

Project North Stand Manchester

Flood Risk Assessment

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For Planning

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Glossary

Term	Definition
Annual Exceedance Probability (AEP)	The probability that a storm event will be exceeded in any given year.
Attenuation	A method to reduce a flood peak to prevent flooding, often utilising temporary storage, but increasing the duration of the flow.
Flood Risk	The level of risk to personal safety and damage to property resulting from flooding due to the frequency or likelihood of flood events.
Flood Risk Assessment (FRA)	An assessment of the flood risks to the Proposed Development over its expected lifetime and the possible flood risks to the surrounding areas, assessing flood flows, flood storage capacity and runoff.
Fluvial Flooding	Flooding resulting from an exceedance event in a river or watercourse.
Groundwater	Water present within underground strata known as aquifers.
Groundwater Flooding	Water occurring below ground in natural formations (typically rocks, gravels and sands).
Impermeable Surface	A surface that does not permit the infiltration of water and, therefore, generates surface water runoff during periods of rainfall.
Inundation	Flooding of land with water
Mitigation	Positive measures taken to reduce either the probability of flooding or the consequences of flooding or a combination of the two.
Permeability	The measures of ease with which a fluid can flow through a porous medium.
Resilience	The degree to which an asset or development can recover from a flooding event.
Return Period	The average frequency of a specified condition. An 'n' year event is one that occurs on average over the long term, once every 'n' years.
Risk	Risk is the probability that an event will occur and the impact (or consequences) associated with that event.
Runoff	Water flow over surfaces to the drainage system. Runoff occurs when rainfall exceeds the rate of permeability of a surface.
Strategic Flood Risk Assessment (SFRA)	An SFRA is the assessment and 'categorisation' of flood risk on an area-wide basis in accordance with the NPPF, usually carried out by the Local Planning Authority.
Surface Water Flooding	Surface water flooding occurs when the volume of water is unable to filtrate through the ground to enter drainage systems, and therefore runs quickly off land and results in localised flooding. This type of flooding is usually associated with intense rainfall.
Sustainable Drainage Systems (SuDS)	SuDS are used as a strategy to manage surface water in a sustainable manner or least damaging solution through management practices and physical structures.

Abbreviations

Term	Definition
AEP	Annual Exceedance Probability
EA	Environment Agency
FRA	Flood Risk Assessment
NPPF	National Planning Policy Framework
PPG	Planning Practice Guidance
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
SBI	Site of Biological Importance

1 Executive Summary

This site-specific Flood Risk Assessment (FRA) has been prepared by Buro Happold on behalf of Manchester City Football Club (the Applicant) as part of a full planning application for a development to the Etihad Stadium North Stand and City Square in Manchester, hereafter referred to as the 'Proposed Development'.

This FRA has been prepared in accordance with the National Planning Policy Framework (NPPF) (2021), the Manchester Core Strategy (2012) and the Manchester City, Salford City and Trafford Councils' Strategic Flood Risk Assessments (SFRAs) (2010, 2011). This FRA contains an assessment of the risk associated with each of the following flood sources:

- Tidal;
- Rivers (fluvial);
- Surface water;
- Sewers;
- Groundwater, including minewater; and
- Lakes, reservoirs and canals.

According to the national flood map produced by the Environment Agency (EA), the entirety of the site is located within Flood Zone 1, which is defined as having a low risk of flooding, with a probability of flooding of less than 1 in 1,000 years (0.1%) in any given year, from rivers and the sea.

The nearest natural watercourse to the Proposed Development is the River Medlock, with a culverted section passing approximately 170m north of the site boundary. Tidal and fluvial flood risk is considered to be low and additional measures to reduce this risk will not be required.

The Proposed Development includes an extension of the existing north stand of the Etihad Stadium, and development of a hotel, bars, restaurants, retail outlets and a museum, as well as commercial workspace. In accordance with the NPPF, the land uses proposed as part of the proposals are identified as appropriate for an area that falls within Flood Zone 1.

The surface water flood map produced by the EA indicates that the site is classified as having a low probability of surface water flooding. The existing site is composed of positively drained impervious surface (2.46ha), with the remaining gravel area considered to have greenfield runoff rates. The existing surface runoff discharge rate has been calculated to be 70.50l/s. Brownfield runoff from the site will be reduced by 50%, with proposed strategy achieving a runoff rate of 38.2l/s. This is further detailed in the Surface Water Drainage Strategy, included in Appendix 8.2.

With the Surface Water Drainage Strategy in place, the risk of surface water flooding is considered to be low.

The Proposed Development is located on Carboniferous Pennine Upper Coal Measures, overlain by Glacial Till. The site has a significant industrial past, including coal mining, meaning the geological makeup is complex. The Manchester City, Salford City and Stratford Councils' SFRA provides detail on areas which are considered to be susceptible to groundwater flooding and the site is not within these areas. The risk of groundwater flooding is therefore considered to be low and the risk of minewater rebound is also considered to be low. For further detail, refer to the Ground Engineering Desk Study, included in Appendix 9.1 of the Environmental Statement (ES) which accompanies this planning application.

The site is not located downstream of any reservoirs; therefore, is not considered to be in an area at risk of flooding in a reservoir breach.

The Ashton Canal runs adjacent to the site and is considered to have some residual risks associated with low probability events such as breaching. However, the Proposed Development is significantly elevated compared to the canal levels, so the risk of flooding from artificial sources is considered to be low.

It is concluded that the Proposed Development is at a low risk of flooding and will have no significant adverse impact in terms of flood risk to the surrounding area.

2 Introduction

2.1 Background

This site-specific FRA has been prepared by Buro Happold on behalf of Manchester City Football Club the as part of a full planning application for a development to the Etihad Stadium North Stand in Manchester, hereafter referred to as the 'Proposed Development'. This assessment has been carried out in accordance with the requirements of the Manchester Core Strategy and National Planning Policy Framework (NPPF) and considers the potential flood risk to the application site from the following sources: fluvial, surface water, sewer, groundwater and artificial sources.

2.2 Site Description

The site is approximately 3.5ha in size and situated in the Etihad Campus, East Manchester, with National Grid Reference SJ868988 (Postcode M11 3FF). It is bound by Alan Turing Way to the east, Ashton Canal to the north, and the Etihad stadium to the south, in the ward of Ancoats and Beswick, Manchester. There are existing buildings on the site: the North Stand of the Etihad Stadium, and the 'City Square' which contains retail outlets. The east side of the site is currently used for car parking.

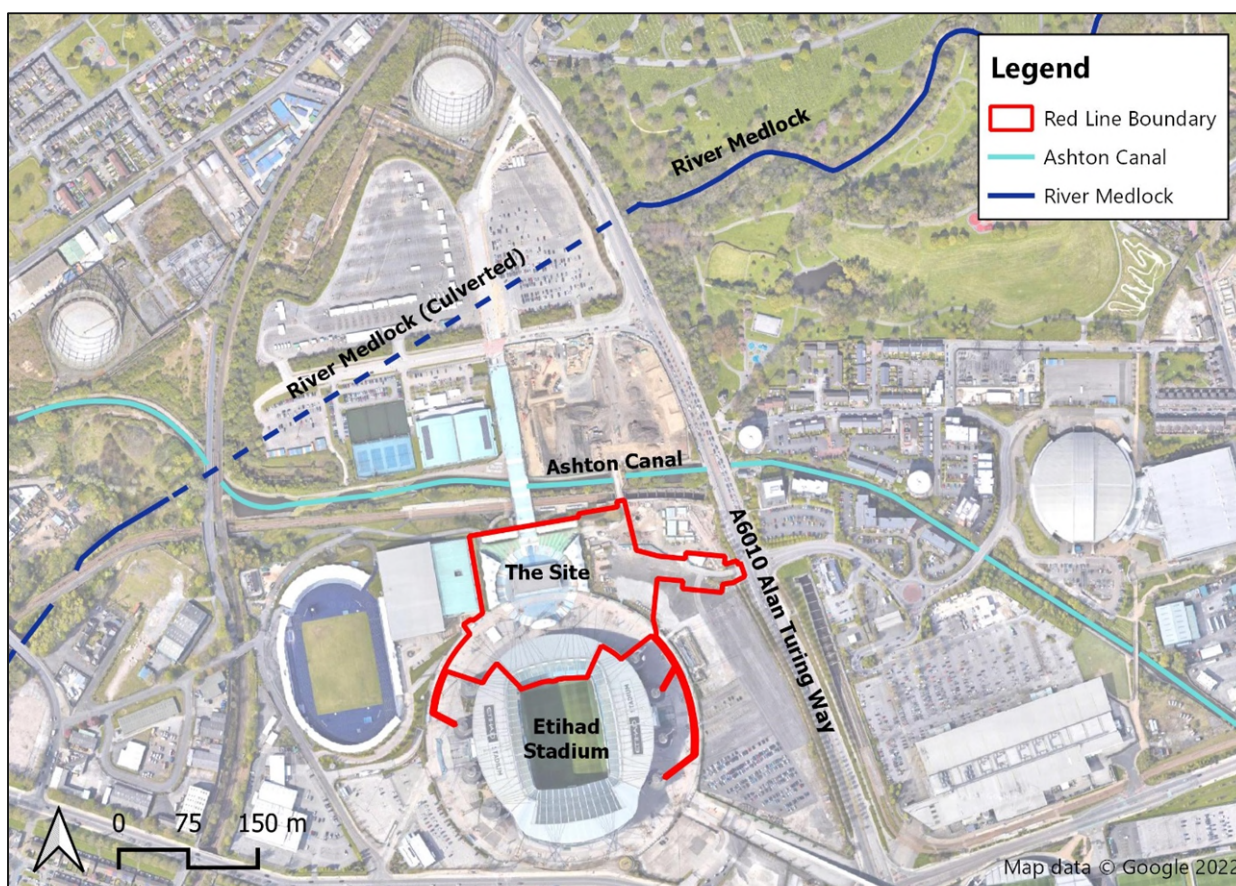


Figure 2—1 Site boundary and key locations. Map data © Google 2022

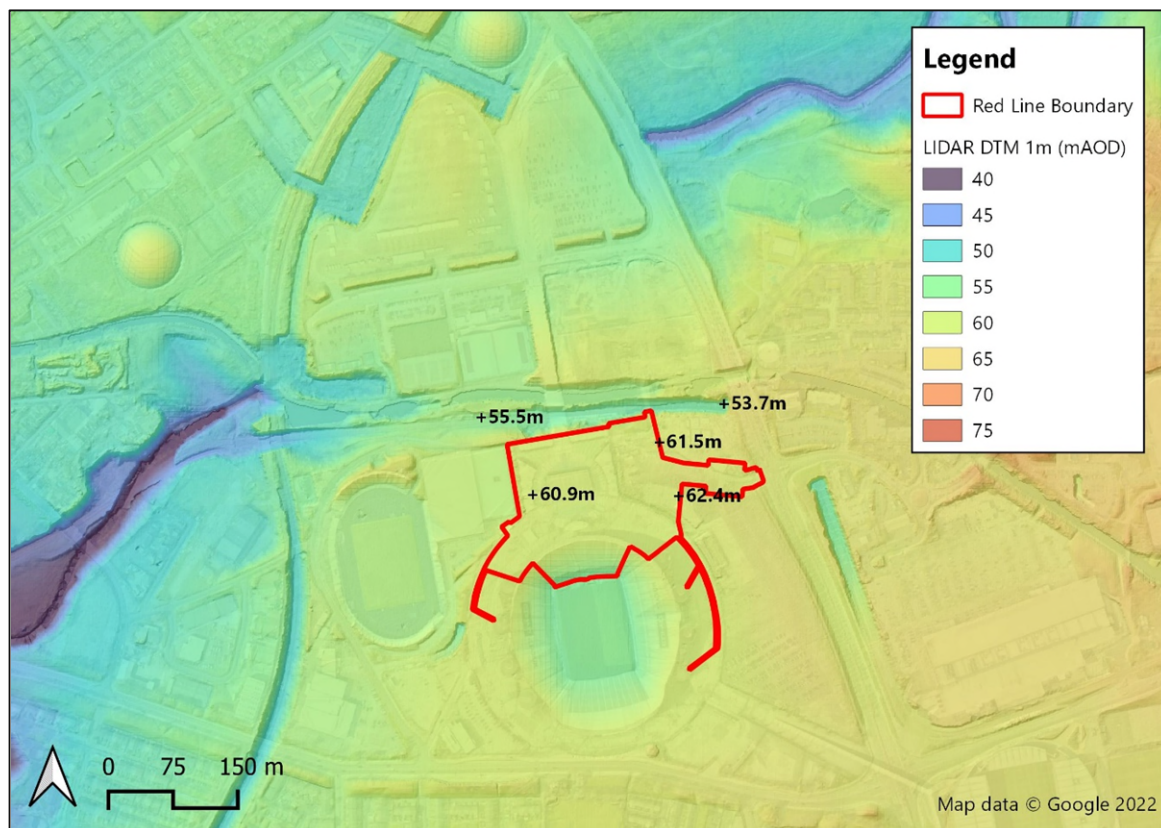


Figure 2—2 Environment Agency LIDAR DTM 1m data (2019) with key site levels. © Environment Agency Copyright and / or database right 2022. All rights reserved. Map data © 2022 Google

The closest natural watercourse is the River Medlock, which passes through a culvert approximately 170m north of the site. The site is located within Flood Zone 1, an area at low probability of flooding (<0.1% annual exceedance probability). It is situated within the Manchester, Salford and Trafford Critical Drainage Area (CDA), as designated in 2011.

The site is not within, and does not contain, any ecological designations. However, it should be noted that the Ashton Canal, 35m to the north of the site boundary, is a non-statutory designated Site of Biological Importance (SBI), protected under national and local planning policy.

2.3 Proposed Development

The Proposed Development consists of alterations to the Etihad Stadium, increasing the overall capacity of the north stand. North of the Stadium, two new buildings will be constructed, one will be a hotel and the other a workspace with a football museum and enhanced City Shop. A covered fan zone area referred to as City Square will also be provided as part of the proposals. The formal description of the Proposed Development and further detail on the proposals can be found in the planning statement and planning application form, both of which accompany the planning application.

The proposed level of the main concourse is +60.550m with the ground floor at +61.050m Above Ordnance Datum (AOD). The proposed ground floor general arrangement, and north elevation be seen in Figure 2—3 and Figure 2—4.

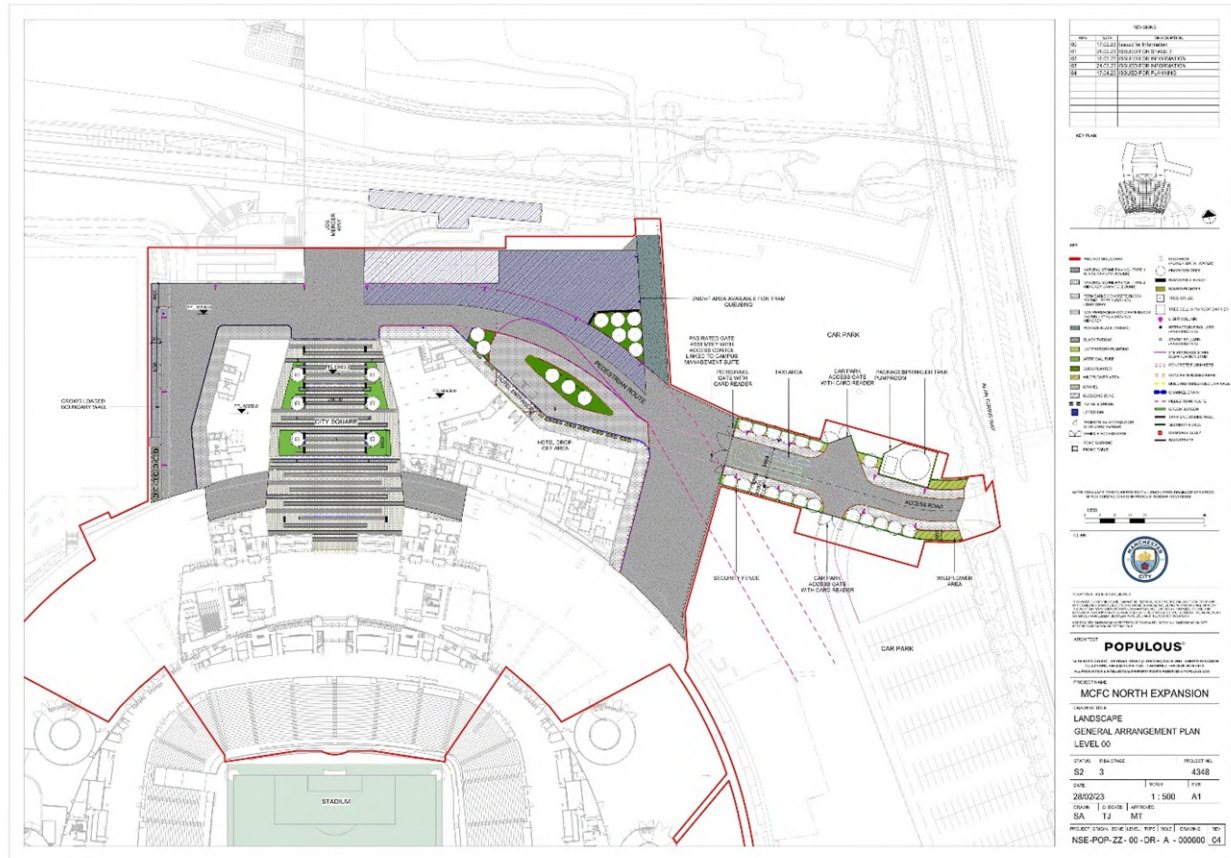


Figure 2—3 General arrangement plan of the Proposed Development, Level 0. (NSE-POP-ZZ-00-DR-A-00600-03 Populous 28.02.23)

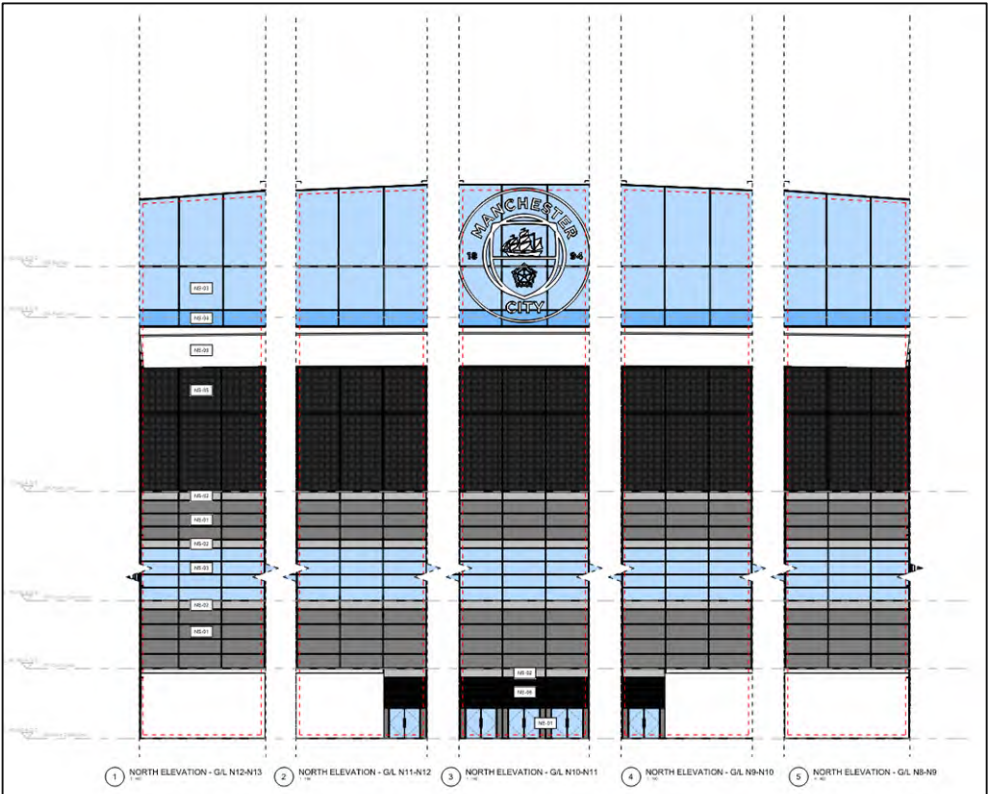


Figure 2—4 North elevation of Proposed Development, with main concourse level L00 at +60.550mAOD. (Populous 10.10.22)

3 Planning Context

3.1 Overview

This site-specific FRA has been prepared in accordance with the policies and guidance applicable to the Proposed Development outlined within the following publications:

- National Planning Policy Framework (March 2012, revised July 2021);
- Planning Practice Guidance; Flood Risk and Coastal Change (August 2022);
- Flood Risk Assessments: Climate Change Allowances (February 2016, updated February 2017);
- Manchester's Local Development Framework, Core Strategy (July 2012);
- Manchester City, Salford City and Trafford Councils Level 1 SFRA (March 2010); and
- Manchester City, Salford City and Trafford Councils Level 2 SFRA (March 2011).

3.2 National Planning Policy Framework

The NPPF sets out the Government's planning policies for England and how these should be applied. It provides a framework within which people and councils can develop local plans and neighbourhood plans, which contribute to the achievement of sustainable development. It defines flood risk and aims to avoid development in areas most vulnerable to flooding. This is attained through the implementation of a Sequential Test, which directs development towards areas with lowest flood risk. Where this is not possible, the NPPF requires that all new developments in flood risk areas are appropriately flood resilient and resistant, include safe access and egress routes where required and that residual risks of flooding are adequately managed.

The NPPF Technical Guidance provides a number of tables aiding the identification of the degree of risk of flooding to a development. These tables provide a land use classification appropriate to the flood risk and the requirements of an FRA within each zone. Specific land use types to each flood risk vulnerability classification are also provided. The proposed land use is an entertainment venue, retail, restaurants, work space and a hotel. The hotel is classed as *More Vulnerable* under the NPPF, and the remaining uses proposed are considered to be *Less Vulnerable*.

For each flood zone and flood risk vulnerability classification, the NPPF categorises where development is appropriate and whether the Exception Test is required. Where the Exception Test is required, development may only be permitted if it can show to provide wider sustainability benefits that outweigh flood risk without increasing the risk of flooding elsewhere.

3.2.1 Flood Zone Assessment

The flood zones refer to the probability of river and sea flooding without the inclusion of flood defences. The NPPF aims to avoid inappropriate development in areas at highest risk of flooding. The Planning Practice Guidance to the NPPF contains a series of tables that help identify the risk of flooding to a development. These tables are duplicated in Appendix B to Appendix D of this FRA.

- Table 1 (Appendix B) defines four Flood Zones by flood risk, gives the land use classification appropriate to the flood risk and specifies the requirements of an FRA within each zone;
- Table 2 (Appendix C) identifies where development is appropriate for each flood risk vulnerability classification and whether the Exception Test is required: and
- Annex 3 (Appendix D) identifies specific land use types for each flood risk vulnerability classification given in Table 1. For example, hospitals and residential buildings are classified as more vulnerable.

The Flood Zones defined in the NPPF are as follows:

- Flood Zone 1** Low Probability:
< 1 in 1,000 annual probability of river or sea flooding in any given year (<0.1% Annual Exceedance Probability (AEP)).
- Flood Zone 2** Medium probability:
Between 1 in 100 and 1 in 1,000 annual probability of river flooding in any year (1% - 0.1% AEP); or
Between 1 in 200 and 1 in 1,000 annual probability of sea flooding in any year (0.5% - 0.1% AEP).
- Flood Zone 3a** High probability:
> 1 in 100 annual probability of river flooding in any year (>1% AEP); or
> 1 in 200 annual probability of sea flooding in any year (>0.5% AEP).
- Flood Zone 3b** Functional floodplain:
> 1 in 20 annual probability of flooding in any year (5% AEP).

3.2.2 Climate Change

Allowances for the predicted effects of climate change should be taken into account when preparing site-specific flood risk assessments. The guidance¹ published by the EA to support the NPPF contains sensitivity ranges that are recommended to be applied to peak rainfall intensities, peak river flows, sea level rise, offshore wind speeds and extreme wave heights. The general trend is for each parameter to increase in the future, which in turn increases the risk of flooding to any site. The site falls within the Irwell Management Catchment, and the allowances for peak rainfall intensity are given in Table 3—1.

Table 3—1 Climate change allowances for peak rainfall intensity¹

	3.3% AEP		1% AEP	
Allowance Category	'2050s'	'2070s'	'2050s'	'2070s'
Upper End	35%	40%	40%	45%
Central	25%	30%	25%	30%

It is recommended by the EA that both the central and upper end allowances are assessed in order to understand the

¹ Environment Agency. 2022. *Flood Risk Assessments: Climate Change Allowances*. [online] Available at: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances> [Accessed 19 October 2022].

range of the impact. The guidance further notes that the following considerations be made in order to decide which allowances are used to inform the flood risk management strategy for a development:

- Likely depth, speed and extent of flooding for each allowance of climate change over time considering the allowances for the relevant epoch (2020s, 2050s and 2080s);
- Vulnerability of the proposed development types or land use allocations to flooding;
- 'Built in' resilience measures used, for example, raised floor levels; and
- Capacity or space in the development to include additional resilience measures in the future, using a 'managed adaptive' approach.

The Proposed Development is considered to be at the upper end and the design life of the building is more than 50 years. The Drainage Strategy, also prepared by Buro Happold, has therefore made an allowance for a 45% increase in peak rainfall intensity.

3.3 Strategic Flood Risk Assessment

Manchester City Council (MCC) are the Lead Local Flood Authority (LLFA) for the Proposed Development. A two level Hybrid SFRA was produced in conjunction with Salford City and Trafford Councils due to the intricate and well-connected network of rivers, streams, sewers and canals within Greater Manchester. This includes both the Level 1 SFRA (2010) and Level 2 SFRA (2011).

These reports consider flooding from fluvial, tidal, surface water, groundwater, sewers and artificial sources for the whole Manchester area. They summarise existing and proposed flood risk management whilst outlining recommendations relating to local and national policy on flooding and development. Findings from the SFRAs have been considered within this assessment and the following items are highlighted for consideration:

- Sustainable Drainage Systems (SuDS) are the preferred method for managing the surface water flood run off for developed sites and managing the associated risk. These should be considered using the SuDS hierarchy; and
- Development should not increase flood risk on the site or elsewhere.

3.4 Manchester Core Strategy

The Core Strategy 2012-2027 was adopted in July 2012 to guide development within Manchester. It sets out the long-term strategic policies for Manchester's future development and will form the framework that planning applications will be assessed against.

Policy EN8 describes the expected measures to be taken to ensure development is adaptable to climate change. These include minimisation of flood risk by appropriate siting, drainage, and treatment of surface areas to ensure rain water permeability and provision of linked and diverse green infrastructure.

Policy EN14 focuses on reduction of flood risk and references PPS25 (now superseded by the NPPF PPG Flood Risk and Coastal Change). In addition, all new development should minimise surface water run-off, including through SuDS. Where feasible and appropriate, developments should seek to open up culverted sections of river to reduce flood risk and any danger of collapse.

Policy EN17 addresses water quality. Development should minimise surface water run-off from development and associated roads and maximise the use of SuDS.

3.5 Consultations

The EA has been consulted for pre-application advice. This response is included in Appendix A. The response confirms that the site is located within Flood Zone 1 and is therefore considered by the EA to be at low risk of flooding. No particular areas of concern were identified. The EA also provided links to the Government's 'Open Data' for access to flood risk information.

4 Appraisal of Flood Risk

4.1 National Planning Policy Framework

4.1.1 Flood Zone

The Flood Map for Planning produced by the EA shows that the site is located entirely within Flood Zone 1. The risk of flooding from rivers or the sea in Flood Zone 1 is classified as low, with an AEP of less than 0.1% or 1 in 1000 years. In accordance with EA guidance, the focus of this FRA will therefore be on the management of surface water run-off and the risk of flooding from other sources.

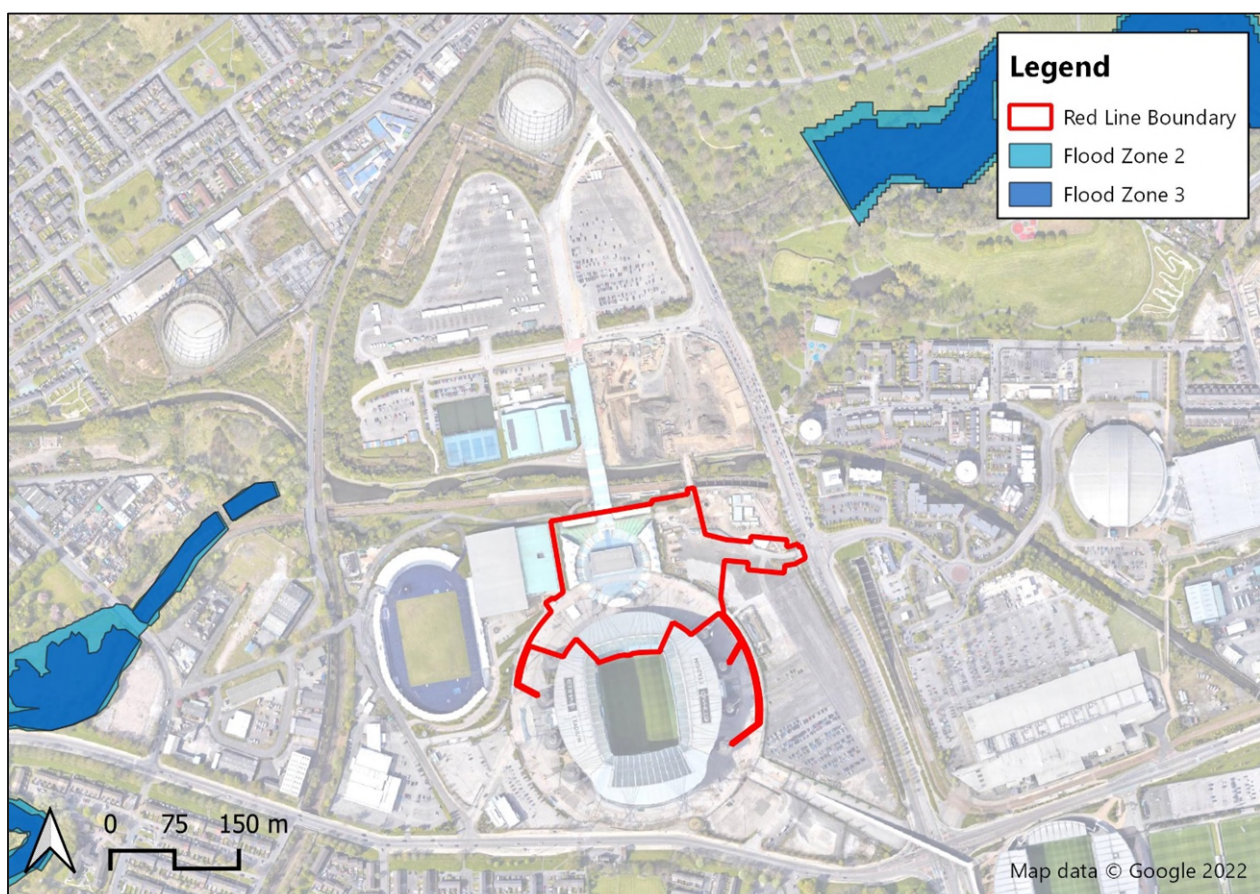


Figure 4—1 Environment Agency Flood Zone map showing the site. © Environment Agency and / or database rights 2021. All rights reserved. (Accessed 2nd November 2022). Map data © Google 2022

4.1.2 Flood Risk Vulnerability Classification

The NPPF Planning Practice Guidance contains a series of tables which identify where development should be permitted, based on the Flood Zone in which the development is located and the proposed uses of that development. These tables are included in Appendices B, C and D of this FRA.

The Proposed Development includes retail, a hotel, workspace, leisure and entertainment spaces. The proposed land uses in the Proposed Development are therefore classified as either *Less Vulnerable* or *More Vulnerable* within the NPPF, with the hotel classified as *More Vulnerable* and all other uses *Less Vulnerable*.

These land uses are considered compatible with Flood Zone 1, in accordance with Table 2 of the Planning Practice Guidance and the Exception Test is not required.

4.2 Historic Flood Events

Records of historic flooding are useful for looking at the sources, seasonality, frequency and intensity of flooding. Although historic records can be incomplete, they provide useful background information. The site location is not within the Environment Agency's recorded historic fluvial flood extent, and the nearest recorded historical fluvial flood event was located over 3km from the site. The SFRA does not note any historic flood events for the area of interest.

4.3 Fluvial and Tidal Flooding

Fluvial flooding occurs when sustained or intense rainfall events increase the flow in rivers causing the water level to rise above the level of the banks and into the surrounding areas.

Tidal flooding occurs when particularly high tides coincide with storm surges. Storm surges are caused by low atmospheric pressure events resulting in temporary localised raising of sea levels.

The flood zone map produced by the EA shows that the site is located entirely in Flood Zone 1 (refer to Figure 4—1). The River Medlock is heavily modified and culverted through the Etihad Campus to the north of the site. Flood Zone 1 is defined as a low probability of fluvial or tidal flooding, with less than a 1 in 1000 year annual probability (<0.01% AEP) of flooding. The risk of fluvial and tidal flooding is therefore considered *low*.

In the event of a blockage in the culverted section of the River Medlock, from inspection of 1m LiDAR data, flows would back up at the upstream end of the culvert, flooding Phillips Park. If levels were sufficient to overtop Alan Turing Way, water may spread along the road. It is not anticipated that this would pose a risk to the site.

4.4 Surface Water Flooding

Surface water flooding occurs when intense rainfall is unable to naturally soak into the ground due to impermeable ground covering such as concrete or tarmac, or low permeability ground conditions preventing infiltration. This excess surface water can flow through built-up areas and open space and pond in lower-lying areas causing localised flooding.

4.4.1 Baseline

The surface water flood map produced by the EA (Figure 4—2) indicates that the majority of the site is classified as having a low or very low probability of surface water flooding. The areas considered to be at low risk of surface water flooding include the radial footway around the Etihad Stadium, and the vehicular access to the Proposed Development at Gibbon Street / Alan Turing Way. Where there are areas of low risk, the surface water drainage strategy will take measures to reduce this risk.

It should be noted that outside the site boundary, south of the proposed access point on Alan Turing Way, there is an area of medium / high surface water flood risk. This is in the location of a depression in the road profile; therefore, is not considered to pose a direct flood risk to the site. However, vehicle site access from Alan Turing Way may be

affected in a high order event. In the event of surface water flooding on Alan Turing Way, emergency or operational access can utilise alternative routes, such as from the bridge to the north, or from the south east of the Etihad Campus.

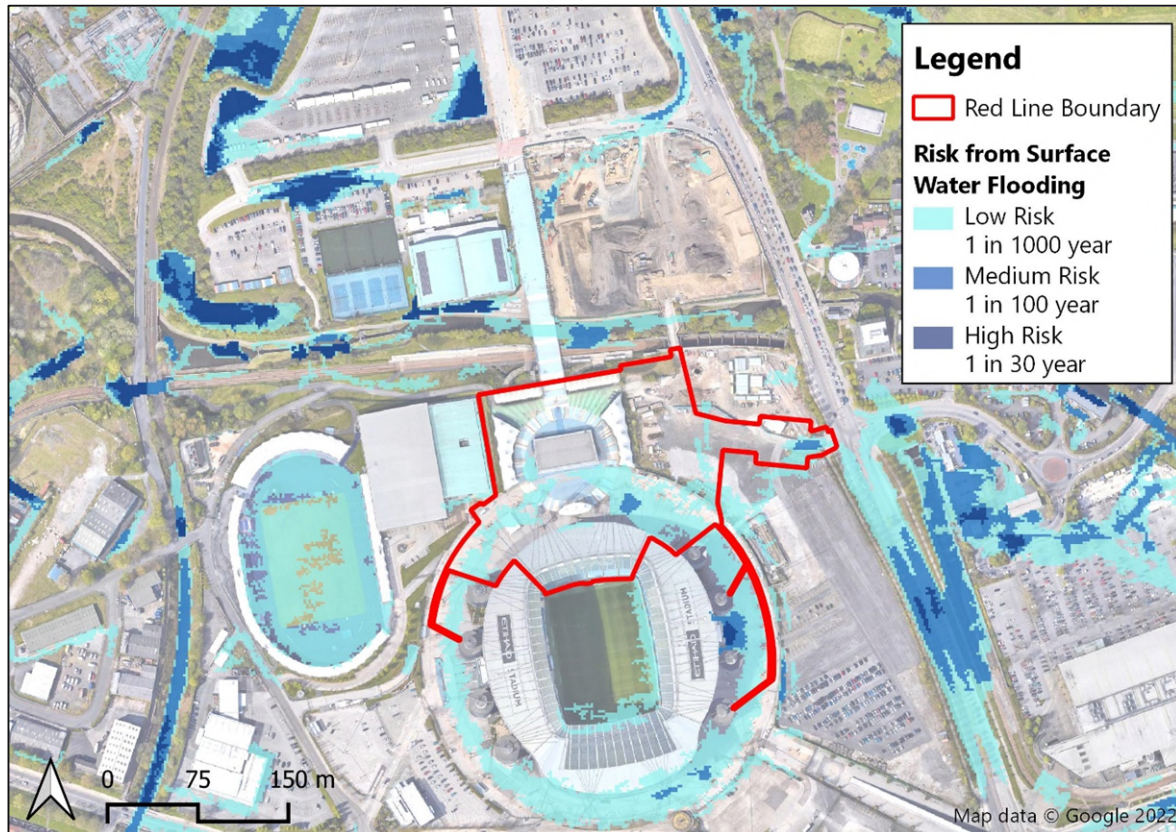


Figure 4—2 Flood Map showing surface water flooding extents. © Crown Copyright 2019. All rights reserved. © Google 2022

Of the site area, 2.46ha can be considered existing positively drained hardstanding and buildings, of which 1.87ha is proposed to be modified and 0.59ha is to remain unchanged. The gravel car park area is not currently positively drained and is therefore considered as greenfield land.

The current surface runoff discharge rate has been calculated to be 70.50l/s.

4.4.2 Proposed

Under the proposed Surface Water Drainage Strategy, the surface water drainage system is designed to limit the discharge rate to 38.2l/s, meeting the requirement of the Manchester, Salford and Trafford SFRA to reduce brownfield runoff rates by 50%.

This will be met through the consideration of SuDS features such as permeable paving, bioretention systems, rain gardens, tree pits and geocellular storage systems. This can be seen in Figure 4—3.

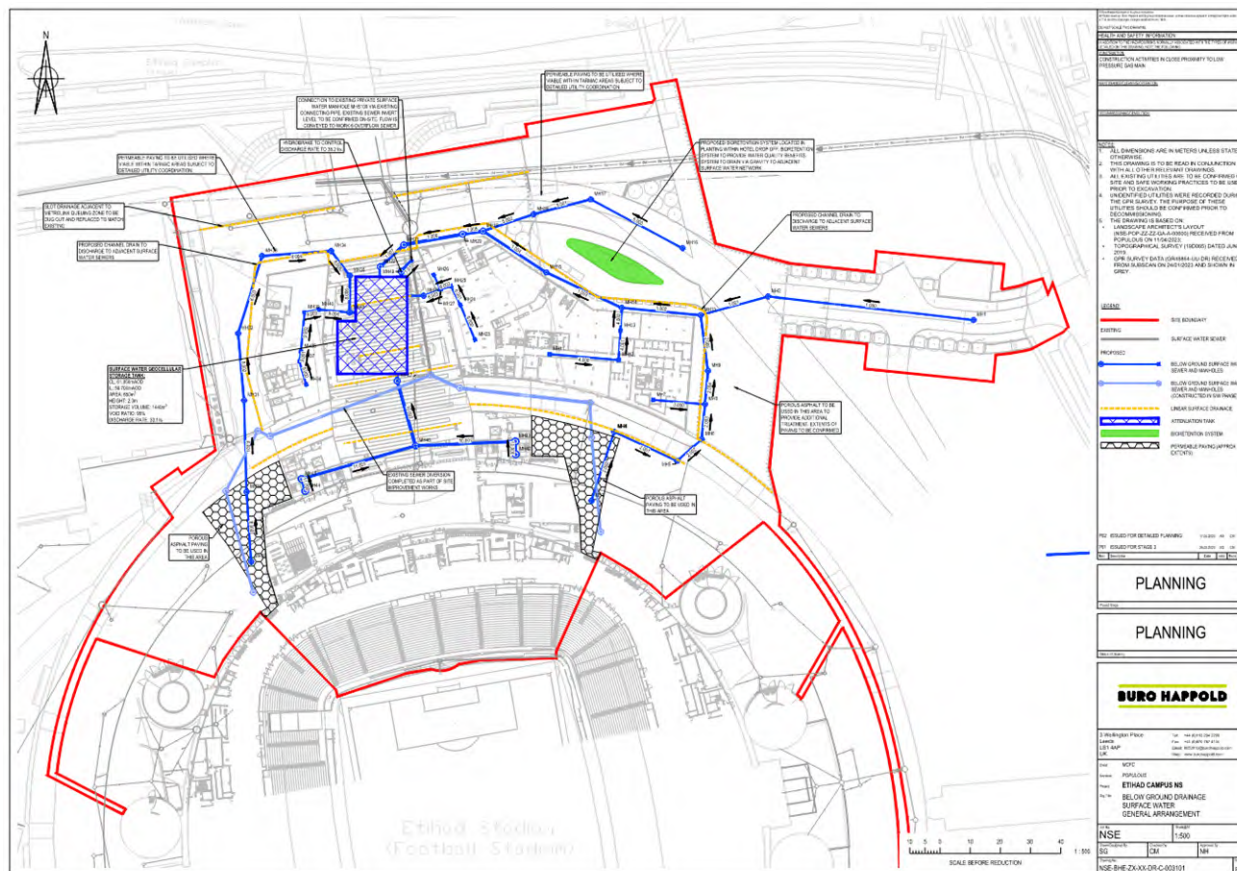


Figure 4—3 Plan showing proposed drainage strategy. (NSE-BHE-ZX-XX-DR-C-003101, Buro Happold 17.04.23)

The surface water drainage strategy will drain areas from hardstanding areas and buildings to geocellular storage tanks, prior to being discharged at the allowable rate. Permeable paving will be used where possible to provide attenuation and delay peak flows from site. This strategy will provide an attenuation volume of 1440m³ in order to achieve this. For further details, refer to the Surface Water Drainage Strategy, included in Appendix 8.2 of the ES which accompanies this planning application.

An overview of the proposed surface water drainage strategy can be seen in Table 4—1.

Table 4—1 Summary of drainage strategy

	Catchment Area (ha)	Proposed Peak Discharge Rate (l/s)	Approximate Total Storage Volume (m ³)
Etihad North Stand Development	2.48	38.2	1440

With this strategy in place, the flood risk from surface water is considered to be low.

4.5 Flooding from Sewers

4.5.1 Baseline

There is an intricate and well-connected network of rivers, streams, sewers and canals within Greater Manchester, however limited information exists in the SFRA regarding flooding from sewers. The site location is not within an area highlighted as at risk from flooding from sewers.

Information obtained from Unities Utilities indicated the following sewers within the vicinity of the site:

- An 850mm diameter surface water sewer running east to west through the north of the site;
- An 900mm diameter combined sewer running from south to north on the east side of the site;
- An 375mm diameter concrete sewer running from south to north on the west side of the site; and
- An 375mm diameter vitrified clay sewer and a 550-950mm running along the northern boundary of the site.

4.5.2 Proposed

The foul water drainage strategy will comprise a traditional gravity drainage network connecting to the existing United Utilities sewer running along the north boundary of the site, to a proposed outfall at MH 7701. The connection to the existing sewer system and capacity to receive flows from site is subject to the approval of the relevant authorities.

With this foul water drainage strategy, the surface water drainage strategy, and the necessary approvals in place, the risk of flooding from sewers to the site is considered *low*.

4.6 Flooding from Groundwater

Groundwater flooding generally occurs in low-lying areas above permeable rock aquifers where the water table meets and rises above the ground surface. The risk of groundwater flooding to basements and other below surface infrastructure can be mitigated with the installation of embedded retaining walls/ waterproofing.

The Level 2 SFRA includes a study of the areas susceptible to groundwater flooding (GW_2.1), based on data from the Coal Authority, British Geological Survey and Defra Groundwater Emergence Mapping². From this, the site is not located in an area that is considered susceptible to groundwater flooding. As described in the Ground Engineering Desk Study (see Appendix 9.1 of the ES), there is limited groundwater data available for the site, and hence further monitoring was recommended to derive a groundwater level. This monitoring is ongoing, and the results will be used to inform the assessment of groundwater flood risk when available. However, baseline groundwater levels were obtained from a neighbouring site (the former gas works to the north), which recorded groundwater within the coal strata between +37 and +39mOD (compared to site levels of over +60mOD).

Therefore, the baseline risk of groundwater flooding is considered to be low, to be confirmed when the ongoing groundwater monitoring is complete.

4.7 Minewater Rebound

Minewater rebound could be a potential groundwater flooding issue at historic mine workings. It occurs when groundwater levels rise following cessation of mine dewatering and the Coal Authority is responsible for monitoring the levels. According to the Level 1 SFRA (2010), *'the Coal Authority considers minewater levels in Manchester, Salford*

² Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA – Groundwater Flooding. Map no. GW_2.1. February 2011.

and Trafford to have recovered or almost recovered. Some areas are likely to experience slight rebound, but the effects of this will be minimal.'

Therefore, it is considered that the risk of flooding from minewater rebound is very low.

4.8 Flooding from Artificial Sources

Artificial sources include ponds, lakes, canals, and reservoirs. These can flood in the event of a structural failure or during peak storm events. The failure of an artificial source of water has the potential to cause catastrophic damage to its surroundings due to the sudden release of large volumes of water. However, the likelihood of such a failure occurring is extremely low. The site is not located downstream of any reservoirs, and the EA flood extent maps suggest no flood risk from reservoirs, as in Figure 4—4.

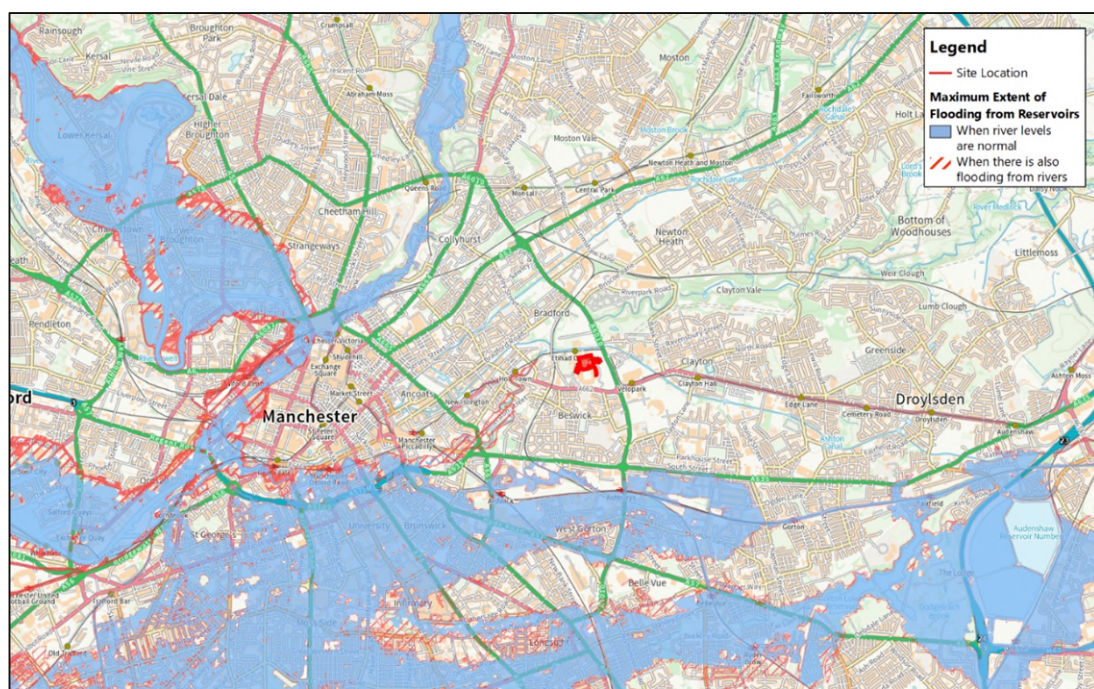


Figure 4—4 Maximum extent of flooding from reservoirs. © Environment Agency and / or database rights 2021. All rights reserved. (Accessed 5th January 2023)

Ashton Canal passes close to the north boundary of the site. Ashton Canal is a broad canal, meaning that it is a controlled water body with a regulated flow. Ashton Canal is considered to have residual risks associated with lower probability events such as breaching and the site area is identified at potential risk of canal flooding in the SFRA, as in Figure 4—5.

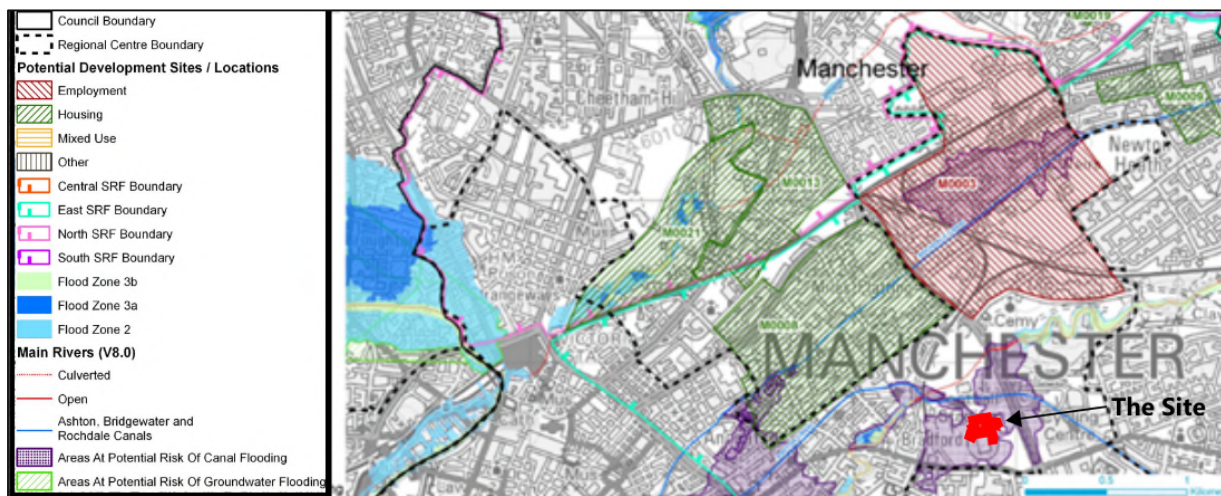


Figure 4—5 Areas at risk of flooding from Canals or Groundwater. Extracted from Level 2 SFRA (March 2011). © Crown Copyright. All rights reserved

The residual risks on the Ashton Canal are considered to be overtopping or breaching. This may occur as a result of high inflows to the canal during flood conditions, or a blockage in the canal. The SFRA considers the probability of this to be very low due to continued canal maintenance by Canal and Rivers Trust. It is also acknowledged that breach flood extent is limited by the volume of water held between locks. For Ashton Canal, this is considered to be relatively small, as pound lengths are shorter than for other canals in the city.

As part of the Manchester City, Salford City and Trafford Councils' Level 2 SFRA, a breach of both the Ashton and Rochdale canals were modelled. A 1D-2D model was used to set out the areas which may be at risk in a breach event. From this model, the site was identified as being located in 'Canal Breach Zones A and B', signifying that it is at potential risk of flooding in the event of a breach. However, due to the large scale of the model, it is likely that the details of the site are not reflected in the topography of the model. The breach volumes modelled also use a pound length of 1.3km, representing the average length along the Ashton Canal. Adjacent to the site, the canal surface elevation rapidly increases, with pound lengths of 60m and 250m, meaning the volume of water from an overtopping event would be significantly less than that modelled for the SFRA.

The adjacent stretch of canal has three locks increasing the surface elevation from 53m to 60m from west to east. The site is located at levels exceeding 60.5mAOD. From inspection of the 1m resolution LiDAR data available from the EA, between the site and the canal, a tram line passes at a level of 54-55mAOD. This can be seen in Figure 4—6.

In the event of a breach of the canal lengths with surface elevations at 53m or 56m, the site is located significantly higher than the surface, and any breach would flow onto the adjacent tram lines. In the event of a breach from the east section of canal, at 60m, any flow from the canal towards the site would be intercepted by the tram lines, located at a significantly lower elevation than the site, and distributed along the tram line. The flow would follow the tram lines, either to the east under Alan Turing Way, or west, draining back into the canal. Therefore, contrary to the breach mapping, the site would only be affected if water depths were high enough to overtop the retaining wall of the tram lines, which is approximately 6m high. This is extremely unlikely given the relatively small volume of water held within a pound length.

For this reason, the risk of flooding from canals is considered to be low.



Figure 4—6 Levels between the Ashton Canal and the site.

5 Summary and Conclusion

This Flood Risk Assessment has been prepared by Buro Happold on behalf of Manchester City Football Club to support the planning application for the Proposed Development at the Etihad Stadium. The assessment has taken the following current and future sources of flooding into consideration: tidal, fluvial, groundwater, artificial sources, surface water and sewers. The assessment has found that there is very low risk of flooding from tidal or fluvial sources and low risk from groundwater, artificial sources, sewer or surface water flooding.

The Surface Water Drainage Strategy has led to a reduction in the overall flood risk to the site by providing a range of attenuation features that reduce runoff to the rate of 38.2l/s. This represents a reduction of 50% of the brownfield runoff compared to the existing estimated 70.50l/s, which will be achieved using 1440m³ of onsite attenuation. The Foul Water Drainage Strategy also manages risk from sewer flooding by limiting discharge to the sewer networks.

Based on available information from adjacent sites, desk study, and ground investigation, the risk of groundwater flooding is considered to be low. See Appendix 9.1 of the ES for further detail.

This FRA demonstrates that, through the careful design of the Proposed Development, the risk of flooding is reduced where possible and the Proposed Development is safe from flooding for its design lifetime. The Proposed Development will not lead to increased flood risk off-site and will reduce the surface water discharge compared to the existing condition.

It is concluded that the Proposed Development has a low risk of flooding and no significant adverse impact to sites elsewhere.

Appendix A Correspondence

Buro Happold
17 Newman Street
London
W1T 1PD

Our ref: SO/2022/122602/01-L01
Your ref: 221020/msr07
Date: 21 October 2022

FAO: Katie Lenton (Buro Happold)

Dear Katie

EA Pre-Application Preliminary Opinion Request

Etihad Stadium, Manchester, M11 3FF NGR: SJ86800 98700

Thank you for requesting pre-application/ preliminary advice and guidance from the Environment Agency (EA) for the development/extension proposal outlined above. This request for advice was initial received by the EA on the 17th October 2022.

To inform response below, we have undertaken a review of the external submissions (detailed below) provided in association with EA's environmental constraint mapping:

- Etihad North Stand Location Plan PDF. Undated.
- Etihad Pre-Application / Preliminary Opinion Request Form. Form Reference: 0053810. Undated.

Please note that as part of this free preliminary advice and guidance service we are unable to provide you with review of any site-specific documentation or detailed site-specific technical advice and guidance. However, this can be accessed via our chargeable pre-application planning advice service. See letter section '*EA Chargeable Planning Advice Service*' below for further details regarding this.

Flood Risk

Please note that we are only able to provide detailed advice and guidance on matters associated with fluvial and tidal flooding. Wider advice and guidance on other forms of flooding (e.g. surface water flooding) should be sought from the Lead Local Flood Authority in the first instance.

A check of the location of the proposed development against EA held mapping confirms that the proposed development is situated within wholly within an area formally designated as 'Flood Zone 1' (lower risk of flooding).

We have produced a series of standard comments for local planning authorities and planning applicants to refer to on 'lower risk' development proposals known as our

Environment Agency
Richard Fairclough House Knutsford Road, Warrington, WA4 1HT.
Customer services line: 03708 506 506
www.gov.uk/environment-agency
Cont/d..

Flood Risk Standing Advice (FRSA). Our FRSA replaces the need for direct consultation with the EA for this aspect of a development.

From the location plan provided, it is evident that the development area will in exceedance of 1ha. In accordance with paragraph 167 (footnote 55) of the National Planning Policy Framework (NPPF) we advise such forms of development should be accompanied by a Site-Specific Flood Risk Assessment (FRA). Our FRSA can be viewed at: <https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications#when-to-follow-standing-advice>

We do not prepare or provide FRAs. However, our Customers and Engagement teams can provide any relevant flood risk information that we have available. To request any information held by the EA for the development site, please contact: InfoRequests.GMMC@environment-agency.gov.uk.

The planning authority should have undertaken a Strategic Flood Risk Assessment (SFRA) which will also include local flood risk information to inform your FRA. Please contact your local planning authority to determine what information is available.

Further advice on what to include in an FRA can be found at <https://www.gov.uk/guidance/flood-risk-and-coastal-change#site-specific-flood-risk-assessment-all>

For all forms of new development whereby avoidance of flood risk cannot be achieved we strongly recommend the use of flood resistance and resilience measures. Physical barriers, raised electrical fittings and special construction materials are just some of the ways you can help reduce flood damage.

To find out which measures will be effective for this development, please contact your building control department. If you'd like to find out more about reducing flood damage, visit the Flood Risk and Coastal Change pages of the planning practice guidance.

Further guidance on flood resistance and resilience measures can also be found in:

- *Government guidance on flood resilient construction*
<https://www.gov.uk/government/publications/flood-resilient-construction-of-new-buildings>
- *CIRIA Code of Practice for property flood resilience*
https://www.ciria.org/Research/Projects_underway2/Code_of_Practice_and_guidance_for_property_flood_resilience.aspx
- *British Standard 85500 – Flood resistant and resilient construction*
<https://shop.bsigroup.com/ProductDetail/?pid=000000000030299686>

Contaminated Land & Groundwater Resources

From a check of EA held constraint mapping and the provided preliminary opinion request form we note the following:

- The development site is situated above Secondary A aquifer and adjacent to the Ashton Canal - sensitive controlled water receptors.
- The proposed development area is known to be in associated with colliery works.

Where land contamination is known or suspected we recommend that developers should:

- Follow the risk management framework provided in [Land Contamination: Risk Management](#), when dealing with land affected by contamination
- Refer to our [Guiding principles for land contamination](#) for the type of information that we require in order to assess risks to controlled waters from the site - the local authority can advise on risk to other receptors, such as human health
- Consider using the [National Quality Mark Scheme for Land Contamination Management](#) which involves the use of competent persons to ensure that land contamination risks are appropriately managed
- Refer to the [contaminated land](#) pages on gov.uk for more information

Dewatering is the removal/abstraction of water (predominantly, but not confined to, groundwater) in order to locally lower water levels near the excavation. This can allow operations to take place, such as mining, quarrying, building, engineering works or other operations, whether underground or on the surface.

The dewatering activities on-site could have an impact upon local wells, water supplies and/or nearby watercourses and environmental interests.

This activity was previously exempt from requiring an abstraction licence. However, since 1 January 2018, most cases of new planned dewatering operations above 20 cubic metres a day will require a water abstraction licence from us prior to the commencement of dewatering activities at the site. More information on this topic is available on gov.uk: <https://www.gov.uk/guidance/water-management-apply-for-a-water-abstraction-or-impoundment-licence#apply-for-a-licence-for-a-previously-exempt-abstraction>

Waste Material

The CL:AIRE Definition of Waste: Development Industry Code of Practice (version 2) provides operators with a framework for determining whether or not excavated material arising from site during remediation and/or land development works is waste or has ceased to be waste. Under the Code of Practice:

- Excavated materials that are recovered via a treatment operation can be reused on-site providing they are treated to a standard such that they are fit for purpose and unlikely to cause pollution
- Treated materials can be transferred between sites as part of a hub and cluster project
- Some naturally occurring clean material can be transferred directly between sites

Developers should ensure that all contaminated materials are adequately characterised both chemically and physically, and that the permitting status of any proposed on-site operations are clear.

For further guidance on this topic, please refer to:

- The [position statement](#) on the Definition of Waste: Development Industry Code of Practice

- The [waste management](#) page on GOV.UK

The Environmental Protection (Duty of Care) Regulations 1991 for dealing with waste materials are applicable to any off-site movements of wastes.

The code of practice applies to you if you produce, carry, keep, dispose of, treat, import or have control of waste in England or Wales.

The law requires anyone dealing with waste to keep it safe and make sure it's dealt with responsibly and only given to businesses authorised to take it.

- The code of practice can be found here: <https://www.gov.uk/government/consultations/waste-duty-care-code-practice-2016>
- If you need to register as a carrier of waste, please follow the instructions here: <https://www.gov.uk/register-as-a-waste-carrier-broker-or-dealer-wales>

Surface Water Drainage

We note no details have been provided as part of preliminary opinion request form as to how disposal of surface water will be achieved.

Approved Document Part H of the Building Regulations 2010 establishes a hierarchy for surface water disposal, and encourages a SuDS approach.

The first option for surface water disposal should be the use of SuDS, which encourage infiltration such as soakaways or infiltration trenches. In all cases, it should be established that these options are feasible, can be adopted and properly maintained and would not lead to any other environmental problems. For example, using soakaways or other infiltration methods on contaminated land carries groundwater pollution risks and may not work in areas with a high water table.

Where the intention is to dispose to soakaway, these should be shown to work through an appropriate assessment carried out under Building Research Establishment (BRE) Digest 365.

Further information on SuDS can be found in:

- the CIRIA C697 document SuDS manual
- HR Wallingford SR 666 Use of SuDS in high density developments
- CIRIA C635 Designing for exceedance in urban drainage – good practice
- the Interim Code of Practice for Sustainable Drainage Systems – the Interim Code of Practice provides advice on design, adoption and maintenance issues and a full overview of other technical guidance on SuDS

Foul Drainage

We note no details have been provided as part of preliminary opinion request form as to how disposal of foul water will be achieved.

Government guidance contained within the national Planning Practice Guidance (Water supply, wastewater and water quality – considerations for planning applications, paragraph 020) sets out a hierarchy of drainage options that must be considered and discounted in the following order:

1. Connection to the public sewer
2. Package sewage treatment plant (adopted in due course by the sewerage company or owned and operated under a new appointment or variation)
3. Septic Tank

Foul drainage should be connected to the main sewer. Where this is not possible, under the Environmental Permitting Regulations 2016 any discharge of sewage or trade effluent made to either surface water or groundwater will need to be registered as an exempt discharge activity or hold a permit issued by the Environment Agency, additional to planning permission. This applies to any discharge to inland freshwaters, coastal waters or relevant territorial waters.

Please note that the granting of planning permission does not guarantee the granting of an Environmental Permit.

EA Chargeable Planning Advice Service

Prior to making a formal planning application, should you wish us to review any technical documents or want further advice to address environmental associated with the development proposal (within EA remit), then we may do this as part of our charged for planning advice service.

Further engagement will provide you with the opportunity to discuss and gain our views on potential options before formally submitting further information as part of your planning application. It should also result in a better quality and more environmentally sensitive development.

As part of our charged for service we will provide a dedicated project manager to act as a single point of contact to help resolve any problems. We currently charge £100 per hour, plus VAT. We will provide you with an estimated cost for any further discussions or review of documents. The standard terms of our charged for service are available [here](#).

If you would like more information on our planning advice service, including a cost estimate, please contact: SPPlanning.RFH@environment-agency.gov.uk

—

We trust that you will find the contents of this letter beneficial to further progression of your development project. However, should you have any queries or questions regarding the contents of this letter, then please don't hesitate to get in contact.

Yours sincerely

Mr Andy Davies
Sustainable Places Advisor

Direct e-mail andy.davies1@environment-agency.gov.uk

Appendix B Planning Practice Guidance Table 1: Flood Zones

Table 1: Flood zones

(Note: These flood zones refer to the probability of river and sea flooding, ignoring the presence of defences)

Zone 1 - low probability Definition This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%). Appropriate uses All uses of land are appropriate in this zone. Flood risk assessment requirements For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a flood risk assessment. This need only be brief unless the factors above or other local considerations require particular attention. Policy aims In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems¹.
Zone 2 - medium probability Definition This zone comprises 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. Appropriate uses Essential infrastructure and the water-compatible, less vulnerable and more vulnerable uses, as set out in table 2, are appropriate in this zone. The highly vulnerable uses are only appropriate in this zone if the Exception Test is passed. Flood risk assessment requirements All development proposals in this zone should be accompanied by a flood risk assessment. Policy aims In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage systems.
Zone 3a - high probability Definition This zone comprises 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. Appropriate uses The water-compatible and less vulnerable uses of land (table 2) are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone. The more vulnerable uses and essential infrastructure should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood.

¹ Sustainable drainage systems cover the whole range of sustainable approaches to surface drainage management. They are designed to control surface water run off close to where it falls and mimic natural drainage as closely as possible.

Flood risk assessment requirements

All development proposals in this zone should be accompanied by a flood risk assessment.

Policy aims

In this zone, developers and local authorities should seek opportunities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;
- relocate existing development to land in zones with a lower probability of flooding; and
- create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.

Zone 3b - the functional floodplain**Definition**

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 Environment Agency. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.

Appropriate uses

Only the water-compatible uses and the essential infrastructure listed in table 2 that has to be there should be permitted in this zone. It should be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows; and
- not increase flood risk elsewhere.

Essential infrastructure in this zone should pass the Exception Test.

Flood risk assessment requirements

All development proposals in this zone should be accompanied by a flood risk assessment.

Policy aims

In this zone, developers and local authorities should seek opportunities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;
- relocate existing development to land with a lower probability of flooding.

Appendix C Planning Practice Guidance Table 2: Flood Risk Vulnerability and Flood Zone Incompatibility

Table 2: 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 zones (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception test required	✓	✓
	Zone 3a	Exception test required	✓	x	Exception test required	✓
	Zone 3b functional floodplain	Exception test required	✓	x	x	x

Key:

- ✓ Development is appropriate.
- x Development should not be permitted.

Notes to table 2:

This table does not show:

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

Appendix D Planning Practice Guidance Annex 3: Flood Risk Vulnerability Classification

Annex 3: Flood risk vulnerability classification

Essential infrastructure • Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly vulnerable • Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use². • Installations requiring hazardous substances consent³. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as "essential infrastructure")⁴.
More vulnerable • Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non-residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste⁵. • Sites used for holiday or short-let caravans and camping, <i>subject to a specific warning and evacuation plan</i>.⁶
Less vulnerable • Police, ambulance and fire stations which are <i>not</i> required to be operational during flooding. • Buildings used for shops, financial, professional and other services, • restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in "more vulnerable", and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).

² For any proposal involving a change of use of land to a caravan, camping or chalet site, or to a mobile home site or park home site, the Sequential and Exception Tests should be applied.

³ See Circular 04/00: *Planning controls for hazardous substances* (paragraph 18) at: www.communities.gov.uk/publications/planningandbuilding/circularplanningcontrols

⁴ In considering any development proposal for such an installation, local planning authorities should have regard to planning policy on pollution in the National Planning Policy Framework

⁵ For definition, see *Planning for Sustainable Waste Management: Companion Guide to Planning Policy Statement 10* at www.communities.gov.uk/publications/planningandbuilding/planningsustainable

⁶ See footnote 3

Water-compatible development

- Flood control infrastructure.
- Water transmission infrastructure and pumping stations.
- Sewage transmission infrastructure and pumping stations.
- Sand and gravel working.
- Docks, marinas and wharves.
- Navigation facilities.
- Ministry of Defence defence installations.
- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (excluding sleeping accommodation).
- Lifeguard and coastguard stations.
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

Notes to Annex 3

a. This classification is based partly on Department for Environment, Food and Rural Affairs and Environment Agency research on *Flood Risks to People (FD2321/TR2)*⁷ and also on the need of some uses to keep functioning during flooding.

b. Buildings that combine a mixture of uses should be placed into the higher of the relevant classes of flood risk sensitivity. Developments that allow uses to be distributed over the site may fall within several classes of flood risk sensitivity.

c. The impact of a flood on the particular uses identified within this flood risk vulnerability classification will vary within each vulnerability class. Therefore, the flood risk management infrastructure and other risk mitigation measures needed to ensure the development is safe may differ between uses within a particular vulnerability classification.

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