Flood Risk and Drainage Assessment

Site 6, Proposed Local Development Order
Reaseheath College, Nantwich

Prepared for Reaseheath College and
Cheshire East Council

March 2016

Doc Ref: JGM/16085/FRA/1
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1 INTRODUCTION

1.1 Project Brief

1.1.1 SCP has been commissioned to undertake a flood risk assessment and drainage impact assessment jointly by Reaseheath College and Cheshire East Council for Site 6 as per the Local Development Order (LDO). The FRA provides information on the nature of flood risk at the site and follows Government guidance with regards to development and flood risk.

1.1.2 The report is based on currently available information and liaison with United Utilities. Information contained within the RSP report number AAC5016, undertaken as part of the adjacent North West Nantwich Development, and in the public domain, has been reviewed with respect to Site 6.

1.1.3 The proposals contained in this report are based on the latest available information regarding development proposals. As development comes forward more detailed design work will be required to validate and confirm the conclusions contained in this report.

1.2 Scope of Work

1.2.1 The FRA has been prepared following the guidance of the National Planning Policy Framework (NPPF) and the associated Technical Guidance, which were published in March 2012. The FRA is required to identify the 1 in 100 year + 30% climate change allowance flood level for the site and ensure development platform will be above this level.

1.2.2 In preparing the report, SCP has:

- Reviewed the RPS information relevant to the site
- Liaised with United Utilities regarding drainage connections
- Considered the existing flood alleviation arrangements
- Considered the potential sources of flooding and assessed the risk of flooding to the site
- Considered the impact of climate change
- Considered the existing sewerage arrangements for the site
- Considered the proposed drainage arrangements for the site
- Assessed the impact of surface water run-off from the development
- Assessed the impact of sustainable drainage systems (SuDS) for the development

1.3 Development Background – Cheshire East Local Plan

1.3.1 Cheshire East Council submitted its Local Plan Strategy to the Secretary of State for Communities and Local Government in May 2014 and it is currently undergoing an independent examination
process (EiP). The EiP was suspended in December 2014 and to allow CEC to address concerns raised by the Inspector. The EiP Hearings recommenced during October 2015 with further interim views from the Inspector having been received in December 2015 which supported the continued preparation of the Local Plan.

1.3.2 The Local Plan will be made up of a number of documents including the Local Plan Strategy and Site Allocations and Development Policies once in place, the Local Plan will be the Statutory Development Plan in Cheshire East and will form the basis of planning decisions until 2030.

1.3.3 At present the current statutory development plan for Cheshire East currently consists of a number of saved policies from previous Local Plans. Relevant to the site is the Crewe and Nantwich Replacement Local Plan 2011 (Adopted February 2005) which covers the whole of the former Borough of Crewe and Nantwich.

1.3.4 Relevant flood risk and drainage policies from the Borough of Crewe and Nantwich Replacement Local Plan 2011 are summarised below:-

**NE.11: RIVER AND CANAL CORRIDORS**

Within River, watercourse and canal corridors throughout the Borough, development which would have an adverse effect on:-

- Nature Conservation;
- Fisheries;
- Landscape
- Public Access
- Water based or Waterside Recreation
- Fluvial Defences; and
- Historic Interest and Features

Will only be permitted where the reasons for development clearly outweigh the conservation value of the river, watercourse or canal corridor.

**NE.20: FLOOD PREVENTION**

Proposals for new development, including the raising of land, in the indicative flood plain as shown on the proposals map, will only be permitted where:
• The proposal is supported by a flood risk assessment with appropriate flood prevention and mitigation measures;

• The proposals would not result in extensive and unacceptable culverting;

• The proposal would not create or exacerbate flooding elsewhere; and

• It does not adversely affect the integrity of, or prevent access for maintenance purposes to, a watercourse or underground services:

In determining applications for development and reviewing the local plan, the Borough Council will apply the risk based approach through Sequential Test or the potential risk of flooding;

**BE.4: DRAINAGE, UTILITIES AND RESOURCES**

Proposals for new development will be permitted provided that the following criteria are met.

• The site can be adequately drained of foul and surface water without causing any environmental problem as a result of the ultimate discharge. Where practicable this will be to public sewers. The developer should also consider the need to assist the permeability of land for storm drainage and protecting amenity through selection and use of sustainable drainage systems (SuDS).

• The development should be serviceable by any necessary infrastructure at economic cost;

• There should be no loss of essential access, for maintenance purposes, to watercourses and utilities infrastructure.

• The development should not prejudice the use of mineral resources; and

• Development proposals should have adequate water supply, and should not lead to an adverse impact on surface water or ground water resources, in terms of their quantity, supply and the ecological features they support.

• The development does not adversely affect the integrity of, or prevent access for maintenance purposes to underground services.

**BE5: INFRASTRUCTURE**

The local planning authority may impose conditions and / or seek to negotiate with developers to make adequate provision for any access or other infrastructure requirements and / or community facilities, the need for which arises directly as a consequence of that development. Such provision may include:
• On-site facilities

• Off-site facilities

• Payment of a commuted sum.

The infrastructure requirements of the development proposals will be assessed based upon individual merits: but in some circumstances, there will be a necessity to view individual applications collectively in assessing off site requirements.

1.4 Development Masterplan

1.4.1 Site 6 of the LDO, to which this FRA relates, involves the introduction of new business incubator space on a site to the south of the A51, adjacent to the College’s Equine centre. This element of the LDO is anticipated to provide approximately 5,760 sq. m of floor space, which could accommodate B1, B2 or B8 employment uses. For the purpose of this FRA and in order to provide a worst case assessment, it has been assumed that all of the floor space will occupied by B1 office use. Given the constraints with access to this site, this element of the LDO will only come forward once the A51 has been realigned as part of the NW Nantwich Urban extension.

1.4.2 A copy of the Concept Masterplan and development plan are contained in Appendix 1.
2 EXISTING SITE DETAILS

2.1 History and Current Use

2.1.1 The site is centred at an OS grid reference 364785, 353570, approximately 1.5km to the north of Nantwich town centre. The site is rectangular and currently a green-field site. The total site area is approximately 1.34 hectares.

Figure 1: Site Location plan

2.2 Existing Watercourses

2.2.1 The River Weaver is located approximately 250m to the east of the proposed development. This is classified as a main river by the Environment Agency. The North and East boundaries of the site are formed by an un-named tributary to the River Weaver and in classified as an ordinary watercourse.

2.3 Existing Drainage

2.3.1 There are no known foul, combined or surface water sewers within the vicinity of the site.
2.3.2 United Utilities has confirmed that the nearest foul sewer is a 150mm diameter pipe, which is located approximately 500m to the South East of the site in Barony Road.

2.4 Topography

2.4.1 Limited topographical survey information has been made available for the site. It has therefore been assumed that the land, in general, falls towards the un-named watercourse.
3 DEVELOPMENT AND FLOOD RISK

3.1 National Planning Policy Framework

3.1.1 In March 2012 the Department of Communities and Local Government published the “National Planning Policy Framework” (NPPF), which provides technical guidance on how flood risk should be assessed during the planning and development process. National Planning Policy Framework details a Sequential Test which local Planning Authorities should apply to all future development proposals to steer new developments away from areas liable to flooding.

3.1.2 Information relating to the Flood Zone Classification and permitted development has been extracted from “Technical Guidance to National Policy Framework” and is contained in Appendix 2.

3.1.3 From a review of the NPPF technical guidance, proposals for B1 office use would be considered as “less vulnerable”. Such types of development would be acceptable in all areas except Flood Zone 3b (functional flood plain).
4 HYDROLOGICAL ASSESSMENT

4.1 Assessment Approach

4.1.1 This study assesses the risk from different types of flooding to the development and the risk of flooding from the development, taking into consideration climate change, as well as how flood risks should be managed. The main types of flooding that may apply to the proposed development site are as follows: fluvial (river) flooding, rising groundwater and surface water flooding (from sewers or overland flow). Fluvial flooding from the River Weaver / unnamed tributary is considered to be the greatest flood risk to the proposed development. The approach to assessing fluvial flood risk at the development site was informed by the requirements of the National Planning Policy Framework in conjunction with the client, Environment Agency requirements.

4.2 Summary of Fluvial Flood Risk

4.2.1 All types of development, as defined by the NPPF lying in Flood Zone 1 are permitted and exempt from Sequential and Exemption Tests.

4.2.2 In October 2012, Cheshire East Council commissioned JBA Consulting to review the review update and consolidate the Strategic Flood Rias Assessments (SFRA), which were produced by the former district councils, which now made up Cheshire East Council. The final version of this document was issued in August 2013.

4.2.3 The SFRA shows the site as being within the North West Nantwich / Kingsley Field Strategic Site. The SFRA notes that flood risk is unlikely to be an issue with this site as development can be directed away from the River Weaver flood plain.

4.2.4 The report also highlights two ordinary watercourses which flow through the site. The northern watercourse forms the northern boundary of the site, which this report reviews. The SFRA confirms that little information was available on the watercourses at the time of its preparation and recommends that they should be assessed as part of a detailed FRA. An extract from the SFRA is shown below with the proposed Kingsley Field Strategic Site:
4.2.5 The watercourse modelling of the northern ordinary watercourse was undertaken by RPS as part of the planning application for the adjacent North West Nantwich urban extension site. The modelling concludes that the 1 in 100 year events are predominantly contained within the channel itself. It is noted that the proposed site masterplan allows for a landscape corridor to the watercourse that would encompass any flooding outside the channel. Consequently, the areas of proposed development on the site would lie within Flood Zone 1.
4.2.6 An extract from the Environment Agency flood map (see below) shows a very similar correlation with the RPS model. Therefore flooding from fluvial and tidal sources is likely to be a low risk to the proposed development.
4.3 Watercourse Maintenance

4.3.1 Regular maintenance of the ordinary watercourse will assist with the conveyance of water and ensure that flows are maintained within the channel.

4.4 Historic Flooding

4.4.1 Appendix B of the Cheshire East Council’s FRA, records the notable flood events across the County

4.4.2 Whilst Appendix B is general in its list of events, with few specific locations, it does highlight a relevant instance in September 2012. The River Weaver broke its banks between Reaseheath Roundabout in the north and the railway line in the south. However, it does not confirm whether the proposed site was affected.

4.5 Risk of Groundwater Flooding

4.5.1 It is understood that no site investigation has been undertaken at the site. It has been assumed that the site is underlain with glacial, clay deposits from river deposition.

4.5.2 At worst case the levels of flood water from groundwater flooding are similar to the fluvial flooding levels and therefore the precautions set out to tackle fluvial flooding will also eliminate flood risk from ground water flooding.
4.6 Risk of Surface Water Flooding from Infrastructure

4.6.1 Surface water sewers are at risk of surcharging during extreme rainfall events with flooding occurring principally from manholes and gullies. Surcharging sewers can result in overland flow which if originating at a higher elevation than a development site can potentially pose a flood risk. New surface water sewers will be constructed to serve the new development.

4.6.2 From analysing the limited topographical survey and assuming infrastructure will generally follow the “lie of the land”, it can be established that the run-off as a result of flooding from surrounding infrastructure will be generally directed in a northerly and easterly directions towards the un-named watercourse. Flooding risk from adjoining properties and highways is therefore considered low.

4.7 Risk of Surface Water Flooding from the Site

4.7.1 Developers are responsible for ensuring that new development does not increase the flood risk elsewhere. Developers are typically required to consider the 100 year storm with an allowance for climate change, to ensure the run-off can be managed safely on site and to restrict any flows leaving the site to the current runoff rates or better.

4.7.2 The proposals for managing surface water run-off from the proposed development are such that no additional flows are to be discharged into the sewerage system with attenuation provided where required. This will result in ensuring that there is no increased risk of flooding as a consequence of the development.

4.7.3 A preliminary assessment of the proposed surface flows is carried out within the drainage impact assessment within section 6 of this report.
5 MITIGATION

5.1 Fluvial Flooding Mitigation

5.1.1 In line with Environment Agency policy, there should be no loss of flood plain storage. Such a loss is unlikely to occur with the proposed development, due to the proposed landscape adjacent to the watercourse retaining existing levels.

5.1.2 To ensure that there is no increased flooding either on or off the site, post-development levels should be no lower than pre-development levels.

5.2 Dry Access

5.2.1 All areas to the south of the landscape zone are presently above the 1 in 100 year flood event. Assuming that site levels remain similar to existing, a dry access and egress will be available at all times.

5.3 Groundwater Flooding Mitigation

5.3.1 The levels of flooding from groundwater are expected not to exceed the levels from fluvial flooding and are therefore dealt with within fluvial flood mitigation.

5.4 Surface Water Flooding Mitigation

5.4.1 The new development site drainage should be designed in accordance with current best practice to provide adequate capacity to convey flows and deal with the 100 year with climate change storm effectively on the site. Peak flows should be restricted to pre-development run-off rates and adequate attenuation should be provided to keep the stored volume of surface water safely on the site.

5.4.2 With no existing sewers within or adjacent to the site, no mitigation is required.

5.4.3 To minimise localised flooding within the site the drainage design should ensure that gullies, drainage channels and drains are all suitably sized to accommodate peak storm flows. Also, all inlet features should have suitably sized sumps to catch silts and should be subject to a documented routine maintenance and cleansing regime.

5.4.4 It is assumed that when the site is developed a new surface water network will be installed and these will be designed to current British Standards to eliminate the risk of flooding to the development.
5.5 **Flood Warning Procedures**

5.5.1 With the site lying in Flood Zone 1, measures for flood warning procedures are not required. However it should be noted that systems may be in place for land / property adjacent to the River Weaver and its associated flood plain.

5.5.2 As a point of note: the Environment Agency operates a free flood warning service – Flood Warnings Direct. Property owners / can sign up to receive free text messages, warning of potential flood issues.
6 DRAINAGE ASSESSMENT

6.1 Scope of Drainage Assessment

6.1.1 This outline strategy is based upon sewer records, which have been provided to SCP and the limited topographical survey information available.

6.1.2 The assessment will consider the existing drainage regime for the area and recommendations for draining the proposed development scheme.

6.1.3 At this stage discussions have been held with United Utilities regarding the existing infrastructure and the impact of the development on such.

6.1.4 No drainage investigations have been undertaken to establish the accuracy of United Utilities records. No CCTV sewer surveys have been undertaken to establish the structural integrity of the systems. It has therefore been assumed that the system is as shown on the sewer records and that it is free from major structural defects.

6.2 Existing Sewers

6.2.1 There are no known foul, combined or surface water sewers within the vicinity of the site.

6.2.2 The nearest foul sewer is a 150mm diameter pipe, which is located approximately 500m to the South East of the site in Barony Road.

6.3 Private Drainage

6.3.1 No details of the existing private drainage system in the vicinity of the site has been made available for review.

6.3.2 No private drainage has been identified from a review of the topographical survey in the vicinity of the proposed development.

6.4 Proposed Drainage - Foul

6.4.1 Discussions with United Utilities have identified that any proposals to discharge foul flows to the existing public sewers in Barony Road, is likely to require the construction of a pumping station. This is due to the following reasons:

- Proximity of the site to the existing sewerage infrastructure
- Topography between the site and the existing sewerage infrastructure
- The proposed sewer would also be required to cross the River Weaver
6.4.2 The preferred option for disposal of foul drainage from the proposed development would be to a public sewer. The nearest foul sewer is located in Barony Road on the south east side of Beam Bridge (over the River Weaver), approximately 0.5km from the site.

6.4.3 Foul drainage from the scheme could be considered as part of the the North West Nantwich / Kingsley Field Strategic development. Liaison would be required with the adjacent developers to ensure that any flows from the development can be incorporated into this development.

6.4.4 An alternative option, would be the provision of a septic tank / micro treatment works. The treated effluent would discharge to the adjacent watercourse. Consent for the construction of the works and the approval to discharge the flow would require the approval of the Environment Agency / Lead local flood authority. There is the potential that the Agency / local authority may require a secondary treatment of the effluent due to the size of the watercourse. If the college / local authority chooses to go down this route, early discussions with the Agency / local authority is advisable.

6.5 Proposed Drainage – Surface Water

6.5.1 Building Regulations Part H sets out the hierarchy for options available for the disposal of surface water. Initial consideration should be given to infiltration method, soakaways etc. Where percolation tests confirm that the underlying strata will not sustain infiltration methods, surface water should be disposed of to a watercourse. Should a discharge to a watercourse be unavailable or impracticable, connection should be made to a public sewer.

6.5.2 At the time of writing, no site investigation information was available, it has therefore been assumed that the ground is unable to sustain soakaways. Percolation tests should be undertaken at detailed design stage in accordance with BRE Digest 365 to confirm the suitability. This should be undertaken in conjunction with an assessment of the ground water depth.

6.5.3 With no percolation test information available, it has been assumed that the underlying strata to be unable to sustain soakaways. Surface water run-off will therefore be directed towards the un-named watercourse along the northern / western boundary of the site.

6.5.4 Discharge rates from the proposed development are to be no greater than pre-development levels.

6.5.5 Calculations have been undertaken using the Micro-Drainage Windes software to calculate existing green-filed run-off rates. This has been calculated as 5.9l/s. Details of the calculation are contained in Appendix 4.
6.5.6 Preliminary calculations have also been undertaken to calculate the volumes of attenuation required for the 1 in 30 year + 10% climate change rainfall event and the 1 in 100 year + 30% climate change rainfall event. The results are summarised below in table 1. Please note that these figures are preliminary and will need to be reviewed at detailed design stage.

Table 1: Summary of Preliminary Surface Water Attenuation Requirements.

<table>
<thead>
<tr>
<th>Impermeable Area (ha)</th>
<th>Greenfield Run-off Rate (l/s)</th>
<th>Attenuation Volume 1 in 30 + 10%CC (m³)</th>
<th>Attenuation Volume 1 in 100 + 30%CC (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.15</td>
<td>5.9</td>
<td>511</td>
<td>853</td>
</tr>
</tbody>
</table>

6.5.7 Surface water attenuation, with no surface flooding, must be provided for rainfall events up to the 1 in 30 year +10% climate change event. For rainfall events exceeding this frequency, above ground / surface attenuation will be required up to the 1 in 100 year + 30% climate change event. It should be noted that this attenuation must not cause flooding to buildings on the site or to adjacent property. Where this is not practicable additional below ground attenuation will be required.

6.5.8 Detailed design of the attenuation facility, should be undertaken in conjunction with consultation with the Local Lead Flood Authority, Cheshire East Council, regarding any alterations or work affecting the un-named watercourse.
7 CONCLUSIONS

7.1.1 A flood risk assessment and drainage impact assessment has been conducted on behalf of Reaseheath College and Cheshire East Council for Site 6 as per the Local Development Order (LDO). The FRA has been conducted in accordance with the requirements of the “National Planning Policy Framework” and the “Technical Guidance to the National Planning Policy Framework”.

7.1.2 The flood risk to the site is considered to be minimal from fluvial (river) flooding from an un-named tributary to the River Weaver. The Environment Agency and RPS report confirm that the areas, where development is proposed would lie in Flood Zone 1.

7.1.3 Proposals for managing surface water run-off from the development are such that no additional flows are to be discharged into the un-named watercourse with attenuation provided.

7.1.4 The drainage impact assessment / foul drainage strategy has been prepared following liaison with United Utilities

7.1.5 The final design of the drainage networks shall to be in accordance with criteria set by the Environment Agency, Local Authority, and sewerage undertaker.

7.1.6 Therefore, if the principles set out within the previous sections of this report are followed, and developed at detail design stage by the Design Engineer:–

- The effects or consequence of flooding occurring at the site can be considered as a low risk,
- To be proved as not increasing the probability of flood risk to other properties within the local catchment area.
APPENDIX 1
RURAL ECONOMY BUSINESS ZONE
B1, B2 ZONE

1.15 hectares

New A51 Carriageway
APPENDIX 2
Appendix 2

Flood Zone Classifications – Table 1

Zone 1 Low Probability

Definition

This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%)

Appropriate Uses

All uses of land are appropriate in this zone

Flood Risk Assessment Requirements

For development proposals on sites comprising one hectare or above, the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a flood risk assessment. This need only be brief unless the factors above or other local considerations require particular attention.

Policy Aims

In this zone, developers and local authorities should seek opportunities to reduce the overall flood risk in the area and beyond through the layout and form of the development and the appropriate application of sustainable drainage systems.

Zone 2 Medium Probability

Definition

This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 01%) in any year.

Appropriate uses

Essential infrastructure and the water-compatible, less vulnerable and more vulnerable uses, as set out in table 2, are appropriate in this zone. The highly vulnerable uses are only appropriate in this zone, if the Exception Test is passed.

Flood Risk Assessment Requirements

All development proposals in this zone should be accompanied by a flood risk assessment.
Policy Aims

In this zone, developers and local authorities should seek opportunities to reduce the overall flood risk in the area and beyond through the layout and form of the development and the appropriate application of sustainable drainage systems.

Zone 3a - High Probability

Definition

This zone comprises land assessed as having 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.

Appropriate uses

The water compatible and less vulnerable uses of land in table 2 are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone.

The more vulnerable and essential infrastructure should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operation and safe for users in times of flood.

Flood Risk Assessment Requirements

All development proposals in this zone should be accompanied by a flood risk assessment.

Policy Aims

In this zone, developers and local authorities should seek opportunities to:

- reduce the overall flood risk in the area and beyond through the layout and form of the development and the appropriate application of sustainable drainage systems;
- relocate existing development to land in zones with a lower probability of flooding; and
- create space for flooding to occur by restoring functional flood plain and flow pathways and by identifying, allocating and safeguarding open space for flood storage.
Zone 3b - The Functional Flood Plain

Definition

This zone comprises land where water has to flow or be stored in times of flood.

Local planning authorities should identify in their SFRA’s areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But 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, should provide a starting point for consideration and discussions to identify the functional floodplain.

Appropriate uses

Only the water-compatible uses and essential infrastructure listed in Table 2 that has to be there should be permitted in this zone. It should be designed and constructed to:

- remain operational and safe for users in flood
- result in no loss of floodplain storage
- not impede water flows, and
- not increase flood risk elsewhere

Essential infrastructure in this zone should pass the Exception Test.

Flood Risk Assessment Requirements

All development proposals in this zone should be accompanied by a flood risk assessment.

Policy Aims

In this zone, developers and local authorities should seek opportunities to:

- reduce the overall flood risk in the area and beyond through the layout and form of the development and the appropriate application of sustainable drainage systems;
- relocate existing development to land in zones with a lower probability of flooding
Flood Risk Vulnerability – Table 2

*Essential Infrastructure*

Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.

Essential utility infrastructure, which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.

Wind turbines

*Highly Vulnerable*

Police, ambulance stations and fire stations and command centres and communications installations required to be operational during flooding.

Emergency dispersal points.

Basement dwellings.

Caravans, mobile homes and park homes for permanent residential use.

Installations requiring hazardous substance consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as “essential infrastructure”)

*More Vulnerable*

Hospitals

Residential institutions such as residential care homes, children’s homes, social services homes, prisons and hostels.

Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.

Non-residential uses for health services, nurseries and educational establishments.
Landfill and sites used for waste management facilities for hazardous waste.

Sites used for holiday or short-let caravans and camping, subject to specific warning and evacuation plan.

**Less Vulnerable**

Police, ambulance and fire stations which are not required to be operational during flooding.

Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in “more vulnerable”, and assembly and leisure.

Land and buildings for agriculture and forestry.

Waste treatment (except landfill and hazardous waste facilities)

Mineral working and processing (except sand and gravel working)

Water treatment works which do not need to remain operational during times of flood.

Sewage treatment works (if adequate measures to control pollution and manage sewage during flood events are in place)

**Water-Compatible Development**

Flood control infrastructure

Water transmission infrastructure and pumping stations

Sewage transmission infrastructure and pumping stations.

Sand and gravel working.

Docks, marinas and wharves.

Navigation facilities

Ministry of Defence installations

Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.

Water-based recreation (excluding sleeping accommodation).

Lifeguard and coastguard stations.

Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

**Table 3: Flood Risk Vulnerability and Flood Zone ‘Compatibility’**

<table>
<thead>
<tr>
<th>Flood Zone</th>
<th>Flood Risk Vulnerability classification</th>
<th>Essential Infrastructure</th>
<th>Highly Vulnerable</th>
<th>More Vulnerable</th>
<th>Less Vulnerable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Zone 1</td>
<td>/</td>
<td>/</td>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td></td>
<td>Zone 2</td>
<td>/</td>
<td>Exception test Required</td>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td></td>
<td>Zone 3a</td>
<td>Exception test Required</td>
<td>x</td>
<td>Exception test Required</td>
<td>/</td>
</tr>
<tr>
<td></td>
<td>Zone 3b</td>
<td>Exception test Required</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

/ Development is appropriate
x Development should not be permitted
Appendix 3

Green-Field Run-Off Rates

Surface water run-off rate from the proposed development is to be limited to **5.9 l/s**.
16085 – Reaseheath College, Nantwich

Preliminary Drainage Calculations

Surface Water Attenuation – 1 in 30 year return period + 10% climate change

For an initial drainage design provide surface water attenuation of $511m^3$ for storms with return periods up to 1 in 30 years with a 10% allowance for climate change.
Provide surface water attenuation of **853m$^3$** for storms with return periods up to 1 in 100 years with a 30% allowance for climate change.

Additional attenuation will be provided above ground, where practicable, for storms with return periods up to 1 in 100 years with a 30% allowance for climate change.

Volume of above ground attenuation to be provided

\[
853 - 511 = 342m^3
\]