



Flood Risk Assessment

Development at
Holly Farm, Great North Road, Cromwell, Newark, NG23 6JE



On behalf of
Mr and Mrs Elliot

Date: 5th January 2021

Reference: WtFR-FRA-2020/09/Q12

WTFR-FRA-2020/09/Q12

Issue sheet

Revision	Prepared by	Date	Checked by	Date
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1. Introduction

WtFR Ltd has been commissioned by Mr and Mrs Elliot to undertake a Flood Risk Assessment (FRA) in connection with the planning application for the proposed development at Holly Farm, Great North Road, Cromwell, Newark, NG23 6JE.

This FRA has been produced to demonstrate how risks from all sources of flooding to the site and flood risk to others from the development will be managed, in order to satisfy the requirements, set out in the National Planning Policy Framework (NPPF).

A full assessment of the flood risk to the site and consideration of the surface water management as a result of the development has been considered as part of this analysis.

Data has been gathered from a number of other sources including: the Environment Agency (EA), the British Geological Society (BGS), National Soil Research Institute (NSRI), aerial photographs, Ordnance Survey (OS), commercially available historical mapping and relevant strategic documents developed by the Newark and Sherwood District Council and Nottinghamshire County Council, in their capacity as the Local Planning Authority and Lead Local Flood Authority, respectively.

2. Site Description

Area Size: 350m²

Grid reference: SK 79821 61873

The proposals are for the construction of two new semi-detached houses at Holly Farm, Great North Road, Cromwell, Newark, NG23 6JE.

Figures 1 and 2 below show location details of the development site. Figure 3 shows an oblique aerial photograph of the development site.



Figure 1 – Location of the site, highlighted.

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Figure 2 –detailed location of the development site, highlighted.



Figure 3 – aerial photograph of the development site.

3. Flood Risk Assessment

3.1 National Planning Policy

Paragraph 163 of the NPPF states “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 assessment⁵⁰. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (the sequential and exception tests, as applicable) it can be demonstrated that:

- a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;
- b) the development is appropriately flood resistant and resilient;
- c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;
- d) any residual risk can be safely managed; and
- e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan”.

Footnote 50 states “A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use”.

Furthermore paragraph 30 of the Planning Practice Guide on Flood Risk and Climate Change states “A site-specific flood risk assessment is carried out by (or on behalf of) a developer to assess the flood risk to and from a development site. Where necessary, the assessment should accompany a planning application submitted to the local planning authority. The assessment should demonstrate to the decision-maker how flood risk will be managed now and over the development’s lifetime, taking climate change into account, and with regard to the vulnerability of its users.

The objectives of a site-specific flood risk assessment are to establish:

- whether a proposed development is likely to be affected by current or future flooding from any source;
- whether it will increase flood risk elsewhere;
- whether the measures proposed to deal with these effects and risks are appropriate;
- the evidence for the local planning authority to apply (if necessary) the Sequential Test, and;
- whether the development will be safe and pass the Exception Test, if applicable”.

Continuing paragraph 31 of the Planning Practice Guidance quotes “The information provided in the flood risk assessment should be credible and fit for purpose. Site-specific flood risk assessments should always be proportionate to the degree of flood risk and make optimum use of information already available, including information in a Strategic Flood Risk

Assessment for the area, and the interactive flood risk maps available on the Environment Agency's web site.

A flood risk assessment should also be appropriate to the scale, nature and location of the development. For example, where the development is an extension to an existing house (for which planning permission is required) which would not significantly increase the number of people present in an area at risk of flooding, the local planning authority would generally need a less detailed assessment to be able to reach an informed decision on the planning application. For a new development comprising a greater number of houses in a similar location, or one where the flood risk is greater, the local planning authority would need a more detailed assessment".

3.2 Local Planning Policy

Local Authorities consider flood risk through relevant environmental and climate change policies which enforce the requirements of the NPPF. Relevant local policy, as outlined by the Newark and Sherwood District Council and Nottinghamshire County Council, is contained within the;

- i) Strategic Flood Risk Assessment
- ii) Local Flood Risk Management Strategy

The Strategic Flood Risk Assessment (SFRA) and the Local Flood Risk Management Strategy (LFRMS) are key sources of flood risk specific information for the area. The SFRA provides a more detailed review of flood risks and recommendations for ensuring developments can be constructed and operated safely in accordance with the NPPF.

3.3 Flood Risk Zones, Vulnerability and Classification

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

Table 1 – Flood Zones

Flood Zone	Definition
Zone 1 <i>Low Probability</i>	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 <i>Medium Probability</i>	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a <i>High Probability</i>	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)
Zone 3b <i>The Functional Floodplain</i>	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency.

	(Not separately distinguished from Zone 3a on the Flood Map)
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Table 2 – Flood Risk Vulnerability Classification

Essential Infrastructure
<ul style="list-style-type: none"> • Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly Vulnerable
<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • 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.

<ul style="list-style-type: none"> • Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.
<p>Water Compatible Development</p> <ul style="list-style-type: none"> • 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 as defined in Schedule 10 to the Environmental Permitting (England and Wales) Regulations 2010.

Table 3 - Flood risk vulnerability and flood zone 'compatibility'

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†	X	Exception Test required	✓	✓
Zone 3b*	Exception Test required*	X	X	X	✓*

Key:

✓ Development is appropriate

X Development should not be permitted.

Notes to table 3:

- This table does not show the application of the Sequential Test which should be applied first to guide development to Flood Zone 1, then Zone 2, and then Zone 3; nor does it reflect the need to avoid flood risk from sources other than rivers and the sea;

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- The Sequential and Exception Tests do not need to be applied to minor developments and changes of use, except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site;
- Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.

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

* In Flood Zone 3b (functional floodplain) essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, should be designed and constructed to:

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

4. Sources of flooding

4.1 Fluvial/Tidal

The Environment Agency's Flood Map for Planning (Rivers and Sea) identifies fluvial and tidal flood zones, and provides an indication of whether or not these zones are protected, due to the presence of flood defences (also highlighted). Figure 4, below, presents the Flood Map for the surrounding area.

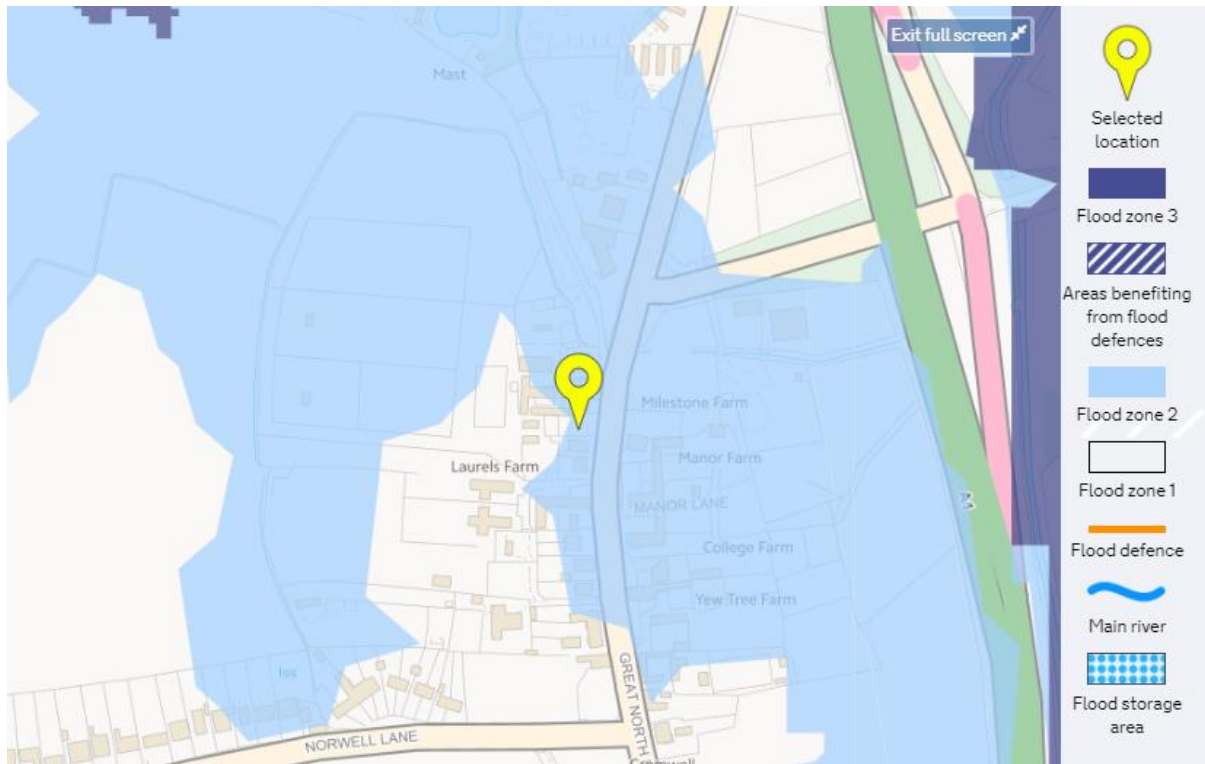


Figure 4 – Fluvial flood risk – EA Flood Map.

The EA Flood Map identifies the development site to lie within flood zone 2, where the chance of flooding in any given year is between 1 in 100 (1%) and 1 in 1000 (0.1%). The development currently benefits from existing flood defences, this is shown in Figure 5 and corresponding details are provided in Table 4.

There is a further smaller watercourse north of the development. This watercourse does not have a flood zone associated with it and is unmodelled.

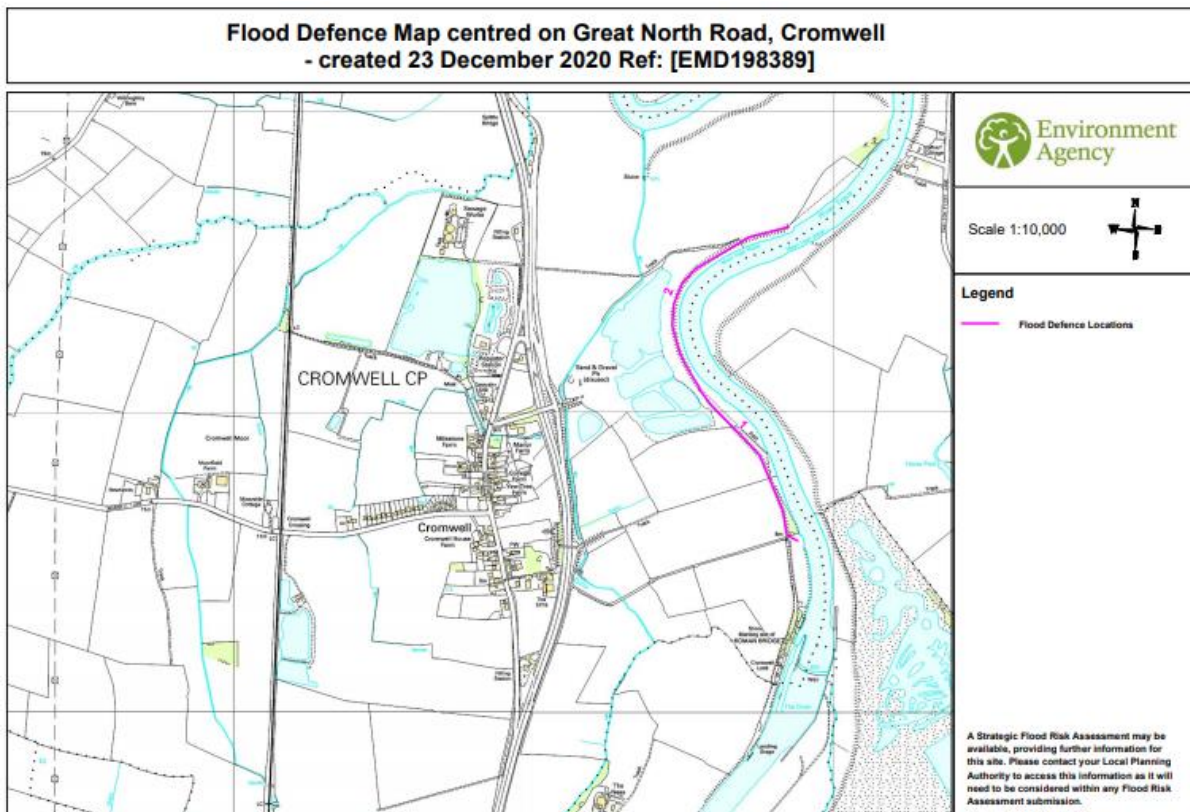


Figure 5 – Defence location map.

Defence ID	Asset Reference	Design Standard	D/S Crest Level (mAOD)	U/S Crest Level (mAOD)	Overall Condition Grade
1	22,495	3	8.638	8.478	3
2	23,686	3	8.771	8.635	3

Table 4 – Defence information.

Modelled flood information is also available from the Tidal Trent SFRM Model, which was completed in 2013 by Mott Macdonald using a 2D ISIS - TUFLOW model the floodplain has been represented as a grid. The flood water levels have been calculated for each grid cell.

Figure 6 show the modelled flood extents within the vicinity of the development site, this shows that the development is only at risk in the 1 in 1000-year scenario.

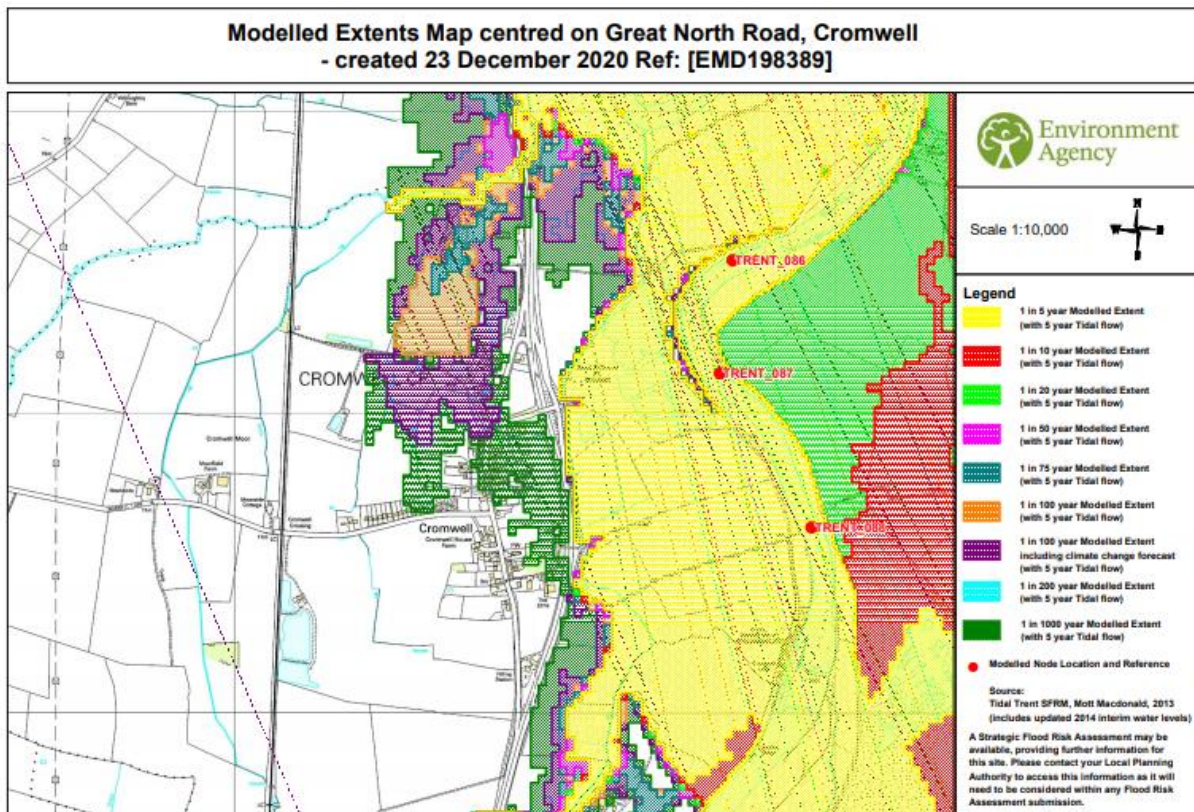


Figure 6 – Modelled flood extents map.

Figures 7-9 below show the 1 in 100 year, 1 in 100+CC% year and 1 in 1000 year scenarios and these confirm the development is only at risk in the 1 in 1000 year event with a flood level of 8.98m AOD.

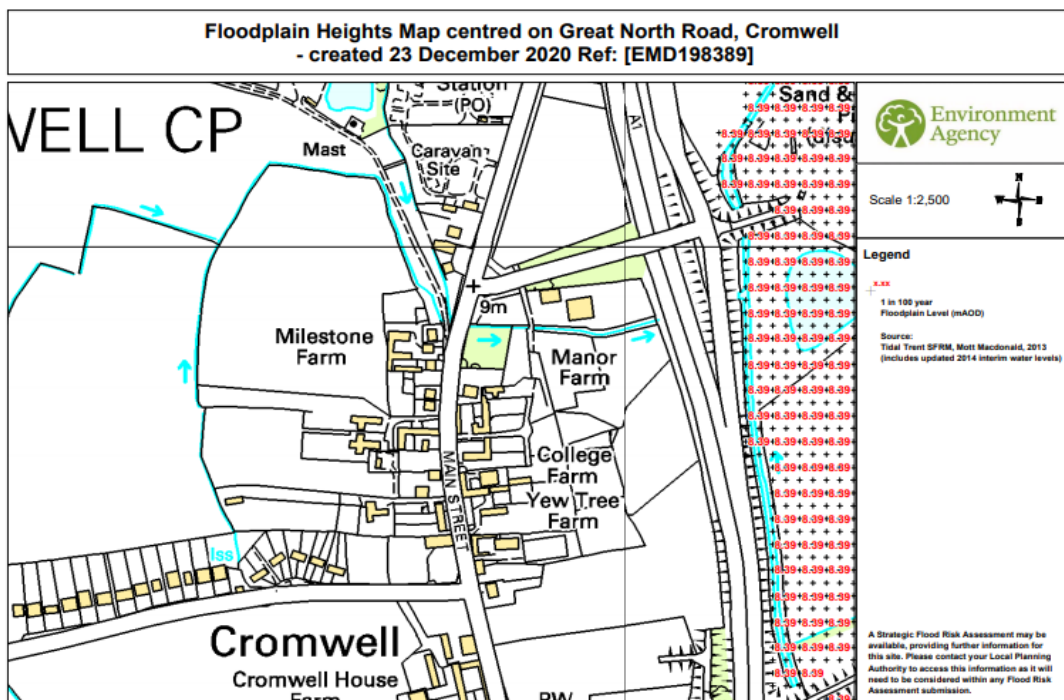


Figure 7 – 2D 1 in 100 flood levels.

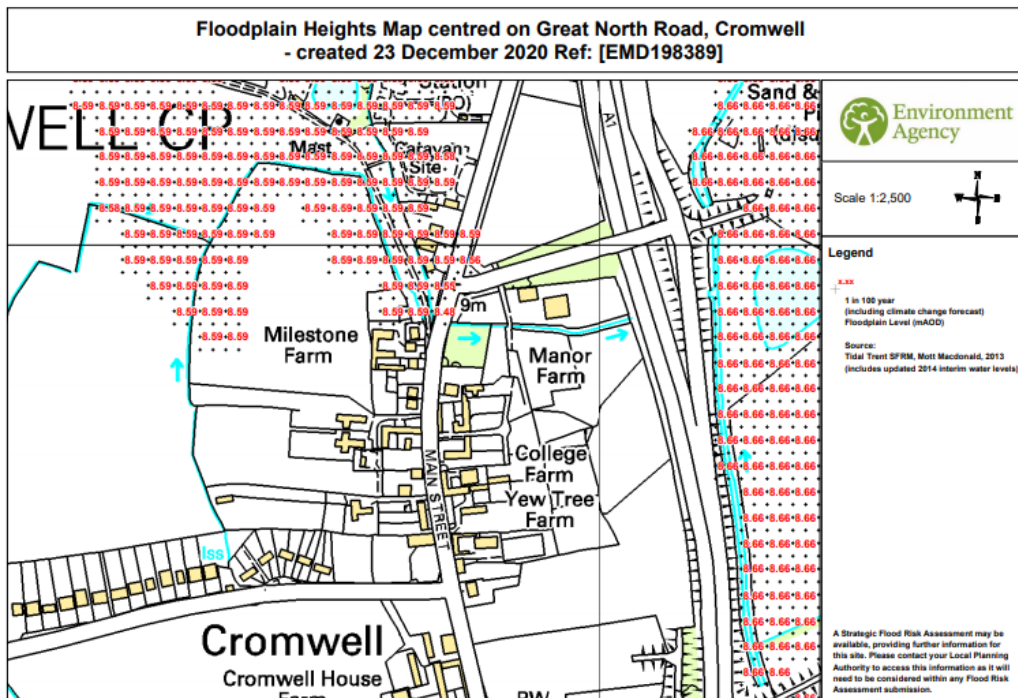


Figure 8 – 2D 1 in 100+CC% flood levels.

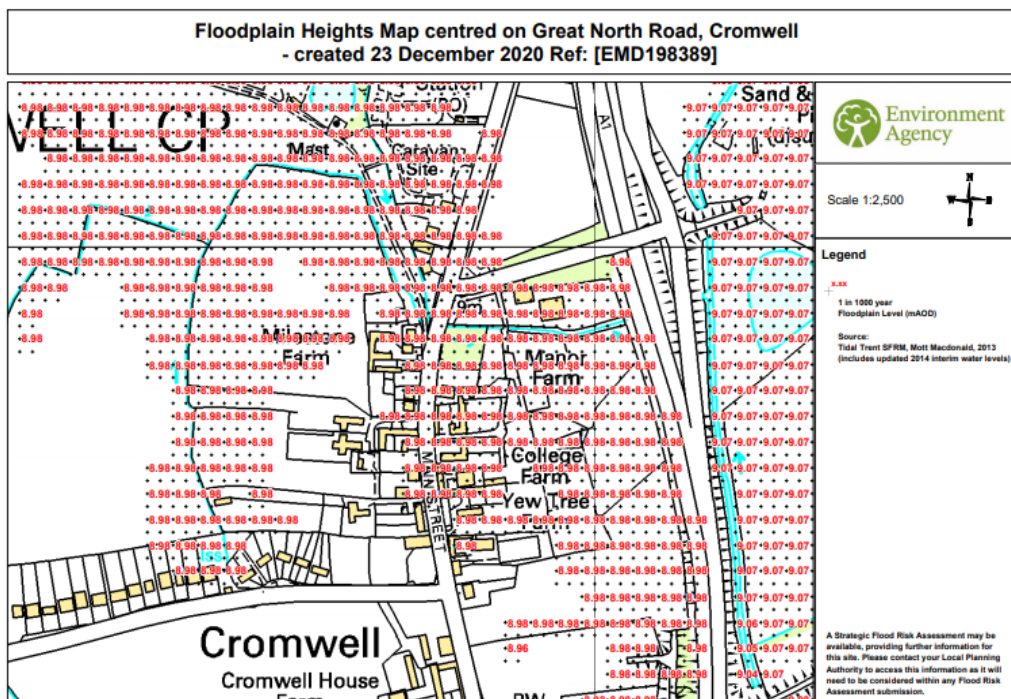


Figure 9 – 2D 1 in 1000 flood levels.

4.2 Historic Flooding

The EA does not have records of historic flood events from rivers affecting the area local to this property. Further analysis of strategic flood risk documents developed by the Newark and Sherwood District Council and Nottinghamshire County Council does not indicate flooding from other sources.

4.3 Surface Water Flooding

The Environment Agency's updated Flood Map for Surface Water (uFMfSW) identifies pluvial flood risk. Figure 10, below, presents the uFMfSW for the development site and the surrounding area.

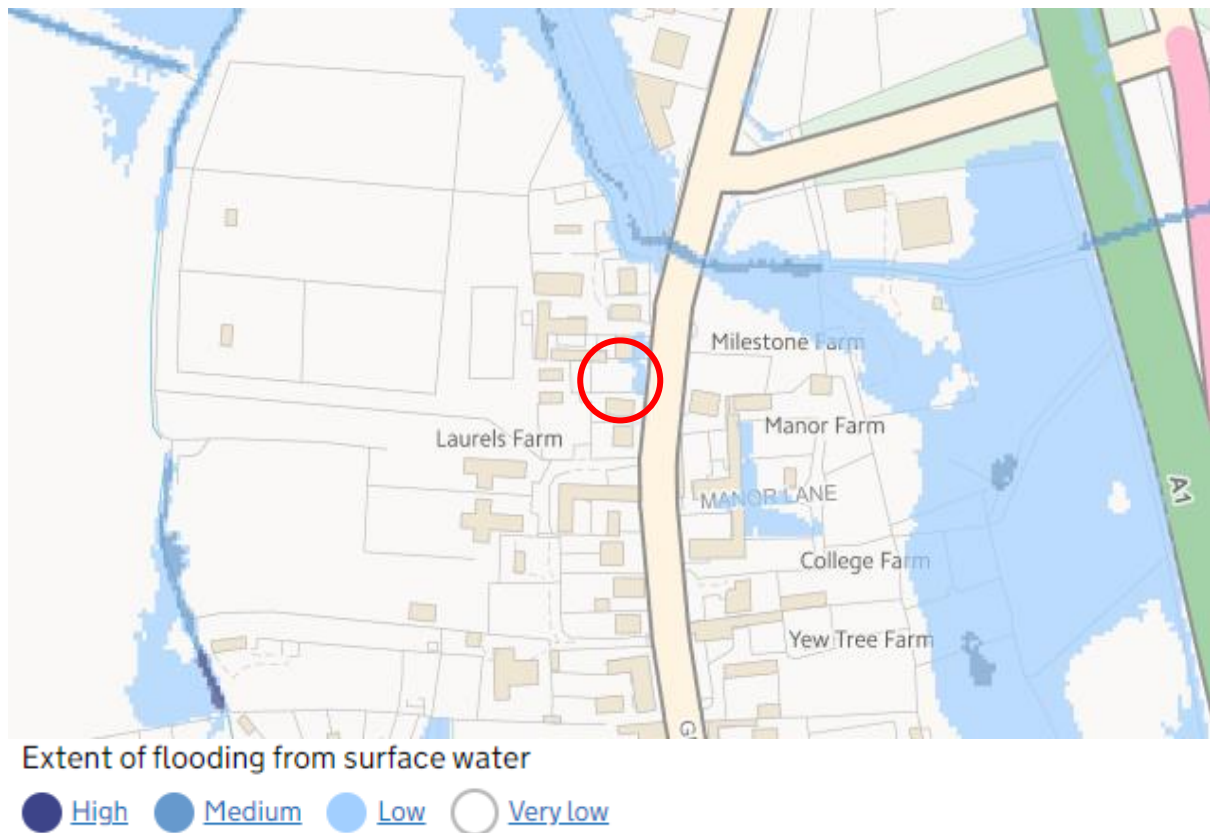


Figure 10 – Flooding from surface water sources, uFMfSW, site highlighted.

The uFMfSW shows that area in the vicinity of the development site is at low risk of surface water flooding. Low risk means that the probability of flooding in any given year is between 1 in 1000 (0.1%) and 1 in 100 (1%).

4.4 Reservoir

The Environment Agency's Risk of Reservoir Flooding Map identifies the maximum extent of flooding that may be expected in the unlikely event that a reservoir dam failed. The development is not at risk of a reservoir failing.

4.5 Groundwater

The Environment Agency's Groundwater Vulnerability Map indicates that the development site is situated over a medium – high groundwater vulnerability area, as shown in Figure 11. Further analysis shows that the development site is not situated over a Groundwater Source Protection Zone as shown in Figure 12.

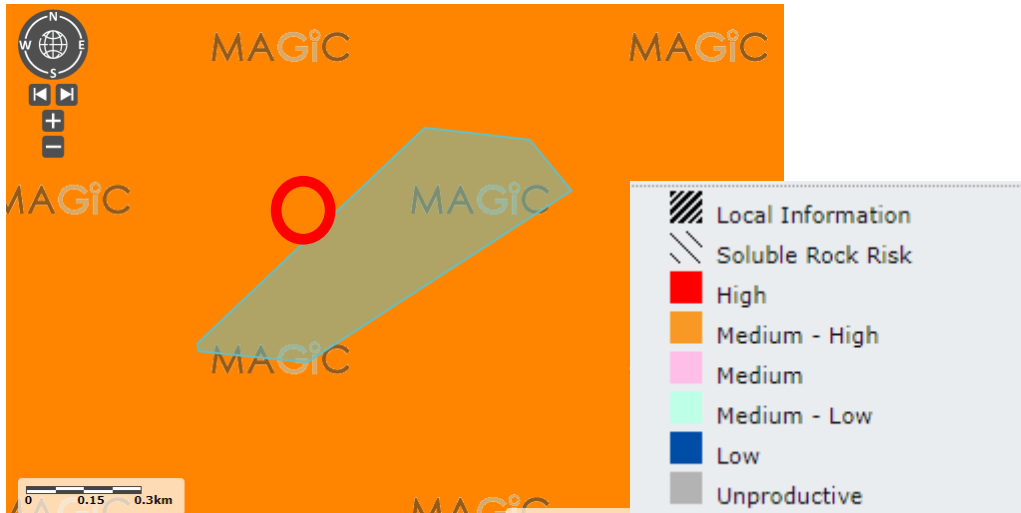


Figure 11 – Groundwater vulnerability map, site highlighted.

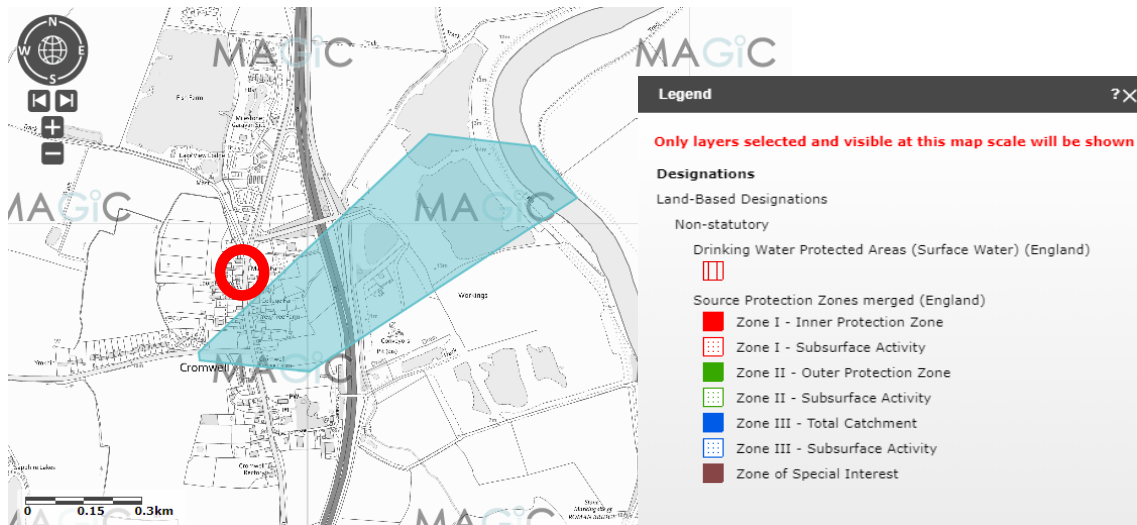


Figure 12 – Groundwater source protection zones, site highlighted.

Due to the minimal groundworks (for the construction of shallow foundations) the impact on groundwater is considered to be negligible.

However, it is recommended that a groundwater mitigation plan is developed that may be implemented if groundwater is encountered during construction.

4.6 Geology

Figures 13 and 14 present information from the British Geological Survey.



Figure 13 – Superficial Geology of the development.



Figure 14 – Bedrock geology of the development

The superficial deposits at the development site are described as the Holme Pierrepont Sand and Gravel Member - Sand and Gravel. The superficial deposits formed up to 3 million years ago in the Quaternary Period. The local environment was previously dominated by rivers (U).

With regards to the bedrock, the site is underlain by the Mercia Mudstone Group - Mudstone. The sedimentary bedrock formed approximately 201 to 252 million years ago in the Triassic Period. The local environment was previously dominated by hot deserts.

5. Proposed development

This FRA is prepared to support a planning application for the construction of two new semi-detached houses at Holly Farm, Great North Road, Cromwell, Newark, NG23 6JE.

Buildings used for residential dwellings are classified as being **More Vulnerable** development within Table 2 of the Planning Practice Guidance. More Vulnerable developments are acceptable within Flood Zone 2.

Figure 15 shows the proposed floor layouts.

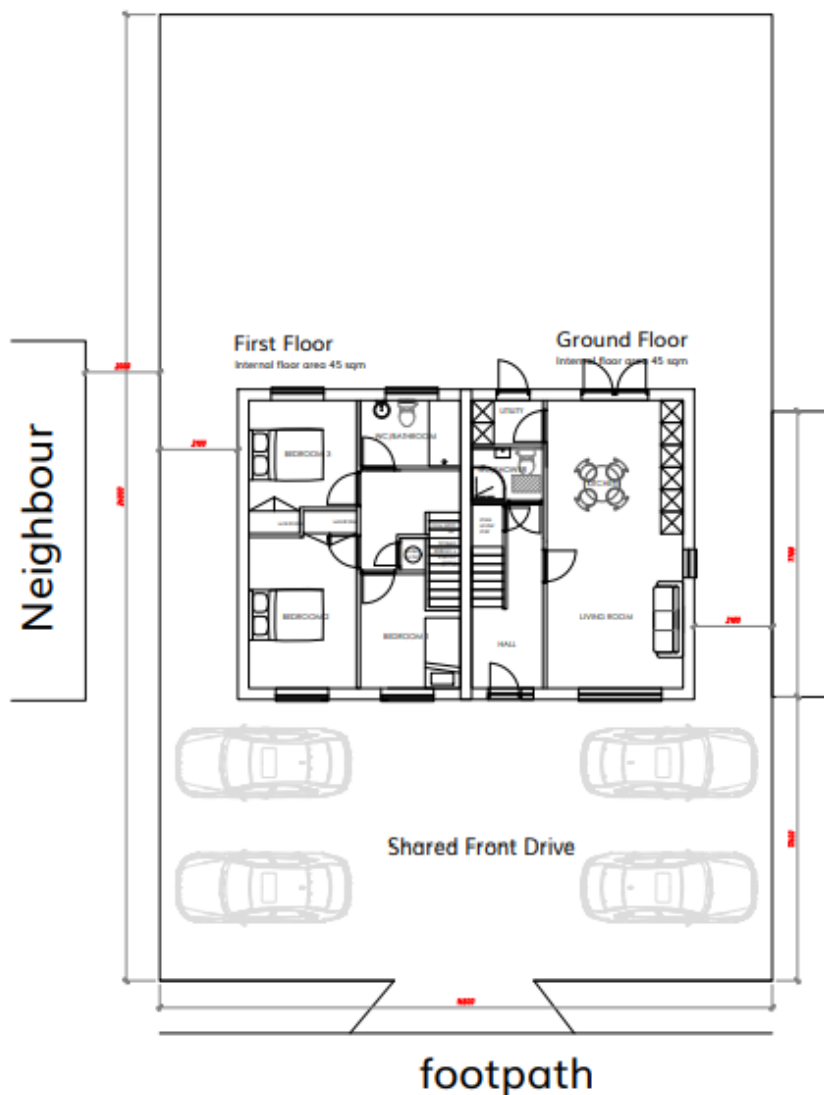



Figure 15 –

Proposed floor layouts.

6. Surface Water Drainage

The greenfield runoff rate has been calculated using IH124 methodology. Table 5 below shows the calculations to determine the existing greenfield runoff rate.



Calculated by:

Site name:

Site location:

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Cire, 2015) and the non-statutory standards for SuDS (Debra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Site Details

Latitude:

Longitude:

Reference:

Date:

Runoff estimation approach

Site characteristics

Total site area (ha):

Methodology

Q_{BAR} estimation method:

SPR estimation method:

Soil characteristics

	Default	Edited
SOIL type:	3	3
HOST class:	N/A	N/A
SPR/SPRHOST:	0.37	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm):	581	581
Hydrological region:	4	4
Growth curve factor 1 year:	0.83	0.83
Growth curve factor 30 years:	2	2
Growth curve factor 100 years:	2.57	2.57
Growth curve factor 200 years:	3.04	3.04

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge of site would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q _{BAR} (l/s):	0.23	0.23
1 in 1 year (l/s):	0.19	0.19
1 in 30 years (l/s):	0.46	0.46
1 in 100 year (l/s):	0.59	0.59
1 in 200 years (l/s):	0.7	0.7

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and license agreement which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CSH, Hydrocoults or any other organisations for the use of this data in the design or operational characteristics of any drainage scheme.

Table 5 – Greenfield runoff calculations.

The Q_{bar} Greenfield runoff rate is 0.23l/s. It is recommended that post development discharge rates are limited to 5l/s in accordance with industry best practice.

Table 6 below looks at the required attenuation that will be required on site. The figures include an allowance of 1.4 (+40%) for climate change.

The calculations show that 4m³ of attenuation storage is required, with a restricted discharge rate of 5l/s.

05/01/2021

Surface water storage volume estimation - member's only area



Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:

Site name:

Site location:

Site Details

Latitude:

Longitude:

Reference:

Date:

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Cirs, 2015) and the non-statutory standards for SuDS (Defra, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site characteristics		Methodology									
Total site area (ha):	<input type="text" value="0.035"/>	estd	<input type="text" value="IH124"/>								
Significant public open space (ha):	<input type="text" value="0"/>	Q _{AVR} estimation method:	<input type="text" value="Calculate from SPR and SAAR"/>								
Area positively drained (ha):	<input type="text" value="0.035"/>	SPR estimation method:	<input type="text" value="Calculate from SOIL type"/>								
Impermeable area (ha):	<input type="text" value="0.02"/>	Soil characteristics									
Percentage of drained area that is impermeable (%):	<input type="text" value="57"/>	SOIL type:	<table border="1"><thead><tr><th>Default</th><th>Edited</th></tr></thead><tbody><tr><td>3</td><td>3</td></tr></tbody></table>	Default	Edited	3	3				
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Impervious area drained via infiltration (ha):	<input type="text" value="0"/>	SPR:	<table border="1"><thead><tr><th>Default</th><th>Edited</th></tr></thead><tbody><tr><td>0.37</td><td>0.37</td></tr></tbody></table>	Default	Edited	0.37	0.37				
Default	Edited										
0.37	0.37										
Return period for infiltration system design (year):	<input type="text" value="10"/>	Hydrological characteristics									
Impervious area drained to rainwater harvesting (ha):	<input type="text" value="0"/>	Rainfall 100 yrs 6 hrs:	<table border="1"><thead><tr><th>Default</th><th>Edited</th></tr></thead><tbody><tr><td>--</td><td>63</td></tr></tbody></table>	Default	Edited	--	63				
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Return period for rainwater harvesting system (year):	<input type="text" value="10"/>	Rainfall 100 yrs 12 hrs:	<table border="1"><thead><tr><th>Default</th><th>Edited</th></tr></thead><tbody><tr><td>--</td><td>91.63</td></tr></tbody></table>	Default	Edited	--	91.63				
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Compliance factor for rainwater harvesting system (%):	<input type="text" value="66"/>	FEH / FBR conversion factor:	<table border="1"><thead><tr><th>Default</th><th>Edited</th></tr></thead><tbody><tr><td>1.19</td><td>1.19</td></tr></tbody></table>	Default	Edited	1.19	1.19				
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1.19	1.19										
Net site area for storage volume design (ha):	<input type="text" value="0.04"/>	SAAR (mm):	<table border="1"><thead><tr><th>Default</th><th>Edited</th></tr></thead><tbody><tr><td>581</td><td>581</td></tr></tbody></table>	Default	Edited	581	581				
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581	581										
Net impermeable area for storage volume design (ha):	<input type="text" value="0.02"/>	M5-60 Rainfall Depth (mm):	<table border="1"><thead><tr><th>Default</th><th>Edited</th></tr></thead><tbody><tr><td>20</td><td>20</td></tr></tbody></table>	Default	Edited	20	20				
Default	Edited										
20	20										
Pervious area contribution to runoff (%):	<input type="text" value="30"/>	'Y' Ratio M5-60/M5-2 day:	<table border="1"><thead><tr><th>Default</th><th>Edited</th></tr></thead><tbody><tr><td>0.4</td><td>0.4</td></tr></tbody></table>	Default	Edited	0.4	0.4				
Default	Edited										
0.4	0.4										
<small>* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 30% of the 'area positively drained', the 'net site area' and the estimates of Q_{AVR} and other flow rates will have been reduced accordingly.</small>											
Design criteria		Hydrological region:									
Climate change allowance factor:	<input type="text" value="1.4"/>	Growth curve factor 1 year:	<table border="1"><thead><tr><th>Default</th><th>Edited</th></tr></thead><tbody><tr><td>0.83</td><td>0.83</td></tr></tbody></table>	Default	Edited	0.83	0.83				
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Urban creep allowance factor:	<input type="text" value="1.1"/>	Growth curve factor 10 year:	<table border="1"><thead><tr><th>Default</th><th>Edited</th></tr></thead><tbody><tr><td>1.49</td><td>1.49</td></tr></tbody></table>	Default	Edited	1.49	1.49				
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Volume control approach:	<input type="text" value="Use long term storage"/>	Growth curve factor 30 year:	<table border="1"><thead><tr><th>Default</th><th>Edited</th></tr></thead><tbody><tr><td>2</td><td>2</td></tr></tbody></table>	Default	Edited	2	2				
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Interception rainfall depth (mm):	<input type="text" value="5"/>	Growth curve factor 100 years:	<table border="1"><thead><tr><th>Default</th><th>Edited</th></tr></thead><tbody><tr><td>2.57</td><td>2.57</td></tr></tbody></table>	Default	Edited	2.57	2.57				
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2.57	2.57										
Minimum flow rate (l/s):	<input type="text" value="2"/>	Q _{AVR} for total site area (l/s):	<table border="1"><thead><tr><th>Default</th><th>Edited</th></tr></thead><tbody><tr><td>0.08</td><td>0.08</td></tr></tbody></table>	Default	Edited	0.08	0.08				
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0.08	0.08										
Site discharge rates		Q _{AVR} for net site area (l/s):									
1 in 1 year (l/s):	<table border="1"><thead><tr><th>Default</th><th>Edited</th></tr></thead><tbody><tr><td>2</td><td>2</td></tr></tbody></table>	Default	Edited	2	2	<table border="1"><thead><tr><th>Default</th><th>Edited</th></tr></thead><tbody><tr><td>0.08</td><td>0.08</td></tr></tbody></table>		Default	Edited	0.08	0.08
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This report was produced using the storage estimation tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and license agreement, which can both be found at <http://uksuds.com/terms-and-conditions.htm>. The outputs from this tool have been used to estimate storage volume requirements. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CDM, Hydrocontractors or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

Table 6 – Estimated attenuation calculations.

7. Hierarchy of disposing surface water

The Planning Practice Guidance and part H of the Building Regulations state that “generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable:

- into the ground (infiltration);
- to a surface water body;
- to a surface water sewer, highway drain, or another drainage system;
- to a combined sewer”.

7.1 Infiltration

Due to the limited amount of permeable ground infiltration is not considered a viable option.

7.2 Surface Water Body

There are no watercourses within the immediate vicinity of the development. The unnamed watercourse north crosses third party land and therefore is not accessible.

7.3 Surface Water or Combined Sewer

It is assumed that a public surface water or combined sewer is available and serves other properties in the vicinity of the development. As such, it is recommended that surface water is continued to be discharged to the public sewerage system.

8. Use of SuDS

The NPPF, Planning Practice Guide and the Ministerial Statement all look at the use of SuDS as a priority to aid the disposal of surface water from new developments.

Due to the nature of the development proposal being a change of use, there is limited capacity to include SuDS measures although soakaways, permeable paving and the use of water butts may be considered for use, where appropriate, to minimise surface water runoff from the site.

9. Management of flood risk

9.1 Fluvial

The analysis of flooding from fluvial and tidal sources shows that the building is in Flood Zone 2 and hence is at a risk of flooding from events between 1 in 100 (1%) and 1 in 1000 (0.1%) year events.

Table 2 of this report details that residential developments are classified as More Vulnerable; Table 3 of the report shows that More Vulnerable developments in Flood Zone 2.

The results from the Tidal Trent SFRM Model indicate that the development site is only at risk in the 1 in 1000-year scenario, with a predicted flood level of 8.38mAOD.

It is proposed that the floor level is set 300mm above the ground level and flood resistant and resilience measures are incorporated into the development. Further information is provided in section 9.4 of this report.

It is also recommended that the residents of the properties register for the EA Flood Warning Service, which is available in the area, and develop a flood plan that may be implemented in the event of extreme flooding. Details of a flood plan are set out in section 9.5 of this report.

9.2 Surface Water

The development site is described as being at low risk from surface water flooding, which means that the flood risk is between 1 in 1000 (0.1%) and 1 in 100 (1%) in any year.

Surface water disposal will be to the public sewerage system.

The calculations show that 4m³ of attenuation storage is required, with a restricted rate of 5l/s.

Appropriate SuDS features and measures will be incorporated within the development to minimise surface water discharges.

As such, the proposed development will not increase the risk of flooding elsewhere from surface water sources.

9.3 Safe access and egress

The proposed development is for two two-storey dwellings. In the event of flooding, all residents will have access to a safe refuge on the first floor of the dwellings.

It is recommended that residents of the property register for the EA Flood Warning Service, which is available within the area and which aims to give a minimum 2 hours advance notification of potential flooding, giving adequate time to implement safety procedures.

In the event of having to evacuate the building, a suitable emergency egress route is available by turning South onto the Great North Road and travel for approximately 200m to reach Flood Zone 1.

9.4 Flood Resistance and Resilience Measures

It is recommended the proposed development incorporate flood resilience and resistance measures. This would ensure that any extreme flooding and flooding in exceedance events could be mitigated against. Such measures could include:

- External walls rendered resistant to flooding to higher level;
- Automatic Flood Doors;
- External ventilation outlets, utility points and air bricks fitted with removable waterproof covers;
- Ground level electrical main ring run from higher level; and on separately switched circuit from first floor;
- Electrical incomer and meter situated at higher level;
- Boilers, control and water storage / immersion installed at higher level;
- Gas meter installed at higher level;
- Plumbing insulation of closed-cell design;
- Non-return valves fitted to all drain and sewer outlets;
- Manhole covers secured;
- Anti-siphon fitted to all toilets;
- Kitchen units of solid, water resistant material;




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- Use of MDF carpentry (i.e. skirting, architrave, built-in storage) avoided at ground floor level.

9.5 Flood plan

As the development is situated in Flood Zone 2 it would be prudent for a flood warning and evacuation plan to be set up and implemented post development. This plan would include residents signing up to the Environment Agency flood warning service.

The flood warning service has three types of warning that will help residents to prepare for flooding and take action.

Flood Warning	Flood Alert	Flood Warning	Severe Flood Warning
			
What it means?	Flooding is possible. Be prepared.	Flooding is expected. Immediate action required.	Severe flooding. Danger to life.
When it's used?	Two hours to two days in advance of flooding.	Half an hour to one day in advance of flooding.	When flooding poses a significant threat to life.
What to do?	Be prepared to act on your flood plan. Prepare a flood kit of essential items. Monitor local water levels and the flood forecast on our website.	Move family, pets and valuables to a safe place. Turn off gas, electricity and water supplies if safe to do so. Put flood protection equipment in place.	Stay in a safe place with a means of escape. Be ready should you need to evacuate from your home. Co-operate with the emergency services. Call 999 if you are in immediate danger.

Recommended Flood Plan:

Before a flood

- Find out if you are at risk of flooding;
- Find out if you can receive flood warnings;
- Prepare and keep a list of all your contacts to hand or save them on your mobile phone/tablet;
- Think about what items you can move now and what you would want to move to safety during a flood such as pets, cars, furniture and electrical equipment;
- Know how to turn off gas, electricity and water supplies;
- Prepare a flood kit of essential items and keep it handy. It can include copies of important documents, a torch, a battery-powered or wind-up radio, blankets and warm clothing, waterproofs, rubber gloves and a first aid kit including all essential medication.

On receipt of a flood warning

- Tune into your local radio station on a battery or wind-up radio;
- Fill jugs and saucepans with water;
- Grab your already prepared flood kit;
- Collect blankets, torch, first aid kit, medication and food;

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- Move important documents, personal items, valuables and lightweight belongings upstairs or to high shelves;
- Raise large items of furniture, or put them in large bags if you have them;
- Move people, outdoor belongings, cars and pets to higher ground;
- Switch off water, gas and electricity at mains when water is about to enter your home. Do not touch sources of electricity when in standing water;
- Fit flood protection products, if you have them, for example flood boards, airbrick covers and sandbags;
- If you do not have non-return valves fitted, plug water inlet pipes with towels or cloths; Know your means of escape;
- Listen to the advice of the emergency service and evacuate if told to do so;
- Avoid walking or driving through flood water. 300mm of fast flowing water can knock over an adult and two feet of water can move a car.

After a flood

- If you have flooded, contact your insurance company as soon as possible;
- Take photographs and videos of your damaged property as a record for your insurance company;
- If you don't have insurance, contact your local authority for information on grants and charities that may help you;
- Flood water can contain sewage, chemicals and animal waste. Always wear waterproof outdoor gear, including gloves, wellington boots and a face mask;
- Have your electrics, central heating and water checked by qualified engineers before switching them back on.

10. Conclusions

The analysis of flooding from fluvial and tidal sources shows that the building is in Flood Zone 2 and hence is at a risk of flooding from events between 1 in 100 (1%) and 1 in 1000 (0.1%) year events.

Table 2 of this report details that residential developments are classified as More Vulnerable; Table 3 of the report shows that More Vulnerable developments in Flood Zone 2.

The results from the Tidal Trent SFRM Model indicate that the development site is only at risk in the 1 in 1000-year scenario, with a predicted flood level of 8.38mAOD.

It is proposed that the floor level is set 300mm above the ground level and flood resistant and resilience measures are incorporated into the development.

The development site is at low risk of surface water flooding.

Surface water disposal will be to the public sewerage system.

The calculations show that 4m³ of attenuation storage is required, with a restricted rate of 5l/s.

Appropriate SuDS features and measures will be incorporated within the development to minimise surface water discharges.

As such, the proposed development will not increase the risk of flooding elsewhere from surface water sources.

The development is not a risk from reservoir failure.

There is no evidence of historic flooding of the development site.

The proposed development is for two two-storey dwellings. In the event of flooding, all residents will have access to a safe refuge on the first floor of the dwellings.

It is recommended that residents of the property register for the EA Flood Warning Service, which is available within the area and which aims to give a minimum 2 hours advance notification of potential flooding, giving adequate time to implement safety procedures.

In the event of having to evacuate the building, a suitable emergency egress route is available by turning South onto the Great North Road and travel for approximately 200m to reach Flood Zone 1.

Based on the likely flooding risk, it is considered that the proposed development can be operated safely in flood risk terms, without increasing flood risk elsewhere and is therefore appropriate development in accordance with the NPPF.

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