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HIGHER COLLEGE FARM, HOTHERSALL, LONGRIDGE

Flood Risk Assessment

Prepared for:

Ribble Valley Properties Ltd

Report Ref: BEK-22068-1

May 2022

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Project Quality Assurance Information Sheet

Site	Higher College Farm, Hothersall, Longridge
Report Title	Flood Risk Assessment
Report Status	Final
Report No	BEK-22068-1
Date	May 2022
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REVISION STATUS / HISTORY

Rev	Date	Issue / Comment	Prepared	Checked

GENERAL REPORT LIMITATIONS

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Where any data supplied by the client or from other sources have been used, it has been assumed that the information is correct. No responsibility can be accepted by BEK for inaccuracies in the data supplied by any other party. The conclusions and recommendations in this report are based on the assumption that all relevant information has been supplied by those bodies from whom it was requested.

No part of this report may be copied or duplicated without the express permission of BEK and the party for whom it was prepared. Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

Unless explicitly agreed otherwise, in writing, this report has been prepared under BEK's limited standard Terms and Conditions as included within our proposal to the Client.

The report needs to be considered in the light of the BEK proposal and associated limitations of scope. The report needs to be read in full and isolated sections cannot be used without full reference to other elements of the report and any previous works referenced within the report.

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Appointment

1.1.1 BEK Enviro Limited (BEK) has been commissioned by Ribble Valley Properties Ltd C/O David Holmes to prepare a Flood Risk Assessment for proposed development of commercial buildings at Higher College Farm, Hothersall (hereafter referred to as 'the site') to assess potential risks associated with flood risk to the development for commercial use.

1.2 Background

1.2.1 A site specific flood risk assessment provides an appraisal of flood risk both within the application site and any potential impact that the development will have on flood risk elsewhere and provides recommendations for mitigation measures which may be included within the design of the development to reduce the overall risk of flooding.

1.2.2 An initial assessment indicates that the primary source of flood risk to the development in an increase in surface water runoff as a result of development.

1.3 Objective and Scope of Work

1.3.1 The objective of this report is to evaluate the issues in regard to flood risk at the application site i.e. development of a number of commercial units and conversion of existing residential dwelling to offices.

1.3.2 To achieve the objective BEK will undertake the following:

- Suitability of the proposed development in accordance with current planning policy
- Identify the risk to both the development and people from all forms of flooding
- Review the relevant background information for the site, including:
  - National Planning Policy Framework
  - Planning Practice Guidance
  - Building Regulations Approved Document H
  - Environment Agency Flood Mapping
  - Lancashire County Council Strategic Flood Risk Assessment (2007)
  - Ribble Valley Strategic Flood Risk Assessment – Level One (April 2017)
  - BGS – Historic Borehole Logs
  - Cranfield University Soilscapes Viewer
- Recommendation of appropriate measures to mitigate against flooding both within the proposed development, and neighbouring land and property.

1.4 National Planning Policy Framework

1.4.1 The requirements for undertaking site specific flood risk assessments are generally as set out in the Planning Practice Guide – Flood Risk & Coastal Change.

1.4.2 Site specific flood risk assessment should always be proportionate to the degree of flood risk and make use of information already available. A flood risk assessment should also be appropriate to the scale, nature and location of the development.

1.5 Sequential & Exception Test

1.5.1 The objective of the Sequential Test is to steer new development to areas of the lowest probability of flooding, this takes into account the flood zones and the flood risk vulnerability classification of developments.

1.5.2 The Environment Agency flood map indicates that the proposed development site is located within Flood Zone 1. Flood Zone 1 is defined as land assessed as having less than 1 in 1000 annual probability of river flooding in any one year.

1.5.3 Proposals for the application site are for the development of a number of commercial buildings separated into approximately 40No units with associated car parking, landscaped areas and access roads.

1.5.4 As such the site should be classified as commercial development and is located wholly within Flood Zone 1. In accordance with Table 2 'Flood Risk Vulnerability Classification' of the Technical Guidance to the National Planning Policy Framework commercial uses are defined as 'less vulnerable' development to flooding.

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test Required	✓	✓
	Zone 3a	Exception Test Required	✓	x	Exception Test Required	✓
	Zone 3b	Exception Test Required	✓	x	x	x

Table 1: Flood Risk Vulnerability and Flood Zone Compatibility

1.5.5 'Less Vulnerable' developments within flood zone 1 are considered appropriate development. As such the undertaking of a Sequential/Exception Test will not be required.

1.6 Climate Change

1.6.1 The National Planning Policy (NPPF) sets out how the planning system should help minimise vulnerability and provide resilience to the impacts of climate change. Table 2 shows anticipated changes in extreme rainfall intensity in small and urban catchments.

1.6.2 Residential developments are usually designed with a lifetime approximating 85 years; and therefore 20% and 40% must be applied to peak rainfall intensities (see table 2).

Applies across all of England	Total potential change anticipated for 2010 to 2039	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
Upper End	10%	20%	**40%**
Central	5%	10%	**20%**

Table 2: Peak rainfall intensity allowance in small and urban catchments

1.6.3 For peak river flow allowances the Environment Agency guidance recommends a number of allowances based on the vulnerability of the site and the river basin it is located within. The site is located within the Ribble Management Catchment with the allowances shown within Table 3 below.

Allowance Category	Total potential change anticipated for 2020s	Total potential change anticipated for 2050s	Total potential change anticipated for 2080s
Central	16%	23%	**36%**
Higher Central	19%	29%	46%
Upper End	27%	44%	71%

Table 3: Peak river flow allowances by river basin district

1.6.4 When applying peak river flow allowances for flood risk assessments the flood zone and appropriate flood risk vulnerability classification should be consulted to decide which allowances applies to the development.

1.6.5 The proposed commercial development is located within Flood Zone 1 therefore 'less vulnerable' development within Flood Zone 1 should use the central allowances. As such 36% should be applied to peak river flow to assess the maximum impact on the development.

1.7 Sustainable Drainage Systems (SUDS)

1.7.1 The key planning objectives in the NPPF are to appraise, manage and where possible, reduce flood risk.

1.7.2 Since April 2015 the Lead Local Flood Authority i.e. Lancashire County Council, is the statutory consultee for surface water flood risk in relation to planning applications. They are now the appropriate body to assess applicants/developers surface water drainage proposals and the Local Planning Authority should consult the Lead Local Flood Authority as necessary during determination of applications.

1.7.3 Sustainable Urban Drainage Systems (SUDS) are designed to reduce the potential impact of new and existing developments with respect to surface water drainage discharges, thereby providing a suitable way of achieving some of these objectives.

1.7.4 Furthermore, the NPPF and Building Regulations Approved Document H encourages developers to use SUDS wherever possible. The Flood and Water Management Act 2010 also reinforces the requirements for SUDS to be implemented where practicable.

1.7.5 The proposals are for the development of a total of approximately 40no commercial units which is classified as 'major' development. The inclusion of SUDS within the detailed drainage design is mandatory for major developments.

1.7.6 Part H of the Building Regulations requires that surface water should be discharged from new development in accordance with the following hierarchy in order of preference:

- Infiltration to the ground via soakaway
- To a watercourse
- To a public surface water sewer
- To a public combined sewer

1.8 Limitations

1.8.1 The conclusions and recommendations presented in this report are the result of our professional interpretation of the information currently available. BEK reserves the right to amend the conclusions and recommendations if further information becomes available.

1.8.2 However, it should be noted that much of the information has been derived from reports written by others and BEK takes no responsibility for the accuracy of that information. Notwithstanding the above, the reports reviewed have all been written by professional environmental consultants with a duty of care to provide relevant and accurate information.

1.9 Local Planning Policy

1.9.1 The following policy relating to flood risk has been taken from the Ribble Valley Borough Council Core Strategy 2008-2028 A Local Plan for Ribble Valley Adopted Version.

Policy DME6: Water Management

Development will not be permitted where the proposal would be at an unacceptable risk of flooding or exacerbate flooding elsewhere.

Applications for development should include appropriate measures for the conservation, protection and management of water such that development contributes to:

1. Preventing pollution of surface and / or groundwater
2. Reducing water consumption
3. Reducing the risk of surface water flooding (for example the use of sustainable drainage systems (suds))

As a part of the consideration of water management issues, and in parallel with flood management objectives, the authority will also seek the protection of the borough's water courses for their biodiversity value.

All applications for planning permission should include details for surface water drainage and means of disposal based on sustainable drainage principles. The use of the public sewerage system is the least sustainable form of surface water drainage and therefore development proposals will be expected to investigate and identify more sustainable alternatives to help reduce the risk of surface water flooding and environmental impact.

2. SITE LOCATION & DESCRIPTION

2.1 Site Location

2.1.1 The site occupies a roughly rectangular plot of agricultural land of approximately 1.5 Hectares (15,000 m^2) and is located to the south of Blackburn Road in Longridge.

2.1.2 The National Grid Reference for the centre of the site is 361570, 437155. The existing plans and site location are shown within Appendix A.

2.2 Existing Site Layout

2.2.1 The site generally falls towards the south and is currently comprised of a large agricultural field in the northern part of the site with Higher College Farmhouse and associated farm buildings located towards the south of the site.

2.3 Surrounding Land Use

2.3.1 The site is located in a predominantly rural area with grassed fields located to the west, east and south. To the north of the site there are residential dwellings with Spade Mill Reservoir located to the north-east of the site.

2.4 Proposed Site Layout

2.4.1 The proposed development plans are for the development of a number of commercial units (approximately 40no units) with associated car parking, landscaped areas and access roads.

2.4.2 The existing and proposed plans for the proposed development is included within Appendix A of this report.

3. HISTORIC FLOODING

3.1 Internet Search

3.1.1 An internet search of flooding in the Hothersall area did not result in any results however it is acknowledged that the area is essentially rural therefore historical incidents of flooding may not have been recorded.

3.1.2 A review of Ribble Valley Borough Council Strategic Flood Risk Assessment indicates that there have been a number of historical flood event in the Ribble Valley area however the Hothersall are of Longridge is not referenced as having experienced flooding.

3.2.3 A number of flooding incidents have been recorded in Ribchester located some 3.8 km south-east of the site however due to the distances involved it is not considered that the site has experienced flooding.

3.2 Environment Agency Historic Flood and Flood Outline Maps

3.2.1 The Environment Agency historic flood map and Environment Agency Flood Outline map indicates that there are no reports of historic flooding and no recorded flood outlines in the vicinity of the site.

4. SOURCES OF FLOOD RISK

4.1 Environment Agency Flood Map

4.1.1 The Environment Agency Flood Map shown within the Figure below confirms that the proposed development site is located wholly within Flood Zone 1.

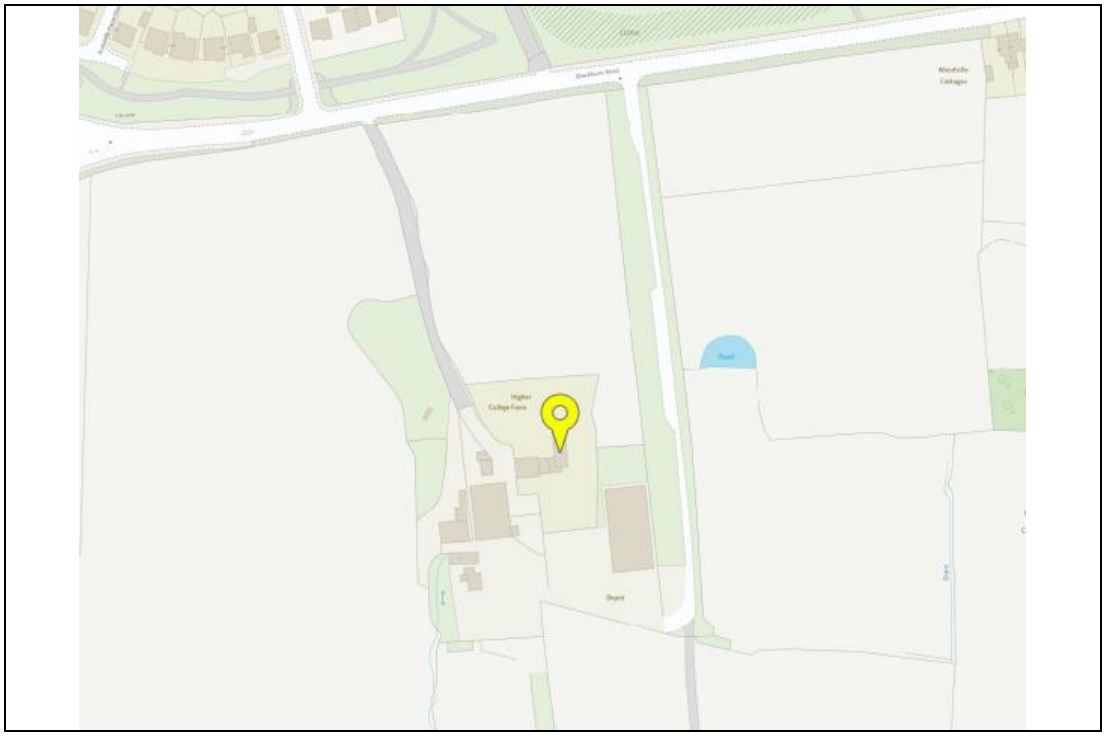
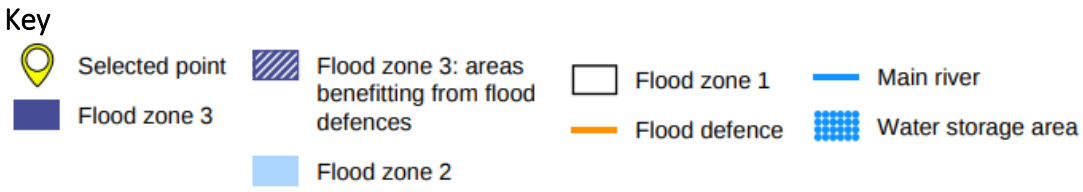


Figure 4: *Environment Agency Flood Map*



4.1.2 Flood Zone 1 is the low flood risk area and is assessed as having a less than 1 in 1000 annual probability of river or sea flooding.

4.2 Reservoir Flooding

4.2.1 The Environment Agency flooding from Reservoirs map identifies that the proposed development is within the extent of flooding following a breach of a reservoir.

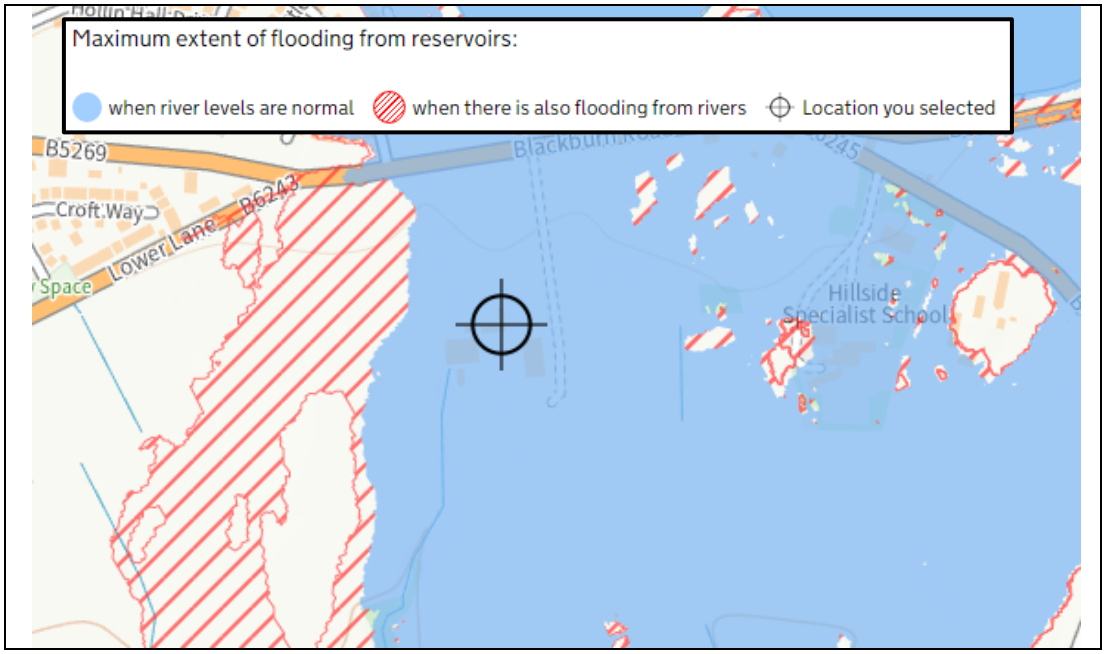


Figure 5: *Environment Agency Flood Risk from Reservoirs*

4.2.2 There are two reservoirs located in close proximity to the site located some 45 m north of the site at the closest point. The reservoirs are known as Spade Mill Reservoir No 1 and No 2 and are owned by United Utilities.

4.2.3 It is noted that reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs are regularly inspected by reservoir panel engineers and the Environment Agency ensures that reservoirs are regularly inspected and essential safety work is undertaken as appropriate. As such the risk of flooding from this source is considered to be low.

4.3 Pluvial: Surface Water Flooding

4.3.1 The Environment Agency Surface Water Flood Map indicates that the site is not at risk of surface water flooding, there is a surface water flow route which flows in a southerly direction to the west of the site. The depth of flooding from this surface water flow route during the low risk event is below 300 mm adjacent to the development site.

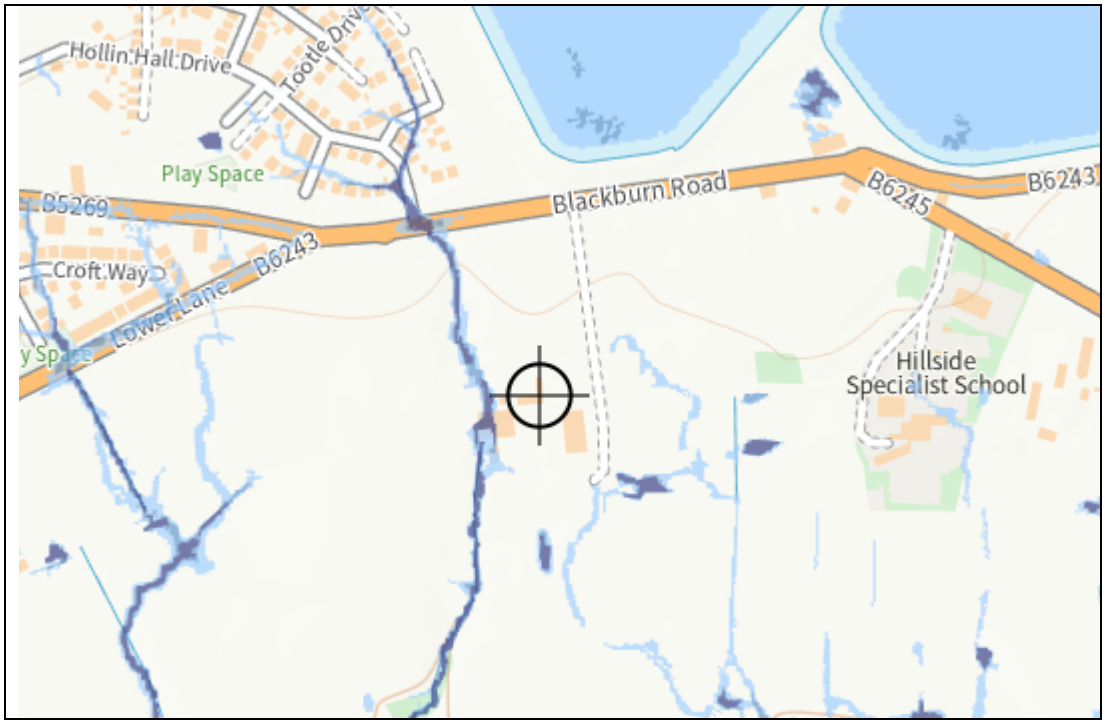
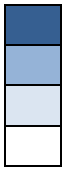


Figure 6: *Environment Agency Flood Risk from Surface Water Map*

Key



High
Medium
Low
Very Low

4.4 Groundwater

4.4.1 Groundwater flooding is caused by the emergence of water originating from beneath the ground. The water may emerge from either point or diffuse locations. The occurrence of groundwater is usually very local.

4.4.2 The risk of groundwater flooding to the site is considered to be low with the Environment Agency Groundwater Designation Map indicating that the site is underlain by superficial deposits classified as a 'Secondary Undifferentiated Aquifer'.

4.4.3 Due to the location of the site on an undifferentiated secondary superficial aquifer with a bedrock designation as a Secondary A aquifer it is not considered likely that groundwater flooding would pose a significant risk to the proposed site. Furthermore the Ribble Valley Strategic Flood Risk Assessment states that:

'Groundwater flooding is not considered by the Environment Agency to be a significant flood risk factor in the Ribble Valley Borough Council area.'

4.5 Blockage Infrastructure Failure: Bridges and Culverts

4.5.1 During flood conditions there is the potential for debris to enter the open channel sections of watercourses, and be washed downstream. An accumulation of debris at bridges and culverted sections of any watercourse may lead to blockages within structures located along the channel, causing flood water to backup.

4.5.2 Similarly should the existing bridges spanning a river fail, the capacity of the enclosed section of watercourse is likely to be greatly reduced, which again is likely to cause flood water to backup within the channel upstream from the existing bridge section.

4.5.3 It is noted that there is a land drain adjacent to the west of the site which may be partially culverted. The risk of flooding caused as a result of blockage of this culvert is considered low due to the size of the watercourse and the freeboard between the watercourse and the site. Furthermore, periodical maintenance of the watercourse should further reduce the risk of flooding caused by a blockage of infrastructure in the vicinity of the site.

5. QUANTITATIVE FLOOD RISK ASSESSMENT

5.1 Environment Agency Flood Map

5.1.1 The proposed development site is located within Flood Zone 1 of the Environment Agency Flood Map for Planning. Flood Zone 1 is defined as land with a low probability (less than 1 in 1000 year (<0.1% AEP) annual probability of river or sea flooding in any year. As such the risk to the site from fluvial flooding is considered to be low.

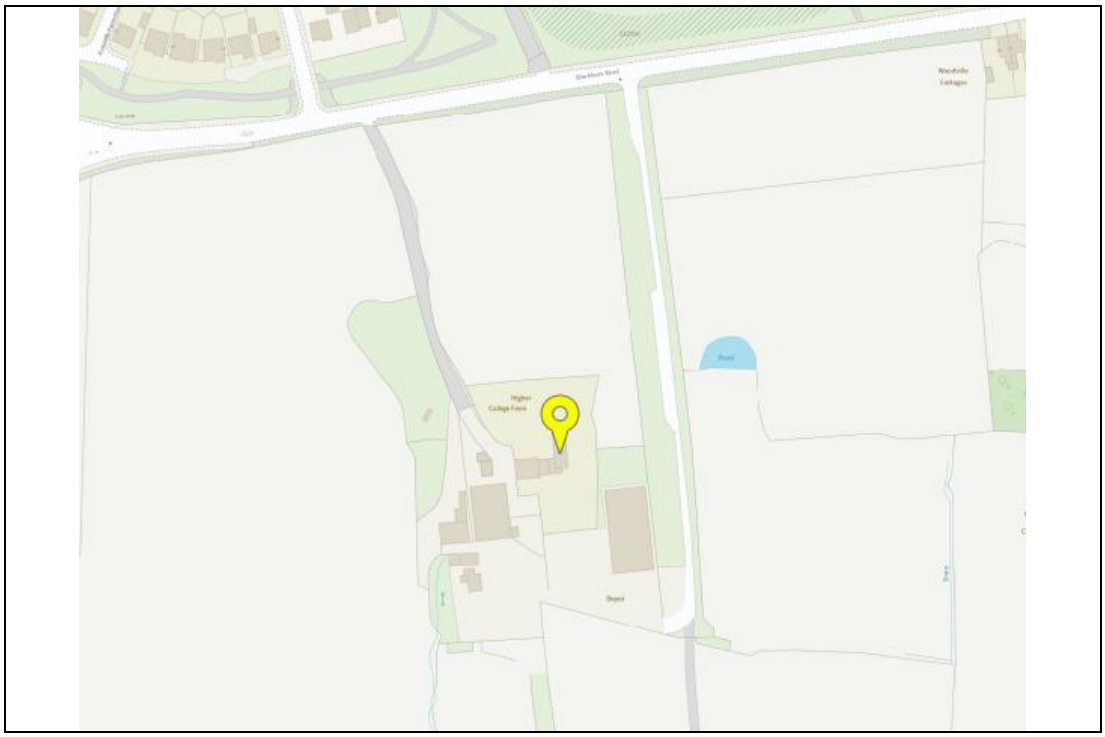


Figure 4: *Environment Agency Flood Map*

6. SURFACE WATER DRAINAGE

6.0.1 The purpose of this section is to provide information on how the site can discharge of surface water created as a result of the development without increasing flood risk at both the site and downstream of the site.

6.0.2 Indicative discharge rates and indicative attenuation volumes have been included within this assessment. The existing site is largely greenfield land with a relatively small impermeable area therefore the greenfield runoff rate has been used for indicative drainage design purposes to give a worst case scenario however this should be re-assessed at the detailed design stage of the project.

6.1 Surface Water Drainage Hierarchy

6.1.1 The hierarchy for disposal of surface water from new developments is outlined within the Buildings Regulations Approved Document H and specifies the following methods in order of preference:

- Infiltration via soakaway or other suitable infiltration device
- Discharge to watercourse
- Discharge to public surface water sewer
- Discharge to public combined sewer

6.2 Infiltration

6.2.1 Site investigation information is not currently available. Therefore in order to assess the potential for infiltration methods to dispose of surface water from the site, a desk top investigation of the general ground conditions within the local vicinity of the site has been undertaken.

6.2.2 A review of historical borehole logs from the British Geological Society website shows there are a number of publicly available borehole records within close proximity to the development site associated with the Spade Mill Reservoir. The boreholes generally identified ‘soft brown sandy clay’.

6.2.3 Information from the National Soil Resource Institute details the development area as being situated on ‘slowly permeable seasonally wet acid loamy and clayey soils with impeded drainage’.

6.2.4 Due to the underlying soils it is considered that disposal of surface water from the proposed development via infiltration is unlikely to be feasible. However the Lead Local Flood Authority may request additional evidence that infiltration is unviable at the site.

6.3 Watercourse

6.3.1 If discharge of surface water from the site via infiltration is not viable then discharge to watercourse should be investigated.

6.3.2 The nearest watercourse to the site is a land drain which flows along the western boundary of the site in a southerly direction. The watercourse eventually discharges into the River Ribble some 3.7 km south of the site.

6.3.3 It is proposed that surface water is discharged into this land drain at existing greenfield runoff rates.

6.4 Surface Water Drainage Design Criteria

6.4.1 There is a requirement to ensure that the surface water drainage for the development does not increase flood risk at the site or downstream of the site.

6.4.2 The proposed drainage design for the site will be completed at the detailed design stage of the project however the following criteria for designing surface water drainage systems for new development have been extracted from the Joint DEFRA/EA R&D Technical Report 'Preliminary Rainfall Runoff Management for Developments' (SC030219) published in October 2013.

1. Discharge Rate

The Environment Agency normally require that, for the range of annual flow rate probabilities, up to and including the 1% annual probability (1 in 100 year event) the developed rate of runoff into a watercourse should be no greater than the undeveloped rate of runoff for the same event based on the calculation of QBAR or QMED and the use of FSSR growth curves.

Exceptions only apply where it is not practical to achieve this due to either constraints on the size of the hydraulic control unit, or excessive storage volumes. The purpose of this is to retain a natural flow regime in the receiving watercourse and not increase peak rates of flow for events of an annual probability greater than 1%. Three annual probabilities are used to define discharge compliance limits though the critical criteria are for the lowest and highest frequency events; 100% (1 year), 3.33% (30 year) and 1% (100 year).

2. 1 in 1 year Design Event

The 1 in 1 year event is the highest probability event to be specifically considered to ensure that flows to the watercourse are tightly controlled for frequent events to provide good morphological conditions.

3. 1 in 30 year Design Event

The 1 in 30 year event is of importance because of its linkage with the level of service requirement of Sewers for Adoption 6th Edition, which requires that surface water sewers should be capable of carrying the 1 in 30 year flows generated by a development within the system without causing flooding to any part of the site.

4. 1 in 100 year Design Event

The 1 in 100 year event has been selected since it represents the boundary between high and medium risks of fluvial flooding defined by the National Planning Policy Framework (2012) and also recognises that it is not practicable to fully limit flows for the most extreme events. Also Sewers for Adoption 6th Edition recognises that, during extreme wet weather, the capacity of surface water sewers may be inadequate.

Sewers for Adoption 6th Edition requires that the site layout should be such that internal property flooding does not result, by demonstrating safe above ground flow paths.

The return period for this analysis is not specified, but it is recommended that 1% annual probability event (i.e. an event with a return period of 100 years) is used.

5. Flood Flows

Runoff up to the 1 in 100 year return period should preferably be managed within the site at designated temporary storage locations unless it can be shown to have no material impact by leaving the site in terms of nuisance or damage, or increase river flow during periods of fluvial flooding. Analysis for overland flood flows within the site will need to use appropriate duration events which may be different to critical events for designing surface water control storage structures.

6. Surface Water Runoff Volume

Theoretically the surface water runoff volume from a site should be limited to the greenfield runoff volume for all event frequencies.

However this is technically extremely difficult to achieve and therefore compliance to two criteria on runoff volume is required.

a. Interception: Where possible, infiltration or other techniques are to be used to try and achieve zero discharge to receiving waters for rainfall depths up to 5 mm.

b. Additional Runoff Due to Development: The difference in runoff volume pre- and post-development for the 100 year 6 hour event, (the additional runoff generated) should be disposed of by way of infiltration, or if this is not feasible

due to soil type, discharged from the site a flow rates below 2/l/s/ha, unless Point 8 (see below) is applicable to the development.

7. Climate Change

In accordance with Table 2 of Flood Risk Assessment: climate change allowances issued in February 2016 by the Environment Agency, a 20% increase to rainfall intensities should be applied for development with a lifetime up to 2115 for the central allowances; and 40% for the upper allowances.

Commercial development is generally expected to have a design life of 85 years; and as such an additional 20% and 40% must be applied within the drainage design for the proposed development situated at Higher College Farmhouse, Longridge.

8. Minimum Limit of Discharge Rate

A practicable minimum limit of discharge rate from a flow attenuation device is often a compromise between attenuating to a satisfactorily low flow rate while keeping the risk of blockage to an acceptable level.

This limit is set to a minimum of 2 l/s, using an appropriate vortex or other flow control device.

Where sedimentation could be an issue, the minimum size of orifice for controlling flow from an attenuation device should normally be 150 mm laid at a gradient not flatter than 1 in 150, which meets the requirements of Sewers for Adoption 6th Edition.

9. Urban Creep

Urban creep is now an acknowledged issue which results in an increase in runoff from an estate over time. An allowance should be made by factoring the impermeability percentage by 1.1 (10% increase) unless a more precautionary requirement is specified by the local planning authority.

6.6 Sustainable Drainage Systems (SUDS)

6.6.1 In accordance with the Flood and Water Management Act 2010; there is a requirement to incorporate sustainable drainage systems i.e. SUDS into new development.

6.6.2 The main objective for the inclusion of SUDS is treatment and control of runoff as near to the source as possible, protecting downstream habitats and enhancing the amenity value of the site and surrounding area.

6.6.3 Undertaking an assessment using the assessment criteria provided within CIRIA C697 'The SUDS Manual' and its companion document CIRIA C522 'SUDS Design Manual for

England and Wales' revealed that a number of different methods would be suitable for inclusion within the proposed drainage strategy for the development.

6.6.4 Reviewing various SUDS methods which may be included within a detailed drainage strategy for the development; it is advised that all methods are considered suitable however space constraints within the development may make some SUDS unviable.

6.6.5 A summary of the evaluation process is tabulated in the table below.

SUDS Group	Type	Comment
Retention	Pond	May be used to attenuate surface water runoff prior to discharge into receiving watercourse. Outflows regulated using a Hydrobrake or orifice plate flow control. Able to provide amenity value; however there may be local issues relating to safety.
	Sub-surface Storage	Large diameter pipes/culverts, concrete storage tank; shallow geocellular storage crate systems; can be used to attenuate surface water runoff, and also to reduce the potential land required for open surface attenuation structures such as ponds and basins.
Wetland	Shallow Wetland	Extended detention wetlands are mainly utilised where significant pollution removal would be required; and as such other types of wetland are more suited to residential development sites. A wetland is considered the most appropriate solution for attenuation at surface level, in areas where there are high groundwater levels; and the base of the structure intersect groundwater to provide a permanent body of water.
	Extended Detention Wetland	
	Pond	
	Pocket Wetland	
	Submerged Gravel	
	Wetland Channel	
Infiltration	Infiltration Trench	It is considered that infiltration is unlikely to be viable at this stage of the study however this may need to be confirmed via a ground investigation and percolation testing.
	Infiltration Basin	
	Soakaway	
Filtration	Surface sand filter	Sand filters are not commonly used within the UK; and although suitable for use within a residential setting are more widely used for development which may require high pollutant removal. Bioretention systems (rain gardens) are aimed at managing and treating runoff from frequent rainfall events; can be incorporated into landscape features; and connected to a drainage
	Sub-surface sand filter	
	Bioretention	
	Filter Trenches	

		system in the event that disposal via infiltration is not feasible. Filter strips and trenches are commonly used adjacent to large impermeable areas such as roads and car parks to provide significant volumes for attenuation purposes.
Detention	Detention Basin	In its basic form, a detention basin is used to manage water quantity while having a limited effectiveness in protecting water quality, unless it includes a permanent pool feature. Designed normally to remain dry unless required to attenuate surface water runoff, such features may provide usable space for leisure activities during dry weather; and be operational only during periods when attenuation of surface water is required.
Swales	Conveyance Swale	Swales are linear vegetated conveyance structures, which are designed to promote low flow velocities in order to provide pollutant removal; and can replace conventional gullies and drainage pipes, when located adjacent to roads. It is noted that the land take required for swales is relatively high and therefore would be unlikely to be viable for the site.
	Enhanced Dry Swale	
	Enhanced Wet Swale	
Source Control	Green Roof	Provides interception storage for first flush of rainfall; and can act to offset any increase in surface water runoff volume generated as a result of the development
	Rainwater Harvesting	
	Permeable Paving	Due to the underlying ground conditions, infiltration is not considered viable for the development however permeable paving may be used for attenuation purposes prior to discharge into the receiving watercourse, or sewer; and is ideally placed within shared driveway area, or car park area.

Table 4: *Initial SUDS Appraisal*

6.6.6 Large diameter pipes, or box culvert arrangements, should be sited within estate roads, or public open spaces, to maintain access for inspection and/or maintenance.

6.6.7 Tank systems for attenuation purposes should be sited within public open space or under car park areas. Permeable paving may be utilised within the development within hardstanding areas to provide infiltration to ground if ground conditions allow, or for treatment and attenuation of flow.

6.6.8 Bioretention areas or rain gardens could be placed within the landscaped areas; and may be used as source control elements i.e. within individual plots. Propriety systems such as Hydro-Biocell or other similar products may be installed in areas where space is a premium, and utilises the natural catchment action of vegetation and the infiltration capacity of specially engineered soils.

6.6.9 If it is deemed that infiltration at the development site is viable then infiltration methods such as infiltration trenches, infiltration basins or soakaways should be used to dissipate surface water into the ground. Soakaways are required to be located at least 5 m from any buildings and at least 10 m apart.

6.7 SUDS – Design Considerations

6.7.1 It is good engineering practice to design drainage systems in accordance with Sewers for Adoption 6th Edition; Building Regulations Approved Document H and other statutory requirements, as appropriate.

6.7.2 During the 1 in 1 year event, flow must be retained within the pipes and manholes of the drainage system. Surcharging, but no surface water flooding is permitted during the 1 in 30 year rainfall event, and some surface flooding is allowed during the 1 in 100 year plus climate change event, however it is noted that levels within the site should be designed to prevent flood water migrating beyond the development boundary, in order to prevent an increase in flood risk to others.

6.8 Maintenance

6.8.1 For drainage elements such as open attenuation structures, or ponds, the Developer will maintain overall responsibility for inspection and maintenance, and as such it is recommended that a contract to undertake such works on a regular basis with a suitably qualified professional is set up and begins upon completion of the project.

6.8.2 During the detailed design stage a Maintenance Plan should be developed using guidance from CIRIA RP992 The SUDS Manual.

6.9 Preliminary Drainage Design

6.9.1 The purpose of this assessment is to demonstrate that a surface water drainage strategy is feasible for the development proposals and land available.

6.9.2 The existing site is comprised of an existing farmhouse with associated buildings and hardstanding and a large agricultural field. Therefore flows leaving the development site will be restricted to existing greenfield runoff rates using a flow control; and excess flows must be attenuated within the new drainage system prior to discharge into the land drain/culverted watercourse which runs adjacent to the west of the site.

6.9.3 It is proposed that foul from the new commercial buildings will be pumped to a receiving foul sewer located towards the north of the site.

6.10 Discharge Rates

6.10.1 The existing site is comprised of a detached residential dwelling with large areas of grassed and woodland areas. It is recommended that a CCTV survey of the existing drainage system serving the site is undertaken prior to the detailed design stage with the CCTV survey used to inform discharge rates, however greenfield runoff rates have been estimated to provide an indication of discharge rates from the site.

6.10.2 Greenfield runoff rate limits are required to meet the normal best criteria in line with the Environment Agency Guidance Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 Rev. E (2012) and the CIRIA SUDS Manual (2007).

6.10.3 Utilising the HR Wallingford Greenfield Runoff Estimation for Sites website greenfield runoff rates have been calculated for the 1 in 1 year, 1 in 30 year and 1 in 100 year return periods, and a summary of the results is tabulated below.

6.10.4 Flows in excess of this must be attenuated within the boundary of the development prior to disposal.

Return Period	Q_{bar}	Peak Flow Rate Site
1 in 1 year	13.41	11.66
1 in 30 year		22.79
1 in 100 year		27.89

***Table 5**: Existing Surface Water Runoff (1.5 Hectares)*

6.11 On-site Storage Requirements

6.11.1 The proposed development site is for commercial use comprising a total impermeable area of 1.08 Hectares which represents 72% of the total site area.

6.11.2 Using the Surface Water Storage Requirement module on HR Wallingford website indicative attenuation volumes for the 1 in 100 year event has been calculated below. An additional 20% and 40% has been added to account for climate change over the lifetime of the development.

Return Period	Indicative Attenuation Volumes (m^3)		
	No Climate Change	20% Climate Change	40% Climate Change
1 in 100 year	532	724	917

***Table 6:** Indicative Attenuation Volumes (1.08 Hectares Impermeable)*

6.11.3 The figures calculated above are indicative at this stage of the project and should not be used for detailed design purposes.

6.11.4 As such it is considered that a geocellular storage tank of 29 m x 28 m and a depth of 1.2 m at 95% porosity would be sufficient to attenuate flows on site for the 1 in 100 year plus 40% climate change rainfall event prior to discharge at greenfield runoff rates.

6.11.5 Alternatively, a mixture of attenuation and SUDS structures such as oversized pipes, swales, permeable paving and attenuation storage tanks could be utilised within the site to attenuate surface water prior to discharge.

6.12 Foul Discharge

6.12.1 At the time of writing the foul connection for the existing buildings on site are unknown however engineering judgment suggests that it is likely that there is an existing connection from the dwelling to a combined or foul sewer within Blackburn Road to the north (via a pump due to the level differences) or there is a septic tank or package treatment plant.

6.12.2 It is proposed that foul from the site is discharged into the pubic sewer network if available or into a suitably sized package treatment plant prior to discharge into the watercourse located south-west.

7. MITIGATION MEASURES

7.1 Finished Development Levels

7.1.1 The Environment Agency Flood Map indicates that the site is located wholly within Flood Zone 1. As such finished development levels are not required to be raised.

7.2 Access and Egress

7.2.1 In accordance with the requirements set out within the National Planning Policy Framework, it is essential to ensure that the route into and out of the application site will not present a danger to people during a flood event.

7.2.2 The Environment Agency flood map shows that the access route into and out of the red-line boundary of the site is located in Flood Zone 1 and therefore would remain dry during the 1 in 100 year plus climate change flood event and extreme 1 in 1000 year event.

8. CONCLUSIONS & RECOMMENDATIONS

8.1 The proposed development at Higher College Farm, Hothersall, Longridge comprises the development of a number of commercial units and conversion of existing residential dwelling to offices.

8.2 The site is shown to be located within Flood Zone 1 of the Environment Agency Flood map.

8.3 The primary source of flood risk to the site is identified to be from an increase in surface water as a result of development.

8.4 Secondary sources such as artificial water sources, groundwater flooding and fluvial flooding have been investigated and are deemed to present a low risk of flooding to the site.

8.5 Discharge via infiltration at the site is not considered to be viable therefore discharge into watercourse has been investigated. The nearest watercourse is a land drain located to the south-west of the site. As such surface water should discharge to the watercourse/land drain in accordance with the surface water drainage hierarchy.

8.6 Surface water from the development will have to be attenuated on site prior to discharge.

8.7 It is recommended that a surface water drainage design is developed for the site with discharge rates and attenuation volumes stored on site via the use of SUDS prior to disposal into the receiving watercourse.

8.8 It is recommended that CCTV investigations are undertaken at detailed design stage to identify any connections which may be re-used.

8.9 Indicative discharge rates have been determined using Greenfield Runoff Estimations with the Qbar for the site estimated to be 13.41 m/s. Indicative attenuation requirements have been estimated to be 917 m^3 however these volumes should be revisited and potentially revised at the detailed design stage of the project following production of the final site layout.

8.10 It is considered that the proposed development is at low risk from all sources of flooding and that surface water as a result of development will have to be managed in accordance with current practices and guidance so as not to increase the risk of flooding at the site or downstream of the site.

APPENDIX A

Proposed Plans

Legend

A	30x15M building providing 5 No. units with potential for first floor / mezzanine
B	30x15M building providing 5 No. units with potential for first floor / mezzanine
C	54x12M building providing 9 No. units with potential for first floor / mezzanine
D	18x9M building providing 3 No. smaller units with spacious south /west external forecourt. (This could be ideal for use a gym, opposite to the proposed treatment rooms/ offices, with a south facing external terrace and potential for first floor / mezzanine)
E	42x9M building providing 7No. units with double frontages which are ideal for craft based artisan uses. The eastern units would benefit from a large south/ east facing terrace and garden. This is close to the offices and with potential for first floor / mezzanine.
F	15x5M single storey extension wing to the existing house to provide additional office space
G	24x6M single storey extension to the existing house to provide additional office, or treatment rooms
H	Existing house to be converted into offices
I	Carport/ garage to be converted into meeting room suite
J	18x9M building providing 3No. units with potential for first floor / mezzanine.
K	18x10.5M building providing 3No. units with potential for first floor / mezzanine
L	18x12M building providing 3No. units with potential for first floor / mezzanine
M	Retain existing access and drive off Lower Road to maintain existing access arrangements for farmer on to adjacent fields only. New gateway installed to separate this with the new roads serving the main development
N	South facing central courtyard to organise the various new buildings and create a space and synergy for various uses to work together and attract visitors. This is an important part of the whole design concept, and a considered hard and soft landscaping scheme would encourage all year around use for the businesses to display/ operate.
O	Open grassed area to character and appearance of the attractive rural setting with Wildflower Meadow areas planted, to enhance wildlife and fauna
P	Parking and forecourt areas with electric car charging points installed with PV solar panels on south facing roofs as part of the sustainable aims for this development. Designated secure bicycle parking areas are to be provided within the development site to encourage sustainable forms of transport.
Q	New development roads to link with the existing drive to continue to serve the southern part of the site including the house conversion
R	Existing hedgerow to be retained
S	Pedestrian crossing
T	Position for new tree planting
U	New hedgerow planted
V	Proposed new vehicular access serving the proposed development

REV A Ex. drive retained for access to the house and various associated layout changes. Schedule updated 18/10/2021 SGH

REV B Internal road altered and parking area adjacent Building E increased. Car charging points added and wild flower areas added 27/10/21

REV C Sedum roof added to Building I 24/11/2021

REV D Entrance arrangements updated 09/12/12

REV E Bin store compounds added Access changed 13/12/21 SGH

REV F Bin store / parking next to the house altered to suit swept path study 16/12/21 SGH

REV G Additional trees and green areas added as per pre-app comments 31/03/22 SGH

Client
Ribble Valley Property Ltd

Job Title
Proposed Development of Land at Higher College Farm Longridge

Drawing Title
Proposed Site Layout Plan

Scale	Date	Drawn
1/500 @ A1	Sept. 2021	SGH

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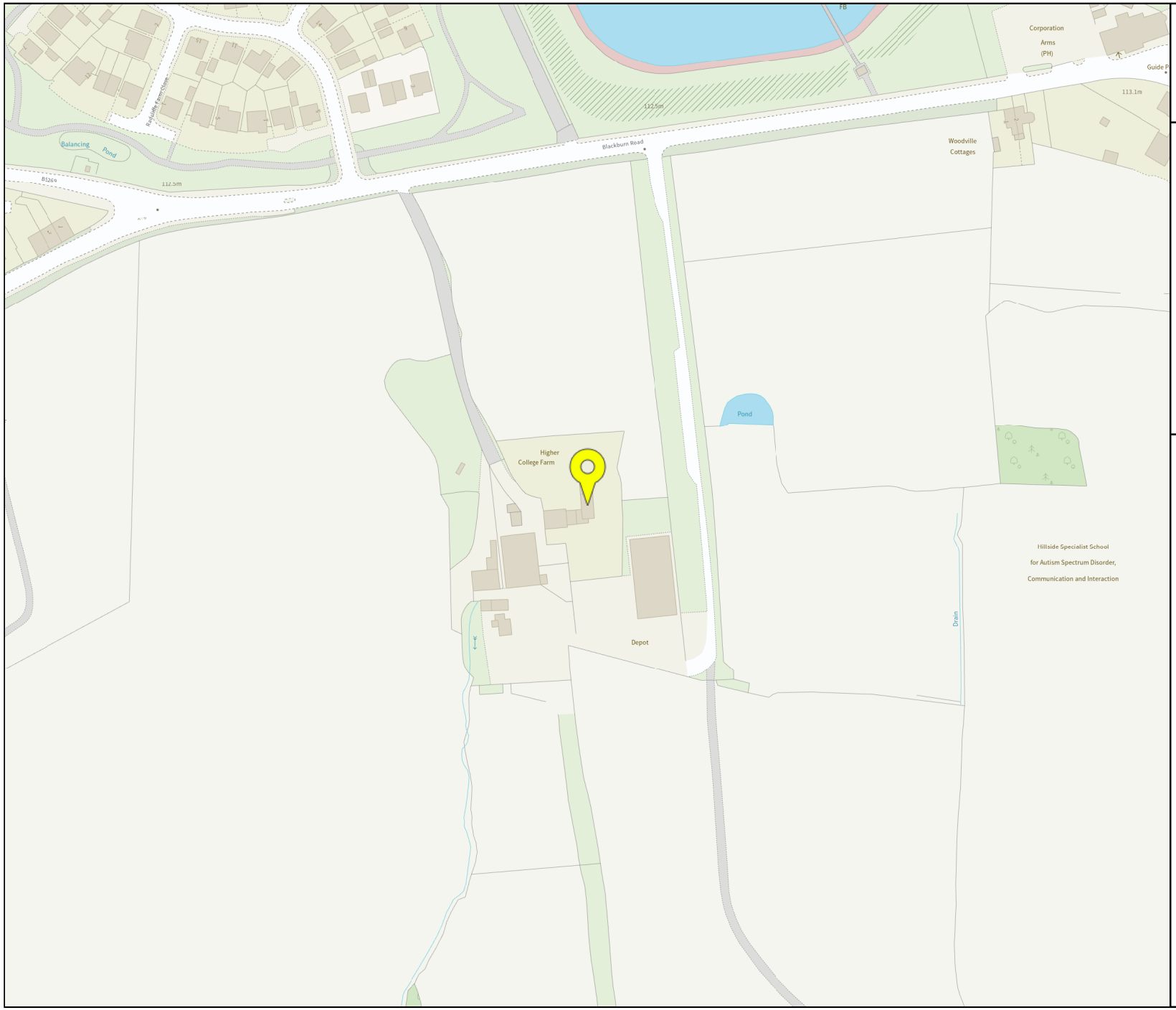
APPENDIX B

Environment Agency Flood Map



Environment Agency

Flood map for planning

Your reference
Hothersall

Location (easting/northing)
361578/437099

Scale
1:2500

Created
6 May 2022 15:00

- Selected point
- Flood zone 3
- Flood zone 3: areas benefitting from flood defences
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

0 20 40 60m

APPENDIX C

Greenfield Runoff Estimation

Print | Close Report

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	
Site name:	Higher College
Site location:	Longridge

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.82938° N
Longitude:	2.58538° W
Reference:	1900011216
Date:	May 13 2022 09:28

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 1.5

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics	Default	Edited
SAAR (mm):	1185	1185
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	13.41	13.41
1 in 1 year (l/s):	11.66	11.66
1 in 30 years (l/s):	22.79	22.79
1 in 100 year (l/s):	27.89	27.89
1 in 200 years (l/s):	31.77	31.77

APPENDIX D

Indicative Surface Water Attenuation Requirements

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	
Site name:	Higher College
Site location:	Longridge

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	53.82926° N
Longitude:	2.58538° W
Reference:	321508602
Date:	May 13 2022 09:33

Site characteristics

Total site area (ha):	1.5
Significant public open space (ha):	0
Area positively drained (ha):	1.5
Impermeable area (ha):	1.08
Percentage of drained area that is impermeable (%):	72
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	1.5
Net impermable area for storage volume design (ha):	1.14
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Design criteria

Climate change allowance factor:	1.0
Urban creep allowance factor:	1.1
Volume control approach	Use long term storage
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	2

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
SPR:	0.47	0.47

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	70
Rainfall 100 yrs 12 hrs:	--	99.96
FEH / FSR conversion factor:	1.19	1.19
SAAR (mm):	1185	1185
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.3	0.3
Hydological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 10 year:	1.38	1.38
Growth curve factor 30 year:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Q_{BAR} for total site area (l/s):	13.41	13.41
Q_{BAR} for net site area (l/s):	13.41	13.41

Site discharge rates	Default	Edited	Estimated storage volumes	Default	Edited
1 in 1 year (l/s):	11.7	11.7	Attenuation storage 1/100 years (m^3):	532	532
1 in 30 years (l/s):	22.8	22.8	Long term storage 1/100 years (m^3):	111	111
1 in 100 year (l/s):	27.9	27.9	Total storage 1/100 years (m^3):	643	643

This report was produced using the storage estimation tool developed by HRWallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at http://uksuds.com/terms-and-conditions.htm. The outputs from this tool have been used to estimate storage volume requirements. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	
Site name:	Higher College
Site location:	Longridge

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	53.82926° N
Longitude:	2.58538° W
Reference:	2304901877
Date:	May 13 2022 09:32

Site characteristics

Total site area (ha):	1.5
Significant public open space (ha):	0
Area positively drained (ha):	1.5
Impermeable area (ha):	1.08
Percentage of drained area that is impermeable (%):	72
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	1.5
Net impermable area for storage volume design (ha):	1.14
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Design criteria

Climate change allowance factor:	1.2
Urban creep allowance factor:	1.1
Volume control approach	Use long term storage
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	2

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
SPR:	0.47	0.47

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	70
Rainfall 100 yrs 12 hrs:	--	99.96
FEH / FSR conversion factor:	1.19	1.19
SAAR (mm):	1185	1185
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.3	0.3
Hydological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 10 year:	1.38	1.38
Growth curve factor 30 year:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Q_{BAR} for total site area (l/s):	13.41	13.41
Q_{BAR} for net site area (l/s):	13.41	13.41

Site discharge rates	Default	Edited	Estimated storage volumes	Default	Edited
1 in 1 year (l/s):	11.7	11.7	Attenuation storage 1/100 years (m^3):	724	724
1 in 30 years (l/s):	22.8	22.8	Long term storage 1/100 years (m^3):	111	111
1 in 100 year (l/s):	27.9	27.9	Total storage 1/100 years (m^3):	836	836

This report was produced using the storage estimation tool developed by HRWallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at http://uksuds.com/terms-and-conditions.htm. The outputs from this tool have been used to estimate storage volume requirements. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	
Site name:	Higher College
Site location:	Longridge

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	53.82926° N
Longitude:	2.58538° W
Reference:	1285174774
Date:	May 13 2022 09:31

Site characteristics

Total site area (ha):	1.5
Significant public open space (ha):	0
Area positively drained (ha):	1.5
Impermeable area (ha):	1.08
Percentage of drained area that is impermeable (%):	72
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	1.5
Net impermable area for storage volume design (ha):	1.14
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
SPR:	0.47	0.47

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	70
Rainfall 100 yrs 12 hrs:	--	99.96
FEH / FSR conversion factor:	1.19	1.19
SAAR (mm):	1185	1185
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.3	0.3
Hydological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 10 year:	1.38	1.38
Growth curve factor 30 year:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Q_{BAR} for total site area (l/s):	13.41	13.41
Q_{BAR} for net site area (l/s):	13.41	13.41

Design criteria

Climate change allowance factor:	1.4
Urban creep allowance factor:	1.1
Volume control approach	Use long term storage
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	2

Site discharge rates	Default	Edited
1 in 1 year (l/s):	11.7	11.7
1 in 30 years (l/s):	22.8	22.8
1 in 100 year (l/s):	27.9	27.9

Estimated storage volumes	Default	Edited
Attenuation storage 1/100 years (m^3):	917	917
Long term storage 1/100 years (m^3):	111	111
Total storage 1/100 years (m^3):	1028	1028