NPPF: Flood Risk Assessment

Land West of Rampton Road, Cottenham

Gladman Developments Ltd

SHF.1132.024.HY.R.001.I

‘Experience and expertise working in union’
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Land West of Rampton Road, Cottenham

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<th>Project:</th>
<th>NPPF: Flood Risk Assessment</th>
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<tr>
<td>For:</td>
<td>Gladman Developments Ltd</td>
</tr>
<tr>
<td>Status:</td>
<td>Issued</td>
</tr>
<tr>
<td>Date:</td>
<td>March 2017</td>
</tr>
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Executive Summary

This report presents an FRA, in accordance with the NPPF and PPG ID: 7, for the development of up to 200 dwellings and up to 70 apartments for care (C2) located on land west of Rampton Road, Cottenham.

The report has included an assessment of the surface water drainage requirements of the Site, and details the flood risk and how this could be managed and mitigated to allow the Site to be developed in support of the outline planning application.

The FRA has demonstrated the following:

- The Site is 14.16 Ha and currently comprises arable land used for crops surrounded by hedgerows, Rampton Road, agricultural land and residential properties.
- The nearest watercourse in relation to the Site is Catch Water Drain which is located approximately 170m to the north of the Site, and is located within the Old West Internal Drainage Board catchment.
- The Environment Agency flood map shows that the Site is located within Flood Zone 1; which is considered to be at low risk of flooding from rivers.
- The proposed residential development is classified as ‘more vulnerable’ which is acceptable in terms of flood risk within Flood Zone 1.

Groundwater flooding was also identified within the southern extent of the Site, as well as some ponding of surface water throughout the Site. Flooding from these sources will be mitigated through the adoption of surface water management strategy and by setting finished floor levels above external ground levels.

The FRA has considered the potential impact of the development on surface water runoff rates, given the increase in impermeable areas post-development. These rates have been calculated, and it has been demonstrated that surface water can be managed, such that flood risk to and from the Site following development will not increase. This will be achieved through restricted discharge rates (IDB rate) and an appropriately sized detention basin, with outfall to watercourse to the north of the Site.

The FRA demonstrates that the proposed development would be operated with minimal risk from flooding, and would not increase flood risk elsewhere. The development should therefore not be precluded on the grounds of flood risk and surface water drainage.
1.0 Introduction

1.1 Background

1.1.1 At the request of Gladman Developments Ltd, a Flood Risk Assessment (FRA) has been undertaken, in accordance with the National Planning Policy Framework (NPPF)\(^1\) and Planning Practice Guidance (PPG ID: 7)\(^2\), for the proposed development of up to 200 dwellings and 70 apartments for care (C2) located on land west of Rampton Road, Cottenham (hereafter referred to as the ‘Site’). This FRA includes an assessment of the surface water drainage requirements of the Site.

1.2 Scope

1.2.1 The project is a development proposal which is the subject of a planning application. As such a Level 2 FRA is required in accordance with the National Planning Policy Framework (NPPF).

1.2.2 A Level 2 FRA is detailed qualitative appraisal to understand the risk of flooding to the Site and the potential impacts the development may present to risks of flooding onsite and/or offsite if flooding is not effectively managed. This FRA includes an assessment of the surface water drainage requirements of the Site.

1.3 Aims and Objectives

1.3.1 The key objectives of an FRA (PPG ID: 7) are to establish:

- Whether a proposed development is likely to be affected by current or future flooding from any source;
- Whether the development will increase flood risk elsewhere;
- Whether the measures proposed to deal with these effects and risks are appropriate;
- The evidence for the local planning authority to apply (where necessary) the sequential test, and;
- Whether the development will be safe and pass the Exception Test, if applicable.

1.3.2 The FRA is undertaken with due consideration of current guidance\(^3\) on development and flood risk and flood risk sustainability aims:

- 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 because of flooding;
- safe access to and from the development should be possible during flood events;
- the development should not increase flood risk elsewhere;

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\(^1\) Department for Communities and Local Government (2012) National Planning Policy Framework.
\(^2\) Department for Communities and Local Government (2014) Planning Practice Guidance; Flood Risk & Coastal Change.
• 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, because of flood risk issues;
• the development should not lead to degradation of the environment; and
• the development should meet all the above criteria for its entire lifetime, including consideration of the potential effects of climate change.

1.4 Report Structure

1.4.1 This FRA has the following structure:

• Section 2 identifies the sources of information that were consulted;
• Section 3 describes the Site and 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 proposes mitigation for those effects; 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 Site was obtained from the OS 1 25 000 mapping (Explorer 225: Huntington & St Ives).

2.1.2 Information on the current flood risk, local flood defences and flood water levels at the Site was obtained from web-based Environment Agency flood mapping: https://www.gov.uk/government/organisations/environment-agency.

2.2 Consultations discussion with Regulators

2.2.1 Consultation and discussions with the Environment Agency, the Local Planning Authority (LPA)/Lead Local Flood Authority (LLFA), and Water Utilities was undertaken during preparation of this FRA.

   Environment Agency

2.2.2 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.

2.2.3 Environment Agency Standing Advice and the NPPF/PPG ID: 7 has been consulted and reviewed during this FRA.

2.2.4 A data request was submitted to the Environment Agency in relation to flood risk at this Site. All correspondence with the Environment Agency have been included within Appendix 1.

   South Cambridgeshire District Council

2.2.5 Planning guidance written by South Cambridgeshire District Council 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.

2.2.6 Information contained within the South Cambridgeshire District Council Strategic Flood Risk Assessment (SFRA) (September 2010) was also reviewed (see Appendix 2).

2.2.7 As part of the FRA process, South Cambridgeshire District Council and Cambridgeshire County Council were consulted with regards to flood risk. At the time this report was written, a response had not been received.

   Old West Internal Drainage Board

2.2.8 As part of the FRA process, Old West Internal Drainage Board (IDB) were consulted with regards to flood risk, and potential discharge of surface water. A response was received on 27th April 2015. All correspondence with the IDB have been included in Appendix 3.
**Anglian Water**

2.6.1 Anglian Water are responsible for the disposal of waste water within the Cottenham area.

2.6.2 Information from Anglian Water, including asset plans, have been included within Appendix 4.
3.0 Description of Application Area

3.1 Site Location

3.1.1 The Site is located on land west of Rampton Road, Cottenham, CB24 8TJ.

3.1.2 The National Grid Reference of the Site is 544066, 267374.

3.1.3 A location plan of the Site and the proposed development is shown on Drawings 1 and 2.

3.2 Existing Development

3.2.1 The development Site is 14.16 hectares (Ha) in area and is currently occupied by fields used for agriculture.

3.2.2 The Site is bounded by Rampton Road and residential properties to the east and agricultural land to the north, west and south.

3.2.3 Vehicular access is from Rampton Road to the east of the Site.

3.3 Proposed Development

3.3.1 The proposal is for outline planning permission for up to 200 residential units and up to 70 apartments with care (C2), introduction of structural planting and landscaping, informal public open space, surface water flood mitigation and attenuation with all matters to be reserved with the exception of main vehicular access.

3.4 Topographic Information

3.4.1 A topographic survey of the Site was undertaken by JLP Surveys during December 2014.

3.4.2 The topographic survey shows there is a topographic high within the middle of the Site, located at 13.92m AOD. From this topographic high, there is a fall of land in a north-west direction, and in a south-east direction.

3.4.3 The area of the Site which falls in a north-west direction, falls from a topographic peak of 13.92m AOD (middle of the Site), to a low of 6.71m AOD (along the northern boundary). The fall is however variable in steepness, falling gently from 13.92m AOD peak, to the 12.0m AOD contour line, an approximate fall of 1.92m over a distance of 195m (an approximate 1:100 slope). From the 12.0m AOD contour line, the Site begins to fall more steeply towards the topographic low of 6.71m AOD, located along the northern boundary. This is an approximate fall of 5.29m over a distance of 125m (an approximate 1:25 slope).

3.4.4 A copy of the topographic survey has been included within Appendix 5.

3.5 Catchment Hydrology

3.5.1 Based on a review of the Environment Agency flood map and Ordnance Survey mapping, there are no watercourses located within or bounding the Site.

3.5.2 New Cut Drain, a ‘Main River’ (watercourses under the authority of the Environment Agency) flows around the northern and eastern boundaries of the Site, approximately 680m and 580m away at their respective nearest points.
3.5.3 Catch Water Drain, an ‘Ordinary Watercourse’ (under the authority of the IDB, see SFRA mapping within Appendix 4), flows in an easterly direction approximately 170m to the north of the Site. It is noted that this is part of a much larger network of land drains, located to the north of the Site.

3.6 Anglian Water Assets

3.6.1 Anglian Water asset plans shows that a rising foul main is pumped in a southerly direction, just inside the Sites eastern boundary. This then proceeds to flow in a westerly direction just inside the Sites southern boundary.

3.6.2 Information from Anglian Water, including asset plans have been included within Appendix 4.

3.7 Soils and Geology

3.7.1 Soils mapping produced by the National Soils Resources Institute (Cranfield University) shows that the north of the Site is underlain by slowly permeable seasonally wet slightly acidic but base-rich loamy and clayey soils. The south of the Site is underlain by freely draining slightly acidic loamy soils.

3.7.2 The British Geological Survey (BGS) online mapping (Geology of Britain Viewer) shows that there are no superficial deposits beneath the Site.

3.7.3 The bedrock geology to the north of the Site is Kimmeridge clay formation (mudstone). The bedrock to the south of the Site is Woburn sands formation (sandstone).

3.7.4 Soakaway testing was undertaken during September 2015, two trial pits found infiltration not to be viable the other trial pit gave an infiltration rate of 0.05m/hr. A summary of soakaway results has been included within Appendix 6.

3.8 Designated Sites

3.8.1 There are no designated sites within the immediate vicinity 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

<table>
<thead>
<tr>
<th>Flooding Source</th>
<th>Potential Flood Risk at Application Site?</th>
<th>Potential Source</th>
<th>Data Sources</th>
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<tr>
<td>Fluvial flooding</td>
<td>No</td>
<td>New Cut Drain (Main River), Catch Water Drain (Ordinary Watercourse)</td>
<td>OS Mapping, Environment Agency mapping, SFRA</td>
</tr>
<tr>
<td>Tidal flooding</td>
<td>No</td>
<td>None Identified</td>
<td>Environment Agency flood mapping, Ordnance Survey Mapping</td>
</tr>
<tr>
<td>Flooding from rising / high groundwater</td>
<td>Yes</td>
<td>Aquifer</td>
<td>BGS Mapping</td>
</tr>
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<td>Surface water flooding</td>
<td>Yes</td>
<td>Poor permeability</td>
<td>JBA Flood Mapping</td>
</tr>
<tr>
<td>Flooding from artificial drainage systems</td>
<td>Yes</td>
<td>Sewers</td>
<td>Anglian Water, SFRA</td>
</tr>
<tr>
<td>Flooding due to infrastructure failure</td>
<td>No</td>
<td>None Identified</td>
<td>Environment Agency. OS Map</td>
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Fluvial (river) Flooding Sources

i. Environment Agency Flood Map

4.1.2 As noted above, there are no Main Rivers or Ordinary Watercourses located within/bounding the Site. The nearest watercourse is Catch Water Drain, located approximately 170m to the north of the Site.

4.1.3 The Environment Agency flood map shows that the Site is located within Flood Zone 1 (low risk); outside the extent of the 1 in 1000 year return period (<0.1% AEP) (see Drawing 5).

ii. SFRA Flood Mapping

4.1.4 It is noted that the SFRA flood zone mapping (see Appendix 2) shows an extent of flooding to the north of the Site, associated with New Cut Drain and Catch Water Drain. The SFRA depicts this area of flooding to be located within Flood Zone 3b (1 in 20 year/5% AEP/‘Functional Floodplain’).
4.1.5 However, the Environment Agency flood mapping (see Drawing 5) depicts this as Flood Zone 3a (defended). Areas shown to benefit from flood defences are usually defended up to a 1 in 100 year (1% AEP) standard of protection. The Environment Agency flood map is updated on a regular basis (unlike the SFRA mapping), therefore the area of flooding to the north of the Site will be taken as Flood Zone 3a (defended).

iii. Historic Flooding

4.1.6 Based on information provided by the SRFA there have been no past flooding events reported within the Site boundary. The Site is just outside the mapped extent of the May 1978 historical flooding outline (see historical data mapping within Appendix 2).

iv. Flood Defences

4.1.7 The Environment Agency flood map confirms that the Site is not protected by flood defence measures, however the Site is located within Flood Zone 1 (low risk).

v. Summary of Fluvial Flood Risk

4.1.8 Based on the above, the Site has a negligible risk of fluvial flooding, and will not be considered further within this FRA report.

**Tidal Flooding Sources**

4.1.9 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 report.

**Flooding from Rising / High Groundwater**

4.1.10 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).

4.1.11 The BGS Groundwater Flooding Susceptibility Map indicates that the northern extent of the Site is located outside of the mapped extent of groundwater flooding. The southern area has potential for groundwater flooding of property situated below ground water with areas of limited potential of groundwater flooding to occur associated with it (see Drawing 3).

4.1.12 The potential for groundwater to occur on Site is likely to be linked to the sandstone bedrock beneath the southern extent of the Site, however, the bedrock is overlain by clay and silt superficial geology and soils, which have low permeability, therefore if water cannot infiltrate it is unlikely that ground water will rise to the surface.

4.1.13 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. As no below surface infrastructure and buildings are proposed for the Site, the Site is not considered to be at risk of flooding from rising / high groundwater. Residual risk will be mitigated by the adoption of a surface water management strategy for the Site (see Section 5).

4.1.14 Based on the above, the risk of groundwater flooding can be mitigated to a low and acceptable level, and will not be considered further within this FRA report.
Surface Water Flooding

4.1.15 Surface water flooding tends to occur sporadically in both location and time and can occur when soil infiltration rates are less than the rainfall precipitation rate. This can occur when either:

- Soils are naturally of low permeability or have been compacted (infiltration excess runoff);
- Soils are of higher permeability but are saturated from previous rainfall either directly or from upslope (saturation excess runoff, and return flow).

4.1.16 The JBA surface water flood map shows the majority of the Site is located outside the extent of the 1 in 1000 year flood risk (see Drawing 4). There is a small area of ponding within the south west corner of the Site, which is located within the 1 in 75 year extent of surface water flooding, with areas of 1 in 200 and 1 in 1000 year extents associated with it. There are also small areas of ponding located within the 1 in 1000 year extent located in the south-east and north-east corners of the Site. Surface water flooding is likely to be linked to topographic low points within the Site.

4.1.17 Based on the above, the Site is at a low to high risk of surface water flooding. It is proposed that this will be managed by the adoption of a surface water management strategy for the Site, which will mitigate surface water flooding to a low and acceptable level (see Section 5).

Flooding from Artificial Drainage Systems

4.1.18 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.

4.1.19 The majority of sewers are built to the guidelines within Sewers for Adoption\(^4\). 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).

4.1.20 Anglian Water are responsible for the disposal of waste 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, Anglian Water 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. 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.

4.1.21 Based on a review of Anglian Water sewer records (see Section 3.6 and Appendix 4) a rising foul main is pumped in a southerly direction just inside the Sites eastern boundary, this then flows in a westerly direction just inside the Sites southern boundary. There is also a foul sewer flowing along Rampton Road just outside the Sites eastern boundary.

4.1.22 It is noted that Anglian Water did not report any sewer flooding incidents within the Site boundary, or within the vicinity of the Site.

4.1.23 As noted above, there is a foul sewer located within the Site boundary. It is recommended that an adequate easement (approx. 4.5m) is provided along the length of this foul water sewer.

4.1.24 Based on the above, there is a low risk of flooding to the Site from sewers. Mitigation measures are detailed below within Section 4.3.

Flooding from Infrastructure Failure

i. Flooding from Reservoirs

4.1.25 Based on the Environment Agency online Flood Maps, the Site is located outside the extent of flooding sourced from reservoirs. The risk of flooding from reservoirs is considered negligible and will not be considered further within this FRA report.

4.2 Environment Agency Flood Map and NPPF Guidance

4.2.1 A review of the Environment Agency’s flood map indicates that the Site is located within Flood Zone 1 (low risk); which is located outside the extent of the 1 in 1000 annual probability of river flooding in any year (<0.1% AEP).

4.2.2 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.

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

4.2.4 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

<table>
<thead>
<tr>
<th>Flood Zone</th>
<th>Probability</th>
<th>Explanation</th>
<th>Appropriate Land use</th>
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<tbody>
<tr>
<td>Zone 1</td>
<td>Low</td>
<td>Less than 1 in 1000 annual probability of river or sea flooding in any year (&lt;0.1%)</td>
<td>All development types generally acceptable</td>
</tr>
<tr>
<td>Zone 2</td>
<td>Medium</td>
<td>Between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year</td>
<td>Most development type are generally acceptable</td>
</tr>
<tr>
<td>Zone 3a</td>
<td>High</td>
<td>A 1 in 100 or greater annual probability of river flooding (&gt;1%) or a 1 in 200 or greater annual probability of flooding from the sea (&gt;0.5%) in any year</td>
<td>Some development types not acceptable</td>
</tr>
<tr>
<td>Zone 3b</td>
<td>‘Functional Floodplain’</td>
<td>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)</td>
<td>Some development types not acceptable</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Flood Risk Vulnerability classification (see Table 1 of PPG ID: 7)</th>
<th>Essential Infrastructure</th>
<th>Water Compatible</th>
<th>Highly Vulnerable</th>
<th>More Vulnerable</th>
<th>Less Vulnerable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 1</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Zone 2</td>
<td>Yes</td>
<td>Yes</td>
<td>Exception test required</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Zone 3a</td>
<td>Exception test required</td>
<td>Yes</td>
<td>No</td>
<td>Exception test required</td>
<td>Yes</td>
</tr>
<tr>
<td>Zone 3b ‘Functional Floodplain’</td>
<td>Exception test required</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

**Key:** Yes: Development is appropriate, No: Development should not be permitted.
4.3 Flood Risk and Mitigation Measures

4.3.1 Groundwater and surface water flooding have been identified as secondary sources of flooding within the Site. These sources of flooding can however be mitigated to a negligible level through the adoption of a surface water management strategy (see Section 5 below). Furthermore, no below ground infrastructure and buildings are proposed for the Site.

4.3.2 It is also recommended that a precautionary approach is taken whereby finished floor levels are located a minimum of +150mm above external levels to mitigate residual flooding.

4.3.3 As noted above, there is a rising foul main located within the Site boundary. It is recommended that an adequate easement, approximately 4.5m, is provided along the length of this public sewer, unless the sewer is diverted within the Site boundary.
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\(^5\). Rainwater shall discharge to one of the following, listed in order of priority:

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

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

ii. a sewer.

5.1.4 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.

5.1.5 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 Site is 14.16 Ha in area and comprises agricultural land.

5.2.2 The Site is almost entirely permeable (i.e. no built development or hardstanding) and it is assumed that runoff is conveyed as overland flow following the topography of the Site, with a small amount of infiltration at source.

5.2.3 There is currently no foul water discharging from the undeveloped Site. Please note that foul drainage has not been considered within the FRA report, but is dealt with in a separate standalone report.

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5.3 Proposed Development

5.3.1 The proposal is for outline planning permission for up to 200 residential units and up to 70 apartments with care (C2), introduction of structural planting and landscaping, informal public open space, surface water flood mitigation and attenuation with all matters to be reserved with the exception of main vehicular access.

5.3.2 This FRA covers two potential development options hereafter referred to as scheme A and B.

5.3.3 The Site is 14.16ha of which developable area will take up 6.33ha within Scheme A (44.7%) and 6.36ha within Scheme B (44.9%). Of the developable areas, residential dwellings will be assumed 55% impermeable with apartments for care assumed 90% impermeable.

5.3.4 A comparison of existing and proposed impermeable areas is included below within Figure 5.1.

<table>
<thead>
<tr>
<th>Table 5.1: Impermeable Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Existing Buildings</td>
</tr>
<tr>
<td>and Hardstanding</td>
</tr>
<tr>
<td>Proposed Buildings</td>
</tr>
<tr>
<td>and Hardstanding</td>
</tr>
<tr>
<td>Difference</td>
</tr>
<tr>
<td>Scheme A</td>
</tr>
<tr>
<td>Area (Ha)</td>
</tr>
<tr>
<td>0.00</td>
</tr>
<tr>
<td>Percentage of Total Site</td>
</tr>
<tr>
<td>Area (%)</td>
</tr>
<tr>
<td>0.00</td>
</tr>
</tbody>
</table>

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

5.4 Greenfield Runoff Rate

5.4.1 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.

5.4.2 The rates of runoff have been determined using the current ‘industry best practice’ guidelines as outlined in the Interim Code of Practice for Sustainable Drainage Systems June 2004, and the Environment Agency Report SC030219 – Rainfall runoff management for developments. The recommended methodology for Sites up to 50 hectares in area is the ICP SUDS method.

5.4.3 The following parameters have been incorporated into the runoff calculations:

- Developable Area: 6.33ha / 6.36ha.
- Average Annual Rainfall (SAAR): 540 mm/year;
- Soil: 0.300
- Region No.: 5

---

Table 5.2 summarised the surface water runoff rates. Extracts from WinDes have been included within Appendix 7.

The measures detailed in Section 5.5 and 5.6 will control the surface water runoff from the Site and therefore surface water flood risk from the developed Site.

Table 5.2: Greenfield Runoff Characteristics

<table>
<thead>
<tr>
<th>Annual Probability (Return Period, years)</th>
<th>Greenfield Runoff Rate (l/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Scheme A</td>
</tr>
<tr>
<td>QBAR (2.3)</td>
<td>8.5</td>
</tr>
<tr>
<td>50% (2)</td>
<td>7.6</td>
</tr>
<tr>
<td>3.33% (30)</td>
<td>20.5</td>
</tr>
<tr>
<td>1% (100)</td>
<td>30.3</td>
</tr>
<tr>
<td>1% + Climate Change</td>
<td>42.4</td>
</tr>
</tbody>
</table>

Note: 40% added to the data to account for long-term climate change as stated in PPG ID: 7. The 2 year, 30 year and 100 year annual probability events are of importance to the Water Companies and the Environment Agency when looking at sewage discharge and flood risk.

Following consultation with the IDB, a rate of 1.1 l/s.Ha for the developable areas of the Site is required. The flat rate is based on the IDB pumping capacity. As such, a rate of 7.0l/s will be carried forward for the respective schemes within this drainage assessment to calculate the storage attenuation required. Limiting the discharge rate to the IDB runoff rate will prevent the proposed development from exacerbating fluvial flooding downstream from the Site.

5.5 Sustainable Drainage Options (SUDS)

Sustainable water management measures should be used to control the surface water runoff from the proposed development Site therefore, managing the flood risk to the Site and surrounding areas from surface water runoff.

Current guidance promotes sustainable water management through the use of SUDS. SUDS options include:

- Water butts
- Permeable paving
- Filter strips
- Cellular Storage
- Detention basins
- Oversized pipes
- Swales

A hierarchy of techniques is identified:

1. **Prevention** – the use of good Site design and housekeeping measures on individual Sites to prevent runoff and pollution (e.g. minimise areas of hard standing).

2. **Source Control** – control of runoff at or very near its source (such as the use of rainwater harvesting).

---

3. **Site Control** – management of water from several sub-catchments (including routing water from roofs and car parks to one/several large soakaways for the whole Site).

4. **Regional Control** – management of runoff from several Sites, typically in a detention pond or wetland.

5.5.3 It is generally accepted that the implementation of SUDS as opposed to conventional drainage systems, provides several benefits by:

- reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream;
- reducing the volumes and frequency of water flowing directly to watercourses or sewers from developed Sites;
- improving water quality over conventional surface water sewers by removing pollutants from diffuse pollutant sources;
- reducing potable water demand through rainwater harvesting;
- improving amenity through the provision of public open spaces and wildlife habitat; and
- replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained.

5.5.4 Enzygo undertook soakaway testing during September 2015. A copy of the soakaway results, including trail pit location plan, have been included within Appendix 6, and a summary has been included below:

5.5.5 Three test pits were undertaken within the Site; SA1 located in the north-east corner (underlain by mudstone), and two further test pits (SA2 and SA3) located in the south-east extent (underlain by sandstone).

5.5.6 Infiltration at SA1 and SA1 was found to be negligible, whereas SA3 had an infiltration rate of 0.05m/hr.

5.5.7 As detailed in section 5.7 below, a detention basin will features as the main attenuation feature.

5.5.8 Maintenance of the SUDS features would be in line with the SUDS Manual (CIRIA C753, 2015), as detailed below in Figures 5.1. The maintenance would likely to be undertaken by a private maintenance company.

5.5.9 Details of other SUDS features and maintenance (as identified in Section 5.6) would be considered further at detailed design, when a detailed layout has been produced. The level of detailed provided within this FRA should be sufficient at outline stage, and demonstrate that the integration of SUDS would be deliverable at detailed design stage.
5.6 Surface Water Management Strategy

i. Introduction

A surface water management strategy for the proposed development has been developed as part of a FRA to manage and reduce the flood risk posed by the surface water runoff from the Site.

ii. Hierarchy of Discharge

5.6.2 As noted above, the use of SUDS alone is considered unfeasible.

5.6.3 There are no watercourses within/bounding the Site. The nearest watercourse is Catch Water Drain, which is located approximately 170m to the north of the Site.

5.6.4 The only public sewer network within the vicinity of the Site, is a rising foul main, which flows within the Site boundary.
5.6.5 Based on the above, it is proposed that outfall is either directed across the land to the northwest of the Site, in order to establish a positive outfall to Catch Water Drain, or, along Rampton Road, located to the north east of the Site, before discharging into Catch Water Drain (ideally downstream side of Rampton culvert crossing).

5.6.6 The land between the Site and the watercourse is under the same ownership, therefore, there would be no requirement to cross third party land.

iii. Greenfield Runoff Rate

5.6.7 All events up to and including the 1 in 100 year (+40%) rainfall event will be attenuated. The surface water runoff from the Site will be attenuated to the IDB 1.1 l/s/ha discharge rate from the proposed developable areas of the Site (see section 5.6 above).

iv. Drainage Design

5.6.8 Surface water runoff would be directed to the drainage system through drainage gullies located around the perimeter of the buildings and through contouring of the hardstanding areas.

5.6.9 Landscaped areas should be incorporated into the layout where possible, and the associated gardens of each unit will allow a proportion of the rainfall to infiltrate into the soil substrate.

5.6.10 Surface water will be directed to the onsite attenuation feature via a gravity fed connection.

v. Attenuation Requirements

5.6.11 The attenuation volume required to reduce the post-application surface water runoff from the Site to the IDB 1.1 l/s/ha discharge rate to watercourse have been shown below.

5.6.12 The following input parameters were assumed in the calculations:

- Developable Area: 6.33ha / 6.36ha;
- Cv (proportion of rainfall forming surface water runoff): 75% summer, 84% winter;
- Assuming infiltration losses: 0.00 m/hour;
- With outfall: 7.0l/s.

5.6.13 Storage should be provided on Site for surface water, up to the 1 in 100 year plus 40% climate change event using the same runoff rate. Attenuation storage could be provided above ground (i.e. attenuation pond). An indicative drainage drawing has been included within Drawings 8.1 and 8.2.

5.6.14 A summary of the flow restrictions and attenuation volumes is provided in Table 5.3.

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Total Site Area (Ha)</th>
<th>Developable Area (Ha)</th>
<th>Flow Restriction (l/s), limited to IDB runoff rate of 1.1 l/s.Ha</th>
<th>M100+40%CC Volume of Storage (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>14.16</td>
<td>6.33</td>
<td>7.0</td>
<td>3206</td>
</tr>
<tr>
<td>B</td>
<td>14.16</td>
<td>6.36</td>
<td>7.0</td>
<td>3216</td>
</tr>
</tbody>
</table>

5.6.15 It should be noted that the above runoff rates and attenuation volumes are indicative only and should be investigated further during detailed design stage.
5.7 Site Drainage Summary

5.7.1 It has been demonstrated that surface water flows from the Site can be managed such that flood risk to and from the Site following development is not increased.
6.0 Summary and Conclusions

6.1 Introduction

6.1.1 This report presents an FRA, in accordance with the NPPF and PPG ID: 7, for the proposed development of land west of Rampton Road, Cottenham, CB24 8TJ. This has included an assessment of the surface water drainage requirements of the Site.

6.1.2 This report details the flood risk at the Site and how this could be managed and mitigated to allow the Site to be developed in support of the submitted planning application. The proposed scale of development may present risks of flooding on-Site and/or off-Site if flooding is not effectively managed.

6.2 Assessment of Flood Risk

6.2.1 The FRA has demonstrated the following:

- There are no Main Rivers within the immediate vicinity of the Site. The nearest watercourse is Catch Water Drain (an Ordinary Watercourse), located approximately 170m to the north of the Site. The nearest Main River is New Cut Drain 580m to the east of the Site at its nearest point.

- The detailed flood map provided by the Environment Agency shows that the Site is located within Flood Zone 1 (low risk); outside the extent of the 1 in 1000 annual probability of flooding / <0.1% AEP, and is considered to be at low risk of fluvial flooding.

- In PPG ID: 7 the appropriate uses have been identified for the Flood Zones. The proposed development is classified as ‘more vulnerable’. All development types are generally deemed acceptable in terms of flood risk in Flood Zone 1. As such, the Sequential Test should be passed and the Exception Test should not be required.

- Secondary flooding sources were identified within the Site, including; groundwater flooding and surface water flooding. These sources of flooding can however be mitigated to a negligible level through the adoption of a surface water management strategy. Furthermore, no below ground infrastructure and buildings are proposed for the Site.

- It is recommended that a precautionary approach is taken whereby finished floor levels are located a minimum of +150mm above external levels to mitigate residual flooding.

- There is a foul sewer located within the Site boundary. It is recommended that an adequate sized easement 4.5m is provided along the length of this foul sewer, unless the sewer is diverted within the Site boundary.

6.2.2 Table 6.1 summarises the probability and consequence of flooding for the Site with and without mitigation measures.
### Table 6.1: Probability and consequences of all sources of flooding

<table>
<thead>
<tr>
<th>Flooding Source</th>
<th>Potential Source</th>
<th>Probability</th>
<th>Consequence &amp; Impact Without Mitigation</th>
<th>Consequence &amp; Impact With Mitigation</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluvial flooding</td>
<td>New Cut Drain (Main River), Catch Water Drain (Ordinary Watercourses)</td>
<td>Negligible</td>
<td>Negligible</td>
<td>Negligible</td>
<td>None</td>
</tr>
<tr>
<td>Tidal flooding</td>
<td>None</td>
<td>Negligible</td>
<td>Negligible</td>
<td>Negligible</td>
<td>None</td>
</tr>
<tr>
<td>Flooding from rising / high groundwater</td>
<td>Aquifer</td>
<td>Low - Medium</td>
<td>Low - Medium</td>
<td>Negligible</td>
<td>None</td>
</tr>
<tr>
<td>Surface water flooding</td>
<td>Poor Permeability</td>
<td>Low - High</td>
<td>Low - High</td>
<td>Negligible</td>
<td>None</td>
</tr>
<tr>
<td>Flooding from artificial drainage systems</td>
<td>Sewers</td>
<td>Low</td>
<td>Low</td>
<td>Negligible</td>
<td>Provide an easement along the onsite rising foul sewer.</td>
</tr>
<tr>
<td>Flooding due to infrastructure failure</td>
<td>None Identified</td>
<td>Negligible</td>
<td>Negligible</td>
<td>Negligible</td>
<td>None</td>
</tr>
</tbody>
</table>

**Key:** Green - Negligible, Yellow - Low, Orange - Medium and Red - High; based on consequence and impact with mitigation from each flooding source.

### 6.3 Site Drainage

6.3.1 The FRA has considered the potential impact of the development on surface water runoff rates.

6.3.2 The surface water management strategy for the proposed development will manage and reduce the flood risk posed by the surface water runoff from the Site.

6.3.3 The attenuation volume required to reduce the post application surface water runoff from the Site to the IDB discharge runoff rate has been calculated, based upon a positive outfall to the watercourse to the north of the Site.

6.3.4 During detailed design the system could be designed to attenuate to the 1 in 1, 1 in 30 and 1 in 100+CC year events. An attenuation volume of 3,206m³ and 3216m³ will be provided by an onsite detention basin for schemes A and B respectively.
6.3.5 It has been demonstrated that surface water flows from the Site can be managed such that flood risk to and from the Site following the proposed development is not increased.

6.4 Conclusion

6.4.1 This FRA demonstrates that the proposed development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of the NPPF and PPG.

6.4.2 The development should not therefore be precluded on the grounds of flood risk and surface water drainage.
THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY
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DRAWING NO: SHF.1132.024.D.001

TITLE: Site Location Plan

PROJECT: Rampton Road, Cottenham

CLIENT: Gladman Developments Ltd

CHECKED: DA

DRAWN: MG

SCALE: 1:20,000@A3

DATE: Apr 2015

PROJECT REF: SHF.1132.024

Key

- Site Location (TL 4401 6734)
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Potential for Groundwater Flooding to Occur at Surface
Limited Potential for Groundwater Flooding to Occur
Potential for Groundwater Flooding of Property Situated Below Ground Level
Limited Potential for Groundwater Flooding to Occur
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Key

- Site Boundary
- Search Extent
- 1 in 75 Year Flooding from Rivers
- 1 in 100 Year Flooding from Rivers
- 1 in 200 Year Flooding from Rivers
THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY
Geological Indicators of Flooding
(based on geological deposits)

Key
- Site Boundary
- Geological Indicators of Flooding from Inland Flooding
Option A: Outfall to 'Catch Water Drain' at 7 l/s IDB rate.

Option B: Outfall to 'Catch Water Drain' along highway at 7 l/s IDB rate.

M100+40% Volume of Storage = 3206m³

TOB= 7.370
WL= 7.070
BL= 5.820
SV= 3243m³

Attenuation Pond
Existing Drainage Routes
Contours @ 0.5m intervals

Two Mill Field

Attenuation Pond
Contours @ 0.5m intervals

Proposed Drainage

Context Plan - Scale 1:10,000

Two Mill Field

Context Plan - Scale 1:10,000

Two Mill Field

Context Plan - Scale 1:10,000

Two Mill Field

Context Plan - Scale 1:10,000

Two Mill Field

Context Plan - Scale 1:10,000

Two Mill Field

Context Plan - Scale 1:10,000

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Context Plan - Scale 1:10,000

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Two Mill Field

Context Plan - Scale 1:10,000

Two Mill Field