BUROHAPPOLD ENGINEERING

NOMA, 2&3 Angel Square

Flood Risk Assessment

0043434

12 September 2019

Revision 00

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date	**12th September 2019**
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date	**12th September 2019**

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Glossary

Term	Definition
AEP	Annual Exceedance Probability
BGS	British Geological Survey
CDA	Critical Drainage Area
CC	Climate Change
EA	Environment Agency
FRA	Flood Risk Assessment
mAOD	Metres Above Ordnance Datum
NPPF	National Planning Policy Framework
SFRA	Strategic Flood Risk Assessment
UU	United Utilities

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1 Executive Summary

This Flood Risk Assessment (FRA) has been carried out as part of the planning application for the 2 & 3 Angel Square development in central Manchester, which consists of two office buildings of 10 and 11 storeys respectively.

This FRA has been prepared in accordance with the National Planning Policy Framework (NPPF) (February 2019) and the Manchester City, Salford City and Trafford Councils Hybrid Strategic Flood Risk Assessment (March 2010). The FRA contains an assessment of the risk associated with each of the following flood sources:

- Rivers (fluvial);
- Surface water;
- The failure of drainage infrastructure;
- Groundwater; and
- Reservoirs and canals.

According to the national flood map produced by the Environment Agency (EA), the Site is located entirely within Flood Zone 1, which is classified as having a low risk of flooding from rivers and the sea. Additional measures to reduce this risk are therefore not required.

The Proposed Development consists of retail and commercial units, office space, car parking, storage and landscaped public open space, all of which are classified as *Less Vulnerable* within the NPPF and therefore appropriate for development within Flood Zone 1.

Surface water is proposed to be discharged to the existing public combined sewers at a restricted rate of 10l/s, in accordance with the pre-development advice from United Utilities. A maximum attenuation volume of 455m^3 is required to restrict the surface water discharge rate to 10l/s for the 100 year rainfall event including a 40% allowance for climate change.

Foul water is proposed to be discharged at an unrestricted rate directly to the existing public combined sewers. United Utilities has confirmed that the existing sewer network has capacity for foul water to be discharged at an unrestricted rate.

With the proposed Foul and Surface Water Drainage Strategy in place, the risk of flooding from surface water and the surcharge of combined sewers is considered to be low.

The risk of flooding from groundwater, the failure of reservoirs or canals is considered to be low.

It is concluded that the risk of flooding from all sources, for the entire design life of the development is considered to be low and that the Proposed Development will not increase the risk of flooding elsewhere.

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2 Introduction

2.1 Background

This site-specific Flood Risk Assessment (FRA) has been prepared by BuroHappold Engineering (BuroHappold) as part of the detailed planning application for the development of 2&3 Angel Square in Manchester, hereafter referred to as the 'Proposed Development'. This assessment has been developed in accordance with the 2019 National Planning Policy Framework[1] (NPPF).

2.2 Site Description

The Proposed Development is located in central Manchester, at Ordnance Survey grid reference SJ 843 989. The Site measures approximately 0.83 hectares of previously developed land, shown in Figure 2-1. The Site is bound by 1 Angel Square (the Co-operative Group headquarters), Miller Street, Angel Gardens residential scheme (under construction and due for completion late 2019) and Angel Street.

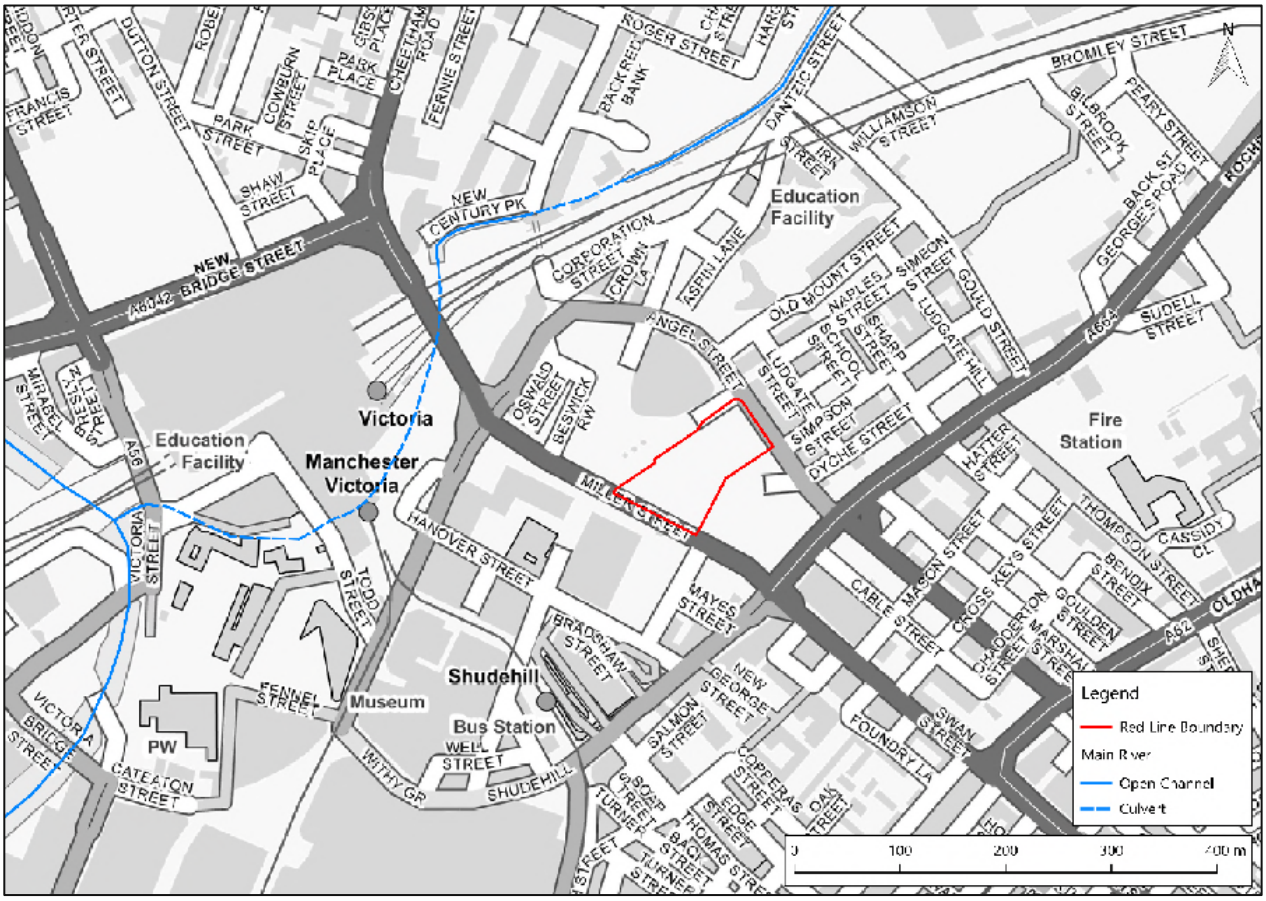


Figure 2-1: Site location plan

[1] Ministry of Housing, Communities and Local Government, (2019). *National Planning Policy Framework*.

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The Site currently comprises two development plots, identified as Plots M & N on the endorsed NOMA Masterplan, which are in temporary use as surface car parking. There is a substantial change in level across the Site, sloping down from Angel Street to Miller Street.

The nearest watercourse is the River Irk, which flows in south-westerly direction approximately 200m to the north west of the Site. The Irk is culverted below Manchester Victoria railway station before it flows into the River Irwell further west.

The online GeoIndex tool produced by the British Geological Survey (BGS) indicates that the bedrock geology underlying the Site forms part of the Chester Formation – Sandstone, with superficial deposits of Devensian Till (Diamicton).

2.3 Proposed Development

The Proposed Development involves the redevelopment of Plots M & N of the adopted NOMA Masterplan (to be known as 2 & 3 Angel Square) to deliver office-led development (Use Class B1a), with ground floor retail and commercial units, external terraces at upper levels, car parking and cycle facilities.

The Proposed Development will comprise two buildings, one of lower and upper ground plus 10 storeys (2 Angel Square) and one of lower and upper ground plus 11 storeys (3 Angel Square). The Proposed Development will include a comprehensive public realm scheme with hard and soft landscaping, access and highways, and other associated works. The ground floor layout of the Proposed Development is shown in Figure 2-2, with full versions included in Appendix A.

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Figure 2-2: Proposed Development, with site boundary shown in red (Source: Planit I.E. drawing L-0001, Rev. P03 dated 29.08.2019)

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3 Planning Context

3.1 Overview

This 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 (February 2019);
- National Planning Policy Framework Planning Practice Guidance website (Updated: March 2014); and
- Manchester City, Salford City and Trafford Councils Hybrid Strategic Flood Risk Assessment (March 2010).

3.2 National Planning Policy Framework

3.2.1 Flood Zone Assessment

The National Planning Policy Framework[2] (NPPF) aims to avoid inappropriate development in areas at highest risk of flooding. The Planning Practice Guidance to the NPPF[3] 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.

- 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 a FRA within each zone;
- Table 2 (Appendix C) 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*; and
- Table 3 (Appendix D) identifies where development is appropriate for each flood risk vulnerability classification and whether the Exception Test is required.

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 year (<0.1%).

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%), or

between 1 in 200 and 1 in 1,000 annual probability of sea flooding in any year (0.5% - 0.1%).

Flood Zone 3a High probability

> 1 in 100 annual probability of river flooding in any year (>1%), or

> 1 in 200 annual probability of sea flooding in any year (>0.5%).

Flood Zone 3b Functional floodplain

> 1 in 20 annual probability of flooding in any year (5%).

[2] Ministry of Housing, Communities and Local Government, (2019). *National Planning Policy Framework*.
[3] Ministry of Housing, Communities and Local Government, (2014). *National Planning Policy Framework Planning Practice Guidance*. [online] Available at: *https://www.gov.uk/guidance/flood-risk-and-coastal-change*. [Accessed 29 January 2019].

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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 guidance[4] published by the Environment Agency (EA) in February 2016 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 recommended allowances for peak rainfall intensity are given in Table 3-1.

Table 3-1: Climate change allowances for peak rainfall intensity in small and urban catchments (Contains Environment Agency information © Environment Agency and database right)

Allowance category	Total potential change anticipated for 2010 to 2039	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
Upper End	+10%	+20%	+40%
Central	+5%	+10%	+20%

It is recommended by the EA that both the central and upper end allowances are assessed in order to understand the 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 Surface Water Drainage Strategy, also prepared by BuroHappold, has therefore made an allowance for a 40% increase in peak rainfall intensity as this 'upper end' allowance represents the more conservative scenario.

3.3 Strategic Flood Risk Assessment

Local authorities are required to carry out a Strategic Flood Risk Assessment (SFRA), which is to be used by developers as guidance on the authority's approach to avoiding, reducing and managing flood risk. The Manchester City, Salford City and Trafford Councils Hybrid SFRA[5] considers the risk of flooding from the following potential sources:

- Rivers (fluvial);
- Surface water;
- Sewers;

[4] Environment Agency, (2016). *Flood risk assessments: climate change allowances*. [online] Available at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances [Accessed 29 January 2019].
[5] JBA Consulting, (2010). *Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA*.

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- Groundwater;
- Reservoirs; and
- Canals.

The risk of flooding to the Proposed Development from each flood source listed above will be assessed in Section 4.2, Flood Risk to Proposed Development.

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4 Appraisal of Flood Risk

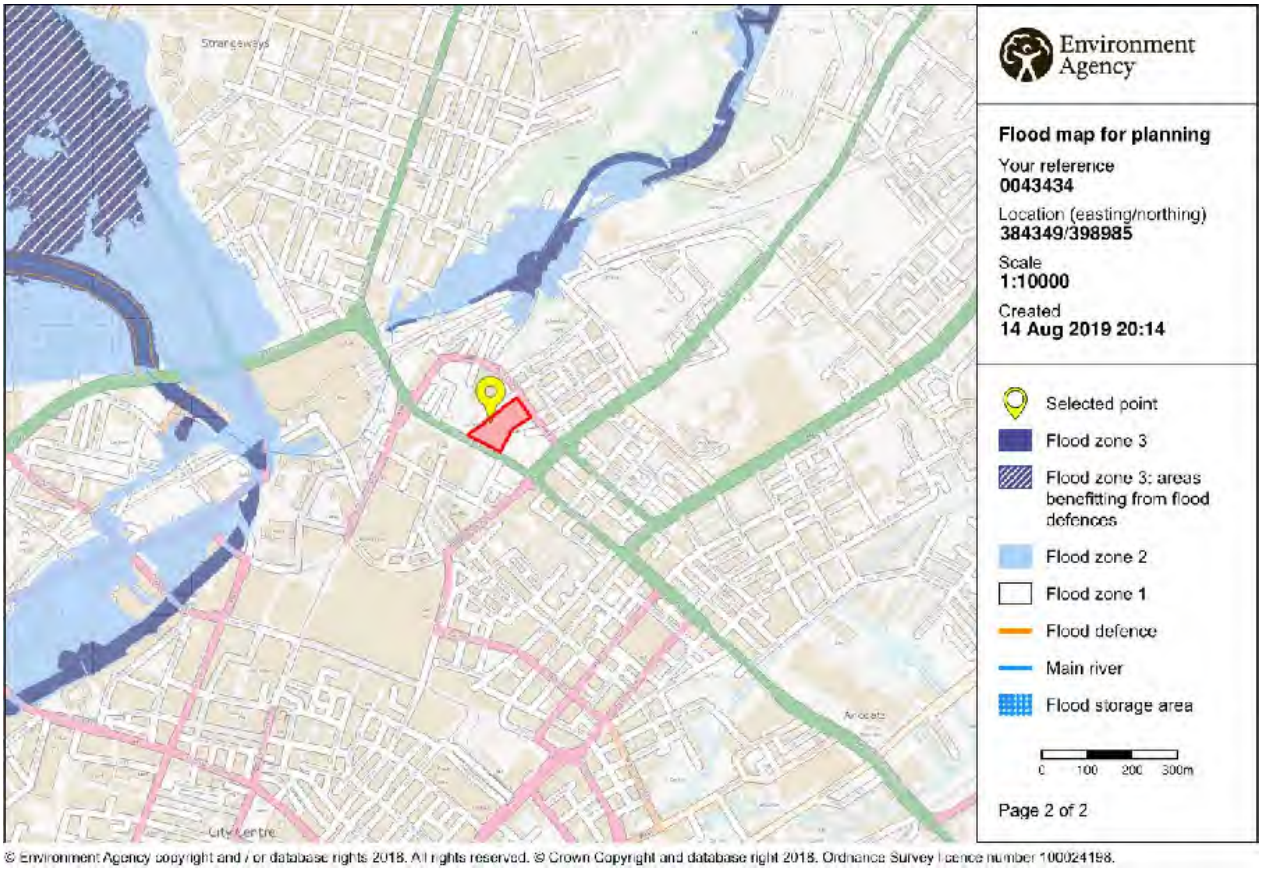
4.1 National Planning Policy Framework

4.1.1 Flood Zone

The Flood Zone mapping produced by the EA shows that the Proposed Development lies entirely within Flood Zone 1. This is shown in Figure 4-1.

Flood Zone 1 is defined as an area with an annual probability of flooding from rivers or the sea of less than 0.1%.

By definition, the risk of flooding from rivers or the sea in Flood Zone 1 is classified as low. In line 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.



© Environment Agency copyright and / or database rights 2018. All rights reserved. © Crown Copyright and database right 2018. Ordnance Survey Licence number 100024198.

Figure 4-1: Environment Agency Flood Zone Map, with site boundary shown in red

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 Appendix C and Appendix D.

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The Proposed Development consists primarily of office space, with some retail space car parking and storage on the ground floor. All of these uses are classified as *Less Vulnerable* within the NPPF and therefore considered appropriate for development within Flood Zone 1.

4.2 Flood Risk to Proposed Development

4.2.1 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.

Since the Proposed Development is located within Flood Zone 1, which is defined as having a low risk of flooding from rivers and the sea, additional measures to reduce this risk will not be required.

4.2.2 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.

Baseline

The surface water flood map produced by the EA (Figure 4-2) indicates that the entire Site is classified as having a very low probability of surface water flooding. The roads to the north east and south west of the Site are shown to have a low to medium probability of surface water flooding.

The Site is within an area defined as a Critical Drainage Area (CDA) within the Manchester City, Salford City and Trafford Councils Hybrid SFRA (Figure 4-3). CDAs are locations that are particularly sensitive to an increase in the rate of surface water runoff and/or volume from new development. The Surface Water Drainage Strategy has been prepared to address the flood risk associated with the CDA.

The existing Site consists almost entirely of impermeable paving or roofing. During a rainfall event, there is therefore very little potential for infiltration, and almost all of the rainfall on the Site would be converted to surface water run-off which, in turn, can result in surface water flooding.

The Surface Water Drainage Strategy notes that the following existing drainage is present within the vicinity of the site:

- 1500 x 600mm brick combined sewer which conveys flows north west beneath Miller Street; and
- 1850mm diameter brick combined sewer in Angel Street which flows south east.

It is understood that there are no existing connections from the site to either of these combined sewers. In the absence of further information, it is assumed that there are no surface water attenuation measures present on site.

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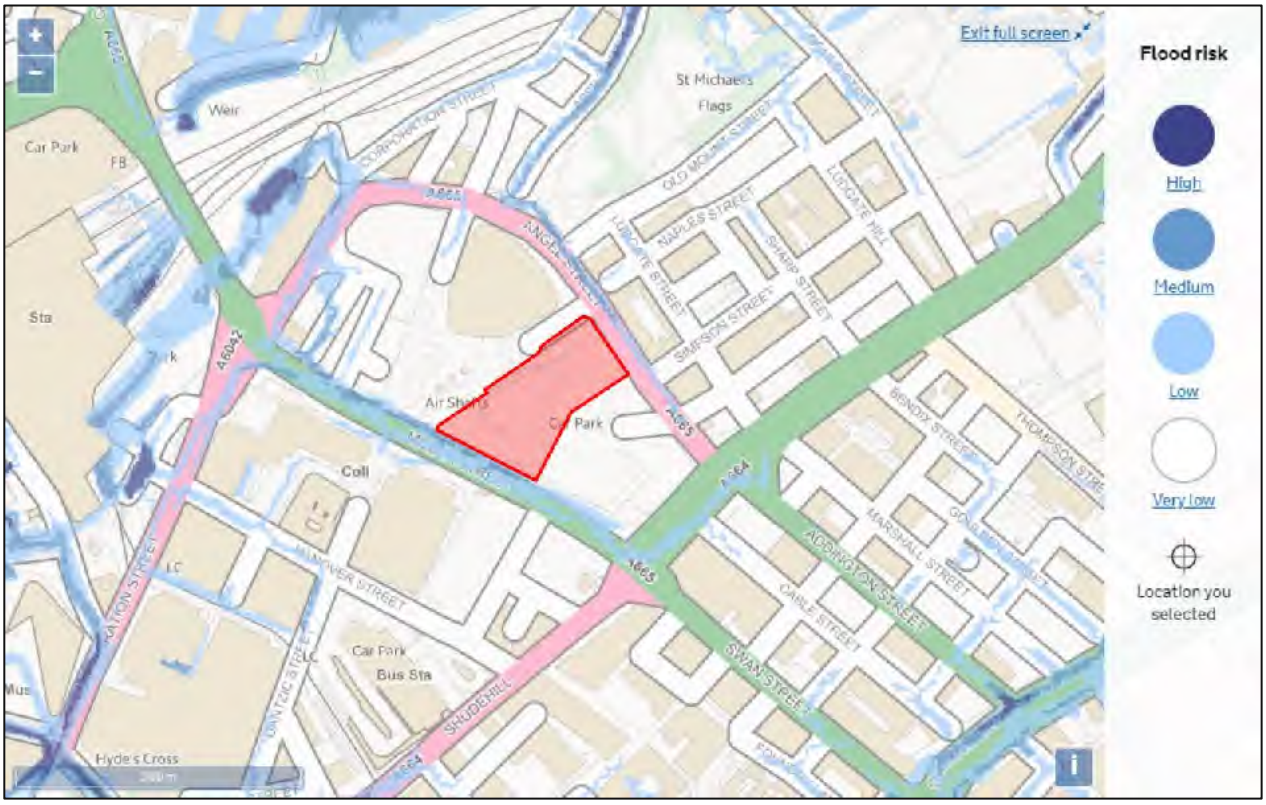


Figure 4-2: Environment Agency surface water flood map, with indicative site boundary marked in red

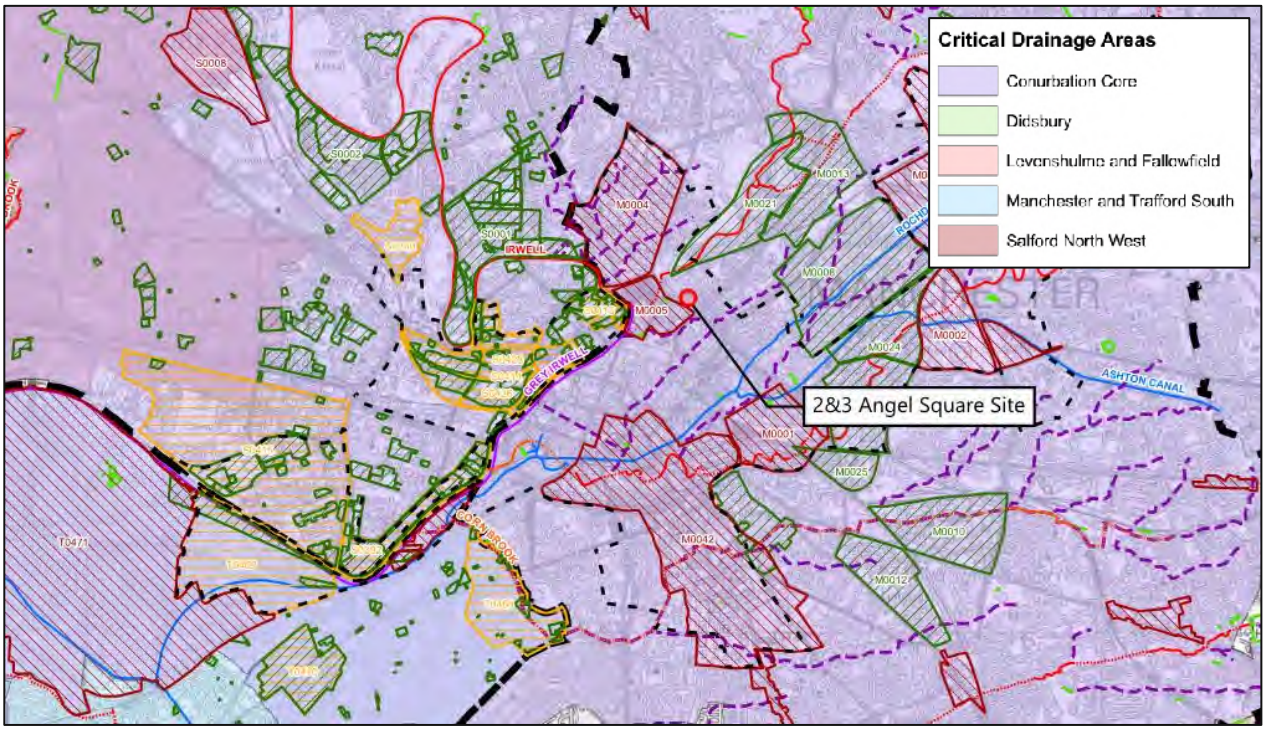


Figure 4-3: SFRA Critical Drainage Area mapping, with site location marked in red (Source: Manchester City, Salford City and Trafford Councils Hybrid SFRA drawing number SS_4.5)

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Proposed

Under the proposed Surface Water Drainage Strategy, also prepared by BuroHappold, surface water will be managed separately from foul water. Surface water is proposed to be discharged to the public combined sewers in Miller Street or Angel Street, via new connections. Further details are given within the Surface Water Drainage Strategy report, submitted as part of the planning application for the Proposed Development.

In response to a pre-development enquiry, United Utilities confirmed that surface water discharge to the combined sewers should be restricted to a maximum rate of 10l/s. It is proposed that attenuation is used to restrict the surface water discharge to 10l/s. A maximum volume of 455m^3 is required to restrict the surface water discharge rate to 10l/s for the 100 year rainfall event including a 40% allowance for climate change (CC). All surface water runoff for the 100 year + 40% CC rainfall event will therefore be contained below ground.

It is considered that with the proposed surface water drainage strategy in place, the overall surface water flood risk at the Site is low.

4.2.3 Flooding from Combined Sewers

Flooding from combined sewers may occur during periods of intense rainfall when high volumes of surface water run-off exceed the capacity of the sewer and cause the pipes to back up and overflow.

Baseline

The site is currently used as a ground level car park and therefore produces no foul water discharge. It is understood that any previous connections to the combined sewers in Miller Street and Angel Street have been closed off.

Proposed

Under the proposed Foul Water Drainage Strategy, also prepared by BuroHappold, foul water will be discharged directly to the combined sewers in Miller Street or Angel Street by gravity, via new connections. Further details are given within the Foul Water Drainage Strategy report, submitted as part of the planning application for the Proposed Development.

In response to a pre-development enquiry, United Utilities confirmed that the foul water flow from the proposed development is permitted to be discharged to the public combined sewer network at an unrestricted rate. The risk of foul water from the proposed development causing the capacity of the existing public combined sewers to be exceeded and cause flooding is therefore considered to be low.

It is considered that with the proposed foul water drainage strategy in place, the risk of flooding associated with combined sewers is low.

4.2.4 Groundwater Flooding

Groundwater flooding generally occurs in low-lying areas above permeable rock aquifers where the water table meets, and rises above, the ground surface.

The groundwater mapping (Figure 4-4) contained within the Manchester City, Salford City and Trafford Councils Hybrid SFRA identifies areas with the following groundwater issues:

- Areas at risk of groundwater flooding;
- Areas of shallow groundwater; and

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- Areas at risk of groundwater rebound, due to a reduction in abstraction from the aquifer.

The Proposed Development is not located within any of the areas identified above. The risk associated with groundwater flooding is therefore considered to be low and no mitigation is required.

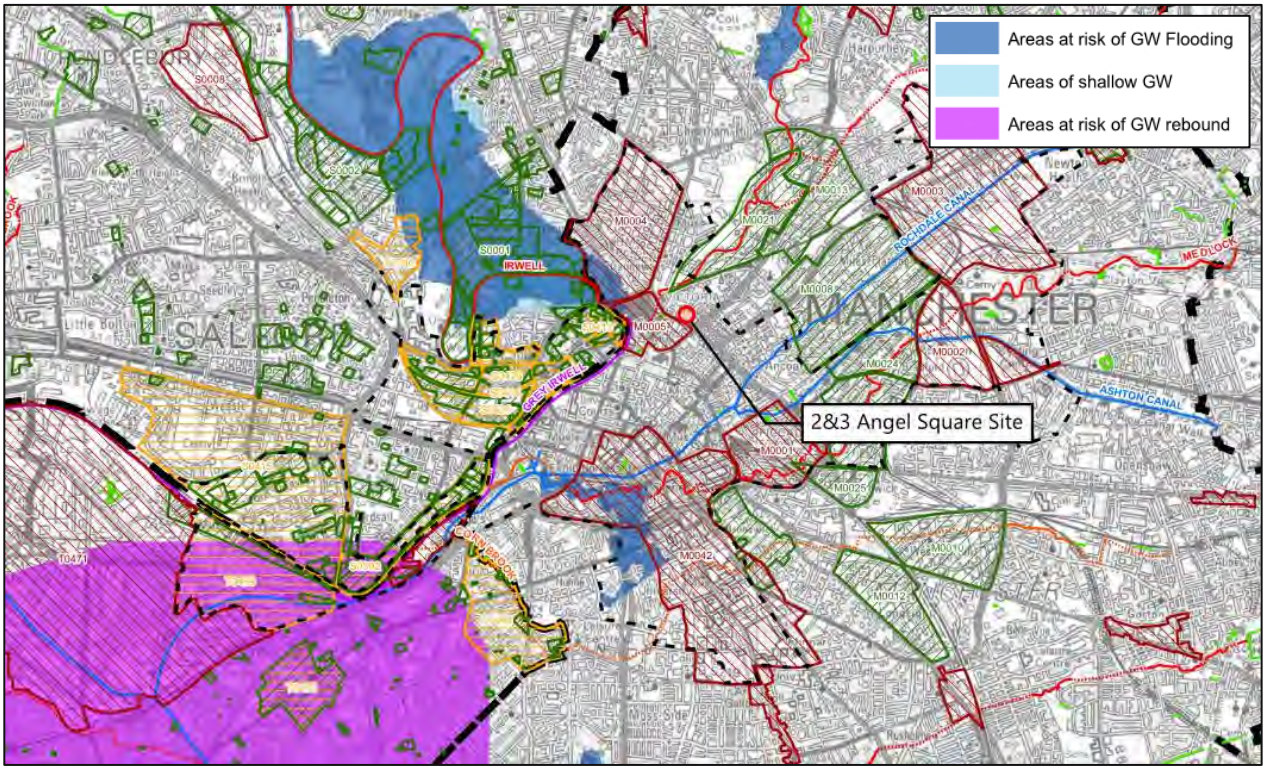


Figure 4-4: SFRA groundwater mapping, with Site location marked in red (Source: Manchester City, Salford City and Trafford Councils Hybrid SFRA drawing number GW_2.1)

4.2.5 Flooding from Reservoirs

The map showing the risk of flooding from reservoirs produced by the EA (Figure 4-5) indicates that the site is not located within the maximum extent of flooding that would occur if an upstream reservoir were to fail. The risk of flooding from reservoirs is therefore considered to be low.

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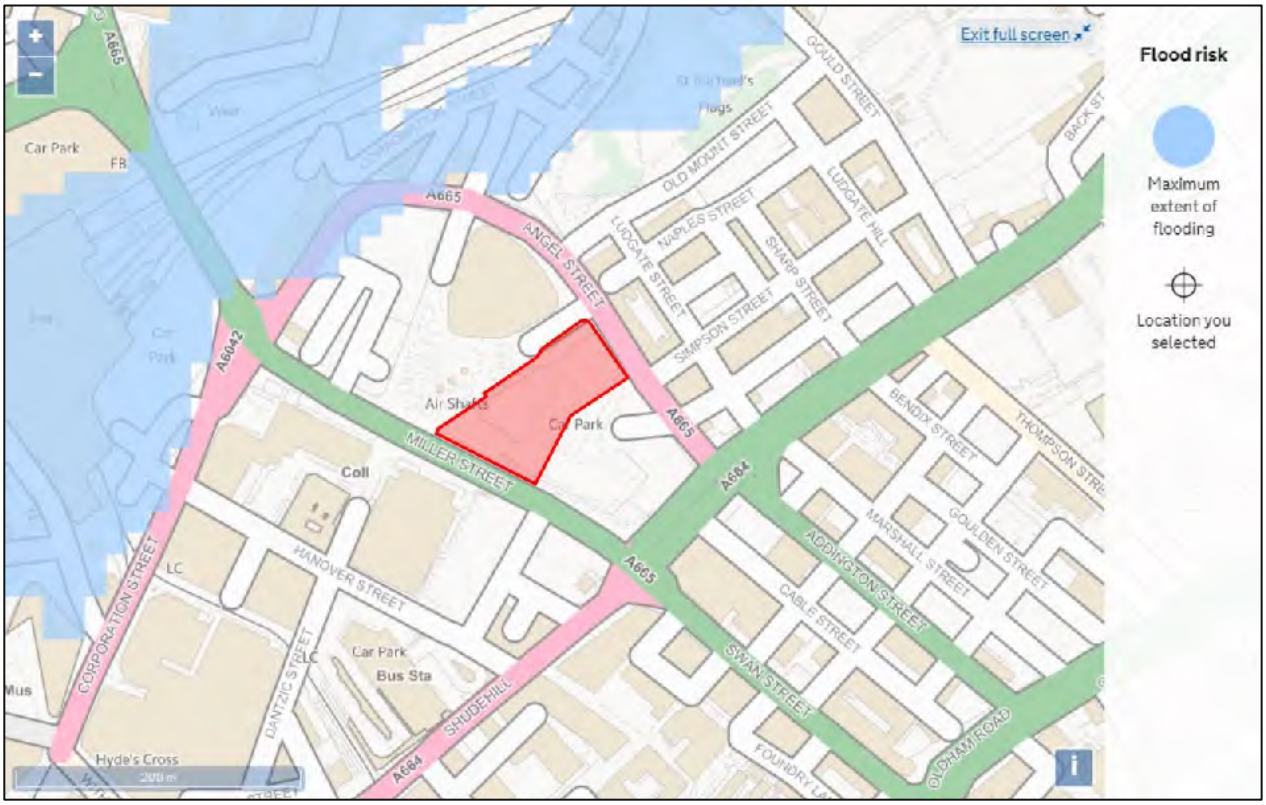


Figure 4-5: Environment Agency map showing the risk of flooding from reservoirs, with site boundary marked in red

4.2.6 Flooding from Canals

The Manchester City, Salford City and Trafford Councils Hybrid SFRA identifies areas that are at risk of flooding from either the overtopping or breach of canals. Drawing MM_3.2B of the Hybrid SFRA, shown in Figure 4-6, indicates that the Proposed Development is not within either of these areas. The risk of flooding from canals is therefore considered to be low.

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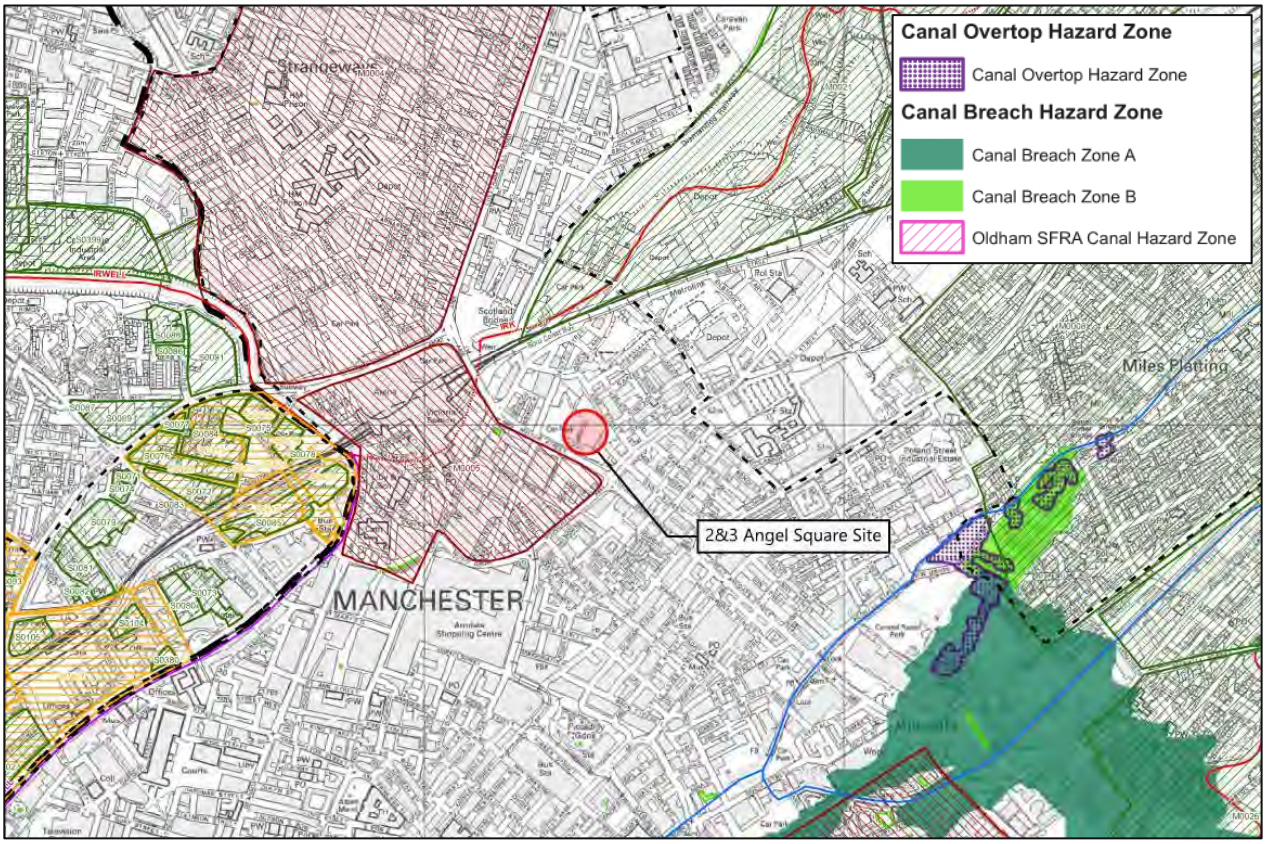


Figure 4-6: SFRA canal flood risk mapping, with Site location marked in red (Source: Manchester City, Salford City and Trafford Councils Hybrid SFRA drawing number MM_3.2B)

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5 Summary and Conclusion

This FRA has been carried out as part of the planning application for the 2 & 3 Angel Square development in central Manchester. The Proposed Development consists of two new buildings, one of lower and upper ground plus 10 storeys (2 Angel Square) and one of lower and upper ground plus 11 storeys (3 Angel Square). The proposed buildings consist of office space on the first floor and above, and retail, commercial, storage and car parking facilities on the ground floor.

According to the national flood map produced by the EA, the Site is located entirely within Flood Zone 1, classified as having a low risk of flooding from rivers and the sea. Further measures to reduce this risk are therefore not required.

The Proposed Development consists of retail and commercial units, office space, car parking, storage and landscaped public open space, all of which are classified as *Less Vulnerable* within the NPPF and therefore appropriate for development within Flood Zone 1.

The surface water flood map produced by the EA indicates that the entire Site is classified as having a very low probability of surface water flooding.

The surface water flood map produced by the EA indicates that the entire Site is classified as having a very low probability of surface water flooding. Surface water is proposed to be discharged to the existing United Utilities public combined sewers at a restricted rate of 10l/s. A maximum attenuation volume of 455m^3 is required to restrict the surface water discharge rate to 10l/s for the 100 year rainfall event including a 40% allowance for climate change. It is considered that with the proposed surface water drainage strategy in place, the overall surface water flood risk at the Site is low.

Foul water is proposed to be discharged at an unrestricted rate directly to the existing United Utilities public combined sewers. United Utilities has confirmed that the existing sewer network has capacity for foul water to be discharged at an unrestricted rate. The risk of flooding from the surcharge of public combined sewers is therefore considered to be low.

The Proposed Development is not located within an area that has been identified as at risk of groundwater flooding, having shallow groundwater levels or at risk of groundwater rebound due to recent reductions in groundwater abstraction. The risk of groundwater flooding is therefore considered to be low.

The Proposed Development is not within the maximum extent of flooding that would occur if an upstream reservoir were to fail. The risk of flooding from reservoirs is therefore considered to be low.

The Proposed Development is not within an area that is identified within the Manchester City, Salford City and Trafford Councils Hybrid SFRA to be at risk of flooding from either the overtopping or breach of canals. The risk of flooding from canals is therefore considered to be low.

It is concluded that the risk of flooding from all sources, for the entire design life is considered to be low and that the Proposed Development will not increase the risk of flooding elsewhere.

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Appendix A Proposed Development Drawings

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NOTES:
1. Do not scale from this drawing.
2. Always work to noted dimensions.
3. All dimensions are in millimetres unless otherwise stated.
4. All setting out, levels and dimensions to be agreed on site.
5. The dimensions of all materials must be checked on site before being laid out.
6. This drawing must be read with the relevant specification clauses and detail drawings.
7. Order of construction and setting out to be agreed on site.

KEY

BOUNDARIES

Application Boundary

HARDWORKS

S1.1 NATURAL STONE SLAB PAVING:
Yorkstone, diamond sawn, random stretcher bond, to match adopted areas. Marshalls Scoutmoor or equal and approved. Colours: greyish buff. Sizes: 600m width x random lengths 600-900mm x 65mm depth.
Jointing: to engineer's detail and specification. Width: 8mm (6-10mm).
Bond: Random stretcher bond across the footway.
Cut units: lengths no smaller than 450mm.
NOTE: All yorkstone paving to adopted footpaths to be retained and reused, subject to condition. Bedding and sub base to MCC Highways standard details and specification.

S1.2 NATURAL STONE SLAB PAVING:
Yorkstone, diamond sawn, herringbone bond.
Whitworth by Hardscape or equal and approved.
Sizes: 100mm(W)x400mm(L)x50mm(D)
Bedding and sub base to engineers details and specification.

S1.3 CLAY PAVING:
Neland by Hardscape or equal and approved.
Sizes: 48mm(W)x200mm(L)x65mm(D)
Colour/Finish: 100% Triton UWF tumbled
Bedding and sub base to engineers details and specification.

S1.4 CONCRETE TO SERVICE YARD:
Aggregate Industries 'Articimo' coloured and exposed-aggregate concrete surfacing.
Colour/Finish: Buff base matrix with limestone aggregate. Bedding and sub base to engineers details and specification.
NOTE: Subject to approval of sample by Local Authority.

S1.5 NATURAL STONE PAVING
To basement car park entrance.
To match adjacent natural stone paving of drop off

S1.6 HOT ROLLED ASPHALT SURFACING:
To engineers details and specification.

FURNITURE / RAISED EDGING
Natural stone plinths with integrated timber seating elements.

STEEL EDGING TO TERRACES AND PLANTING AREAS
Structural steel edgings to form terraces and planting edges. Corten Steel finish

SOFTWORKS

Shrub and Herbaceous planting areas, to have raised steel edgings (Refer to softworks plan and schedule)

Semi Mature Tree Planting (various sizes - refer to softworks plan and schedule)

Revision	Date	Description	Drawn	Apprvd.
S3-P03	29-08-19	Review and Comment	SAB	MS
S3-P02	27-08-19	Review and Comment	SAB	MS
S1-P01	08-08-19	Review and Comment	SAB	MS

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LIVERPOOL
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T: 0151 363 1230

Client NOMA (GP) Limited

Project 2&3 Angel Square Manchester

Drg Title Landscape Masterplan

Created on	Created by	Approved by
08.08.19	SAB	MS

Scale	Size	Workstage
1:250	A1	Stage 2

Drg No.	Suitability	Revision
2190.1-PLA-XX-XX-DR-L-0001	S3	P03

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Appendix B Planning Practice Guidance Table 1: Flood Zones

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Table 1: Flood Zones

These Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences. They are shown on the Environment Agency's Flood Map for Planning (Rivers and Sea), available on the Environment Agency's web site, as indicated in the table below.

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding.(Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

Note: The Flood Zones shown on the Environment Agency's Flood Map for Planning (Rivers and Sea) do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding. Reference should therefore also be made to the Strategic Flood Risk Assessment when considering location and potential future flood risks to developments and land uses.

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Appendix C Planning Practice Guidance Table 2: Flood Risk Vulnerability Classification

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Table 2: 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 and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding.
- Emergency dispersal points.
- Basement dwellings.
- Caravans, mobile homes and park homes intended for permanent residential use.
- Installations requiring hazardous substances consent. (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’).

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 waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

Less vulnerable

- Police, ambulance and fire stations which are not required to be operational during flooding.
- Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the ‘more vulnerable’ class; 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.

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.

” * “ Landfill is as defined in Schedule 10 of the Environmental Permitting (England and Wales) Regulations 2010.

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Appendix D Planning Practice Guidance Table 3: Flood risk vulnerability and flood zone 'compatibility'

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

Table 3: flood risk vulnerability and flood zone ‘compatibility' (PDF, 58.1KB, 1 page)

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 should be applied first to guide development to Flood Zone 1, then Zone 2, and then Zone 3; nor does it reflect the need to avoid flood risk from sources other than rivers and the sea;
- The Sequential and Exception Tests do not need to be applied to minor developments and changes of use, except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site;
- Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.

† In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

” * “ In Flood Zone 3b (functional floodplain) essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, 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.

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Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓*

Key:

✓ Development is appropriate

✗ Development should not be permitted.

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