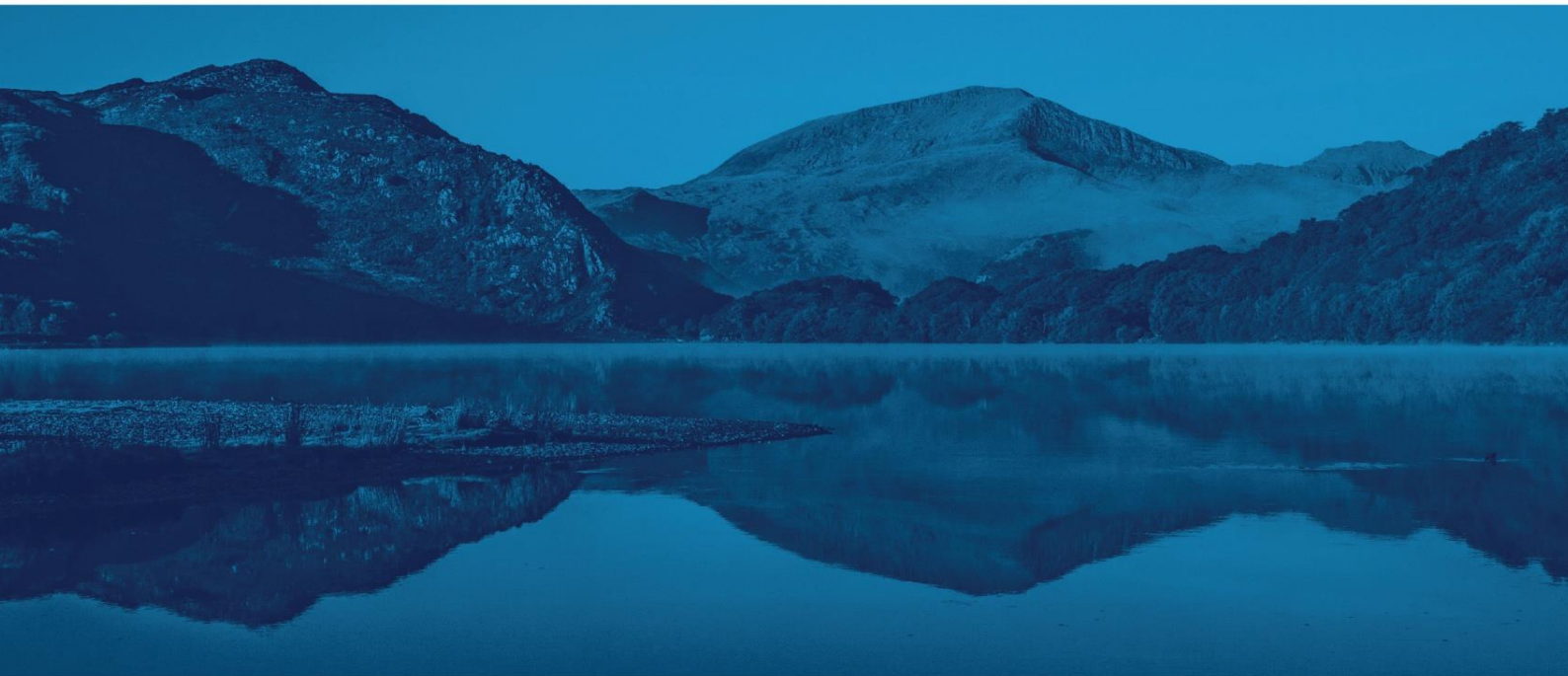




Mulsford Farm, Sarn Malpas

Flood Consequences Assessment

September 2017



Assessment / Modelling / Design

waterco.co.uk

DOCUMENT VERIFICATION RECORD

CLIENT:	D. J. Huxley (Farms) Limited
SCHEME:	Proposed poultry units at Mulsford Farm, Mulsford, Sarn Malpas, SY14 7LP – Flood Consequences Assessment
INSTRUCTION:	The instruction to carry out this Flood Consequences Assessment was received from Rosina Bloor of Roger Parry and Partners acting on behalf of the client.

DOCUMENT REVIEW & APPROVAL

AUTHOR:	Ifan Jones BSc (Hons) MSc
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APPROVER:	Aled Williams BSc (Hons) MCIWEM

ISSUE HISTORY

ISSUE DATE	COMMENTS
27/06/2017	First issue
28/06/2017	Second issue
08/09/2017	Third issue – Revised site plan

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Introduction

Waterco Consultants have been instructed to prepare a Flood Consequences Assessment & Drainage Strategy in relation to the development of two poultry units at Mulsford Farm, Mulsford, Sarn Malpas, SY14 7LP.

The purpose of this report is to outline the potential flood risk to the site, the impact of the proposed development on flood risk elsewhere, and the proposed measures which could be incorporated to mitigate the identified flood risk. This report has been prepared in accordance with the guidance contained in Planning Policy Wales (PPW) and Technical Advice Note 15 (TAN15): Development and Flood Risk. Reference has also been made to the Wrexham County Borough Council Preliminary Flood Risk Assessment (PFRA) (June 2011).

From April 2015, Wrexham County Borough Council as a Lead Local Flood Authority (LLFA) is a statutory consultee for major planning applications in relation to surface water drainage, requiring that all planning applications are accompanied by a Sustainable Drainage Strategy. The aim of the Sustainable Drainage Strategy is to identify water management measures to provide surface water runoff reduction and treatment.

Site Description

The 1.36 hectares site is located at National Grid reference 343413E 345025N. A location plan and an aerial image are included in Appendix A.

The site comprises agricultural land and is bordered by agricultural land on all sides. Wych Brook (watercourse) is located immediately north-east of the site. Access to the site is provided from a private track to the south-west of the site leading onto Mulsford Lane.

Local Topography

A Topographical Survey has been provided by Roger Parry & Partners in April 2017 and is included in Appendix B. The Topographical Survey shows that the site slopes from 26.50metres Above Ordnance Datum (m AOD) in the south-west to 23.06m AOD in the north-east. Levels fall sharply towards Wych Brook to the north-east of the site. The access road slopes from 30.06m AOD in the west to 26.11m AOD in the north-east.

Topographic levels to m AOD have also been derived from a 1m resolution Natural Resources Wales (NRW) composite 'Light Detecting and Ranging' (LiDAR) Digital Terrain Model (DTM). The LiDAR generally confirms the levels shown within the Topographical Survey. The LiDAR shows that the topography of the wider area is sloping north-east. A LiDAR extract is included in Appendix B.

Ground Conditions

British Geological Survey (BGS) online mapping (1:50,000 scale) indicates that the site is underlain by superficial deposits of Devensian Till, generally comprising Diamicton. The superficial deposits are identified as being underlain by the Helsby Sandstone Formation consisting of conglomerate.

The Cranfield University 'Soilscapes' map indicates that the site is underlain by 'Slowly permeable loamy and clayey soils.'

Local Drainage

The site is not formally drained. The site is located in a rural area and there are no public sewers in the immediate vicinity of the site.

Development Proposals

The proposed development is for two poultry units and associated works. A proposed development plan is included in Appendix B.

The proposed development will introduce hardstanding areas in the form of the poultry units and yard area. Hardstanding will occupy the entire 1.36 hectare site.

Flood Zone Category and Policy Context

The Welsh Government 'Development Advice Map' included in Appendix C shows that the site is located within Flood Zone A – an area considered to be at little / no risk of fluvial and coastal flooding with a less than 1 in 1000 (0.1%) annual probability of flooding.

The Natural Resources Wales (NRW) 'Flood Map for Planning' included in Appendix C shows that the site is located outside of the extreme 0.1% annual probability fluvial and tidal flood extent.

Development Vulnerability Classification

The proposed poultry units are considered to be 'less vulnerable' development in accordance with Figure 2 of the Welsh Government's Technical Advice Note 15 – Development and Flood Risk (TAN15). Less vulnerable development is considered appropriate in Flood Zone A, subject to ensuring no increase in flood risk elsewhere.

Local Planning Policy

The Wrexham Unitary Development Plan (UDP) contains the following policy in relation to flood risk and sustainable drainage:

Development and Flood Risk

Surface Water Run-off

Policy EC13 *Development which would result in an unacceptable adverse impact on the water environment due to additional surface water run-off will not be permitted*

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

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

require the developer to demonstrate, both financially and practically, how the long term maintenance of any attenuation facilities or mitigation measures will be achieved.

Consultation

A pre-planning opinion request was submitted to NRW in May 2017. A full response is included in Appendix D. NRW have stated that:

Flood Risk

Although it is difficult to determine from the proposed site layout plan, it is possible that the north eastern portion of the proposed buildings lie either within, or in very close proximity to Zone C2...

We consider that all “built” development and associated engineering operations should be steered away from the potential flood risk area. This is advocated by TAN15 (para. 6.2), which states that “new development should be directed away from Zone C and towards suitable land in Zone A”. For this site, we would recommend the production of a proposed layout plan which clearly shows the buildings will be located outside of the flood risk area. In addition, finished floor level information should be provided, which demonstrates that the floor levels of the buildings will be sufficiently elevated above potential flood risk areas.

Management of surface water runoff

The scale of the proposed development has the potential to increase flood risks both on and offsite if surface water is not effectively managed. We would recommend that the Applicant refers to Wrexham County Council’s “Management of Surface Water Generated from New Development” guide, which details the surface water drainage information that is likely to be required as part of the EIA, or any future planning application(s).

Wych Brook – Flood Risk Activity Permit

A Flood Risk Activity Permit may be required from Natural Resources Wales for any structures (or works) located in, under, over or within 8 metres of the bank top of Wych Brook, designated “main river”.

Surface Water and Groundwater quality

The site lies within a Nitrate Vulnerable Zone (NVZ) and would therefore have to comply with the NVZ action programme measures and record keeping requirements. This should be acknowledged within any future planning application.

The site also lies within a Principal Aquifer. The risk to the Principal Aquifer before, during and after active operation of the plant, as well as in emergency/nonstandard situations should be considered.

Sources of Flooding and Probability**Fluvial**

The nearest major watercourse is Wych Brook which is located approximately 30m north-east of the site. Wych Brook flows north-west in this location. Other watercourses in the area include an unnamed watercourse which discharges into Wych Brook approximately 60m north-east of the site.

Fluvial flooding could occur if Wych Brook overtopped its banks during or following an extreme rainfall event. There are no records of fluvial flooding at the site.

A review of LiDAR data (Appendix B) indicates that Wych Brook is situated at approximately 17m AOD in its nearest position to the site. The 'Flood Zone Contour Plan' (Appendix B) indicates that the Flood Zone 3 and Flood Zone 2 extents reach a maximum elevation of 20m AOD. The site is situated at a minimum of 23.06m AOD. As such the site is located at a minimum of 3.06m above the Flood Zone 2 and 3 extents i.e. 3.06m above the 0.1% annual probability flood extent.

It can be concluded that the site is at low risk of fluvial flooding with a less than 0.1% annual probability of occurrence.

Tidal

The site is situated at a minimum of 23.06m AOD and is significantly above sea level. The site is therefore not at risk of tidal flooding.

Surface Water

Surface water flooding occurs when rainwater does not drain away through the normal drainage system or soak into the ground. It is usually associated with high intensity rainfall events, but can also occur with lower intensity rainfall or melting snow where the ground is saturated, frozen or

developed, resulting in overland flow and ponding in depressions in topography. Surface water flooding can occur anywhere without warning. However flow paths can be determined by consideration of contours and relative levels.

The NRW 'Flood Map for Surface Water' (Appendix C) shows that the site is at very low risk of surface water flooding, meaning it has a less than 0.1% annual probability of flooding.

A small extent of the access road is shown at low risk of surface water flooding, meaning it has between a 1% and 0.1% annual probability of flooding. The flood risk is associated with a flow path which flows north towards Wych Brook.

The PRFA 'Flooding Incidents within WCBC' map (Appendix E) indicates that there are no historic surface water flooding incidents at or near to the site.

It can be concluded that the risk of surface water flooding is low.

Sewer Flooding

Flooding from sewers can occur when a sewer is overwhelmed by heavy rainfall, becomes blocked, is damaged, or is of inadequate capacity. Flooding is mostly applicable to combined and surface water sewers.

The site is located in a rural area and there are no public sewers in the immediate vicinity of the site. As such, there is no risk of flooding from public sewers.

Groundwater Flooding

Groundwater flooding occurs when water levels beneath the ground rise above normal levels. Prolonged heavy rainfall soaks into the ground and can cause the ground to become saturated. This results in rising groundwater levels which leads to flooding above ground.

The PRFA states that 'there were no records of past groundwater flooding within WCBC; this is due to the topography and geology of the area'. There are no records of groundwater flooding at or near to the site. The site will include hardstanding which will limit the vertical migration of groundwater to the surface.

It can therefore be concluded that the risk of groundwater flooding is low.

Artificial Sources of Flooding

There are no canals within the vicinity of the site. The NRW 'Risk of Flooding from Reservoirs' map (Appendix C) shows that the site is not at risk of flooding from reservoirs. It can therefore be concluded that the risk of flooding from artificial sources is low.

Summary of Potential Flooding

It can be concluded that the risk of flooding from all sources is considered to be low. Finished floor levels should be set 150mm above surrounding ground levels in accordance with Building Regulations.

Surface Water Management

The site is not formally drained and is therefore considered to be 100% permeable.

The proposed development will introduce 1.36ha of hardstanding in the form of two poultry units and yard area.

The introduction of hardstanding area will result in an increase in surface water runoff rates and volumes. In order to ensure the proposed development will not increase flood risk elsewhere, surface water discharge from the site will be controlled.

In accordance with TAN15 new developments should not create additional runoff when compared with the undeveloped situation.

The Wrexham County Council's 'Management of Surface Water Generated from New Development' guide (September 2015) contains the following requirements for greenfield sites:

Discharge rates and volumes are normally required to be limited to the equivalent greenfield runoff rate (with on-site attenuation for all events up to the 1% (1 in 100 year) rainfall event with an appropriate allowance for climate change).

Existing greenfield runoff rates have been estimated using the Revitalised Flood Hydrograph Model (ReFH2) method (see Appendix F). The existing 1 in 2 year (equivalent to QMED) greenfield runoff rate for the 1.36ha development site is 7.2 l/s.

In order to ensure no increase in surface water runoff as a result of the development, the runoff rate will be controlled to 7.2 l/s and sustainable drainage systems will be used to accommodate the 1 in 100 year plus 30% Climate Change (CC) event.

Attenuation Storage

In order to achieve a discharge rate of 7.2 l/s, attenuation storage will be required. A storage estimate is included in Appendix F. An estimated storage volume of 720m³ will be required to accommodate the 1 in 100 year plus 30% climate change event. The storage estimate is based on storage within a tank or pond structure, an impermeable drainage area of 1.36ha, a design head of 1m and hydro-brake flow control. The required attenuation could be provided in the form of an underground attenuation tank located within the proposed yard area.

Discharge Method

Infiltration

The first consideration for the disposal of surface water is soakaways. As previously stated, the site is underlain by superficial deposits of Devensian Till generally, comprising Diamicton. The superficial deposits are underlain by the Helsby Sandstone Formation consisting of conglomerate.

Given the sites proximity to the watercourse and the general impermeability of the underlying superficial deposits, it can be concluded that soakaways are unlikely to be suitable for the discharge of surface water runoff.

Infiltration test should be undertaken in accordance with the BRE365 specification to determine the suitability of soakaways. Soakaways should be located a minimum of 5m from new buildings.

Watercourse

Where soakaways are not suitable a connection to watercourse is the next consideration.

The nearest watercourse is the Wych Brook which is located 30m north-east of the site. Discharge to this watercourse, at a limited discharge rate of 7.2 l/s appears feasible. Discharge should be agreed with NRW. A review of the LiDAR data indicates that Wych Brook is situated at approximately 17m AOD. A comparison with minimum site levels indicates that a gravity fed system to Wych Brook is feasible. Land between the site and Wych Brook is within the client's ownership.

A new outfall to Wych Brook will require a Flood Risk Activity Permit from Natural Resources Wales.

Sewer

As previously sated, the site is located in a rural area and there are no public sewers in the immediate vicinity of the site.

Concept Surface Water Drainage Scheme

Where soakaways are not feasible, surface water runoff will be discharged to Wych Brook at the 1 in 2 greenfield runoff rate of 7.2 l/s. Surface water runoff up to the 1 in 100 year plus 30% climate change allowance event will be attenuated on site. A total attenuation volume of 720m³ will be required to achieve the discharge rate and will be provided in the form of an underground attenuation tank located within the yard area. There is also potential to utilise a pond or similar above ground storage features.

The proposed surface water drainage scheme will ensure no increase in runoff over the lifetime of the development.

Foul Drainage

Foul water should be directed to a dirty water tank located within the yard area. The dirty water tanks will be emptied by a tanker with dirty water taken to an offsite facility for treatment. The frequency of emptying is subject to the frequency of the wash-down procedure. It is recommended that the dirty water tanks have an audible and visual high level alarm system.

Conclusions

The proposed development is for two poultry units and associated works.

The site is located within Flood Zone A – an area considered to be at little / no risk of fluvial flooding with a less than 1 in 1000 (0.1%) annual probability.

The site has been shown at low risk of flooding from all sources and no mitigation measures are considered necessary. The site is a minimum of 3.06m above the 0.1% AEP flood extent.

The proposed development will introduce impermeable drainage area in the form of two poultry units and hardstanding area. The introduction of impermeable area will result in an increase in surface water runoff. In order to ensure the increase in surface water runoff will not increase flood risk elsewhere, flow control will be used and attenuation provided on site to accommodate storm events up to and including the 1 in 100 year plus 30% climate change event.

All methods of surface water discharge have been assessed. Where soakaways are not possible, discharge of surface water to Wych Brook at a greenfield rate of 7.2 l/s appears to be the most practical option.

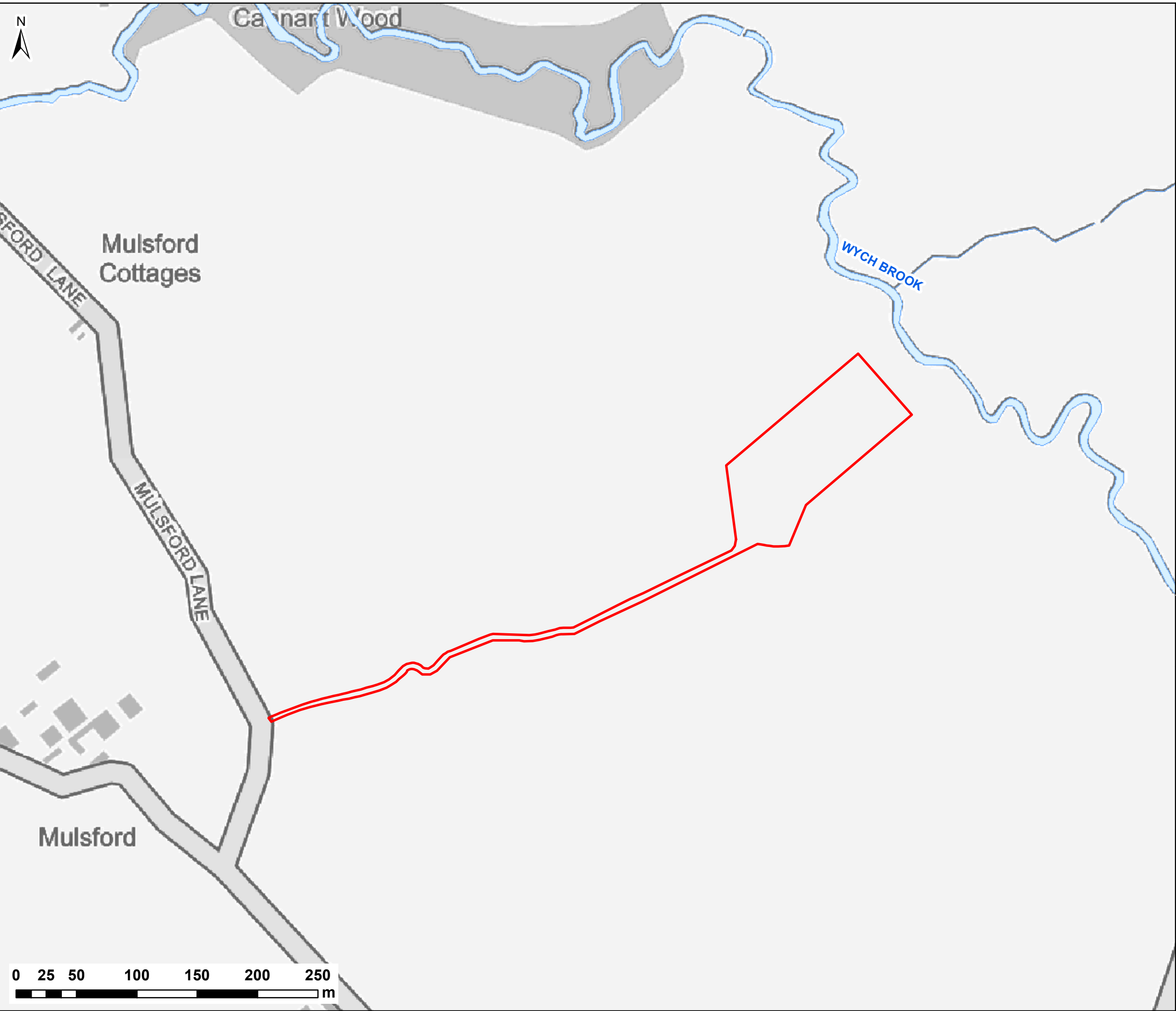
Attenuation storage will be required on site in order to restrict surface water discharge to 7.2 l/s. Attenuation can be provided in the form of an underground attenuation tank located within the yard area.

Foul water from the development will be directed to a dirty water tank. Dirty water will be taken offsite to a treatment facility.

Recommendations

1. Submit this Flood Risk Assessment and Drainage Strategy to the Planning Authority in support of the Planning Application;

Appendix A – Location Plan & Aerial Image



NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

Site Boundary

Watercourses / Water Bodies

CLIENT:

**D.J. HUXLEY
(FARMS) LIMITED**

www.waterco.co.uk

SCHEME:

**MULSFORD FARM,
SARN MALPAS**

PLOT TITLE:

LOCATION PLAN

PLOT STATUS:			DATE:
FINAL			30/05/2017

DRAWN:	CHECKED:	APPROVED:	PLOT SCALE @ A3:
AC	JR	VG	1:3,000
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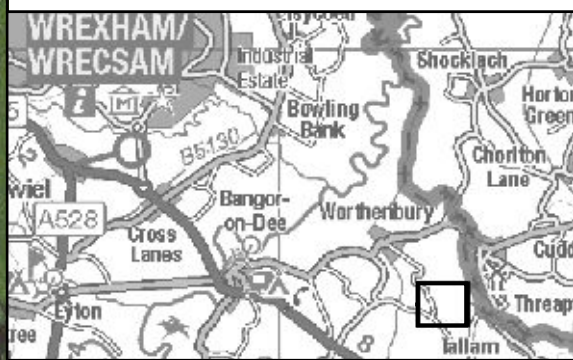
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NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES
ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

Site Boundary



CLIENT:
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waterco
consultants
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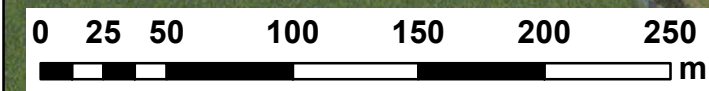
SCHEME:
**MULSFORD FARM,
SARN MALPAS**

PLOT TITLE:
AERIAL PLAN

PLOT STATUS:	FINAL	DATE:	30/05/2017
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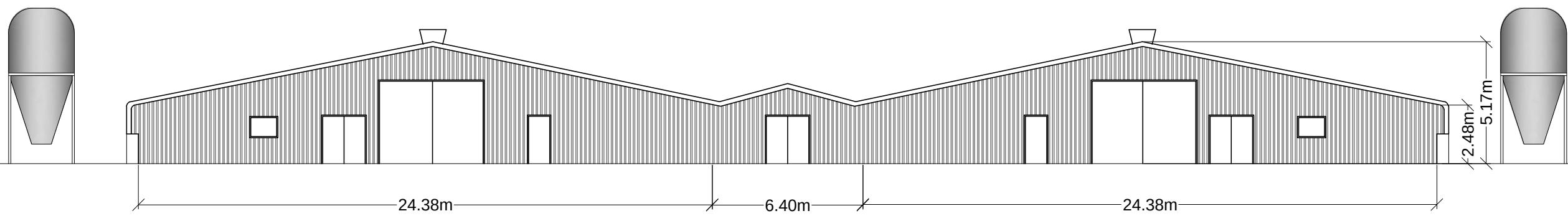
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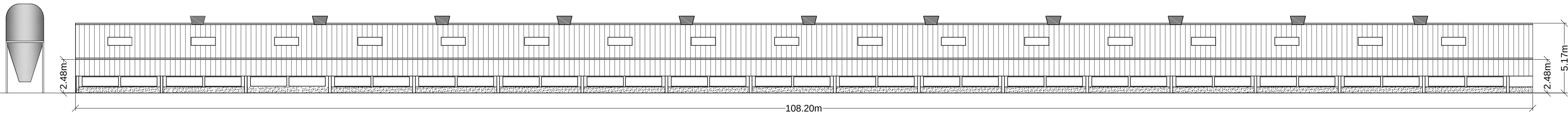


Appendix B – Development Plan & Topographical Data

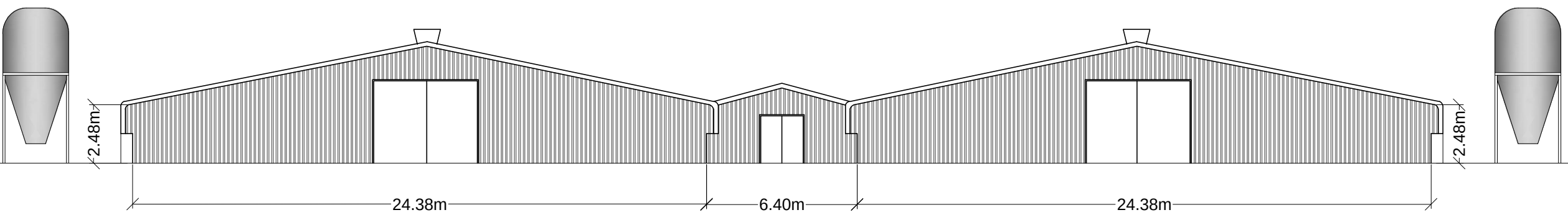
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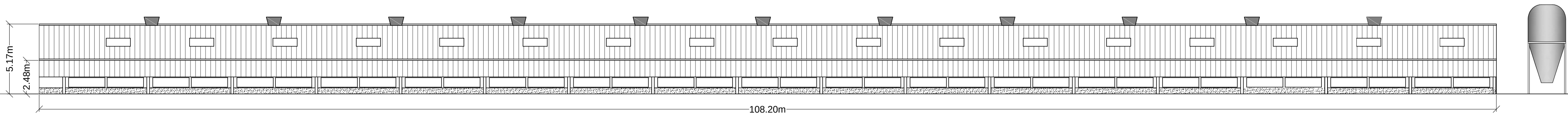
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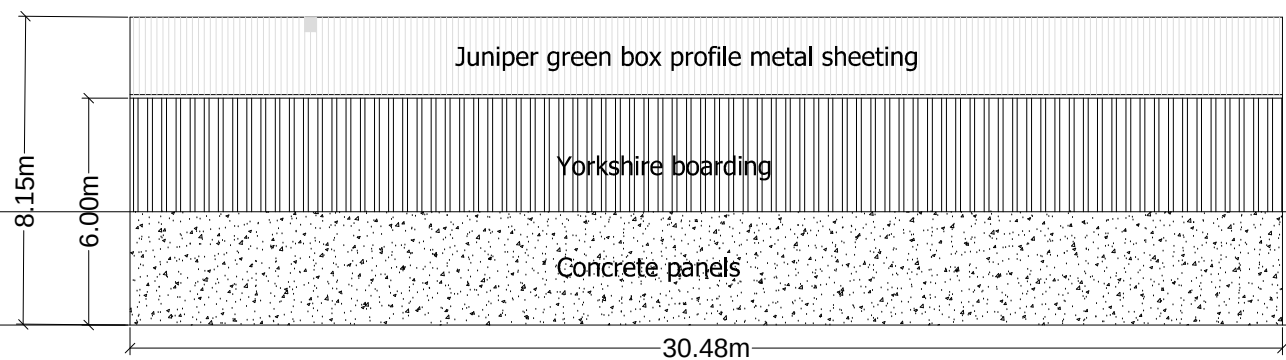
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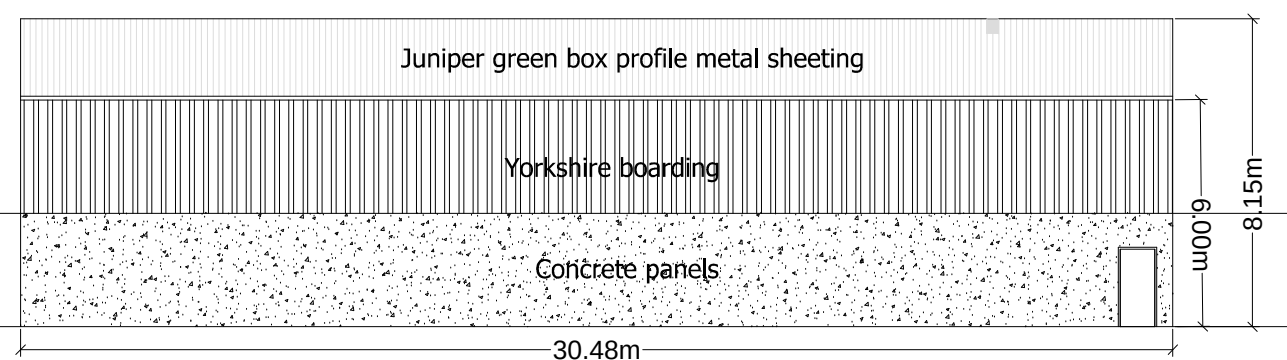
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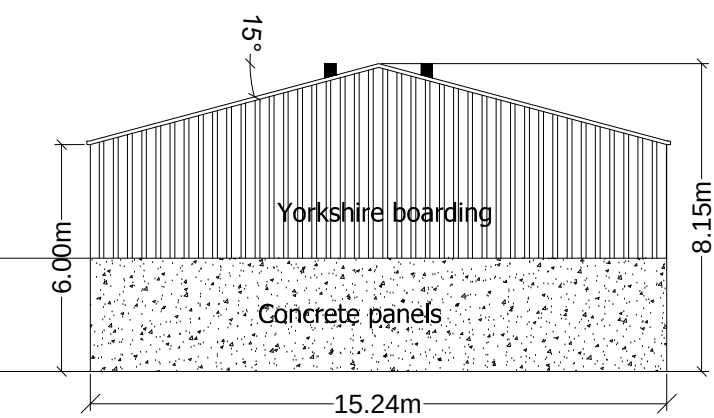
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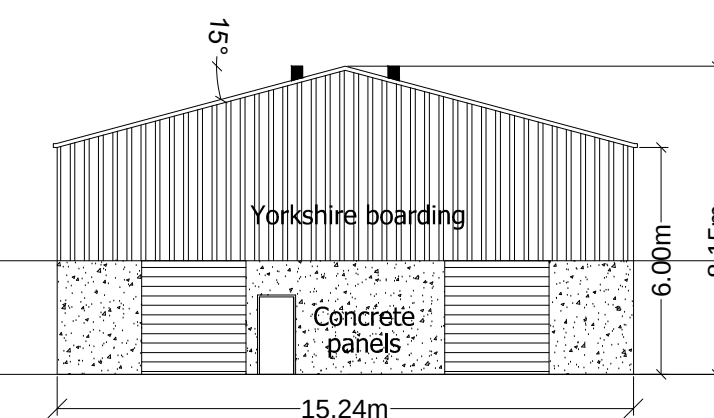
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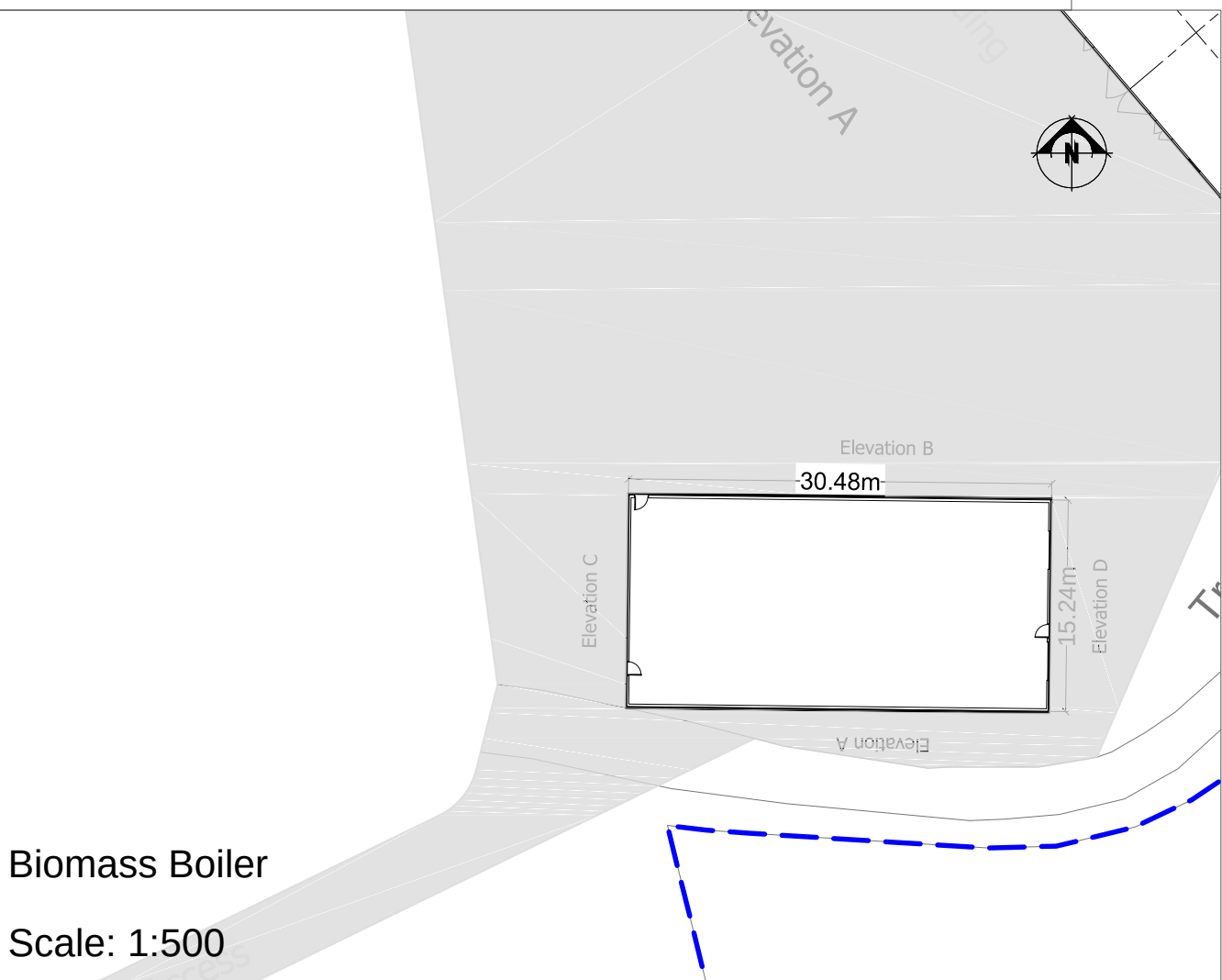
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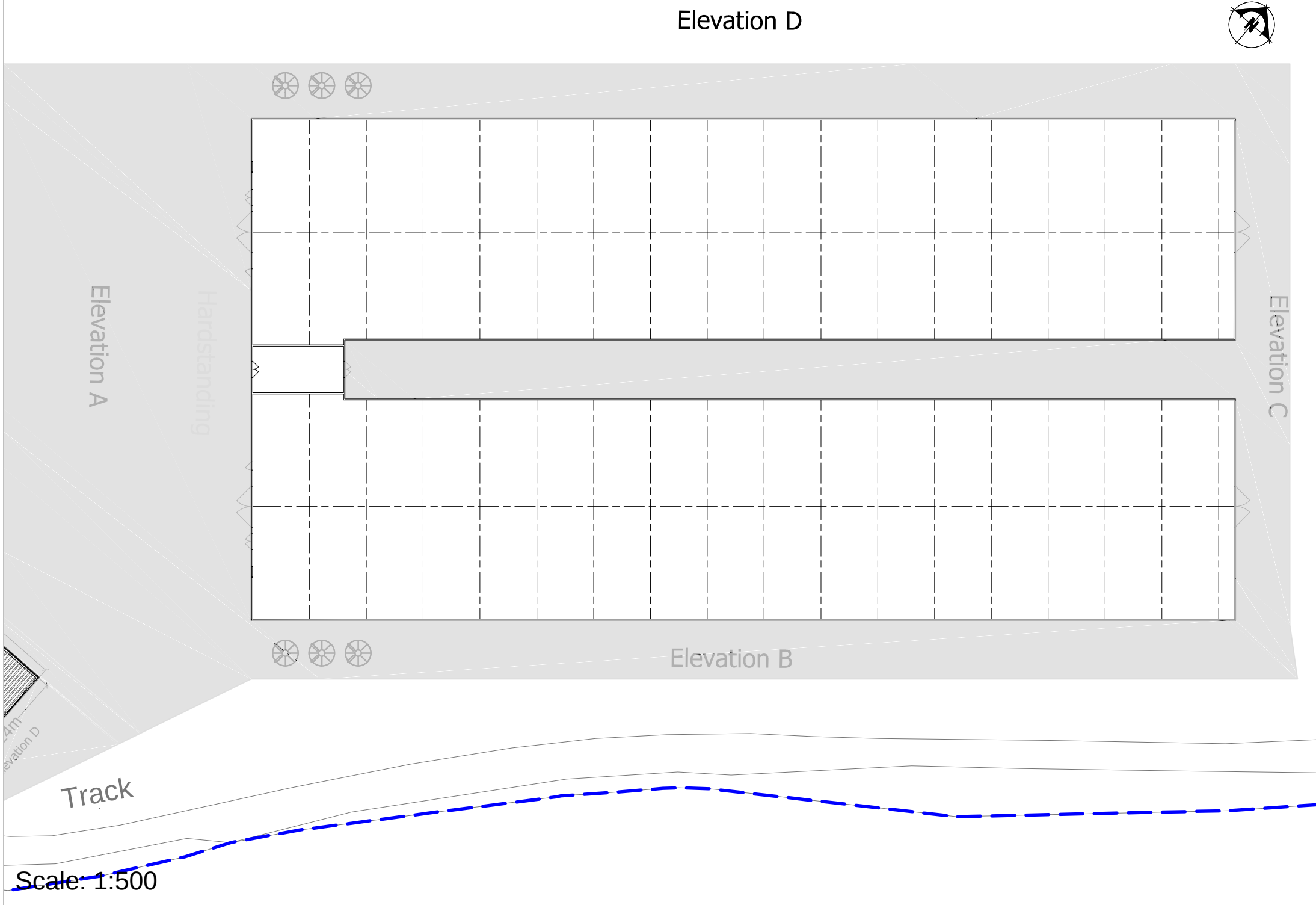
Elevation C



Elevation D



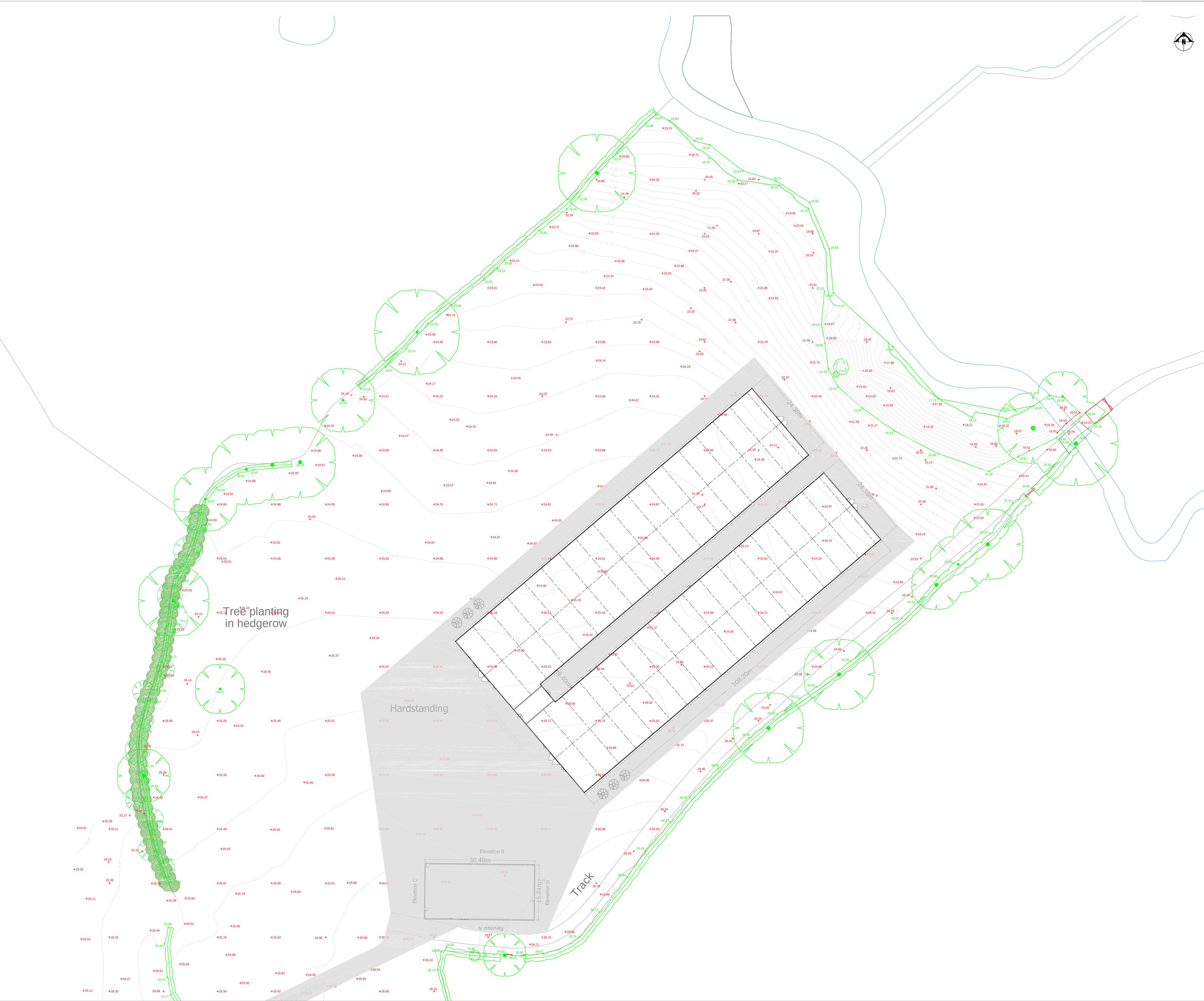
Biomass Boiler
Scale: 1:500



Rev	Description	Date	Dr by	App by
Original	by			



Residential - Agricultural - Commercial		
Job	Intensive Poultry Units	
Title	Proposed Elevations	
Location	Mulsford Farm Mulsford Sarn Malpas SY14 7LP	
Client	Huxley Farms	
Scales	1:200 @ A1	
Drawing No.	RJC-MZ63-Huxley-04	
Drawn by	MZ	Date 06/04/2017
HOGSTOW HALL, MINSTERLEY SHREWSBURY, SHROPSHIRE, SY5 0HZ Tel: 01743 791336 Fax: 01743 792770 email: mail@rogerparry.net Web address: www.rogerparry.net Roger Parry & Partners LLP partnership no 01512203 Registered Office Hoxstow Hall, Minsterley, Shrewsbury, SY5 0HZ Registered in England and Wales		



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KEY

Rev	Description	Date	Dr by	App by
Original	by			



Residential - Agricultural - Commercial

Job	Intensive Poultry Units
Title	Proposed Block Plan
Location	Mulsford Farm Mulsford Sarn Malpas SY14 7LP
Client	Huxley Farms
Scales	A1 @ 1:500
Drawing No.	RJC-MZ63-Huxley-02
Drawn by	MZ
Date	19/06/2017

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Blue Boundary

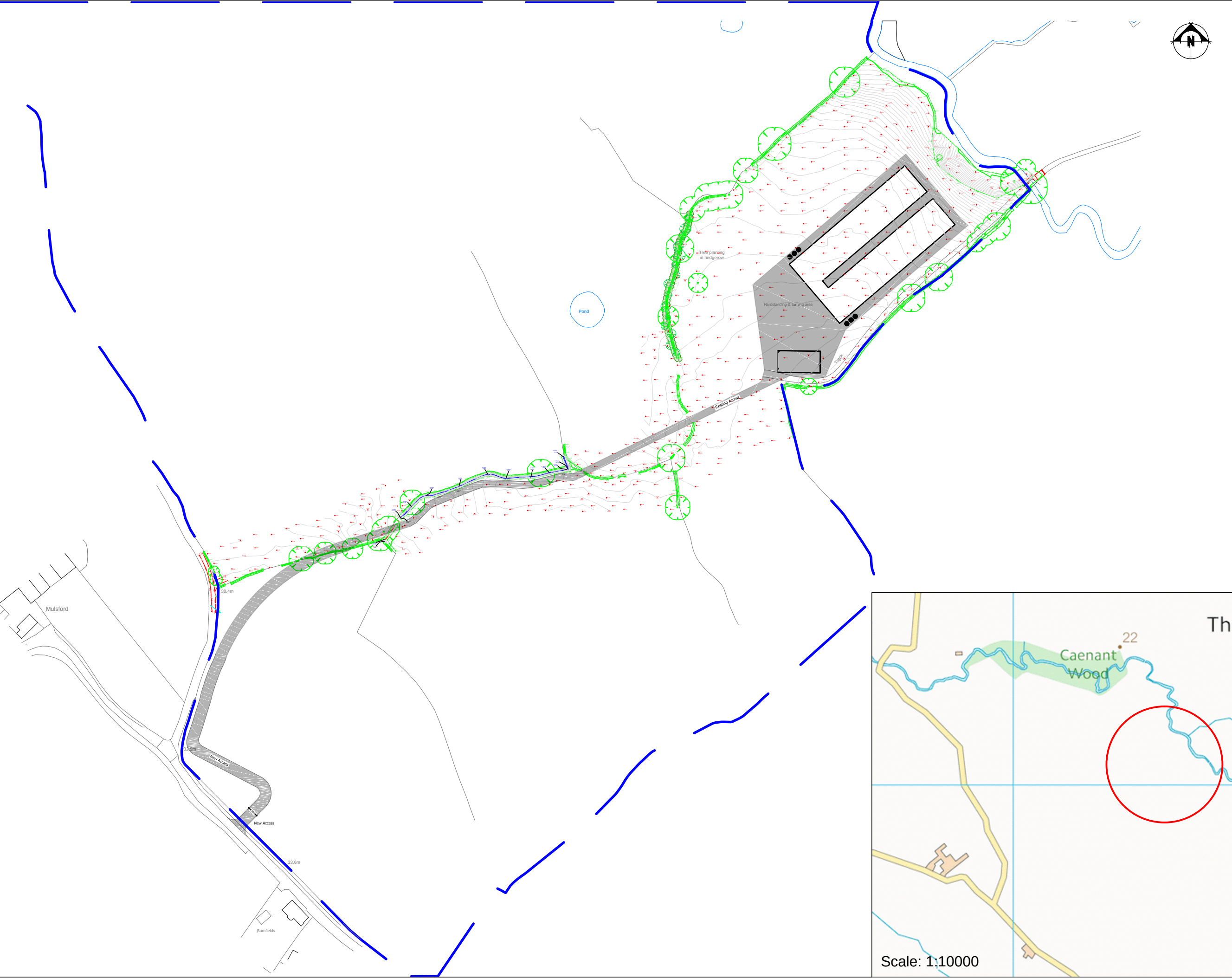
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Original	by			

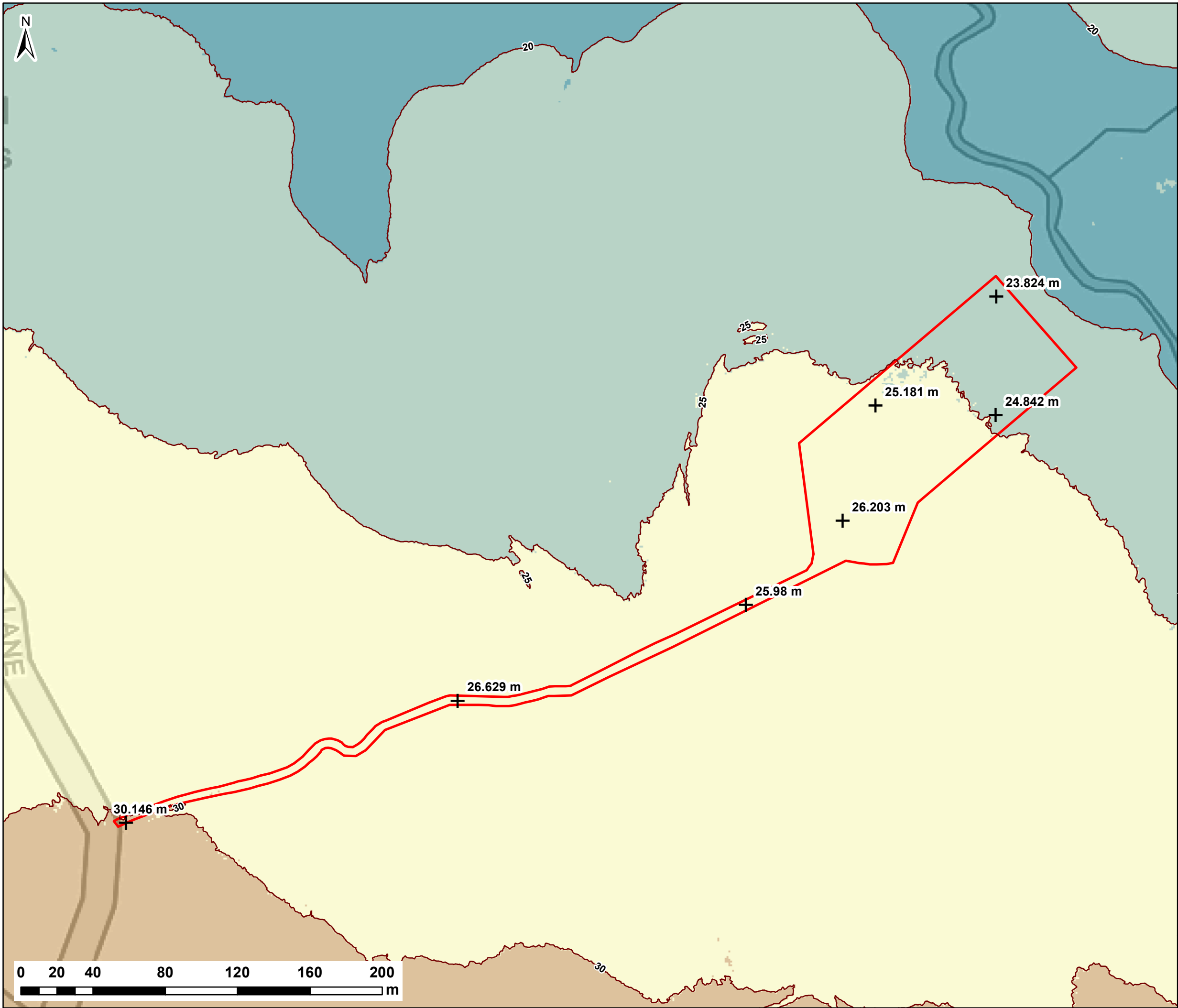


Residential - Agricultural - Commercial

Job	Intensive Poultry Units			
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Client	Huxley Farms			
Scales	1:2500 @ A3			
Drawing No.	RJC-MZ63-Huxley-01			
Drawn by	MZ	Date	07/09/2017	

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NOTES:
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LEGEND

Site Boundary

Spot Levels

LIDAR Elevations (mAOD)

< 20

20 - 25

25 - 30

30 - 35

> 35

CLIENT:

**D.J. HUXLEY
(FARMS) LIMITED**

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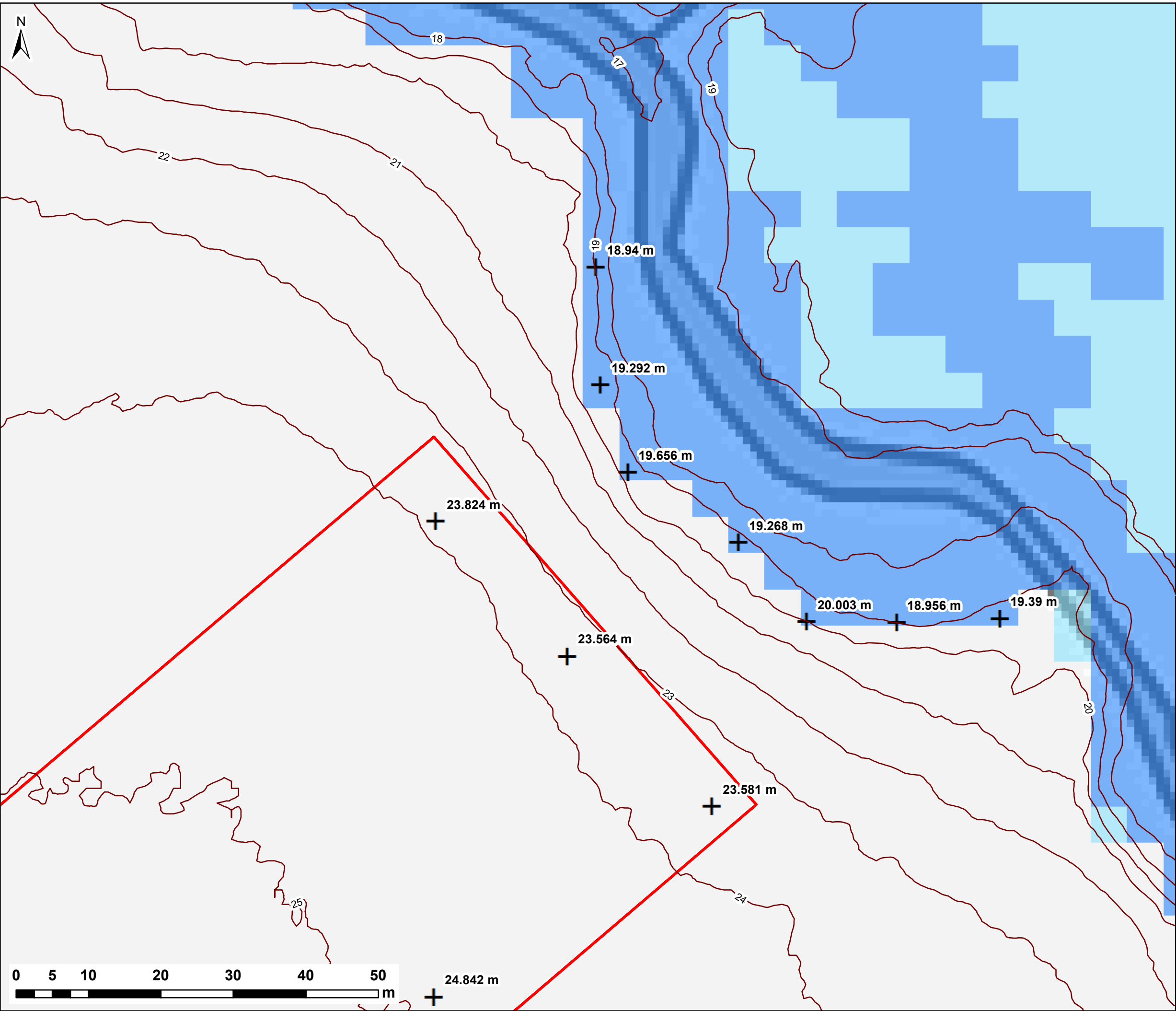
SCHEME:

**MULSFORD FARM,
SARN MALPAS**

PLOT TITLE:

**LIDAR ELEVATIONS
1m RESOLUTION**

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FINAL			30/05/2017
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE @ A3:
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w10377-LIDAR_Elevations			-



NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- Site Boundary
- Spot Levels
- Flood Zone 3
- Flood Zone 2

CLIENT:

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SCHEME:

**MULSFORD FARM,
SARN MALPAS**

PLOT TITLE:

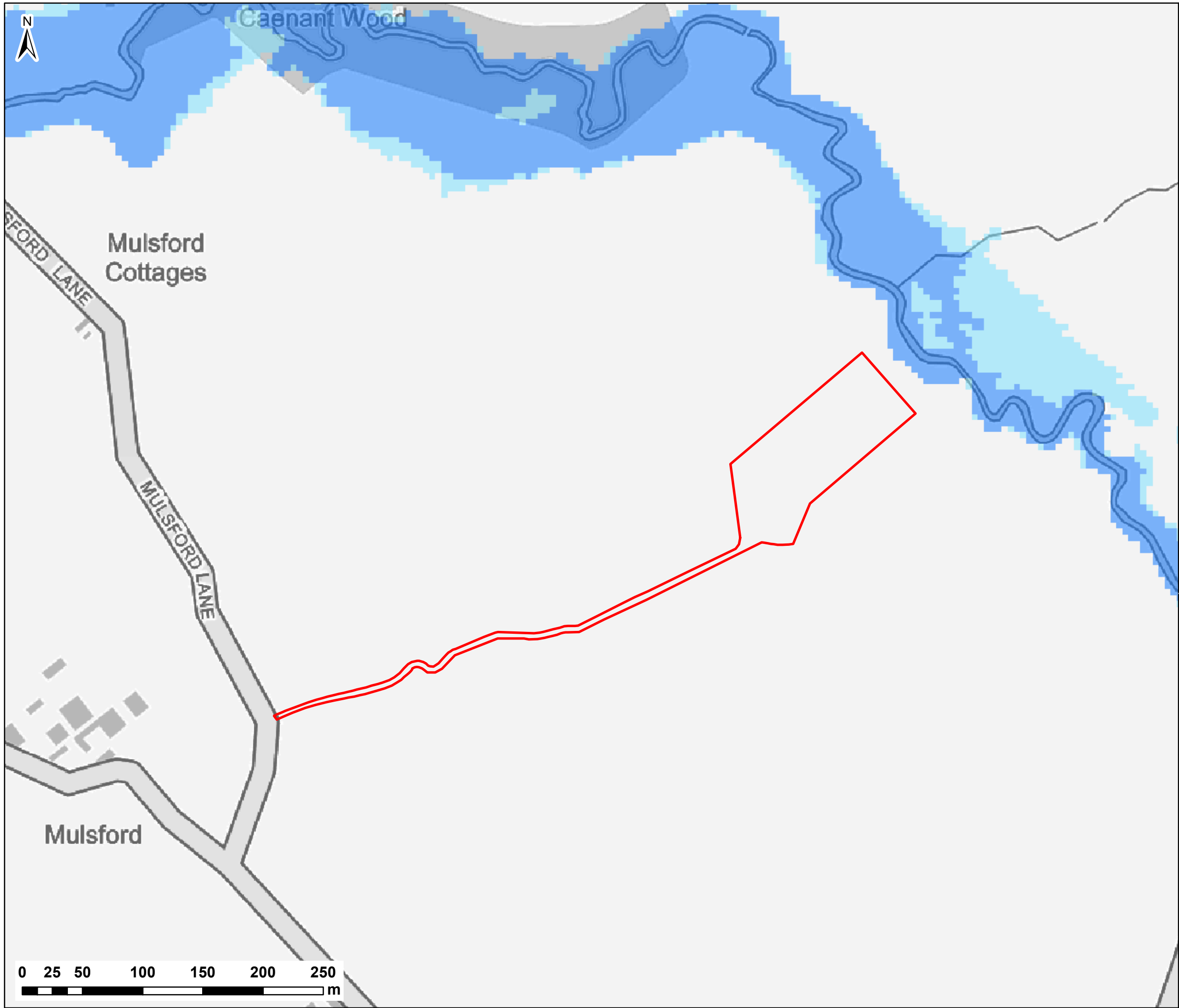
FLOOD ZONE CONTOUR PLAN
1m RESOLUTION

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FINAL			27/06/2017

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PLOT NAME:	REV:
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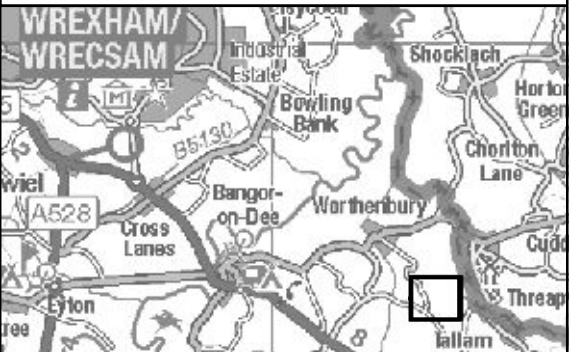
Appendix C – Flood Maps



NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- Site Boundary
- Flood Zone 2
- Flood Zone 3



CLIENT:

**D.J. HUXLEY
(FARMS) LIMITED**



www.waterco.co.uk

SCHEME:

**MULSFORD FARM,
SARN MALPAS**

PLOT TITLE:

**NRW FLOOD MAP FOR
PLANNING
MAY 2017**

PLOT STATUS:

FINAL

DATE:

30/05/2017

DRAWN:

AC

CHECKED:

JR

APPROVED:

VG

PLOT SCALE @ A3:

1:3,000

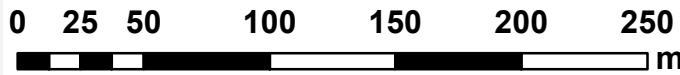
(UNLESS STATED OTHERWISE)

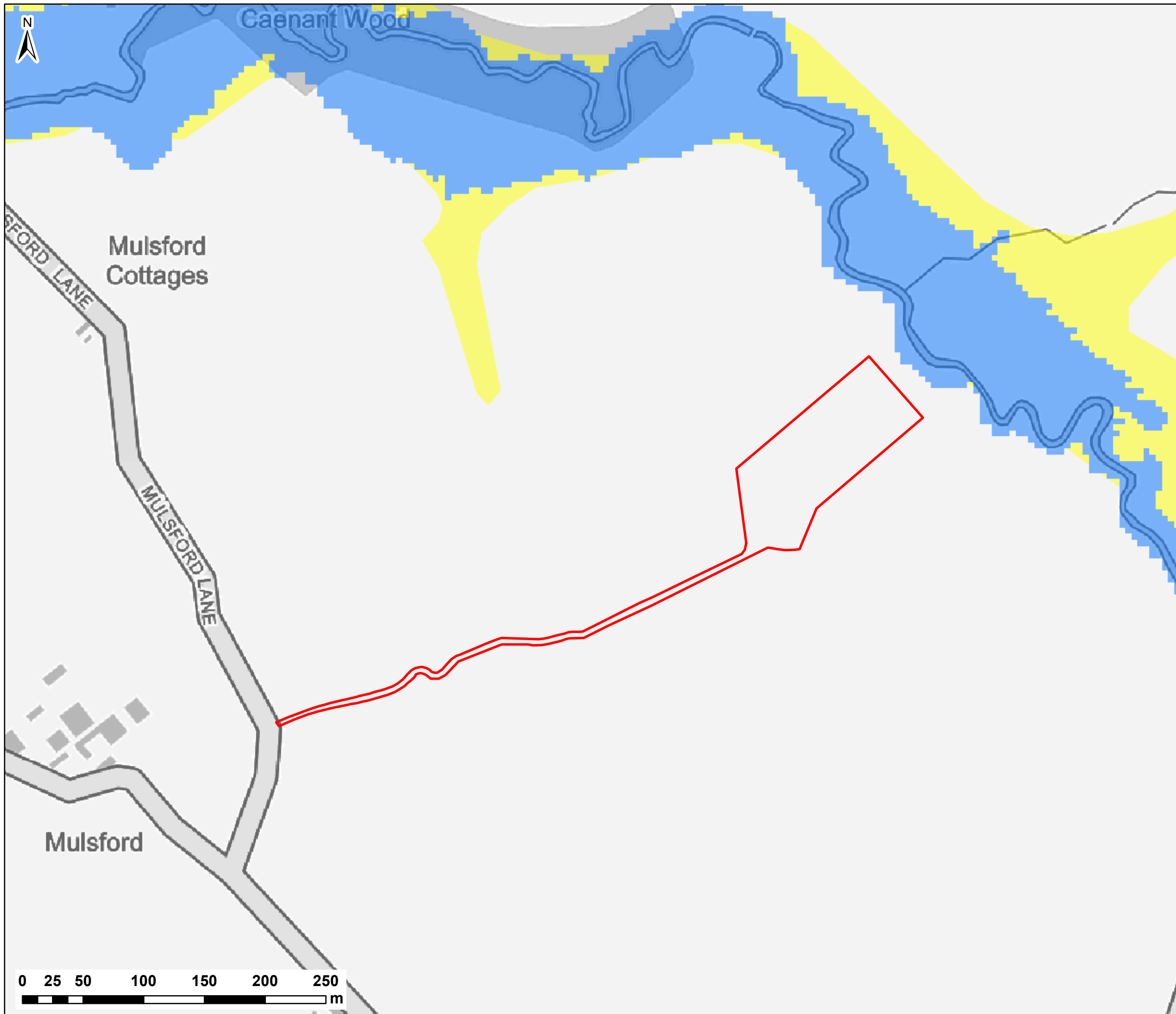
PLOT NAME:

w10377-NRW_Flood_Map

REV:

-





NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- Site Boundary
- Zone A
- Zone B
- Zone C1
- Zone C2

CLIENT:

**D.J. HUXLEY
(FARMS) LIMITED**

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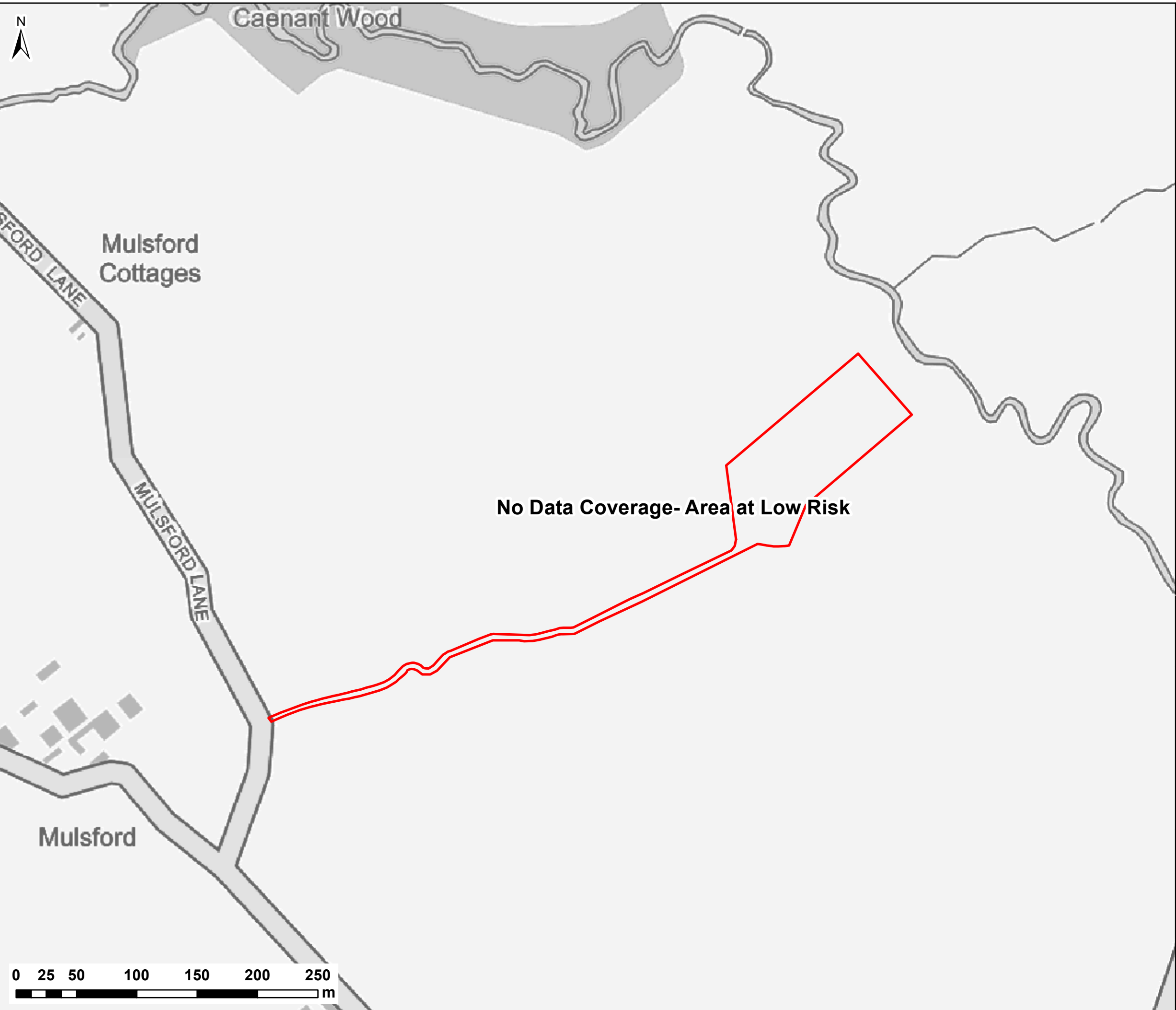
SCHEME:

**MULSFORD FARM,
SARN MALPAS**

PLOT TITLE:

**WELSH GOVERNMENT
DEVELOPMENT ADVICE MAP
MAY 2017**

PLOT STATUS:			DATE:
FINAL			31/05/2017
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE @ A3:
AC	JR	VG	1:3,000 (UNLESS STATED OTHERWISE)
PLOT NAME:			REV:
w10377-NRW_TAN15_Flood_Map			-



NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

Site Boundary

NRW Historic Flood Map

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SCHEME:

**MULSFORD FARM,
SARN MALPAS**

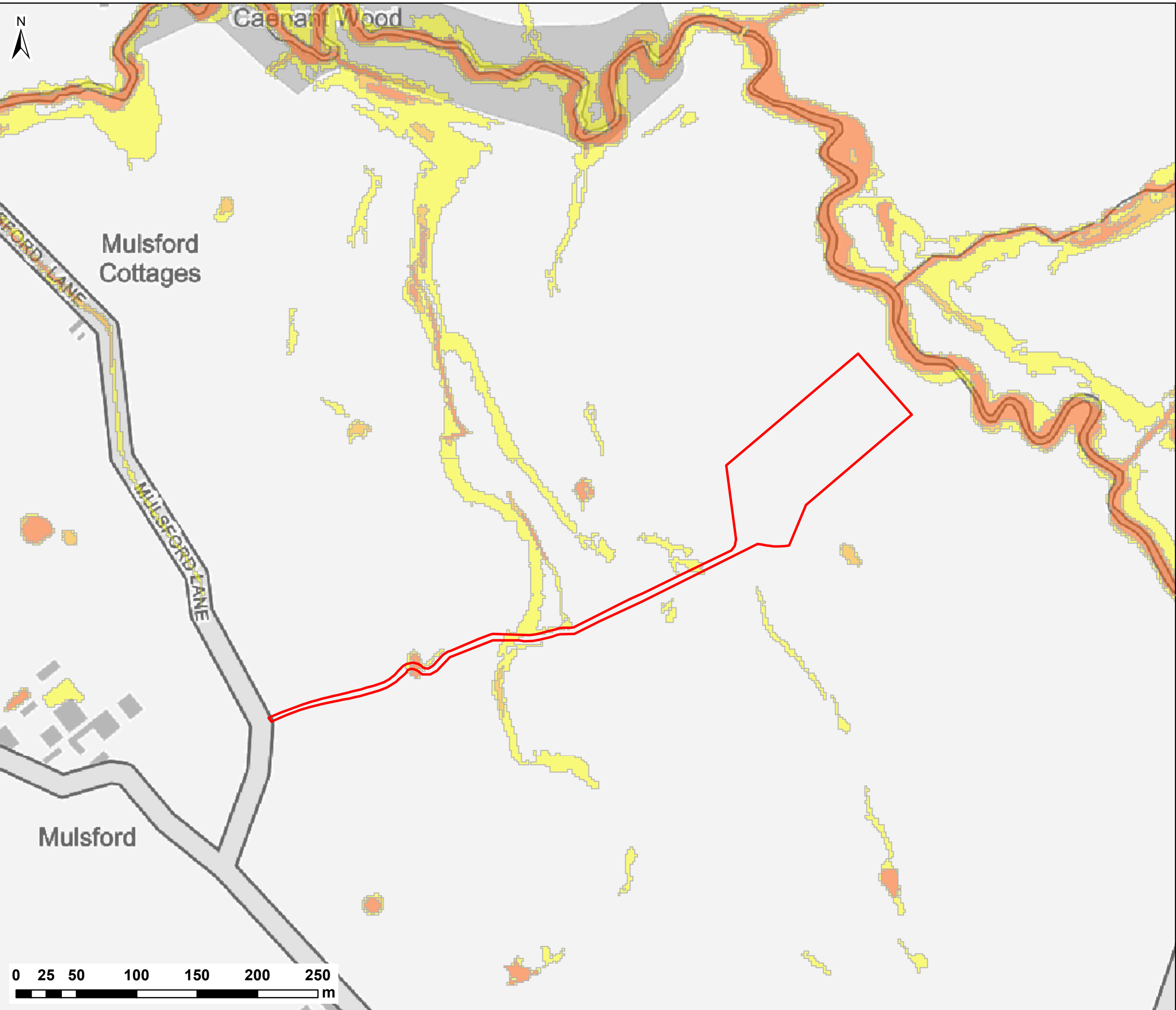
PLOT TITLE:

NRW HISTORIC FLOOD MAP
MAY 2017

PLOT STATUS:			DATE:
FINAL			30/05/2017

DRAWN:	CHECKED:	APPROVED:	PLOT SCALE @ A3:
AC	JR	VG	1:3,000 (UNLESS STATED OTHERWISE)

PLOT NAME:	REV:
w10377-NRW_Historic_Flood_Map	-



NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- Site Boundary
- High Risk (3.33% AEP Event)
- Medium Risk (1% AEP Event)
- Low Risk (0.1% AEP Event)

CLIENT:

**D.J. HUXLEY
(FARMS) LIMITED**

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SCHEME:

**MULSFORD FARM,
SARN MALPAS**

PLOT TITLE:

**NRW FLOOD MAP FOR
SURFACE WATER
MAY 2017**

PLOT STATUS:			DATE:
FINAL			31/05/2017

DRAWN:	CHECKED:	APPROVED:	PLOT SCALE @ A3:
AC	JR	VG	1:3,000 (UNLESS STATED OTHERWISE)

PLOT NAME:	REV:
w10377-NRW_SW_Map	-



Allwedd / Map Key

-  Risk of Flooding from Reservoirs - Extent

Appendix D – Correspondence

Waterco

For the attention of: Ifan Dafydd Jones

Dear Mr Jones

PRELIMINARY PRE-APPLICATION ADVICE

**COMMERCIAL DEVELOPMENT CONSISTING OF TWO POULTRY UNITS WITH
ASSOCIATED ACCESS ROAD**

MULSFORD FARM, SARN MALPAS

Thank you for your enquiry received at this office on 31 May 2017.

We have considered your enquiry in relation to our Development Planning checklist. We advise that the following matters are relevant to the above site / proposed development and suggest the developer considers these further prior to the submission of any planning application:

Flood Risk

Although it is difficult to determine from the proposed site layout plan, it is possible that the north eastern portion of the proposed buildings lie either within, or in very close proximity to Zone C2, as defined by Welsh Government's Development Advice Map (DAM) referred to under TAN15: Development & Flood Risk. This is confirmed by our flood map information.

We consider that all "built" development and associated engineering operations should be steered away from the potential flood risk area. This is advocated by TAN15 (para. 6.2), which states that "new development should be directed away from Zone C and towards suitable land in Zone A". For this site, we would recommend the production of a proposed layout plan which clearly shows the buildings will be located outside of the flood risk area. In addition, finished floor level information should be provided, which demonstrates that the floor levels of the buildings will be sufficiently elevated above potential flood risk areas. If the buildings are to be located and/or if engineering works are required within the potential flood risk area, we would advise that a full Flood Consequences Assessment (FCA) should be produced to support and inform development proposals on the site. The FCA will need to demonstrate that the flood risks to, and arising from the

development, can be acceptably managed in accordance with the requirements of TAN15.

Management of surface water runoff

The scale of the proposed development has the potential to increase flood risks both on and offsite if surface water is not effectively managed. We would recommend that the Applicant refers to Wrexham County Council's "Management of Surface Water Generated from New Development" guide, which details the surface water drainage information that is likely to be required as part of the EIA, or any future planning application(s).

https://www.wrexham.gov.uk/english./planning_portal/publications/surface_water.htm

Wych Brook – Flood Risk Activity Permit

A Flood Risk Activity Permit may be required from Natural Resources Wales for any structures (or works) located in, under, over or within 8 metres of the bank top of Wych Brook, designated "main river". Further information and guidance is available on our website at:

<http://www.naturalresources.wales/apply-for-a-permit/flood-risk-activities>

Surface Water and Groundwater quality

The site lies within a Nitrate Vulnerable Zone (NVZ) and would therefore have to comply with the NVZ action programme measures and record keeping requirements. This should be acknowledged within any future planning application.

The site also lies within a Principal Aquifer. The risk to the Principal Aquifer before, during and after active operation of the plant, as well as in emergency/nonstandard situations should be considered.

Water Resources

If it is intended to abstract more than 20 cubic metres of water per day, then a licence for the abstraction will be required from Natural Resources Wales. Further information and guidance is available on our website at:

<http://www.naturalresources.wales/>

Air Quality

The proposed development would be above the threshold for environmental permit from NRW. As such, the majority of the air emission issues could be dealt with as part of a permit application.

An EIA was previously submitted for the proposed development and used the Simple Calculation of Ammonia Impact (SCAIL) screening tool to determine whether the ammonia and nitrogen from the proposal would be likely to damage the sensitive features of designated sites.

If the SCAIL tool indicates that the ammonia and nitrogen are potentially significant and exceed the significance threshold applied for an environmental permit, this will warrant further detailed modelling using the criteria for permitted farm assessments. The applicant/developer should contact NRW to ascertain exactly what would be required in such a detailed assessment. The information can then be used to inform the EIA.

Please note the view expressed in this letter is a response to a pre-planning enquiry only. We trust these comments will prove helpful but they should not set a precedent for any future Natural Resources Wales' response to any formal application for planning permission or other legal consent. Such applications shall be assessed on the information submitted and regulations of relevance at that time. The details contained in this letter are based on the information available to date.

If you have any queries on the above please do not hesitate to contact us.

Yours sincerely

Meryl Read

MRS MERYL W READ
Technical Specialist

Direct dial 03000 653785

Direct e-mail meryl.read@cyfoethnaturiolcymru.gov.uk

Appendix E – PRFA Map

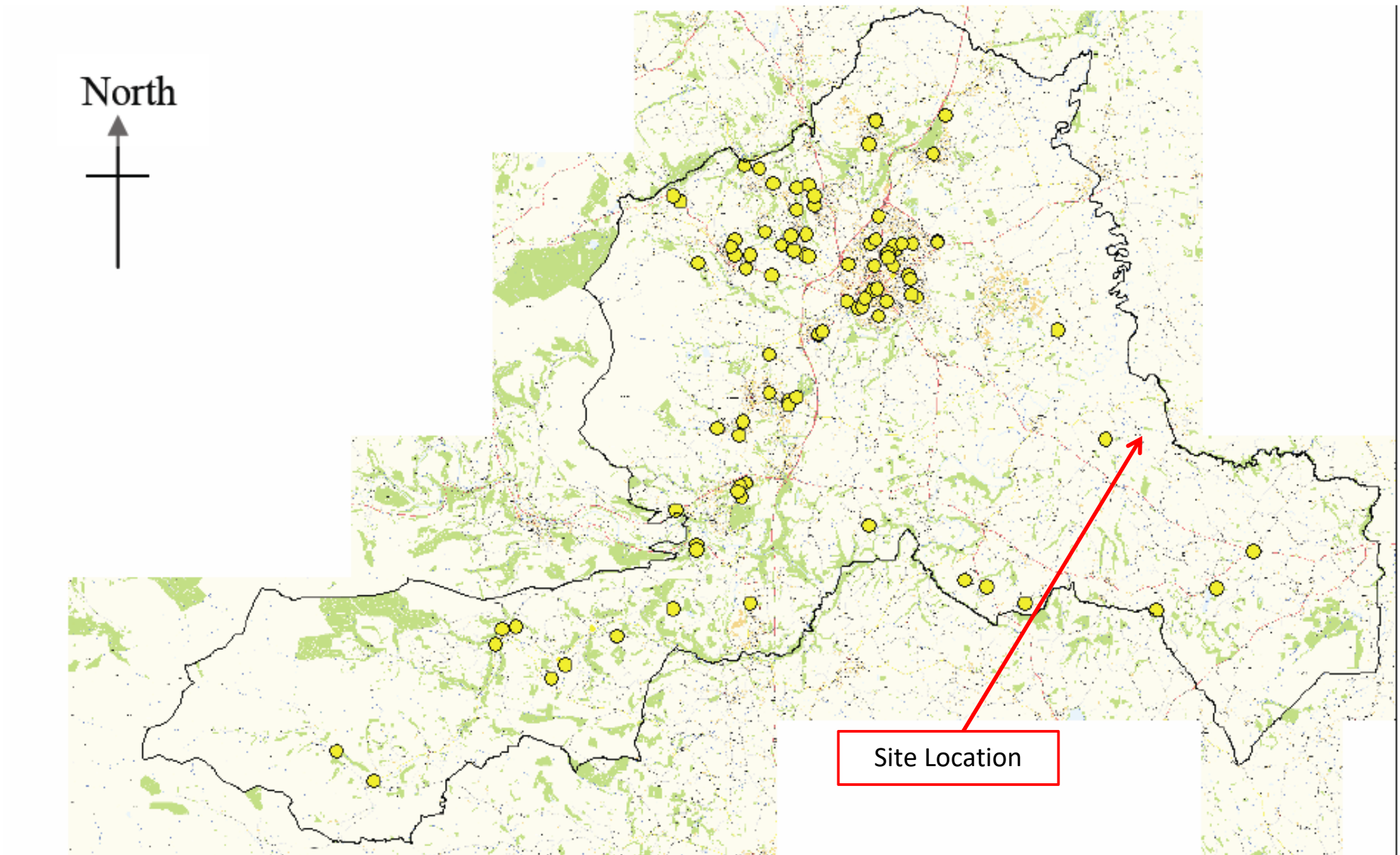


Figure 3 - Flooding Incidents within WCBC

Appendix F – ReFH2 Runoff Rates & MicroDrainage Storage Volumes

Job number: w10377	Author: IJ
Scheme name: Mulsford Farm	Checked: JR
ReFH2 Runoff Rates	Date: 23/06/2017

Greenfield Runoff Rates			
Return period (yrs)	As-rural peak flow (m ³ /s)	As-rural peak flow (l/s)	As-rural direct runoff (ML)
1	0.006229977	6.229976855	0.072312669
2	0.007172396	7.172396341	0.084441266
5	0.010534728	10.53472786	0.127723983
10	0.013375973	13.37597282	0.164310953
30	0.018833268	18.83326785	0.234612733
50	0.02184487	21.84486983	0.273422722
75	0.024422383	24.42238277	0.306645872
100	0.026348399	26.34839883	0.331475544
200	0.031304454	31.30445443	0.395382504
1000	0.044028494	44.02849402	0.559540595

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Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ		Mulsford Farm Sarn Malpas Attenuation Calcs (1 in 30yr)			
Date 06/06/2017 File		Designed by IJ Checked by JR			
XP Solutions		Source Control 2016.1			
<u>Summary of Results for 30 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.568	0.568	7.0	200.6	O K
30 min Summer	9.656	0.656	7.1	231.7	O K
60 min Summer	9.745	0.745	7.1	263.0	Flood Risk
120 min Summer	9.821	0.821	7.1	289.9	Flood Risk
180 min Summer	9.848	0.848	7.1	299.4	Flood Risk
240 min Summer	9.854	0.854	7.1	301.3	Flood Risk
360 min Summer	9.830	0.830	7.1	292.9	Flood Risk
480 min Summer	9.803	0.803	7.1	283.4	Flood Risk
600 min Summer	9.781	0.781	7.1	275.7	Flood Risk
720 min Summer	9.762	0.762	7.1	268.8	Flood Risk
960 min Summer	9.750	0.750	7.1	264.6	Flood Risk
1440 min Summer	9.712	0.712	7.1	251.2	Flood Risk
2160 min Summer	9.639	0.639	7.1	225.4	O K
2880 min Summer	9.560	0.560	7.0	197.6	O K
4320 min Summer	9.362	0.362	6.9	127.8	O K
5760 min Summer	9.210	0.210	6.9	74.2	O K
7200 min Summer	9.103	0.103	6.8	36.3	O K
8640 min Summer	9.036	0.036	6.8	12.8	O K
10080 min Summer	9.003	0.003	6.8	0.9	O K
15 min Winter	9.638	0.638	7.1	225.4	O K
30 min Winter	9.739	0.739	7.1	260.9	Flood Risk
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	81.172	0.0	206.7	16	
30 min Summer	47.911	0.0	244.2	31	
60 min Summer	28.280	0.0	288.6	62	
120 min Summer	16.692	0.0	340.2	122	
180 min Summer	12.262	0.0	374.7	180	
240 min Summer	9.852	0.0	401.6	240	
360 min Summer	7.238	0.0	443.0	342	
480 min Summer	5.815	0.0	474.6	396	
600 min Summer	4.908	0.0	500.8	458	
720 min Summer	4.272	0.0	522.9	520	
960 min Summer	3.507	0.0	572.4	662	
1440 min Summer	2.656	0.0	650.2	938	
2160 min Summer	2.012	0.0	738.4	1344	
2880 min Summer	1.651	0.0	808.4	1756	
4320 min Summer	1.203	0.0	883.4	2504	
5760 min Summer	0.961	0.0	941.0	3176	
7200 min Summer	0.807	0.0	986.9	3888	
8640 min Summer	0.700	0.0	1027.5	4496	
10080 min Summer	0.620	0.0	1063.1	5136	
15 min Winter	81.172	0.0	231.6	16	
30 min Winter	47.911	0.0	273.5	31	
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Winter</td><td>9.899</td><td>0.899</td><td>7.2</td><td>317.2</td><td>Flood Risk</td></tr><tr><td>960 min Winter</td><td>9.876</td><td>0.876</td><td>7.1</td><td>309.3</td><td>Flood Risk</td></tr><tr><td>1440 min Winter</td><td>9.806</td><td>0.806</td><td>7.1</td><td>284.5</td><td>Flood Risk</td></tr><tr><td>2160 min Winter</td><td>9.677</td><td>0.677</td><td>7.1</td><td>239.0</td><td>O K</td></tr><tr><td>2880 min Winter</td><td>9.545</td><td>0.545</td><td>7.0</td><td>192.3</td><td>O K</td></tr><tr><td>4320 min Winter</td><td>9.255</td><td>0.255</td><td>6.9</td><td>89.9</td><td>O K</td></tr><tr><td>5760 min Winter</td><td>9.060</td><td>0.060</td><td>6.8</td><td>21.2</td><td>O K</td></tr><tr><td>7200 min Winter</td><td>9.000</td><td>0.000</td><td>6.5</td><td>0.0</td><td>O K</td></tr><tr><td>8640 min Winter</td><td>9.000</td><td>0.000</td><td>5.6</td><td>0.0</td><td>O K</td></tr><tr><td>10080 min Winter</td><td>9.000</td><td>0.000</td><td>5.0</td><td>0.0</td><td>O K</td></tr></tbody></table> <table><thead><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Time-Peak (mins)</th></tr></thead><tbody><tr><td>60 min Winter</td><td>28.280</td><td>0.0</td><td>322.8</td><td>60</td></tr><tr><td>120 min Winter</td><td>16.692</td><td>0.0</td><td>381.2</td><td>120</td></tr><tr><td>180 min Winter</td><td>12.262</td><td>0.0</td><td>419.8</td><td>178</td></tr><tr><td>240 min Winter</td><td>9.852</td><td>0.0</td><td>449.7</td><td>234</td></tr><tr><td>360 min Winter</td><td>7.238</td><td>0.0</td><td>496.1</td><td>346</td></tr><tr><td>480 min Winter</td><td>5.815</td><td>0.0</td><td>531.4</td><td>450</td></tr><tr><td>600 min Winter</td><td>4.908</td><td>0.0</td><td>560.4</td><td>488</td></tr><tr><td>720 min Winter</td><td>4.272</td><td>0.0</td><td>585.2</td><td>562</td></tr><tr><td>960 min Winter</td><td>3.507</td><td>0.0</td><td>641.2</td><td>720</td></tr><tr><td>1440 min Winter</td><td>2.656</td><td>0.0</td><td>728.3</td><td>1024</td></tr><tr><td>2160 min Winter</td><td>2.012</td><td>0.0</td><td>826.8</td><td>1468</td></tr><tr><td>2880 min Winter</td><td>1.651</td><td>0.0</td><td>905.1</td><td>1872</td></tr><tr><td>4320 min Winter</td><td>1.203</td><td>0.0</td><td>989.2</td><td>2596</td></tr><tr><td>5760 min Winter</td><td>0.961</td><td>0.0</td><td>1053.8</td><td>3224</td></tr><tr><td>7200 min Winter</td><td>0.807</td><td>0.0</td><td>1106.2</td><td>0</td></tr><tr><td>8640 min Winter</td><td>0.700</td><td>0.0</td><td>1151.1</td><td>0</td></tr><tr><td>10080 min Winter</td><td>0.620</td><td>0.0</td><td>1190.5</td><td>0</td></tr></tbody></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	60 min Winter	9.842	0.842	7.1	297.3	Flood Risk	120 min Winter	9.939	0.939	7.2	331.6	Flood Risk	180 min Winter	9.981	0.981	7.2	346.2	Flood Risk	240 min Winter	9.997	0.997	7.2	352.0	Flood Risk	360 min Winter	9.993	0.993	7.2	350.6	Flood Risk	480 min Winter	9.963	0.963	7.2	340.1	Flood Risk	600 min Winter	9.925	0.925	7.2	326.4	Flood Risk	720 min Winter	9.899	0.899	7.2	317.2	Flood Risk	960 min Winter	9.876	0.876	7.1	309.3	Flood Risk	1440 min Winter	9.806	0.806	7.1	284.5	Flood Risk	2160 min Winter	9.677	0.677	7.1	239.0	O K	2880 min Winter	9.545	0.545	7.0	192.3	O K	4320 min Winter	9.255	0.255	6.9	89.9	O K	5760 min Winter	9.060	0.060	6.8	21.2	O K	7200 min Winter	9.000	0.000	6.5	0.0	O K	8640 min Winter	9.000	0.000	5.6	0.0	O K	10080 min Winter	9.000	0.000	5.0	0.0	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	60 min Winter	28.280	0.0	322.8	60	120 min Winter	16.692	0.0	381.2	120	180 min Winter	12.262	0.0	419.8	178	240 min Winter	9.852	0.0	449.7	234	360 min Winter	7.238	0.0	496.1	346	480 min Winter	5.815	0.0	531.4	450	600 min Winter	4.908	0.0	560.4	488	720 min Winter	4.272	0.0	585.2	562	960 min Winter	3.507	0.0	641.2	720	1440 min 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120 min Winter	16.692	0.0	381.2	120																																																																																																																																																																																																							
180 min Winter	12.262	0.0	419.8	178																																																																																																																																																																																																							
240 min Winter	9.852	0.0	449.7	234																																																																																																																																																																																																							
360 min Winter	7.238	0.0	496.1	346																																																																																																																																																																																																							
480 min Winter	5.815	0.0	531.4	450																																																																																																																																																																																																							
600 min Winter	4.908	0.0	560.4	488																																																																																																																																																																																																							
720 min Winter	4.272	0.0	585.2	562																																																																																																																																																																																																							
960 min Winter	3.507	0.0	641.2	720																																																																																																																																																																																																							
1440 min Winter	2.656	0.0	728.3	1024																																																																																																																																																																																																							
2160 min Winter	2.012	0.0	826.8	1468																																																																																																																																																																																																							
2880 min Winter	1.651	0.0	905.1	1872																																																																																																																																																																																																							
4320 min Winter	1.203	0.0	989.2	2596																																																																																																																																																																																																							
5760 min Winter	0.961	0.0	1053.8	3224																																																																																																																																																																																																							
7200 min Winter	0.807	0.0	1106.2	0																																																																																																																																																																																																							
8640 min Winter	0.700	0.0	1151.1	0																																																																																																																																																																																																							
10080 min Winter	0.620	0.0	1190.5	0																																																																																																																																																																																																							
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Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ	Mulsford Farm Sarn Malpas Attenuation Calcs (1 in 30yr)	
Date 06/06/2017 File	Designed by IJ Checked by JR	
XP Solutions Source Control 2016.1		

Rainfall Details

Rainfall Model	FEH	D3 (1km)	0.303	Cv (Winter)	0.840
Return Period (years)	30	E (1km)	0.284	Shortest Storm (mins)	15
Site Location		F (1km)	2.381	Longest Storm (mins)	10080
C (1km)	-0.025	Summer Storms	Yes	Climate Change %	+0
D1 (1km)	0.324	Winter Storms	Yes		
D2 (1km)	0.399	Cv (Summer)	0.750		

Time Area Diagram

Total Area (ha) 1.360

Time (mins)	Area
From:	To: (ha)
0	1 1.360

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 9.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	353.0	1.000	353.0

Hydro-Brake Optimum® Outflow Control

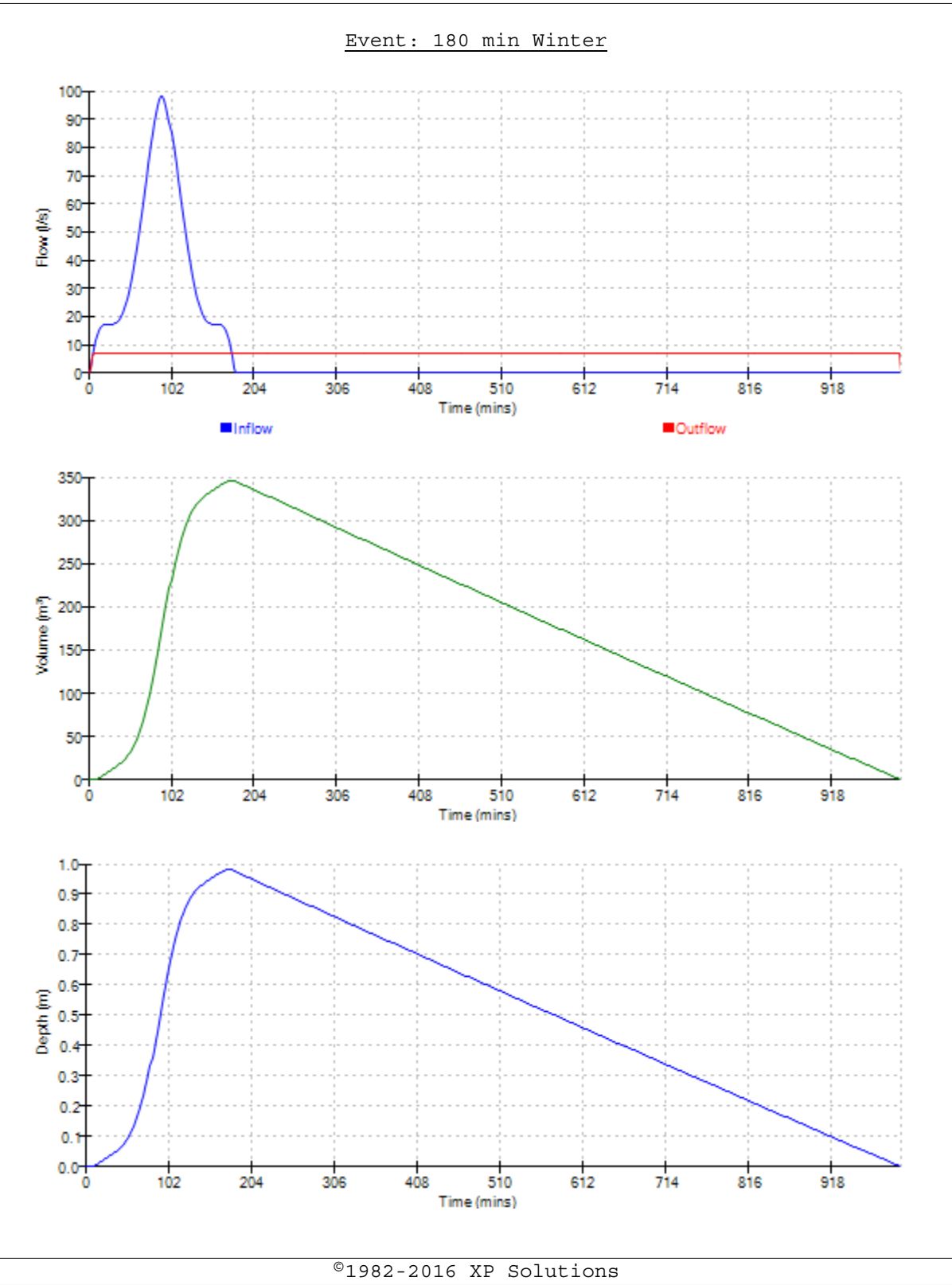
Unit Reference	MD-SHE-0077-7200-8995-7200
Design Head (m)	8.995
Design Flow (l/s)	7.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	77
Invert Level (m)	1.000
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	8.995	7.2
Flush-Flo™	0.320	2.8
Kick-Flo®	0.684	2.2
Mean Flow over Head Range	-	5.0

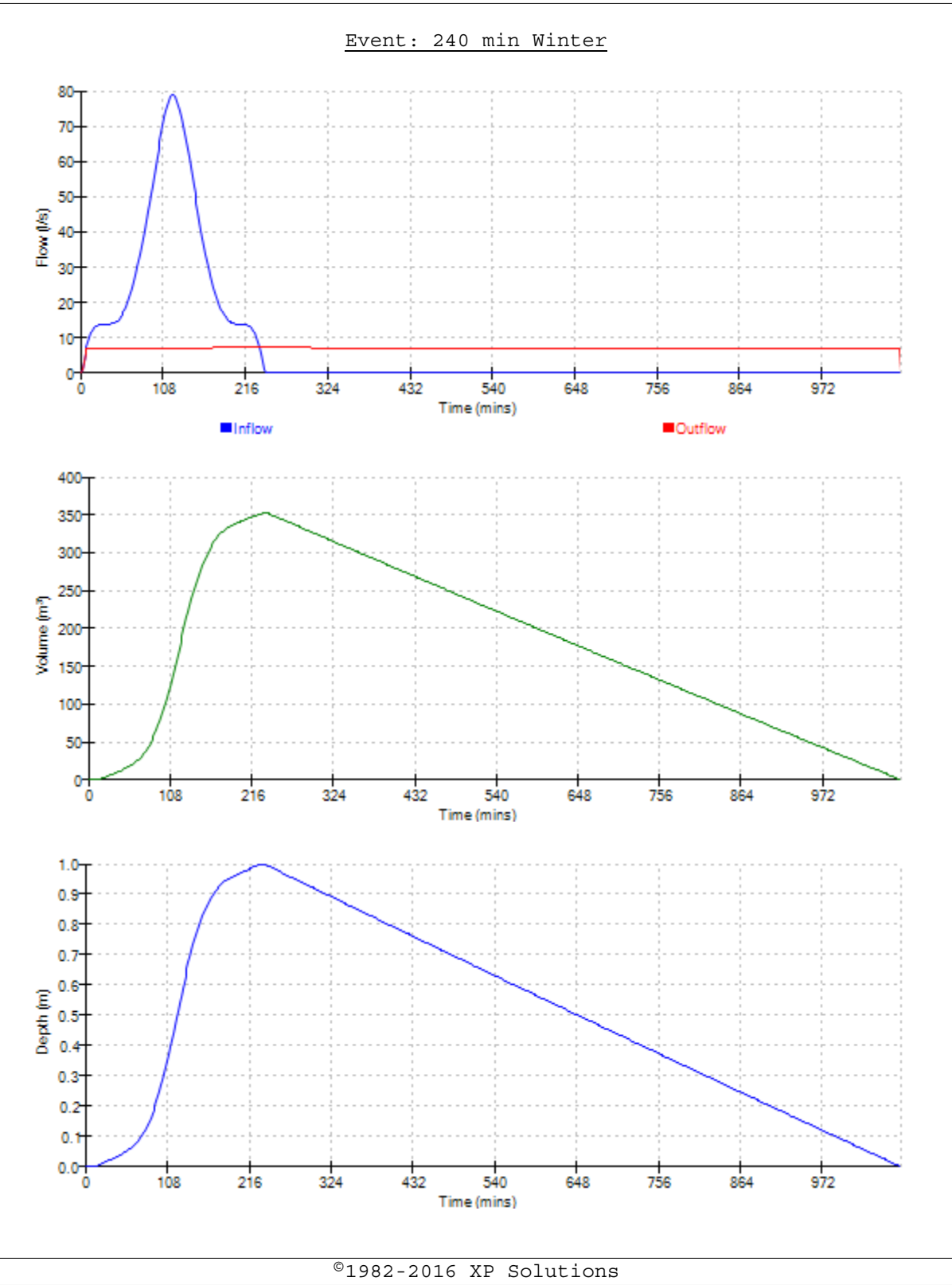
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.2	1.200	2.8	3.000	4.3	7.000	6.4
0.200	2.7	1.400	3.0	3.500	4.6	7.500	6.6
0.300	2.8	1.600	3.2	4.000	4.9	8.000	6.8
0.400	2.7	1.800	3.4	4.500	5.2	8.500	7.0
0.500	2.7	2.000	3.6	5.000	5.4	9.000	7.2
0.600	2.5	2.200	3.7	5.500	5.7	9.500	7.4
0.800	2.3	2.400	3.9	6.000	5.9		
1.000	2.6	2.600	4.0	6.500	6.2		

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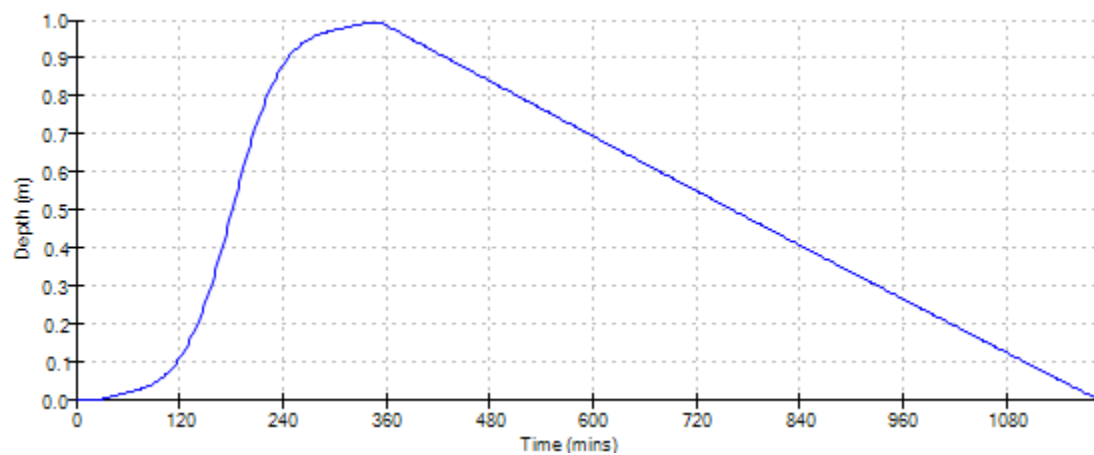
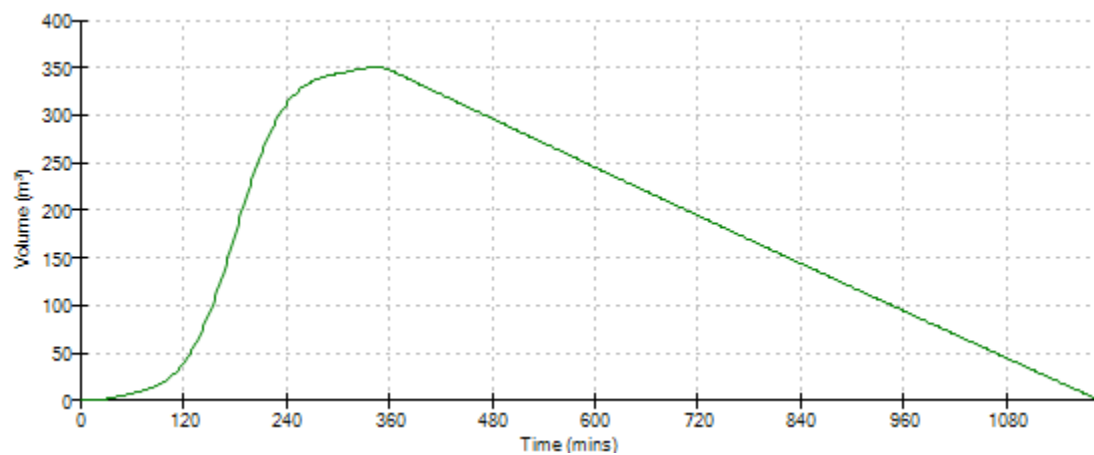
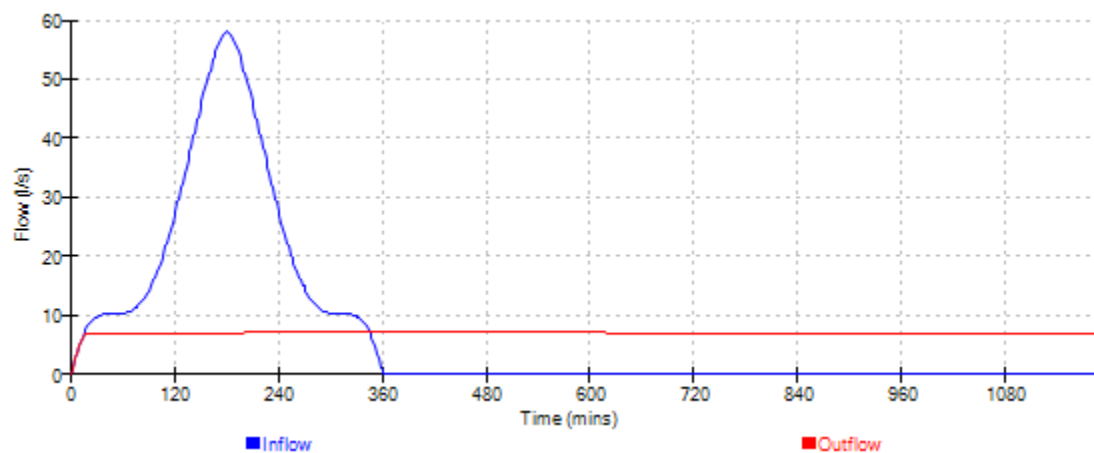


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Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ	Mulsford Farm Sarn Malpas Attenuation Calcs (1 in 30yr)	
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Event: 360 min Winter



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Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ		Mulsford Farm Sarn Malpas Attenuation Calcs (30%CC)			
Date 06/06/2017 File		Designed by IJ Checked by JR			
XP Solutions		Source Control 2016.1			
<u>Summary of Results for 100 year Return Period (+30%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.542	0.542	7.0	390.0	O K
30 min Summer	9.619	0.619	7.0	445.5	O K
60 min Summer	9.700	0.700	7.1	504.2	Flood Risk
120 min Summer	9.780	0.780	7.1	561.7	Flood Risk
180 min Summer	9.820	0.820	7.1	590.7	Flood Risk
240 min Summer	9.843	0.843	7.1	606.8	Flood Risk
360 min Summer	9.860	0.860	7.1	619.1	Flood Risk
480 min Summer	9.857	0.857	7.1	616.9	Flood Risk
600 min Summer	9.842	0.842	7.1	606.0	Flood Risk
720 min Summer	9.820	0.820	7.1	590.1	Flood Risk
960 min Summer	9.808	0.808	7.1	581.7	Flood Risk
1440 min Summer	9.788	0.788	7.1	567.3	Flood Risk
2160 min Summer	9.755	0.755	7.1	543.7	Flood Risk
2880 min Summer	9.716	0.716	7.1	515.4	Flood Risk
4320 min Summer	9.583	0.583	7.0	419.5	O K
5760 min Summer	9.464	0.464	7.0	333.9	O K
7200 min Summer	9.358	0.358	6.9	257.9	O K
8640 min Summer	9.269	0.269	6.9	193.4	O K
10080 min Summer	9.193	0.193	6.9	138.7	O K
15 min Winter	9.608	0.608	7.0	437.5	O K
30 min Winter	9.695	0.695	7.1	500.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	155.457	0.0	396.0	16	
30 min Summer	89.845	0.0	458.0	31	
60 min Summer	51.925	0.0	529.0	62	
120 min Summer	30.010	0.0	612.0	122	
180 min Summer	21.776	0.0	666.1	182	
240 min Summer	17.344	0.0	707.5	242	
360 min Summer	12.585	0.0	769.8	360	
480 min Summer	10.024	0.0	817.4	480	
600 min Summer	8.402	0.0	856.4	600	
720 min Summer	7.273	0.0	890.0	684	
960 min Summer	5.920	0.0	965.4	798	
1440 min Summer	4.428	0.0	1083.3	1052	
2160 min Summer	3.312	0.0	1215.4	1468	
2880 min Summer	2.696	0.0	1318.8	1876	
4320 min Summer	1.939	0.0	1424.3	2680	
5760 min Summer	1.535	0.0	1503.5	3464	
7200 min Summer	1.281	0.0	1567.2	4184	
8640 min Summer	1.105	0.0	1622.3	4928	
10080 min Summer	0.975	0.0	1670.4	5640	
15 min Winter	155.457	0.0	443.7	16	
30 min Winter	89.845	0.0	512.7	31	
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Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ		Mulsford Farm Sarn Malpas Attenuation Calcs (30%CC)			
Date 06/06/2017 File		Designed by IJ Checked by JR			
XP Solutions		Source Control 2016.1			
<u>Summary of Results for 100 year Return Period (+30%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	9.788	0.788	7.1	567.7	Flood Risk
120 min Winter	9.883	0.883	7.1	635.5	Flood Risk
180 min Winter	9.933	0.933	7.2	671.5	Flood Risk
240 min Winter	9.963	0.963	7.2	693.3	Flood Risk
360 min Winter	9.992	0.992	7.2	714.5	Flood Risk
480 min Winter	10.000	1.000	7.2	719.8	Flood Risk
600 min Winter	9.994	0.994	7.2	715.9	Flood Risk
720 min Winter	9.981	0.981	7.2	706.2	Flood Risk
960 min Winter	9.970	0.970	7.2	698.7	Flood Risk
1440 min Winter	9.930	0.930	7.2	670.0	Flood Risk
2160 min Winter	9.878	0.878	7.1	632.4	Flood Risk
2880 min Winter	9.813	0.813	7.1	585.0	Flood Risk
4320 min Winter	9.610	0.610	7.0	439.4	O K
5760 min Winter	9.431	0.431	7.0	310.6	O K
7200 min Winter	9.279	0.279	6.9	200.8	O K
8640 min Winter	9.155	0.155	6.9	111.7	O K
10080 min Winter	9.062	0.062	6.8	44.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	51.925	0.0	592.9	62	
120 min Winter	30.010	0.0	685.7	120	
180 min Winter	21.776	0.0	745.7	178	
240 min Winter	17.344	0.0	792.2	238	
360 min Winter	12.585	0.0	862.6	354	
480 min Winter	10.024	0.0	915.5	468	
600 min Winter	8.402	0.0	959.4	582	
720 min Winter	7.273	0.0	996.9	692	
960 min Winter	5.920	0.0	1081.6	902	
1440 min Winter	4.428	0.0	1180.7	1126	
2160 min Winter	3.312	0.0	1361.1	1600	
2880 min Winter	2.696	0.0	1478.0	2048	
4320 min Winter	1.939	0.0	1594.4	2896	
5760 min Winter	1.535	0.0	1684.4	3688	
7200 min Winter	1.281	0.0	1755.5	4400	
8640 min Winter	1.105	0.0	1816.4	5096	
10080 min Winter	0.975	0.0	1870.5	5648	
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Rainfall Details

Rainfall Model	FEH	D3 (1km)	0.303	Cv (Winter)	0.840
Return Period (years)	100	E (1km)	0.284	Shortest Storm (mins)	15
Site Location		F (1km)	2.381	Longest Storm (mins)	10080
C (1km)	-0.025	Summer Storms	Yes	Climate Change %	+30
D1 (1km)	0.324	Winter Storms	Yes		
D2 (1km)	0.399	Cv (Summer)	0.750		

Time Area Diagram

Total Area (ha) 1.360

Time (mins)	Area
From:	To: (ha)
0	1 1.360

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Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 9.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	720.0	1.000	720.0

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0077-7200-8995-7200
Design Head (m)	8.995
Design Flow (l/s)	7.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	77
Invert Level (m)	1.000
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

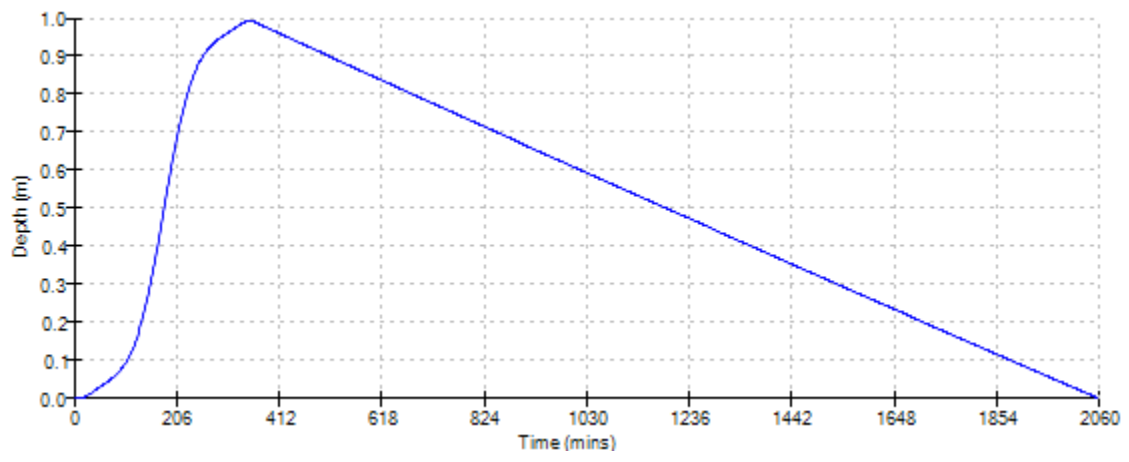
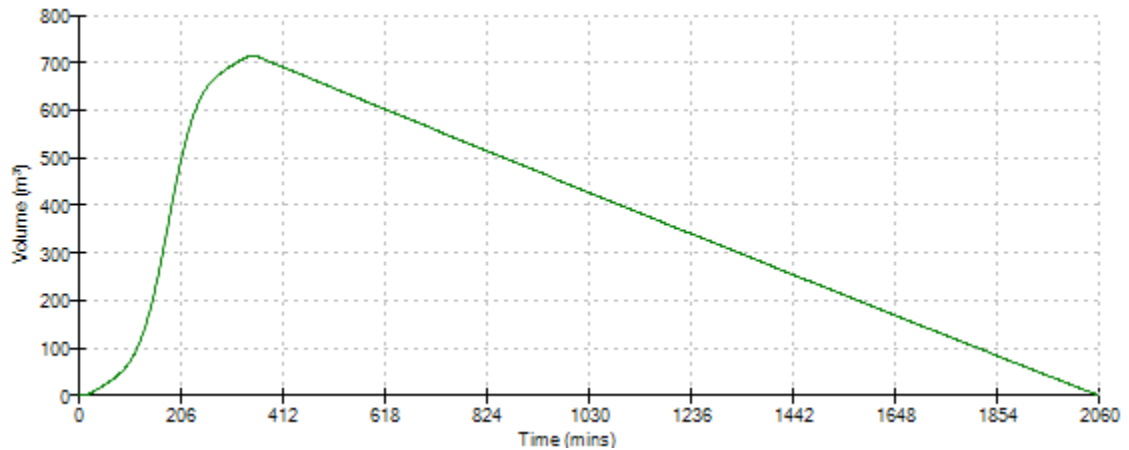
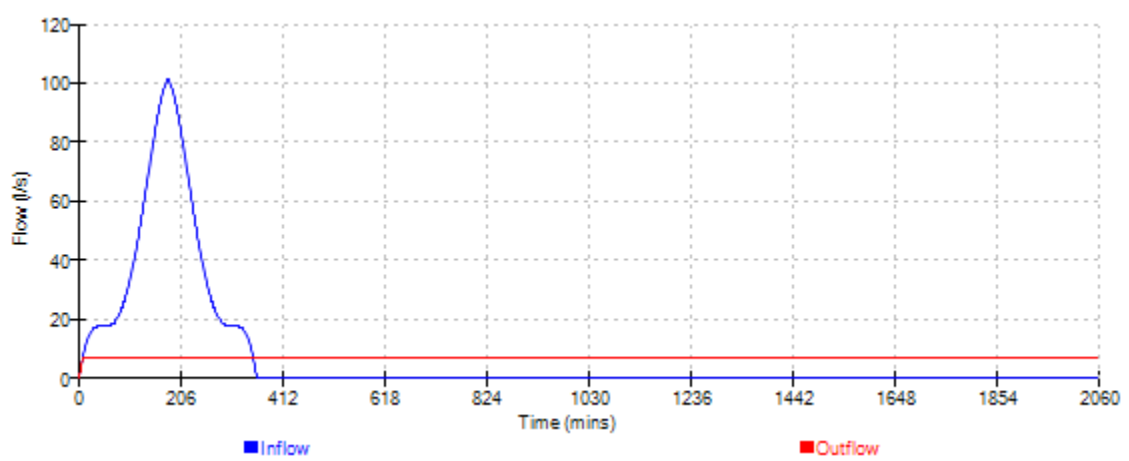
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	8.995	7.2
Flush-Flo™	0.320	2.8
Kick-Flo®	0.684	2.2
Mean Flow over Head Range	-	5.0

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

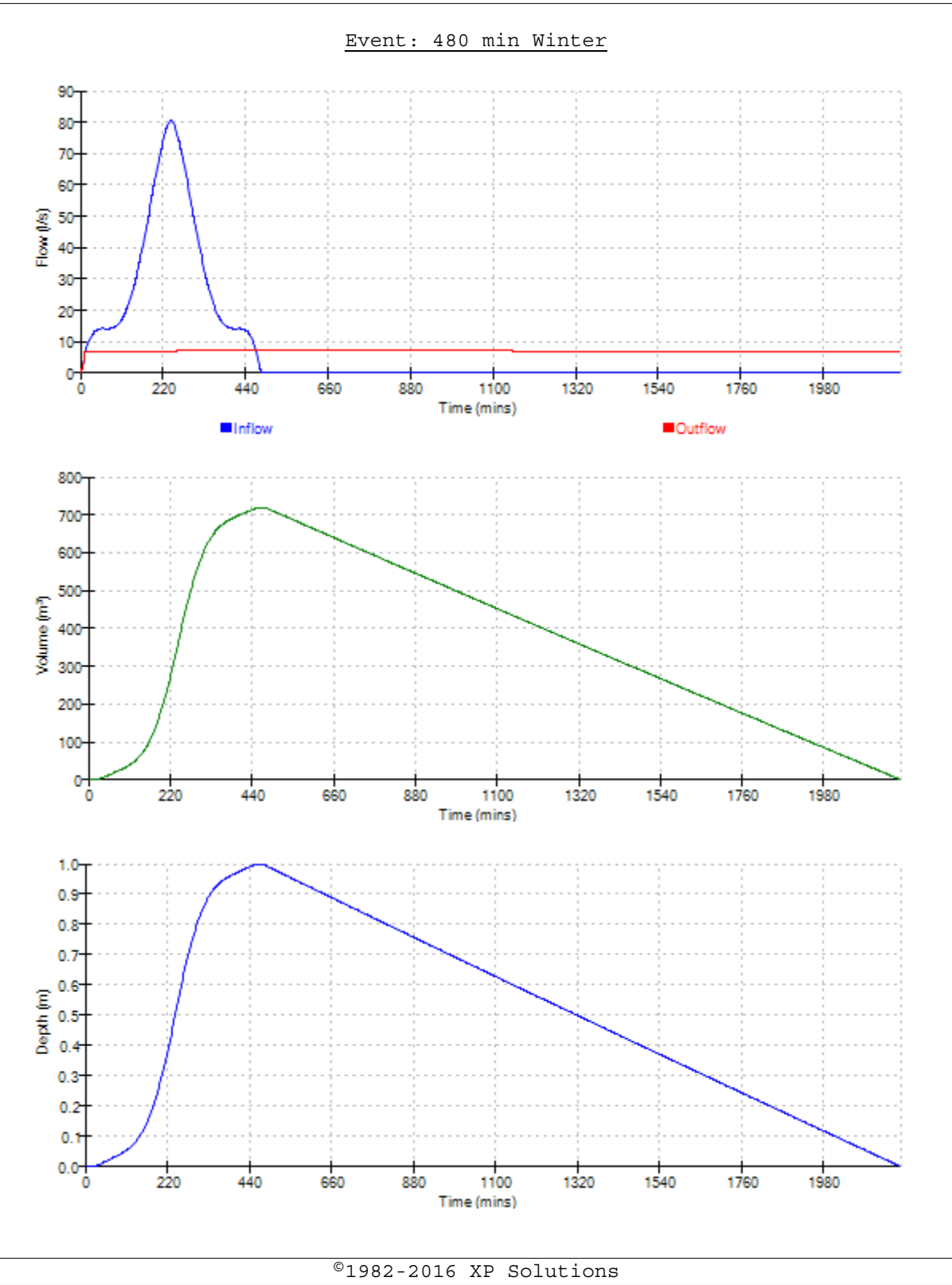
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.2	1.200	2.8	3.000	4.3	7.000	6.4
0.200	2.7	1.400	3.0	3.500	4.6	7.500	6.6
0.300	2.8	1.600	3.2	4.000	4.9	8.000	6.8
0.400	2.7	1.800	3.4	4.500	5.2	8.500	7.0
0.500	2.7	2.000	3.6	5.000	5.4	9.000	7.2
0.600	2.5	2.200	3.7	5.500	5.7	9.500	7.4
0.800	2.3	2.400	3.9	6.000	5.9		
1.000	2.6	2.600	4.0	6.500	6.2		

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Event: 360 min Winter



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