SUNDERLAND PEACOCK ARCHITECTS SURVEYORS

FLOOD RISK ASSESSMENT

PROPOSED DEMOLITION OF EXISITNG STABLE BUILDING AND ERECTION OF AGRICULTURAL BUILDING AT

LAND TO NORTH EAST OF BEECH HOUSE
ALSTON LANE
LONGRIDGE
PR3 3BN

The Application site is located within an area designated as flood zone 3, with the entirety of the site being allocated as such. Planning permission was previously granted for a much larger development on the site and consisted of the construction of 4no holiday lets, with associated amenity space and parking. The flood risk assessment which was submitted with the application (application ref: 3/2017/0153) demonstrated that the flood risk of the site from all sources is low and is the equivalent of a site within flood zone 1. The report states;

"detailed analysis undertaken as part of this report has shown that the development would remain unaffected by flooding under both the 1 in 100 year and 1 in 1000 year return period flood events from both the River Ribble and adjacent watercourse. Consequently, the risk of flooding to the development can be seen to be less than is inferred by the EA's coarse flood zone mapping. In line with the EA's definition of the Flood Zones, the site is considered to be located in the equivalent of Flood Zone 1. The Development will therefore meet the requirements of the Sequential Test."

The construction of the proposed agricultural building will not worsen current site conditions in respect of flooding.

There are no other parcels of land within our client ownership which could accommodate the building and all are within flood zone 3 and are therefore no more favorable than the application site. Land not in the applicant's control or land for sale locally has not been considered as a site remote from Beech House would not be suitable for the development due to operational requirements.

The previous flood risk assessment for the site has been appended.




Client: Dewhurst Builders Ltd.

Flood Risk Assessment for the Proposed Development at Beech House, Alston Lane, Preston

February 2018

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Client: Dewhurst Builders Ltd.

Flood Risk Assessment for the Proposed Development at Beech House, Alston Lane, Preston

Contents Amendment Record

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1 Background and Scope of Appraisal

Flooding is a major issue in the United Kingdom. The impacts can be devastating in terms of the cost of repairs, replacement of damaged property and loss of business. The objectives of the Flood Risk Scoping Assessment (FRSA) are therefore to establish the following:

- whether a proposed development is likely to be affected by current or future flooding from any source
- whether the development will increase flood risk elsewhere within the floodplain
- whether the measures proposed to deal with these effects and risks are appropriate
- whether the site will pass the second element of the Exception Test (where appropriate).

Herrington Consulting has been commissioned by Dewhurst Builder Ltd to prepare a Flood Risk Assessment (FRA) for the proposed development at **Beech House, Alston Lane, Longridge, Preston, PR3 3BN**.

This appraisal has been undertaken in accordance with the requirements of the National Planning Policy Framework (March 2012) and the National Planning Practice Guidance Suite (March 2014) that has been published by the Department for Communities and Local Government. The *Flood Risk and Coastal Change* planning practice guidance included within the Suite represents the most contemporary technical guidance on preparing FRAs. In addition, reference has also been made to Local Planning Policy.

To ensure that due account is taken of industry best practice, this FRA has been carried out in line with the CIRIA Report C624 'Development and flood risk - guidance for the construction industry'.

2 Development Description and Planning Context

2.1 Site Location and Existing Use

The site is located at OS coordinates 584292, 144104, off Alston Lane in Preston. In total the site covers an area of approximately 0.13 hectares and currently comprises of a single-story barn with an access road. The location of the site in relation to the surrounding area and the River Ribble is shown in Figure 2.1.

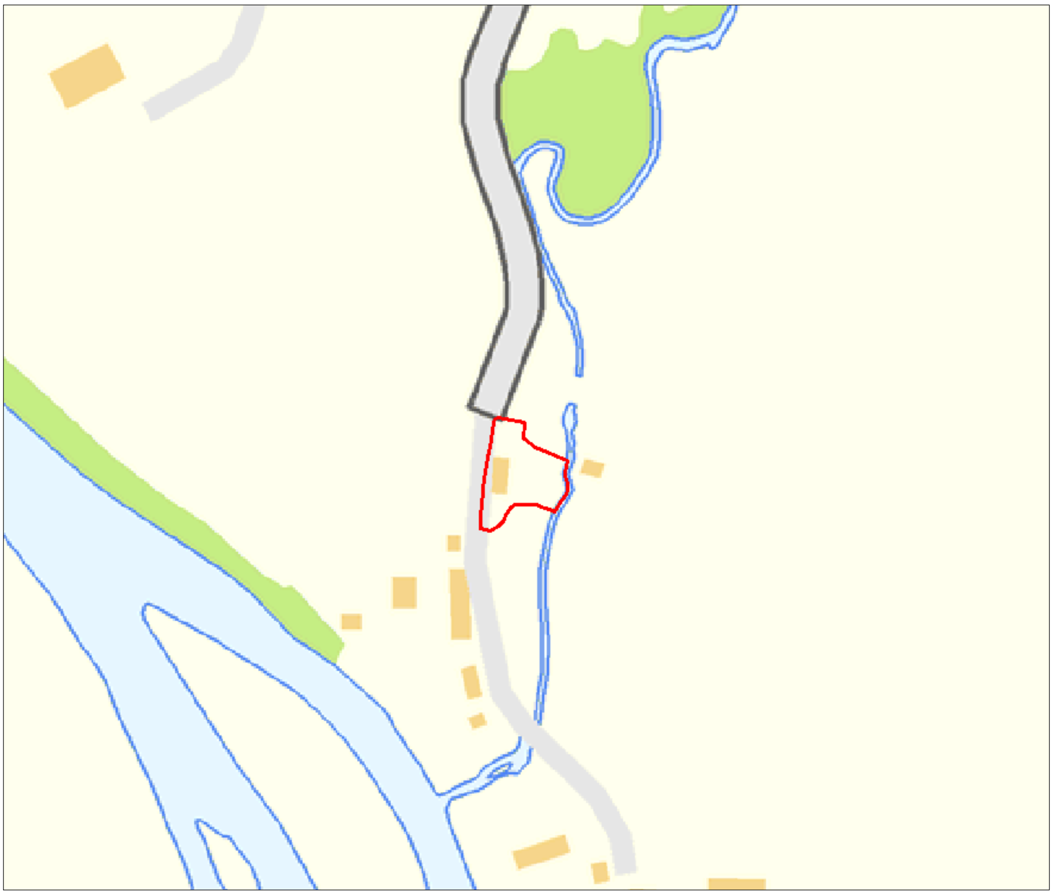


Figure 2.1 – Location map (Contains Ordnance Survey data © Crown copyright and database right 2018).

The site plan included in Appendix A.1 of this report provides more detail in relation to the site location and layout.

2.2 Proposed Development

The proposals for development comprise of the conversion of the existing barn into two single storey residential units.

Drawings of the proposed scheme are included in Appendix A.1 of this report.

3 Definition of Flood Hazard

3.1 Site Specific Information

In addition to the high level flood risk information shown in the Environment Agency (EA) flood zone maps, additional data from detailed studies, topographic site surveys and other information sources is referenced. This section summarises the additional information collected as part of this FRA.

Site specific flood level data provided by the EA – The EA has been consulted as part of the development of this FRA and a copy of their response is included in Appendix A.2 of this report.

Information contained within the SFRA – The Ribble Valley Borough SFRA (2010) contains detailed mapping of flood extents from a wide range of sources. This document has been referenced as part of this site-specific FRA.

Site specific topographic surveys – A topographic survey has been undertaken for the site and a copy of this is included in Appendix A.1. From this it can be seen that the level of the site varies between 19.5m and 20.9m Above Ordnance Datum Newlyn (AODN). Land levels fall across the site in a north-easterly direction.

Geology – Reference to the British Geological Survey map shows that the underlying solid geology in the location of the subject site is Samlesbury Formation (mudstone). Overlying this are superficial River Terrace Deposits (sand and gravel).

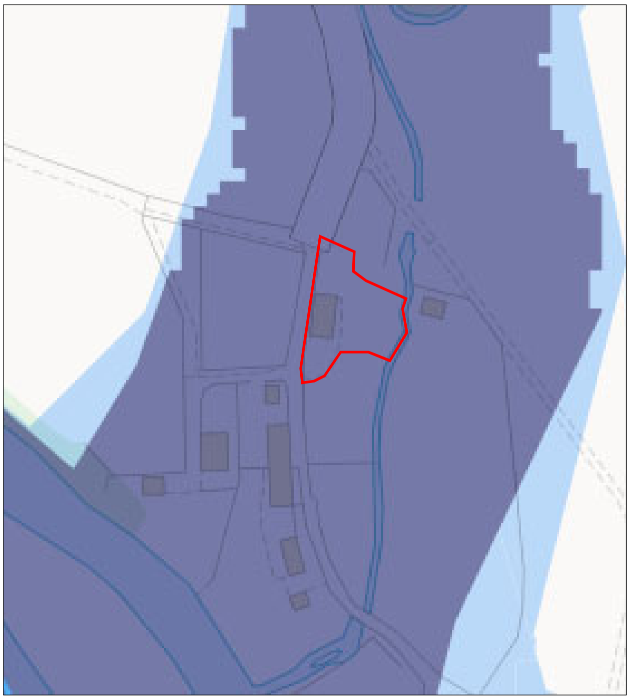
Historic flooding – Information provided by the EA shows the development site to be located on the edge of the extent of flooding for an event which occurred on 27th October 1980. The extent of flooding provided cannot be wholly relied upon as it is not accurately surveyed, but based upon anecdotal evidence which may have been observed prior to, or following the peak of the flood event. In addition to the EA mapping, the applicant has provided photographs of flooding within the surrounding catchment which occurred in December 2015 and has confirmed that the development site remained unaffected during this event. No other records of historic flooding in this location were identified from desktop searches.

In consideration of the above, the risk of flooding from this source is considered in more detail in Section 5 this report.

3.2 Potential Sources of Flooding

The main sources of flooding have been assessed as part of this appraisal. The specific issues relating to each one and its impact on this particular development are discussed below. Table 3.1 at the end of this section summarises the risks associated with each of the sources of flooding.

Flooding from Rivers – The site lies within Flood Zone 3 of the River Ribble (main river), which is situated 110m to the south of the site, as shown on the EA's flood map (Figure 3.1 below).



Key to flood map

Zone 3 - Extent of flooding from rivers or the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year or from a river by a flood that has a 1% (1 in 100) or greater chance of happening each year.

Zone 2 - Additional extent of an extreme flood from rivers or the sea. These outlying areas are likely to be affected by a major flood, with up to a 0.1% (1 in 1000) chance of occurring each year.

Flood defences

Areas benefiting from flood defences (Flood Zone 3)

Main rivers

Flood Storage Area

Location of development site

Figure 3.1 – Flood zone map showing the location of the development site (© Environment Agency)

The flood zone maps are used as a consultation tool by planners to highlight areas where more detailed investigation of flood risk is required. Consequently, given the location of the site within Flood Zone 3, the risk of flooding from this source has been examined in more detail as part of this FRA.

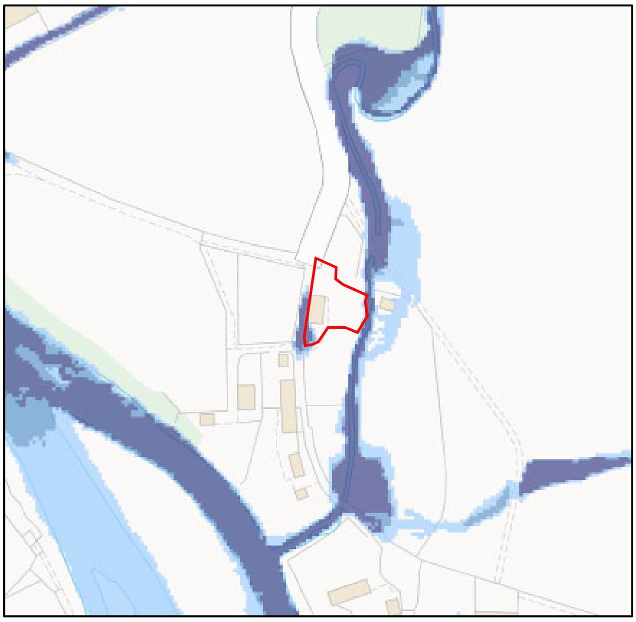
Flooding from Ordinary or Man-made Watercourses – Natural watercourses that have not been enmained and man-made drainage systems such as irrigation drains, sewers or ditches could potentially cause flooding.

Inspection of OS mapping and aerial height data of site and surrounding area reveals that there is a small watercourse 32m east of the site which flows into the River Ribble. Consequently, given the close proximity of this watercourse to the site, the risk of flooding from this source will be appraised in greater detail as part of this FRA.

Flooding from the Sea – The site is located a significant distance inland and is elevated well above predicted extreme tide levels. Consequently, the risk of flooding from this source is considered to be negligible and therefore, the impacts of flooding from the sea are not considered further in this appraisal.

Flooding from Land (overland flow and surface water runoff) – Overland flooding typically occurs in natural valley bottoms as normally dry areas become covered in flowing water and in low spots where water may pond. This flooding mechanism can occur almost anywhere but is likely to be of particular concern in any topographical low spot, or where the pathway for runoff is restricted by terrain or man-made obstructions.

Figure 3.2 below is an extract of the Environment Agency's 'Risk of Flooding from Surface Water' map which can be interrogated to identify whether the site is located in an area at risk of surface water flooding.



Probability of Flooding

High – Extent of flooding from surface water that has a 3.3% (1 in 30) or greater chance of happening each year.

Medium - Extent of flooding from surface water that has between a 3.3% (1 in 30) and 1% (1 in 100) chance of happening each year.

Low - Extent of flooding from surface water that has between a 1% (1 in 100) and 0.1% (1 in 1000) chance of happening each year.

Location of development site

Figure 3.2 – Surface water flooding map showing the location of the development site (© Environment Agency)

The above mapping shows that the majority of the development site is shown to be located outside the flood extents of an extreme pluvial event with a return period of 1 in 1000 years (i.e. it has a very low probability of flooding). However, a small area near the southwest of the site is shown to be at 'low' to 'high' risk of surface water flooding.

Examination of aerial height data and the site-specific topographic survey reveals that there is a small topographic depression within Alston Lane, located to the southwest of the site. Land levels in this area suggest that water could pond at this location following an extreme rainfall event, with the potential to reach a maximum level equal to 20.0m AODN. Above this level water would flow away from the site in a south-easterly direction, toward the watercourse. The floor level of existing barn is elevated to 20.15m AODN, and as such is likely to remain unaffected. This is supported by the EA's mapping and the Ribble SFRA which show the barn to be in an area at 'very low' risk of surface water flooding, with no historic records of flooding from surface water. The risk of flooding to the site from this source is therefore concluded to be *low.*

Flooding from Groundwater – Water levels below the ground rise during wet winter months, and fall again in the summer as water flows out into rivers. In very wet winters, rising water levels may lead to the flooding of normally dry land, as well as reactivating flow in 'bournes' (streams that only flow for part of the year).

Groundwater flooding is most likely to occur in low-lying areas that are underlain by permeable rock (aquifers). The underlying geology in this area is Samlesbury Formation (mudstone), which is not typically associated with groundwater flooding. Furthermore, the River Ribble and adjacent watercourse will act to drain the soils in this location, thus maintaining lower groundwater levels in the surrounding area. This is supported by mapping on groundwater emergence provided as part of the Defra Groundwater Flood Scoping Study (May 2004), which shows that no groundwater flooding events were recorded during the very wet periods of 2000/01 or 2002/03. It also shows that the site itself is not located within an area where groundwater emergence is predicted.

In addition to the above, the barn is situated approximately 3.0m above the watercourse. Therefore, even in the unlikely instance of groundwater emergence at or near to the site, any floodwater would simply flow away from the barn in a south-easterly where it would be intercepted by the watercourse. It is therefore concluded that the risk of flooding from this source is *low*.

Flooding from Sewers – In urban areas, rainwater is frequently drained into surface water sewers or sewers containing both surface and wastewater known as “combined sewers”. Flooding can result when the sewer is overwhelmed by heavy rainfall, becomes blocked, or is of inadequate capacity; this will continue until the water drains away. When this happens to combined sewers, there is a high risk of land and property flooding with water contaminated with raw sewage as well as pollution of rivers due to discharge from combined sewer overflows.

The Ribble Valley Borough SFRA holds no historic record of sewer flooding in this area, furthermore, no past sewer flooding events were discovered through a desktop search. Additionally, the topography of the land within the site and the surrounding area suggests that any above ground flooding that might occur as a result of a surcharged sewer would be encouraged to flow away from the site, flowing southwards towards the lower lying River Ribble. Therefore, the risk of flooding from this source is considered to be *low.*

Flooding from Reservoirs, Canals and other Artificial Sources – Non-natural or artificial sources of flooding can include reservoirs, canals and lakes where water is retained above natural ground level, operational and redundant industrial processes including mining, quarrying and sand and gravel extraction, as they may increase floodwater depths and velocities in adjacent areas. The potential effects of flood risk management infrastructure and other structures also need to be considered. Reservoir or canal flooding may occur as a result of the facility being overwhelmed and/or as a result of dam or bank failure.

Inspection of the Ordnance Survey mapping for the area shows that there are no artificial sources of flooding within close proximity to the site. However, the EA’s ‘Risk of Flooding from Reservoirs’ website (Figure 3.3) shows that the site is located within an area considered to be at risk of flooding from the Alston Reservoirs No.1 and No.2 which are situated 2.7km to the north. The site is also within an area considered to be at risk of flooding from the Spade Mill Reservoirs No.1 and No.2 which are 3.9km to the north of the site.

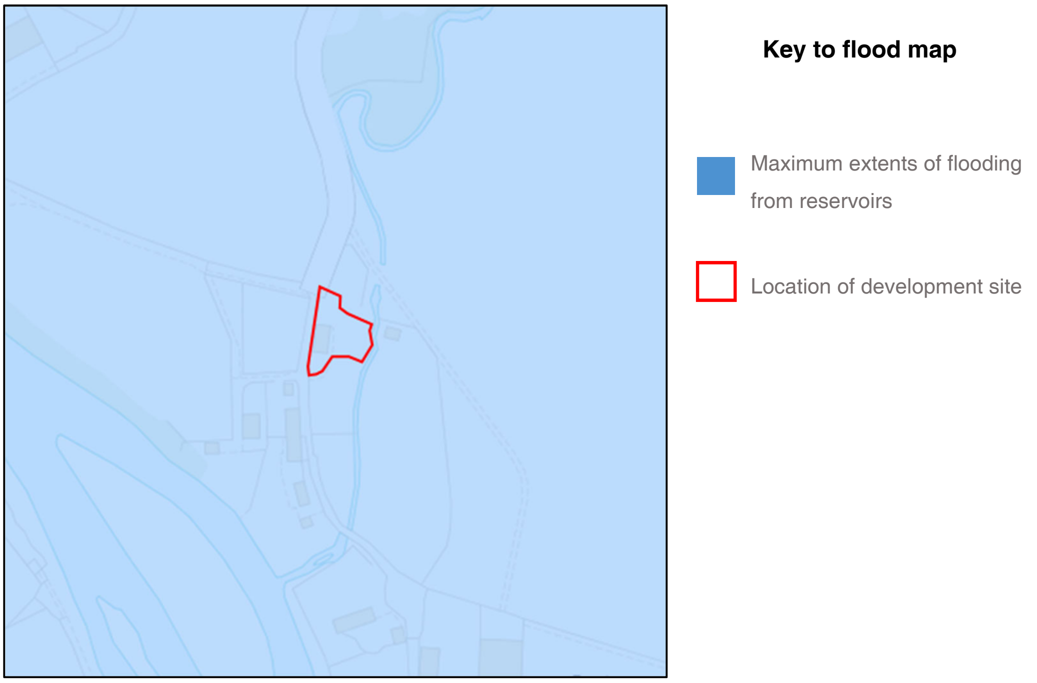


Figure 3.3 – Risk of Flooding from Reservoirs map showing the location of the development site (© Environment Agency).

When considering the risk of flooding from this source it is necessary to take into account the fact that these reservoirs are located a significant distance from the site and are owned and operated by the relevant water companies, who have a duty under the Reservoirs Act to ensure that they are maintained in a good working order and are inspected regularly. Consequently, due to the high standard of protection the risk of flooding from these man-made water bodies is considered to be low.

A summary of the overall risk of flooding from each source is provided in Table 3.1 below.

Source of flooding	Initial level of risk	Appraisal method applied at the initial flood risk assessment stage
Rivers (fluvial)	Appraised further in Section 5	Environment Agency flood zone map, Ordnance Survey mapping
Sea	Low	Environment Agency flood zone map, Ordnance Survey mapping
Ordinary and man-made watercourses	Appraised further in Section 5	Ordnance Survey mapping and aerial height data
Overland flow	Low	Environment Agency ‘Risk of Flooding from Surface Water’ flood maps, aerial height data, OS mapping, topographic survey
Groundwater	Low	Defra Groundwater Flood Scoping Study, geological data, aerial height data, OS mapping, topographic survey.
Sewers	Low	Aerial height data, OS mapping, topographic survey, historic records in Ribble Valley Borough SFRA
Artificial sources	Low	Ordnance Survey mapping and Environment Agency ‘Risk of Flooding from Reservoirs’ flood map

Table 3.1 – Summary of flood sources and risks.

3.3 Existing Flood Risk Management Measures

There are no formal flood defence structures that provide protection to the development site.

4 Climate Change

When the impact of climate change is considered it is generally accepted that the standard of protection provided by current defences will reduce with time. The global climate is constantly changing, but it is widely recognised that we are now entering a period of accelerating change. Over the last few decades there have been numerous studies into the impact of potential changes in the future and there is now an increasing body of scientific evidence which supports the fact that the global climate is changing as a result of human activity. Past, present and future emissions of greenhouse gases are expected to cause significant global climate change during this century.

The nature of climate change at a regional level will vary: for the UK, projections of future climate change indicate that more frequent short-duration, high-intensity rainfall and more frequent periods of long-duration rainfall of the type responsible for the recent UK flooding could be expected.

These effects will tend to increase the size of flood zones associated with rivers, and the amount of flooding experienced from other inland sources. The rise in sea level will change the frequency of occurrence of high water levels relative to today's sea levels. It will also increase the extent of the area at risk should sea defences fail. Changes in wave heights due to increased water depths, as well as possible changes in the frequency, duration and severity of storm events are also predicted.

To ensure that any recommended mitigation measures are sustainable and effective throughout the lifetime of the development, it is necessary to base the appraisal on the extreme flood level that is commensurate with the planning horizon for the proposed development. The NPPF and supporting Planning Practice Guidance Suite state that residential development should be considered for a minimum of 100 years, but that the lifetime of a non-residential development depends on the characteristics of the development. For commercial development, a 60 year design life is assumed. The development that is the subject of this FRA is classified as residential.

4.1 Potential Changes in Climate

Peak River Flow

Recognising that the impact of climate change will vary across the UK, the peak river flow allowances show the anticipated changes to peak river flow by river basin district. The proposed development site is covered by North West River Basin District, as defined by the Environment Agency River Basin maps.

For each district a range of climate change allowances are provided for different time epochs over the next century, which correlate with the planning horizons for the varying classifications of development.

For each epoch there are three climate change allowances defined. These represent different levels of statistical confidence in the possible emissions scenarios on which they are calculated. The three levels of allowance are as follows:

- Central: based on the 50th percentile
- Higher Central: based on the 70th percentile
- Upper End: based on the 90th percentile

As well as encouraging sustainable development to meet the demands of a growing population, the NPPF also promotes a precautionary approach. For more vulnerable development in areas of higher risk of flooding, a higher percentile allowance is recommended in order to manage the risk of flooding over the lifetime of the proposed development. The Environment Agency has therefore provided guidance regarding the application of the climate change allowances and how they should be applied in the planning process. The range of allowance for the river basin in which the development site is located are shown in Table 4.1 below.

River Basin District	Allowance Category	2015 to 2039	2040 to 2069	2070 to 2115
North West	Upper End	20%	35%	70%
	Higher Central	20%	30%	35%
	Central	15%	25%	30%

Table 4.1 – Recommended peak river flow allowances for each epoch for the North West River Basin District (1961 to 1990 baseline)

For more vulnerable development with a design life of 100 years in Flood Zone 3a, a **Higher Central** climate change allowance is recommended. From Table 4.2 above, it can be seen that the recommended climate change allowance for this site is a **35%** increase for all peak river flows.

5 Probability and Consequence of Flooding

When appraising the risk of flooding to new development it is necessary to assess the impact of the 'design flood event' to establish depths, velocities and the rate of rise of floodwater under such conditions. Flood conditions can be predicted for a range of return periods and these are expressed in either years or as a probability, i.e. the probability that the event will occur in any given year, or Annual Exceedance Probability (AEP). The design flood event is taken as the 1 in 100 year (1% AEP) event for fluvial flooding.

The analysis in Section 3.2 of this report has identified that the primary risk of flooding to the development site is from fluvial sources, including the River Ribble and the watercourse located to the east of the development site. The risk of flooding from these rivers have therefore been appraised independently in the following sections.

5.1 Risk of Flooding from the River Ribble

The EA has provided modelled data taken from the Ribble-Douglas Strategic Flood Risk Mapping Study (2010). The information includes in-channel flood levels and flows for a number of node points along the river. The location of the node points in relation to the development site is shown in Figure 5.1 below.

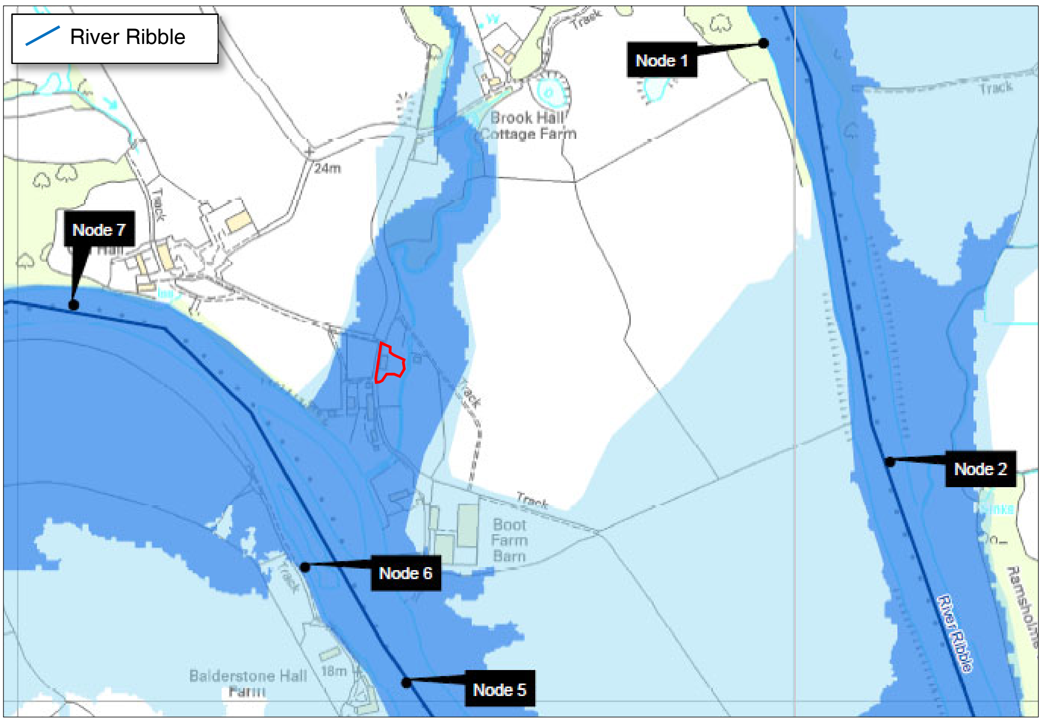


Figure 5.1 – Flood node location map (provided by the EA). Development site outlined in red.

As part of their response the EA has confirmed that this location is not currently protected by any formal flood defence infrastructure and therefore results for an 'undefended' scenario have been provided. The modelled flood levels for the nearest node point to the development site (node 6) are outlined in Table 5.1 below.

Return Period (Years)	Modelled flood levels at Node 6 (m AODN)
1 in 100	18.65
1 in 100 (+20% allowance for climate change)	19.08
1 in 200	18.92
1 in 1000	19.52

Table 5.1 – Modelled in-channel flood levels provided by the EA (at Node 6)

As part of their response, the EA has provided modelled flood level data and flows for a range of return period events, including the 100 year plus 20% climate change event. However, the data does not include the correct allowance for climate change, as defined by EA's most recent climate change guidance. This more recent guidance states that for a residential development with an assumed lifetime of 100 years, a 35% increase for all peak river flows should be considered (refer to Section 4.1 of this report).

In the absence of modelled flood level data for the 35% increase in peak river flow, a stage-flow discharge rating curve for current day conditions has been derived. This curve has subsequently been extrapolated to derive a flood level based on a 35% increase in peak flow. Figure 5.2 below shows the stage-discharge curve constructed for the node 6.

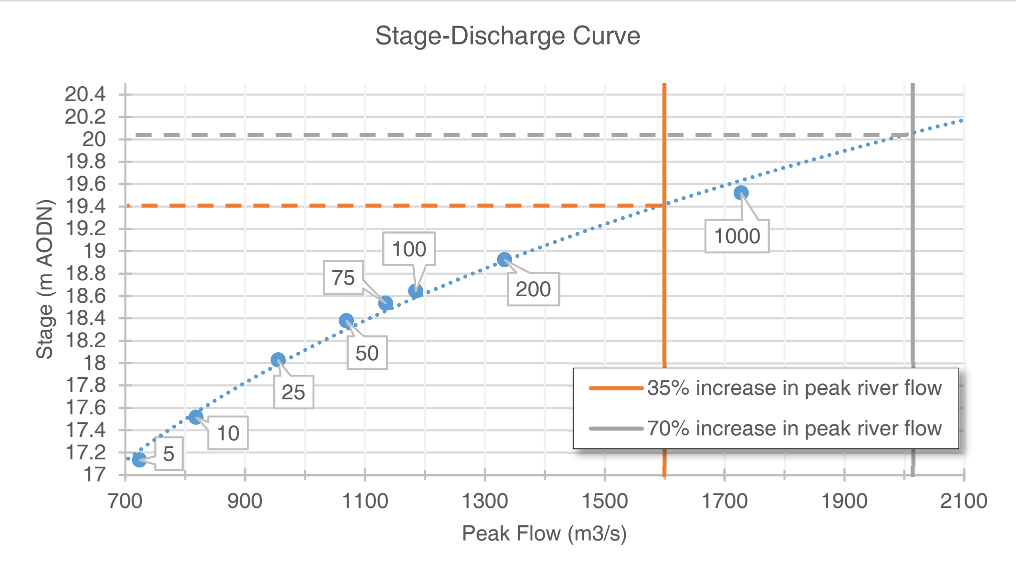


Figure 5.2 – Stage-discharge curve for in-channel node 6.

In order to derive the peak river flow for the 'design event' (i.e. the 1 in 100 year event, including a 35% allowance for climate change), the peak flow under the 1 in 100 year flood event (1184m^3/s) has been multiplied by 1.35, yielding a peak river flow of 1598 m^3/s. Reference to the stage-discharge curve identifies that for a 35% increase in peak river flow, the in-channel water level is predicted to be approximately 19.4m AODN.

Comparison of this flood level with the land levels from the topographic survey identifies that it is only the easternmost part of the site, where land levels are sloping steeply toward the watercourse, that could be affected by flooding. However, the internal floor level of the barn is situated at a minimum of 20.15m, at least 0.75m above the flood level.

Residual Risk

When considering residual risk, it is necessary to make predictions as to the impacts of a flood event that exceeds the design event, or in the case of areas that are already defended to an adequate standard, the impact of a failure of these defences.

The EA has confirmed that the development site does not benefit from defences, and therefore the impact of an exceedance event has been considered. Using the stage-discharge curve in Figure 5.2, the flood level for the EA's 'Upper End' climate change allowance (i.e. a 70% increase in peak river flow) has been calculated. The peak flow under the 1 in 100 year flood event (1184 m^3/s) has been multiplied by 1.70, yielding a peak river flow of 2013 m^3/s under the 1 in 100 year flood event (including a 70% allowance for climate change). Reference to the stage-discharge curve identifies that for a 70% increase in peak river flow, the in-channel water level is predicted to be approximately 20.1m AODN.

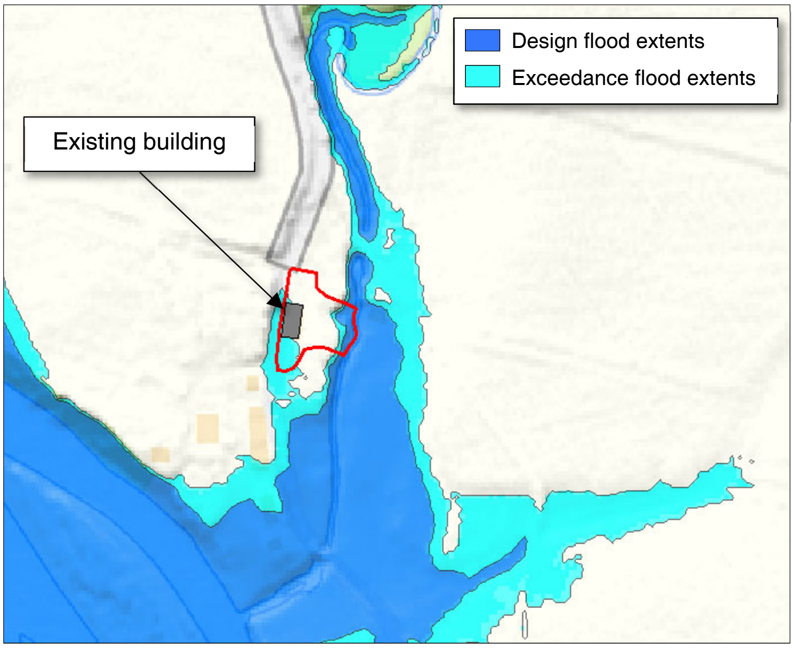


Figure 5.3 – Predicted extent of flooding under design flood event and exceedance flood event (1 in 100 year including 70% allowance for climate change)

Comparison of the exceedance flood level with the land levels at the site identifies that the south-westernmost corner of the site could be affected by flooding (Figure 5.3 above). Notwithstanding this, the finished ground floor level of the building is still shown to be situated 0.05m above the flood level and the building is predicted to remain dry during this exceedance flood event. There is, however, always the risk that this event could be exceeded, regardless of how unlikely it is to occur. Consequently, whilst it is not necessary to incorporate mitigation to defend against the residual risk event, a conservative approach has been adopted and the impact has been considered in the recommendations of this report.

5.2 Risk of Flooding from the Watercourse

There is no detailed modelled data of the watercourse to the east of the site and therefore, in order to determine the exact extent of flooding across the site from an extreme fluvial event, including an allowance for climate change, a detailed hydrodynamic model of the watercourse has been constructed.

Numerical Model

The hydraulic numerical model that has been used is ESTRY (version 4.3.6458.29637), which is an industry standard one-dimensional solver. With this approach, the channel is defined by a number of cross sections which include data on geometric features such as banks, the boundary of the domain to be modelled, and material zones with material properties such as Manning's 'n' value.

Land use	Manning's *n*
In-channel (free of weed)	0.04
Channel banks (grassy)	0.03
Concrete pipe (moulded)	0.018
Bridge main channel archway (cobbles and stones)	0.04
Bridge secondary channel archways (stones brush and vegetation)	0.05

Table 5.2 - Manning's n values used in the 1D model according to land use

Flood routing equations in the model calculate the water surface elevation within the cross sections over time, as well as information on flow rate, and energy. This numerical model uses cross-section data which has been derived using a combination of;

- 2m resolution LiDAR Digital Terrain Model (DTM) provided by the Environment Agency
- Elevations taken from the site-specific topographic survey site

Using the cross-section data, the flow along the watercourse is calculated using a number of governing equations for flow in open channels and hydraulic structures. The 1D network is shown in Figure 5.4.

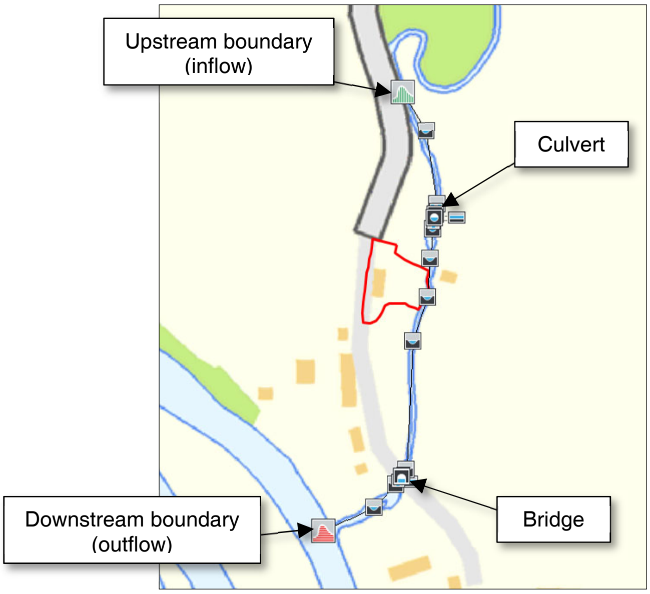


Figure 5.4 – Schematic showing the extent of the 1d model network in relation to the development site (outlined in red).

The 1d model has been constructed for the length of watercourse from approximately 85m upstream of the site, to the confluence with the River Ribble to the south of the development site. Photographs provided by the applicant identify a 1.2m diameter culvert located approximately 30m upstream from the site which has been included within the model. In addition, the road bridge south of the site has also been included within the model and the dimensions of this bridge has been based on information derived from aerial height data and Google Streetview imagery.

Derivation of Inflows

As there are no gauged flow data for the watercourse, the maximum extreme flows within the watercourse have been calculated using a combination of the hydrological prediction methods.

The first stage in the process is to define the catchment boundaries, which have been derived from the FEH web service. The elevation data used to derive this catchment has a resolution of 50m, and therefore it has been necessary to review the catchment boundaries using the more accurate 2m resolution LiDAR data provided by the EA. Following a review of the LiDAR, the catchment boundary has been adjusted. Figure 5.5 shows the original catchment boundary in comparison to revised catchment.

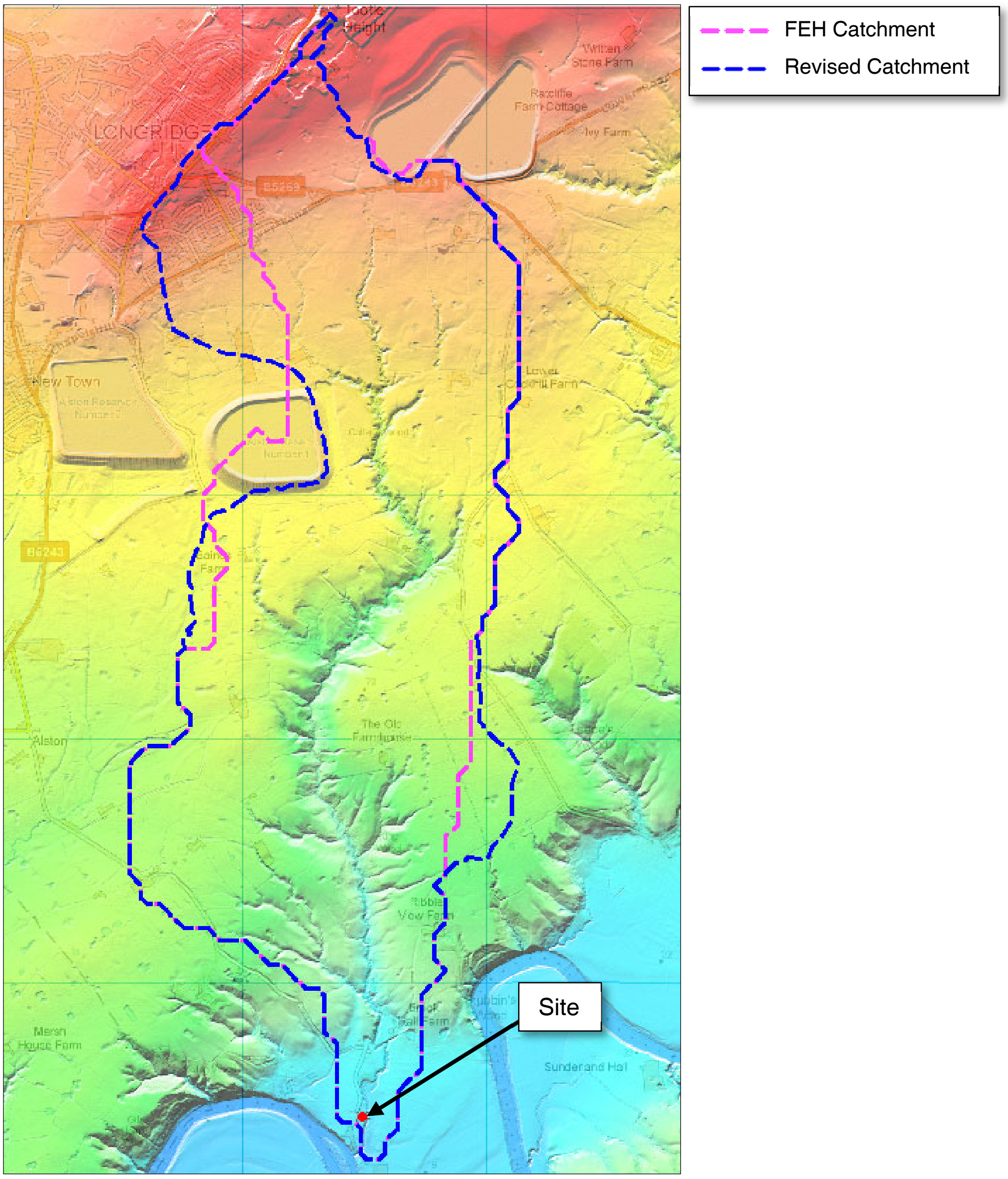


Figure 5.5 – Catchment boundaries derived from FEH online web service, and revised boundary using 2m resolution LiDAR data.

The FEH software then generates ‘catchment descriptors’ and these are listed below:

FARL	0.988	RMED-1H	10.4
PROPWET	0.51	RMED-1D	39.3
ALTBAR	80	RMED-2D	50.9
ASPBAR	171	SAAR	1108
ASPVAR	0.62	SAAR4170	1090
BFIHOST	0.394	SPRHOST	40.43
DPLBAR	2.92	URBCONC1990	-999999
DPSBAR	47.4	URBEXT1990	0.0018
LDP	5.82	URBLOC1990	-999999
C	-0.025	C(1km)	-0.025
D1	0.40629	D1(1km)	0.39
D2	0.33274	D2(1km)	0.332
D3	0.41325	D3(1km)	0.413
E	0.297	E(1km)	0.297
F	2.45055	F(1km)	2.445

Table 5.3 – Catchment Descriptors from FEH

Using the catchment descriptors, two industry standard methods can be used to derive extreme flows; the Flood Estimation Handbook (FEH) Statistical Procedure and the Revitalised Flood Hydrograph (ReFH2) model methodology. The FEH advises that ReFH2 should not be used for highly permeable catchments (where either the BFIHOST value is greater than 0.65 or the SPR value is lower than 0.20) or highly urbanised catchments (URBEXT is greater than 0.025).

The catchment in which the site is located is relatively impermeable with a BFIHOST value of 0.394 and following the review of the catchment boundary (shown in Figure 5.2) has an updated URBEXT value of 0.04. The FEH statistical method is therefore recommended for the estimation of extreme flows in this instance.

Given that there is no gauged data for the catchment, the pooled analysis methodology has been adopted for the derivation of flood flows. This method uses catchment characteristics to identify a number of gauged catchments which are hydrologically similar to the target catchment. The observed flood data for the 'similar' gauged catchments are then used to estimate peak flows at the ungauged target catchment.

To account for 100 years of climate change the 1 in 100 year flow rate was further increased by 35%, in accordance with the values stated in the NPPF. The peak flows derived from the analysis are shown in Table 5.4.

Return Period in years (%AEP)	Peak flow rate Q (m^3/s)
2 (50%)	2.6
20 (5%)	5.4
50 (2%)	6.8
100 (1%)	8.0
100+35%cc	**10.8**

Table 5.4 – Values of flow rate derived using FEH statistical method (m^3/s)

Whilst the FEH statistical method provides estimates of peak flow, it is necessary to use flood hydrographs generated using the ReFH2 model for input into the model. The design hydrographs are calculated for a specified initial soil moisture content and a design rainfall event. Both soil moisture and rainfall are specified on a seasonal basis depending on the degree of urbanisation of the catchment under consideration. In this instance, a winter profile has been used.

Model Outflow

The downstream end of the watercourse discharges directly into the River Ribble. The analysis in Section 5.1 has demonstrated that under the design flood event, floodwater could reach the development site but would not affect the existing barn (to be converted). Given that the catchment of the River Ribble is at least an order of magnitude greater than the catchment of the watercourse adjacent to the site, and comprises a large number of other tributaries, the likelihood of a rainfall event large enough to result in the design flood event in all sub-catchments of the Ribble is considered to be extremely low. Therefore, it is considered that the circumstances related to a design flood event occurring in the adjacent watercourse would be independent from those resulting in the design flood event within the River Ribble. Consequently, it is not deemed appropriate to apply the water level under design flood conditions within the River Ribble catchment to the downstream boundary of the watercourse model.

To determine the risk of flooding to the site under the design flood event from the watercourse as an independent source, the water level within the Ribble under normal flow conditions has been applied. To represent 'normal' flow condition, a conservative approach has been adopted where by the 1 in 2 year flood level for the Ribble has been used. The EA has not provided model data for the Ribble for a 1 in 2 year return period, and therefore the in-channel flow rate has been approximated by considering the relationship between return period and flow based on the model data provided by the EA. Using this flow rate (628m^3/s), the stage-discharge curve (Figure 5.2) has been extrapolated to derive an in-channel water level of 16.83m AODN for the 1 in 2 year event.

Calibration of Detailed Modelling

Although the hydrological procedures outlined in the FEH are suitable for determining flood flows within catchments of this size, the main controlling factor when constructing any model is being able to validate the results using known historic events. This enables the model to be calibrated and adjustments made to ensure that the model is representative of real life.

The applicant has provided photographs of the site and surrounding area during a flood event in December 2015 during which time the existing barn was shown to remain unaffected by flooding. However, as there is no gauge data available for this catchment under this event, it is not possible to comment on the estimated return period of this event and therefore the information cannot be used to verify the magnitude of flooding predicted under design flood conditions. Notwithstanding this, the images have been used to confirm the areas which could be affected during flood conditions. Desktop searches have revealed that there are no further records of historic flooding at the site.

Notwithstanding the above, given the absence of gauged data available to calibrate the model, sensitivity runs were undertaken to test the model's response to changes in the parameters applied.

Model Results

Design Flood Event

The model was run for a range of scenarios up to and including the design event. In order to determine the impact of climate change on the site, flows within the watercourse were increased to represent the design event; i.e. an extreme event with a 1 in 100 year return period, including an allowance for climate change (increase of 35% peak flow rate).

The maximum modelled water level under the design flood event is shown in Figure 5.6 below. From this it can be seen that, due to the steeply sloping bed of the channel, the maximum modelled water level varies from 18.4m AODN at the northern end of the site, to 17.3m AODN at the southern end of the site.

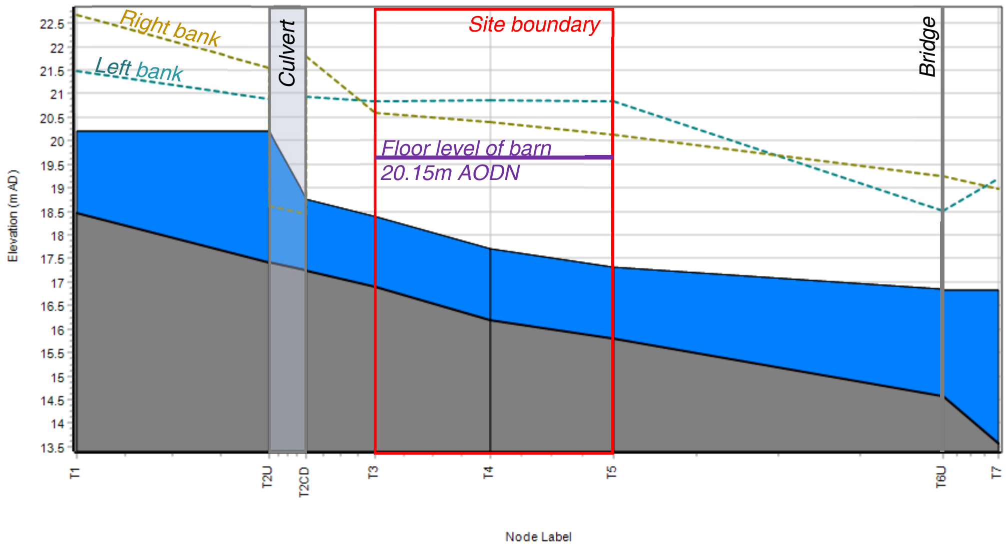


Figure 5.6 – The maximum modelled flood level for the design flood event showing the extent of the development site, hydraulic structures, and the left and right bank level.

Inspection of the topographic survey identifies that it is only the easternmost part of the site, where land levels are sloping steeply toward the watercourse, which could be affected by flooding. The land levels and internal floor level of the building are situated above the design flood level, and will therefore remain unaffected by flooding under the design flood event.

Sensitivity Testing

In line with the precautionary principle that is promoted by the NPPF, a number of sensitivity tests have been undertaken for the design event;

1. *Channel Blockage:* This comprises two separate scenarios where by the culvert upstream of the site, and bridge downstream of the site were blocked by 50%, thus restricting the volume of water that can leave the system.

2. *Changes to channel roughness:* This comprises increasing and decreasing the roughness value within the channel by 20% to evaluate the impact that this would have on the modelled results. This can be interpreted as representing a scenario in which either the channel became overgrown (increased roughness) or where clearance of the channel was undertaken (decreased roughness).

3. *Exceedance event:* The flow hydrograph for the 1 in 100 year return period event was increased by 70%, to represent the Upper End climate change allowance. This highlights the sensitivity of flooding at the site in respect to changes in water level, and clarifies any uncertainty that may be present when calculating the flood hydrograph.

The maximum modelled water level for the development site for each scenario is summarised in Table 5.5 below.

Scenario	Maximum modelled water level at the site
20% increase in roughness coefficient	18.50
20% decrease in roughness coefficient	18.27
50% blockage of culvert	18.39
50% blockage of bridge	18.40
Exceedance event (1 in 100 year+70%cc)	18.53

Table 5.5 – Maximum modelled water level at the site for a range of sensitivity scenarios tested within the model.

From the results of the sensitivity testing, it can be seen that the exceedance scenario results in the highest predicted water level at the site. Even under this worst-case scenario, both the internal floor level of the barn and surrounding land levels are elevated at least 0.87m above the maximum predicted flood level.

6 Offsite Impacts and Other Considerations

6.1 Displacement of Floodwater

The development will not result in an increase in the built footprint of the building, and has been shown to remain unaffected during the design flood event. Consequently, the development will not increase the risk of flooding elsewhere as a result of floodwater being displaced.

6.2 Public Safety and Access

The NPPF states that safe access and escape should be available to/from new developments located within areas at risk of flooding. The Practice Guide goes on to state that access routes should enable occupants to safely access and exit their dwellings during design flood conditions and that vehicular access should be available to allow the emergency services to safely reach the development.

The proposed development has been shown to be located outside of the predicted flood extents from the River Ribble and adjacent tributary. Furthermore, the access route to the site via Alston Lane will also remain unaffected. Consequently, safe access/egress to/from the site can be achieved.

6.3 Proximity to Watercourse

The proposed development will not result in a change in the built footprint of the building and therefore, will not encroach on the existing access to the watercourse. Furthermore, the existing building is located approximately 25m from the watercourse and as such, will compromise any of the LLFA's maintenance or access requirements.

6.4 Impact on Fluvial Morphology and Impedance of Flood Flows

The proposals for development comprise internal changes to an existing building and therefore the development will not affect fluvial morphology.

7 Flood Mitigation Measures

The key objectives of flood risk mitigation are:

- to reduce the risk of the development being flooded.
- to ensure continued operation and safety during flood events
- to ensure that the flood risk downstream of the site is not increased by increased runoff
- to ensure that the development does not have an adverse impact on flood risk elsewhere

The following section of this report examines ways in which the risk of flooding at the development site can be mitigated.

Mitigation Measure	Appropriate	Comment
Careful location of development within site boundaries (i.e. Sequential Approach)		
Raising floor levels		
Land raising	x	Not required. The development proposals comprise internal changes to an existing building only. Furthermore, the building has been shown to be located outside the predicted extent of flooding under the design flood event (for both the River Ribble and adjacent watercourse).
Compensatory floodplain storage		
Flood defences		
Alterations/ improvements to channels and hydraulic structures		
Management of development runoff	x	Refer to Section 7.1
Flood resistance & resilience	✓	Refer to Section 7.2
Flood warning	✓	Refer to Section 7.3

Table 7.1 – Appropriateness of mitigation measures.

7.1 Management of Surface Water Run-off

The general requirement for all new development with respect to surface water runoff is to ensure that the runoff is managed sustainably and that the drainage solution for the development does not increase the risk of flooding at the site, or within the surrounding area.

In the case of brownfield sites, drainage proposals are typically measured against the existing performance of the site, although it is preferable (where practicable) to provide runoff characteristics that are similar to greenfield behaviour.

The proposals for development comprise a conversion of the existing building into two residential dwellings, and as such, will maintain the percentage of impermeable area within the boundaries of the site and consequently this will not increase the rate and volume of surface water runoff discharged from the site. Consequently, it will not be necessary to provide mitigation measures to ensure the rate of runoff discharged from the site.

Notwithstanding this, the potential use of SuDS within the proposed development will be considered to assess the practicality of better replicating greenfield behaviour. However, as the existing structure of the building is not proposed to change as part of the development proposals, the opportunities for the incorporation of SuDS may be limited. Whilst, it may not be possible to retrofit SuDS into the retained parts of the development if a large part of the existing drainage onsite remains unchanged, the following measures could present an option for providing a betterment over the existing situation;

Rain Gardens – For small areas of isolated hardstanding such as garden paths and sheds, it may be possible to discharge runoff to dedicated areas of landscaped rain gardens. These rain gardens could be profiled to allow runoff to pond and infiltrate into a thin soil substrate of permeable sand or gravel.

Water Butts – Given the nature of the development there is the opportunity for the incorporation of water butts within the proposed scheme. Typical sizes and dimensions of water butts are outlined in Table 7.2 below.

Typical House Water Butt Options	Dimensions of a typical house water butt	Volume of storage provided (litres)
Type 1 (wall mounted – Small)	1.22m high x 0.46m x 0.23m	100
Type 2 (Standard house water butt)	0.9m high x 0.68m diameter	210
Type 3 (Large house water butt)	1.26m high x 1.24m x 0.8m	510
Type 4 (Column tank – Very large)	2.23m high x 1.28m diameter	2000

Table 7.2 - Estimated storage capacity of available water butts

7.2 Flood Resistance and Resilience

During a flood event, floodwater can find its way into properties through a variety of routes including:

- Ingress around closed doorways.
- Ingress through airbricks and up through the ground floor.
- Backflow through overloaded sewers discharging inside the property through ground floor toilets and sinks.
- Seepage through the external walls.
- Seepage through the ground and up through the ground floor.
- Ingress around cable services through external walls.

Since flood management measures only manage the risk of flooding rather than eliminate it completely, flood resilience and resistance measures may need to be incorporated into the design of the buildings. The two possible alternatives are:

Flood Resistance or 'dry proofing', where flood water is prevented from entering the building. For example, using flood barriers across doorways and airbricks, or raising floor levels. These measures are considered appropriate for 'more vulnerable' development where recovery from internal flooding is not considered to be practical.

Flood Resilience or 'wet proofing', accepts that flood water will enter the building and allows for this situation through careful internal design for example raising electrical sockets and fitting tiled floors. The finishes and services are such that the building can quickly be returned to use after the flood. Such measures are generally only considered appropriate for some 'less vulnerable' uses and where the use of an existing building is to be changed and it can be demonstrated that no other measure is practicable.

In this circumstance, the existing building has been shown to remain unaffected by flooding under the design flood event from both the River Ribble and watercourse adjacent to the site. Furthermore, the analysis has shown that under an exceedance event within the River Ribble catchment, the finished floor levels of the building will be situated 0.05m above the design flood. Whilst it is not necessary to design to the exceedance event, it is recommended that (where practicable) flood resistance and resilience measures are retrofitted into the existing building up to 300mm above the exceedance flood level (i.e. 20.1m AODN + 300mm) as part of the proposed conversion. Information on measures which can be retrofitted to an existing building can be found at;

https://nationalfloodforum.org.uk/

7.3 Flood Warning

The analysis in Section 5 of this report has shown that the development site is at low risk of flooding from the watercourse adjacent to the site and the River Ribble. In addition, the finished floor levels of the existing barn have been shown to be elevated above the water level for an exceedance flood event from both watercourses. Whilst the building will not be subject to internal flooding during such an event, the southern part of the site could be affected and therefore, it is recommended that the occupants sign up to the EA's Flood Warning service to ensure that they are aware of flooding in the surrounding flood compartment.

Occupants of the site can sign up to the EA's Flood Warning Service either by calling 0345 988 1188, or by visiting;

https://www.gov.uk/sign-up-for-flood-warnings

8 The Sequential and Exception Test

8.1 The Sequential Test

Local Planning Authorities (LPA) are encouraged to take a risk-based approach to proposals for development in areas at risk of flooding through the application of the Sequential Test. The objectives of this test are to steer new development away from high risk areas towards those areas at lower risk of flooding. However, in some areas where developable land is in short supply there can be an overriding need to build in areas that are at risk of flooding. In such circumstances, the application of the Sequential Test is used to ensure that the lower risk sites are developed before the higher risk ones.

The National Planning Policy Framework (NPPF) requires the Sequential Test to be applied at all stages of the planning process and generally the starting point is the Environment Agency's flood zone maps. The development site is shown by the EA's mapping (Figure 3.1) to be located within Flood Zone 3 and therefore it is necessary to apply the Sequential Test.

A Sequential Test assessment has not been undertaken in support of the development. However, from the detailed analysis undertaken as part of this report has shown that the development would remain unaffected under both the 1 in 100 year and 1 in 1000 year return period flood events from both the River Ribble and adjacent watercourse. Consequently, the risk of flooding to the development can be seen to be less than is inferred by the EA's coarse flood zone mapping. In line with the EA's definition of the Flood Zones, the site is considered to be located in the equivalent of Flood Zone 1. The development will therefore meet the requirements of the Sequential Test.

8.2 The Exception Test

Whilst the detailed analysis undertaken in this report has shown that the risk of flooding to the development is low, and that the development fits within the EA's definition of Flood Zone 1, the EA's Flood Zone mapping still shows the development to be classified as Flood Zone 3 and as such, the application of the Execution Test has been considered based on the type and nature of the development.

The Planning Practice Guidance: *Flood Risk and Coastal Change* defines the type and nature of different development classifications in the context of their flood risk vulnerability. This has been summarised in Table 8.1 below.

Flood Risk Vulnerability Classification	Zone 1	Zone 2	Zone 3a	Zone 3b
Essential infrastructure – Essential transport infrastructure, strategic utility infrastructure, including electricity generating power stations	✓	✓	e	e
High vulnerability – Emergency services, basement dwellings caravans and mobile homes intended for permanent residential use	✓	e	×	×
More vulnerable – Hospitals, residential care homes, buildings used for dwelling houses, halls of residence, pubs, hotels, non-residential uses for health services, nurseries and education	✓	✓	e	×
Less vulnerable – Shops, offices, restaurants, general industry, agriculture, sewerage treatment plants	✓	✓	✓	×
Water compatible development – Flood control infrastructure, sewerage infrastructure, docks, marinas, ship building, water-based recreation etc.	✓	✓	✓	✓

Key :
✓ Development is appropriate
× Development should not be permitted
e Exception Test required

(grey) Classification based on EA's Flood Zone maps
(green) Classification based on results of detailed analysis

Table 8.1 – Flood risk vulnerability and flood zone compatibility.

From Table 8.1 above, it can be seen that, based on the results of the site-specific analysis undertaken within this report, the development site is considered to fall within a classification in which more vulnerable development is considered appropriate. Notwithstanding this, the site is technically classified as being located within Flood Zone 3 based on the EA's Flood Zone mapping and therefore the development falls into a classification that requires the Exception Test to be applied. For the Exception Test to be passed there are two criteria that must be satisfied, and these are listed below:

- *it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and*
- *a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*

Both elements of the test will have to be passed for development to be allocated or permitted.

Demonstrating that the development provides wider sustainability benefits to the community that outweigh flood risk is outside the scope of this report, nevertheless, reference is made to the SFRA to establish the key risks associated with flooding to help demonstrate that this objective can be achieved. The key focus of this FRA is therefore to establish whether the site is likely to pass the second element of the Exception Test.

From the analysis undertaken it has been demonstrated that the development site would be at low risk of flooding from all sources, even in the unlikely event of an exceedance flood event from either the River Ribble or watercourse adjacent to the site. This remains the case even when considering the impacts of climate change over the lifetime of the development. It has also been shown that the development will not increase the risk of flooding elsewhere. Therefore, it is concluded that the development passes the second criteria of the Exception test.

9 Conclusions

The key aims and objectives for a development that is to be sustainable in terms of flood risk are summarised in the following bullet points:

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

In determining whether the proposals for development at Alston Lane, Preston are sustainable in terms of flood risk and are compliant with the NPPF and its Planning Practice Guidance, all of the above have been taken into consideration as part of this FRA.

It has been recognised that it may be necessary for the planning authority to demonstrate that the development can pass the Sequential Test. Nevertheless, the evidence provided within this report can be used to support the application of the Sequential Test, demonstrating that the risk is significantly lower than that depicted by the coarse EA flood zone map.

In addition to the Sequential Test it is also necessary to consider the type and nature of the development and whether the Exception Test is applicable. From Table 8.1 it can be seen that, whilst the detailed appraisal within the report has shown that the site is located in the equivalent to Flood Zone 1, it has been necessary to apply the Exception Test based on the EA's Flood Zone mapping. It is the conclusion of this report, that the site passes the second element of the Exception Test.

In determining the risk of flooding from all sources, it has been necessary to construct a detailed numerical model of the watercourse adjacent to the site, and undertake a site-specific analysis of the risk of flooding from the River Ribble. The results of this analysis have shown that proposed development site is at a low risk of flooding from all sources. The south-westernmost corner of the site could experience shallow flooding following an extreme rainfall event, or under an event which exceeds the design fluvial flood event. However, the ground floor of the building is elevated above the anticipated flood level and therefore, occupants will remain safe and dry within their dwellings.

Notwithstanding this, opportunities to reduce the risk of flooding to both the site and surrounding area have been considered and it is recommended that flood resistance and resilience measures are retrofitted into the proposed conversion where practicable, and that the use of raingardens and water butts is considered for inclusion within the scheme design. In addition, this report also recommends that occupants sign up to the EA's flood warning service to ensure that all occupants are aware of the potential risk of flooding in the surrounding flood compartment, to enable sufficient forewarning to evacuate the area if required.

This report demonstrates that the risk of flooding to the development is low and that the development will not increase the risk of flooding elsewhere. It is therefore concluded that the development can pass the second element of the Exception Test and will meet the requirements of the NPPF.

10 Recommendations

The findings of this report conclude that the development will not increase the risk of flooding at the site, or elsewhere. There are, however, a number of mitigation measures and recommendations that could further reduce the risk to the development and other areas within the floodplain.

- Where practicable, flood resistance and resilience measures should be considered for retrofitting into the existing building up to an equivalent level of 300mm above the exceedance flood level (i.e. 20.1m AODN + 300mm) as part of the proposed conversion.

- The use of SuDS should be considered as part of the scheme design to further minimise the risk of flooding to the surrounding area, providing a betterment when compared to the existing site. For this development, the use of water butts and rain gardens is recommended (where practicable).

- The owner and occupants of the proposed dwelling should sign up to the EA's Floodline warnings. The flood warnings will ensure that residents are aware of flooding within the surrounding flood compartment in the unlikely instance of an exceedance event.

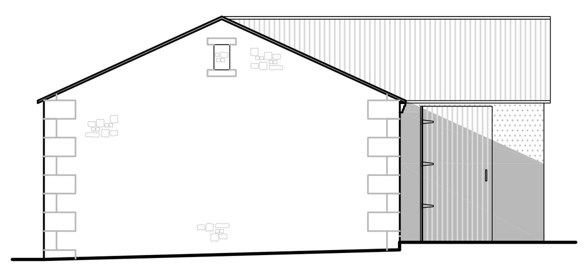
With the above mitigation measures incorporated into the design of the development the proposals will meet the requirements of the NPPF and its Planning Practice Guidance and will therefore be acceptable and sustainable in terms of flood risk.

11 Appendices

Appendix A.1 – Drawings

Appendix A.2 – Environment Agency Flood Report

Appendix A.1 – Drawings



Existing South Elevation
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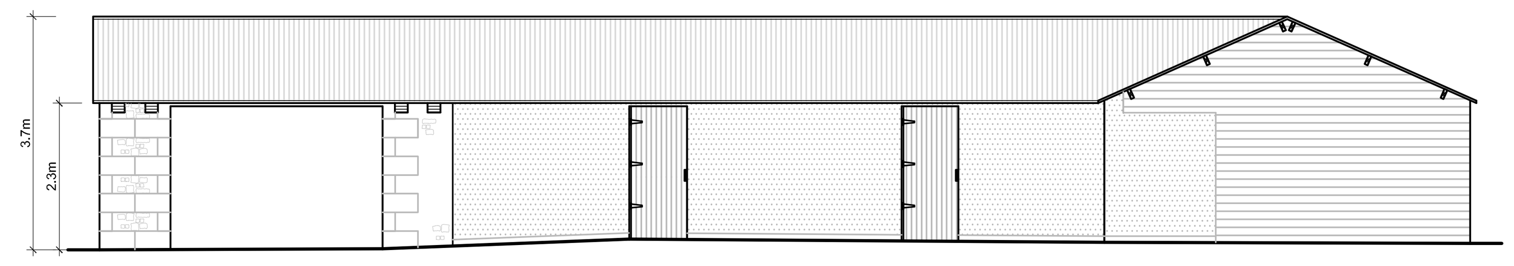
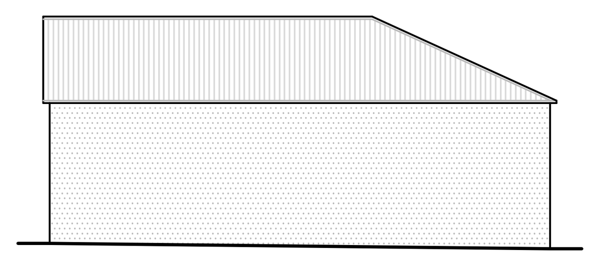
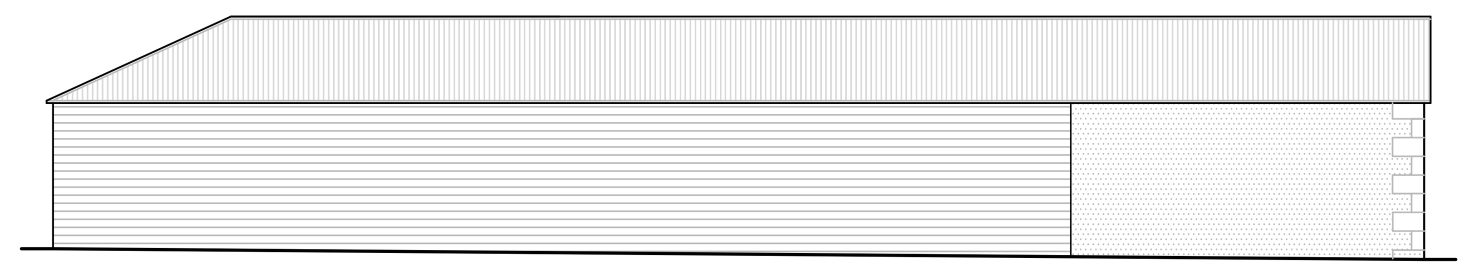


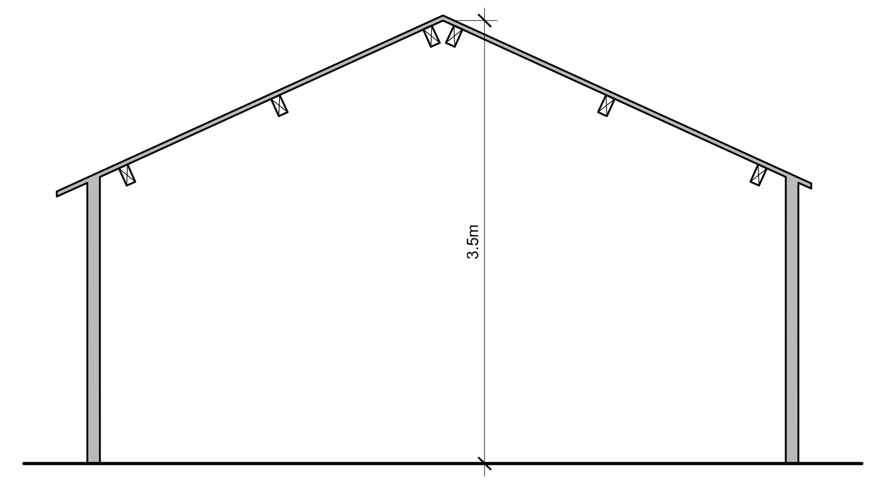
Existing East Elevation
Scale 1:100



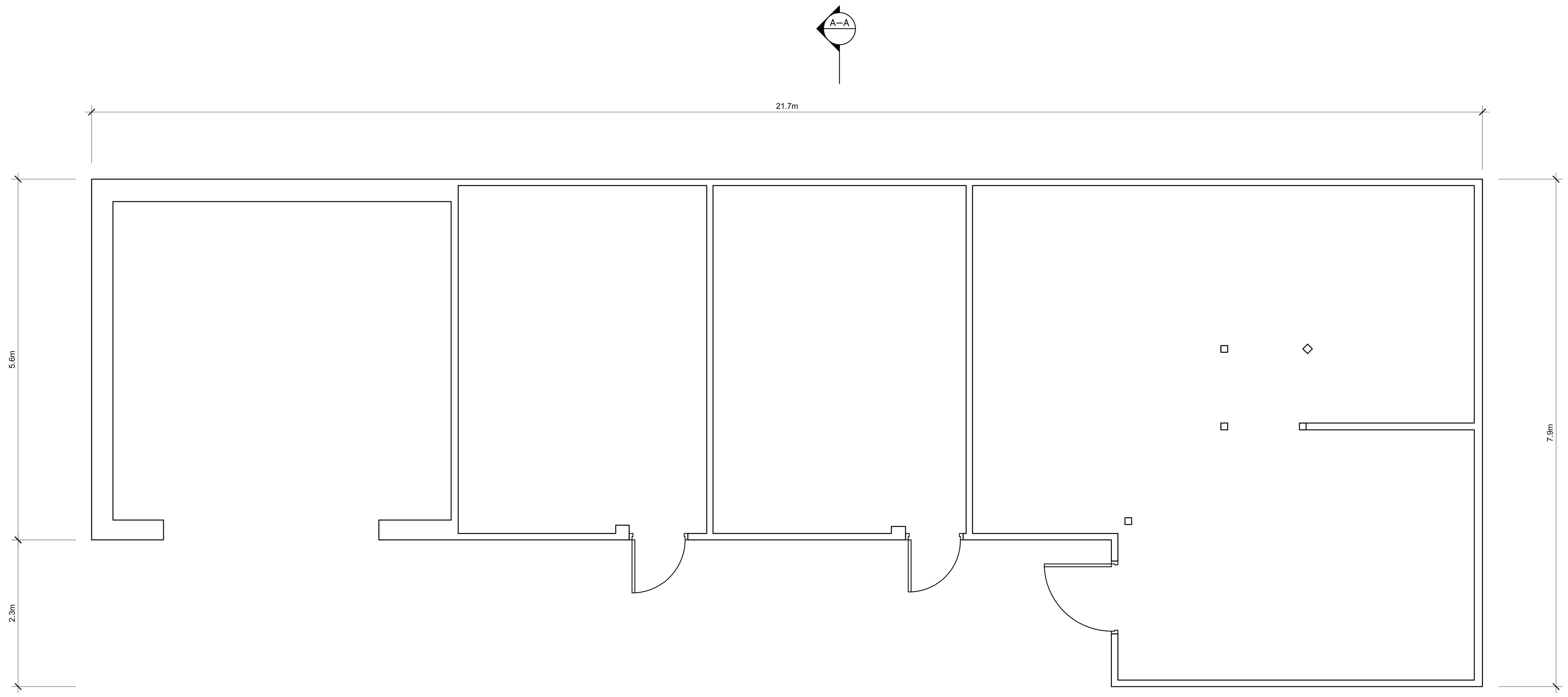
Existing North Elevation
Scale 1:100



Existing West Elevation
Scale 1:100

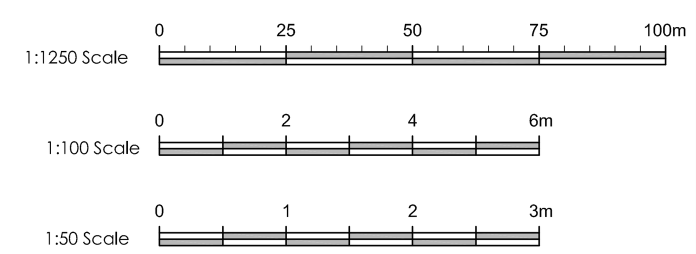


Existing Section A-A
Scale 1:50



Existing Ground Floor Plan
Scale 1:50

OS Plan
Scale 1:1250



Client	Dewhurst Holdings Ltd
Job Title	Beech House Alston
Drawing Title	Existing Floor Plans and Elevations

Scale	Date	Drawn
As Shown@A1	March 2017	PRG

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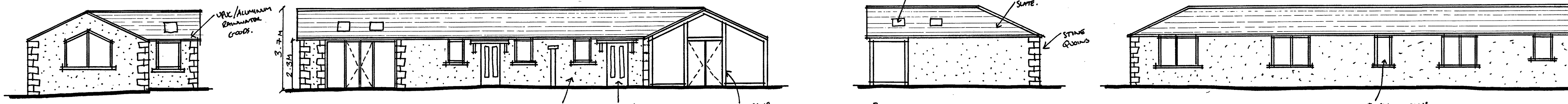


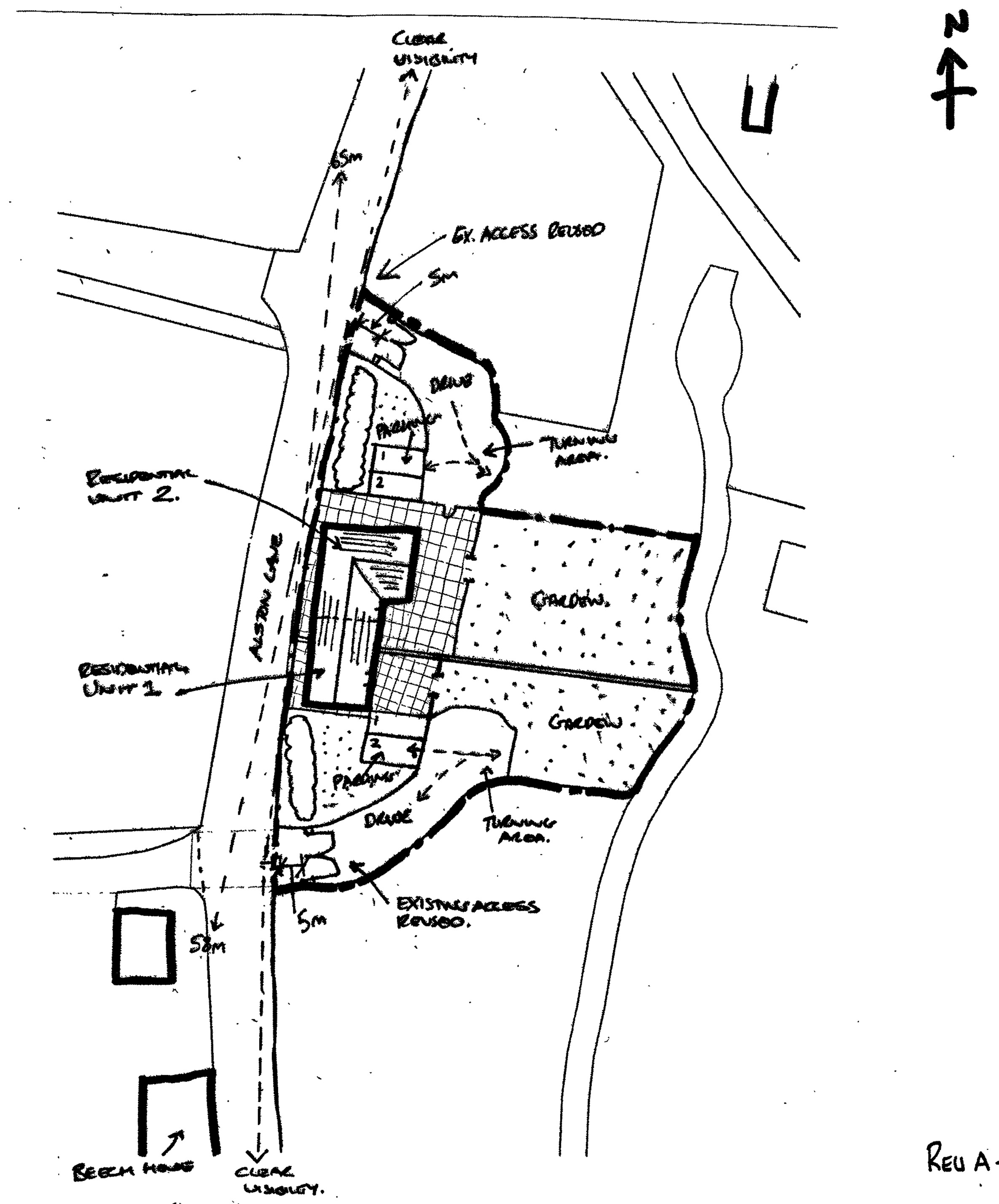
Proposed South Elevation

Proposed East Elevation

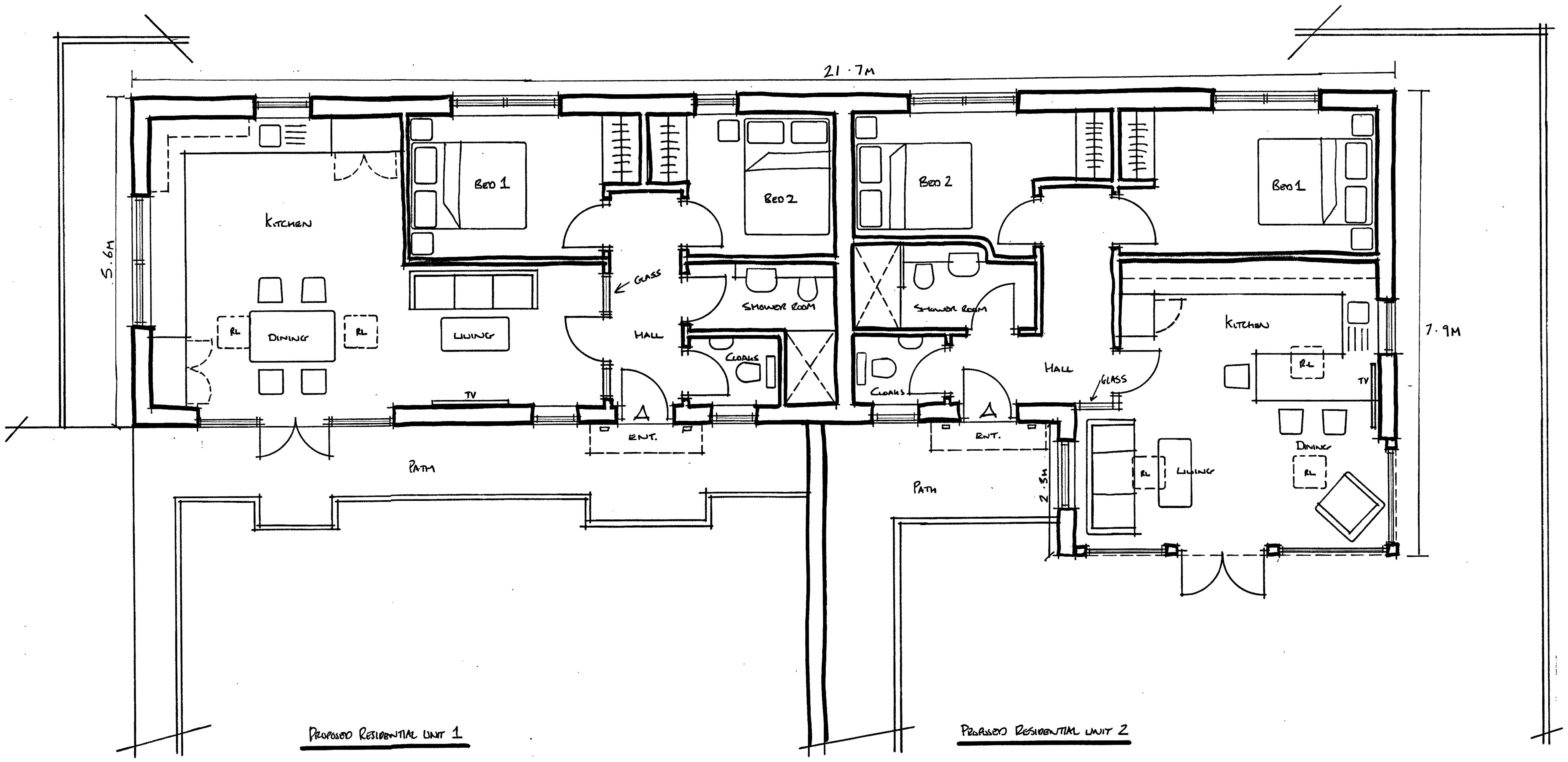
Proposed North Elevation

Proposed West Elevation

Proposed Elevations - Scale 1:100



Site Plan - Scale 1:500



Proposed Residential Unit 1

Proposed Residential Unit 2

Proposed Plans - Scale 1:50

Rev A - Site Plan Amended - March 17. PDC.

Client
Dewhurst Holdings

Job Title
Conversion of Redundant outbuildings at Beech House Aston

Drawing Title
Proposals

Scale	Date	Drawn
AS SHOWN	MARCH 17	PDC

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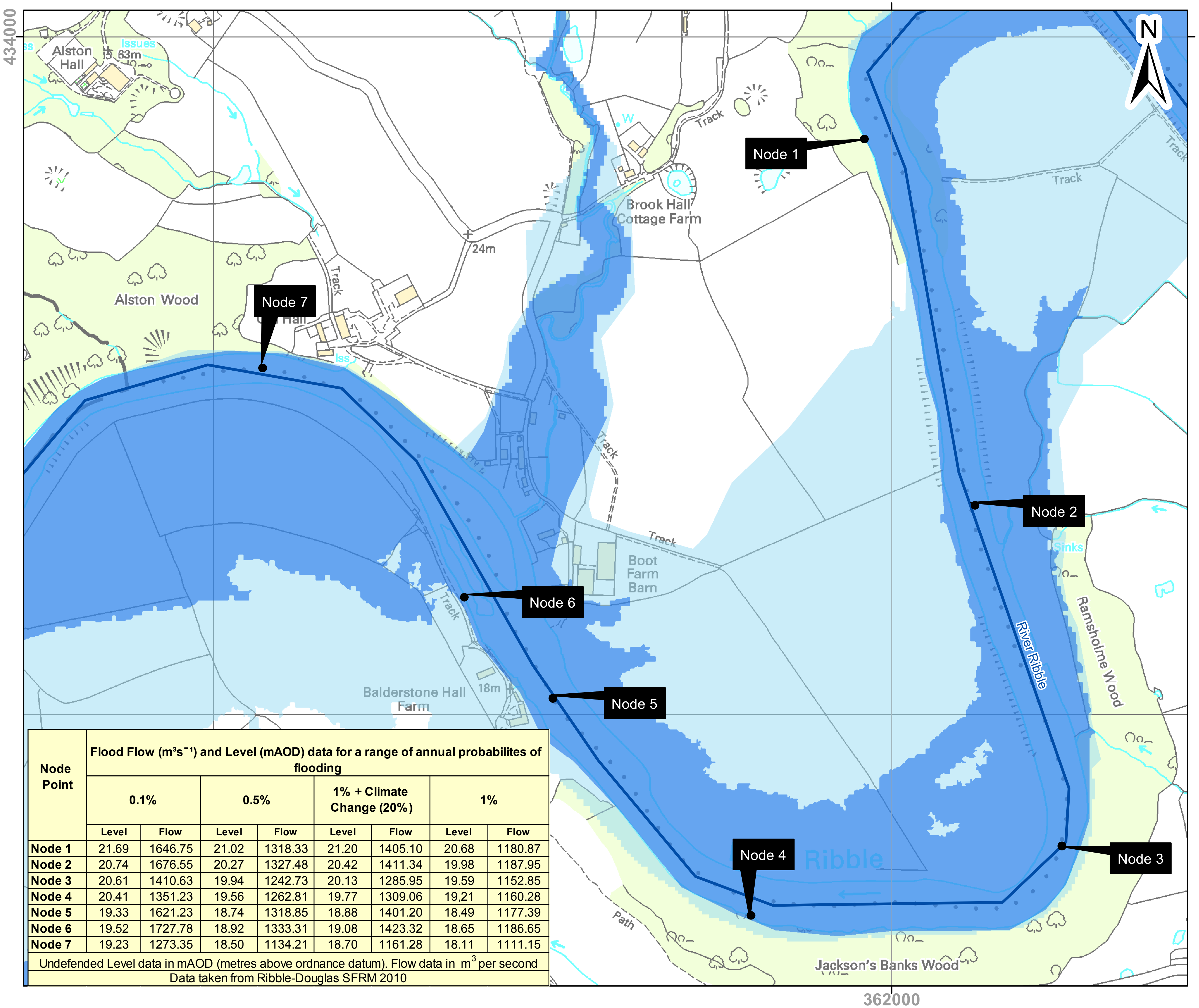
Appendix A.2 – Environment Agency Flood Report



Node Point	Flood Flow (m^3s^{-1}) and Level (mAOD) data for a range of annual probabilites of flooding							
	0.1%		0.5%		1% + Climate Change (20%)		1%	
	Level	Flow	Level	Flow	Level	Flow	Level	Flow
Node 1	21.69	1646.75	21.02	1318.33	21.20	1405.10	20.68	1180.87
Node 2	20.74	1676.55	20.27	1327.48	20.42	1411.34	19.98	1187.95
Node 3	20.61	1410.63	19.94	1242.73	20.13	1285.95	19.59	1152.85
Node 4	20.41	1351.23	19.56	1262.81	19.77	1309.06	19,21	1160.28
Node 5	19.33	1621.23	18.74	1318.85	18.88	1401.20	18.49	1177.39
Node 6	19.52	1727.78	18.92	1333.31	19.08	1423.32	18.65	1186.65
Node 7	19.23	1273.35	18.50	1134.21	18.70	1161.28	18.11	1111.15
Undefended Level data in mAOD (metres above ordnance datum). Flow data in m^3 per second								
Data taken from Ribble-Douglas SFRM 2010								

Environment Agency

Fluvial Flood Level Map: Alston Lane, Longridge, PR3 3BN

Produced: 24 October 2017
Our Ref: CL62790
NGR: SD 61488 33472

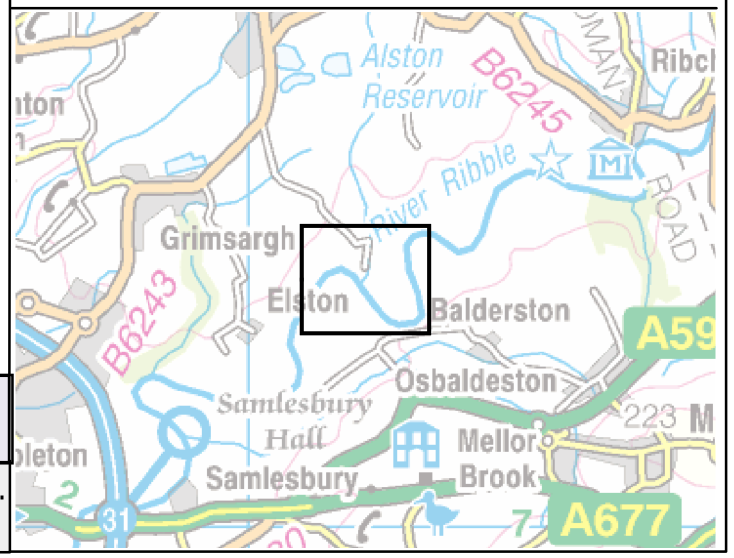
Key

Main River
Areas Benefitting from Defences
Flood Zone 3
Flood Zone 2

Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

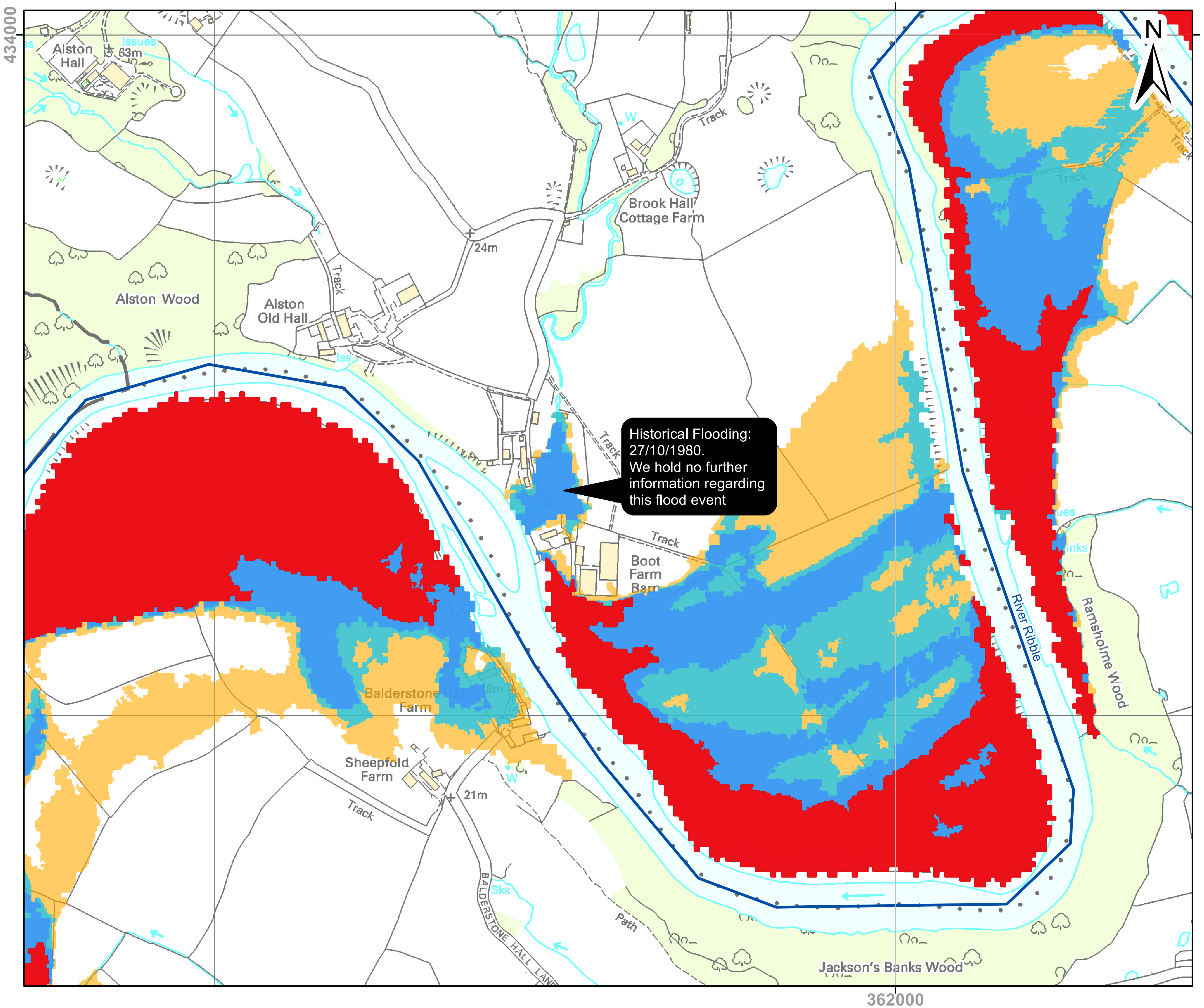
Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

ABDs (Areas Benefiting from Defences) show the area benefiting from defences during a 1 in 200 tidal, or 1 in 100 fluvial flood event.



Modelled water levels with climate change using +20% flow allowances are not suitable for the majority of planning purposes. New climate change allowances can be checked on the following website; www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk



Undefended Modelled Flood Outlines: Alston Lane, Longridge, PR3 3BN

Produced: 24 October 2017
Our Ref: CL62790
NGR: SD 61488 33472

Key

Main River

Fluvial Undefended Scenario 1.0% annual probability of flooding

Fluvial Undefended Scenario Climate Change (+20%) 1.0% annual probability of flooding

Fluvial Undefended Scenario 0.5% annual probability of flooding

Fluvial Undefended Scenario 0.1% annual probability of flooding

Flood Zone 3 shows the area that could be affected by flooding:
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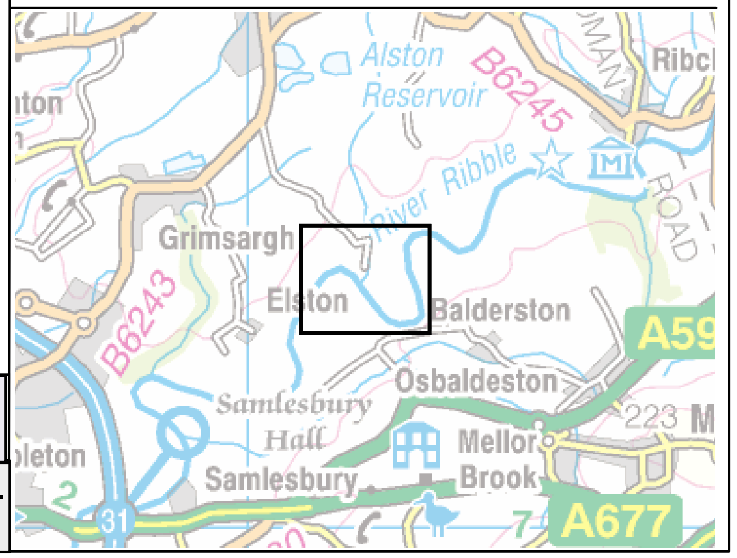

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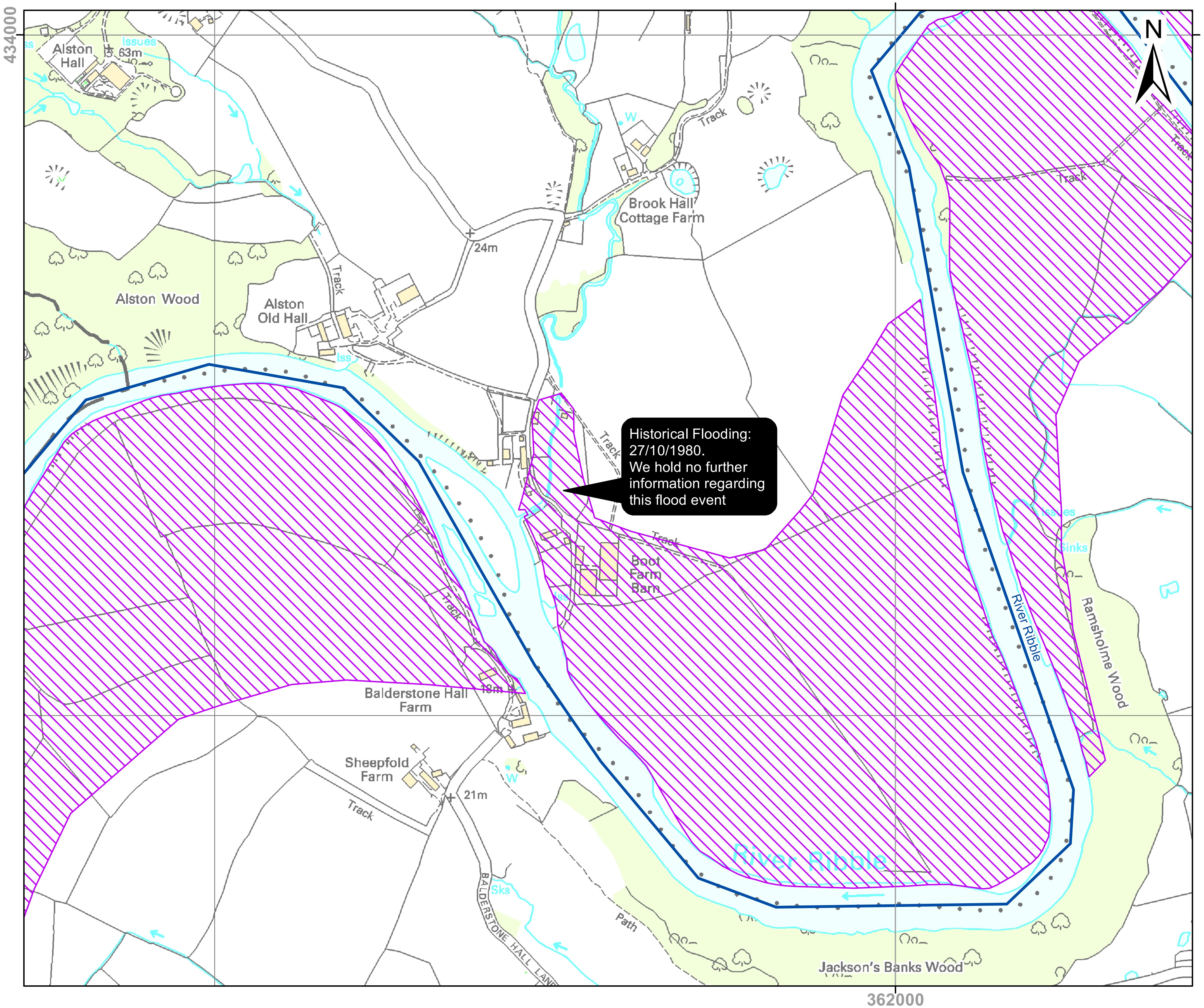
Environment Agency

Historical Flood Map: Alston Lane, Longridge, PR3 3BN

Produced: 24 October 2017
Our Ref: CL62790
NGR: SD 61488 33472



Key

Main River

Historic Flooding

Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

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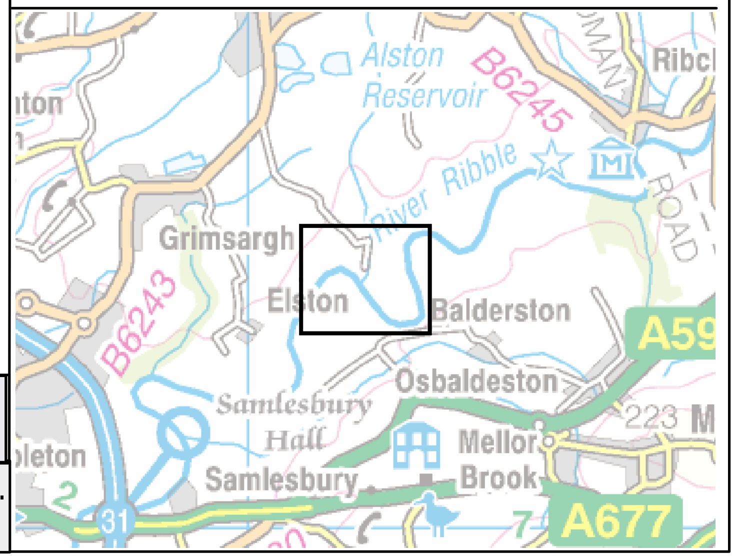
ABDs (Areas Benefiting from Defences) show the area benefiting from defences during a 1 in 200 tidal, or 1 in 100 fluvial flood event.



Modelled water levels with climate change using +20% flow allowances are not suitable for the majority of planning purposes. New climate change allowances can be checked on the following website; www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances.

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