

BORAD OAK FARM, ROSSETT

DRAINAGE ASSESSMENT Final Report v1.1

November 2017

**Weetwood Services Ltd
Park House
Broncoed Business Park
Ffordd Byrnwr Gwair
Mold
CH7 1FQ**

t: 01352 700045
e: info@weetwood.net
w: www.weetwood.net

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Drainage Assessment
Final Report v1.1

Client: Cornish Hall Barns Ltd

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Prepared by: Jamie Eden BEng (Hons)
Technical Engineer

Checked and
Approved by: Adam Edgerley BSc (Hons)
Associate Director

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1 INTRODUCTION

1.1 PURPOSE OF REPORT

Weetwood Services Ltd ('Weetwood') has been instructed by Cornish Hall Barns Ltd to undertake a Drainage Assessment for the proposed development of land at Broad Oak Farm in Rossett.

1.2 STRUCTURE OF THE REPORT

The report is structured as follows:

- Section 1** Introduction and report structure
- Section 2** Presents national and local drainage planning policy
- Section 3** Provides background information relating to the development site
- Section 4** Addresses the effect of the proposed development on surface water runoff and presents an illustrative surface water drainage scheme to ensure that surface water runoff is sustainably managed and flood risk is not increased elsewhere.
- Section 5** Presents a summary of key findings
- Section 6** Presents the recommendations

2 PLANNING POLICY AND GUIDANCE

2.1 NATIONAL PLANNING POLICY

2.1.1 National Planning Policy Framework

The aim of the National Planning Policy Framework (NPPF) is to ensure that flood risk is taken into account at all stages in the planning process and is appropriately addressed.

2.1.2 House of Commons Written Statement (HCWS161), December 2014

Planning applications for major developments¹ are required² to provide Sustainable Drainage Systems (SuDS) for the management of surface water runoff, unless demonstrated to be inappropriate³ or disproportionately expensive.

SuDS aim to mimic natural drainage and can achieve multiple objectives such as removing pollutants from urban runoff at source, controlling surface water runoff from developments, and ensuring that flood risk is not increased downstream. Combining water management with green space can provide amenity and biodiversity enhancement.

2.1.2.1 DEFRA Technical Standards for Sustainable Drainage Systems, March 2015

In considering a development that includes a sustainable drainage system, the local planning authority will need to be satisfied that the proposed minimum standards of operation are appropriate and that there are clear arrangements in place for ongoing maintenance.

According to Technical Standards⁴ published by DEFRA, surface water drainage systems must be designed so that:

- Flooding does not occur on any part of the site for a 1 in 30 annual probability rainfall event, unless an area is designed to hold and/or convey water as part of the design;
- Flooding does not occur in any part of a building during a 1 in 100 annual probability event; and
- Flows resulting from rainfall in excess of a 1 in 100 annual probability rainfall event are managed in exceedance routes that minimise the risks to people and property, so far as is reasonably practicable.
- For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.

¹ Developments of 10 dwellings or more; or equivalent non-residential or mixed development (as set out in Article 2(1) of the Town and Country Planning (Development Management Procedure) (England) Order 2010)

² Written Statement (HCWS161) made by the Secretary of State for Communities and Local Government (Mr Eric Pickles) on 18 December 2014

³ Paragraph 082 (Reference ID: 7-082-20150323) of the Planning Practice Guidance outlines how a sustainable drainage system might be judged to be inappropriate

⁴ Non-Statutory Technical Standards for Sustainable Drainage Systems, DEFRA, March 2015

- Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event
- Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

2.2 LOCAL PLANNING POLICY AND GUIDANCE

Policy EC13 Surface Water Run-off of the Wrexham Unitary Development Plan (UDP) 1996 - 2011 states:

'Development which would result in an unacceptable adverse impact on the water environment due to additional surface water run-off will not be permitted

5.18 Development on green field sites usually results in an increase in the amount of impermeable land. This can alter the natural water cycle as rates and volumes of surface water reaching a surface watercourse generally increase. Drains and sewers generally convey surface water from impermeable areas directly, or via a sewerage system, to a watercourse. Such arrangements not only reduce the natural recharge of groundwater, which wastes a valuable resource and increases pollution risk (for example from contaminated urban run-off and combined sewage overflows) but can also increase river flows. Increased river flows can cause physical damage to the banks and bed of a watercourse, and increase the risk of flooding.

5.19 Wherever practicable surface water should be disposed of as close to the source as possible. Where potential risks are identified appropriate flow attenuation facilities or mitigation measures may be a pre-requisite for development. Consideration should be given to the use of softer engineering structures referred to as Sustainable Urban Drainage Systems (SUDS). SUDS is a concept that focuses decisions about drainage design, construction and maintenance on the quality of the receiving environment and people. SUDS are physical structures built to receive surface water runoff. They typically include swales, ponds, infiltration basins and porous surfaces and should be considered as alternatives to conventional drainage where appropriate. The Environment Agency Wales can provide guidance on the design of SUDS and have produced a document entitled "Protecting the Quality of Our Environment, Sustainable Urban Drainage Systems - An Introduction". The Council will require the developer to demonstrate, both financially and practically, how the long term maintenance of any attenuation facilities or mitigation measures will be achieved'.

3 SITE DETAILS AND PROPOSED DEVELOPMENT

3.1 SITE LOCATION

The site is located north-east of Cobblers Lane at Ordnance Survey National Grid Reference SJ 367 584, as shown in **Figure 1**. The site is approximately 1.27 hectares (ha) in area.

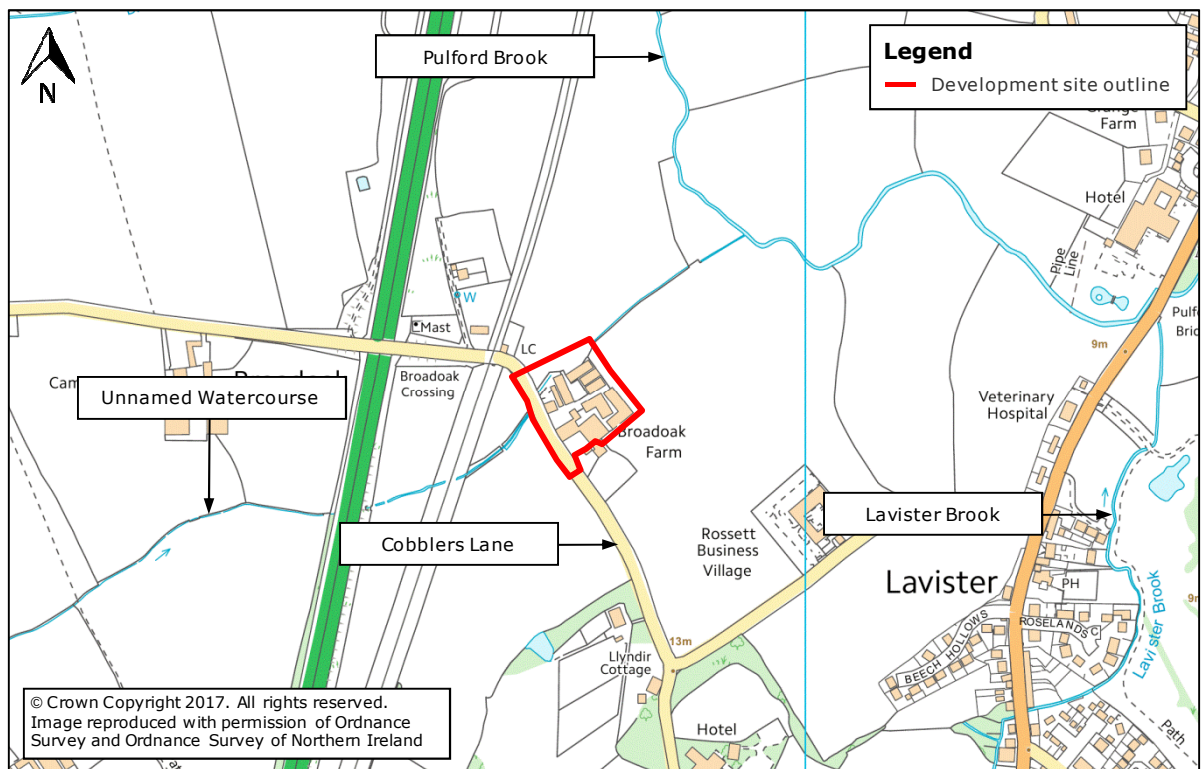


Figure 1: Site Location

3.2 EXISTING AND PROPOSED DEVELOPMENT

The site currently comprises existing agricultural buildings with associated hardstanding and landscaping.

The proposals are for the conversion of the agricultural barns into 13 residential dwellings (**Appendix A**). Several Agricultural buildings in the northern portion of the site will be retained.

3.3 WATERBODIES IN THE VICINITY OF THE SITE

An unnamed watercourse runs through the northern portion of the site via a culvert and flows in a north-westerly direction. The unnamed watercourse discharges into Pulford Brook which is located approximately 240 m to the north-east of the site.

Lavister Brook is located approximately 580 m west of the site. Lavister Brook flows in a northerly direction before discharging into Pulford Brook.

Pulford Brook and Lavister Brook are classified as 'main rivers'.

The unnamed watercourse is classified as an 'ordinary watercourse'.

3.4 GROUND CONDITIONS

According to the British Geographical Survey bedrock geology at the site is '*Kinnerton Sandstone Formation - Sandstone*' whilst superficial deposits are likely to be '*River Terrace Deposits (undifferentiated) - Sand and Gravel*'.

According to the Soilscales maps produced by the National Soils Research Institute⁵, soil conditions at the site and within the surrounding area are described as '*freely draining loamy soils*'.

BGS borehole records⁶ located approximately 220 m east of the site and 390 m north of the site indicate that ground conditions consist of an initial layer of silty sand and clay at depths to around 3 m followed by a layer of stiff clay. Groundwater was encountered at 8.6 m and 6.9 m below ground level respectively for each borehole.

3.5 SITE LEVELS

LiDAR data has been utilised to develop a digital elevation model as illustrated in **Figure 2**.

Site levels are generally shown to be in the region of 11.90 to 12.95 metres Above Ordnance Datum (m AOD) with the highest point of the site at its centre.

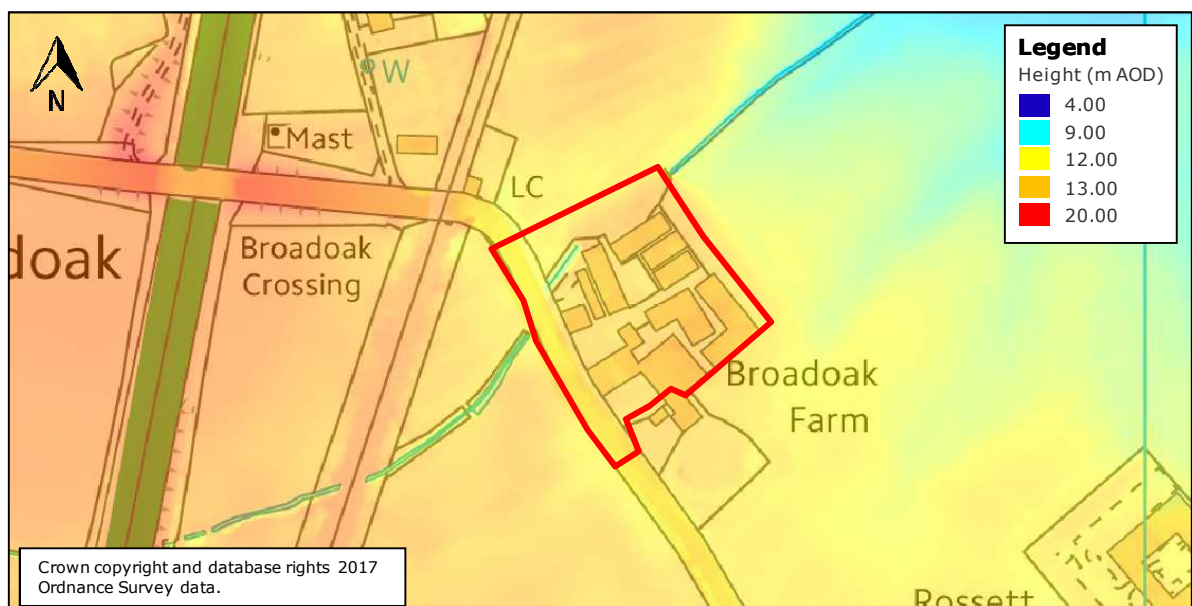


Figure 2: Digital Elevation Model

⁵ Soilscales www.landis.org.uk/soilscales/

⁶ www.bgs.ac.uk/data/boreholescans/home.html, Ref: SJ35NE65, SJ35NE22

4 SURFACE WATER MANAGEMENT

4.1 REQUIREMENTS FOR SURFACE WATER MANAGEMENT

TAN15 provides an overview of the requirements for the management of surface water to ensure that development does not increase flood risk at the site or elsewhere.

Paragraph 8.3 of TAN15 states “...the aim should be for new development not to create additional run-off when compared with the undeveloped situation, and for redevelopment to reduce runoff where possible. It is accepted that there may be practical difficulties in achieving this aim”.

4.2 SURFACE WATER DRAINAGE AT THE EXISTING SITE

The developable area (**Figure 3**) of the site has a total area of 0.61 ha of which 0.50 ha currently comprises of impermeable land.

It is understood surface water currently drains to the unnamed watercourse via a large holding tank. Further details regarding the surface water drainage network are not available at the time of writing.

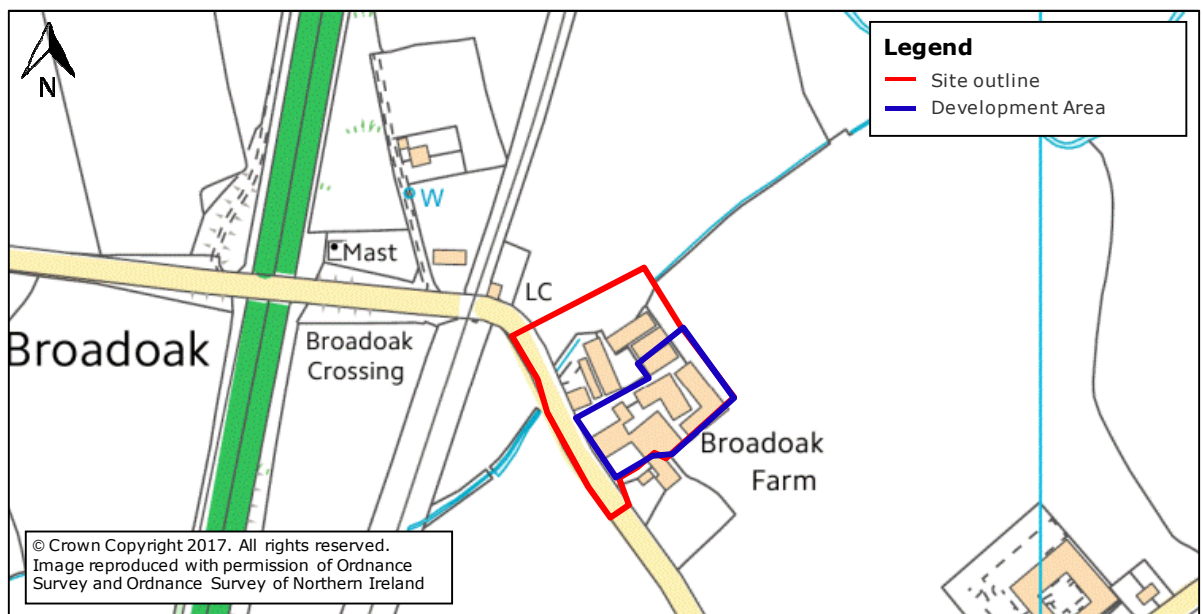


Figure 3: Development Areas

4.2.1 Surface Water Runoff Rate

The peak discharge rates of surface runoff from the existing development area have been calculated based on the Modified Rational Method (MRM) (refer to **Appendix B**) and the peak flow rates are presented in **Table 1**.

Table 1: Peak Runoff Rate - Existing Site

Annual probability of rainfall event	Discharge Rate (l/s)
1 in 1	34.8
1 in 30	85.0
1 in 100	109.0

4.3 SURFACE WATER RUNOFF FROM THE REDEVELOPED SITE

4.3.1 Site Areas

Current proposals indicate that there would be a net decrease in impermeable area at the redeveloped site, reducing from 0.50 to 0.36 ha by providing new areas of green space. The peak runoff rates for the redeveloped site have been recalculated using the MRM (**Appendix C**) as shown in **Table 2**, which indicates that they will decrease compared to the existing situation (**Table 1**) even when accounting for the impact of climate change over the lifetime of the development.

Table 2: Peak Runoff Rate – Redeveloped Site

Annual probability of rainfall event	Discharge Rate (l/s)
1 in 1	25.0
1 in 30	61.2
1 in 100	78.4
1 in 100 +CC (30%)	101.9

4.3.2 Disposal of Surface Water

Building Regulations Approved Document Part H sets out a hierarchy of preferred methods for the disposal of surface water runoff. Disposal by infiltration is preferred, followed by disposal to a watercourse, with disposal to a public sewer the least preferred option⁷.

As discussed in **Section 4.2**, the site may be underlain by soils that could be suitable for infiltration. However, given the site currently drains to the watercourse and the betterment which will be provided, it is recommended that the site continues to drain via the existing connection to the unnamed watercourse.

It should be noted that any existing impermeable areas that are to be retained, namely in the northern parts of the site, will continue to drain as per the existing situation (to the unnamed watercourse).

4.3.3 Storage Calculations

As highlighted in **Table 1** and **Table 2**, redevelopment of the site will provide betterment in terms of discharge rates for all events, even when accounting for climate change over the lifetime of the development. Furthermore, discharge volumes would also decrease given the reduction in impermeable area.

⁷ Building Regulations Approved Document H, Section 3 page 45

As such, it is considered that surface water storage should not be required in this instance given the significant betterment which will already be provided over the existing situation.

SuDS features such as rainwater harvesting, permeable paving, swales or filter drains may be incorporated into the surface water drainage strategy at the detailed design stage.

4.3.4 Maintenance of SuDS

Any SuDS elements within the curtilage of the overall development would be the responsibility of the owner of the property.

5 SUMMARY

This Drainage Assessment has been prepared on behalf of Cornish Hall Barns Ltd and relates to the proposed development of land at Broad Oak Farm, Rossett.

The site may be underlain by soils that could be suitable for infiltration. However, given the site currently drains to the watercourse and the betterment which will be provided, it is recommended that the site continues to drain via the existing connection to the unnamed watercourse.

It should be noted that any existing impermeable areas that are to be retained, namely in the northern parts of the site, will continue to drain as per the existing situation (to the unnamed watercourse).

It is considered that surface water storage should not be required in this instance given the significant betterment which will already be provided over the existing situation in relation to runoff rates and volumes.

SuDS features such as rainwater harvesting, permeable paving, swales or filter drains may be incorporated into the surface water drainage strategy at the detailed design stage.

Surface water runoff from the developed site may therefore be sustainably managed in accordance with the TAN15 and local policy.

6 RECOMMENDATIONS

This Drainage Assessment has demonstrated that the proposed development may be completed without conflicting with the requirements of TAN15 subject to the following:

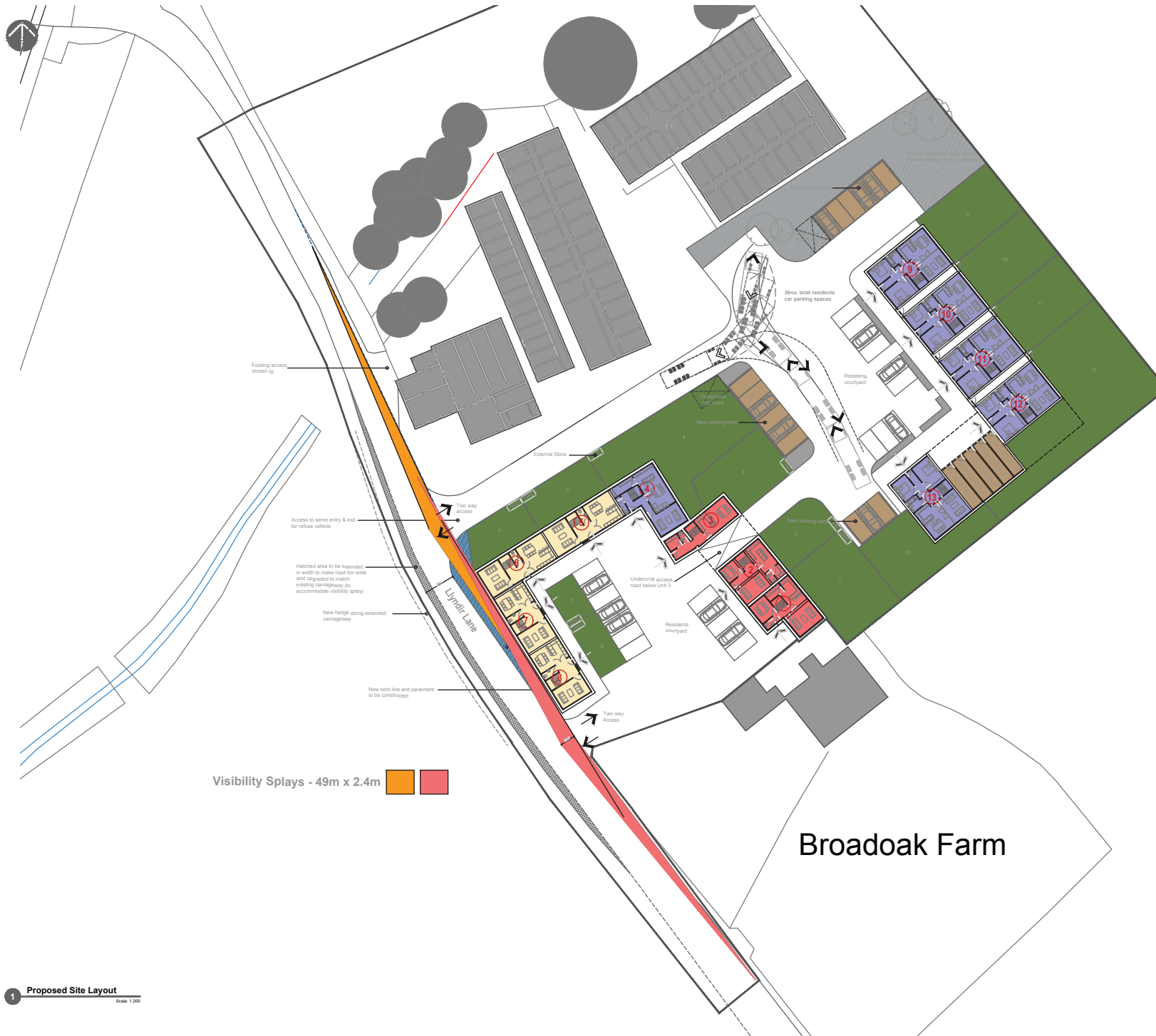
- The detailed drainage design, developed in accordance with the principles set down in this Drainage Assessment, should be submitted to and approved by the local planning authority prior to the commencement of development

APPENDIX A:

Development Proposals

Accommodation Schedule

Unit 1	Part 2/3 storey	4no. bed	138sqm (1,485sqft)
Unit 2	Part 2/3 storey	4no. bed	147sqm (1,582sqft)
Unit 3	Part 2/3 storey	4no. bed	147sqm (1,582sqft)
Unit 4	2 storey	3no. bed	120sqm (1,292sqft)
Unit 5	2 storey	2no. bed	105sqm (1,130sqft)
Unit 6	2 storey	2no. bed	102sqm (1,098sqft)
Unit 7	2 storey	2no. bed	92sqm (990sqft)
Unit 8	2 storey	2no. bed	92sqm (990sqft)
Unit 9	Part 1/2 storey	3no. bed	107sqm (1,152sqft)
Unit 10	Part 1/2 storey	3no. bed	107sqm (1,152sqft)
Unit 11	Part 1/2 storey	3no. bed	107sqm (1,152sqft)
Unit 12	Part 1/2 storey	3no. bed	107sqm (1,152sqft)
Unit 13	Part 1/2 storey	3no. bed	107sqm (1,152sqft)



Visibility Splays - 49m x 2.4m

Broad Oak Farm

APPENDIX B:

Peak Runoff Rate from Impermeable Areas - Existing Site

The Modified Rational Method⁸ has been used to calculate the runoff from the impermeable surfaces at the existing site.

The following parameters have been obtained from the maps in Volume 3 of the Wallingford Procedure:

M5-60 minute rainfall depth:	17 mm
Ratio of M5-60 to M5-2 day rainfall:	0.3
Average Annual Rainfall:	699 mm
Winter Rain Acceptance Potential/ Soil Type:	4
The Urban Catchment Wetness Index (UCWI) value:	68.2

A time of concentration of 15 minutes has been used.

A rainfall estimation calculation has been carried out to convert the M5-60 minute rainfall to the 5-minute duration rainfall for the 1 in 2, 1 in 30 and 1 in 100 annual probability rainfall events. The calculated rainfall intensities for these events are 24.47, 59.78 and 76.63 mm/hr respectively.

The flow rate as given by the Modified Rational Method is:

$$Q = 2.78 \times C_v \times C_r \times \text{rainfall intensity} \times \text{impermeable area}$$

where:

C_v is the volumetric runoff coefficient = $P_r / \text{PIMP} = 0.78$

where P_r is Percentage Runoff and PIMP is Percentage Impermeable Area

C_r is the routing coefficient = 1.3

Impermeable Area = 0.50 ha

The peak discharges of surface runoff from impermeable areas of the existing site are shown in the table below:

Peak Discharge for Impermeable Areas - Existing Site

Annual probability of rainfall event	Peak discharge for 0.69 ha impermeable area (l/s)
1 in 1	34.80
1 in 30	85.00
1 in 100	108.96

⁸ The Wallingford Procedure, Volume 4, 1981

APPENDIX C:

Peak Runoff Rate from Impermeable Areas – Developed Site

The Modified Rational Method⁹ has been used to calculate the runoff from the impermeable surfaces at the existing site.

The following parameters have been obtained from the maps in Volume 3 of the Wallingford Procedure:

M5-60 minute rainfall depth:	17 mm
Ratio of M5-60 to M5-2 day rainfall:	0.3
Average Annual Rainfall:	699 mm
Winter Rain Acceptance Potential/ Soil Type:	4
The Urban Catchment Wetness Index (UCWI) value:	68.2

A time of concentration of 15 minutes has been used.

A rainfall estimation calculation has been carried out to convert the M5-60 minute rainfall to the 5-minute duration rainfall for the 1 in 2, 1 in 30 and 1 in 100 and 1 in 100 +CC annual probability rainfall events. The calculated rainfall intensities for these events are 24.47, 59.77, 76.62 and 99.62 mm/hr respectively.

The flow rate as given by the Modified Rational Method is:

$$Q = 2.78 \times C_v \times C_r \times \text{rainfall intensity} \times \text{impermeable area}$$

where:

C_v is the volumetric runoff coefficient = $P_r / \text{PIMP} = 0.78$

where P_r is Percentage Runoff and PIMP is Percentage Impermeable Area

C_r is the routing coefficient = 1.3

Impermeable Area = 0.36 ha

The peak discharges of surface runoff from impermeable areas of the existing site are shown in the table below:

Peak Discharge for Impermeable Areas – Developed Site

Annual probability of rainfall event	Peak discharge for 0.48 ha impermeable area (l/s)
1 in 1	25.04
1 in 30	61.17
1 in 100	78.42
1 in 100 +CC (30%)	101.94

⁹ The Wallingford Procedure, Volume 4, 1981



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