

FLOOD RISK CONSULTANCY LIMITED

Level 2 Scoping Study Flood Risk Assessment

Land adjacent to 'The Garage
House' at Great North Road,
South Muskham

Client: Mr & Mrs Brown

Report No: 2017-075

Date: 13/07/2017

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Report No: 2017-075

Document Control

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Contract

This report describes work commissioned by Mark Crowther on behalf of Mr & Mrs Brown, dated 2nd June 2017. Donna Metcalf of the Flood Risk Consultancy carried out the work.

Prepared by.....Donna Metcalf (Managing Director)

Reviewed by.....Chris Vose (Flood Risk Consultant)

Approved by.....Donna Metcalf (Managing Director)

Disclaimer

This document has been prepared solely as a Flood Risk Assessment for Mr & Mrs Brown. The Flood Risk Consultancy accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

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Executive Summary

Flood Risk Consultancy Ltd has been commissioned by Mr & Mars Smith to undertake a Flood Risk Assessment in accordance with the National Planning Policy Framework to support residential development at South Muskham in Newark.

The site is shown to be located within Flood Zone 2 of the Environment Agency Flood Map.

The primary flood risk at the application site is identified to be from the fluvial source known as the River Trent. South Muskham and the surrounding area has a long history of flooding from this major watercourse.

Modelled 1D & 2D flood data has been provided by the Environment Agency to facilitate the flood risk assessment at the application site.

Comparing in-channel flood levels, 2D flood depths, and site levels it is concluded that the risk of inundation at the development site from overtopping currently is low, with no viable route for flood water to ingress into the site.

This is largely due to a brick wall providing a physical barrier against flooding from the north. The wall is located along the north boundary of the residential plot known as The Garage House, and extends along the full width.

The access track located along the west boundary of the site is elevated above 11.13m AOD i.e. the 2D modelled level for the 1 in 1000-year event.

Similarly, levels along the Great North Road along the east boundary of the site are also elevated above 11.22m AOD i.e. the 2D modelled flood level to the east of the site.

Detailed assessment therefore indicates that flood risk at the application site is actually lower than originally anticipated. However the risk is likely to increase in the event that the brick wall boundary between The Garage House and neighbouring development to the north is ever removed.

Secondary sources of flooding such as groundwater, artificial water sources; overland flows; and ponding have been investigated; and are deemed to present a low risk of flooding to the proposed development site.

To mitigate against potential flood risk at the site both now and in the future, a number of measures have been recommended for incorporation into the building design, as follows:

- Finished floor levels should be set at a minimum of 300mm above external ground levels.
- Flood resistance/resilience measures recommended for minimizing ingress associated with flood water is incorporated into the ground floor building design.
- Due to proximity to the River Trent it is recommended that residents register to receive Environment Agency Flood Warnings/Alerts.
- Residents must be encouraged to complete a personal flood plan.
- Evacuation away from the property should be undertaken under advisement of the Environment Agency and/or emergency services, as appropriate.
- Safe place of refuge to be designed into the new dwelling to provide a high place outside of the flood waters where the occupant can easily retreat to if onset of flooding is too rapid or flood waters are too deep for safe evacuation to occur.

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- Surface Water Management – surface water management using sustainable methods is encouraged. Such methods including rainwater re-use should be considered.

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Appendices

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- Appendix B: - SFRA Mapping
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- Appendix D: - Personal Flood Plan Template

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1.0 Introduction

1.1 Terms of Reference

Flood Risk Consultancy Ltd has been appointed by Mr & Mrs Brown to provide a Flood Risk Assessment in support of a planning application for a new residential dwelling adjacent to The Garage House at Great North Road in South Muskham, near Newark in Nottinghamshire.

The site is located within Flood Zone 2; and as such the site is considered to have a medium risk of fluvial flooding.

Definitions of the different Flood Zones are provided within Section 2.2.2 of this report.

It is usual for the Environment Agency to raise an objection to development applications within the floodplain, or Zones 2 and 3 of the flood map until the issue of flood risk has been properly evaluated. The Agency will also object to developments where the total site area is in excess of 1 Hectare until suitable consideration has been given to surface water runoff.

1.2 Objectives

The objective of this assessment is to evaluate the following issues in regard to flood risk at the application site i.e. proposed residential development at South Muskham (Newark):

- Suitability of the proposed development in accordance with current planning policy.
- Identify the risk to both the proposed development and people from all forms of flooding.
- Provide a preliminary assessment of foul and surface water management.
- Increasing the risk of flooding elsewhere e.g. surface water flows; flood routing; and loss of floodplain storage.
- Recommendation of appropriate measures to mitigate against flooding both within the proposed development, and neighbouring land and property.

1.3 Data Sources

This assessment is based on desk-top study of information from the following sources:

- National Planning Policy Framework (Original Publication 2012)
- Planning Practice Guidance – Flood Risk & Coastal Change (Updated Nov 2016)
- Building Regulations Approved Document H (March 2015)
- Environment Agency Flood Mapping
- Newark & Sherwood Level 1 SFRA (WSP July 2009)
- Newark & Sherwood Level 1 SFRA (WSP June 2010)
- Newark & Sherwood LDF Core Strategy (March 2011)
- British Geological Society – Historic Borehole Logs
- Cranfield University's Soilscape Viewer
- CIRIA C753 The SUDS Manual (Updated Nov 2015)
- MicroDrainage Windes

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2.0 Planning Policy Context

2.1 Approach to the Assessment

The project is currently at the planning stage and consequently a detailed site-specific flood risk assessment is required.

A Level 2 Scoping Study is designed to provide a qualitative appraisal of flood risk both within the application site and any potential impact that the development will have on flood risk elsewhere; and provide recommendations for mitigation measures which may be included within the design of the development to reduce the overall risk of flooding.

An initial assessment indicates that the primary source of flood risk to the site is fluvial i.e. the River Trent.

Consideration has also been given to the site flooding from secondary sources such as pluvial; groundwater; artificial water bodies; infrastructure failure; overland flow and ponding.

2.2 National Planning Policy Framework (NPPF)

The requirements for undertaking site specific flood risk assessments are generally as set out in Guidance Point 10 from the Planning Practice Guide – Flood Risk & Coastal Change (www.gov.uk).

The information provided in the flood risk assessment should be credible and fit for purpose.

Site-specific flood risk assessments should always be proportional 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 website.

A flood risk assessment should also be appropriate to the scale, nature and location of the development.

2.2.1 Sources of Flooding

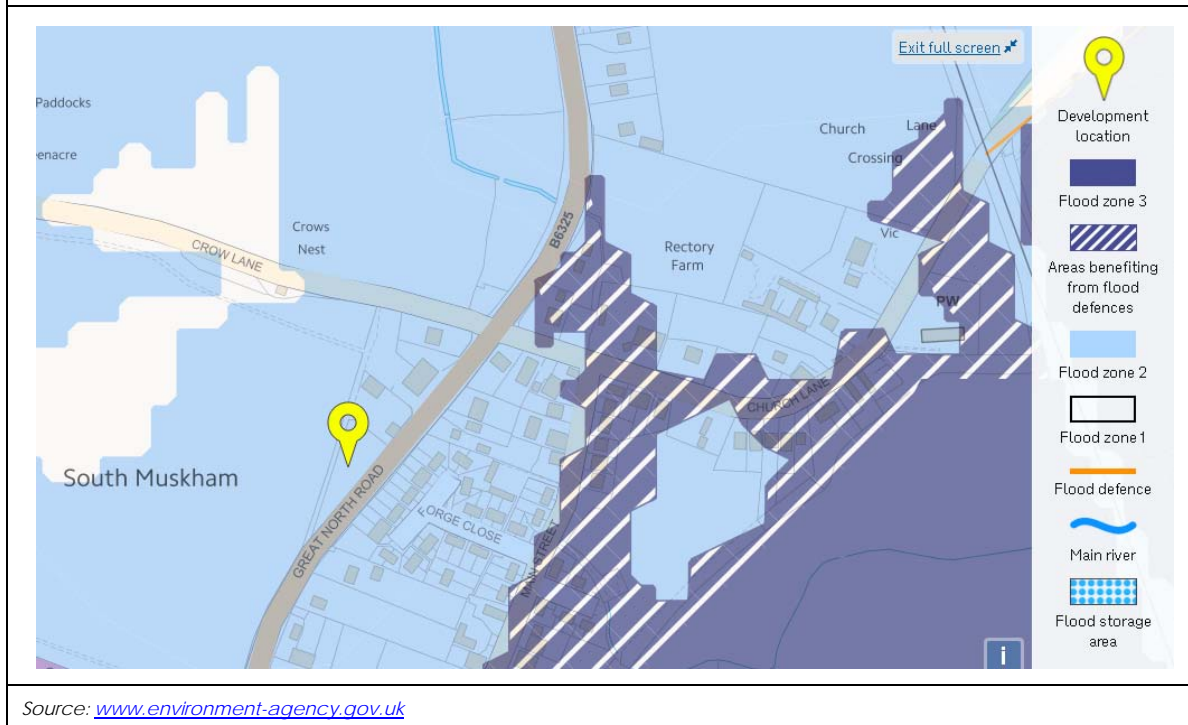
- **Rivers (fluvial):** Flooding occurs when flow within river channels exceeds capacity; and the type of flood event experienced e.g. flash flooding; depends upon the characteristics of the river catchment.
- **The Sea (tidal):** Flooding at low lying coastline and tidal estuaries is caused by storm surges and high tides; with overtopping and breach failure of sea defences possible during extreme storm events.
- **Pluvial (surface flooding or overland flows):** Heavy rainfall, which is unable to soak away via infiltration or enter drainage systems can flow overland, resulting in localised flooding. Topography generally influences the direction and depth of flooding caused by this mechanism.
- **Groundwater:** Caused when ground water levels rise to the surface; and is most likely to occur in low lying areas underlain by aquifers.
- **Sewers and drains:** Generally, occurs in more urban areas; where sewers and drains are overwhelmed by heavy rainfall or blocked pipes and gullies.
- **Artificial Sources (reservoirs, canals, lakes and ponds):** Reservoir and canal flooding may occur as a result of capacity exceedance or structural failure.

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Figure 2.1: The Environment Agency Flood Map



2.2.2 Flood Zones

- **Flood Zone 1:** Low probability (less than 1 in 1000-year (<0.1% AEP) annual probability of river or sea flooding in any year).
- **Flood Zone 2:** Medium probability (between 1 in 100-year (1.0% AEP) and 1 in 1000-year (0.1% AEP) annual probability of river flooding; or between 1 in 200-year (0.2% AEP) and 1 in 1000-year (0.1% AEP) annual probability of sea flooding in any year).
- **Flood Zone 3a:** High probability (1 in 100-year (1.0% AEP) or greater annual probability of river flooding in any year or 1 in 200-year (0.5% AEP) or greater annual probability of sea flooding in any year).
- **Flood Zone 3b:** This zone comprises land where water has to flow or be stored in times of flood. Land which would flood with an annual probability of 1 in 20 (5% AEP), or is designed to flood in an extreme flood (0.1%) should provide a starting point for discussions to identify functional floodplain.

2.2.3 Vulnerability of Different Development Types

- **Essential Infrastructure:** Transport infrastructure (railways and motorways etc...); utility infrastructure (primary sub-stations, water treatment facilities; power stations; and wind turbines).
- **Water Compatible Development:** Flood control infrastructure; water and sewage infrastructure; navigation facilities.
- **Highly Vulnerable:** Emergency services; basement dwellings; mobile home parks; industrial or other facilities requiring hazardous substance consent.
- **More Vulnerable:** Hospitals; residential dwellings; educational facilities; landfill sites caravan and camping sites.
- **Less Vulnerable:** Commercial premises; emergency services not required during a flood; agricultural land.

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2.2.4 Sequential & Exceptions Test

As set out in the National Planning Policy Framework, the aim of the Sequential Test is to steer new development to areas at the lowest probability of flooding.

The Flood Zones are the starting point for the sequential approach.

The Environment Agency Flood Map shows the development site to be within Zone 2, which is considered to have a medium risk of flooding i.e. between 1 in 100-year (1.0% AEP) and 1 in 1000-year (0.1% AEP) annual probability of river flooding; or between 1 in 200-year (0.2% AEP) and 1 in 1000-year (0.1% AEP) annual probability of sea flooding in any year).

Proposals for the application site involve the development of a single dwelling adjacent to an established residential plot.

In accordance with Table 2 'Flood Risk Vulnerability Classification' of the Technical Guidance to the National Planning Policy Framework, residential sites are defined as 'More Vulnerable'.

Table 1: Flood Risk Vulnerability and Flood Zone 'Compatibility'¹

| Flood Risk Vulnerability Classification | | Essential Infrastructure | Water compatible | Highly Vulnerable | More Vulnerable | Less Vulnerable |
|---|---------|--------------------------|------------------|-------------------------|-------------------------|-----------------|
| Flood Zone | Zone 1 | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Zone 2 | ✓ | ✓ | Exception Test required | ✓ | ✓ |
| | Zone 3a | Exception Test required | ✓ | x | Exception Test required | ✓ |
| | Zone 3b | Exception Test required | ✓ | x | x | x |

✓ Development is appropriate

x Development should not be permitted



Environment Agency Flood Map (Flood Zone 2)

Site Specific Flood Risk Assessment (Flood Zone 1)

Table 1 above indicates that the type of development proposed is considered both acceptable and appropriate for the site.

Following completion of the site-specific flood risk assessment it was found that although the site is partially lower than the 2d flood level during the 1 in 1000-year event, there is no viable route for flood water to enter the site, due to higher ground levels; and therefore, it is concluded that the site is actually located within Flood Zone 1 and has a low risk of flooding from tidal/fluvial sources.

As such it is considered that the Sequential and Exceptions Tests do not need to be applied.

¹ Extracted from Table 3 of the Technical Guidance to the National Planning Policy Framework Document (March 2012)

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2.2.5 Climate Change

The NPPF requires the application of climate change over the lifetime of a development.

Following the nationwide floods which occurred on Boxing Day (26th December) 2015, the Technical Guidance for NPPF was updated to provide revised climate change allowances based on the river basin district. These updates were published in February 2016; and updated in April 2016.

The village of South Muskham is located within the Humber River Basin District; and the climate change allowances for this district are therefore tabulated below:

Table 2: North West Climate Change Allowances²

| Parameter | Allowance Category | 2010 - 2039 | 2040 - 2059 | 2060 - 2069 | 2070 - 2115 |
|-------------------------|--------------------|-------------|-------------|-------------|-------------|
| Peak Rainfall Intensity | Upper end | + 10% | + 20% | + 40% | |
| | Central | + 5% | + 10% | + 20% | |
| Peak River Flow | Upper end | + 20% | + 30% | | + 50% |
| | Higher Central | + 15% | + 20% | | + 30% |
| | Central | + 10% | + 15% | | + 20% |
| Offshore Wind Speed | N/A | + 5% | | + 10% | |
| Extreme Wave Height | N/A | + 5% | | + 10% | |

The selection of climate change allowance should be chosen appropriate to the flood zoning, type, vulnerability and expected lifespan of the proposed development.

For assessment purposes, residential development is taken to have a lifespan approximating 100-years; and as such an additional 20% and 40% should be applied to peak rainfall intensities to assess the range of impact for this development.

Furthermore for 'more vulnerable' types of development within Flood Zone 2, the latest guidance indicates that the central and higher central allowances should be applied to peak river flows, to assess the impact of climate change at the development site over its lifetime.

2.2.6 Sustainable Urban Drainage Systems (SUDS)

The key planning objectives in the NPPF are to appraise, manage and where possible, reduce flood risk.

From April 2015, the Lead Local Flood Authority or LLFA i.e. Nottinghamshire County Council, is the statutory consultee for approving the management of surface water runoff in relation to 'major' planning applications.

² Extracted from Tables 1-4 of the Technical Guidance for flood risk assessments: Climate change allowances Document (February 2016)

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For residential development comprising 10+ dwellings or development area in excess of 1 Hectare, details of how surface water runoff from the site will be sustainably managed must be provided within the details of the planning application.

It is highlighted development proposals incorporate only a single dwelling and therefore a detailed appraisal of surface water runoff and its management on-site will not be required.

It is advised however that the incorporation of Sustainable Urban Drainage Systems (SUDS) into development designs are strongly encouraged by all Statutory Consultees to assist in reducing the potential impact of new and existing developments with respect to surface water discharges.

Furthermore, the NPPF and Building Regulations Approved Document Part H direct developers towards the use of SUDS wherever possible; and The Floods and Water Management Act 2010 also reinforces the requirements for SUDS to be implemented where practicable.

Part H of the Building Regulations requires that surface water should be discharged from new development in accordance with the following hierarchy in order of preference:

- By infiltration to the ground via soakaway or other infiltration device
- To a watercourse
- To a public surface water sewer
- To a public combined sewer

2.2.7 Local Planning Policy

The Newark and Sherwood Core Strategy was adopted in March 2011 and sets out the District Council's spatial policy framework for delivering the development and change needed to realise the District Council's vision for the District up to 2026. A number of policies have been extracted from the Core Strategy document, which cover flood risk and have been highlighted below:

Spatial Policy 9 – Selecting appropriate sites for allocation

Sites allocated for housing, employment and community facilities as part of the Allocations & Development Management DPD will:

1. Be in, or adjacent to, the existing settlement;
2. Be accessible and well related to existing facilities;
3. Be accessible by public transport, or demonstrate that the provision of such services could be viably provided;
4. Be the most sustainable in terms of impact on existing infrastructure, or demonstrate that infrastructure can be provided to address sustainability issues;
5. Not impact adversely on the special character of the area, including not impacting on important open spaces and views, all designated heritage assets including listed buildings or locally important buildings, especially those identified in Conservation Area Character Appraisals;
6. Appropriately address the findings of the Landscape Character Assessment and the conservation and enhancement actions of the particular landscape policy zone/zones affected.
7. Not lead to the loss, or adverse impact on, important nature conservation or biodiversity sites;
8. Not lead to the loss of locally important open space or, in the case of housing and employment, other locally important community facilities (unless adequately replaced); and

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9. Not be located in areas of flood risk or contribute to flood risk on neighbouring sites.

Core Policy 5 - Criteria for Considering Sites for Gypsies & Travellers and Travelling Show People

The following criteria will be used to guide the process of allocation, in the Allocations & Development Management DPD, of individual sites and to help inform decisions on proposals reflecting unexpected demand:

1. The site would not lead to the loss, or adverse impact on, important heritage assets, nature conservation or biodiversity sites;
2. The site is reasonably situated with access to essential services of mains water, electricity supply, drainage and sanitation and to a range of basic and everyday community services and facilities – including education, health, shopping and transport facilities;
3. The site has safe and convenient access to the highway network;
4. The site would offer a suitable level of residential amenity to any proposed occupiers and have no adverse impact on the amenity of nearby residents;
5. The site is capable of being designed to ensure that appropriate landscaping and planting would provide and maintain visual amenity;
6. In the case of any development proposal which raises the issue of flood risk, regard will be had to advice contained in PPS 25: Development and Flood Risk and the findings of the Newark and Sherwood Strategic Flood Risk Assessment. Where flooding is found to be an issue, the District Council will require the completion of a site-specific Flood Risk Assessment. Subject to the other provisions of this policy, the District Council will be prepared to consider proposals for additional pitch provision for Gypsies and Travellers on existing caravan sites (of all kinds) – including unused or under-used sites.

Core Strategy Document Paragraph 5.43

The need to minimise future developments vulnerability to climate change is also significant in the design and construction of new development, particularly in terms of reducing flood risk through its location and active management of surface water. Sustainable Drainage Systems (SuDS), dependent upon site specific characteristics, can aid the reduction of the rate and volume of surface water run-off and thus reduce flood risk

Core Strategy Document Paragraph 5.51

In terms of the potential impacts of climate change, the District is, due to there being a number of significant rivers within the area, particularly vulnerable to flood risk. In order to avoid locating inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk, national planning policy requires a sequential approach to flood risk. Thus, the District Council has undertaken a Strategic Flood Risk Assessment to inform decisions over future site allocations and in the determination of planning applications. The District Council will expect developers, as part of proposals, to take the study into account.

Core Policy 10 – Climate Change

The District Council is committed to tackling the causes and effects of climate change and to delivering a reduction in the Districts overall CO2 emissions. The LDF, through its approach to development, will seek to:

- Mitigate the impacts of climate change through ensuring that new development proposals minimise their potential adverse environmental impacts during their construction and eventual operation, including the need to reduce the causes and impacts of climate change and flood risk. New proposals should:

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- o Ensure that the impacts on natural resources are minimised and the use of renewable resources is maximised; Be efficient in the consumption of energy, water and other resources.
- o Be located in order to avoid both present and future flood risk. Therefore in considering site allocations and in determining development proposals the District Council will, informed by national guidance and the District's Strategic Flood Risk Assessment, apply a sequential approach to future development; and will work with partners to secure strategic flood mitigation measures as part of new development.

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3.0 Details of the Site

3.1 Site Details

Table 3: Development Location

| | |
|--|--------------------------------------|
| Site Name: | Land adjacent to The Garage House |
| Purpose of Development: | Residential |
| Existing Land Use: | Undeveloped Land |
| OS NGR: | SK 789 572 |
| Country: | England |
| County: | Nottinghamshire |
| Local Planning Authority: | Newark and Sherwood District Council |
| Lead Local Flood Authority: | Nottinghamshire County Council |
| Critical Drainage Area: | No |
| Internal Drainage Board: | Trent Valley IDB |
| Other Authority (e.g. British Waterways/ Harbour Authority) | Not Applicable |

Location Plan:

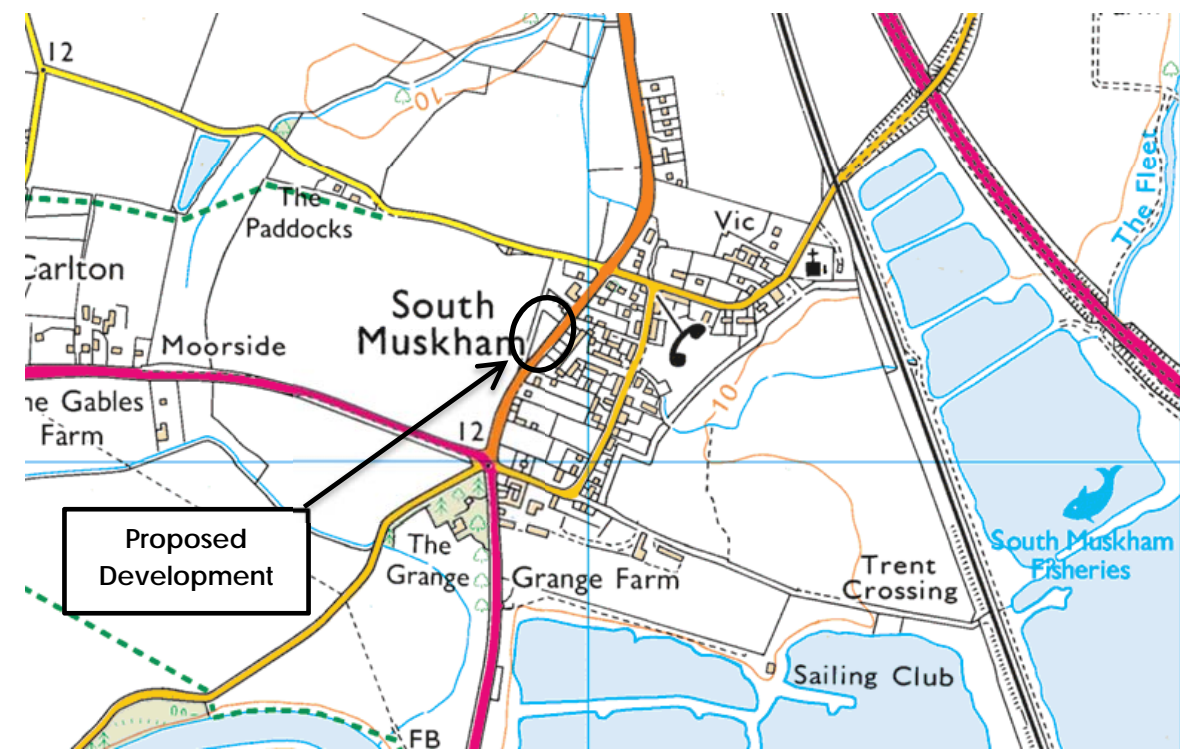


Image produced from the Ordnance Survey Get-a-map service.
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3.2 Site Description

The application site is located within an undeveloped plot immediately adjacent to a property known as The Garage House.

The development plot is triangular in shape and is bounded by established hedgerow.

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A garden shed is located within the north-east corner of the site, with access leading from the adjacent property along the north side of the development plot.

An access track is located along the west boundary, with Great North Road located along the east boundary of the site.

The site is undeveloped and has a grass lawn surface.

South Muskham is a rural village situated 3.4 kilometres to the north of the centre of Newark.

Table 4: Boundaries

| | |
|--------------|--|
| North | The site is bound immediately to the north by established property known as The Garage House, with Crow Lane beyond which provides a transport route to the neighbouring village of Little Carlton. |
| East | A1 Pits - South Muskham Fisheries are located to the east, between the development site and the River Trent. The village of Winthorpe is located along the east bank of the River. Great North Road forms the east boundary of the site. |
| South | A616 Ollerton Road is located to the south of the site, which provides a transport link to Newark (south) and Ollerton to the north east. Newark is located to the south of South Muskham. The River Trent is located approximately 750m south of the application site |
| West | Agricultural land borders the west site boundary, with the village of Little Carlton located a distance approximating 1.1 kilometre from the development area. |

A topographical survey has been provided, and levels some pertinent locations within the site have been extracted and listed below:

- East Boundary: 10.916 – 11.415mAOD
- West Boundary: 11.011 – 11.415mAOD
- North Boundary: 10.916 - 11.011mAOD
- Low Point: 10.916mAOD

3.3 Proposed Development Details

No development plans have been made available, however it is understood that the proposals include the construction of a single bespoke residential property.

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4.0 Historic Flooding

4.1 Internet Search

An internet search for the South Muskham area did not highlight any specific recorded incidents of flooding, in immediate proximity of the development site, however a document published following the UK wide event that occurred in June 2007 by the Carlton on Trent Parish Council indicates that both Carlton on Trent and Little Carlton were significantly affected.

4.2 Newark & Sherwood Level 1 SFRA (2009)

South Muskham is identified to historically have issues with fluvial/tidal flooding associated with the River Trent.

Map reference 0703-B-4 within Appendix B of the SFRA document indicates that the development site lies outside of the area affected during the historic 1947 flood.

Table 4A indicates that the village of South Muskham was affected by flooding from the River Trent during the 2007 event, however the specific locations affected are not identified within the SFRA report.

4.3 Environment Agency Data

The EA data provided does not indicate any records available in regard to historic flooding at the application site.

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5.0 Initial Evaluation of Flood Risk

5.1 The Environment Agency Flood Map

The Environment Agency Flood Map illustrated within Figure 2.1, indicates that the proposed development site is located within Flood Zone 2.

The definition for the flood zone highlighted above is provided for reference within Section 2.2.2 of this report.

Table 5: Possible Flooding Mechanisms

| Source/Pathway | Significant? | Comment/Reason |
|--------------------------|--------------|---|
| Fluvial | Yes | River Trent |
| Canal | No | No canals within close proximity to the site |
| Tidal/Coastal | No | Outside the extents of tidal flooding |
| Reservoir | No | Flood Maps ³ indicate site lies outside of flood risk associated with reservoirs |
| Pluvial (urban drainage) | No | Site is <1Ha in size and surface water runoff will be suitably managed using sustainable methods (where appropriate) |
| Surface Water Flooding | No | Flood Maps ⁵ indicate that the site has a very low risk from surface water flooding |
| Groundwater | No | No records of groundwater flooding found for South Muskham |
| Overland flow | No | Low lying area within the Trent Valley, overland flow generated by upland areas is likely to be intercepted before reaching South Muskham |
| Blockage | No | River Trent is a large and wide river. The nearest bridge crossings are located a distance approximating 1.7km south-east of South Muskham, where the A1 crosses the watercourse (known as Winthorpe Bridge). |
| Infrastructure failure | No | |
| Rainfall Ponding | No | Flood Maps ⁵ indicate that the site has a very low risk from surface water flooding |

From the initial assessment, it is concluded that the primary source of flood risk at the site will be from the River Trent.

Fluvial: River Trent

The River Trent is located approximately 750m south/south-west of the proposed site at its nearest point.

As the development is located within Flood Zone 2 i.e. has a medium risk of flooding and has therefore been evaluated further within section 6.2 of this report.

Blockages at structures over the watercourse may cause impedence to flood flows within a river channel; and act to trap debris transported downstream, which can exacerbate flood levels.

³ <https://flood-warning-information.service.gov.uk/long-term-flood-risk/>

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The nearest bridge structure to the site is identified to be Winthorpe Bridge, at a location approximately 1.7km south-east from the development site.

Figure 5.1: Winthorpe Bridge



Source: Bob Danylec via Panoramio (Google Earth)

It is noted that the structure provides a large single aperture spanning the whole channel width, with additional flood conveyance provision under the structure along each river bank.

Whilst some blockage of the structure may occur during flood conditions, it is considered that such blockages are unlikely to be substantial, and conveyance of flood flow beneath the structure is unlikely to be significantly impeded.

As such blockage or infrastructure failure overall is not considered to present an increased flood risk at the application site.

Groundwater

Groundwater flooding is caused by the emergence of water originating from underground. The water may emerge from either point or diffuse locations. The occurrence of groundwater flooding is usually very local.

There are no records available which suggest that groundwater presents a flood risk at North Muskham; and therefore, the risk associated with this flood source is considered to be low.

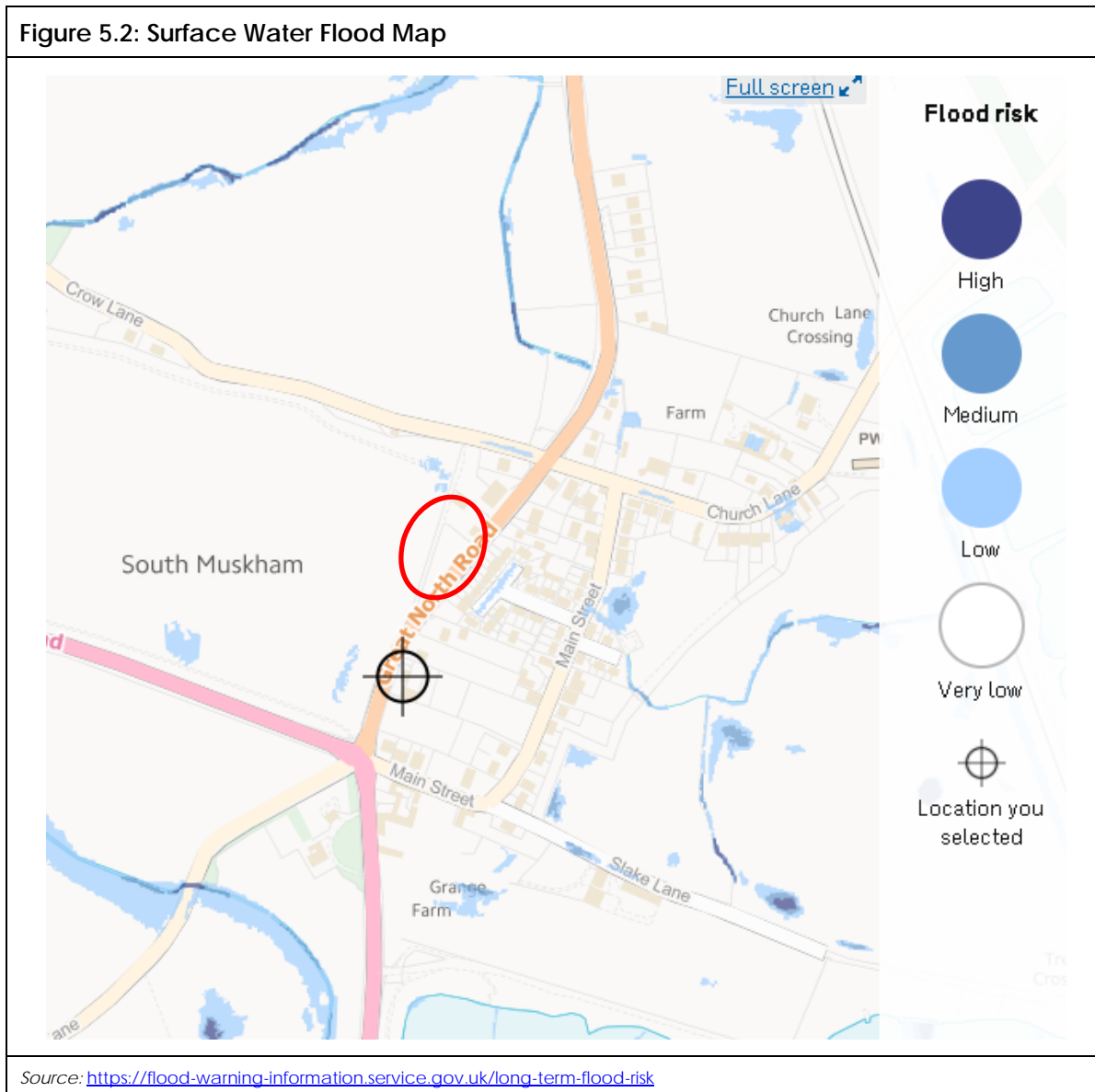
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Surface Water Flood Routes & Ponding

Figure 5.2: Surface Water Flood Map



Site is located within an area shown to have a 'very low' risk from surface water flooding, which is defined as having a probability of less than 1 in 1000-years or 0.1% AEP.

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6.0 Quantitative Flood Risk Assessment

6.1 National Planning Policy Framework

6.1.1 Site Specific Flood Risk Assessment Checklist

The following checklist has been extracted from Paragraph 068 from the Flood Risk & Coastal Change Section available from www.gov.uk, updated in November 2016.

1. Development site and location

Provide a description of the site you are proposing to develop, including, or making reference to, a location map which clearly indicates the development site.

- a. Where is the development site located? (e.g. postal address or national grid reference)
- b. What is the current use of the site? (e.g. undeveloped land, housing, shops, offices)
- c. Which Flood Zone (for river or sea flooding) is the site within? (i.e. Flood Zone 1, Flood Zone 2, Flood Zone 3). Check the [Flood Map for Planning](#) (Rivers and Sea) and the Strategic Flood Risk Assessment for the area available from the local planning authority.

2. Development proposals

Provide a general summary of the development proposals, including, or making reference to, an existing block plan and a proposed block plan, where appropriate.

- a. What are the development proposal(s) for this site? Will this involve a change of use of the site and, if so, what will that change be?
- b. In terms of vulnerability to flooding, what is the vulnerability classification of the proposed development?
- c. What is the expected or estimated lifetime of the proposed development likely to be? (E.g. less than 20 years, 20-50 years, 50-100-years?).

3. Sequential test

For developments in flood zones 2 or 3 only.

Note: If the development site is wholly within flood zone 1, this section can be skipped - go to section 4.

Describe how the sequential test has been applied to the development (if required, and as set out in paragraphs 101-104 of the National Planning Policy Framework); and provide the evidence to demonstrate how the requirements of the test have been met.

See paragraph 033 of the NPPF guidance for further information. (It is recommended that the Developer or Agent contacts the LPA to confirm whether the sequential test should be applied and to ensure the appropriate level of information is provided).

- a. What other locations with a lower risk of flooding have you considered for the proposed development?
- b. If you have not considered any other locations, what are the reasons for this?

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- c. Explain why you consider the development cannot reasonably be located within an area with the lowest probability of flooding (flood zone 1); and, if your chosen site is within flood zone 3, explain why you consider the development cannot reasonably be located in flood zone 2.
- d. As well as flood risk from rivers or the sea, have you taken account of the risk from any other sources of flooding in selecting the location for the development?

4. Climate Change

How is flood risk at the site likely to be affected by climate change? (The local planning authority's Strategic Flood Risk Assessment should have taken this into account). Further advice on how to take account of the impacts of climate change in flood risk assessments is available from the Environment Agency.

5. Site specific flood risk

Describe the risk of flooding to and from the proposed development over its expected lifetime, including appropriate allowances for the impacts of climate change. It would be helpful to include any evidence, such as maps and level surveys of the site, flood datasets (e.g. flood levels, depths and/or velocities) and any other relevant data, which can be acquired through consultation with the Environment Agency, the lead local flood authority for the area, or any other relevant flood risk management authority. Alternatively, you may consider undertaking or commissioning your own assessment of flood risk, using methods such as computer flood modelling.

- a. What is/ are the main source(s) of flood risk to the site? (E.g. tidal/sea, fluvial or rivers, surface water, groundwater, other?). You should consider the flood mapping available from the Environment Agency, the Strategic Flood Risk Assessment for the area, historic flooding records and any other relevant and available information.
- b. What is the probability of the site flooding, taking account of the maps of flood risk available from the Environment Agency, the local planning authority's Strategic Flood Risk Assessment and any further flood risk information?
- c. Are you aware of any other sources of flooding that may affect the site?
- d. What is the expected depth and level for the design flood? See paragraph 055 of the NPPF guidance for information on what is meant by a "design flood". If possible, flood levels should be presented in metres above Ordnance Datum (i.e., the height above average sea level).
- e. Are properties expected to flood internally in the design flood and to what depth? Internal flood depths should be provided in metres.
- f. How will the development be made safe from flooding and the impacts of climate change, for its lifetime? Further information can be found in paragraphs 054 and 059 (including on the use of flood resilience and resistance measures) of the NPPF guidance.
- g. How will you ensure that the development and any measures to protect the site from flooding will not cause any increase in flood risk off-site and elsewhere? Have you taken into account the impacts of climate change, over the expected lifetime of the development? (e.g. providing compensatory flood storage which has been agreed with the Environment Agency).
- h. Are there any opportunities offered by the development to reduce the causes and impacts of flooding?

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6. Surface water management*

Describe the existing and proposed surface water management arrangements at the site using sustainable drainage systems wherever appropriate, to ensure there is no increase in flood risk to others off-site.

- a. What are the existing surface water drainage arrangements for the site?
- b. If known, what (approximately) are the existing rates and volumes of surface water run-off generated by the site?
- c. What are the proposals for managing and discharging surface water from the site, including any measures for restricting discharge rates? For major developments (e.g. of ten or more homes or major commercial developments), and for all developments in areas at risk of flooding, sustainable drainage systems should be used, unless demonstrated to be inappropriate.
- d. How will you prevent run-off from the completed development causing an impact elsewhere?
- e. Where applicable, what are the plans for the ongoing operation and/or maintenance of the surface water drainage systems?

7. Occupants and users of the development

Provide a summary of the numbers of future occupants and users of the new development; the likely future pattern of occupancy and use; and proposed measures for protecting more vulnerable people from flooding.

- a. Will the development proposals increase the overall number of occupants and/or people using the building or land, compared with the current use? If this is the case, by approximately how many will the number(s) increase?
- b. Will the proposals change the nature or times of occupation or use, such that it may affect the degree of flood risk to these people? If this is the case, describe the extent of the change.
- c. Where appropriate, are you able to demonstrate how the occupants and users that may be more vulnerable to the impact of flooding (e.g., residents who will sleep in the building; people with health or mobility issues; etc..) will be located primarily in the parts of the building and site that are at lowest risk of flooding? If not, are there any overriding reasons why this approach is not being followed?

8. Exception test

Provide the evidence to support certain development proposals in flood zones 2 or 3 if, following application of the sequential test, it is appropriate to apply the exception test, as set out in paragraphs 102-104 of the National Planning Policy Framework.

It is advisable to contact the local planning authority to confirm whether the exception test needs to be applied and to ensure the appropriate level of information is provided.

- a. Would the proposed development provide wider sustainability benefits to the community? If so, could these benefits be considered to outweigh the flood risk to and from the proposed development?

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- b. How can it be demonstrated that the proposed development will remain safe over its lifetime without increasing flood risk elsewhere?
- c. Will it be possible for the development to reduce flood risk overall (e.g. through the provision of improved drainage)?

8. Residual risk

Describe any residual risks that remain after the flood risk management and mitigation measures are implemented, and to explain how these risks can be managed to keep the users of the development safe over its lifetime.

- a. What flood related risks will remain after the flood risk management and mitigation measures have been implemented?
- b. How, and by whom, will these risks be managed over the lifetime of the development? (e.g., putting in place flood warning and evacuation plans).

9. Flood risk assessment credentials

Provide details of the author and date of the flood risk assessment.

- a. Who has undertaken the flood risk assessment?
- b. When was the flood risk assessment completed?

Other considerations

* Managing surface water

The site-specific flood risk assessment will need to show how surface water runoff generated by the developed site will be managed. In some cases, it may be advisable to detail the surface water management for the proposed development in a separate drainage strategy or plan. You may like to discuss this approach with the lead local flood authority.

Surface water drainage elements of major planning applications (e.g., of ten or more homes) are reviewed by the lead local flood authority for the area. As a result, there may be specific issues or local policies, for example the Local Flood Risk Management Strategy or Surface Water Management Plan, that will need to be considered when assessing and managing surface water matters.

It is advisable to contact the appropriate lead local flood authority prior to completing the surface water drainage section of the flood risk assessment, to ensure that the relevant matters are covered in sufficient detail.

Proximity to Main Rivers

If the development of the site involves any activity within specified distances of main rivers, a flood risk activity permit may be required in addition to planning permission.

For non-tidal main rivers, a flood risk activity permit may be required if the development of the site is within 8 metres of a river, flood defence structure or culvert.

For tidal main rivers, a flood risk activity permit may be required if the development of the site is within 16 metres of a river, flood defence structure or culvert.

Details on obtaining a Flood Risk Activity Permit are available from the Environment Agency.

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6.2 Fluvial: River Trent

6.2.1 General

The River Trent is the third-longest river in the UK.

Its source is in Staffordshire on the southern edge of Biddulph Moor; and it flows through and drains most of the northern Midlands around and east of Birmingham.

The river is known for dramatic flooding after storms and spring snowmelt, which in past times often caused the river to change course.

The river passes through Stoke-on-Trent, Burton upon Trent and Nottingham before joining the River Ouse at Trent Falls to form the Humber Estuary, which empties into the North Sea between Hull in Yorkshire and Immingham in Lincolnshire. The wide estuary is a traditional boundary between northern England and the Midlands.

6.2.2 History of Flooding

The Trent is widely known for its tendency to cause significant flooding along its course, and there is a well-documented flood history extending back over 900 years.

In Nottingham, the heights of significant historic floods from 1852 have been carved into a bridge abutment next to Trent Bridge, with flood marks being transferred from the medieval Hethbeth bridge that pre-dated the existing 19th-century crossing. Historic flood levels have also been recorded at Girton and on the churchyard wall at Collingham.

One of the earliest recorded floods along the Trent was in 1141, and like many other large historical events was caused by the melting of snow following heavy rainfall. The flood also caused a breach in the outer flood bank at Spalford, which has been used historically to assess the magnitude of flooding incidents, as it has been estimated that the bank only failed when flows were greater than 1,000 m³/s were achieved. The bank was also reported to have breached in 1403 and 1795.

Flooding on the Trent has also been attributed to the effects of storm surges independently of fluvial flows, a series of which occurred during October and November 1954.

The storm surges resulted in the worse tidal flooding experienced along the lower reaches and revealed the need for a tidal protection scheme, which would cope with the flows experienced in 1947 and the tidal levels from 1954. Subsequently the flood banks and defences along the lower river were improved to this standard with the works being completed in 1965.

In December 2013, the largest storm surge since the 1950s occurred on the Trent, when a high spring tide combined with strong winds and a low-pressure weather system, produced elevated tidal river levels in the lower reaches. The resulting surge overtopped the flood defences in the area near Keadby and Burringham, flooding 50 properties.

6.2.3 Environment Agency Flood Data

i. Flood Defences

Information in regard to flood defences, indicates that an earth embanked flood defence follows the route South Muskham Church (St Wilfrid's) and Slake Lane.

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- Asset reference: 54,549
- Design standard of protection: 1 in 50 years
- Upstream Crest Level = 11.613mAOD
- Downstream Crest Level = 11.136mAOD
- Overall condition grade = 2 (good – minor defects)

ii. Historic Flood Mapping

The Environment Agency indicate that the application site is located outside of the recorded historic flooding events.

iii. Flood Extents

The Modelled Flood Outlines Map provided covers the proposed development site, and indicates that the plot lies outside of the flood extent predicted for all events with the exception of the 1 in 1000-year flood extent (based on the model data for the (Trent and Tributaries at Newark SFRM2, Halcrow July 2011).

iv. Modelled Flood Levels (In-channel)

The nearest node to the site using the available information is identified to be Node Ref. 403521868.

Modelled water levels for the River Trent at Node Ref. 403521868 are provided below, and a copy of the data can be found within Appendix B & C of this report.

Table 6: River Trent Modelled In-Channel Water Levels at Node Ref. 403513420

| Return Period | Modelled Water Level (mAOD) | Modelled Flow (m ³ /s) |
|------------------------|-----------------------------|-----------------------------------|
| 1 in 5 year | 10.28 | 389.64 |
| 1 in 10 year | 10.52 | 419.11 |
| 1 in 20 year | 10.68 | 428.30 |
| 1 in 50 year | 10.96 | 431.10 |
| 1 in 75 year | 11.03 | 430.71 |
| 1 in 100-year | 11.14 | 430.48 |
| 1 in 100-year + 20% CC | 11.41 | 446.60 |
| 1 in 200-year | 11.26 | 433.04 |
| 1 in 1000-year | 11.63 | 471.03 |

The topographical survey indicates the following existing ground levels on-site:

- East Boundary: 10.916 – 11.415mAOD (within red-line boundary)
- East Boundary: 11.296 – 11.536mAOD (road levels external to the site)
- West Boundary: 11.011 – 11.415mAOD
- North Boundary: 10.916 - 11.011mAOD
- Low Point: 10.916mAOD (north east corner)

Comparing the levels directly indicates that the south corner of the site is marginally lower than the 1 in 1000-year in-channel flood level for the River Trent; with a difference in level of 0.215m.

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In the event of overtopping, flood water expands outwards away from the river banks and/or flood defences. Water levels within the flood plain are therefore typically lower than those within the channel of the watercourse. The Environment Agency has provided details of 2D modelling, which takes account of this occurrence.

The details of which have been used to further assess flood risk at the application site.

v. 2D Flood Depth – 1 in 100-year

Current mapping indicates a flood level east of the existing flood embankment of 10.89mAOD; and 11.19mAOD to the south-west side of the A616. These flood levels are lower than existing ground levels on-site.

The site is therefore unlikely to be impacted during this return period flood event.

vi. 2D Flood Depth – 1 in 100-year + 20% Climate Change

Current mapping indicates a flood level at Great North Road (east site boundary) of 11.01mAOD. The surveyed road level adjacent to the site is 11.296mAOD; and therefore, it is anticipated that flood water is not able to ingress into the development from the east boundary.

2D flood levels from the south west side of the site reach 11.45mAOD; and mapping indicates that the flood envelope associated with the 2D 1 in 100-year plus 20% climate change scenario terminates at the A616; and does not reach the application site.

It is therefore anticipated that with increased water levels associated with climate change, there is likely to be negligible impact at the proposed development site.

vii. 2D Flood Depth – 1 in 1000-year

Current mapping suggests that flood waters enter the site during the extreme 1 in 1000-year event via the north boundary; at a level approximating 11.13mAOD.

Existing ground levels external to the north boundary associated with 'The Garage House' range between 11.132mAOD (north east corner) and 11.123mAOD, with a brick wall forming the boundary.

Figure 6.1 overleaf illustrates the difference in level between The Garage House and the neighbouring commercial site along its northern boundary.

It is noted that the application site is located to the south side of The Garage House.

Levels within the north boundary of The Garage House site range between 11.078mAOD at the driveway access to 10.598mAOD to the rear of the stable building, illustrating a drop-in level between the existing development north of the application site, between 100 and 600mm.

The brick wall boundary extends 7 courses (approximately 0.5m) above the car park area associated with the commercial development across the full width of the site; and provides a physical boundary to flooding from the north.

The level in the centre of the highway at the location of the driveway into The Garage House is 11.225mAOD; and as such notwithstanding the opportunity for seepage through the

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boundary wall, existing ground levels are such that there is no viable flow route into the site during the 1 in 1000-year flood event.

**Figure 6.1: Existing Boundary between The Garage House & Commercial Site
(North of the Application Site)**



Source: Google Maps

The access track located along the west boundary of the site is elevated above 11.13mAOD; and therefore there is also no route into the site from this direction.

viii. Conclusion

The 2D modelling information indicates that flood risk at the development site during the 1 in 1000-year flood event within the River Trent.

However, following detailed review of flood levels and ground levels surrounding the development site, it is apparent that there is no viable route for flooding to encroach into the site from the northern site boundary.

As such it is concluded that the application site off Great North Road has a low risk from fluvial/tidal flooding associated with the River Trent; and as such is actually located within Flood Zone 1.

However, it is noted that removal of the brick wall along the north boundary of the residential plot known as The Garage House will increase the risk of flooding at the site from low to medium risk.

6.3 Surface Water Runoff

The development involves construction of a single residential dwelling within land adjacent to The Garage House.

The site undeveloped and is not currently drained.

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6.3.1 Sustainable Urban Drainage Systems (SUDS)

In accordance with the Flood Water and Management Act 2010; there is a requirement to incorporate sustainable drainage systems i.e. SUDS into new development.

SUDS act to reduce the impact of surface water runoff from the development by limiting runoff volumes and rates from leaving the site.

Undertaking an assessment using the SUDS Planner Module within MicroDrainage Windes revealed that a number of different methods would be suitable for inclusion within the surface water management system for the site.

A summary of the results is tabulated below.

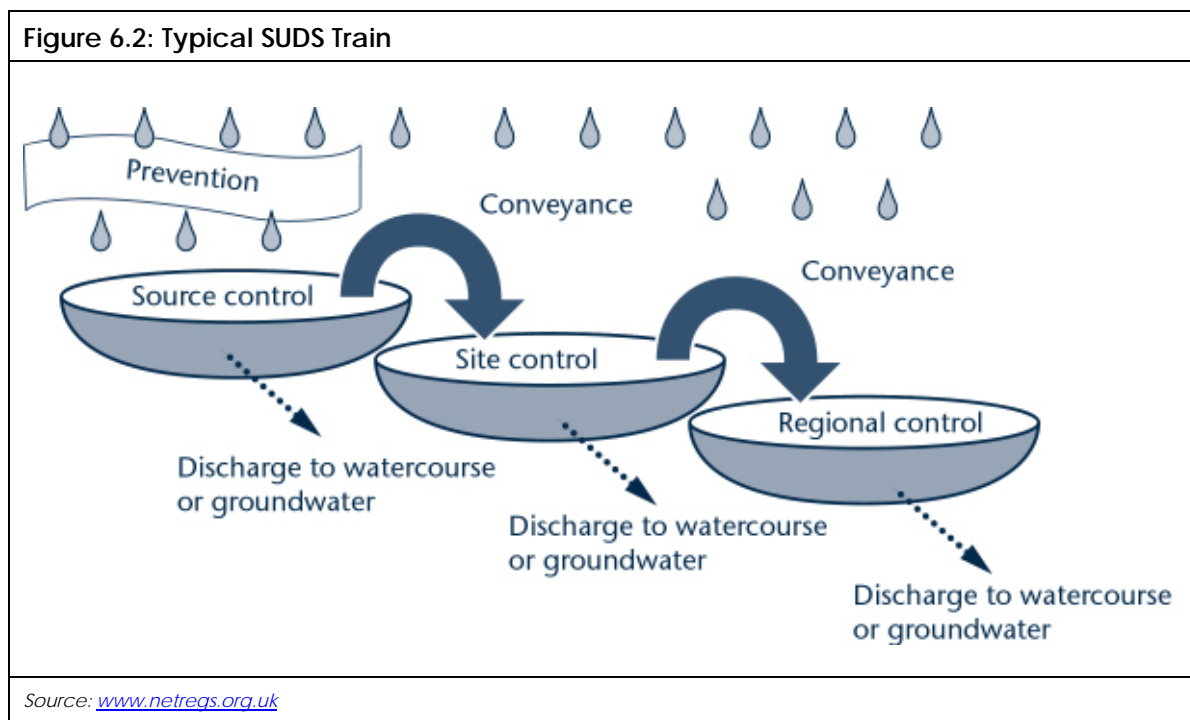


Table 7: SUDS Planner

| SUDS Criteria | Rank 1 | Rank 2 | Rank 3 |
|-------------------------|-------------------------------------|------------------------------|-------------------------------|
| Hydrological | Permeable Pavements | Infiltration Trench/Soakaway | Infiltration Basin |
| Land Use | Infiltration Trench/Soakaway | Bioretention Area | Infiltration Basin |
| Site Features | Permeable Pavements | Green Roofs | Filtration Techniques |
| Community & Environment | Online/Offline Storage | Grassed Filter Strips | Bioretention Area |
| Economics & Maintenance | Wet Ponds | Grassed Filter Strips | Dry Detention |
| Total | Infiltration Trench/Soakaway | Permeable Pavements | Online/Offline Storage |

It is noted that the precise combination of methods used will be dependent upon the site constraints identified at the final design stage; and it is the developer's decision to include or exclude such methods.

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A copy of the SUDS Planner is provided for reference within Appendix E.

or smaller residential developments, there is also the option of installing rainwater re-use i.e. rainwater harvesting or rain butts, to offer a sustainable approach to dealing with rainwater management at the site.

6.4 Residual Flood Risk

Flood risk attributed to fluvial sources from overtopping of the river banks and earth embanked flood defences is considered to be low; however, will be increased if ever the physical boundary i.e. brick wall extending across the north boundary associated with The Garage House to the north of the development is removed.

Given the proximity of the area understood to be impacted by flooding within South Muskham it is considered prudent to incorporate some mitigation into the building design to ensure that the building and people are safe from the risk of fluvial flooding both now and in the future.

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7.0 Mitigation Measures

7.1 Finished Development Levels

In accordance with the NPPF, residential development within Flood Zone 1, ground floor levels should be set a minimum of 150mm above the external ground level.

However, given the proximity of development/land impacted by Flood Zone 2 i.e. the 1 in 1000-year event, it is considered prudent to lift finished floor levels to **300mm above external ground level.**

To assist with development proposals for the proposed residential dwelling, it is highly recommended that a single storey or bungalow type dwelling at this location is avoided.

7.2 Resistance/Resilience Measures

Due to the proximity of the proposed development to areas affected by flooding from the River Trent, the developer has the option to incorporate measures into the building which act to provide resistance/resilience to flooding, in the event that modelled flood levels are ever exceeded.

Such measures are typically incorporated within the ground floor level of the building design and are put forward in accordance with 'Development and Flood Risk Guidance for the Construction Industry' CIRIA C624, London 2004; and 'Improving the Flood Performance of New Buildings' (CLG 2007).

Full details of manufacturers or suppliers of flood protection equipment may be obtained from the Flood Protection Association (website: www.thefpa.org.uk).

Table 8: Typical Flood Proofing Measures

| Feature | Considerations To Improve Flood Proofing |
|--------------------------------|---|
| External Walls | Careful consideration of materials: use low permeability materials to limit water penetration if dry proofing required. Avoid using timber frame and cavity walls. Consider applying a water-resistant coating. Provide fitting for flood boards or other temporary barriers across openings in the walls. |
| Internal Walls | Avoid use of gypsum plaster and plasterboards; use more flood resistant linings (e.g. hydraulic lime, ceramic tiles). Avoid use of stud partition walls. |
| Floors | Avoid use of chipboard floors. Use concrete floors with integrated and continuous damp proof membrane and damp proof course. Solid concrete floors are preferable; if a suspended floor is to be used, provide facility for drainage of sub-floor void. Use solid insulation materials. |
| Fitting, Fixtures and Services | If possible, locate all fittings, fixtures and services above design floor level. Avoid chipboard and MDF. Consider use of removable plastic fittings. Use solid doors treated with waterproof coatings. Avoid using double-glazed window units that may fill with flood water. Use solid wood staircases. Avoid fitted carpets. Locate electrical, gas and telephone equipment and systems above flood level. Fit anti-flooding devices to drainage systems. |

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7.3 Access and Egress

The Environment Agency Flood Map and modelled flood levels indicate that the access routes leading away from the site within the village are situated within fluvial Flood Zones 2 & 3 and as such may become inundated during flood conditions within the River Trent.

Evacuation away from the property may become compromised in flood conditions. It has been recommended that the dwelling has more than 1No storey; and therefore, a safe place of refuge will be available to the residents at all times within the proposed dwelling.

It is recommended however that prospective residents are advised to prepare a personal flood plan in accordance with Environment Agency Advice.

A copy of an example Personal Flood Plan is provided within the Appendices.

7.4 Flood Warning

It has been determined that currently there is a low risk of flooding to the proposed development from fluvial sources.

The site is covered by the Environment Agency's Flood Warning's Direct Service.

It is therefore highly recommended that new residents register an interest in receiving such warnings, so that they will be able to receive notice of flood events in the area, enabling them to take the necessary action to evacuate away from the property as necessary.

The Environment Agency also provides the **Floodline 0845 988 1188** service, where occupants can listen to recorded flood warning information for the area or speak to an operator for advice 24 hours a day.

Using the latest available technology, the Environment Agency is able to monitor rainfall, river levels and sea conditions 24 hours a day and use the information to forecast the possibility of flooding.

If flooding is forecast, they are able to issue alerts using a set of three different types, described within Table 9 overleaf.

Flood Warnings/Alerts can be accessed online via the following:

- Three-day flood risk forecast
- River and sea levels
- Floodline Warnings Direct - FREE flood warning service
- Flood warnings on Facebook
- Live Flood Warning map

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Figure 7.1: Environment Agency Flood Warning/Alert Coverage Map



Source: <https://www.riverlevels.uk/flood-warning-river-trent-at-south-muskham-and-little-carlton#.WWZb2tTyuHs>


Table 9: Environment Agency Flood Warning Codes

| Flood Warning Code | What it means | When it's used | What to do |
|---|--|--|---|
|  FLOOD ALERT | Flooding is possible. Be Prepared | 2 hours – 2 days in advance of flooding. | <ul style="list-style-type: none"> • Be prepared to act on your flood plan • Prepare a flood kit • Monitor local water levels and the flood forecast of the EA website |
|  FLOOD WARNING | Flooding is expected. Immediate action is required. | ½ hour – 1 day in advance of flooding. | <ul style="list-style-type: none"> • Move people to a safe place • Turn off gas, electricity and water supplies if safe to do so • Put flood protection equipment in place |

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| | | | |
|---|---|---|--|
|  | <p>Severe flooding. Danger to life.</p> | <p>When flooding poses a significant threat to life.</p> | <ul style="list-style-type: none"> • Stay in a safe place with means of escape • Be ready to evacuate • Co-operate with the emergency services • Call 999 if you are in immediate danger |
| <p>Warnings no longer in force</p> | <p>No further flooding is currently expected in your area</p> | <p>When river or sea conditions begin to return to normal</p> | <ul style="list-style-type: none"> • Be careful as flood water may still be around for several days • If you have been flooded, ring your insurance company as soon as possible |

7.5 Evacuation Plan

For health and safety reasons there is a preference to evacuate, as failure to do so, would put residents; visitors and others (e.g. rescuers) at risk of injury.

Due to the proximity of the River Trent, it is highly recommended that a personal flood plan, incorporating a strategy for evacuation away from the proposed dwelling is prepared by the residents.

During evacuation, all persons should move away from the site towards an area outside of the floodplain i.e. Flood Zone 1, where shelter, food and support may be reached.

The EA Flood Map indicates that much of the area surrounding South Muskham is likely to be impacted in the event of an extreme 1 in 1000-year flood event.

Evaluation of evacuation routes:

- SOUTH: The route south away from the site along the B6325/A16 Great North Road to Newark must cross the River Trent, and a significant portion of the route is located within Flood Zone 3 i.e. high-risk flood area. It is concluded that this route should be avoided.
- WEST: The route west away from South Muskham follows the A616 Ollerton Road. The route away from the site passes through an area of high flood risk (Flood Zone 3) at Moorside, however it is apparent from the latest flood maps, that flood defences provide some protection against flooding at this location. A second area of high risk occurs at Caunton, which is not defended. It is advised that this route is not suitable as an evacuation route and therefore should be avoided during flood conditions.
- EAST: All routes east direct people towards the River Trent, via various routes which have a high flood risk, and therefore should be avoided.
- NORTH: B6325/A16 Great North Road traverses through areas as far as Cromwell within Flood Zones 1 and 2, and is therefore considered to be the safest route away from South Muskham if evacuation is required. St Giles Church within the village of Cromwell is shown to lie within Flood Zone 1.

Level 2 Scoping Study Flood Risk Assessment

Land adjacent to 'The Garage House' at Great North Road, South Muskham

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Practical advice in developing a flood warning and evacuation plan is provided via the following:

- Government Webpages 'Prepare for Flooding'
<https://www.gov.uk/prepare-for-flooding/future-flooding>
- Download a personal flood plan template
<https://www.gov.uk/government/publications/personal-flood-plan>

It is advised that pedestrian travel through water depth in excess of 300mm; and vehicle travel in water depths over 600mm is considered extremely hazardous and must be avoided.

In the event that onset of flooding is rapid and the property becomes enclosed by flooding before safe evacuation is considered possible i.e. hazardous water depths are reached, it is recommended that people should retreat to the upper floors of the dwelling, which will provide a safe place of refuge, until rescue is possible, or significant reduction in water levels occurs (whichever is first).

Level 2 Scoping Study Flood Risk Assessment

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8.0 Conclusions & Recommendations

The proposed development is located at land adjacent to The Garage House in the Newark village of South Muskham.

Proposals incorporate construction of a single residential dwelling within the site; and is shown to be located within Flood Zone 2 of the Environment Agency Flood Map.

The primary source of flood risk to the development are identified to be the River Trent.

Environment Agency data for the River Trent has been made available to provide a detailed site-specific assessment of flood risk from the River Trent.

Records indicates that the application site lies outside of the recorded extent of historic flood events.

Detailed evaluation of modelled flood levels for the River Trent against known site levels; and also, levels surrounding the development site indicates that the site has a lower risk of inundation than originally anticipated.

This is due to a brick wall providing a physical barrier against flood waters entering the site via the north boundary.

It is concluded that its current status is Flood Zone 1 i.e. low risk, however in the event that the existing barrier is removed, flood risk at the site will be increased to medium risk, as per the current flood map.

Secondary sources of flooding such as artificial water sources; overland flows; and ponding have been investigated; and are deemed to present a low risk of flooding to the proposed development.

Owing to the flood risk at South Muskham associated with the River Trent, it is recommended that suitable mitigation is incorporated into the development plan to make the dwelling and people safe from fluvial (river) flooding, as follows:

- Finished floor levels set at a minimum of 300mm above external ground levels.
- Flood resistance/resilience measures recommended for minimizing ingress associated with flood water is incorporated into the ground floor building design.
- Due to proximity to the River Trent it is recommended that residents register to receive Environment Agency Flood Warnings/Alerts.
- Residents must be encouraged to complete a personal flood plan.
- Evacuation from the property should be undertaken if advised by the Police, Environment Agency or other emergency service.
- Safe place of refuge to be designed into the new dwelling to provide a high place outside of the flood waters where residents can get to if onset of flooding is too rapid or flood waters are too deep for safe evacuation to occur.
- Surface Water Management – surface water to be managed using sustainable methods, where appropriate. Methods such as rainwater re-use is encouraged and should be considered.

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APPENDICES

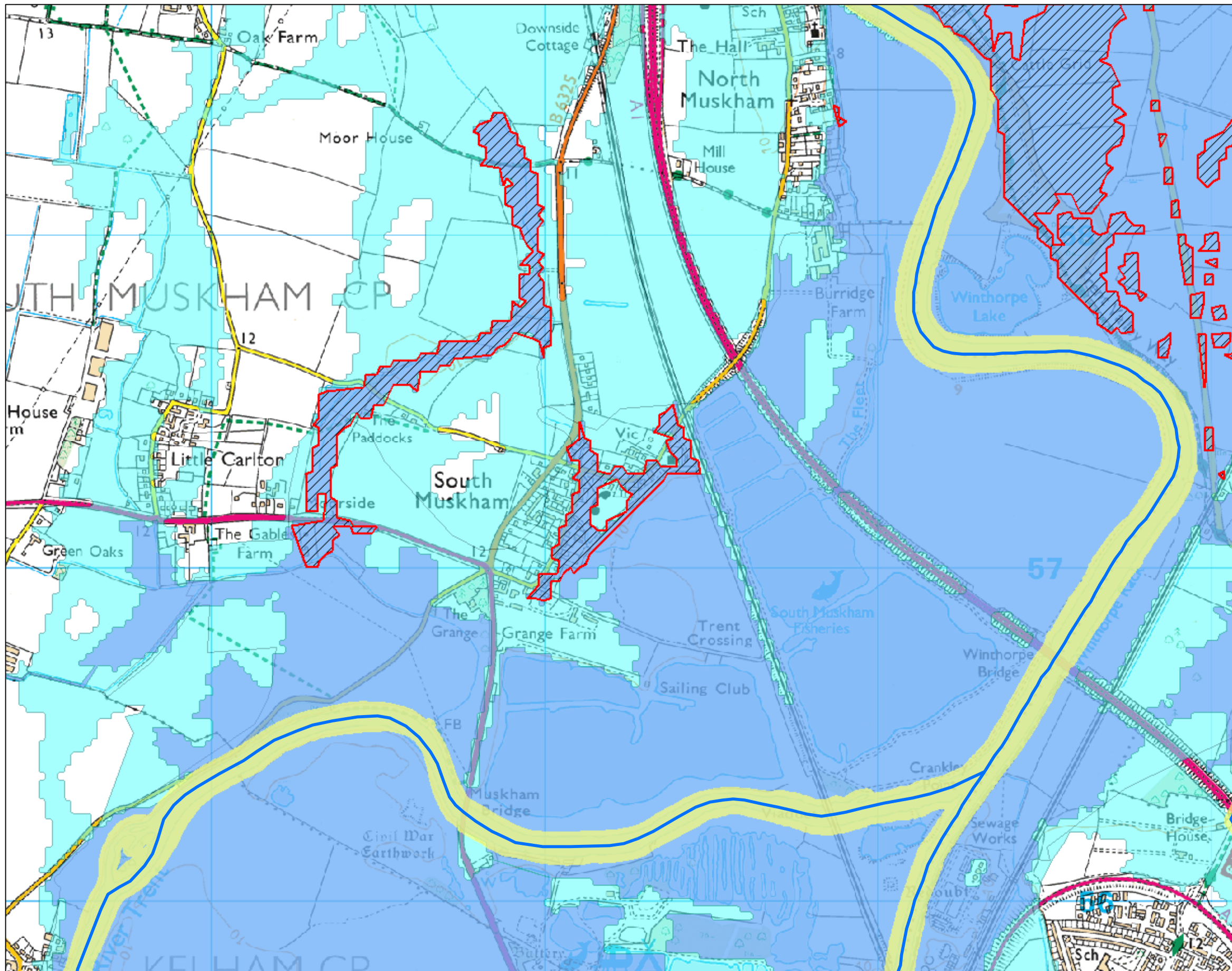
Level 2 Scoping Study Flood Risk Assessment

Land adjacent to 'The Garage House' at Great North Road, South Muskham

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Appendix A: - Environment Agency Data







Detailed FRA/FCA Map centred on South Muskham, Newark - created 22 June 2017 Ref: [EMD49917]



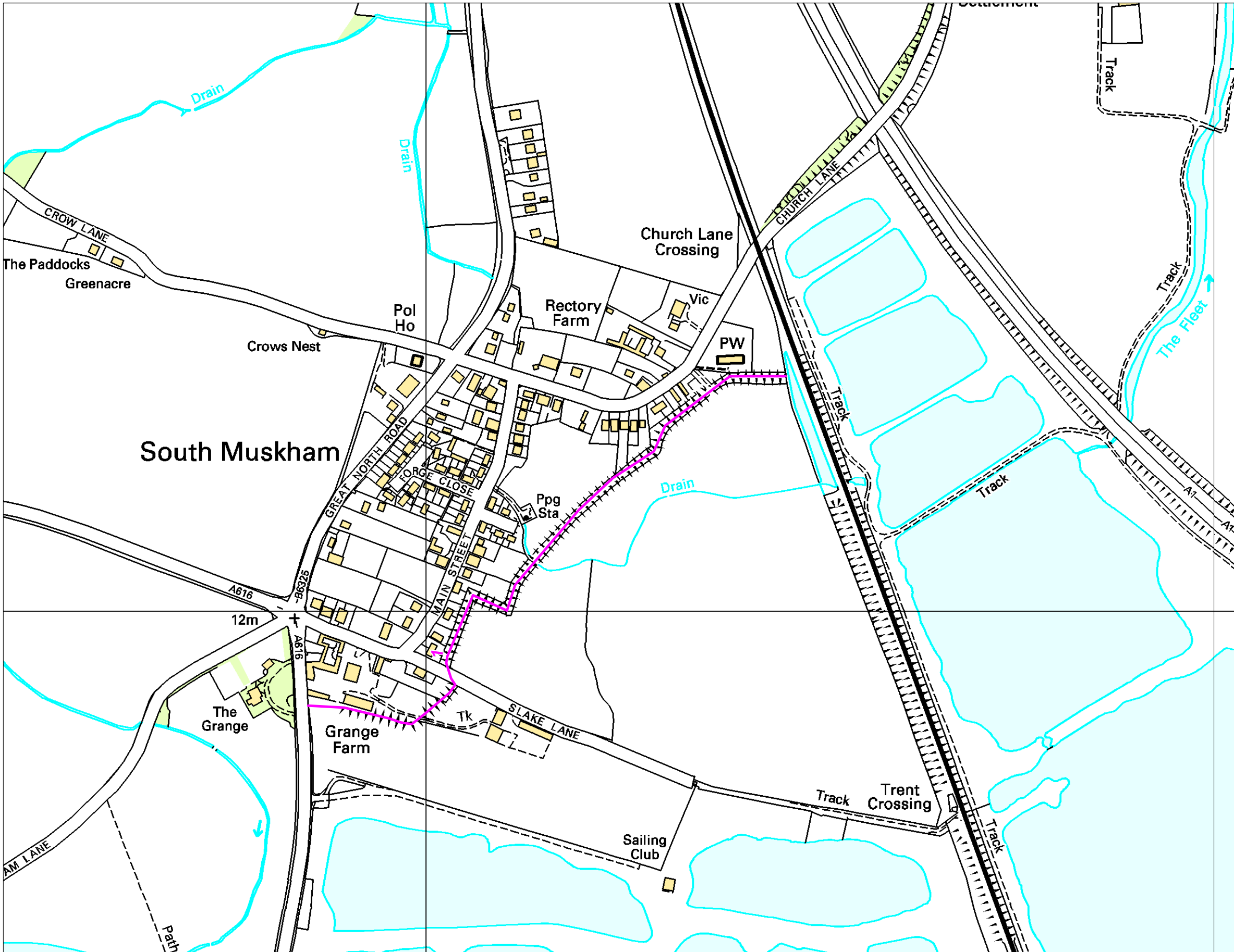
Scale 1:10,000



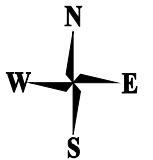
Legend

-  Main River
-  Areas Benefiting from Defences
-  Flood Storage Areas
-  Bank Top Eplanning Tool
-  1% (1 in 100 year) floodplain
-  0.1% (1 in 1000 year) floodplain

Defences Map centred on South Muskham, Newark - created 22 June 2017 Ref: [EMD49917]



Scale 1:5,000



Legend

 Flood Defence Locations

A Strategic Flood Risk Assessment may be available, providing further information for this site. Please contact your Local Planning Authority to access this information as it will need to be considered within any Flood Risk Assessment submission.

Ref: EMD49917

Modelled Information

The following information, including the modelled extents mapping, has been produced including the effect of any local defences.

| Node point reference | Location | 20% (1 in 5 year) modelled level (mAOD) | 20% (1 in 5 year) modelled flow (m ³ /s) | 10% (1 in 10 year) modelled level (mAOD) |
|----------------------|----------------|---|---|--|
| 403522373 | SK 78212 56486 | 10.43 | 381.69 | 10.66 |
| 403521868 | SK 78601 56515 | 10.28 | 389.64 | 10.52 |
| 403521868a | SK 78681 56412 | 10.27 | 392.38 | 10.50 |

Source: Trent and Tributaries at Newark SFRM2, Halcrow, July 2011

| Node point reference | Location | 10% (1 in 10 year) modelled flow (m ³ /s) | 5% (1 in 20 year) modelled level (mAOD) | 5% (1 in 20 year) modelled flow (m ³ /s) |
|----------------------|----------------|--|---|---|
| 403522373 | SK 78212 56486 | 399.25 | 10.82 | 402.40 |
| 403521868 | SK 78601 56515 | 419.11 | 10.68 | 428.30 |
| 403521868a | SK 78681 56412 | 427.78 | 10.67 | 444.18 |

Source: Trent and Tributaries at Newark SFRM2, Halcrow, July 2011

| Node point reference | Location | 2% (1 in 50 year) modelled level (mAOD) | 2% (1 in 50 year) modelled flow (m ³ /s) | 1.33% (1 in 75 year) modelled level (mAOD) |
|----------------------|----------------|---|---|--|
| 403522373 | SK 78212 56486 | 11.06 | 404.13 | 11.14 |
| 403521868 | SK 78601 56515 | 10.96 | 431.10 | 11.03 |
| 403521868a | SK 78681 56412 | 10.93 | 462.14 | 11.00 |

Source: Trent and Tributaries at Newark SFRM2, Halcrow, July 2011

| Node point reference | Location | 1.33% (1 in 75 year) modelled flow (m ³ /s) | 1% (1 in 100 year) modelled level (mAOD) | 1% (1 in 100 year) modelled flow (m ³ /s) |
|----------------------|----------------|--|--|--|
| 403522373 | SK 78212 56486 | 404.42 | 11.24 | 405.02 |
| 403521868 | SK 78601 56515 | 430.71 | 11.14 | 430.48 |
| 403521868a | SK 78681 56412 | 467.53 | 11.11 | 475.52 |

Source: Trent and Tributaries at Newark SFRM2, Halcrow, July 2011

| Node point reference | Location | 0.5% (1 in 200 year) modelled level (mAOD) | 0.5% (1 in 200 year) modelled flow (m ³ /s) | 0.1% (1 in 1000 year) modelled level (mAOD) |
|----------------------|----------------|--|--|---|
| 403522373 | SK 78212 56486 | 11.36 | 406.42 | 11.72 |
| 403521868 | SK 78601 56515 | 11.26 | 433.04 | 11.63 |
| 403521868a | SK 78681 56412 | 11.23 | 493.80 | 11.60 |

Source: Trent and Tributaries at Newark SFRM2, Halcrow, July 2011

| Node point reference | Location | 0.1% (1 in 1000 year) modelled flow (m ³ /s) | 1% + 20% flow (1 in 100 year plus climate change) modelled level (mAOD) | 1% + 20% flow (1 in 100 year plus climate change) modelled flow (m ³ /s) |
|----------------------|----------------|---|---|---|
| 403522373 | SK 78212 56486 | 427.29 | 11.50 | 408.11 |
| 403521868 | SK 78601 56515 | 471.03 | 11.41 | 446.60 |
| 403521868a | SK 78681 56412 | 552.35 | 11.37 | 520.24 |

Source: Trent and Tributaries at Newark SFRM2, Halcrow, July 2011

Please note: The flows provided represent in channel flow only and do not take into account flow on the floodplain.

On 19th February 2016, the [Flood risk assessments: climate change allowances'](#) was published on www.gov.uk website. It has replaced previous guidance [Climate Change Allowances for Planners](#).

The climate change guidance can be found at: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>
If your RFI is to assist with a Flood Risk Assessment (FRA) for a future planning application, please review this guidance to consider which allowances should be used for your site. The climate change allowance provided with this RFI is a 20% increase in the peak river flow for the 1% Annual Exceedance Probability (1 in 100 year) scenario.

EMD49917 Defence Information

| Defence ID | Asset Reference | Design Standard | D/S Crest Level (mAOD) | U/S Crest Level (mAOD) | Overall Condition Grade |
|-------------------|------------------------|------------------------|-------------------------------|-------------------------------|--------------------------------|
| 1 | 54,549 | 50 | 11.136 | 11.613 | 2 |

EMD49917 Historic Information

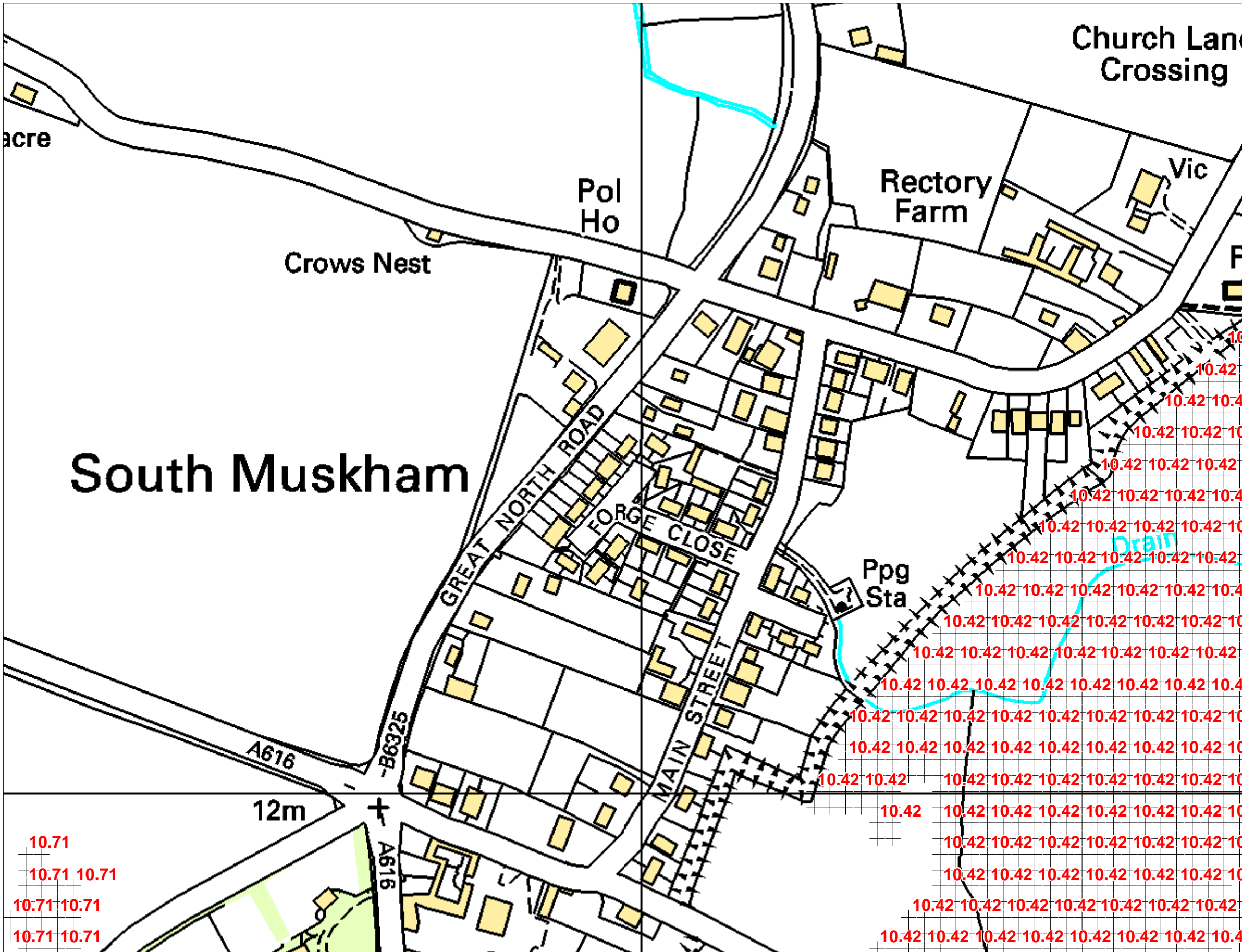
We have no records of historic fluvial flooding at this location. However, we would advise that this does not mean there has never been historic flooding in this location or that the area is automatically free from a risk of flooding. We do not claim that all flood events have been recorded.

Open Data

The below datasets are now classed as Open Data and as such can be downloaded free of charge under an open data licence from the following address: <https://data.gov.uk/publisher/environment-agency>

- Risk of Flooding from Rivers and Sea (RoFRS) data
- LiDAR Data
- Flood Map for Planning (Rivers and Sea)
- Historic Flooding Data

Floodplain Heights Map centred on South Muskham, Newark - created 22 June 2017 Ref: [EMD49917]



Scale 1:2,500



Legend

x.xx

1 in 20 year
Floodplain Level (mAOD)

Source:
Trent and Tributaries at Newark SFRM2,
Halcrow, July 2011

A Strategic Flood Risk Assessment may be available, providing further information for this site. Please contact your Local Planning Authority to access this information as it will need to be considered within any Flood Risk Assessment submission.

Floodplain Heights Map centred on South Muskham, Newark - created 22 June 2017 Ref: [EMD49917]



Scale 1:2,500



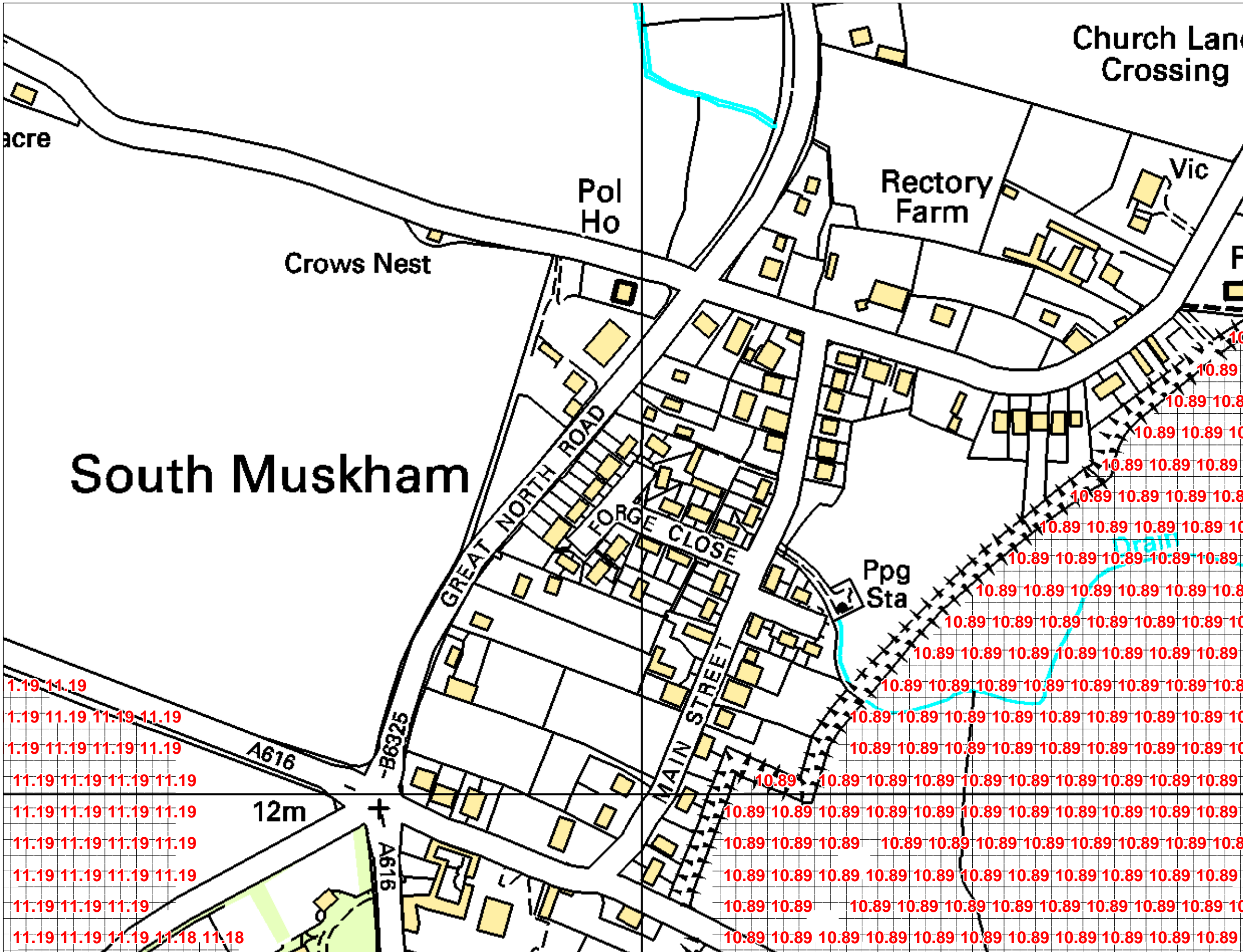
Legend

x.xx

1 in 100 year
Floodplain Level (mAOD)

Source:
Trent and Tributaries at Newark SFRM2,
Halcrow, July 2011

A Strategic Flood Risk Assessment may be available, providing further information for this site. Please contact your Local Planning Authority to access this information as it will need to be considered within any Flood Risk Assessment submission.



Floodplain Heights Map centred on South Muskham, Newark - created 22 June 2017 Ref: [EMD49917]



Scale 1:2,500



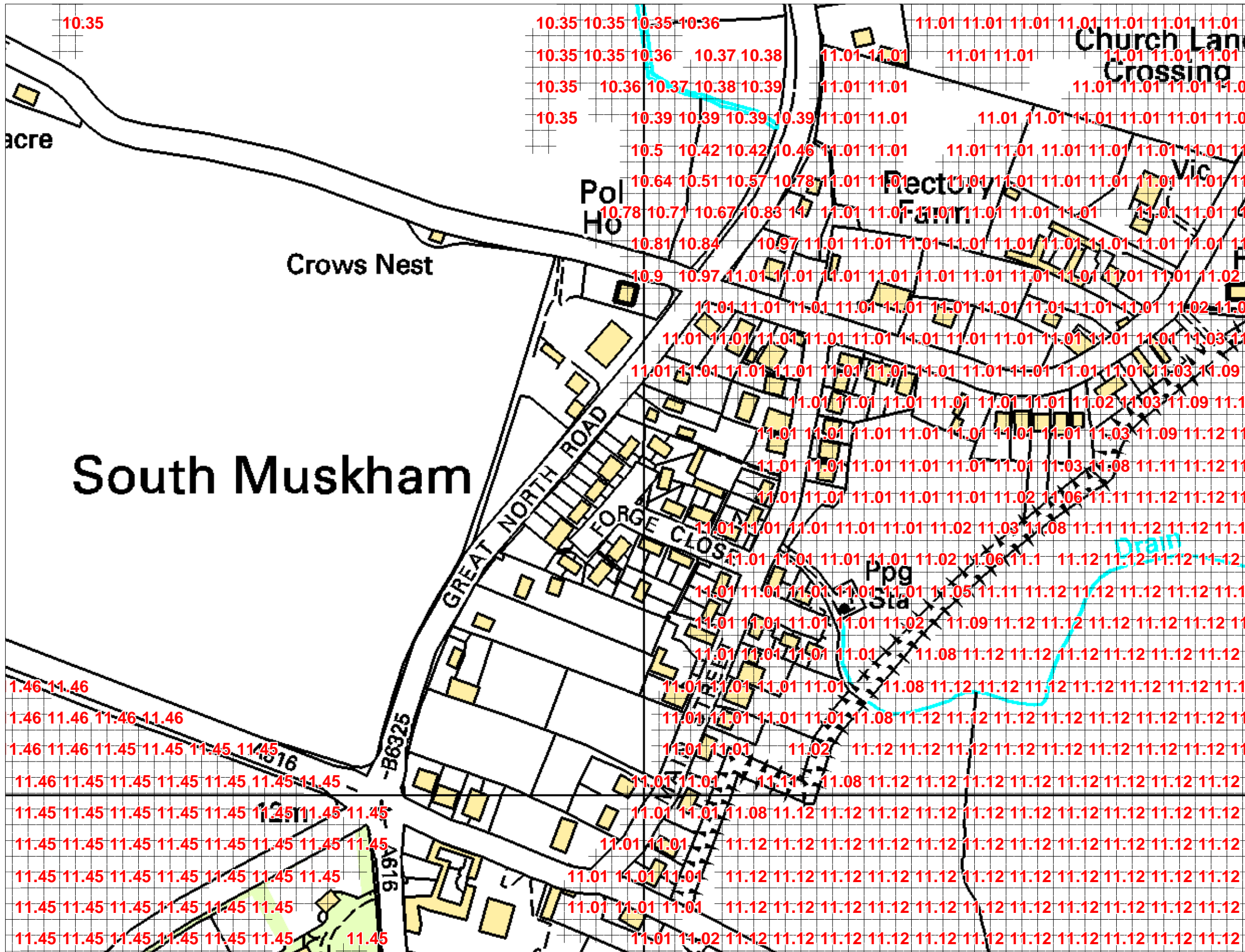
Legend

x.xx

1 in 100 year plus climate change
Floodplain Level (mAOD)

Source:
Trent and Tributaries at Newark SFRM2,
Halcrow, July 2011

A Strategic Flood Risk Assessment may be available, providing further information for this site. Please contact your Local Planning Authority to access this information as it will need to be considered within any Flood Risk Assessment submission.



Floodplain Heights Map centred on South Muskham, Newark - created 22 June 2017 Ref: [EMD49917]



Scale 1:2,500



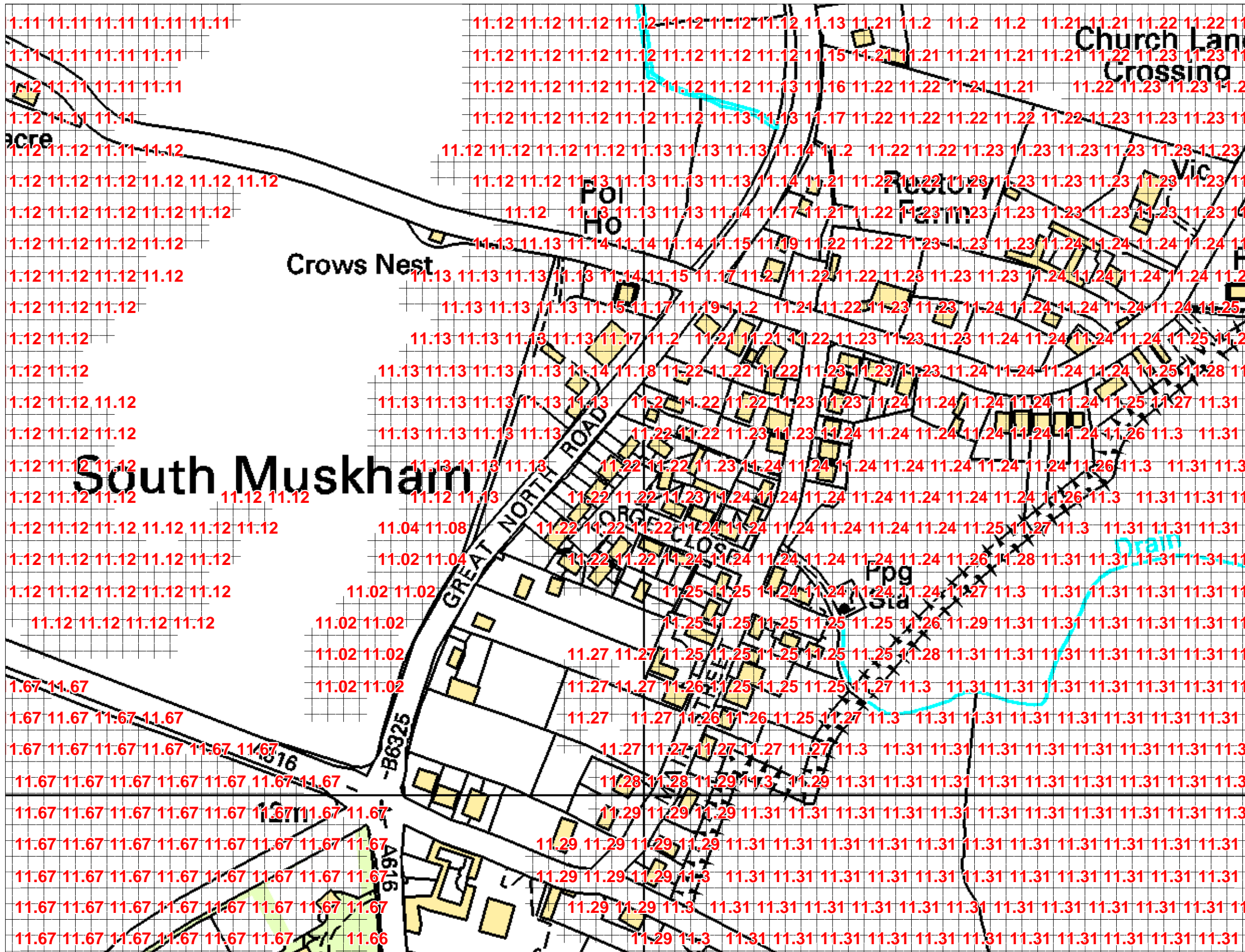
Legend

x.xx

1 in 1000 year
Floodplain Level (mAOD)

Source:
Trent and Tributaries at Newark SFRM2,
Halcrow, July 2011

A Strategic Flood Risk Assessment may be available, providing further information for this site. Please contact your Local Planning Authority to access this information as it will need to be considered within any Flood Risk Assessment submission.

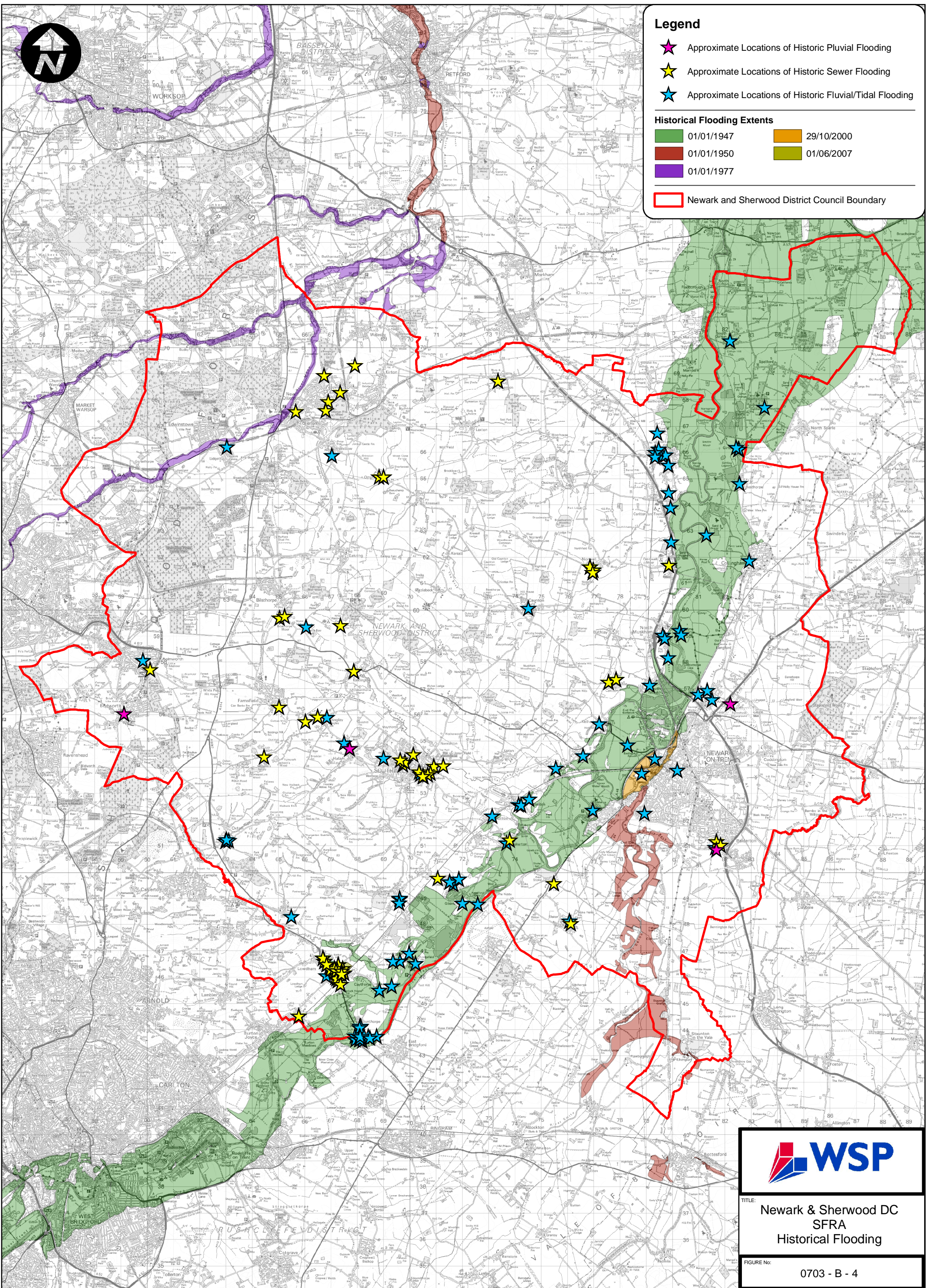


Level 2 Scoping Study Flood Risk Assessment

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Appendix B: - SFRA Mapping




Legend

- ★ Approximate Locations of Historic Pluvial Flooding
- ★ Approximate Locations of Historic Sewer Flooding
- ★ Approximate Locations of Historic Fluvial/Tidal Flooding

Historical Flooding Extents

| | | | |
|--|------------|--|------------|
| | 01/01/1947 | | 29/10/2000 |
| | 01/01/1950 | | 01/06/2007 |
| | 01/01/1977 | | |

Newark and Sherwood District Council Boundary

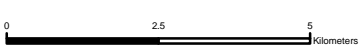


WSP

TITLE: Newark & Sherwood DC
SFRA
Historical Flooding

FIGURE No: 0703 - B - 4

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SCALE: 1:125,000

Level 2 Scoping Study Flood Risk Assessment

Land adjacent to 'The Garage House' at Great North Road, South Muskham

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Appendix C: -SUDS Planner

| | | |
|---|---|---|
| The Flood Risk Consultancy | | Page 6 |
| 20 Church Street Colne Lancashire BB8 0LG | Land at Great North Road South Muskham |  |
| Date 13/07/2017 18:36 File | Designed by DM Checked by | |
| XP Solutions | Source Control 2017.1.2 | |

SUDS Planner

Results

Ordered By Total

| | Quick Rank View | Hydrological | Land Use | Site Features | Total | Community and Environment | Economics and Maintenance |
|--------------------------------|--------------------|--------------|----------|------------------|-----------|---------------------------------|---------------------------------|
| Infiltration Trench / Soakaway | (1, 4, 8) | 18 (1st) | 5 (1st) | 30 (1st) | 53 (1st) | 16 (4th) | 20 (8th) |
| Pervious Pavements | (2, 4, 5) | 18 (1st) | 3 (8th) | 30 (1st) | 51 (2nd) | 16 (4th) | 22 (5th) |
| Online / Offline Storage | (3, 1, 8) | 16 (4th) | 4 (2nd) | 30 (1st) | 50 (3rd) | 20 (1st) | 20 (8th) |
| Green Roofs | (4, 9, 2) | 16 (4th) | 3 (8th) | 30 (1st) | 49 (4th) | 14 (9th) | 24 (2nd) |
| Infiltration Basin | (5, 12, 8) | 18 (1st) | 4 (2nd) | 22 (10th) | 44 (5th) | 12 (12th) | 20 (8th) |
| Filter Drains | (6, 4, 11) | 14 (7th) | 2 (11th) | 26 (6th) | 42 (6th) | 16 (4th) | 18 (11th) |
| Grassed Swales | (7, 4, 5) | 14 (7th) | 3 (8th) | 24 (8th) | 41 (7th) | 16 (4th) | 22 (5th) |
| Filtration Techniques | (8, 4, 13) | 8 (11th) | 2 (11th) | 30 (1st) | 40 (8th) | 16 (4th) | 14 (13th) |
| Bioretention Area | (9, 2, 11) | 8 (11th) | 4 (2nd) | 26 (6th) | 38 (9th) | 18 (2nd) | 18 (11th) |
| Wet Ponds | (10, 9, 1) | 16 (4th) | 4 (2nd) | 14 (11th) | 34 (10th) | 14 (9th) | 26 (1st) |
| Grassed Filter Strip | (10, 2, 2) | 8 (11th) | 2 (11th) | 24 (8th) | 34 (10th) | 18 (2nd) | 24 (2nd) |
| Dry Detention | (12, 12, 2) | 14 (7th) | 4 (2nd) | 14 (11th) | 32 (12th) | 12 (12th) | 24 (2nd) |
| Stormwater Wetlands | (13, 9, 5) | 12 (10th) | 4 (2nd) | 14 (11th) | 30 (13th) | 14 (9th) | 22 (5th) |

Level 2 Scoping Study Flood Risk Assessment

Land adjacent to 'The Garage House' at Great North Road, South Muskham

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Appendix D: - Personal Flood Plan Template

Personal flood plan

Name



Are you signed up to receive flood warnings?

If not call Floodline on 0345 988 1188 to see if your area receives free flood warnings.

Let us know when you've completed your flood plan by calling Floodline on **0345 988 1188**. This will help us learn more about how people are preparing for flooding.

| General contact list | Company name | Contact name | Telephone |
|-------------------------------------|--------------------|--------------|---------------|
| Floodline | Environment Agency | | 0345 988 1188 |
| Electricity provider | | | |
| Gas provider | | | |
| Water company | | | |
| Telephone provider | | | |
| Insurance company and policy number | | | |
| Local council | | | |
| Local radio station | | | |
| Travel/weather info | | | |

Key locations

| Service cut-off | Description of location |
|-----------------|-------------------------|
| Electricity | |
| Gas | |
| Water | |

Who can help/who can you help?

| Relationship | Name | Contact details | How can they/you help? |
|---------------------|------|-----------------|------------------------|
| Relative | | | |
| Friend or neighbour | | | |

Be prepared for flooding. Act now

Personal flood plan

What can I do NOW?



Put important documents out of flood risk and protect in polythene

Look at the best way of stopping floodwater entering your property

Find out where you can get sandbags

Identify what you would need to take with you if you had to leave your home

Check your insurance covers you for flooding

Make a flood plan and prepare a flood kit

Identify who can help you/ who you can help

Understand the flood warning codes

What can you do if a flood is expected in your area?

| Actions | Location |
|---|----------|
| Home | |
| ● Move furniture and electrical items to safety | |
| ● Put flood boards, polythene and sandbags in place | |
| ● Make a list now of what you can move away from the risk | |
| ● Turn off electricity, water and gas supplies | |
| ● Roll up carpets and rugs | |
| ● Unless you have time to remove them hang curtains over rods | |
| ● Move sentimental items to safety | |
| ● Put important documents in polythene bags and move to safety | |
| Garden and outside | |
| ● Move your car out of the flood risk area | |
| ● Move any large or loose items or weigh them down | |
| Business | |
| ● Move important documents, computers and stock | |
| ● Alert staff and request their help | |
| ● Farmers move animals and livestock to safety | |
| Evacuation - Prepare a flood kit in advance | |
| ● Inform your family or friends that you may need to leave your home | |
| ● Get your flood kit together and include a torch, warm and waterproof clothing, water, food, medication, toys for children and pets, rubber gloves and wellingtons | |

There are a range of flood protection products on the market to help you protect your property from flood damage. A directory of these is available from the **National Flood Forum** at www.bluepages.org.uk

Be prepared for flooding. Act now