FLOOD RISK ASSESSMENT

Land at Hoyland Common, Barnsley, S74 0EA

for

Newlands Developments Ltd

RCEF76268
Flood Risk Assessment
003
12 August 2020

rpsgroup.com

Quality Management

Version	Status	Authored by	Reviewed by	Approved by	Review date
001	Draft for comment	Matthew Bell	Ola Holmstrom	Ola Holmstrom	22 May 2020
002	Report for Planning	Matthew Bell	Ola Holmstrom	Ola Holmstrom	11 Jun 2020
003	Update following drainage alterations	Matthew Bell	Ola Holmstrom	Ola Holmstrom	12 Aug 2020

Approval for issue

Ola Holmstrom	22 May 2020

The report has been prepared for the exclusive use and benefit of our client and solely for the purpose for which it is provided. Unless otherwise agreed in writing by RPS Group Plc, any of its subsidiaries, or a related entity (collectively 'RPS') no part of this report should be reproduced, distributed or communicated to any third party. RPS does not accept any liability if this report is used for an alternative purpose from which it is intended, nor to any third party in respect of this report. The report does not account for any changes relating to the subject matter of the report, or any legislative or regulatory changes that have occurred since the report was produced and that may affect the report.
The report has been prepared using the information provided to RPS by its client, or others on behalf of its client. To the fullest extent permitted by law, RPS shall not be liable for any loss or damage suffered by the client arising from fraud, misrepresentation, withholding of information material relevant to the report or required by RPS, or other default relating to such information, whether on the client's part or that of the other information sources, unless such fraud, misrepresentation, withholding or such other default is evident to RPS without further enquiry. It is expressly stated that no independent verification of any documents or information supplied by the client or others on behalf of the client has been made. The report shall be used for general information only.

Prepared by:

RPS Consulting Services Ltd

8 Exchange Quay
Salford, Greater Manchester M5 3EJ

T +44 161 786 8550

Prepared for:

Newlands Developments Ltd

Contents

1 INTRODUCTION 5

2 PLANNING POLICY CONTEXT 6
National Planning Policy 6
Local Planning Policy 6

3 CONSULTATION 9
Lead Local Flood Authority 9
Environment Agency 9
Yorkshire Water 10
Internal Drainage Board 10

4 SITE SETTING AND DESCRIPTION 11
Site Setting 11
Site Description 11
Surrounding Land Uses 11
Topography 12

5 PROPOSED DEVELOPMENT 13

6 HYDROLOGICAL SETTING 14
Nearby Watercourses 14
Site Catchments 14
Flood Risk Classification 15
Strategic Flood Risk Assessment 15

7 HYDROGEOLOGICAL SETTING 17

8 EXISTING DRAINAGE 18
Drainage Infrastructure Catchment Observations 18
Barnsley Metropolitan Borough Council Highway Drains 18
Yorkshire Water Sewers 19

9 FLOOD RISK AND MITIGATION 20
Fluvial / Tidal Flooding 20
Flooding from sewers 20
Surface water flooding (overland flow) 20
Groundwater flooding 21
Other Sources 21
Event Exceedence and Residual Risk 22

10 SURFACE WATER MANAGEMENT 23
Introduction 23
Drainage Catchments 24
Discharge Rates and Climate Change 24
Drainage Hierarchy 25
Consideration of Sustainable Drainage Systems 26
Conceptual Surface Water Attenuation Scheme 27
Maintenance of Sustainable Drainage Systems 27
Treatment 28
Event Exceedance 28

11 SEQUENTIAL TEST AND EXCEPTIONS TEST 29
Sequential Test 29
The Exception Test 29

12 SUMMARY AND CONCLUSIONS 30

Figures

Figure 1 Site Observations

Figure 2 Flood Map for Planning

Figure 3 Long Term Surface Water Flood Map

Figure 4 Long Term Reservoir Flood Map

Appendices

Appendix A Regulator Consultation

Appendix B Site Location Plan

Appendix C Topographic Survey

Appendix D Proposed Development Plans

Appendix E Existing Drainage Plans

1 INTRODUCTION

1.1 RPS was commissioned to undertake a Flood Risk Assessment of Hoyland Common on behalf of Newlands Developments Limited in relation to the proposed development and in support of the hybrid planning application.

1.2 The aim of the Flood Risk Assessment is to outline the potential for the site to be impacted by flooding, the impacts of the proposed development on flooding in the vicinity of the site, and the proposed measures which could be incorporated into the development to mitigate the identified risk. The report has been produced in accordance with the guidance detailed in the National Planning Policy Framework (NPPF). Reference has also been made to the CIRIA SuDS manual (C753) and the Barnsley Council Strategic Flood Risk Assessment (SFRA) and the Barnsley Local Flood Risk Management Strategy (LFRMS).

1.3 This report has been produced in consultation with the Environment Agency and Barnsley Metropolitan Council (BMC) who act as the Lead Local Flood Authority. The site is not located within an Internal Drainage Board District.

1.4 A Drainage Strategy Report (reference HOYLA-RPS-SI-D-RP-DS01, P04 dated 27th July 2020) for the development has been produced and should be read in conjunction with this FRA. A summary of the drainage is included within the report.

1.5 The desk study has been undertaken with reference to information provided / published by the following bodies:

- Environment Agency (EA);
- Barnsley Metropolitan Borough Council (BMBC) who act as the Lead Local Flood Authority (LLFA);
- Yorkshire Water (YW)
- Ordnance Survey (OS); and
- British Geological Survey (BGS).

1.6 A site visit was conducted on 6th May 2020. Observations made during the site visit are discussed within this report.

2 PLANNING POLICY CONTEXT

National Planning Policy

2.1 The National Planning Policy Framework (NPPF) was released in March 2012 and was updated in February 2019. The document advises of the requirements for a site specific Flood Risk Assessment (FRA) for any of the following cases (Planning and Flood Risk paragraph 163 (footnote 50):

2.2 "All proposals (including minor development and change of use) located within the Environment Agency designated floodplain, recognised as either Flood Zone 2 (medium probability) or Flood Zone 3 (high probability);

- *All proposals greater than 1 ha in area located in Flood Zone 1 (low probability);*
- *All proposals within an area which has critical drainage problems (as notified to the Local Planning Authority by the Environment Agency);*
- *Land identified in a Strategic Flood Risk Assessment as being at increased flood risk in the future; and*
- *Where proposed development may be subject to other sources of flooding, where its development would introduce a more vulnerable use".*

2.3 Paragraph 165 of the updated NPPF identifies that major developments should incorporate Sustainable Drainage Systems unless there is clear evidence that this would be inappropriate. The systems used should:

a. "Take account of advice from the Lead Local Flood Authority;

b. Have appropriate proposed minimum operational standards;

c. Have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and

d. Where possible, provide multifunctional benefits".

Local Planning Policy

2.4 The Barnsley Local Plan was adopted on 3rd January 2019 and contains the following Policies relating to flood risk and drainage:

Policy CC3 Flood Risk

2.5 "The extent and impact of flooding will be reduced by:

- *Not permitting new development where it would be at an unacceptable risk of flooding from any sources of flooding, or would give rise to flooding elsewhere;*
- *Ensuring that in the Functional Floodplain (Flood Zone 3b), only water compatible development or essential infrastructure (subject to the flood risk exception test) will be allowed. In either case it must be demonstrated that there would not be a harmful effect on the ability of this land to store floodwater;*
- *Requiring developers with proposals in Flood Zones 2 and 3 to provide evidence of the sequential test and exception test where appropriate;*

- *Requiring site-specific Flood Risk Assessments (FRAs) for proposals over 1 hectare in Flood Zone 1 and all proposals in Flood Zones 2 and 3;*
- *Expecting proposals over 1000 m^2 floor space or 0.4 hectares in Flood Zone 1 to demonstrate how the proposal will make a positive contribution to reducing or managing flood risk; and*
- *Expecting all development proposals on brownfield sites to reduce surface water run-off by at least 30% and development on greenfield sites to maintain or reduce existing run-off rates requiring development proposals to use Sustainable Drainage Systems (SuDS) in accordance with policy CC4; and*
- *Using flood resilient design in areas of high flood risk".*

Policy CC4 Sustainable Drainage Systems (SuDS)

2.6 *"All major development will be expected to use Sustainable Drainage Systems (SuDS) to manage surface water drainage, unless it can be demonstrated that all types of SuDS are inappropriate.*

2.7 *The Council will also promote the use of SuDS on minor development.*

2.8 *To enable the Council to determine the suitability of a proposed SuDS scheme:*

- *Outline Planning applications must be supported by a conceptual drainage plan and SuDS design statement; and*
- *Detailed Planning applications must be supported by a detailed drainage plan and SuDS design statement, which should contain information on how the SuDS will operate, be managed and maintained for the lifetime of the development".*

Local Flood Risk Management Strategy

2.9 The Barnsley Local Flood Risk Management Strategy (LFRMS) (dated December 2017) sets out the Council's objectives with regard to managing flood risk within the Borough in order to:

- *"Promote appropriate development within and outside areas at risk of flooding;*
- *Raise and maintain awareness of flooding;*
- *Improve flood resilience in Barnsley;*
- *Promote sustainability through all our flood risk work;*
- *Embed BMBC's role as the Lead Local Flood Authority (LLFA) into the wider Council service; and*
- *[provide] An effective and supported recovery effort during and after a flood event".*

Strategic Flood Risk Assessment

2.10 The Barnsley Strategic Flood Risk Assessment (SFRA) (dated September 2010) identifies and maps flood risk from all sources at a borough-wide scale as well as providing guidance on producing site specific FRAs. Relevant information from the SFRA has been referenced throughout this Flood Risk Assessment report.

2.11 Guidance from Detailed Flood Risk Guidance section from the SFRA indicates the following key messages:

- *"Primary sources (PPS25, PPS25 Practice Guide and CIRIA Report 624) should be used for FRAs and be supplemented by information in this SFRA;*
- *FRAs are required for all development proposals in Flood Zones 2 and 3 and also for developments over 1 ha in Flood Zone 1;*
- *Surface water drainage assessments are required as an integral part of the FRA;*
- *Demonstration that technically feasible flood risk mitigation options are available is required;*
- *Overtopping and breach of flood defences should be considered along with emergency access, egress and evacuation;*
- *FRAs should demonstrate that the development and it's users and occupiers will remain safe in times of flood; and*
- *Functional floodplain should be considered as essential green infrastructure and safeguarded wherever possible."*

3 CONSULTATION

Lead Local Flood Authority

3.1 The site is within the administrative boundary of Barnsley Metropolitan Borough Council who act as the Lead Local Flood Authority have identified the following:

- *"BMBC would normally require a 30% climate change adjustment and do not require the 10% urban creep adjustment;*
- *Use of FSR rainfall data is acceptable to BMBC;*
- *It is currently BMBC policy to resist connection of flows from Development Sites into the Highway Drainage Network;*
  - *If it can be proven that connection to the Highway Drain is the only viable option then we would require:*
  - *Full CCTV survey of the Highway Drain to be submitted to the Highway Authority prior to consent being given*
  - *Any repairs deemed necessary by the Highway Authority to be carried out at the developer's expense.*
  - *Assessment of existing hydraulic capacity of the Highway Drain together with an assessment of flows into the drain in agreed storm intensities to prove capacity is available in the Drain for proposed flows to be carried out by the developer prior to consent being given".*

3.2 The initial drainage plans for the site have been issued to the LLFA, who are generally agreeable with the proposals for the southern parcel of land.

3.3 Subsequent to the planning application submission, further information regarding existing drainage has become available and is discussed in further detail in Section 8 and Section 10 of this report. The result of this additional information is that drainage from the site will pass entirely to the south towards Harley Dyke. This has been discussed with the LLFA who have agreed to this approach provided that the contributing catchment isn't considered as part of the run-off rate calculations to Harley Dyke.

Environment Agency

3.4 The Flood Risk Assessment has been produced in consultation with the Environment Agency. A preliminary opinion request has been submitted to the Environment Agency, who have provided the following response (included in full at Appendix A) with regard to flooding and surface water drainage:

- "Based on our records, the proposed development is within an area identified as:
  - Flood zone 1 with a low probability of flooding from rivers and/or sea.
  - Bedrock aquifer – secondary A
- Based on the information currently available, the development raises no environmental concerns for the Agency. However, we do have the following advice.

Surface Water

The Lead Local Flood Authority are responsible for providing advice on the management of surface water from new larger developments. Please consult them for their comments on your proposal.

Sustainable Drainage Systems (SuDs) should always be carefully considered in discussions with the Lead Local Flood Authority. However, any drainage system must not pose a risk to groundwater quality and must not be constructed in ground affected by contamination".

Yorkshire Water

3.5 The public sewer network within the vicinity of the site is operated by Yorkshire Water.

3.6 A pre-development enquiry has been made to Yorkshire Water, who have identified that:

- *"Sustainable Drainage Systems (SuDS), for example the use of soakaways and/or permeable hardstanding etc, may be a suitable solution for surface water disposal appropriate in this situation. You are advised to seek comments on the suitability of SuDS in this instance from the appropriate authorities;*
- *As the proposed site is currently undeveloped no surface water is known to have previously discharged to the public sewer network;*
- *As such, the local public sewer network does not have capacity to accept any surface water from the proposed site. If SuDS are not viable, the developer is advised to contact the Environment Agency/local Land Drainage Authority/Internal Drainage Board* with a view to establishing a suitable watercourse for discharge.*
- *It is understood that a watercourse is located to the south of the site. This appears to be the obvious place for surface water disposal (if SuDS are not viable). Please note Yorkshire Water cannot provide plans of culverted watercourses or highway drains. To obtain plans please contact the Lead Local Flood Authority for more details".*

3.7 YW also provided commentary regarding foul water drainage, however, this is discussed within the Drainage Design Philosophy. The full pre-development enquiry is included at Appendix A.

Internal Drainage Board

3.8 The site is not located within an Internal Drainage Board area. The nearest IDB is the Dearne and Dove IDD.

4 SITE SETTING AND DESCRIPTION

Site Setting

4.1 The site is located at National Grid Reference 435573, 399637. It is irregular in shape, occupying an area of approximately 52.43 hectares. A site location plan is provided at Appendix B.

4.2 The site is located to the southwest of the village of Hoyland Common and approximately 6 km south of Barnsley.

4.3 The site comprises two distinct parcels of land:

- One located to the south of Tankersley Road, with main portion of site occupying approximately 45.1 ha, for the purpose of this FRA is referred to as the southern parcel; and
- One located to the north of Tankersley Lane, occupying approximately 7.33 ha, for the purpose of this FRA referred to as the northern parcel.

Site Description

4.4 The site comprises undeveloped greenfield and open pastureland.

4.5 Access to the site is via the A6135 Sheffield Road from the east and from the A61 from the north.

4.6 The site is bisected by Tankersley Lane as noted above

4.7 Reference to the MAGIC (Multi Agency Geographic Information for the Countryside) Website indicates the site is not in or close to a Special Area of Conservation (SAC) or Special Protection Area (SPA). There are no other environmentally sensitive sites (i.e RAMSAR sites, Special Area of Conservation or Special Protection Area) within a 1 km radius of the site.

Surrounding Land Uses

4.8 The surrounding land use is summarised in Table 1.

Table 1 Summary of surrounding land uses

Direction	Land use
North	The site is bounded to the north by Birdwell Roundabout, the A61 and M1 junction to the northwest, beyond which is an area of commercial land and Hoyland Common to the northeast
South	The site is bounded to the south by agricultural land beyond this is a railway line
West	The site is bounded to the east by the M1 motorway

East	The site is largely bounded to the east by Sheffield Road (A6135) and agricultural land

Topography

4.9 Reference to OS mapping indicates a section of the site within the main part of the site is approximately 151 metres above ordnance datum (m AOD). The lowest part of the site is approximately 95 m AOD.

4.10 A topographic survey for the site has been completed and is included at Appendix C. The topographic survey identifies the following features at the site:

Southern Parcel

- The highest point on the site is located within the southern parcel of land at approximately 151 m AOD;
- From this point the majority of the southern parcel of land slopes to the southeast;
  - Levels along the southern boundary of the main portion of the site are between 131 m AOD and 135 m AOD to the north of Bell Ground (woodland);
  - Levels along the southern boundary of the site (north of the and associated with Farm Shop and adjoining the south-eastern corner of Bell Ground) are between 126 m AOD (at the Sheffield Road end and 118 m AOD at the Bell Ground end;
- Levels to the south of the main site are within the application boundary generally slop aware to the south to approximately 94 m AOD at the railway line.
- South of Tankersley Lane levels slope to the south from approximately 151 m AOD, and subsequently turn to the southeast.
- The area within the western portion of the site immediately south of Tankersley Lane slopes to the west from a level of approximately 146 m AOD to approximately 142 m AOD adjacent to the M1 slip road.

Northern Parcel

- The southern fields slope east to west from a level adjacent to Sheffield Road of approximately 150 m AOD to a level of 140 m AOD adjacent to the M1 junction.
- The northern fields slope away from Sheffield Road to the west and to the north, from a level of approximately 149 m AOD to a level between 142 m AOD and 144m AOD.

5 PROPOSED DEVELOPMENT

5.1 The proposed development comprises:

'Hybrid planning application for a development of employment uses (B1, B2 and B8), new link road, associated works including provision of internal access roads, drainage and landscaping

a. *Outline with all matter reserved apart from means of access for up to 71,515 sq.m of employment uses (B1, B2, B8)*
b. *Full application for 31,568 sq.m of B8, new link road including new roundabout to link with Hoyland south Masterplan Area (Local Plan references HS68, HS65, HS61, HS58,HS6, SL5).*

5.2 The proposed development plans are included at Appendix D.

5.3 Access to the site will be provided by the new link road to Plots 1 and 2 in the southern parcel of land and to the northern parcel of land. An access is also proposed to the northern parcel of land via Tankersley Lane.

5.4 The proposed development includes the development of earthworks plateaus within the site to provide platforms for the development construction. Approximate proposed levels are shown on the drainage plans included within the Drainage Strategy Report and in summary:

- Plot 1 – Building level approx. 144.50 m AOD;
- Plot 2 – 134.75 m AOD; and
- Plot 3 – 145.60 m AOD.

5.5 Final levels need to be confirmed through detailed cut and fill analysis.

5.6 Following completion of the development there will be an increase in hardstanding at the site from its current state. The proposed development will include approximately 35 Ha of hardstanding across Plots 1, 2 and 3. In addition to this the road will be wholly hardstanding.

5.7 The proposed use of the site is classified as 'Less Vulnerable' within the PPG.

5.8 A Drainage Design Philosophy has been produced for the site and is submitted with the application as a standalone document. A summary of the attenuation measures including discharge rates, consideration of the drainage hierarchy for discharge locations and types of SuDS features is included within Section 10. The acceptable discharge rate to the existing mains sewer will need to be agreed with Barnsley Council in consultation with the Environment Agency.

6 HYDROLOGICAL SETTING

Nearby Watercourses

6.1 Reference to Ordnance Survey Mapping indicates that the nearest surface water feature is Harley Dyke located approximately 250 m west of the site (beyond the M1 motorway) and about 500m south of the main development area for plots 1 and 2.

6.2 Harley Dyke is classed as an 'Ordinary Watercourse' which flows in a south easterly direction before passing beneath the railway line and subsequently flows to the east.

6.3 Harley Dyke flows into the River Dearne 7km downstream from Harley Dyke. The River Dearne is classed as a 'Main River' flows in a generally easterly direction and forms a confluence with River Don.

6.4 Two small drains have been identified and form part of the catchment of the watercourse known as Harley Dyke (which ultimately passes to the River Dearne).

6.5 No artificial watercourses / features (e.g. canals, reservoirs) have been identified within 1km of the site.

Site Catchments

6.6 The main development area for Plots 1 and 2 and the link road within the southern parcel of land generally form two catchments:

- The Eastern catchment collects approximately 26.1 hectares of the proposed development site and forms a tributary of Harley Dyke down the eastern edge of the site in an existing 400 mm culvert. This passes beneath the railway line and ultimately into Harley Dyke. This can be seen on the plan included at Figure 1. Photograph 1 upstream of the Farm Shop shows the initial section of culvert on Figure 1.
  - Anecdotal evidence suggest that flooding occurs in the lower part of the catchment due to the undersized 400 mm culvert.
- The Western catchment collects approximately 16.7 hectares of Hoyland West; this is currently funnelled into Harley Dyke and can be seen on the plan included at Figure 1. This passes beneath the railway line in a 1200 mm culvert as shown in photograph 9.

6.7 The northern parcel of land forms the northern catchment and is split into two:

- The southern portion passing towards the Highways England drain or overland flow towards the M1; and
- The northern portion passing towards the BMBC highways drain.

6.8 This can be seen on the plan included at Figure 1. Further information regarding these is included within Section 8 – Existing Drainage Infrastructure.

6.9 Off site to the south, the land is relatively densely wooded and has been manipulated by anthropogenic processes. It appears that a portion of surface water runoff from this area passes to the eastern catchment, whilst the remainder passes to the western catchment. This can also be seen based on the surface water flood mapping discussed below.

Flood Risk Classification

Fluvial Flooding

6.10 The EA's online Flood Map for Planning, included as Figure 2, indicates that the site is located within Flood Zone 1 whereby the annual probability of fluvial and/or tidal flooding is classified as less than 1 in 1,000.

Surface Water (Pluvial) Flooding

6.11 Reference to the Long Term Surface Water Flood Map, included as Figure 3, indicates the site is predominantly shown to have a 'very low' (flooding occurring as a result of a rainfall with less than 1 in 1,000 chance in any given year) risk of surface water flooding.

6.12 Within the site there are some areas at an elevated risk of surface water flooding. These appear to be limited to low points within the site and route along drainage ditches. There are no surface water flows paths indicated to pass through from upstream areas through the site (i.e. they are indicated to be generated within the site).

- During a high risk event (flooding occurring as a result of rainfall with a greater than 1 in 30 chance in any given year), surface water flooding is indicated within a small area towards the northern corner of the southern parcel of land and within the northmost area of the northern parcel of land (adjacent to the A61 Birdwell roundabout).
  - Away from the main parcels of land, a larger surface water flooding area is indicated off site to the south, immediately adjacent to the railway line.
  - In addition, a surface water ponding area is identified to the northwest of the wooded area located south east of the Bell Ground.
- In addition to the areas mentioned above, a small area of 'medium' risk (flooding occurring as a result of rainfall of between 1 in 100 and 1 in 30 chance in any given year) is shown along the open section of the eastern catchment drain passing through the site. The other areas mentioned are shown to increase in size.
- During and 'low' risk (flooding occurring as a result of rainfall of between 1 in 1,000 and 1 in 100 chance in any given year) surface water flooding is shown to increase within the areas noted during the medium and high risk events. A small flow path is show to encroach into the eastern area of the site from the adjacent allotments.

6.13 To the south of the site, surface water is shown to follow the topography and route around physical barriers observed during the site walkover. Essentially, a portion to the east of the high ground falls towards the eastern catchment, whilst a portion from Bell Ground is routed around the woodland to the south of Bell Ground and towards the western catchment.

Reservoir Flooding

6.14 Reference to the Long Term Reservoir Flood Map, included as Figure 4 indicates the site is located within an area that would not be impacted by flooding in the event of reservoir failure.

Strategic Flood Risk Assessment

6.15 The Barnsley Strategic Flood Risk Assessment SFRA was published in September 2010 and identifies and maps flood risk from all sources at a borough-wide scale as well as providing guidance on producing site specific FRAs. Relevant information from the Level 1 SFRA is summarised below:

- Flood zone mapping indicates the site is located entirely within Flood Zone 1. The SFRA identifies that this area comprises Flood Zone 1 which comprises land assessed as having a less than 1 in 1000 annual probability of river and sea flooding in any year (<0.1%)
- Surface water mapping identifies some flood extent along the route as Harley Dyke similar to the surface water flood risk as identified on the Long Term Surface Water Flood Map, however does not indicate the pond area and route along eh eastern catchment;
- The site is shown to not be impacted by tidal flooding;
- The site is shown to not be located within a Critical Drainage Area (CDA);

7 HYDROGEOLOGICAL SETTING

7.1 Reference to BGS online mapping (1:50,00 scale) does not indicate the presence of any superficial deposits underlying the site. The site is shown to be wholly underlain by bedrock deposits from the Pennine Middle Coal Measures Formation – which is described as Mudstone, Siltstone and Sandstone.

7.2 During the site visit it was observed that the surface soils appeared to be cohesive in nature.

7.3 It is understood that a site-specific site investigation has been undertaken. At the time of writing draft information (Applied Geology, reference AG3030 -19-AK21) has been made available and indicates:

- In the opencast backfill north of Tankersley Lane, groundwater levels were measured between 1.85 and 4.5m bgl (144.9 to 143.3mOD).
- In the opencast backfill south of Tankersley Lane, groundwater levels were measured between 2.80m and 'dry' (>7m) bgl (149.6 to below 144.5mOD).
- Groundwater levels in the bedrock were measured at between 0.86m and 9.88m bgl (146.9 to 116.8mOD) broadly mirroring topography but with some deeper levels in the deeper Coal Measures strata.

7.4 Reference to BGS Borehole records indicates that there are several borehole logs within the site mostly which are labelled as confidential and restricted.

- A single borehole log (reference: SK39NE376), is accessible online and has been undertaken within the site adjacent to the western boundary of the southern parcel, adjacent to the M1 motorway;
  - the borehole log taken in 1999 at coordinates 435290, 399572, indicates that the first 0.8m depth of ground comprises topsoil initially over Made Ground (grey sandy clay) and then weathered Mudstone to a depth of 1.4m where the borehole records ends;
  - No mention ground water is given within the record; and
- Reference to further BGS borehole (reference SK30NE69) located east of the northern parcel of land, adjacent Hoyland Common Primary School, was advanced to 3.0 m bgl, and confirms the presence of Made Ground, over firm mottled Clay, over light grey Mudstone (slightly weathered).

7.5 Reference to the MAGIC website indicates the underlying Pennine Middle Coal Measures Formation is classified as a Secondary A Aquifer. These are permeable layers capable of supporting water supplies at local rather than strategic scale and in some cases form an important source of base flow to rivers.

7.6 Reference to the MAGIC website indicates the site is not located within a groundwater Source Protection Zone.

8 EXISTING DRAINAGE

Drainage Infrastructure Catchment Observations

8.1 As discussed within Section 6, the site has 3 main catchments, north, east and west, and a number of outfalls are existing from these catchments. The catchments and main outfalls from the east and west catchments are discussed in Section 6. The catchments to existing infrastructure associated with the northern catchment are discussed below:

- Highway Drain – this appears to link to the Birdwell Roundabout Attenuation built for the road and collects the field in a perimeter French drain from the northern portion of the northern parcel of land (north of Tankersley Lane) (further details below);
- Motorway Drain – this appears to be a low point collecting water from the southern portion of the northern parcel of land (north of Tankersley Lane) but no outfall could be seen in the dense vegetation but did show signs of ponding water;
- Motorway Drain – this appears to be a low ditch discharging towards the motorway but no evidence how it connects; and
- Motorway Sheet flow – this field also has a low point that sheet flows water onto the motorway that has a series of gullies to collect it.

8.2 In addition to the above, an agricultural drain was observed along the boundary of the small woodland to the southeast of Bell Ground. This passes long the western boundary of the woodland, across the Tran Pennine Trail and across the agricultural field towards the western catchment culvert beneath the railway line. Upstream of the small woodland, and within Bell Ground this drainage route appears to comprises a series of unmaintained drains, culvert crossings and additional piped runs.

Barnsley Metropolitan Borough Council Highway Drains

8.3 BMBC have provided highway drainage plans for the area located to the north of the northern parcel of land. These are provided at Appendix E and summarised below:

- French drain located along boundary of the site between the site and the Birdwell Roundabout. This is indicated to connect at manhole CP3.
- Combined kerb and drainage block located along the road on the western side of the parcel of land, passing to a 225 mm drain, and subsequently discharging, via a 375 mm drain at the last manhole, into a detention basin located within the centre of Birdwell Roundabout.
  - This detention basin is subsequently shown to pass to the northeast;
- Combined kerb and drainage block located along the road on the northern side of the parcel of land (around ‘Roundabout 1’ on the BMBC plan, passing to a 300 mm drain, and subsequently discharging, via a 375 mm drain at the last manhole (as noted above), into a detention basin located within the centre of Birdwell Roundabout.

8.4 With regard to the French drain noted at Paragraph 8.3 bullet point 1, additional survey works have been undertaken (included at Appendix E) and it is understood that this drain flows to the west and connects into the drains to the west of Birdwell Roundabout and subsequently passes north towards Birdwell Village.

Yorkshire Water Sewers

8.5 Reference to Yorkshire Water plans of public sewers (shown in Appendix E) indicates that there are no surface water sewers within Sheffield Road located to the east of the site or within Tankersley Lane shown to bisect the site.

9 FLOOD RISK AND MITIGATION

9.1 The key sources of flooding that could potentially impact the site are discussed below:

Fluvial / Tidal Flooding

9.2 The Environment Agency Flood Map, included as Figure 2, indicates that the site is located entirely within Flood Zone 1 whereby the land is classified as having a less than 1 in 1,000 annual probability of fluvial flooding.

9.3 Based on the proposed development being located within Flood Zone 1, there would be no obstruction to fluvial flood flow routes and no requirement to provide floodplain compensation. Access and egress would be available to the site from the north and to the east via the proposed access routes.

Proposed Mitigation

9.4 Based on the above assessment the risk of fluvial flooding is considered to be low, therefore no mitigation is considered necessary.

Flooding from sewers

9.5 Sewer flooding can occur during periods of heavy rainfall when a sewer becomes blocked or is of inadequate capacity. The site is currently undeveloped and as such there are no Yorkshire Water sewers present.

9.6 There are known field and perimeter drains within parts of the site, namely the field drain running from Bell Ground and discharging into Harley Dyke north of the railway line and the Highways drainage taking run-off from the northern parcel of land, as described in the sections above.

9.7 The existing formal drainage within the site is located downstream of the development and the development proposal would ultimately reduce the flow rates passing to these features.

Proposed Mitigation

9.8 Based on the above the risk of flooding from sewers is considered to be low, therefore no mitigation is required for the proposed development.

9.9 As part of the development on site drainage infrastructure will be implemented. In order to prevent the potential for flooding in the event this infrastructure surcharges, it is recommended that either buildings are raised up slightly compared to external ground levels or external ground levels are graded away from the buildings.

Surface water flooding (overland flow)

9.10 This can occur during intense rainfall events when water cannot soak into the ground or enter drainage systems. The Long Term Surface Water Flood Map indicates the site predominantly has a ‘very low’ risk of surface water flooding.

9.11 There are some areas of low to high risk of surface water flooding within the site, as discussed within Section 6, however, these are primarily limited to ponding areas, and low points along short sections of open channel. These flow paths generally start within the site and do not appear to constitute

surface water flow paths through the site. A small flow path is show to encroach into the eastern area of the site from the adjacent allotments during the low risk event.

9.12 To the south of the site, surface water is shown to follow the topography and route around physical barriers observed during the site walkover. Essentially, a portion to the east of the high ground falls towards the eastern catchment, whilst a portion from Bell Ground is routed around the woodland to the south of Bell Ground and towards the western catchment.

9.13 Surface water flooding from on-site sources is considered in Section 10 of this report.

Proposed Mitigation

9.14 Based on the above, the risk of surface water flooding is considered to be low.

9.15 Notwithstanding, floor levels of the proposed development will be altered from the existing ground and mitigation including a dedicated surface water drainage network will provide for reducing the potential for the ingress of water in the event of surface water flooding. The drainage for the site includes an allowance for the small flow path from the adjacent allotments

9.16 It is recommended that either buildings are raised up slightly compared to external ground levels or external ground levels are graded away from the buildings.

Groundwater flooding

9.17 This can occur in low-lying areas when groundwater levels rise above surface levels, or within underground structures. BGS mapping indicates the site is shown to not be underlain by any superficial deposits. The site is shown to be wholly underlain by bedrock deposits from the Pennine Middle Coal Measures Formation.

9.18 The Barnsley SFRA identifies that the nearest location to the site which has potential to exhibit groundwater flooding in Hoyland is the Millhouses area which is approximately 2.40km east of the site.

9.19 There are no basements proposed for the development. The development proposal will include a large earthworks program including cut and fill. It should be noted that large areas at the southern end of the site will be significantly raised compared to current levels, whilst the highest points at the site will be lowered. There is potential that shallow or perched groundwater could be encountered at the site.

9.20 It is recommended that a detailed site investigation and seasonal groundwater monitoring is undertaken in order to confirm the depths to groundwater.

Proposed Mitigation

9.21 Based on the above, the risk of groundwater flooding is considered to be low therefore at this stage no mitigation is considered to be necessary. This position should be further considered upon conclusion of the site investigation program and finalisation of levels for the site.

Other Sources

9.22 There is a limited risk of flooding occurring as a result of a break in a water main, however, these are likely to be limited within the vicinity of the site. In the event of a burst of such main, water would likely take a preferential pathway along highway routes.

9.23 Reference to the Long Term Reservoir Flood Map, included as Figure 4, indicates the site is located within an area that would not be impacted by flooding in the event of reservoir failure.

9.24 There will be no increase in flood risk from sources such as water mains, canals or other artificial water bodies as a result of the development.

Proposed Mitigation

9.25 Based on the above, the risk of flooding from artificial sources is considered to be low.

9.26 It is recommended that either buildings are raised up slightly compared to external ground levels or external ground levels are graded away from the buildings.

Event Exceedence and Residual Risk

9.27 The mitigation measures proposed as part of the development scheme are considered appropriate to mitigate against any residual risks or event exceedence scenarios.

10 SURFACE WATER MANAGEMENT

Introduction

10.1 The development primarily comprises construction of commercial units along with a new link road on an area of previously undeveloped land. Therefore, as a result of the development proposal there will be an increase in hardstanding within the site.

10.2 A Drainage Strategy Report document has been produced by RPS reference HOYLA-RPS-SI-XX-D-RP-DS01, P04 dated 27th July 2020, to support the planning application for Plots 1, the link road (southern parcel of land) and the outline application for Plots 2 (southern parcel of land) and Plot 3 (the northern parcel of land). The Drainage Strategy Report provides full details of the surface water drainage strategy for the site and should be read in conjunction with this FRA. This section of the FRA discusses the surface water drainage strategy in terms of flood risk catchments and inclusion of SuDS option and refers to the aforementioned document.

10.3 In addition to the above, a separate standalone document has been produced to support the application relating to Plot 1 only. The Drainage Design Philosophy produced by RPS, reference HOYLA-RPS-SI-XX-RP-D-1030, dated June 2020, details the drainage for Plot 1 freely discharging into the drainage system for the wider site covered in the report above. This drainage strategy should also be read in conjunction with this FRA.

10.4 Consultation with the LLFA (BMBC) has been undertaken, and is discussed in Section 3, with correspondence included at Annex A. In summary:

- *"BMBC would normally require a 30% climate change adjustment and do not require the 10% urban creep adjustment;*
- *Use of FSR rainfall data is acceptable to BMBC;*
- *It is currently BMBC policy to resist connection of flows from Development Sites into the Highway Drainage Network;*
- *If it can be proven that connection to the Highway Drain is the only viable option then we would require:*
  - *Full CCTV survey of the Highway Drain to be submitted to the Highway Authority prior to consent being given*
  - *Any repairs deemed necessary by the Highway Authority to be carried out at the developer's expense.*
  - *Assessment of existing hydraulic capacity of the Highway Drain together with an assessment of flows into the drain in agreed storm intensities to prove capacity is available in the Drain for proposed flows to be carried out by the developer prior to consent being given".*

10.5 Subsequent to the planning application submission, further information regarding existing drainage has become available and is discussed in further detail in Section 8 and Section 10 of this report. The result of this additional information is that drainage from the site will pass entirely to the south towards Harley Dyke. This has been discussed with the LLFA who have agreed to this approach provided that the contributing catchment isn't considered as part of the run-off rate calculations to Harley Dyke.

Drainage Catchments

10.6 As discussed in Section 6 and Section 8 there are three main catchments to which the current topography of the site falls:

- The Eastern catchment collects approximately 26.1 hectares of the proposed development site and connects to the Harley Dike down the eastern edge of the site in an existing Culvert. This can be seen on the plan included at Figure 1.
  - It is not proposed to re-utilise this outfall, but instead, runoff within this catchment will be diverted to other catchments within the site, as discussed below.
- The Western catchment collects approximately 16.7 hectares of the site; this is currently funnelled into Harley Dike and can be seen on the plan included at Figure 1.
  - As this outfall is proposed to be the primary outfall for the development, greenfield runoff calculations have been done, to ensure that proposed runoff rates resulting from the development are not greater than those currently experienced from the existing contributing catchment.
- The Northern catchment is split into two outfalls, both appearing to connect to Highway agency drains, as discussed in Section 8.
  - Additional survey works have been undertaken (included at Appendix E) and it is understood that this drain flows to the west and connects into the drains to the west of Birdwell Roundabout and subsequently passes north towards Birdwell village. Therefore, it is not considered that this is a viable surface water receptor to take surface water run-off from the proposed development. As discussed earlier in Section 3 and above, it is not proposed to pass flows from the northern parcel of land towards the south and ultimately into Harley Dyke.

Discharge Rates and Climate Change

10.7 Based on the information above, discharge rates have been calculated using the HR Wallingford greenfield run-off rate estimate for sites, for the catchment areas currently falling to the south, in order not to increase discharge rate to the receptor. The QBAR discharge rate for the southern parcel of land calculated as 84.2 l/s.

10.8 As noted above, based on the limited connection to the existing surface water receptor to the north, it has been agreed with the LLFA that flows from the northern parcel of land will be attenuated within the proposed attenuation basin to the south and passed forward at a rate no greater than this existing contributing catchment as discussed above at Paragraph 10.7.

10.9 Based on discharging at QBAR rates for the hardstanding areas proposed, there will be an improvement in the rate of discharge for event from QBAR to the 1 in 100 year plus 30% allowance for climate change.

10.10 The proposed development comprises the construction of commercial properties. Generally, this type of development is considered to have a design life of 60 years. Therefore, for the purposes of this assessment, taking into account the requirements of BMBC a 30% increase in peak rainfall intensity has been included as climate change allowance.

Drainage Hierarchy

10.11 The NPPF (paragraph 80) identifies the hierarchy for discharge of surface water to be considered, as reasonably practicable:

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

10.12 The guidance notes that '*particular types of sustainable drainage systems may not be practicable in all locations'.*

10.13 The following surface water drainage discharge hierarchy is required:

Disposal by Infiltration

10.14 As discussed in Section 7, the site is underlain by the Middle Pennine Coal Measures Strata, which are described as comprising mudstone, siltstone and sandstone.

10.15 During the site walkover it was noted that the surface soils appeared to be cohesive in nature. Review of the Soilscapes website (http://www.landis.org.uk/soilscapes/) indicates that the soils beneath the site are 'slowly permeable, seasonally wet' and with *'impeded drainage'*.

10.16 Based on the large built and hardstanding footprint along with the poor soils of infiltration it is considered that infiltration is not a suitable method for dispose of surface water at the site.

Discharge to Surface Watercourse

10.17 At this stage, it is considered tht the site will discharge into the southern catchment as this is the most suitable method of discharge of surface water from the site is to a surface watercourse at a controlled discharge rate. Based on the information noted above (paragraphs 10.6-10.10), it is considered that the most feasible option is to discharge to the western catchment, located to the south of the site, at the QBAR discharge rate for the area of the site currently passing this direction. This will seek to mimic the natural catchment depicted by topographic contours across the western catchment, albeit controlling flows for larger events.

10.18 It should be noted that additional flows would pass into this watercourse, however, at a much lower rate than could currently occur. The western and eastern catchments merge to the south of the railway line and as such, the flows entering the downstream catchment would be unaltered, with the exception of the controlled discharge rate.

10.19 Based on the hydrological setting of the northern parcel (land north of Tankersley Lane) there are no direct surface watercourse receptors. It is intended that these flows will also pass to the south, but will be attenuated based on the discharge rate for the existing contributing catchment.

Discharge to Surface Water Sewer, Highway Drain or another Drainage System

10.20 No Yorkshire Water surface water sewers are located within the vicinity of the site.

10.21 The next alternative drainage system is the BMBC highways drainage system located at Birdwell Roundabout. This is described in Section 8, but in summary comprises:

- French drain located along the field boundary;
- Existing Highway drainage and kerb drains; and
- Detention basin within Birdwell Roundabout.

10.22 Further survey works have confirmed that this French drain passes to the west to a connection to the west of Birdwell Roundabout and ultimately to a drainage network that passes towards Birdwell Village. There is no confirmed connection to the highways drainage at Birdwell Roundabout, nor the attenuation basin located within Birdwell Roundabout, therefore as discussed above at paragraphs 10.17-10.19, flows will pass to the south to existing surface watercourses.

10.23 The expectation is that the 'flank' of the field around the northern parcel of land, which currently falls towards this French drain system, will continue to drain as per this existing situation. It is likely that this alteration to the drainage form the norther parcel of land could represent a betterment to the existing drainage system towards Birdwell Village, particularly at times of high flow.

10.24 We would note that there are Highways England drains located adjacent to the western boundaries of the northern parcel of land however, this is not considered to be a viable solution for discharge of surface water from the site.

Discharge to Combined Sewer

10.25 No combined sewers suitable for taking the discharge from the are located within close proximity. Therefore, this option as not been considered further at this stage.

Consideration of Sustainable Drainage Systems

10.26 The potential for the use of Sustainable Drainage Systems (SuDS) has been considered at this stage.

Soakaways

10.27 As noted above and discussed in Section 7, the site is underlain by the Middle Pennine Coal Measures Strata, which are described as comprising mudstone, siltstone and sandstone. During the site walkover it was noted that the surface soils appeared to be cohesive in nature.

10.28 In addition, based on a review of the Soilscapes website (http://www.landis.org.uk/soilscapes/) indicates that the soils beneath the site are 'slowly permeable, seasonally wet' and with *'impeded drainage'*.

10.29 Given the reported geological conditions beneath the site, it is considered that soakaways are unlikely to provide a feasible method for the disposal of surface water runoff from the site.

Swales, detention basins and ponds

10.30 Due to the nature of the proposed development it is proposed to include attenuation basins within the site to provide surface water attenuation. It is proposed to locate this feature to the south of the southern parcel of land.

Rainwater Harvesting

10.31 The attenuation benefits provided through the use of rainwater harvesting are considered to be limited and would only be realised when the tanks are not full. Such features may be suitable to

meet the needs of all future tenants, and as such their consideration could be revisited at the detailed design stage on a plot by plot basis.

10.32 It is understood that Plot 1 proposed to incorporate a rainwater harvesting tank and this is discussed in the Drainage Design Philosophy specific to that plot reference HOYLA-RPS-SI-XX-RP-D-1030, dated June 2020.

Green Roofs

10.33 Based on the scale and nature of the development it is unlikely that green roofs will be suitable for use at the site. The buildings will comprise large span (likely pitched roofs) and as such would represent a future maintenance and health and safety liability.

Porous / Permeable Paving

10.34 At this stage it is considered that the car parking areas could be considered further for the use of porous paving at the detailed design stage.

10.35 The large service yards for the units would not likely be to suitable for porous paving due to them heavily trafficked areas and used for turning of HGVs.

Modular Underground Attenuation Tanks

10.36 At this stage it is not proposed that attenuation tanks will be required by the southern parcel of land at the site.

10.37 The northern parcel of land may need to consider the use of underground attenuation tank at the detailed design stage. Based on the potential for varying circumstances, such as increased hardstanding, reduced potential for above ground surcharging the total volume of underground storage will need to be considered as part of the detailed drainage design.

Conceptual Surface Water Attenuation Scheme

10.38 It is proposed that surface water run-off associated with the development proposal will be positively drained via an underground piped drainage network.

10.39 The drainage network will convey the surface water to attenuation pond located to the south of the site, and subsequently discharge to the Harley Dyke, at a controlled discharge rate of 82.4 l/s.

10.40 On the basis of the calculations above:

- a total attenuation volume of 43,000 m^3 will be required to achieve the required discharge rate for the site (it should be noted that this drainage system also makes an allowance for future plots of land separate to this application and further details are provided within the Drainage Strategy Report).

10.41 It should be noted that appropriate consideration should be given to the design of the attenuation basins with regard to the Reservoir Act 1975 at the detailed design stage, with the attenuation ponds being designed and engineered accordingly.

Maintenance of Sustainable Drainage Systems

10.42 As described in CIRIA C753 (the SuDS Manual, 2015), regular inspection and maintenance will be required following construction to allow effective operation of the proposed attenuation. A SuDS

Maintenance Plan for the features highlighted above is included within the Drainage Strategy Report (reference HOYLA-RPS-SI-XX-D-RP-DS01, P04 dated 27th July 2020).

Treatment

10.43 A treatment plan for the features highlighted above is included in the Drainage Strategy Report (reference HOYLA-RPS-SI-XX-D-RP-DS01, P04 dated 27th July 2020).

Event Exceedance

10.44 The proposed indicative surface water drainage concept provides storage up to the 1 in 100 year plus climate change event. In an event exceeding this magnitude, detailed drainage design will identify mitigation measures to ensure that the resulting above-ground flooding will be confined to temporary shallow flooding of the on-site road network and will not affect the buildings on site or significantly increase flood risk to off-site locations.

10.45 Event exceedance planning will be undertaken as part of the final design process. Suitable mitigation measures will be incorporated into the development to ensure water is retained on-site should surcharging of on-site drains occur during extreme rainfall events.

11 SEQUENTIAL TEST AND EXCEPTIONS TEST

Sequential Test

11.1 The NPPF requires the Local Authority to apply the Sequential Test in consideration of new development. The aim of the test is steer new development to areas at the lowest probability of flooding. Given that the subject site has not been allocated as one of the Council's proposed future development site, it has not been specifically assessed within the SFRA. Therefore, the Sequential Test is based on the EA's online Flood Map for Planning and information contained within the SFRA.

11.2 The proposed development is wholly located within Flood Zone 1 and is considered to have a low risk of flooding from all other sources. Some limited areas at a slightly higher of surface water flooding are indicated within the site, however, these will be managed by the sites drainage system.

11.3 The site is therefore considered to meet the requirements of the Sequential Test.

The Exception Test

11.4 According to Table 3 of the PPG, 'Less Vulnerable' developments are considered appropriate within Flood Zone 1 without the requirement to apply the Exception Test. Therefore, application of the Exception Test is not required for the proposed development.

12 SUMMARY AND CONCLUSIONS

12.1 The aim of the Flood Risk Assessment is to outline the potential for the site to be impacted by flooding, the potential impacts of the development on flooding both onsite and in the vicinity, and the proposed measures which can be incorporated into the development to mitigate the identified risks. The report has been produced in accordance with the guidance detailed in the NPPF and in consultation with the EA and LLFA. Reference has also been made to the BMBC SFRA and the CIRIA SuDS Manual (C753).

12.2 The potential flood risks to the site, and the measures proposed to mitigate the identified risks, are summarised in the table below:

Source of flooding	Identified Risk			Mitigation proposed	Residual risk		
	L	M	H		L	M	H
Fluvial	✓			No mitigation considered necessary	✓		
Tidal	✓			No mitigation considered necessary	✓		
Sewers	✓			It is recommended that either buildings are raised up slightly compared to external ground levels or external ground levels are graded away from the buildings.	✓		
Surface Water	✓	✓		It is recommended that either buildings are raised up slightly compared to external ground levels or external ground levels are graded away from the buildings.	✓		
Groundwater		✓		It is recommended at the detailed site investigation and seasonal monitoring us undertaken to confirm depths to groundwater	✓	✓	
Other Sources (e.g. reservoirs, water mains)	✓			No mitigation is considered necessary	✓		

12.3 The site is located within Flood Zone 1 and is therefore considered to have a low risk of fluvial flooding.

12.4 A Drainage Strategy Report has been produced as a separate document and is referred to within this report. In summary:

- Surface water attenuation will be provided in the form of an above ground attenuation pond, limited to QBAR discharge rate, for the existing contributing catchment for the southern parcel of land and will discharge to Harley Dyke.

12.5 It is therefore considered that the proposed development will be safe throughout its lifetime and maintains surface water run-off rates in line with local and national policy requirements.