WeStruct

274 Manley Road, Manchester, M21 0RF

FLOOD RISK ASSESSMENT

WE-FRA-16-05-23
JUNE 2023

CONFIDENTIAL

274 Manley Road, Manchester, M21 0RF

FLOOD RISK ASSESSMENT

REPORT (RV0) CONFIDENTIAL

PROJECT NO. WE-16-05-23

OUR REF. NO. WE-FRA-16-05-23

DATE: JUNE 2023

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QUALITY CONTROL

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EXECUTIVE SUMMARY

This Flood Risk Assessment has been undertaken to accompany the 274 Manley Road, Manchester, M21 0RF, application for the proposed development at South East Oxford, in accordance with the guidelines set out in the National Planning Policy Framework (NPPF) published in 2018 along with other relevant local and national guidance including CIRIA C624 Development and Flood Risk.

Item	Overview
Site Location	274 Manley Road, Manchester, M21 0RF
Development Proposals	Proposed erection of a 2 storey side extension and a part single/part 2 storey rear extension to form additional living accommodation
Environment Agency Flood Zone(s)	The proposed development site lies within Flood Zone 2.
Vulnerability Classification(s)	The development is classified as 'More Vulnerable' under the NPPF, as it comprises, amongst others, of 'buildings used for dwelling houses'.
Fluvial Flood Risk	Medium risk of fluvial flooding.
Tidal Flood Risk	Medium of tidal flooding
Surface Water Flood Risk	Low risk of surface water flooding.
Groundwater Flood Risk	Medium risk of ground water flooding.
Artificial Flood Risk	Low risk of flooding from artificial sources.
Sequential & Exception Test	The proposed development site is located within Flood Zone 2, so in accordance with current national, local and Environment Agency guidance, as the proposed development is considered 'More Vulnerable & minor non-residential dwellings: industrial/commercial/leisure etc with a footprint less than 250 square metres. The sequential and exception test are not required and therefore considered as an appropriate.
Storm Drainage	It is proposed to be connected to the existing private sewer pipe.
Foul Drainage	N/A

1. INTRODUCTION

1.1. BACKGROUND

WESTRUCT has been appointed by client to prepare a Flood Risk Assessment (FRA) to support the planning application number (136691/FH/2023) at the 274 Manley Road, Manchester, M21 0RF.

1.1.1. The objective of the study is to demonstrate that the site can be developed safely, without exposing the development to an unacceptable degree of flood risk or increasing the flood risk to third parties. The objectives are to:

- Confirm the sources of flooding which may affect the site;
- Provide a drainage strategy for the proposed development
- Provide an appraisal of the availability and adequacy of existing information; and
- Undertake an appraisal of the flood risk posed to the site and potential impact of the development on flood risk elsewhere.

1.2. LIMITATIONS

1.2.1. WESTRUCT has prepared this report in accordance with the instructions of their client, for their sole and specific use. Any person who uses any information contained herein do so at their own risk. © WESTRUCT.

1.2.2. The conclusions and recommendations contained herein are limited by the availability of background information and the planned use for the site.

1.2.3. Third party information has been used in the preparation of this report, which WESTRUCT, by necessity assumes is correct at the time of writing. Whilst all reasonable checks have been made on data sources and the accuracy of the data, WESTRUCT accepts no liability for same.

1.3. CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS 2015

1.3.1. The revised Construction (Design and Management) Regulations 2015 (CDM Regulations) came into force on April 2015 to update certain duties on all parties involved in a construction project, including those promoting the development. One of the designer's responsibilities under clause 9 (1) is to ensure that the client organisation, in this instance 16 Gentian Rd Road, is made aware of their duties under the CDM Regulations.

1.4. SCOPE OF ASSESSMENT

1.4.1. The assessment has been undertaken in accordance with the overarching national requirements for Flood Risk Assessments for proposed developments including, but not limited to, the following:

- National Planning Policy Framework (NPPF)
- Development and Flood Risk (C624)
- The SuDS Manual (CIRIA C753)
- Flood Risk Assessments: Climate Change Allowances 2017
- DEFRA R&D Technical Report W5-074/A/TR/1 Revision D
- Rainfall Runoff Management for Developments Report – SC030219

- Manchester's Local Development Framework Core Strategy Development Plan Document (Adopted 11th July 2012)

1.4.2. The flood risk assessment is solely to be used for the proposed residential erection of a 2 storey side extension and a part single/part 2 storey rear extension to form additional living accommodation at 274 Manley Road, Manchester, M21 0RF.

1.5. CONSULTATION

1.5.1. Ahead of production of this report, initial pre-application consultation requests were issued to the relevant stakeholders with the following responses received

Table 1 - Stakeholder Consultation Summary

Stakeholder	Date Received	Comments
Manchester City Council	12 May 2023	I refer to your latest email in respect of the need for a Flood Risk Statement. While the area may not have flooded previously, the site is within Flood Zone 2, as shown on the Environment Agency records. As such a Flood Risk Statement (FRS) is required to be submitted with this application.
Environment Agency	Wed 03/05/2023	We have no records of flooding affecting the site. However, this does not mean flooding has not occurred in the past or that it will not flood in future. We recommend that you also contact United Utilities and Manchester Council Who may hold additional information (the former especially in relation to sewer flooding). There are no flood defences in the vicinity of the site. Manchester Council is responsible for issues relating to surface water and hold information on surface water flooding.

1.5.2. The full consultation responses are contained in an *APPENDIX* B and have been thereafter used, where relevant within the report.

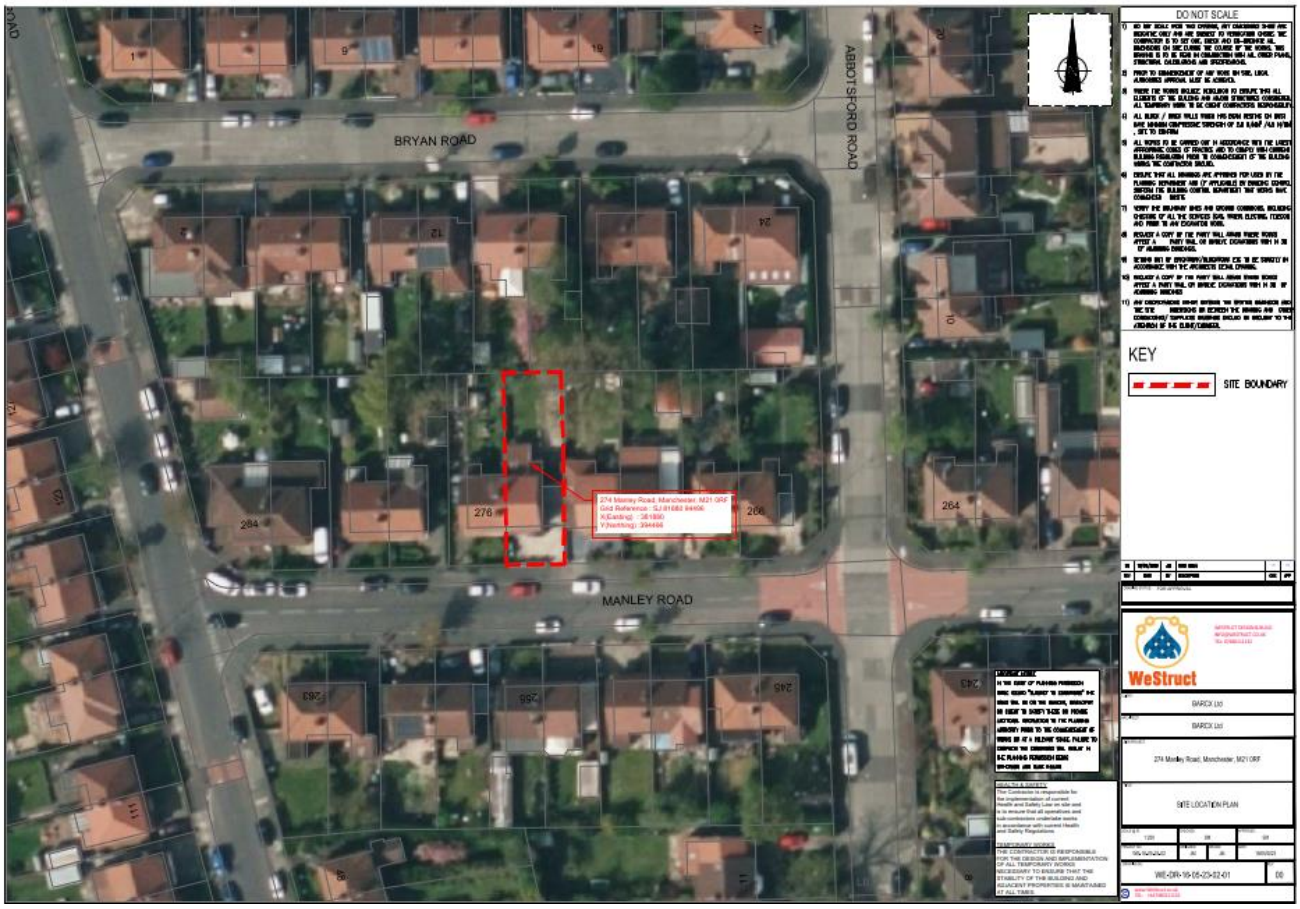
2. SITE SETTING

2.1. LOCATION

2.1.1. The site is located off the 274 Manley Road, Manchester, M21 0RF.

2.1.2. The site location plan is shown in ***Figure 1 – Site Location*****.**

Figure 1 – Site Location



2.2. DEVELOPMENT PROPOSALS

2.2.1. The development proposal comprises of proposed erection of a 2 storey side extension and a part single/part 2 storey rear extension to form additional living accommodation

2.2.2. with a total floorspace of circa (5m x 4.5) 22.5 sqm. Shown in ***APPENDIX A***

2.3. EXISTING DRAINAGE NETWORK

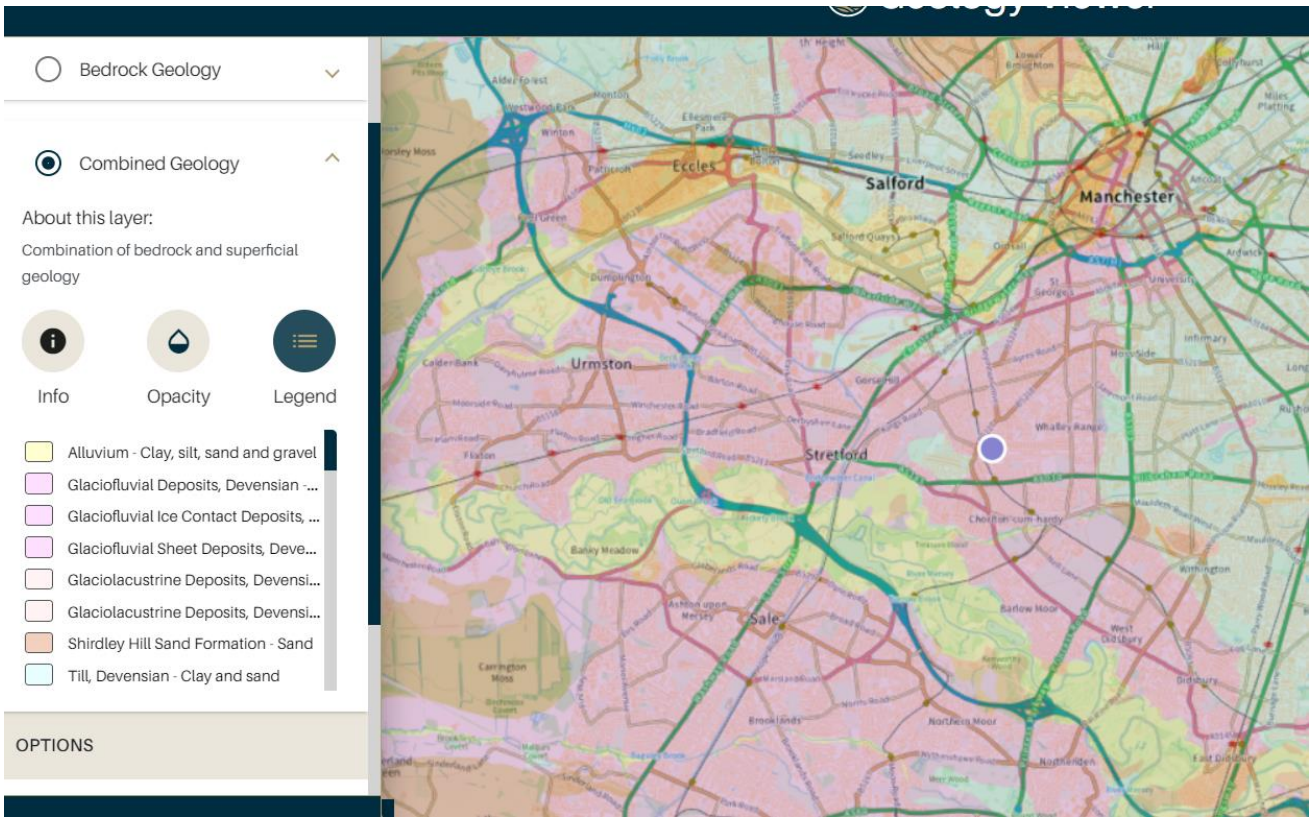
2.3.1. The site is currently served by an existing surface and foul water network which discharges into the existing sewer surrounding the site.

2.4. GEOLOGICAL AND HYDROGEOLOGICAL CONTEXT

Geology

2.4.1. Reference to the BGS published mapping identifies the site to be underlain by Wilmslow Sandstone Formation - Sandstone. Sedimentary bedrock formed between 252.2 and 247.1 million years ago during the Triassic period. The site has no identified superficial deposits. An extract of the BGS map is shown in ***Figure 2.***

Figure 2 – BGS Map Extract



2.4.2. There are no boreholes located within the site boundary therefore we have selected the nearest by (Boreholes: SJ89SW48. The boreholes in question are predominantly deep (**max depth circa 9.0m**) and do provide an approximation of the ground conditions. The water table is approximately 1.65m below the ground. An approximate summary of the borehole data is given in **Table 2** & **Appendix C**

Table 2 - BGS Borehole Summary

Description	Approximate Depth [mBGL]
Made ground	0 – 2
Firm Clay rubble fill	0.2 – 0.6
Medium dense SAND SILT, with CLAY	0.6 – 1.65
Water Table	1.65m

Hydrogeology

2.4.3. The online BGS Aquifer Map In the Cheshire Basin and northwards into Cumbria, the formation comprises red-brown to brick-red, fine- to medium-grained, generally pebble-free, cross-bedded sandstones, with sporadic siltstones. The sand grains are well rounded and indicate an aeolian origin; in Cumbria, they are coarse- to very coarse-grained. There are thin units of fluvial sandstones that have subangular to subrounded sand grains and more common beds of mudstone. Southwards, these pass into bright orange-red to dark brick-red, generally silty or argillaceous, fine- to medium-grained, micaceous sandstones with subordinate siltstone and mudstone beds. The sand grains are subangular to subrounded and pebbles are rare..

2.4.4. According to the Source Protection Zone map provided by the Environment Agency, the site lies within the Total Catchment (Zone 2) which is defined as: “as the total area *needed to support the abstraction or discharge from the protected groundwater source”*. This was confirmed by the **Product 4 data** that the **EA provided and can be found in *APPENDIX D***.

3. POLICY CONTEXT

3.1. NATIONAL PLANNING POLICY FRAMEWORK 2018

3.1.1. The Updated National Planning Policy Framework (NPPF) was published in July 2018 and sets out the Government's national policies for flood risk management in a land use planning context within England.

3.1.2. Paragraph 159 of the NPPF states "*Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere".*

3.1.3. The guidance further states that local planning authorities should "*ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment".*

3.1.4. Allocation and planning of development must therefore be considered against a risk based search sequence as provided by the guidance.

3.2. MANCHESTER LOCAL DEVELOPMENT

3.2.1. Guidance from Manchester Local Development .

3.2.2. Flood risk has become a key issue at the national policy level, as the number and severity of recent floods seems to be on the increase. Flooding can lead to serious problems in social, economic and environmental terms, depending on the location of the flood. Some land uses are more vulnerable than others, but flood risk must be considered in all cases. PPS25 (Development and Flood Risk) sets out the approach Local Authorities and Developers should follow in considering flood risk, including a hierarchy of flood risk assessment documents.

3.2.3. PPS25 requires local authorities to identify flood risk in their area through an appropriately-detailed Strategic Flood Risk Assessment (SFRA) which covers all sources of flood-risk; for Manchester this is flooding from rivers (fluvial), canals and reservoirs, groundwater, surface-water and sewers, and the implications of climate change. The Council (working with the neighbouring authorities of Salford and Trafford in recognition of the cross-boundary nature of flood risk) has produced an SFRA to inform future development which consists of a Level 1 and a Level 2 report and a mapping volume. The SFRA informs policies in the Core Strategy and provides a context for developers' site-specific Flood Risk Assessments (FRA).

3.2.4. Policy EN 14 Flood Risk

- In line with the risk-based sequential approach contained within PPS25, development should be directed away from sites at the greatest risk of flooding and towards sites with little or no risk of flooding; this should take account of all sources of flooding identified in the Manchester-Salford-Trafford Strategic Flood Risk Assessment (SFRA).

- In addition to the requirements for site-specific Flood Risk Assessments (FRAs) set out in PPS25, an appropriate FRA will also be required for all development proposals, including changes of use, on sites greater than 0.5ha within Critical Drainage Areas (CDAs) and Canal Hazard Zones identified in the SFRA.

- All new development should minimise surface water run-off, including through Sustainable Drainage Systems (SUDS) and the appropriate use of Green Infrastructure. Developers should have regard to the surface water run-off rates in the SFRA User Guide. In CDAs, evidence to justify the surface water run-off approach / rates will be required.

    1) Raise the floor level above the anticipated level (AOD 28.109).
    2) Keep floor as an existing floor level adjacent level but incorporating flood resilient construction and flood entry strategies such as flood gate , air brick flaps etc.
    3) The finished floor levels (FFLs) MUST be no lower than existing floor levels or 300mm Higher than the above the estimated flood level 1 in 100 years + 30% CC.

- 12.71 PPS25 sets out when FRAs are required in terms of fluvial flood risk, and with reference to the SFRA, a similar approach has been developed for canal and surface water flooding. Critical Drainage Areas are identified in the SFRA, which designates them as High Flood Risk Areas. Canal Hazard Zones, also identified in the SFRA, are areas at risk from potential breaches or overtopping of canals. Where an FRA is required, it should accord with PPS25, and the level of detail should be commensurate with the scale and type of development proposed, and the degree of risk that exists. With reference to the SFRA and the PPS25 Practice Guide, some developments may only require a Level 1 Screening FRA or a Level 2 Scoping FRA, while others will require a Level 3 Detailed FRA. Discussions with the Local Planning Authority can help inform what will be required.
    1) Discussed with the Local Planning Authority see ***APPENDIX B.***

3.2.5. Local Policy EN 17 WATER QUALITY

- Development should avoid any adverse impact on water quality, including during the construction phase, and wherever possible should seek to enhance water quality, both chemical and ecological.
- Development should minimise surface water run-off from development and associated roads, and maximise the use of appropriate sustainable drainage systems, to minimise groundwater contamination, and to avoid pollutants reaching watercourses.
- Development close to a watercourse should also ensure that waste or litter cannot enter the watercourse from the site;

    1) store rainwater for later use; then: Harvesting rainwater should be use at the rear of the property to provide and re-use the rain water from the proposed roof.

    2) discharge to a surface water body; then: The proposed foul and surface water will be connected to existing network.

    3) Foul Drainage Developers are encouraged to separate foul and surface water sewers on all brownfield sites delivering new development . For clarity this does not include householder extensions or conversions that input into the existing network .

4. ASSESSMENT OF FLOOD RISK

4.1. OVERVIEW

Having completed a desk based assessment, the possible flooding mechanisms at the site are summarised below: **Table 3 - Flood Risk Overview**

Item	Overview
Environment Agency Flood Zone(s)	The proposed development site lies within Flood Zone 2.
Zone 2 Medium Probability	Land having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Vulnerability Classification(s)	The development is classified as 'More Vulnerable' under the NPPF **Annex 3** provided in an **APPENDIX D**, as it comprises, amongst others, of 'buildings used for dwelling houses'.
Fluvial Flood Risk	Medium risk to fluvial flooding.
Pluvial (Urban Drainage)	Proposed erection of a 2 storey side extension and a part single/part 2 storey rear extension to form additional living accommodation
Tidal Flood Risk	Low risk of tidal flooding - The site does not lie within proximity to the sea.
Surface Water Flood Risk	Low risk of surface water flooding.
Groundwater Flood Risk	Low risk of ground water flooding.
Artificial Flood Risk	Low risk of flooding from artificial sources.
Sequential & Exception Test	The proposed development site is located within Flood Zone 2, so in accordance with current national, local and Environment Agency guidance NPPF Annex 3 , as the proposed development is considered 'More Vulnerable & minor non-residential dwellings: industrial/commercial/leisure etc, with a footprint less than 250 square metres. The sequential and exception test are not required and therefore considered passed.
Storm Drainage	It is proposed to utilise a Sustainable Drainage Scheme (SuDS) to manage surface water run-off from the proposed development site in line with current best practice recommendations. Harvesting rainwater should be use
Foul Drainage	It is proposed to connect foul drainage into the existing foul sewers.

4.2. HISTORIC FLOODING

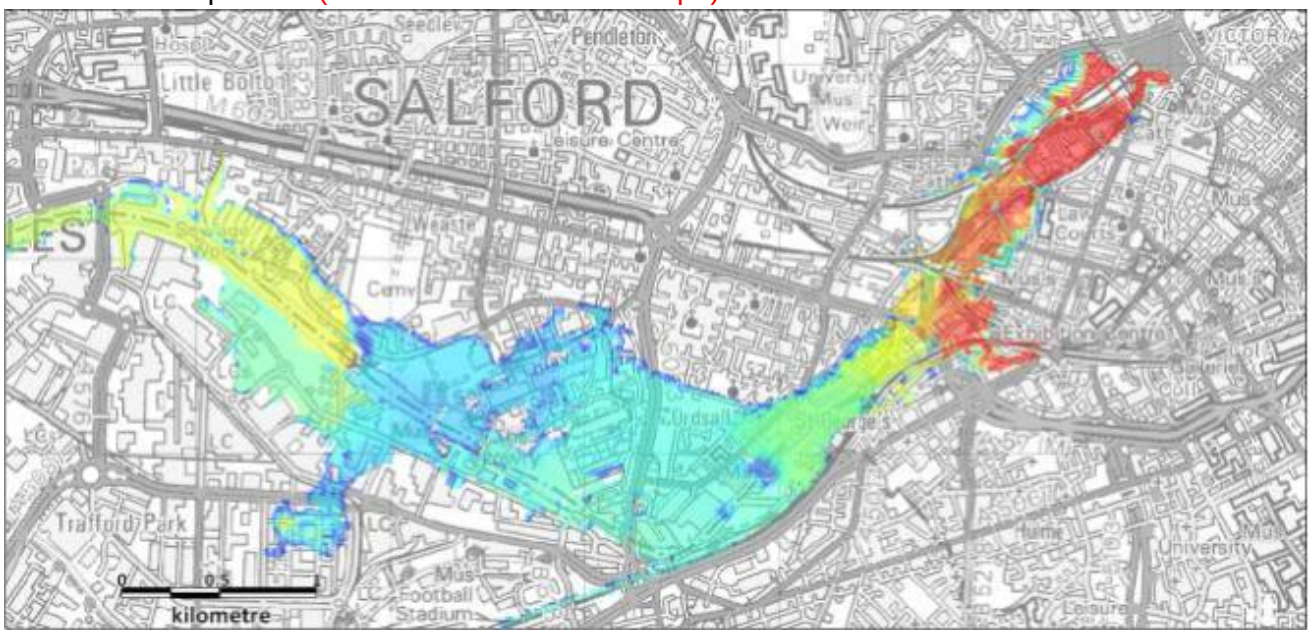
For the SFRA, the Environment Agency's Manchester Ship Canal 1D (ISIS) model has been linked with a 2D TUFLOW model to provide an understanding of flood depths and hazards. The 2D model extends from the River Medlock confluence around Woden Street footbridge to Woods End near Flixton. For practical reasons the 2D model grid was created with a cell size of 10m based on filtered LIDAR where available. This is sufficient to model the broad scale pattern of flooding but will lack accuracy within dense urban areas. There are no raised flood defences on the Manchester Ship Canal and the canal is in cut in the study area and so a breach scenario was not considered. Quay walls are represented in the modelling where these have been picked up on LIDAR and in cross section survey. In this model, only 3 out of the 4 sluices are operational at Mode Wheel Locks and the sluices do not operate as efficiently as in the "defended model". A summary of the modelling is provided in **Table 2-2** and the assumptions and limitations listed in section 2.3 are also applicable to the Manchester Ship Canal model results.

The following events were run for the Manchester Ship Canal:

- 1 in 100 year event
- 1 in 100 year event, considering climate change
- 1 in 1000 year event
- 1 in 1000 year event, considering climate change

The model results are sensitive to the hydrology (model inflows) and the results of the 1 in 1000 year flow sensitivity test for the Manchester Ship Canal (considering the impact of attenuation on the Lower Irwell) are reproduced alongside those of the Grey Irwell in Figure 2-2. This illustrates that flood levels in the Salford Quays area during such a scenario could be on average around 0.35m lower than those depicted in the main SFRA output maps

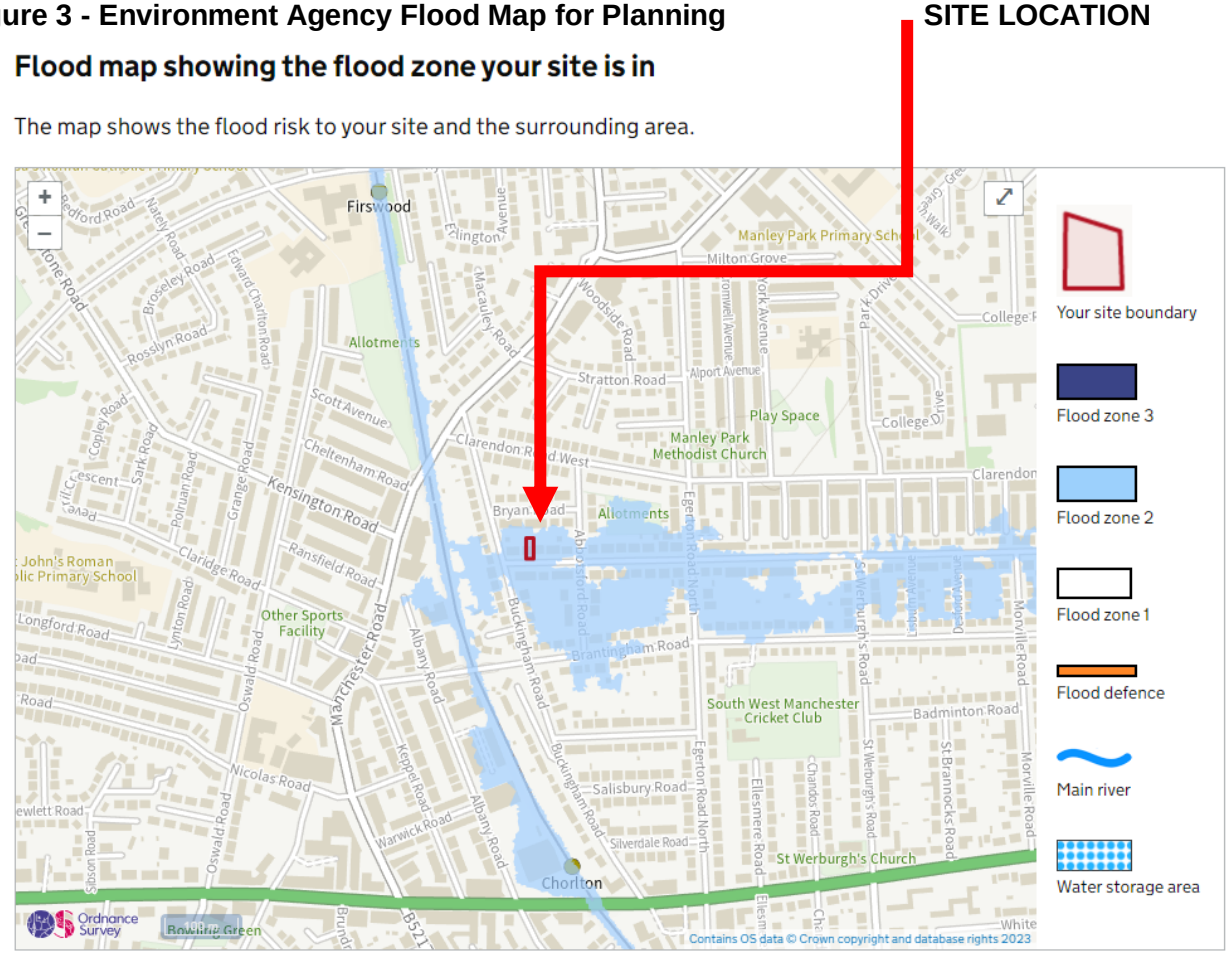
Figure 2-2: Flood level difference map for attenuated (1 in 1000 year) flow along the Grey Irwell and Manchester Ship Canal (where is the site on the map?)



4.3. FLUVIAL FLOOD RISK

Reference to the Environment Agency Flood Zone Mapping, reprinted as **Figure 3**, confirms that the site currently lies wholly within **Flood Zone 2**, outside of both the **1 in 100 and 1 in 1,000** year flood events of the nearby **River Lirwell**. Detailed flood data provided by **the Figure 3 - Environment Agency Flood Map for Planning SITE LOCATION**. **Error! Reference source not found.** show the calculation for the site within the Flood zone 2 having a 1 in 100 year or greater annual probability of fluvial flooding) . As the entrance to the site lies and the highest point within the site is approximately **27.709mAOD**, it is anticipated that the depth of flooding during the 1 in 100 years + 30% climate change flood event would be **100mm.** A Floodplain heights map centred on the site shows the flood plan to reach **100mm,** the higher levels on Manley Rd is **27.709mOAD for AEP and (+30% climate change).** Therefore, the finish floor level need to be set **300mm** above the Finish Flood level which is **(28.109+0.3= 28.109m OAD)**

Figure 3 - Environment Agency Flood Map for Planning **SITE LOCATION**



Vulnerability Classification

4.3.1. The development is classified as More Vulnerable under the NPPF which is defined as follows:

"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."*

4.3.2. Given the sites location within *Flood Zone 2*, The proposed development site is located within Flood Zone 2, so in accordance with current national, local and Environment Agency guidance, as the proposed development is considered 'More Vulnerable & minor non-residential new dwellings:

industrial/commercial/leisure, with a footprint less than 250 square metres. The sequential and exception test are not required and therefore considered passed. in accordance with current national guidance, the site is not required to undertake the Sequential and Exception Tests and is considered to be in an appropriate location for development, as demonstrated by *Table 4*.

Table 4 - Flood Vulnerability and Flood Zone Compatibility (PPG Table 3)

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Fluvial Flood Zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test Required	✓	✓
	Zone 3a	Exception Test Required	✓	×	Exception Test Required	✓
	Zone 3b	Exception Test Required	✓	×	×	×

4.3.3. Due to the proposed location of the built development in Flood Zone 2, the risk of fluvial flooding may be considered to be Medium.

Identified Fluvial Flood Risk: Medium

4.4. TIDAL FLOOD RISK

4.4.1. Due to its inland location, this site may be considered to be at low risk of tidal flooding.

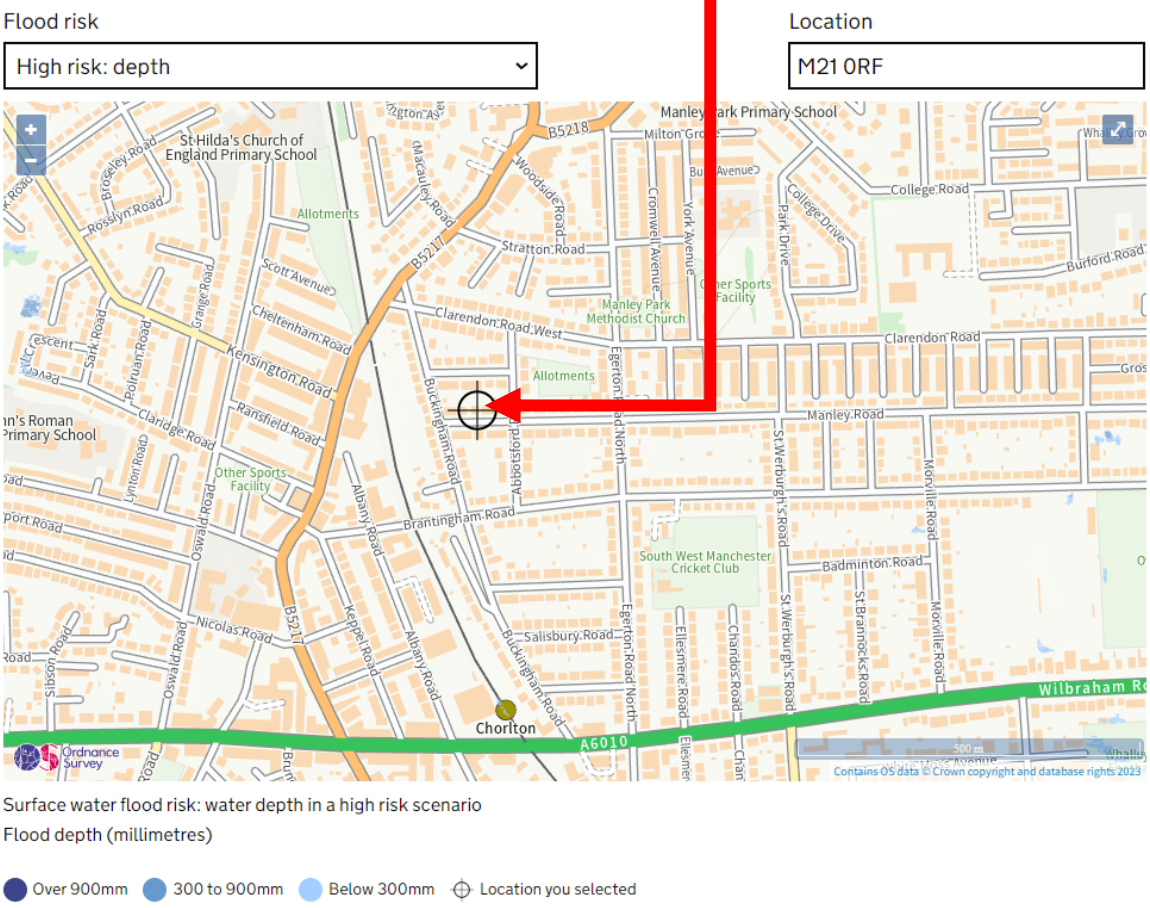
Identified Tidal Flood Risk: Low

4.5. SURFACE WATER FLOOD RISK

4.5.1. The 'Long Term Flood Risk Information,' in particular relating to the 'Flood Risk from Surface Water,' as published by the Environment Agency, was reviewed and identifies the the site is not have a surface water flooding. However, there are localised areas of low risk identified as shown in

Figure 4 – Surface Water Flood Risk Map ***SITE LOCATION***

Figure 4 – Surface Water Flood Risk Map **SITE LOCATION**



4.5.2. The production of this mapping has been undertaken at a national scale to provide the first publically available generation of surface water flood risk mapping. The two previous generations were primarily developed for regulator use as the approach and risk was refined. For example, the first did not include any allowance for sewers, whilst the second incorporated a national loss coefficient.

4.5.3. Although this generation incorporates local estimates of the sewer infiltration loss, generally at a LLFA level along with various other refinements in runoff estimation, it does not allow for local improvements to the underlying Digital Terrain Model (DTM). This means that local features such as the adjoining highways are represented as determined from the LiDAR without any consideration to drainage features such as culverts or small watercourses which typically provide the associated surface water drainage.

4.5.4. As part of the final site design, to ensure that there is no increase to the flood risk to the development or third-party land, appropriate measures will be implemented in accordance with best practice guidance to ensure any surface water is directed away from the existing and proposed properties.

4.5.5. The majority of the site is shown to be at ‘low risk’, with only small, localised areas identified as ‘medium to high’ risk of surface water flooding, therefore, the development may be considered at low risk of surface water flooding.

Identified Surface Water Flood Risk: Low

4.6. UNDERGROUND WATER FLOOD RISK

4.6.1. The BGS records from the nearest boreholes to the site indicate that groundwater was hit at **5'6" 1.65m** below the surface as shown in an **APPENDIX C**

4.6.2. The Environment Agency stated that they had no historical groundwater flood data for this site.

4.6.3. As the site is located in an area identified in the SFRA as being of a low probability of groundwater flooding and borehole records, demonstrate that groundwater is **1.65m** below site levels, with no historical records of groundwater flooding, the risk of groundwater flooding to the site may be considered low

Identified Groundwater Flood Risk: Low

4.7. ARTIFICIAL SOURCE FLOOD RISK

Reservoirs

4.7.1. The Environment Agency's Risk of Flooding from Reservoirs Map shows the site is within the maximum extent of flooding all over the area from Bridgwater Canal & River Irwell . Bridgwater Canal lies approximately **1.15miles** West of the site and River Irwell approximately **2.0miles** to the North of the site

4.7.2. The publicly available Flood Risk from Reservoirs Map identifies the site to lie inside of the zone of influence for reservoir flooding.

4.7.3. "Reservoir flooding is likely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs must be inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in England, we ensure that reservoirs are inspected regularly and essential safety work is carried out"

4.7.4. Given that the site is inside of the zone of influence for any reservoir, and that reservoir flooding is rare, the development may be considered to be at Medium risk of reservoir flooding.

Identified Flood Risk from Reservoirs: Low

Figure 5 Maximum extent of flooding from reservoirs:



Canals

4.7.5. Canal flooding is generally rare, and the canal network is designed in such a way to direct all additional water beyond the navigation capacity to impounding areas or surrounding watercourses to be conveyed downstream. The risk from canal flooding becomes more of a concern where the structure is elevated on an earth embankment and if there is a rare instance of a catastrophic breach, leading to a sudden drain-down of the pound and resultant overland flow flood risk to development immediately downstream.

4.7.6. The nearest canal is Bridgewater Canal at **15.0 miles** West of the site.

4.7.7. The nearest river is River Irwell at **2.0 miles** to the north of the site

4.7.8. The site is considered of medium risk of flooding from Canal and River.

Medium risk means that this area has a chance of flooding of between **1% and 3.3%** each year.

Identified Flood Risk from Canals: Low

4.8. DEVELOPMENT EXCEEDANCE FLOWS

4.8.1. Careful regard has to be made regarding potential exceedance flows, being events that are more extreme than current design criteria. Various national guidance has been published on the matter of exceedance flows and measures that should be incorporated into development to ensure the safety of occupiers and those using the infrastructure.

4.8.2. Published guidance in the form of A Design and Construction Guide for Developers and the Environment Agency document *"Improving the Flood Performance of New Buildings: Flood Resilient Construction*" advocate the design of developments that implement infrastructure routes that will safely convey floodwaters resulting from sewer flooding or overland flows away from buildings and along defined corridors.

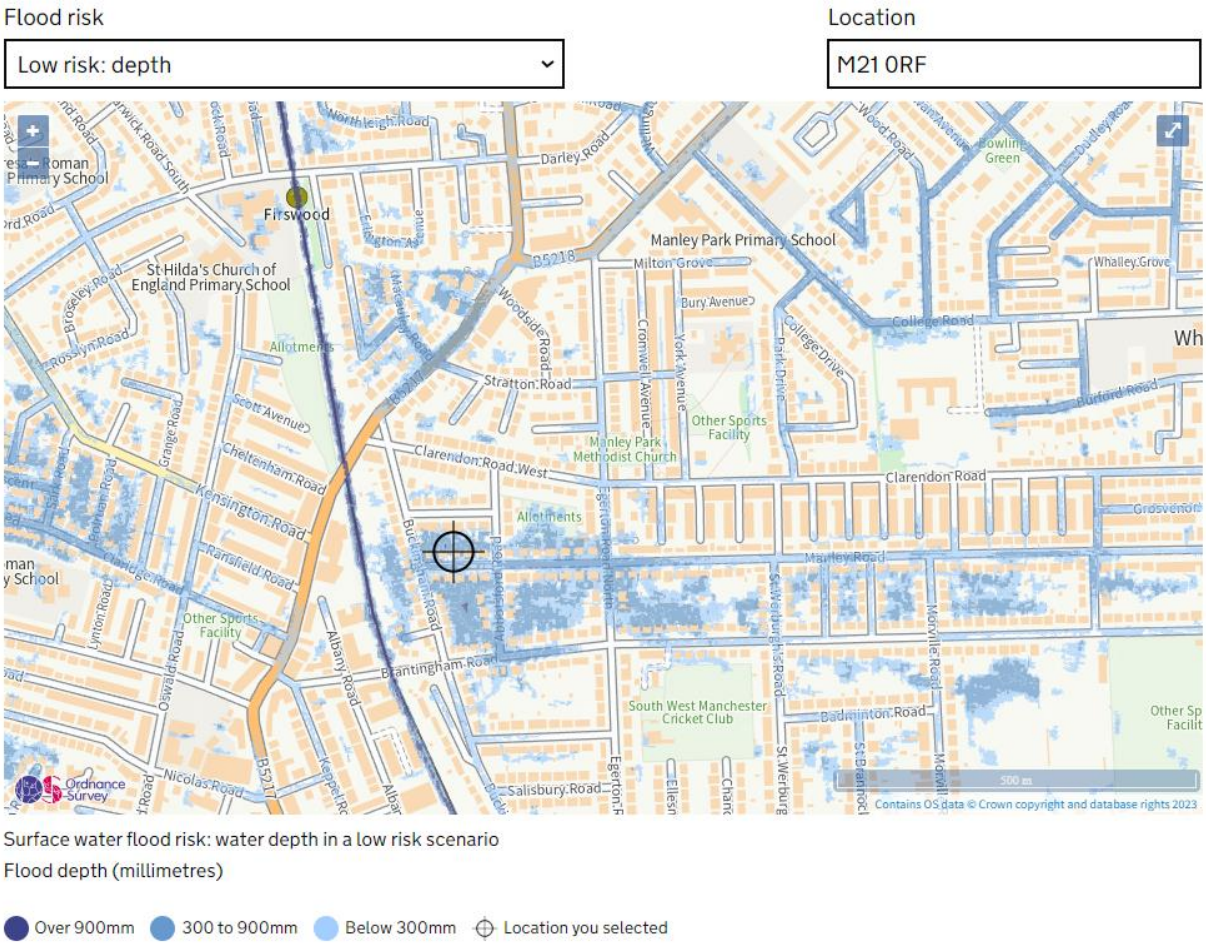
4.8.3. The principal aim is to direct exceedance flows away from properties and along defined corridors. At a local level, this may mean water being conveyed along a length of the highway, as long as the predicted flow depths and velocities are acceptable. More strategically, the implementation of conveyance corridors are important in avoiding deep, and high velocity flows that present a high risk.

The site is in **Zone 2**; therefore, it naturally floods in the event of an extreme event. **The Environment Agency** and calculation within **APPENDIX F indicates that the maximum flood will be 100mm on site**. This corresponds to a finish floor level **28.109mAOD** *see Figure 6 Environment Agency Map Maximum flood Level lower* 0.30m. To prevent flood waters from accumulating within the house it is proposed to introduce a 2 No of steps allowing a rise of 300mm before entering the building. The finish floor level will be **28.109mAOD** above the ground level to mitigate the risk of the floodwaters from flowing toward the building.

4.8.4. Further measures for dealing with exceedance flows, including raised finished floor and external levels, will be set ***300mm minimum above the existing ground level***.

Identified Flood Risk from Exceedance Flows: Low

Figure 6 Environment Agency Map Maximum flood Level lower 0.30m



7.0 MITIGATION MEASURES

The purpose of this section of the report is to provide information for utilisation as part of the planning application for the proposed development site. The mitigation measure outlined below may be adopted to reduce the consequences of the flooding to people and property

7.1 FLOOD RISK ASSESSMENT

The application recognises the need to address the current situation with regards to flooding and to this end National Planning Policy Framework 2021 (NPPF Flood Risk and Development is relevant. The Policy clearly states that:

Planning and flood risk

159. Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.

In response to the paragraph **159** we are providing flood plain compensation by the provision of lower garden of the property, a permeable pavement for the carpark areas and rain water harvesting at the rear of the property.

160. Strategic policies should be informed by a strategic flood risk assessment, and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards.

Consideration of flood risk various sources have been addressed.

167. When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment55. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

- The development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;
- It incorporates sustainable drainage systems.
- Any residual risk can be safely managed.
- Safe access and escape routes are included at the front of the property.

7.2 FLOOD RESISTANT AND RESILIENT DESIGN

As the site has been shown to lie within flood zone 2, certain measures can be undertaken to reduce the impact of the flooding on the building. Set a Finish Floor Level 300mm above the flood level & using water resilient paints and fittings/fixtures, ensuring electrical sockets are raised above the 1 in 100 years + 30% Climate change flood level using flood (sealed UPVC) exterior doors and flood guards are an example of ways to minimise flood damage (CIRIA 2004). It is recommended that the exterior door to the building are fitted with detachable flood guards, which can be installed during times of high water levels and when flood warnings are issued by the Environment Agency.

7.3 ACCESS AND EGRESS

Access and egress to the site are currently only available from Gentian Road. 274 Manley Roadis located within Flood Zone 2, and therefore safe dry access and egress to and from the site is available above the 1 in 100-Yar +30%CC flood level plus climate change.

Suggested rout for egress is relatively short. Water depth is less then (100mm). Velocity are indicated is low in the flood map Error! Reference source not found. & **Figure 8 Manning Equation Calculator** , therefore this egress rout is acceptable.

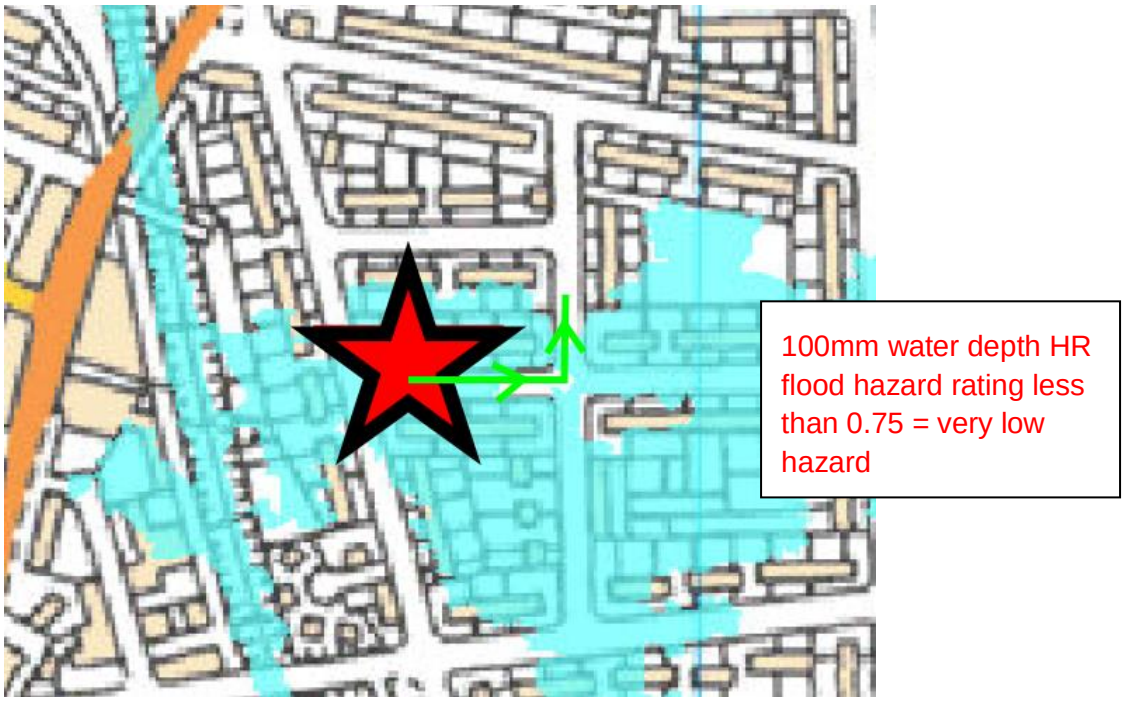
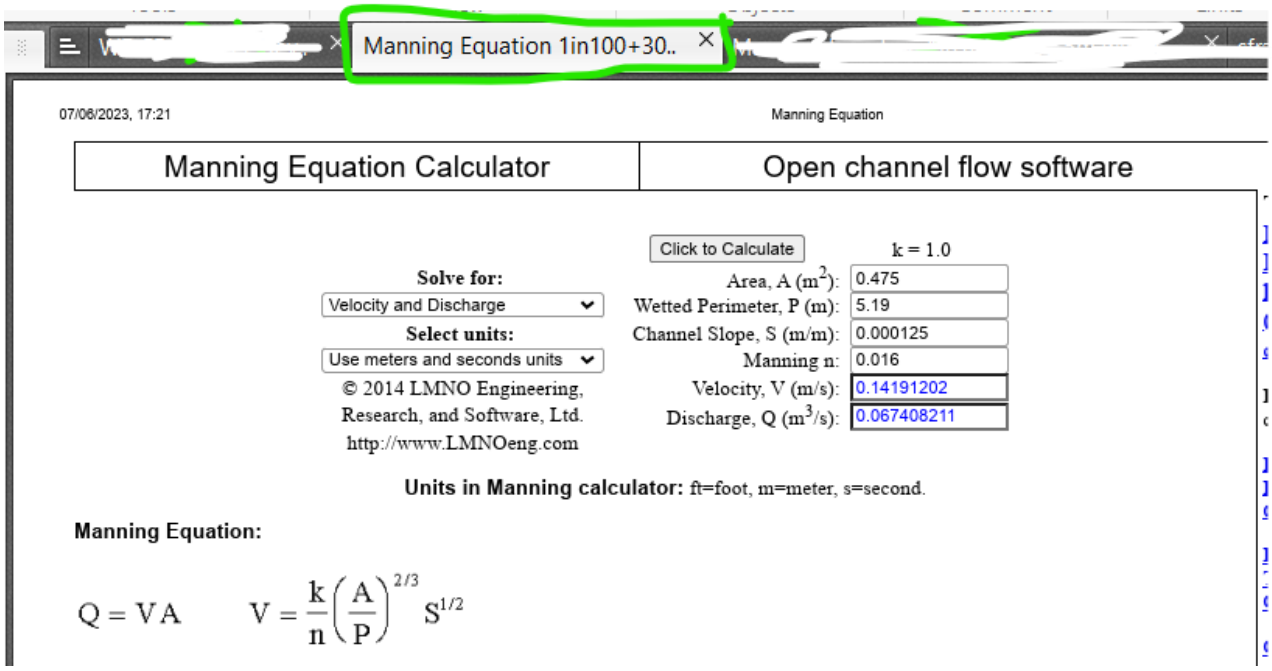


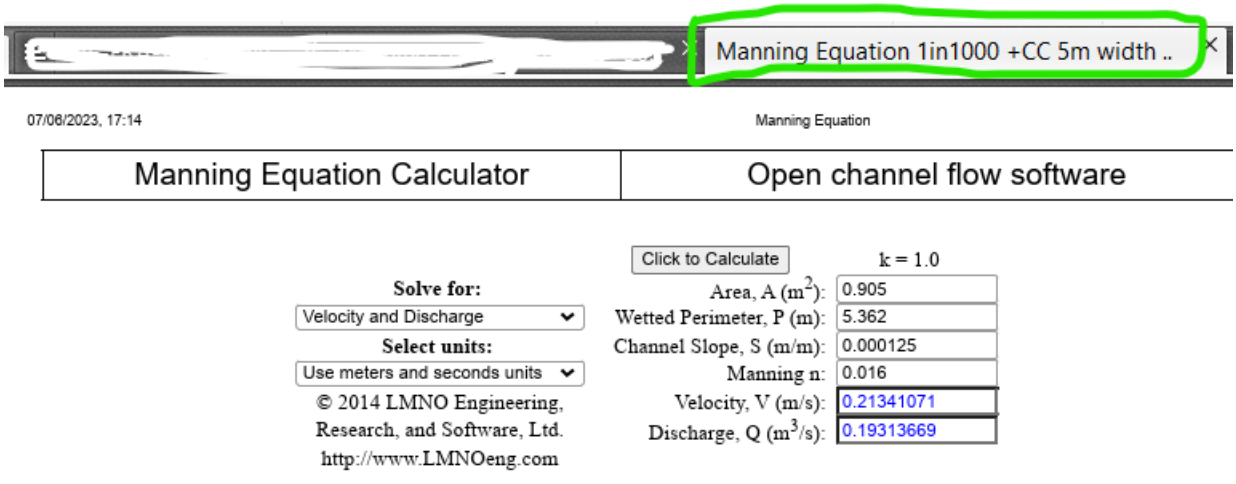
Figure 7 Egress Route

Safe access and egress has been shown. The site must demonstrate a 'Very low' route of access/egress to dry land. Depth and velocity are referred to, however, the velocity has been taken from the surface water information, not the fluvial flood information. Either EA mapping showing a safe route provided, or demonstrated by calculations using the Defra formula for flood hazard been considered as shown in the

Figure 9 Table 4 Hazard to People Classification Rating**.**

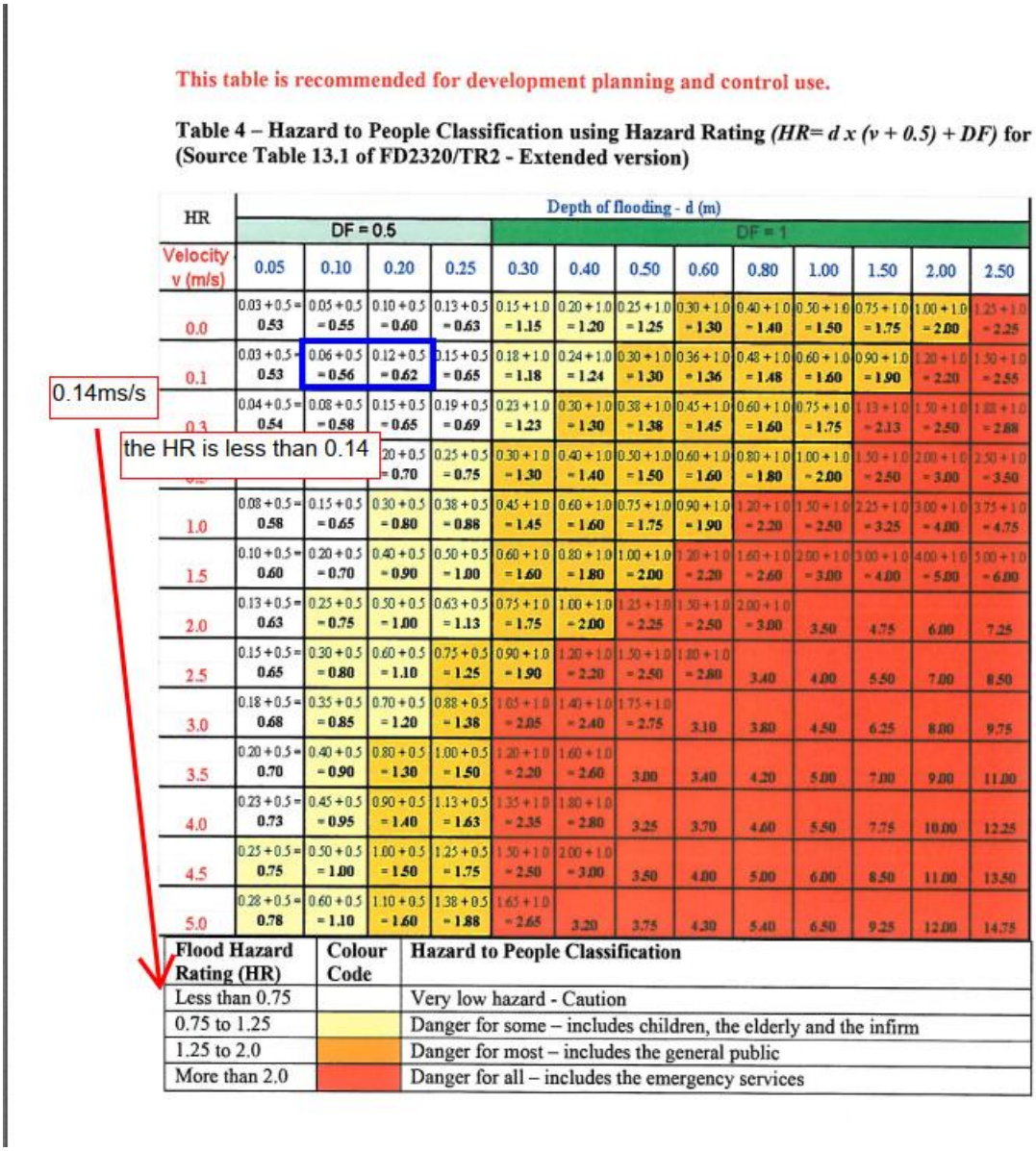
Figure 8 Manning Equation Calculator





k is a unit conversion factor: k=1.49 for English units (feet and seconds). k=1.0 for SI units (meters and seconds).
A=Flow area of the pipe, culvert, or channel.
P=Wetted perimeter which is the portion of the circumference that is in contact with water.
Q=Discharge (flow rate).
S=Downward (longitudinal) slope of the culvert.
V=Average velocity in the pipe, culvert, or channel.

Figure 9 Table 4 Hazard to People Classification Rating



This table is recommended for development planning and control use.

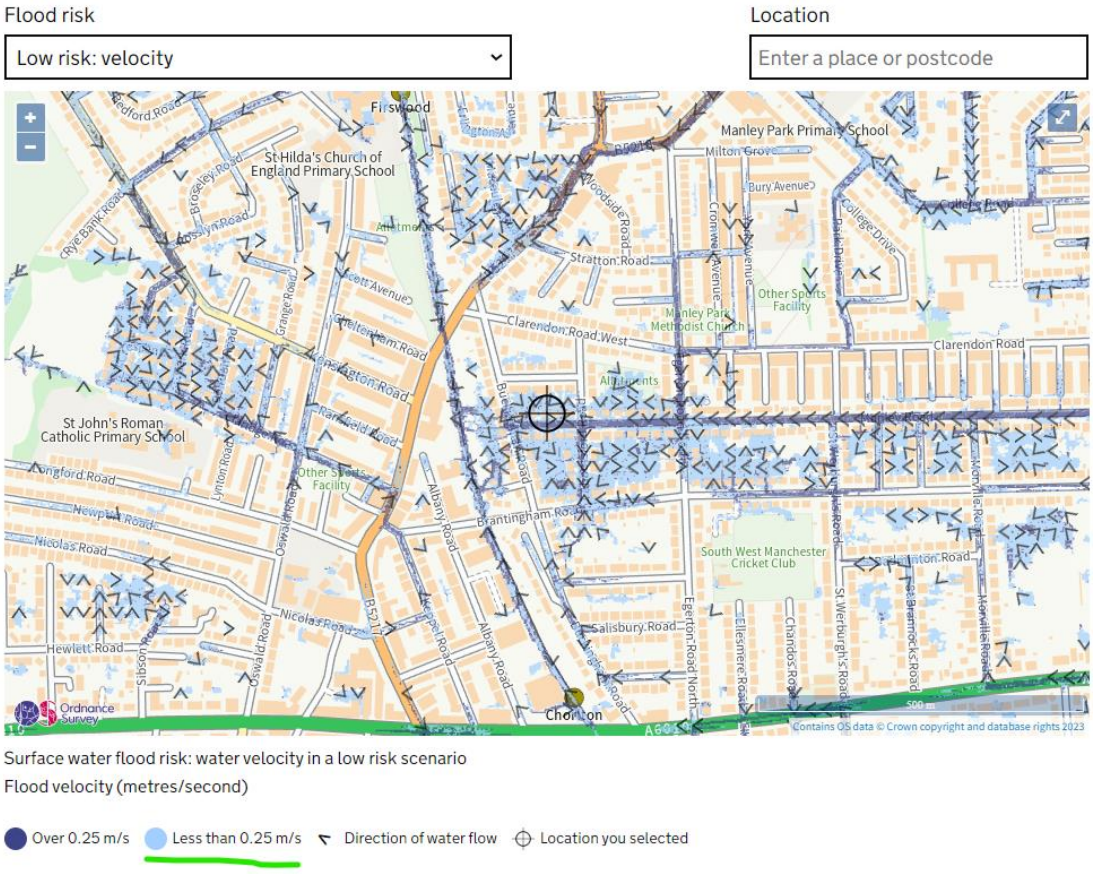
Table 4 – Hazard to People Classification using Hazard Rating *(HR= d x (v + 0.5) + DF)* for (Source Table 13.1 of FD2320/TR2 - Extended version)

HR	Depth of flooding - d (m)												
	DF = 0.5				DF = 1								
Velocity v (m/s)	0.05	0.10	0.20	0.25	0.30	0.40	0.50	0.60	0.80	1.00	1.50	2.00	2.50
0.0	0.03 + 0.5 = 0.53	0.05 + 0.5 = 0.55	0.10 + 0.5 = 0.60	0.13 + 0.5 = 0.63	0.15 + 1.0 = 1.15	0.20 + 1.0 = 1.20	0.25 + 1.0 = 1.25	0.30 + 1.0 = 1.30	0.40 + 1.0 = 1.40	0.50 + 1.0 = 1.50	0.75 + 1.0 = 1.75	1.00 + 1.0 = 2.00	1.25 + 1.0 = 2.25
0.1	0.03 + 0.5 = 0.53	0.06 + 0.5 = 0.56	0.12 + 0.5 = 0.62	0.15 + 0.5 = 0.65	0.18 + 1.0 = 1.18	0.24 + 1.0 = 1.24	0.30 + 1.0 = 1.30	0.36 + 1.0 = 1.36	0.48 + 1.0 = 1.48	0.60 + 1.0 = 1.60	0.90 + 1.0 = 1.90	1.20 + 1.0 = 2.20	1.50 + 1.0 = 2.50
0.3	0.04 + 0.5 = 0.54	0.08 + 0.5 = 0.58	0.15 + 0.5 = 0.65	0.19 + 0.5 = 0.69	0.23 + 1.0 = 1.23	0.30 + 1.0 = 1.30	0.38 + 1.0 = 1.38	0.45 + 1.0 = 1.45	0.60 + 1.0 = 1.60	0.75 + 1.0 = 1.75	1.13 + 1.0 = 2.13	1.50 + 1.0 = 2.50	1.88 + 1.0 = 2.88
			20 + 0.5 = 0.70	0.25 + 0.5 = 0.75	0.30 + 1.0 = 1.30	0.40 + 1.0 = 1.40	0.50 + 1.0 = 1.50	0.60 + 1.0 = 1.60	0.80 + 1.0 = 1.80	1.00 + 1.0 = 2.00	1.50 + 1.0 = 2.50	2.00 + 1.0 = 3.00	2.50 + 1.0 = 3.50
1.0	0.08 + 0.5 = 0.58	0.15 + 0.5 = 0.65	0.30 + 0.5 = 0.80	0.38 + 0.5 = 0.88	0.45 + 1.0 = 1.45	0.60 + 1.0 = 1.60	0.75 + 1.0 = 1.75	0.90 + 1.0 = 1.90	1.20 + 1.0 = 2.20	1.50 + 1.0 = 2.50	2.25 + 1.0 = 3.25	3.00 + 1.0 = 4.00	3.75 + 1.0 = 4.75
1.5	0.10 + 0.5 = 0.60	0.20 + 0.5 = 0.70	0.40 + 0.5 = 0.90	0.50 + 0.5 = 1.00	0.60 + 1.0 = 1.60	0.80 + 1.0 = 1.80	1.00 + 1.0 = 2.00	1.20 + 1.0 = 2.20	1.60 + 1.0 = 2.60	2.00 + 1.0 = 3.00	3.00 + 1.0 = 4.00	4.00 + 1.0 = 5.00	5.00 + 1.0 = 6.00
2.0	0.13 + 0.5 = 0.63	0.25 + 0.5 = 0.75	0.50 + 0.5 = 1.00	0.63 + 0.5 = 1.13	0.75 + 1.0 = 1.75	1.00 + 1.0 = 2.00	1.25 + 1.0 = 2.25	1.50 + 1.0 = 2.50	2.00 + 1.0 = 3.00	3.50	4.75	6.00	7.25
2.5	0.15 + 0.5 = 0.65	0.30 + 0.5 = 0.80	0.60 + 0.5 = 1.10	0.75 + 0.5 = 1.25	0.90 + 1.0 = 1.90	1.20 + 1.0 = 2.20	1.50 + 1.0 = 2.50	1.80 + 1.0 = 2.80	3.40	4.00	5.50	7.00	8.50
3.0	0.18 + 0.5 = 0.68	0.35 + 0.5 = 0.85	0.70 + 0.5 = 1.20	0.88 + 0.5 = 1.38	1.05 + 1.0 = 2.05	1.40 + 1.0 = 2.40	1.75 + 1.0 = 2.75	3.10	3.80	4.50	6.25	8.00	9.75
3.5	0.20 + 0.5 = 0.70	0.40 + 0.5 = 0.90	0.80 + 0.5 = 1.30	1.00 + 0.5 = 1.50	1.20 + 1.0 = 2.20	1.60 + 1.0 = 2.60	3.00	3.40	4.20	5.00	7.00	9.00	11.00
4.0	0.23 + 0.5 = 0.73	0.45 + 0.5 = 0.95	0.90 + 0.5 = 1.40	1.13 + 0.5 = 1.63	1.35 + 1.0 = 2.35	1.80 + 1.0 = 2.80	3.25	3.70	4.60	5.50	7.75	10.00	12.25
4.5	0.25 + 0.5 = 0.75	0.50 + 0.5 = 1.00	1.00 + 0.5 = 1.50	1.25 + 0.5 = 1.75	1.50 + 1.0 = 2.50	2.00 + 1.0 = 3.00	3.50	4.00	5.00	6.00	8.50	11.00	13.50
5.0	0.28 + 0.5 = 0.78	0.60 + 0.5 = 1.10	1.10 + 0.5 = 1.60	1.38 + 0.5 = 1.88	1.65 + 1.0 = 2.65	3.20	3.75	4.30	5.40	6.50	9.25	12.00	14.75

Flood Hazard Rating (HR)	Colour Code	Hazard to People Classification
Less than 0.75		Very low hazard - Caution
0.75 to 1.25		Danger for some – includes children, the elderly and the infirm
1.25 to 2.0		Danger for most – includes the general public
More than 2.0		Danger for all – includes the emergency services

The hazard rating is less than 0.75 and classified as a “very low hazard – caution”. therefore the short egress to dry land can be undertaken with caution, and not a danger to children, the elderly and infirm.

Figure 10 Flood velocity (metres/second)



The anticipated depth of flooding during the 1 in 100 years + Climate change & 1 in 1000 event is contained outside of the building and is less than **100mm** in depth. The presence of floodwater is only associated with water flowing past the site due to the surrounding topography. Therefore, it is recommended that occupants of the building remain within the building during the time of the flood. This is considered a last resort. Occupants should monitor flood levels and warning and evacuate the site in the first instance, prior to flood water reaching the site. Occupants should then not return to the site until flood water has dispersed and heavy rainfall has ceased. Provisions for such an occurrence should be detailed within the resident flood evacuation plan. Refer **to APPENDIX G Flood Level Calc**

7.4 SURFACE WATER MANAGEMENT

The proposed development is comprising a proposed erection of a 2 storey side extension and a part single/part 2 storey rear extension to form additional living accommodation. It is considered a minimum increased to the existing building footprint by 22.5sqm , therefore its unlikely there will be an increase in the surface water runoff rate. As the green areas surrounding the site are to remain unaffected, it is considered un-necessary to provide any betterment.

8.0 CONCLUSIONS

8.1.1 The risk of flooding to and from the proposed development has been assessed in accordance with the NPPF updated 2021.

8.1.2 This assessment demonstrates that the site lies within an appropriate location for the proposed land uses in accordance with the vulnerability classifications of the NPPF and supported by the Planning Authority and the Environment Agency.

8.1.3 Management of extreme event flood risk can be achieved through ensuring the finished floor levels of the proposed building are set at a ***minimum of 300mm*** above the ground and open space levels in areas where designated overland flood routes are identified.

8.1.4 In response to the paragraph **159** we are providing flood plain compensation by the provision of lower garden of the property, a permeable pavement for the carpark areas and rain water harvesting at the rear of the property.

8.1.5 In addition to the NPPF, the proposed drainage strategy complies with local policy and site-specific requirements.

8.1.6 This report demonstrates that the proposed development can be undertaken in a sustainable manner without increasing the flood risk either at the site or to any third-party land in line with NPPF requirements.

8.1.7 The proposed development site is located within **Flood Zone 2**, so in accordance with current national, local and Environment Agency guidance, as the proposed development is considered 'More Vulnerable & minor non-residential dwellings: with a footprint less than **250 square** metres. The sequential and exception test are not required and are therefore considered as appropriate. We appreciate there is an extension the increased footprint of approximately **22.5.msq**. Therefore, this is below the 250msq threshold, based on the requirement Environment Agency. Therefore, we believe the Exception test is not required in accordance with the EA guidance noted above.

8.1.8 We have managed and demonstrated the flood risk on our proposed site, the floor level set 300mm above the calculated flood level.

8.1.9 There is a footpath link to the main link, suggested route for egress is relatively short. The water depth is less than **100mm**. Velocity are indicated is low in the flood map. Therefore, this egress route is acceptable. As indicated in **section 7.4** in the report.

8.1.10 The Flood level **1 in 100 years + 30 CC is 27.719mAOD**. Therefore, the design Finish Floor Level FFL would be set as **28.019mAOD**

Therefore, the flood level in 1 in 100 years + 30% is 27.709+0.1=**28.109.mAOD**

The average level beneath the new build is 27.709mAOD, and the area of the new build is 22.5sqm. Therefore the lost flood volume is (100mm)*22.5 =**2.25cum.**

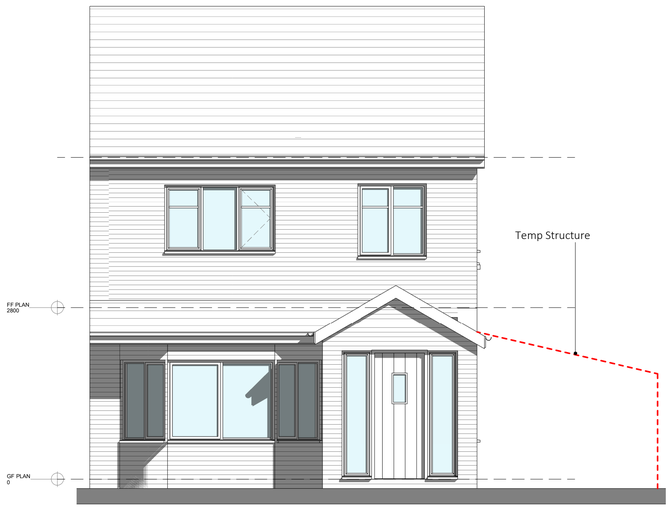
The calculation of envisaged sheet flow velocity is shown below.

8.1.11 Therefore, the hazard rating is less than **0.75.** The HR is considered as a very low hazard, indicating “caution” Therefore, it is suggested that egress from the property is possible with caution and that the risk poses no risk to children, the elderly and infirm.

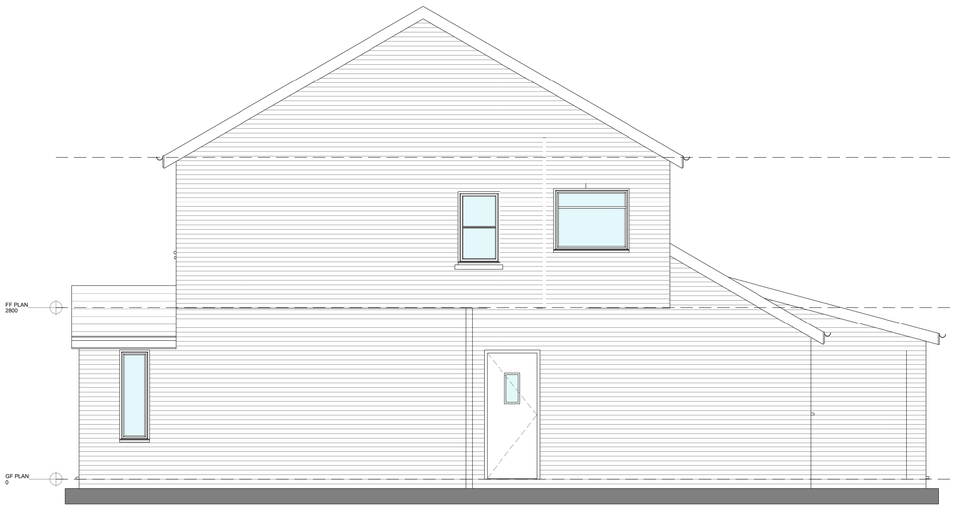
8.1.12 The development may utilise rainwater harvesting techniques such as the use of water butts, to help encourage water re-use for irrigation etc. It is not proposed to provide any betterment ort other SUDs techniques as there is no increase to the surface water run-off) Remember, you need to provide extra areas (roof & external hard standings_ and proposed areas. If you are not increasing this ten you need to prove it.

APPENDIX A

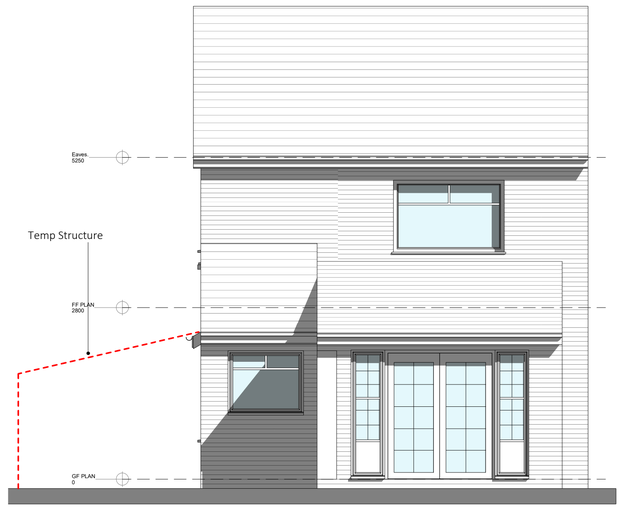
PROPOSED DEVELOPMENT LAYOUT



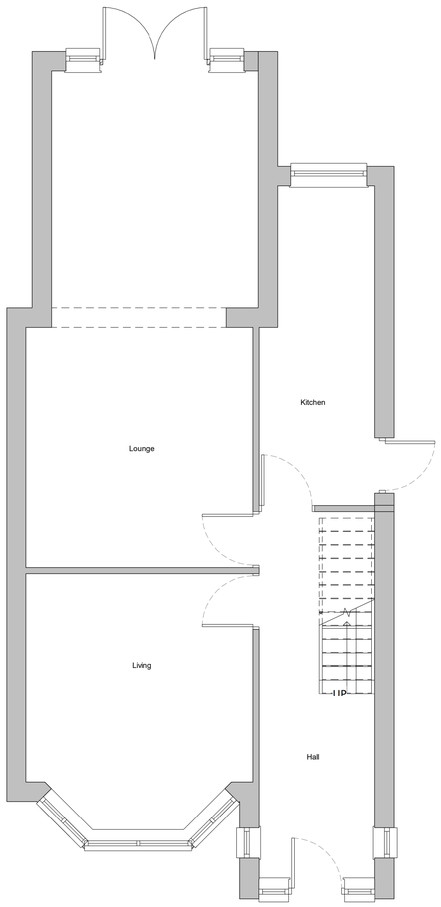
Existing Front Elevation
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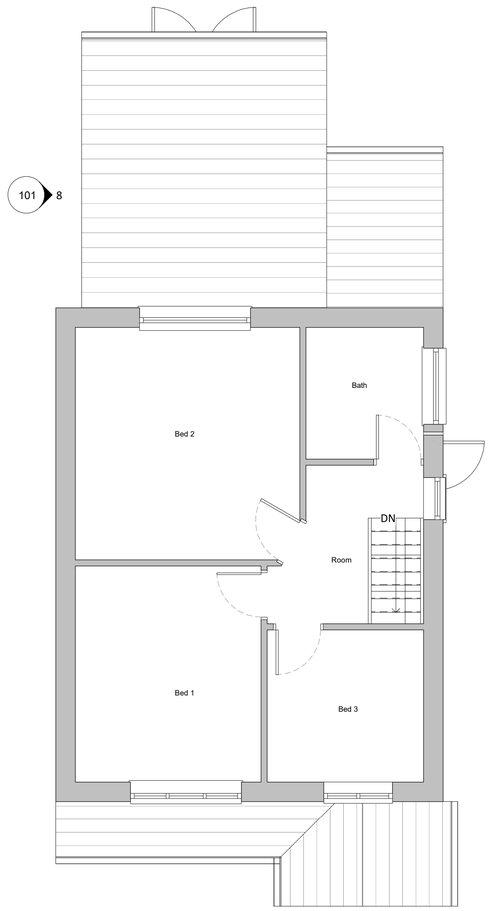
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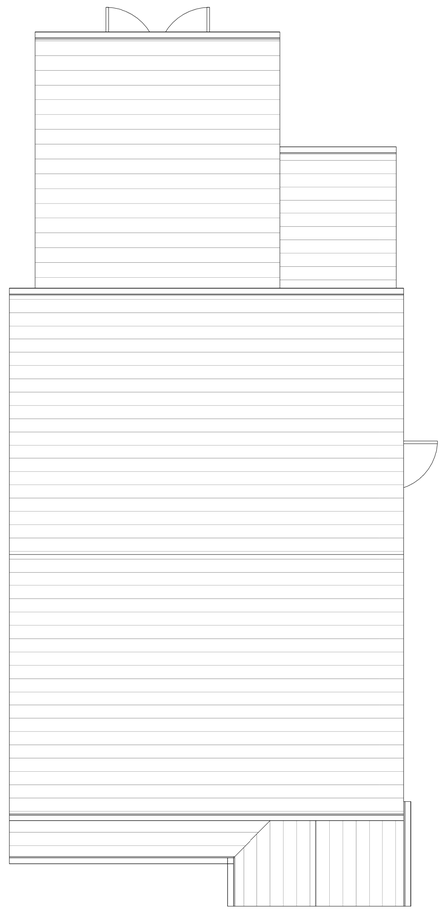
Existing Rear Elevation
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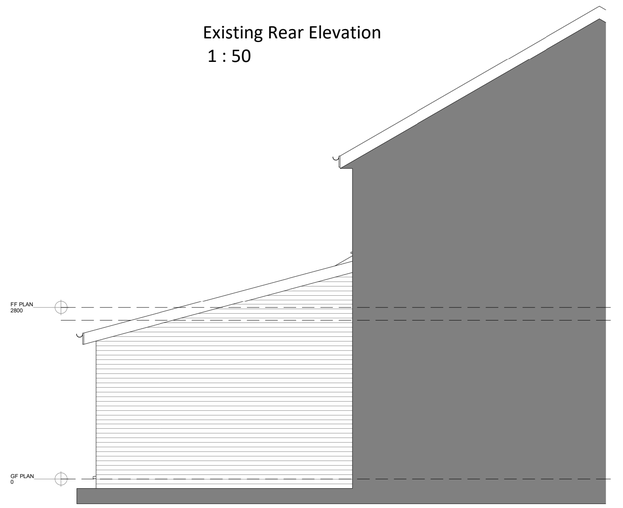
Existing Ground Floor Plan
1 : 50



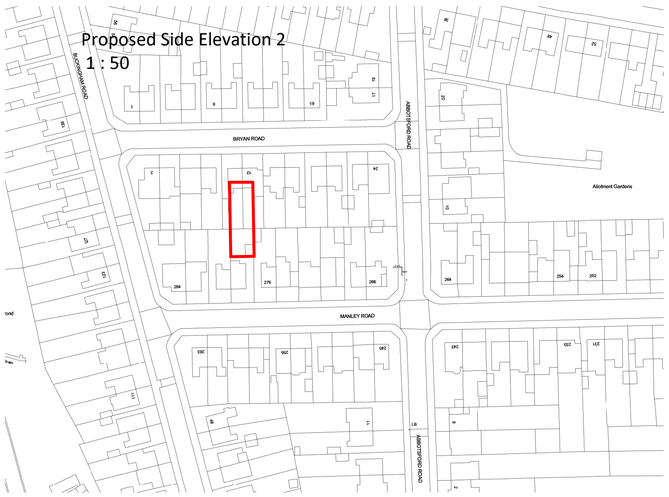
Proposed First Floor Plan
1 : 50



Existing Roof Plan
1 : 50



Proposed Side Elevation 2
1 : 50



Site Location Plan
1 : 1250

revision	date	drawn	description
A	27/04/23	KH	Side Elevation 2 Added

Note:
Walls - Red Brick
Roof - Terracotta Pantile Roof Tiles
Windows - Grey uPVC
Door - Grey Composite

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0m 1m 2m 3m 4m 5m

Site Location Plan Existing Floor Plans and Elevations

B-2017-101-Site Location Plan Existing Floor Plans and Elevations

A
revision

Mr Usman
274 Manley Rd

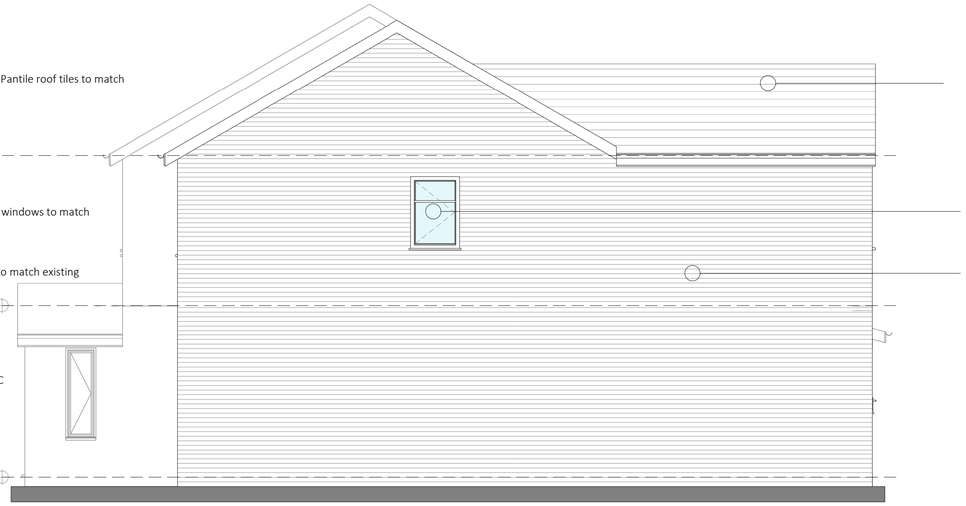
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scale

B-2017
job reference

KH
drawn



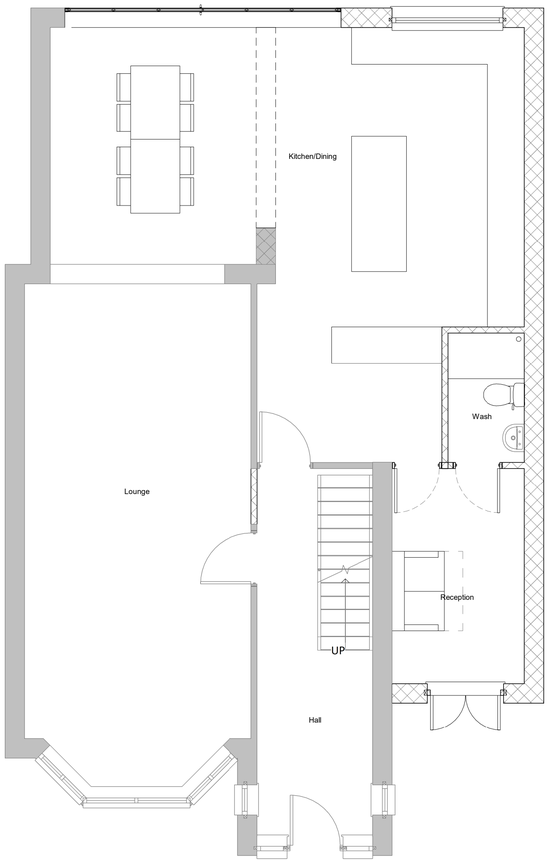
Proposed Front Elevation
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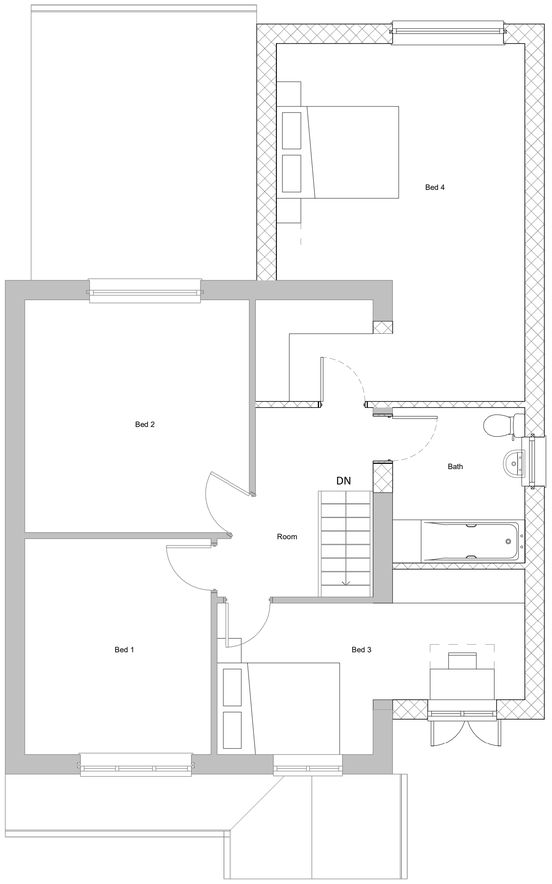
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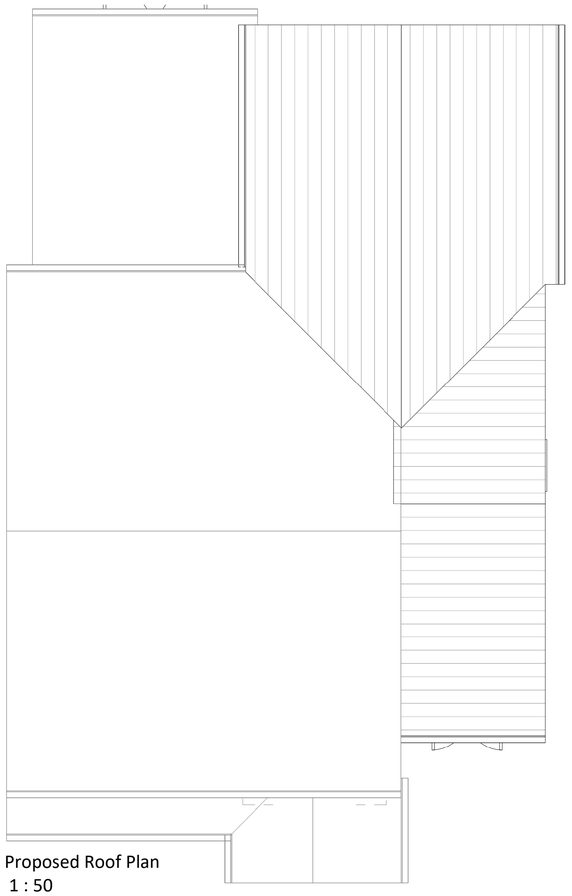
Proposed Rear Elevation
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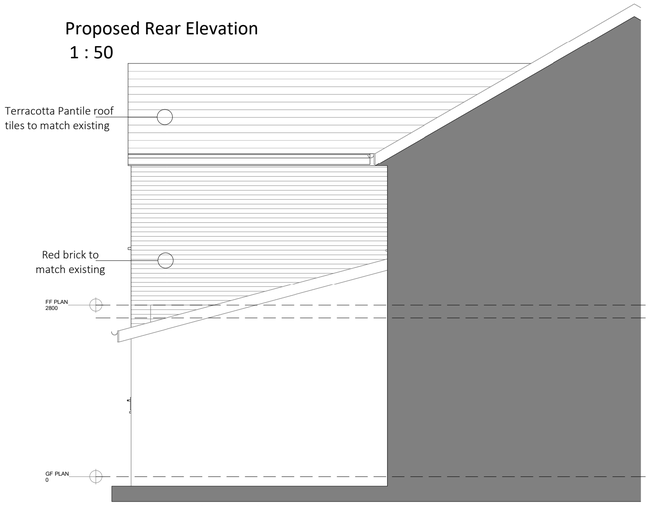
Proposed Ground Floor Plan
1 : 50



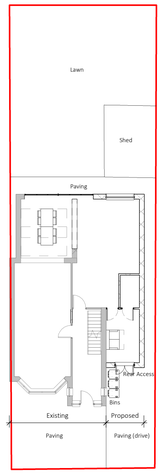
Proposed First Floor Plan
1 : 50



Proposed Roof Plan
1 : 50



Proposed Side Elevation 2
1 : 50



Proposed Site Plan
1 : 200

revision	date	drawn	description
A	27/04/23	KH	Side Elevation 2 Added

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0m 1m 2m 3m 4m 5m

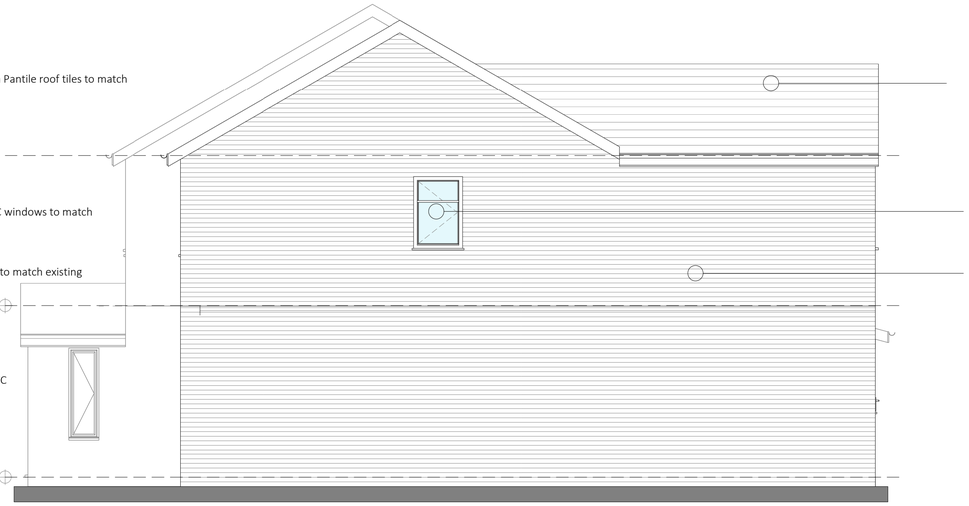
Proposed Site Plan Floor Plans and Elevations

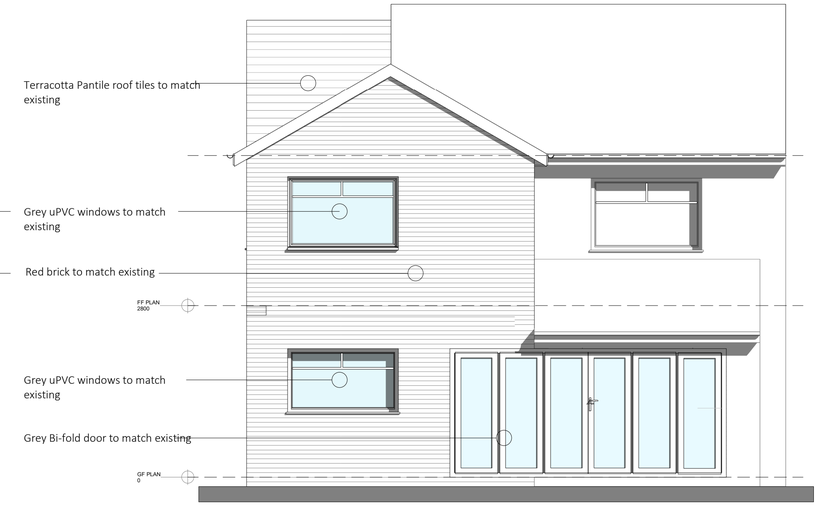
Mr Usman
274 Manley Rd

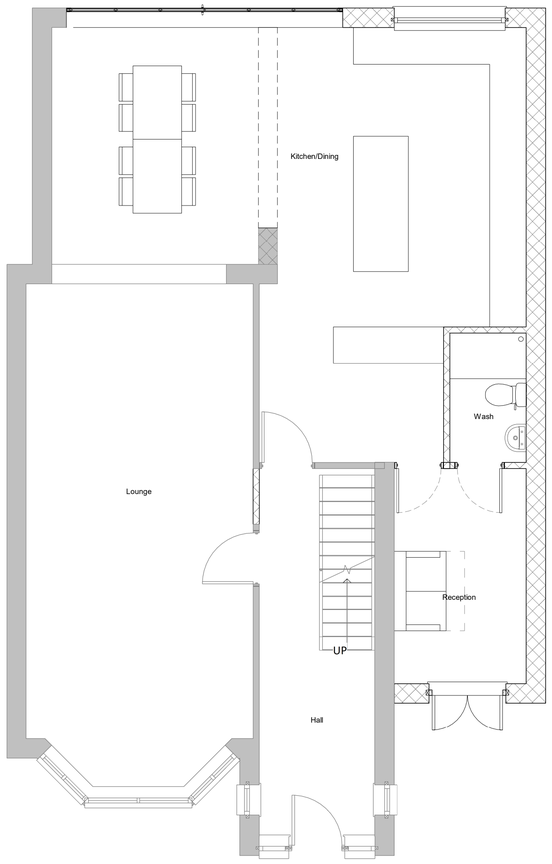
B-2017-102-Proposed Site Plan Floor Plans and Elevations — revision A

1:50 @ A1 — scale
B-2017 — job reference
KH — drawn

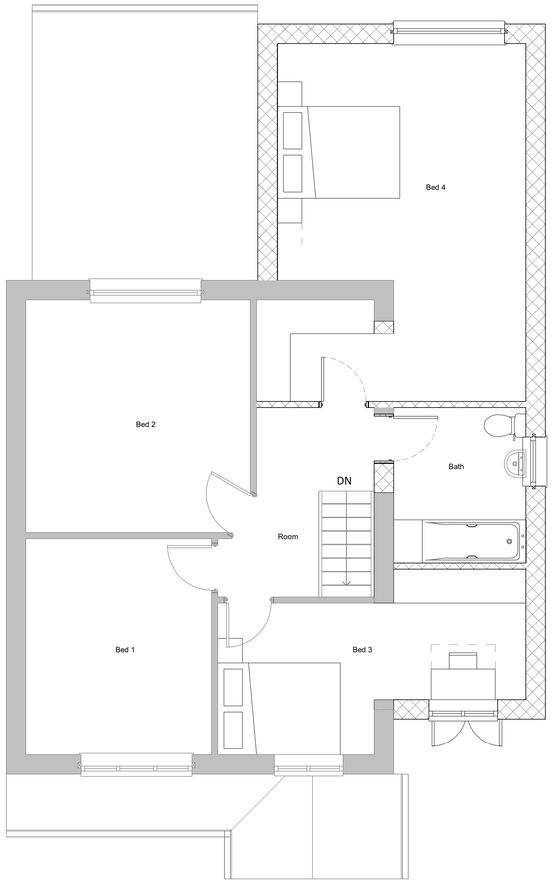




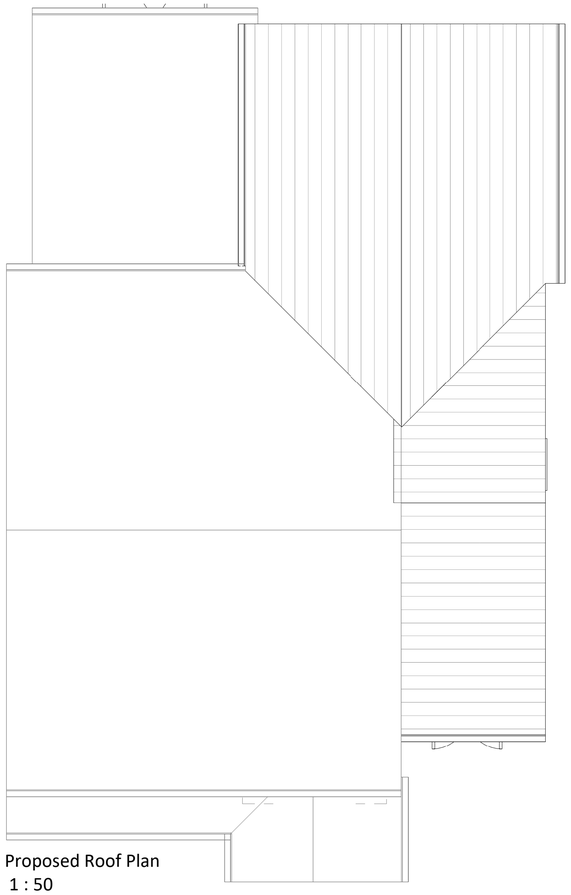




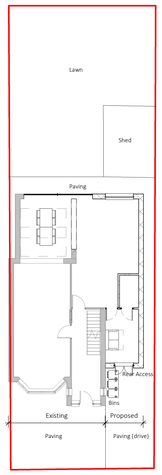
Proposed Ground Floor Plan
1 : 50



Proposed First Floor Plan
1 : 50



Proposed Roof Plan
1 : 50



Proposed Site Plan
1 : 200

revision	date	drawn	description

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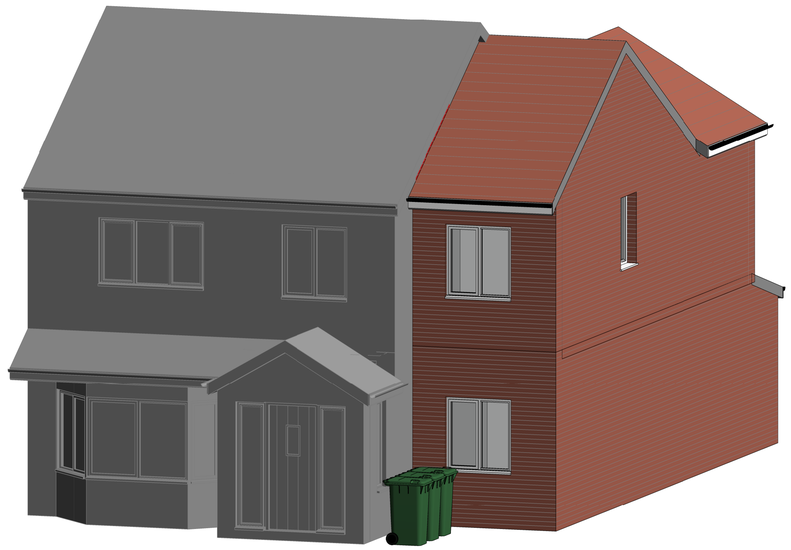
0m 1m 2m 3m 4m 5m

Proposed Site Plan Floor Plans and Elevations

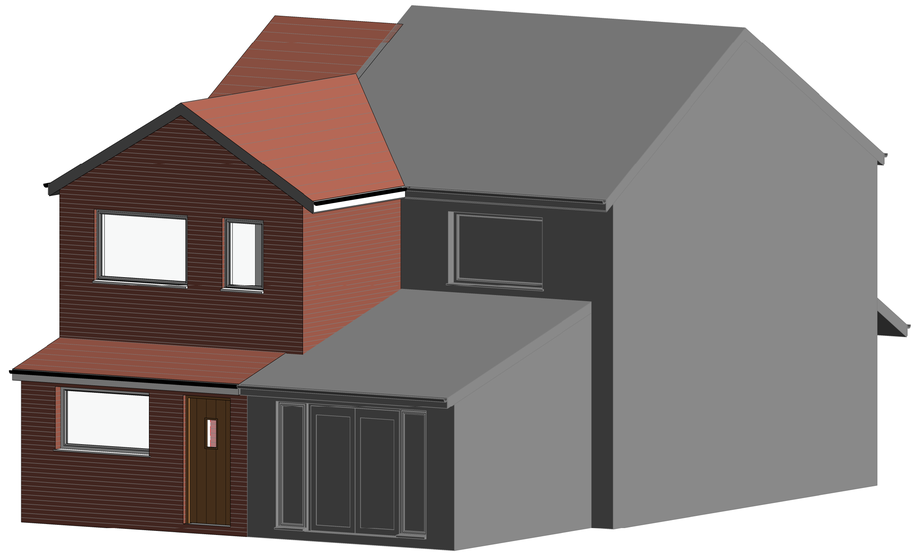
Mr Usman
274 Manley Rd

B-2017-102-Proposed Site Plan Floor Plans and Elevations — revision

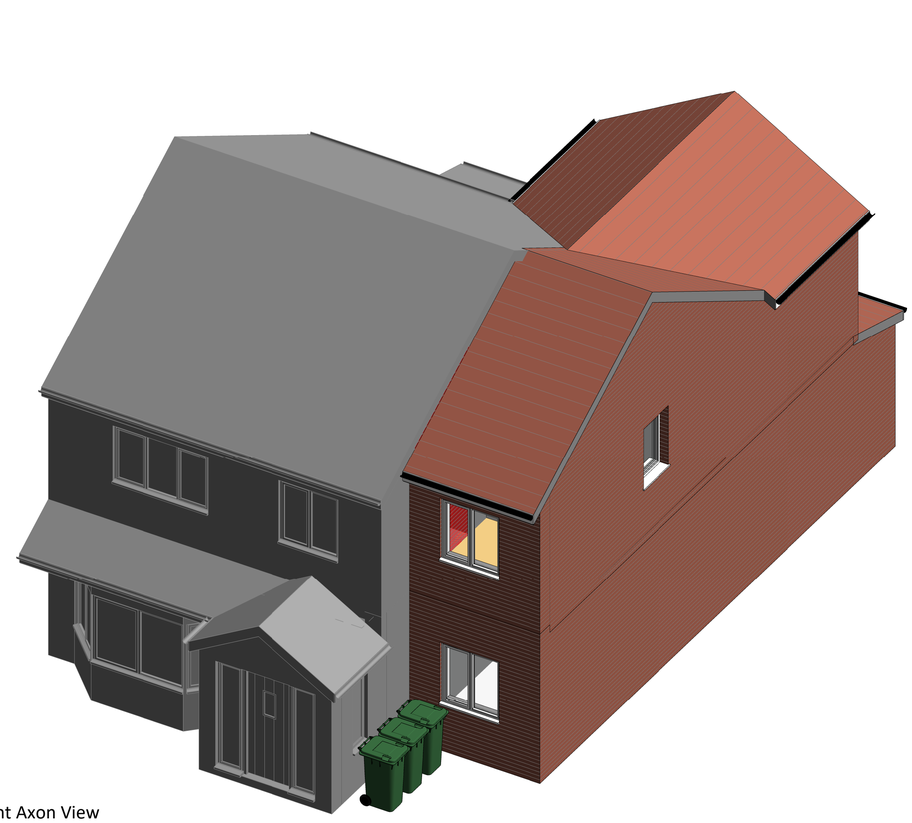
1:50 @ A1 — scale
B-2017 — job reference
KH — drawn



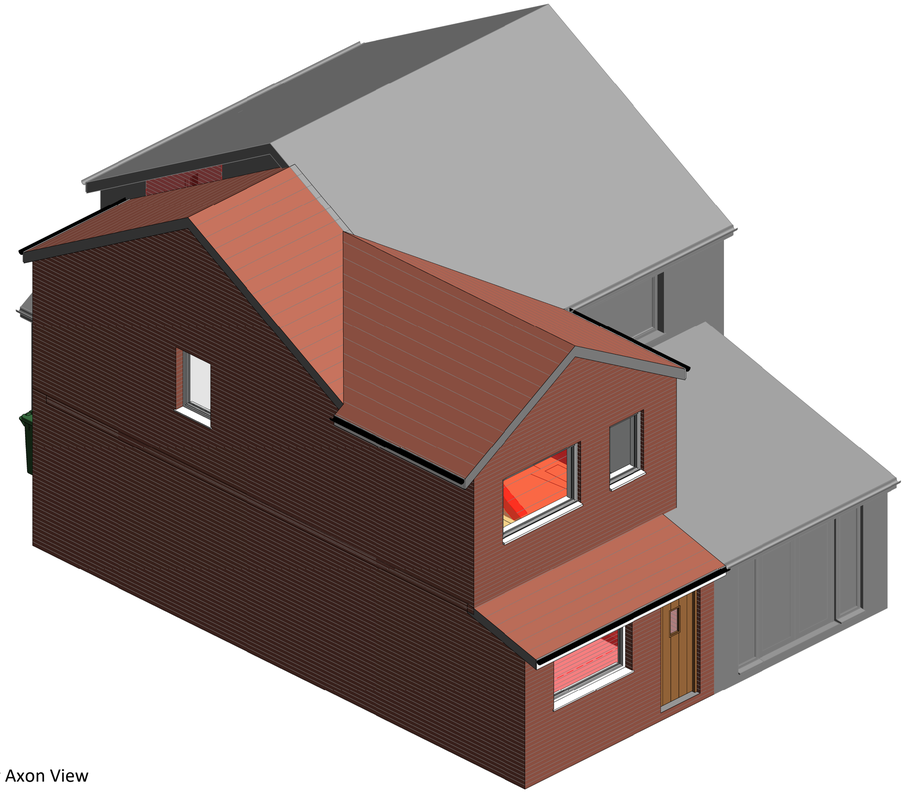
Front 3D View



Rear 3D View



Front Axon View



Rear Axon View

revision date drawn description

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0m 1m 2m 3m 4m 5m

Sketch 3D views

B-2017-901-Sketch 3D views
number revision

Mr Usman
274 Manley Rd

1:50 @ A1
scale

B-2017
job reference

KH
drawn



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KEY

SITE BOUNDARY

REV	DATE	BY	DESCRIPTION	CHK	APP
01	12/10/2022	JM	FIRST ISSUE	SM	SM

DRAWING STATUS: FOR APPROVAL

WESTRUCT DESIGN & BUILD
INFO@WESTRUCT.CO.UK
TEL: 07480111132

CLIENT: Agron Nuzi

ARCHITECT: G. SOAME PLANNING & DEVT LTD

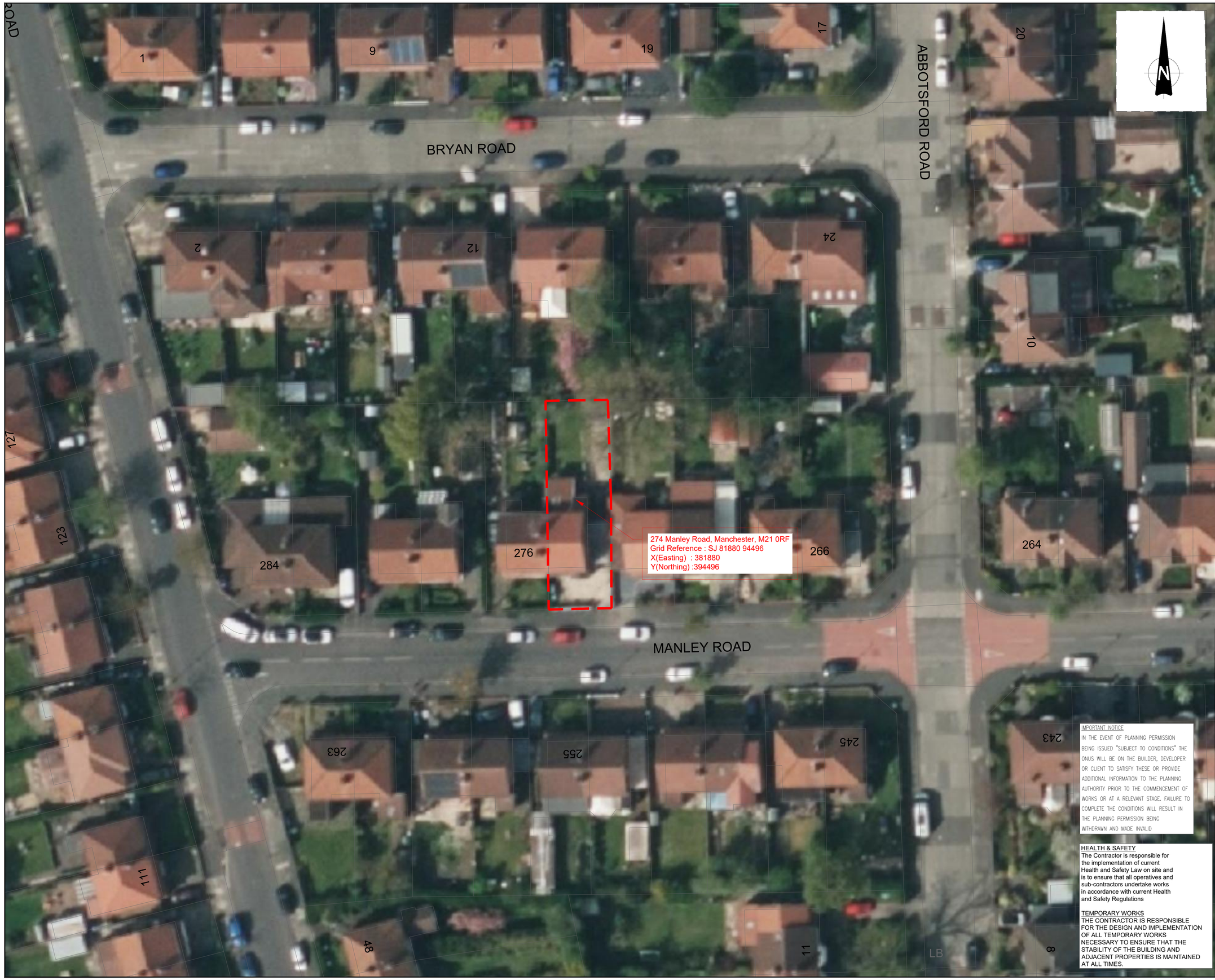
SITE/PROJECT: 16 Gentian Road Oxford Ox4 6qe

TITLE: SITE PLAN LOCATION

SCALE @ A1:	CHECKED:		APPROVED:
1:100	SM		SM
PROJECT NO:	DESIGNED:	DRAWN:	DATE:
WE-23-11-21-01	JM	JM	12/10/2022

DRAWING No: WE-DR-23-11-21-01-02 REV: 01

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KEY

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HEALTH & SAFETY

The Contractor is responsible for the implementation of current Health and Safety Law on site and is to ensure that all operatives and sub-contractors undertake works in accordance with current Health and Safety Regulations

TEMPORARY WORKS

THE CONTRACTOR IS RESPONSIBLE FOR THE DESIGN AND IMPLEMENTATION OF ALL TEMPORARY WORKS NECESSARY TO ENSURE THAT THE STABILITY OF THE BUILDING AND ADJACENT PROPERTIES IS MAINTAINED AT ALL TIMES.

REV	DATE	BY	DESCRIPTION	CHK	APP
00	18/05/2023	JM	FIRST ISSUE	SM	SM

DRAWING STATUS: FOR APPROVAL

WESTRUCT DESIGN & BUILD
INFO@WESTRUCT.CO.UK
TEL: 07480111132

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CLIENT: BARCX Ltd

ARCHITECT: BARCX Ltd

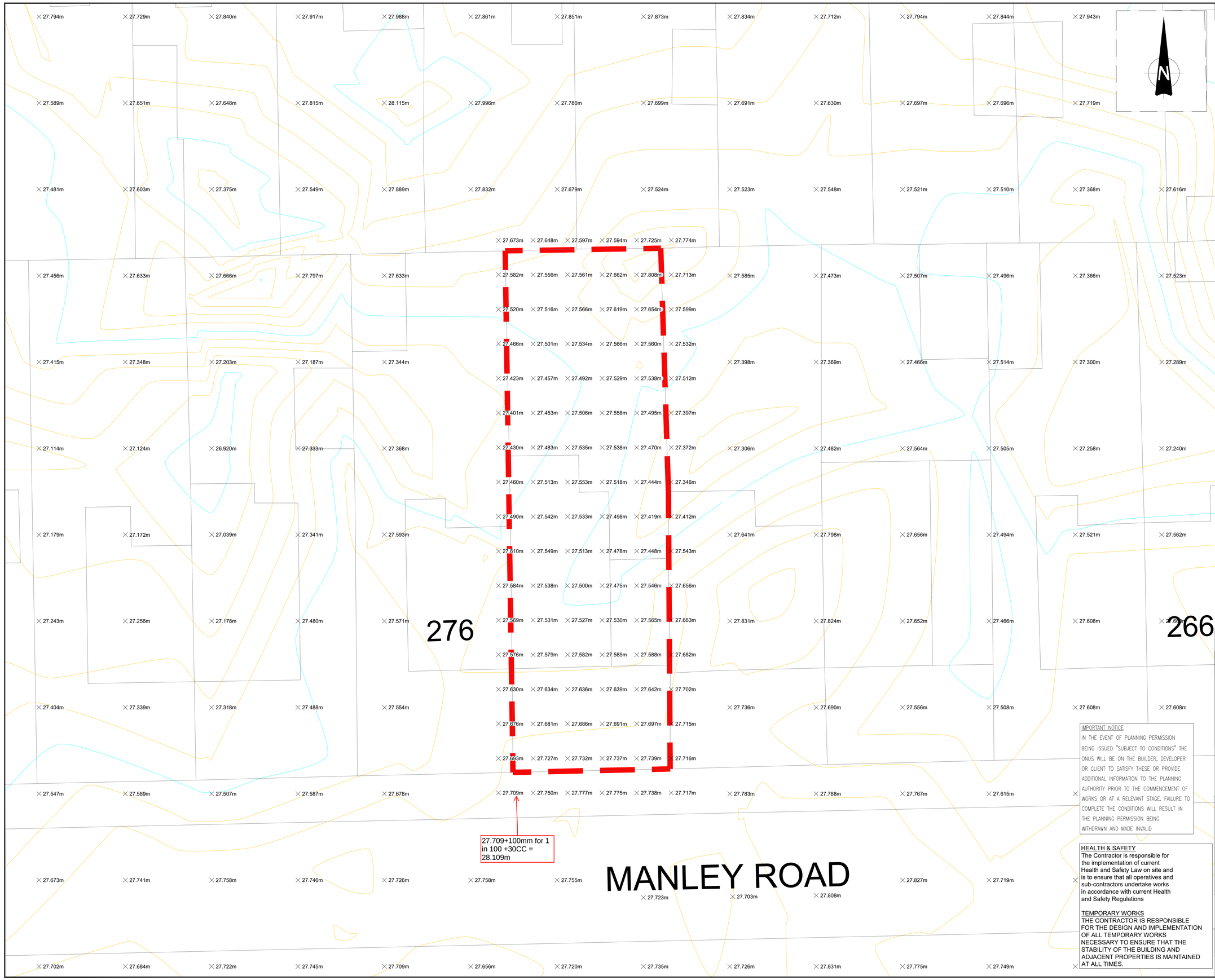
SITE/PROJECT: 274 Manley Road, Manchester, M21 0RF

TITLE: SITE LOCATION PLAN

SCALE @ A1:	CHECKED:		APPROVED:
1:250	SM		SM
PROJECT NO:	DESIGNED:	DRAWN:	DATE:
WE-16-05-23-02	JM	JM	18/05/2023

DRAWING No: WE-DR-16-05-23-02-01 REV: 00

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REV	DATE	BY	DESCRIPTION	CHK	APP
00	18/05/2023	JM	FIRST ISSUE	SM	SM

DRAWING STATUS: FOR APPROVAL

WESTRUCT DESIGN & BUILD
INFO@WESTRUCT.CO.UK
TEL: 07480111132

WeStruct

CLIENT: BARCX Ltd

ARCHITECT: BARCX Ltd

SITE/PROJECT: 274 Manley Road, Manchester, M21 0RF

TITLE: EXISTING TOPOGRAPHIC PLAN

SCALE @ A1:	CHECKED:	APPROVED:
1:100	SM	SM

PROJECT NO:	DESIGNED:	DRAWN:	DATE:
WE-16-05-23-02	JM	JM	18/05/2023

DRAWING No: WE-DR-16-05-23-02-02 REV: 00

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APPENDIX B

CORRESPONDENCE

sherwan@westruct.co.uk

From: GMMC Info Requests <InfoRequests.GMMC@environment-agency.gov.uk>
Sent: 03 May 2023 10:41
To: Soreen Billbas
Subject: GMMC308610SW Response attached from the Environment Agency
Attachments: GMMC308610SW DFM.pdf; GMMC308610SW Table.pdf

Dear Soreen,

Thank you for your enquiry which was received on 30/04/23.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004.

Please find attached the data requested and my colleague's supporting comments below;

We have no records of flooding affecting the site.
However, this does not mean flooding has not occurred in the past or that it will not flood in future.
We recommend that you also contact United Utilities and Manchester Council
Who may hold additional information (the former especially in relation to sewer flooding).

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

Manchester Council is responsible for issues relating to surface water and hold information on surface water flooding.

Please be aware you can check your risk of flooding on our external website https://flood-warning-information.service.gov.uk/long-term-flood-risk/
Here are some useful links below:
https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities
https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Please refer to the Open Government Licence which explains the permitted use of this information.

Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

Kind regards,

Sarah

Sarah Walters | Customer and Engagement Officer
Greater Manchester, Merseyside and Cheshire

Direct email: **Inforequests.GMMC@environment-agency.gov.uk**
Office address: Richard Fairclough House, Knutsford Road, Latchford, Warrington, WA4 1HT

Please consider this a "thanks" in advance.
Every email has a carbon footprint. So if you don't hear back from me,
it's not because of you, it's because of the planet.
#WhatWeCanDo

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From: Soreen Billbas <soreen@barcx.co.uk>
Sent: 30 April 2023 10:56
To: GMMC Info Requests <InfoRequests.GMMC@environment-agency.gov.uk>
Cc: usmanm58@yahoo.com
Subject: GMMC308610SW 274 Manley Road, M21 0RF - flood levels

> You don't often get email from soreen@barcx.co.uk. Learn why this is important

Dear Sir/Madam,

I've been informed on my client's planning application as attached that the site is located within a designated flood zone.

The site falls into flood zone 2. I am currently looking for information on the existing flood levels and the estimated flood level information as requested by the planning. Could I obtain this information about the site from you?

Your assistance is very much appreciated.

Thank you.

Soreen Billbas
Founding Partner | RIBA Architect
dd: +44 (0)7533 142213

BARCX

Connect with me on Instagram!

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Planning Services

St Aldate's Chambers
109 – 113 St Aldate's
Oxford OX1 1DS

Central Number 01865 249811

www.oxford.gov.uk

OXFORD CITY COUNCIL

On Behalf Of: Mr Agron Nuzi
C/o Mr Graham Soame
G. Soame Planning & Development Ltd
Acre Cottage Chapel Road
South Leigh
Witney
OX29 6UP

Date: 16th November 2021
Ref Number: 21/03006/FUL
Phone 01865 529113
Email:: planning@oxford.gov.uk

Dear Mr Agron Nuzi

ACTION REQUIRED – A CHARGE MAY APPLY

Town and Country Planning Act 1990

APPLICATION NO: 21/03006/FUL

LOCATION: 16 Gentian Road Oxford OX4 6QE

PROPOSAL: Erection of two storey building to create 2 x 1 bed flats (Use Class C3). Provision of car parking, private amenity space and bin and bike stores.

The above application was received in this office on 29th October 2021. Unfortunately I am unable to process the application for the following reason(s), I do apologise for not requesting this in a previous letter:-

1 The property is sited in an area designated within the Environment Agency's Flood Zones 2/3. Therefore, in accordance with Local and National policy, please provide a full site specific flood risk assessment, which should include as a minimum:

- The site address
- A description of the development
- An assessment of the flood risk for the development (considering all sources of flooding- rivers, surface water, groundwater, reservoirs).
- The estimated flood level for the development, i.e. the 1 in 100 year + Climate Change allowance flood level. (Environment Agency Product 4 Data, Detailed Modelled Flood Information)
- Floor/ ground levels (Topographical survey/floor levels plan)
- Details of any flood resilience and resistance plans
- Any supporting plans and drawings
- Any other relevant information from GOV.UK advice

For further guidance on the requirements for a site specific flood risk assessment, please

visit:

https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications

If you do not supply the requested information by the 30th November 2021 we will return your application and a charge will be applied to cover the cost of handling it. Charges are:

£50 for householder applications
£75 for minor/other applications
£100 for major applications

These charges will be removed from any refund of fees you may be owed and you will need to re-apply in full, including re-submitting all fees and documents if you wish to proceed with your proposal.

Please note the statutory eight week period will not commence, until the application is complete.

If you submitted your application via the Planning Portal and need to send additional information, please do not submit the information through the Planning Portal but email the information to planning@oxford.gov.uk. Please quote the planning reference or planning portal reference in your correspondence.

If you believe you have already supplied some or all of this information, please contact us as soon as possible on 01865 529113 or email us at planning@oxford.gov.uk, ensuring you quote your reference number 21/03006/FUL in all communication.

If you are having trouble preparing your application, we recommend the following links for assistance:

Oxford City Council Local List for Validation and Guidance for drawing standards:

https://www.oxford.gov.uk/downloads/download/452/planning_application_requirements

Yours sincerely,

Samantha
Customer Services Applications Team

Contact: planning@oxford.gov.uk or 01865 529113, quoting your reference number 21/03006/FUL, for all enquiries regarding this case.

Sent on behalf of Adrian Arnold, Head of Planning Services

Privacy notice: *Thank you for your application. Oxford City Council operates under the Data Protection Act 2018 in regards to the processing and holding of your application information. Relevant data you have supplied to us for this application will be made public where it is a legal requirement (for the purpose of advertising your planning application), however your sensitive personal data (email address, phone number etc) will not be made public. Sensitive personal data will only be used to help process your application(s). Please note that all information supplied to Oxford City Council as part of a planning application will be held indefinitely, where it is a legal requirement to do so. If you have any questions about how your data will be used or stored, or wish to change the contact information we hold for you, please contact planning@oxford.gov.uk or call 01865 529113.*

sherwan@westruct.co.uk

From: GMMC Info Requests <InfoRequests.GMMC@environment-agency.gov.uk>
Sent: 08 June 2023 13:20
To: sherwan@westruct.co.uk
Subject: GMMC308610SW Response attached from the Environment Agency

Dear Sherwan,

To clarify - the only modelled scenarios which reach the site are the 1 in 1000 year event and 1 in 1000 year +30% CC event, so there is no 2D data at the site location for the 1 in 100 year scenario. We have provided all of the scenarios available at the site location.

Many thanks,

Anne Ball - Customer and Engagement Officer
Greater Manchester, Merseyside and Cheshire
Please note I am part-time and work on Tuesday, Thursday and Friday.
Direct email: **Inforequests.GMMC@environment-agency.gov.uk**
Office address: Richard Fairclough House, Knutsford Road, Latchford, Warrington, WA4 1HT

Please accept my thanks for your email in advance – it is estimated that each UK adult sending one less 'thank you' email a day would save more than 16,400 tonnes of carbon a year. Equivalent to over 811,522 flights to Madrid or taking 33,343 diesel cars off the road.

From: sherwan@westruct.co.uk <sherwan@westruct.co.uk>
Sent: 08 June 2023 11:57
To: GMMC Info Requests <InfoRequests.GMMC@environment-agency.gov.uk>
Cc: Soreen Billbas <soreen@barcx.co.uk>
Subject: RE: GMMC308610SW Acknowledgement attached from the Environment Agency

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Dear Anne,

Thanks you very much for quick response,

The location of the proposed plans is (4 & 5) which you have provided 1 in 1000 years not I in 100 years, that is what I am after .

Can you please provide us 1 in 100 years please ?

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2	ea013_0249_corn3215	383465	396002	Modelled Model
3	ea013_0249_corn2587	382951	396140	Modelled Model

Map Reference	Model Node Reference	Easting	Northing	
4	2D Levels	381880	394506	Modelled
5		381881	394494	Modelled

Model data taken from Corn Brook 2017

AEP - Annual Exceedence Probability

m aodN - metres above ordnance datum Newlyn

cumecs - cubic metres per second

Notes:

Regards
Sherwan Mohammed

From: GMMC Info Requests <InfoRequests.GMMC@environment-agency.gov.uk>
Sent: Thursday, June 8, 2023 9:39 AM
To: sherwan@westruct.co.uk
Subject: GMMC308610SW Acknowledgement attached from the Environment Agency

Dear Sherwan,

Thank you for your further query. I have forwarded it to the team and will be in touch shortly,

Kind regards,

Anne Ball - Customer and Engagement Officer
Greater Manchester, Merseyside and Cheshire
Direct email: **Inforequests.GMMC@environment-agency.gov.uk**
Office address: Richard Fairclough House, Knutsford Road, Latchford, Warrington, WA4 1HT

From: sherwan@westruct.co.uk <sherwan@westruct.co.uk>
Sent: 07 June 2023 12:36
To: GMMC Info Requests <InfoRequests.GMMC@environment-agency.gov.uk>
Cc: 'Soreen Billbas' <soreen@barcx.co.uk>
Subject: RE: GMMC308610SW Response attached from the Environment Agency

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Dear Sarah

I want to introduce myself; I am a Civil engineer providing the Flood risk assessment for the project.

Thanks for the email below and attached both the flood zone map and floor levels.

However, the flood level still needs to be provided for the location area we required 1 in 100 years + 30% CC.

Can you please provide us with the requested information above?

GMMC3086.. | GMMC3086.. | B-2017-102-Proposed Si.. | ufm1.. | B-2017-102-Proposed Si.. | B-2017-90.. | B-2017-101-Site Locatio.. | 127970_FH_2020-DETA.. | 127970_FH_2020-FLOO.. | 127970_FH_2020-FLOO

Map Reference	Model Node Reference	Easting	Northing	Data	50 % AEP (1 in 2 year)	20 % AEP (1 in 5 year)	10 %
1	ea013_0249_corn3908	384113	396116	Modelled Water Level (m aodN)	32.15	32.28	
				Modelled Flow (cumecs)	0.19	0.27	
2	ea013_0249_corn3215	383465	396002	Modelled Water Level (m aodN)	30.61	30.71	
				Modelled Flow (cumecs)	0.24	0.34	
3	ea013_0249_corn2587	382951	396140	Modelled Water Level (m aodN)	29.22	29.36	
				Modelled Flow (cumecs)	0.26	0.37	

					Undefended	
Map Reference	Model Node Reference	Easting	Northing	Data	0.1 % AEP (1 in 1000 year)	0.1 % AEP (1 in 1000 year) + 30% increase in flow
4	2D Levels	381880	394506	Modelled Water Level (m aodN)	27.81	27.89
5		381881	394494	Modelled Water Level (m aodN)	27.81	27.89

Model data taken from Corn Brook 2017

AEP - Annual Exceedence Probability

m aodN - metres above ordnance datum Newlyn

cumecs - cubic metres per second

We are looking forward to hearing from you soon.

Kind regards
Sherwan Mohammed

From: GMMC Info Requests <InfoRequests.GMMC@environment-agency.gov.uk>
Sent: Wednesday, May 3, 2023 10:41 AM
To: Soreen Billbas <soreen@barcx.co.uk>
Subject: GMMC308610SW Response attached from the Environment Agency

Dear Soreen,

Thank you for your enquiry which was received on 30/04/23.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004.

Please find attached the data requested and my colleague's supporting comments below;

We have no records of flooding affecting the site.
However, this does not mean flooding has not occurred in the past or that it will not flood in future.

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We recommend that you also contact United Utilities and Manchester Council
Who may hold additional information (the former especially in relation to sewer flooding).

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

Manchester Council is responsible for issues relating to surface water and hold information on surface water flooding.

Please be aware you can check your risk of flooding on our external website https://flood-warning-information.service.gov.uk/long-term-flood-risk/
Here are some useful links below:
https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities
https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Please refer to the Open Government Licence which explains the permitted use of this information.

Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

Kind regards,

Sarah

Sarah Walters | Customer and Engagement Officer
Greater Manchester, Merseyside and Cheshire

Direct email: **Inforequests.GMMC@environment-agency.gov.uk**
Office address: Richard Fairclough House, Knutsford Road, Latchford, Warrington, WA4 1HT

Please consider this a "thanks" in advance.
Every email has a carbon footprint. So if you don't hear back from me,
it's not because of you, it's because of the planet.
#WhatWeCanDo

From: Soreen Billbas <soreen@barcx.co.uk>
Sent: 30 April 2023 10:56
To: GMMC Info Requests <InfoRequests.GMMC@environment-agency.gov.uk>
Cc: usmanm58@yahoo.com
Subject: GMMC308610SW 274 Manley Road, M21 0RF - flood levels

> You don't often get email from soreen@barcx.co.uk. Learn why this is important

Dear Sir/Madam,

I've been informed on my client's planning application as attached that the site is located within a designated flood zone.

The site falls into flood zone 2. I am currently looking for information on the existing flood levels and the estimated flood level information as requested by the planning. Could I obtain this information about the site from you?

Your assistance is very much appreciated.

Thank you.

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Soreen Billbas
Founding Partner | RIBA Architect
dd: +44 (0)7533 142213

BARCX

Connect with me on Instagram!



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Information in this message may be confidential and may be legally privileged. If you have received this message by mistake, please notify the sender immediately, delete it and do not copy it to anyone else. We have checked this email and its attachments for viruses. But you should still check any attachment before opening it. We may have to make this message and any reply to it public if asked to under the Freedom of Information Act, Data Protection Act or for litigation. Email messages and attachments sent to or from any Environment Agency address may also be accessed by someone other than the sender or recipient, for business purposes.
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sherwan@westruct.co.uk

From: Enquiries, Unit <enquiries@environment-agency.gov.uk>
Sent: 20 April 2022 16:06
To: 'sherwan@westruct.co.uk'
Subject: Ref 220420/KAY04: 16 Gentian Road Oxford Ox4 6qe

Dear Sherwan

I have passed your enquiry to the local Customers & Engagement Team, who will deal with your request.

The Freedom of Information Act and Environmental Information Regulations state that a public authority must respond to requests for information within 20 working days.

You can find more information about our service commitment by clicking on the link below:

https://www.gov.uk/government/publications/environment-agency-customer-service-commitment

You can contact our customer team directly on the contact details below, or call the National Customer Contact Centre on 03708 506506 who will transfer you to the area team.

Please quote your enquiry reference 220420/KAY04 in any correspondence.

Customers and Engagement
Environment Agency
Thames Area
Redkite House
Howbery Park
WALLINGFORD
OX10 8BD

Enquiries_THM@environment-agency.gov.uk

I hope this meets with your approval but please feel free to contact us if you require any further assistance.

Kind regards

Kay Hall
Customer Service Advisor, Email Management Unit, NCCC
Contact Centre Services - Part of Operations, Regulation & Customer

☎ Tel: 03708 506 506
Web Site: www.gov.uk/environment-agency

Pronouns: She/Her (why is this here?)

Click an icon to keep in touch with us:-



From: sherwan@westruct.co.uk [mailto:sherwan@westruct.co.uk]
Sent: 09 April 2022 01:00
To: Enquiries, Unit <enquiries@environment-agency.gov.uk>

Cc: 'Agron' <agron.nuzi@hotmail.com>
Subject: 16 Gentian Road Oxford Ox4 6qe

Dear Sir or Madam,

Can you provide me with the modelled flood plain, please?

- product 4: Detailed Flood Risk Assessment Map, including flood zones, defences and storage areas, areas benefiting from defences, statutory main river designations, historic flood event outlines and more detailed information from our computer river models (including model extent, information on one or more specific points, flood levels, flood flows).

We are looking forward to hearing from you soon.

Kind Regards
Sherwan Mohammed

Director

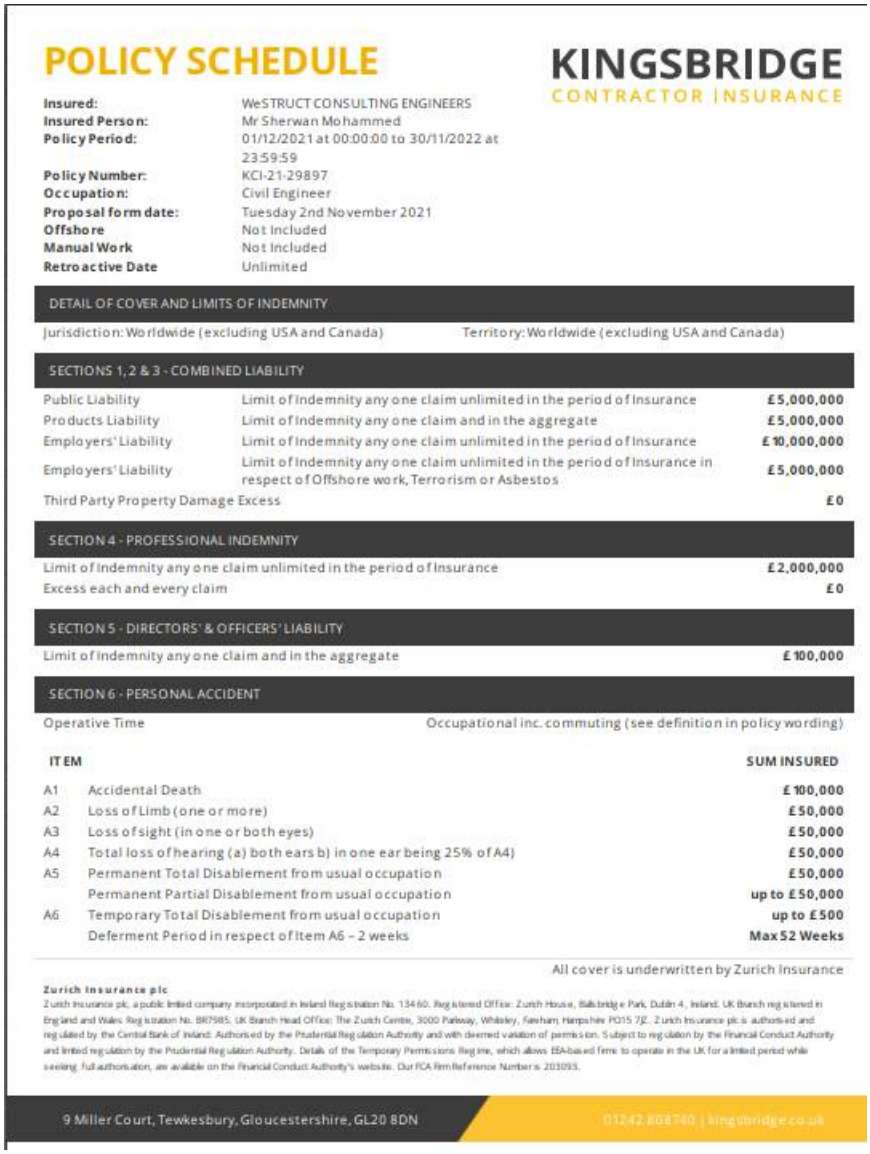
Phone Number +44 (0) 7480 111 132
www.westruct.co.uk

Education
MSc Civil & Structural Engineer Design - Materials
BA Civil & Structural Engineer Design -
2D & 3D Autocad University Level Degree
GMICE CEng

We also hold comprehensive professional indemnity insurance for UK building projects cover up to £2.0M

Professional Indemnity Insurance Term And Condition Documents Are Provided In HERE
Examples of some of our projects are available HERE and our customer FEEDBACK HERE & HERE

Any other person is strictly prohibited from reading, using, disclosing or copying this message. If you have received this message in error, please notify the sender and delete the message. Thank you.



POLICY SCHEDULE

KINGSBRIDGE
CONTRACTOR INSURANCE

Insured:	WeSTRUCT CONSULTING ENGINEERS
Insured Person:	Mr Sherwan Mohammed
Policy Period:	01/12/2021 at 00:00:00 to 30/11/2022 at 23:59:59
Policy Number:	KCI-21-29897
Occupation:	Civil Engineer
Proposal form date:	Tuesday 2nd November 2021
Offshore	Not Included
Manual Work	Not Included
Retroactive Date	Unlimited

DETAIL OF COVER AND LIMITS OF INDEMNITY

Jurisdiction: Worldwide (excluding USA and Canada) Territory: Worldwide (excluding USA and Canada)

SECTIONS 1, 2 & 3 - COMBINED LIABILITY

Public Liability	Limit of Indemnity any one claim unlimited in the period of Insurance	£5,000,000
Products Liability	Limit of Indemnity any one claim and in the aggregate	£5,000,000
Employers' Liability	Limit of Indemnity any one claim unlimited in the period of Insurance	£10,000,000
Employers' Liability	Limit of Indemnity any one claim unlimited in the period of Insurance in respect of Offshore work, Terrorism or Asbestos	£5,000,000
Third Party Property Damage Excess		£0

SECTION 4 - PROFESSIONAL INDEMNITY

Limit of Indemnity any one claim unlimited in the period of Insurance	£2,000,000
Excess each and every claim	£0

SECTION 5 - DIRECTORS' & OFFICERS' LIABILITY

Limit of Indemnity any one claim and in the aggregate	£100,000

SECTION 6 - PERSONAL ACCIDENT

Operative Time Occupational inc. commuting (see definition in policy wording)

ITEM		SUM INSURED
A1	Accidental Death	£100,000
A2	Loss of Limb (one or more)	£50,000
A3	Loss of sight (in one or both eyes)	£50,000
A4	Total loss of hearing (a) both ears b) in one ear being 25% of A4)	£50,000
A5	Permanent Total Disablement from usual occupation	£50,000
	Permanent Partial Disablement from usual occupation	up to £50,000
A6	Temporary Total Disablement from usual occupation	up to £500
	Deferment Period in respect of Item A6 – 2 weeks	Max 52 Weeks

All cover is underwritten by Zurich Insurance

Zurich Insurance plc

Zurich Insurance plc, a public limited company incorporated in Ireland Registration No. 13460. Registered Office: Zurich House, Ballsbridge Park, Dublin 4, Ireland. UK Branch registered in England and Wales: Registration No. BR7985. UK Branch Head Office: The Zurich Centre, 3000 Parkway, Whiteley, Fareham, Hampshire PO15 7JZ. Zurich Insurance plc is authorised and regulated by the Central Bank of Ireland. Authorised by the Prudential Regulation Authority and with deemed variation of permission. Subject to regulation by the Financial Conduct Authority and limited regulation by the Prudential Regulation Authority. Details of the Temporary Permissions Regime, which allows EEA-based firms to operate in the UK for a limited period while seeking full authorisation, are available on the Financial Conduct Authority's website. Our FCA Firm Reference Number is 203093.

9 Miller Court, Tewkesbury, Gloucestershire, GL20 8DN 01242 808740 | kingsbridge.co.uk

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sherwan@westruct.co.uk

From: GMMC Info Requests <InfoRequests.GMMC@environment-agency.gov.uk>
Sent: 03 May 2023 10:41
To: Soreen Billbas
Subject: GMMC308610SW Response attached from the Environment Agency
Attachments: GMMC308610SW DFM.pdf; GMMC308610SW Table.pdf

Dear Soreen,

Thank you for your enquiry which was received on 30/04/23.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004.

Please find attached the data requested and my colleague's supporting comments below;

We have no records of flooding affecting the site.
However, this does not mean flooding has not occurred in the past or that it will not flood in future.
We recommend that you also contact United Utilities and Manchester Council
Who may hold additional information (the former especially in relation to sewer flooding).

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

Manchester Council is responsible for issues relating to surface water and hold information on surface water flooding.

Please be aware you can check your risk of flooding on our external website https://flood-warning-information.service.gov.uk/long-term-flood-risk/
Here are some useful links below:
https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities
https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

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Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

Kind regards,

Sarah

Sarah Walters | Customer and Engagement Officer
Greater Manchester, Merseyside and Cheshire

Direct email: **Inforequests.GMMC@environment-agency.gov.uk**
Office address: Richard Fairclough House, Knutsford Road, Latchford, Warrington, WA4 1HT

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it's not because of you, it's because of the planet.
#WhatWeCanDo

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From: Soreen Billbas <soreen@barcx.co.uk>
Sent: 30 April 2023 10:56
To: GMMC Info Requests <InfoRequests.GMMC@environment-agency.gov.uk>
Cc: usmanm58@yahoo.com
Subject: GMMC308610SW 274 Manley Road, M21 0RF - flood levels

> You don't often get email from soreen@barcx.co.uk. Learn why this is important

Dear Sir/Madam,

I've been informed on my client's planning application as attached that the site is located within a designated flood zone.

The site falls into flood zone 2. I am currently looking for information on the existing flood levels and the estimated flood level information as requested by the planning. Could I obtain this information about the site from you?

Your assistance is very much appreciated.

Thank you.

Soreen Billbas
Founding Partner | RIBA Architect
dd: +44 (0)7533 142213

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MANCHESTER CITY COUNCIL

Information, Delivery & Support Team
Planning

Telephone: 0161 234 4516
planning@manchester.gov.uk

P O Box 532 Town Hall
Manchester M60 2LA

Mr soreen Billbas
BARCX LTD
48 Overlea Drive
Burnage
Manchester
M191QU

Date: 12 May 2023

Dear Sir/Madam,

Application number: 136691/FH/2023
Proposal: Erection of a 2 storey side extension and a part single/part 2 storey rear extension to form additional living accommodation
Location: 274 Manley Road, Manchester, M21 0RF

Further to our previous correspondence, I am unable to progress your proposal as the application remains invalid or incomplete for the following reason(s):

1) I refer to your latest email in respect of the need for a Flood Risk Statement. While the area may not have flooded previously, the site is within Flood Zone 2, as shown on the Environment Agency records. As such a Flood Risk Statement (FRS) is required to be submitted with this application.

For the avoidance of doubt, as per the government standing advice, the FRS must include the following:
- A description of your development.
- An assessment of the flood risk from all sources of flooding for your development (this does not require bespoke hydraulic modelling, and may be based on data obtained freely via an Environment Agency data request and opensource data on the DEFRA and government platforms).
- The estimated flood level for your development (the estimated flood level is a river flood level with a 1 in 100 or greater annual probability, plus an allowance for climate change). The estimated flood level may be obtained freely from the Environment Agency.
- Provide a plan showing the finished floor levels (FFLs) and the estimated flood levels. FFLs should take into consideration predicted flood levels and should be set to an appropriate level, this may be either no lower than existing floor levels or 300 millimetres (mm) above the estimated flood level. All levels should be in mAOD.
- If you cannot raise FFLs 300 mm above the estimated flood level, you should demonstrate flood resilience and resistance in your design. Use the following guidance: https://www.gov.uk/guidance/flood-risk-assessment-standing-advice#extra-flood-resistance-and-resilience-measures
- Details of your flood resilience and evacuation plans where required.
- Any supporting plans and drawings.
- See https://www.gov.uk/guidance/flood-risk-assessment-standing-advice for further guidance on preparing your documents and obtaining the required data.

I am therefore holding your application and if you wish to discuss the information required members of my staff will be pleased to assist.

Please return any documents/information required to the Technical Support Team, Planning at the above address. If we have not heard from you by 9 June 2023 we will return your application.

Yours faithfully,



Julie Roscoe
Director of Planning, Building Control & Licensing

APPENDIX C

BOREHOLE

British Geological Survey
BGS ID: 864931 : BGS Reference: SJ89SW48
EPSG: 27700 : 381700,394400

MINISTRY OF PUBLIC BUILDING AND WORKS
CENTRAL UNIT (CIVIL ENGINEERING)

Task No. S/2225

Appendix F.
Sheet No. 4

Location CHORLTON-CUM-HARDY

Task T.U.C. EXTENSION

SJ 89 SW 48
817 944

BOREHOLE LOG

Borehole No. 4

Ground Level 52.04

Date 20.1.66 to 22.1.67

Note: Very slow compage of water from 6'-0" to 9'-6"

Description of Strata	Legend	Sample	Depth	O.D.	Remarks
			0'-0"	52.04	
CONCRETE			0'-6"		
Firm clay, rubble FILL.		10			N = 11 (5/7/4)
Medium dense SAND, SILT, with clay binder.		11	5'-6"		▽
Medium dense well graded sandy GRAVEL.			7'-6"		N = 17 (CONE) (5/7/10)
			9'-6"		
Stiff brown CLAY, smooth, a few stones.		12			
		13			
			22'-0"		
Stiff brown CLAY, with thin laminae of silt		14			
		15			
			30'-0"		
Hard dark brown sandy CLAY, stoney, and SAND.		16			N > 102 (21/46)
			37'-6"		N > 144 (20/67)

Contact BGS: ngdc@bgs.ac.uk

Norwest Holst Soil Engineering Ltd.

Borehole No. **B19**

BOREHOLE LOG SP50SE 68

Contract No. F6211
Location Blackbird Leys Development
Client Oxford City Council
Method of Boring Cable Percussion 150mm
Diameter of Borehole
55826 02483
Sheet 1 of 1
Chainage
Ground Level 81.77 m.A.O.D.
Date 25/1/85

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
MADE GROUND - road surfacing		0.30	81.47				
MADE GROUND, gravel and cobbles.		0.50	81.27				
MADE GROUND - Soft silty clay with gravel and cobbles of building rubble and ash.		1.60	80.17	150mm to 2.00m	1.00 (30) 2.00 C	*50 for 40mm	25/1
Moderately weathered light grey fine grained calcareous SILTSTONE, weak to moderately weak.		2.00	79.77				

Type of Sample

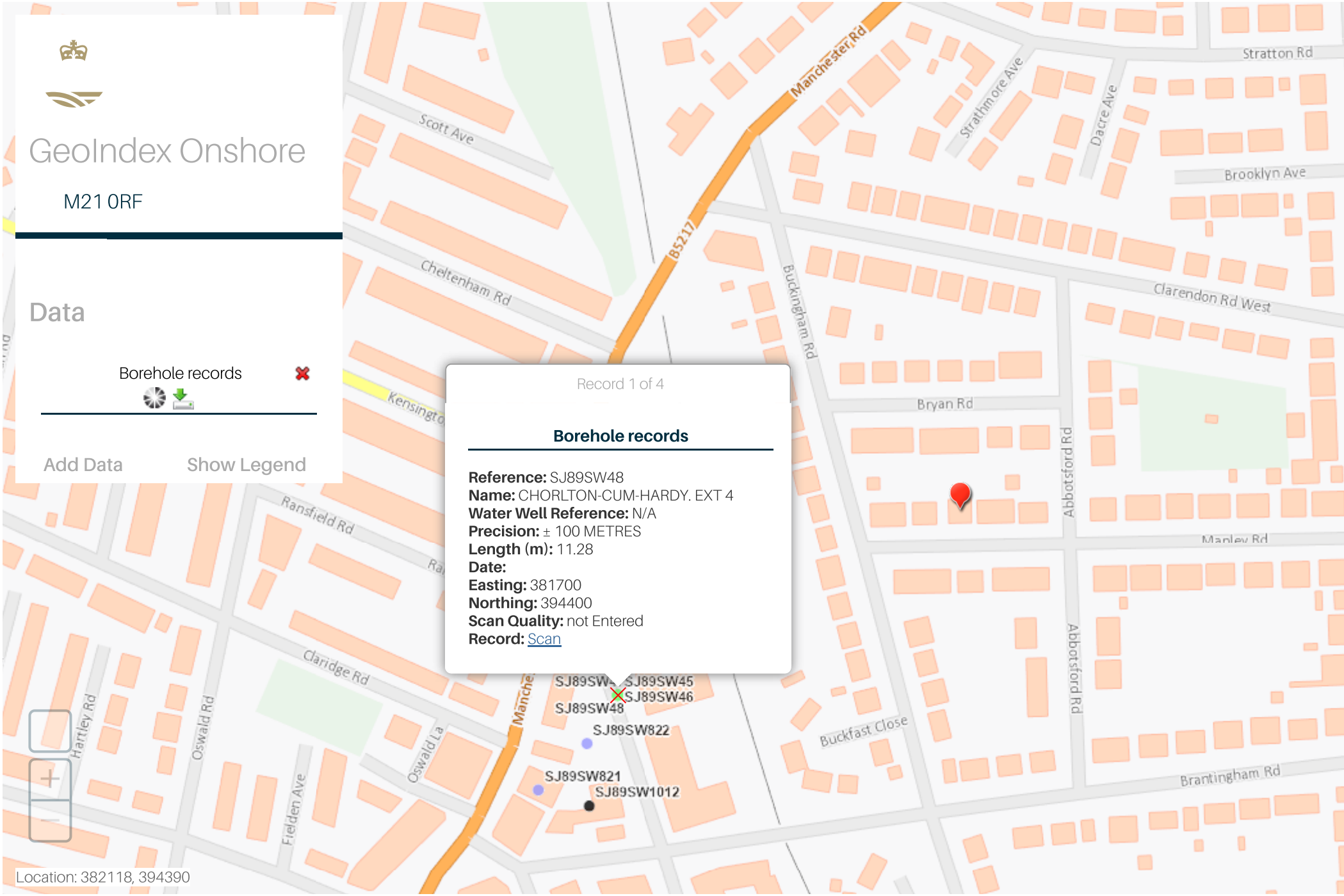
S.P.T. ■ Undisturbed
Ic. C.P.T. ✕ Vane
O Jar △ Water
● Bulk ▓ Piezometer

Remarks (Observations of Ground Water etc.)

* Seating blows only
() blows to drive U100
Groundwater encountered at 1.60m, with casing at 1.60m, inflow slight.
Chiselling required from Ground level to 0.50m - 1½ hrs. and from 1.60m to 2.00m - 1½ hrs.
Standpipe installed to 2.00m.

Water levels are subject to seasonal or tidal variations and should not be taken as constant

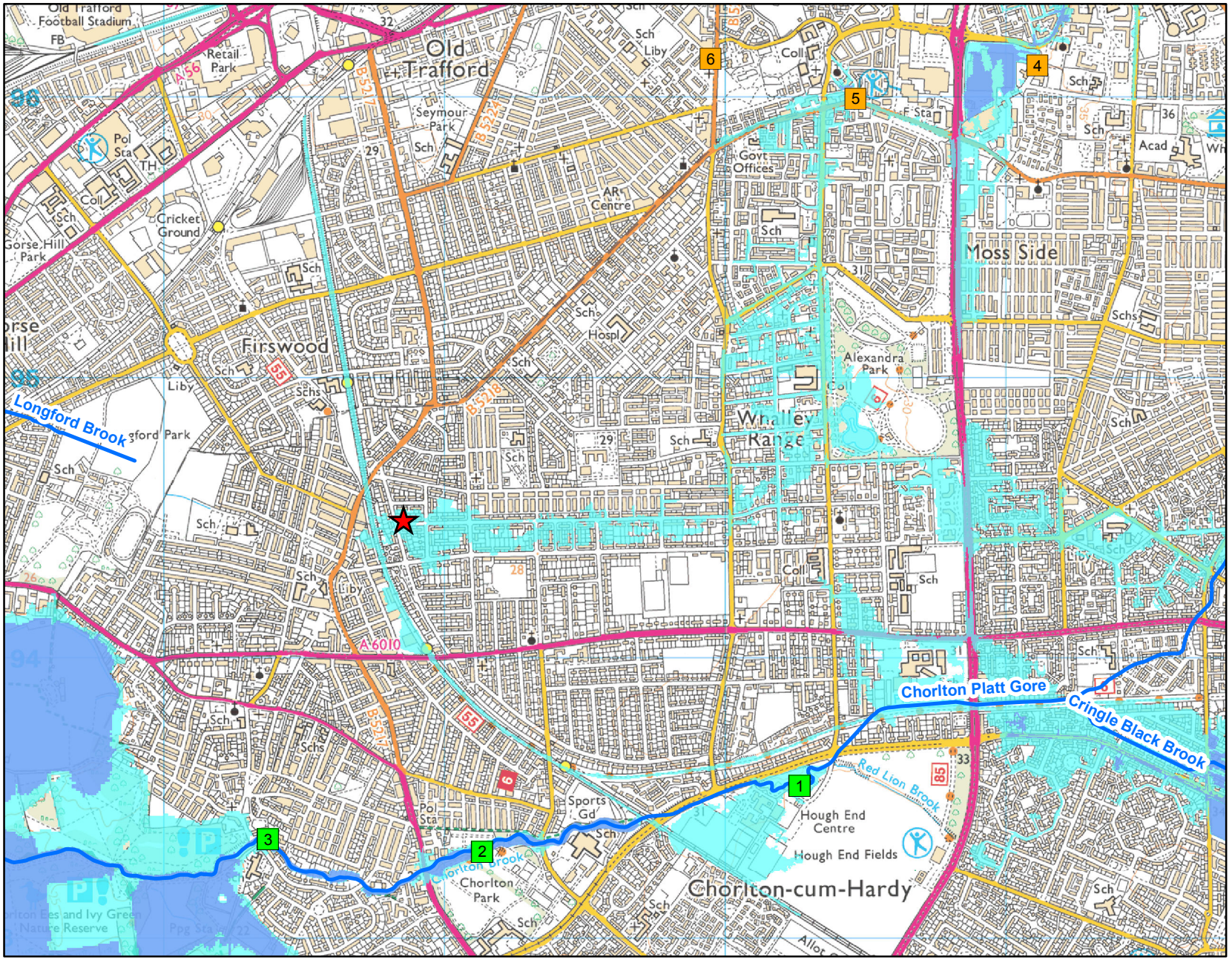
British Geological Survey


GeoIndex Onshore
M21 0RF
Data
Borehole records
Add Data
Show Legend
Record 1 of 4
Borehole records
Reference: SJ89SW48
Name: CHORLTON-CUM-HARDY. EXT 4
Water Well Reference: N/A
Precision: ± 100 METRES
Length (m): 11.28
Date:
Easting: 381700
Northing: 394400
Scan Quality: not Entered
Record: Scan
Manchester Rd
B5217
Scott Ave
Cheltenham Rd
Kensington
Ransfield Rd
Claridge Rd
Hartley Rd
Oswald Rd
Oswald La
Fielden Ave
Buckingham Rd
Bryan Rd
Abbotsford Rd
Buckfast Close
Brantingham Rd
Clarendon Rd West
Manley Rd
Brooklyn Ave
Stratton Rd
Strathmore Ave
Dacre Ave
SJ89SW45
SJ89SW46
SJ89SW48
SJ89SW822
SJ89SW821
SJ89SW1012
Location: 382118, 394390

APPENDIX D

EA – DOCUMENTS

Detailed Flood Map centred on Manley Road, Manchester, M21 0RF. Created on 01/10/2020 [GMMC186002CC]



Environment Agency

1:20,000

N

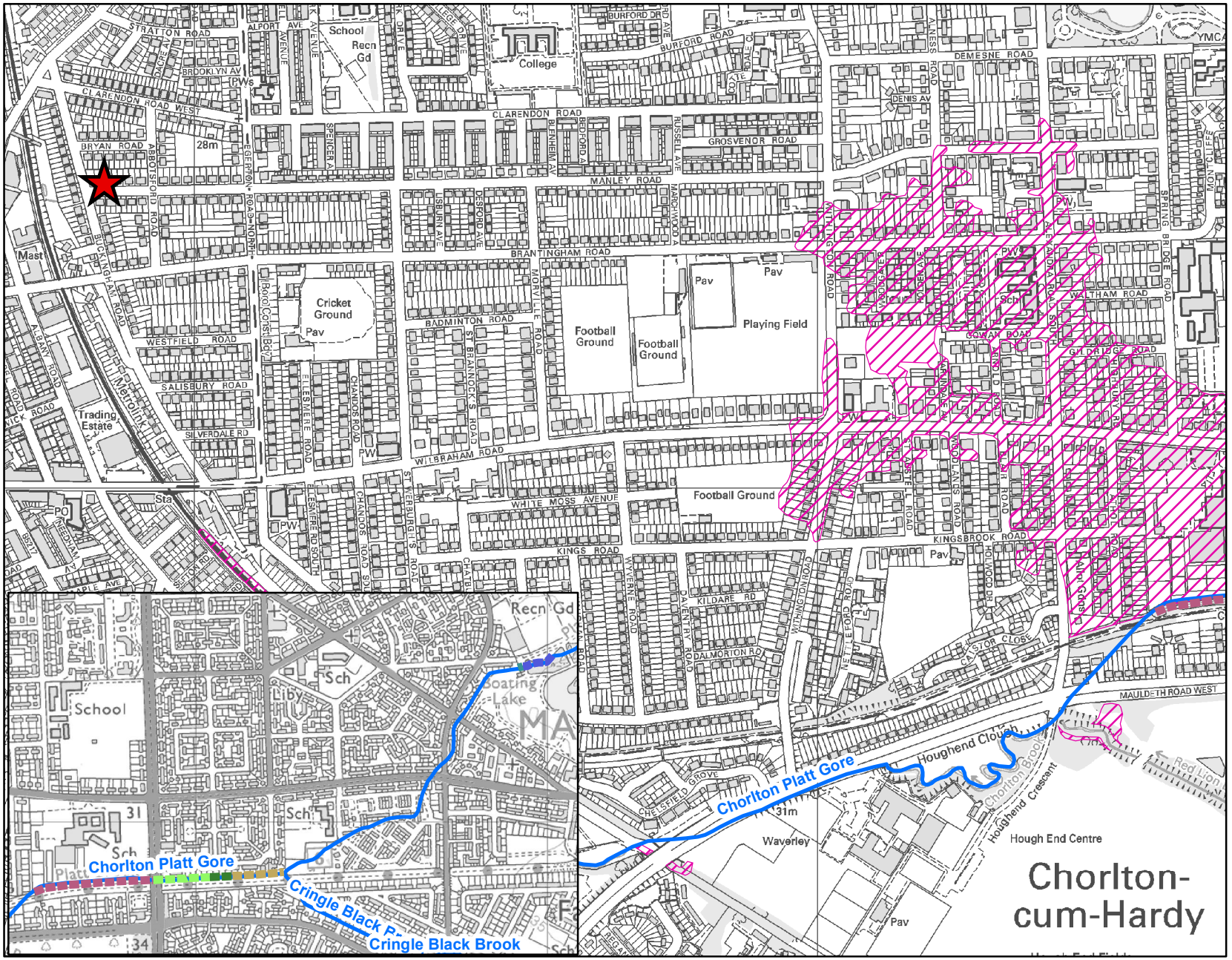
Legend

- Site Location
- Chorlton Platt Gore
- Corn Brook
- Main River
- Flood Zone 3
- Flood Zone 2

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Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Flood Defence Map centred on Manley Road, Manchester, M21 0RF. Created on 28/09/2020 [GMMC186002CC]



Environment Agency

1:9,000

N

Legend

Site Location

Defences (EA maintained)

Asset Id

- 32518
- 32543
- 59788
- 120082
- 120657
- 122064

Main River

Areas Benefiting

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Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Product 4 (Detailed Flood Risk) for: Sam Murray (Amey)
Site: Land at Kingsnorth
Reference: KSL151125 KR79
Date: 30th November 2015

Contents

- Flood Map Confirmation
- Flood Map Extract
- Model Output Data
- Data Point Location Map
- Modelled Flood Outlines Map
- Defence Details
- Historic Flood Data
- Additional Data
- Environment Agency Standard Notice

The information provided is based on the best data available as of the date of this letter.

You may feel it is appropriate to contact our office at regular intervals, to check whether any amendments/ improvements have been made to the data for this location. Should you re-contact us after a period of time, please quote the above reference in order to help us deal with your query.

This information is provided subject to the enclosed notice which you should read.

Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH.
Email: kslenquiries@environment-agency.gov.uk

Flood Map Confirmation

The Flood Map:

Our Flood Map shows the natural floodplain for areas at risk from river and tidal flooding. The floodplain is specifically mapped ignoring the presence and effect of defences. Although flood defences reduce the risk of flooding they cannot completely remove that risk as they may be over topped or breached during a flood event.

The Flood Map indicates areas with a 1% (0.5% in tidal areas), Annual Exceedance Probability (AEP) - the probability of a flood of a particular magnitude, or greater, occurring in any given year, and a 0.1% AEP of flooding from rivers and/or the sea in any given year. The map also shows the location of some flood defences and the areas that benefit from them.

The Flood Map is intended to act as a guide to indicate the potential risk of flooding. When producing it we use the best data available to us at the time, taking into account historic flooding and local knowledge. The Flood Map is updated on a quarterly basis to account for any amendments required. These amendments are then displayed on the internet at www.gov.uk/prepare-for-a-flood..

At this Site:

The Flood Map shows that this site partly lies within the outline of the 1% and the 0.1% chance of flooding in any given year.

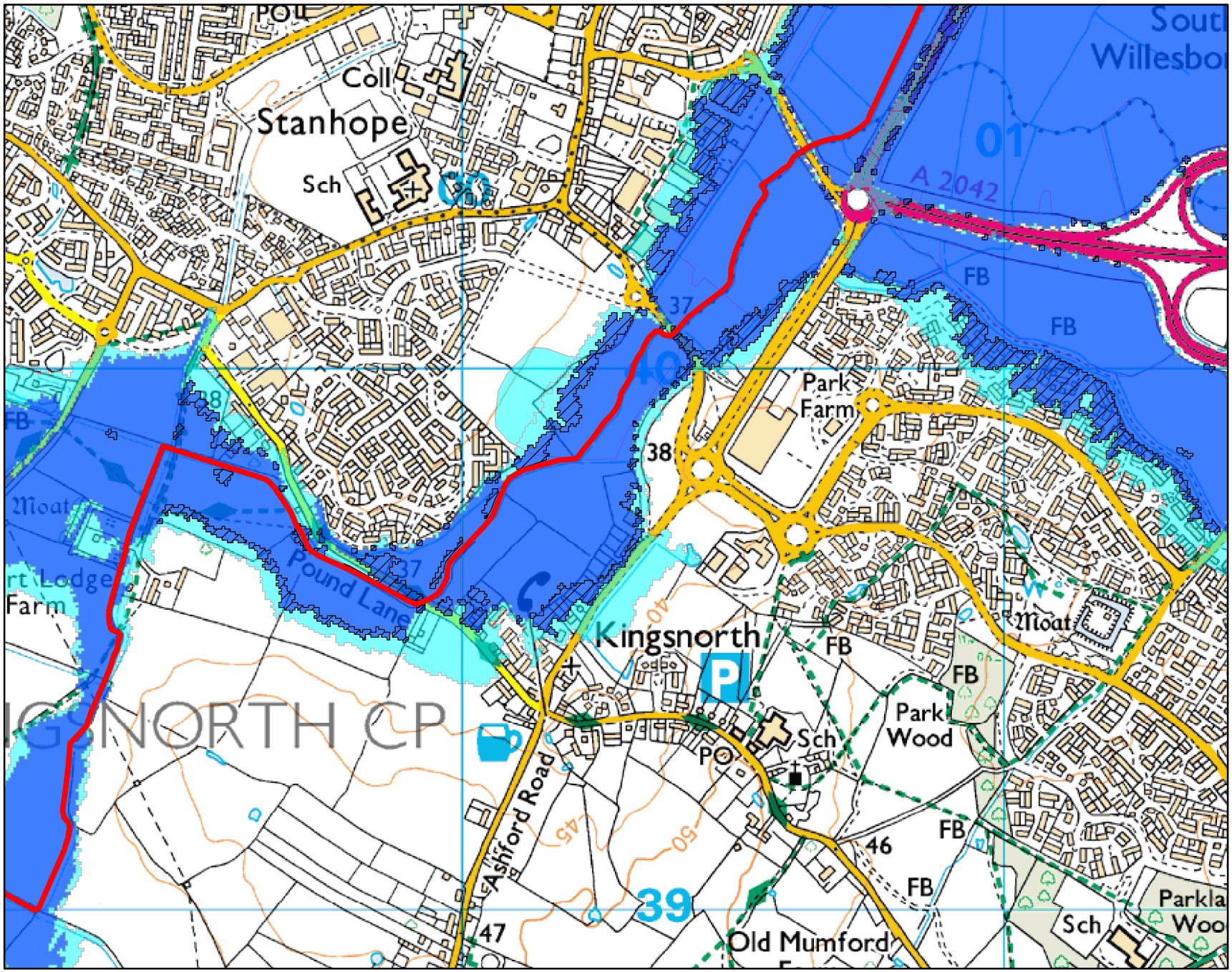
Enclosed is an extract of our Flood Map which shows this information for your area.

Method of production

The Flood Map at this location has been derived using detailed 2D modelling of Ashford ABD and Hazard 2012 update completed by JBA Consulting in 2012.

Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH.
Email: kslenquiries@environment-agency.gov.uk

Flood map centred on site by Kingsnorth
Created 30th November 2015 (Ref KSL151125 KR79)



Environment Agency

N

Legend

- Main River
- Flood Defences
- Flood Storage Area
- Areas Benefiting From Flood Defence
- 1% AEP of Fluvial Flooding or 0.5% Tidal
- 0.1% AEP of Flooding

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occuring in any given year.

Scale 1:10,000

0 250 500

Meters

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Model Output Data

You have requested flood levels for various return periods at this location.

The modelled flood levels for the closest most appropriate model grid cells, any additional information you may need to know about the modelling from which they are derived and/or any specific use or health warning for their use are set out below.

Using a 2D TuFLOW model the floodplain has been represented as a grid. The flood water levels have been calculated for each grid cell.

A map showing the location of the points from which the data is taken is enclosed. Please note you should read the notice enclosed for your specific use rights.

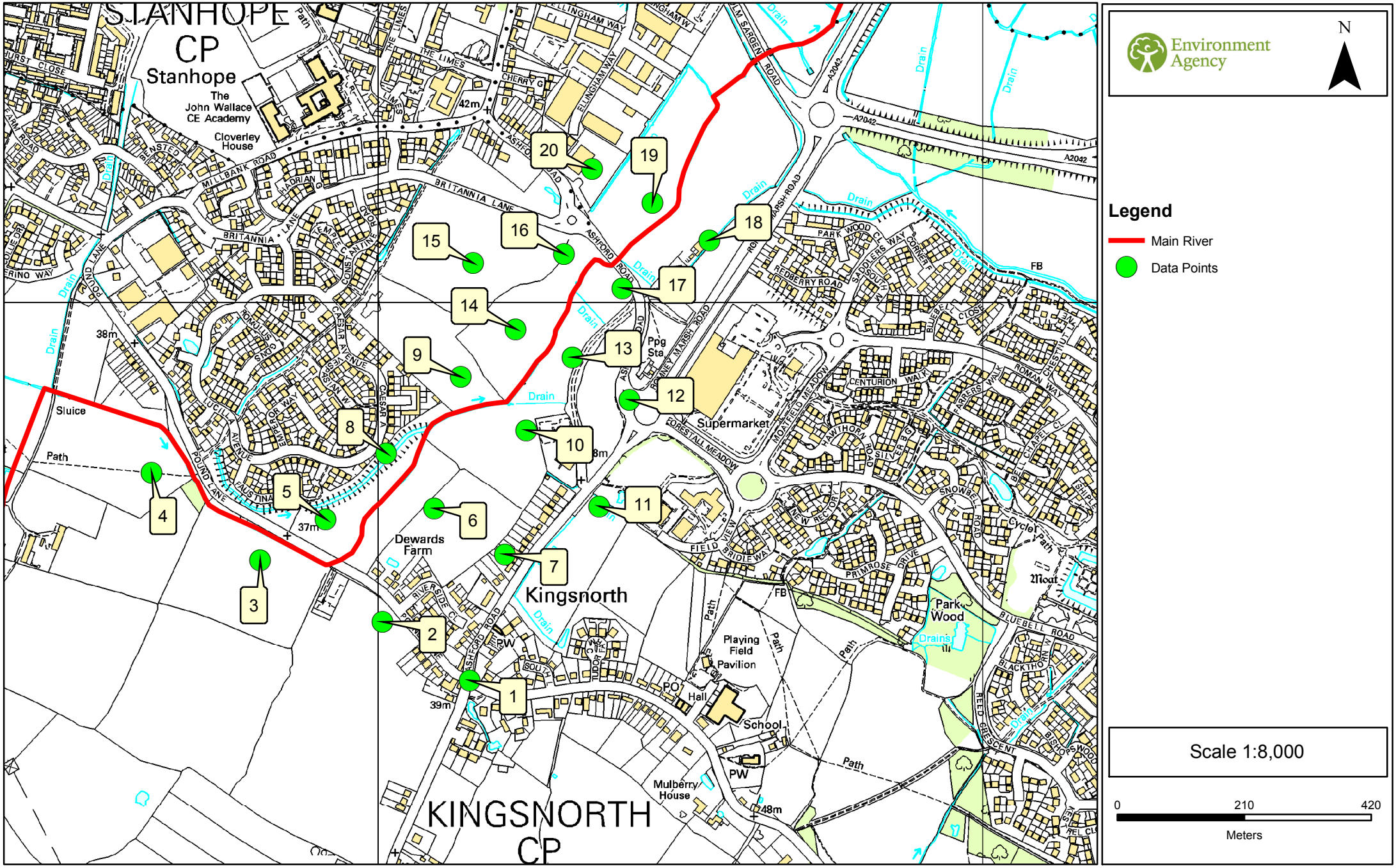
Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH.
Email: kslenquiries@environment-agency.gov.uk

Table 1: Modelled Flood Levels (metres AOD)

	National Grid Reference		Modelled Flood Levels For Scenario Shown, in Metres AOD								
			Undefended				Defended				
Node ID	Easting	Northing	5% AEP	1% AEP	1% +cc AEP	0.1% AEP	10% AEP	5% AEP	2% AEP	1% AEP	1% +cc AEP
1	600151	600151	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	600007	600007	0.00	0.00	37.53	37.91	0.00	0.00	0.00	0.00	0.00
3	599805	599805	37.04	37.34	37.53	37.92	36.88	36.95	37.02	37.11	37.22
4	599625	599625	37.05	37.34	37.53	37.92	0.00	37.00	37.07	37.14	37.25
5	599913	599913	37.03	37.33	37.53	37.92	0.00	0.00	36.94	37.01	37.15
6	600093	600093	37.03	37.33	37.53	37.92	36.66	36.75	36.85	37.00	37.15
7	600210	600210	0.00	37.33	37.53	37.92	0.00	0.00	0.00	0.00	37.15
8	600013	600013	37.03	37.33	37.53	37.91	0.00	0.00	36.86	37.00	37.15
9	600137	600137	0.00	0.00	0.00	37.89	0.00	0.00	0.00	0.00	0.00
10	600246	600246	37.03	37.34	37.53	37.93	36.66	36.75	36.85	36.99	37.15
11	600366	600366	0.00	0.00	37.53	37.89	0.00	0.00	0.00	0.00	0.00
12	600416	600416	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	600322	600322	37.03	37.33	37.53	37.90	0.00	0.00	0.00	36.99	37.15
14	600228	600228	37.03	37.34	37.53	37.90	0.00	0.00	36.84	36.99	37.15
15	600157	600157	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	600307	600307	0.00	0.00	37.53	37.88	0.00	0.00	0.00	0.00	0.00
17	600404	600404	37.03	37.33	37.53	37.88	0.00	36.73	36.84	36.99	37.15
18	600548	600548	37.02	37.32	37.52	37.87	0.00	0.00	0.00	36.95	37.13
19	600454	600454	37.02	37.32	37.53	37.87	36.59	36.70	36.82	36.95	37.13
20	600354	600354	0.00	37.32	37.52	37.87	0.00	0.00	0.00	0.00	37.13

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Data points map centred on site by Kingsnorth
Created 30th November 2015 (Ref KSL151125 KR79)



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Table 2: Modelled depth levels (metres)

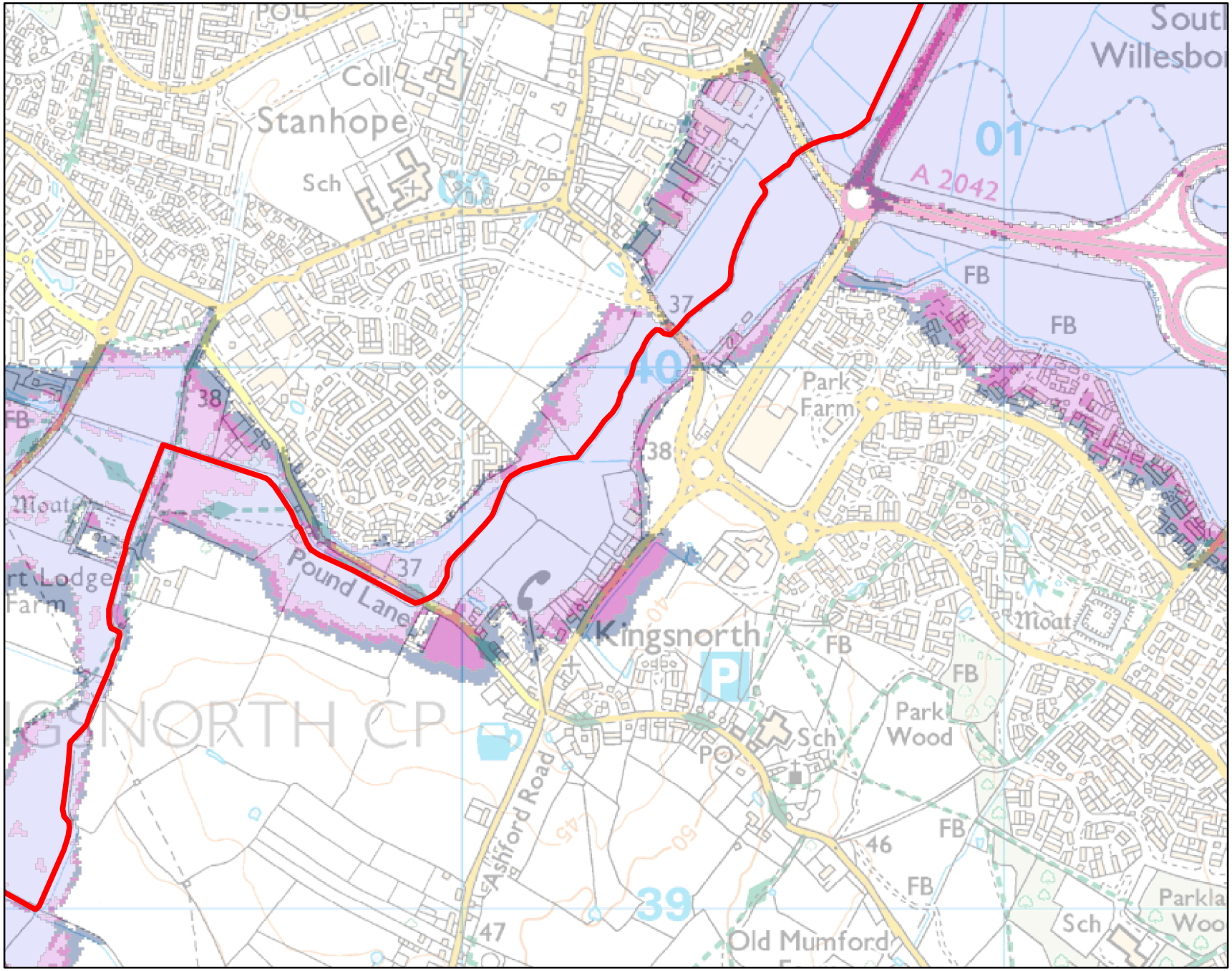
	National Grid Reference		Modelled Flood Levels For Scenario Shown, in Metres AOD								
			Undefended				Defended				
Node ID	Easting	Northing	5% AEP	1% AEP	1% +cc AEP	0.1% AEP	10% AEP	5% AEP	2% AEP	1% AEP	1% +cc AEP
1	600151	600151	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	600007	600007	0.00	0.00	0.26	0.64	0.00	0.00	0.00	0.00	0.00
3	599805	599805	0.23	0.52	0.72	1.11	0.07	0.14	0.21	0.30	0.40
4	599625	599625	0.09	0.39	0.58	0.97	0.00	0.05	0.12	0.19	0.30
5	599913	599913	0.15	0.45	0.65	1.04	0.00	0.00	0.06	0.13	0.27
6	600093	600093	0.38	0.68	0.88	1.26	0.02	0.10	0.20	0.34	0.50
7	600210	600210	0.00	0.16	0.35	0.74	0.00	0.00	0.00	0.00	0.02
8	600013	600013	0.36	0.49	0.67	1.05	0.00	0.00	0.31	0.36	0.40
9	600137	600137	0.00	0.00	0.00	0.49	0.00	0.00	0.00	0.00	0.00
10	600246	600246	0.56	0.86	1.06	1.45	0.19	0.28	0.38	0.52	0.67
11	600366	600366	0.00	0.00	0.18	0.55	0.00	0.00	0.00	0.00	0.00
12	600416	600416	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	600322	600322	0.15	0.39	0.58	0.95	0.00	0.00	0.00	0.12	0.24
14	600228	600228	0.30	0.60	0.80	1.17	0.00	0.00	0.14	0.26	0.42
15	600157	600157	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	600307	600307	0.00	0.00	0.39	0.73	0.00	0.00	0.00	0.00	0.00
17	600404	600404	0.47	0.77	0.97	1.32	0.00	0.17	0.28	0.43	0.59
18	600548	600548	0.07	0.37	0.57	0.92	0.00	0.00	0.00	0.01	0.19
19	600454	600454	0.53	0.83	1.04	1.38	0.10	0.21	0.33	0.46	0.64
20	600354	600354	0.00	0.09	0.29	0.64	0.00	0.00	0.00	0.00	0.04

All levels are taken from Ashford ABD and Hazard 2012 update, JBA Consulting, 2012.

A 0.00 figure indicates that the data point is outside of the flood extent for a particular return period at that location.

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Undefended modelled outlines map centred on site by Kingsnorth
Created 30th November 2015 (Ref KSL151125 KR79)



Environment Agency

N

Legend

- Main River
- 5% AEP Undefended Extent
- 1% AEP Undefended Extent
- 1% AEP + CC Undefended Extent
- 0.1% AEP Undefended Extent

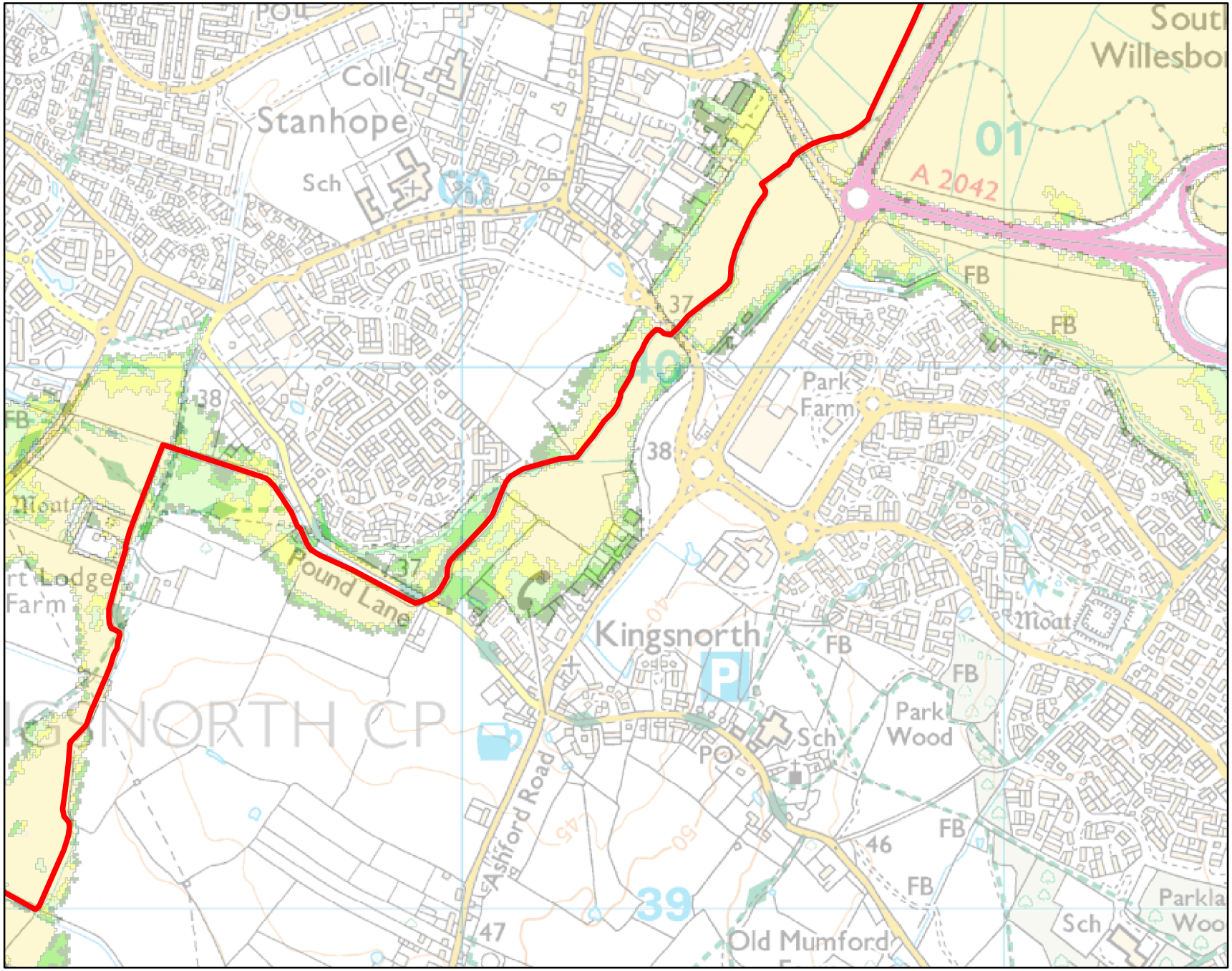
Scale 1:10,000

0 250 500

Meters

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Defended modelled outlines map centred on site by Kingsnorth
Created 30th November 2015 (Ref KSL151125 KR79)



Environment Agency

N

Legend

- Main River
- 10% AEP Defended Extent
- 5% AEP Defended Extent
- 2% AEP Defended Extent
- 1% AEP Defended Extent
- 1% AEP + CC Defended Extent

Climate Change (CC) extent based on an increase of 20% in river flows.

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occuring in any given year.

Scale 1:10,000

0 250 500

Meters

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Defence Details

There are currently no formal flood defences owned or maintained by the Environment Agency in the immediate area of this site.

Areas Benefiting from Flood Defences

This site is within an area benefiting from flood defences, as shown on the enclosed extract of our Flood Map. Areas benefiting from flood defences are defined as those areas which benefit from formal flood defences specifically in the event of flooding from rivers with a 1% (1 in 100) chance in any given year, or flooding from the sea with a 0.5% (1 in 200) chance in any given year.

If the defences were not there, these areas would be flooded. An area of land may benefit from the presence of a flood defence even if the defence has overtopped, if the presence of the defence means that the flood water does not extend as far as it would if the defence were not there.

The flood defences currently in place for Ashford store water in upstream reservoirs on the Great Stour (Hothfield flood storage reservoir) and East Stour (Aldington flood storage reservoir). These reservoirs store water upstream of the town during times of high flows and then release it downstream at a controlled rate.

This regulates the amount of flow in the Great Stour and East Stour, thus reducing the likelihood of flooding in the surrounding area. The reservoirs are maintained and managed by the Environment Agency and provide a combined 1 in 100 year standard of protection.

There are currently no immediate flood risk management improvements planned for Ashford.

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Historic Flood Data

Flood Event Data

We hold records of historic flood events from rivers and the sea. Information on the floods that may have affected the area local to your site are provided below and in the enclosed map (if relevant).

Dates of historic flood events in this area – September 1973, March 1974, November 2000 and February 2001.

Please note that our records are not comprehensive. We would therefore advise to make further enquiries locally with specific reference to flooding at this location. You should consider contacting the relevant Local Planning Authority and/or water/sewerage undertaker for the area.

We map flooding to land, not individual properties. Our historic flood event record outlines are an indication of the geographical extent of an observed flood event. Our historic flood event outlines do not give any indication of flood levels for individual properties. They also do not imply that any property within the outline has flooded internally.

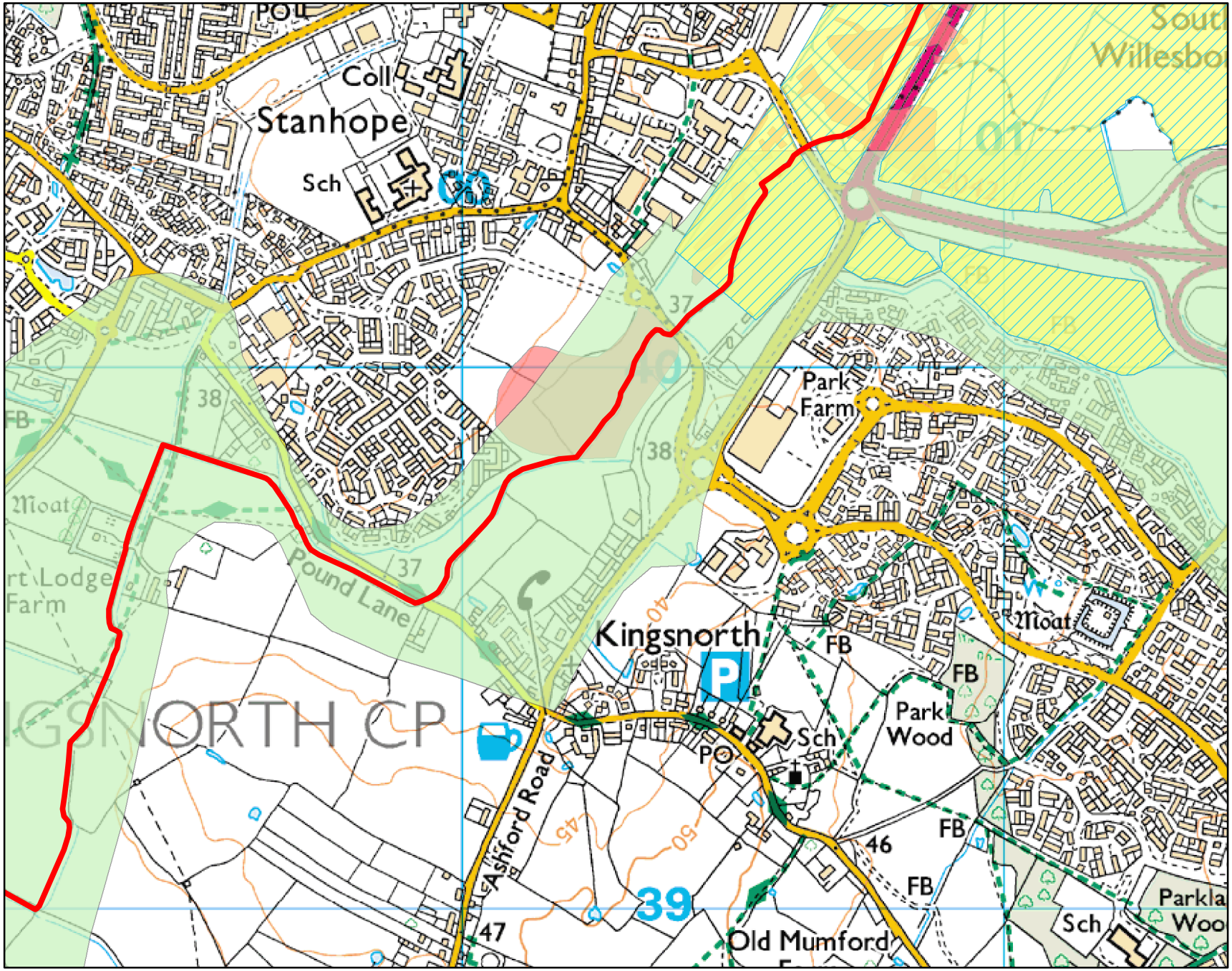
Please be aware that flooding can come from different sources. Examples of these are:

- from rivers or the sea;
- surface water (i.e. rainwater flowing over or accumulating on the ground before it is able to enter rivers or the drainage system);
- overflowing or backing up of sewer or drainage systems which have been overwhelmed,
- groundwater rising up from underground aquifers

Currently the Environment Agency can only supply flood risk data relating to the chance of flooding from rivers or the sea. However you should be aware that in recent years, there has been an increase in flood damage caused by surface water flooding or drainage systems that have been overwhelmed.

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Email: kslenquiries@environment-agency.gov.uk

Historic flood map centred on site by Kingsnorth
Created 30th November 2015 (Ref KSL151125 KR79)



Environment Agency

N

Legend

- Main River
- Feb 2001
- Nov 2000
- Sept 1973
- Mar 1974

Scale 1:10,000

0 250 500

Meters

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Surface Water

We have provided two national Surface Water maps, under our Strategic Overview for flooding, to your Lead Local Flood Authority – Kent County Council, who are responsible for local flood risk (i.e. surface runoff, ground water and ordinary watercourse), which alongside their existing local information will help them in determining what best represents surface water flood risk in your area.

Kent County Council have reviewed these and determined what it believes best represents surface water flood risk. You should therefore contact this authority so they can provide you with the most up to date information about surface water flood risk in your area.

You may also wish to consider contacting the appropriate relevant Local Planning Authority and/or water/sewerage undertaker for the area. They may be able to provide some knowledge on the risk of flooding from other sources. We are working with these organisations to improve knowledge and understanding of surface water flooding.

Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH.
Email: kslenquiries@environment-agency.gov.uk

Additional Information

Use of Environment Agency Information for Flood Risk / Flood Consequence Assessments

Depending on the enquiry, we may also provide advice on other issues related to our responsibilities including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

In **England**, you should refer to the Environment Agency's Flood Risk Standing Advice, the technical guidance to the National Planning Policy Framework and the existing PPS25 Practice Guide for information about what flood risk assessment is needed for new development in the different Flood Zones. These documents can be accessed via:

https://www.gov.uk/government/publications/flood-risk-standing-advice-for-local-planning-authorities-frsa
http://planningguidance.planningportal.gov.uk/

You should also consult the Strategic Flood Risk Assessment produced by your local planning authority.

You should note that:

1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk / Consequence Assessment (FRA / FCA) where one is required, but does not constitute such an assessment on its own.

2. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or overland runoff. The information produced by the local planning authority referred to above may assist here.

3. Where a planning application requires a FRA / FCA and this is not submitted or deficient, the Environment Agency may well raise an objection.

4. For more significant proposals in higher flood risk areas, we would be pleased to discuss details with you ahead of making any planning application, and you should also discuss the matter with your local planning authority.

Orchard House, Endeavour Park, London Road, Addington, West Malling, Kent, ME19 5SH.
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GOV.UK **Flood map for planning**

BETA This is a new service – your feedback (/feedback) will help us to improve it.

< Back

This location is in flood zone 2

What flood zone 2 means

Land within flood zone 2 has a medium probability of flooding from rivers and the sea.

You need to carry out a flood risk assessment (FRA) as part of the planning application for this development.

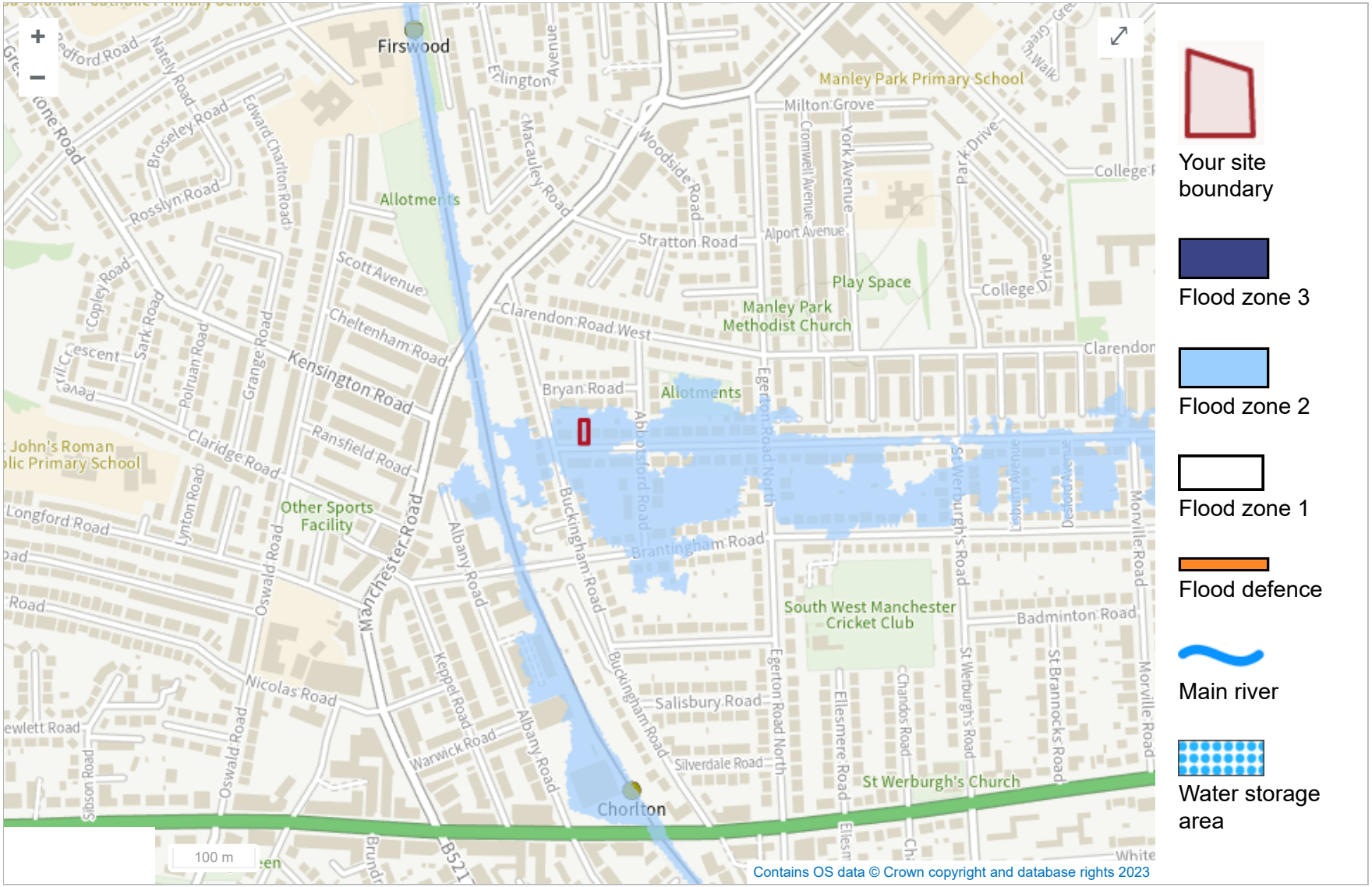
Find out more about flood zones and what they mean (/flood-zone-results-explained?zone=FZ2).

To find out about other factors that might affect the flood risk of this location, you should also check:

- surface water, groundwater and reservoir flood risk (https://check-long-term-flood-risk.service.gov.uk/long-term-flood-risk/map?easting=381863&northing=394498&map=SurfaceWater)
- Manchester planning authority's strategic flood risk assessment (SFRA), which includes future flood risk

Flood map showing the flood zone your site is in

The map shows the flood risk to your site and the surrounding area.



▶ What the flood map shows

Download the flood map for this location

The flood map is suitable for a local planning authority to use when checking a planning application to see if a development is:

- in flood zone 1, 2 or 3
- within 20 metres of a main river or a flood defence
- a water storage area (also likely to be flood zone 3b in the SFRA)

▶ Add a reference to the flood map and set the scale

Download this flood map (PDF)

Decide what you need for your planning application

You should:

- contact Manchester local planning authority to check their planning requirements
- get an FRA, you'll normally need to pay a flood risk specialist to carry it out

Order flood risk data for rivers and the sea

The flood risk data usually includes:

- detailed flood data
- historic flood event data
- modelled flood levels and extents
- flood defence locations and attributes

We aim to email you the data within 20 working days or sooner if we can.

Order flood risk data (/contact?easting=381863&northing=394498&polygon=[[381858,394484],[381858,394513],[381868,394513],[381868,394484],[381858,394484]]&center=[381863,394498]&location=M21%200RF&zoneNumber=2)

> For developments in flood zone 2, your FRA should include an assessment of all sources of flooding and take into account climate change allowances. (https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances)
>
> Find out how to do an assessment (https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications#how-to-do-an-assessment).

Get help deciding what flood risk information you need

Email the Environment Agency team in Greater Manchester, Merseyside and Cheshire at: inforequests.gmmc@environment-agency.gov.uk.

Change the location

- Redraw the boundary of your site
- Search for a different location

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Flood map for planning

Your reference	Location (easting/northing)	Created
flood risk map	**455868/202505**	**21 Jul 2022 12:27**

Your selected location is in flood zone 3, an area with a high probability of flooding.

This means:

- you must complete a flood risk assessment for development in this area
- you should follow the Environment Agency's standing advice for carrying out a flood risk assessment (see www.gov.uk/guidance/flood-risk-assessment-standing-advice)

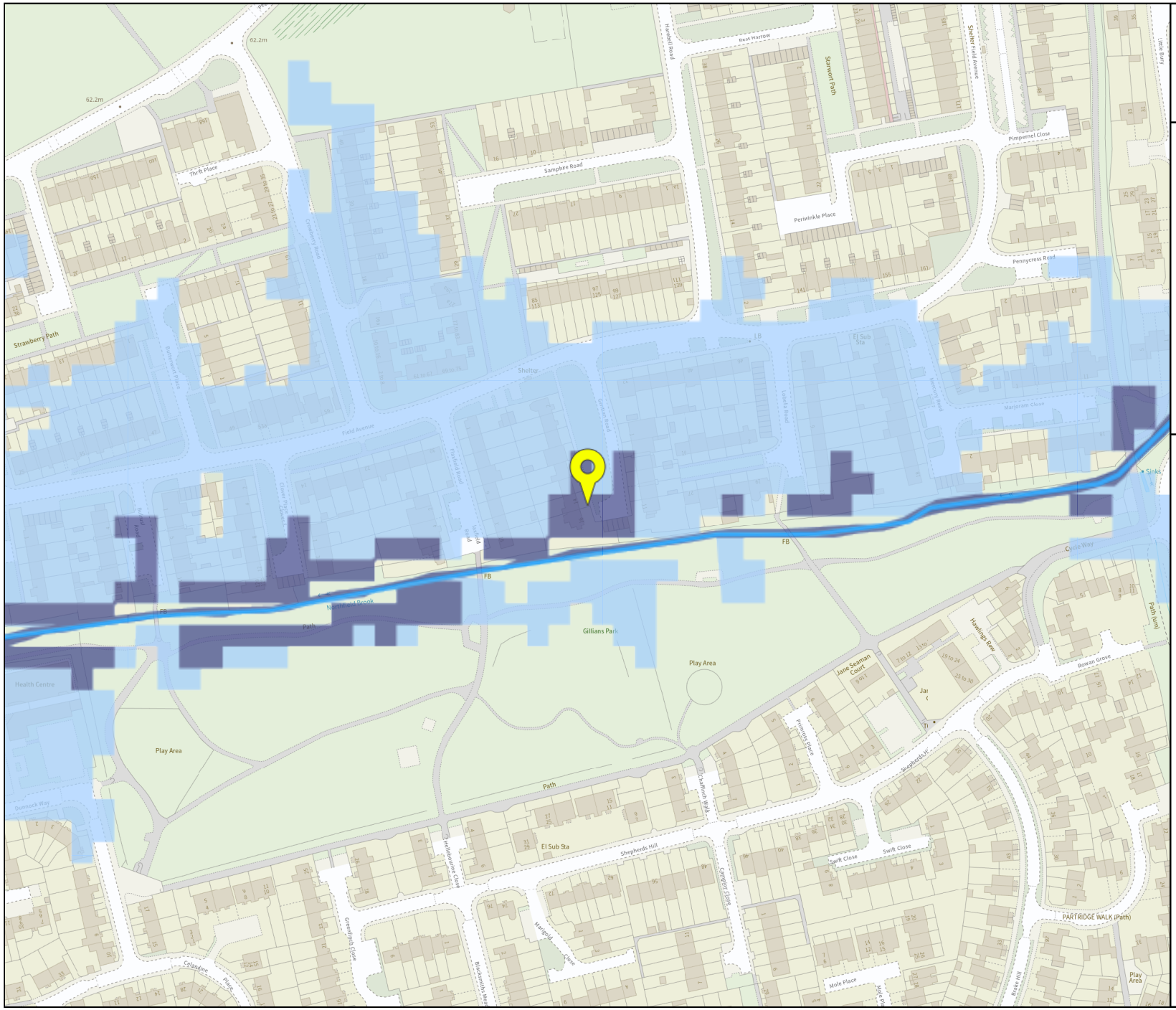
Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

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Environment Agency

Flood map for planning

Your reference
flood risk map

Location (easting/northing)
455868/202505

Scale
1:2500

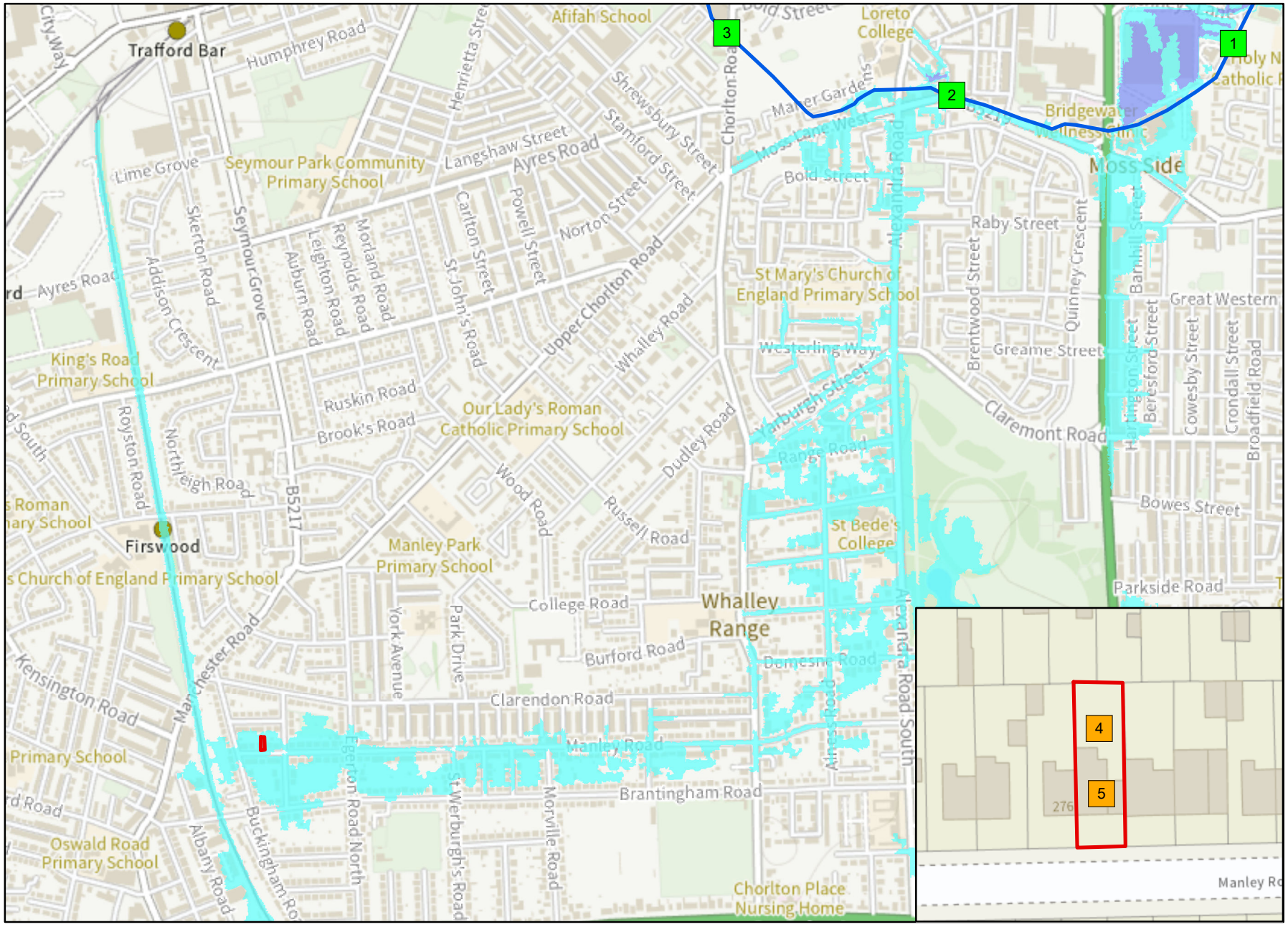
Created
21 Jul 2022 12:27

- Selected point
- Flood zone 3
- Flood zone 3: areas benefitting from flood defences
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

0 20 40 60m

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Detailed Flood Map Centred on Manley Road, Manchester, M21 0RF.
Created 02/05/2023 [GMMC308610SW]



Environment Agency

1:12,500

N

Legend

- Site Location
- Model Measurements
- 2D Levels
- Main River
- Flood Zone 3
- Flood Zone 2

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					Undefended													
Map Reference	Model Node Reference	Easting	Northing	Data	50 % AEP (1 in 2 year)	20 % AEP (1 in 5 year)	10 % AEP (1 in 10 year)	5 % AEP (1 in 20 year)	4 % AEP (1 in 25 year)	2 % AEP (1 in 50 year)	1.33 % AEP (1 in 75 year)	1 % AEP (1 in 100 year)	1 % AEP (1 in 100 year) + 30% increase in flow	1 % AEP (1 in 100 year) + 35% increase in flow	1 % AEP (1 in 100 year) + 70% increase in flow	0.5 % AEP (1 in 200 year)	0.1 % AEP (1 in 1000 year)	0.1 % AEP (1 in 1000 year) + 30% increase in flow
1	ea013_0249_corn3908	384113	396116	Modelled Water Level (m aodN)	32.15	32.28	32.37	32.44	32.51	32.77	33.26	33.47	33.75	33.79	34.02	33.83	34.34	34.46
				Modelled Flow (cumecs)	0.19	0.27	0.34	0.39	0.47	0.81	1.03	1.21	1.57	1.63	2.05	1.70	3.47	4.51
2	ea013_0249_corn3215	383465	396002	Modelled Water Level (m aodN)	30.61	30.71	30.80	30.90	31.01	31.93	32.43	32.58	32.78	32.81	32.99	32.84	33.28	33.39
				Modelled Flow (cumecs)	0.24	0.34	0.42	0.49	0.58	1.03	1.32	1.57	2.03	2.11	2.66	2.24	4.60	5.98
3	ea013_0249_corn2587	382951	396140	Modelled Water Level (m aodN)	29.22	29.36	29.46	29.55	29.63	29.95	30.07	30.16	30.34	30.39	30.82	30.47	31.73	31.99
				Modelled Flow (cumecs)	0.26	0.37	0.46	0.53	0.63	1.13	1.46	1.72	2.24	2.33	2.93	2.47	5.10	6.63

					Undefended	
Map Reference	Model Node Reference	Easting	Northing	Data	0.1 % AEP (1 in 1000 year)	0.1 % AEP (1 in 1000 year) + 30% increase in flow
4	2D Levels	381880	394506	Modelled Water Level (m aodN)	27.81	27.89
5		381881	394494	Modelled Water Level (m aodN)	27.81	27.89

Model data taken from Corn Brook 2017

AEP - Annual Exceedence Probability

m aodN - metres above ordnance datum Newlyn

cumecs - cubic metres per second

Notes:

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

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National Planning Policy Framework

From: **Department for Levelling Up, Housing and Communities (/government/organisations/department-for-levelling-up-housing-and-communities)**

Published 27 March 2012

Updated: 27 March 2012, **see all updates**

Contents

Annex 3: Flood risk vulnerability classification

Information on 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 infrastructure for electricity supply including generation, storage and distribution systems; including electricity generating power stations, grid and primary substations storage; and water treatment works that need to remain operational in times of flood.
- Wind turbines.
- Solar farms.

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.
- Car parks.

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 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.

OGL

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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.

Product 4 (Detailed Flood Risk) for OX4 6QE
Our Ref: THM263086

Product 4 is designed for developers where Flood Risk Standing Advice FRA (Flood Risk Assessment) Guidance Note 3 Applies. This is:

i) "all applications in Flood Zone 3, other than non-domestic extensions less than 250 sq metres; and all domestic extensions", and

ii) "all applications with a site area greater than 1 ha" in Flood Zone 2.

Product 4 includes the following information:

Ordnance Survey 1:25k colour raster base mapping;

Flood Zone 2 and Flood Zone 3;

Relevant model node locations and unique identifiers (for cross referencing to the water levels, depths and flows table);

Model extents showing *defended* scenarios;

FRA site boundary (where a suitable GIS layer is supplied);

Flood defence locations (where available/relevant) and unique identifiers; (supplied separately)

Flood Map areas benefiting from defences (where available/relevant);

Flood Map flood storage areas (where available/relevant);

Historic flood events outlines (where available/relevant, not the Historic Flood Map) and unique identifiers;

Statutory (Sealed) Main River (where available within map extents);

A table showing:

i) Model node X/Y coordinate locations, unique identifiers, and levels and flows for *defended* scenarios.

ii) Flood defence locations unique identifiers and attributes; (supplied seperately)

iii) Historic flood events outlines unique identifiers and attributes; and

iv) Local flood history data (where available/relevant).

Please note:

If you will be carrying out computer modelling as part of your Flood Risk Assessment, please request our guidance which sets out the requirements and best practice for computer river modelling.

This information is based on that currently available as of the date of this letter. You may feel it is appropriate to contact our office at regular intervals, to check whether any amendments/ improvements have been made. Should you re-contact us after a period of time, please quote the above reference in order to help us deal with your query.

This information is provided subject to the enclosed notice which you should read.

This letter is not a Flood Risk Assessment. The information supplied can be used to form part of your Flood Risk Assessment. Further advice and guidance regarding Flood Risk Assessments can be found on our website at:

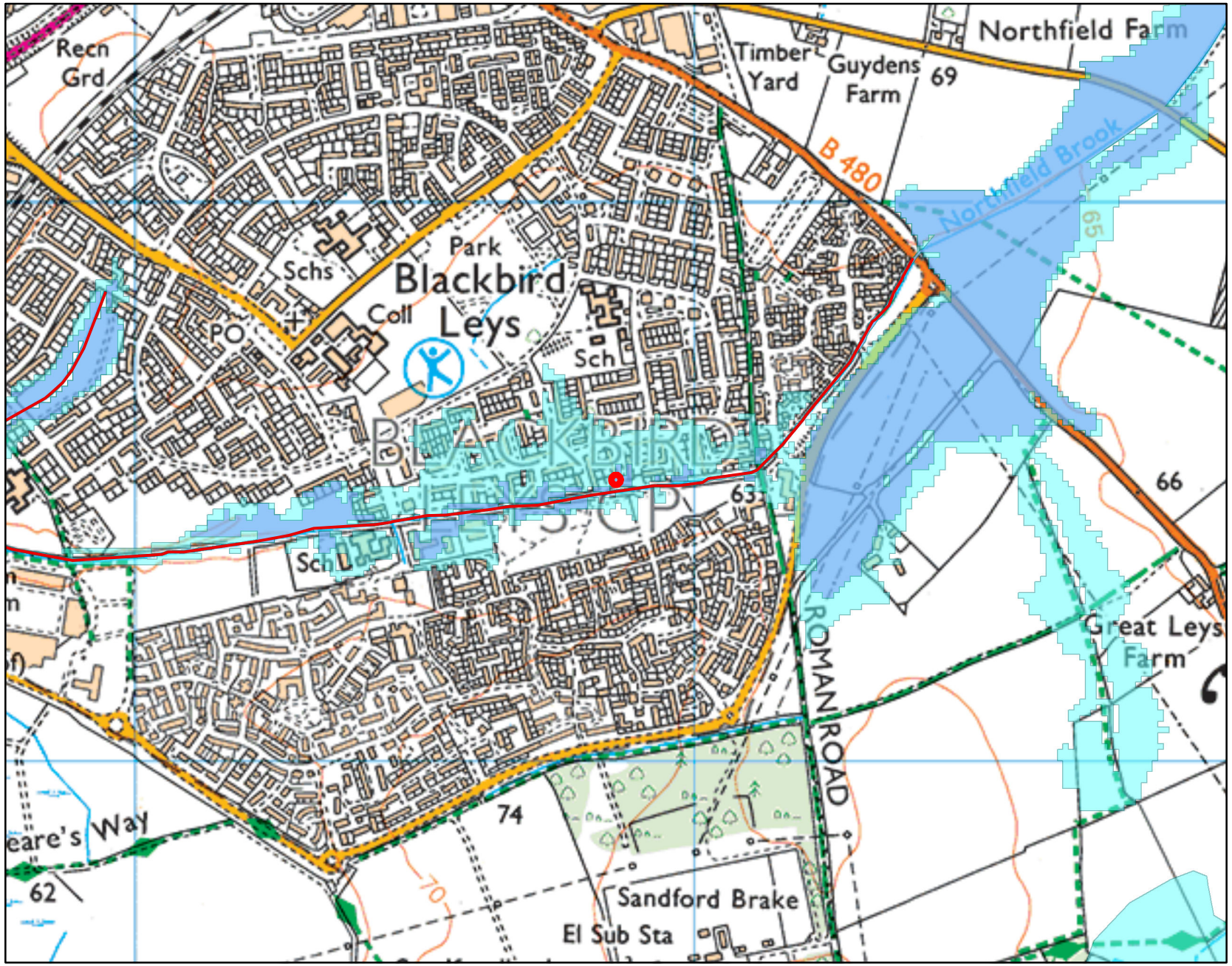
https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities

If you would like advice from us regarding your development proposals you can complete our pre application enquiry form which can be found at:

https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion

Red Kite House, Howbery Park, Wallingford, Oxon OX10 8BD
Customer services line: 08708 506 506
Email: enquiries_THM@environment-agency.gov.uk

Flood Map for Planning centred on OX4 6QE
Created on 17/5/2022 REF: THM263086



Environment Agency

Kilometres

0 0.25 0.5

Legend

- Main River
- Flood defences
- Areas benefiting from flood defences
- Flooding from rivers or sea (FZ3)
- Extent of extreme flood (FZ2)
- Flood Map - flood storage areas

Flooding from rivers or sea without defences (Flood Zone 3) shows the area that could be affected by flooding:
- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

The Extent of an extreme flood (Flood Zone 2) shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

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Defence information

THM263086

Defence Location:	No defences on Main River
Description:	This location is not currently protected by any formal defences and we do not currently have any flood alleviation works planned for the area. However we continue to maintain certain watercourses and the schedule of these can be found on our internet pages.

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Model information

THM263086

Model:	Northfield & Littlemore Brook 2011
Description:	The information provided is taken from the Northfiled & Littlemore Brook detail modelling project 2011. The study was carried out using 1D-2D modelling software (ISIS-Tuflow). Model design runs: 1 in 5 / 20% Annual Exceedance Probability (AEP); 1 in 20 / 5% AEP; 1 in 100 / 1% AEP; 1 in 1000 / 0.1% AEP and 1 in 100+20% / 1% AEP plus 20% increase in flows Mapped Outputs: 1 in 5 / 20% AEP; 1 in 20 / 5% AEP; 1 in 100 / 1% AEP and 1 in 1000 / 0.1% AEP Model accuracy: Levels ± 250mm

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Modelled in-channel flood flows and levels

THM263086

The modelled flood levels and flows for the closest most appropriate model node points for your site that are within the river channel are provided below:

				Flood Levels (mAOD)							
Node label	Model	Easting	Northing	20% AEP	5% AEP	1% AEP	1% AEP (+20% increase in flows)	1% AEP (+25% increase in flows)	1% AEP (+35% increase in flows)	1% AEP (+70% increase in flows)	0.1% AEP
Northfield2011_North018_i	Northfield & Littlemore Brooks 2011	456038	202507	62.54	62.65	62.82	62.89	0.00	0.00	0.00	63.02
Northfield2011_North017	Northfield & Littlemore Brooks 2011	455963	202492	62.28	62.37	62.53	62.59	0.00	0.00	0.00	62.73
Northfield2011_North017_i	Northfield & Littlemore Brooks 2011	455887	202485	62.08	62.17	62.33	62.39	0.00	0.00	0.00	62.48
Northfield2011_North016_ds	Northfield & Littlemore Brooks 2011	455816	202474	61.86	61.96	62.12	62.17	0.00	0.00	0.00	62.33
Northfield2011_North016_i	Northfield & Littlemore Brooks 2011	455744	202461	61.69	61.80	62.00	62.07	0.00	0.00	0.00	62.29

				Flood Flows (m3/s)							
Node label	Model	Easting	Northing	20% AEP	5% AEP	1% AEP	1% AEP (+20% increase in flows)	1% AEP (+25% increase in flows)	1% AEP (+35% increase in flows)	1% AEP (+70% increase in flows)	0.1% AEP
Northfield2011_North018_i	Northfield & Littlemore Brooks 2011	456038	202507	5.06	6.30	8.81	10.34	0.00	0.00	0.00	12.16
Northfield2011_North017	Northfield & Littlemore Brooks 2011	455963	202492	5.06	6.30	8.83	10.46	0.00	0.00	0.00	12.62
Northfield2011_North017_i	Northfield & Littlemore Brooks 2011	455887	202485	5.05	6.29	8.80	10.42	0.00	0.00	0.00	12.55
Northfield2011_North016_ds	Northfield & Littlemore Brooks 2011	455816	202474	5.05	6.29	8.77	10.27	0.00	0.00	0.00	11.23
Northfield2011_North016_i	Northfield & Littlemore Brooks 2011	455744	202461	5.05	6.29	8.16	8.87	0.00	0.00	0.00	9.51

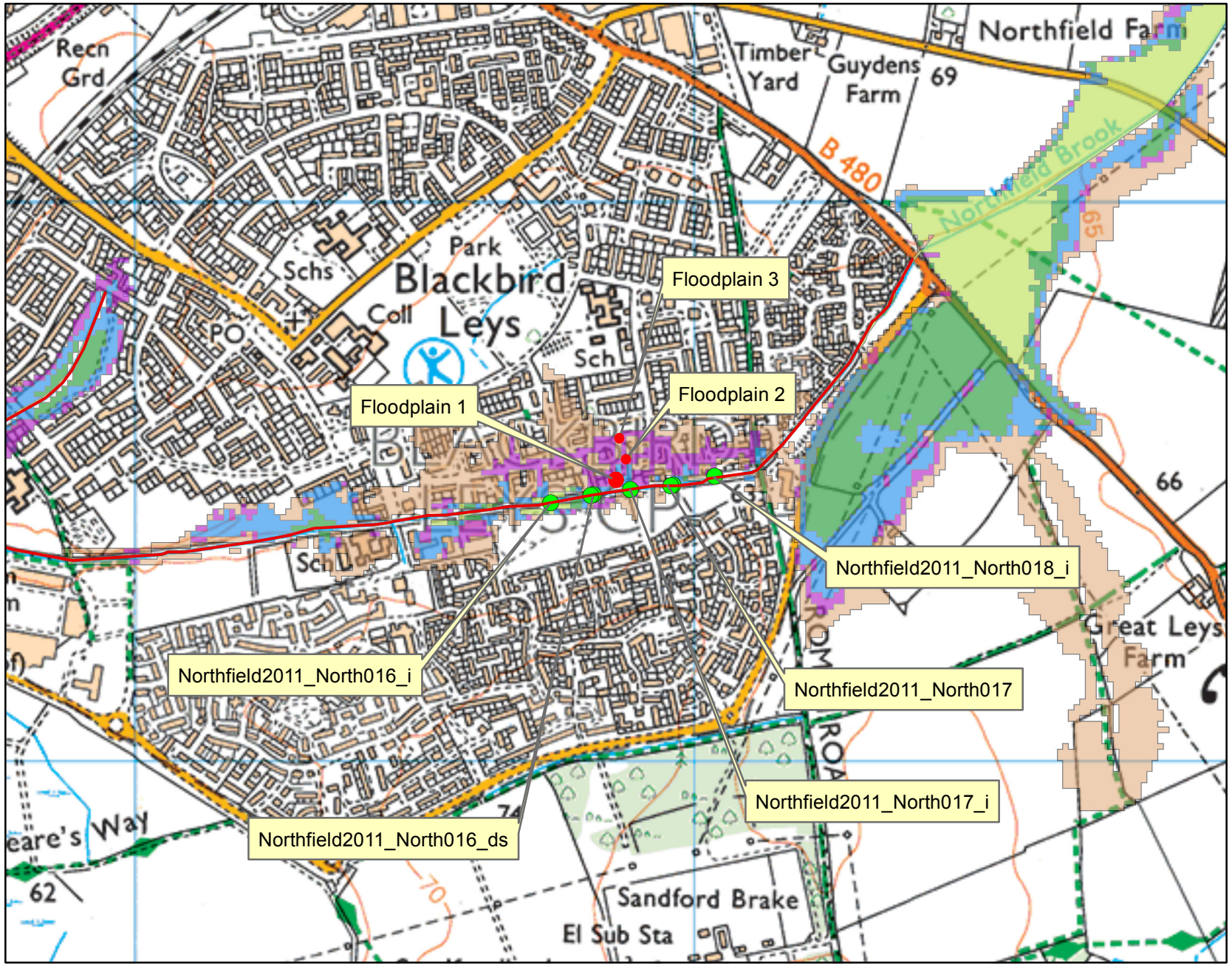
Note:

Due to changes in guidance on the allowances for climate change, the percentage increase in river flows above should no longer to be used for development design purposes. The data included in this Product can be used for interpolation of levels as part of an intermediate level assessment.

For further advice on the new allowances please visit
https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

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Detailed FRA Map centred on OX4 6QE
Created on 17/5/2022 REF: THM263086



Environment Agency

Kilometres

0 0.25 0.5

Legend

- Main River
- Model Nodes
- 20% AEP Flood Outline
- 5% AEP Flood Outline
- 1% AEP Flood Outline
- 1%+20% AEP Flood Outline
- 0.1% AEP Flood Outline
- Floodplain Node

AEP = Annual Exceedance Probability
The probability of a flood of a particular magnitude, or greater, occuring in any given year

Where available climate change extents have been calculated with an additional flow added to an AEP event. An example of how this is written is 1%+20% AEP.

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Modelled floodplain flood levels

THM263086

The modelled flood levels for the closest most appropriate model grid cells for your site are provided below:

				flood levels (mAOD)				
2D grid cell reference	Model	Easting	Northing	20% AEP	5% AEP	1% AEP	1% AEP (+20% increase in flows)	0.1% AEP
Floodplain 1	Northfield & Littlemore Brook 2011	455,858	202,497	no data	no data	62.22	no data	62.45
Floodplain 2	Northfield & Littlemore Brook 2011	455,878	455,878	no data	no data	no data	no data	62.41
Floodplain 3	Northfield & Littlemore Brook 2011	455,866	202,576	no data	no data	no data	no data	62.37

This flood model has represented the floodplain as a grid.
The flood water levels have been calculated for each grid cell.

Note:
Due to changes in guidance on the allowances for climate change, the percentage increase in river flows above should no longer to be used for development design purposes. The data included in this Product can be used for interpolation of levels as part of an intermediate level assessment.

For further advice on the new allowances please visit
https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

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APPENDIX E

APPENDIX E SITE SPECIFIC TOOLKIT, DEFR

Appendix E Site Specific Toolkit, DEFRA (FD2320/TR2) and Data Register

Site Specific FRA 'Toolkit'

A1 OVERVIEW OF FLOOD RISK

A.1.1 Mapping within Appendix D of the SCDC and CCC Level 1 SFRA provides a graphical representation of the variation in flood risk across the study area. These maps highlight the fluvial extent of Flood Zones 1 (Low Flood Risk), 2 (Medium Flood Risk), 3a (High Flood Risk) and 3b (Functional Floodplain). The Functional Floodplain is defined as land where water has to flow or be stored in times of flood. PPS25 provides guidance on how sustainable development should be implemented within these various flood risk areas. Where available, Flood Hazard mapping has also been provided.

A.1.2 SCDC and CCC should review the risk of flooding posed to a particular site by reference to the maps in Appendix D of the SFRA. Clear planning and development control recommendations have been provided in Section A.5 of this note, should be applied only once the Sequential Test has been applied in accordance with PPS25 (refer to Sections 1.4 of the SFRA). One of the key recommendations of the Pitt Review; *"Learning lessons from the 2007 floods",* was that Local Authorities should lead on the management of local flood risk, with the support of the relevant organisations. The Flood and Water Management Act (2010), also highlights how a lead local authority in England, must; *develop, maintain, apply and monitor* a *strategy for local flood risk management in its area.*

A.1.3 It is highlighted that, in addition to a risk of flooding from rivers, there is also a potential risk of flooding from localised sources, including sewers, blocked gullies and culverts, and surface water runoff. This is more difficult to predict, and within more intensely urbanised areas within the districts, may occur at any location and / or point in time. It is essential that all future development is designed to minimise the potential impacts of localised flooding (e.g. through the provision of SuDS, overland flood flow routing, and careful location of on-site flood detention areas). All sources of flooding should be taken into consideration.

A.1.4 Within Sections A.3 and A.4 of this note, a 'toolkit' has been provided to inform SCDC and CCC and prospective developers of the likely flood risk issues to be addressed on a site-specific basis.

A2 SCOPE OF THE DETAILED FLOOD RISK ASSESSMENT

A.2.1 The Level 1 SFRA is a strategic document that provides an overview of flood risk throughout the area. It is imperative that a site based Flood Risk Assessment (FRA) is carried out by the developer for all proposed developments. This should be submitted as an integral part of the planning application (when it is submitted to the Local Planning Authority).

A.2.2 The site specific FRA toolkit has been based upon planning policies and information available at the time of report issue (September 2010). Flood risk classifications may be subject to change in line with future planning policy. It should also be noted that flood zoning may be subject to change following consideration of detailed topographical information, and following investigation of site specific flood risk issues. This relates to further detail as part of a site specific FRA. An FRA is required to be undertaken by developers to accompany any future planning applications for developments, and for any proposed development in a medium (FZ2) or high probability (FZ3) flood risk area.

A.2.3 Flood risk will need to be considered by developers as part of any specific development proposals in the future. Developers must:

- carry out site specific FRA's;
- engage the EA from the outset; and
- seek guidance from the EA on requirements for an FRA.

A.2.4 The FRA should be commensurate with the risk of flooding to the proposed development. For example, where the risk of flooding to the site is negligible (e.g. 'low probability' Flood Zone 1), there is little benefit to be gained in assessing the potential risk to life and / or property as a result of fluvial (river) flooding. Rather, emphasis should be placed on ensuring that runoff from the site does not exacerbate flooding elsewhere i.e. adjacent developments. The particular requirements for FRAs, for specific development uses, and within each delineated flood zone are outlined within Sections A.3 and A.4 of this note.

A.2.5 In all areas, a localised risk of flooding may also occur, typically associated with local catchment runoff following intense rainfall (Pluvial Flooding) passing directly over the local catchment area. Surface water sheet flow as a result of pluvial flooding, must be taken into consideration as an integral part of a site specific FRA. Reference should be made to the Environment Agency's (EA) surface water flood maps provided in Appendix B of the Level 1 SFRA. These maps should be used as a starting point, when considering surface water flooding across a site. Reference should be made to section 4.11 of the SFRA for further background on the production and application of these maps.

A3 FRA TOOLKIT: BY PROPOSED DEVELOPMENT USE

A.3.1 Set out below is an initial guide to the key issues identified as part of the SFRA, but this is not an exhaustive list. The exact scope and requirements of any site specific FRA will be set by the Environment Agency and South Cambridgeshire District Council or Cambridge City Council. It is recommended that early consultations take place with the EA in order to ensure a satisfactory FRA is prepared and submitted with any future planning application for new development. Reference should be made to the EA's standing advice on the Flood Risk Assessment process which can be found on the web link below;

http://www.environment-agency.gov.uk/research/planning/93498.aspx

The vulnerability of a development in relation to the level of flood risk should be taken into consideration. Reference should be made to the tables provided in Annex D of PPS25. Reliable site level information, preferably in the form of a topographical survey, set to Global Positioning System (GPS) datum, will be required in the first instance to determine the actual flood zone for the site.

Essential Infrastructure

A.3.2 The FRA will need to address the safe access and egress to any bridge structures or other essential infrastructure to be sited in flood risk areas. The design of any bridge deck arrangements will need to allow sufficient clearance (to be advised by the EA) above the 1 in 100 year flood level (incorporating an allowance for climate change) and ensure that no constriction in flow is generated by the proposed deck and parapet arrangements.

A.3.3 The FRA will need to ensure that the infrastructure is designed and constructed to:

- Remain operational in times of flood;
- Compensate the net loss of floodplain storage;
- Not impede water flows;
- Not increase flood risk elsewhere.

Other Proposed Development

A.3.4 **The FRA should consider the appropriateness of proposed development uses in flood risk areas in line with Table D.3 of PPS25. This is shown in section 10.2 of the SFRA.**

A.3.5 Further investigation of any recently modelled flood levels and topography will give a better understanding of the flooding mechanism of the site.

A.3.6 Sustainable drainage techniques should be implemented wherever practicable as part of the development proposals (see section 8.1) of the SFRA.

A.3.7 Surface water runoff should look to be controlled as close to the source as possible with run-off rates set to mitigate any impact to the receiving environment. They should also seek to provide a tangible reduction in flood risk to adjacent and downstream areas prone to historic flooding. Areas prone to surface water flooding are also likely to be identified as part of the Cambridge detailed Surface Water Management Plan (SWMP) and Cambridgeshire Flood Risk Management Plan.

A.3.8 The developer should **seek to reduce runoff rates and volumes to the receiving surface water drainage system** and watercourse 'post development' in order to reduce the flood risk to downstream areas prone to historic flooding (or identified as having a high potential for flood risk as identified in the SWMP). For areas served by separate sewer systems, a 20% reduction in surface water flows should be sought 'post development' for the lifetime of the development. Nil detriment should be viewed as the absolute minimum requirement. Discharge rates and volumes from the proposed development into the receiving watercourse and drainage systems should be agreed with the EA, Local Planning Authority, relevant sewerage undertaker or relevant IDB.

A.3.9 The impact of foul and surface water flows resulting from proposed development upon the receiving combined public sewer should be assessed, following liaison with Anglian Water Services Ltd and the EA. For areas served by combined sewer systems, a 20% reduction in net foul and surface water flows should be sought 'post development' for the lifetime of the development. Nil detriment should be viewed as the absolute minimum requirement.

A.3.10 The FRA should take into account the requirements for safe access (dry access where possible), and compensatory flood storage to mitigate any loss of potential flood storage volumes as a result of development proposals.

A.3.11 Where volumes of flood storage are displaced by the development proposals, compensatory flood storage must be provided within the site (or upstream) on a 'level for level', 'volume for volume' basis up to and including the 1 in 100 year flood level incorporating climate change.

A.3.12 Climate change impacts should also be considered for all types of flooding (including sewer flooding) and minimum finished floor levels for the development should be set above the 1 in 100 year flood level (incorporating climate change), with an allowance for freeboard. Typically this freeboard should be 300mm above the 1 in 100 plus climate change flood level or 600mm above the 1 in 100 year flood level.

A.3.13 Appropriate to the scale and nature of the development, the FRA should take into account residual risks due to extreme events and potential culvert blockages.

Sequential Test

A.3.14 A risk-based Sequential Test (see section 1.4 of the SFRA) should be applied at all stages of the planning process on a case by case basis. Reference should be made to the Flood Risk Constraints Mapping provided in Appendix D; undefended flood outlines should be used. In areas at risk from fluvial or tidal flooding, preference should be given to locating new development in Flood Zone 1. If there is no reasonably available site in Flood Zone 1, the flood vulnerability of the proposed development can be taken into account in locating development in Flood Zone 2 and the current Flood Zone 3. If, following the application of the Sequential Test it is not possible or consistent with wider sustainability objectives, for the development to be located in zones of lower probability of flooding, the Exception Test can be applied.

Exception Test

A.3.15 PPS25 describes the Exception Test as providing a 'method of managing flood risk while still allowing necessary development to occur'. For the Exception Test to be passed it must be demonstrated that;

a) the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared;

b) the development should be on developable previously developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously developed land; and

c) a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible will reduce flood risk overall.

A4 FRA TOOLKIT: BY FLOODZONE

*Proposed Development within **Zone 3a 'High Probability'** and **Zone 3b 'Functional Floodplain'** (Developed Areas)*

A.4.1 All FRAs supporting proposed development within both Zone 3b 'Functional Floodplain' (existing developed areas only) and Zone 3a 'High Probability' should include an assessment of the following:

- It is important to note that only limited forms of development are permitted in Flood Zone 3b (Functional Floodplain). Only Water-Compatible uses and Essential Infrastructure listed in table D3 of PPS25 (see section 10.2.4 of the SFRA), are permitted in this zone. Essential Infrastructure in this zone should pass the Exception Test. No other forms of development are permitted.
- The vulnerability of the development to flooding from other sources (e.g. surface water drainage, groundwater) as well as from river flooding. This will involve discussion with the Environment Agency, Anglian Water Services Ltd, SCDC/CCC, Cambridgeshire County Council and relevant IDB to confirm whether a localised risk of flooding exists at the proposed site.
- The vulnerability of the development to flooding over the lifetime (typically 60 years for commercial and 100 years for residential) of the development (including the potential impacts of climate change), i.e. maximum water levels, flow paths and flood extents within the property and surrounding area. The Environment Agency may have carried out detailed flood risk mapping within localised areas that could be used to underpin this assessment (see Flood Risk Constraints Mapping in Appendix D of SFRA). Where available, this will be provided at a cost to the developer. Where detailed modelling is not available, hydraulic modelling by a suitably qualified professional will be required to determine the risk of flooding to the site. Reference should be made to the EA's Computer River Modelling guidance (2009) as part of a Flood Risk Assessment.
- The effect of the new development upon depth and velocity of floodwater. This will require a detailed assessment, to be carried out by a suitably qualified professional. Reference should be made to areas that fall within the Flood Hazard Mapping extents as shown in Appendix D of the SFRA.
- Volumes of flood storage displaced as a result of the development proposals. Compensation should be provided on a level for level, volume for volume basis up to and including the 1 in 100 year event including climate change.
- The potential for the development to increase flood risk elsewhere through the addition of hard surfaces, and the effect of the new development on surface water runoff. Details of proposed mitigation measures and SuDS must be provided, with accompanying hydraulic calculations to demonstrate the robustness of the approach taken. A tangible reduction in surface water flows should be sought 'post development' for the lifetime of the development.
- For areas deemed to be protected by flood defences (see defence plans in Appendix C of the SFRA) or alleviation schemes, the risk of breach (failure) of defences or exceedance of their design criteria. This will require a detailed assessment, to be carried out by a suitably qualified professional.

- A demonstration that residual risks of flooding (after existing and proposed flood management and mitigation measures are taken into account) are acceptable. Measures may include flood defences, flood resistant and resilient design, escape / evacuation, effective flood warning and emergency planning (see section 4.14 of SFRA).
- Details of existing site levels, proposed site levels and proposed ground floor levels. All levels should be stated relevant to Ordnance Datum (confirmed by Global Positioning System Datum).

*Proposed Development within **Zone 2 'Medium Probability'** (Incorporating Areas Affected by the 1 in 100 Year Flood Including Climate Change)*

A.4.2 For all sites within Zone 2 'Medium Probability' an FRA should be prepared based upon readily available existing flooding information, sourced from the EA, and should include an assessment of the following:

- The vulnerability of the development to flooding from other sources (e.g. drainage, groundwater) as well as from river flooding. This will involve discussion with the Environment Agency, relevant IDB, Anglian Water Services Ltd, SCDC/CCC and Cambridgeshire County Council to confirm whether a localised risk of flooding exists at the proposed site.
- The vulnerability of the development to flooding over the lifetime of the development (including the potential impacts of climate change) (see section 6.1.7 of the SFRA).
- Volumes of flood storage displaced as a result of the development proposals. Compensation should be provided on a level for level, volume for volume basis up to and including the 1 in 100 year event including climate change.
- A demonstration that residual risks of flooding are effectively managed through, for example, the provision of raised floor levels, and the provision of a planned evacuation route and / or safe refuge.
- The potential for the development to increase flood risk elsewhere through the addition of hard surfaces, and the effect of the new development on surface water runoff. Details of proposed mitigation measures and SuDS must be provided, with accompanying hydraulic calculations to demonstrate the robustness of the approach taken. A tangible reduction in surface water flows should be sought 'post development' for the lifetime of the development.
- Details of existing site levels, proposed site levels and proposed ground floor levels. All levels should be stated relevant to Ordnance Datum (confirmed by Global Positioning System Datum).

*Proposed Development within **Zone 1 'Low Probability'***

A.4.3 For all sites within Zone 1 'Low Probability' a basic FRA should be prepared, and should include an assessment of the following:

- Alternative sources of flooding (e.g. surface water/urban drainage and / or groundwater).
- The potential for the development to increase flood risk elsewhere through the addition of hard surfaces, and the effect of the new development on surface water runoff. Details of proposed mitigation measures and SuDS must be provided, with accompanying hydraulic calculations to demonstrate the robustness of the approach taken. A tangible reduction in surface water flows should be sought 'post development' for the lifetime of the development.

POTENTIAL FLOOD MITIGATION MEASURES

A.4.4 The SFRA provides specific recommendations with respect to the provision of sustainable flood risk mitigation opportunities that will address both the risk to life and the residual risk of flooding to development within particular 'zones' of the area. These recommendations should form the basis for the site-based FRA, and have been briefly set out below.

Raised Floor Levels and Basement Thresholds (Freeboard)

A.4.5 The raising of finished floor levels above the 1 in 100 year fluvial flood level plus climate change, will ensure that the damage to property is minimised.

A.4.6 Wherever possible, finished floor levels should be situated a minimum of 300mm above the 1 in 100 year plus climate change flood level, determined as an outcome of the site based FRA. A minimum of 600mm above the 1 in 100 year flood level should be adopted if no specific climate change data is available. The height that the floor level is raised above flood level is referred to as the 'freeboard'.

A.4.7 The use of basements within flood affected areas should be discouraged. Where basement uses are permitted however, it is necessary to ensure that the basement access points are situated 300mm above the 1 in 100 year flood level plus climate change. The basement must be of a waterproof construction to avoid seepage during flooding conditions. Habitable uses of basements within flood affected areas should not be permitted.

Sustainable Drainage Systems (SuDS)

A.4.8 SuDS is a term used to describe the various approaches that can be used to manage surface water drainage in a way that mimics the natural environment. Reference should be made to section 8.1 of the SFRA. The management of rainfall (surface water) is considered an essential element of reducing future flood risk to both the site and its surroundings.

A.4.9 SuDS may improve the sustainable management of water for a site by:

- Reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream;
- Reducing volumes and the frequency of water flowing directly to watercourses or sewers from developed sites;
- Improving water quality over conventional surface water sewers by removing pollutants from diffuse pollutant sources;
- Reducing potable water demand through rainwater harvesting;
- Improving amenity through the provision of public open space and wildlife habitat;
- Replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained.

A.4.10 In catchment terms, any reduction in the amount of water that originates from any given site is likely to be small. But if applied across the catchment in a consistent way, the cumulative effect of a number of sites could be significant.

A.4.11 There are numerous different ways that SuDS can be incorporated into a development; information relating to the most commonly found components of a SuDS system can be found in the various documents listed below. The appropriate application of a SuDS scheme to a specific development is heavily dependent upon the topography and geology of the site (and its surrounds). Careful consideration of the site characteristics must be assured to ensure the future sustainability of the adopted drainage system. SuDS Infiltration Feasibility mapping based on underlying ground conditions has been provided in Appendix C of the Level 1 SFRA.

A.4.12 The location of Source Protection Zones (see maps in Appendix C in SFRA) in the study area, should be taken into consideration, when considering the application of SuDS.

A.4.13 For more guidance on SuDS, the following documents and websites are recommended as a starting point:

- Planning Policy Statement 25: Development and Flood Risk Practice Guide (2009)

http://www.communities.gov.uk/publications/planningandbuilding/pps25guideupdate

- CIRIA SuDS Manual (C697)

http://www.ciria.com/suds/index.htm

- Cambridge Sustainable Drainage Design and Adoption Guide (Cambridge City Council June 2009)

http://www.cambridge.gov.uk/public/docs/SUDS-Design-and-Adoption-Guide.pdf

- Water Cycle Strategy, Major Growth Areas in and around Cambridge, Phase 1 Outline Strategy (October 2008) and Phase 2 (late 2010)

http://www.cambridgeshirehorizons.co.uk/our_challenge/environment_sustainability/water_cycle_strategy.aspx

- The South Cambridgeshire District Council, District Design Guide (Supplementary Planning Document, Adopted March 2010)

http://www.scambs.gov.uk/environment/planning/districtplanning/localdevelopmentframework/spds/districtdesignguidespd.htm

A.4.14 Furthermore, the Environment Agency issues best practice guidance for Sustainable Drainage Systems, available from the Environment Agency development and flood risk teams. This provides clear hierarchy for SuDS, reflecting the degree of sustainability offered by the SuDS application as captured in Table A.1 below:

	SuDS Technique	Flood Reduction	Water Quality Improvement	Landscape & Wildlife Benefit
Most Sustainable ↓	Living Roofs	✓	✓	✓
	Basins and ponds - Constructed wetlands - Balancing ponds - Detention basins - Retention ponds	✓	✓	✓
	Filter strips and swales	✓	✓	✓
	Infiltration devices - Soakaways - Infiltration trenches and basins	✓	✓	✓
	Permeable surfaces and filter drains - gravelled areas - Solid paving blocks - Porous paving	✓	✓	
Least Sustainable	Tanked systems - Over-sized pipes/tanks - Storms cells	✓		

Table A.1

LOCAL COMMUNITY ACTIONS TO REDUCE FLOOD DAMAGE

A.4.16 Where properties are deemed to be at 'significant' risk of flooding (i.e. situated in Flood Zone 3) it is essential to provide the community with the knowledge (and tools) that will enable them to help themselves should a flood event occur. The Level 1 SFRA is a key source of flood risk information in the public domain.

A.4.17 Details of flood warning and flood resilience have been set out within the following 'community based measures' that local communities may introduce to minimise the damage sustained to their own homes in the event of flooding. Reference should also be made to section 7.4 of the SFRA and EA Flood Warning Areas provided in Appendix C of the SFRA.

Flood Warning

A.4.18 Where available, communities in flood risk areas should be registered with the EA's Floodline facility. While this may not always cover the specific local watercourses that pose the greatest risk to the locale, advance warning of the onset of extreme weather conditions may be gathered and actions taken by residents at a local level. See section 7.4. of the SFRA.

Flood Resilience / Resistance

A.4.19 Flood resistance involves constructing a building in such a way so as to prevent floodwater entering the structure and damaging it's fabric. Flood resilience involves constructing a building so as to permit floodwater to enter the structure but to reduce the impact of any damage caused (i.e. no permanent damage is caused, structural integrity is maintained and drying and cleaning are facilitated). Details of flood resilient construction can be found within the Department for Communities and Local Government publication; 'Improving the Flood Performance of New Buildings published in May 2007.

A.4.20 One of the Key recommendations of the Pitt Review; *"Learning lessons from the 2007 floods"*, was that building regulations should be revised to ensure that all new or refurbished buildings in high flood-risk areas are flood resistant or resilient. Examples of flood resilient and resistant measures that can be adopted are listed below;

Raising of floor levels (Resistance)

The raising of floor levels above the anticipated maximum flood level ensures that the interior of the property is not directly affected by flooding, avoiding damage to furnishings, wiring and interior walls. It is highlighted that plumbing may still be impacted as a result of mains sewer failure.

Raising of electrical wiring (Resilience)

The raising of electrical wiring and sockets within flood affected buildings reduces the risks to health and safety, and reduces the time required after a flood to rectify the damages sustained.

Use of sacrificial construction materials (Resilience)

These are materials used in housing fittings that are likely to be damaged in case of flooding but can also be repaired i.e. gypsum plaster board. This would be used for a 'water entry' strategy where the emphasis is placed on allowing water into the building, facilitating draining and consequent drying.

Flood boards / gates (Resistance)

The placement of a temporary watertight seal across doors, windows and air bricks to avoid inundation of the building interior. This may be suitable for relatively short periods of flooding, however, the porosity of brickwork may result in damage being sustained should water levels remain elevated for an extended period of time.

Boundary walls and fencing (Resistance)

Boundary walls and fencing can be designed with high water resistance materials and/or effective seals to minimise water penetration for low depth, short duration floods (but not for groundwater flooding).

A5 DEVELOPMENT CONTROL RECOMMENDATIONS

Future Developments within Flood Zone 3b 'Functional Floodplain' (developed areas)

A.5.1 Table D.3 of Planning Policy Statement 25: Development and Flood Risk (PPS25) advises that only essential infrastructure (subject to the Exception Test) and water compatible development uses are appropriate in Flood Zone 3b. No other forms of development are permitted. See Flood Risk Constraints Mapping in Appendix D of SFRA for areas identified as Functional Floodplain. Further reference should be made to EA's standing advice on Flood Risk Assessments on the weblink below;

http://www.environment-agency.gov.uk/research/planning/93498.aspx

A.5.2 Any proposed future development within Zone 3b 'Functional Floodplain' will require a detailed Flood Risk Assessment (FRA).

A.5.3 SuDS should be implemented to ensure that runoff from the site is not increased and where possible reduced; any SuDS design must take due account of groundwater and geological conditions.

A.5.4 As previously mentioned in section A.3.10 of this note, dry access is to be provided wherever possible (above the 1 in 100 year flood level) to enable the safe evacuation of residents and / or employees in the event of flooding. In exceptional circumstances where this is not achievable, safe access must be provided at all locations, defined in accordance with DEFRA research as outlined in "Flood Risks to People" (FD2320). It is essential to ensure that the nominated evacuation route does not divert evacuees into a 'dry island' upon which essential supplies (i.e. food, shelter and medical treatment) will not be available for the duration of the flood event. Reference should be made to the Flood Risk Constraints Mapping provided in Appendix D.

A.5.5 Proposed development shall not result in an increase in maximum flood levels within adjoining properties. This may be achieved by ensuring (for example) that the existing building footprint is not increased and / or flood plain compensation should be provided on a level for level, volume for volume basis up to the 1 in 100 year event including climate change.

A.5.6 A suitable buffer zone (the EA have advised a minimum set back distance of 9m) must be provided to the base of a flood wall or embankment or to the 'top of bank' within sites immediately adjoining the river corridor. This buffer will differ for IDB watercourses. This may be reduced for ordinary watercourses where sufficient maintenance access is available. The Environment Agency (EA) has established a policy directive that encourages the retention of an open river corridor for environmental and recreational purposes. Future development should give due consideration to these directives, ensuring a setback from the riverfront is provided. South Cambridgeshire District Council Byelaws require no obstruction within 5m of watercourses in the control of the Council (e.g. award drains).

Future Development within Flood zone 3a 'High Probability'

A.5.7 All proposed future development within Zone 3a 'High Probability' will require a detailed Flood Risk Assessment (FRA), in compliance with PPS25, current guidance and policy. All potential sources of flood risk are to be considered. See Flood Risk Constraints Mapping in Appendix D of SFRA for areas identified as Flood Zone 3a. Further reference should be made to EA's standing advice on Flood Risk Assessments on the weblink below;

http://www.environment-agency.gov.uk/research/planning/93498.aspx

A.5.8 Minimum finished floor levels must be situated above the 1 in 100 year predicted maximum flood level plus climate change, incorporating a 300mm allowance for freeboard.

A.5.9 Where possible, dry access is to be provided (above the 1 in 100 year flood level) to enable the safe evacuation of residents and / or employees in the event of flooding. Where this is not achievable, safe access must be provided at all locations. Reference should be made to the Flood Risk Constraints Mapping provided in Appendix D of the SFRA.

A.5.10 Basements are not to be utilised for habitable purposes. All basements must provide a safe evacuation route in times of flood, providing an access point that is situated above the 1 in 100 year plus climate change flood level.

A.5.11 The SuDS principles relevant to Flood Zone 3b should be applied to Flood Zone 3a.

A.5.12 Proposed development shall not result in an increase in maximum flood levels within adjoining properties. This may be achieved by ensuring (for example) that the existing building footprint is not increased; compensation should be provided on a level for level, volume for volume basis up to the 1 in 100 year event including climate change.

A.5.13 As with Flood Zone 3b, a suitable buffer zone (the EA have advised a minimum setback distance of 9m) must be provided to the base of a flood wall or embankment or to the 'top of bank' within sites immediately adjoining the river corridor.

Future Development within Zone 2 'Medium Probability'

A.5.14 All proposed future development within Zone 2 'Medium Probability' will require a Flood Risk Assessment (FRA) in compliance with PPS25, current guidance and policy, that is commensurate with the risk posed to the proposed development. All potential sources of flood risk are to be considered. See Flood Risk Constraints Mapping in Appendix D of SFRA for areas identified as Flood Zone 2. Further reference should be made to EA's standing advice on Flood Risk Assessments on the weblink below;

http://www.environment-agency.gov.uk/research/planning/93498.aspx

A.5.15 Minimum finished floor levels must be situated 600mm above the 1 in 100 year predicted maximum flood level or 300mm above the climate change flood level.

A.5.16 Where possible, dry access is to be provided (above the 1 in 100 year flood level). In exceptional circumstances where this is not achievable, safe access must be provided at all locations, defined in accordance with the emerging DEFRA research as outlined in "Flood Risks to People" (FD2320). Reference should be made to the Flood Risk Constraints Mapping provided in Appendix D of the SFRA.

A.5.17 SuDS should be implemented to ensure that runoff from the site (post redevelopment) is not increased.

Future Development within Zone 1 'Low Probability'

A.5.18 All proposed 'major' future development within Flood Zone 1 'low probability' will require a basic Flood Risk Assessment (FRA), in compliance with PPS25, current guidance and policy. Major development is typically defined as exceeding 1 hectare. The FRA will need to focus primarily upon drainage impact assessment, implementation of appropriate forms of SUDS, and control of surface water runoff. See Flood Risk Constraints Mapping in Appendix D of SFRA for areas identified as Flood Zone 1. Further reference should be made to EA's standing advice on Flood Risk Assessments on the weblink below;

http://www.environment-agency.gov.uk/research/planning/93498.aspx

A.5.19 It is important, however, that all potential sources of flood risk are considered. Control of surface water runoff will involve the introduction of SuDS techniques.

This table is recommended for development planning and control use.

Table 4 – Hazard to People Classification using Hazard Rating *(HR= d x (v + 0.5) + DF)* for (Source Table 13.1 of FD2320/TR2 - Extended version)

HR	Depth of flooding - d (m)												
	DF = 0.5				DF = 1								
Velocity v (m/s)	0.05	0.10	0.20	0.25	0.30	0.40	0.50	0.60	0.80	1.00	1.50	2.00	2.50
0.0	0.03 + 0.5 = 0.53	0.05 + 0.5 = 0.55	0.10 + 0.5 = 0.60	0.13 + 0.5 = 0.63	0.15 + 1.0 = 1.15	0.20 + 1.0 = 1.20	0.25 + 1.0 = 1.25	0.30 + 1.0 = 1.30	0.40 + 1.0 = 1.40	0.50 + 1.0 = 1.50	0.75 + 1.0 = 1.75	1.00 + 1.0 = 2.00	1.25 + 1.0 = 2.25
0.1	0.03 + 0.5 = 0.53	0.06 + 0.5 = 0.56	0.12 + 0.5 = 0.62	0.15 + 0.5 = 0.65	0.18 + 1.0 = 1.18	0.24 + 1.0 = 1.24	0.30 + 1.0 = 1.30	0.36 + 1.0 = 1.36	0.48 + 1.0 = 1.48	0.60 + 1.0 = 1.60	0.90 + 1.0 = 1.90	1.20 + 1.0 = 2.20	1.50 + 1.0 = 2.55
0.3	0.04 + 0.5 = 0.54	0.08 + 0.5 = 0.58	0.15 + 0.5 = 0.65	0.19 + 0.5 = 0.69	0.23 + 1.0 = 1.23	0.30 + 1.0 = 1.30	0.38 + 1.0 = 1.38	0.45 + 1.0 = 1.45	0.60 + 1.0 = 1.60	0.75 + 1.0 = 1.75	1.13 + 1.0 = 2.13	1.50 + 1.0 = 2.50	1.88 + 1.0 = 2.88
0.5	0.05 + 0.5 = 0.55	0.10 + 0.5 = 0.60	0.20 + 0.5 = 0.70	0.25 + 0.5 = 0.75	0.30 + 1.0 = 1.30	0.40 + 1.0 = 1.40	0.50 + 1.0 = 1.50	0.60 + 1.0 = 1.60	0.80 + 1.0 = 1.80	1.00 + 1.0 = 2.00	1.50 + 1.0 = 2.50	2.00 + 1.0 = 3.00	2.50 + 1.0 = 3.50
1.0	0.08 + 0.5 = 0.58	0.15 + 0.5 = 0.65	0.30 + 0.5 = 0.80	0.38 + 0.5 = 0.88	0.45 + 1.0 = 1.45	0.60 + 1.0 = 1.60	0.75 + 1.0 = 1.75	0.90 + 1.0 = 1.90	1.20 + 1.0 = 2.20	1.50 + 1.0 = 2.50	2.25 + 1.0 = 3.25	3.00 + 1.0 = 4.00	3.75 + 1.0 = 4.75
1.5	0.10 + 0.5 = 0.60	0.20 + 0.5 = 0.70	0.40 + 0.5 = 0.90	0.50 + 0.5 = 1.00	0.60 + 1.0 = 1.60	0.80 + 1.0 = 1.80	1.00 + 1.0 = 2.00	1.20 + 1.0 = 2.20	1.60 + 1.0 = 2.60	2.00 + 1.0 = 3.00	3.00 + 1.0 = 4.00	4.00 + 1.0 = 5.00	5.00 + 1.0 = 6.00
2.0	0.13 + 0.5 = 0.63	0.25 + 0.5 = 0.75	0.50 + 0.5 = 1.00	0.63 + 0.5 = 1.13	0.75 + 1.0 = 1.75	1.00 + 1.0 = 2.00	1.25 + 1.0 = 2.25	1.50 + 1.0 = 2.50	2.00 + 1.0 = 3.00	3.50	4.75	6.00	7.25
2.5	0.15 + 0.5 = 0.65	0.30 + 0.5 = 0.80	0.60 + 0.5 = 1.10	0.75 + 0.5 = 1.25	0.90 + 1.0 = 1.90	1.20 + 1.0 = 2.20	1.50 + 1.0 = 2.50	1.80 + 1.0 = 2.80	3.40	4.00	5.50	7.00	8.50
3.0	0.18 + 0.5 = 0.68	0.35 + 0.5 = 0.85	0.70 + 0.5 = 1.20	0.88 + 0.5 = 1.38	1.05 + 1.0 = 2.05	1.40 + 1.0 = 2.40	1.75 + 1.0 = 2.75	3.10	3.80	4.50	6.25	8.00	9.75
3.5	0.20 + 0.5 = 0.70	0.40 + 0.5 = 0.90	0.80 + 0.5 = 1.30	1.00 + 0.5 = 1.50	1.20 + 1.0 = 2.20	1.60 + 1.0 = 2.60	3.00	3.40	4.20	5.00	7.00	9.00	11.00
4.0	0.23 + 0.5 = 0.73	0.45 + 0.5 = 0.95	0.90 + 0.5 = 1.40	1.13 + 0.5 = 1.63	1.35 + 1.0 = 2.35	1.80 + 1.0 = 2.80	3.25	3.70	4.60	5.50	7.75	10.00	12.25
4.5	0.25 + 0.5 = 0.75	0.50 + 0.5 = 1.00	1.00 + 0.5 = 1.50	1.25 + 0.5 = 1.75	1.50 + 1.0 = 2.50	2.00 + 1.0 = 3.00	3.50	4.00	5.00	6.00	8.50	11.00	13.50
5.0	0.28 + 0.5 = 0.78	0.60 + 0.5 = 1.10	1.10 + 0.5 = 1.60	1.38 + 0.5 = 1.88	1.65 + 1.0 = 2.65	3.20	3.75	4.30	5.40	6.50	9.25	12.00	14.75

0.14ms/s

the HR is less than 0.14

Flood Hazard Rating (HR)	Colour Code	Hazard to People Classification
Less than 0.75		Very low hazard - Caution
0.75 to 1.25		Danger for some – includes children, the elderly and the infirm
1.25 to 2.0		Danger for most – includes the general public
More than 2.0		Danger for all – includes the emergency services

South Cambridgeshire District Council and Cambridge City Council Strategic Flood Risk Assessment
Data Register

LPA: South Cambridgeshire District Council and Cambridge City Council

Lead Agency Area: EA Central Area Office - Brampton

Project Commencement Date: 13/04/10

Complete	Data Description	Format	Source	Date Received
Y	Historic Flooding Locations (with dates, levels and photos where available)	any relevant	Various	Various
Y	Ground Water Flooding Locations	any relevant	EA	01/06/2010
Y	Current standards of protection through the area of consideration	any relevant	EA	17/05/2010
Y	Details of hydraulic structures in the area	any relevant	EA	17/05/2010
Y	Any maintenance schedules for the flood defences within the area of consideration	any relevant	EA	17/05/2010
Y	Planned Major Developments	any relevant	SCDC	08/07/2010
Y	Reservoir Locations	any relevant	EA	14/05/2010
Y	Sewage Treatment Works locations	any relevant	Anglian Water	21/05/2010
Y	Surface Water Flood Risk Areas	any relevant	SCDC	02/06/2010
Y	Flood Warning Areas	any relevant	EA	22/06/2010
	GIS Layers from NFCDD for the following			
Y	Watercourse locations and classifications	any relevant	Mixed	Various
Y	Flood Zone Outlines	any relevant	SCDC, CCC & EA	Various
Y	Source Protection Zones	any relevant	EA	17/05/2010
Y	River Catchment Areas	any relevant	EA	-
Y	Hydraulic Structures	any relevant	EA	17/05/2010
Y	Flood Defence locations / Level of protection	any relevant	EA	17/05/2010
Y	Groundwater Extraction Points	any relevant	EA	17/05/2010
	LiDAR Data			
Y	ALL LiDAR data available for the study area	any relevant	EA	20/04/2010
	Hydraulic Modelling Data / Plans / Reports			
Y	River Cam Flood Mapping (JBA)	any relevant	EA	14/05/2010
Y	Longstanton Brook Model Audit Review (Faber Maunsell)	any relevant	EA	14/05/2010
Y	St Ives and The Hemmingsford's Flood Alleviation Scheme (Atkins)	any relevant	EA	14/05/2010
Y	Swavesey Drain Standard of Protection Study (Royal Haskoning)	any relevant	EA	14/05/2010
Y	Cottenham Lode Flood Alleviation Scheme (Halcrow)	any relevant	EA	14/05/2010
Y	River Great Ouse, Offord D'arcy to Earith (Royal Haskoning)	any relevant	EA	14/05/2010
Y	Catchment Management Plans	Electronic	EA	01/08/2010
	IDB			
N	Levels and return periods for historic flood events and their locations	any relevant	IDB	-
N	Any flood levels for varying return periods	any relevant	IDB	-
N	Groundwater Levels and Groundwater Flooding Reports	any relevant	IDB	-
N	Location of implemented of planned Flood Alleviation Schemes	any relevant	IDB	-
N	Flood Defence locations/Current standards of protection through the area of consideration	any relevant	IDB	-
N	Any pumped drainage in the area/pumping facilities	any relevant	IDB	-
Y	IDB Boundary and Drains locations	any relevant	SCDC	20/04/2010

APPENDIX F

Manning Equation Calculator | Open channel flow software

Click to Calculate

k = 1.0

Solve for:

Velocity and Discharge

Select units:

Use meters and seconds units

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Area, A (m^2):	0.475
Wetted Perimeter, P (m):	5.19
Channel Slope, S (m/m):	0.000125
Manning n:	0.016
Velocity, V (m/s):	0.14191202
Discharge, Q (m^3/s):	0.067408211

Units in Manning calculator: ft=foot, m=meter, s=second.

Manning Equation:

$$Q = VA \qquad V = \frac{k}{n}\left(\frac{A}{P}\right)^{2/3} S^{1/2}$$

k is a unit conversion factor: k=1.49 for English units (feet and seconds). k=1.0 for SI units (meters and seconds).
A=Flow area of the pipe, culvert, or channel.
P=Wetted perimeter which is the portion of the circumference that is in contact with water.
Q=Discharge (flow rate).
S=Downward (longitudinal) slope of the culvert.
V=Average velocity in the pipe, culvert, or channel.

Manning n varies with the roughness of the pipe, culvert, or channel. The higher the n, the rougher the material. Table of Manning n values.

The Manning Equation is the most commonly used equation to analyze open channel flows. It is a semi-empirical equation for simulating water flows in channels and culverts where the water is open to the atmosphere, i.e. not flowing under pressure, and was first presented in 1889 by Robert Manning. The channel can be any shape - circular, rectangular, triangular, etc. The units in the Manning equation appear to be inconsistent; however, the value k has hidden units in it to make the equation consistent. The Manning Equation was developed for uniform steady state flow (see Discussion and References for Open Channel Flow). S is the slope of the energy grade line and $S=h_f/L$ where

To:
LMNO Engineering home page (more calculations)

Related calculations:

Design of Rectangular Channels

Design of Trapezoidal Channels

Circular Culverts using Manning Equation

Culvert Design using Inlet and Outlet Control

Q=VA simple flowrate calculator

Manning n values

Unit Conversions

Other

h_f is energy (head) loss and L is the length of the channel or reach. For uniform steady flows, the energy grade line = the slope of the water surface = the slope of the bottom of the channel.

The product A/P is also known as the hydraulic radius, R_h.

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Please contact us for consulting or questions about the Manning equation.

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information:

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Discussion and References for Open Channel Flow

Manning Equation Calculator | Open channel flow software

Click to Calculate k = 1.0

Solve for:

Velocity and Discharge

Select units:

Use meters and seconds units

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Area, A (m^2):	0.905
Wetted Perimeter, P (m):	5.362
Channel Slope, S (m/m):	0.000125
Manning n:	0.016
Velocity, V (m/s):	0.21341071
Discharge, Q (m^3/s):	0.19313669

Units in Manning calculator: ft=foot, m=meter, s=second.

Manning Equation:

$$Q = VA \qquad V = \frac{k}{n}\left(\frac{A}{P}\right)^{2/3} S^{1/2}$$

k is a unit conversion factor: k=1.49 for English units (feet and seconds). k=1.0 for SI units (meters and seconds).
A=Flow area of the pipe, culvert, or channel.
P=Wetted perimeter which is the portion of the circumference that is in contact with water.
Q=Discharge (flow rate).
S=Downward (longitudinal) slope of the culvert.
V=Average velocity in the pipe, culvert, or channel.

Manning n varies with the roughness of the pipe, culvert, or channel. The higher the n, the rougher the material. Table of Manning n values.

The Manning Equation is the most commonly used equation to analyze open channel flows. It is a semi-empirical equation for simulating water flows in channels and culverts where the water is open to the atmosphere, i.e. not flowing under pressure, and was first presented in 1889 by Robert Manning. The channel can be any shape - circular, rectangular, triangular, etc. The units in the Manning equation appear to be inconsistent; however, the value k has hidden units in it to make the equation consistent. The Manning Equation was developed for uniform steady state flow (see Discussion and References for Open Channel Flow). S is the slope of the energy grade line and $S=h_f/L$ where

To:
LMNO Engineering home page (more calculations)

Related calculations:

Design of Rectangular Channels

Design of Trapezoidal Channels

Circular Culverts using Manning Equation

Culvert Design using Inlet and Outlet Control

Q=VA simple flowrate calculator

Manning n values

Unit Conversions

Other

h_f is energy (head) loss and L is the length of the channel or reach. For uniform steady flows, the energy grade line = the slope of the water surface = the slope of the bottom of the channel.

The product A/P is also known as the hydraulic radius, R_h.

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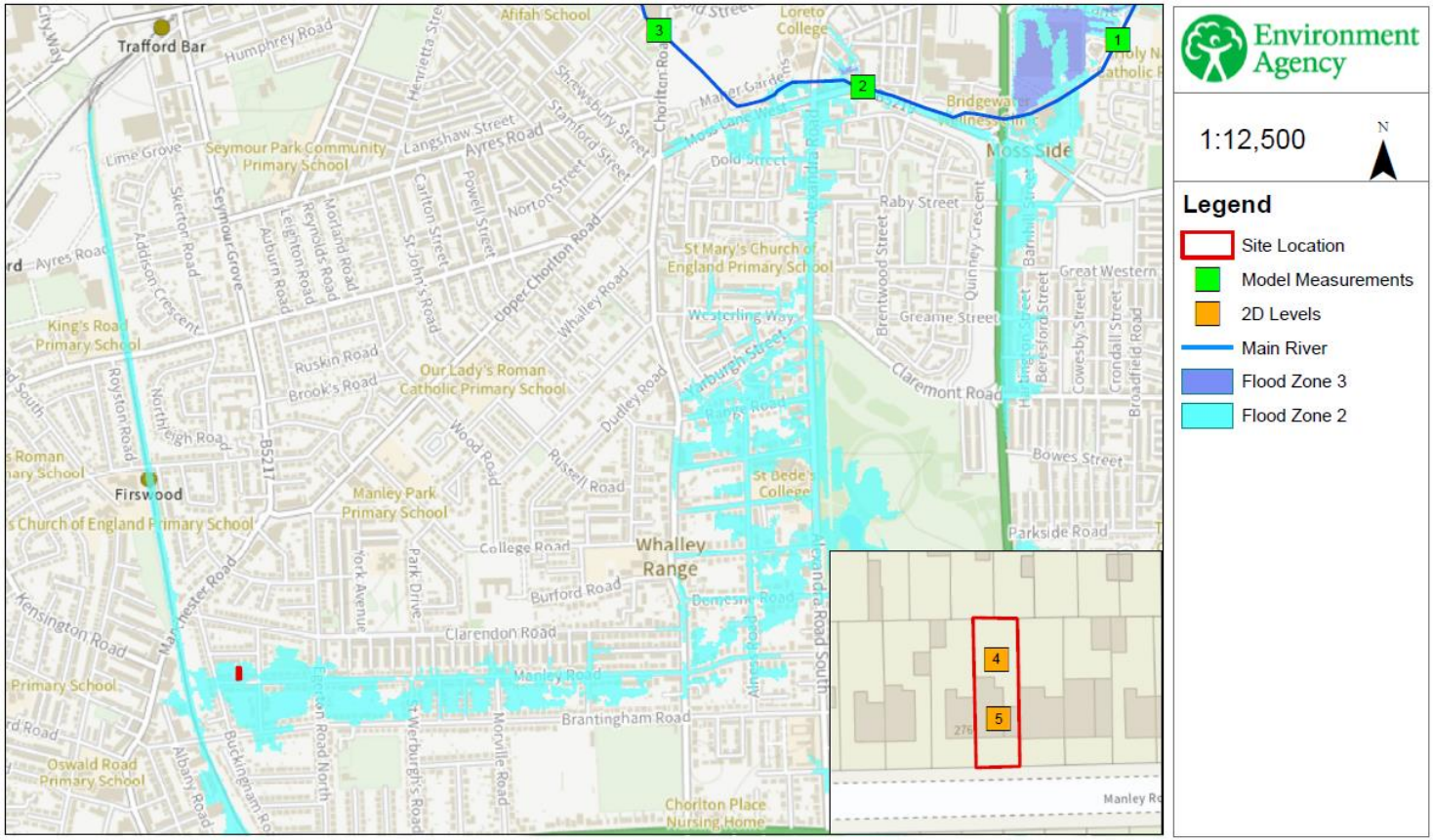
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Discussion and References for Open Channel Flow

APPENDIX F

APPENDIX G

Detailed Flood Map Centred on Manley Road, Manchester, M21 0RF.
Created 02/05/2023 [GMMC308610SW]



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To determine the 1 in 100 + 30% flood levels for points 4 & 5, data from points 1, 2 & 3 were assessed.

The flood levels and estimated flows are as follows:

Map Ref	Node Ref	1% AEP (1 in 100 yr) + 30%	0.1% AEP (1 in 1000 yr) + 30%	Ratio 1% to 0.1% flows
1	_com3908	33.75	34.46	
		1.57 cu.m	4.51cu.m	0.348
2	_com3215	32.78	33.39	
		2.03cu.m	5.98cu.m	0.34
3	_com2587	30.34	31.99	
		2.24cu.m	6.63cu.m	0.337

Using Manning, a comparable flow was calculated given the 27.89m AoD level (points 4 & 5 shown below) compared to the 27.709m AOD extg level outside the property.

This gives the manning flow as shown below, based upon 5m wide road.

The estimated flow for the 1 in 1000yr + cc was 0.193m3/sec.



07/06/2023, 17:14 Manning Equation

Manning Equation Calculator	Open channel flow software

Click to Calculate k = 1.0

Solve for: Velocity and Discharge

Select units: Use meters and seconds units

Area, A (m^2):	0.905
Wetted Perimeter, P (m):	5.362
Channel Slope, S (m/m):	0.000125
Manning n:	0.016
Velocity, V (m/s):	0.21341071
Discharge, Q (m^3/s):	0.19313669

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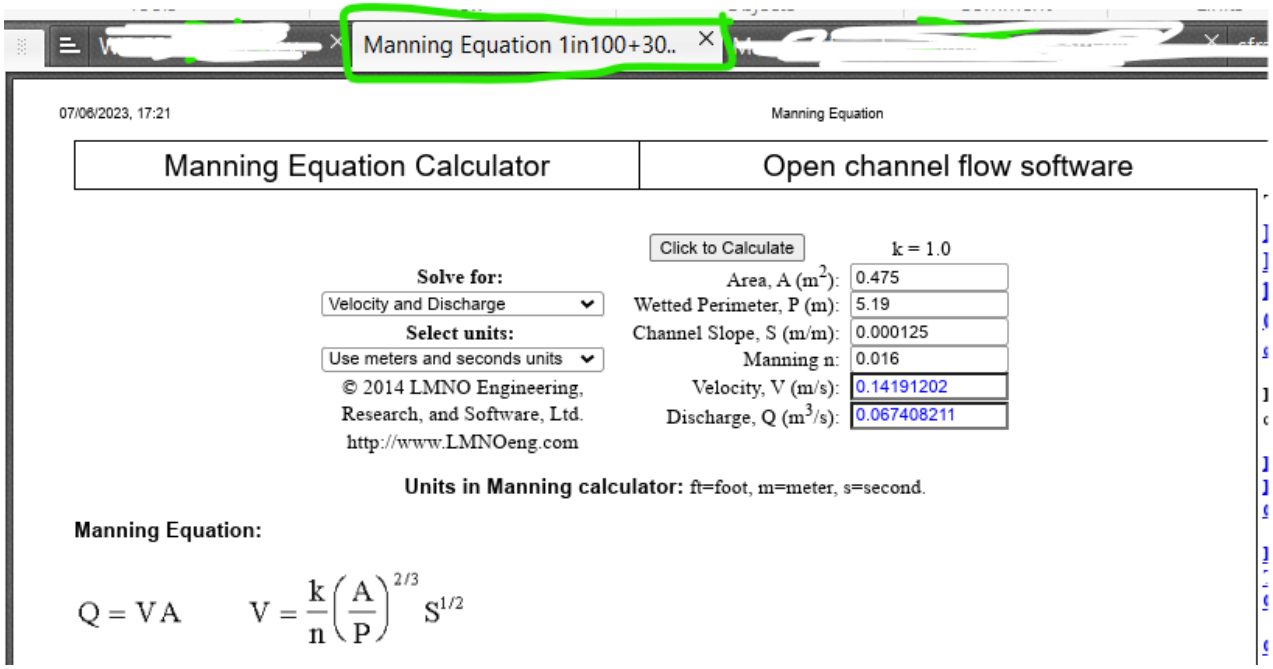
Units in Manning calculator: ft=foot, m=meter, s=second.

Manning Equation:

$$Q = VA \qquad V = \frac{k}{n}\left(\frac{A}{P}\right)^{2/3} S^{1/2}$$

k is a unit conversion factor: k=1.49 for English units (feet and seconds). k=1.0 for SI units (meters and seconds).
A=Flow area of the pipe, culvert, or channel.
P=Wetted perimeter which is the portion of the circumference that is in contact with water.
Q=Discharge (flow rate).
S=Downward (longitudinal) slope of the culvert.
V=Average velocity in the pipe, culvert, or channel.

From the ratio between 0.1% and 1% above, the ratio flow was estimated at 0.066m3/sec (0.194 x 0.34). Using the manning equation, a water depth of 95mm was obtained which corresponded to the flow of 0.066m3/sec. Therefore, the 1 in 100yr flood level is calculated at 27.809m AOD +/- 5mm.



Wp = 0.095m + 0.095m + 5m

Area = 5 x 0.095.

					Undefended	
Map Reference	Model Node Reference	Easting	Northing	Data	0.1 % AEP (1 in 1000 year)	0.1 % AEP (1 in 1000 year) + 30% increase in flow
4	2D Levels	381880	394506	Modelled Water Level (m aodN)	27.81	27.89
5		381881	394494	Modelled Water Level (m aodN)	27.81	27.89

APPENDIX G FLOOD LEVEL CALC

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