	0.058
2	$Q_{\text{BAR(rural)}} \times 0.93$		6.38	0.06
5	$Q_{\text{BAR(rural)}} \times 1.19$		8.16	0.08
10	$Q_{\text{BAR(rural)}} \times 1.38$		9.47	0.09
25	$Q_{\text{BAR(rural)}} \times 1.64$		11.25	0.11
30	$Q_{\text{BAR(rural)}} \times 1.68$		11.52	0.115
50	$Q_{\text{BAR(rural)}} \times 1.85$		12.69	0.13
100	$Q_{\text{BAR(rural)}} \times 2.08$		14.27	0.14
200	$Q_{\text{BAR(rural)}} \times 2.32$		15.91	0.16

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)	25.35	0.01	0.47	1.2
1	24.01	0.01	0.47	1.1
10	39.18	0.01	0.47	1.8
30	52.25	0.01	0.47	2.5
100	70.94	0.01	0.47	3.3

Developed site run-off calculation sheet																
1 in 1 year				1 in 30 year								1 in 100 year				
Proposed impermeable area		0.009 ha		Proposed impermeable area		0.009 ha				Proposed impermeable area		0.009 ha				
CC Factor		40%		CC Factor		40%				CC Factor		40%				
Total volume for surfaces during 6 hour event		2.04 m³		Total volume for surfaces during 6 hour event		4.44 m³				Total volume for surfaces during 6 hour event		6.03 m³				
Total volume for 6 hour event inc CC		2.86 m³		Total volume for 6 hour event inc CC		6.22 m³				Total volume for 6 hour event inc CC		8.44 m³				
Total volume for 6 hour event exc CC		2.04 m³		Total volume for 6 hour event exc CC		4.44 m³				Total volume for 6 hour event exc CC		6.03 m³				
Duration		Rainfall 1 yr event	Run-off rate 1 yr event	Run-off rate 1 yr +cc event	Duration		Rainfall 30 yr event	Run-off volume 30 yr event	Run-off volume 30 yr +cc event	Duration		Rainfall 100 yr event	Run-off volume 100 yr event	Run-off volume 100 yr +cc event		
hours	mm	m³	m³		hours	mm	m³	m³		Outflow at 1 l/s	inflow from rain	Diff (storage required)	hours	mm	m³	m³
0.25	7.22	0.61	0.86		0.25	18.59	1.58	2.21		0.90	1.58	0.68	0.25	25.35	2.15	3.02
0.5	9.44	0.80	1.12		0.5	24.71	2.10	2.94		1.80	2.10	0.30	0.5	34.05	2.89	4.05
0.75	10.86	0.92	1.29		0.75	28.61	2.43	3.40		2.70	2.43	-0.27	0.75	39.68	3.37	4.72
1	11.96	1.02	1.42		1	31.58	2.68	3.76		3.60	2.68	-0.92	1	43.86	3.73	5.22
2	15.98	1.36	1.90		2	38.40	3.26	4.57		7.20	3.26	-3.94	2	53.19	4.52	6.33
3	18.65	1.59	2.22		3	43.06	3.66	5.12		10.80	3.66	-7.14	3	59.32	5.04	7.06
4	20.74	1.76	2.47		4	46.69	3.97	5.56		14.40	3.97	-10.43	4	63.98	5.44	7.61
5	22.49	1.91	2.68		5	49.68	4.22	5.91		18.00	4.22	-13.78	5	67.76	5.76	8.06
6	24.01	2.04	2.86		6	52.25	4.44	6.22		21.60	4.44	-17.16	6	70.94	6.03	8.44
8	26.56	2.26	3.16		8	56.53	4.81	6.73		28.80	4.81	-23.99	8	76.09	6.47	9.05
10	28.70	2.44	3.42		10	60.02	5.10	7.14		36.00	5.10	-30.90	10	80.20	6.82	9.54
12	30.55	2.60	3.64		12	63.00	5.36	7.50		43.20	5.36	-37.85	12	83.62	7.11	9.95
16	33.73	2.87	4.01		16	67.86	5.77	8.08		57.60	5.77	-51.83	16	89.14	7.58	10.61
20	36.37	3.09	4.33		20	71.78	6.10	8.54		72.00	6.10	-65.90	20	93.51	7.95	11.13
24	38.65	3.29	4.60		24	75.10	6.38	8.94		86.40	6.38	-80.02	24	97.18	8.26	11.56
28	40.67	3.46	4.84		28	77.99	6.63	9.28		100.80	6.63	-94.17	28	100.35	8.53	11.94
32	42.52	3.61	5.06		32	80.60	6.85	9.59		115.20	6.85	-108.35	32	103.21	8.77	12.28
36	44.22	3.76	5.26		36	83.00	7.06	9.88		129.60	7.06	-122.53	36	105.82	8.99	12.59
40	45.82	3.89	5.45		40	85.23	7.24	10.14		144.00	7.24	-136.76	40	108.24	9.20	12.88
44	47.32	4.02	5.63		44	87.31	7.42	10.38		158.40	7.42	-150.98	44	110.51	9.39	13.15
48	48.74	4.14	5.80		48	89.29	7.59	10.63		172.80	7.59	-165.21	48	112.65	9.58	13.41

Summary				
Entire site area:	0.010 ha			
Climate Change Factor	40%			
	Current	Proposed		
Permeable Surface (ha)	0.010	0.002		
Impermeable Surface (ha)	0.000	0.009		
1 in 1 year				
Greenfield run-off volume total:	1.13 m ³			
RUN-OFF During a 1 in 1 year 6 hour event:	Greenfield Site	Current Development	Proposed Development	Proposed Development +CC
From permeable surfaces (using GF total run-off) (m ³)	1.13	1.13	0.17	0.24
From impermeable surfaces (m ³)		0.00	2.04	2.86
TOTAL run-off produced from Site (m ³)	1.13	1.13	2.21	3.09
Difference between greenfield site and proposed +cc development (m ³):				1.97
				174%
Difference between current and proposed +cc development (m ³):				1.97
				174%
Peak Greenfield run-off rate that must not be exceeded in the run-off from the proposed development (l/s):				0.06
1 in 10 year				
Greenfield run-off volume total:	1.84 m ³			
RUN-OFF During a 1 in 1 year 6 hour event:	Greenfield Site	Current Development	Proposed Development	Proposed Development +CC
From permeable surfaces (using GF total run-off) (m ³)	1.84	1.84	0.28	0.39
From impermeable surfaces (m ³)		0.00	3.20	4.48
TOTAL run-off produced from Site (m ³)	1.84	1.84	3.48	4.87
Difference between greenfield site and proposed +cc development (m ³):				3.03
				164%
Difference between current and proposed +cc development (m ³):				3.03
				164%
Peak Greenfield run-off rate that must not be exceeded in the run-off from the proposed development (l/s):				0.09
1 in 30 year				
Greenfield run-off volume total:	2.46 m ³			
RUN-OFF During a 1 in 30 year 6 hour event:	Greenfield Site	Current Development	Proposed Development	Proposed Development +CC
From permeable surfaces (using GF total run-off) (m ³)	2.46	2.46	0.37	0.52
From impermeable surfaces (m ³)		0.00	4.44	6.22
TOTAL run-off produced from Site (m ³)	2.46	2.46	4.81	6.73
Difference between greenfield site and proposed +cc development (m ³):				4.28
				174%
Difference between current and proposed +cc development (m ³):				4.28
				174%
Peak Greenfield run-off rate that must not be exceeded in the run-off from the proposed development (l/s):				0.12
1 in 100 year				
Greenfield run-off volume total:	3.33 m ³			
RUN-OFF During a 1 in 100 year 6 hour event:	Greenfield Site	Current Development	Proposed Development	Proposed Development +CC
From permeable surfaces (using GF total run-off) (m ³)	3.33	3.33	0.50	0.70
From impermeable surfaces (m ³)		0.00	6.03	8.44
TOTAL run-off produced from Site (m ³)	3.33	3.33	6.53	9.14
Difference between greenfield site and proposed +cc development (m ³):				5.81
				174%
Difference between current and proposed +cc development (m ³):				5.81
				174%
Peak Greenfield run-off rate that must not be exceeded in the run-off from the proposed development (l/s):				0.14

Appendix C

Regulated Drainage and Water 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: 73040
Our Ref: UUPS-ORD-168257
Date: 16/06/2020**

Dear Sirs

Location: 174 Lightdowne

I acknowledge with thanks your request dated 15/06/2020 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

Abandoned	Foul	Surface Water	Combined	
				Public Sewer
				Private Sewer
				Section 104
				Rising Main
				Sludge Main
				Overflow
				Water Course
				Highway Drain

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: 16/06/2020

SEWER RECORDS

Address or Site Reference: 174 Lightdowne
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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