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# NPPF: Flood Risk Assessment

Houghton Main, Barnsley

**Peel Environmental**

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# Houghton Main, Barnsley

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# Contents

## Tables & Figures

# 1.0 Introduction

## 1.1 Background

1.1.1 At the request of Peel Environmental, a Flood Risk Assessment (FRA) has been undertaken, in accordance with the National Planning Policy Framework (NPPF)[1] and Planning Practice Guidance[2], to support a planning application for a Timber Resource Recovery Centre on land off Houghton Main Colliery Roundabout, Park Spring Road, Barnsley, South Yorkshire, S71 5EX (see Drawing 1). This has included an assessment of the surface water drainage requirements of the site.

1.1.2 This report details the flood risk at the site and how this could be managed and mitigated to allow the site to be developed. The proposed development may present risks of flooding on-site and/or off-site if flooding is not effectively managed.

1.1.3 It is recognised that developments that are designed without regard to flood risk may endanger lives, damage property, cause disruption to the wider community, damage the environment, be difficult to insure and require additional expense on remedial works. Current guidance on development and flood risk[3] identifies several key aims for a development to ensure that it is sustainable in flood risk terms. These aims are as follows:

- the development should not be at a significant risk of flooding and should not be susceptible to damage due to flooding;
- the development should not be exposed to flood risk such that the health, safety and welfare of the users of the development, or the population elsewhere, is threatened;
- normal operation of the development should not be susceptible to disruption as a result of flooding;
- safe access to and from the development should be possible during flood events;
- the development should not increase flood risk elsewhere;
- the development should not prevent safe maintenance of watercourses or maintenance and operation of flood defences;
- the development should not be associated with an onerous or difficult operation and maintenance regime to manage flood risk. The responsibility for any operation and maintenance required should be clearly defined;
- future users of the development should be made aware of any flood risk issues relating to the development;
- the development design should be such that future users will not have difficulty obtaining insurance or mortgage finance, or in selling all or part of the development, as a result of flood risk issues;
- the development should not lead to degradation of the environment; and
- the development should meet all of the above criteria for its entire lifetime, including consideration of the potential effects of climate change.

[1] Department for Communities and Local Government (2012) National Planning Policy Framework.
[2] Department for Communities and Local Government (2014) Planning Practice Guidance, ID: 7, Flood Risk and Coastal Change
[3] CIRIA (2004) Funders report CP/102 Development and Flood Risk – Guidance for the Construction Industry.

1.1.4 The FRA is undertaken with due consideration of these sustainability aims.

1.1.5 The key objectives of the FRA are:

- To assess the flood risk to the proposed development and to demonstrate the feasibility of appropriately designing the development such that any residual flood risk to the development and its users would be acceptable;
- To assess the potential impact of the proposed development on flood risk elsewhere and to demonstrate the feasibility of appropriately designing the development such that the development would not increase flood risk elsewhere; and
- To satisfy the requirements of national planning policy guidance which require FRAs to be submitted in support of planning applications.

## 1.2 Project Scope

1.2.1 In order to achieve the aims outlined above, a staged approach has been adopted in undertaking this FRA, in accordance with current best practice. A screening study has initially been undertaken to identify whether there are any potential sources of flooding at the site, which may warrant further consideration. Any potential flooding issues identified in the screening study have subsequently been considered in a scoping study. The aim of the scoping study is to review all available information and provide a qualitative assessment of the flood risk to the site and the impact of the site on flood risk elsewhere.

## 1.3 Report Structure

1.3.1 This FRA has the following report structure:

- Section 2 identifies the sources of information that have been consulted during the FRA;
- Section 3 describes the application area including the existing and proposed development;
- Section 4 outlines the flood risk to the existing and proposed development;
- Section 5 assesses the potential impacts of the proposed development on surface water drainage; and
- Section 6 presents a summary and conclusions.

# 2.0 Sources of Information

## 2.1 Sources of Information

2.1.1 General information regarding the site setting and hydrology of the application site has been obtained from the OS Explorer 278: Sheffield & Barnsley.

2.1.2 Information regarding the current flood risk at the application site, local flood defences and flood water levels has been checked against Environment Agency flood mapping available online.

2.1.3 A location plan of the buildings/structures that form the development is shown on Drawing 1.

## 2.2 Discussion with Regulators

2.2.1 A wide range of regulators should be consulted when carrying out an FRA. These include the Environment Agency, the Local Planning Authority (LPA), and Water Regulators. Consultation and discussions with the relevant regulators have been undertaken during this FRA.

## 2.3 Environment Agency

2.3.1 The Flood and Water Management Act 2010 gives the Environment Agency a strategic overview role for all forms of flooding and coastal erosion. They also have direct responsibility for the prevention, mitigation and remediation of flood damage for main rivers and coastal areas. The Environment Agency is the statutory consultee with regards to flood risk and planning.

2.3.2 Environment Agency Standing Advice and the NPPF has been consulted and reviewed during this FRA.

2.3.3 A meeting was held with Gary Cliff and Lesley Slaney, Environment Agency Representatives in the Yorkshire and North East Regional Office on 19th February 2014 to discuss the proposals and nature and scale of the flood risk assessment to be carried out.

2.3.4 A data request was submitted to the Environment Agency in relation to flood risk at this site. All correspondences with the Environment Agency have been included within Appendix 3.

## 2.4 Local Authorities

2.4.1 Planning guidance written by BMBC regarding flood risk was consulted to assess the mitigation policies in place. These documents include the evidence base for the Local Development Framework and the Local Plan.

2.4.2 As part of this consultation the Barnsley Strategic Flood Risk Assessment (SFRA)[4] was also reviewed.

2.4.3 A data request was issued to BMBC. At the time this report was written, a response from BMBC has not been received in relation to flood risk aspects of the site.

2.4.4 Flood mapping produced as part of the SFRA has been included within Appendix 5.

[4] Barnsley Strategic Flood Risk Assessment, Level 1, Barnsley Metropolitan Borough Council, September 2010.

## 2.5 Yorkshire Water

2.5.1 Yorkshire Water is responsible for the disposal of waste water and supply of clean water within the Barnsley area.

2.5.2 Information with regards to sewer and water main flooding contained within the SFRA has been consulted as part of this FRA. All Water Companies have a statutory obligation to maintain a register of properties/areas which are at risk of flooding from the public sewerage system, and this is shown on the DG5 Flood Register.

2.5.3 All correspondences with Yorkshire Water, including asset plans, have been included within Appendix 4.

# 3.0 Description of Application Area

## 3.1 Site Location

3.1.1 The development site is located on land off Park Spring Road, Grimethorpe, Barnsley, S72 0HW (see Drawing 1).

3.1.2 The National Grid Reference of the site is 441799, 406582.

## 3.2 Existing Development

3.2.1 The development site is approximately 3.00 hectares (ha) in area.

3.2.2 The site is currently a brownfield site which is largely grassland with limited areas of a mixture of young and mature tree cover located towards the westernmost boundary of the site, with a number of hedgerows around the site perimeter. Its brownfield classification is related to the sites former use as mine pithead location with disused railway lines bounding the southern and western extents of the site with a former rail junction at the southern and western boundary intersection. The rails have been removed; however, much of the ballast remains.

3.2.3 The site is bounded by agricultural land on the southern, western and northern boundaries. The east is bounded by a large distribution warehouse with agricultural land beyond.

3.2.4 The existing site is largely permeable and is currently accessed via an exit off the Houghton Main Colliery roundabout on Park Spring Road. A *de facto* access track leads from the roundabout in westerly direction linking up to the southern disused railway heading west.

## 3.3 Proposed Development

3.3.1 It is understood the proposal is for the construction of a Timber Resource Recovery Centre.

3.3.2 The proposed development (see Appendix 1) may present risks of flooding on-site and/or off-site if flooding is not effectively managed.

3.3.3 Further details with regard to the proposed development can be found in the information submitted with the planning application.

## 3.4 Topographic Information

3.4.1 A topographic survey of the site has been undertaken by SLR Consulting in May 2011, and a further survey was undertaken by QuicSurv in March 2014.

3.4.2 The site generally slopes in a south-westerly direction towards the River Dearne, falling from approximately 33.77mAOD in the northern corner of the site to approximately 30.17mAOD in the westernmost corner of the site closest to the River Dearne. This equates to a fall of approximately 3.6m over a distance of approximately 320m.

3.4.3 There are some constructed mounds on the southernmost boundary close to the access track from Houghton Main roundabout with a peak of 34.83mAOD. These are not representative of the overall slope of the site.

3.4.4 A copy of the topographic survey has been included within Appendix 2.

### 3.5 Catchment Hydrology

3.5.1 Based on a review of the Environment Agency online flood maps, the River Dearne dominates the hydrology of the site. The River Dearne flows close to the western and southern boundaries of the site. At the westernmost point of the site, the river passes beneath a former railway bridge 85m away from the site. The River Dearne is a 'Main River' and is maintained by the Environment Agency.

3.5.2 A short distance upstream of the railway bridge, a confluence with the River Dearne and an unnamed river occurs, 100m north-west of the westernmost corner of the site. This unnamed river is an 'Ordinary Watercourse' and maintained by the local drainage authority, Barnsley Metropolitan Borough Council (BMBC).

3.5.3 A land drain exists 100m east of the northernmost corner of the site which flows in a south-easterly direction, remaining on the northern side of the A6195. This is an 'Ordinary Watercourse' and maintained by the local drainage authority, BMBC.

3.5.4 Two flood storage reservoirs (FSRs), which are also classed as wetlands, are located to the north and west of the site. OS Mapping and site walkover has shown the northern FSR is located 220m to the north-west of the northernmost corner of the site. The western FSR is located beyond spillway within constructed flood defences on the right bank of the River Dearne, located 125m to the west of the western corner of the site.

# 4.0 Flood Risk

## 4.1 Potential Sources of Flooding – Level 1 Screening Study

4.1.1 All potential sources of flooding must be considered for any proposed development. A summary of the potential sources of flooding and a review of the potential risk posed by each source at the application site is presented in Table 4.1.

**Table 4.1: Potential Risk Posed by Flooding Sources**

| Flooding Source | Potential Flood Risk at Application Site? | Potential Source | Data Sources |
|---|---|---|---|
| Fluvial flooding | Yes | River Dearne, Unnamed Tributary | Environment Agency, SFRA, OS Map |
| Tidal flooding | No | None Identified | Environment Agency |
| Flooding from rising / high groundwater | Yes | Aquifer | BGS Map, SFRA |
| Overland flow flooding | Yes | Poor permeability | RMS Map, SFRA |
| Flooding from artificial drainage systems | No | Sewers | Yorkshire Water, SFRA |
| Flooding due to infrastructure failure | No | Houghton Washland Reservoir | Environment Agency. OS Map |

*Fluvial Flooding Sources*

4.1.2 As noted above, there is a Main River located within the vicinity of the site; namely the River Dearne.

4.1.3 Furthermore, there are two unnamed Ordinary Watercourses located within the vicinity of the site. The first is a tributary to the River Dearne flowing in at a confluence located 100m north-west of the westernmost corner of the site. The catchment for this watercourse is land surrounding the northern FSR.

4.1.4 The second Ordinary Watercourse is an unnamed drainage ditch located on the northern side of the A6195 Park Spring Road and is not considered further within this FRA as it will not affect the site.

4.1.5 The Environment Agency flood map shows that the site is located largely within Flood Zone 1; outside the 1 in 1000 year return period (<0.1% AEP) (see Drawing 3), which is considered to be at low risk of fluvial flooding.

4.1.6 A small section in the westernmost part of the site is located within the current mapped Flood Zone 2; located between the 1 in 100 to 1 in 1000 annual probability of fluvial flooding (<1% AEP->0.1% AEP), which is considered to be at medium risk of fluvial flooding .

4.1.7 Based on the above, the site has a low to medium risk of fluvial flooding. The extent of Flood Zone 2 as depicted by the Environment Agency mapping is however disputed, which is discussed in more detail below in Section 4.2.

*Tidal Flooding Sources*

4.1.8 The site is not located within the vicinity of tidal flooding sources. Therefore, flooding from this source is considered negligible and has not been considered further within this FRA.

*Flooding from rising / high groundwater*

4.1.9 The BGS Groundwater Flooding Susceptibility Map indicates the site lies within an area with at least a limited potential for groundwater flooding to occur. Furthermore, the central region of the site lies within an area with the potential for groundwater flooding to occur at the surface while northern and southern areas have areas with a potential for groundwater flooding to occur in property situated below ground level (see Drawing 3).

4.1.10 The BGS data set is a hazard data set, not a risk data set, meaning that it does not provide any information about the likelihood of a groundwater flooding event occurring. It is noted that the BGS flood map is to be used as a screening tool, and should not be used to inform planning decisions.

4.1.11 Groundwater flooding tends to occur sporadically in both location and time. When groundwater flooding does occur, it tends to mostly affect low-lying areas, below surface infrastructure and buildings (for example, tunnels, basements and car parks) underlain by permeable rocks (aquifers).

4.1.12 The BGS Hydrogeology online viewer[5] shows the sites is underlain by superficial deposits of Pennine Middle Coal Measures with a regional, cyclic multi-layered aquifer with moderate yields from sandstones and many springs.

4.1.13 The plans in Appendix 1 indicate there is no proposed constructed development below ground level.

4.1.14 As such the site is not considered at risk of flooding from rising / high groundwater. This will be mitigated by the adoption of a surface water management strategy for the site (see Chapter 5).

*Overland flow flooding*

4.1.15 Overland land flow flooding tends to occur sporadically in both location and time.

4.1.16 Soils mapping produced by the National Soils Resources Institute (Cranfield University) shows that the south-west section of the site is underlain by loamy and clayey floodplain soils with naturally high groundwater. The north-eastern section of the site is underlain by slowly permeable, seasonally wet, acid, loamy and clayey soils.

4.1.17 The British Geological Survey (BGS) online mapping (Geology of Britain Viewer) shows that the superficial deposits beneath the site area comprise of Pennine Middle Coal Measures Formation with Sandstone, Mudstone and Siltstone.

4.1.18 From the information sources above, it is likely that the site will experience low rates of infiltration resulting in a potentially higher incidence of overland flow flooding.

4.1.19 The Risk Management Solutions (RMS) overland flow flood map shows central sections of the site located on the southern and northern boundaries of the site reside within the 1 in 1000 annual probability of flooding from this source. Limited sections of the site along the eastern boundary reside within a 1 in 75 annual probability of overland flow flooding (see Drawing 4).

[5] http://mapapps.bgs.ac.uk/hydrogeologymap/hydromap.html

4.1.20 Based on the above, the site is considered to be at a low risk of overland flow flooding. . This will be mitigated by the adoption of a surface water management strategy for the site (see Chapter 5).

*Flooding from Artificial Drainage Systems/Infrastructure Failure*

Artificial Drainage Systems

4.1.21 Sewer flooding occurs when urban drainage networks become overwhelmed and maximum capacity is reached. This can occur if there is a blockage in the network causing water to back up behind it or if the sheer volume of water draining into the system is too great to be handled. This type of flooding tends to occur sporadically in both location and time.

4.1.22 The majority of sewers are built to the guidelines within Sewers for Adoption[6]. These sewers have a design standard to the 1 in 30 year flood event and therefore it is likely that the majority of sewer systems will surcharge during rainstorm events with a return period greater than 30 years (e.g. 100 years). This was clearly the case during the 2007 national flooding event when drains and sewers were rapidly overwhelmed by the intense and prolonged rainfall, and as such played a considerable role in the flood event.

4.1.23 Yorkshire Water is responsible for the disposal of waste water and supply of clean water within the area. Information with regards to sewer and water main flooding contained within the SFRA has been consulted as part of this FRA. Like all Water Companies, Yorkshire Water has a statutory obligation to maintain a register of properties/areas which are at risk of flooding from the public sewerage system, and this is shown on the DG5 Flood Register. This includes records of flooding incidents from public foul sewers, combined sewers and surface water sewers which are maintained by the Water Company. When an incident is reported, a decision chart is used to assess whether the properties/areas are 'at risk' and then the record is added to the appropriate register.

4.1.24 Yorkshire Water sewer asset plans show that there are no public sewer assets crossing the proposed site. The nearest asset is foul only located approximately 380m south-east of the southernmost site boundary located at the northern end of Ings Lane.

4.1.25 Yorkshire Water confirm there is sufficient capacity to receive the additional flows into this asset via a requisitioned foul sewer following the western side of the A6195.

4.1.26 Based on the above, there is a low risk of flooding from sewers.

Flooding from Reservoirs

4.1.27 Based on the Environment Agency Flood Map, the site's western boundary is located within the extent of flooding sourced from Houghton Washland Reservoir. Although the outline of modelled flooding from this source is shown to potentially affect the site, flooding from reservoirs is seen as being very unlikely to occur. It is also worthy of note that the mapping error within the current EA flood zones, is likely to also be present within the reservoir mapping.

4.1.28 With reference to Environment Agency information on reservoir flooding, owners of reservoirs are obliged to maintain them according to the Reservoir Act (1975) where reservoir assets are to be inspected and supervised by panel engineers.

4.1.29 The Environment Agency state that no loss of life has occurred as a result of reservoir flooding since 1925. Therefore, with the mitigation measures that are in place to maintain all reservoirs, the likelihood of an event occurring is extremely low.

[6] WRC (2012) Sewers for Adoption 7th Edition.

4.1.30 Therefore, the risk posed by this source of flooding is considered low.

Summary

4.1.31 Given the information that is available, it is considered that a 'low' level of flood risk is posed by this source of flooding.

### 4.2 Environment Agency Flood Map

4.2.1 A review of the Environment Agency's flood map indicates that the site is largely located in Flood Zone 1; outside the 1 in 1000 annual probability of river flooding in any year (<0.1% AEP).

4.2.2 A small section in the westernmost area of the site is, according to Environment Agency mapping, located in Flood Zone 2; within the 1 in 100 to 1 in 1000 annual probability of fluvial flooding (1-0.1% AEP).

4.2.3 Based on the Environment Agency online mapping, the site is considered to be at 'low' to 'moderate' risk of fluvial flooding, sourced from the River Dearne.

4.2.4 A meeting was held with Gary Cliff and Lesley Slaney, Environment Agency Representatives in the Yorkshire and North East Regional Office on 19th February 2014 regarding the location of the site in relation to the current Flood Zone 2 outline. After discussions were held, it was agreed that topographic information for the site illustrates that the Flood Zone 2 outline may not be truly representative and that further modelling work was not required to discount the Flood Zone 2 location in relation to the site.

4.2.5 A site walkover confirmed there are informal flood defence assets running along the right bank (southern bank) of the River Dearne. A spillway in this defence asset is designed to allow flood water into adjacent agricultural washland (Houghton FSR). The flood alleviation area is large and it is proposed that this will aid in reducing the flood water levels for the reach of the Dearne near the site such that inundation will reach no higher than the former railway embankment.

4.2.6 Enzygo has mapped the modelled flood levels obtained after consultation with the Environment Agency (see Appendix 3). This modelling work was conducted by JBA Consulting Ltd in May 2004. Using detailed topographical information for the site area and the modelled flood levels from the Environment Agency, it can be seen in Drawing 1 (modelled flood zones) that the flood zone associated with a 1 in 200 year flooding event (0.5% AEP) does not extend to the site area.

4.2.7 The difference between the 1 in 200 year flood height (28.34mAOD) from the model node 14806 provided by the Environment Agency and the lowest known point on the western boundary of the site (30.17mAOD) is 1.83m. This gives a margin of clearance. It is not known if this model included the spillway and flood alleviation area in its calculations.

4.2.8 The Environment Agency were unable to provide a 1 in 1000 year modelled flood level for these node points as they had not been established in the modelling work carried out on the River Dearne in 2004.

4.2.9 Upon reviewing the standard Flood Zone mapping from the Environment Agency, the extent of Flood Zone 2 in relation to the topographical heights of the land, which this zone inundates, has some discrepancies.

4.2.10 The level of flooding for a 1 in 1000 year event, when viewing the periphery of the zone outline directly west of the site, shows inundation to occur at one location to elevations >40mAOD according to OS contour lines. If one then follows the outline of the Flood Zone a short distance south (downstream) by approximately 500m, the outline of the inundation for this flooding is

at topographical levels of <30mAOD. There are no topographical obstructions that would explain the 10m fall in inundation across this reach of the River Dearne where channel gradients are extremely low; a 5m fall over 3.5km according to Ordnance Survey contours equivalent to a slope of 0.001m/m. On the opposite bank of the River Dearne, levels for the same reach are currently shown to exceed 30mAOD on the western edge of the site. It could be argued that flood levels on site should be similar to the opposite bank and not exceed 30mAOD. Therefore, this would rule out the site area being located within Flood Zone 2, and would place the site entirely within Flood Zone 1 (low risk).

4.2.11 It can be seen in Drawing 9 that similar anomalies with flood inundation areas in EA flood maps misaligning to topographic information exist on the site. As the 1 in 1000 year flood/Flood Zone 2 outline enters the site, it does so near the height marker of 30.53mAOD. The edge of the Flood Zone 2 as it crosses the site then rises in height to nearer 32mAOD as it leaves the site on the western boundary. This rise in flood level of approximately 1.5m over a distance of approximately 80m. This is an unlikely occurrence and it is proposed that flood levels would not rise above 30m as per the explanation in section 4.2.9.

4.2.12 The Environment Agency Flood Zones and acceptable development types are explained in Table 4.2. All development types are generally deemed acceptable in terms of flood risk in Flood Zone 1.

4.2.13 In PPG ID: 7 (Table 1), the appropriate uses have been identified for the Flood Zones. Applying the Flood Risk Vulnerability Classification in Table 2 and 3 of PPG ID: 7, the proposed development is classified as 'less vulnerable'.

4.2.14 Based on the above, the Sequential Test should be passed and the Exception Test should not be required.

**Table 4.2: Environment Agency Flood Zones and Appropriate Land Use**

| Flood Zone | Probability | Explanation | Appropriate Land use |
|---|---|---|---|
| Zone 1 | Low | Less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%) | All development types generally acceptable |
| Zone 2 | Medium | Between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% 0.1%) in any year | Most development type are generally acceptable |
| Zone 3a | High | A 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year | Some development types not acceptable |

| Flood Zone | Probability | Explanation | Appropriate Land use |
|---|---|---|---|
| Zone 3b | 'Functional Floodplain' | Land where water has to be flow or be stored in times of flood. SFRAs should identify this zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1% flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes) | Some development types not acceptable |

***Note:*** *The Flood Zones are the current best information on the extent of the extreme flood from rivers or the sea that would occur without the presence of flood defences, because these can be breached, overtopped and may not be in existence for the lifetime of the development.*

**Table 4.3: Flood Risk Vulnerability and Flood Zone 'Compatibility' as identified in Table 3 of PPG ID: 7**

| Flood Risk Vulnerability classification (see Table 1 of PPG ID: 7) | Essential Infrastructure | Water Compatible | Highly Vulnerable | More Vulnerable | Less Vulnerable |
|---|---|---|---|---|---|
| Zone 1 | Yes | Yes | Yes | Yes | Yes |
| Zone 2 | Yes | Yes | Exception test required | Yes | Yes |
| Zone 3a | Exception test required | Yes | No | Exception test required | Yes |
| Zone 3b 'Functional Floodplain' | Exception test required | Yes | No | No | No |

***Key:*** *Yes: Development is appropriate, No: Development should not be permitted.*

## 4.3 Historic Flooding

4.3.1 Environment Agency mapping shows that flooding has occurred on the River Dearne near to the site in 1947, 1982, 2000 and 2007. The historic flood outline for June 2007 is the only one to indicate flooding affected the site (Drawing 7). The outline of this appears to assimilate the outline of the current Environment Agency Flood Zone 2 outline and affected the westernmost corner of the development site.

4.3.2 Based on the above, the extent of flooding during June 2007 is derived from limited on-the-ground evidence, collated by the authorities, during a flood event. During a flooding event a considerable amount of man hours are inherently taken up dealing with the initial effects of flood, in particular where communities are impacted (i.e. 'more vulnerable' residential development) rather than 'less vulnerable' industrial units, less so for undeveloped land which is considered to be a floodplain (i.e. the site) and expected to flood. As such, the inherent inaccuracy of the historical flood event mapping is less reliable than the modelled flood levels, from which the Environment Agency flood maps are derived. As such, the Environment

Agency flood maps (based on modelled flood levels) are considered the best available baseline conditions to base the FRA report on.

The British Hydrological Society "Chronology of British Hydrological Event[7]" has no further records of flooding in the immediate area. No other historical records of flooding for the site have been recorded.

### 4.4 Existing and Planned Flood Defence Measures

4.4.1 The Environment Agency confirmed in writing that the site is not protected by formal flood defence measures (Appendix 3).

4.4.2 A site walkover confirms that the site is naturally protected by the former railway embankment on the western and northern boundaries. There are additional informal flood defence assets and washlands as part of a flood alleviation scheme to protect downstream villages. The washlands are located to the north (Cudworth FSR) and west (Houghton FSR) of the site. The plans of these defences can be seen in Appendix 3.

4.4.3 These defence assets are maintained by BMBC.

### 4.5 Current Flood Risk

4.5.1 The site is largely located within Flood Zone 1 and is at 'low risk' of fluvial flooding.

4.5.2 Two secondary flooding sources have been identified for the site:

- Groundwater flooding
- Overland Flow flooding

4.5.3 The secondary flooding sources identified above will be dealt with by an adequately designed drainage system, and these sources would only inundate the site to a relatively low water depth and water velocity, will only last a short period of time, in very extreme cases and will not have an impact on the whole of the proposed development site.

4.5.4 As noted in Section 4.2, the site has a 'low probability' of fluvial flooding as the majority of the site is located within Flood Zone 1; outside the extent of the 1 in 1000 year annual probability of the fluvial flooding (<0.1 % AEP).

4.5.5 The proposed development is classified as 'less vulnerable'. Less vulnerable uses are appropriate within Flood Zones 1, 2 and 3 after the completion of a satisfactory FRA. All development is, however, appropriate within Flood Zone 1.

[7] http://www.dundee.ac.uk/geography/cbhe/

# 5.0 Site Drainage

## 5.1 Surface Water Drainage

5.1.1 It is recognised that consideration of flood issues should not be confined to the floodplain. The alteration of natural surface water flow patterns through developments can lead to problems elsewhere in the catchment, particularly flooding downstream. For example, replacing vegetated areas with roofs, roads and other paved areas can increase both the total and the peak flow of surface water runoff from the development site. Changes of land use on previously developed land can also have significant downstream impacts where the existing drainage system may not have sufficient capacity for the additional drainage. This section considers the existing drainage system at the application site and potential impacts resulting from the development.

5.1.2 A surface water management strategy for the development will be required to manage and reduce the flood risk posed by the surface water runoff from the site. The developer will be required to ensure that any scheme for surface water should build in sufficient capacity for the entire site.

5.1.3 There are three possible options to discharge the surface water runoff in accordance with requirement H3 of the Building Regulations 2010[8]. Rainwater shall discharge to one of the following, listed in order of priority:

5.1.4 An adequate soakaway or some other adequate infiltration system; or, where that is not reasonably practicable,

- a watercourse; or where that is not reasonably practicable,
- a sewer.

5.1.5 An assessment of the surface water runoff rates has been undertaken, in order to determine the surface water options and attenuation requirements for the site. The assessment considers the impact of the site compared to current conditions. Therefore, the surface water attenuation requirement for the developed site can be determined and reviewed against existing arrangements.

5.1.6 The surface water drainage arrangements for any development site should be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the proposed development, unless specific off-site arrangements are made and result in the same net effect.

## 5.2 Existing Drainage System

5.2.1 The development site is approximately 3.00 hectares (ha) in area and is currently a brownfield site which is largely grassland with limited areas of a mixture of young and mature tree cover located towards the westernmost boundary of the site, with a number of hedgerows around the site perimeter. The site is almost entirely permeable.

5.2.2 Following a site walkover, it was observed that rainfall which falls on to the site partially infiltrates at source, and the remainder as overland flow to the river Dearne.

5.2.3 There is currently no foul water discharging from the site.

[8] Office of the Deputy Prime Minister, The Building Regulations 2010.

## 5.3 Current Runoff Rate

5.3.1 It is assumed that the majority of rainfall currently infiltrates into the ground or occurs as overland flow at source. This is considered feasible given the soils and geology beneath the site.

5.3.2 Soils mapping produced by the National Soils Resources Institute (Cranfield University) shows that the south-west section of the site is underlain by loamy and clayey floodplain soils with naturally high groundwater. The north-eastern section of the site is underlain by slowly permeable, seasonally wet, acid, loamy and clayey soils.

## 5.4 Proposed Development

5.4.1 It is understood the proposals are for a Timber Resource Recovery Centre with associated buildings, storage tanks, parking areas and access roads within the 3.00ha site, which is currently entirely permeable.

5.4.2 Based on the proposed site layouts, the site will be approximately 51% impermeable (1.54ha). Current site layouts show that the proposed development will increase the impermeable area by approximately 51% (1.54ha) when compared to the existing brownfield site.

**Table 5.1: Impermeable Area**

| | Existing Buildings and Hardstanding | Proposed Buildings and Hardstanding | Difference |
|---|---|---|---|
| **Area (Ha)** | 0 | 1.54 | +1.54 |
| **Percentage of Total Site Area (%)** | 0 | 51 | +51 |

***Note -*** *The above permeable/impermeable areas are defined in Drawing 9.*

5.4.3 Based on the above it has been shown that the proposed development will increase the overall areas of permeable surfaces. Attenuation of surface runoff for the proposed development will still need to be introduced.

## 5.5 Post-Development Runoff Rate

5.5.1 It is understood the proposals are for a Timber Resource Recovery Centre with associated buildings, storage tanks, parking areas and access roads within the 3.00ha site, which is currently entirely permeable. Landscaped areas will be incorporated into the layout of the site.

5.5.2 The incorporation of landscaping areas will result in a proportion of the rainfall infiltrating into the soil substrate therefore, reducing the surface water runoff compared to current conditions and ensuring that the development will not increase flood risk elsewhere.

5.5.3 Conditions will result in the rainfall discharging as surface water runoff from the site being controlled, treated, managed and mitigated.