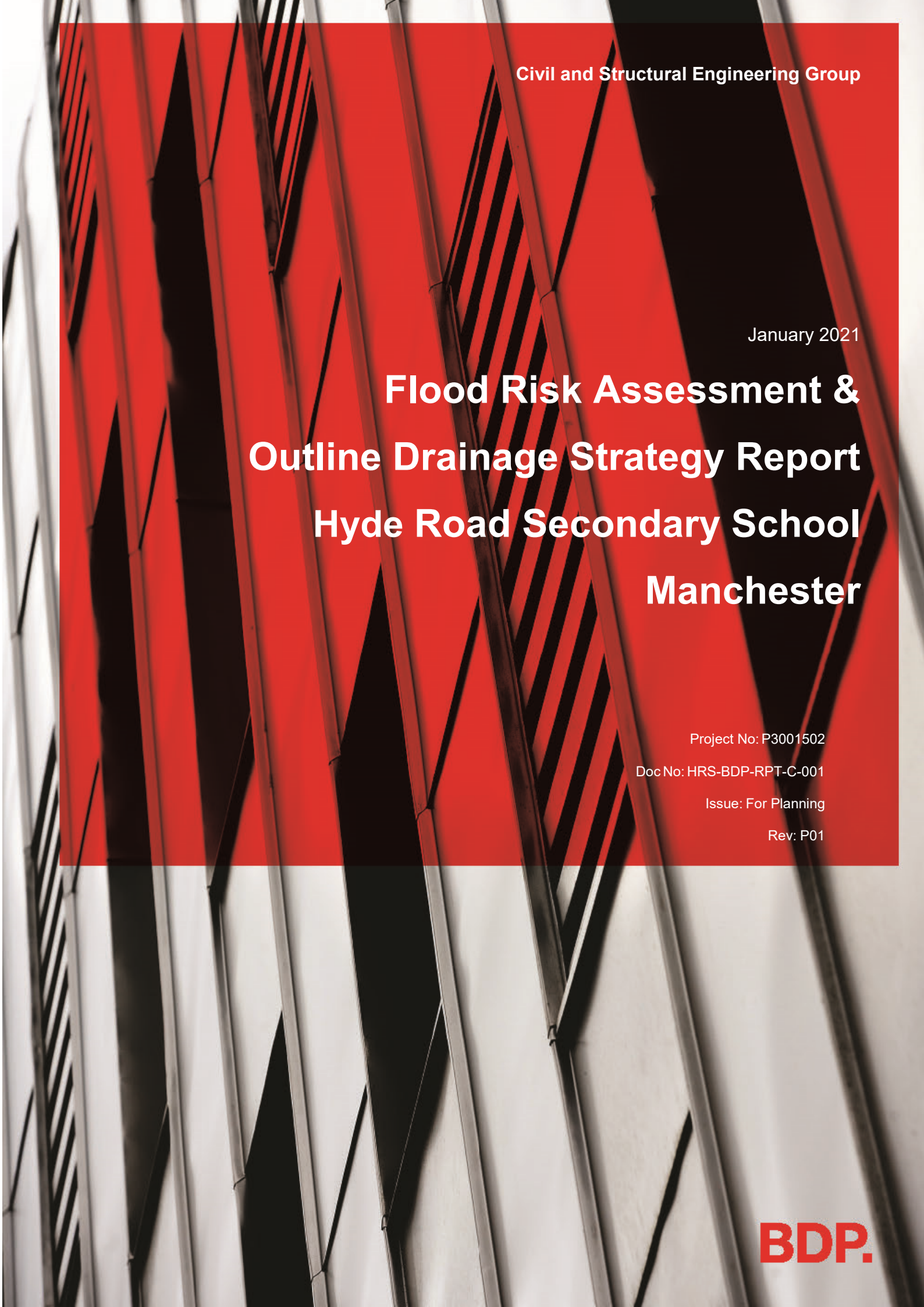




Civil and Structural Engineering Group

January 2021

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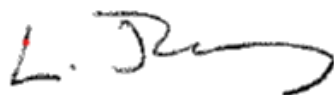


Date 05.01.2021

Approved

Lee Jones
Senior Civil Engineer

Signature



Date 05.01.2021

This report is prepared for the sole benefit of our client Sir Robert McAlpine

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1.0 Executive Summary

The proposed development includes the demolition of the existing Showcase Manchester building, associated car park, general clearance of the site and the construction of a new secondary school, adjacent facilities, hard and soft landscaping and associated infrastructure works.

A copy of the Proposed Site Layout can be found in Appendix I.

The site is in an area identified as having a 'low' probability of flooding on the Environment Agency Flood Map and is located in Flood Zone 1.

The Flood Risk Assessment (FRA) has reviewed all sources of flood risk to both the proposed development and to the existing adjacent properties as a result of the development proposals, including fluvial, tidal, pluvial, groundwater, sewers and flooding from artificial sources.

It is assessed that the site has a 'medium - low' risk of flooding from pluvial and groundwater sources, all other sources are assessed to be low. Residual risk remains which will be mitigated following a new development through appropriated engineered below ground drainage systems and application of suitable SuDS.

The development is accessible for emergency access and egress during times of extreme flooding as the known flood plain does not extend into the area proposed for development.

Consultation responses have been received from Manchester City Council and United Utilities. There have been no known historic flooding problems in the vicinity of the site but Manchester City Council have confirmed that the site is within a Critical Drainage Area (CDA).

The site is indicated to lie within the Conurbation Core Critical Drainage Area, which is indicated to be an area of major regeneration and redevelopment that could have significant impact on surface water runoff to the sewer network. However, there is indicated to be no history of surface water flooding at the site. Proposed surface water runoff rates are to be limited in accordance with the LLFA requirements and have been considered within the drainage strategy, which have been prepared based on sustainable drainage principles.

The Flood Risk Assessment is considered to be commensurate with the development proposals and in summary, the development can be considered appropriate for Flood Zone 1, in accordance with the NPPF and Local Planning Policy/Core Strategy, and subject to the mitigation measures proposed. The site has an acceptable flood risk from all sources and will not increase flood risk to the wider catchment area, as a result of suitable management of surface water runoff discharging from the site.

The site is brownfield in nature. Thus, the proposed surface water developments peak discharge flow rate will be limited in accordance with Manchester City Council's requirements that "Development should aim for a minimum reduction in surface water runoff rates of 50% for Brownfield sites, with an aim of reducing runoff to Greenfield rates up to a 1 in 100-year storm event, considering climate change".

Following review of the historic reports (Appendix E), the site is unsuitable for the use of infiltration techniques for surface water management due to high perched groundwater, soil condition and presence of Made Ground, refer to Appendix E.

It is proposed that the new surface water and foul water drainage will be separate systems and will discharge to the surrounding public networks, subject to agreement with United Utilities and the LLFA.

A copy of the Proposed Below Ground Drainage Layout is included in Appendix J.

2.0 Introduction

2.1 Appointment and Brief

BDP have been commissioned by Sir Robert McAlpine (SRM) to carry out a formal site specific Flood Risk Assessment and Outline Drainage Strategy Report in support of a planning application, seeking full planning permissions for the proposed development located off Hyde Road, Manchester, M12 5AL.

The Ordnance Survey grid reference at the centre of the existing building, north of the site is 387532E, 396327N.

The proposed development includes the demolition of the existing Showcase Manchester building, associated car park, general clearance of the site and the construction of a new secondary school, adjacent facilities, hard and soft landscaping and associated infrastructure works.

A copy of the Proposed Site Layout can be found in Appendix I.

The planning application site is 5.3 ha and is located in Flood Zone 1. This Flood Risk Assessment has been prepared in accordance with the National Planning Policy Framework (NPPF) and the accompanying Technical Guidance to assess all forms of flooding including the management of surface water on-site.

2.2 Objective of Strategy

The objective of the strategy is to undertake a Flood Risk Assessment in accordance with the National Planning Policy Framework (NPPF).

The detail and complexity of a Flood Risk Assessment should reflect the level of risk to the site. The NPPF is the official document that regulates the assessment of flood risks and their appropriate mitigations to the planning process.

The 'Technical Guidance to the National Planning Policy Framework' provides requirements for a Site Specific FRA, which can be summarised as follows:

- be proportionate to the risk and appropriate to the scale, nature and location of the site;
- consider the risk of flooding arising from development in addition to the risk of flooding to the site;
- take the impacts of climate change into account;
- consider both the potential adverse and beneficial effects of flood risk management infrastructure including raised defences, flow channels, flood storage areas and other artificial features together with the consequences of their failure;
- consider the vulnerability of those that could occupy and use the site, taking account of the Sequential and Exception Tests and the vulnerability classification including arrangements for safe access/ egress;
- consider and quantify the different types of flooding (whether from natural and human sources and including joint and cumulative effects) and identify flood risk reduction measures, so that assessments are fit for the purpose of the decisions being made;
- consider the effects of a range of flooding events including extreme events on people, property, the natural and historic environment and river and coastal processes;
- include the assessment of the remaining (known as 'residual') risks after risk reduction measures have been taken into account and demonstrate that this is acceptable for the particular development or land use;
- consider how the ability of water to soak into the ground may change with development, along with how the proposed layout of development may affect drainage systems;
- be supported by appropriate data and information, including historical information on previous events.

This report therefore assesses flood risk to the site and any impact on flood risk to other land because of the development proposals. Where required, flood risk mitigation measures have been proposed.

This report also provides information and present proposals relating to the following:-

- The existing surface and foul water drainage systems within and in the vicinity of the site.
- Proposed surface water and foul water flows.
- Proposed surface water and foul water networks.
- Proposed surface water and foul water discharge points.
- Constraints imposed by the regulatory bodies, including; - The Environment Agency, LLFA, Local Water Company and Highway Authorities.

In accordance with the National Planning Policy Framework, the drainage strategy takes account of climate change over the longer term of the development and gives priority to the use of sustainable drainage systems. This is discussed in Section 8.0.

2.3 Limitations

This report has been prepared for exclusive use by our client SRM, for the purpose of assisting them in evaluating the potential risk of flooding associated with the site, proposed drainage strategy and in making a Full Planning Application. Building Design Partnership (BDP) accepts no liability for any use of this document other than by its client and only for the purposes, stated in the document, for which it was prepared and provided. No person other than the client may copy (in whole or in part) use or rely on the contents of this document, without the prior written permission of BDP. Any advice, opinions or recommendations within this document should be read and relied upon only in the context of the document as a whole.

BDP has endeavoured to assess all information provided to them during this appraisal. The report summarises from a number of external sources and cannot offer any guarantees or warranties for the completeness or accuracy of information relied upon.

This Flood Risk Assessment addresses the flood risk posed to and from the proposed development, the extent of which is shown on the Proposed Below Ground Drainage Layout contained within Appendix J and outlined in Section 5.0. This report has been undertaken with the assumption that the site will be developed in accordance with the above proposals without significant change. The conclusions resulting from this study are not necessarily indicative of future conditions or operating practices at or adjacent to the site.

A topographic survey of the site was undertaken by Survey Operations (July 2020) and is included within Appendix B. Where possible (and if applicable), this included for the lifting of manhole covers to establish incoming/ outgoing connections, diameters, system type and invert levels.

A GPR survey of the site was undertaken by Site Vision Surveys (06/07/2020) and is included within Appendix C. Further below ground drainage CCTV survey is to be carried out to further inform the original GPR survey. This is to confirm outfall points, invert levels, alignment, system type, route and condition of any existing drainage within the site boundary and the surrounding area within the site boundary.

3.0 Site Context

3.1 Site Location

The site is located south-east of Manchester City Centre.

Site location plan is shown in Appendix A. The Ordnance Survey grid reference at the centre of the existing building north of the site is 387532E, 396327N. An approximate postcode for the site is M12 5AL.

3.2 Site Characterisation/ Land-Use

Area		The planning application site area is 5.3 hectares (ha).
Site Description and Current Use		The large majority of the site is developed land and is currently covered by car park and Showcase Manchester building. The west of the site is well vegetated with the remaining site is sparsely vegetated. Existing drainage is present on site, along with other services as shown in Appendix C. An assessment of the existing drained areas is indicated on the drawing "Existing Pre-Development Drained Areas" which is included in Appendix D.
Access	Vehicular	The existing site can be accessed via a main entrance off Hyde Road, with a secondary access also provided off Kirkmanshulme Lane.
	Pedestrian	Access from Hyde Road and Kirkmanshulme Lane.

3.3 Topography

A topographic survey of the site was undertaken by Survey Operations (July 2020) and is included within Appendix B. Where possible (and if applicable), this included for the lifting of manhole covers to establish incoming/ outgoing connections, diameters, system type and invert levels.

The site levels vary approximately between 59.7m to 61.7m. Generally, the eastern side is higher than the western, with the lowest levels at the south of the site.

3.4 Geology

In accordance with 'Phase 2 Intrusive Ground Investigation & Assessment' report ref. 10041634-ARC-XX-XX-RP-ZZ-0005-01-P2GIA dated August 2020 (refer to Appendix E), the site is underlain by superficial deposits of Glacial Till, which in turn overlies the bedrock of Sandstone. Made Ground has been proven to be present beneath the site given the site nature. The made ground is of varying thickness with the maximum depth of 3.3m below ground level, comprising a mixture of sandy gravel of type 1 material and clayey slightly sandy fine to coarse gravel with fragments of brick, sandstone, limestone, concrete and occasional wood and clinker. Glacial Till typically comprises firm to stiff gravelly clay with layers or lenses of sand and gravel. The bedrock was only observed in one borehole location at 12.9m below ground level and recorded as orangish brown fine to medium sandstone of the Chester Pebble Bed Formation and was recovered as angular coarse gravel.

3.5 Hydrogeology

In accordance with 'Phase I Geo-Environmental Desk Study' ref. 10041634-ARC-XX-XX-RP-ZZ-0002-01-P1DS dated June 2020 (refer to Appendix E), the site is located within the Superficial geology which is classified as a Secondary Undifferentiated Aquifer. Generally, these layers have been previously designated as minor and non-aquifers due to variable characteristics of the rock type.

The bedrock geology is classified as a Principle Aquifer. Principle aquifers have high intergranular and/or fracture permeability, providing a high level of water storage and may support water supply/river base flow on a strategic scale.

3.6 Groundwater Protection Zones

The Environment Agency have defined Source Protection Zones (SPZs) for 2000 groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The closer the activity, the greater the risk. The maps show three main zones (inner, outer and total catchment) and a fourth zone of special interest, which the Environment Agency occasionally applies, to a groundwater source.

The proposed development site is not within a groundwater Source Protection Zone (SPZ).

3.7 Existing Public Sewers

United Utilities sewer record (Appendix F) indicates that there are existing sewers within the highways surrounding the site: Scarcroft Road, Bracewell Close and Ellen Wilkinson Crescent. The sewer are separate surface and foul networks, discharging towards the east away from the site.

3.8 Existing Private Drainage

A GPR survey of the site was undertaken by Site Vision Surveys (06/07/2020) and is included within Appendix C.

Further below ground drainage CCTV survey is to be carried out to further inform the original GPR survey. This is to confirm outfall points, invert levels, alignment, system type, route and condition of any existing drainage within the site boundary and the surrounding area within the site boundary.

The above survey indicates that the site is positively drained via separate surface and foul networks. The surface water runoff is generated from the existing car park and road surfaces as well as the existing building roof. The drainage systems are conventional with no attenuation on site. At least four interceptors have been identified by the survey.

There are two surface water outfalls to the public sewer located in Ellen Wilkinson Crescent and one foul water outfall also connecting to the public sewer in Ellen Wilkinson Crescent.

It is intended that the development will utilise the existing connections to the public network wherever possible, subject to confirmation of level, condition, capacity and agreement with United Utilities.

Following the 'Transfer of Private Sewers Regulations (2011)', it is possible that sections of the existing onsite drainage would be the responsibility of United Utilities. This is to be confirmed by United Utilities.

3.9 Watercourses, Land Drainage and other Waterbodies

The nearest surface water body is Core Brook located approximately 380m south.

There are no other watercourses identified near the site.

3.10 Existing Flood Defences and Other Structures

There are no known flood defences in the vicinity of the site.

3.11 Historical Land Uses

In accordance with 'Phase I Geo-Environmental Desk Study' ref. 10041634-ARC-XX-XX-RP-ZZ-0002-01-P1DS dated June 2020 (refer to Appendix E), the site was originally part of Belle Vue Gardens, later becoming the Belle Vue Zoological Gardens. Several ponds and boating lake features were subsequently infilled and by 1991 the site was redeveloped to the current layout principally comprising a cinema building and associated car park. The recent buildings located on the northwest parcel have been demolished.

Surrounding land has comprised a mix of industrial, commercial leisure and residential uses. Nearby breweries, tanks, engineering and other works were present locally from the late 1800's, however heavy industry has since faded from the area.

3.12 Historical Flood Records

The table below summarises responses received to date through consultation with the various bodies contacted as part of this study. Appendix H contains all consultation responses currently received.

Information Source	Flood Records/ Details
Environment Agency	No response to date, awaiting response
Manchester City Council	Response received on 17/12/2020 No historic record of flooding reported
United Utilities	Response received on 21/12/2020 No historic record of flooding reported

In accordance with 'Phase I Geo-Environmental Desk Study' ref. 10041634-ARC-XX-XX-RP-ZZ-0002-01-P1DS dated June 2020 (refer to Appendix E), there are no records of historic flood events from rivers, the sea, groundwater or surface water.

4.0 Policy and Guidance

In carrying out our assessment and preparing this report, regard has been taken of the provisions of the development plan and a range of other material considerations. However, it is the Government's National Planning Policy Framework (NPPF), Manchester City Council's PFRA, level 1 & 2 SFRA, LFRMS and CIRIA document C624, which provide the most up to date and specific guidance on the Scope of Flood Risk Assessments.

4.1 National Planning Policy Framework (NPPF) & Planning Policy Statement 25 (PPS25)

The National Planning Policy Framework (NPPF) was first published in England in March 2012 and a revised version was published on 19th February 2019. As a result, all previous Planning Policy Guidance Notes (PPGs) and Planning Policy Statements (PPSs) were superseded. This included PPS25: Development and Flood Risk, along with its supplement on Development and Coastal Change.

One of the key aims of the NPPF is to ensure that flood risk is taken into account at all stages of the planning process to avoid inappropriate development in areas at risk of flooding and to direct development away from areas of highest risk.

It advises that where new development is necessary in areas of higher risk, this should be safe, without increasing flood risk elsewhere, and where possible should reduce flood risk overall.

The NPPF's flood risk advice is set out in section 14 of the Framework document. It is also accompanied by a Technical Guidance document which contains more details of carrying out development with regard to flood risk.

A comparison of the new NPPF Technical Guidance and the PPS25 documents reveals that the technical approach to the FRA process is largely unchanged with the presumption for development in Flood Zone 1.

Notable topics that have been retained from PPS25 within NPPF and its Technical Guidance include:

- The same Flood Zone definitions and vulnerability classifications of development are retained.
- The Sequential & Exceptions tests tie in more closely with NPPF's principle to promote the most sustainable development.
- Climate Change and Sea Level rise are key considerations in the assessment.
- Management of Residual Risk discusses matters of Flood Risk Management and Mitigation, including Flood Resistance and Resilience. This clearly allows for development opportunities in areas where prospective sites are in Flood Zones 2 and 3, as long as flood ingress, impact, rate of onset etc are understood and mitigated.

4.2 Manchester City Council (MCC) Preliminary Flood Risk Assessment (PFRA)

The Manchester City Council PFRA written by JBA Consulting in May 2011, provides a high level overview of flood risk within the area. Including information on historic and future potential floods and their potential consequences.

4.3 Manchester City Council User Guide, Level 1 & Level 2 Strategic Flood Risk Assessment (SFRA)

Local Planning Authorities are required to produce Local Development Frameworks, which are a portfolio of Local Development Documents (LDD's) that collectively deliver the spatial planning strategy for the Authority area. The LDD's undergo a Sustainability Appraisal which assists Planning Authorities in ensuring their policies fulfil the principles of sustainability. Strategic Flood Risk Assessments are one of the documents to be used as

the evidence base for planning decisions and are a component of the Sustainability Appraisal process. Therefore, SFRA's should be used in the review or production of LDD's.

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 the drainage systems in the area should function and also how the risks in vulnerable areas can be reduced and/or mitigated. The National Planning Policy Framework states that Regional Planning Bodies (RPB's) or Local Planning Authorities (LPA's) should prepare SFRA's in consultation with the Environment Agency.

User Guide – written by JBA Consulting, Final, May 2010

This provides detailed guidance for Policy Planners, Development Control Officers and Emergency Planners on their responsibilities within regional and local flood risk management as defined within PPS25 and the use of the

Strategic Flood Risk Assessment – Level 1 – written by JBA Consulting, Final, March 2010

The Manchester City Council Level 1 SFRA has used mostly existing data to make an assessment of flood risk from all sources now and in the future and builds on the Association of Greater Manchester Authorities (AGMA) Sub-Regional SFRA. It looks at the risk of flooding from rivers, canals, reservoirs, groundwater, surface water and sewers. Providing evidence for the LPA officers to apply the Sequential Test and identify the need to pass the Exception Test where required.

Strategic Flood Risk Assessment – Level 2 – written by JBA Consulting, Final, March 2011

The Manchester City Council Level 2 SFRA provides more detailed information on flood risk from rivers (The Lower Irwell, Grey Irwell, Rivers Irk, Medlock and Mersey and the Corn Brook), canals (Manchester Ship Canal and the Bridgewater Rochdale and Ashton Canals), surface water and sewers. It also looks at the impacts of development on flood risk and the interactions between different sources of flooding. The additional detail can also inform a sequential approach to development allocation within flood risk areas, the likelihood of sites passing the Exception Test and mitigation options where appropriate.

The above document(s) state that:

“Development should aim for a minimum reduction in surface water runoff rates of 50% for Brownfield sites, with an aim of reducing runoff to Greenfield rates up to a 1 in 100-year storm event, considering climate change”.

“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.”

Critical Drainage Area

The proposed development site is within the Level 2 SFRA 'Critical Drainage Areas' (CDA).

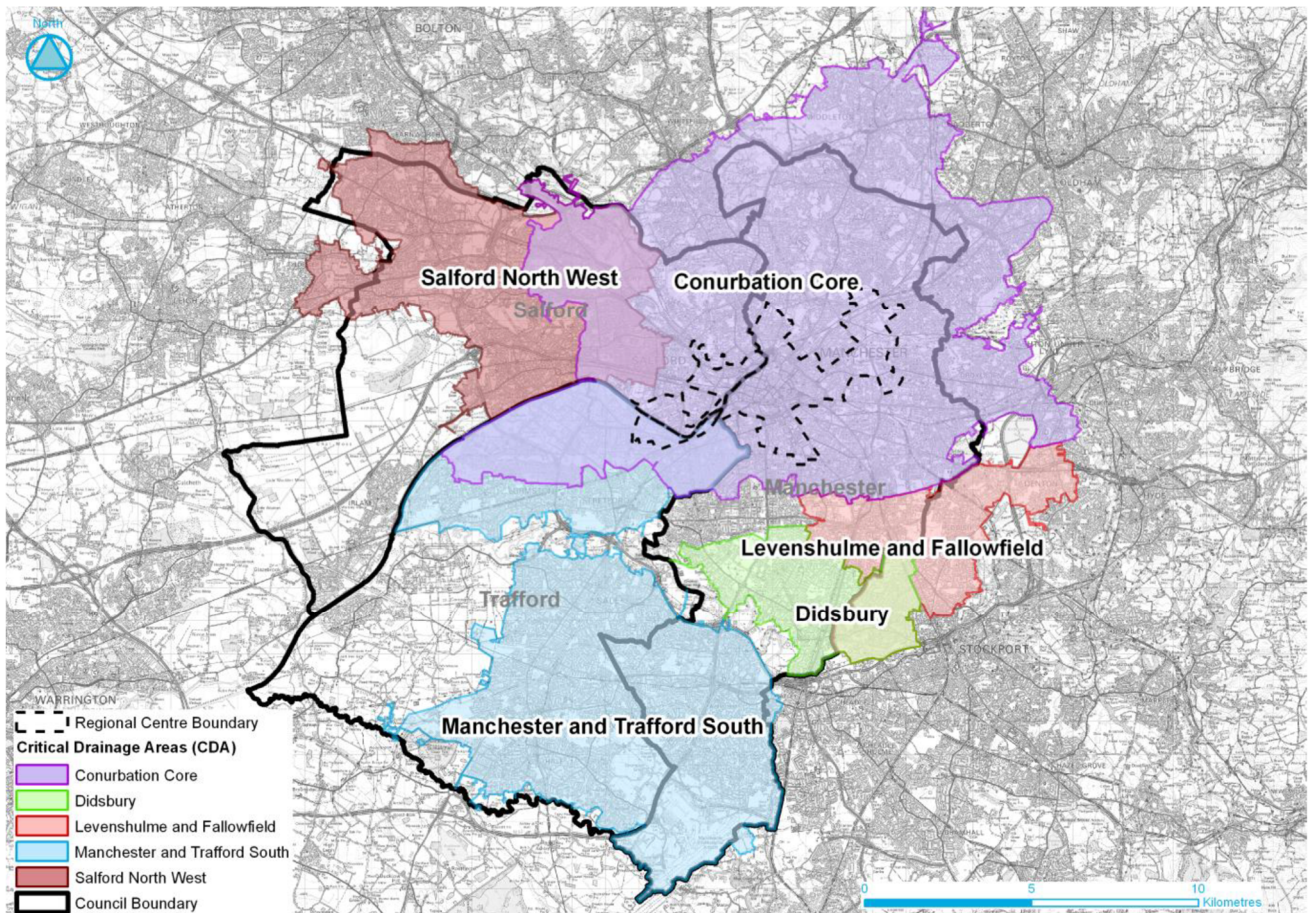


Figure 4.0 – Manchester, Salford and Trafford CDAs overview
(Source: 2009s0290 Final MST Level 2 SFRA March 2011_V1.1.docx)

The Town and Country Planning Order 2006 defines Critical Drainage Areas as “an area within Flood Zone 1 which has critical drainage problems and which has been notified to the local planning authority by the Environment Agency”.

Certain locations are particularly sensitive to an increase in the rate of surface water runoff and/or volume from new development. There are generally known local flooding problems associated with these areas. These areas have been defined as CDAs in the SFRA. Specific drainage requirements are required in these areas to help reduce local flood risk. These are areas with complex surface water flooding problems that would benefit from a Surface Water Management Plan and subsequent drainage strategy.

The SFRA has developed Critical Drainage Areas where:

1. There is a high risk of localised flooding from ordinary watercourses, including culverts surcharging and overland surface water flows, including the potential for flooding from the sewer network due to failure/blockage or exceedance events when the storm return period is greater than the sewer was designed for; or
2. Where there are areas of significant redevelopment planned that could have a significant impact on surface water runoff to local watercourses and the sewer network.

Based on the SFRA Critical Drainage Area Map ‘SS_4.5’, the development site is within the ‘Conurbation Core’. The following reasons have been provided as to why this area is within the CDA:

- Localised flooding problems in central Manchester and Salford
- Includes Lower Broughton which was focused of Defra Making Space for Water IUD pilot

- Focus of major regeneration and redevelopment that could have a significant impact on surface water runoff to local watercourses and the sewer network
- Many lost watercourses that are interconnected with the sewers, canals and open channel watercourses that pose a significant risk
- SFRA analysis shows significant surface water flooding hotspots between the Irk and Medlock and in Crumpsall, Cheetham Hill, Clifton Green, Newtown, Charlestown and Broughton
- 5 postcode areas with over 10 properties affected in the DG5 register

4.4 Manchester City Council Local Flood Risk Management Strategy (LFRMS)

Manchester's LFRMS (2014) will be an important tool to help everyone understand and manage risk within the City and will set out a risk-based approach to achieve the best results possible using the budgets and resources available. It will look to reduce both the likelihood of flooding occurring and the impacts of a flood should it happen, promoting the use of a wide range of measures to manage local flood risk, including what affected communities can do for themselves.

The LFRMS's overall aim is to **Ensure that local flood risk is properly managed by using the full range of options in a coordinated way**. This will be achieved by meeting overarching objectives for managing local flood risk:

- Reduce the likelihood, severity and consequences of flooding from Ordinary Watercourses, from Groundwater, and from Surface Water Runoff.
- Seek opportunities to improve water quality and biodiversity through flood risk management activities.

To meet these objectives will take a range of actions, from different stakeholders and at different spatial levels. This will involve:

- Developing effective Communication protocols between the main local flood risk management stakeholders within Manchester to:
- Ensure stakeholders are aware of their legal roles and responsibilities for flood risk management,
- Warn communities of potential risk and engage with them in terms of managing risk and improving resilience,
- Investigate floods that occur,
- Coordinate responses to flood events,
- Plan and coordinate investment,
- Share information,
- Enable flood incidents, or problems with flood defences or drainage infrastructure to be reported.
- Improving knowledge of drainage infrastructure within or affecting the city, to identify priorities, help inform interventions, and thereby effectively manage risk.
- Developing an appropriate policy response framework for local flood risk management to inform and direct the work of the Council as LLFA and other stakeholders, including a basis for prioritising interventions, and an up-to-date evidence base.
- Cooperating to maximise funding from all available sources to enable appropriate flood risk management interventions to be progressed, such as flood defence / drainage infrastructure capacity works at priority locations;
- Monitoring and maintaining flood defence / drainage infrastructure, including responsive maintenance to address problems should they arise;
- Engaging with the planning process to ensure flood risk is appropriately considered in new developments / landscaping.

4.5 Manchester City Council Core Strategy Development Plan

The Core Strategy was adopted by Manchester City Council on 11th July 2012. It is the key document in Manchester's Local Development Framework and covers a period of 15 years from 2012 to 2027. It describes Manchester today and outlines the Council's vision for Manchester in 2027 along with the planning policies which will be used to deliver that vision.

Some of the relevant drainage related policies include:

Policy EN 14: Flood Risk

- In line with the risk-based sequential approach contained within PPS25, development should be directed away from sites at the greatest risk of flooding, and towards sites with little or no risk of flooding; this should take account of all sources of flooding identified in the Manchester-Salford-Trafford Strategic Flood Risk Assessment (SFRA).
- In addition to the requirements for site-specific Flood Risk Assessments (FRAs) set out in PPS25, an appropriate FRA will also be required for all development proposals, including changes of use, on sites greater than 0.5ha within Critical Drainage Areas (CDAs) and Canal Hazard Zones identified in the SFRA.
- All new development should minimise surface water run-off, including through Sustainable Drainage Systems (SUDS) and the appropriate use of Green Infrastructure. Developers should have regard to the surface water run-off rates in the SFRA User Guide. In CDAs, evidence to justify the surface water run-off approach / rates will be required.
- The City of Manchester contains many sections of rivers which are culverted or 'hidden'; where these are indicated in the SFRA beneath the proposed development site, further investigation will be required and the development proposal should take this into account; where feasible and appropriate development should seek to open up culverted/hidden rivers to reduce the associated flood risk and danger of collapse, taking advantage of opportunities to enhance biodiversity and Green infrastructure.

4.6 CIRIA Guidance

The CIRIA publication 'C624 Development and Flood Risk – Guidance for the Construction Industry', define three levels of FRA which can be undertaken:

Levels / Scope of Flood Risk Assessment

FRA Level	Description / Scope
Level 1	Screening Study to identify whether there are any flooding or surface water management issues related to a development site that may warrant further consideration. This should be based on readily available existing information, including the SFRA, Environment Agency Flood Map and Standing Advice. The Screening Study will ascertain whether a FRA is required.
Level 2	Scoping Study to be undertaken if the Level 1 FRA indicates that the site may lie within an area that is at risk of flooding or that the site may increase flood risk due to increased run-off. This Study should confirm the sources of flooding which may affect the site and should include the following: an appraisal of the availability and adequacy of existing information; a qualitative appraisal of the flood risk posed to the site, and potential impact of the development on flood risk elsewhere; an appraisal of the scope of possible measures to reduce the flood risk to acceptable levels. The Scoping Study may identify that sufficient quantitative information is already available to complete a FRA appropriate to the scale and nature of the development.

Level 3	Detailed Study to be undertaken if the Level 2 FRA concludes that further quantitative analysis is required to assess flood risk issues related to the development site. The Study should include: quantitative appraisal of the potential flood risk to the development; quantitative appraisal of the potential impact of development site on flood risk elsewhere; quantitative demonstration of the effectiveness of any proposed mitigation measures.
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This report will follow the format of a Level 2 qualitative study.

5.0 Development Proposals

5.1 Nature of the development

The proposed development includes the demolition of the existing Showcase Manchester building, associated car park, general clearance of the site and the construction of a new secondary school, adjacent facilities, hard and soft landscaping and associated infrastructure works.

A copy of the Proposed Site Layout can be found in Appendix I and an assessment of the pre-development drained area in Appendix D, which are also summarised in the tables below.

Pre-Development

Impermeable Hardstanding (positively drained) (ha)	Planning Application Site Area (ha)
3.63	5.30

The above is not necessarily indicative of future proposals and is subject to change at detailed design stage.

The site is brownfield in nature, currently occupied by the existing cinema building and parking areas, which are positively drained to the surrounding sewer network.

In accordance with Manchester City Council's SUDS Requirements for New Developments (updated 2019) and Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA, User Guide, Final, dated May 2010 (Section 3.4.1 Critical Drainage Areas, page 31),

"Development should aim for a minimum reduction in surface water runoff rates of 50% for Brownfield sites, with an aim of reducing runoff to Greenfield rates up to a 1 in 100-year storm event, considering climate change".

"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."

5.2 Proposed Levels

At the time of writing this report, the proposed levels strategy has not been developed. However it is anticipated that the new levels will be close to the existing topography.

A site levels strategy for the proposed development will be produced by Space, architectural consultancy. The current site proposal is included in Appendix I.

5.3 Proposed Surface Water & Foul Water Management Strategy

A drainage strategy has been produced and is included in Appendix J. The disposal of foul and surface water is discussed further in section 9.0, 10.0 & 11.0 of this report.

The drainage strategy and drainage proposals for the site have been developed in accordance with the principles of Sustainable Drainage Systems (SuDS) as set out in the National Planning Policy Framework, SuDS management train, DEFRA's technical standards sustainable drainage systems, Manchester City Council's Lead Local Flood Authority (LLFA) standing advice/guidance/SFRA's/Core Strategy, Building Regulations and other standards and best practice guidance. Consideration and preference have been given to utilising, as much as reasonably practicable, SuDS techniques throughout the site. Discharge of surface water will follow the hierarchal approach.

Following review of the historic reports (Appendix E), the site is unsuitable for the use of infiltration techniques for surface water management due to high perched groundwater, soil condition and presence of Made Ground, refer to Appendix E.

It is therefore proposed, to apply suitable SuDS without use of infiltration such as swale, filter drains, rain gardens, permeable surface areas with storage and below ground attenuation tank to accommodate a 1:100 critical storm event with 40% allowance for climate change. The proposed discharge rate will be restricted to meet the requirements. The proposed surface water site outfall will be connected to the existing public surface water network located on Ellen Wilkinson Crescent.

The post-development foul drainage is proposed to discharge without restriction as per the UU response (Appendix H) to the adjacent public foul water sewer, also located on Ellen Wilkinson Crescent.

The existing Bingo Hall drainage will require diversions across the site as shown in Appendix J.

The design intent is to utilise existing manholes/ networks for the new connections to the public sewer. This is to be further reviewed at detailed design stage and are subject to level, condition, capacity and agreement with the LLFA and United Utilities.

The above is not necessarily indicative of future proposals and are subject to change at detailed design stage.

5.4 Sustainable urban Drainage Systems (SuDS)

Where possible the site drainage will look to utilise SuDS features. Section 1.1 of the SuDS Manual (Ciria C753) states the following:

“Sustainable drainage systems (SuDS) can deliver multiple benefits.

Surface water is a valuable resource, and this should be reflected in the way it is managed and used in the built environment. It can add to and enhance biodiversity, beauty, tranquillity and the natural aesthetic of buildings, places and landscapes and it can help make them more resilient to the changing climate.

The philosophy of sustainable drainage systems is about maximising the benefits and minimising the negative impacts of surface water run-off from developed areas.

The SuDS approach involves slowing down and reducing the quantity of surface water runoff from a developed area to manage downstream flood risk, and reducing the risk of that runoff causing pollution. This is achieved by harvesting, infiltrating, slowing, storing, conveying and treating runoff on site and, where possible, on the surface rather than underground. Water then becomes a much more visible and tangible part of the built environment, which can be enjoyed by everyone.”

6.0 Sources of Flood Risk

Summary of Flood Risk

From the evidence collated and subsequent negotiations, the flood risk proposed to the development can be summarised as indicated in the table below:

SOURCE	LIKELIHOOD
Fluvial	Low
Coastal – Sea	N/A
Coastal – Estuarine	N/A
Pluvial Flooding	Medium - Low
Sewer - SWS, FWS, CS, CSO	Low
Groundwater	Medium - Low
Other Sources	Low

6.1 Fluvial Flood Risk

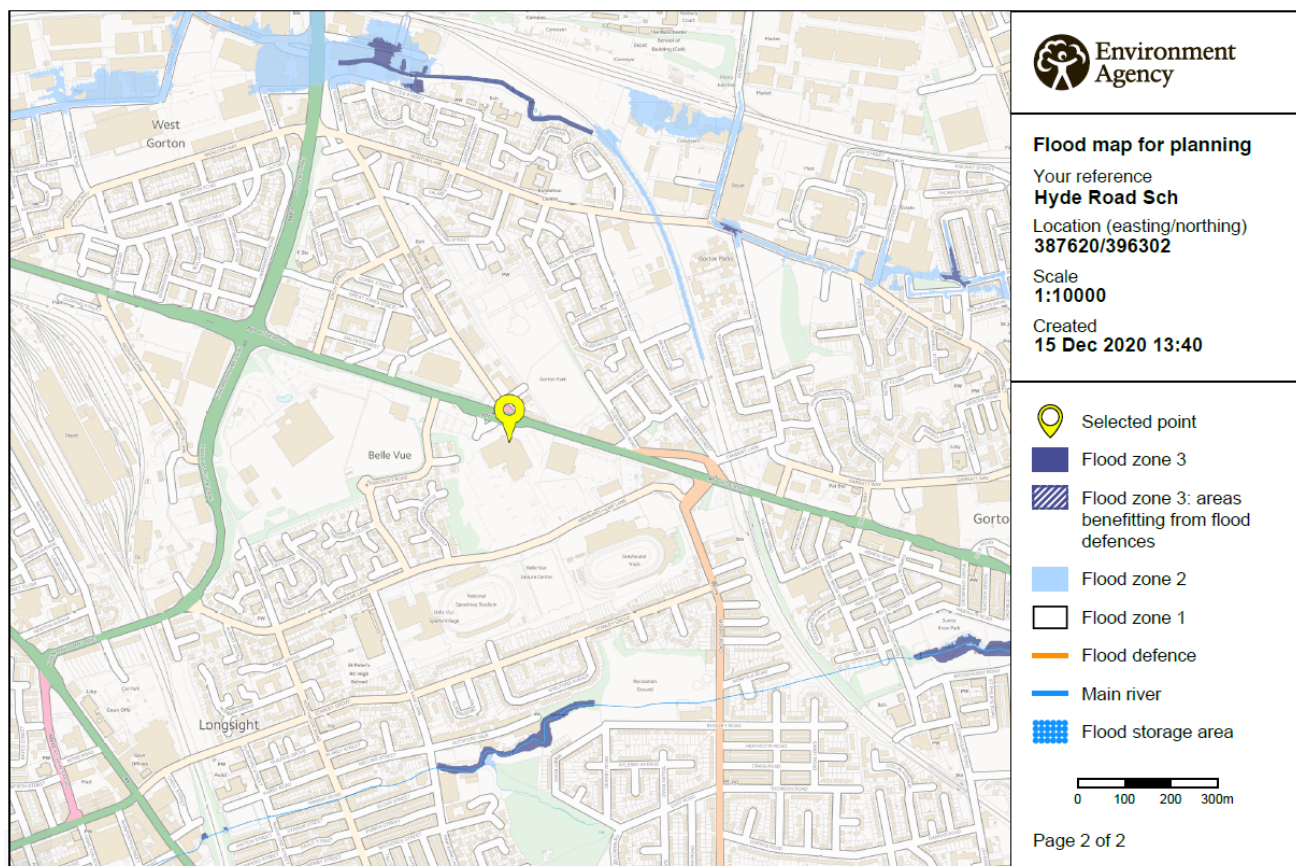


Figure 6.0 – Environment Agency Flood Map for Planning – Flooding from rivers and sea
(Source: <https://flood-map-for-planning.service.gov.uk/>)

The Environment Agency Flood Zone Map indicates that the proposed development site is located in Flood Zone 1 (low risk) and the risk of flooding from Rivers or the Sea is considered to be 'low'. The SFRA indicates that there are no specific risks to the site.

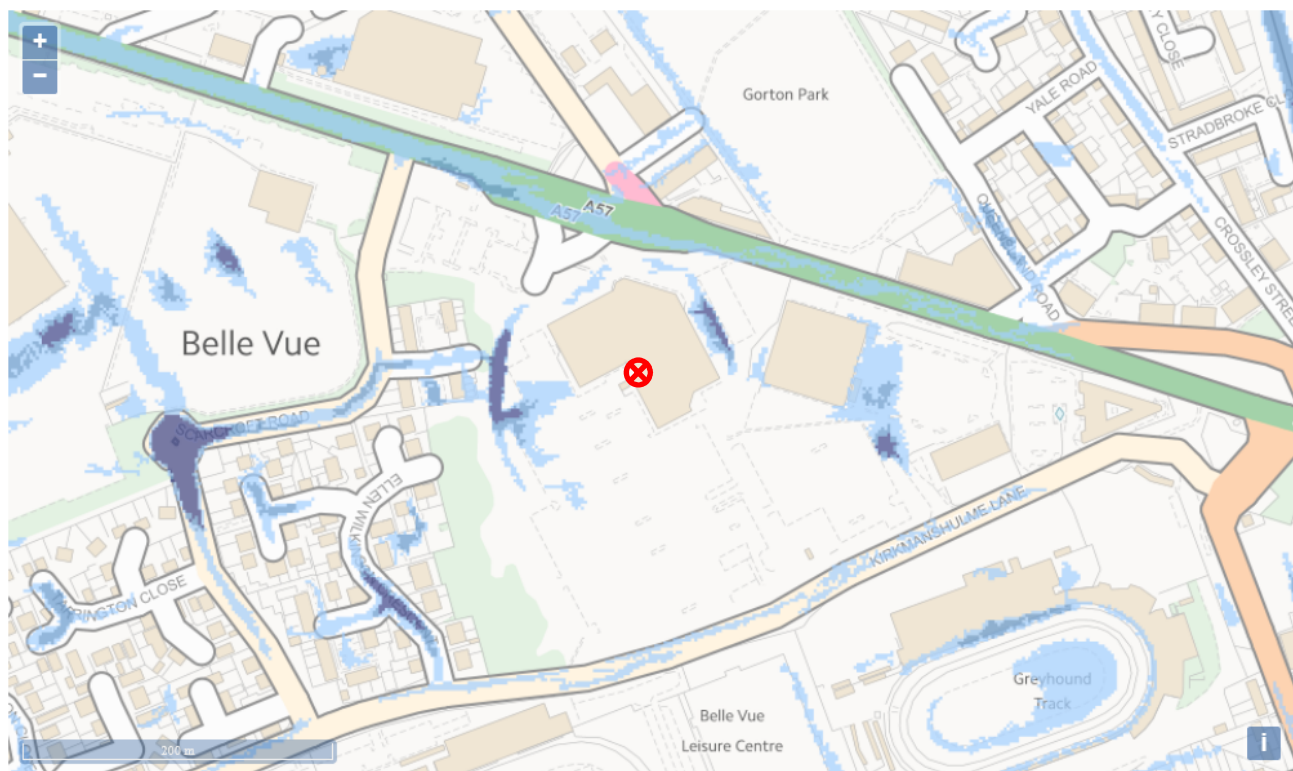
This is land designated as having a less than 0.1% annual probability of flooding from rivers or the sea in any year (less than a 1 in 1000 annual probability of flooding).

Flood zone designation ignores the presence of any flood defences and only considers flooding from fluvial and tidal sources.

Information relating to flood risk at the site has been obtained from the EA and Groundsure report enclosed to 'Phase I Geo-Environmental Desk Study' ref. 10041634-ARC-XX-XX-RP-ZZ-0002-01-P1DS dated June 2020 (refer to Appendix E).

It is therefore considered that the risk from fluvial flooding to the site is low. In order to maintain this low probability, the existing site levels should be retained where possible and as far as reasonably practicable.

6.2 Pluvial Flood Risk



Extent of flooding from surface water

● High ● Medium ● Low ○ Very low

Figure 6.1 – Environment Agency Flood Map for Planning – Extent of flooding from surface water
(Source: <https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>)

Pluvial flooding is defined as flooding resulting from rainfall-generated overland flow, before runoff enters any watercourse or sewer.

It is usually associated with high intensity rainfall events but can also occur with low intensity rainfall or melting snow where ground is saturated, frozen, developed or otherwise has low permeability resulting in overland flow and ponding in depressions in the topography. Large catchment areas are particularly prone to this type of flooding.

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%

In accordance with the EA Risk of Flooding from Surface Water map shown in Figure 6.1, the some areas of the site are at low to high risk of surface water flooding.

The 'Phase I Geo-Environmental Desk Study' ref. 10041634-ARC-XX-XX-RP-ZZ-0002-01-P1DS dated June 2020 (refer to Appendix E) and the enclosed Groundsure report indicate that there are localised areas of the existing site, around the northern perimeter of the cinema building and the access road along the west of the site, are indicated to have a low to high risk of surface water flooding. The highest risk on site is for the 1 in 30 year rainfall event with the estimated depth between 0.3m to 1.0m, refer to Appendix E.

The topography of the site and surrounding area means that there is little likelihood of significant flows impacting on the proposed development or on land and property adjacent to the development. The only flows that are likely to be present on site are from direct rainfall on areas of hardstanding.

The SFRA has no record of historical pluvial flooding. The SFRA does not identify the area being located at the risk of surface water flooding (Appendix G).

Therefore, considering all of the above, the risk of flooding from overland flow is considered to be medium for the existing site.

The proposed new development will be served by a new surface water drainage network, which will be designed to accommodate surface water flows within the site for up to and including the 100 year storm with allowance for 40% climate change. The design intent is to incorporate sustainable drainage as far as practical into the proposed drainage scheme. These measures will reduce the existing surface water flood risk identified above to a low probability.

6.3 Sewer Flood Risk

At the time of writing this report, consultation responses have been received from Manchester City Council and United Utilities, which did not report any flooding issues from sewers on site.

The site is indicated to lie within the Conurbation Core Critical Drainage Area, which is indicated to be an area of major regeneration and redevelopment that could have significant impact on surface water runoff to the sewer network. However, there is indicated to be no history of surface water flooding at the site. Proposed surface water runoff rates are to be limited in accordance with the LLFA requirements and should be considered within an appropriate drainage strategy, which will need to be prepared based on sustainable drainage principles.

Drainage designs will be in accordance with the LLFA's and United Utilities requirements.

Based on the above it is considered that the risk of flooding to the site from surcharged sewers is low.

6.4 Groundwater Flood Risk

In general terms groundwater flooding can occur from three main sources, raised water tables, seepage and percolation, and groundwater recovery or rebound. If groundwater levels are naturally close to the surface then this can present a flood risk during intense rainfall.

In accordance with the SFRA, the site is not located at the risk of groundwater flooding (Appendix G).

Defra's vulnerability map (Figure 6.3) shows that the site is located within medium to low vulnerability, indicating the vulnerability of groundwater to a pollutant discharged at ground level based on the hydrological, geological, hydrogeological and soil properties.

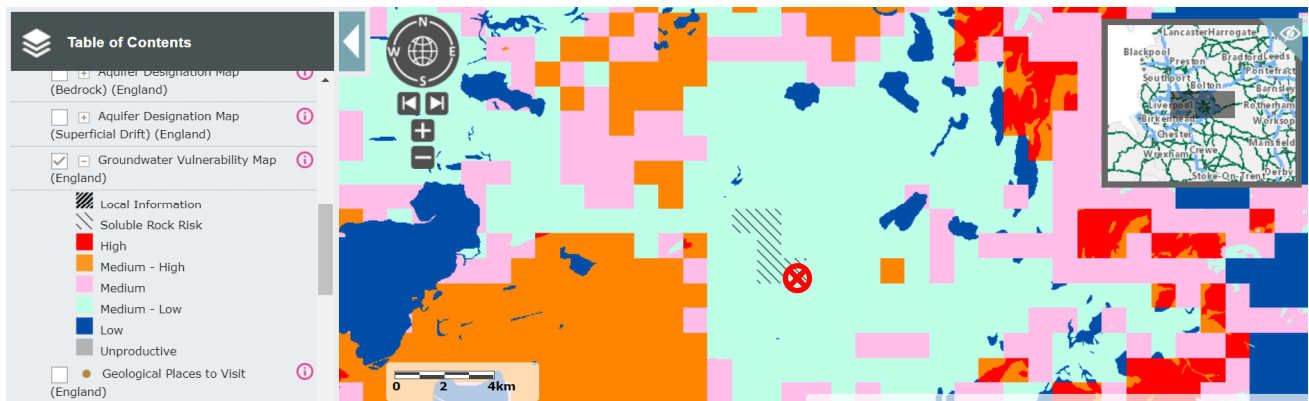


Figure 6.3 – Aquifer Designation and Groundwater Vulnerability Map
(Source: <http://magic.defra.gov.uk>)

The 'Phase I Geo-Environmental Desk Study' ref. 10041634-ARC-XX-XX-RP-ZZ-0002-01-P1DS dated June 2020 (refer to Appendix E), and the enclosed Groundsure report indicate that some areas of the site is located at moderate to high risk of groundwater flooding, refer to Appendix E.

The above report indicates presence of perched groundwater (below 2.0m bgl). This will need to be considered for the proposed drainage design and construction as well as through application of suitable sustainable drainage solutions.

Generally, it is anticipated that the existing topography will be retained. Thus, the probability of the high perched groundwater remains.

Considering the above, it is assessed that the site has a medium risk of flooding from groundwater sources.

Residual risk remains due to the perched groundwater near the surface. In order to mitigate this risk, the proposed surface water drainage will be designed without infiltration to prevent any groundwater entering the new systems and to avoid contamination due to the existing Made Ground across the site.

The proposed below ground strategy will reduce the existing groundwater flood risk identified above to a low probability.

6.5 Flooding from Other Sources

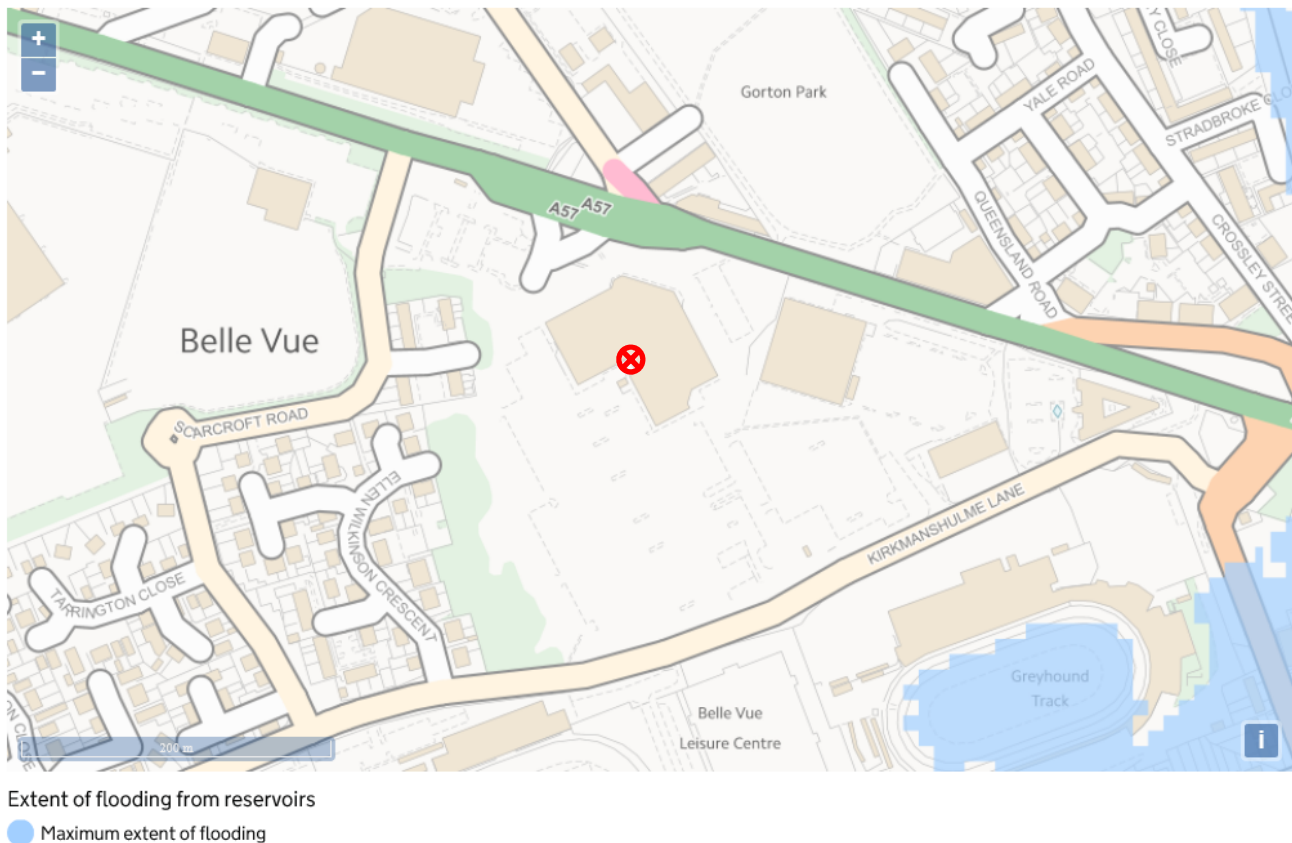


Figure 6.4 – Environment Agency Flood Map for Planning – Extent of flooding from reservoirs
(Source: <https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>)

Non-natural or artificial sources of flooding can include reservoirs, lakes and canals etc.

No other potential sources of flood risk have been identified in the vicinity of the site.

The Environment Agency website does not locate the site within an area at risk from reservoir flooding. The risk of flooding from artificial sources is low.

6.6 Historical and Anecdotal Flooding Information

An internet based search for flooding events did not recall any historical flooding in the immediate vicinity. Pre-development enquiries with various interested parties, for which responses have been received also failed to highlight any historical flooding events.

6.7 Flood Risk Vulnerability Classification

The proposed development is commercial/ industrial and can be considered as 'Less vulnerable' *within Table 3: Flood Risk Vulnerability and flood zone 'compatibility'* in the NPPF. This type of development would be wholly appropriate for Flood Zone 1.

Table 3: Flood risk vulnerability and flood zone ‘compatibility’

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	×	×	×

Key: ✓ Development is appropriate.
 × Development should not be permitted.

Notes to table 3:

This table does not show:

- the application of the Sequential Test which guides development to Flood Zone 1 first, then Zone 2, and then Zone 3;
- flood risk assessment requirements; or
- the policy aims for each flood zone.

7.0 Residual Risks and Impacts

7.1 Flood Risk Management Measures

The proposed developments peak discharge flow rates have been limited in accordance with Manchester City Council's requirements that *"Development should aim for a minimum reduction in surface water runoff rates of 50% for Brownfield sites, with an aim of reducing runoff to Greenfield rates up to a 1 in 100-year storm event, considering climate change"*.

SuDS site control measures and controlled discharge to the surrounding public network are to be incorporated to mitigate increase to flood risk and impact on sewer capacity. Drainage designs will be in accordance with Manchester City Council's and United Utilities requirements.

As a result of this reduction in discharge rate and increase in impermeable area, attenuation has been proposed in the form of site control measures. The proposed site surface water drainage system will be designed in accordance with current design guidance and standards to maintain the surface water flows below ground for up to and including the 1 in 30 year return period. Flows above this and up to the 100 year plus climate change event will also be below ground or where this is not reasonably practicable, will be retained safely (where acceptable) within the site on the surface.

The intent within the Landscaping plan is to retain the existing levels as much as feasible with appropriate consideration to the proposed finish floor level of the new building. Gradients of the hardstanding areas, where possible, will be designed to fall away from buildings such that any overland flow resulting from extreme events would be channelled away from entrances.

As the site and surrounding areas are located within Flood Zone 1, it is considered that access and egress should not be affected during flooding.

7.2 Off Site Impacts

To ensure that the proposed development will not increase flood risk elsewhere, surface water drainage discharge rates will be restricted. This restricted discharge in conjunction with surface water SuDS techniques on site, will mitigate against flood risk to other land.

By reducing the post development peak runoff prior to its point of discharge into the surrounding public sewer network, this will reduce the potential for surface water flooding on the downstream network.

Review of the surrounding topography has been considered and risk of overland flow onto site is low.

7.3 Residual Risks

The development and its drainage system will be designed to cope with the intense storm events up to and included the 100 year return period rainfall event with an allowance for climate change. If an extreme rainfall event exceeds the design criteria for the drainage network it is likely that there will be some overland flows which are unable to enter the system. It is therefore important that these potential overland flows are catered for within the proposed planning layout in the event that the capacity of the drainage system is exceeded.

Any overland flows generated by the proposed development must be directed away from the adjacent existing properties surrounding the site and towards the highway network or towards the watercourse, where it can follow natural flow paths.

As with any drainage system, blockages within the surface water system have potential to cause flooding or disruption. It is important that any drainage systems that are not offered for adoption to either the Water Company or the Local Authority have an appropriate maintenance regime scheduled and an appropriate management company appointed to carry out the works.

Residual risk remains due to the perched groundwater near the surface. In order to mitigate this risk, the proposed surface water drainage will be designed without infiltration to prevent any groundwater entering the new systems and to avoid contamination due to the existing Made Ground across the site.

8.0 Climate Change

The issue of climate change is discussed in the NPPF Technical guidance with impacts likely on sea levels, peak rainfall intensities, peak river flows, wind speeds and wave heights. The current DEFRA and EA recommended allowances for possible future climate change are summarised on in Table 2 on Gov.uk website (<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>) and are summarised below.

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

Table 2: peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline).

Planning Practice Guidance current advice on Climate Change for peak rainfall intensity allowance in small and urban catchments for a development with a lifespan of greater than 50 years '2080s' (2070 to 2115) is Central 20% and Upper End 40%. Due to the location and topography of the site the Upper End 40% has been applied.

The development and its drainage system will be designed to cope with the intense storm events up to and included the 100 year return period rainfall event with a 40% allowance for climate change.

9.0 Proposed Foul Water Drainage

9.1 Introduction

It is proposed that the new surface water and foul water drainage will be separate systems. It is not anticipated that the new drainage networks will be offered to United Utilities for adoption. Connections to the surrounding public sewer networks are subject to approval from United Utilities.

The foul water system will be designed and constructed in accordance with the current Building Regulations, BS EN:752 drainage and sewer systems outside buildings, the local authority building control specifications and requirements, Sewers for Adoption 7th Edition and the Civil Engineering Specification for the Water Industry 7th Edition.

9.2 Foul Water Discharge Rate

At this stage, the existing discharge rate from the existing facilities have not been estimated.

For the purpose of this report, the proposed total peak foul water discharge rate has been estimated based on the school occupancy and the assumed 20 l/person/day water usage in accordance with Plumbing Engineering Services Design Guide 2002, table 2.

The proposed occupancy of the development site is as follows (to be confirmed at the following stages):

1200 pupils

75 staff

Therefore, the total estimated peak foul outflow generated by the proposed development, based on a gravity system, has been calculated as **1.77 l/s** as shown below.

$$Q_{ww} = (1200+75) \times 20 = 25500 \text{ l/day} = 0.295 \text{ l/s} \times 6 \text{ peak factor} = 1.77 \text{ l/s}$$

United Utilities have advised that foul will be allowed to drain to the adjacent public sewer network at an unrestricted rate however, final discharge locations are subject to agreement with UU.

The above is not necessarily indicative of future proposals and is subject to change at detailed design stage.

Foul flows are subject to change at detailed design stage following any revision to the proposed site plan.

9.3 Foul Water Capacity and Point of Connection

United Utilities sewer record (Appendix F) indicates that there is foul water sewers within the vicinity of the site.

United Utilities have advised that foul will be allowed to drain to the public sewer network at an unrestricted rate (Appendix H). *"Foul flow from this site will be allowed to drain into the public foul water/combined sewer system. Our preferred point of discharge would be to the 225mm diameter public combined sewer within the site at an unrestricted rate."*

It is therefore proposed that the site will have one independent connection to the adjacent foul water network as shown on the proposed below ground drainage layout in Appendix J, subject to agreement with United Utilities.

The design intent is to utilise the existing foul water manhole within the site for the new connection.

The existing Bingo Hall foul water drainage will be diverted as shown on the Proposed Below Ground Drainage Layout in Appendix J.

10.0 Proposed Surface Water Drainage

10.1 Introduction

The National Planning Policy Framework (NPPF) and accompanying Technical Guidance indicate surface water run-off should be controlled as near to its source as possible through a sustainable drainage approach to surface water management.

Consideration should therefore firstly be given to using sustainable urban drainage (SuDS) techniques including soakaways, infiltration trenches, permeable pavements, grassed swales, ponds and wetlands to reduce flood risk by attenuating the rate and quantity of surface water run-off from a site. This approach can also offer other benefits in terms of promoting groundwater recharge, water quality improvement and amenity enhancements. Approved document Part H of the Building Regulations (2000) sets out a hierarchy for the disposal of surface water which encourages a SUDS approach.

10.2 Sustainable urban Drainage Systems (SuDS)

Current policy and best practice encourages the use of Sustainable Drainage Systems (SuDS) and in particular, infiltration systems. Where possible the site drainage will look to utilise SuDS features. This is also discussed further within Section 5.4.

The Environment Agency recommends that “surface water run-off should be controlled as near to its source as possible through a sustainable drainage approach to surface water management. This approach involves using a range of techniques including soakaways, infiltration trenches, permeable pavements, grassed swales, rain gardens, ponds and wetlands to reduce flood risk by attenuating the rate and quantity of surface water run-off from a site. This approach can also offer other benefits in terms of promoting groundwater recharge, water quality improvement and amenity enhancements. Approved document Part H of the Building Regulations (2000) sets out a hierarchy for surface water disposal which encourages a SUDS approach” (Environment Agency, 2004).

In accordance with the MCC and UU guidelines, all surface water flow from the proposed development should drain in-line with the drainage hierarchy as follows, in order of priority:

1. into the ground (infiltration);
2. to a surface waterbody;
3. to a surface water sewer or highway drain;
4. to a combined sewer.

In accordance with ‘Phase 2 Intrusive Ground Investigation & Assessment’ report ref. 10041634-ARC-XX-XX-RP-ZZ-0005-01-P2GIA dated August 2020 (refer to Appendix E), the site is unsuitable for the use of infiltration techniques for surface water management due to high perched groundwater, soil condition and presence of Made Ground.

It is considered likely that perched groundwater will be encountered in shallow excavations (i.e. <2.0mbgl) at the site”.

“Given the presence of site wide cohesive Glacial Till deposits underlying the Made Ground, infiltration drainage via soakaways are unlikely due to the anticipated low infiltration rate of the underlying soils”.

Thus at this stage, no infiltration is assumed across the site. Infiltration testing should be carried out across the site at detailed design stage, following which the use of infiltration SuDS techniques can be reviewed further. A review of any leachable contaminants in the Made Ground should be undertaken prior to site infiltration testing.

If it is confirmed that ground conditions limit the use of infiltration techniques, then non-infiltration SuDS components should be incorporated. Non-infiltration techniques can be used as first stage treatment.

Subject to the detailed design and layout of the site, the outline drainage strategy proposes the use of filter drains, rain garden, permeable surface and attenuation storage as shown on the Proposed Below Ground Drainage Layout in Appendix J.

The piped system will incorporate sections of oversized pipework (locations to be confirmed) where SuDS features are not practicable, which will provide additional attenuation, if required. In accordance with Manchester City Council's requirements, drainage proposals will utilise SuDS features as far as reasonably practicable and below ground attenuation will be avoided/limited. Drainage proposals are subject to agreement with the LLFA and United Utilities.

The further design of the SuDS features would be undertaken at the detailed design stage in conjunction with the design of the piped drainage systems.

10.3 Discharge via Infiltration

Following review of 'Phase 2 Intrusive Ground Investigation & Assessment' report ref. 10041634-ARC-XX-XX-RP-ZZ-0005-01-P2GIA dated August 2020 (refer to Appendix E), which indicates a large extent of Made Ground, high perched groundwater and unsuitable soil condition for infiltration, at this stage, ground conditions have been considered to be unsuitable for infiltration drainage. As a result, at this stage infiltration SuDS techniques have not been considered further.

Infiltration testing should be carried out across the site at detailed design stage, following which the use of infiltration SuDS techniques can be reviewed further. The testing should comply with the UU requirements: *"Surface water runoff generated from this development should discharge to the ground via infiltration system where feasible. A detailed evidence based feasibility assessment must be carried out in line with Chapter 25 of the CIRIA SuDS Manual 2015 to determine whether infiltration is a suitable method of surface water disposal."*

10.4 Discharge to a Watercourse

The site is located 380m to the nearest water body, Core Brook.

Given the excessive distance, and the need to cross land belonging to third parties, it is considered that discharge to a watercourse would not be practicable and therefore it has not been considered further.

10.5 Discharge to Public Sewer

United Utilities sewer record (Appendix F) indicates that there is a dedicated surface water public network adjacent to the site.

United Utilities have advised (Appendix H) that *"United Utilities will consider a connection to the 450mm diameter public surface water sewer located on-site at a pass forward flow to be agreed by the Lead Local Flood Authority. United Utilities request that any agreed rate does not exceed 45 l/s."*

The proposed development peak discharge surface water flow rate has been limited in accordance with Manchester City Council's requirements that *"Development should aim for a minimum reduction in surface water runoff rates of 50% for Brownfield sites, with an aim of reducing runoff to Greenfield rates up to a 1 in 100-year storm event, considering climate change"*.

It is therefore proposed that the site will have one independent connection to the adjacent surface water network as shown on the Proposed Below Ground Drainage Layout in Appendix J, subject to agreement with United Utilities.

The design intent is to utilise the existing surface water manholes/ network within the site for the new connection. However, a new connection might be required, subject to agreement (to be confirmed at the next stage).

The existing Bingo Hall surface water drainage will be diverted as shown on the Proposed Below Ground Drainage Layout in Appendix J.

All information shown on the above noted drawings are subject to change as the scheme is progressed.

10.6 Climate Change

There are indications that the climate in the UK is changing significantly and it is widely believed that the nature of climate change will vary greatly by region. Current expert opinion indicates the likelihood that future climate change would produce more frequent short duration and high intensity rainfall events with the addition of more frequent periods of long duration rainfall.

Planning Practice Guidance current advice on Climate Change for peak rainfall intensity allowance in small and urban catchments for a development with a lifespan of greater than 50 years '2080s' (2070 to 2115) is Central 20% and Upper End 40%. It is widely believed that the impact of climate change means there is likely to be long term increase in the average sea levels, with an expectation that sea levels will rise gradually. Due to the location and topography of the site, the Upper End 40% climate change has been applied.

An increase in flood water levels means that future flooding events will occur more frequently and will have a greater impact.

Any increase in the level of flood risk to the proposed development from climate change is likely to be related to the increase in rainfall intensity and duration and its impact upon the surface water drainage system.

10.7 Pre-development Surface Water Runoff

The existing development site is classed as brownfield and comprise a mixture of hard and soft landscaping, with the majority being hard landscaping. The existing hard landscaping areas include, existing parking areas and buildings, which are positively drained to the surrounding sewer network.

The following table summarises the pre-development impermeable and permeable catchment areas. Catchments are also identified on the Existing Pre-Development Drained Areas Layout in Appendix D. The 'contributing areas' of 1.57 ha shown on the Proposed Below Ground Drainage Layout in Appendix J are soft landscaping Sport and MUGA pitches and will be engineered to allow for suitable storage serving these areas, and therefore, excluded from the total hard-standing area of 1.47 ha shown below.

Area Summary

Pre-Development Impermeable Hardstanding (positively drained) (ha)	Post-development Impermeable Hardstanding (ha)	Planning Application Site Area (ha)
3.63	1.47	5.30

Runoff from Impermeable Brownfield Areas

The estimated runoff rate and volume from the existing site has been calculated using the Modified Rational (Wallingford) Method. This method allows estimation of the amount of runoff that is likely to be generated from an urban area. Peak short storm rainfall intensities have been generated for a range of storm return periods using MicroDrainage version 2018.1.1 drainage design software by Innovyze.

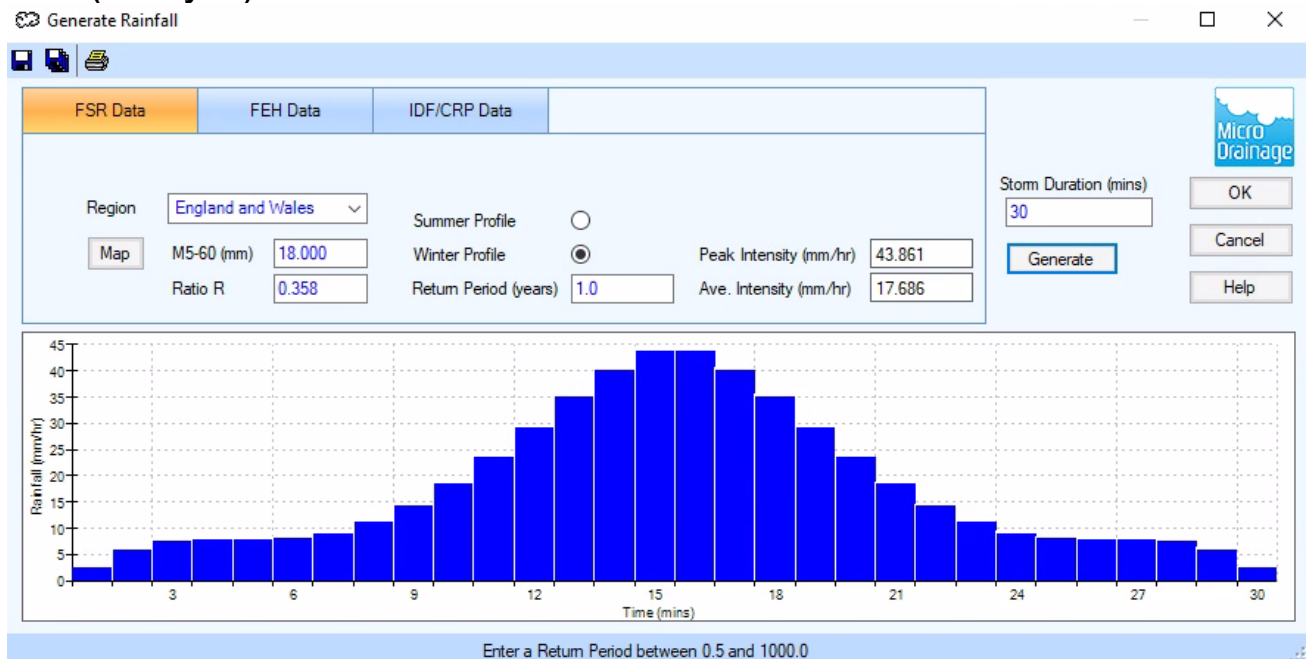
The Modified Rational method uses the following equation to calculate peak runoff rate from an area:

Q_p	=	$2.78 C_v C_r i A$
<i>Where :</i>		
C_v	=	0.9 Volumetric Runoff Coefficient
C_r	=	1.3 Routing Coefficient
i	=	Rainfall Intensity (mm/h)
A	=	Area (ha)
2.78	=	Coefficient which accounts for the differences in units used for the inputs and the outputs of the equation.

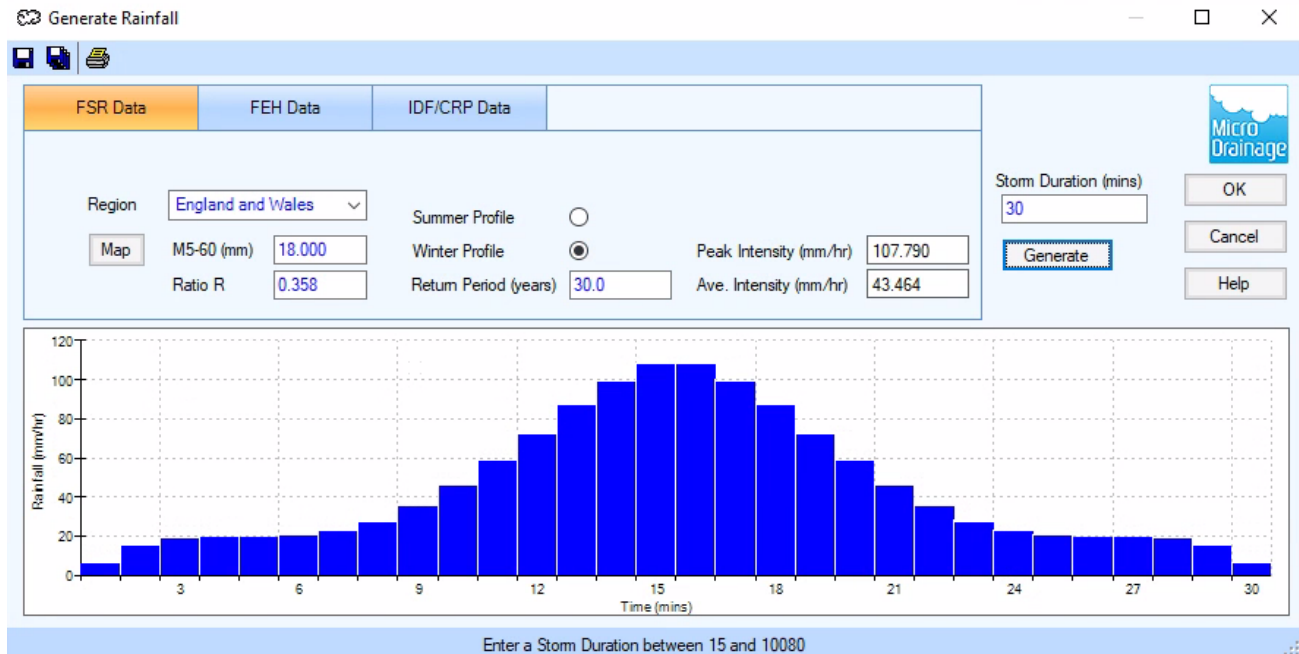
The variable C_v is a co-efficient that describes the proportion of rainfall appearing in the surface water drainage system. C_r is a routing co-efficient added to the Rational Method to represent runoff characteristics of a particular site or area in a more accurate manner.

Rainfall intensity data has been obtained from the MicroDrainage software, peak rainfall intensities have been generated for a range of storm return periods for a 30 minute duration winter storm. Output from the software is shown below.

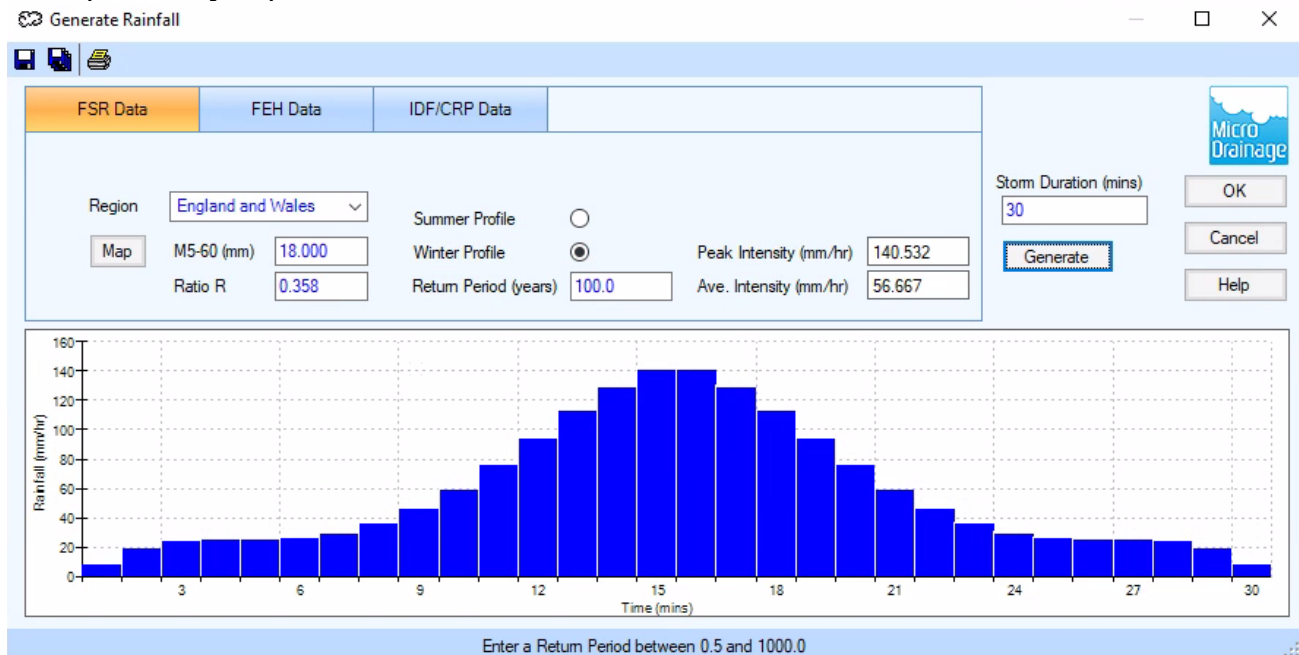
100% (1 in 1 year) AEP Rainfall Event



3.33% (1 in 30 year) AEP Rainfall Event



0.1% (1 in 100 year) AEP Rainfall Event



Based on the available survey information, hardstanding areas are positively drained and discharge to the surrounding public sewer network.

A standard runoff coefficient of 0.9 (Cv) was applied to each catchment assessed as impermeable. The variable Cv is a coefficient that describes the proportion of rainfall entering the surface water drainage system. Cr is a routing coefficient added to the Rational Method to represent runoff characteristics of a particular site or area in a more accurate manner.

The table below summarises the existing brownfield runoff rates for the development for a range of storm return periods, using the average rainfall intensity. The constant average rainfall intensity of 50 mm/hr has been added for comparison analyses as a typical conservative value as per CIRIA C753 The SuDS Manual.

Existing Brownfield Runoff Rates (considering various rainfall intensities)

Impermeable Area (ha)	Ave. i1 (mm/hr)	Ave. i30 (mm/hr)	Ave. i100 (mm/hr)	Const. Ave. (mm/hr)	Ave. i100+40% (mm/hr)
3.63	17.68	43.46	56.66	<u>50.00</u>	79.32
Existing Runoff					
	1 yr (l/s)	30 yr (l/s)	100 yr (l/s)	Const. Ave. (l/s)	100 yr + 40% (l/s)
	208.75	513.13	668.98	<u>590.34</u>	936.53

Greenfield Runoff Rates

Site Area (ha)	Qbar (l/s)	1 yr (l/s)	30 yr (l/s)	100 yr (l/s)	100 yr + 40% (l/s)
3.04 (1.47 + 1.57)	19.49	16.96	33.13	40.54	56.76

The greenfield runoff contributory area has been estimated to consist of the hardstanding area of 1.47 ha and the contributing area allocated for MUGA and Sport pitches of 1.57 ha, refer to Appendix J. The contributing areas (1.57 ha) will be engineered to allow for suitable storage serving these areas as shown on the Proposed Below Ground Drainage Layout in Appendix J.

The design intent is to reduce the site runoff rate to as close as practically feasible to the estimated greenfield runoff rate of 56.76 l/s for 1:100 + 40% climate change event. The greenfield runoff rates and variations in the greenfield runoff estimates above are shown for information only.

Refer to Appendix K for Greenfield runoff rate estimation for the site.

Proposed Restricted Discharge Rates

In accordance with Manchester City Council's SUDS Requirements for New Developments (updated 2019) and Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA, User Guide, Final, dated May 2010 (Section 3.4.1 Critical Drainage Areas, page 31):

"Development should aim for a minimum reduction in surface water runoff rates of 50% for Brownfield sites, with an aim of reducing runoff to Greenfield rates up to a 1 in 100-year storm event, considering climate change".

"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."

To meet these requirements, a 50% reduction on the calculated Brownfield rate has been applied. The table below therefore summarises the final proposed restricted discharge rate for the development. Detailed calculations are above and below.

Following review of the existing drainage network capacity and to meet the above requirements, it is proposed to restrict discharge for the post-development site for all return periods up to 1 in 100 year storm event plus a 40% allowance for climate change to the existing discharge rate of **104.38 l/s** for the **1 year return period with 50% reduction** as indicated in the table below.

Maximum Allowable Discharge Rate

1 yr with 50% reduction (l/s)	Maximum Allowable Discharge Rate (l/s)
208.75 x 0.5 = 104.38	<u>104.38</u>

It is acknowledged that United Utilities has stated, following the pre-development enquiry (Appendix H): “*United Utilities request that any agreed rate does not exceed 45 l/s*”. However, this is deemed to be stringent restriction for the proposed development, considering that the proposed maximum allowable discharge rate of 104.38 l/s represents 82% betterment in comparison to the estimated existing discharge rate of 590.34 l/s. The proposed discharge rate also allows for 40% climate change, which improve the betterment even further.

10.8 Post-development Surface Water Runoff

It is proposed that the new development will have independent connection to the adjacent public surface water drainage network, subject to agreement with United Utilities. The discharge rate for this connection will be restricted (in accordance with the above requirements) and can be re-proportioned accordingly following detailed design stage but the total must not exceed the maximum allowable discharge rate noted above.

The proposed restricted discharge and calculated post-development runoff rates generate a storage requirement during periods of intense rainfall. The MicroDrainage ‘Quick Storage Estimate’ module has been used to estimate the storage volume required on-site for both the North and South areas of the site for the 1 in 100 year storm event plus a 40% allowance for climate change. These volumes are detailed in the table below.

For the purpose of calculating storage, it should be noted that the figures below are indicative only as they will change once the detailed hydraulic model is simulated in the MicroDrainage software at the next stage, which will take into account the time of concentration, storage capacity of the network and various SuDS solutions proposed. This can be reviewed and updated accordingly at detailed design stage.

Proposed Discharge Rate and Estimated Storage Volume

Discharge Rate (l/s)		Impermeable Area (ha)	100 yr + 40% Estimated Storage Volume Range (m³)	100 yr + 40% Estimated Storage Volume Average (m³)
104.38	1:1, 30 min	1.47	304 - 557	430

The proposed maximum allowable discharge rate of 104.38 l/s represents 82% betterment in comparison to the estimated existing discharge rate of 590.34 l/s. The proposed discharge rate also allows for 40% climate change, which improve the betterment even further.

The current proposal in Appendix J provides 430 m³ of storage across the site located within the proposed permeable surface areas, MUGA storage and below ground drainage attenuation tank. The Sports pitches contribute to the drainage network at an estimated maximum discharge rate of 5 l/s per pitch with storage provided below the pitches. The Sports pitches are to be engineered to Sport England standards and are to be detailed by the specialist contractor.

The above is not necessarily indicative of future proposals and is subject to change at detailed design stage.

11.0 Drainage Summary

11.1 Outline Drainage Strategy

The drainage strategy and drainage proposals for the site have been developed in accordance with the principles of Sustainable Drainage Systems (SuDS) as set out in the National Planning Policy Framework, SuDS management train, DEFRA's technical standards sustainable drainage systems, Manchester City Council's Lead Local Flood Authority (LLFA) standing advice/guidance/SFRA's/Core Strategy, Building Regulations and other standards and best practice guidance. Consideration and preference should be given to utilising, as much as reasonably practicable, SuDS techniques throughout the site. Discharge of surface water will follow the hierarchical approach.

As described above, the hierarchy for surface water disposal, as set out in Part H of the Building Regulations (2000) indicates that priority should be given to the use of infiltration systems; second priority to discharge to a watercourse and third priority to discharge to the public sewer.

Following review of 'Phase 2 Intrusive Ground Investigation & Assessment' report ref. 10041634-ARC-XX-XX-RP-ZZ-0005-01-P2GIA dated August 2020 (refer to Appendix E), which indicates a large extent of Made Ground, high perched groundwater and unsuitable soil condition for infiltration, at this stage, ground conditions have been considered to be unsuitable for infiltration drainage.

The proposed developments peak discharge flow rates have been limited in accordance with Manchester City Council's requirements that *"Development should aim for a minimum reduction in surface water runoff rates of 50% for Brownfield sites, with an aim of reducing runoff to Greenfield rates up to a 1 in 100-year storm event, considering climate change"*.

Following review of the existing drainage network capacity and to meet the above requirements, it is proposed to restrict the surface water discharge for the post-development site for all return periods up to 1 in 100 year storm event plus a 40% allowance for climate change to the existing total runoff rate for the 1 year return period with 50% reduction, which is estimated to be 104.38 l/s. This is 82% betterment in comparison to the estimated existing discharge rate, which also allows for 40% climate change. Therefore, making a significant reduction to the existing surface water discharge rate off-site.

The surface water drainage systems will be designed to accommodate 1 in 100 year storm event plus 40% climate change allowance so that flooding does not occur during a 1 in 100 year rainfall event in any part of the building in accordance with the MCC SuDS requirements for New Developments (update 2019).

The general principle of the proposed surface water drainage strategy for the development site is to collect runoff from buildings and hard standing areas (roads, parking) and to attenuate at source as much as practicable feasible, following a controlled discharge to the surrounding public surface water network.

Suitable Sustainable Urban Drainage Systems (SUDS) will be applied on site such as filter drains, rain gardens, permeable paving, swale and attenuation storage. These measures will slow down the site runoff, mimicking the natural processes, reducing quantity and improving water quality as well as contributing to biodiversity enhancement and improving amenity.

The new systems will be managed and maintained in accordance with the SuDS Manual CIRIA C753 (2015).

The proposed foul water will consist of a conventional below ground drainage pipe network with unrestricted discharge rate of 1.77 l/s (total peak flow).

The design intent is to utilise the existing drainage connections off-site for the new drainage networks (foul and surface water).

The proposed drainage strategy is subject to approval by MCC. The proposed discharge rates and points of connection are subject to agreement with United Utilities.

The Proposed Below Ground Drainage Layout is shown in Appendix J. It is subject to the detailed design, proposed levels and agreed layout of the site.

11.2 Gravity Drainage System

Based on available information it is expected that gravity connections for the proposed surface water and foul water to the surrounding public sewers will be achievable.

11.3 Adoption and Maintenance

It is not anticipated that the new drainage network will be offered for adoption to United Utilities.

11.4 Performance Criteria

The foul and surface water drainage systems serving the site will be designed and installed in accordance with the following standards and best practice guidance.

- Manchester City Council (MCC) Preliminary Flood Risk Assessment (PFRA);
- Manchester City Council Level 1 & Level 2 Strategic Flood Risk Assessment (SFRA);
- Manchester City Council Local Flood Risk Management Strategy (LFRMS);
- Manchester City Council Core Strategy Development Plan;
- Lead Local Flood Authority – Manchester City Council – SuDS Requirements for New Developments Update 2019;
- Building Regulations Approved Documents H - Drainage and waste disposal;
- BS EN 752:2008 - Drain and sewer systems outside buildings;
- Sewers For Adoption 7th Edition;
- National Planning Policy Framework (NPPF) and Planning Policy Statement 25 (PPS25);
- CIRIA Report 156 – Infiltration Drainage, Manual of Good Practice;
- CIRIA Report C635 - Designing for Exceedance in Urban Drainage;
- CIRIA C753 The SuDS Manual;
- Non-Statutory Technical Standards for SuDS.