FLOOD RISK ASSESSMENT

Land at Hoyland Common, Barnsley, S74 0AL

for

Newlands Developments Ltd

RCEF77804
Flood Risk Assessment
001
21 August 2020

rpsgroup.com

Quality Management

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1 INTRODUCTION

1.1 RPS was commissioned to undertake a Flood Risk Assessment of land to the east of Hoyland Common on behalf of Newlands Developments Limited in relation to the proposed development and in support of the 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 A Drainage Concept Drawing (reference HOYLA-RPS-SI-XX-DR-D-1351) for the development has been produced and should be reviewed in conjunction with this FRA.

1.4 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).

1.5 A site visit was conducted on 14th August 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. Previously RPS have consulted BMBC with regard to the adjacent development proposal have identified the following which are expected to be relevant to this site:

- Consideration of the drainage hierarchy;
- BMBC would normally require a 30% climate change adjustment and do not require the 10% urban creep adjustment; and
- Use of FSR rainfall data is acceptable to BMBC.

Environment Agency

3.2 The site is located within Flood Zone 1 and as such the Environment Agency are not expected to be consulted as part of this application.

Yorkshire Water

3.3 The public sewer network within the vicinity of the site is operated by Yorkshire Water. Sewer plans have been obtained from Yorkshire Water covering the area of the site and are discussed in Section 8.

Internal Drainage Board

3.4 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 436058, 399779. It is irregular in shape, occupying an area of approximately 4.38 hectares. A site location plan is provided at Figure 1 below.

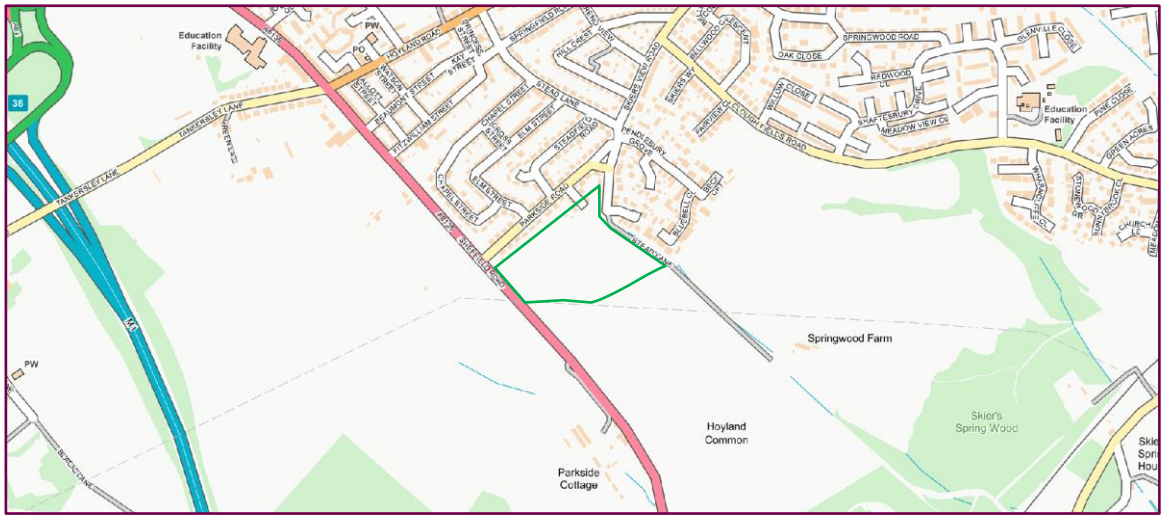

Figure 1 Site Location Plan (approximate site boundary shown in green)

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

Site Description

4.3 The site comprises undeveloped greenfield and open pastureland.

4.4 Access to the site is via the A6135 Sheffield Road from the west.

4.5 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

4.6 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 Hoyland village, which also wraps around the northwest and northeast flanks of the site. Directly northeast of the site is a road named Stead Lane, beyond

	which are residential properties of Warren View and Bluebell Close.
South	The site is bounded to the south by agricultural
West	The site is bounded to the west by the Sheffield Road (A6135) beyond which is agricultural land
East	The site is bounded to the east by Stead Lane beyond which is agricultural land

Topography

4.7 Reference to OS mapping indicates that in general the site falls towards the east/southeast and the following contours are indicated within the site:

- The northern end of the site is at or above the 135 m AOD contour;
- The 130 m AOD contours passed through the central portion of the site;
- The 125 m AOD contour passes through the eastern corner of the site;
- The southwestern corner of the site appears to site approximately mid-way between the 130 m AOD and 125 m AOD contours.

4.8 A topographic survey has been made available for the site and is included at Appendix B. In summary the topographic survey indicates that:

- The highest point of the site is located in the northwest corner where levels are in the region of 136.76 m AOD;
- The lowest point of the site is located in the southeast corner at approximately 124.5 m AOD;
- The site generally falls to the south east at a gradient of between 1 in 20 to 1 in 25;
- The area in the northeastern corner of the site fall back to the north slightly to form a low point from the housing to the north of the site to Stead Lane at the eastern side of the site.

Site Observations

4.9 During the site visit it was observed that the northernmost portion of the site, forming a small triangle located between a side road off Parkside Road and Warren View falls back towards the northeast and Stead Lane.

4.10 In addition, during the site visit it was observed that the field adjacent to Stead Lane was generally raised a little compared to Stead Lane (approximately 300-500 mm).

5 PROPOSED DEVELOPMENT

5.1 It is understood that the site will be developed in two phases:

- During the initial phase (Phase 1) the plateaus will be developed along with the archery range with an access and temporary (permeably) surfaced car parking area.
- During Phase 2 the sport pitches will be constructed along with a more permanent (hardstanding) car parking arrangements.

5.2 The proposed development plans are included at Appendix C.

5.3 Vehicular access to the site will be provided Sheffield Road at the western corner of the site. A pedestrian access (Public Right of Way) will be maintained along the northern boundary of the site.

5.4 The proposed development includes earthworks plateaus within the site to provide platforms for the development sports facilities. Approximate proposed levels are shown plateau plans and in summary:

- Archery range – 128.50 m AOD; and
- Sports pitches – 133.00 m AOD.

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

5.6 A Drainage Drawing has been produced for the site and is submitted with the application as a standalone document for Phase 1. Consideration of the drainage hierarchy for discharge locations and types of SuDS features is included within Section 10.

5.7 For Phase 2 consideration of attenuation measures including discharge rates will be required based on the hardstanding areas proposed at that time. The acceptable discharge rate to the existing watercourse will need to be agreed with Barnsley Council.

6 HYDROLOGICAL SETTING

Nearby Watercourses

6.1 Reference to Ordnance Survey Mapping indicates that the nearest surface water feature is an unnamed drain located over Stead Lane to the northeast of the site. The OS mapping indicates that the drain has a number of open reaches and culverted reaches between Warren View and the residential houses on Bluebell Close located to the southeast of the site.

6.2 The open sections of drain to the south of the residential houses were not observed, primarily as a result of private residential gardens and overgrown bushes. Adjacent to the residential properties on Bluebell Close, over Stead Lane and opposite the eastern side of the site, the drain emerged from a culvert pipe (approximately 600 mm) and flows within an open channel on the northern site of Stead Lane. The Channel is estimated to be approximately 1 m below the level of Stead Lane.

Photographs 1 and 2 indicating the pipe outfall located adjacent to Stead Lane

6.3 The drain continues to the southeast and open and culverted sections were observed along the route of Stead Lane. Stead Lane becomes increasingly narrower and impacted by overland flows, until ultimately it ends up as a single track. The drain was observed for the majority of Stead Lane until it headed away into Skiers Springs Wood.

6.4 The drain appears to pass into Skiers Springs Wood and is likely to pass beneath the railway line and Broadcarr Road and ultimately into Harley Dyke is located approximately 1 km southeast of the site.

6.5 Harley Dyke flows into the River Dearne 7km downstream of the site via Elsecar Reservoir. The River Dearne is classed as a ‘Main River’ flows in a generally easterly direction and forms a confluence with River Don.

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

Site Catchment

6.7 As discussed in the Section 4 the topography of the site generally slopes to the south and east, thereby forming a catchment to the drain located adjacent to the eastern boundary of the site.

Flood Risk Classification

Fluvial Flooding

6.8 The EA's online Flood Map for Planning, included as Figure 2 below, 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.

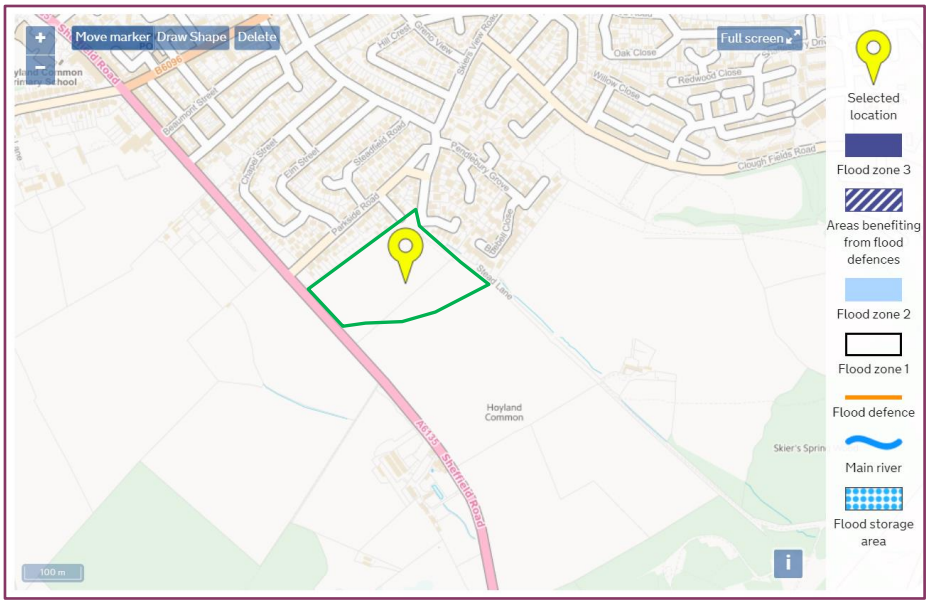

Figure 2. EA Flood Map for Planning (approximate site boundary shown in green)

Surface Water (Pluvial) Flooding

6.9 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.

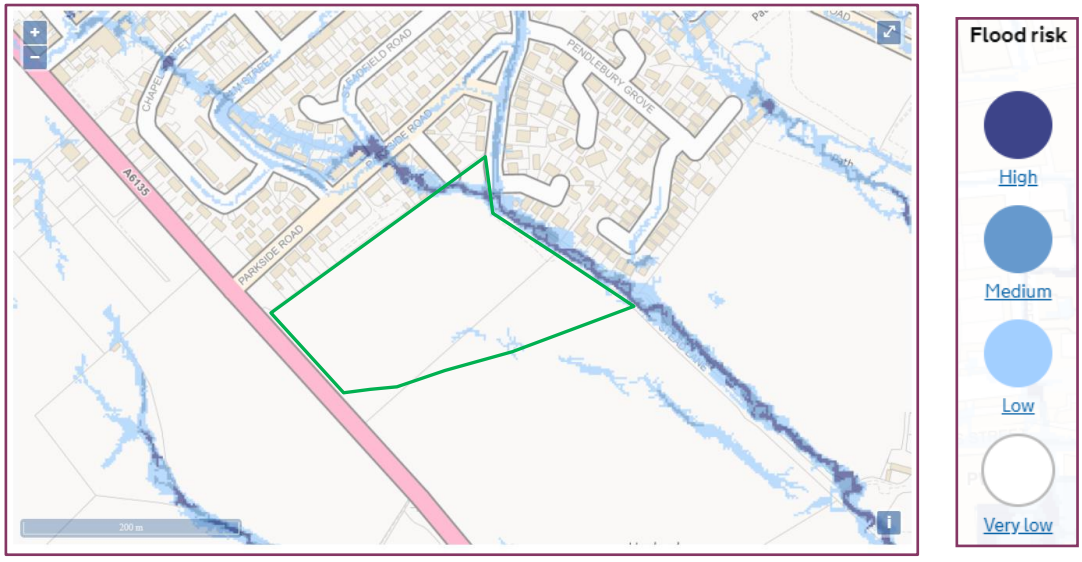

Figure 3 Long Term Surface Water Flood Map (approximate site boundary shown in green)

6.10 Within the site there are some areas at a slightly elevated risk of surface water flooding. This appears to be limited to a section through the centre of the site where the flow path starts in the central area of the site. This flow route is only shown to be present during the 'low' risk (flooding occurring as a result of rainfall of between 1 in 1,000 and 1 in 100 chance in any given year) event. This flow path is quite 'patchy' within the site and only properly forms a continuous path in the adjacent field to the south. This is shown to direct towards the east the drain discussed at Paragraphs 6.1 – 6.5 above.

6.11 A flow path is indicated along the north-eastern boundary of the site through a topographic low point within this area, and appears to pass along the route of the drain through the residential houses to the north, cutting across the northern corner of the site and along the drain adjacent to the eastern boundary. This flow path is present during 'low' risk (flooding occurring as a result of rainfall of between 1 in 1,000 and 1 in 100 chance in any given year) to 'high' risk flooding occurring as a result of rainfall with a greater than 1 in 30 chance in any given year) flooding events. The flow path is indicated to be approximately 300 mm deep, with some small areas of 300-900 mm depth.

6.12 There are no other surface water flows paths indicated to pass through from upstream areas through the site.

Reservoir Flooding

6.13 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

6.14 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%);

- The site is not shown to be located within an area designated as Flood Zone 3b;
- The site is shown to not be impacted by tidal flooding;
- Surface water mapping identifies that the site is not shown to be impacted by surface water flooding;
- The site is not shown to have been impacted by historic flood events.

7 HYDROGEOLOGICAL SETTING

7.1 Reference to BGS online mapping 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 Reference to BGS Borehole records indicates that there are no borehole logs within the site or within the immediate vicinity of the site.

7.4 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.

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

8 EXISTING DRAINAGE

Existing Site Drainage

8.1 The site is currently undeveloped agricultural land and as such no formal drainage is likely to be present within the site. Agricultural land drainage may have historically been installed.

Yorkshire Water Sewers

8.2 Reference to Yorkshire Water plans of public sewers (shown in Appendix D) indicates that there are surface and foul water sewers passing through the northern corner of the site, along with additional sewers located within Warren View and Bluebell Close. In summary:

- A 450 mm surface water sewer is shown as passing through the northern corner of the site, into the area to the rear of the properties on Warren View, likely into the route of the culverted drain discussed in Section 6;
- A 225 mm foul sewer is shown as passing parallel to the above surface water sewer but passes forwards towards Warren View;
- A 300 mm surface water sewer is shown to flow into an open section of drain to the rear of No. 10 Warren View; and
- A 225 mm surface water sewer is shown to flow into a culverted section of drain to the rear of No. 22 Bluebell Close.

8.3 As discussed in section 6, these surface water sewers appear to flow out of a pipe (approximately 600 mm) into the drain located on the eastern side of Stead Lane.

8.4 During the site visit a manhole was observed within Stead Lane approximately 20-30 m south of the entrance to Warren View. It is thought that this is a manhole chamber associated with the foul sewer.

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 west 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.

Surface water flooding (overland flow)

9.5 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.

9.6 Within the site there are some areas at a slightly elevated risk of surface water flooding. This appears to be limited to a section through the centre of the site where the flow path starts in the central area of the site. This flow route is only shown to be present during the ‘low’ risk (flooding occurring as a result of rainfall of between 1 in 1,000 and 1 in 100 chance in any given year) event. This flow path is quite ‘patchy’ within the site and only properly forms a continuous path in the adjacent field to the south.

9.7 A flow path is indicated along the north-eastern boundary of the site through a topographic low point within this area, and appears to pass along the route of the drain through the residential houses to the north, cutting across the northern corner of the site and along the drain adjacent to the eastern boundary. This flow path is present during ‘low’ risk (flooding occurring as a result of rainfall of between 1 in 1,000 and 1 in 100 chance in any given year) to ‘high’ risk flooding occurring as a result of rainfall with a greater than 1 in 30 chance in any given year) flooding events. The flow path is indicated to be approximately 300 mm deep, with some small areas of 300-900 mm depth.

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

Proposed Mitigation

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

9.10 Notwithstanding this, the following recommendations are made:

- It is recommended that the area towards the northern corner of the sport pitches plateau is maintained at a higher level than the lowest point in the northern corner of the site and a small bund (c. 300 mm) placed around this corner to maintain the surface water flow path as per the current situation hence away from the pitches.

- In addition, it is recommended at a toe drain is included along the tow of the slope that wraps around the northern and north-eastern fringes of the sports pitches.

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

Flooding from sewers

9.12 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 no formal sewers are presently draining the site.

9.13 There are Yorkshire Water sewers present beneath the northernmost corner of the site. This includes a 450 mm surface water sewer and a 225 mm foul sewer. Based on the topography in this area, in the event of surcharging of these sewers it is likely that flows would follow the topography onto Stead Lane and ultimately into the drain located on the eastern boundary of Stead Lane.

Proposed Mitigation

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

Groundwater flooding

9.15 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.

9.16 There are no basements proposed for the development. The development proposal will include an earthworks program including cut and fill.

9.17 It should be noted that there will be a cut and fill exercise at the site in order to form two platform areas, with the northernmost portion of the site being lowered, and area through the central portion of the site being raised. A further area to the south being lowered and the southernmost area of the site being raised. areas at the southern end of the site will be raised compared to current levels, whilst the highest points at the site will be lowered.

9.18 There is potential that shallow or perched groundwater could be encountered at the site.

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

Proposed Mitigation

9.20 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

9.21 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.

9.22 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.

9.23 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

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

9.25 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

9.26 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 sports facilities at the site in two phases:

- Phase 1 – development of site plateaus and archery range in south parcel of land and temporary (permeably surfaced parking area);
- Phase 2 – creation of sports pitches in northern parcel of and creation permanent (hardstanding) car parking area and access road.

10.2 As a result of the development proposal there will be an area surfaced with crushed stone comprising the access road and car parking area.

10.3 At this stage consideration has been given to Phase 1 and future hardstanding drainage and attenuation will need to be considered as part of Phase 2 at a later stage.

Drainage Catchments

10.4 As discussed in Section 6 the site forms a drainage catchment passing towards a surface water drain located to the east of Stead Lane.

10.5 Based on the information described earlier in this report it is considered that surface water will continue to pass forward from the site in a similar manner to the existing situation, albeit with flows directed from the access road and car parking area and archery range within a drainage channel within the site.

Discharge Rates and Climate Change

10.6 The catchment contributing to the drainage channel for the site has been calculated at 3.56 ha, for which a QBAR calculations has been undertaken using the Micro drainage ICP SuDS method and is included at Appendix D. The QBAR has been calculated as 14.6 l/s.

10.7 Future phases with hardstanding should consider discharging at QBAR rates and will be required to include an allowance for climate change. Typically, BMBC require a 30% increase in peak rainfall intensity has been included as climate change allowance.

Drainage Hierarchy

10.8 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.

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

10.10 The surface water drainage discharge hierarchy has been considered:

Disposal by Infiltration

10.11 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.

10.12 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'*.

10.13 Based on the reported geological conditions along with the poor soils for infiltration it is considered that infiltration is not a suitable method for dispose of surface water at the site.

Discharge to Surface Watercourse

10.14 A surface water drain is located to the east of the site, over Stead Lane. Based on the existing topography at the site, it is considered most likely that the majority of water generated within the site will migrate towards Stead Lane, and ultimately the drain beyond.

10.15 It is considered that this is the most suitable receptor for surface water from the site.

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

10.16 No suitable Yorkshire Water sewers have been identified got the disposal of surface water from the site. Therefore, this option has not been considered further at this stage.

Discharge to Combined Sewer

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

Consideration of Sustainable Drainage Systems

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

Soakaways

10.19 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.

10.20 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'*.

10.21 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.

Filter Drains and Detention Basins

10.22 Due to the nature of the proposed development it is proposed to include a 'filter drain' located between the two proposed development plateaus. Flows will be directed to these points via 'mole drains'.

10.23 These features will primarily be used to convey overland flow from the archery range and sports pitches, however, the central Filter Drain will also likely be used to take flows from the final drainage solution for the clubhouse and car parking area. This will need to be considered further at the implementation of Phase 2.

10.24 Storage will also be provided in a detention basin located at the south-eastern corner of the site.

Rainwater Harvesting

10.25 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.

Green Roofs

10.26 Based on the scale and nature of the development it is unlikely that green roofs will be suitable for use at the site.

Porous / Permeable Paving

10.27 At this stage it is considered that the car parking area and access road will be surface with permeable material whilst it serves the archery range alone.

10.28 Following completion of the site it is likely that the car parking area will comprise hardstanding with flows attenuated for the road and car parking. At that stage attenuation will be required in order to restrict flows from the new hardstanding area at the site. This will need to be considered further as part of the detailed design stage at Phase 2.

Modular Underground Attenuation Tanks

10.29 Based on the development proposal comprising sports pitches and permeable surfaced access roads and parking areas underground attenuation tanks are not considered to be required.

10.30 At a later stage it is considered likely that attenuation tanks will be required to form the attenuation solution for the proposed hardstanding areas at the site (i.e. hard surfaced road and car parking area).

Conceptual Surface Water Attenuation Scheme

10.31 The drainage network will convey the surface water to proposed 'filter drain' feature taking overland flows from the sports pitches, car parking area and archery range.

10.32 The contributing catchment for the site has been calculated as 3.56 ha and the QBAR discharge rate has been calculated as 14.6 l/s. This will be collected by 'filter drains' and pass via an detention basin providing approximately 650 m^3 for the 1 in 100 year event plus 30% allowance for climate change assuming 33% run-off from the contributing catchment area.

10.33 A Micro drainage Quick Storage Estimate for this event is included at Image 1 below. Detailed calculations will be required at the detailed design stage.

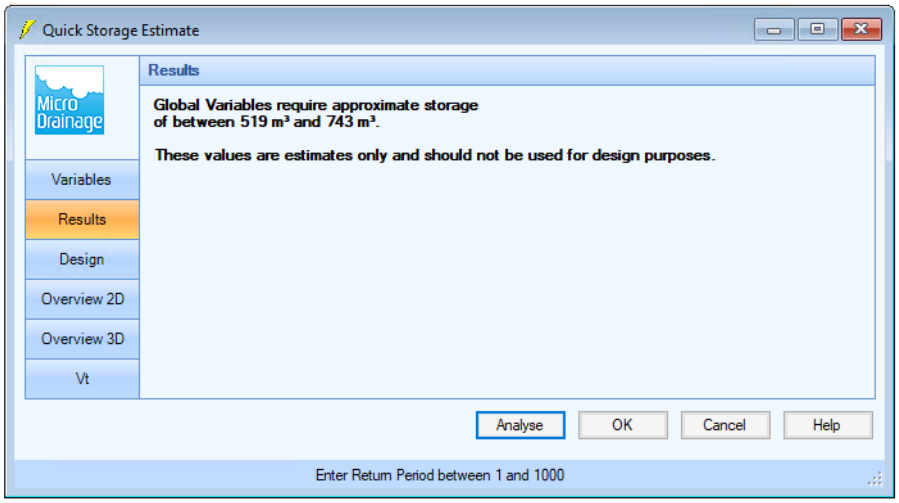

Image 1 Micro drainage QSE

10.34 The detention basin will pass forward to the drain located to the east of Stead Lane mimicking the natural situation. This is shown on the Drainage Plan produced by RPS reference HOYLA-RPS-SI-XX-DR-D-1351, which is included at Appendix E.

10.35 As part of the future Phase 2 consideration to a positive drainage system and attenuation will be required.

Maintenance of Sustainable Drainage Systems

10.36 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 drainage system.

Event Exceedance

10.37 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.

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. 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	✓			No mitigation considered necessary	✓		
Surface Water	✓	✓		It is recommended that a small bund is included at the north-eastern corner of the sport pitches plateau to maintain existing surface water flows and that a toe drain is included at the bottom of the slope to the sports pitches.	✓		
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 Drainage will be directed towards the drain located to the east of Stead Lane using a central ‘filter drain’ and a detention basin to provide attenuation for the 1 in 100 year plus 30% allowance for climate change event. This seeks to mimic the natural drainage discharge location for the site. The proposed access road and car parking area will be permeably surfaced.

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.

APPENDICES