

5222 Albert Bridge House
Drainage Strategy Report
May 2025

Consulting Structural and Civil Engineers

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1 Introduction

AKT II have been commissioned to undertake a foul and surface water drainage strategy in support of the proposed redevelopment of Albert Bridge House on behalf of Oval Real Estate, the Client.

The site area is approximately 0.89 hectares and consists of an office building with open ground level car parking and a public area adjacent to the River Irwell. The proposed scheme involves the demolition of all existing structures and will provide a mixed-use scheme, comprising of 3 buildings - 2 residential towers (Block A & Block B), and a commercial building (Block C) as well as, a new public realm to the external areas around the buildings.

The site is located in central Manchester, Bridge Street (M3 5AH) and is adjacent to retail and commercial areas, as well as bordering the River Irwell. The Northings and Eastings for the development land are 383420 and 398370, respectively.

The site slopes from St. Mary's Parsonage in the East down to Albert Bridge to the West and significantly further towards the River Irwell to the North-west. The current levels vary from circa 33 m AoD to the north-east down to 21m AoD on the riverbank to the north-west.

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

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

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

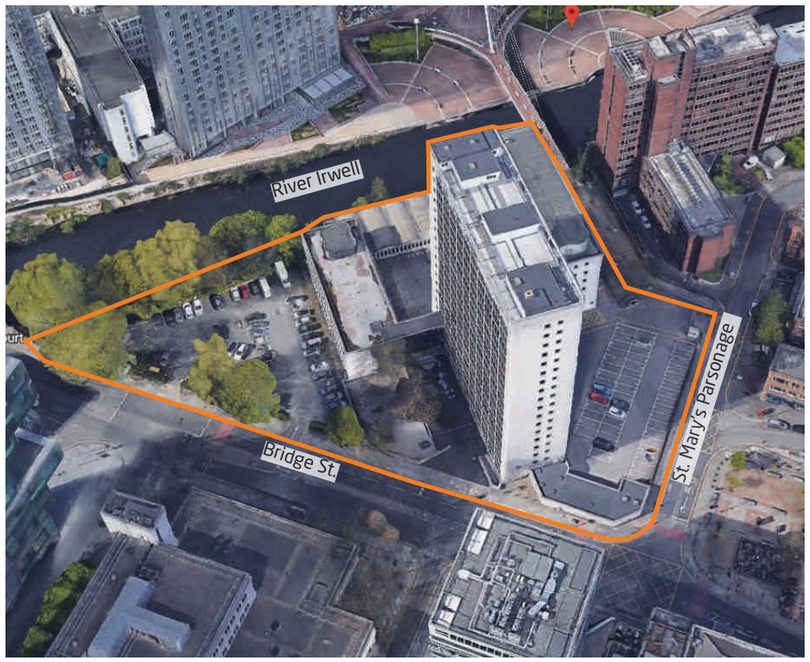


Figure 1.1 Existing site - Aerial view

2 Requirements of National Planning Policy Framework (NPPF) & Local Supplementary Planning Documents

2.1 NPPF (2024)

The National Planning Policy Framework (NPPF) superseded Planning Policy Statement 25 "Development and Flood Risk" (PPS 25) although the requirements and goals remain essentially the same:

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

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

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

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

2.2 Local Standards and Guidance

Strategic Flood Risk Assessments (SFRA) are produced by Local Authorities in order to form the basis for preparing appropriate policies for flood risk management. The Environment Agency advise that Developers "should consult the Strategic Flood Risk Assessment prepared by your local planning authority" when preparing their design.

The site is the subject of the Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA dated March 2011. The key findings and recommendations from this report are:

- The likely sources of flooding within the Greater Manchester area include surface water and rivers.
- The site lies within a Critical Drainage Area (CDA) identified as Conurbation Core (see Figure 2.2). A Critical Drainage Area is defined as "*an area that has critical drainage problems and which has been notified to the local planning authority as such be the Environment Agency in line with the NPPF*".
- The majority of the site is situated in Zone 1 – land assessed as having a less than 1 in 1000 annual probability of river or sea flooding (<0.1%).
- Part of the site (riverbank) is situated in flood zone 3a - land assessed as having a annual probability of river flooding higher than 1 in 100 (>1.0%) and sea flooding higher 1 in 200 (0.5%).

  The Environment Agency splits flood zone 3 in flood zone 3a and flood zone 3b - functional floodplain. The site's riverbank seems to be situated in flood zone 3a.
- The EA maintains the River Irwell Flood Control Scheme which was designed to provide a 1 in 75 year standard of protection through Kersal and Lower Broughton.

Refer to the Flood Risk Assessment produced by AKT II for detailed assessment.

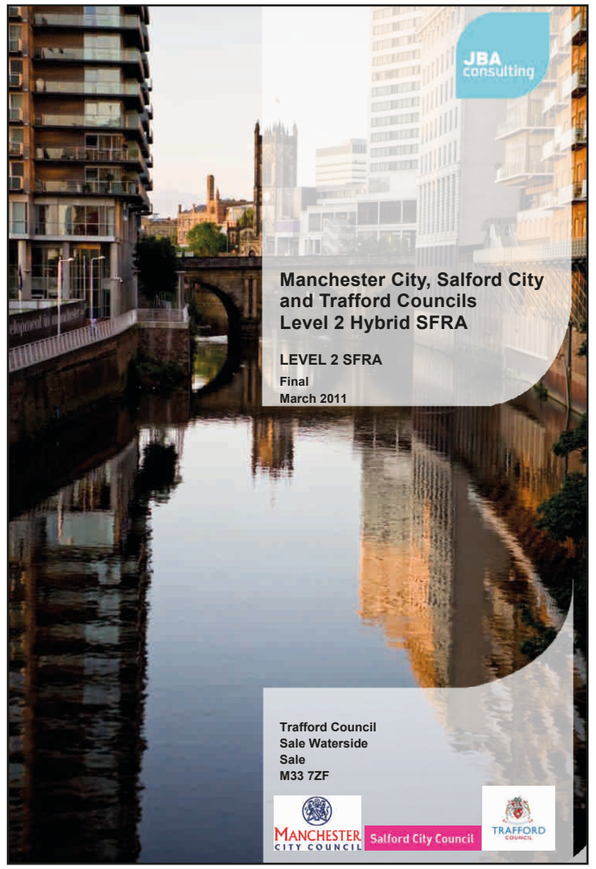


Figure 2.1 SFRA for Greater Manchester - cover page

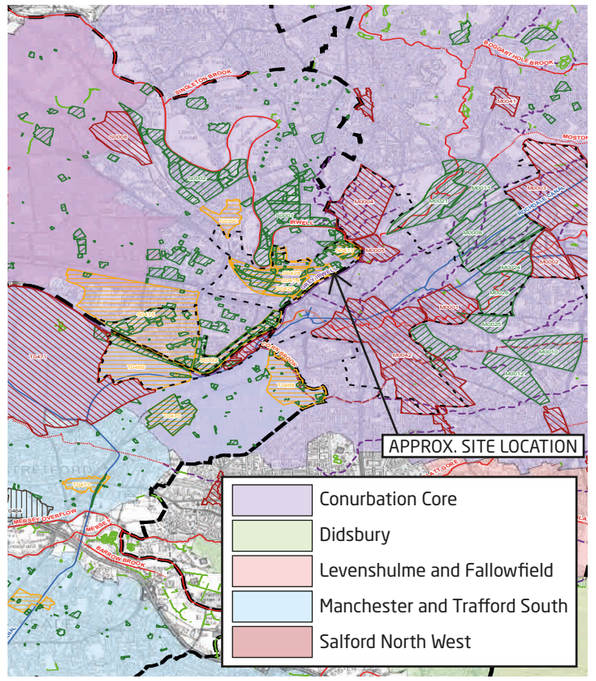


Figure 2.2 SFRA of Greater Manchester Critical Drainage Area Map

3 Surface water drainage

3.1 Existing site

The available United Utilities record plans indicate that the closest surface water or combined public sewers to the site are:

- A 300 mm dia. combined sewer running from north to south under St. Mary's Parsonage, to the east of the site. This then increases to 525 mm dia. and continues towards west under Bridge St. to the south of the site.
- A 300 mm dia. combined sewer running under Bridge St. to the south-west of the site.
- A 530 x 830 mm combined water sewer running from the south-east to the south-west under Bridge St., to the south of the site. This increases to 510 x 850 mm and successively to 620 x 1010 mm.
- A 610 x 860 mm combined water overflow running within the site, to the south-west. We assume that this overflow would take the excess water from the 525 mm combined water sewer and discharges it into the River Irwell in extreme rainfall or emergency surcharge events.
- A 630 x 870 mm combined water overflow crossing the site to the south-west. We assume that this overflow would take the excess water from the 620 x 1010 mm combined water sewer under Bridge St. and discharges it into the River Irwell in extreme rainfall or emergency surcharge events.

An extract from the record plans is shown Figure 3.1 for reference.

It is believed that all surface water from the building currently discharges directly to one of these public sewers without any form of attenuation, but it is not clear which one and it is therefore recommended that a CCTV survey of the existing site drainage network is undertaken to confirm the location and size of all existing connections from the site.

In addition, the River Irwell runs adjacent to the site, to the west. It might be possible that part / all the surface water from the site is currently discharged into the river with no attenuation, however, this will need to be confirmed via a CCTV survey.

The total site area is approximately 8,926 m² of which approximately 8,495 m² is currently hardstanding. In accordance with the Modified Rational Method, the peak existing run-off from the site is calculated from the formula:

$$Q = 3.61 \times C_v \times A \times i$$

where C_v is the volumetric runoff coefficient, A is the catchment area in hectares and i is the peak rainfall intensity in mm/hr.

For the peak 1-in-1-year return period storm event this gives an existing discharge rate from the site of:

$Q_1 = 3.61 \times 0.75 \times 0.8495 \times 31.2 =$ **71.7 litres/sec**

and for the peak 1-in-100-year return period storm event this gives an existing discharge rate from the site of:

$Q_{100} = 3.61 \times 0.75 \times 0.8495 \times 82.6 =$ **190.0 litres/sec**

3.2 Proposed site

The proposed impermeable area used for the surface water coagulations is 6,536 m². This figure excludes any soft landscaping above the basement boxes on the basis that the rainwater from these areas will be captured and attenuated. Again using the Modified Rational Method, the proposed (unattenuated) peak run-off from the site for the 1-in-1-year return period storm would be:

$Q_1 = 3.61 \times 0.75 \times 0.6536 \times 31.2 =$ **55.2 litres/sec**

and for the peak 1-in-100-year return period storm event:

$Q_{100} = 3.61 \times 0.75 \times 0.6536 \times 82.6 =$ **146.2 litres/sec**

The Environment Agency updated their guidance on climate change allowance in February 2016 to include an upper and lower allowance to be considered depending on the specific site characteristics. Figure 3.2 shows the revised figures based on various building life spans. Therefore, making an allowance for climate change of 40% this would give an unattenuated design discharge of:

$Q_{1\,(+40\%)}$ **= 77.3 litres/sec** and $Q_{100\,(+40\%)}$ **= 204.7 litres/sec**

In accordance with the Environment Agency's guidelines, the Building Regulations and the Water Authority's advice, the preferred means of surface water drainage for any new development is into a suitable soakaway or infiltration drainage system. Sustainable Urban Drainage Systems (SuDS) can reduce the impact of urbanisation on watercourse flows, ensure the protection and enhancement of water quality and encourage recharging of groundwater in a manner which mimics nature.

In addition to this, the National Planning Policy Framework requires that surface water arising from a developed site should, as far as is practicable, be managed in a sustainable manner to mimic surface water flows arising from the site prior to the proposed development, whilst reducing flood risk to the site itself and elsewhere, taking climate change into account.

Therefore, as an absolute minimum, the proposed site discharge under the 1-in-100-year storm plus climate change should be no greater than the existing 1-in-100-year storm discharge (i.e. mitigate the impact of climate change and any increase in the area of hardstanding). In this case, this would mean that, rather than discharging 204.7 litres/sec, the maximum permissible discharge from the site would be 146.2 litres/sec.

Further to the above, the CIRIA SuDS Manual state that previously developed sites should reduce the site runoff to the greenfield rates wherever possible.

In accordance with the method outlined in the Institute of Hydrology Report 124, the Greenfield runoff for the site is calculated from the formula:

$$Q_{BAR} = 0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$$

where AREA is the site area in km² (pro rata of 50 ha if the site is less than 50 ha), SAAR is the Standard Average Annual Rainfall in mm and SOIL is the Soil Index both read from The Wallingford Procedure maps. This gives a greenfield runoff for the site of:

$Q_{BAR} = 0.00108 \times 0.5^{0.89} \times 889^{1.17} \times 0.45^{2.17} =$ **290.5 litres/sec (for 50 ha)**

Scaling this for the actual area of the site to be attenuated gives:

$Q_{BAR} = (290.5 \times 0.07578) \div 50 =$ **9.16 litres/sec**

Using the Hydrological Growth Curve for north-west England, the growth factor from Q_{BAR} to Q_{100} is 2.081 which gives a value for Q_{100} = **9.16 litres/sec.**

Based on previous experience, it is likely that the local authority (MCC) will require the site to restrict the discharge to **4.40 litres/sec**. The local authority might accept the site to discharge into the River Irwell at unrestricted rate if this is confirmed acceptable by the Manchester Ship Canal Company Limited (MSCCL) and a surface water discharge agreement is in place with them.

MSCCL have confirmed that discharging at unrestricted rate into the river Irwell could be possible subject to this discharge being documented within a licence agreement.

At the moment of writing this report a licence agreement is not in place with MSCCL, therefore it is assumed that the site will be required to restrict the discharge rate to **4.40 litres/sec** and SuDS options for the development are discussed in the next section.

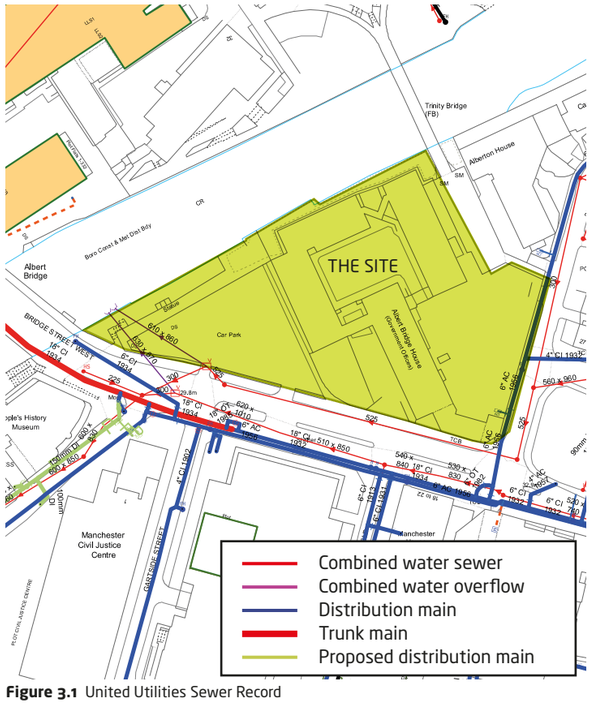


Figure 3.1 United Utilities Sewer Record

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

Figure 3.2 Peak rainfall intensity allowance

3.3 Disposal methods

SuDS management train

A useful concept used in the development of sustainable drainage systems is the SuDS management train (sometimes referred to as the treatment train). Just as in a natural catchment, drainage techniques can be used in series to change flow and quality characteristics of the runoff in stages. There are a variety of measures that can be implemented to achieve these goals:

Site management / Prevention

Site management procedures are used to limit or prevent runoff and pollution and include:

- Minimising the hardened areas within the site
- Frequent maintenance of impermeable surfaces
- Minimising the use of de-icing products

Source control

Source control techniques will be used where possible as they control runoff at source in smaller catchments. They can also provide effective pollution control and treatment, thereby improving the quality of the effluent discharged to the receiving waters.

Site control

Where source control techniques do not provide adequate protection to the receiving watercourses in terms of flood protection and pollution control, site control may be required.

Regional control

Where large areas of public space are available regional control can be incorporated to provide additional 'communal' storage and treatment to runoff from a number of sites. However, in this case, all storage and treatment will be implemented on site.

Drainage hierarchy

Based on the above and in line with the Sustainable Drainage Manual published by CIRIA, the following drainage hierarchy will therefore need to be considered when preparing the surface water disposal strategy:

1. Rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)
2. Rainwater infiltration to ground at or close to source
3. Rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)
4. Rainwater discharge direct to a watercourse (unless not appropriate)
5. Controlled rainwater discharge to a surface water sewer or drain
6. Controlled rainwater discharge to a combined sewer

Assessment of SuDS techniques

Rainwater harvesting

This involves the capture of rainwater into a tank for re-use (usually non-potable) such as irrigation, toilet flushing or vehicle cleaning. Systems are now available which combine rainwater harvesting with tanked attenuation. This means that water is stored during dry periods for re-use but released ahead of predicted storms in order to ensure that the full attenuation capacity remains available when it is needed.

A rainwater harvesting (RWH) system is viable for this development and is recommended as an integral component of the overall Sustainable Drainage Systems (SuDS) strategy. To maximise water reuse and achieve greater sustainability benefits, it is further recommended that a smart RWH system be implemented in conjunction with attenuation tanks. This will need to be further investigated at the next design stages.

Green / brown / blue roofs

These are used on flat or shallow pitched roofs to provide a durable roof covering which also provides thermal insulation, amenity space, biodiversity habitat as well as attenuation of rainwater. Depending on the design, these roofs can attenuate differing volumes of rainwater. The term 'blue roof' is reserved for those roofs designed to maximise water retention. This is a relatively recent area of increased focus and can involve effectively an attenuation tank at roof level which reduces (or avoids) the need for pumping of basement tanks.

This technique would provide attenuation and water treatment during smaller storm events although during large storm events the impact will be negligible and would have minimal effect on the attenuation tank.

Blue roofs are viable at this development. This will need to be further investigated at the next design stages.

Raingardens

Raingardens are planted areas (usually close to buildings but not immediately adjacent) that allow the diversion of a portion of rainwater from either downpipes or the surrounding paved surfaces. These techniques can be incorporated into the landscaping plans for a site and are most effective where the landscaping regime is designed with the aim of capturing as much rainfall as possible. They can either allow infiltration into the ground or have tanked systems for water retention, depending on the site and soil conditions. There are also a number of vertical raingardens attached to building walls with rainwater downpipes diverted through a stacked series of planters.

Raingardens features are proposed at the development.

Bio-retention

This refers to a chain of landscaped features, potentially including reed beds, filter drains, etc. designed to hold and treat surface water. They are often used where there is a high risk of low-level pollution, for example from road run-off. However, it does require areas of open space. The design of a bio-retention system can vary widely depending on site conditions and available space. At a small scale this could include flow through planters or tree pits.

As the site is heavily developed and the basement footprint occupies the majority of the site area it does not seem feasible to provide bio-retention systems within the landscape.

Permeable surfacing

Permeable hard surfaces which work in much the same way as traditional impermeable surfaces apart from the ability to allow rainwater to pass through. Permeable blocks are traditionally used but there are now a range of permeable asphalt and resin bound gravel pavings being used increasingly commonly. Permeable surfaces can either allow infiltration into the ground or have tanked systems for water retention, depending on the site and soil conditions. They are suitable in even the most densely built-up development. However, they're not well suited to roads carrying heavy or fast motor traffic.

Permeable paving is proposed at this development. However, as there is a proposed basement which covers a big portion of the site and the underlying soil porosity is believed to be low it will be a tanked system for water retention and conveyance rather than disposal. This will be confirmed by the findings of the Soil Investigation.

Swales

These are dry ditches used as landscape features to allow the storage, carriage and infiltration of rainwater and are often used as linear features alongside roads, footpaths or rail lines. They can also be integrated into the design of many open spaces.

As areas of soft and hard landscaping are proposed for the development, there might be an opportunity to incorporate swales for conveyance into the scheme. This will need to be further investigated at the next design stages.

Detention basin / ponds

Landscape features designed to store and in some cases infiltrate rainwater. Detention basins are usually dry, whereas a pond should retain water. These features need areas of open space but can often be combined with other sustainable drainage techniques.

As the site is heavily developed and the basement footprint occupies the majority of the site area there is insufficient space to provide a basin or pond.

Infiltration systems

Geological maps from the British Geological Society (Figure 3.4) suggest the underlying bedrock to be Chester Pebble Beds Formation Sandstone. Sandstone is generally classified as having low permeability (hydraulic conductivity (K) ranging between 10^{-10} - 10^{-6} m/s). Therefore, infiltration techniques are limited to the soft landscape areas.

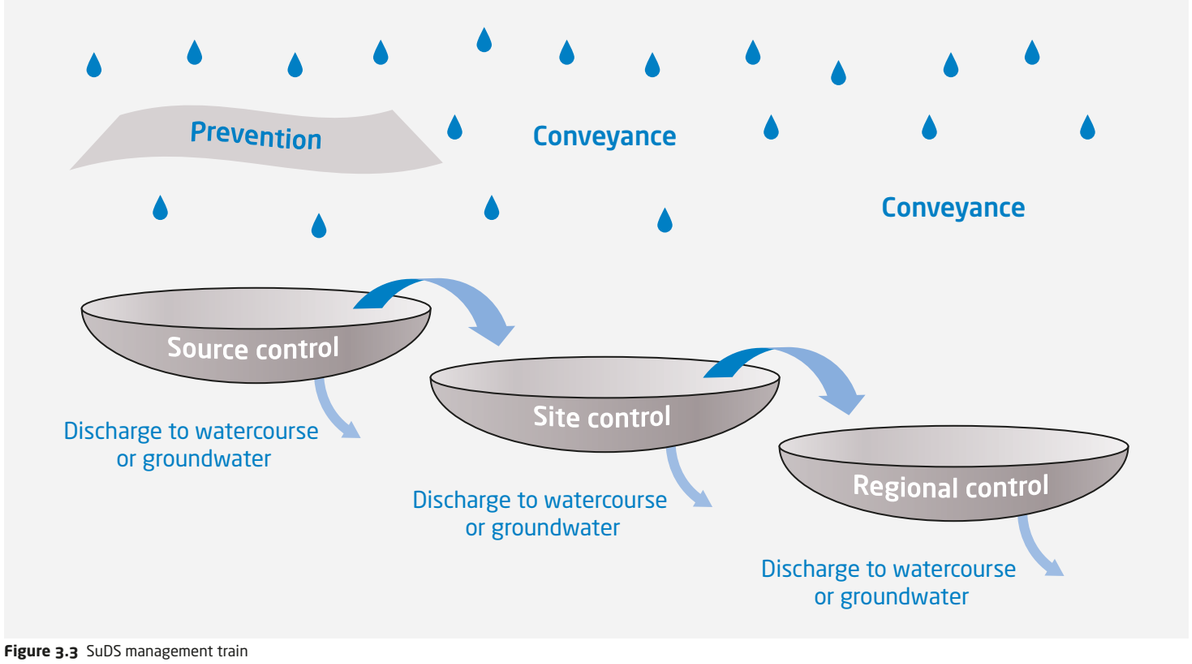


Figure 3.3 SuDS management train

Discharge to tidal river / dock / canals

Discharging clean rainwater directly to tidal rivers, canals or docks isn't normally a sustainable drainage technique. Other more productive techniques should be used first. However, it is generally more sustainable than discharging to the combined or surface drainage systems. Residual surface water can be discharged to tidal / large waterbodies, in some cases with no limitation on volumes. Some storage may be required to allow for outfalls becoming tide locked. Care is needed to prevent scour in the receiving waterbody and potentially to prevent pollution. Consent from the Environment Agency, the asset owner and where applicable the Canal and River Trust is required.

The River Irwell runs adjacent to the site, to the north-west. Discharging into the River Irwell could be possible subject to the discharge being documented within a licence agreement with the MSCCL, to be confirmed at the next design stages.

Storage tanks / geocellular storage

Storage tanks are single GRP units usually located (but not necessarily) below ground level which attenuate rainwater for later slow release back into the drainage system but do not provide the wider benefits of green infrastructure sustainable drainage. They can also have the disadvantage that pumping may be required to empty the tank into the drainage system – especially if the tank is located at or below basement level. Where tanks are designed for large storm events, care is needed to ensure that they still perform a useful sustainable drainage function for low order storms.

Geocellular storage tanks are similar to storage tanks except that the volume is made up from multiple units rather than a single tank meaning they can be more flexible in terms of shape to suit constrained sites.

The table below presents the approximate storage volumes required for a range of discharge rates under the 1-in-100-year (plus 40% climate change) storm event:

Discharge condition	Discharge rate	Storage volume required
Mitigate climate change only (Absolute minimum)	169.4 litres / sec	60 m³
50% reduction on existing	84.70 litres / sec	120 m³
Pre-development 1-year peak flow rate	63.99 litres / sec	140 m³
Greenfield (Environment Agency's preferred rate)	**4.40 litres / sec**	**410 m³**

A storage volume of 410 m³ (Greenfield rate) has been allowed for the development to restrict the discharge rate to 4.40 litres/sec as we believe that United Utilities and Manchester City Council will require the site to discharge at the Greenfield Run-off rate.

The storage volume will be provided via a combination of attenuation tanks, permavoid and tanked permeable pavements.

The attenuation tank should be located at a high enough level to allow a connection to be made to the public sewer by gravity. Locating the tank below this level would result in a pumped surface water system which is both unsustainable and uneconomic. A CCTV survey will be required to confirm invert level of existing outfalls from the site, this will provide the level above which the attenuation tank should be located.

Oversized piping

Using larger than necessary pipework creates more room to store rainwater. Potentially more sustainable than storage tanks / geocellular storage if the pipes drain by gravity and do not require pumping. However, lacks the wider benefits of the green infrastructure-based techniques.

As the attenuation storage has been sized to accommodate the 1-in-100 year plus climate change event there is no need for oversized piping.

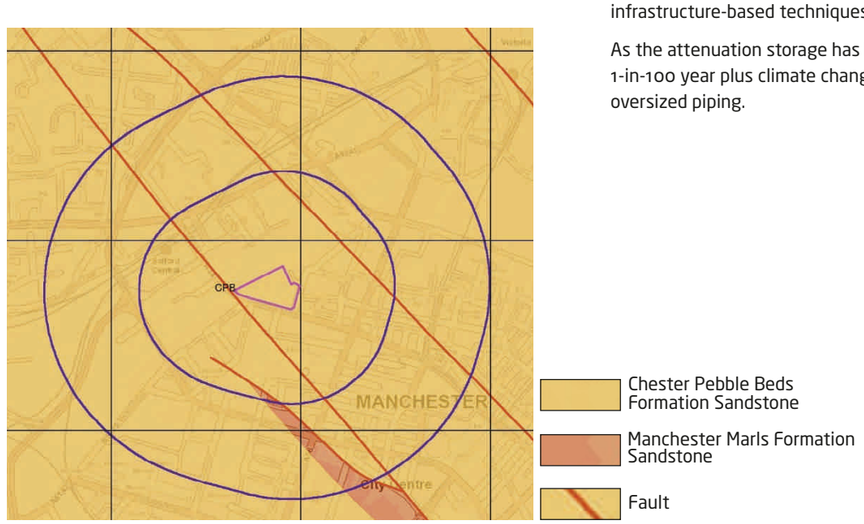


Figure 3.4 Bedrock Geology

Design for exceedance

This involves designing areas within a site such that they will flood and hold water during rare storm events (typically a frequency of once in ten years or longer).

As the attenuation storage has been sized to accommodate the 1-in-100 year plus climate change event there is no need to design for exceedance.

Summary of the Proposed SuDS Strategy

It is proposed to limit surface water discharge from the development to the greenfield run-off rate of 4.4 litres/second. The proposed SuDS strategy will incorporate the following measures:

- Unrestricted rainwater discharge from areas adjacent to the River Irwell, consistent with the existing situation;
- Permavoid system located above the basement structure;
- Soft landscaped areas beyond the basement footprint, including rain gardens to promote ground infiltration;
- Permeable pavements designed to support partial infiltration and/or temporary water storage, subject to the results of soakage testing;
- Potential rainwater harvesting and storage via dedicated tanks.

Potential attenuation options can be found in the sketches in Appendix B of this report.

The outfall from the site will connect to the existing public sewer either with a new connection or, preferably, by reusing one of the existing connections. Based on the existing utility survey, there is a 225 mm dia. and a 100 mm dia. existing foul water outfall connection into the 525 mm dia. combined sewer under Bridge St. It is proposed to reuse the 225 mm dia. connection to discharge surface water from the site into the 525 mm dia. public sewer subject to levels, condition and size to be confirmed by a CCTV survey.

Once the CCTV and level survey of the existing network has been undertaken the location and layout of the outfall(s) can be determined but due to the depth of the existing public combined sewers it is recommended that, if possible, the existing drainage connection(s) should be reused to prevent the need for constructing a new, deep connection. This would minimise both the cost of the work and the disruption to the surrounding roads which are busy thoroughfares and consequently require significant traffic management to be provided during the work.

Alternatively, it may be possible to discharge at unrestricted rate into the Rirver Irwell subject to a licence agreement with the MSCCL and this will be confirmed at the next design stages.

Schematic SuDS layouts are contained in Appendix B for reference.

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

Figure 3.5 Summary of potential SuDS devices

4 Flood risk assessment requirements

The Environment Agency's Indicative Floodplain Map (see Figure 4.1) shows that the majority of the site lies in Zone 1 – land assessed as having a less than 1 in 1000 annual probability of river or sea flooding (<0.1%). The riverbank is situated in flood zone 3 - land assessed as having a annual probability of river flooding higher than 1 in 100 (>1.0%) and sea flooding higher 1 in 200 (0.5%).

In addition, the site lies within a Critical Drainage Area (CDA) identified as Conurbation Core.

A detailed Flood Risk Assessment (FRA) has been undertaken by AKT II which concluded that the site will not increase the flood risk to other properties and the proposed development has an acceptable flood risk within the terms and requirements of the NPPF. Refer to AKT II FRA report.

The main findings of the AKT II FRA report can be summarised as:

- In accordance with the NPPF, the land uses of the proposed development are suitable for the site's location under the terms of the Sequential Test and are considered appropriate to the location.
- The majority of the site is considered to have a **very low probability of flooding** from fluvial or tidal sources, the riverbank is considered to have a low to medium probability of flooding from fluvial or tidal sources.
- The site has a **low probability of flooding** from groundwater provided that the recommendations included in this report are implemented.
- The site has a **low probability of flooding** from artificial sources as it is situated at a considerable distance away from artificial water features.
- The site has a **low probability of flooding** from sewers and the local drainage network, as long as they continue to be adequately maintained and non-return valves are included at the proposed outfall drainage points of the scheme.
- The site has been assessed as being at **low risk from surface water flooding** provided that the recommendations included in this report are implemented.
- The site does not currently cause flooding to adjacent sites and SUDs measure are proposed, therefore, the risk to adjacent properties will be reduced. A sustainable drainage system is to be specified to reduce the peak surface water discharge from the proposed development. In order to reduce the risk of flooding from sewer to the site and other properties downstream and in order to comply with legislative requirements the existing surface water discharge should be reduced as described in Section 3.2.
- The proposed development has an acceptable flood risk within the terms and requirements of National Planning Policy Framework.

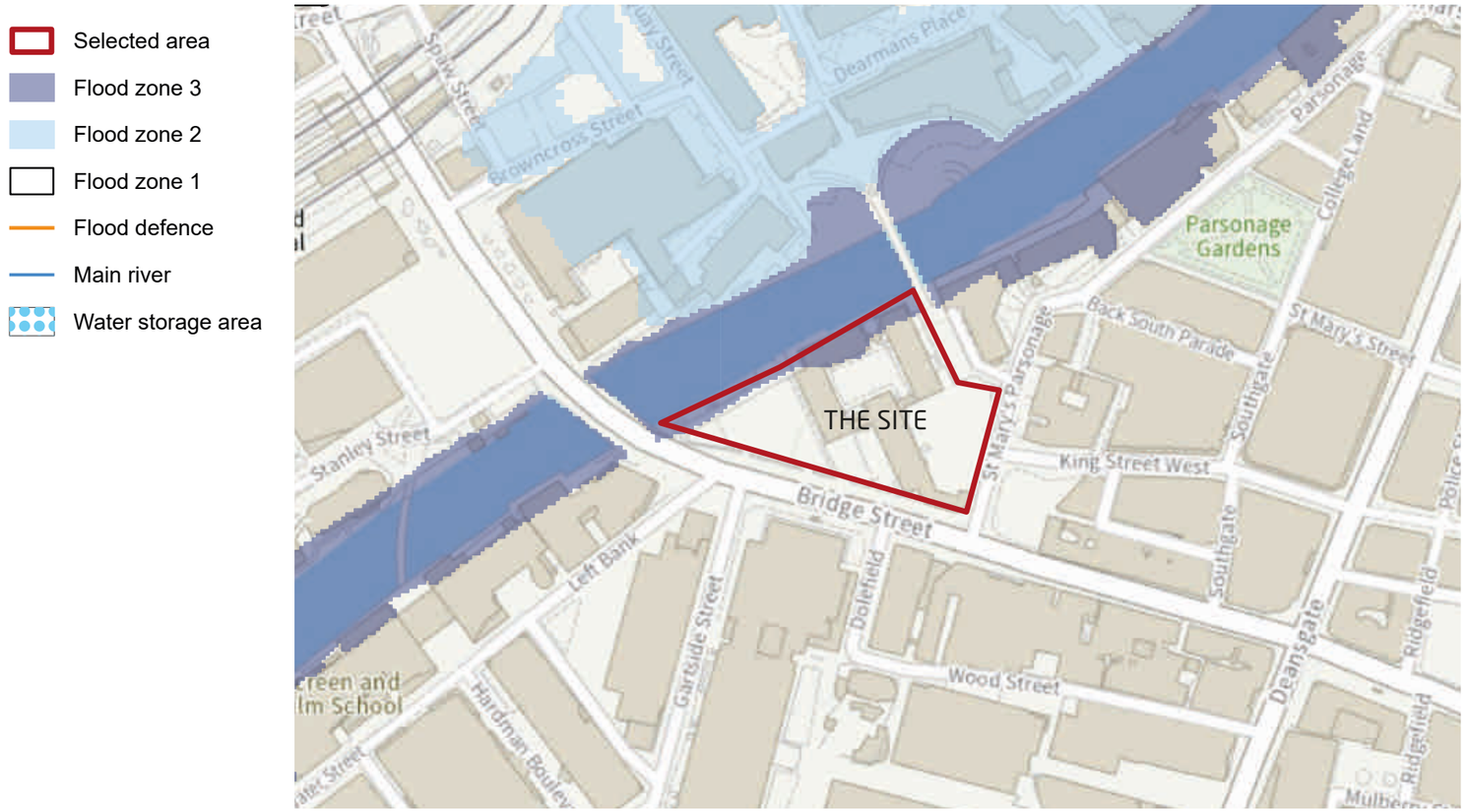


Figure 4.1 Environment Agency indicative flood map

5 Foul water drainage

5.1 Existing scheme

The available Thames Water record plans indicate that there are:

- A 300mm dia. combined sewer running from north to south under St. Mary's Parsonage, to the east of the site. This then increases to 525mm dia. and continues towards west under Bridge St. to the south of the site.
- A 300mm dia. combined sewer running under Bridge St. to the south-west of the site.
- A 530 x 830mm combined water sewer running from the south-east to the south-west under Bridge St., to the south of the site. This increases to 510 x 850mm and successively to 620x1010mm.
- A 610 x 860mm combined water overflow running within the site, to the south-west. We assume that this overflow would take the excess water from the 525mm combined water sewer and discharges it into the River Irwell in extreme rainfall or emergency surcharge events
- A 630 x 870mm combined water overflow crossing the site to the south-west. We assume that this overflow would take the excess water from the 620 x 1010mm combined water sewer under Bridge St. and discharges it into the River Irwell in extreme rainfall or emergency surcharge events.

An extract from the record plans is shown in Figure 3.1 for reference.

Based on the existing utility survey, there is a 225mm dia. and a 100mm dia. existing foul water outfall connections into the 525mm dia. combined sewer under Bridge St.

It is believed that all foul water from the buildings currently discharges directly to the 525mm dia. combined sewer under Bridge St via the two existing outfalls. However, it is recommended that a CCTV survey of the existing site drainage network is undertaken to confirm the location, size and condition of all existing connections from the site to confirm their suitability for reuse.

Although some floor plans are available for the existing buildings, foul appliances such as sinks and toilets are indicated only for one of the existing buildings (the 18th floor building) and these have been used for estimate the existing foul flow.

Using the guidelines for commercial developments given in BS EN 12056-2:2000 - "Gravity Drainage Systems Inside Buildings - Part 2: Sanitary Pipework, layout and calculation", the proposed foul flow is calculated from the formula:

$Q = K \times \sqrt{DU}$

For 'intermittent use' (representing dwellings, offices, etc.) K has a value of 0.5 giving:

Appliance	No.	Discharge units per appliance	Total number of discharge units
Wash hand basin	104	0.5	52.0
Shower	1	0.6	0.6
Kitchen sinks	34	0.8	27.2
WC	53	2.0	106.0
Dishwasher	36	0.8	28.8
Urinals	30	0.5	15.0
Floor drains	2	2.0	4.0
		Total discharge units for site =	**233.6**
		Therefore, total flow from site =	**7.6 litres / sec**

In addition, 5.0 litres/sec are assumed for the plant rooms at basement levels. Therefore, a total foul flow of 12.6 litres/sec has been estimated for the existing site.

5.2 Proposed scheme

Proposed foul water flows have been calculated using the "population method". This method calculates a daily discharge volume from typical figures of discharge per person, per day based on internal floor area.

The accommodation schedule indicates that there are 800 residential dwellings. Based on average population of 3.5 person per dwelling this generates a total residential population of **2,800 people**.

Based on a residential use of 150 litres per person, per day, over 24 hours this generates a base flow of:

(2,800 x 150) / (24 x 60 x 60) = **4.86 litres / sec**

The foul water flow rates have been estimated based on the proposed flood area, use of building using the following assumptions on the anticipated daily discharge:

- 750 litres per 100 m² floor area of office space;
- 400 litres per 100 m² floor area of retail and cafe space.

Therefore, over 24 hours this generates a base flow of:

(29,902 m² GIA of office space x 750 / 100) / (24 x 60 x 60) = **2.60 litres / sec**

(560 m² GIA of retail space x 400 / 100) / (24 x 60 x 60) = **0.026 litres / sec**

The overall flows from the proposed development will be **7.49 litres/sec.**

Assuming a peaking factor of 6.6 the peak flow becomes:

7.49 x 6.6 = **49.43 litres / sec**

Based on the above, the proposed foul flow rates from the site will be higher than the existing. A Pre-planning enquiry is to submitted to United Utilities to confirm capacity within their sewer network.

It is assumed that any foul water drainage from ground floor level and above will be drained by gravity in order to minimise the amount of pumping required. Until the levels of the existing connections and public sewers are confirmed it is unclear whether the basement level will need to be pumped although this appears to be likely. It is therefore recommended that an allowance is made at this stage for pumping foul water from below the basement level slab up to high level in the basement to allow it to discharge by gravity to the public sewer.

As with the surface water drainage, due to the depth of the public sewers it is recommended that, if possible, the existing drainage connection(s) should be reused. Refer to Appendix B for the proposed connections to the public sewers and discharge rates per connections.

6 Overflow pipe diversion

There are 2 United Utilities combined overflow pipes crossing the site to the west:

- A 610 x 860mm combined water overflow running within the site, to the south-west. We assume that this overflow would take the excess water from the 525mm combined water sewer and discharges it into the River Irwell in extreme rainfall or emergency surcharge events
- A 630 x 870mm combined water overflow crossing the site to the south-west. We assume that this overflow would take the excess water from the 620 x 1010mm combined water sewer under Bridge St. and discharges it into the River Irwell in extreme rainfall or emergency surcharge events.

See to Figure 6.1 for reference.

The proposed basement clashes with the United Utilities 610 x 860mm combined water overflow pipe and its upstream manhole MH.1.

To avoid the clash between the proposed basement and the United Utilities asset it may be proposed to divert the 610 x 860mm combined water overflow pipe, the 525mm combined water sewer and MH1 as shown in Appendix C (an extract is shown in Figure 6.2). This is subject to further development.

A formal S185 Sewer Diversion Application has been submitted to United Utilities who confirmed that the diversion proposal appears to be feasible. However, United Utilities will need to further assess our design and a formal approval will be required.

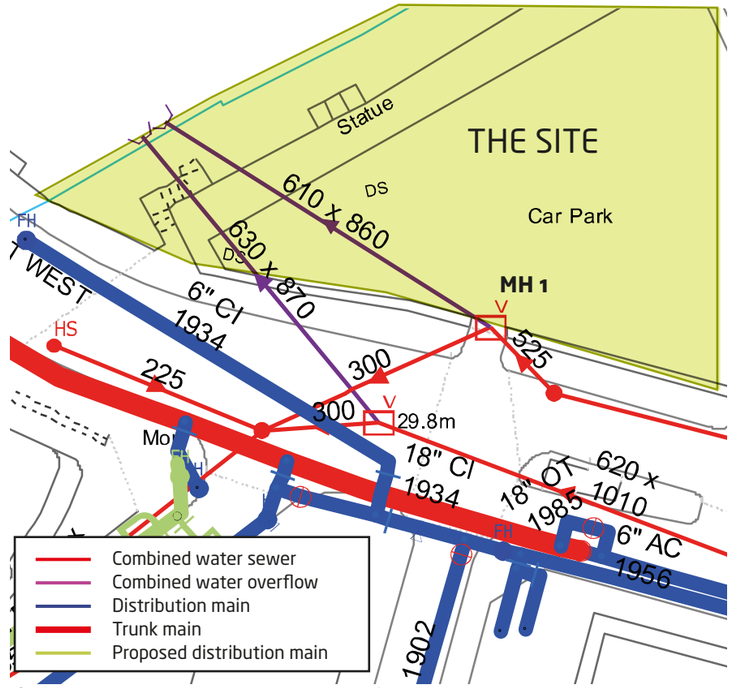


Figure 6.1 United Utilities Asset Map / combined overflow pipes

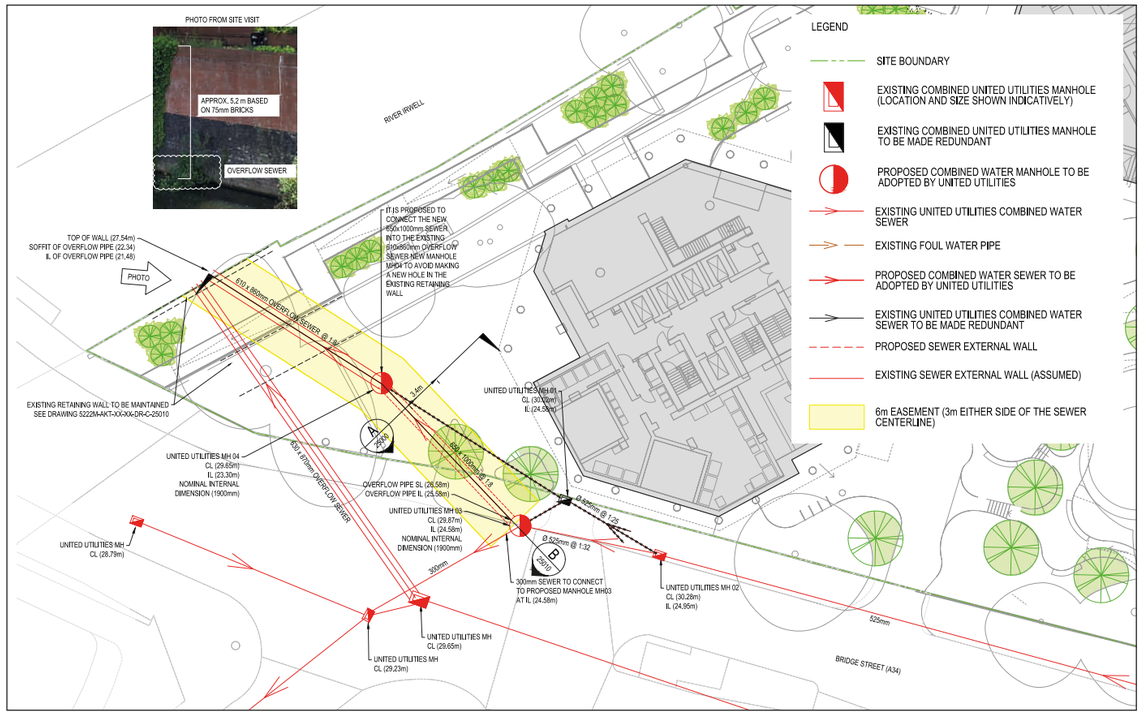


Figure 6.2 Proposed combined water overflow diversion

7 BREEAM

Pol 03: Flood and surface water management

Prerequisite

1. An appropriate consultant is appointed to carry out and demonstrate the development's compliance with all criteria.

Up to two credits – Flood resilience

Two credits - Low flood risk

2. A site specific flood risk assessment (FRA) confirms the development is in a flood zone that is defined as having a low annual probability of flooding. The FRA takes all current and future sources of flooding into consideration.

One credit - Medium or high flood risk

3. A site specific FRA confirms the development is in a flood zone that is defined as having a medium or high annual probability of flooding and is not in a functional floodplain. The FRA must take all current and future sources of flooding into consideration.
4. To increase the resilience and resistance of the development to flooding, one of the following must be achieved:
   - **a.** The ground level of the building and access to both the building and the site, are designed (or zoned) so they are at least 600 mm above the design flood level of the site's flood zone; **OR**
   - **b.** The final design of the building and the wider site reflects the recommendations made by an appropriate consultant in accordance with the hierarchy approach outlined in Section 5 of BS 8533:2017.

Two credits – Surface water run-off

Prerequisite for surface water run-off credits

5. Surface water run-off design solutions must be bespoke, i.e. they must take account of the specific site requirements and natural or man-made environment of and surrounding the site. The priority levels detailed in the Methodology must be followed, with justification given by the appropriate consultant where water is allowed to leave the site.

One credit - Surface Water Run-Off - Rate

6. For brownfield site, drainage measures are specified so that the peak rate of run-off from the site to the watercourses (natural or municipal) shows a 30 % improvement for the developed site compared with the pre-developed site. This should comply at the 1-year and 100-year return period events.
7. For greenfield site, drainage measures are specified so that the peak rate of run-off from the site to the watercourses (natural or municipal) is no greater for the developed site than it was for the pre-development site. This should comply at the 1-year and 100-year return period events.
8. Relevant maintenance agreements for the ownership, long term operation and maintenance of all specified Sustainable Drainage Systems (SuDS) are in place.
9. Calculations include an allowance for climate change. This should be made in accordance with current best practice planning guidance.

One Credit - Surface Water Run-Off - Volume

10. Flooding of property will not occur in the event of local drainage system failure (caused either by extreme rainfall or a lack of maintenance); **AND EITHER**
11. Drainage design measures are specified so that the post-development run-off volume, over the development lifetime, is no greater than it would have been prior to the assessed site's development. This must be for the 100-year 6-hour event, including an allowance for climate change.
12. Any additional predicted volume of run-off for this event is prevented from leaving the site by using infiltration or other SuDS techniques.

OR (only where Criteria 10 & 11 cannot be achieved)

13. Justification from the appropriate consultant indicating why the above criteria cannot be achieved, i.e. where infiltration or other SuDS techniques are not technically viable options.
14. Drainage design measures are specified so that the post-development peak rate of run-off is reduced to the limiting discharge. The limiting discharge is defined as the highest flow rate from the following options:
    - **a.** The pre-development one-year peak flow rate **OR**
    - **b.** The mean annual flow rate Q_{BAR} **OR**
    - **c.** 2 litres / sec / ha

    For the one-year peak flow rate, the one year return period event criterion applies.
15. Relevant maintenance agreements for the ownership, long-term operation and maintenance of all specified SuDS are in place.
16. For either option, above calculations must include an allowance for climate change; this should be made in accordance with current best practice planning guidance.

One credit – Minimising watercourse pollution

One credit

17. There is no discharge from the developed site for rainfall up to 5 mm (confirmed by the appropriate consultant).
18. Areas with a low risk source of watercourse pollution, an appropriate level of pollution prevention treatment is provided, using appropriate SuDS techniques.
19. Areas with a high risk of contamination or spillage of substances, such as petrol and oil, have separators (or an equivalent system) installed in surface water drainage systems.
20. Chemical or liquid gas storage areas have a means of containment fitted to the site drainage system (i.e. shutoff valves). This is to prevent the escape of chemicals to natural watercourses in the event of a spillage or bunding failure.
21. All water pollution prevention systems have been designed and installed in accordance with the recommendations of documents such as the SuDS Manual and other relevant industry best practice. They must be bespoke solutions taking account of the specific site requirements and natural or man-made environment of and surrounding the site.
22. A comprehensive and up-to-date drainage plan of the site will be made available for the building or site occupiers.
23. Relevant maintenance agreements for the ownership, long term operation and maintenance of all specified SuDS must be in place.
24. All external storage and delivery areas designed and detailed in accordance with the current best practice planning guidance.

Up to two credits – Simple buildings – Surface water run-off

Two credits

For "simple buildings", the criteria below should be applied to award one or two credits. Alternatively, two credits and an Exemplary credit is awarded where criteria 5-15 are achieved.

25. Either 24a below or 24b below is met:
    - **a.** There is a decrease in the impermeable area by 50 % or more, from the pre-existing impermeable hard surfaces; **OR**
    - **b.** All run-off from the roof, including new and existing parts of the building, has been managed on site using source control methods. This must be achieved for rainfall depths up to 5 mm.

One credit - Simple buildings - Surface water run-off

26. Either 25a below or 25b below is met:
    - **a.** There is no increase in the impermeable surfaces as a result of the new construction; **OR**
    - **b.** If there is an increase in the impermeable surface as a result of the new construction then the following must be met:
      - **i.** Hard standing areas: additional (or equivalent area of) hardstanding must be permeable or be provided with on-site SuDS to allow full infiltration of the additional volume. The permeable hardstanding must include all pavements and public rights of way, car parks, driveways and non-adoptable roads. Small garden paths which will drain onto a naturally permeable surface can be excluded.
      - **ii** Building (new-build or extension): for an increase in building footprint, extending onto any previously permeable surfaces, the additional run-off caused by the area of the new construction must be managed on site using an appropriate SuDS technique for rainfall depths up to 5 mm.

Assessment of available credits

Prerequisite

Criterion	AKT II assessment	
1.	AKT II are appropriate consultants with the relevant qualifications and experience to design SuDS and flood prevention measures and completing peak rate of run-off calculations.	✓

Flood resilience

Criterion	AKT II assessment	
2.	The majority of the site is situated in Flood Zone 1. The riverbank is situated in flood zone 3.	✓
3.	A site-specific Flood Risk Assessment has been carried out which confirms that the development is at low risk from all flooding sources	✓
4a.	Not applicable - the site is located in Flood Zone 1.	N/A
4b.	The design of the building and the wider site is in accordance with the flood risk assessment and the hierarchical approach outlined in the relevant standards.	✓

Based on this we believe that potentially two credit out of a possible two can be awarded under these criteria.

Surface water run-off

Run-off criteria	AKT II assessment	
5.	The drainage strategy has been prepared in line with the NPPF, National non-statutory SuDS standards and the Sustainable Drainage Manual produced by CIRIA and the priority levels detailed in the BREEAM Methodology.	✓
6.	The proposed peak run-off rate has been reduced to greenfield rate which represents a 92% reduction on the pre-developed site for a 1-in-1 year storm event and a 97% reduction for a 1-in-100 year storm event.	✓
7.	Not applicable- the site is not a greenfield site	N/A
8.	The ownership, operation and maintenance requirements for each SuDS device will be written into the O&M Manual for the site.	✓
9.	An allowance of 40% has been made for climate change in all calculations in line with the Environment Agency's guidance.	✓
10.	The site-specific FRA carried out by AKT II confirms that the site is at low risk of flooding from local drainage system failure.	✓
11.	As the post development hard standing area is less than the pre development hard standing area then there cannot be any more run-off volume over the lifetime of the building.	✓
12.	The site investigation will confirm whether infiltration techniques are a viable solution. It is currently not believed to be possible to use infiltration due to the underlying soil condition and the extent of the proposed basement.	✗
13.	The site investigation will confirm whether infiltration techniques are a viable solution. It is currently not believed to be possible to use infiltration due to the underlying soil condition and the extent of the proposed basement.	✗
14.	Pre-development 1-year peak flow rate = 68.9 litres/sec Mean annual flow rate Q_{bar} = 5.3 litres/sec 2 litres/sec/ha = 1.8 litres/sec It is proposed to reduce the proposed peak discharge rate to Q_{bar}.	✓
15.	The ownership, operation and maintenance requirements for each SuDS device will be written into the O&M Manual for the site.	✓
16.	An allowance of 40% has been made for climate change.	✓

Based on this we believe that potentially two credits out of a possible two can be awarded under these criteria.

Minimising watercourse pollution

Pollution criteria	AKT II assessment	
17.	As confirmed above, no infiltration is possible and there is insufficient green roof coverage therefore this criterion cannot be achieved.	✗
18.	SuDS devices will be specified where possible within the limitations of the development.	✓
19.	As there are no high risk areas being provided as part of the scheme and therefore no separators require to be provided.	N/A
20.	There are no chemical/liquid gas storage areas proposed as part of the scheme.	N/A
21.	All water pollution prevention and SuDS devices will be designed in accordance with the SuDS Manual.	✓
22.	An up-to-date drainage plan will be made available to the site occupiers upon completion.	✓
23.	The ownership, operation and maintenance requirements for each SuDS device will be written into the O&M Manual for the site.	✓
24.	There are no external storage or delivery areas proposed as part of the scheme.	N/A

Based on this we believe that no credit can be awarded under these criteria.

Overall, we believe that potentially four credits out of a possible five can be awarded under the Po103 criteria outlined above.

8 Maintenance and operation

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

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

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

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

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

8.1 General drainage

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

Where possible, connections from stacks or gullies will be made directly to these manholes or inspection chambers to allow the connection to be rodded or jetted from the downstream end. Where this is not possible, each stack will be detailed to have an access hatch provided just above floor level (see Figure 8.1) to allow the connection to be rodded or jetted from the upstream end. Similarly, the gullies will have a rodding access provided within their body allowing the pipework to be rodded or jetted from the gully downstream.

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

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

8.2 Pumped systems

Pumps will be designed as duplex units operating on a duty / standby based on hours run, pump failure and high / high water level. A suitable BMS interface shall be provided monitoring each pump system for the following status points:

- Pump 1 running / Pump 2 running – These statuses shall be provided to the BMS in the form of a volt free contact that is closed when the pump is running.
- Pump 1 failed / Pump 2 failed – These statuses shall be provided to the BMS in the form of a volt free contact that is closed when the pump has deemed to have failed, i.e. failed to run when requested. This shall cause a latched general alarm on the BMS.
- High water level – This status shall be provided to the BMS in the form of a volt free contact that is closed when a high water level is breached. The level shall set at a level that is higher than the normal pump control level switch. This shall cause a latched general alarm on the BMS.
- High / High water level – This status shall be provided to the BMS in the form of a volt free contact that is closed when a high / high water level is breached. The level shall set at a level that is higher than the high water level switch. This shall cause a critical latched alarm on the BMS.
- System not in automatic / not available – This status shall be provided to the BMS in the form of a volt free contact that is open (failsafe) when the system is not available to operate. This shall operate should any event occur that could prevent the system from operating, such as power loss to the control panel, hand / off / auto switches not in Auto, isolators opened. This shall cause a critical latched alarm on the BMS.

The BMS shall be capable of raising the following alarms:

- Excessive Pump Running Alarm – The BMS shall monitor the running status of each pump. Should any pump run for longer than 20 minutes, a general alarm shall be raised on the BMS.
- Excessive Pump Starts Alarm – The BMS shall calculate from the running status the number of starts per hour. Should the number of starts per hour exceed 4, a general alarm shall be raised on the BMS.

A control panel local to each pump station shall be provided to monitor the same status points and alarms as defined for the BMS Interface above.

8.3 Attenuation tanks

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

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

8.4 Petrol separators

The separator shall be provided with a robust device to provide visual and audible warning to an appropriate location when the level of oil reaches 90 % of the oil storage volume under static liquid level conditions. Appropriate maintenance shall then be carried out.

Maintenance schedule	Required action	Recorded frequency
Regular maintenance	Follow the manufacturer's recommended guidelines.	As manufacturer's recommendations
	Remove sediment / oil from separator.	Six-monthly or as manufacturer's recommendations
	Service all electrical equipment.	As manufacturer's recommendations
	Inspect integrity of separator and all mechanical parts.	Six-monthly or as manufacturer's recommendations

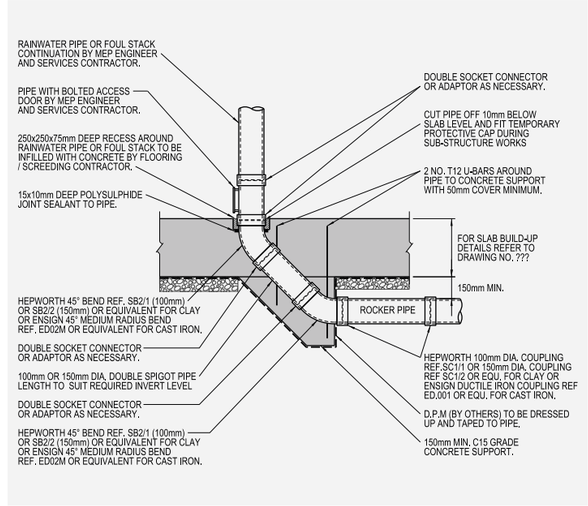


Figure 8.1 Rodding / jetting access detail

8.5 Blue / Green Roofs

Ensure safe access can be gained to the roof and that relevant Health and Safety procedures are followed when working at roof level. It is advised that the contractor should always seek proof of current maintenance for any roof access, fall arrest / restraint systems prior to proceeding with the work on site. The level of maintenance required is dependent on the final finish. Paved podium decks and extensive green roofs are relatively low maintenance whereas intensive green roofs require maintenance like any garden.

Remove all dead vegetation and debris from the roof and ensuring all outlets, gutters and downpipes are clear. Where the species mix incorporates wildflowers and grasses it is recommended that all dead vegetation is mown / strimmed down and the waste is removed from the roof and disposed off.

Any vegetation which has encroached into drainage outlets, walkways and the vegetation barriers (pebbles) should be removed. Weeding an extensive green roof is necessary to maintain a healthy roof and all aggressive species of shrub sapling and undesirable plants should be removed. Some weeds however are helpful to the biodiversity of the roof and considered as a problem only of aesthetics. If considered excessive, they can be removed ensuring that care is taken to follow specific instructions as to the type and species of vegetation removed. All extensive green roof installations will at times include some moss and grass.

Areas of dead vegetation / bare patches can be easily repaired and this is best done during the main growing seasons of March/ April or from late August until the end of September. Take plug plants (new) or vegetation cuttings from surrounding areas of healthy mature plants and place on bare patches, pressing gently into the soil. A light sprinkling of sand mixed with compost should then be dressed over the affected area and watered to improve the uptake of the cuttings. If the vegetation is showing signs of distress, but has received regular rainfall, then the most likely problem is a lack of nutrient and a fertiliser should be applied.

Remove the lids of all Inspection chambers, ensure that all rainwater outlets and downpipes are free from blockages and that water can flow freely away, clean filters to outlets twice yearly and replace every three years. Ensure that any protective metal flashings and termination bars remain securely fixed in place.

Examine all mastic sealant and mortar pointing for signs of degradation. Check that all promenade tiles and paving slabs are securely fixed to the roof surface and in good condition.

Advise the client of the need to repair or renew any defects as necessary.

Ensure that any new items of plant/equipment on the roof are mounted on suitable isolated slabs and that any fixings used to secure the plant/equipment in place do not penetrate the waterproofing. Report signs of damage or degradation to the waterproofing to manufacturer immediately, in order that arrangements can be made for remedial work to be carried out if necessary. It is recommended that a record is kept of the findings of the inspection to avoid confusion and provide an on-going record of roof performance. Plants suitable for an extensive green roof which will colonise in partial and full shade will generally be greener in colour and grow "taller" in these locations. There will be a significant variance in the growth and colour between the plants growing in full or partial shade and those exposed to full sunlight and this should be recognised as a feature of the biodiversity of each individual roof.

8.6 Outlets from blue roof

Inspection chambers containing orifice plates to be inspected regularly in accordance with the manufacturer recommendations (minimum twice annually):

- Remove litter and blockages as required
- Records of inspections and maintenance undertaken should be kept by the client.
- Check orifice plate for any sign of blockages Drainage design standards

9 Drainage design standards

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

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

10 Materials

	Item	Material	British standard
a)	Drainage pipe work	Vitrified clayware	BS EN 295-1
		Cast iron	BS EN 877
		Concrete	BS 5911-1 and BS EN 1916
		uPVC	BS EN 1401-1
b)	Precast inspection chambers	Precast concrete	BS 5911 Part 200
c)	Drainage gullies and gratings	Vitrified clayware	BS EN 295-1
		Ductile iron	BS EN 124 D 400
d)	Drainage channels and gratings	Polymer concrete	
		Ductile iron	BS EN 124 D 400
e)	Access covers	Grey iron	BS EN 124
		Galvanised steel	Facta Class A, B & D
f)	Cellular units	Polypropylene	
g)	Geotextiles		

Appendix A

Topographic survey drawing



Notes:

1. GRID AND LEVELS BASED ON ORDNANCE DATUM, DERIVED FROM THE NATIONAL GNSS NETWORK. LOCAL SCALE FACTOR REMOVED.
2. TREE AND HEDGE SPECIES HAVE BEEN IDENTIFIED AS ACCURATELY AS POSSIBLE BUT SHOULD BE CROSS CHECKED IN CRITICAL AREAS.

Coordinate Table

Station	Description	Easting	Northing	Level
S1	Road Nail	383396.807	398380.950	30.350
S10	Road Nail	383425.184	398451.724	23.893
S11	Hilti Nail	383336.803	398365.559	26.802
S12	Road Nail	383377.850	398386.710	26.886
S13	Hilti Nail	383330.455	398360.992	29.096
S2	Road Nail	383349.454	398354.370	29.445
S3	Hilti Nail	383406.913	398329.697	31.122
S4	Road Nail	383450.083	398330.079	32.109
S5	Hilti Nail	383488.398	398306.723	33.255
S6	Hilti Nail	383493.422	398382.521	33.210
S7	Road Nail	383461.826	398354.873	31.560
S71	Hilti Nail	383469.298	398381.457	31.996
S8	Road Nail	383439.403	398401.425	31.191
S9	Road Nail	383464.134	398420.502	31.127

TOPOGRAPHICAL KEY

GENERAL ABBREVIATIONS

SURVEY STATION — BANKING — HEDGE SPREADS — WOODLAND/CANOPY — ARROW ON STEPS / RAMPS INDICATES DIRECTION UPWARDS — TREES — GATE — KERB/CHANNEL — ROAD UNMETRED — FOOTPATH — CHANGE IN SURFACE — FENCE — WALL — OVERHEAD ELECTRIC — OVERHEAD TELECOM — FOUL SEWER — SURFACE SEWER — P-TRAP — BACK DROP (EXTERNAL) — BACK DROP (INTERNAL) — BUILDING — OPEN SIDED BUILDING — OVERHANG / CANOPY — GLASSHOUSE — CONTOUR — SPOT LEVEL — SONAR LEVEL — BORE HOLE — TRIAL HOLE

AIR CONDITIONING UNIT	ACU	MANHOLE	MH
AIR VALVE	AV	MARKER POST	MK
BACK DROP	BD	METER	MT
BASE LEVEL	BL	OVERGROUND SURVEY BENCH MARK	OSBM
BOLLARD/BEACON	BO	P-TRAP	PT
BOLLARD LIGHT	BOL	POST	PO
BRICK	BK	POST BOX	PBOX
BUS STOP	BS	RAIN WATER EYE	RE
CABLE TV COVER	CATV	ROAD SIGN	RS
CABLES TO GROUND	CTG	RAIN WATER PIPE	RWP
CAT A TREE	CA	RETAINING WALL	RW
CONTROL BOX	CB	SOFT BELL	SB
COVER LEVEL	CL	STOP COCK	SC
CROSSING CONTROL BUTTON	CCB	STREET NAME PLATE	SNP
DAMP PROOF COURSE	DPC	STOP VALVE	SV
DRAINAGE CHANNEL	DC	SIGN	SN
DROP KERB	DK	SOIL VENT PIPE	SVP
ELECTRICITY POLE	EP	SURFACE WATER	SW
FENCE	FE	TELEGRAPH POLE	TP
FIRE HYDRANT	FH	TELECOM KIOSK	TK
FLOOR LEVEL	FL	TELECOM INSPECTION COVER	TEL
FOUL WATER	FW	TELEPHONE CALL BOX	TCB
GAS MAIN	GM	TICKET MACHINE	TM
GAS VALVE	GV	TOP OF WALL	TOW
GULLY	GY	TRAFFIC LIGHT	TL
INSPECTION COVER	IC	TRAFFIC LIGHT COVER	TLC
INVERT LEVEL	IL	UNABLE TO LIFT	UTL
KERB OUTLET	KO	UNABLE TO LOCATE	UTL
LAMP POST	LP	UNABLE TO RAISE	UTR
MARKPOST	MP	UNABLE TO SURVEY	UTS

FENCE ABBREVIATIONS

BARBED WIRE FENCE	BWF	IRON RAILINGS	IR
CLOSE BOARDED FENCE	CBF	LARCH LAP FENCE	LL
CONCRETE PANEL FENCE	CPL	POST AND RAIL FENCE	PRF
CORRUGATED IRON FENCE	CI	POST AND WIRE FENCE	PWF
CHAIN LINK FENCE	CLF	WIRE MESH FENCE	WMF
CHESTNUT PALING	CNP		

0m 2 4 6 8 10 12 14 16 18 20 22

mksurveys

Tel 01908 565501 — Milton Keynes — enquiries@mksurveys.co.uk
Tel 01865 564479 — Oxford — oxford@mksurveys.co.uk
Tel 01491 201742 — Eye, Midlands — eastmidlands@mksurveys.co.uk
Tel 01483 243700 — West Midlands — westmidlands@mksurveys.co.uk
Fax 01483 243702 — Horsham — horsham@mksurveys.co.uk

www.mksurveys.com — www.surveys4bim.co.uk

Mapeley Estates Ltd

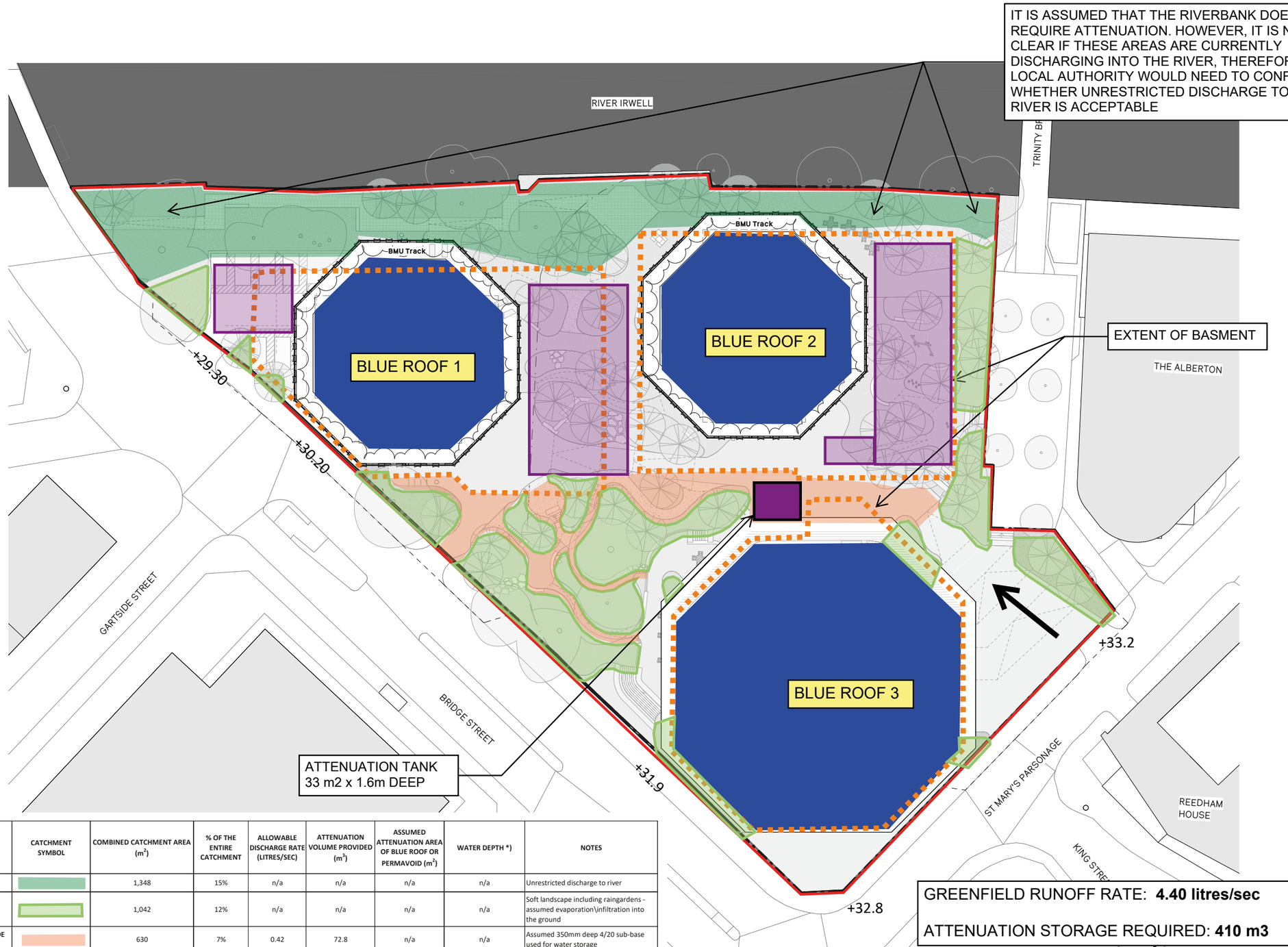
Albert Bridge House
St Mary's Parsonage
Manchester
M3 2RD

Provisional Topographical Survey

Scale	Sheet Size:	Sheet Number:	Date:
1:200	A0	1	October 2018
Project Number:	Rev:	Surveyed By:	Approved By:
26100	-	AMG	AJ / TJF

Appendix B

SuDS Strategy Options

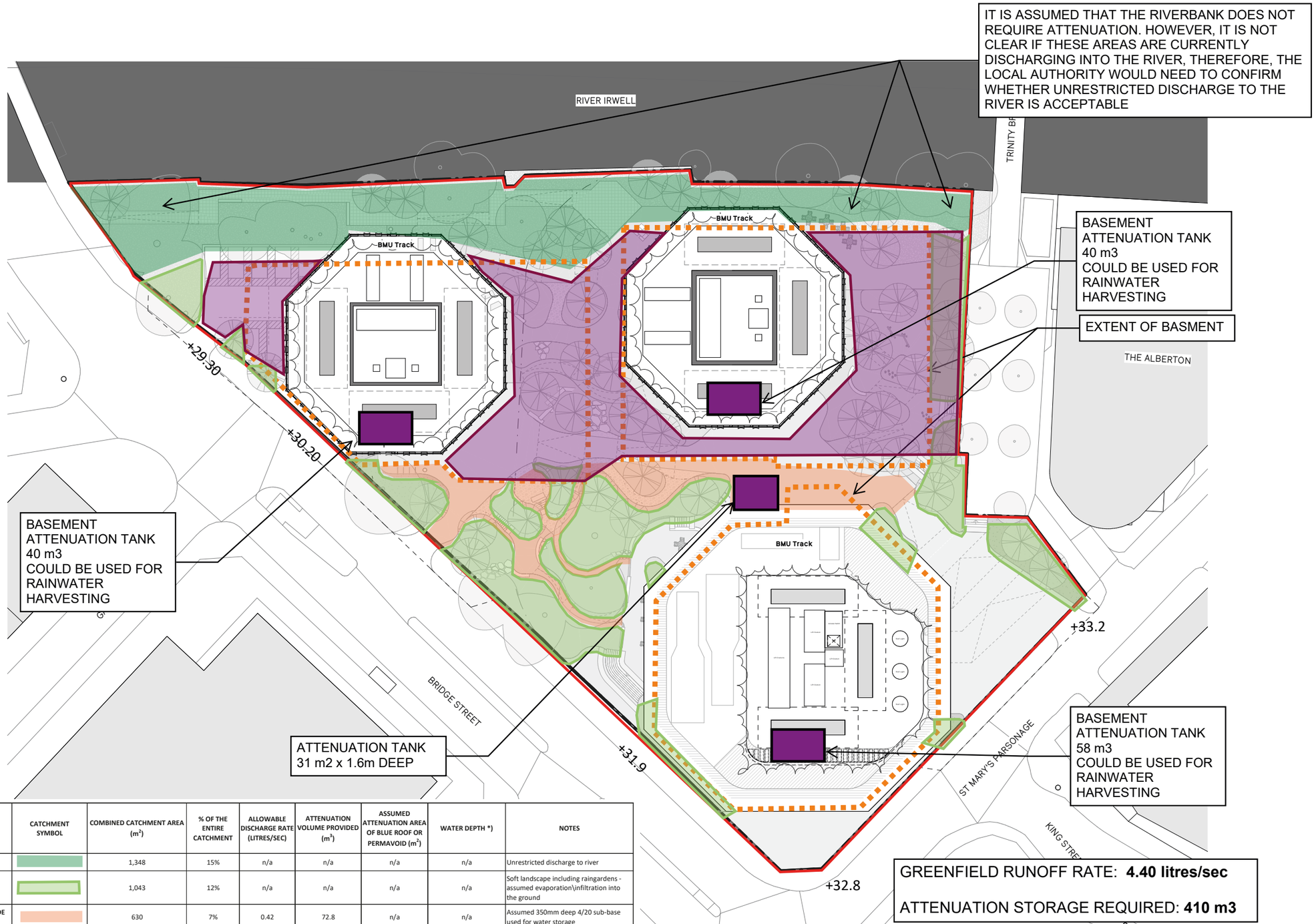


ATTENUATION FEATURE	CATCHMENT SYMBOL	COMBINED CATCHMENT AREA (m^2)	% OF THE ENTIRE CATCHMENT	ALLOWABLE DISCHARGE RATE (LITRES/SEC)	ATTENUATION VOLUME PROVIDED (m^3)	ASSUMED ATTENUATION AREA OF BLUE ROOF OR PERMAVOID (m^2)	WATER DEPTH *)	NOTES
UNRESTRICTED		1,348	15%	n/a	n/a	n/a	n/a	Unrestricted discharge to river
SOFT LANDSCAPING		1,042	12%	n/a	n/a	n/a	n/a	Soft landscape including raingardens - assumed evaporation\infiltration into the ground
PERMEABLE PAVING OUTSIDE BASEMENT BOX		630	7%	0.42	72.8	n/a	n/a	Assumed 350mm deep 4/20 sub-base used for water storage
BLUE ROOF 1		760	9%	0.51	47.7	650	77	Assumed 100mm deep system
BLUE ROOF 2		730	8%	0.49	45.8	630	77	Assumed 100mm deep system
BLUE ROOF 3		1,615	18%	1.09	101.3	1,400	76	Assumed 100mm deep system
PERMAVOID ABOVE BASEMENT BOX		1,560	17%	1.05	97.9	700	147	Assumed 150mm deep Permavoid
ATTENUATION TANKS		1,241	14%	0.84	50.0	N/A	n/a	Could be used for rainwater harvesting
TOTAL		**8,926**		**4.40**	**415.4**			

*) Assumed 95% void ratio

akt II

PROJECT ALBERT BRIDGE HOUSE		TITLE ATTENUATION STRATEGY - BLUE ROOF, EXTERNAL ATTENUATION TANKS AND PERMAVOID	
DATE 25/04/2025	SCALE N.T.S.	CAD FILENAME -	STATUS FOR DISCUSSION
DRAWN SZ / CHECKED DN	PROJECT No. 5222	DRAWING No. 5222-CSK05	REV P6



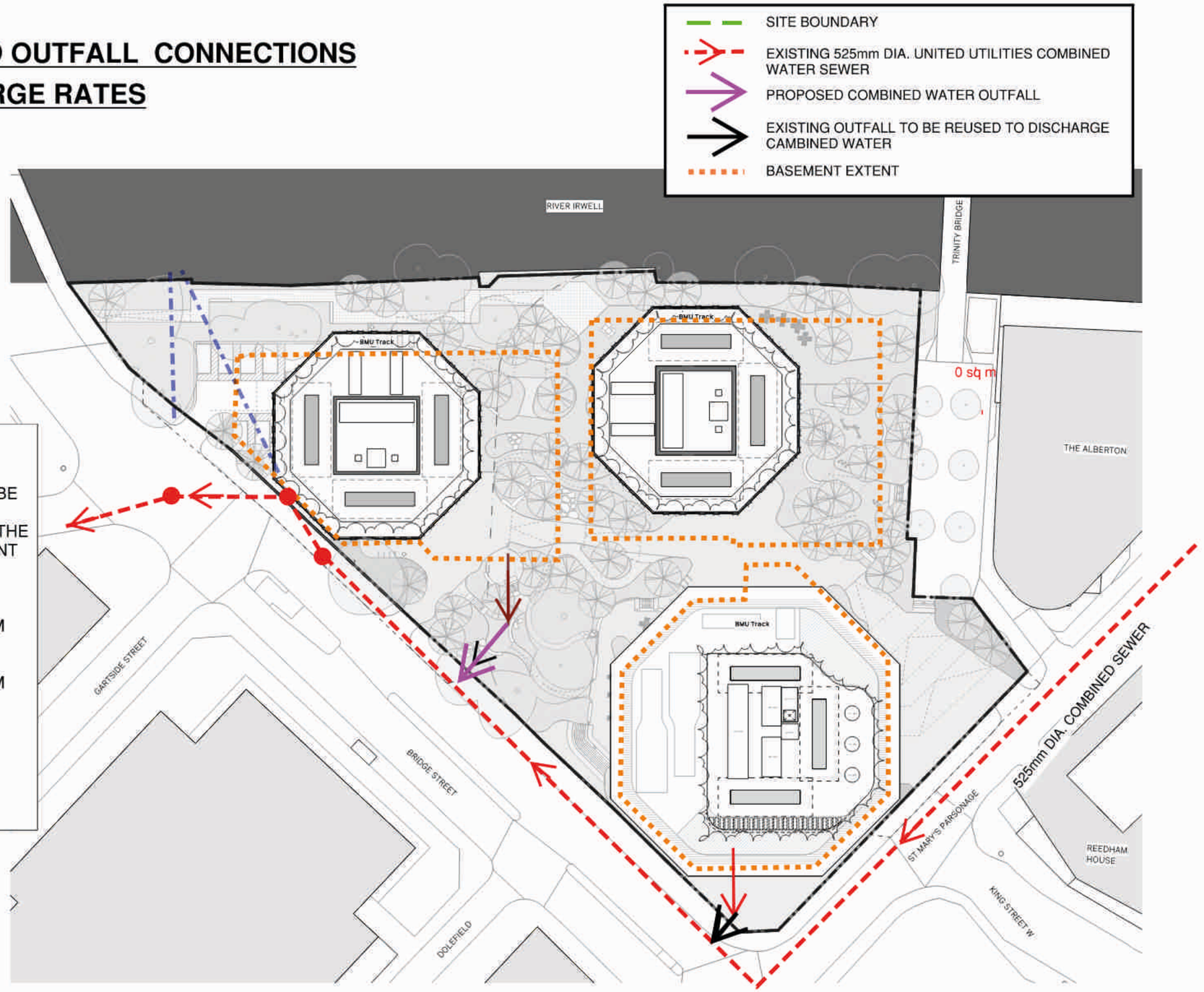
ATTENUATION FEATURE	CATCHMENT SYMBOL	COMBINED CATCHMENT AREA (m^2)	% OF THE ENTIRE CATCHMENT	ALLOWABLE DISCHARGE RATE (LITRES/SEC)	ATTENUATION VOLUME PROVIDED (m^3)	ASSUMED ATTENUATION AREA OF BLUE ROOF OR PERMAVOID (m^2)	WATER DEPTH *)	NOTES
UNRESTRICTED		1,348	15%	n/a	n/a	n/a	n/a	Unrestricted discharge to river
SOFT LANDSCAPING		1,043	12%	n/a	n/a	n/a	n/a	Soft landscape including raingardens - assumed evaporation\infiltration into the ground
PERMEABLE PAVING OUTSIDE BASEMENT BOX		630	7%	0.42	72.8	n/a	n/a	Assumed 350mm deep 4/20 sub-base used for water storage
PERMAVOID ABOVE BASEMENT BOX		2,500	28%	1.68	156.8	1,350	122	Assumed 150mm deep Permavoid
ATTENUATION TANKS		3,405	38%	2.29	185.0	N/A	n/a	Could be used for rainwater harvesting
TOTAL		**8,926**		**4.40**	**414.6**			

*) Assumed 95% void ratio

akt II

PROJECT **ALBERT BRIDGE HOUSE**		TITLE **ATTENUATION STRATEGY - EXTERNAL ATTENUATION TANKS AND PERMAVOID (NO BLUE ROOFS)**	
DATE 25/04/2025	SCALE N.T.S.	CAD FILENAME -	STATUS FOR DISCUSSION
DRAWN SZ	CHECKED DN	PROJECT No. 5222	DRAWING No. 5222-CSK14	REV P3

LOCATION OF PROPOSED OUTFALL CONNECTIONS AND PROPOSED DISCHARGE RATES



TOTAL PROPOSED SURFACE WATER DISCHARGE RATE: **4.40 litres/sec**

IT IS ASSUMED THAT THE SURFACE WATER WILL BE DISCHARGED BY GRAVITY INTO THE 525mm DIA. COMBINED WATER SEWER. THE SPLIT BETWEEN THE 2 OUTFALLS IS SUBJECT TO DESIGN DEVELOPMENT

PROPOSED FOUL WATER DISCHARGE RATE FROM RESIDENTIAL BUILDINGS: **32.07 litres/sec**

PROPOSED FOUL WATER DISCHARGE RATE FROM COMMERCIAL BUILDING: **18.68 litres/sec**

TOTAL PEAK FOUL FLOW RATE FROM THE SITE: **50.75 litres/sec**

akt II

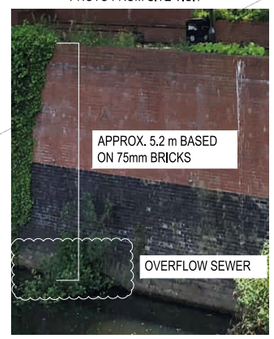
PROJECT: ALBERT BRIDGE HOUSE		TITLE: PROPOSED OUTFALL CONNECTIONS AND DISCHARGE RATES	
DATE: 14/04/2025	SCALE: N.T.S.	LAD FRAMING: -	STATUS: FOR DISCUSSION
DRAWN: SZ	CHECKED: DN	PROJECT No.: 5222	DRAWING No.: 5222-CSK12	REV: P3

Appendix C

Proposed sewer diversion

N

PHOTO FROM SITE VISIT



RIVER IRWELL

TOP OF WALL (27.54m)
SOFFIT OF OVERFLOW PIPE (22.34)
IL OF OVERFLOW PIPE (21.48)

PHOTO

610 x 860mm OVERFLOW SEWER @ 1:8

IT IS PROPOSED TO CONNECT THE NEW 650x1000mm SEWER INTO THE EXISTING 610x860mm OVERFLOW SEWER NEW MANHOLE MH04 TO AVOID MAKING A NEW HOLE IN THE EXISTING RETAINING WALL

EXISTING RETAINING WALL TO BE MAINTAINED
SEE DRAWING 5222M-AKT-XX-XX-DR-C-25010

3.4m

A 25010

650 x 1000mm @ 1:8

650 x 870mm OVERFLOW SEWER

UNITED UTILITIES MH 04
CL (29.65m)
IL (23.30m)
NOMINAL INTERNAL DIMENSION (1900mm)

OVERFLOW PIPE SL (26.58m)
OVERFLOW PIPE IL (25.58m)

UNITED UTILITIES MH 03
CL (29.87m)
IL (24.58m)
NOMINAL INTERNAL DIMENSION (1900mm)

UNITED UTILITIES MH 01
CL (30.02m)
IL (24.58m)

Ø 525mm @ 1:25

Ø 525mm @ 1:32

B 25010

300mm

300mm SEWER TO CONNECT TO PROPOSED MANHOLE MH03 AT IL (24.58m)

UNITED UTILITIES MH 02
CL (30.28m)
IL (24.95m)

525mm

UNITED UTILITIES MH
CL (28.79m)

UNITED UTILITIES MH
CL (29.65m)

UNITED UTILITIES MH
CL (29.23m)

BRIDGE STREET (A34)

NOTES

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL AKT II DRAWINGS AND ALL OTHER RELEVANT ARCHITECT'S, ENGINEER'S AND LANDSCAPE ARCHITECTS DRAWINGS AND SPECIFICATIONS.
2. ALL DIMENSIONS AND LEVELS SHOWN ARE IN METRES UNLESS INDICATED OTHERWISE.
3. DO NOT SCALE FROM THIS DRAWING.
4. BEFORE STARTING WORK, THE CONTRACTOR IS TO CHECK INVERT LEVELS AND POSITIONS OF ALL EXISTING DRAINS, SEWERS, INSPECTION CHAMBERS AND MANHOLES AGAINST DRAWINGS AND REPORT ANY DISCREPANCIES TO THE ENGINEER.
5. THIS DRAWING HAS BEEN PRODUCED USING THE INFORMATION AVAILABLE, IN PARTICULAR UNITED UTILITIES ASSET MAP AND THE UTILITY SURVEY DRAWING NUMBER 26100 PRODUCED BY MK SURVEYS DATED OCTOBER 2018

LEGEND

- SITE BOUNDARY
- EXISTING COMBINED UNITED UTILITIES MANHOLE (LOCATION AND SIZE SHOWN INDICATIVELY)
- EXISTING COMBINED UNITED UTILITIES MANHOLE TO BE MADE REDUNDANT
- PROPOSED COMBINED WATER MANHOLE TO BE ADOPTED BY UNITED UTILITIES
- EXISTING UNITED UTILITIES COMBINED WATER SEWER
- EXISTING FOUL WATER PIPE
- PROPOSED COMBINED WATER SEWER TO BE ADOPTED BY UNITED UTILITIES
- EXISTING UNITED UTILITIES COMBINED WATER SEWER TO BE MADE REDUNDANT
- PROPOSED SEWER EXTERNAL WALL
- EXISTING SEWER EXTERNAL WALL (ASSUMED)
- 6m EASEMENT (3m EITHER SIDE OF THE SEWER CENTERLINE)

REV	DATE	DESCRIPTION	BY	CHECKED
P3	25/04/2025	DRAWING UPDATED	DN	DP
P2	01/08/2022	SEWER DIVERSION APPLICATION	SZ	DP
P1	27/05/2022	SEWER DIVERSION APPLICATION	SZ	DP

WHERE DIGITAL MODELS/FILES ARE ISSUED, THESE ARE PROVIDED FOR INFORMATION ONLY TO ASSIST OTHER PARTIES ON ALLIED THEIR DESIGN DRAWINGS/ DOCUMENTATION. THIS DRAWING IS THE ONLY VALID DOCUMENT FOR CONSTRUCTION PURPOSES. AKT II ACCEPT NO RESPONSIBILITY FOR THE ACCURACY OF THE DIGITAL DATA SUPPLIED.

THE CONTRACTUAL DRAWINGS/INFORMATION PRODUCED BY AKT II UNDER OUR APPOINTMENT ARE A RECORD TO THE WORK INTENDED AS AT ISSUE DATE. WITH RESPECT TO CONSTRUCTION DRAWINGS, WHILE REASONABLE ATTENTION HAS BEEN

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E info@akt-uk.com
W www.akt-uk.com

CLIENT
OVAL REAL ESTATE LIMITED

PROJECT
ALBERT BRIDGE HOUSE

TITLE
OVERLOW SEWER
PROPOSED DIVERSION

SZ DRAWN BY	11.04.2022 ORIGIN DATE	DN CHECKED BY	A0 PAPER SIZE
5222M PROJECT No.	STAGE 2 PROJECT STAGE	S2 SUITABILITY CODE	1:100 SCALE

5222M AKT XX 00 DR C 20010 P3
PROJECT No. | ORIGINATOR | ZONE | LEVEL | TYPE | ROLE | DRAWING No. | REVISION

FOR INFORMATION ONLY

Appendix D

Geological Maps

Geology 1:10,000 Maps Legends

Artificial Ground and Landslip

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	MGR	Made Ground (Undivided)	Artificial Deposit	Holocene - Holocene
	WMGR	Infilled Ground	Artificial Deposit	Holocene - Holocene
	WGR	Worked Ground (Undivided)	Void	Holocene - Holocene

Superficial Geology

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	ALV	Alluvium	Sand with Clay And Gravel	Flandrian - Pleistocene
	ALV	Alluvium	Clay, Silt, Sand and Gravel	Flandrian - Pleistocene
	GFSDD	GLACIOFLUVIAL SHEET DEPOSITS, DEVENSIAN	Sand and Gravel	Devensian - Ipswichian
	TILLD	Till, Devensian	Diamicton	Devensian - Ipswichian
	RTD1	River Terrace Deposits, 1	Sand and Gravel	Quaternary - Ryazanian

Bedrock and Faults

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	CPB	Chester Pebble Beds Formation	Sandstone	Early Triassic - Early Triassic
	MM	Manchester Marls Formation	Mudstone	Late Permian - Late Permian
	Fault			

Geology 1:10,000 Maps

This report contains geological map extracts taken from the BGS Digital Geological map of Great Britain at 1:10,000 scale and is designed for users carrying out preliminary site assessments who require geological maps for the area around a site. This mapping may be more up to date than previously published paper maps.

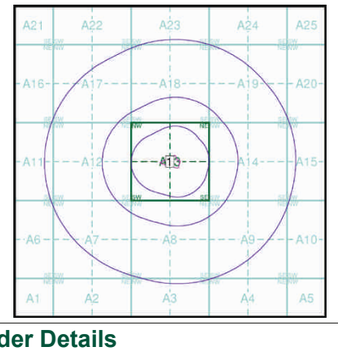
The various geological layers - artificial and landslip deposits, superficial geology and solid (bedrock) geology are displayed in separate maps, but superimposed on the final 'Combined Surface Geology' map. All map legends feature on this page.

Please Note: Not all of the layers have complete nationwide coverage, so availability of data for relevant map sheets is indicated below.

Geology 1:10,000 Maps Coverage

Map ID: 1
Map Name: SJ89NW
Map Date: 1973
Bedrock Geology: Available
Superficial Geology: Available
Artificial Geology: Available
Faults: Available
Landslip: Not Available
Rock Segments: Not Available

Geology 1:10,000 Maps - Slice A



Order Details

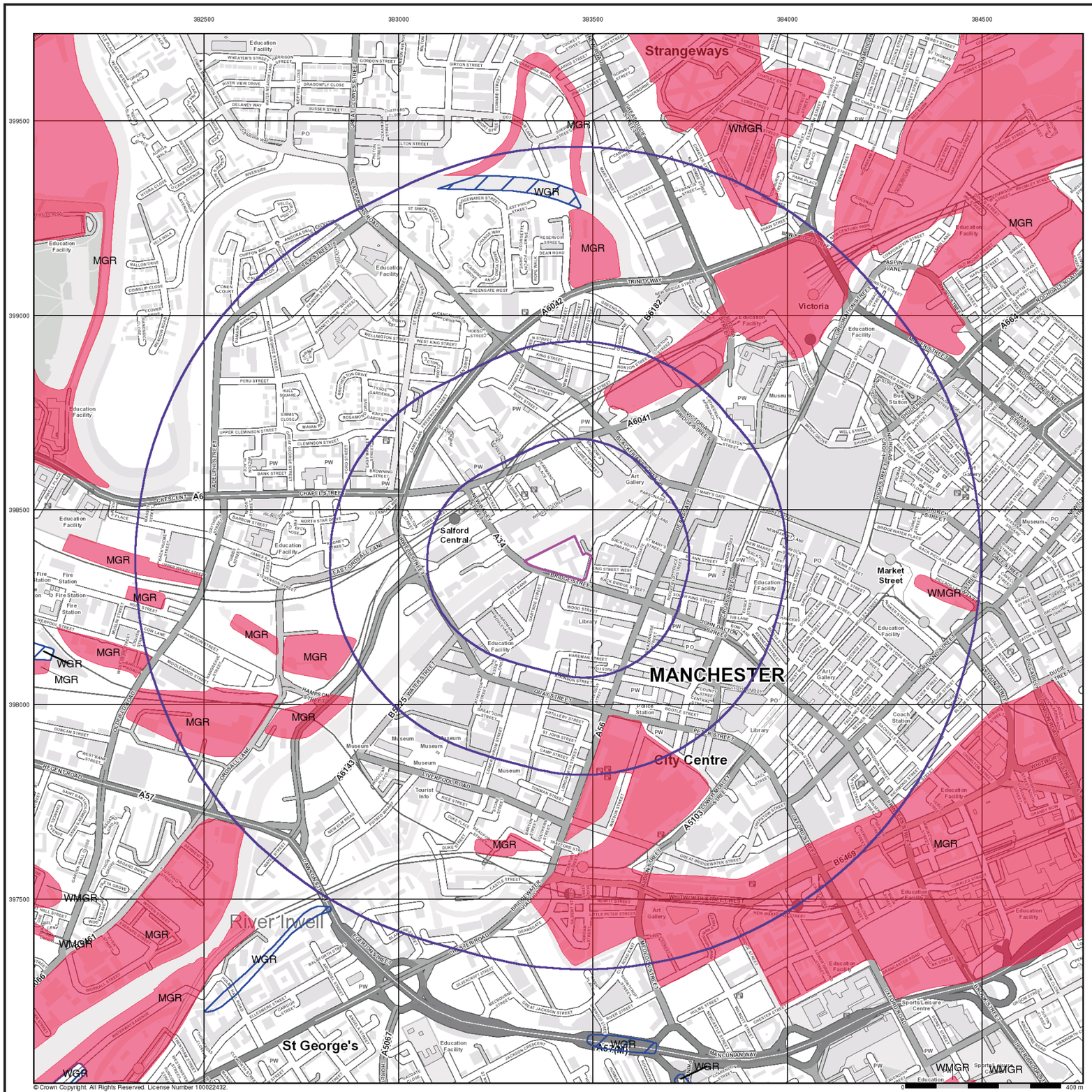
Order Number: 173200128_1_1
Customer Ref: 4387
National Grid Reference: 383420, 398370
Slice: A
Site Area (Ha): 1.04
Search Buffer (m): 1000

Site Details

Brother UK Ltd, Bridge House, Bridge Street, AUDENSHAW, M34 5JD

Landmark INFORMATION GROUP

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



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0 400 m

Artificial Ground and Landslip

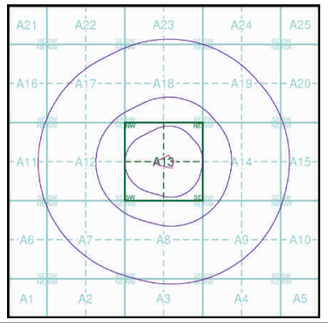
Artificial ground is a term used by BGS for those areas where the ground surface has been significantly modified by human activity. Information about previously developed ground is especially important, as it is often associated with potentially contaminated material, unpredictable engineering conditions and unstable ground.

Artificial ground includes:

- Made ground - man-made deposits such as embankments and spoil heaps on the natural ground surface.
- Worked ground - areas where the ground has been cut away such as quarries and road cuttings.
- Infilled ground - areas where the ground has been cut away then wholly or partially backfilled.
- Landscaped ground - areas where the surface has been reshaped.
- Disturbed ground - areas of ill-defined shallow or near surface mineral workings where it is impracticable to map made and worked ground separately.

Mass movement (landslip) deposits on BGS geological maps are primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground. The dataset also includes foundered strata, where the ground has collapsed due to subsidence.

Artificial Ground and Landslip Map - Slice A



Order Details

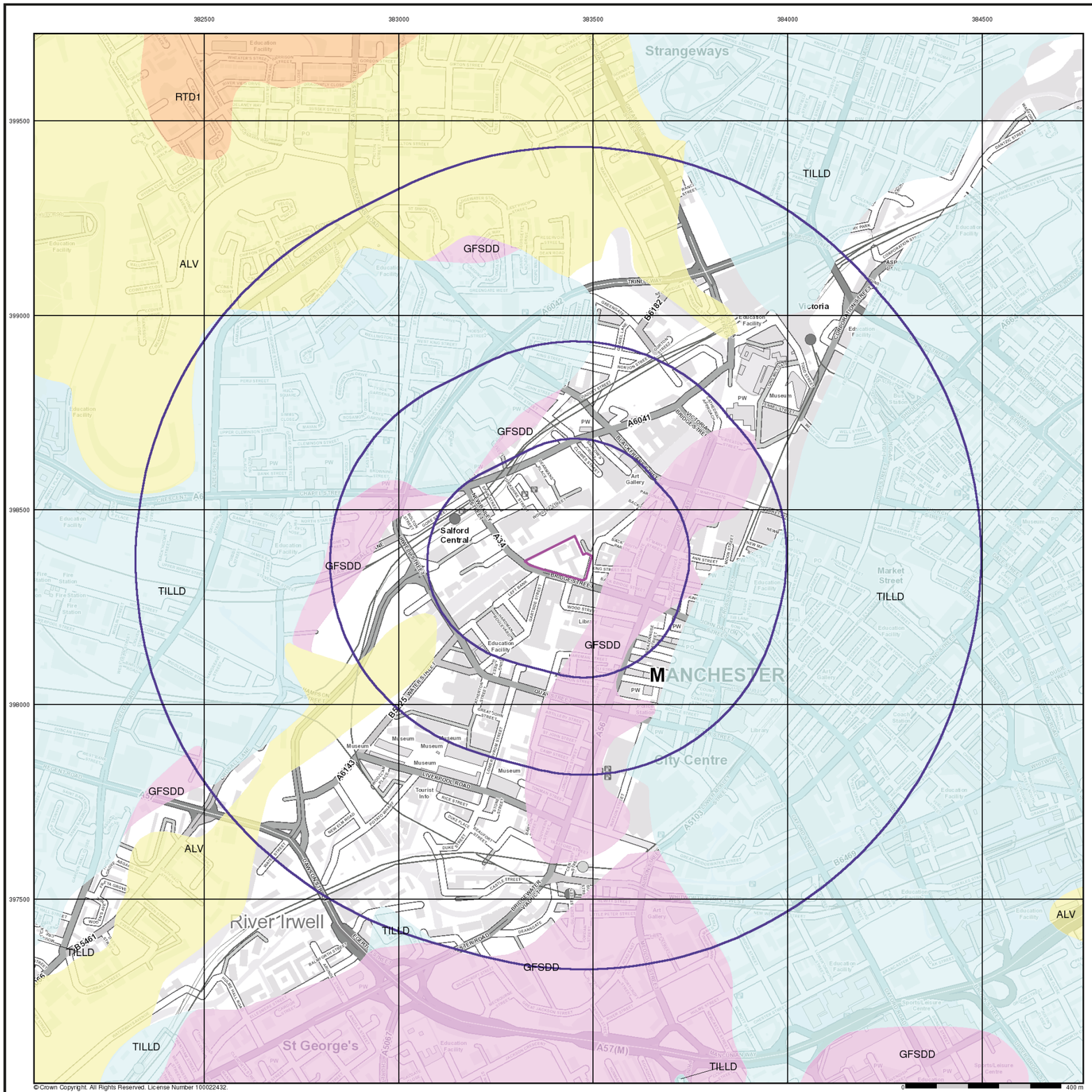
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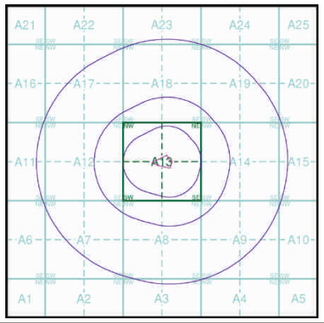
Superficial Geology

BGS 1:10,000 Superficial Deposits are the youngest geological deposits formed during the most recent period of geological time, which extends back about 1.8 million years from the present.

They rest on older deposits or rocks referred to as Bedrock. This dataset contains Superficial deposits that are of natural origin and 'in place'. Other superficial strata may be held in the Mass Movement dataset where they have been moved, or in the Artificial Ground dataset where they are of man-made origin.

Most of these Superficial deposits are unconsolidated sediments such as gravel, sand, silt and clay, and onshore they form relatively thin, often discontinuous patches or larger spreads.

Superficial Geology Map - Slice A



Order Details

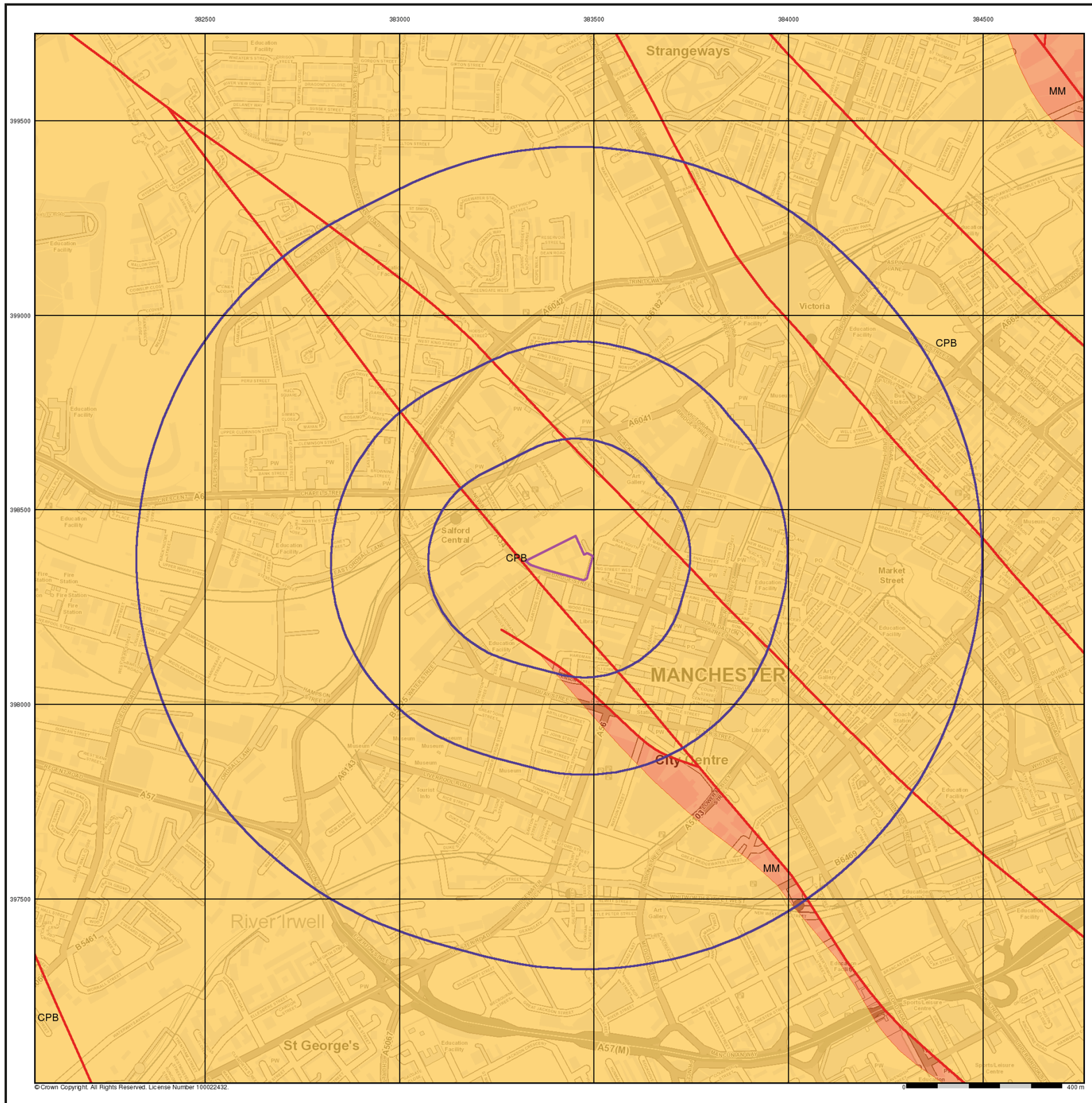
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National Grid Reference:	383420, 398370
Slice:	A
Site Area (Ha):	1.04
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Bedrock and Faults

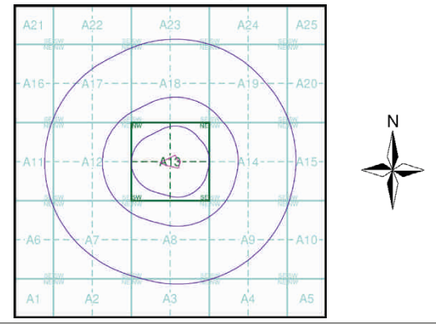
Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

The bedrock has formed over vast lengths of geological time ranging from ancient and highly altered rocks of the Proterozoic, some 2500 million years ago, or older, up to the relatively young Pliocene, 1.8 million years ago.

The bedrock geology includes many lithologies, often classified into three types based on origin: igneous, metamorphic and sedimentary.

The BGS Faults and Rock Segments dataset includes geological faults and thin beds mapped as lines such as coal seams and mineral veins. These are not restricted by age and could relate to features of any of the 1:10,000 geology datasets.

Bedrock and Faults Map - Slice A



Order Details

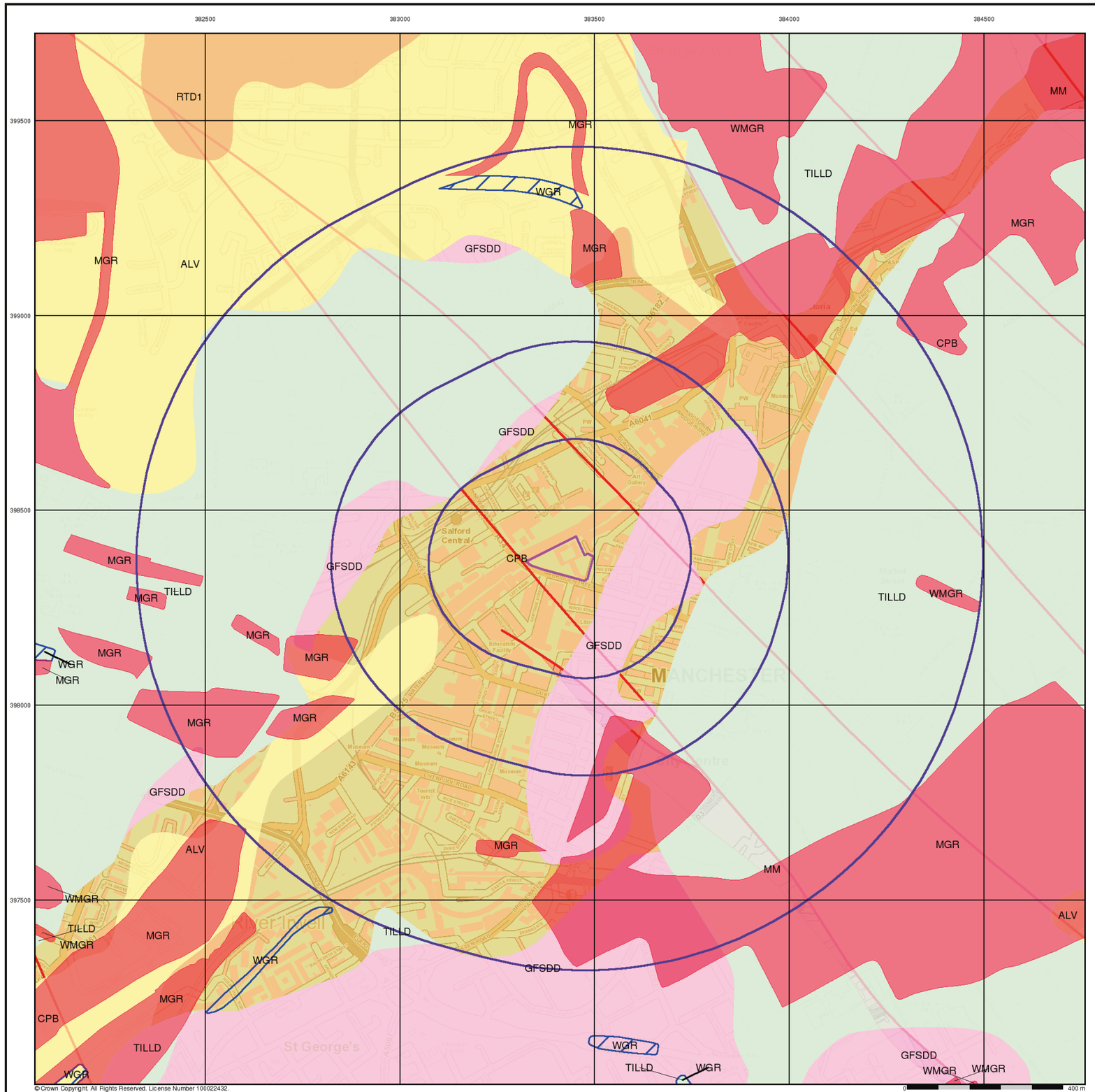
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Combined Surface Geology

The Combined Surface Geology map combines all the previous maps into one combined geological overview of your site.

Please consult the legends to the previous maps to interpret the Combined "Surface Geology" map.

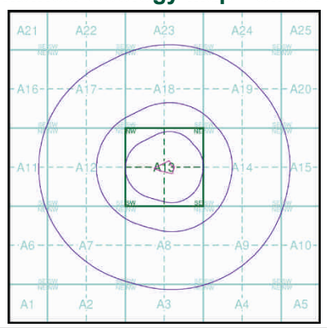
Additional Information

More information on 1:10,000 Geological mapping and explanations of rock classifications can be found on the BGS website. Using the LEX Codes in this report, further descriptions of rock types can be obtained by interrogating the 'BGS Lexicon of Named Rock Units'. This database can be accessed by following the 'Information and Data' link on the BGS website.

Contact

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email: enquiries@bgs.ac.uk
website: www.bgs.ac.uk

Combined Geology Map - Slice A



Order Details

Order Number:	173200128_1_1
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