

LITTLE DONGRAY FARM, BANGOR-ON-DEE

FLOOD CONSEQUENCES ASSESSMENT

Final Report v1.1

January 2018

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Report Title: **Little Dongray Farm, Bangor-on-Dee**
Flood Consequences Assessment
Final Report v1.1

Client: Mrs K Taylor

Date of Issue: 8 January 2018

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This document has been prepared solely as a Flood Consequences Assessment for Mrs K Taylor. This report is confidential to Mrs K Taylor and Weetwood Services Ltd accepts no responsibility or liability for any use that is made of this document other than by Mrs K Taylor for the purposes for which it was originally commissioned and prepared.

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1 INTRODUCTION

1.1 PURPOSE OF REPORT

Weetwood Services Ltd ('Weetwood') has been instructed by Mrs K Taylor to undertake a Flood Consequences Assessment (FCA) in association with the proposed development of a stable building and the subsequent change of land use from agricultural to form a horse manège on Little Dongray Farm, Bangor-on-Dee.

This FCA has been prepared in accordance with the requirements of Technical Advice Note 15 (TAN15): Development and Flood Risk.

1.2 STRUCTURE OF THE REPORT

The report is structured as follows:

- Section 1** Introduction and report structure
- Section 2** Presents national and local flood risk and drainage planning policy
- Section 3** Provides background information relating to the development site, the development proposals, ground conditions and existing site access arrangements
- Section 4** Assesses the potential sources of flooding to the development site
- Section 5** Presents flood risk mitigation measures based on the findings of the assessment
- Section 6** Presents a summary of key findings
- Section 7** Presents the recommendations

2 PLANNING POLICY AND GUIDANCE

2.1 TECHNICAL ADVICE NOTE 15; DEVELOPMENT AND FLOOD RISK

The general approach of TAN15 is to set out a precautionary framework to guide planning decisions in areas at high risk of flooding. The overarching aim of the framework is, in order of preference, to:

- Direct new development away from those areas which are at a high risk of flooding.
- Where development has to be considered in high risk areas (i.e. Zone C) only those development which can be justified should be located in such areas.

2.1.1 Justification Test

In accordance with Paragraph 6 of TAN15 for the Justification Test to be passed it must be demonstrated that:

- i Its location in Zone C is necessary to assist, or be part of, a local authority regeneration initiative or a local authority strategy required to sustain an existing settlement; **or**,
- ii Its location in Zone C is necessary to contribute to key employment objectives supported by the local authority, and other key partners, to sustain an existing settlement or region;

and,

- iii It concurs with the aims of Planning Policy Wales (PPW) and meets the definition of previously developed land (PPW Fig 2.1); and,
- iv The potential consequences of a flooding event for the particular type of development have been considered, and in terms of the criteria contained in sections 5 and 7 and appendix 1 found to be acceptable.

2.2 LOCAL PLANNING POLICY AND GUIDANCE

The Wrexham County Borough Council (WCBC) Unitary Development Plan (UDP) 1996-2011 was adopted in 2005 and is the current Development Plan for the administrative area of Wrexham County Borough Council.

The following policies are relevant in respect of flood risk:

Policy EC12; Development and Flood Risk

- Development (including the raising of land) within defined flood plains will only be permitted if it:-
 - a. would not be subject to an unacceptable risk of flooding on-site; and/or
 - b. does not result in an unacceptable risk of flooding on or off-site; and/or
 - c. does not adversely affect flood management or maintenance schemes

Policy EC13; Surface Water Run-off

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

Wrexham County Borough Council is currently preparing a Local Development Plan for the Borough covering the period 2018-2028, which will replace the current adopted UDP.

2.3 CONSENTS

An Environmental Permit for Flood Risk Activities may be required from Natural Resources Wales (NRW) for work:

- in, under, over or near a main river (including where the river is in a culvert)
- on or near a flood defence on a main river
- in the flood plain of a main river
- on or near a sea defence

Further information can be found by visiting the .Gove website¹

If the location of your activity is on any watercourse that lies within an Internal Drainage District (IDD) you will need to apply to Natural Resources Wales for a Flood Risk Activity Permit.

Ordinary Watercourse Consent may be required from the lead local flood authority for work to an ordinary watercourse..

Undertaking activities controlled by local Byelaws (made under the Water Resources Act 1991) also requires the relevant consent.

2.4 RELEVANT DOCUMENTS

The FCA has been informed by the following documents:

- Local Flood Risk Management Strategy (LFRMS), WCBC, April 2013
- Flood Risk Management Plan (FRMP), WCBC, July 2016

¹ <https://naturalresources.wales/apply-for-a-permit/flood-risk-activities/flood-risk-activity-permits-information/?lang=en>

3 SITE DETAILS AND PROPOSED DEVELOPMENT

3.1 SITE LOCATION

The site is located 270 m north of the B5069 (Station Road) at Ordnance Survey National Grid Reference SJ 399 458 as shown in **Figure 1**.

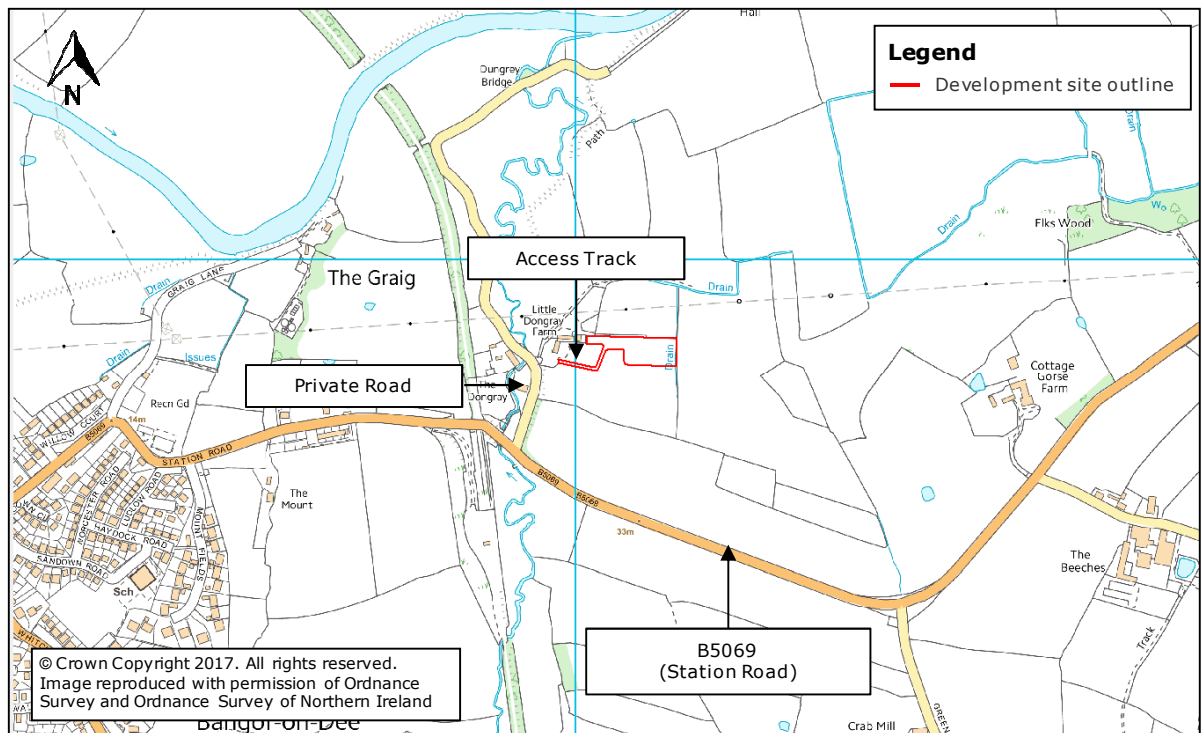


Figure 1: Site Location

3.2 EXISTING AND PROPOSED DEVELOPMENT

The site currently consists of grassland used for agricultural purposes.

A planning application has been submitted for the erection of a stable building and the subsequent change of land use from agricultural to form a horse manège along with its associated infrastructure. (**Appendix A**). It is understood that an area of hardstanding has already been installed for the base of the stable building.

WCBC has been consulted to ascertain the land use vulnerability classification for proposed development in line with TAN15. A response was received² indicating that for the stable building a 'less vulnerable' land use classification may be considered. The manège and associated infrastructure is not attributed a land use vulnerability classification in TAN15³.

² Email from Wrexham County Borough Council to Weetwood on 11 December 2017

³ TAN15, Figure 2

3.3 WATERBODIES IN THE VICINITY OF THE SITE

The River Dee flows in a north-easterly direction approximately 485 m north of the site.

Dungrey Brook is located approximately 64 m west of the site and flows in a northerly direction, ultimately outfalling into the River Dee.

Watercourse A is located approximately 5 m east of the site and flows in a northerly direction, outfalling to Dol-Enion Brook approximately 95 m to the north-east. This Brook in turn flows in a easterly/north-easterly direction ultimately outfalling to the River Dee.

The River Dee, Dungrey Brook and Dol-Enion Brook are classified as 'main river'.

Watercourse A may be classified as an 'ordinary watercourse'.

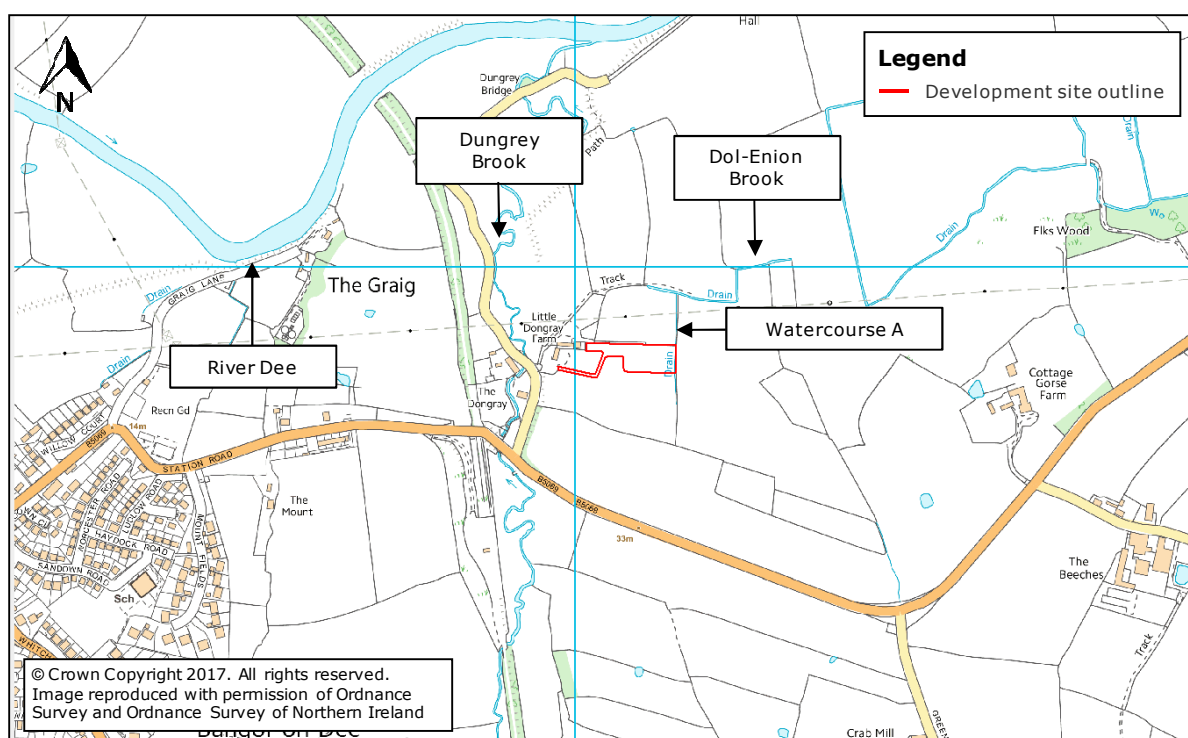


Figure 2: Location of Waterbodies

3.4 GROUND CONDITIONS

According to the Soilscales maps produced by the National Soils Research Institute⁴, soil conditions at the site and within the surrounding area are described as '*slowly permeable and seasonally wet, slightly acidic but base-rich loamy and clayey soils*'.

According to the British Geological Survey (BGS) the bedrock at the site is '*Chester Formation – Sandstone, Pebbly (gravelly)*', which is overlain by superficial deposits comprising '*Alluvium – Clay, Silt, Sand and Gravel*'.

⁴ Soilscales www.landis.org.uk/soilscales/

BGS borehole records⁵ located approximately 635 m north west of the site at Dongray Hall show ground conditions to be comprised of 'silt, greyish brown clay' between 3.3 – 5.0 metres below ground level (m bgl). Between 7.7 – 13.0 m bgl, the recorded strata is shown to consist of 'course gravel, reddish-brown clay and silt with clayey layers'. Groundwater was encountered at 9.0 m bgl.

3.5 SITE LEVELS

LiDAR data has been utilised to develop a digital elevation model for the site and surrounding areas as illustrated in **Figure 3**. Levels on site are generally shown to be in the region of 12.1 – 16.4 m AOD, with levels shown to rise from east to west.

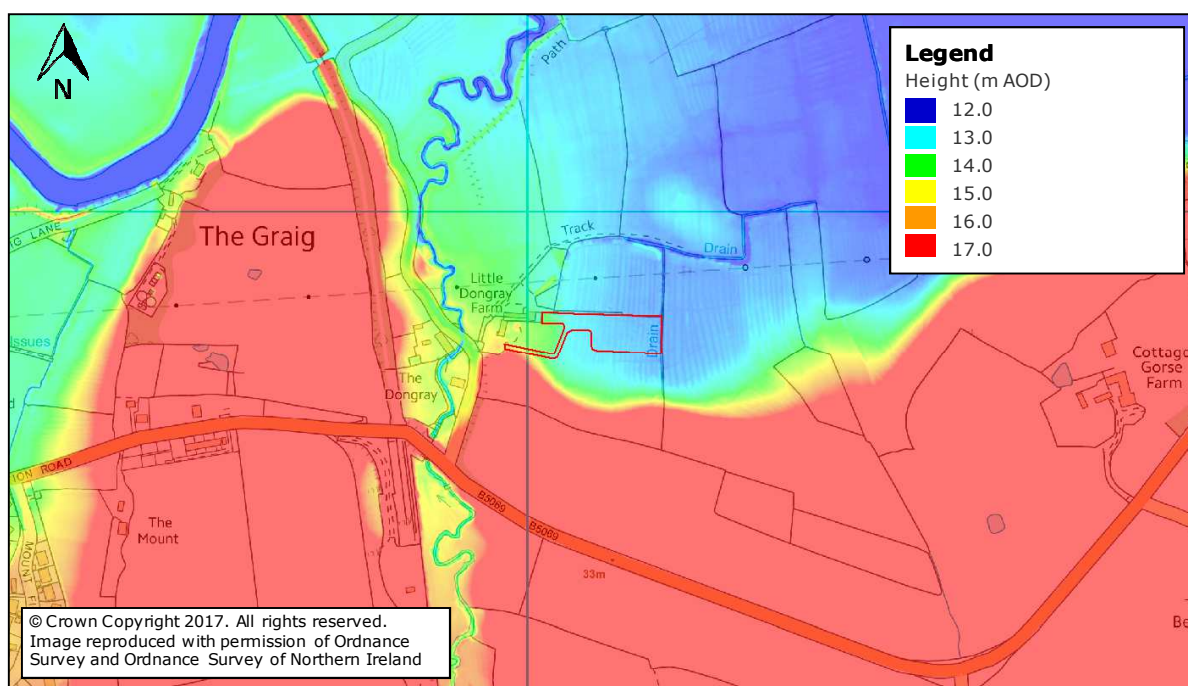


Figure 3: Digital Elevation Model

3.6 ACCESS AND EGRESS

Access and egress to the site is provided via a private road that branches north off the B5069 (Station Road).

Levels along the private road are generally shown to be in the region of 13.4 - 21.3 m AOD, with levels shown to rise from north to south.

At the junction of the B5069 (Station Road) and the private road, ground levels are shown to be in the region of 18.4 – 21.4 m AOD.

⁵ www.bgs.ac.uk/data/boreholescans/home.html, Ref: SD37NE15/B

4 REVIEW OF FLOOD RISK

4.1 FLOOD ZONE DESIGNATION

Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences. TAN15 defines flood zones as follows⁶:

- **Zone A.** Considered to be at little or no risk of fluvial or tidal/coastal flooding.
- **Zone B.** Areas known to have been flooded in the past evidenced by sedimentary deposits.
- **Zone C.** Based on Environment Agency extreme flood outline, equal to or greater than 0.1% (river, tidal or coastal). Zone C is subdivided into the following two zones:
 - **Zone C1.** Areas of the floodplain which are developed and served by significant infrastructure, including flood defences.
 - **Zone C2.** Areas of the floodplain without significant flood defence infrastructure.

The Flood Zones are currently shown on the NRW Flood Risk Map and do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding.

4.1.1 Development Advice Map

According to the latest Development Advice Map the site is located towards the extremity of Zone C2 (**Figure 4**).

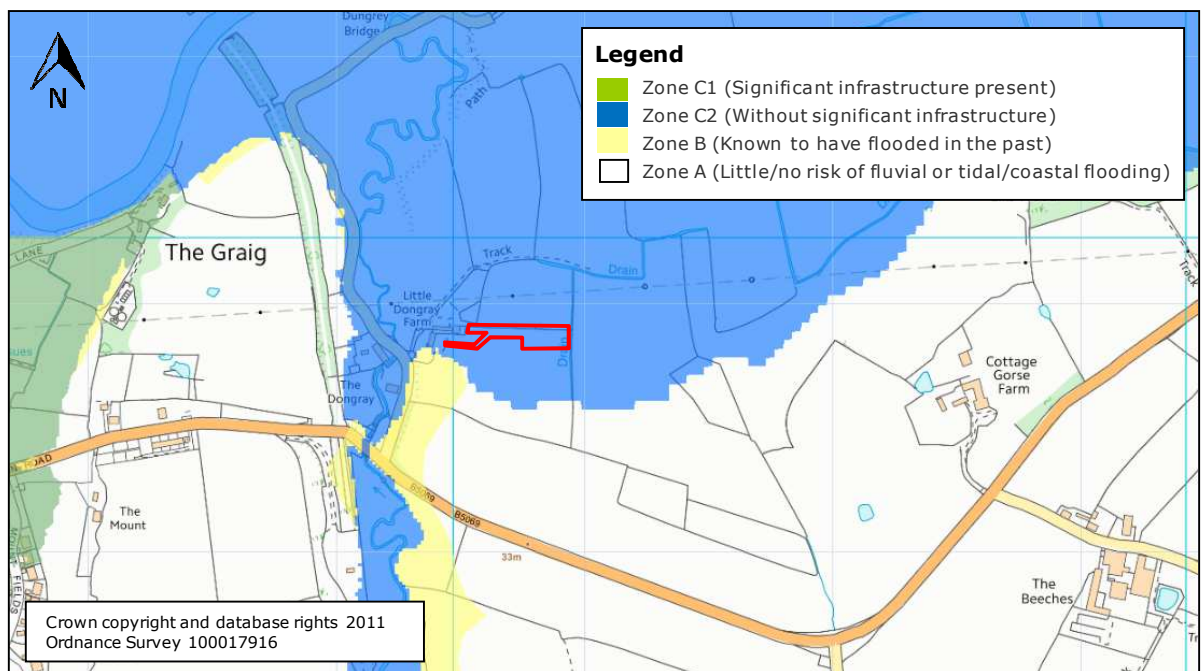


Figure 4: Development Advice Map
(Source: NRW website)

⁶ TAN15, Figure 1

4.1.2 Natural Resources Wales Flood Map

According to the NRW Flood Map the site is located in the 1 in 100 fluvial annual probability flood outline. The site is not shown to be located within an area benefiting from defences and as such supports the current Zone C2 categorisation.

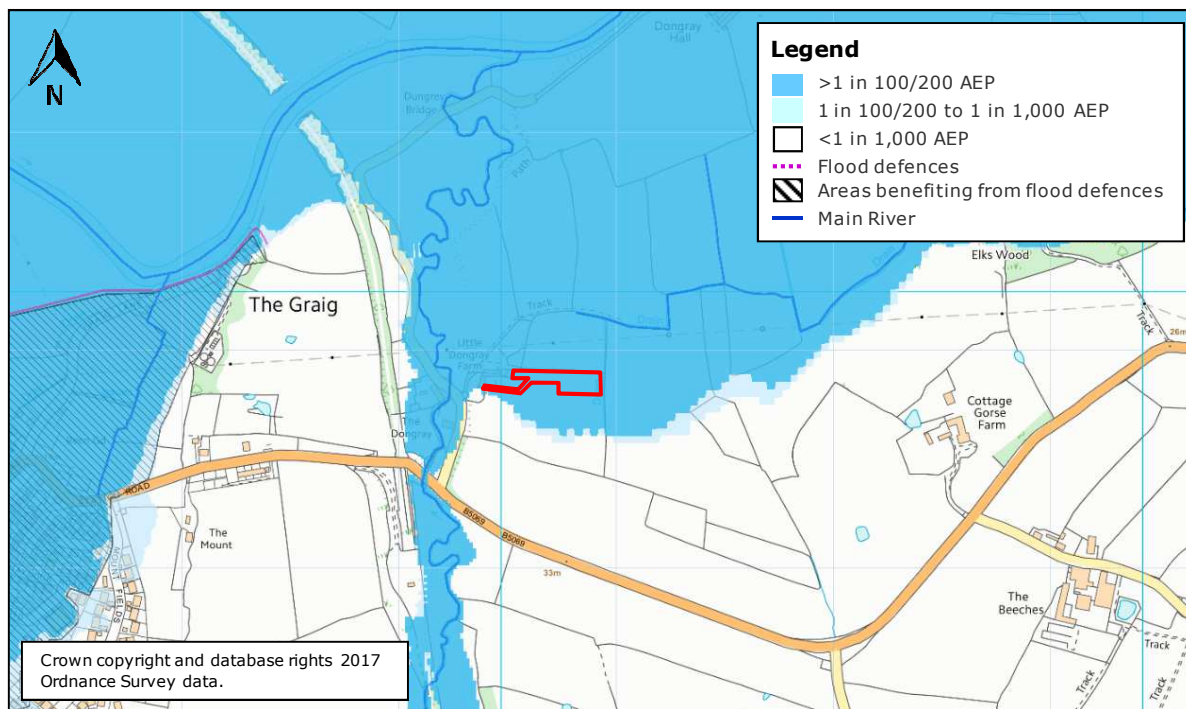


Figure 5: Natural Resources Wales Flood Map
(Source: NRW website)

4.2 JUSTIFICATION TEST

As outlined in **Section 3.2**, WCBC have indicated that in line with TAN15 the proposed stable building may be considered to have a 'less vulnerable' land use classification, whilst the manège and associated infrastructure are not attributed a land use vulnerability classification in TAN15.

Recognising the above, and given the scale of the development, WCBC has been consulted regarding the requirement for the application of the Justification Test in this instance. A response was received⁷ indicating that the development would be considered in light of the proposals being appropriate in terms of flood risk based on paragraph 7.2 of TAN15 and Policy EC12 of the UDP (**Section 2.2**)

WCBC has indicated that subject to being satisfied that the development itself is not at an unacceptable risk of flooding and/or it does not result in unacceptable risk to off-site flooding, along with the findings of this FCA being accepted by the NRW, then it would determine the application in accordance with advice received.

⁷ Email from Wrexham County Borough Council to Weetwood on 11 December 2017

4.3 HISTORICAL RECORDS OF FLOODING

NRW historical flood outlines⁸ indicate that the site has been flooded previously, notably in January 1964. The source of flooding for the event has been classified as fluvial, with floodwater overtopping flood defences, however no further details are provided regarding the depths of flooding that may have been experienced on site.

4.4 FLUVIAL FLOOD RISK – RIVER DEE

As detailed previously the River Dee is located approximately 485 m north of the site.

4.4.1 Modelled Flood Levels & Extents

The River Dee at Bangor-on-Dee Flood Risk Mapping Study was completed by JBA Consulting in May 2012 and comprised the development of a 1D-2D ISIS-TUFLOW hydraulic model of the River Dee. The hydraulic model and accompanying modelling report have been obtained from NRW for the purpose of this report.

The model outputs have subsequently been interrogated in order to determine the level, depth and velocity of floodwater expected on site during the 1 in 100, 1 in 100 +CC (climate change) (20%) and 1 in 1,000 annual probability events as detailed in **Table 1**.

Table 1: River Dee Flood Information for the Site
(Source: JBA River Dee at Bangor-on-Dee Flood Risk Mapping Study May 2012)

Annual Probability Event	Max Depth (m)		Max Velocity (m/s)	
	Defended	Undefended	Defended	Undefended
1 in 100	1.21	1.25	0.31	0.11
1 in 100 +CC (20%)	1.54	1.49	0.43	0.15
1 in 1,000	1.76	2.21	0.79	0.49

4.4.1.1 Defended Scenario

Although the site is shown not to benefit from flood defences on the NRW Flood Risk Map, modelled outputs have been provided by NRW for the defended scenario. This indicates that the site marginally benefits from upstream flood defences positioned on the right bank of the River Dee protecting Bangor-on-Dee.

Table 1 indicates that flooding on site would be expected during all of the aforementioned defended scenario events, with depths and velocities reaching up to 1.54 m and 0.43 m/s during a 1 in 100 +CC (20%) annual probability event.

Modelled flood extents for the defended scenarios are provided in **Figure 6**.

A small part of the access track (**Figure 1**) is expected to flood to depths in the region of 0.2 – 0.6 m (**Figure 6**) in up to the 1 in 1,000 annual probability event; however, the B5069 (Station Road) and the connecting private road leading to the site would be expected to remain dry during all of the aforementioned defended events.

The risk of flooding from this source will be mitigated through the implementation of the measures proposed in **Section 5** of this report.

⁸ Lle Catalogue Website

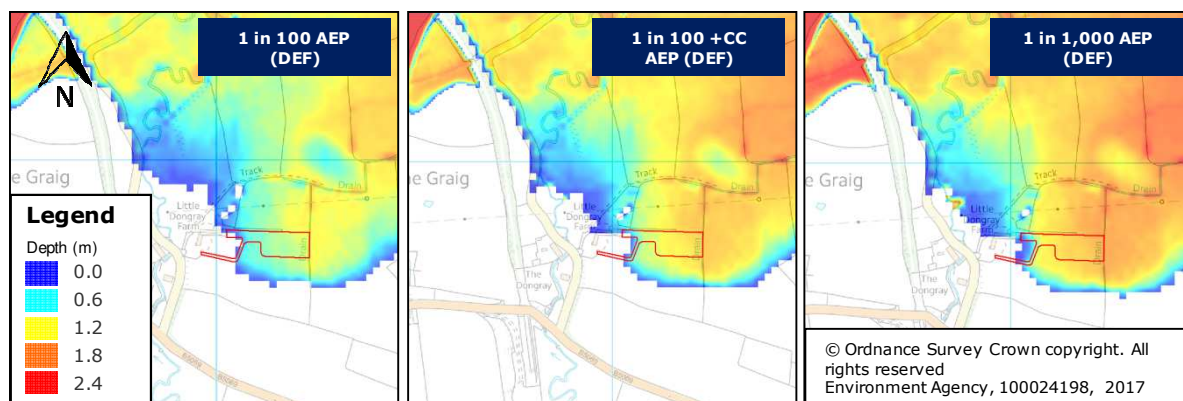


Figure 6: Defended Modelled Flood Outline
(Source: JBA River Dee at Bangor-on-Dee Flood Risk Mapping Study May 2012)

4.4.1.2 Undefended Scenario

Modelled outputs have also been provided for the undefended 1 in 100, 1 in 100 + CC (20%) and 1 in 1,000 annual probability events.

Parallel to the modelled defended scenarios, flooding is expected on site during all of the aforementioned undefended scenario events, with depths and velocities reaching up to 1.49 m and 0.15 m/s during a 1 in 100 +CC (20%) annual probability event.

Modelled flood extents for the undefended scenarios are provided in **Figure 7**.

Part of the access track (**Figure 1**) is again expected to flood with depths in the region of 0.6 – 1.2 m (**Figure 7**) in up to the 1 in 1,000 annual probability event; however, the B5069 (Station Road) and the connecting private road leading to the site would be expected to remain dry.

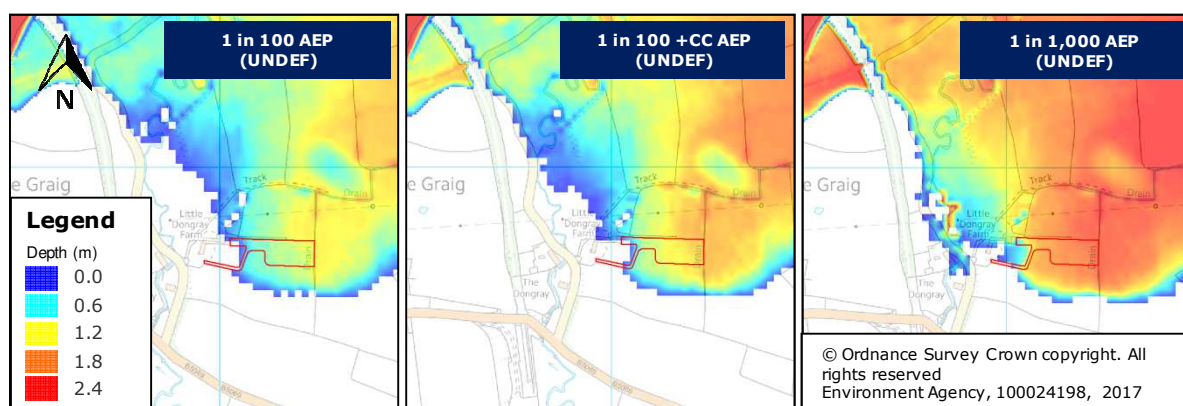


Figure 7: Undefended Modelled Flood Outline
(Source: JBA River Dee at Bangor-on-Dee Flood Risk Mapping Study May 2012)

The risk of flooding from this source will be mitigated through the implementation of the measures proposed in **Section 5** of this report.

4.5 FLUVIAL FLOOD RISK – DUNGREY BROOK, DOL-ENION BROOK AND WATERCOURSE A

As discussed in **Section 3.3**, Dungrey Brook, Dol-Enion Brook and Watercourse A are located approximately 64 m, 95m and 5 m away from the site respectively. Dungrey Brook, Dol-Enion Brook and Watercourse A are shown to flow away from the site and ultimately outfall into the River Dee.

Given the limited catchment area of the watercourses (12.82 km²), and the capacity of their channels, it is not considered that these watercourses would pose significant risk of flooding to the site.

In the event of floodwaters overtopping their banks, the decrease in ground elevation across the site from west to east would suggest that floodwaters would be expected to be conveyed across/away from the site. As a result, floodwaters would not be expected to accumulate to any significant depth on site. This is reiterated by the NRW Risk of Flooding from Surface Water map (**Figure 10**).

Any residual risk of flooding from this source will be mitigated through the implementation of the measures proposed in **Section 5** of this report.

4.6 FLOOD RISK FROM RESERVOIRS, CANALS AND OTHER ARTIFICIAL SOURCES

Reservoir or canal flooding may occur as a result of the facility being overwhelmed and/or as a result of dam or bank failure.

The NRW Risk of Flooding from Reservoirs map (**Figure 8**) indicates that the site is located within the maximum flood extents of reservoirs Llyn Celyn, Llyn Brenig and Alwen. However, it is important to consider that reservoir flooding is extremely unlikely to happen as all large reservoirs are regularly inspected by reservoir panel engineers and essential safety work is carried out.

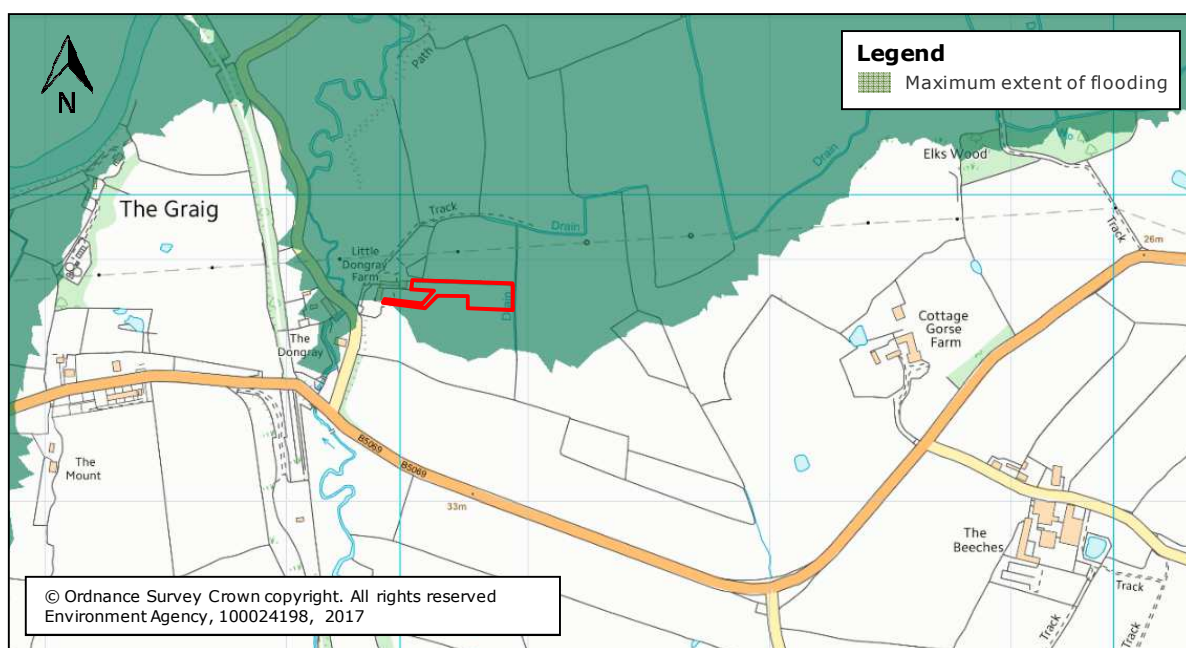


Figure 8: Risk of Flooding from Reservoirs Map
(Source: NRW website)

4.7 FLOOD RISK FROM GROUNDWATER

Groundwater flooding generally occurs during intense, long-duration rainfall events, when infiltration of rainwater into the ground raises the level of the water table until it exceeds ground levels. It is most common in low-lying areas overlain by permeable soils and permeable geology, or in areas with a naturally high water table.

As detailed in **Section 3.4** ground conditions at the site and within the surrounding area are described as '*slowly permeable and seasonally wet, slightly acidic but base-rich loamy and clayey soils*'. The permeability of the underlying soil conditions and the subsequent propensity for groundwater flooding may therefore be assessed to be low.

According to the BGS Groundwater Flooding Hazard map (**Figure 9**) the susceptibility to groundwater flooding is moderate.

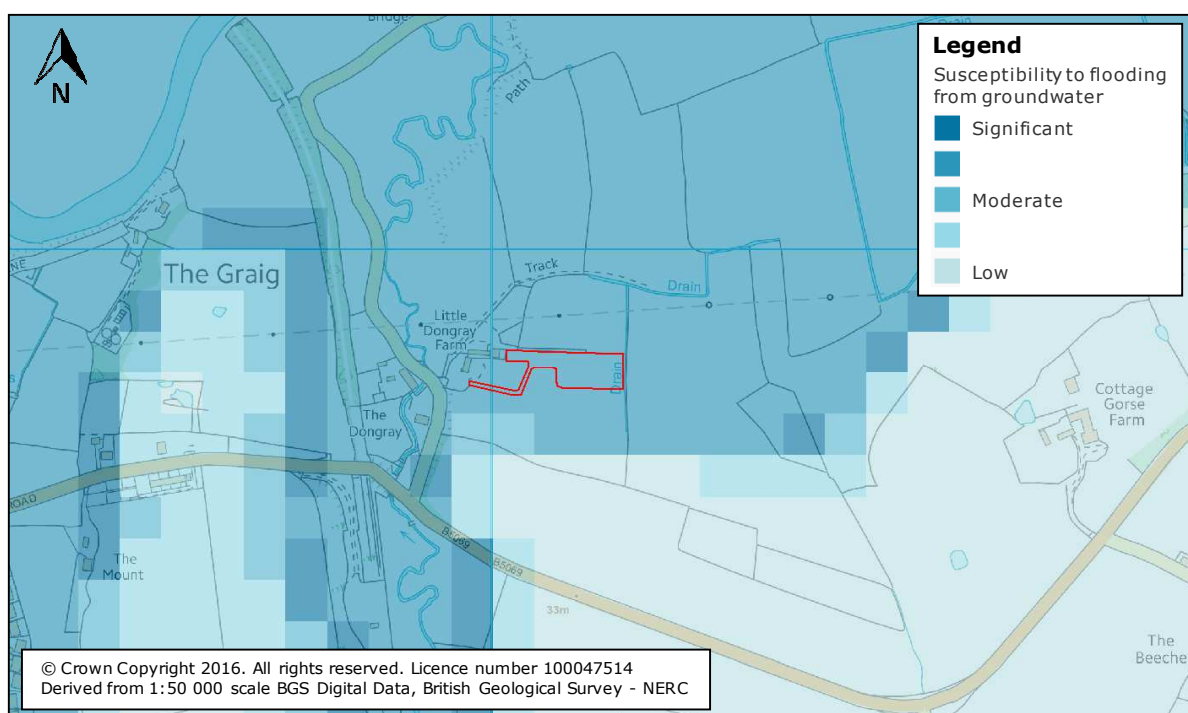


Figure 9: Groundwater Flooding Hazard Map
(Source: Findmaps)

Any residual risk of flooding from this source will be mitigated through the implementation of the measures proposed in **Section 5** of this report.

4.8 FLOOD RISK FROM SURFACE WATER

Surface water flooding comprises pluvial flooding and flooding from sewers and highway drains and gullies.

4.8.1 Risk of Pluvial Flooding

Pluvial flooding results from rainfall-generated overland flow, before the runoff enters any watercourse or sewer, or where the sewerage/drainage systems and watercourses are overwhelmed and therefore unable to accept surface water.

Pluvial flooding is usually associated with high intensity rainfall events but may also occur with lower intensity rainfall where the ground is saturated, developed or otherwise has low permeability resulting in overland flow and ponding within depressions in the topography.

As detailed in **Section 3.4** ground conditions at the site and within the surrounding area are described as '*slowly permeable and seasonally wet, slightly acidic but base-rich loamy and clayey soils*'. There may therefore be the propensity for surface water flooding at the existing site. However, given the fall in ground levels from west to east surface water would not be expected to accumulate to any significant depth at the site itself.

This is reiterated by the NRW Risk of Flooding from Surface Water map (**Figure 10**), which indicates that the site is at a very low risk of flooding from this source.

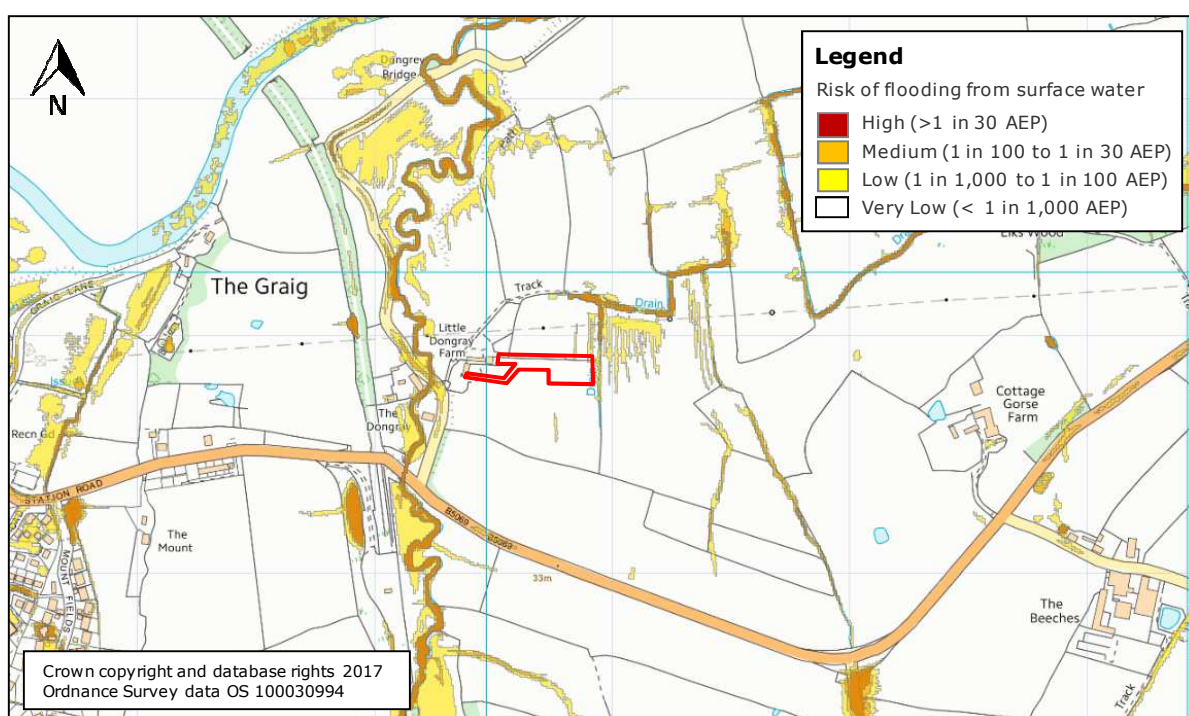


Figure 10: Natural Resources Wales Risk of Flooding from Surface Water

(Source: NRW website)

The risk of pluvial flooding at the site is assessed to be low. However, any residual flood risk from this source will be addressed through the mitigation measures as detailed in **Section 5**.

4.8.2 Risk of Flooding from Sewers and Highway Drains and Gullies

Flooding of land and/or property can occur when the capacity of the sewer/drainage system is overwhelmed by heavy rainfall, becomes blocked or is of inadequate capacity or where the normal discharge of sewers and drains through outfalls is impeded by high water levels in receiving waters.

Dŵr Cymru Welsh Water has been consulted to ascertain whether it holds any records of sewer flooding at the site. A response was received⁹ indicating there are no records of sewer flooding within the direct vicinity of the site.

Wrexham County Borough Council has been consulted to ascertain whether it holds any records of highways flooding at or within the vicinity of the site. A response was received¹⁰ indicating that there are records of historical flooding at the site. The events date back to 2009 and 2012, and involved the request for sandbags.

⁹ Email from Dŵr Cymru Welsh Water to Weetwood dated 14 December 2017

¹⁰ Email from Wrexham County Borough Council to Weetwood dated 13 December 2017

5 FLOOD RISK MITIGATION MEASURES

5.1 FLOOD MITIGATION

The risk of flooding from the River Dee, and any residual risk of flooding from reservoirs and groundwater will be mitigated through the implementation of the measures proposed within the following section of this report.

5.1.1 Finished Floor Levels

The finished floor level of the stable should be set at a minimum of 0.15 m above adjacent ground levels following reprofiling of the site.

This will enable any potential overland flows to be conveyed safely across the site without affecting property in accordance with the approach promoted by government policy¹¹.

5.1.2 Flood Resistant and Resilient Construction

Appropriate flood resilient construction techniques should be incorporated into the design of the stable building, in line with government guidance¹². These include design features and finish materials to minimise the damage in the unlikely event of the development being inundated.

In particular it is advised that any electrical wiring, switches and equipment, along with high valued items are positioned at a higher level within the stable building.

5.2 FLOOD RISK ELSEWHERE

Any proposal to modify ground levels should demonstrate that there is no increase in flood risk to the development itself, or to any existing buildings which are known to, or are likely to flood.

Due to the nature of the proposals and that the design of the stable building, manège and associated infrastructure, it is not expected that this would adversely impact the conveyance of floodwater across the site.

5.3 ACCESS AND EGRESS

The B5069 (Station Road) and connecting private road are shown to provide safe access and egress to the site during all modelled flood events for the River Dee. Whilst some minor flooding may be expected on the access track this is only for a short section.

5.3.1 Flood Warning

According to the NRW Flood Warning Areas map (**Figure 11**); the site is included in an NRW flood warning area.

¹¹ Making Space for Water, Taking forward a new Government strategy for flood and coastal erosion risk management in England, March 2005, Dept for Environment, Food and Rural Affairs

¹² Improving the Flood Performance of New Buildings: Flood Resilient Construction. Dept for Communities and Local Government. May 2007.

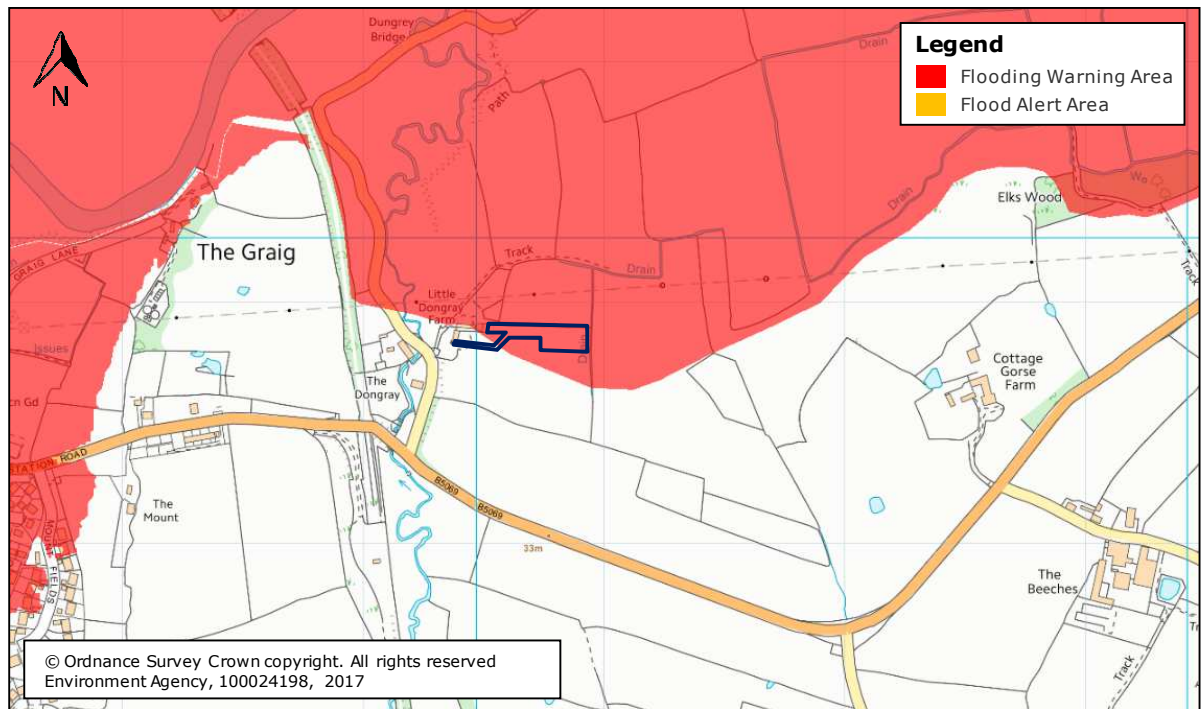


Figure 11: Natural Resources Wales Flood Warning Areas
(Source: NRW website)

NRW offers a free flood warning service called Floodline Warnings Direct. Flood alerts/warnings may be provided by telephone, email, text or fax. When registering, users must request to receive Flood Alerts.

To register for the Floodline Warnings Direct service, or for more information, visit NRW's website <http://naturalresources.wales/flooding/sign-up-to-receive-flood-warnings/?lang=en> or call Floodline on 0345 988 1188.

The owner of the property must ensure that they are registered to receive both Flood Alerts and Flood Warnings via the Floodline Warnings Direct service.

6 SUMMARY

This FCA has been prepared on behalf of Mrs K Taylor and relates to the proposed planning application which has been submitted for the erection of a stable building and the subsequent change of land use from agricultural to form a horse manège along with its associated infrastructure.

According to the NRW Flood Map the proposed development site is located within the 1 in 100 fluvial annual probability flood outline and is defined by TAN15 as being situated within Zone C2.

WCBC has indicated that in respect of the application of the Justification Test the development would be considered in light of the proposals being appropriate in terms of flood risk in accordance with paragraph 7.2 of TAN15 and Policy EC12 of the UDP.

Defended and undefended modelled fluvial flood information for the River Dee has been obtained from NRW. This indicates that some flooding of the site may be expected for both scenarios during the 1 in 100, 100 +CC (+20%) and 1,000 annual probability events.

The site is not considered to be at significant risk from Dungrey Brook, Dol-Enion Brook Watercourse A.

The NRW Risk of Flooding from Reservoirs Map indicates that the site is located within the maximum flood extents of reservoirs Llyn Celyn, Llyn Brenig and Alwen; however, the propensity for reservoir flooding is considered to be low.

The susceptibility of groundwater flooding at the site is moderate. The site is shown to be at very low risk from surface water flooding.

The finished floor level of the stable building should be set at a minimum of 0.15 m above adjacent ground levels following reprofiling of the site to enable any potential overland flows to be conveyed safely across the site.

Appropriate flood resilient construction techniques should be incorporated into the design of the stable building, in line with government in order to minimise the damage in the unlikely event of the development being inundated.

The B5069 (Station Road) and connecting private road provides safe access and egress during all flood events. Whilst some minor flooding of the access track may be expected this is only for a short section.

The site owner should register with NRW to receive flood warnings.

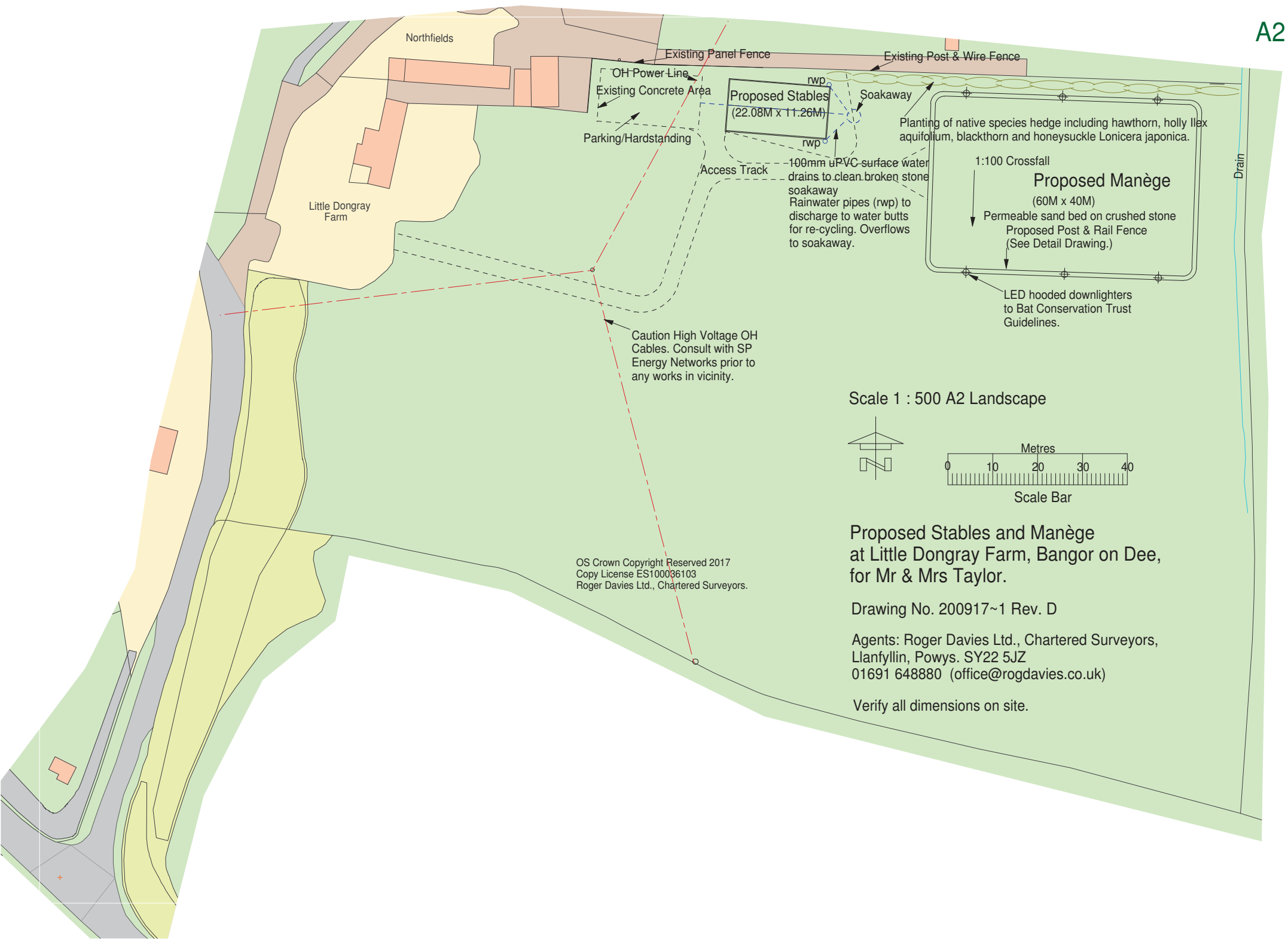
7 RECOMMENDATIONS

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

- Finished floor level of the stable building to be set a minimum of 0.15 m above adjacent ground levels
- The latest best practice flood resilient construction techniques to be incorporated into the design of the buildings.
- Site owner to register with NRW to receive flood warnings

APPENDIX A:

Development Proposals





Development • Planning • Environment

Delivering client focussed services

Flood Risk Assessments
Flood Consequences Assessments
Surface Water Drainage
Foul Water Drainage
Environmental Impact Assessments
River Realignment and Restoration
Water Framework Directive Assessments
Flood Defence Consent Applications
Sequential, Justification and Exception Tests
Utility Assessments
Expert Witness and Planning Appeals
Discharge of Planning Conditions

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