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Client

Torsion Homes

The Tannery

Water Street

Stockport

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Site Address

Little Peter Street

Manchester

M15 4PS

Document Title

**Flood Risk Assessment &
Outline Drainage Strategy**



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Executive Summary

The proposal is for the construction of a new multi level residential apartment block on land adjacent to Little Peter Street, Manchester, M15 4PS. The overall site is approximately 0.015Ha in plan footprint and to address the requirements of the National Planning Policy Framework (NPPF) a Flood Risk Assessment and Drainage Strategy Report is appropriate.

According to the Environment Agency (EA) indicative flood maps, the site boundary is located in Flood Zone 3, i.e. land assessed as having greater than a 1 in 100 (>1.0%) annual probability of fluvial flooding in any year. This is due to the surcharging of the River Medlock (Classed by the EA as Main River) that is located at its closest point some 30m to the southwest of the site.

Assessing the existing and proposed ground levels against the hydraulic flood data as provided by the Environment Agency via a Product 4 flood data has confirmed that the proposed finished flood level of the new building will be located above the fluvial flood influence for the 1 in 100 year, 1 in 100 year plus 35% climate change and 1 in 1000-year events. It is noted that the flooding associated with the site is related to overland flood flow routing where the surcharged water passes out of the River Medlock channel to the east of the site and flows overland between the existing buildings. In light of this, flood resistance and flood resilient measures are not required though the occupiers will be made aware of the flood evacuation strategy.

The development target has been assessed against the NPPF 'Sequential Test'. Taking into consideration that the application is for a residential development in Flood Zone 3, Tables 1 & 2 of the NPPF have been appraised to determine that a sequential test is required. This report has been prepared separately to this FRA.

The Flood Risk Assessment has considered all other forms of flooding and overall, has found that the site is at low risk of flooding from all other sources.

During extreme flood events a safe dry access route is assured from the building to the north of the site with raised highways. Safe access for the Emergency Services and egress for the occupiers is assured for higher order storm events up to and including the 100-year event due to the increased ground levels to this side. The occupiers will also sign up to the EA's flood warning service

The surface drainage strategy as outlined below is to restrict the proposed flow rate to ensure that the flood risk to the site and surrounding catchment is not increased by the development. The Sustainable Drainage Systems (SuDS) hierarchy has been considered in the drainage strategy discussed in Section 6. The surface water runoff will be collected from the impermeable areas and directed via a short length of underground network prior to outfall to the combined water sewer via a new connection. As the impermeable area is circa 150m², the peak discharge rate would be no greater than 5l/s, which is considered the minimum flow rate to prevent blockage. Furthermore there is no suitable accessible area for any flow controls and attenuation beneath the ground floor.

An outline drainage strategy layout has been prepared to support this approach and can be found in the Appendices.

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There is no residual flood risk from the development site to the surrounding district due to the reduction in storm water flow rates. The development does not therefore increase the risk of flooding to other adjacent neighbourhoods. Out of chamber or gully flooding for the extreme 100 year plus climate change event may occur within the development site and is classed as exceedance flows. Any Exceedance flood water from this event will be contained within the development boundary and directed away from the building to the external areas.

Foul water generated by the development will be discharged to the existing combined water public sewer within Little Peter Street to the north of the site. The foul discharge does not present an increased flood risk to the surrounding district.

1.0 Introduction

- 1.1 Brennan Consult has been appointed by Torsion Homes to prepare this Flood Risk Assessment and Drainage Strategy Report to support a planning submission for the proposal for the construction of a new multi level residential apartment block on land adjacent to Little Peter Street, Manchester, M15 4PS. The assessment has been undertaken in line with Section 14 of the National Planning Policy Framework (NPPF) plus the accompanying Technical Guidance on Flood Risk. The current outline Architectural Plans can be found in Appendix A provides an indication of the proposed development within the site.
- 1.2 This Flood Risk Assessment and Drainage Strategy Report has been commissioned by Torsion Homes and is specific to their interests in the development proposals as described by the Architectural plan in Appendix A. This report may not be assigned.
- 1.3 The report has been commissioned to identify any flood related issues associated with the proposed development and any likely constraints that could be imposed, plus to consider the drainage strategy for it. The following issues have been suggested by the Environment Agency (EA), Manchester City Council as Lead Local Flood Authority (LLFA) and United Utilities (UU), and subsequently addressed within this report.
- Identify available data relating to flood risk at the site.
 - Determine whether the site is at risk from flooding from all sources, including from breach or overtopping of any existing flood defences, surface water flooding and/or ground water flooding.
 - Assess the proposed flood levels affecting the site and where appropriate provide a number of flood mitigation measures to remove this risk.
 - Identify available data relating to drainage at the existing site, including historical discharges.
 - Consider the flood risk from all other sources.
 - Determine any the current surface water drainage regime and assess any potential increase in surface water runoff as a result of the proposed development.
 - Discuss Sustainable Drainage Systems (SUDS) as an option for reducing surface water flood risk and devise an outline Drainage layout.
 - Devise an appropriate outline surface water drainage strategy (including calculation where appropriate) to deal with any potential increase in surface water runoff and include for climate change.
 - Devise an appropriate outline foul water drainage strategy.
 - Consider the recommendations of Manchester Strategic Flood Risk Assessment (SFRA).
 - Assess mitigation measures & off-site impacts and define any residual risks.

2.0 Development Description and Location

2.1 Site Location

2.1.1 The site is referenced in Figure 1, and a site location map is provided in Appendix A.

Item	Brief Description
Project name	Little Peter Street
Site address and location	Little Peter Street, Manchester, M5 4PS.
Council Area	Manchester City Council (MCC)
Approximate Grid Reference	OS: 383436, 397454
General Locality	The site is located approximately 1km to the southwest of Manchester City Centre within the area of Deansgate.

Figure 1. Site Referencing Information

2.2 Existing Site Description

2.2.1 The site is square in plan shape and encompasses an area of unmade land used for car parking. The site abuts Little Peter Street to the north and Constance Street to the east. A retained building is located to the west with an open tarmac car park to the south.

2.2.2 The general area is a mix of both residential and office developments.

2.2.3 Figure 2 identifies the overall site location details.

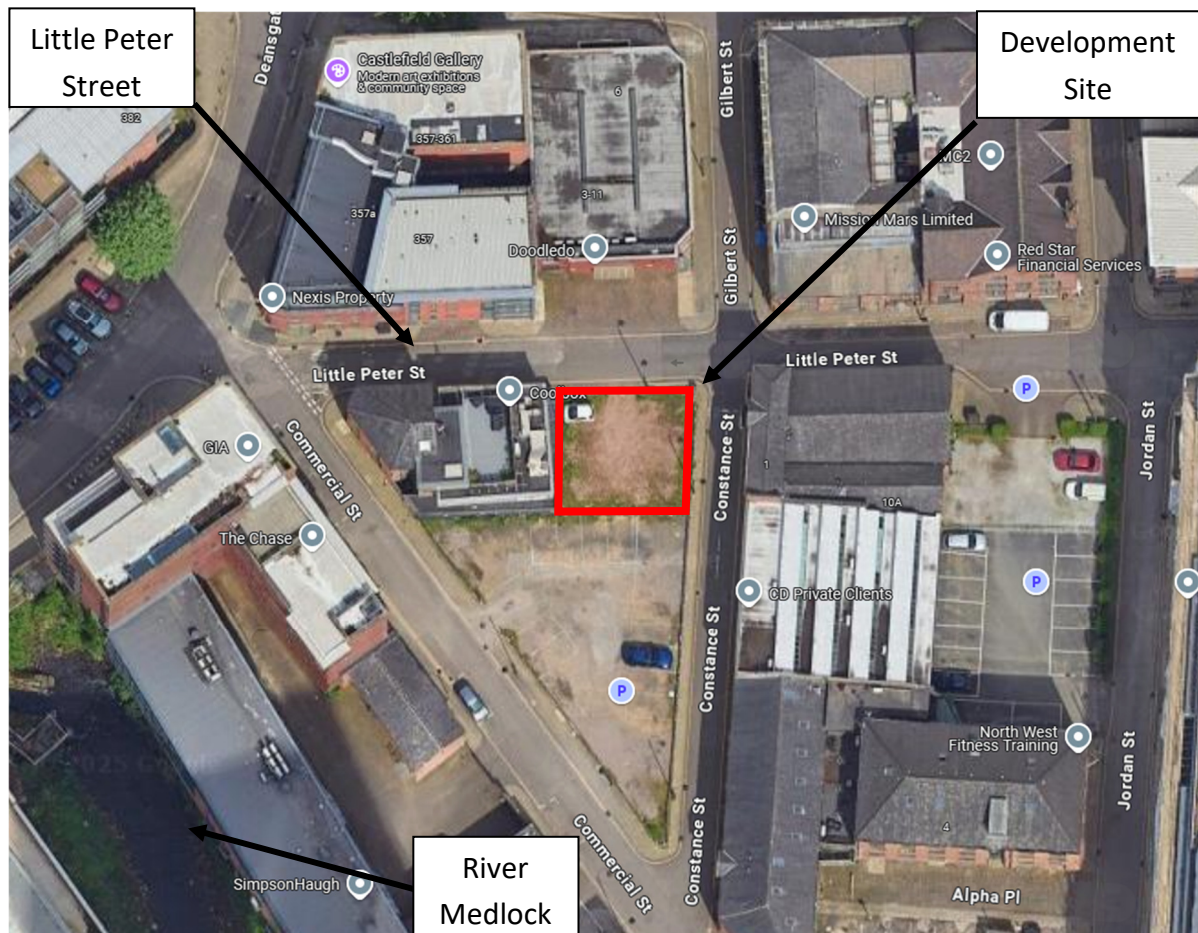


Figure 2. Site Location plan

2.3 Topography

- 2.3.1 A topographical survey has been undertaken and shows a moderate fall across the site from the northeast corner at 29.47m AOD down to the southwest corner at 29.00m AOD. Further details can be identified on the Topographical survey in Appendix B.

2.4 Hydrology

- 2.4.1 The closest identified watercourse is the River Medlock that flows in a clockwise direction around the site, located at its closest point some 30m to the southwest of the site. It then passes into a culvert that generally flows in a westerly direction before outfalling into the Manchester Ship Canal.

3.0 Planning Policy and Consultation

3.1 Planning Policy Framework

3.1.1 According to the Environment Agency (EA) Indicative flood maps the site boundary is located in Flood Zone 3, i.e. land assessed as having greater than a 1 in 100 (>1.0%) annual probability of fluvial flooding in any year.

3.1.2 As a requirement of the NPPF (2024), Section 14, the proposed development should satisfy the requirements of the Sequential Test and where applicable the Exception Test

3.1.3 Sequential & Exception Test:

Under the NPPF (2024), Zone 3 is defined as high probability flood risk. The proposal is for a residential development, which in line with Table 1 is classified as 'More Vulnerable'.

Placing both these criteria into Table 1 (Flood Risk Vulnerability and Flood Zone Incompatibility), More Vulnerable development in Flood Zone 3 determines that a sequential test is required. This report has been prepared separately to this FRA.

3.2 Strategic Flood Risk Assessment (SFRA)

3.2.1 SFRA's assess the risk associated with all types of flooding and provide the information required to identify the amount of development permitted in an area; how drainage systems in the area should function and also how risks in vulnerable areas can be reduced and/or mitigated. The NPPF states that Regional Planning Bodies (RPB's) or Local Planning Authorities (LPA's) should prepare SFRA's in consultation with the EA.

3.2.2 Manchester City Council in partnership with Salford CC and Trafford MBC, produced the Level 2 Strategic Flood Risk Assessment (SFRA) in 2011. The purpose of the SFRA is to assess and map all known sources of flood risk including fluvial, surface water, sewer, groundwater and all impounded water bodies, taking into account future climate change predictions.

3.2.3 A summary of the main elements from the SFRA are detailed below. The full report can be obtained from the Manchester City Council website.

- SFRA provides a detailed understanding of flood risks across the borough from all sources.
- Flood maps indicate that the site is at high risk of fluvial flooding.
- Sequential and Exception tests to be undertaken where required.
- Current Surface Water flood maps indicate the site to be at low risk from surface water flooding. This information is taken from a number of sources.
- Policies to reduce surface water discharges from new development will help to reduce localised flooding with wider catchment studies (Surface Water Management Plans) an essential tool in reducing the overall flood risk. Local policy asks for a 50% reducing in existing brown-field runoff rates.
- No recorded groundwater flood incidences.
- Site is located in the Conurbation Core Critical Drainage Area (CDA).
- Development should be designed so that there is no flooding to the development in a 1 in 30-year event and so that there is no property flooding in a 1 in 100 year plus climate change event.
- For all sites, development proposals should look at opportunities to incorporate SuDS to reduce the risk of surface water flooding.

3.3 Statutory Authority Correspondence

Environment Agency

Brennan Consult have requested the latest EA flood levels for the River Medlock via a Product 4 request application. Refer to Appendix F for further details on the flood data received.

4.0 Definition of Flood Hazard

4.1 Generally

- 4.1.1 Flood risk to the proposed development site is considered from all sources of flooding, as defined by the NPPF (2024).

4.2 Sources of Information

- 4.2.1 THE NPPF (2024) requires the developer to consider the impact of runoff generated by the proposed development onto the downstream catchment, and to assess the risk of runoff from the surrounding district impacting on the development's footprint. Further, the report is to consider flood risk from all other sources. The following section defines the flood risk receptors and anticipated flood risk. Section 4.9 then tabulates the probability of flooding and the likely impacts.
- 4.2.2 Figure 3 summarises the main sources of information used in the identification of flood risk.

Source of Information	Details
Environment Agency	Product 4 Flood Data
United Utility Sewer Records	Various Maps
Historic Maps	From various websites
Manchester CC SFRA	Report & Various Maps

Figure 3. Sources of information used in the identification of flood risk

4.3 Flooding from Rivers (Fluvial)

- 4.3.1 The closest known watercourse to the site is the River Medlock located at its closest point approximately 30m to the southwest flowing generally in a westerly direction.
- 4.3.2 The National Planning Policy Framework (NPPF) categorises flood risk as follows:
- Zone 1 (low probability) – Land assessed as having less than a 1 in 1,000 annual probability of river or sea flooding (<0.1%);
 - Zone 2 (medium probability) – Land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year; and
 - Zone 3a (high probability) - Land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

- Zone 3b The Functional Floodplain - This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the EA. (Not separately distinguished from Zone 3a on the Flood Map).

4.3.3 Figure 4 below locates the site on the Environment Agency's indicative floodplain map. This shows that the site is located entirely in Flood Zone 3, i.e. land assessed as having greater than a 1 in 100 (>1.0%) annual probability of fluvial flooding in any year. This is due to the surcharging of the River Medlock watercourse to the southeast and the overland flood flow waters heading towards and into the site boundary. Refer to Section 5 for further details.

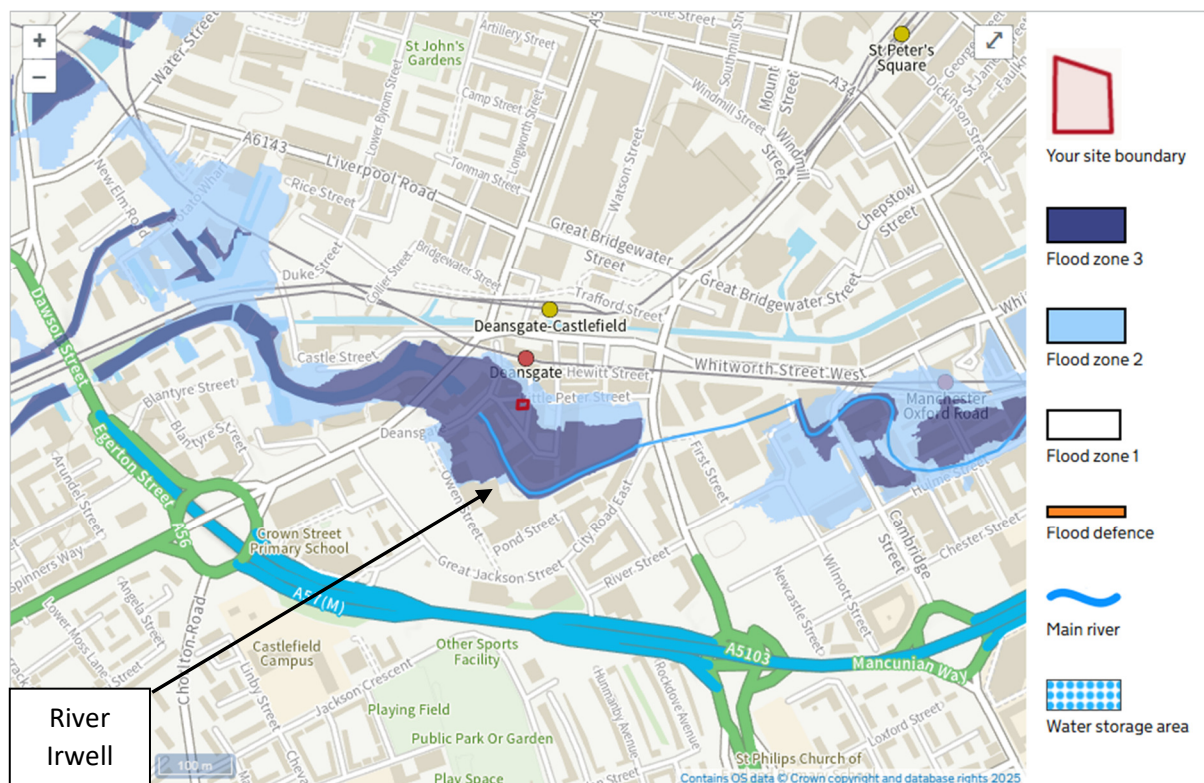


Figure 4. EA indicative Flood Map for Planning

4.4 Flooding from Land (Overland Flow)

4.4.1 The EA descriptions for the High, Medium and Low risk scenarios for surface water flooding are as follows:

- High risk means that each year this area has a chance of flooding of greater than 3.3%.
- Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%.
- Low risk means that each year this area has a chance of flooding of between 0.1% and 1%.
- Very Low risk means that each year this area has a chance of flooding of less than 0.1%.

- 4.4.2 The existing red line boundary has a moderate fall from the northeast of the site adjacent Little Peter Street, down to the southwest corner. The boundary of the site is elevated above the kerb line to both Little Peter Street and Constance Street such that the water would not pass into the site. In light of this there is limited risk of overland flows causing any flood risk to the new development buildings.
- 4.4.3 A review of the EA surface water flood maps (Figure 5 below) indicates that the site is classified as at 'very low risk'. Furthermore, there are no existing surface water flow routes through the site that would need to be maintained.
- 4.4.4 Therefore, based on this assessment, the site can be considered at low risk from surface water flooding.

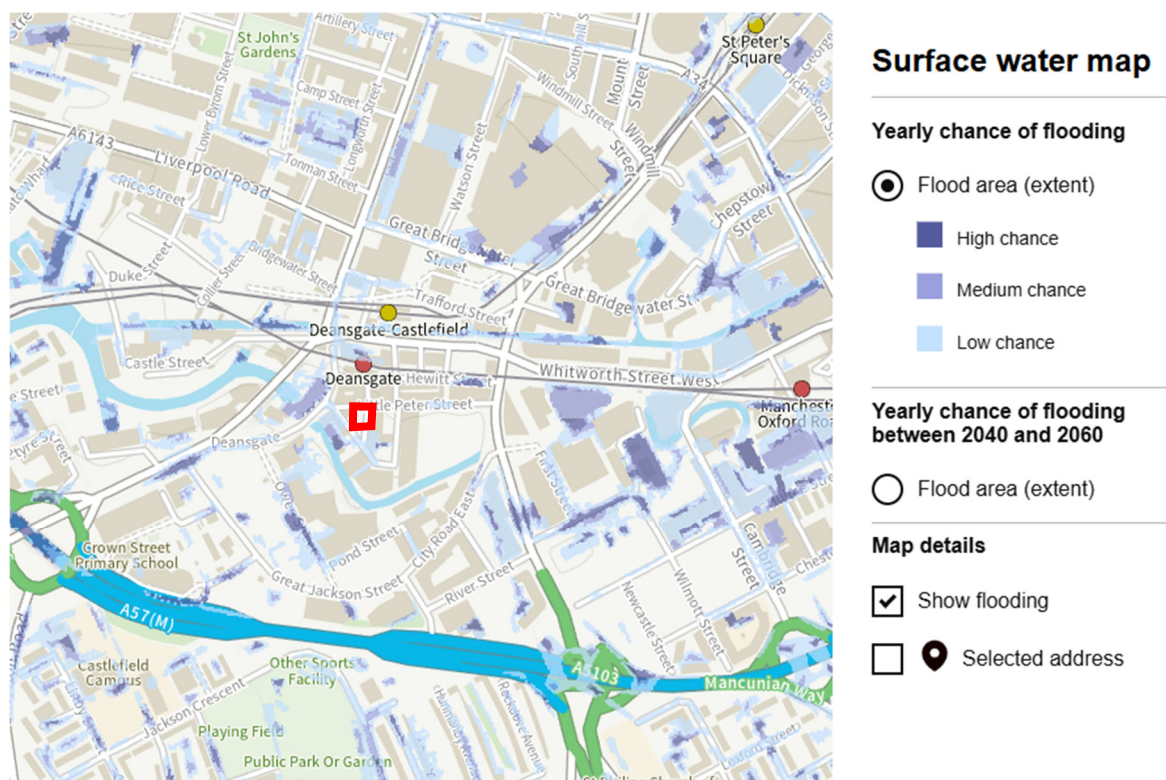


Figure 5. EA Indicative Surface Water Flood Map

4.5 Flooding from Sewers and Private Drainage

- 4.5.1 The United Utilities (UU) sewer records have been reviewed and confirms there are no sewers crossing the development site. There is a 300mm combined public sewer in Little Peter Street to the north of the site, flowing in an easterly direction. There are no surface water sewers in close proximity.
- 4.5.2 All new drainage will be private, maintained by the owners & management company, designed in line with their approved guidance. Further details on the overall drainage strategy can be found in Section 7.

4.5.3 The extensive UU adopted drainage network serving the surrounding urban district ensures that the development footprint is protected from the impact of both upstream and downstream runoff. It is speculated that complete protection may well exist beyond a storm event equivalent to the 30-year statistical event. Beyond this projection, there may be a small degree of peripheral 'Exceedance' flooding within the areas above the sewers. However, this is expected to be localised and restricted to the location of specific manhole covers located outside the development footprint.

4.5.5. Thus, flood risk to the site from sewers is diminished to acceptable levels and considered to be low.

4.6 Flooding from Groundwater

4.6.1 Groundwater flooding occurs when the water table, the level of water below the ground, rises above the ground surface or into cellars and basements. Groundwater flooding is most likely to occur in low lying areas underlain by permeable rocks (aquifers). These may be extensive, regional aquifers, such as chalk or sandstone, or may be localised sands or river gravels in valley bottoms underlain by less permeable rocks.

4.6.2 At the time of writing no specific intrusive phase 2 site investigation has been carried out at the site.

4.6.3 According to the Manchester City Council SFRA, it states that it does not consider groundwater flooding to be a significant issue in its administrative boundary, as there is no historic evidence to suggest that groundwater flooding is an issue worth further investigation.

4.6.4 In light of these findings, the site is considered to have a low susceptibility to groundwater flooding.

4.7 Flooding from Artificial Sources

4.7.1 The site is not shown to be at risk from any other sources.

4.8 Reservoir Flooding

4.8.1 Reservoir flooding is extremely unlikely to happen and there has been no loss of life in the UK from reservoir flooding since 1925. The Environment Agency is the enforcement authority and ensures that reservoirs are inspected regularly, and essential safety work is carried out.

4.8.2 The Long-Term Flood Risk Assessment (Flood Risk from Reservoirs) map shows the largest area that might be flooded if a reservoir were to fail and release the water it holds.

4.8.3 The site is located within the maximum extent of flooding from a reservoir at the same time the rivers are flooded. As these maps are worst case scenarios and given the unlikelihood that such an event would ever occur there is no further investigation required.

4.9 Summary

4.9.1 Below is a table summary of the flood risks associated with the development site.

Source	Flood Risk	Likely Impacts	Remarks
Tidal	Low	Low	Site not located in tidally influenced flood zones.
Fluvial (Watercourse)	High	Low-Medium (with Mitigation)	Site located in Flood Zone 3 (High risk). Further assessment required.
Surface (Overland Flood Flow)	Low	Low	Site is elevated above surrounding area and so no risk of overland flows identified.
Sewers	Low	Low	No existing sewers within site boundary. Development elevated above sewers. All new drainage to take account of any potential flood risk and be sized accordingly.
Groundwater	Low	Low	No indication through SFRA that site at risk of groundwater flooding.
Artificial Sources	Very Low	Low	Not considered relevant at site specific level.

Figure 6. Flood Risk Summary Table

5.0 Assessment Of Flood Risk on Proposed Development

5.1 Summary

- 5.1.1 As discussed in Section 3, the development site has been categorised in accordance with the SFRA and EA Flood Maps as being located within a high flood risk area from fluvial flooding. This is related to flood risk from the River Medlock to the southeast and southwest.
- 5.1.2 Other flood risk sources such as groundwater, sewer and overland flows have been considered and have been found not to be a flood risk generator to the site.

5.2 Flooding From River Medlock

- 5.2.1 The River Medlock, designated by the EA as Main River, is located at its closest point some 30m to the southwest of the site.
- 5.2.2 The EA have been consulted via a Product 4 and Product 6 flood data request and have subsequently provided flood defence and flood level data both adjacent the development site boundary as taken from two studies. These are the River Medlock 2011 Study and the Manchester Ship Canal (MSC) 2016 study. Refer to Appendix E for full details.
- 5.2.3 Figures 7 & 8 provides the various flood level data for the node point to the east of the site where any overland out of bank flooding would first occur from both models for various storm events with climate change also taken into account.

1 in 100 year undefended (1% AEP)	1 in 100 year + 35% CC undefended (1% AEP + 35%)	1 in 100 year + 70% CC undefended (1% AEP + 70%)	1 in 1000 year undefended (0.1 AEP)
28.54m AOD	29.12m AOD	29.34m AOD	29.55m AOD

Figure 7. Peak Flood Level at from the River Medlock 2011 Study

1 in 100 year Normal Operation (1% AEP)	1 in 100 year + 35% CC Normal Operation (1% AEP + 35%)	1 in 100 year + 70% CC Normal Operation (1% AEP + 70%)	1 in 1000 year Normal Operation (0.1 AEP)
29.31m AOD	29.67m AOD	30.03m AOD	30.35m AOD

Figure 8. Peak Flood Level at from the Manchester Ship Canal 2016 Study

- 5.2.4 The Environment Agency data provided refers to the application of updated climate change allowances for peak river flows for catchments across the UK in February 2016, with further updates released in 2021.

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- 5.2.5 Based on the 'More Vulnerable' land use assuming a design life of greater than 100 years; the central allowance (2080's) should be assessed. In the case of the Manchester area this is **+35%**.
- 5.2.6 Based on a review of these flood levels it is evident that the MSC data would have the most significant impact on the site. On review of the P6 data within the QGIS software, the MSC model does not include the River Medlock length. The EA were consulted as to why this was the case but were unable to provide a definitive answer. The location is a significant distance from the MSC and has no hydraulic connectivity. As such we are unsure why this length of model is included and why then it has flood level outputs much higher than the Medlock study. A meeting was to be organised with the EA to discuss further but due to staff shortages this was not possible at this time.
- 5.2.7 In light of this and not being able to confirm the viability of the Medlock model at this time we have had to use the flood data levels from this study. Taking into account the distance from the Node point referenced in Figure 8, the 1 in 100 year plus 35% allowance flood level is 29.60m AOD with the 1 in 1000 year at 30.25m AOD. Taking into account a 600mm freeboard above the 1 in 100 year plus 35% allowance flood level and no lower than the 1 in 1000 flood level, the proposed finished floor level of the new residential development building will be set no lower than is **30.25m AOD**.
- 5.2.8 As the proposed building will take up the full development footprint there is no opportunity to provide any flood compensation. Assessing the 1 in 100 year + 35% allowance for climate change MSC level against the topographical survey would estimate a flood volume loss of less than 78m³. It is also acknowledged that this volume is based on the MSC model which is evidently greater than the Medlock study for the same area. If the Medlock study is considered to be the more appropriate then the volume would reduce to less than 8m³. Also taking into account the distance of the site boundary from the river and on the periphery of the flood plain, the loss of this flood volume is considered to have a negligible impact on the surrounding flood levels for the equivalent events.
- 5.2.9 An outline flood evacuation statement has been prepared in support of this assessment and can be found in Section 6. A full and detailed flood evacuation plan and strategy will be prepared and provided to the future residents in advance of occupation of the new development.

6.0 Outline Emergency Planning Statement

6.1 Summary

- 6.1.1 Government Guidance asks that for all Flood Risk Assessments where the site is found to be in Flood Zone 2 or 3 that an Emergency Planning Statement outlining flood warning and evacuation measures be included.
- 6.1.2 The FRA has found that the new elevated building would not be prone to flood risk during the 1 in 100 year plus climate change fluvial flooding event, though an overland flood flow could pass around the external areas. For this scenario the flood depths could reach some 0.67m.
- 6.1.3 Providing the procedures outlined in the statement are followed, flooding at the site will only affect the external areas – and therefore the safety of their inhabitants during a more extreme fluvial flood event is reduced.

6.2 Flood Depths and Velocities

- 6.2.1 For the worse case scenario flood levels of greater than 0.67m could adjacent the site.
- 6.2.2 The speed of flood waters is expected to be relatively slow due to the distance of the building from where flooding occurs to the northeast and the overland routes the flood water will take. However, all residents will need to be aware that fast flowing, deep water will be sufficient to knock people of their feet and pose a threat to life.
- 6.2.3 Other hazards and areas of particularly deep water may be hidden, for example where manhole covers have been blown off.

6.3 Flood Duration

- 6.3.1 Once the flood peak has passed the site could remain affected by flooding for up to several days, depending upon the nature of the event. Floodwaters would leave the site via the site drainage network, soaking into the ground, and flowing over land back in a south easterly direction.

6.4 Flood Warnings

- 6.4.1 Any flooding adjacent the building that could potentially occur will be through a persistent and prolonged rainfall event within the upper catchment. Flood water data loggers on this network will inform both the EA and Manchester Council that water levels are rising and that a risk to the downstream catchments could occur.
- 6.4.2 The EA and Manchester Council aim to provide a minimum two hours notice of flooding, day or night, to enable.
- 6.4.3 people to take necessary action to protect themselves and their properties. This will take the form of automated phone calls and for the residents to log onto the EA website where there is potential for water levels to rise.

6.5 Site evacuation Procedures & Routes

- 6.5.1 Once a flood warning has been received to the property owners, they will have the opportunity to egress from the residential building to higher ground levels to the north of the site.
- 6.5.2 If immediate flooding is forecast and the opportunity to safely evacuate is gone then the occupants must remain in their apartments and either await rescue if necessary or wait until the flood levels recede.
- 6.5.3 Residents should not wade through floodwater to escape the area; there can be hidden dangers such as dislodged manhole covers and health issues from polluted water.
- 6.5.4 During a serious and widespread event when large numbers of people require rescue, it could take several hours for the building to be evacuated; priority will be given to rescuing vulnerable people first.

6.6 Reoccupation of the Site

- 6.6.1 Reoccupation of the building will be a decision taken by the key stake holders such as the emergency services, Manchester Council and the Environment Agency.
- 6.6.2 Key checks will be to establish whether there is any damage to power supply etc. If all the checks confirm that there has been no damage to the building infrastructure and the flood incident has now passed, the building will be re-opened.
- 6.6.3 It will be up to the residents to coordinate any clear up works with the local authority and their insurance companies.
- 6.6.4 Restoration of services shall commence at the earliest opportunity subject to all requirements regarding health and safety being met.

7.0 Drainage Strategy

7.1 External Consultation

- 7.1.1 Brennan Consult have been in contact with United Utilities via a predevelopment drainage enquiry for the development site. At this time their considered response is awaited. However, based on the feedback from other similar schemes UU would require evidence that the SuDS Hierarchy has been assessed. Should it be proven that infiltration is not feasible then UU would allow connection to the combined water sewer in Little Peter Street at a peak rate not exceeding 5l/s.

7.2 Existing Drainage

United Utilities

- 7.2.1 The United Utilities (UU) sewer records have been reviewed and confirms there are no sewers crossing the development site. There is a 300mm diameter combined public sewer beneath Little Peter Street to the north. There are no surface water sewers in close proximity.
- 7.2.2 Although not identified, it is anticipated that the drainage from the site connects to the combined sewer in Cannon Street.

7.3 Existing Runoff

- 7.3.1 The area of the proposed residential development currently encompasses an area of unmade land. As the area of 150m² is so small, the greenfield runoff rates have not been defined.

7.4 Geology

- 7.4.1 At this time a Phase 2 site Investigation has not been undertaken at the site. The British Geological Survey (BGS) dataset would indicate the superficial deposits to be Glaciofluvial Deposits, Divensian – sands and gravels, with the Bedrock Geology comprising the Chester Sandstone Formation – Sandstone.
- 7.4.2 Taking into account the building takes up the footprint redline boundary, the minimum offset distance to foundations cannot be achieved and therefore infiltration as a means of draining the site is discounted.

7.5 Hydrological Assessment

- 7.5.1 As discussed in previous sections, a review of the topographical survey, OS Maps and Environment Agency maps would indicate the closest surface water feature to the site is the River Medlock, located approximately 30m southwest of the site beyond 3rd party land.

7.6 Sustainable Drainage Systems (SuDS) Assessment

7.6.1 SuDS Objectives

Sustainable drainage developed in line with the ideals of sustainable development is collectively referred to as Sustainable Drainage Systems (SuDS). At a particular site, these systems are designed both to manage the environmental risks resulting from the urban runoff and to contribute wherever possible to environmental enhancement. SuDS objectives are therefore to minimise the impacts from the development on the quantity and quality of the runoff and maximise amenity and biodiversity opportunities (CIRIA C753, 2015).

7.6.2 SuDS Design Themes

1.4 The 'Management Train Approach' should be central to the surface water drainage strategy of the proposed site. The main objective is treatment and control of runoff as near to the source as possible protecting downstream habitats and further enhancing the amenity value of the site. This concept uses a hierarchy of drainage techniques to incrementally reduce pollution, flow rates and volumes of storm water discharge from the site, and is as follows:

- i. **Prevention** – The use of good site design and housekeeping measures to prevent runoff and pollution and includes the use of rainwater reuse / harvesting.
- ii. **Source Controls** – Control of runoff at source or as close to source as possible (e.g. soakaways, green roofs, pervious pavements).
- iii. **Site Control** – Management of water in a local area and can include below ground storage / attenuation, detention basins, large infiltration devices.
- iv. **Regional Control** – Management of water from a site or various sites and can include wetlands and balancing ponds.

7.6.3 SuDS Site Constraints

SuDS techniques are suitable for all sites; therefore, an assessment of the existing site is required so that SuDS limitations can be determined.

- *Land Use Characteristics:* The size and type of development enables the potential range of site control SuDS devices to be considered.
- *Site Characteristics:* A site investigation has not been carried out at the site. Desk based information would indicate that infiltration techniques would not be suitable.
- *Catchment Characteristics:* The site is currently classed as Greenfield.
- *Environmental and Amenity Performance:* The inclusion of SuDS within the overall development is a key driver in providing both amenity and habitat creation. All types of SuDS will be considered and blended into the landscaping zone, if possible. Safety to all future users is paramount and so best practice guidance will be incorporated so that these devices blend into the surrounding without the need for significant safety precautions. Maintenance plans will be prepared for all SuDS devices that are included.

7.6.4 SuDS Methods

Figures 9 & 10 below provide an assessment of various above and below ground SuDS methods that can provide water quality treatment and management of flows to reduce runoff rates and volumes and whether they can be suitably incorporated at this development site. The purpose of this assessment is to set out options to be considered at the planning stage with consideration to time constraints, viability and lifetime maintenance of the residential led development.

Method	Comment	Suitability for Development
Green Roofs	Can be used on suitable low-rise buildings to provide retention, attenuation and treatment of rainwater, and promotes evaporation and local biodiversity.	<u>Not suitable:</u> Architectural proposals for the development and maintenance issues deem this unsuitable.
Water Butts	Plastic tanks placed at the base of rainwater down pipes to collect rainwater runoff from the roof areas.	<u>Not suitable:</u> Not suitable on an apartment led scheme with internal RWP's.
Rainwater Harvesting	Rainwater harvesting reduces the total runoff volume from the developed site and reduces treated water consumption.	<u>Not Suitable:</u> - Additional costs of installation would have severe effect on viability of the development. - Running and maintenance costs would not be acceptable to residents. - The ability to restrict peak flow rates and short-term peak volumes is non-existent where a critical storm event occurs.
Infiltration Options	Reduces total run off volume from the development.	<u>Not Suitable:</u> Building takes up the full development footprint.
Permeable Surfacing (Infiltration)	- Reduces total run off volume from the development. - Can be used to enhance water quality.	<u>Not Suitable:</u> No external areas.

Permeable Surfacing (Standard)	• Can be used to enhance quality of runoff water. • Sub-base provides 'source' storage and reduces the volume of storage downstream. • The storage can be created with selection of the stone fill or use of plastic box stems.	<u>Not Suitable:</u> • No external areas.
Swales, basins and ponds	• Provide areas for above ground runoff storage. • Allow filtering of particulate matter, improving water quality	<u>Not Suitable:</u> • No external areas.
Bio-Retention	• Collect and retain run-off to help improve water quality, prior to discharge in piped system on infiltration.	<u>Not Suitable:</u> • No external areas.

Figure 8. Surface SuDS Methods

Method	Comment	Suitability for Development
Geocellular Storage	• Suitable for sites with insufficient space for basins etc. • Suitable for sites where topography prevents the use of open basins etc. • Can be very effective infiltration devices subject to ground conditions.	<u>Suitable:</u> • Subject to detailed design and drainage layout.
Large Diameter Pipes, Culverts or Tanks	• Suitable for sites with insufficient space for basins etc. • Provide a volume of below ground storage with a high void ratio and good man entry provision to allow for future maintenance and cleaning. • Generally, be suitable for adoption by the statutory water company (e.g. United Utilities)	<u>Not suitable:</u> • Limited external areas for large, over-sized pipes.

Figure 9. Sub-Surface SuDS Methods

7.6.5 SuDS Hierarchal Approach

Based on the SuDS assessment in Figure 9 and 10, plus an assessment of the local site conditions, the SuDS hierarchal approach for discharge of surface water at the development site is considered in greater detail below:

Method	Suitability	Suitability for Development
Infiltration to Ground	No	Building takes up the full development footprint.
Connection to Watercourse	No	No accessible watercourse in close proximity.
Connection to Surface Water Sewer	No	No surface water sewer in close proximity to the site.
Connection to a Combined Sewer	Yes	New connection to the combined sewer.

Figure 10. SuDS Hierarchal Approach

7.6.6 SuDS Design Philosophy

Due to the identified constraints, the SuDS philosophy for the development site is the promotion of Site Control Techniques:

The following design philosophy is proposed:

- Surface water treatment using the 'Management Train' approach to remove and isolate contamination at all SuDS facilities prior to conveyance to the local sewerage network.
- Surface water discharge into the combined sewer north of the site.
- Aim to limit where possible the impermeable fraction of development.

7.7 Climate Change

7.7.1 In May 2022, the Environment Agency released updated climate change allowances for peak rainfall intensities which should be applied to new developments. Rather than nation wide allowances, each area will have its own peak rainfall allowances. In the case of the Manchester area, this is the Irwell Management Catchment peak rainfall allowances.

7.7.2 Based on the nature of the development, a lifespan of circa 100 years is anticipated. Therefore, the potential climate change allowance for the 2070's Upper End Allowance for residential developments is 45%, which will be included in the hydraulic calculations.

7.8 Outline Surface Water Drainage Strategy

- 7.8.1 The general principal of the surface water drainage strategy is to collect the runoff from the new roof area via new downpipes and direct it to a below ground surface water drainage network located beneath the building that will ultimately outfall to the combined public sewer. As the impermeable area is only 150m², no flow control is required as the peak flow rate will not exceed 5l/s, considered the minimum orifice size to prevent blockage.
- 7.8.2 The proposed drainage layout will be designed in accordance with BS EN 752: 2008 and Building Regulations part H guidance. This is to provide no flooding up to the 30-year storm return period criterion.
- 7.8.3 Drawing 3034-BCL-00-XX-DR-C-0100 in Appendix C indicates the outline drainage strategy based on the Architects masterplan.

7.9 Pollution Control

- 7.9.1 Runoff from roofs is generally considered to be clean and will be discharged directly into the new drainage network.

7.10 Maintenance

- 7.10.1 The long-term maintenance of the new drainage and SuDS infrastructure will be with a management company for the private drainage elements in line with best practice guidance. Annual inspections will need to be carried out and clearing of gullies, channel drains, catchpits constructed.

Typically the maintenance regime will be in line with Figure 12 below.

Future Maintenance of the Drainage System			
Responsibility	Feature	Maintenance	Frequency
Management company	Rainwater gutters, downpipes and above ground drainage.	Regular maintenance and inspections.	Ad-hoc sweeping and emptying of silt and debris required. Annual visual inspections to check for damage/leaks.
	Pipes, sewers, manholes, outfall headwall.	Regular maintenance / removal of blockages and debris.	Annual inspection and removal of silts if required.

Figure 11. Outline Management and Maintenance Strategy

7.11 Foul Water Strategy

- 7.11.1 The outline foul water drainage strategy is to construct a new private gravity foul water drainage network to serve the building. This network will then outfall to the existing public combined sewer within Little Peter Street via the same connection as the surface water drain.
- 7.11.2 The proposed private drainage layout for the new development site will be designed in accordance with BS EN 752: 2017 and Building Regulations Part H guidance.
- 7.11.3 An indicative foul water drainage layout can be found on the drainage strategy drawing in Appendix C.

8.0 Management Measures, Off Site Impacts & Residual Risk

8.1 Flood Risk Management Measures

- 8.1.1 The assessment has determined that the finished floor level of the new building will be located a minimum of 0.60m above both the 1.0% AEP (1 in 100 year) event level plus a 35% increase in climate change and the 0.1% AEP (1 in 1000 year) event.
- 8.1.2 A detailed flood evacuation plan will be prepared for the redevelopment and provided to all future occupants of the buildings. This will be a fluid document that is regularly updated when new information and flood data / strategies become available.
- 8.1.3 As the development buildings will be raised above the external areas, flood resistant and flood resilient measures will not be required.
- 8.1.4 Should an extreme flood event occur, safe egress for the occupiers is assured for higher order storm events up to and including the 1000-year event to the higher ground levels to the north of the site.
- 8.1.5 All other flood risks have been considered and found not to be a flood risk generator to the development.
- 8.1.6 The surface water drainage strategy for the new development site will be to discharge the surface water runoff to the public combined sewer.
- 8.1.7 There will be a site management health and safety document prepared in respect of the final development. This will include the required maintenance regime for the onsite drains and drainage facilities such as the channels, gullies, pipes, manholes and all SuDS facilities. A management company will be responsible for site cleanliness, gully emptying and drain cleansing to ensure that the surface water drainage system will always operate at its maximum efficiency.

8.2 Offsite Impacts

- 8.2.1 The development of the site does not impair the hydraulic continuity of any watercourse and the current “local hydraulics” of distributing watercourses / outfalls.
- 8.2.2 The Development footprint does not cross or cover any existing or declared future catchment flood defences. Consequently, the Applicant does not propose to augment or compromise the current catchment defences.

8.3 Residual Risk

- 8.3.1 With careful design of the drainage elements as described above there will be no residual flood-related risks that will remain after the development has been completed.
- 8.3.2 Flood risk to people and property can be managed but it can never be completely removed; a residual risk remains after flood management or mitigation measures have been put in place. The only known flood related residual risk that will remain after flood management or mitigation measures have been put in place will be the risk of flooding from the River Medlock and drainage networks beyond the extreme event. With the building level being raised above the external levels, the risk is mitigated.

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Appendix A – Architects Drawings



PROPOSED GROUND PLAN

Little Lever Street,
Manchester

9no. Apartments

ACCOMMODATION SCHEDULE		
4no. 1 Bed Apartments (556sqft ave.)	2,225sqft	
2no. 2 Bed Apartments (705sqft ave.)	1,410sqft	
2no. 3 Bed Apartments (1260sqft ave.)	2,520sqft	
1no. 2 Bed Penthouse (1260sqft ave.)	1,260sqft	
NIA		7,415sqft
Circulation	1,495sqft	
Bins/Bikes/Plant	330sqft	
GIA		9,240sqft

REVISION	DATE	DESCRIPTION

CLIENT: TBC	
PROJECT: PROPOSED RESIDENTIAL DEVELOPMENT	
ADDRESS: LITTLR LEVER STREET, MANCHESTER	
DRAWING TITLE: PROPOSED SITE PLAN - GROUND	
SCALE: 1:100@A3	DATE: DEC 2024
DRAWING NO: A886_SK_100	

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Report Title Flood Risk Assessment
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Date 4th February 2025



Appendix B – Topographical Survey

Quickdraw Surveys Ltd, 58 Mavis Drive
Coppull, Lancashire, PR7 5AF

Telephone: 01257 795111

E-mail: admin@QuickdrawSurveys.co.uk
Web Site: www.QuickdrawSurveys.co.uk

Notes:

- The survey has been related to the Ordnance Survey National Grid and level datum using Leica GPS SmartNet data.
- The extent of tree canopies and tree bole sizes are estimated.
- Only features that are accessible/visible at the time of survey can be detailed.
- There are no gaurantees offered on the drainage information supplied.
- Before commencing works please check important dimensions on-site.
- Should there be any discrepancies, inconsistencies,omissions or queries please contact Quickdraw Surveys Ltd as soon as possible for a resolution.

Abbreviations:

Topographical Surveys

BT	British Telecom Cover	FPR	Post & Rail	RS	Road Sign
Bin	Litter Bin	FPW	Post & Wire	RWP	Rain water pipe
BL	Basement Lights	FSP	Safety Barrier	SV	Stop Valve
BT	British Telecom Cover	FWM	Wire Mesh	Stoy	Cable Stay
CPS	Concrete Paving Slabs	FL	Floodlight	TB	Telephone Box
CTV	Cable Television Cover	FP	Flagpole	TL	Traffic Light
Elec	Electric Cover	G	Gully	TP	Telegraph Pole
EP	Electric Pole	GV	Gas Valve	VP	Vent Pipe
ER	Earthing Rod	Hyd	Hydrant	WM	Water Meter
Fence	Mixed Fencing	IC	Inspection Cover	WO	Water Outlet
FSW	Banded Wire	JB	Junction Box	UTL	Unable to Lift
FCB	Close Board	KO	Kerb Outlet		
FCI	Corrugated Iron	LB	Lateral Box		
FCL	Chain Link	LP	Lamp Post		
FOP	Concrete Panel	Mir	Utility marker		
F(OL)	Disappearing Fence	PM	Parking Marker		
FIR	Iron Railings	P	Post		
FOB	Open Board	RE	Rodding Eye		
FOC	Post & Chain	RHP	Road Name Plate		
ALev	Arch Level	ILev	Inset Level	ThLev	Threshold Level
BLev	Bed Level	PLev	Parapet Level	ToF	Top of Fence Level
CLev	Cover Level	RLev	Ridge Level	ToW	Top of Wall Level
ELev	Eaves Level	SLev	Soft Level	WLLev	Water Level

Station Coordinates:

Station	Easting	Northing	Level
STN1	383449.252	397463.713	29.633
STN2	383393.351	397456.463	28.189
STN3	383410.424	397437.261	28.309
STN4	383438.992	397417.014	28.565

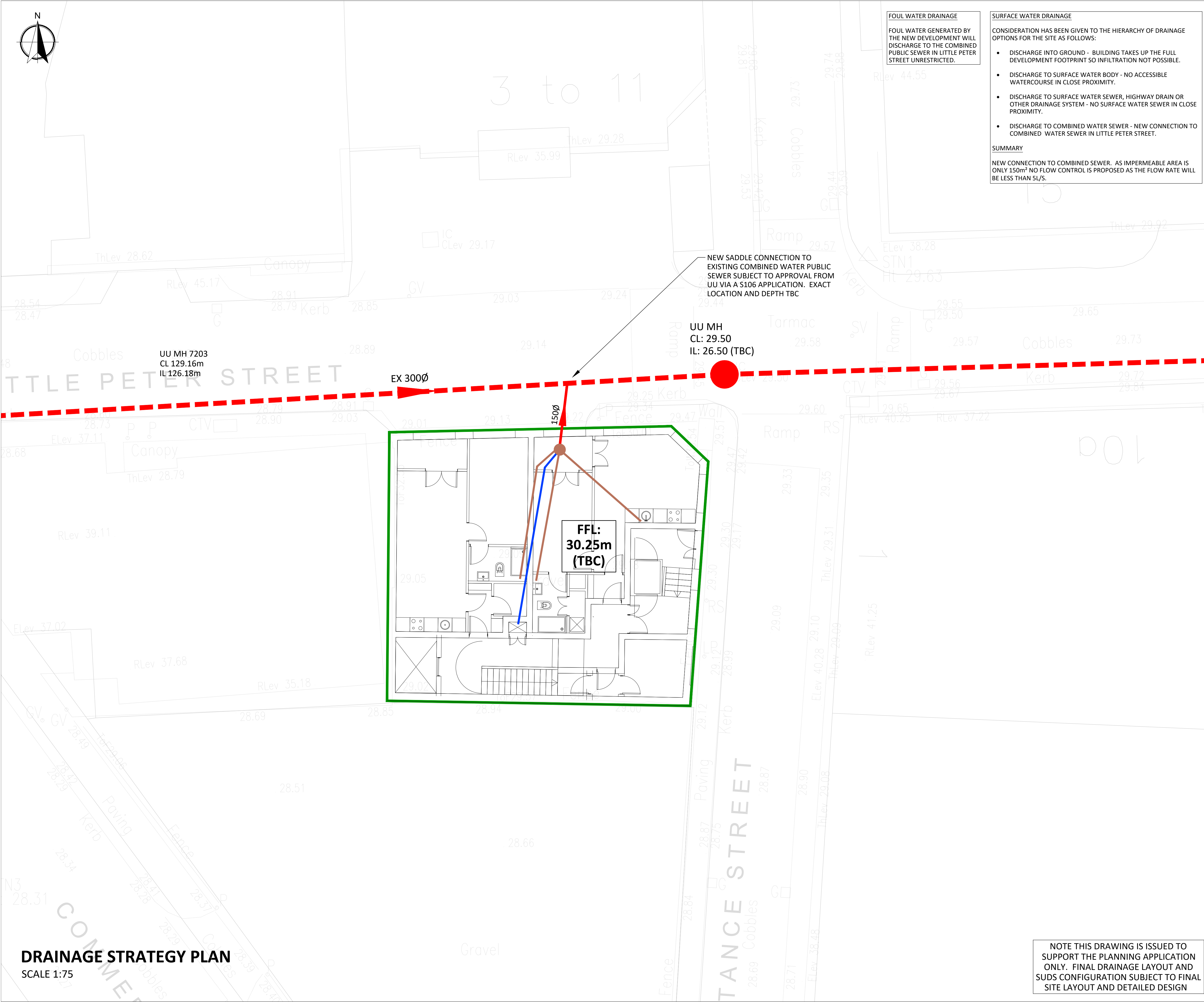
A1 Plot @ 1:200

Client	Torsion Homes Ltd
Date	January 2025
Project	Topographical Survey Land off Little Peter Street, Manchester, M15 4PS.
Scale	1:200
Drawing Number	QDS/350/1467/TOP
Revision	0

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Appendix C – Brennan Consult Drawings



FOUL WATER DRAINAGE

FOUL WATER GENERATED BY THE NEW DEVELOPMENT WILL DISCHARGE TO THE COMBINED PUBLIC SEWER IN LITTLE PETER STREET UNRESTRICTED.

SURFACE WATER DRAINAGE

CONSIDERATION HAS BEEN GIVEN TO THE HIERARCHY OF DRAINAGE OPTIONS FOR THE SITE AS FOLLOWS:

- DISCHARGE INTO GROUND - BUILDING TAKES UP THE FULL DEVELOPMENT FOOTPRINT SO INFILTRATION NOT POSSIBLE.
- DISCHARGE TO SURFACE WATER BODY - NO ACCESSIBLE WATERCOURSE IN CLOSE PROXIMITY.
- DISCHARGE TO SURFACE WATER SEWER, HIGHWAY DRAIN OR OTHER DRAINAGE SYSTEM - NO SURFACE WATER SEWER IN CLOSE PROXIMITY.
- DISCHARGE TO COMBINED WATER SEWER - NEW CONNECTION TO COMBINED WATER SEWER IN LITTLE PETER STREET.

SUMMARY

NEW CONNECTION TO COMBINED SEWER. AS IMPERMEABLE AREA IS ONLY 150m² NO FLOW CONTROL IS PROPOSED AS THE FLOW RATE WILL BE LESS THAN 5L/S.

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GENERAL NOTES

- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER ASSOCIATED DRAWINGS. ANY DISCREPANCY TO BE RAISED PRIOR TO CONSTRUCTION. ANY CONSTRUCTION WORKS WHICH COMMENCE BEFORE THESE DRAWINGS ARE APPROVED ARE AT THE RISK OF THE BUILDING CONTRACTOR.
- ALL DIMENSIONS ARE IN MILLIMETERS (mm). DO NOT SCALE FROM THIS DRAWING. WORK TO STATED DIMENSIONS ONLY.
- BUILDING CONTRACTOR TO ENSURE ALL WORKS COMPLY WITH THE CURRENT EDITION OF THE BUILDING REGULATIONS. ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH APPROVED DOCUMENT REGULATION 7.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN, FABRICATION, ERECTION AND REMOVAL OF ALL TEMPORARY WORKS AND SHALL PROVIDE ALL TEMPORARY BRACING AS NECESSARY TO MAINTAIN STRUCTURAL STABILITY DURING CONSTRUCTION.
- IF THE CONTRACTOR CONSIDERS THAT HE DOES NOT HAVE SUFFICIENT INFORMATION TO SAFELY COMPLETE THE WORKS DETAILED ON THIS DRAWING, HE SHOULD CONTACT THE ENGINEER.

DRAINAGE LEGEND

INDICATES EXISTING CW SEWER

SITE BOUNDARY

INDICATES NEW FW DRAINAGE

INDICATES NEW SW DRAINAGE

INDICATES NEW CW DRAINAGE

CDM DESIGNER'S RISK ASSESSMENT

BRENNANCONSULT ASSUME THAT THE CONTRACTOR IS COMPETENT IN MATTERS OF HEALTH & SAFETY AND IS AWARE OF ALL THE NORMAL RISKS ASSOCIATED WITH CONSTRUCTION OF THE TYPE SHOWN ON THIS DRAWING. REMAINING UNUSUAL RISKS ARE:-

CONSTRUCTION	CHK'D.
NO UNUSUAL RISKS	CB
MAINTENANCE / CLEANING	
NO UNUSUAL RISKS	CB
DECOMMISSIONING / DEMOLITION	
NO UNUSUAL RISKS	CB

P01	PRELIMINARY ISSUE	PG	04.02.25	LM
REV	REVISION DESCRIPTION	BY	DATE	CHECKED

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LITTLE PETER STREET,
MANCHESTER

RESIDENTIAL DEVELOPMENT
DRAINAGE STRATEGY PLAN

Status:
PRELIMINARY

Project No.	Originator	Zone	Level	Type	Role	Drawing No.	Revision
3034	BCL	00	XX	DR	D	0100	P01

Scale	Size	Drawn	Date	Checked	Passed
1:75	A1	PG	FEB 25	LM	CB

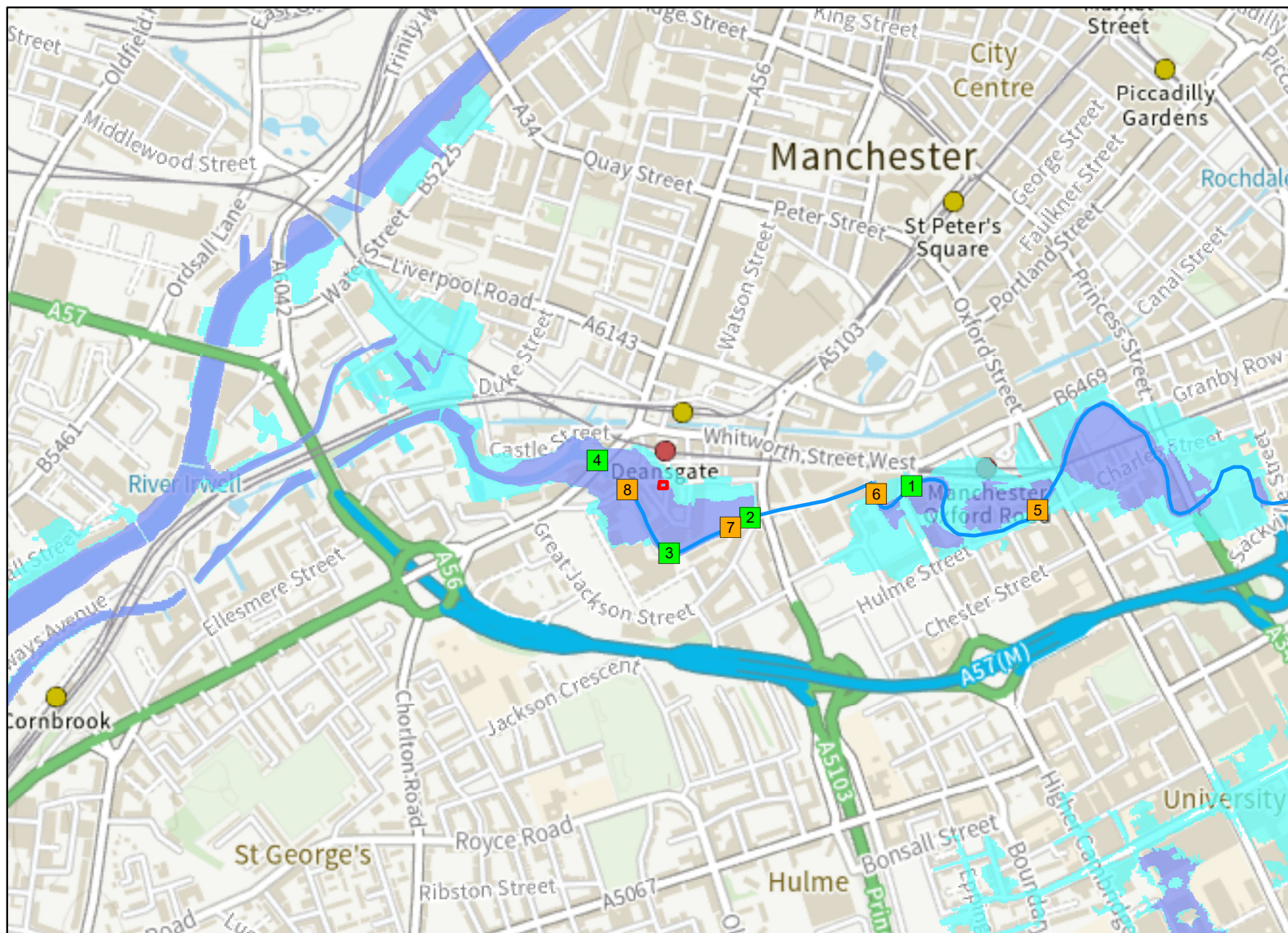
NOTE THIS DRAWING IS ISSUED TO SUPPORT THE PLANNING APPLICATION ONLY. FINAL DRAINAGE LAYOUT AND SUDS CONFIGURATION SUBJECT TO FINAL SITE LAYOUT AND DETAILED DESIGN

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Appendix D – Environment Agency Flood Data

**Detailed Flood Map Centred on Little Peter Street, Manchester, M15 4PS.
Created 10/01/2025 [GMMC392097SW]**



1:10,001



Legend

-  Site Location
-  Medlock
-  MSC
-  Main River
-  Flood Zone 2
-  Flood Zone 3

Map Reference	Model Node Reference	Easting	Northing	Data	Undeferred				
					4 % AEP (1 in 25 year)	1 % AEP (1 in 100 year)	1 % AEP (1 in 100 year) + 35% increase in flow	1 % AEP (1 in 100 year) + 70% increase in flow	0.1 % AEP (1 in 1000 year)
1	ea013_0127_MEDL01_0639D	383888	397449	Modelled Water Level (m aodN)	28.72	29.10	29.97	30.38	30.97
				Modelled Flow (cumecs)	52.23	59.56	69.32	72.66	78.50
2	ea013_0127_MEDL01_0297M	383594	397392	Modelled Water Level (m aodN)	28.23	28.54	29.12	29.34	29.55
				Modelled Flow (cumecs)	51.47	59.55	69.39	77.12	89.52
3	ea013_0127_MEDL01_0131	383446	397327	Modelled Water Level (m aodN)	27.82	28.13	28.80	29.04	29.22
				Modelled Flow (cumecs)	51.45	59.55	69.16	77.04	88.55
4	ea013_0127_BRGW01_0933E	383315	397496	Modelled Water Level (m aodN)	25.61	25.79	26.02	26.30	26.67
				Modelled Flow (cumecs)	38.45	46.15	54.81	62.96	75.23

Model data taken from River Medlock 2011

AEP - Annual Exceedence Probability

m aodN - metres above ordnance datum Newlyn

cumecs - cubic metres per second

Notes: "Climate Change Scenario - 35% and 70% increases in flow calculated for the 2080's (2070 - 2115). Please see <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances> for more information regarding the new climate change guidance. The location of the site and the type (vulnerability) of development determine the climate change allowances to consider in any flood risk assessment.

Map Reference	Model Node Reference	Easting	Northing	Data	Normal Operation										Latchford 1 Gate Closed		Latchford 3 Gates Closed	
					20 % AEP (1 in 5 year)	10 % AEP (1 in 10 year)	4 % AEP (1 in 25 year)	2 % AEP (1 in 50 year)	1.33 % AEP (1 in 75 year)	1 % AEP (1 in 100 year)	1 % AEP (1 in 100 year) + 30% increase in flow	1 % AEP (1 in 100 year) + 35% increase in flow	1 % AEP (1 in 100 year) + 70% increase in flow	0.5 % AEP (1 in 200 year)	0.1 % AEP (1 in 1000 year)	1 % AEP (1 in 100 year)	1 % AEP (1 in 100 year)	0.1 % AEP (1 in 1000 year)
5	ea013_0251_MEDL01_0998	384118	397405	Modelled Water Level (m aodN)	29.41	29.76	30.20	30.70	31.06	31.37	31.80	31.84	32.10	31.72	32.28	31.37	31.37	32.28
				Modelled Flow (cumecs)	31.53	36.82	43.49	50.55	55.50	59.70	76.05	78.75	99.10	71.42	121.21	59.70	59.70	121.21
6	ea013_0251_MEDL01_0532	383823	397436	Modelled Water Level (m aodN)	28.78	28.96	29.17	29.37	29.51	29.62	30.04	30.11	30.59	29.92	30.92	29.62	29.62	30.92
				Modelled Flow (cumecs)	32.18	37.58	44.38	51.59	56.64	60.92	77.65	80.40	101.99	72.88	122.90	60.92	60.92	122.90
7	ea013_0251_MEDL01_0270	383558	397375	Modelled Water Level (m aodN)	28.64	28.80	28.96	29.12	29.23	29.31	29.62	29.67	30.03	29.54	30.35	29.31	29.31	30.35
				Modelled Flow (cumecs)	32.32	37.75	44.58	51.82	56.89	61.19	78.00	80.77	102.62	73.19	122.66	61.19	61.19	122.77
8	ea013_0251_MEDL01_0000u	383370	397443	Modelled Water Level (m aodN)	28.59	28.73	28.88	29.03	29.12	29.19	29.46	29.51	29.81	29.39	30.11	29.19	29.19	30.12
				Modelled Flow (cumecs)	32.90	38.43	45.39	52.76	57.93	62.30	79.44	82.26	104.14	74.52	127.68	62.30	62.30	128.24

Model data taken from Manchester Ship Canal 2016

AEP - Annual Exceedence Probability

m aodN - metres above ordnance datum Newlyn

cumecs - cubic metres per second

Notes: "Climate Change Scenario - 30%, 35% and 70% increases in flow calculated for the 2080's (2070 - 2115). Please see <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances> for more information regarding the new climate change guidance. The location of the site and the type (vulnerability) of development determine the climate change allowances to consider in any flood risk assessment.

- For the Manchester Ship Canal Model, we provide the following three scenarios:
1. Normal Operation: All sluice gates operate automatically to maintain a navigable pounded water level upstream of each set of sluice gates. During times of high flow the gates are opened automatically to allow excess water pass downstream. During extreme conditions the sluice gates can be manually overridden to extend the opening heights.
 2. Latchford 1 Gate Closed Scenario: This scenario represents a single operational sluice gate at Latchford Locks fixed closed. Therefore, only operational movements from 2 active sluice gates. The model setup removes the gate from PID controller setup and an IED file is used to define the sluice gate as fixed in the closed position.
 3. Latchford 3 Gates Closed Scenario: This scenario has been defined as the removal of operational rules at all three sluice gates at Latchford Locks, thus, all gates are fixed in the closed position resulting in no regulation of upstream water levels. The model setup removes each of the gates from PID controller setup and an IED file is used to define sluice gates fixed in the closed position.