FCA, for a Poultry Unit at Upper Bryon, Abermule, Montgomery, Powys, SY15 6JW

Contract Ref: FD042 Rev.2

Roger Parry and Partners

Contents

QUALITY ASSURANCE RECORD

Contributors for Townsend Water Engineering:

Name	Role
Charles Townsend	Project Director

Document Status and Revision History:

Version	Date	Author	Reviewer	Authoriser	Status / Comment
1	14/12/21	C. Townsend	C. Townsend	C. Townsend	First Issue
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1. INTRODUCTION

1.1 Background (A1.2)

Townsend Water Engineering Ltd. has been appointed by Roger Parry and Partners to undertake a Flood Consequence Assessment for a proposed free range Poultry Unit (the site) at Upper Bryon, Abermule. This report constitutes a response to the Welsh Assembly's Technical Advice Note, TAN15 and to identify where additional work may be required, in order to satisfy the Advice Note.

There are three principal issues to be addressed in any Flood Consequence Assessment:

- The consequence of flooding on the development.
- The consequences of the development of the site upon flood risk elsewhere in the catchment for a range of potential flooding scenarios up to that flood having a probability of 0.1% (the 1,000 year flood).
- To establish whether appropriate mitigation measures can be incorporated within the design of the development to ensure that the development minimises risk to life, damage to property and disruption to people living and working on the site or elsewhere in the catchment.

Furthermore Powys County Council have made the following request:

Comment: The Authority holds no historical flooding information relating to this site. However, from the surface water flood mapping in our possession, there is a risk of surface water flooding to the site. This flood risk information can be seen on NRW's flood risk mapping webpage, in particular, flooding from surface water, where it shows areas with a Low, Medium, and High chance of flooding form surface water. Development should not be permitted within an area at risk from flooding unless it can be demonstrated that the consequences of any flooding would be acceptable for the development proposed and that it would not give rise to any acceptable flooding impacts elsewhere.

Recommendation: A limited Flood Consequences Assessment (FCA) should be prepared and submitted to the LPA in order to evaluate and assess the risk from surface water flooding prior to the granting of any planning permission.

Comment: Historic Ordnance Survey maps show an ordinary watercourse is located within the site along the south eastern boundary. The LLFA suspect that this watercourse has been culverted. The local planning authority (LPA) shall require the developer to carry out a detailed investigation to identify of this culvert structure prior to the granting of any planning permission. No buildings, structures, fences, planting or changing of contours shall take place within 5 metres of the top of the bank of any watercourse, or 3 metres either side of any culverted watercourse (which would allow also allow for overland flows). The LLFA is not in support of this application until further details have been submitted to demonstrate how the ordinary watercourse system will be safeguarded/ protected.

Recommendation: The applicant shall carry out a detailed investigation which should be submitted to the LPA prior to the granting of planning permission. This detailed investigation identify the location and structural integrity of the culverted watercourse.

TAN15 also requires other issues to be considered, such as site runoff and recommendations for drainage systems, which are included in appropriate sections.

Powys Council questions will be answered within this report.

1.2 Consultation with Natural Resources Wales (A1.1)

A review of Natural Resources Wales's (NRW) flood maps confirm the site is located variously in Development Zones A (Flood Zone 1) and Powys Council have confirmed the site is potentially at risk of flooding from surface water.

This Report has been informed by:

- Information available and previously available on internet sites:
  - https://naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en
  - http://lle.gov.wales/

1.3 Structure of this Report

The Report has been structured in order to deal with each of the points raised in Appendix 1 (Assessing Flood Consequence Assessments) of Technical Advice Note (TAN 15) of the Welsh Assembly's Planning Guidelines. Where relevant, each sub-heading in this report incorporates the section number of Appendix 1, TAN15 in parentheses.

- Section 2 describes the existing site and the characteristics of catchments that affect the site
- Section 3 presents an assessment of the existing flood risk at the application site.
- Section 4 presents an assessment of flood risks associated with the proposed development along with any mitigation that may be required.
- Section 5 presents a summary of the main findings.

The following Appendices are also provided:

- Appendix A TAN15 Requirements
- Appendix B Topographical Survey
- Appendix C Lead Local Flood Authority Comments
- Appendix D Infiltration Rates
- Appendix E NRW comments
- Appendix F Surface Water Management Plan

2. SPATIAL PLANNING CONSIDERATIONS

2.1 The Site

The site is located at Upper Bryon, Abermule, Montgomery, Powys, SY15 6JW. The proposed site is a greenfield site, and the building is approximately 0.27ha. There is ditch running near the building. Details of the location of the site are shown in table 1. The location of the site is shown in figure 1 and Figure 2 and an aerial photograph of the site is shown in Figure 3.

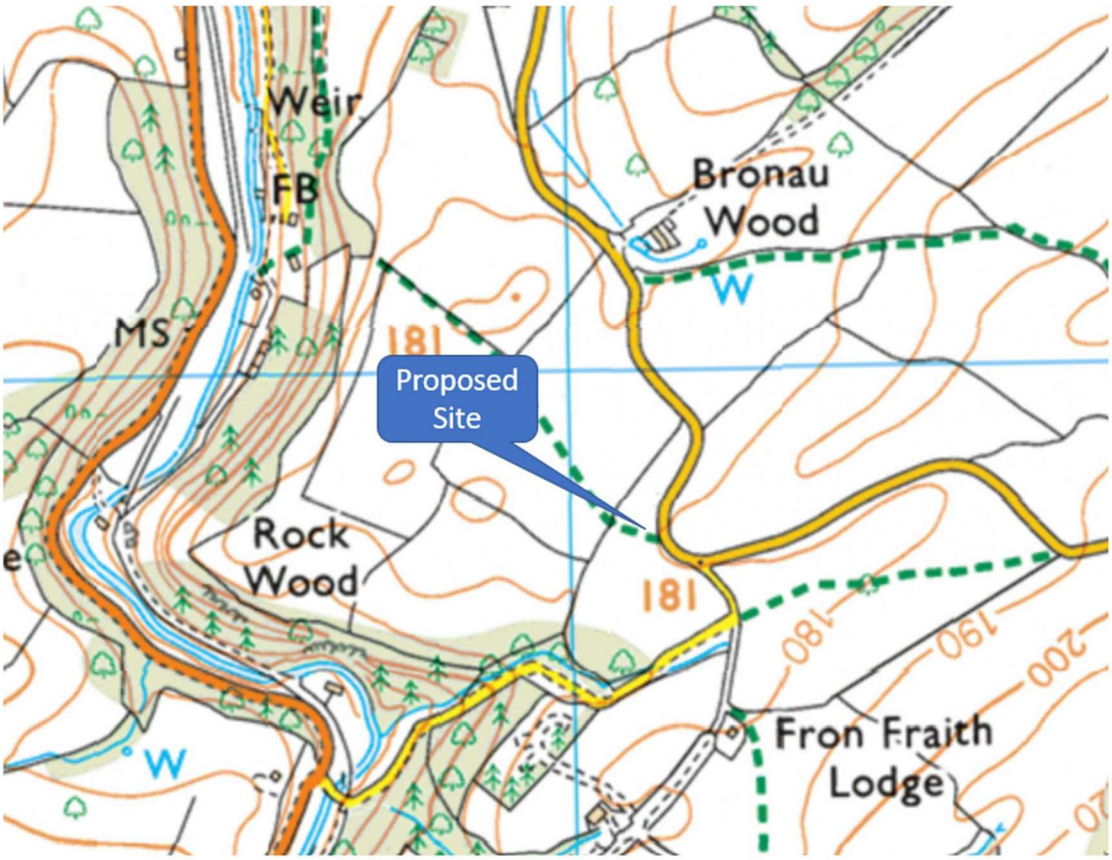

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Figure 1: Location of the Development Site

Reference	Value
OS X (Eastings)	317066
OS Y (Northings)	293830
Nearest Post Code	SY15 6NN
Lat (WGS84)	N52:32:10 (52.535992)
Long (WGS84)	W3:13:27 (-3.224136)

Table 1: Grid Reference details for the site (www.streetmap.co.uk)

Figure 2: Development site Block Plan

Figure 3:Aerial photo of the site (boundary in red)

2.2 Topography

A contoured topography map of the location of the site is shown in Figure 4, the full topographical survey is in appendix B. As can be seen, the only culvert is under the road, upstream of the development. The ditch near the development is flowing to the south west.

The road culvert is outside the curtilage of the development and is under a different riparian owner (most likely Powys County Council). Therefore within this development works to the culvert could not be undertaken as it is owned by third parties. There are no known culvert within the curtilage of the development. This has been accepted by the council, please see appendix C.

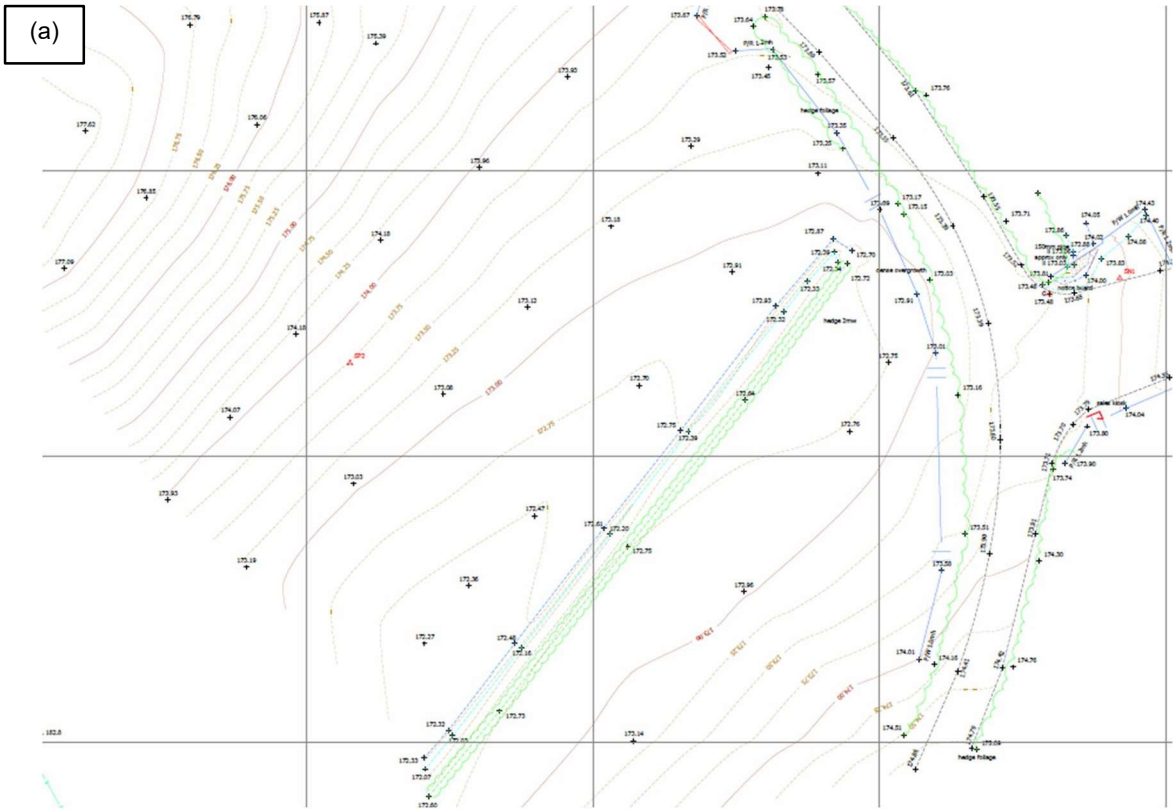


Figure 4: Topography of the Development Site (boundary in red))

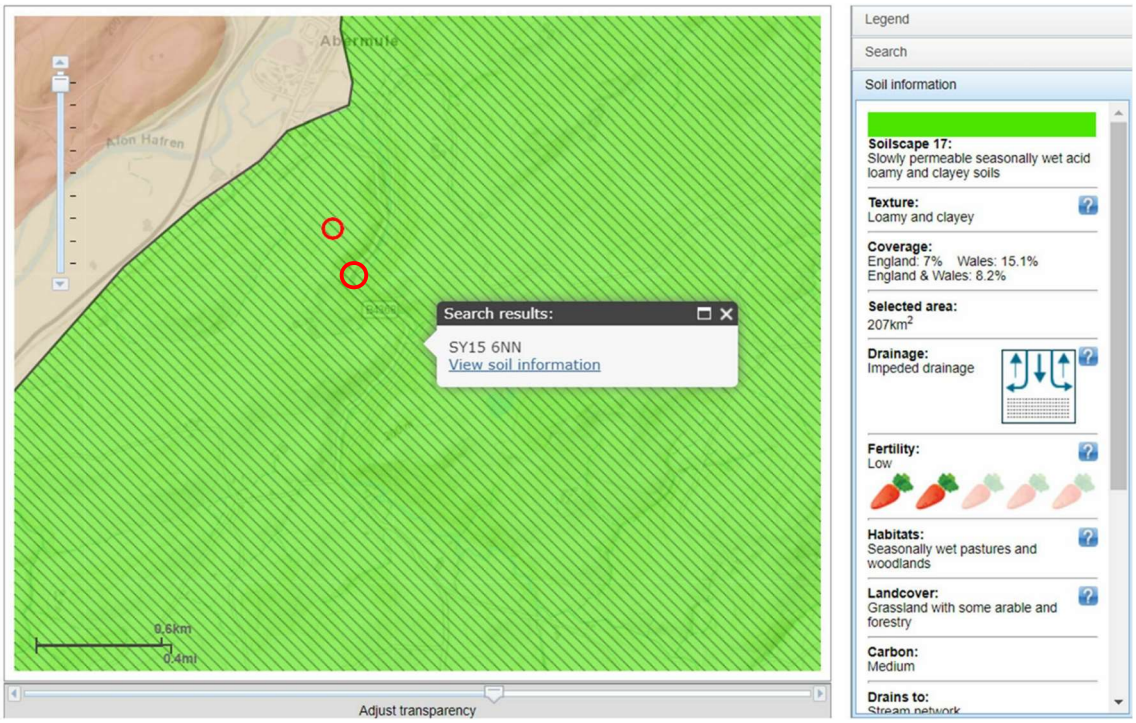
2.3 Soils and Geology

Soils at the site are described on the Cranfield University "Soilscapes" website as, *slowly permeable seasonally wet acid loamy and clayey soils*, and water drains to *the river network*. The soil characteristics indicate that soils at the site could be permeable (Figure 5).

According to the British Geological Survey geological maps indicates the site is underlined by Sandstone and Siltstone, interbedded.

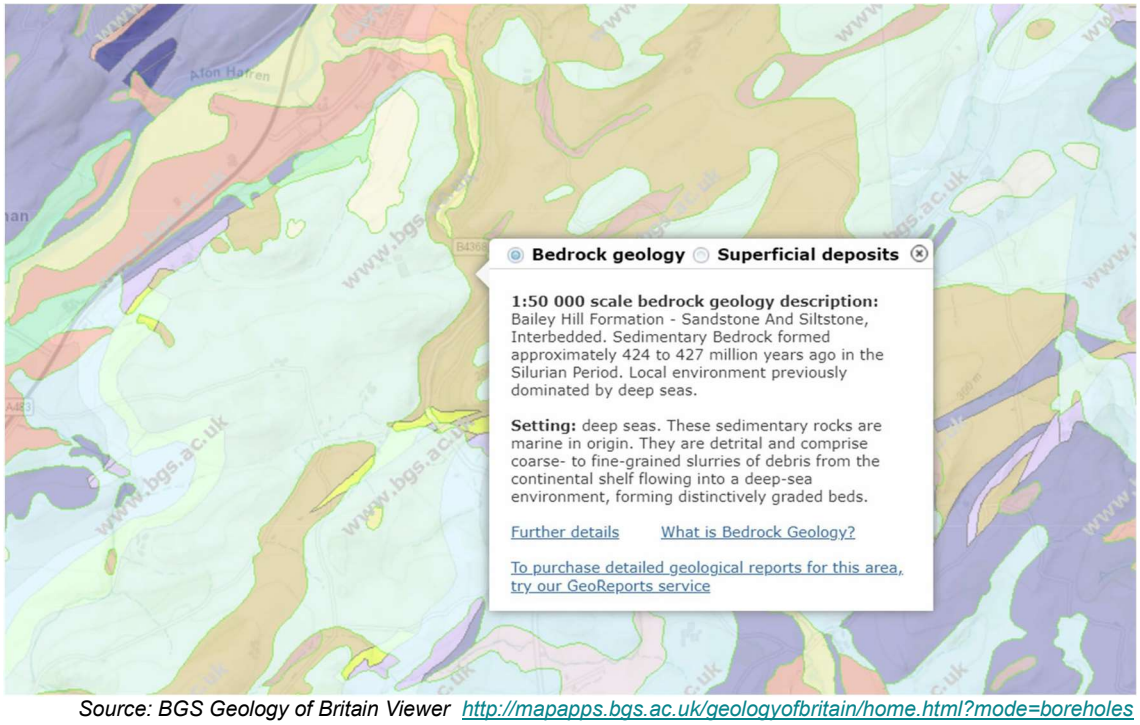
Infiltration tests have been undertaken by the client on the 2nd September. The weather was fine. These tests where undertaken to BRE365 and they give an infiltration rate of between $1.45x10^{-5}$m/s and $5.56x10^{-5}$m/s. Please see Appendix D. The lowest value has been used in the calculations.

These results suggest the site can be drained via infiltration.



Source: Cranfield University Soil Mapping http://www.landis.org.uk/soilscapes/

Figure 5: Soil Map of the Site (circled in red) and Surrounding Area



Source: BGS Geology of Britain Viewer *http://mapapps.bgs.ac.uk/geologyofbritain/home.html?mode=boreholes*

Figure 6: Superficial deposits underlying the site and surrounding area

2.4 Natural Resources Wales Flood Zone

The Natural Resources Wales TAN 15 Development map (Figure 7) shows that the development site is located in Development Flood Zones A. Development Flood Zone A shows no sign of flooding.

Powys County Council have also commented that the site is at risk of surface water flooding, please see below NRW surface flood map figure 8. NRW, confirm they have no levels for this particular watercourse, please see appendix

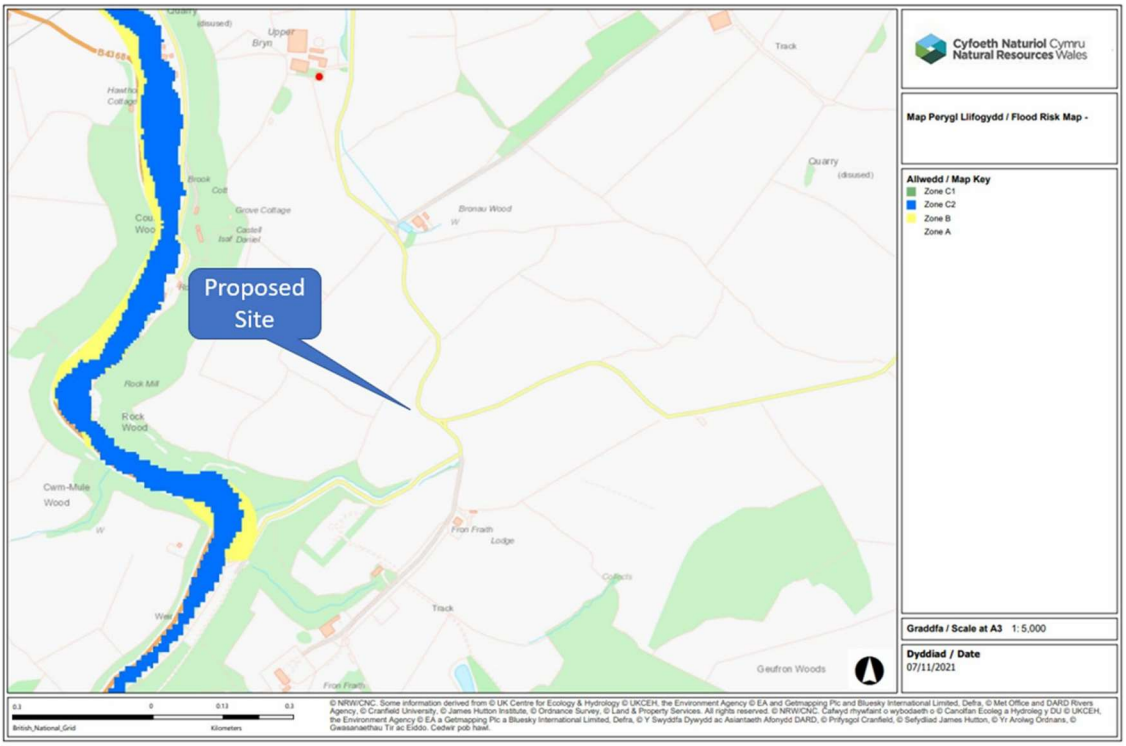


Figure 7: TAN15 Development Advice Map (Natural Resources Wales) (site boundary in red)

The proposed building has been placing outside of the surface water map area and is 9m away from the watercourse as asked by Powys County Council. This should minimise the risk of flooding. Please see appendix C when Powys Council confirm this is acceptable.

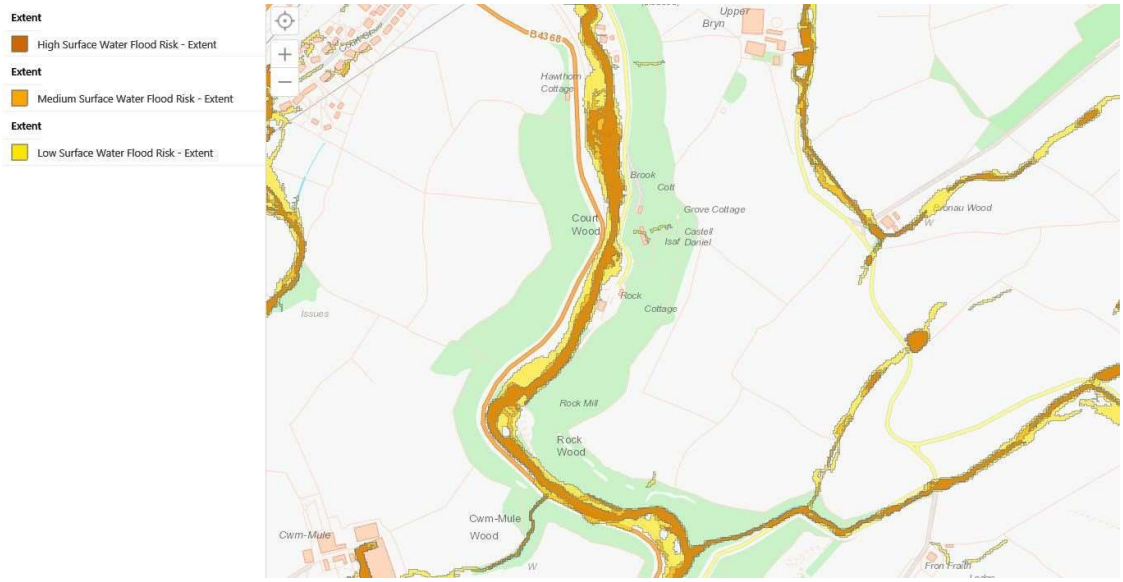


Figure 8: NRW Flood Zone map (Natural Resources Wales 2019) (site outlined in red)

2.5 Justification Test

As stated in section 2.4 the development site is within Zones A. From Tan15 Figure 2 reproduced here as Table 2 the development is "*Less Vulnerable*". It can be considered in zone A and passes the justification test, including acceptability of consequences (Table 3, Tan 15 Figure 1).

Development category	Types
Emergency services	hospitals, ambulance stations, fire stations, police stations, coastguard stations, command centres, emergency depots and buildings used to provide emergency shelter in time of flood
Highly vulnerable development	all residential premises (including hotels and caravan parks), public buildings (e.g. schools, libraries, leisure centres), especially vulnerable industrial development (e.g. power stations, chemical plants, incinerators), and waste disposal sites
Less vulnerable development	General industrial, employment, commercial and retail development, transport and utilities infrastructure, car parks, mineral extraction sites and associated processing facilities, excluding waste disposal sites

Table 2: Development categories (TAN15 Pg.7)

Description of Zone		Use within the precautionary framework
Considered to be at little or no risk of fluvial or tidal/coastal flooding.	A	Used to indicate that justification test is not applicable and no need to consider flood risk further.
Areas known to have been flooded in the past evidenced by sedimentary deposits.	B	Used as part of a precautionary approach to indicate where site levels should be checked against the extreme (0.1%) flood level. If site levels are greater than the flood levels used to define adjacent extreme flood outline there is no need to consider flood risk further.
Based on Environment Agency extreme flood outline, equal to or greater than 0.1% (river, tidal or coastal)	C	Used to indicate that flooding issues should be considered as an integral part of decision making by the application of the justification test including assessment of consequences.
Areas of the floodplain which are developed and served by significant infrastructure, including flood defences.	C1	Used to indicate that development can take place subject to application of justification test, including acceptability of consequences.
Areas of the floodplain without significant flood defence infrastructure.	C2	Used to indicate that only less vulnerable development should be considered subject to application of justification test, including acceptability of consequences. Emergency services and highly vulnerable development should not be considered.

Table 3: Flood Risk Vulnerability and Flood Zone compatibility (TAN15 Pg. 5)

3. FLOOD HAZARD FOR EXISTING SITE

3.1 Source of Flood Risk

A review of flood sources is given in Table 4, which shows possible causes at the site. As discussed in Section 2.4, the proposed site is in Flood Zones A. The NRW fluvial Flood Zone map shows the site to be in wholly flood zones A.

Natural Resources Wales surface water flood risk map (Figure 8) shows the majority of the site to be at very low risk of surface water flooding (less than 1:1,000 annual probability of flooding), with an area indicating that the site is at medium to high risk of flooding.

Examination of NRW flood mapping confirms the following flood related information.

- The site does not fall within an area benefitting from flood defences, nor within a flood storage area.
- There are no records of historical flooding at the site.
- The site is not at risk of flooding from infrastructure (reservoir) failure.

NRW has no levels for this site (Appendix D).

Key sources of flooding	Possibility at Site
Fluvial (Rivers)	The site is at low risk of flooding from fluvial sources, Figure 7
Tidal	N/A. The site is above sea level (it is at elevation of approximately 172mAOD)
Groundwater	Low risk, Upper Bryon has low susceptibility to groundwater flooding based on the underlying geology. No specific incidents of groundwater flooding have been identified. (CBC 2015)
Sewers	The site is not in an area identified to be at risk from sewer flooding. (CBC 2011)
Surface water	The site is predominantly at Very Low risk. There is an area of high to medium risk following the ditch Figure 8. The proposed building has been set 9m away from the ditch, 
Infrastructure failure	The site is at low risk of infrastructure water flooding

Table 4: Possible sources of flood risk

3.2 Flood Mechanisms

The primary source of flooding at the site is surface water flooding.

Surface water flood risk at the site is likely to be the result of rainfall falling onto the existing ground which then drains to the ditch. A review of the topography of the site (section 2.3) suggests any rainfall on the site would runoff towards the ditch, where it would accumulate. The surface water flood risk map of the site shown in Figure 8 supports this interpretation the surface water flood map follows the low points in the topography.

Runoff from upslope of the site is likely to infiltrate before it reaches the site.

3.3 Existing Surface Water Drainage Arrangements (A1.17.11)

The site is currently a greenfield site. It is understood that there are no existing formal surface water drainage arrangements in place at the site.

4. ASSESSMENT OF FLOOD RISK FOR PROPOSED DEVELOPMENT

4.1 The Development Proposals

The proposals are for the construction of a free range poultry unit and associated works. The internal finished floor levels of the units would be raised above ground level. The buildings would be classified as Less Vulnerable development.

External areas of the site would be landscaped. The proposed vehicular access point would be to the north and a new access point created, this will be a gravel drive which is permeable. The roads and parking have been excluded from the drainage calculations.

Following discussion with Powys County Council a filter drain will replace the ditch at the bottom of the valley. This will improve flow as the ditch really is a low spot of the valley. The filter drain is nothing to do with the drainage. This has agreed with Powys Council. The replacement filter drain will consist of a perforated pipe with stone on top and then soil. This will improve the drainage. Please see the confirmation from Powys Council (appendix C).

The proposed surface coverage is detailed in Table 5; the existing site is entirely greenfield. Figure 9 shows the outline layout plan for the site.

Area Description	Surface Type	Dimensions (m x m)	Area (m2)
Poultry Unit	Impermeable	118x23	2714

Table 5: Proposed surface coverage

There is no known risk associated with damage or blockage of infrastructure near the development site (CBC 2015).

Figure 9: Proposed Site Layout (source Roger Parry and Partners)

4.2 Flood Risk Management Measures to Protect the Site (A1.5, A1.6, A1.7, A1.8, A1.11, A1.14, A1.15)

4.2.1 Appreciation of dangers (A1.5)

As discussed in Section 2.4, 2.5 and 3, the NRW Development Advice map (Figure 7) shows the site and the poultry unit to be located in Flood Zones A. The surface water maps indicate that the site is at risk of flooding.

As agreed and confirmed with Powys County Council the buildings will be set 9m away from the ditch. The ditch will be converted to a filter drain, this will improve connectivity. This will decrease the risk of flooding. This has been confirmed as acceptable, Appendix C.

It is proposed to make the ditch into a filter drain which includes a perforated pipe to aid drainage. This will ensure that the water can drain away. It will also provide some water quality benefits in regards to the free range poultry units. This will need to be maintained by the owner.

The site is at low to very low risk from all other forms of flooding.

4.2.2 Finished Floor Levels

There are no flood levels for the field drain as confirmed by NRW (Appendix E), however the buildings are 9m away from the ditch and will be set approximately 500mm above the ditch which gives a finished floor level of approximately 173.5mAOD.

4.2.3 Appreciation of structural adequacy (A1.7)

The poultry unit should be constructed above and outside the flood area, therefore this development would not be subject to any special structural requirements deriving from the design flood events considered.

There are no formal flood defences associated with the site and there are no structures likely to affect flooding.

4.2.4 Awareness of Flooding Consequences and Access/Egress arrangements (A1.14, A1.15, A1.16)

The proposed development is outside of the flood plain and so has safe access and egress.

4.3 Management of Flood Consequences elsewhere in the Floodplain (A1.9)

4.3.1 General

TAN15 requires that the proposed development would not lead to an increase in flood risk elsewhere, whether through reduction in flood plain storage, obstruction of flood flow or increase in surface water runoff. The proposed building is situated outside of the watercourse and the surface water area: therefore no compensatory storage is required.

4.3.2 Surface Water Management

TAN15 requires that the proposed development would not lead to an increase in flood risk elsewhere. The site is currently a greenfield site and therefore there will be an increase in surface water flooding.

As said previously infiltration is feasible on the site. Therefore it is recommended that the surface water is collected from the roof of the poultry unit and discharge into ground via a swale/ infiltration basin.

Appendix E presents a scheme whereby surface water runoff is routed to a swale/ infiltration basin where it would attenuate up to and including the 1 in 100 year event plus climate change.

The swale/ infiltration basin will be south of the poultry unit. Below is a summary of the results.

Structure	**Swale/Infiltration Basin**
Total Area	**275m^2**
Side Slope	**1 in 3**
Depth	**1.20m**
Discharge rate	**To ground**

Table 6: Infiltration structure characteristics

FSR: Critical Storm Per Item

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. Avg. Depth (m)	Total Discharge Volume (m³)	Half Drain Down Time (mins)	Percentage Available (%)	Status
Dry Swale	FSR: 100 years: +40 %: 960 mins: Winter	1.098	1.098	1.073	1.085	0.000	951	14	OK

Table 7: Infiltration structure performance

A potential layout for the scheme is illustrated in Figure 10, this includes the filter drain at the 9m easement.

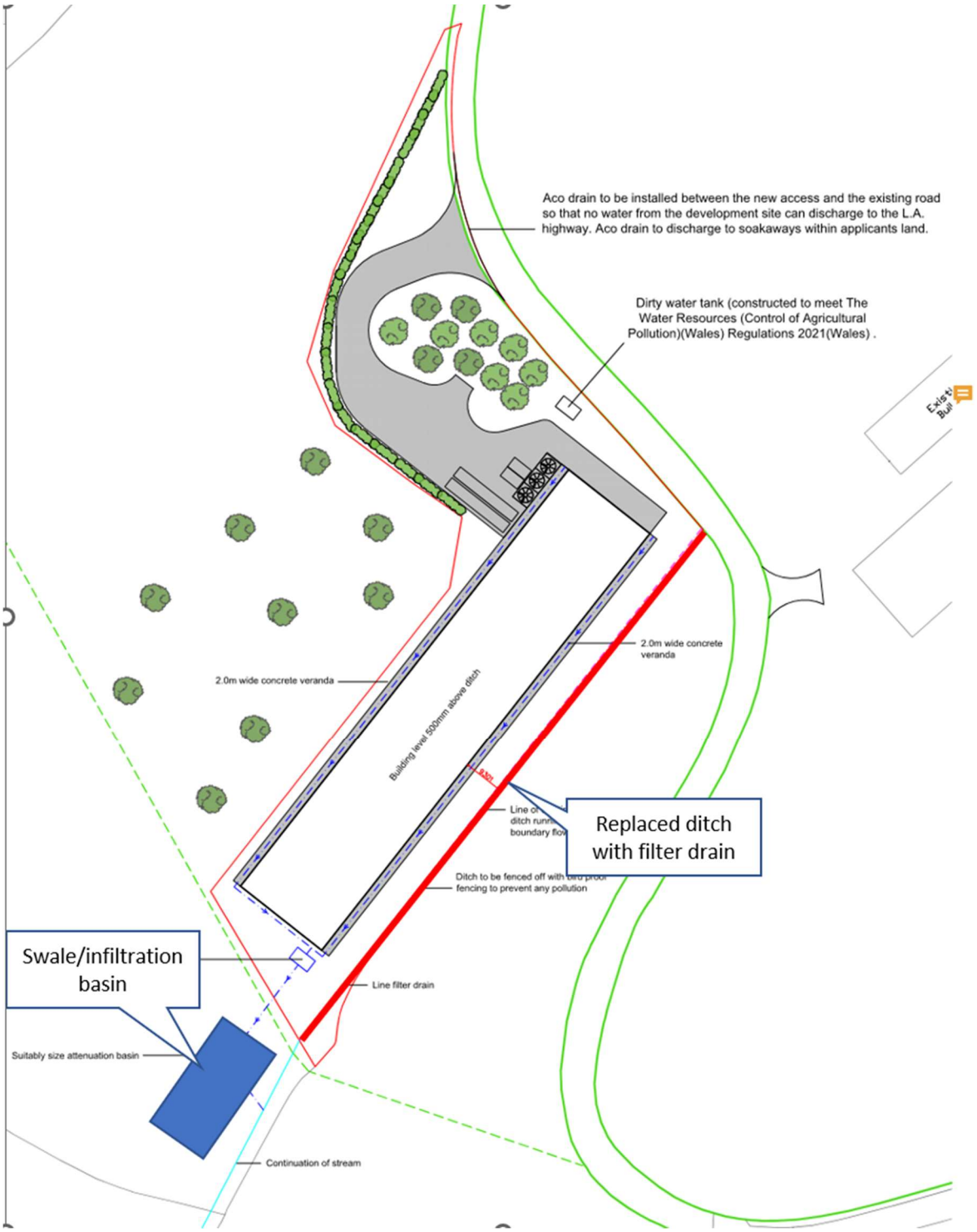


Figure 10: Proposed Drainage Layout (source Roger Parry and Partners)

4.4 Residual Risks

Residual risks include the need to manage storms of a significantly greater magnitude than those considered in this report or poor maintenance of any attenuation structure.

Structures which manage surface water runoff require little maintenance, however a regular maintenance schedule, on a monthly basis and after heavy rainfall, should be established by the property owners/ designated maintenance company to reduce the risk of blockage within the drainage system and ensure the systems remain in good working order. Filters and silt traps should be installed within the system upstream of the granular storage. Manholes should be included in the system design to allow access for maintenance to take place. Please see below the recommended maintenance regime for the proposed attenuation basin.

TABLE 13.2 Operation and maintenance requirements for infiltration basins

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter, debris and trash	Monthly
	Cut grass – for landscaped areas and access routes	Monthly (during growing season) or as required
	Cut grass – meadow grass in and around basin	Half yearly: spring (before nesting season) and autumn
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
Occasional maintenance	Reseed areas of poor vegetation growth	Annually, or as required
	Prune and trim trees and remove cuttings	As required
	Remove sediment from pre-treatment system when 50% full	As required
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realign the rip-rap	As required
	Repair or rehabilitate inlets, outlets and overflows	As required
	Rehabilitate infiltration surface using scarifying and spiking techniques if performance deteriorates	As required
	Relevel uneven surfaces and reinstate design levels	As required
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and pre-treatment systems for silt accumulation; establish appropriate silt removal frequencies	Half yearly
	Inspect infiltration surfaces for compaction and ponding	Monthly

Table 8: Operation and maintenance requirement for Infiltration Basins

4.5 Climate Change Impacts

For increase in rainfall intensities to 2115, and adopting a precautionary approach, an allowance of 40% has been applied for the development of the surface water management plan presented in Appendix C and summarised in section 4.5.2.

4.6 Qualifications of those undertaking Flood Consequence Assessment (A1.10)

Charles Townsend: Project Director

Charles Townsend is director at Townsend Water Engineering. He is a surface water management and SuDS expert who has specialised in drainage networks for the last 17 years. He is a chartered scientist and chartered Water and Environment Manager.

5. SUMMARY AND CONCLUSIONS

This report documents work undertaken by Townsend Water Engineering for Roger Parry and Partners during October 2022. It is a Flood Consequence Assessment (FCA) for a proposed Free Range Poultry Unit at Upper Bryon, Abermule.

The principal tasks undertaken were as follows:

i. To assess flood risk at this site in terms of TAN15 and, where necessary, to recommend measures to achieve compliance.
ii. Produce a Flood Consequence Assessment (FCA) for the proposed development to satisfy the requirements of TAN15.
iii. Provide surface water management solutions for the development.

The key outcomes of the work are:

i. The proposals are for a poultry unit. The development would be classified as *less vulnerable.* The building has been situated 9m away from the watercourse and outside the flood area. This has been agreed to be acceptable to Powys County Council.

ii. The external land use is for the ranging of the poultry.

iii. Safe Access and Egress would be to the road to the north that does not go through the flood zone areas.

iv. Soils at the site are indicated to be *slowly permeable, seasonally wet, acid, loamy and clayey soils.*

v. Infiltration tests have been undertaken and indicate the site can drain by infiltration.

vi. A surface water management plan based on a swale/infiltration basin has been prepared. The scheme has been shown to accommodate runoff resulting from rainfall events up to and including the 100 year plus 40%climate change design rainfall event.

vii. It is recommended that the surface water management system should be checked on a monthly basis and after heavy rains, all such costs should be borne by the site owner/ designated management company.

viii. The only culvert in the area is the culvert under the road. This is under third party land (Powys County Council) and therefore not owned by the client. My client cannot amend this as they do not own it. There are no other culverts in the area. This has been agreed by Powys County Council.

ix. It is recommended that a filter drain is placed at the bottom of the valley replacing the ditch at the bottom of the valley, it will improve the flow of the watercourse and water quality in the area. It is recommended that the filter drain has a perforated pipe at the bottom and then covered in stone and then top soil. This has been agreed with Powys Council.

x. The finished floor levels will be set at 173.5mAOD, this is approximately 500mm above the ditch level.

In summary, the proposed development would not significantly increase flood risk at the site or elsewhere, and the risks have been appropriately managed. If the recommendations provided in this report were implemented, this development would comply with the requirements of TAN15.

6. REFERENCES

Author	Date	Title/Description
British Geological Survey	2019	BGS Geology of Britain Viewer http://mapapps.bgs.ac.uk/geologyofbritain/home.html?mode=
Centre for Ecology and Hydrology.	2019	The Flood Estimation Handbook Web Service https://fehweb.ceh.ac.uk/GB/map
CIRIA	2015	The SUDS Manual - CIRIA Report C753.
Cranfield University	2019	Soilscapes Map. Available at: http://www.landis.org.uk/soilscapes/
Defra/EA	2008	Flood and Coastal Defence Programme; Flood Risks to People Phase 2 FD2321/TR2 Guidance Document
Natural Resources Wales	2019, 2021	Natural Resources Wales Interactive Flood Map and TAN15 Development Advice Map. Available at: https://naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en
Welsh Assembly	2004	Technical Advice Note 15. Development and Flood Risk, July 2004.
Welsh Government	August 2016	Climate change allowances for planning purposes. Available at: http://gov.wales/topics/planning/policy/policyclarificationletters/2016/cl-03-16-climate-change-allowances-for-planning-purposes/?lang=en

Appendix A: TAN 15 Requirements

Table A-1 follows the bullet points in Section A1.12 of TAN15.

Table A-1 Conditions of Acceptability Criteria (A1.12)

No	Conditions of acceptability criteria (A1.12)	*Check*
1	Flood defences must be shown by the developer to be structurally adequate particularly under extreme overtopping conditions (i.e. that flood with a probability of occurrence of 0.1%)	*No defences are present, and no new defences are recommended.*
2	The cost of future maintenance for all new/approved flood mitigation measures, including defences must be accepted by the developer and agreed with the Natural Resources Wales	*The cost of all proposed measures to be borne by the site owner / designated maintenance company.*
3	The developer must ensure that future occupiers of development are aware of the flooding risks and consequences	*This and any subsequent FCA reports should be available to future owners.*
4	Effective flood warnings are provided at the site	*This site is in a Flood Zone A and therefore does not require a flood warning.*
5	Escape/evacuation routes are shown by the developer to be operational under all conditions	*See section 4.2.4 Safe emergency access and egress should always be possible under low hazard conditions.*
6	Flood emergency plans and procedures produced by the developer must be in place	*N/A as the site is in a Flood Zone A.*
7	The development is designed by the developer to allow the occupier the facility for rapid movement of goods / possessions to areas away from the floodwaters	*The buildings are set outside the area of flood risk.*
8	Development is designed to minimise structural damage during a flooding event and is flood proofed to enable it to be returned to its prime use quickly in the aftermath of the flood	*The building is set outside of the flood plain.*
9	No flooding elsewhere	*The use of SuDS is recommended to ensure a reduction in runoff from the site to below current rates.*

Technical Requirements for Assessing Flooding Consequences

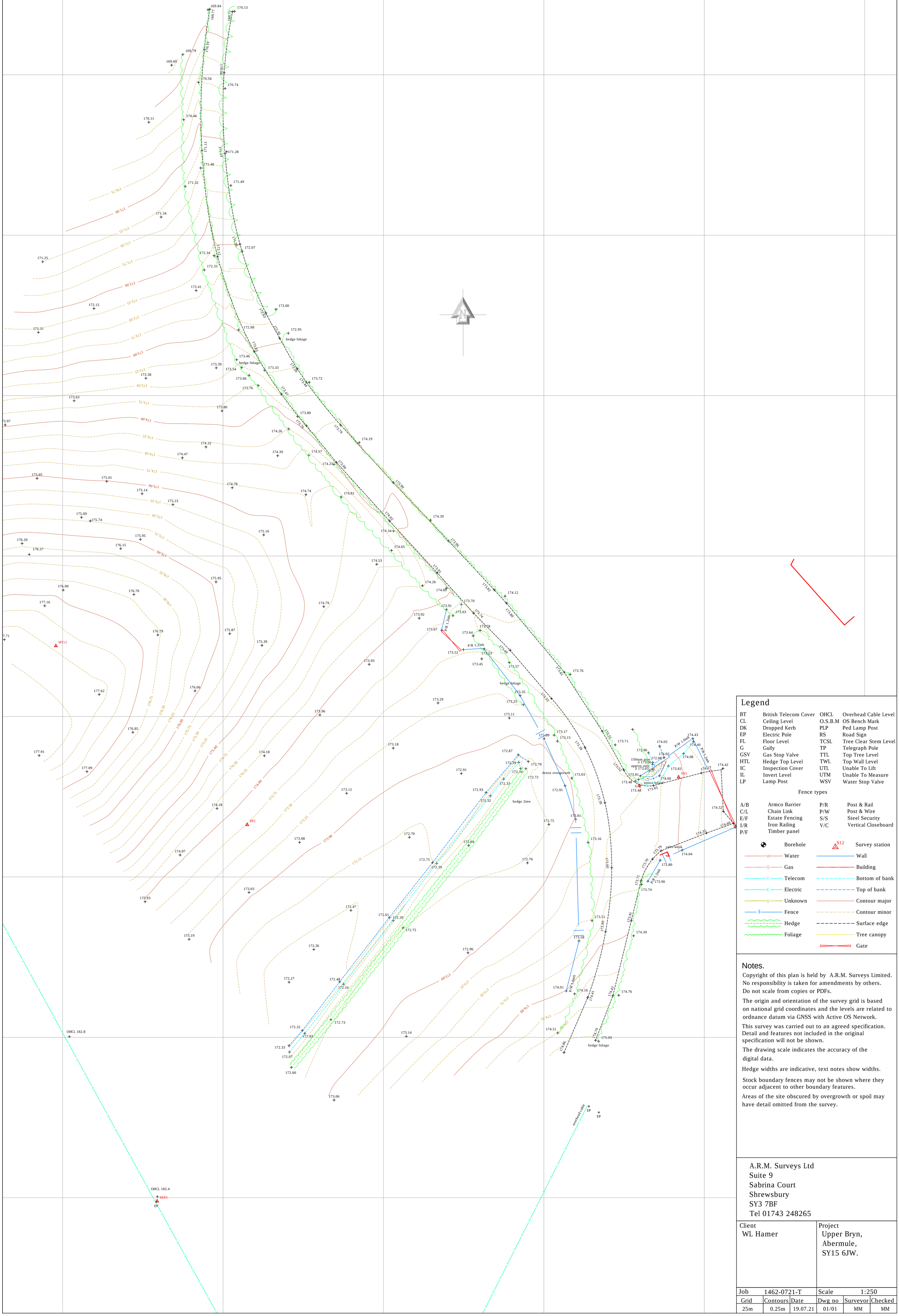
The technical requirements listed in Appendix 1E of TAN15 are considered in Table A-2 of this Flood Consequence Assessment. This is a summary of our findings.

Table A2 Technical Requirement Checklist -

No.	Short Description (See Appendix 1E)	*Cross-Reference*
1	A location plan identifying all possible sources of flooding including overtopping of existing defences.	*Location maps are given in section 2.1, Identification of sources of flooding and flood maps are shown in Section 3*
2	A plan of the site showing existing levels related to Ordnance Datum, both current and following the proposed development.	*Existing topography is shown in Figure 4 The topography will remain unchanged outside the*

		building. Finished floor levels will increase to 173.5mAOD.
4	A plan of the area showing access/evacuation routes from the proposed development site, giving existing levels relative to Ordnance Datum.	*The building is within Flood Zone A. The evacuation is to the north onto the road.*
6	A plan of the site showing any existing information on extent and depth of flood events or on flood predictions.	*Flood map giving on site flood risk are shown in,* Figure7 and 8.
9	Cross-sections of the site showing proposed finished floor levels or road levels, or other relevant levels relative to the source of flooding, and to anticipated water levels and associated probabilities.	*The proposed finished floor levels are 173.5mAOD, which is higher than the stream.*
12	An estimate of the volume of water that would be displaced from the site for various flood levels following development of the site and of the run-off likely to be generated from the development	*None, as the site is in Flood Zone A.*
13	An assessment of the likely impact of any displaced water on neighbouring or other locations which might be affected subsequent to development. This should address the potential for change of the flooding regime both upstream and downstream of the site due to ground raising or flood embankments.	*N/A as the proposed development is in Flood Zone A.*
16	An assessment of the residual risks after the construction of any necessary defences. Consideration should always be given to the behaviour of any new or modified defences in extreme events greater than those for which they are designed, and information should be provided on the consideration given to minimising risks to life in such circumstances.	*N/A*
17	The report should include a clear and comprehensive summary describing the items listed in Appendix A1E 17	*This Table*

Appendix B: Topographical Survey



Legend

BT	British Telecom Cover	OHCL	Overhead Cable Level
CL	Ceiling Level	O.S.B.M	OS Bench Mark
DK	Dropped Kerb	PLP	Ped Lamp Post
EP	Electric Pole	RS	Road Sign
FL	Floor Level	TCSL	Tree Clear Stem Level
G	Gully	TP	Telegraph Pole
GSV	Gas Stop Valve	TTL	Top Tree Level
HTL	Hedge Top Level	TWL	Top Wall Level
IC	Inspection Cover	UTL	Unable To Lift
IL	Invert Level	UTM	Unable To Measure
LP	Lamp Post	WSV	Water Stop Valve

Fence types

A/B	Armco Barrier	P/R	Post & Rail
C/L	Chain Link	P/W	Post & Wire
E/F	Estate Fencing	S/S	Steel Security
I/R	Iron Railing	V/C	Vertical Closeboard
P/F	Timber panel		

Borehole — Survey station

W Water — Wall

G Gas — Building

T Telecom — Bottom of bank

E Electric — Top of bank

U Unknown — Contour major

|| Fence — Contour minor

Hedge — Surface edge

Foliage — Tree canopy

Gate

Notes.

No responsibility is taken for amendments by others.
Do not scale from copies or PDFs.

The origin and orientation of the survey grid is based on national grid coordinates and the levels are related to ordnance datum via GNSS with Active OS Network.

This survey was carried out to an agreed specification. Detail and features not included in the original specification will not be shown.

The drawing scale indicates the accuracy of the digital data.

Hedge widths are indicative, text notes show widths.

Stock boundary fences may not be shown where they occur adjacent to other boundary features.

Areas of the site obscured by overgrowth or spoil may have detail omitted from the survey.

A.R.M. Surveys Ltd
Suite 9
Sabrina Court
Shrewsbury
SY3 7BF
Tel 01743 248265

Client	Project
WL Hamer	Upper Bryn, Abermule, SY15 6JW.

Job	1462-0721-T		Scale	1:250	
Grid	Contours	Date	Dwg no	Surveyor	Checked
25m	0.25m	19.07.21	01/01	MM	MM

Appendix C: Lead Local Flood Authorities Comments

Charles Townsend

From: Carwyn Price <carwyn.price2@powys.gov.uk> on behalf of Land Drainage <land.drainage@powys.gov.uk>
Sent: 05 November 2021 14:10
To: Charles Townsend
Subject: RE: 19/2069/FUL Upper Bryn

Good afternoon,

From your proposals for flood risk mitigation, in principle we deem that this would be acceptable.

As a reminder, SAB approval will be required in relation to surface water drainage.

Many thanks,

Carwyn Price

Carwyn Price
Flood Risk and Sustainable Drainage Technician

Email | Ebost: land.drainage@powys.gov.uk
Tel | Ffon: 01597 827465

Powys County Hall, | Neuadd y Sir
Spa Road East, | Spa Road East
Llandrindod Wells, | Llandrindod
Powys | Powys
LD1 5LG

Croesawu gohebiaeth yn Gymraeg/we welcome correspondence in Welsh

From: Charles Townsend <ctownsend@hydro-int.com>
Sent: 05 November 2021 10:07
To: Land Drainage <land.drainage@powys.gov.uk>
Cc: Gail Jenkins <gail@rogerparry.net>
Subject: RE: 19/2069/FUL Upper Bryn

Hi Carwyn,

Thank you for the discussion. As discussed the only culvert is the road which is a 6 inch pipe. This is Powys County Council remit not my clients. There are no other culvert within the development site. This road culvert is upstream of the development so the surface water drainage from the development will not effect this culvert as it is downstream of it.

Therefore we do not think that a culvert survey is required, as this asset is not my client so they could not do any work to it, and it is upstream of the development so the development should not effect the site.

Flood Consequence assessment.

The surface water maps have picked up a low spot which does drain water but only in the winter. As advise in your letter the buildings have been move 9m back from the low point which is outside the flood outline.

Due to this not really being a formal watercourse we would like to put a filter drain instead in, this would be a perforated pipe with stone on top and then grass. This would improve the flood of the low point and would then provide some water quality benefit to the development.

In principle are you happy with the above, I am trying to finish the report shortly so an email today would be very useful.

Kind regards
Charles

Charles Townsend
Tel: 07786912617
Principal Consultant Flood Risk, Hydro-Logic Services (International) Ltd.

Framework suppliers to: Environment Agency, Scottish Water, South-East Water, Severn Trent Water, Welsh Water, SSE, Viridor and responsible for over 700 flood warning sites in the UK.
Hydro-Logic Services (International) Ltd. is a wholly owned subsidiary of Hydro-International Ltd.

Hydro-Logic Services data analysis advice
www.hydro-logic.co.uk

Hydro International
www.hydro-int.com

From: Carwyn Price <carwyn.price2@powys.gov.uk> **On Behalf Of** Land Drainage
Sent: 08 October 2021 16:47
To: Charles Townsend <ctownsend@hydro-int.com>
Cc: Gail Jenkins <gail@rogerparry.net>
Subject: RE: 19/2069/FUL Upper Bryn

Good afternoon,

The requirements for the culvert survey would be:

- Size, condition and material
- Exact line and depth of culvert
- Any required remedial works
- How any future maintenance of the culvert would be carried out

We note that the site location is susceptible to surface water flooding, and would recommend that suitable steps are taken to mitigate the impacts of flooding on the development.

Many thanks,

Carwyn Price

Carwyn Price

Flood Risk and Sustainable Drainage Technician

Email | Ebost: land.drainage@powys.gov.uk
Tel | Ffon: 01597 827465

Powys County Hall, | Neuadd y Sir
Spa Road East, | Spa Road East
Llandrindod Wells, | Llandrindod
Powys | Powys
LD1 5LG

Croesawu gohebiaeth yn Gymraeg/we welcome correspondence in Welsh

Byw, dysgu, gweithio a chwarae ym Mhowys
Live, learn, work and play in Powys
Powys

From: Charles Townsend <ctownsend@hydro-int.com>
Sent: 08 October 2021 11:32
To: Land Drainage <land.drainage@powys.gov.uk>
Cc: Gail Jenkins <gail@rogerparry.net>
Subject: RE: 19/2069/FUL Upper Bryn

> You don't often get email from ctownsend@hydro-int.com. Learn why this is important

Have you got any comments on the email below
Thanks
Charles

Charles Townsend
Tel: 07786912617
Principal Consultant Flood Risk, Hydro-Logic Services (International) Ltd.

From: Charles Townsend
Sent: 04 October 2021 15:00
To: land.drainage@powys.gov.uk
Cc: Gail Jenkins <gail@rogerparry.net>
Subject: 19/2069/FUL Upper Bryn

Dear Carwyn, I hope are well.

My name is Charles Townsend and I am the consultant undertaking the Flood Consequence assessment. The proposed job is to build a poultry unit at Upper Bryn. There is a watercourse running through the middle of the site. You have also asked for a culvert survey.

Please could you call me to discuss what exactly you require my phone number is 07786912617.

If you have any queries please do not hesitate to contact me.

Kind regards
Charles

Charles Townsend
Tel: 07786912617
Principal Consultant Flood Risk, Hydro-Logic Services (International) Ltd.

Framework suppliers to: Environment Agency, Scottish Water, South-East Water, Severn Trent Water, Welsh Water, SSE, Viridor and responsible for over 700 flood warning sites in the UK.
Hydro-Logic Services (International) Ltd. is a wholly owned subsidiary of Hydro-International Ltd.

Hydro-Logic Services data analysis advice

www.hydro-logic.co.uk

Hydro International

www.hydro-int.com

Mae'r e bost hwn ac unrhyw atodiad iddo yn gyfrinachol ac fe'i bwriedir ar gyfer y sawl a enwir arno yn unig. Gall gynnwys gwybodaeth freintiedig. Os yw wedi eich cyrraedd trwy gamgymeriad ni ellwch ei gopio, ei ddosbarthu na'i ddangos i unrhyw un arall a dylech gysylltu gyda Cyngor Sir Powys ar unwaith. Mae unrhyw gynnwys nad yw'n ymwneud gyda busnes swyddogol Cyngor Sir Powys yn bersonol i'r awdur ac nid yw'n awdurdodedig gan y Cyngor.

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Appendix D: Infiltration Rates

DATA ENTRY FORM – TRIAL PIT 1

Date of Testing: 2nd Sept 2022

TEST 1

Upper Bryn

Length (m)	300MM
Width (m)	300MM
Depth (m)	300MM

DRY.

	Time	Water Level (m)	Notes
Start	9:00 AM	300 MM	Monitored to 75% full then
1	9:10 AM	285 MM	to 25% full.
2	9:20 AM	225 MM	300 MM water put in
3	9:25 AM	150 MM	
4	9:30 AM	85 MM	
5	9:35 AM	75 MM	
6			
7			2100 secs ÷ 150 = 14.
8			
9			

TEST 2

WET OVERNIGHT.

	Time	Water Level (m)	Notes
Start	10:00 AM	300MM	
1	10:10 AM	240 MM	
2	10:15 AM	225 MM	
3	10:20 AM	175 MM	
4	10:30 AM	125 MM	
5	10:35 AM	95 MM	
6	10:40 AM	70 MM	
7			2400 secs ÷ 150 = 16.
8			
9			

TEST 3

WET OVERNIGHT AND AM.

	Time	Water Level (m)	Notes
Start	9 AM	300 MM	
1	9:05	280 MM	
2	9:10	245 MM	
3	9:15	230 MM.	
4	9:20	205 MM	
5	9:25	180 MM	
6	9:30	150 MM	
7	9:40	98 MM	2500 secs ÷ 150 = 20
8	9:50.	80 MM.	
9	10 AM.	60 MM	

Test pit dimensions	Test 1
Width (m)	0.3
Length (m)	0.3
Height (m)	0.3

Test No.	1

enter time *enter water depth*

Time (hh:mm:ss)	Time (sec)	Water depth (m)
09:00:00	0	0.300
09:10:00	600	0.285
09:20:00	1200	0.225
09:25:00	1500	0.150
09:30:00	1800	0.085
09:35:00	2100	0.075
09:40:00	2400	0

update yellow cell to apply equation to all records

checked OK

Effective depth	0.300
50% Effective depth	0.15
75% Effective depth	0.225
25% Effective depth	0.075
V(p75-25)	0.0135
a(p50)	0.27
t(p75-25)	900
infiltration rate (m/s)	5.56E-05
infiltration rate (m/h)	0.200

enter time again *enter water depth again*

Time	Time (sec)	Water depth (m)
10:00:00	0	0.300
10:10:00	600	0.240
10:15:00	900	0.225
10:20:00	1200	0.175
10:30:00	1800	0.125
10:35:00	2100	0.095
10:40:00	2400	0.07
10:45:00	2700	0

update yellow cell to apply equation to all records

checked OK

Effective depth	0.300
50% Effective depth	0.15
75% Effective depth	0.225
25% Effective depth	0.075
V(p75-25)	0.0135
a(p50)	0.27
t(p75-25)	1440
infiltration rate (m/s)	3.47E-05
infiltration rate (m/h)	0.125

Test No.	3

enter time *enter water depth*

Time (hh:mm:ss)	Time (sec)	Water depth (m)
09:00:00	0	0.300
09:05:00	300	0.280
09:10:00	600	0.245
09:15:00	900	0.230
09:20:00	1200	0.205
09:25:00	1500	0.18
09:30:00	1800	0.15
09:40:00	2400	0.098
09:50:00	3000	0.08
10:00:00	3600	0.06
10:05:00	3900	0

update yellow cell to apply equation to all records

checked OK

Effective depth	0.300
50% Effective depth	0.15
75% Effective depth	0.225
25% Effective depth	0.075
V(p75-25)	0.0135
a(p50)	0.27
t(p75-25)	2190
infiltration rate (m/s)	2.28E-05
infiltration rate (m/h)	0.082

Test pit dimensions		Test 2
Width (m)	0.3	
Length (m)	0.3	
Height (m)	0.3	

Test No.	1

enter time ***enter water depth***

Time (hh:mm:ss)	Time (sec)	Water depth (m)
10:00:00	0	0.300
10:10:00	600	0.230
10:20:00	1200	0.175
10:30:00	1800	0.120
10:40:00	2400	0.095
10:50:00	3000	0.068
11:20:00	4800	0

update yellow cell to apply equation to all records

checked OK

Effective depth	0.300
50% Effective depth	0.15
75% Effective depth	0.225
25% Effective depth	0.075
V(p75-25)	0.0135
a(p50)	0.27
t(p75-25)	2203
infiltration rate (m/s)	2.27E-05
infiltration rate (m/h)	0.082

enter time again ***enter water depth again***

Time	Time (sec)	Water depth (m)
09:00:00	0	0.300
09:10:00	600	0.270
09:20:00	1200	0.260
09:30:00	1800	0.230
09:35:00	2100	0.205
09:40:00	2400	0.18
09:45:00	2700	0.145
09:50:00	3000	0.11
09:55:00	3300	0.094
10:00:00	3600	0.081
10.30.00	5400	0

update yellow cell to apply equation to all records

checked OK

Effective depth	0.300
50% Effective depth	0.15
75% Effective depth	0.225
25% Effective depth	0.075
V(p75-25)	0.0135
a(p50)	0.27
t(p75-25)	1878
infiltration rate (m/s)	2.66E-05
infiltration rate (m/h)	0.096

enter time again ***enter water depth again***

Time	Time (sec)	Water depth (m)
09:00:00	0	0.300
09:10:00	600	0.280
09:20:00	1200	0.248
09:30:00	1800	0.230
09:50:00	3000	0.2
10:10:00	4200	0.15
10:20:00	4800	0.11
10:30:00	5400	0.078
10:55:00	7000	0

update yellow cell to apply equation to all records

checked OK

Effective depth	0.300
50% Effective depth	0.15
75% Effective depth	0.225
25% Effective depth	0.075
V(p75-25)	0.0135
a(p50)	0.27
t(p75-25)	3456
infiltration rate (m/s)	1.45E-05
infiltration rate (m/h)	0.052

Test pit dimensions	Test 3
Width (m)	0.3
Length (m)	0.3
Height (m)	0.3

Test No.	3

enter time *enter water depth*

Time (hh:mm:ss)	Time (sec)	Water depth (m)
08:00:00	0	0.300
08:10:00	600	0.270
08:20:00	1200	0.232
08:25:00	1500	0.198
08:30:00	1800	0.145
08:35:00	2100	0.12
08:40:00	2400	0.075
09:00:00	3600	0

update yellow cell to apply equation to all records

checked OK

Effective depth	0.300
50% Effective depth	0.15
75% Effective depth	0.225
25% Effective depth	0.075
V(p75-25)	0.0135
a(p50)	0.27
t(p75-25)	1139
infiltration rate (m/s)	4.39E-05
infiltration rate (m/h)	0.158

enter time again *enter water depth again*

Time	Time (sec)	Water depth (m)
10:00:00	0	0.300
10:10:00	600	0.245
10:15:00	900	0.220
10:20:00	1200	0.160
10:30:00	1800	0.115
10:35:00	2100	0.08
10:40:00	2400	0.065
09:00:00	3600	0

update yellow cell to apply equation to all records

checked OK

Effective depth	0.300
50% Effective depth	0.15
75% Effective depth	0.225
25% Effective depth	0.075
V(p75-25)	0.0135
a(p50)	0.27
t(p75-25)	1400
infiltration rate (m/s)	3.57E-05
infiltration rate (m/h)	0.129

enter time again *enter water depth again*

Time	Time (sec)	Water depth (m)
10:00:00	0	0.300
10:10:00	600	0.245
10:15:00	900	0.225
10:20:00	1200	0.170
10:25:00	1500	0.11
10:30:00	1800	0.095
10:35:00	2100	0.075
10:45:00	2700	0

update yellow cell to apply equation to all records

checked OK

Effective depth	0.300
50% Effective depth	0.15
75% Effective depth	0.225
25% Effective depth	0.075
V(p75-25)	0.0135
a(p50)	0.27
t(p75-25)	1200
infiltration rate (m/s)	4.17E-05
infiltration rate (m/h)	0.150

Appendix E: NRW comments

Appendix F: Surface Water Management

C.1 Overview

TAN15 requires that the proposed development would not lead to an increase in flood risk elsewhere. The site is currently a greenfield site. The proposed development will be a poultry unit and associated road and parking.

As discussed in section 2.3 of the main report, infiltration tests have been undertaken and suggest that infiltration is feasible. The infiltration was found to be between $1.45x10^{-5}$m/s and $5.56x10^{-5}$m/s. Therefore a swale/infiltration basin will be used.

C.2 Infiltration System Design

As summarised in table 5 of the main report, the total proposed new impermeable surface area at the site is approximately 2714 m^2. The roads and parking will be gravel and permeable.

The basis of the swale/infiltration basin is to collect runoff from the proposed unit roofs in gutters and route it via downpipes into a swale/ infiltration basin where the surface water would soakaway.

The characteristics of the infiltration structure was analysed using the Infodrainage. The following conservative assumptions and design parameters were applied within the Source Control module.

- Rainfall depths were obtained using the FSR methodology and an allowance of 40% applied for climate change over the 100 year design life of the proposed light industrial development.
- The total proposed unit roof area was considered, estimated to be 2714m^2, as listed in Table 5 of the main report.
- 100% of runoff from the roofs is collected and routed to the infiltration structure.
- A factor of safety of 2 was applied to the estimated infiltration rate.
- The swale/infiltration basin will have 1 in 3 sides.
- Using an iterative approach to varying the depth and size of the swale/ infiltration basin were assessed. The software was used to analyse the response of the 100 year plus 40% climate change summer and winter storms of durations between 15 minutes and 7 days. The design imperatives were that the surface area and maximum water depth within the structure should be accommodated within the practical limits of the site.
- It was found that a swale/infiltration basin with the specification shown in Table 9 produced the best design to suit the site. The performance of the attenuation basin structure is summarised in Table 10. The full results produced by the Infodrainage software are reproduced below.

Structure	**Swale/Infiltration Basin**
Total Area	**275**
Side Slope	**1 in 3**
Depth	**1.20m**
Discharge rate	**To ground**

Table 9: Swale/Infiltration structure Performance

FSR: Critical Storm Per Item

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. Avg. Depth (m)	Total Discharge Volume (m³)	Half Drain Down Time (mins)	Percentage Available (%)	Status
Dry Swale	FSR: 100 years: +40 %: 960 mins: Winter	1.098	1.098	1.073	1.085	0.000	951	14	OK

Table 10: Swale/ Infiltration results

The proposed layout of the site places the swale/infiltration basin over 5m away from the poultry unit (see Figure 1). The half time is approximately 951mins.

Other combinations of attenuation structure(s) parameters are of course possible, but this analysis illustrates one way in which the necessary infiltration scheme can be achieved.

C.3 Drainage Layout

Figure B-1 illustrates an outline drainage layout. Although it is not the intension of this report to provide a surface water drainage specification, the following key points should be considered when designing the drainage layout.

- Runoff from the building roofs should be collected by a system of gutters and downpipes and discharged to ground level grilled drainage inlets.
- Buried pipes should direct the runoff to the infiltration basins.

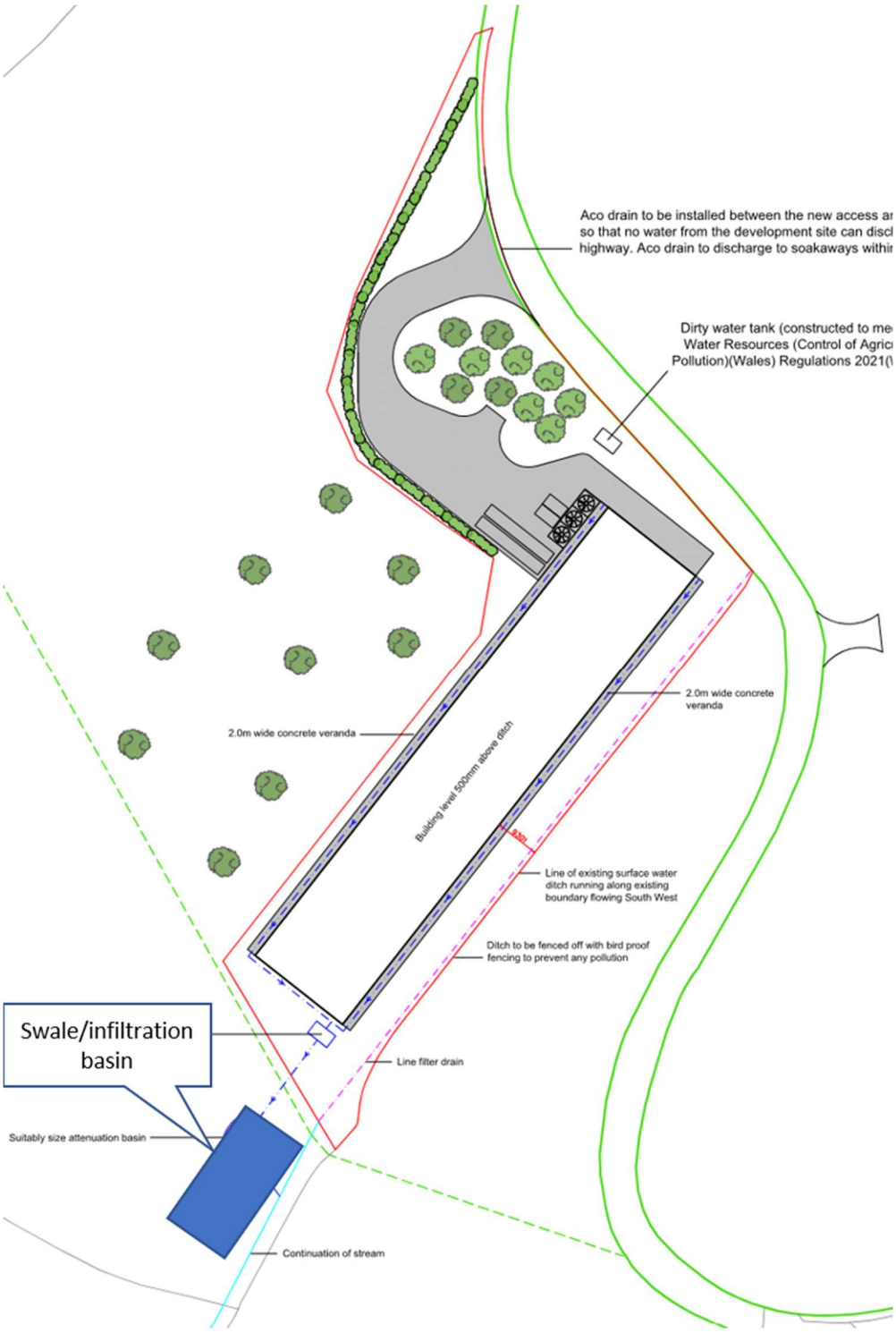

Figure 11: Proposed Drainage Layout (source Roger Parry and Partners)

C.4 Residual Risks

Residual risks for the scheme include the possibility of the occurrence of rainstorms in excess of the 100 year plus 40% climate change design storm, and a blockage of the drainage system or infiltration system.

Blockages to the drainage system should be avoidable if appropriate maintenance procedures are followed.

The 100 yr. plus 40% climate change design storm would result in a maximum water level of 1.085m leaving a 0.115m freeboard in the infiltration structure. If an exceedance rainfall event occurred, the capacity of the infiltration structure could be exceeded leading to surface water flooding. Such surface water flooding is likely to be short lived and would drain when the water level in the infiltration structure drops below capacity.

C.5 Operation and Maintenance

The recommended surface water management scheme is based on infiltration, with storage kept within the swale/infiltration basin. The function of the surface water management system must be understood by those responsible for maintenance, regardless of whether individual components are on the surface or below ground. Performance deterioration can usually be minimised if the system is properly designed, monitored and maintained. The responsibility of maintaining the infiltration structure would be with the property owner(s).

Infodrainage Source Control Outputs.

Charles Townsend

From: Data Distribution [redacted]
Sent: 06 October 2022 10:05
To: Charles Townsend
Subject: ATI-24045a P5&6, Upper Bryn Abermule SY15 6JW

Dear Mr Townsend,

Further to our discussion on the telephone earlier today and as promised, please see your confirmation below:

Unfortunately we have no detailed model data for this area and so are unable to provide any flood products.

Self Service Open Data:

You can now make the most of open data provided **free online:**

- Please see the Flooding pages on the NRW website for the NRW Flood Risk Map Viewer and the Development Advice Map/Flood Map for Planning. You will find many spatial risk layers including the Flood Risk Assessment Wales (FRAW) maps, reservoir hazard data, Recorded Flood Extents, flood defences and more.

- **DataMapWales** and **Lle**: Spatial data is free to download, view and use within your own GIS system. The flood datasets include: Flood Risk Assessment Wales (FRAW) Maps, Flood Map for Planning (FMfP), Recorded Flood Extents, Flood Defences, Areas Benefitting from Flood Defences, FMfP TAN 15 Defences Zones and LIDAR data.

- Please note that you can find a GIS layer of our flood models in the Flood Map for Planning viewer. This is not an exhaustive list but does give a good idea as to the most relevant models for an area. This can be accessed via the following link: https://flood-map-for-planning.naturalresources.wales/. Select the 'Detailed Map' tab and the layer in question is called 'NRW Local Model Manager'.

Please Note the Following:

- All information supplied will need to be verified by the recipient **PRIOR** to using in a Flood Consequences Assessment (FCA). We would expect to see a review of hydrology, in-channel survey, floodplain topography etc. to demonstrate the data is suitable for the purposes of producing an FCA. Please see our website for further information on Modelling for Flood Consequence Assessments and Developing hydraulic models for flood risk.

- Climate change allowances will need to be applied carefully to ensure compliance with Welsh Government climate change allowances and flood consequence assessments.

- **Pre-application Advice:** As part of our advice service to developers, NRW offer a free initial opinion on your proposal. However, in cases where you would like to access any extra advice that falls outside of our statutory duties, we can only offer this as part of our Discretionary Planning Advice Service (DPA Service). For more information regarding free service and our discretionary planning can be found in the following links: Welsh Version / English version.

Your request for our free or charged discretionary advice service needs to be accompanied by the relevant 'Request Form' which is available to download from our website. You will then need to send the form to northplanning@cyfoethnaturiolcymru.gov.uk who will coordinate our response.

Please note for any future flood data/environmental data requests, to contact us using the above email and apologies we could not have been of any further assistance to you, on this occasion.

Yn gywir / Yours sincerely,

Michelle Lewis

[redacted]

Yn falch o arwain y ffordd at ddyfodol gwell i Gymru trwy reoli'r amgylchedd ac adnoddau naturiol yn gynaliadwy.

Proud to be leading the way to a better future for Wales by managing the environment and natural resources sustainably.

cyfoethnaturiol.cymru / naturalresources.wales

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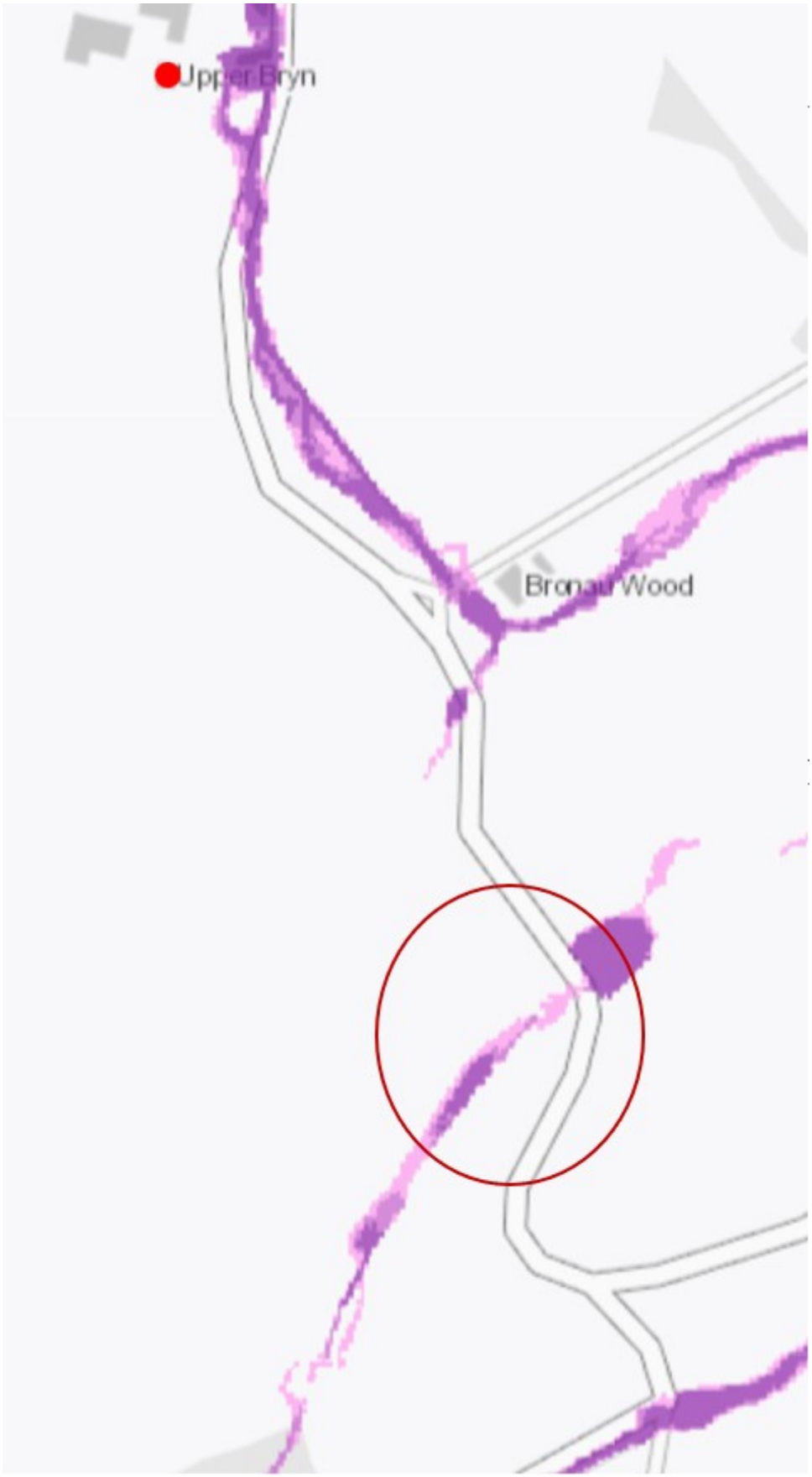
[redacted]

Dear Alex, thanks you for talking the time to talk to me.

As discussed, I am building a shed and a FCA was required I agreed that the building would be 9m away from the channel, however the LLFA have come back and said you have levels. Therefore please can I have flood levels for Upper Bryn Abermule SY15 6JW. The post address is not exactly where the proposed building is to be place please se below for the exact position.



If you can help that would be great.

Kind regards
Charles