Dear Sir/Madam

Please find attached representations to the Rushcliffe City Council Local plan Part 2: Land and Planning Policies Publication Version made by Oxalis Planning on behalf of Bloor Homes in relation to Land west of Wilford Road Ruddington - Policy 6.1

It would be appreciated, if you would kindly confirm the receipt of this email.

Kind regards

Naheida Janjua
Please return by 5pm on Thursday 28 June 2018 to: Rushcliffe Borough Council
Rushcliffe Arena, Rugby Road
Nottingham
NG2 7YG

This form has two parts:

Part A – Personal details
Part B – Your representation(s). Please fill in a separate part B for each issue/representation you wish to make.

Please read the Representation Guidance Notes (available separately) and the Data Protection Notice (see below) before completing the form.

Part A (Please complete in full; in order for the Inspector to consider your representations you must provide your name and postal address).

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Representations must be received by 5pm Thursday 28 June 2018. Representations received after this time will not be considered duly made.
Part B (please use a separate Part B form for each representation)

Name/Organisation: Oxalis Planning on behalf of Bloor Homes

3a. To which document does your response relate? (please tick one)

- Local Plan Part 2 Publication Version
- Local Plan Part 2 Policies Map
- Other supporting document please state which:

3b. To which part of the document does this representation relate? (complete all that apply)

- Page no. 44
- Paragraph no. 3.72 - 3.76
- Policy ref. Policy 6.1: Housing Allocation – Land west of Wilford Road, Ruddington
- Site ref. Policy 6.1: Housing Allocation – Land west of Wilford Road, Ruddington
- Policies Map

4. Do you consider the Local Plan Part 2:

4(1) Legally compliant

Yes ✓ No

4(2) Sound

Yes No ✓

4(3) Complies with the Duty to Co-operate

Yes ✓ No

→ If you have selected No to Question 4(2), please continue to Question 5.
→ In all other circumstances, please go to Question 6.

What makes a Local Plan “sound”? 

Positively prepared - the plan should be prepared in a way that meets the need for housing and other development, including infrastructure and business development.

Representations must be received by 5pm Thursday 28 June 2018. Representations received after this time will not be considered duly made.
Justified – the plan should be based on evidence, and be the most appropriate strategy for the district when considered against other reasonable alternatives.

Effective – the plan should be deliverable; the housing and other development should be capable of being carried out.

Consistent with national policy – the plan should enable sustainable development and be consistent with the policies in the National Planning Policy Framework (NPPF).

5. If you consider the Development Plan is UNSOUND, do you consider this to be because it is NOT: (please tick all that apply)

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6. Please give reasons for you answer to Questions 4(1), 4(2), 4(3) and 5, where applicable. You may also use this box if you wish to make representations on one of the Local Plan Part 2’s supporting documents (e.g. Sustainability Appraisal, Habitat Regulations Assessment or Equalities Impact Assessment). You can attach additional information but please make sure it is securely attached and clearly referenced.

Please see attached Statement.

7. Please set out what change(s) you consider necessary to make the Local Plan Part 2 legally compliant or sound, having regard to your responses to Questions 5 and 6. You will need to say why this change will make the Local Plan Part 2 legally compliant or sound. It will be helpful if you could put forward your suggested revised wording of any policy or text. Please be as precise as possible.

(If you are suggesting that the Local Plan Part 2 is legally compliant or sound please write “Not applicable”).

Please see attached Statement.

8. If your representation is seeking a change, do you consider it necessary to participate at the hearing sessions of the Public Examination? (please tick one box only)
No, I do not wish to participate at the hearing session at the examination. I would like my representation to be dealt with by written representation

Yes, I wish to appear at the examination

If you have selected No, your representation(s) will still be considered by the independent Planning Inspector by way of written representations.

9. If you wish to participate at the hearing sessions of Public Examination, please outline why you consider this to be necessary:

To examine the land supply issues and site specific matters.

Please note: the Planning Inspector will determine the most appropriate procedure to adopt to hear those who have indicated that they wish to participate at the hearing session of the examination.

10. Please indicate if you wish to be notified that: (please tick all that apply)

The Local Plan Part 2 has been submitted for independent examination.

The recommendations of the Planning Inspector appointed to carry out the independent examination have been published.

The Local Plan Part 2 has been adopted

Date form completed 25/06/2018

Please return the completed form by no later than 5pm on Thursday 28 June 2018 to:

localdevelopment@rushcliffe.gov.uk; or

Planning Policy
Rushcliffe Borough Council
Rushcliffe Arena
Rugby Road,
Nottingham
NG2 7YG

(Electronic copies of this form are available to download at www.rushcliffe.gov.uk/planningpolicy).

If you have any questions, please contact the Planning Policy team by telephone on 0115 981 10

Representations must be received by 5pm Thursday 28 June 2018. Representations received after this time will not be considered duly made.
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Data Protection Notice

The personal information you provide will only be used by Rushcliffe Borough Council, the Data Controller, in accordance with General Data Protection Regulation 2016/Data Protection Act 2018 to undertake a statutory function (also known as a ‘public task’).

Your personal information will be shared with the Planning Inspectorate in connection with the above purpose.

Your personal data will be kept in accordance with the Council’s retention policy and schedule. Details of which can be found on the Council’s website at http://www.rushcliffe.gov.uk/retention_schedule/

Your data protection rights are not absolute and in most cases are subject to the Council demonstrating compliance with other statutory legislation, for further information see http://www.rushcliffe.gov.uk/privacy/

Representations will be available to view on the Borough Council’s website, but any signatures, addresses, email addresses or telephone numbers will not be included. However, as copies of representations must be made available for public inspection, comments cannot be treated as confidential and will be available for inspection in full.
Policy 6.1 Housing Allocation: Land west of Wilford Lane, Ruddington
CONTENTS

1.0 BACKGROUND TO HOUSING REQUIREMENTS IN RUDDINGTON

2.0 THE SUITABILITY OF LAND WEST OF WILFORD LANE, RUDDINGTON

ATTACHEMENTS:

A. ALLOCATION SITE ANALYSIS AND MASTERPLAN
B. TRANSPORT PROMOTIONAL DOCUMENT
C. FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY
1.0 Background to housing requirements in Ruddington

1.1 Land west of Wilford Road, Ruddington is a suitable and sustainable site for development and its proposed allocation under Policy 6.1 of the Plan is strongly supported.

1.2 Significant concerns have been raised in separate representation, in relation to the soundness of the Plan because it is considered that as set out it will not ensure the delivery of the housing requirement in full in the Plan Period. These issues are set out in detail under separate representations prepared by Oxalis Planning.

1.3 Within this context, land west of Wilford Road is essential to help to meet the unmet housing needs of the area. Whilst a recent decision on land at Asher Lane, Ruddington, will increase the supply of housing in Ruddington above that envisaged in the Publication Plan, it is considered that the village can and should accommodate significant levels of growth.

1.4 Ruddington is a large village with a wide range of services and facilities and excellent links with the Nottingham principle urban area. Compared to other villages of a similar size it is proposed to accommodate a relatively small level of growth. Even with the scheme at Asher Lane, development in Ruddington will be around 525 dwelling compared to over 1000 in Bingham and East Leake, 920 in Radcliffe, 600 in Keyworth and 840 in Cotgrave. Within this context it is considered that Ruddington can accommodate a greater level of growth.

2.0 The suitability of land west of Wilford Lane, Ruddington

2.1 The proposed allocation of land west of Wilford Lane, Ruddington is supported.

2.2 The site lies on the northern edge of the village, well related to existing development and the village centre. It is proposed that built development is contained within the line of the existing watercourse, which would be enhanced through additional planting to form a new defensible Green Belt boundary.

2.3 Considerable work has been undertaken to assess the suitability of the site for development and to consider the form in which development might be bought forward. Key aspects of this work have been summarised in an Allocation Site Analysis and Masterplan Document, which is appended to this Statement. This document summarises the site and landscape context, sets out an assessment of the visual amenity of the site and details the merits of the development of the site in Green Belt terms. The document then sets out and explains the approach to the concept masterplan for the site including the proposed detailed approach to key areas of the site.

2.4 The work undertaken also include assessment work in relation to Transport matters and Flood Risk Issues. This work is set out in a Transport Promotional Document and a Flood Risk Assessment and Drainage Strategy. These documents are also attached to this Statement in support of these representation.

2.5 In relation to Transport matters the Transport Document concludes that:

- The site is conveniently located for access to the local and wider highway networks.
- The site is well located to existing sustainable transport infrastructure and would be accessible for cyclists, pedestrians and public transport users.
- There is not considered to be any road safety issues associated with the scheme or the existing local highway network.

- A satisfactory access arrangement could be provided into the site from Wilford Road.

- The impact of associated development traffic on the operation and safety of the highway network is not considered to be ‘severe’.

2.6 The site is identified as being at risk from flooding and therefore detailed site specific assessment work has been undertaken. This includes the modelling of the watercourse, which has been agreed with the EA and the identification of suitable measures to mitigate the effects of the scheme and ensure that risks of flooding are not increased elsewhere. The FRA has been submitted to and agreed with the Environmental Agency. The key points are:

- Hydraulic modelling of the flood-extents were produced and agreed with the Environment Agency to update the understanding of the site and the issues;

- The drainage strategy proposed would successfully transfer the risk of flooding to land to the north of Packman Dyke (under Bloors’ control). The strategy would include a small diversion of the Dyke to create an attenuation feature with water quality and capacity benefits in the watercourse, together with biodiversity benefits;

- Through ground reprofiling and earth-works the development site (south of the Dyke) would all be 600mm above the 100 year, plus appropriate allowance for climate change, flood level (some parts of the site are already at or above this level), removing it from the flood plain;

- The overall drainage strategy described in the report would, in addition to removing the development site from the area at risk of flooding, also reduce the risk of flooding to nearby residential areas through capacity improvements and more regulated surface water drainage rates.

2.7 Correspondences from the Environmental Agency confirm that the modelling shows that the scheme would not increase the risk of flooding elsewhere and would provide for betterment.

2.8 It is considered therefore that the Council’s judgement in relation to the sequential test is correct. They have appropriately weighted in the balance flood risk matters with other sustainability and general planning criteria, which collectively weigh strongly in favour of land west of Wilford Road.

2.9 The NPPF is clear that its policies should be read as a whole and in relation to flood risk the NPPF and NPPG explain that it might not be possible to direct development to areas at lower risk of flooding ‘consistent with wider sustainability objectives’. It is our view that the Wilford Lane site scores extremely well in relation to other sustainability objectives, including the potential community benefits associated with the scheme.

2.10 These other community benefits, in addition to flood risk betterment and biodiversity enhancement, include the potential for significant areas of open space to the north of the watercourse. The Plans currently show the provision of additional mini football pitches, together with areas of biodiversity enhancement and new public footpaths.
RUDDINGTON

Allocation Site Analysis and Masterplan
Introduction

Bloor Homes Ltd control the “Land west of Wilford Road” to the north of Ruddington that the Publication Version of the Rushcliffe Local Plan Part 2: Land and Planning Policies proposes to remove from the Green Belt and allocate for the development of around 130 homes. They also control a further area of land to the immediate north of the allocation site.

The initial site assessments and masterplanning undertaken in relation to the site have confirmed that up to 160 dwellings, associated public open space and infrastructure can be provided in accordance with the terms of Policy 6.1. That includes the provision of a large area of Green Infrastructure to the north of the allocation site, where floodplain compensation will be provided to facilitate the residential development.

This report provides an explanation of the emerging Masterplan proposals, particularly in the context of the landscape character and visual amenity of the site and surrounding area, and the nature of the Green Belt in the area.

The emerging Masterplan proposals illustrate how the development of the site would deliver an attractive and sustainable development that respects and directly responds to the site’s features and its setting as a natural extension to Ruddington. Moreover, how in accordance with part c of Policy 6.1, it would provide a “visually attractive gateway to the village and boundary to the village”, and in accordance with part d of the policy, it would deliver “substantial green infrastructure including recreation spaces and a landscape buffer”. 
The Site & Landscape Context

The allocation site is located on the northern edge of Ruddington. It is approximately 6.4ha, and comprises a large open field in agricultural use. The northern boundary is marked by Packman Dyke, and Bloor Homes also control the open arable fields to the north of the allocation site.

A recent residential development (Silk Gardens) lies to the west of the allocation site, and a more well established residential area lies to the south. The site wraps Sellors’ Playing Field, the boundary of which is marked by mature trees. The site’s western boundary is otherwise defined by Wilford Road that runs to Ruddington Village centre approximately 800m to the south and (after passing under the A52) connects to West Bridgford to the north. The verdant Ruddington Grange Golf Course lies beyond Wilford Road to the east.

The allocation site itself is relatively flat and contains few features of note. Patchy hedgerows delineate the site’s boundaries to the east, south and west, and there are also some established trees close to the western boundary.

The site forms part of the wider landscape to the north and north west which is characterised by arable fields with a weak hedgerow structure on gently undulating land. There are occasional linear woodland blocks (notably Long Plantation) and mature vegetation lines the disused railway (in part) and Fairham Brook. The buildings associated with Lodge Farm are located to the north of the site and the academic facilities on the eastern edge of Clifton can be seen to the west.

The emerging Masterplan proposals include a comprehensive landscape scheme that retains the existing landscape features around the site’s periphery and seeks to strengthen the landscape structure with new hedgerows and tree planting including a substantial area of Green Infrastructure to the north of the built development. That will provide an attractive setting for the proposed development and ensure that it is assimilated into the landscape. The treatment (density, orientation, height and materials) of the fringes of the built development will also be important. These measures will ensure the creation of an attractive gateway to the village and a sensitive new northern edge to the settlement form.
Visual Amenity

The visual amenity of the site and its surroundings has been appraised through the preparation of a Zone of Theoretical Visibility (ZTV) and an assessment of key viewpoints. The ZTV indicates the potential extent of the allocation site’s visibility based on the topography of the area and the screening provided by blocks of vegetation or buildings. The ZTV has been verified through fieldwork.

Within the ZTV presented opposite, the lighter areas highlight locations where there would be a potential view of the site and the darker areas indicate where there would not be a view of the site.

To the north the allocation site is visible from the open agricultural land beyond its boundaries, but there are no readily accessible public viewpoints (in the absence of any public rights of way) and the extent of visibility is contained to approximately 250m by the Lodge Farm buildings and the rise in land form on which they sit.

An open and continuous view of the site is, however, available from Wilford Road, south of the entrance to Lodge Farm on the approach to Ruddington (refer to VP1). The existing urban edge view is clearly visible above the patchy hedgerow that lines the road. The trees surrounding Sellors’ Field recreation ground are prominent in the view, as are the properties that surround the site to the south and east.

The development of the allocation site, however, would not significantly change the nature of that view. Indeed as set in provisions section the development provides an opportunity to enhance the view through the creation of a more sensitive urban edge where the new residential properties sit unobtrusively within their landscaped setting.

To the east and north east of the allocation site, the layering of the thick mature vegetation within the golf course effectively screens the site in any public views from beyond Wilford Road, notably on the A60.

It is evident the allocation site is well contained by the existing built form of Ruddington to the west / south west, south and south east. Views into the site are limited to the immediate surrounds (i.e. neighbouring properties, Wilford Road (refer to VP2) and Sellors’ Field (refer to VP3)).

The topography and woodland blocks largely contain views beyond 250-300m to the east and north east of the site. There is, however, a “window” south of Long Plantation close to Central College on the edge of Clifton (circa 400m), where an open view to the allocation site is available from the new public right of way running north along the line of Fairham Brook (refer to VP4).

In this view the new development would benefit from a mature landscape backdrop. Moreover, the provision of an area of Green Infrastructure to the north of Packman’s Dyke with significant tree planting around the proposed wetland and meadow areas would effectively screen and/or filter views to the development from the new public right of way.

The ZTV suggests that views of the allocation site should be available at more distant locations on higher ground at the southern edge of the Nottingham urban area to the north of the A52, (e.g. Spinney Hill and Sharp Hill), and from within Clifton (e.g. Glapton Wood). However, in reality the allocation site is not discernible in those views beyond the intervening built form and mature vegetation.

The extent of the allocation site’s visibility, and therefore, any future development on the site is extremely limited. Moreover, the majority of the views of the site that are available from public vantage points in the surrounding area are not considered to be particularly sensitive, principally because existing housing or other urban elements are commonly visible, albeit often set amongst the existing vegetation structure. There is also significant scope for further mitigation through the provision of a substantial area of Green Infrastructure north of the proposal built development.
View from Wilford Road north of site

View from Loughborough Road north east of site

View from Wilford Road opposite Bradmore Avenue south of site

View from footpath at Fairham Brook north west of site

Viewpoint Locations

Zone of Theoretical Visibility (ZTV)
Green Belt

The allocation site currently forms part of the designated Green Belt in this area, and its role in that regard was assessed in the Rushcliffe Green Belt Review- PART 2 (b) (Detailed Review of the Nottingham-Derby Green Belt within Rushcliffe – Rural Towns and Villages). The allocation site was considered as “RUD1,” located within the “Ruddington North” broad strategic Green Belt area.

The area scored relatively lowly in relation to the Green Belt purposes set out in the NPPF, other than in relation to preventing “the merging of Ruddington, Clifton and Nottingham’s main urban area”. It received a total score of 13 and as a consequence was determined to be of low-medium value Green Belt, but of high importance in relation to the prevention of coalescence specifically.

The allocation site itself, however, scored lowly in all respects and the assessment highlights both its relationship with the existing urban form and its urban fringe character. It received a total score of 11 and as a consequence was determined to be of low-medium value. The further land to the north, much of which is also controlled by Bloors, scored more highly with a total score of 18 and was therefore, determined to be of medium-high value. However, that area will be enhanced to provide multi-functional Green Infrastructure including informal recreation space, pedestrian connections, SUDS and improved ecological habitats.

Urban Sprawl

The site is already bordered to the south and east by well established development and has a frontage with Wilford Road that leads to the heart of the settlement to the south. The location and configuration of the site, therefore, means that its development would ensure that the settlement retains a compact and balanced nucleated form, and not result in urban sprawl. It would also provide a sympathetic and well defined edge to the countryside to the north, sitting unobtrusively within its setting by virtue of the nature of the surrounding topography and screening provided by the existing vegetation.
Moreover, the large open green space to the north of the allocation site would be dedicated as public open space and will provide a clearer and more defensible boundary to the Green Belt than currently exists. This will help to contain the further growth of the urban form of Ruddington in the future.

**Coalescence**

The nearest settlements to Ruddington are West Bridgford to the north and Clifton to the west (refer to Urban Form and Green Belt Figure). The development of the allocation site would not extend the urban form of Ruddington any further north or west than the neighbouring residential area. Therefore, there is no threat of the settlements physically merging together.

Furthermore, the visual appraisal outlined above has highlighted the limited intervisibility between the settlements that results from the topography and intervening built form and vegetation. This would significantly mitigate any perception of coalescence arising from the development of the site. The proposed area of Green Infrastructure north of the allocation site would also provide further mitigation.

**Countryside Encroachment**

Whilst the site’s development would represent a limited encroachment into the countryside (in so far as the development of any greenfield site would), the urban form, topography and established landscape structure surrounding the site (as described above) would very much negate the perception of encroachment. Indeed, as described in the preceding section the visibility of the development would be limited to the site’s immediate environs.

**Historic Towns**

Ruddington is not specifically identified as a historic town, although its historic core is designated as a conservation area because of its special architectural and historic interest. The subsequent growth of Ruddington as a settlement is evident in the established residential areas between the site and the historic centre. As a result the proposed development of the site will not impact at all on the setting and character of the conservation area, or indeed the character, appearance or setting of any other heritage assets in the village.

**Urban Regeneration**

The site performs the same role in relation to this matter as any other greenfield site within the designated Green Belt in the Borough.

**Summary**

The development of the site will inevitably result in the growth of Ruddington’s urban form and an encroachment on the surround countryside, but the extent of that is very limited. Indeed, the location and aspect of the site combined with the landscape structure mean that it does not form a particularly sensitive part of the Green Belt. The proposed development will incorporate a substantial area of green infrastructure to the north of Packman’s Dyke that further mitigates the potential impact on the Green Belt purposes and will create a clear and robust defensible boundary.
The emerging Masterplan proposals for site have been prepared with a clear knowledge and understanding of the specific characteristics of the site (the opportunities and constraints). The core aim is to create an attractive and sustainable environment that respects, and responds to, the site’s setting, retaining natural key features wherever possible, and taking advantage of the existing landscape framework to create a high quality distinctive development with a sense of place that is well integrated into its surroundings.

Moreover, an iterative assessment and design process has ensured that the appropriate mitigation required to address the potential environmental impacts that may arise from the development, notably on the landscape character and visual amenity of the area, but also the drainage matters as set out in the Flood Risk Assessment and Drainage Strategy, have been embedded into the emerging Masterplan proposals.

This section, therefore, provides an outline of the development proposals and principles as established by the emerging Masterplan.

**Development Proposals & Key Design Principles**

- The emerging scheme would, provide up to 160 dwellings in a compact development form well related to the village’s existing urban form.
- Vehicular access will be provided via a new junction on the Wilford Road. The arrangement of the dwellings in relation to that access and along the seeks to create a green gateway into the village from the north.
- New pedestrian and cycle links would be provided to the established residential areas to the south and east.
- A substantial landscaped green space (approximately 11ha) will be provided to the north of Packman’s Dyke, providing the floodplain compensation for the development of the allocation site.
- The eastern part of the green space will provide a large area of natural open space with including the diverted watercourse, SUDs features, new wetland and a meadow area providing significant biodiversity enhancement.
- A comprehensive landscaping scheme that retains the existing landscape features and seeks to strengthen the landscape structure with new hedgerows and tree planting set within public open space will provide an appropriate setting for the proposed development and assimilate it into the landscape.
- The development in the northern part of the allocation site would be predominantly detached houses provided in an informal arrangement. A new hedgerow and trees will be planted to soften the view from Wilford Road when approaching Ruddington from the north.
- It is proposed that bungalows are provided along the southern edge of the site backing onto the rear of the existing properties on Brookside Road with a separation distance of around 25m between the existing and new dwellings.

**Legend**

1. Proposed site access off Wilford Road.
2. Linear open space running along Wilford Road frontage, including trees and footpath link.
3. Gabled frontage reflecting existing housing on Wilford Road.
4. Bungalows and deeper back gardens along southern edge to respond to adjacent properties. May include additional tree planting along boundary.
5. Informal Grassland Area
6. Existing vegetation retained where possible.
7. Balancing pond.
8. Diverted watercourse.
9. Ecological wetland and meadow area.
10. Tree planting within flood mitigation area.
11. Informal footpath.
12. Retained watercourse.
13. Informal housing edge presents a softer edge to the settlement in views from the north.
14. Primary internal road forms access loop within the development, characterised by tree planting.
15. Potential strategic footpath links on alignment of old railway line connecting site with land to the north.
16. Proposed surface water runoff relief ditch to divert water in the event of a culvert blockage on the golf course.
Proposed site access off Wilford Road.

Open field

Golf Course

Wilford Road (B680)

Brookside Road

Linear open space running along Wilford Road frontage, including trees and footpath link.

Gabled frontage reflecting existing housing on Wilford Road.

Bungalows and deeper back gardens along southern edge to respond to adjacent properties. May include additional tree planting along boundary.

Informal Grassland Area

Existing vegetation retained where possible.

Balancing pond.

Diverted watercourse.

Ecological wetland and meadow area.

Tree planting within flood mitigation area.

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Informal housing edge presents a softer edge to the settlement in views from the north.

Primary internal road forms access loop within the development, characterised by tree planting.

Potential strategic footpath links on alignment of old railway line connecting site with land to the north.

Proposed surface water runoff relief ditch to divert water in the event of a culvert blockage on the golf course.

Legend

Base Aerial © Getmapping.plc

Concept Masterplan
Northern Edge
1. Informally arranged detached housing.
2. Tree planting positioned to help soften housing edge in views from the north.
3. Private drives provide access to frontages.
4. Hedgerow boundary
5. Gradual slope from housing edge to pond area.
6. Diverted watercourse.

Southern Boundary
7. Bungalows and deeper back gardens along southern edge to respond to adjacent properties.
8. Possible additional tree planting to provide screening along boundary.
9. Gradual increase in height of properties away from boundary towards 2 storey housing.

Northern Edge Elevation
Dear Sir/Madam

Please find attached representations to the Rushcliffe City Council Local plan Part 2: Land and Planning Policies Publication Version made by Oxalis Planning on behalf of Bloor Homes in relation to Land west of Wilford Road Ruddington - Policy 6.1

It would be appreciated, if you would kindly confirm the receipt of this email.

Kind regards

Naheida Janjua

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This email has been scanned for spam and malware by The Email Laundry.
Land off Wilford Road, Ruddington

Transport Promotional Document

June 2018

On Behalf of:

BLOOR HOMES

Waterman Infrastructure & Environment Limited

www.watermangroup.com
1. Introduction

1.1 Background

This document has been prepared by Waterman Infrastructure & Environment Ltd (Waterman) on behalf of Bloor Homes who are seeking to promote a site off the B680 (Wilford Road) in Ruddington as an immediate and deliverable development opportunity which should be identified as a housing allocation.

The purpose of this report is to provide a strategic overview on accessibility to the site, in particular vehicular access from Wilford Road. Consideration is also given to sustainability of the site by all modes of transport, and accessibility to key local services and facilities.

This high-level appraisal forms the basis for the consideration of the site for inclusion within the Rushcliffe Local Plan, as an immediate and deliverable development which should be identified for housing allocation.

Bloor Homes consider its land at Ruddington to be in a location which could be developed immediately if planning permission was sought and granted. This is supported by guidance contained in the National Planning Policy Framework (NPPF) which requires Local Planning Authorities (LPAs) to “significantly boost housing supply”.

1.2 Report Layout

Following this introductory section, the layout of the report is as follows:

- Section 2 describes the local highway network and sustainable transport facilities;
- Access to local facilities, such as, education, health services, employment, leisure and retail are considered in Section 3;
- Section 4 details the development proposals;
- The potential highway impact of the proposals is considered in Section 5;
- Section 6 discusses the deliverability of the site; and
- The report is summarised in Section 7.
2. Existing Conditions

2.1 Site Location

The site is located to the west of Wilford Road in Ruddington, Nottinghamshire. A plan showing the location of the site is provided below in Figure 1.

Figure 1: Site Location Plan

[Image showing site location plan]

2.2 Ruddington

Ruddington is situated 5 miles (8.0 km) south of Nottingham in the Borough of Rushcliffe. It had a population of 6,441 at the 2001 UK census, increasing to 7,216 at the time of the 2011 census.

Ruddington is considered to be a sustainable village with a broad range of services/amenities available within the village envelope and the surrounding area. Many services are located within a short walking distance of the site including a Community Centre, Village Hall, Post Office, Nursery, Primary School, Library, Medical Surgery and Pharmacy along with general stores and takeaway restaurants. A plan illustrating the location of the site in respect to these facilities is provided in Appendix A.

Further, more extensive facilities are provided in Nottingham City Centre which is within easy reach of the site with excellent connections (via public transport).

Ruddington is considered to be within an accessible location. Development within Ruddington is likely to minimise the need for car-based transport, whilst focussing development where there is good existing access to health, leisure, recreational and cultural activities. The provision of, and access to, services such as schools, doctor’s surgeries and shops is likely to be maintained or enhanced in the future by the development.
2.3 Local Highway Network

Located to the east of the site the B680 (Wilford Road) is a street lit single carriageway road which provides a link between Wilford to the north and Ruddington village centre to the south. The speed limit on Wilford Road changes from 30mph to the National Speed Limit (60mph) adjacent to the site. The change in speed limit occurs when entering the Ruddington urban area (as shown in Photograph 2 below).

Pedestrian/cycle provision is provided adjacent to the carriageway with a shared use footway/cycleway linking Wilford to the north and Ruddington village centre to the south. The footway provision to the west of the carriageway (Wilford Road) terminates midpoint along the site frontage.

Wilford Road currently provides two vehicular points of access into the site (suitable for agricultural vehicles).

Photographs 1 and 2 below illustrate the existing conditions along Wilford Road. Photograph 1 is taken looking north (opposite the proposed site access) whilst Photograph 2 is taken looking south (at the entrance to Ruddington).

The site is bounded by Wilford Road. The highway network offers opportunities for providing access to the site by all modes of transport. The current site access arrangements are not considered suitable to serve as vehicular accesses into a development, without considerable upgrading / improvement. New footways would be required to tie into the existing footway network. As part of the development proposals a speed limit review would be required along Wilford Road, which would seek to extend the 30mph zone north (past the site access) and would therefore represent the start of the extended urban area.

Collision data from the ‘Crashmap’ website reveals that for the 5-year period between 2013 and 2017, there have been 4 collisions on Wilford Road in the vicinity of the site. Each of the four collisions was classified as slight in severity.

Based on the high-level analysis to date, there is not considered to be a collision/safety problem on the local highway network.

It is considered that the additional trips generated by the proposed development would not have a detrimental impact on highway safety.
2.4 Sustainable Transport

Regarding pedestrian movement and to a lesser degree cycling, accessibility would be governed by available / proposed routes, trip length and topography. Locally there is an extensive network of footways which offer good pedestrian access to various facilities/services within Ruddington. Several Public Rights of Way (PRoW) are located within the local area including Ruddington FP12 which routes to the south of the site alongside the playing fields, between Wilford Road and Brookside Road (via Trent Avenue).

A review of [www.sustrans.org.uk](http://www.sustrans.org.uk) highlights that there are no formal cycle routes within the village of Ruddington. However, there is a traffic free route for cyclists along Wilford Road. There are also small pockets of traffic free routes further north of Wilford Road which lead into Nottingham city centre. Cycling in the vicinity of the site is achieved largely by on-road cycling. Nevertheless, cycling trips should still be encouraged to/from the development as a number of local roads are suitable for cycling due to reasonably low levels of vehicular traffic and wide street lit carriageways.

There are several regular bus services operating to/from Ruddington which provide access to Nottingham City Centre and neighbouring towns (Clifton and West Bridgford) and villages (Keyworth and East Leake). The nearest bus stops are located circa 150m to the south of the site on Wilford Road. The bus stops include timetable information, flagpoles and level access. Service number 3 provides a 15-minute frequency along Wilford Road. This is the only service calling at the Wilford Road bus stops. Table 1, provides a summary of this service.

### Table 1: Bus Service Information - Welford Road only

<table>
<thead>
<tr>
<th>Service &amp; Operator</th>
<th>Key Destinations</th>
<th>Monday to Saturday Frequency</th>
<th>Sunday Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Daytime</td>
<td>Evening</td>
</tr>
<tr>
<td>3 Navy Line NCT</td>
<td>Nottingham – Clifton</td>
<td>15 mins</td>
<td>60 mins</td>
</tr>
</tbody>
</table>

Elsewhere within Ruddington services stop within the village centre (circa 600m from the site) and along the A60 (circa 1km from the site). Table 2 below provides a summary of the bus services operating to/from Ruddington.

### Table 2: Bus Service Information - All other Ruddington services

<table>
<thead>
<tr>
<th>Service &amp; Operator</th>
<th>Key Destinations</th>
<th>Monday to Saturday Frequency</th>
<th>Sunday Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Daytime</td>
<td>Evening</td>
</tr>
<tr>
<td>9 Kinchbus</td>
<td>Nottingham – Loughborough</td>
<td>30 mins</td>
<td>120 mins</td>
</tr>
<tr>
<td>10/10C/10X Green Line NCT</td>
<td>Nottingham – Ruddington</td>
<td>15 mins</td>
<td>30 mins</td>
</tr>
<tr>
<td>863 NCC Transport Services</td>
<td>Ruddington – East Leake – Keyworth</td>
<td>3 daytime services</td>
<td>No Services</td>
</tr>
<tr>
<td>L22 – CT4N</td>
<td>West Bridgford Circular</td>
<td>60 mins</td>
<td>No Services</td>
</tr>
<tr>
<td>L23 – CT4N</td>
<td>West Bridgford Circular</td>
<td>60 mins</td>
<td>No Services</td>
</tr>
<tr>
<td>N48 Night Bus NCT</td>
<td>Nottingham – Clifton – Ruddington</td>
<td>-</td>
<td>Late night services only</td>
</tr>
</tbody>
</table>
Bus service provision near the site is considered to be excellent with frequent buses operating to/from Nottingham city centre.

The nearest rail station to the site is Nottingham Station located circa 7km to the north of the site. This station provides a link to major cities including London and Birmingham. Sheltered cycle storage spaces are available at this station along with a large multi-storey car park (circa 950 spaces). The Station is also accessible via public transport via the NCT Navy Line 3 service.

The nearest Tram stop to the site is situated at ‘Ruddington Lane’, circa 1km to the north of the site. From here trams run every 7-10 minutes into Nottingham city centre and Clifton during the daytime and every 15 minutes early morning/evening.

Existing walking, cycle, bus, rail and tram services provide a realistic opportunity for future residents of the site to travel to destinations within Ruddington and further afield for employment and leisure opportunities by non-car modes of transport in Nottingham.
3. Accessibility

3.1 Introduction

Planning policy now highlights the need for sustainable developments to have good accessibility to education, health facilities, employment, leisure and retail. Paragraph 38 of the National Planning Policy Framework (NPPF) states:

“Where practical, particularly within large scale developments, key facilities such as primary schools and local shops should be located within walking distance of most properties”.

To demonstrate the sustainability of the site, guidelines from the CIHT with regards to acceptable walking distances to services have been used. For a settlement such as Ruddington it is considered that a distance of 400m is desirable, 800m acceptable, with a maximum distance of 1.6km walking distance to local services. This section considers the accessibility from the development, by modes of sustainable transport to local facilities including education, health services, employment, leisure and retail. The location of local facilities in the vicinity of the site is illustrated in Appendix A.

3.2 Accessibility to Education

Accessibility to education from the site has been considered and schools located within the local area include the following (approximate distances to the centre of the site are provided);

Key education facilities for infants are located within 1km of the site. Hermitage Pre-School (2-5 years) and James Peacock Infant and Nursery (3-7 years) are located less than 600m from the site. The closest Primary School to the site is Ruddington Saint Peters C of E Controlled Junior School (7-11 years). Other Primary, Secondary School and Further Education provision are located in neighbouring towns and villages and are accessible via bus services operating along The Green.

A key objective of the development would be to encourage as many people (i.e. children and parents) as possible to walk / or cycle (where appropriate) to the existing schools.

3.3 Accessibility to Health

The developments most accessible primary health care facility is the Ruddington Medical Centre off Church Street, approximately 750m to the south of the site. This is considered accessible on foot or by cycle.

3.4 Accessibility to Employment

Ruddington has some significant employers within the area, located at the business park off the A60 (circa 2km to the south of the site). However, Ruddington is not considered to be a primary employment location and many residents are likely to commute out of Ruddington to access employment opportunities in destinations such as Nottingham (which can be easily accessed by public transport).

3.5 Accessibility to Retail and Leisure

Retail facilities locally are focused within the centre of the village and include independent shops, cafes, restaurants, pubs, Post Office, Co-op Food Store, Sainsburys Local, butchers, chemist, estate agents, hairdressers, hardware store, etc.

The site is well serviced by existing local facilities and services in Ruddington and further afield in Nottingham. Overall, the site performs well in terms of proximity to existing services and facilities that help to support day-to-day living. These services/facilities are also accessible via sustainable modes of transport which would limit the number of vehicle trips to/from the development.
4. Development Proposals

4.1 Development

The development would seek to deliver up to 160 residential dwellings on the site.

4.2 Site Access Strategy

Access into the site would be provided in accordance with national and/or local guidance, including 'Manual for Streets' and the 6C’s Design Guide.

The site access strategy would include the provision of a new vehicular access from Wilford Road. A preliminary design (included within Appendix B) includes the provision of a simple priority ‘T’ junction on Wilford Road. The access strategy would utilise land either under the control of the Client or land which forms part of the adopted public highway.

The exact geometries of the junction included the visibility splays would be determined through detailed analysis and consultation with the Local Highway Authority (Nottinghamshire County Council), and through detailed junction modelling. This work would be undertaken as part of the transport work required in support a Planning Application. The layout illustrated in Appendix B and Figure 2 below is indicative to illustrate a possible arrangement.

Figure 2: Preliminary Site Access Design

4.3 Internal Layout

The development proposals would be required to take a balanced approach to movement and providing for the needs of all users of the streets and spaces, not just the needs of vehicles. The design and layout would therefore need to ensure that the main route is easy to recognise and follow. Additionally, the road layout would incorporate loops wherever feasible to ensure that there is more than one route option available, in the event that a section of the main highway becomes blocked.
Within the site the main internal road would be required to measure 5.5 wide (minimum). This width is appropriate for allowing two-way traffic to flow in a safe manner. Internally road widths would reduce to:

- 4.8m = where the road serves up to 50 dwellings;
- 7.5m corridor – Serving up to 25 dwellings;
- 4.8 = for a private drive serving 6-25 dwellings;
- 4.25 = for a private drive serving 2-5 dwellings; and
- 2.75m = for a private drive serving a single dwelling.

The layout and design of the development would aim to reduce the need to travel by car, and encourage alternative modes of transport. It would also ensure that this new part of the community is comprehensively integrated with the surrounding area and rest of Ruddington by building on existing links and creating new links to deliver a strong network of pedestrian and cycle routes. It is therefore essential that the road layout provides clear, legible, direct routes and promotes a safe and accessible movement framework for all. The following paragraphs consider accessibility to/from the site for non-car users.

Access to the site would be provided in accordance with national and / or local guidance, including ‘Manual for Streets’ and the 6C’s Design Guide. The site access would utilise land either under the control of the Client or land which forms part of the adopted public highway.
5. Highway Impact

5.1 Trip Generation

To estimate the trips likely to be generated by the development, vehicle trip rates have been derived from the TRICS online database (version 7.5.1) for sites with similar characteristics to the size/location of the site. Trip rates have been obtained for the periods 08:00-09:00 and 17:00-18:00 only, which are typically when the wider highway network is under the greatest level of stress. The resulting morning and evening peak hour trip rates/trip generation calculations are shown in Table 3 below.

Table 3: Residential Trip Rates and Trip Generation

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Trip Rate per Dwelling</th>
<th>Trip Generation for 160 Dwellings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Arrivals</td>
<td>Departures</td>
</tr>
<tr>
<td>AM Peak</td>
<td>0.114</td>
<td>0.334</td>
</tr>
<tr>
<td>PM Peak</td>
<td>0.290</td>
<td>0.132</td>
</tr>
</tbody>
</table>

5.2 Modal Split

2011 method of travel to work census data was obtained for the Ruddington ward. This data is presented in Table 4 below.

Table 4: Method of Travel to Work - Ruddington Ward

<table>
<thead>
<tr>
<th>Mode</th>
<th>Journey to Work Trips</th>
<th>Journey to Work %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underground, Metro, Tram</td>
<td>5</td>
<td>0%</td>
</tr>
<tr>
<td>Train</td>
<td>34</td>
<td>1%</td>
</tr>
<tr>
<td>Bus, Minibus or Coach</td>
<td>354</td>
<td>10%</td>
</tr>
<tr>
<td>Taxi</td>
<td>3</td>
<td>0%</td>
</tr>
<tr>
<td>Motorcycle, Scooter or Moped</td>
<td>20</td>
<td>1%</td>
</tr>
<tr>
<td>Driving a Car or Van</td>
<td>2,524</td>
<td>72%</td>
</tr>
<tr>
<td>Passenger in a Car or Van</td>
<td>174</td>
<td>5%</td>
</tr>
<tr>
<td>Bicycle</td>
<td>125</td>
<td>4%</td>
</tr>
<tr>
<td>On Foot</td>
<td>256</td>
<td>7%</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
<td>0%</td>
</tr>
<tr>
<td>Total People</td>
<td>3,503</td>
<td>100%</td>
</tr>
</tbody>
</table>

It can be seen from Table 4, that 72% of journeys to work in the Ruddington ward are undertaken by driving in a car or van. It should be noted that the above Census data was undertaken in 2011, which was before the Nottingham Express Tram was extended out to Clifton and Beeston. As a result, the above percentage for car driver is considered to be a worst case, as residents now take advantage of the Tram (located circa 1km to the north of the site) for trips to/from Nottingham.
5.3 Trip Distribution

To provide an understanding of the distribution of trips generated by the development, it is important to identify the likely trip purposes. This is because trips with different purposes would have different distributions. An indication of the likely split of trips by purpose is provided by the National Travel Survey (NTS).

Based upon the information from the NTS the vehicular trips generated by the proposed development can be proportioned into trip purposes. It has been assumed that 50% of tips would be commuting/business trips with the remaining 50% non-commuting trips (i.e. education, shopping and leisure). Trips to/from education, shopping and leisure are all likely to take place within the local area i.e. Ruddington. Trips to/from the Nottingham would predominantly occur for commuting/business purposes.

Origin/destination statistics included within the 2011 Census data, provide a useful indication as to where people within Ruddington travel to/from for work purposes. Census data for the Rushcliffe 011 Super Output Area (which incorporates the village of Ruddington) reveals that people currently travel to the following local destinations (Local Authorities) for work. See Table 5 below.

Table 5: 2011 Travel to Work Data - Rushcliffe 011 (Ruddington)

<table>
<thead>
<tr>
<th>Local Authority</th>
<th>Number of Trips</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nottingham</td>
<td>753</td>
<td>35%</td>
</tr>
<tr>
<td>Rushcliffe</td>
<td>610</td>
<td>28%</td>
</tr>
<tr>
<td>Gedling</td>
<td>78</td>
<td>4%</td>
</tr>
<tr>
<td>Broxtowe</td>
<td>83</td>
<td>4%</td>
</tr>
<tr>
<td>Charnwood</td>
<td>81</td>
<td>4%</td>
</tr>
<tr>
<td>Derby</td>
<td>46</td>
<td>2%</td>
</tr>
<tr>
<td>Erewash</td>
<td>34</td>
<td>2%</td>
</tr>
<tr>
<td>Leicester</td>
<td>36</td>
<td>2%</td>
</tr>
<tr>
<td>Newark &amp; Sherwood</td>
<td>46</td>
<td>2%</td>
</tr>
<tr>
<td>North West Leicestershire</td>
<td>47</td>
<td>2%</td>
</tr>
<tr>
<td>Other</td>
<td>336</td>
<td>15%</td>
</tr>
</tbody>
</table>

As shown in Table 5, the majority of people travel to work within Nottinghamshire i.e. to destinations such as Nottingham and Rushcliffe (Bingham, Radcliffe-on-Trent, Ruddington, Cotgrave, West Bridgford etc).

Trips to/from education, shopping and leisure are all likely to take place within the local area i.e. Ruddington. These trips would therefore not involve vehicle movements onto the A60 or A52.

5.4 Highway Impact

The impact of development traffic upon the local/wide highway network would be considered in detail as part of a future Planning Application. Where an impact is identified, improvements would be identified to mitigate the additional traffic travelling through the junction. NPPF states that “development should only be prevented or refused on transport grounds where the residual cumulative impacts on development are severe.” This would be taken into consideration before identifying improvement schemes.

The impact of development traffic upon the local/wide highway network would be considered in detail as part of any future Planning Application. Where an impact is identified an improvement scheme would be identified to mitigate the additional traffic travelling through the junction.
6. Site Technical Analysis

It is considered that the site is deliverable from a traffic and transport perspective, for the following key reasons:

- Vehicular access can be provided into the site from Wilford Road. The site access design accords with the relevant design standards and is within land under the control of the landowner and/or adopted highway;
- The site is located within close proximity to bus and rail services, providing frequent public transport links to Nottingham;
- An excellent range of local services are provided in Ruddington, all of which are within a reasonable walking/cycling distance from the site and is supported by good pedestrian infrastructure. This includes access to local educational establishments;
- The impact of development associated traffic is likely to be adequately accommodated on the local highway network, and should have no adverse impact on the safe and free flow of traffic. The impact of development traffic upon the local/wide highway network would be considered in detail as part of any future Planning Application; and
- The proposals accord with both national and local transport policy. In particular, residents of the proposed development would be able to access local facilities, utilise existing bus services, and any additional vehicular traffic would not have a detrimental impact on the local road network.

There are considered to be no highways constraints preventing the site coming forward, however, if required off-site highway improvements would be delivered in agreement with the relevant Highway Authority's.
7. Conclusions

This report investigates the feasibility of delivering a parcel of land situated in Ruddington. Overall:

- The site is **conveniently located** for access to the local and wider highway networks.
- The site is well located to existing sustainable transport infrastructure and would be accessible for cyclists, pedestrians and public transport users. **Excellent sustainable transport opportunities.**
- There is **not considered to be any road safety issues** associated with the scheme or the existing local highway network.
- A **satisfactory access arrangement** could be provided into the site from Wilford Road.
- The **impact** of associated development traffic on the operation and safety of the local highway network is **not considered to be ‘severe’**.

With regards to future development proposals and submission of documents to support a planning application it is likely that a Transport Assessment and Framework Travel Plan would be required. These reports would provide a comprehensive assessment of the impact of traffic generated by the development upon the highway network.

Overall in transportation terms, there are no highways constraints preventing the site for being allocated for residential purposes.
A. Local Facilities Plan
LAND OFF WILFORD ROAD, RUDDINGTON
LOCAL FACILITIES PLAN

BLOOR HOMES

PRELIMINARY

Scales @ A3
work to figured dimensions only

Key
Site Boundary
Bus Stops
Nottingham College Clifton
James Peacock Infant & Junior School
St Peters C of E Junior School
The Hermitage Pre-School
Wilford Road Playing Fields
Local Centre/Shops (Post Office, Food Outlets, Pharmacy, hairdressers etc)
Sainsbury's Local
Co-op Food Store
Ruddington Medical Centre

1
2
3
4
5
6
7
8
9

1. Nottingham College Clifton
2. James Peacock Infant & Junior School
3. St Peters C of E Junior School
4. The Hermitage Pre-School
5. Wilford Road Playing Fields
6. Local Centre/Shops (Post Office, Food Outlets, Pharmacy, hairdressers etc)
7. Sainsbury's Local
8. Co-op Food Store
9. Ruddington Medical Centre

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Halifax House  Halifax Place  Nottingham NG1 1QN
t 0115 948 2612
B. Site Access Design
UK and Ireland Office Locations

[Map of UK and Ireland with locations marked: Glasgow, Edinburgh, Perth, Leeds, Manchester, Sheffield, Dublin, Bristol, Birmingham, Nottingham, Redhill, London (head office), Brentwood]
CONTENTS

EXECUTIVE SUMMARY ............................................................................................................... 1
1  INTRODUCTION .................................................................................................................. 3
2  BACKGROUND ..................................................................................................................... 8
3  ASSESSMENT OF EXISTING FLOOD RISK ........................................................................... 15
4  EXISTING DRAINAGE ........................................................................................................ 19
5  ASSESSMENT OF POTENTIAL FLOOD RISK ....................................................................... 20
6  PROPOSED DRAINAGE ..................................................................................................... 23
7  CLIMATE CHANGE ............................................................................................................ 27
8  RESIDUAL RISK AND MITIGATION MEASURES ................................................................. 28
9  ADOPTION AND MAINTENANCE ...................................................................................... 29
10 CONCLUSION .................................................................................................................... 30

APPENDICES

Appendix 1  Drawings
Appendix 2  Hydroland Modelling Report
Appendix 3  Microdrainage Calculations
Appendix 4  Flood Risk and Drainage Technical Appraisal, Halcrow 2012
Appendix 5  Severn Trent Water Data
Appendix 6  Environment Agency Correspondence

DRAWINGS         TITLE                                                                 SCALE
WM11065-100     Site Location Plan                                           1:2500
WM11065-101     Foul Water and Future Discharge Points                         1:1000
WM11065-102     Flood Compensation Works General Arrangement                 1:1000
WM11065-103     Flood Compensation Works Cross Sections (Sheet 1 of 5)        AS SHOWN
WM11065-104     Flood Compensation Works Cross Sections (Sheet 2 of 5)        AS SHOWN
WM11065-105     Flood Compensation Works Cross Sections (Sheet 3 of 5)        AS SHOWN
WM11065-106     Flood Compensation Works Cross Sections (Sheet 4 of 5)        AS SHOWN
WM11065-107     Flood Compensation Works Cross Sections (Sheet 5 of 5)        AS SHOWN
WM11056-108     Masterplan                                                 1:2000
WM11065–109     Existing Constraints Plan                                   1:1000
WM11065-110     Node and Cross Section Alignment                             1:1000
EXECUTIVE SUMMARY

Wardell Armstrong LLP have been commissioned by Bloor Homes LTD to produce a Flood Risk Assessment and Drainage Strategy report for the development at the Land West of Wilford Road, Ruddington.

This report has been updated to reflect changes in the masterplan, redline boundary revisions and includes the latest correspondence with the Environment Agency.

This report assesses the risk of flooding from all sources, including from fluvial, tidal, surface water, groundwater, drainage infrastructure and other artificial sources in accordance with the National Planning Policy Framework. This strategy acts as an update to the Flood Risk and Drainage Technical Appraisal produced by Halcrow in July 2012.

The 2012 Technical Appraisal included recommendations to carry out hydraulic modelling of Packman Dyke, the tributary that borders the site to the north. Existing flood extents were produced by Halcrow circa 2012, these were consequently approved by the Environment Agency and placed the site for development in Flood Zone 3a.

In October 2015, this model was updated by Hydroland with improved accuracy, additionally, further modelling was carried out to produce the post development flood extents. The flood mitigation techniques and the surface water management proposals were included in the design flood extents and as a result proved that the flood risk associated with the existing site had been transferred to the public open space to the north, also within the client’s ownership.

It was also concluded that there was no increase to the flood levels along Packman Dyke, caused by the proposed arrangement.

This report demonstrates the foul water and surface water disposal to be adopted by the development. Following a pre development enquiry, Severn Trent Water confirmed the development can discharge to the existing system; the potential connection points (MH1801 and MH9801) allow the development to drain via gravity. However, due to that date of the response a new pre developer enquiry has been submitted to STW to reconfirm the availability of network capacity. It is expected that there will no issues with capacity as no major development has taken place in the area.

The surface water strategy includes an attenuation feature 2435m$^3$ in size, to attenuate surface water runoff from the development for the 100 year event with accommodations for climate change, if exceeded a free board of 300mm has been provided, supplying a volume of 916m$^3$.

The proposed point of discharge is Packman Dyke, in order to maintain the water levels within
the tributary, the water will be held at a restricted rate equivalent to a QBAR value of 3.7 l/s/ha.

With regards to ground conditions, the area has an alluvium (clay, silt, sand and gravel) superficial deposit, furthermore the whole site is underlain by aquifers and so these properties indicate there is limited soakaway potential, in order to confirm this, further ground investigation is recommended.
1 INTRODUCTION

1.1.1 Wardell Armstrong LLP (WA) have been commissioned by Bloor Homes LTD to produce a Flood Risk Assessment (FRA) and Drainage Strategy report for a development at the Land West of Wilford Road, Ruddington; Nottinghamshire.

1.1.2 The objective of the study is to promote a residential development for a site located in Flood Zones 1, 2 and 3a by assessing the constraints and opportunities associated with flood risk, surface water and foul water drainage. Additionally, it aims to provide an input to the Local Planning Authority’s (LPA) application of sequential and exemption tests in accordance with the National Planning Policy Framework (NPPF). Existing and proposed surface and foul water drainage measures will be appraised in this report.

1.1.3 In July 2012, Halcrow Group Ltd completed a Flood Risk and Drainage Technical Appraisal, and recommended that detailed hydraulic modelling of Packman Dyke, a tributary of Fairham Brook, as it runs along the northern boundary of the site. The Environment Agency (EA) approved the existing flood extents produced, circa 2012.

1.1.4 This FRA and Drainage Strategy is to provide an update to the Halcrow 2012 report. It includes the detailed hydraulic modelling of both the pre development and the post development arrangements, as provided by Hydroland Consulting.

1.1.5 Flood extents for the proposed development have been modelled for this site with the inclusion of the surface water management and flood mitigation techniques.

1.2 Structure of Report

1.2.1 The desk study comprises of existing site information, including the aforementioned hydraulic modelling, the development proposal, geological and other available mapping. Information from the following sources have been used:

- The EA
- The British Geological Survey (BGS)
- Sewer undertaker: Severn Trent Water (STW)
- Lead Local Flood Authority (LLFA): Nottinghamshire County Council (NCC)
- Local Authority (LA): Rushcliffe Borough Council (RBC)

1.3 Site Location and Description

1.3.1 The Land West of Wilford Road is situated east of Clifton and west of Edwalton,
located on the northern edge of Ruddington, refer to Appendix 1; Drg. WM11065 - 100 for a site location plan.

1.3.2 The site for development is located at the approximate Grid Reference SK570338 (E:457023, N:333876). The nearest post code to the site is NG11 6AU. The total area of the site covers 6.6 ha, is currently undeveloped and used for agricultural purposes and therefore is considered greenfield. See Figure 1 below:

![Figure 1 - Site Location](image)

The site for development is bounded to the north by agricultural land and to the east by the B680 (Wilford Road) and Sellor’s Playing Field. To the south and the south east lies the built up area of Ruddington.

1.3.4 The topography of the site lies fairly flat, there is a minimal amount of fall. The highest levels are in the south east at approximately 30.0m AOD and the lowest in the north west at approximately 29.2 m AOD.

1.4 Proximity to Watercourses

1.4.1 The watercourse of greatest influence to the site is Packman Dyke, a tributary of Fairham Brook, it forms the northern boundary of the development site and flows west. The tributary re-joins Fairham Brook approximately 525m west of the site.
Fairham Brook is a tributary of the River Trent and re-joins the river approximately 3 km from the site.

1.4.2 There are three small waterbodies situated at 160m east, 330m north-east and 380m also north-east of the site. These waterbodies are likely to function as attenuation or feature ponds.

1.5 Geology and Ground Contamination

1.5.1 Online mapping produced by BGS has been reviewed as part of this FRA. The mapping indicates that the bedrock geology of the site predominantly consists of ‘Edwalton Member Mudstone’. The superficial geology is identified to comprise of an alluvium of clay, silt, sand and gravel.

Figure 2 - BGS Borehole Location Plan

1.5.2 There are no BGS borehole records located within the boundary however, there are a number of records available to the west of the site adjacent to Woodhouse Gardens and to the south of the site adjacent to Clifton Road. The nearest are labelled SK53SE36, SK53SE37 and SK53SE38. The data from these boreholes can be found in Table 1, below:

<table>
<thead>
<tr>
<th>Borehole Reference</th>
<th>Borehole Depth (m)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SK53SE36</td>
<td>5</td>
<td>Made ground consisting of clay with stones, followed by soft to firm mottled fine sand clay underlain by marl clay and pebbles, followed by firm sandy marl and firm crumbly red sandy marl to the base of the bore hole. Water encountered at approx. 2.4m.</td>
</tr>
</tbody>
</table>
Table 1 - BGS Borehole Data

<table>
<thead>
<tr>
<th>Borehole Reference</th>
<th>Borehole Depth (m)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SK53SE37</td>
<td>5</td>
<td>Made ground consisting of clay and stones, underlain by soft grey and brown mottled organic silty clay followed by soft brittle brown marl clay, to the base of the borehole consists of soft red sandy clayey marl. Water encountered at approx. 1.7m.</td>
</tr>
<tr>
<td>SK53SE38</td>
<td>5</td>
<td>Made ground consisting of sandy clay with tarmac stone brick, underlain by soft grey very sandy organic clay mottled. To the base of the borehole, the strata consists of wet, very soft to fine brittle red marl. Water encountered at approx. 1.5m.</td>
</tr>
</tbody>
</table>

1.5.3 There is a significant presence of clay in the three examples, clay properties are synonymous with limited soakaway potential.

1.5.4 No evidence of contamination was found in the closest borehole data records.

1.6 Description of Development

1.6.1 The proposed 6.6 ha development is for residential use, to deliver circa 200 dwellings, with a housing density of circa 30 per hectare and supporting infrastructure.

1.6.2 The development has a flood risk associated with it, as discussed in later sections, and so the development is to include the mitigation measures to offset this risk and cause no increase in flood risk to the adjacent areas.

1.7 Acknowledgement

1.7.1 Within this report, data from the BGS website has been ‘Reproduced with the permission of the British Geological Survey © NERC All Rights Reserved. Reproduction of any BGS materials does not amount to an endorsement by NERC or any of its employees of any product or service and no such endorsement should be stated or implied.

1.7.2 Additionally, data from the EA has been included in this review, flood zone data is now classed as open data; ‘Open Data can be accessed, used and shared by anybody. It allows access to our data under the Open Government Licence - free of charge and free of restriction, even for commercial use.’

1.8 Report Revisions

1.8.1 The January 2017 report has been revised to accommodate the following revisions:

- The masterplan has been revised and the developable area has been reduced slightly however, there are no changes to the flood modelling and proposed compensation works.
• The redline boundary has also been revised to include the flood compensation area.

• A response from the EA dated 6th July 2017 has been included in Appendix 6. This confirms that the proposed works do not increase flood risk elsewhere. It is proposed to make a flood map challenge when the compensation works have been completed to ensure the flood maps are updated.
2 BACKGROUND

2.1 National Planning Policy Framework

2.1.1 The NPPF and associated Technical Guidance was published by the Department for Communities and Local Government (DCLG) in March 2012. The NPPF supersedes Planning Policy Statement 25 (PPS 25) ‘Development and Flood Risk’ that had been in place since 2006.

2.1.2 The Technical Guidance to the NPPF was archived on 7th March 2014 and replaced by the new Planning Practice Guidance (PPG) ‘Flood Risk and Coastal Change’ which was launched online by the DCLG on 6th March 2014.

2.1.3 The NPPF stated that Local Plans should be supported by a Strategic Flood Risk Assessment (SFRA) which refines information regarding the probability of flooding, taking other sources of flooding and the impacts of climate change into account. SFRA’s provide the foundation for applying the sequential test on the basis of flood zones.

2.2 Planning Practice Guidance - Flood Risk and Coastal Change

2.2.1 The department for communities and Local Government (DCGL) published PPG in March 2014, a web based resource containing similar information to that contained in the Planning Policy Statement Practice Guide. The online PPG provides direction on flood risk during development and planning.

2.2.2 The ‘Flood Risk and Coastal Change’ PPG advises on how planning can take account of the risks associated with flooding and coastal change in plan making and the application process.

2.3 Flood Zones

2.3.1 The EA have published various maps identifying areas at risk of flooding from fluvial, tidal, pluvial/overland flow, reservoirs and groundwater sources. These maps are based on improved hydraulic modelling and detailed local data, and are published on the EA website. ‘Flood Zones’ are designated based on their predicted flood risk. See Table 2, taken from Table 1 of the PPG defines the levels of flood risk:
Table 2 - Flood Zones from Planning Practice Guidance: Flood Risk and Coastal Change

<table>
<thead>
<tr>
<th>Flood Zone</th>
<th>Flood Zone Classification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood Zone 1</td>
<td>Low Probability</td>
<td>This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding (&lt;0.1%).</td>
</tr>
<tr>
<td>Flood Zone 2</td>
<td>Medium Probability</td>
<td>This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year.</td>
</tr>
<tr>
<td>Flood Zone 3a</td>
<td>High Probability</td>
<td>This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (&gt;1%) or a 1 in 200 or greater annual probability of flooding from the sea (&gt;0.5%) in any year.</td>
</tr>
<tr>
<td>Flood Zone 3b</td>
<td>Functional Floodplain</td>
<td>The zone comprises land where water has to flow or be stored in times of flood.</td>
</tr>
</tbody>
</table>

2.3.2 The PPG states that all development within Flood Zones 2 or 3, and/or are over 1ha in size must be accompanied by a site-specific FRA undertaken as part of the planning application process.

2.3.3 EA mapping indicates that the development site is predominantly located in Flood Zones 2 and within the northern boundary and north east falling in Flood Zone 3. See Figure 3 below.

Figure 3 – EA Flood Map
2.3.4 Due to the size of the site exceeding 1ha and the flood risk associated with the land for development a full FRA must be completed.

2.4 **Flood Risk Vulnerability**

2.4.1 Table 2 of the PPG identifies the Flood Risk Vulnerability Classification of development types. Development types are classed as ‘Essential Infrastructure’, ‘Highly Vulnerable’, ‘More Vulnerable’, ‘Less Vulnerable’ and ‘Water Compatible Development’ depending on their use and vulnerability.

2.4.2 ‘More Vulnerable’ development includes ‘Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels’. Therefore, the site is considered to be ‘More Vulnerable’ in accordance with the PPG.

2.5 **The Sequential and Exception Tests**

2.5.1 The PPG details the Sequential and Exception Tests. The aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding.

2.5.2 It states that ‘Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 (areas with a high probability of river or sea flooding) be considered, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required.’

2.5.3 An exemption test is defined as the measures, ‘to demonstrate and help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk are not available’.

2.5.4 Table 3 of the PPG identifies when the Exception Test should be applied, and is reproduced below:

<table>
<thead>
<tr>
<th>Table 3 - Flood Risk Vulnerability Classifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flood Zones</strong></td>
</tr>
<tr>
<td>Essential Infrastructure</td>
</tr>
<tr>
<td>Zone 1</td>
</tr>
<tr>
<td>Zone 2</td>
</tr>
<tr>
<td>Zone 3a</td>
</tr>
</tbody>
</table>
Table 3 - Flood Risk Vulnerability Classifications

<table>
<thead>
<tr>
<th>Flood Zones</th>
<th>Essential Infrastructure</th>
<th>Highly Vulnerable</th>
<th>More Vulnerable</th>
<th>Less Vulnerable</th>
<th>Water Compatible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 3b</td>
<td>Exception Test Required</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✓</td>
</tr>
</tbody>
</table>

- ✓ Development is appropriate
- ✗ Development should not be permitted

2.5.5 With reference to Table 3, ‘More Vulnerable’ development can be appropriately located within Flood Zones 3a, 2 and 1. However, an Exception Test is required in this instance.

2.6 Preliminary Flood Risk Assessment

2.6.1 Preliminary Flood Risk Assessments (PFRA’s) are a requirement of the Flood Risk Regulations (2009), and are produced by Lead Local Flood Authorities (LLFA’s). Their purpose is to provide information on significant historical flood events and summarise future flood risk from all sources of flooding.

2.6.2 The PFRA for Nottinghamshire was completed by JBA Consulting in 2011. Key points of the PFRA relevant to this site include:

- Historical flooding events have been recorded in Nottinghamshire, however none have been recorded within the Borough of Rushcliffe; the study area. A majority of the recorded incidents of flooding in the Nottinghamshire County have been caused by intense rainfall events leading to surface water runoff exceeding the capacity of local drainage, watercourses and associated structures.

- Significant flooding events occurred in June/July 2007 and affected many settlements across the north, east and west of the county. This included the flooding of the River Ryton at Worksop and River Idle at Retford, estimated total of 1412 properties were flooded across the county.

2.7 Strategic Flood Risk Assessment (SFRA) – Level 1

2.7.1 The NPPF states that Local Plans should be supported by an SFRA which refines information regarding the probability of flooding, taking other sources of flooding and the impacts of climate change into account. SFRA’s provide the foundation for applying the Sequential Test, on the basis of the Flood Zones.
2.7.2 In June 2008, Black and Veatch produced a Level 1 SFRA for Greater Nottingham as commissioned by the EA on behalf of the Greater Nottingham SFRA partnership.

- The River Trent Catchment has long history of flooding, with notable fluvial flooding events occurring in 1795, 1875 and 1947. However, there are no recorded flood events at the site.

- ISIS modelling of Fairham Brook specifically indicates that Clifton Lane along with three other locations at lesser proximity to the site, are at risk to of 1 in 100 annual chance flood event.

- Modelling results additionally demonstrate that during a 1 in 20 annual chance flood event, the Fairham Brook is predicted to overtop its banks and flood surrounding fields (with no damage to properties).

- As part of the sustainable flood risk management strategy, a catchment-wide approach to flooding is promoted, through the use of natural processes and systems, to slow down and store water. SUDS techniques have been outlined as favourable in this report.

2.8 Local Development Framework

2.8.1 A Local Development Framework (LDF) is a spatial planning strategy for England and Wales, and is the responsibility of district councils. The LDF comprises of Local Development Documents (including Local Plans), Supplementary Planning Documents (SPD’s), Statements of Community Involvement and other documents as required.

2.9 Core Strategy

2.9.1 The Rushcliffe Local Plan ‘Part 1 Core Strategy’ was adopted in December 2014 and sets out the spatial vision for development of Rushcliffe to 2028.

2.9.2 Spatial Objective I of the Core Strategy is the obligation for ‘Environmentally responsible development addressing climate change’. This comprises of the reduction of the causes of climate change and minimisation of its impacts, through locating development where it can be highly accessible by sustainable transport, requiring environmentally sensitive design and construction and reducing the flood risk.

2.9.3 Local plan policies relevant to this site are:

- **Policy 2** – *Development proposals are anticipated to mitigate against and adapt to climate change and to conform to national and local targets on reducing carbon emissions and energy use.*
Flood risk and sustainable drainage:

- Development proposals that avoid areas of current and future flood risk and which do not increase the risk of flooding elsewhere and where possible reduce flood risk, adopting the precautionary principle to development, will be supported.

- Where no reasonable site within Flood Zone 1 is available, allocations and other development proposals in Flood Zone 2 and Flood Zone 3 are considered on a sequential basis in accordance with national planning policy on flood risk and the SFRA.

- Areas in Flood Zone 2 and Flood Zone 3 where windfall site development is appropriate in flood risk terms, subject to the application of the Exception Test, will be defined in the Local Plan Part 2 (Land and Planning Policies) in accordance with NPPF on flood risk and the SFRA.

- Where it is necessary to apply the Exception Test the following factors will be taken into account when considering if development has wider sustainability benefits to the community that outweigh flood risk:
  - There are exceptional and sustainable circumstances for locating the development within such areas, including the necessary re-use of brownfield sites; and
  - The flood risk can be fully and safely mitigated by engineering and design measures.
  - All new development should incorporate measures to reduce surface water run-off, and the implementation of SUDS into all new development will be sought unless it can be demonstrated that such measures are not viable or technically feasible.

2.10 Sustainable Drainage Systems

2.10.1 As of 6th April 2015, the use of Sustainable Drainage Systems (SUDS) is a requirement in all new ‘Major Developments’ where appropriate. As of 15th April 2015, LLFA’s became Statutory Consultees on all major developments with surface water drainage implications. This role is similar to that previously held by the EA.

2.10.2 In line with local policy and in order to ensure there are no adverse water quality impacts on the receiving watercourse, SUDS have been considered.
2.10.3 The design of surface water drainage systems to serve the development considers both water treatment and on site attenuation in accordance with CIRIA C753.

2.10.4 Where practical SUDS aim to emulate the natural drainage systems of a site.

2.10.5 The attenuation basins are intended to achieve the three basic design principles of SUDS; quality control, quantity control and amenity value.

2.10.6 Attenuation basins are generally described as depressions in the surface designed to store water and where the ground conditions permit, allow discharge to the ground via infiltration.
3 ASSESSMENT OF EXISTING FLOOD RISK

3.1.1 The main source of flooding associated with this site, as identified by the EA flood risk maps and defined by the PPG, is from ‘river and seas sources’; directly from rainfall on the ground surface overwhelming the local watercourses and sewers.

3.2 Fluvial Flooding

3.2.1 Fluvial flooding occurs when the capacity of watercourses (including streams, brooks and ditches etc.) are exceeded due to intense rainfall, and water levels come out of bank.

3.2.2 As shown in section 2, figure 3 – EA Flood Map; the site is located in Flood Zones 1, 2 and 3. In accordance with Table 1 in section 2 taken from the PPG, Zone 1 has a less than 0.1% (1 in 1000 year) probability of flooding annually, Zone 2 between 0.1% and 1% (1 in 100 year) and Zone 3 has a greater than 1% probability of annual flooding.

3.2.3 This risk is associated with Packman Dyke, located along the northern boundary, when it overflows when overwhelmed by rainfall it breaches its banks flooding the area to the south.

3.3 Hydraulic Modelling

3.3.1 The Technical Appraisal produced by Halcrow in July 2012 recommended modelling of Packman Dyke. The existing flood extents were subsequently produced by Halcrow circa 2012. This placed the site for development within the 100-year flood event, these flood extents were approved by the EA.

3.3.2 In October 2015 Hydroland Consultants completed hydraulic modelling to update the ISIS 1D 2D hybrid model for Packman Dyke. Additionally, post development flood extents were produced based on the development including flood mitigation measures.

3.3.3 Following updated guidance from the EA regarding climate change Hydroland, provided additional model simulations and analysis showing greater climate change allowances and their impact on the proposal.

3.3.4 The model of the tributary was initially run to show the baseline (pre development) condition. The flood extents of the pre development site can be seen in Figure 4 overleaf.
3.4 Tidal Flooding

3.4.1 Tidal flooding is caused by exceptionally high sea level and extreme wave heights. Tidal flooding is incorporated into the EA’s fluvial flood mapping and Flood Zone Designation.

3.4.2 The site is at a significant distance (approximately 83 km) from the coast and has not been identified as at risk of tidal flooding.

3.5 Pluvial/ Surface Water Flooding

3.5.1 Surface water flooding is caused by rain falling onto the ground (which has either become saturated or is impermeable), and does not reach watercourses or drainage infrastructure. The EA surface water flood risk map examines the risk of flooding from surface water assuming no infiltration or drainage systems.

3.5.2 According to the EA’s online mapping resource, the site is located in a low risk of surface water flooding. Low risk, as defined in the PPG, is between 0.1% and 1% of annual flooding. This coincides with the hydraulic modelling showing that the site falls within the 1 in 100 year plus climate change flood extents.
Groundwater flooding can occur anywhere that groundwater levels rise above the ground surface. Groundwater flooding can be difficult to predict and identify, and is often linked to surface water flooding.

In the 2008 SFRA, groundwater flooding was not identified as a concern in the area of Greater Nottingham.

Additionally, the site is not located in a GWSPZ.

The application site is underlain by aquifers consisting of superficial deposits and bedrock. According to the information from Table 1; data gathered from the BGS website, the superficial deposit aquifer comprises of alluvium (clay, silt, sand and gravel). The EA have classed this aquifer as a Secondary A (minor) Aquifer. A Secondary Aquifer generally consist of permeable layers capable of supporting water supplies and in this case can be an important source for base flows for watercourses such as Packman Dyke.

The bedrock aquifer consists of the aforementioned Edwalton Member Mudstone; this aquifer is classified as a Secondary B (minor) Aquifer. By nature, these aquifers
have predominantly low permeability and yield little amounts of groundwater.

3.7.3 These characteristics indicate that the potential to soakaway may be limited, however, this should be determined through the appropriate ground investigations and percolation tests.

3.8 Other sources of flooding

3.8.1 According to the SFRA the site is only at risk of flooding from surface water and river and sea sources. It is therefore assumed that other sources including reservoirs, canals and other artificial sources do not pose a risk to the site for development.

3.9 Historic Flooding

3.9.1 The SFRA noted significant flood events in the wider area, and flood issues related to Fairham Brook, the immediate area of the site was not signified to have a history of flooding. However, it is likely that Packman Dyke has flooded the development area due to the aforementioned flood risk and sources associated with the site.

3.9.2 The PFRA also made reference to flooding in the wider area of Nottinghamshire.
4 EXISTING DRAINAGE

4.1 Foul Water Drainage

4.1.1 Public sewer records obtained from STW; indicated that there is a 375mm φ foul gravity sewer crossing the site from east to west, this sewer requires a 5m easement on both sides from any building or structure.

4.1.2 There is a 150mm φ pipe leading to a 225mm φ along Wilford Road to the east of the site. In the south and south east, the residential areas are served by foul gravity sewers. The STW records can be found as part of Appendix 4.

4.1.3 The sewer records were obtained as part of the response from a developer enquiry submitted by Halcrow in 2012 as part of their Technical Appraisal, this will require review after outline planning.

4.2 Surface Water Drainage

4.2.1 The sewer records from STW show that there is no surface water sewer present within the site boundary.

4.2.2 Based on the topography and the greenfield nature of the site, it is assumed that the site drains naturally to Packman Dyke along the northern boundary.

4.2.3 The tributary is assumed to accept surface water runoff at a greenfield discharge rate, Table 4 below shows the values of QBAR obtained using Microdrainage. Two different methods have been used, the IH 124 method is recommended for sites over 50 ha, however, produces very similar results to the ICP SUDS method intended for smaller sites.

<table>
<thead>
<tr>
<th>Method</th>
<th>QBAR (l/s/ha)</th>
<th>100 yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>IH 124</td>
<td>3.67</td>
<td>7.63</td>
</tr>
<tr>
<td>ICP SUDS</td>
<td>3.67</td>
<td>7.64</td>
</tr>
</tbody>
</table>
5 ASSESSMENT OF POTENTIAL FLOOD RISK

5.1.1 The proposed development is for circa 200 residential units and associated infrastructure; however, as part of the site is located within Flood Zone 3a. Hydraulic analysis was required as a result of this.

5.1.2 The hydraulic modelling was carried out by Hydroland Consulting in August 2016, using ISIS 1D – 2D hybrid modelling.

5.1.3 Pre development flood extents were produced as were the post development, and a comparison was made between the two, to ensure that the proposed development did not increase the water levels at the observation points located along Packman Dyke. The comparison for the 1000 year and 100 CC year events can be found below in Table 5 below and the 100 year and 20 year events can be found overleaf in Table 6, reference has been made to cross sections and can be seen in Drg. WM11065-110.

| Table 5 - Flood Levels; Existing and Proposed for the 1%CC and 0.1% Events |
|------------------|------------------|------------------|------------------|-------------------|-------------------|-------------------|
| Node Label | Cross Section | Water Level (m) 1000yr (0.1%) | Difference | Water Level (m) 100ccyr (1%CC) | Difference |
| RUD931 | 30.141 | 30.169 | 0.03 | 30.069 | 30.068 | 0.00 |
| RUD919 | 13 | 30.080 | 30.113 | 0.03 | 30.028 | 30.027 | 0.00 |
| RUD893 | 30.031 | 30.061 | 0.03 | 29.967 | 29.963 | 0.00 |
| RUD873 | 29.951 | 29.965 | 0.01 | 29.908 | 29.901 | -0.01 |
| RUD848 | 29.858 | 29.857 | 0.00 | 29.836 | 29.825 | -0.01 |
| RUD822 | 11 | 29.816 | 29.807 | -0.01 | 29.795 | 29.781 | -0.01 |
| RUD796 | 29.779 | 29.767 | -0.01 | 29.748 | 29.724 | -0.02 |
| RUD771 | 29.677 | 29.641 | -0.04 | 29.652 | 29.616 | -0.04 |
| RUD742 | 9 | 29.620 | 29.554 | -0.07 | 29.592 | 29.521 | -0.07 |
| RUD711 | 29.579 | 29.453 | -0.13 | 29.540 | 29.379 | -0.16 |
| RUD424 | 1 | 28.985 | 28.981 | 0.00 | 28.938 | 28.917 | -0.02 |
| RUD406 | 28.776 | 28.753 | -0.02 | 28.645 | 28.597 | -0.05 |
| RUD393 | 28.707 | 28.693 | -0.01 | 28.599 | 28.552 | -0.05 |
| RUD365 | 28.641 | 28.622 | -0.02 | 28.511 | 28.508 | 0.00 |
| RUD340 | 28.604 | 28.603 | 0.00 | 28.501 | 28.498 | 0.02 |

| Table 6 - Flood Levels; Existing and Proposed for the 1% and 5% Events |
|------------------|------------------|------------------|------------------|-------------------|-------------------|
| Node Label | Cross Section | Water Level (m) 100yr (1%) | Difference | Water Level (m) 20yr (5%) | Difference |
| RUD931 | 30.003 | 29.996 | -0.01 | 29.872 | 29.849 | -0.02 |
Table 6 - Flood Levels; Existing and Proposed for the 1% and 5% Events

<table>
<thead>
<tr>
<th>Node Label</th>
<th>Cross Section</th>
<th>Water Level (m) 100yr (1%)</th>
<th>Water Level (m) 20yr (5%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Existing</td>
<td>Design</td>
</tr>
<tr>
<td>RUD919</td>
<td>13</td>
<td>29.969</td>
<td>29.962</td>
</tr>
<tr>
<td>RUD893</td>
<td></td>
<td>29.910</td>
<td>29.901</td>
</tr>
<tr>
<td>RUD873</td>
<td></td>
<td>29.869</td>
<td>29.859</td>
</tr>
<tr>
<td>RUD848</td>
<td></td>
<td>29.814</td>
<td>29.801</td>
</tr>
<tr>
<td>RUD822</td>
<td>11</td>
<td>29.775</td>
<td>29.759</td>
</tr>
<tr>
<td>RUD796</td>
<td></td>
<td>29.719</td>
<td>29.694</td>
</tr>
<tr>
<td>RUD771</td>
<td></td>
<td>29.634</td>
<td>29.600</td>
</tr>
<tr>
<td>RUD742</td>
<td>9</td>
<td>29.573</td>
<td>29.499</td>
</tr>
<tr>
<td>RUD711</td>
<td></td>
<td>29.515</td>
<td>29.329</td>
</tr>
<tr>
<td>RUD424</td>
<td>1</td>
<td>28.906</td>
<td>28.892</td>
</tr>
<tr>
<td>RUD406</td>
<td></td>
<td>28.561</td>
<td>28.517</td>
</tr>
<tr>
<td>RUD393</td>
<td></td>
<td>28.514</td>
<td>28.470</td>
</tr>
<tr>
<td>RUD365</td>
<td></td>
<td>28.419</td>
<td>28.376</td>
</tr>
<tr>
<td>RUD340</td>
<td></td>
<td>28.338</td>
<td>28.302</td>
</tr>
</tbody>
</table>

5.1.4 Hydroland’s technical report concludes that the flood level of the surrounding area and downstream sections of the tributary show slight improvement. The additional simulations of the proposed model show that climate change allowances according to new guidance can be accommodated in the proposal. The full report can be found in Appendix 2.

5.1.5 Modelling data files have been provided for EA review.

5.2 Summary of Flood Risk

5.2.1 On implementation of the strategy detailed in section 6 and shown in Appendix 1 – Drg. WM11065-102, it can be considered that the development will be at a low risk of flooding.

Table 7 - Potential Sources of Flooding

<table>
<thead>
<tr>
<th>Flood Source</th>
<th>Presence at site?</th>
<th>Potential risk at site (high/ medium/ low)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluvial</td>
<td>Yes</td>
<td>Low</td>
<td>A flood alleviation area will be provided, removing the development from the 1 in 100yr + climate change floodplain.</td>
</tr>
<tr>
<td>Tidal</td>
<td>No</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Groundwater</td>
<td>No</td>
<td>Low</td>
<td></td>
</tr>
</tbody>
</table>
### Table 7 - Potential Sources of Flooding

<table>
<thead>
<tr>
<th>Flood Source</th>
<th>Presence at site?</th>
<th>Potential risk at site (high/medium/low)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pluvial</td>
<td>Yes</td>
<td>Medium</td>
<td>Surface water flow routes mirror the modelled fluvial floodplain, therefore mitigation will be provided by ground raising and the flood alleviation area.</td>
</tr>
<tr>
<td>Sewers and Drains</td>
<td>No</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Other Artificial Sources</td>
<td>Yes</td>
<td>Low</td>
<td>Reservoir mapping is indicative only and excludes known constraints.</td>
</tr>
</tbody>
</table>
6 PROPOSED DRAINAGE

6.1 Foul Water Drainage

6.1.1 The foul water discharge from the proposed development is to discharge to the existing public foul water sewer that cuts through the site from east to west. The 10m easement required by STW has been incorporated into the masterplan as can be seen in Appendix 1; Drg. WM11065-102.

6.1.2 The two potential locations proposed are located on the 375 mm φ crossing the site, MH 1801 and MH 9801 have been identified and can be seen in Appendix 1; Drg. WM11065-101.

6.1.3 A pre development enquiry was submitted to STW and in the response it was stated that the development, can be accommodated within the existing system.

6.1.4 The foul sewer arrangement allows the site to drain via gravity, to the identified manholes, there is no requirement for offsite improvement works.

6.1.5 The response to the enquiry was provided to Halcrow in 2012 and can be found in Appendix 4, this will require reviewed once outline design is completed.

6.1.6 A new pre developer enquiry has been submitted to STW in order to reconfirm that capacity is available in the network to accommodate the foul flows from the proposed development. However, It is expected that there will no issues with capacity as no major development has taken place in the area.

6.2 Surface Water Drainage

6.2.1 The flood risk associated with the existing site spreads through the site boundary, it is proposed to remove the flood extents within the boundary and relocate it to the area north of the site using ground re-profiling. The proposed flood compensation requirements are detailed in Table 8 below:
Table 8 - Flood Compensation Requirements

<table>
<thead>
<tr>
<th>Elevation (m AOD)</th>
<th>Existing Southern Floodplain Volume (m³)</th>
<th>Existing Northern Floodplain Volume (m³)</th>
<th>Required Compensation Volume (m³)</th>
<th>Compensation Volume Provided (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>29.2</td>
<td>104</td>
<td>300</td>
<td>404</td>
<td>500</td>
</tr>
<tr>
<td>29.3</td>
<td>302</td>
<td>1062</td>
<td>1364</td>
<td>2133</td>
</tr>
<tr>
<td>29.4</td>
<td>1356</td>
<td>2116</td>
<td>3472</td>
<td>5106</td>
</tr>
<tr>
<td>29.5</td>
<td>3953</td>
<td>3306</td>
<td>7259</td>
<td>9593</td>
</tr>
<tr>
<td>29.6</td>
<td>7332</td>
<td>4611</td>
<td>11943</td>
<td>15592</td>
</tr>
<tr>
<td>29.7</td>
<td>11138</td>
<td>6053</td>
<td>17191</td>
<td>22600</td>
</tr>
<tr>
<td>29.8</td>
<td>15159</td>
<td>7619</td>
<td>22788</td>
<td>30277</td>
</tr>
</tbody>
</table>

6.2.2 Level for level the compensation provided through the new ground levels exceeds that required from the northern and southern plots.

6.2.3 The compensation required is provided by the volumes generated by the contouring of the area to the north of the proposed development. This will also provide sports pitches, wetlands and public open space.

6.2.4 The proposed development plateaus will be raised to a level that is 600mm above the 100-year event plus 20% allowance for climate change flood level. Depending on existing site contours, levels (some of which may already achieve this level requirement) and associated existing and proposed infrastructure to tie into, the required 600mm above the 100-year event plus 20% flood level will vary across the site. Ground reprofiling in line with a cut and fill design across the site will take this flood risk level requirement into account at the detailed design stage. Additional analysis of 35% and 70% climate change allowance for peak river flow were completed to ensure the safety of the development. These simulations are shown below in Table 9, showing that a freeboard is still available in from the Finished Floor Level in the 70% climate change allowance.
Table 9 - Climate Change Levels

<table>
<thead>
<tr>
<th>Node Label</th>
<th>20% 100ccyr</th>
<th>Finished floor level</th>
<th>35% 100ccyr</th>
<th>Remaining Freeboard (m)</th>
<th>70% 100ccyr</th>
<th>Remaining Freeboard (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUD931</td>
<td>30.068</td>
<td>30.668</td>
<td>30.191</td>
<td>477</td>
<td>30.294</td>
<td>374</td>
</tr>
<tr>
<td>RUD919</td>
<td>30.027</td>
<td>30.627</td>
<td>30.133</td>
<td>494</td>
<td>30.207</td>
<td>420</td>
</tr>
<tr>
<td>RUD893</td>
<td>29.963</td>
<td>30.563</td>
<td>30.082</td>
<td>481</td>
<td>30.154</td>
<td>409</td>
</tr>
<tr>
<td>RUD873</td>
<td>29.901</td>
<td>30.501</td>
<td>29.983</td>
<td>518</td>
<td>30.059</td>
<td>442</td>
</tr>
<tr>
<td>RUD848</td>
<td>29.825</td>
<td>30.425</td>
<td>29.871</td>
<td>554</td>
<td>29.906</td>
<td>519</td>
</tr>
<tr>
<td>RUD822</td>
<td>29.781</td>
<td>30.381</td>
<td>29.831</td>
<td>550</td>
<td>29.894</td>
<td>487</td>
</tr>
<tr>
<td>RUD796</td>
<td>29.724</td>
<td>30.324</td>
<td>29.783</td>
<td>541</td>
<td>29.829</td>
<td>495</td>
</tr>
<tr>
<td>RUD771</td>
<td>29.616</td>
<td>30.216</td>
<td>29.667</td>
<td>549</td>
<td>29.735</td>
<td>481</td>
</tr>
<tr>
<td>RUD742</td>
<td>29.521</td>
<td>30.121</td>
<td>29.571</td>
<td>550</td>
<td>29.616</td>
<td>505</td>
</tr>
<tr>
<td>RUD711</td>
<td>29.379</td>
<td>29.979</td>
<td>29.47</td>
<td>509</td>
<td>29.584</td>
<td>395</td>
</tr>
<tr>
<td>RUD424</td>
<td>28.917</td>
<td>29.517</td>
<td>28.988</td>
<td>529</td>
<td>29.102</td>
<td>415</td>
</tr>
<tr>
<td>RUD406</td>
<td>28.597</td>
<td>29.197</td>
<td>28.779</td>
<td>418</td>
<td>28.958</td>
<td>239</td>
</tr>
<tr>
<td>RUD393</td>
<td>28.552</td>
<td>29.152</td>
<td>28.739</td>
<td>413</td>
<td>28.941</td>
<td>211</td>
</tr>
<tr>
<td>RUD340</td>
<td>28.498</td>
<td>29.098</td>
<td>28.73</td>
<td>368</td>
<td>28.94</td>
<td>158</td>
</tr>
</tbody>
</table>

6.2.5 From those nodes that fall adjacent to the site (refer to Drg. WM11065 – 110) the minimum remaining freeboard for the 100 year plus 70% allowance is 374mm, and therefore is considered suitable.

6.2.6 Packman Dyke will require a small diversion in order to create an attenuation feature to the north of the site as can be seen in Appendix 1, Drg. WM11065-102. This land is within the client’s ownership and the diversion enables the full utilisation of the site for the residential development. The diversion can provide water quality improvements and increase the capacity within the tributary, therefore the benefits of greater capacity and filtration opportunities will benefit areas downstream.

6.2.7 In addition, a small ditch is proposed in order to direct flows in the event of a blockage along Packman Dyke. As Packman Dyke flows from east to west it passes under Wilford Road, at this point blockage can be an issue. In order to direct flows away from the development, a small ditch is proposed to route any potential spill over the left bank through the ditch and away from the residential development. Hydroland has also modelled this blockage scenario and has concluded it is suitable.

6.2.8 Surface water from the development is proposed to discharge to the attenuation feature to the north through a pipe network, and discharged at a limited discharge rate of 3.7 l/s/ha to imitate greenfield surface water management conditions, to Packman Dyke.
6.2.9 The attenuation feature has been sized to hold 60% of the developable area within the site boundary, to hold the 1 in 100-year event plus accommodations for climate change and assumes no infiltration at this stage to be conservative. Table 10 below details the attenuation requirements for the development.

<table>
<thead>
<tr>
<th>Area (ha)</th>
<th>60% Area (ha)</th>
<th>QBAR Discharge (l/s)</th>
<th>Approximate Storage Requirement (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.6</td>
<td>3.96</td>
<td>14.53</td>
<td>2413</td>
</tr>
</tbody>
</table>

6.2.10 The proposed attenuation feature has the geometry displayed below in Table 11, where at 29.750m AOD, an additional 916 m³ has been provided for a 300mm freeboard for storm events more extreme than the 1 in 100 year plus climate change:

<table>
<thead>
<tr>
<th>Elevation (m AOD)</th>
<th>Area (m²)</th>
<th>Volume Provided (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>28.450</td>
<td>2050</td>
<td></td>
</tr>
<tr>
<td>29.450</td>
<td>2842</td>
<td>2435</td>
</tr>
<tr>
<td>29.750</td>
<td>3105</td>
<td>3351</td>
</tr>
</tbody>
</table>

6.2.11 The proposed attenuation feature provides more than the required attenuation at 1m depth for the 100-year event plus 30% for climate change. The new guidelines suggest an allowance of 20% as a central allowance and 40% as an upper allowance, as explained further in section 7. In order to be conservative 30% was used in the instance that the central allowance is exceeded. Anything above 30% climate change is anticipated to be stored in the freeboard.

6.2.12 The proposed development was then modelled hydraulically, and the flood map of the proposed development below was produced, concluding that the ground re profiling and ditch diversion do not increase the risk to the site for development. Please refer to Appendix 2 for the technical note. The LLFA will be consulted on land consents for the watercourse diversion.
7 CLIMATE CHANGE

7.1.1 In assessing the potential flood risk at the site over the lifetime of the development, climate change must be taken into account. Climate change allowances have been based on the guidance set out by the EA as of the 19th Feb 2016, the guidance regarding peak rainfall intensity has been reproduced below.

<table>
<thead>
<tr>
<th>Applies Across all of England</th>
<th>Total Potential Change Anticipated for 2010 to 2039</th>
<th>Total Potential Change Anticipated for 2040 to 2059</th>
<th>Total Potential Change Anticipated for 2060 to 2115</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper End</td>
<td>10%</td>
<td>20%</td>
<td>40%</td>
</tr>
<tr>
<td>Central</td>
<td>5%</td>
<td>10%</td>
<td>20%</td>
</tr>
</tbody>
</table>

7.1.2 In assessing the volume of surface water attenuation needed for the attenuation of the surface water runoff from the developed site, a 30% climate change allowance has been included. Consideration has also been given to the Upper End allowance and this additional volume can be accounted for in the freeboard of each feature.

7.1.3 The peak river flow allowances are based on river basin district. The allowances for the Severn and Humber districts are shown in Table 13.

<table>
<thead>
<tr>
<th>River Basin District</th>
<th>Allowance Category</th>
<th>Total Potential Change Anticipated for the ‘2020s’ (2015 to 2039)</th>
<th>Total Potential Change Anticipated for the ‘2050s’ (2040 to 2069)</th>
<th>Total Potential Change Anticipated for the ‘2080’s (2070 to 2115)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severn</td>
<td>Upper end</td>
<td>25%</td>
<td>40%</td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td>Higher Central</td>
<td>15%</td>
<td>25%</td>
<td>35%</td>
</tr>
<tr>
<td></td>
<td>Central</td>
<td>10%</td>
<td>20%</td>
<td>25%</td>
</tr>
<tr>
<td>Humber</td>
<td>Upper end</td>
<td>20%</td>
<td>30%</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>Higher Central</td>
<td>15%</td>
<td>20%</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>Central</td>
<td>10%</td>
<td>15%</td>
<td>20%</td>
</tr>
</tbody>
</table>

7.1.4 The hydraulic modelling of Packman Dyke completed by Hydroland included analysis of the upper end and higher central allowances of 70% and 35% respectively. The results of the analysis are shown in Appendix 2. These values were used in order to be conservative, although the site is located in Humber river basin district and has lower values, the values used guarantee the safety of the development.
8 RESIDUAL RISK AND MITIGATION MEASURES

8.1.1 A flood alleviation area will be provided in the undeveloped area to the north of the site. This will relocate the existing flood risks from within the development site boundary to the open area in the north. This will be achieved by contouring the ground levels to encourage the overland flows and the exceedance flows from Packman Dyke away from the development and to the north. This will consequently remove the site for development from the 1 in 1000-year floodplain.

8.1.2 The modelling carried out by Hydroland showed no increase to the water levels in the watercourse following the application of the mitigation methods and the proposed development. Therefore, the site for development is removed from the floodplain. It is concluded that this contouring of the undeveloped area is a suitable flood mitigation technique.

8.1.3 Flood risk posed by the developed area is mitigated by storing the surface water runoff in an attenuation feature and restricting the discharge to the tributary to a QBAR discharge rate. The proposed attenuation feature volume exceeds that required by the development for the 1 in 100-year event plus 30% climate change, and is therefore suitable for the proposal. Additionally, a further 916m3 has been provided for a 300mm freeboard for events in excess of the 100 year plus climate change.

8.1.4 In diverting Packman Dyke, the length of the watercourse is increased, this subsequently will provide a greater capacity and therefore provide benefits downstream.

8.1.5 In order to remove the flood risk from the area for development, a flood alleviation area has been proposed. There are a number of benefits associated with removing the flood risk from an unrestrained area and placing it in a controlled area. The residential areas to the south and the south east are no longer adjacent to a flood risk area.

8.1.6 These proposed measures are not only intended to confirm the sustainability benefits of the proposals and form an input to the LPA’s application of the exemption test, but would also have benefits to residential areas surrounding the site through provision of the additional flood-capacity to land to the north of the brook, reducing future risk of flooding beyond the site.
9 ADOPTION AND MAINTENANCE

9.1.1 The attenuation feature will be offered to Ruddington Parish Council, LLFA; Nottinghamshire CC and LA; Rushcliffe BC for adoption, as an alternative a management company will be considered.

9.1.2 A general maintenance regime is outlined below in Table 14 to ensure the functionality of the surface water management features:

<table>
<thead>
<tr>
<th>Table 14 - Maintenance Regime</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Regular Maintenance</strong></td>
</tr>
<tr>
<td>Litter and debris removal from site</td>
</tr>
<tr>
<td>Amenity grass cutting (at 35 -50mm) where appropriate; overland flood routes, spillways etc.</td>
</tr>
<tr>
<td>Grass cutting to access routes, overflows and basin where required (at 75-100mm, not to exceed 150mm)</td>
</tr>
<tr>
<td>Meadow grass cutting where appropriate (at 50mm) and remove wildlife or compost piles</td>
</tr>
<tr>
<td>Managing wetland planting in micropools by cutting and remove wildlife or compost piles</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

| | | |
| | | As required |
10 CONCLUSION

10.1.1 The proposal within this report is to promote the development of a residential area consisting of circa 200 units, the masterplan can be seen in Appendix 1; Drg. WM11065-108.

10.1.2 The site for development is located within Flood Zones 1, 2 and 3a, according to the mapping produced by the EA. Packman Dyke, a tributary of Fairham Brook, is located along the northern boundary of the site, this watercourse is the main influence to the site in terms of flood risk.

10.1.3 Due to this associated flood risk the existing flood extents were modelled by Halcrow circa 2012, these flood extents were approved by the EA. These flood extents were updated in October 2015 by Hydroland consulting and in August 2016 following update guidelines from the EA regarding climate change, the model was checked against higher peak river flow allowances and it was concluded that the flood risk management proposal was sufficient.

10.1.4 Flood mitigation measures include the establishment of an allowable flood area through ground profiling of the public open space to the north of the site, in order to relocate the flood risk entirely to the north.

10.1.5 Ground raising will be required in order for the finished floor levels of the site to be 600mm above the 100 year plus climate change flood level so that the site is out of the floodplain.

10.1.6 Additional modelling by Hydroland showed the flood extents for the proposed development were produced to conclude that the flood mitigation measures proposed were suitable for the development.

10.1.7 The development itself requires an attenuation volume of 2413m$^3$ and is proposed to discharge to a feature of 2435m$^3$, also located to the north of the site as can be seen in Drg. WM11065-102. A further 916m$^3$ is provided for a 300mm freeboard to accommodate more events more extreme than the 1 in 100 year plus climate change.

10.1.8 The attenuation feature is proposed to discharge to Packman Dyke at a restricted discharge rate of 3.7 l/s/ha (QBAR) and is designed to hold the 100-year rain event with 30% accommodation for climate change. Packman Dyke will require diverting to maximise the area for development and create a space upstream of the watercourse.
10.1.9 Packman Dyke will be diverted to provide a suitable location for the attenuation feature, the diversion offers an increase in length and therefore capacity, it can also provide additional benefits including improvements to water quality through the increase in length offering additional filtering opportunities.

10.1.10 The current proposal is to discharge to an existing watercourse as the alluvium superficial deposits of the site and the underlying aquifers indicate limited soakaway potential, however it is recommended that ground investigations are carried out to confirm this assumption.

10.1.11 The combination of these surface water management techniques ensure that the flood levels of Packman Dyke do not increase and the site for development is removed from Flood Zone 3.

10.1.12 These proposed measures are not only intended to confirm the sustainability benefits of the proposals and form an input to the LPA’s application of the exemption test, but would also have benefits to residential areas surrounding the site through provision of the additional flood-capacity to land to the north of the brook, reducing future risk of flooding beyond the site.

10.1.13 Other than Pluvial and Fluvial, no other sources of flood risk are associated with this site.

10.1.14 Foul water is proposed to discharge to the existing system, following a pre development enquiry it was shown that a 375mm φ foul water sewer cuts across the site from east to west. Manholes 1801 and 9801 have been identified as potential foul water discharge locations as can be seen on Drg. WM11065-101.

10.1.15 Comments made by the Environment Agency in the response dated 6th July 2017 will be addressed at detailed design.
<table>
<thead>
<tr>
<th>CHAINAGE</th>
<th>EXISTING GROUND PROFILE</th>
<th>FINISHED GROUND PROFILE</th>
</tr>
</thead>
<tbody>
<tr>
<td>31.523</td>
<td>29.869</td>
<td>29.839</td>
</tr>
<tr>
<td>31.574</td>
<td>29.891</td>
<td>29.844</td>
</tr>
<tr>
<td>31.648</td>
<td>29.915</td>
<td>29.924</td>
</tr>
<tr>
<td>31.722</td>
<td>29.958</td>
<td>29.924</td>
</tr>
<tr>
<td>31.796</td>
<td>29.995</td>
<td>29.958</td>
</tr>
<tr>
<td>31.869</td>
<td>29.985</td>
<td>29.962</td>
</tr>
<tr>
<td>31.951</td>
<td>30.000</td>
<td>30.027</td>
</tr>
</tbody>
</table>

**KEY:**
- **EXISTING GROUND LEVEL**
- **PROPOSED GROUND LEVEL**
- **1:20 YEAR FLOOD LEVEL (29.822 m AOD)**
- **1:100 YEAR FLOOD LEVEL (29.962 m AOD)**
- **1:100+CC YEAR FLOOD LEVEL (30.027 m AOD)**
- **1:1000 YEAR FLOOD LEVEL (30.113 m AOD)**

**NOTES:**
1. Flood levels applied to cross sections that coincide with nodes. See drawing WM11065-110 for details.
KEY:

POINT REFERENCES:
1. PROPOSED SITE ACCESS OFF WILFORD ROAD
2. LINEAR OPEN SPACE RUNNING ALONG WILFORD ROAD FRONTAGE, INCLUDING TREE FOOTPATH LINK AND CHILDREN'S PLAY AREA
3. GABLED FRONTAGE REFLECTING EXISTING HOUSING ON WILFORD ROAD.
4. BUNGALOWS AND DEEPER BACK GARDENS ALONG SOUTHERN EDGE TO REFLECT EXISTING PROPORTIONS. MAY INCLUDE ADDITIONAL TREE PLANTING ALONG BOUNDARY.
5. INFORMAL GRASSLAND AREA
6. EXISTING VEGETATION RETAINED WHERE POSSIBLE.
7. BALANCING FLOOD
8. DIVERTED WATERCOURSE
9. ECOLOGICAL WETLAND AND MEADOW AREA
10. TREE PLANTING WITHIN FLOOD MITIGATION AREA
11. INFORMAL FOOTPATH
12. RETAINED WATERCOURSE
13. INFORMAL HOUSING EDGE PRESENTS A SOFTER EDGE TO THE SETTLEMENT IN VIEWS FROM THE NORTH
14. PRIMARY INTERNAL ROAD FORMS ACCESS LOOP WITHIN THE DEVELOPMENT, CHARACTERISED BY TREE PLANTING
15. POTENTIAL STRATEGIC FOOTPATH LINKS ON ALIGMENT OF OLD RAILWAY LINE CONNECTING SITE WITH LAND TO THE NORTH

NOTES:
1. MASTERPLAN REFERENCE: DRG NO. DEF_63B. 3401

BASE ANGLES OF MEASUREMENT

SCALE 1:2000
KEY:

- Site Boundary
- Water
- Existing Levels (mAOD)
- Proposed Levels (mAOD)

NOTES:

KEY:

- Site Boundary
- Water
- Existing Levels (mAOD)
- Proposed Levels (mAOD)

NOTES:
APPENDIX 2

HYDROLAND MODELLING REPORT
Ruddington

21 Oct 2015
1. Introduction
Hydroland has been commissioned by Wardell Armstrong LLP to update the Halcrow ISIS 1D-2D 2012 hybrid model for Packman Dyke (a tributary of the Fairham Brook) at the site of interest located to the north of Ruddington Nottinghamshire. The update work is initially to improve the numerical instability of the model, prior to it being used as a tool to fully assess the existing fluvial flood risk posed by the watercourses on the area of interest and its surroundings. Consequently, the current best estimate of the flood risk for the area will be used (where suitable) as a benchmark to:

- Determine the suitability of the location for the proposed development; and
- Assess the impact of the development to the surrounding area mainly downstream areas;

If the above two tests are positive, use as baseline case to build the design scenario and determine design parameters such as new channel geometry and levels, finished floor level of properties, design soffit level of online structures or road crossing levels.

Impact of the development proposal and any mitigation measures will be tested against the baseline scenario to ensure flood risk doesn’t increase in and around the development area or doesn’t transfer risk to third party.

Model results will be used to produce a Flood Risk Assessment (FRA) to accompany a planning application to the local planning authorities.

2. Data Used
Data and information have been obtained from the following sources:

- Halcrow 2012 model
- Indicative development master plan;
- Topographical survey data
- LiDAR data
- National Planning Policy Framework (NPPF 2012)
- Planning Practice Guidance (PPG 2014)
3. Model Extent

Halcrow 1D and 2D Domains

The model extends 3km in length in Fairham Brook from cross section FairUp_4915 (NGR 455412 332663) to FairLo_1876 (NGR 456466 335049) and approximately 1.3km length in the Fairham tributary also called Packman Dyke at Ruddington from cross section RUD1382 (NGR 457624 333808) to its confluence with the Fairham Brook.

The 1D model build by Halcrow represented Packman Dyke using cross sections surveyed for the purposes of this study. However due to the lack of Lidar data, cross sections of the Packman Dyke, between RUD1382 and RUD1096, have been manually extended on both banks based on the profile of cross section RUD1072.

The model was built as 1D for most part except the green shaded region shown in figure 1 which was modelled as an ISIS 2D component but dynamically linked to the 1D model using level exchange link (HX). The same roughness as the previous Halcrow was adopted as this coefficient was based on text-book values (e.g. Chow), satellite images and survey photographs. A roughness coefficient of 0.04 was used for the main channel and 0.055 for the floodplain. Panel markers were added where necessary in order to correct the model cross section conveyance capacity.

The 2D domain elevations have been sampled at 2m grid from the final Halcrow merged DTM following the detail analysis Halcrow carried out prior to merging the data. Full detail is given in the Halcrow report.

Figure 1: model schematic
Hydroland 1D and 2D Domains

The 1D component for the existing scenario is essentially kept the same as the Halcrow model except the right bank of the Packman Dyke. The right bank shown in pink shaded region in figure 1 was replaced with new ISIS 2D domain, and the same right floodplain part of the extended cross-section was de-activated using the ISIS1D de-activation facility with in the cross-section unit. This change has reduced the numerical oscillation the Halcrow model simulation had and made it more stable around the peak flow, as can be seen in figure 2.

![Figure 2: 100yr flow at cross-section RUD424 for hydroland and Halcrow model runs](image)

The design model was created by taking the existing model and diverting the section of the Packman Dyke north as part of the proposed channel diversion work and all the floodplain flood storage was created with in the 2D domain based on the design level as can be seen in the figure 3 and 4 below and this DTM was merged to the Halcrow final DTM mention in the above section.

![Figure 3: Off line storage and diversion channel](image)
Figure 4: Indicative master plan and proposed storage design

4. Hydrology

Halcrow reviewed all historic hydrological studies and carried out further work and this study adopts the Halcrow hydrology.

5. Existing Model Results

The linked model was stabilised and run with supplied Halcrow hydrology for 5% AEP, 1% AEP, 1%+CC AEP and the 0.1%AEP scenarios. The results from those runs formed the baseline scenario which was taken as the best estimate of existing flood risk to the area.

This baseline flood risk was then used to assess the impact of design scenario (post development scenario) as like Existing Channel. Figure 5 below show the flood outlines for the different return periods.
6. Design Scenario

The design scenario model is developed by making use of the above existing scenario and raising the ground level of the development area to reflect the proposed change and figure 4 below show the approximate size of the development area.

The design model was stabilised and run with supplied Halcrow hydrology for 5% AEP, 1% AEP, 1%+CC AEP and the 0.1%AEP scenarios and the figure 6 show the flood outlines of the different return periods.

Figure 5: Existing scenario flood outlines

Figure 6: Design outline for different return periods
7. Results

The water level results from the design runs was compared with the baseline scenario model results to assess impact of development to the downstream and upstream areas. Figure 7 show the selected observation points for the comparison, and the tables show the water level comparison at the observation points.

![Figure 7: Observation points](image)

Table 1 show the water level difference between the design and existing scenario for 0.1% AEP and 1% AEP +CC while Table 2 show water level difference for both scenarios but for the 1% AEP and 5% AEP.

**Table 1: Level difference between design and existing scenario**

<table>
<thead>
<tr>
<th>Label</th>
<th>Existing 100yr</th>
<th>Design 100yr</th>
<th>diff (m)</th>
<th>Existing 20yr</th>
<th>Design 20yr</th>
<th>diff (m)</th>
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Table 2: Level difference between design and existing scenario

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<th>Design 100ccyr</th>
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Impact of the proposed development on the hydrology of the downstream area was assessed using flow hydrograph and figure 8 below show the 100yr and 20yr flow hydrographs at observation point RUD406 which is located immediately downstream of the development area.

Figure 8: Design and Existing Flow hydrograph at RUD406

8. Conclusion

Based on the above analysis, flood risk (extent or flood level) of the surrounding area or downstream sections show slight improvement but is very small and is within the accuracy of the numerical model.
The development and associated storage has reduced the peak flow slightly as can be seen in the figure 8 and this reduction occurs in the higher range of return periods.
APPENDIX 3
CALCULATIONS
### Summary of Results for 100 year Return Period (+30%)

<table>
<thead>
<tr>
<th>Storm Event</th>
<th>Max Level (m)</th>
<th>Max Depth (m)</th>
<th>Max Control (l/s)</th>
<th>Max Volume (m³)</th>
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<th>Storm Event</th>
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<th>Flooded Volume (m³)</th>
<th>Discharge Volume (m³)</th>
<th>Time-Peak (mins)</th>
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### Rainfall Details

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<td>Cv (Winter)</td>
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<td>Shortest Storm (mins)</td>
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### Time Area Diagram

Total Area (ha) 3.960

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<td>0</td>
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Model Details

Storage is Online Cover Level (m) 29.450

Tank or Pond Structure

Invert Level (m) 28.150

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<th>Depth (m)</th>
<th>Area (m²)</th>
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Hydro-Brake Optimum® Outflow Control

Unit Reference MD-SHE-0172-1450-1000-1450
Design Head (m) 1.000
Design Flow (l/s) 14.5
Flush-Flo™ Calculated
Objective Minimise upstream storage
Diameter (mm) 172
Invert Level (m) 28.150
Minimum Outlet Pipe Diameter (mm) 225
Suggested Manhole Diameter (mm) 1200

Control Points

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<th>Depth (m)</th>
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<td>1.000</td>
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<td>22.7</td>
<td>6.500</td>
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The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated.
Flood Risk & Drainage Technical Appraisal

Wilford Road, Ruddington

Document Reference: GIA030-R020

Bloor Homes Ltd

July 2012
Flood Risk & Drainage
Technical Appraisal

Wilford Road, Ruddington

Document Reference: GIA030-R020

Bloor Homes Ltd

July 2012
## Document history

**Wilford Road, Ruddington**

Bloor Homes Ltd

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## Contents

1. **Introduction** 1

2. **Site Description** 1
   - 2.1 Location & Details 1
   - 2.2 Development Criteria 2

3. **Flood Risk** 2
   - 3.1 Development & Flood Risk Compatibility 3
   - 3.2 Other Forms of Flooding 5

4. **Ground Conditions** 6

5. **Drainage** 7
   - 5.1 Foul Drainage 7
   - 5.1.1 Existing Foul Water Drainage Infrastructure 7
   - 5.1.2 Proposed Foul Drainage 7
   - 5.2 Surface Water 8
   - 5.2.1 Existing Surface Water Drainage Regime 8
   - 5.2.2 Drainage Design Guidance 8
   - 5.2.3 Surface Water Discharge Locations 8
   - 5.2.4 Attenuation Size & Locations 9

6. **Conclusion** 10
   - 6.1 Flood Risk 10
   - 6.2 Surface Water 11
   - 6.3 Foul Water 11
## Appendix

### Appendix A  Drawings

| A.1 | Drawing No. GIA030-100: Site Location Plan |
| A.2 | Drawing No. GIA030-101: Indicative Floodplain Compensation Proposal |
| A.3 | Drawing No. GIA030-102: Foul Water & Future Discharge Points |
| A.4 | Drawing No. GIA030-103: Potential Attenuation Basin Location & Discharge Point |
| A.5 | Drawing No. GIA030-104: Constraints Plan |
| A.6 | Drawing No. GIA030-106: Existing Surface Water Features |

### Appendix B  Correspondence with EA

| B.1 | Environment Agency Response (Date: 13th June 2012) |
| B.2 | Environment Agency Site Floodplain Map |

### Appendix C  Developer Enquiry

| C.1 | Severn Trent Developer Enquiry Response (Date: 20/06/12) |
1 Introduction

1.1 Halcrow Group Ltd has been appointed by Bloor Homes to undertake a technical appraisal of drainage and flood risk for the proposed development of land located to the West of Wilford Road, Ruddington, in Nottinghamshire.

1.2 The objective of the study is to assess the constraints and opportunities associated with flood risk, surface water and foul water drainage in relation to development of the site into a residential end use.

1.3 This report summarises the findings of the study and specifically addresses the following issues in the context of the current legislative regime:

- Flooding characteristics & required mitigation measures;
- Ground conditions & groundwater;
- Foul & surface water drainage options.

2 Site Description

2.1 Location & Details

Grid Reference X: 457023 Y:333876

The site is located on the northern edge of Ruddington village, approximately 800m north of the village high street. The site area is shown in Figure 1.

A detailed location plan of the site can be found in Appendix A.1. The site covers a total area of approximately 6.6ha which comprises agricultural land, currently cultivated with crops. The topography survey shows that the site is almost flat with a

Figure 1: Ruddington Site Location
minimal amount of fall. The highest levels recorded are approximately 30mAOD in the south east area of the site and the lowest levels being approximately 29.2mAOD to the north west, adjacent to the unnamed tributary, which forms the northern boundary of the site. The site is generally surrounded by agricultural land to the north and west, a golf course (beyond Wilford Road) to the east and residential development to the south.

2.2 Existing Surface Water Features

Drawing GIA030-106 in Appendix A.5 highlights surface water features in the locality of the site, which shows the tributary of the Fairham Brook along the northern boundary of the application site and a land drain/ditch within the western area of the site. The Environment Agency (EA) has confirmed that this unnamed tributary of the Fairham Brook, the latter being located approximately 500m to the west of the site, is classified as non Main River and as such is regulated by Rushcliffe Borough Council (refer to Appendix B).

The land drain/ditch within the western area of the site splits into two different channels and directions at the western boundary of the site. The first channel continues as an open ditch course along the western boundary of the site falling northward toward the unnamed tributary. The second becomes culverted under the new development (at Woodhouse Gardens) before re-emerging at the dismantled railway to the west of the site and eventually discharging to the unnamed tributary.

2.3 Development Criteria

2.2.1 It is proposed that the site is allocated for residential end use and could potentially deliver circa 150 dwellings, a low housing density of approximately 23 dwellings per hectare.

3 Flood Risk

The main source of flood risk to the site is the unnamed tributary, which forms the northern boundary of the application site. The EA’s Flood Zone mapping shows the predicted extents of fluvial flooding from this watercourse, as shown in Figure 2 and in detail in Appendix B.
According to Table 1 of the Technical Guidance to the National Planning Policy Framework (TGNPPF) – Department for Communities & Local Government (2012), the site is partly located within Flood Zone 2 (medium probability or the 1 in 1000 year event) and Flood Zone 3 (high probability or the 1 in 100 year event).

3.1 Development & Flood Risk Compatibility

Based on the EA’s floodplain maps it is possible to determine what type of development at the site is suitable by referring to the flood zone compatibility matrix (refer to Figure 3) in TGNPPF.

<table>
<thead>
<tr>
<th>Flood risk vulnerability classification (see table 2)</th>
<th>Essential infrastructure</th>
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<th>Highly vulnerable</th>
<th>More vulnerable</th>
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<td>✓</td>
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<tr>
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<td>Zone 3b functional floodplain</td>
<td>Exception Test required</td>
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<td>×</td>
<td>×</td>
<td>×</td>
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</tbody>
</table>

**Key:**
- ✓ Development is appropriate.
- × Development should not be permitted.

According to guidance within the TGNPPF, residential development, being designated as “More Vulnerable”, should lie outside the predicted 1 in 100 year plus
climate change flood envelope, with preference given to sites located within Flood Zone 1.

Sites with the potential to flood during the 1 in 100 year flood event (Flood Zone 3a) are not normally considered appropriate for proposed residential development unless on application of the “Sequential Test” (as described in the National Planning Policy Framework and TGNPPF) it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower probability of flooding. In such circumstances the “Exception Test” can be applied if appropriate.

For the Exception Test to be passed:

- It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment (SFRA) where one has been prepared; and

- A site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, reduce flood risk overall.

Both elements of the test will have to be passed for development to be allocated or permitted.

However if residential development can steered away from Flood Zone 3 and provided within both Flood Zones 1 & 2, the Exception Test may not be required. Enlarging the areas of Flood Zones 1 and 2 within the site may be achievable through incorporating floodplain storage compensation and raising the ground levels within the site above the 1 in 100 year floodplain as discussed in detail in Section 3.3. However the EA will be more receptive to this approach of achieving development compatibility once the site has passed the Sequential Test.

### 3.2 Accuracy of Floodplain Mapping

The EA have confirmed that the 1 in 100 year and 1 in 1000 year floodplain maps of the unnamed tributary have been mapped using the EA’s broad scale J-Flow modelling software (see Appendix B). The EA has also confirmed that they do not hold any modelled flood levels for this tributary. As such the accuracy and reliability of the floodplain map is disputable and the extent of flooding could be greater or less throughout the main site.

It is recommended that a detailed hydrological assessment of the unnamed tributary is carried out to not only accurately define the floodplain extents within the site but also enable the promotion of alleviation options which will provide wider sustainability benefits in addition to increasing the amount of land available for development.

### 3.3 Floodplain Compensation

In order to optimise the developable area, safeguard residential dwellings from fluvial flooding and provide safe access and egress from Wilford Road, a preliminary floodplain compensation design has been carried out based on the current EA
floodplain map. The areas of compensation are illustrated on drawing GIA030-101 in Appendix A. In order to raise the level of the application site above the 1 in 100 year floodplain an equivalent area of approximately 40215m\(^2\) will require lowering to match the volume of occupied floodplain.

Floodplain compensation will be provided for by reducing the level of ground along the northern bank of the watercourse, such that the same volume is available at every flood level and it can freely fill and drain i.e. cut and fill will equate on a level for level basis.

This will ensure that the proposed development is located outside of Flood Zone 3 and in Flood Zone 2 instead, where ‘More Vulnerable’ development is appropriate according to the flood zone compatibility matrix of the TGNPPF. The floodplain compensation scheme would also ensure that the existing flood regime and storage capacity is maintained so as not to lead to any third party detriment.

The proposed area of floodplain compensation is preliminary only and is anticipated to change once detailed hydraulic modelling of the tributary has been carried out to refine the extents of the floodplain. Discussions with the EA are currently ongoing to determine the extents of modelling required and initiate discussions regarding the feasibility of carrying floodplain compensation works.

If floodplain compensation works are permitted and the site is raised above Flood Zone 3 it should be noted that an 8m wide easement from the top of the unnamed tributary’s bank, where no development is allowed, still applies.

### 3.4 Other Forms of Flooding

A preliminary investigation of other sources of flooding has been undertaken using readily available resources such as the internet and published documents that include the:

- Greater Nottingham Strategic Flood Risk Assessment (SFRA) – Technical Report Volume 4 for Nottingham City Council (Black and Veatch, 2008);

The SFRA report does not highlight any other sources of flooding in Ruddington other than that from the Fairham Brook. However the Nottinghamshire Preliminary FRA report has identified areas in Ruddington to experience flooding from watercourses and surface water runoff during the July 2007 floods. Specific affected areas within Ruddington have not been identified however due to the Data Protection Act. A telephone conversation with John Van of the EA (dated 2\(^{nd}\) August 2012) did confirm that the site has experienced flooding on a number of occasions from the unnamed tributary in the past. The return periods of each of these historical flood events are unknown.
4 Ground Conditions

The EA mapping service ‘My Backyard’ shows there to be no Groundwater Protection Zones (GwPZ) present within a 3.3km radius of the site as illustrated in Figure 4. The nearest GwPZ is classified as a Zone 3 (source catchment protection zone) located to the north of the site. Zone 3 is defined as the area that is presumed to recharge groundwater to the point of abstraction, which is used as a source of potable water supply. The GwPZ is of a sufficient distance not to pose a constraint to the development and potential drainage options.

Figure 4: Groundwater Protection Zone Map (Source: www.environment-agency.gov.uk).

The application site is entirely underlain by aquifers consisting of superficial deposits and bedrock. The geology of the superficial deposits aquifer comprises alluvium (clay, silt, sand and gravel) according to British Geological Survey (BGS) maps. The EA has designated this aquifer as a Secondary A (minor) aquifer. These types of aquifer generally consists of permeable layers capable of supporting water supplies at a local level and in some cases form an important source of base flow to watercourses such as the unnamed tributary.

The bedrock aquifer underlying the site consists entirely of mudstone (classified as the Edwalton Member according to BGS maps). The EA has classified the bedrock rock aquifer as Secondary B (minor). Such aquifers predominantly comprise layers of lower permeability and yield limited amounts of groundwater.

Such geological properties indicate that the ground underlying the site is relatively impermeable and not suitable for utilising soakaway/infiltration systems as part of the surface water drainage system. This should be determined however as part of a
ground investigation and percolation tests of the site. The ground investigation should also determine the level of the groundwater at the site due to the extensive area of alluvium underlying the site and the proximity of the watercourse, during the winter months. These geological properties in addition to the land drain located within the site, indicate that the ground has the propensity to become readily saturated which can cause localised surface water drainage and flooding issues.

5 Drainage

5.1 Foul Drainage

5.1.1 Existing Foul Water Drainage Infrastructure

The statutory water authority within the area is Severn Trent Water Ltd (STWL). Public sewer records shows there to be a large public foul sewer (375mm diameter) located within the middle of the site flowing from east to west. Drawing GIA030-102, Appendix A.3 shows the location of this sewer and other public foul sewers proximate to the application site. According to Sewers for Adoption 6th Edition, this sewer will require a 10m width easement (5m either side), which is the minimum distance from any building or structure. Soft landscaping is permissible within the 10m easement where most shrubs can be planted 3 metres from the centre line of the sewer. However tree planting is more stringent and should must be distanced at a minimum of 6 metres either side of the sewer, depending on the type of tree.

Alternatively, the sewer could be diverted by applying for a Section 185 to STWL. Due to the size of the sewer in relation to the size of the Ruddington catchment and population, it is considered that the pipe crossing the site is a strategic sewer, in which case it would be prudent to initiate discussions with STWL early in the project programme to determine whether a diversion is feasible, as the location of the diverted sewer will affect the masterplan. It should be noted that STWL can take up to 18 months to design and commission the diversion of a strategic sewer.

5.1.2 Proposed Foul Drainage

A developer enquiry has been submitted to STWL who has confirmed that foul water generated from the development (based on a development of 150 residential dwellings) can be satisfactorily accommodated by the existing public sewerage network. The developer enquiry response and further correspondence with STWL can be viewed in Appendix C. Drawing GIA030-102 in Appendix A.3 shows these potential discharge points into the public foul sewer.

Based on a topographical survey it can be determined that the proposed development will be able to drain by gravity toward the public foul sewer in its existing location. It is undeterminable at this time however whether the proposed development will be able to drain by gravity if sewer diversion in addition to the floodplain compensation works being carried out, altering the levels of the application site. This will be determined as part of a drainage strategy following detailed hydraulic modelling of the unnamed tributary to facilitate the floodplain compensation design.
5.2 Surface Water

5.2.1 Existing Surface Water Drainage Regime

Public sewer records show there to be no surface water sewers present within the site. The nearest surface water sewer is shown as Section 104 sewer located within the new development approximately 25m west of the site. The natural surface water drainage regime has been assumed based on topography information and Ordnance Survey maps, which shows the site to fall in a north westerly direction toward the unnamed tributary.

5.2.2 Drainage Design Guidance

In accordance with the National Planning Policy Framework (NPPF) and TGNPPF, any new and re-development should apply and give priority to Sustainable Drainage Systems (SuDS), which are designed to control surface water runoff close to where it falls and mimic natural drainage as closely as possible. Therefore in accordance with planning policy the site should implement a site storm drainage system that provides sustainable drainage measures consistent with the recommendations of NPPF, guidance contained within the local SFRA and industry standards contained within CIRIA documents C522, C609, C697 and others.

When appraising suitable storm water discharge options for a development site, Part H of the Building Regulations 2002 provides the following hierarchy, listed in order of priority:

a) an adequate soakaway or some other adequate infiltration system; or where that is not reasonably practicable;
b) a watercourse; or where that is not reasonably practicable,
c) a sewer.

5.2.3 Surface Water Discharge Locations

In the absence of site investigation data to prove the viability of an infiltration based drainage system, it has been assumed that site-runoff is discharged to a watercourse. The most appropriate discharge location for the site in accordance with Building Regulations is the unnamed tributary to the north and land drain to the west of the site. Both of these watercourses are located within land under Bloor Homes’ ownership. As such Bloor Homes is the riparian owner of both watercourses, providing an automatic right to discharge uncontaminated surface water runoff to either watercourse. Drawing GIA030-103 in Appendix A.4 illustrates potential discharge locations for surface water.

It is anticipated that the site should be able to drain surface water by gravity. However potential constraints as to whether this can be achievable cannot be fully appreciated at this stage, which includes finished ground levels following completion of a floodplain compensation scheme, location of the diverted foul sewer and bed level of the unnamed tributary.

Any proposed works in, under, over or within 8 metres of the top of bank of the unnamed tributary will require prior written consent in the form of a Land Drainage or Flood Defence Consent from the Lead Local Flood Authority.
5.2.4 Attenuation Size & Locations

Based on the topography of the site, assumed area of floodplain compensation (where site levels will be raised) and outfall options available, the strategic drainage network across the site has been considered to assist with the development of the masterplan. To achieve the requirements of the NPPF, it is proposed that the drainage system will utilise SuDS to control peak discharges to match the greenfield runoff rate for rainfall events of varying return periods. Greenfield runoff values for the site have been determined using methodology set out by the Institute of Hydrology (IoH) 124 and are provided in Table 1.1.

Table 1.1: Site Specific Greenfield Runoff Rates

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<tr>
<th>Return Period (years)</th>
<th>Greenfield Runoff Rate for Total Site 6.56 ha (l/s)</th>
<th>Greenfield Runoff Rate (l/s/ha)</th>
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<td>9.43</td>
<td>37.15</td>
</tr>
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</table>

*Based on a percentage impermeability of 60% – see design criteria below.

It is anticipated that the development will implement different types of detention and conveyance features as part of the surface water drainage system to restrict runoff rates to 30% below the existing greenfield runoff rate as required by the TGNPPF.

The detention basin has been sized using the Micro Drainage WinDes W.12 programme, which was used to calculate the volume of the attenuation required to limit the rate of runoff to the allowable discharge rates provided in Table 1.1. The results of the WinDes calculations can be referred to in Appendix C, which give an approximate maximum attenuation volume of 2,458m³ based on the following design criterion:

- Critical duration rainfall design event – 100yr plus 30% for climate change.
- Restricted discharge rate - Greenfield mean annual flood flow rate (QBar).
- Open attenuation based on 1m maximum depth of water and 300mm freeboard.
- Assumed 60% impermeability for residential development (3.94ha).

Drawing GIA030-103 in Appendix A.4 indicatively shows the location of the detention basin, which has been provisionally placed to the north west of the site.
based on existing ground levels and flood zones. The size of the basin and the resulting land take have been based on 1m depth of water and 1 in 4 side slopes (which is the minimum slope where mowing is required in accordance with the Construction Design Management Regulations 2007). The size of the pond can be offset through the provision of other SuDS features such as permeable paving, swales, pocket street gardens etc.

Alternative SuDS features, in addition to the detention basin should be considered and incorporated within the development layout in order to achieve the SuDS treatment train as recommended in the SuDS manual (CIRIA C697) and the emerging SuDS National Standards.

6 Conclusion

The site under consideration covers approximately 6.6ha, which comprises greenfield land. The site is bounded by Wilford Road to the east, which will provide access to the site, an unnamed tributary to the north and housing development to the south and west. The type of development proposed for the site will comprise low density, residential housing, located to the north of the Ruddington catchment.

6.1 Flood Risk

The EA’s Flood Zone mapping identifies fluvial flooding within the application site, emanating from the unnamed tributary to the north of the site. As such the site is partially located in Flood Zones 2 and 3 (medium and high probability of flooding respectively). The EA has confirmed that the floodplain of the unnamed tributary has been represented using their broad brush J-Flow modelling software. As such it is recommended that a detailed hydraulic model of the unnamed tributary is built to accurately determine the floodplain extents within the site. Consultation with the EA has confirmed that the site has historically experienced fluvial flooding.

According to the Flood Risk Vulnerability & Flood Zone ‘Compatibility Matrix’ in the TGNPPF, sites located in Flood Zone 3 are not normally considered appropriate for residential development unless on application of the Sequential Test it is not possible consistent with wider sustainability objectives, for the development to be located in zones with a lower probability of flooding.

In such circumstances engineering options to safeguard the proposed development from flooding can be explored. As such a preliminary assessment of providing floodplain compensation at the site has been carried out. A floodplain compensation scheme would involve raising levels at the site above the 1 in 100 year floodplain and offsetting this reduction in floodplain volume by reducing ground levels along the northern bank of the unnamed tributary opposite the site on a level for level, volume for volume basis. This would alter the Flood Zones classification the site, resulting in the site only be partially located in Flood Zone 2 which is appropriate for residential development according to the TGNPPPF. A floodplain compensation scheme would also provide a means of dry access and egress to the proposed development in addition to ensuring that there is no increase in fluvial flood risk to neighbouring developments.

Initial discussions with the EA have suggested that a floodplain compensation scheme for the application site would be acceptable provided the sequential test was
passed. However before a floodplain compensation scheme is designed a detailed hydraulic model of the unnamed tributary will be required to accurately determine the extents of the floodplain and floodplain compensation required.

No other sources of flooding have been identified as part of this assessment.

6.2 Surface Water

Public sewer records show there to be no surface water sewers present within the site. In accordance with planning policy the site should implement a site storm drainage system that provides sustainable drainage measures consistent with the recommendations contained within Building Regulations Part H and the NPPF. The preferred means of surface water disposal from the development will be to soakaway following percolation tests and a ground investigation to determine the suitability of the underlying ground as part of the detailed design stage. Should the ground preclude the use of soakaways then the surface water drainage design will incorporate adequate sustainable source control techniques to ensure that surface water runoff is attenuated to discharge to the tributary of the Fairham Brook at a greenfield runoff rate of 3.67 l/s/ha up to and including the 1 in 100yr +30%.

WinDes has been used to determine the volume of storage required to sustainably drain the proposed development to achieve the above criteria, giving a maximum volume of 2,458m$^3$. The storage volume required has been used to identify the potential constraints to the site layout, and inform the masterplanning process to ensure that the development is designed to provide sufficient space for a pond or basin to hold the maximum volume of storage required. However in addition to an attenuation basin it is anticipated that the development will implement different types of SuDS such as rainwater harvesting systems, permeable paving and bioretention to ensure that the SuDS Management Train is implemented.

It is anticipated that the site will drain by gravity and discharge to either the unnamed tributary or the land drain within the site. This will be dependent however on finished ground levels as part of the floodplain compensation scheme and the potential diversion of the public foul sewer located within the site. The client has the automatic right to discharge uncontaminated surface runoff to either watercourse as the client is the riparian owner of both watercourses.

Any proposed works in, under, over or within 8 metres of the top of bank of the unnamed tributary will require prior written consent in the form of a Land Drainage or Flood Defence Consent from the Lead Local Flood Authority.

The site layout should also ensure that an 8m easement is provided for from the top of bank of the unnamed tributary.

6.3 Foul Water

Public sewer records shows there to be a large public foul sewer (375mm diameter) located within the middle of the site flowing from east to west. This sewer will require a 10m wide easement (5m either side), where no built development can occur and is the minimum distance from any building or structure. Alternatively, a Section 185 to divert the sewer could be applied for to STWL. Due to the size of the sewer it is considered that the sewer is strategic to STWL’s drainage network and as such
discussions with STWL should be initiated to determine the feasibility of a diversion and potential location as this process will inform development lay out.

A developer enquiry has been submitted to STWL who has confirmed that foul water generated from the development (based on a development of 150 residential dwellings) can be satisfactorily accommodated by the existing public sewerage network.

Based on a topographical survey it can be determined that the proposed development will be able to drain by gravity toward the public foul sewer in its existing location. It is undeterminable at this time however whether the proposed development will be able to drain by gravity if sewer diversion in addition to the floodplain compensation works being carried out, altering the levels of the application site. This will be determined as part of a drainage strategy following detailed hydraulic modelling of the unnamed tributary to facilitate the floodplain compensation design.
Appendix A  Drawings

A.1  Drawing No. GIA030-100: Site Location Plan
A.2  Drawing No. GIA030-101: Indicative Floodplain Compensation Proposal
A.3  Drawing No. GIA030-102: Foul Water & Future Discharge Points
A.4  Drawing No. GIA030-103: Potential Attenuation Basin Location & Discharge Point
A.5  Drawing No. GIA030-104: Constraints Plan
A.6  Drawing No. GIA030-106: Existing Surface Water Features
Appendix B

Appendix B EA Correspondence
Appendix B  Correspondence with EA

B.1  Environment Agency Response (Date: 13th June 2012)

B.2  Environment Agency Site Floodplain Map
Appendix C  Developer Enquiry

C.1  Severn Trent Developer Enquiry Response (Date: 20/06/12)
Appendix D

Appendix D WinDes Calculations
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APPENDIX 5
SEVERN TRENT WATER DATA
Halcrow Group  
Red Hill House  
227, London Road  
Worcester  
WR5 2JG

F.A.O: Mr Graham Whitehouse

20th June 2012

Dear Sirs,

**Land off Wilford Road, Ruddington, Nottinghamshire (457023, 333876)**

I refer to your recent Development Enquiry Request in respect of the above site. Please find a copy of the sewer records and ‘Additional Guidance Notes’ enclosed for your information.

**Sewer Crossing**

A 375mm dia public foul sewers crosses the site from east to west. This sewer will require a 10m easement. No building shall be located within that 10m.

**Foul Water Drainage**

The proposed development of 150 houses will discharge less than 2 l/sec therefore I can accept an un-attenuated foul discharge to the public sewer.

**Surface Water Drainage**

Under the terms of Section H of the Building Regulations 2000, the disposal of surface water by means of soakaways should be considered as the primary method. If this is not practical and no watercourse is available as an alternative, the use of sewerage should be considered. In addition, other sustainable drainage methods should also be explored before a discharge to the public sewerage system is considered.
If these are found to be unsuitable, satisfactory evidence will need to be submitted. The evidence should be either percolation test results or a statement from the SI consultant (extract or a supplementary letter).

Subject to the use of soakaways and other SUDS being investigated you will also need to demonstrate how the site is currently drained, if indeed it is positively drained, identifying which impermeable areas drain to which pipeline and the connections/outrfalls to the public sewerage system identified. Ideally, a drainage survey of the existing site is required; in the case of multiple connections the survey needs to also identify which impervious areas drain to which pipeline. Once this information has been made available, a decision on the permitted surface water discharge rate will be made.

Any flows generated by the site in excess of the permitted discharge rate will have to be attenuated within the development site.

For any new connection(s) into the public sewer network or the reuse of an existing sewer connection(s), you will need to apply under Section 106 Water Industry Act 1991 as amended by the Water Act 2003. Our New Connections Team currently processes Section 106 applications, please contact them on 0800 707 6600 for an application pack and guidance notes (or visit www.stwater.co.uk). For the avoidance of doubt, it is suggested that you quote the reference number above. Applications to make such connections should be made separately from any application for adoption of the related sewers under Section 104 Water Industry Act 1991 as amended by the Water Act 2003.

I must inform you that this evaluation is only valid for 6 months from the date of this letter. Please quote the reference number above, in all future correspondence.

Yours faithfully,

WF Walton
Asset Protection Manager - East
Waste Water
Additional Guidance Notes

If you experience difficulty in the provision of off-site sewers to serve your proposed development, an application for requisition sewers under Section 98 Water Act 2003 may be appropriate on request to this office.

If there are existing public sewers within the curtilage of the development site that may affect the proposed development, the option to divert them under Section 185 Water Act 2003 may be available. All costs incurred would lay with the Applicant.

All potentially adoptable sewers must be designed and constructed in accordance with the guidelines in Sewers for Adoption (6th Edition), after 1st May 2006. A Severn Trent Water Addendum for Foul Sewage Pumping Stations will be available at www.wrcplc.co.uk/sfa.

If the sewers are to be offered for adoption or if the development works could affect the public sewerage system, the Developer should approach Severn Trent Water Ltd to discuss their proposals in detail. This is to ensure the Developer is aware of the Company’s requirements which could affect the development design and/or programme.

In cases where the complexity of both the existing receiving sewerage system and the proposed additional sewerage necessitates the construction of a suitable computer model, Severn Trent Water can offer this service. Enquiries should be addressed to Fay Bull in our Infrastructure Strategy Team who can be contacted on 07889 633882, or fay.bull@severntrent.co.uk.

Severn Trent Water has no knowledge of any specific land drainage issues involving this site. The Developer is to contact and seek approval of The Environment Agency, Local Authority etc. regarding any means of surface water disposal to the land drainage system, required attenuation, discharge consent etc.

All enquiries with respect to the supply of sewer records only should be directed to Severn Trent Water Limited, Asset Data Management, PO Box 5344, Coventry. CV3 9FT (Tel. 0845 601 6616).

Asset Protection
Waste Water East
APPENDIX 6
ENVIRONMENT AGENCY CORRESPONDENCE
Dear Luxmy

REVIEW OF HYDROLOGICAL MODEL IN ANTICIPATION OF FUTURE RESIDENTIAL DEVELOPMENT LAND ADJACENT TO WILFORD LANE, RUDDINGTON

I refer to your enquiry regarding the above.

My colleagues have completed the review of the modelling works submitted for the above site and have confirmed that the works do not increase risk elsewhere and provide a betterment in the 100 year event. However there are a number of points that may need to be clarified if this work is to be included in a flood risk assessment submitted in support of a future planning application.

- It is not clear from the model report whether the land being provided as compensation/storage is within the red line boundary of what may become a planning application in the future and in the ownership of the applicant in perpetuity. If the land for floodplain compensation is not within the applicants ownership then the Agency is likely to object.

- The climate change ranges used here are 20, 35 and 70%. Whilst these are conservative it’s worth noting that for the Humber area the climate change ranges are 20, 30 and 50%.

- Once the development has been completed the applicant may wish to make a flood map challenge using the data provided for the FRA. This would remove the houses built from the flood zone. This is entirely up to
the applicant and we wouldn’t be able to alter the Flood Zone maps until all works are completed.

- The diversion of the watercourse may require consent from the LLFA on top of planning permission.

Yours sincerely

Mr Stuart Taylor
Planning Advisor