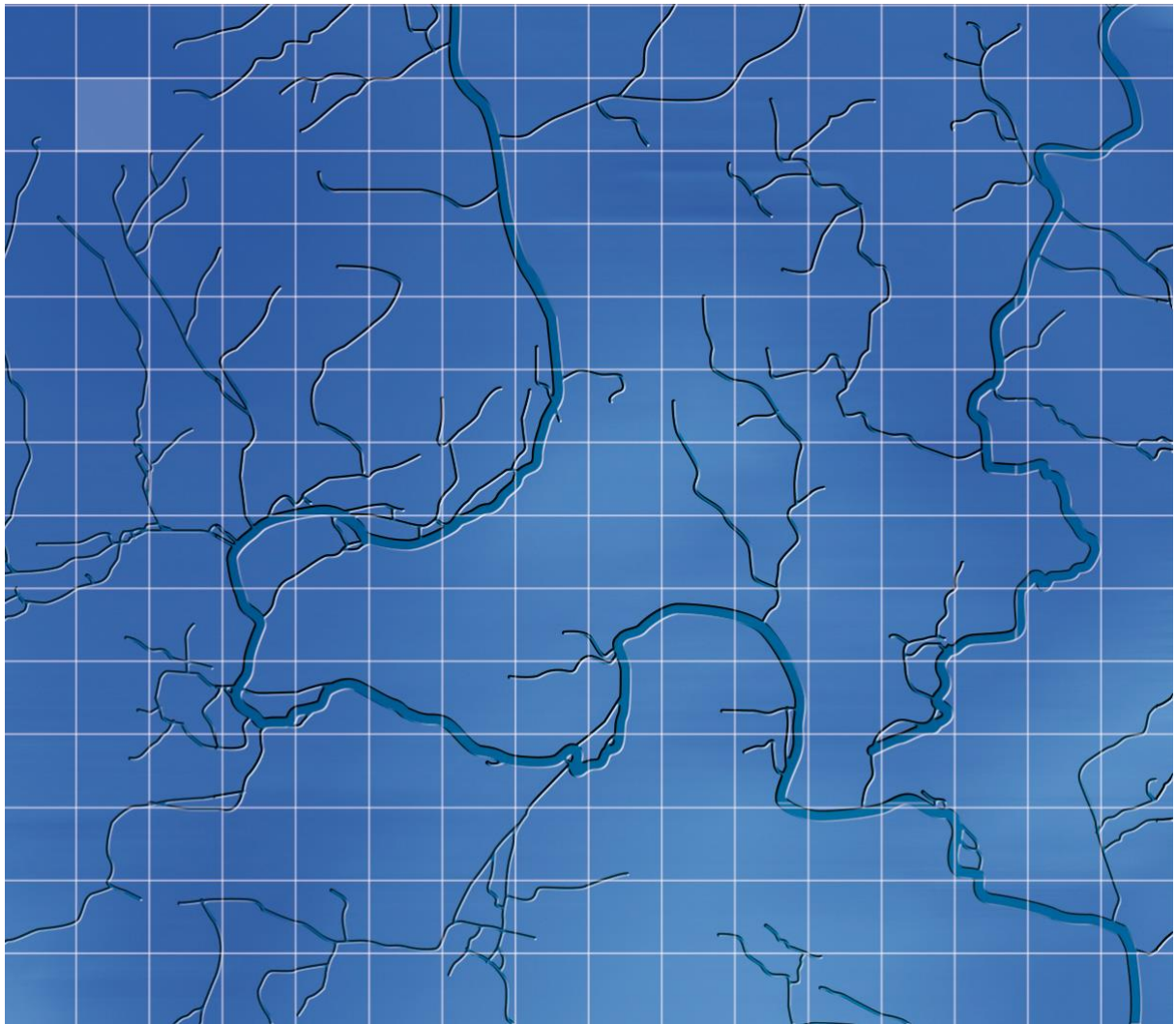


Davies & Co.

December 2019

Cefn Mably Farm Park Access Track Retrospective FCA



WHS

Davies & Co.

Cefn Mably Farm Park Access Track Retrospective FCA

Document issue details

WHS1720

Version	Issue date	Issue status	Prepared By	Approved By
1	03/12/19	Draft	Harry Koido-Bunt (Consultant)	Daniel Hamilton (Senior Consultant)

For and on behalf of Wallingford HydroSolutions Ltd.

This report has been prepared by WHS with all reasonable skill, care and diligence within the terms of the Contract with the client and taking account of both the resources allocated to it by agreement with the client and the data that was available to us. We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above. This report is confidential to the client and we accept no responsibility of any nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at their own risk.



The WHS Quality & Environmental Management system is certified as meeting the requirements of ISO 9001:2015 and ISO 14001:2015 providing environmental consultancy (including monitoring and surveying), the development of hydrological software and associated training.



Registered Office Maclean Building, Benson Lane, Wallingford OX10 8BB
www.hydrosolutions.co.uk

Contents

1	Introduction	1
1.1	Background	1
1.2	Scope	1
1.3	Sources of Data	1
2	Site Description	2
2.1	Location	2
2.2	Topography	2
2.3	General Arrangement	3
3	Flood Risk	4
3.1	NRW Flood Map	4
3.2	DAM Flood Map	4
3.3	Modelled Flood Depths	5
3.4	Surface Water Flooding	8
3.5	Historical Flooding	8
3.6	Groundwater Flooding	9
4	Flood Consequence Assessment	10
4.1	Planning Policy	10
4.2	Justification for Development	10
4.3	3 rd Party Flood Impacts	10
4.4	Flood Warnings	11
5	Conclusion	11

Appendix 1

1 Introduction

1.1 Background

Wallingford HydroSolutions Ltd has been commissioned by Davies & Co. to undertake a retrospective Flood Consequences Assessment (FCA) for the development of a crushed aggregate access track on private land to the east of Cefn Mably Farm Park (NGR: 323315, 184371).

The site lies adjacent to the eastern bank of the River Rhymney, with the dominant mechanism of flooding believed to be fluvial. According to the NRW fluvial flood risk maps the site partially lies in Flood Zone 2, an area at risk of flooding during the 1 in 100-year event. The Development Advice Map defines the site to be partially in Zone C2, an area at risk during the 1 in 1000 year without significant flood defence infrastructure. The flood map in this area is based on the Llanederyn 2013 hydraulic model which is a 1D/2D ISIS/TUFLOW model.

In communications with Natural Resources Wales (NRW) there is no objection to the application as submitted 9th of September 2019, but they did advise the developer to be made aware of the potential flood risk to the area (0). This FCA seeks to demonstrate that the proposed development can remain compliant with TAN15 for the lifetime of development and that the risk of flooding can be managed to an acceptable level.

1.2 Scope

Due to the location of the site being partially in DAM Zone C2, a site-specific FCA is required. This report will seek to address the requirements of an FCA as set out in TAN15 and provide a document appropriate for submission with the planning application for the site.

In summary, this report will;

- Collate and analyse environmental and flood risk information obtained from a desk-based review of available data to identify and quantify the flood risks associated with the development.
- Apply justification test reviewing the nature of the development and acceptability of consequences

1.3 Sources of Data

The main data source used to inform this FCA is the Llanederyn Valley flood model, supplied by NRW. The full list and associated footnote references can be found below.

- Llanederyn Flood Model (2013)¹
- Technical Advice Note 15
- NRW Flood Maps²
- NRW correspondence
- Site layout plans

A major limitation of the 2013 Llanederyn model in this FCA is the location of the site of interest in proximity to the model upstream boundary. While this proximity can have potential effects upon the reliability of results at the site, WHS has not undertaken a hydraulic model build and extension upstream as advised by NRW. While this would not be appropriate for “more vulnerable” residential developments, WHS does not believe the “less vulnerable” nature of this development justifies hydraulic modelling. In light of this the FCA is based on the best currently available data without

¹ Natural Resources Wales (2013) Data available by contacting datadistribution@cyfoethnaturiolcymru.gov.uk

² Natural Resources Wales (2019) Detailed Map View and Development Advice Map <https://naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en>

extending the model. The case justifying our choice regarding the nature of the development and modelling not being appropriate is expanded upon in Section 43.4.

2 Site Description

2.1 Location

The site is located on land adjacent to Cefn Mably Farm Park, Newport, South Wales (NGR: 323315, 184371). The site is located on private land close to the River Rhymney and is in a wider greenfield setting. The access road crosses one small watercourse which runs from east to west through the site. A site layout is provided in Figure 1.

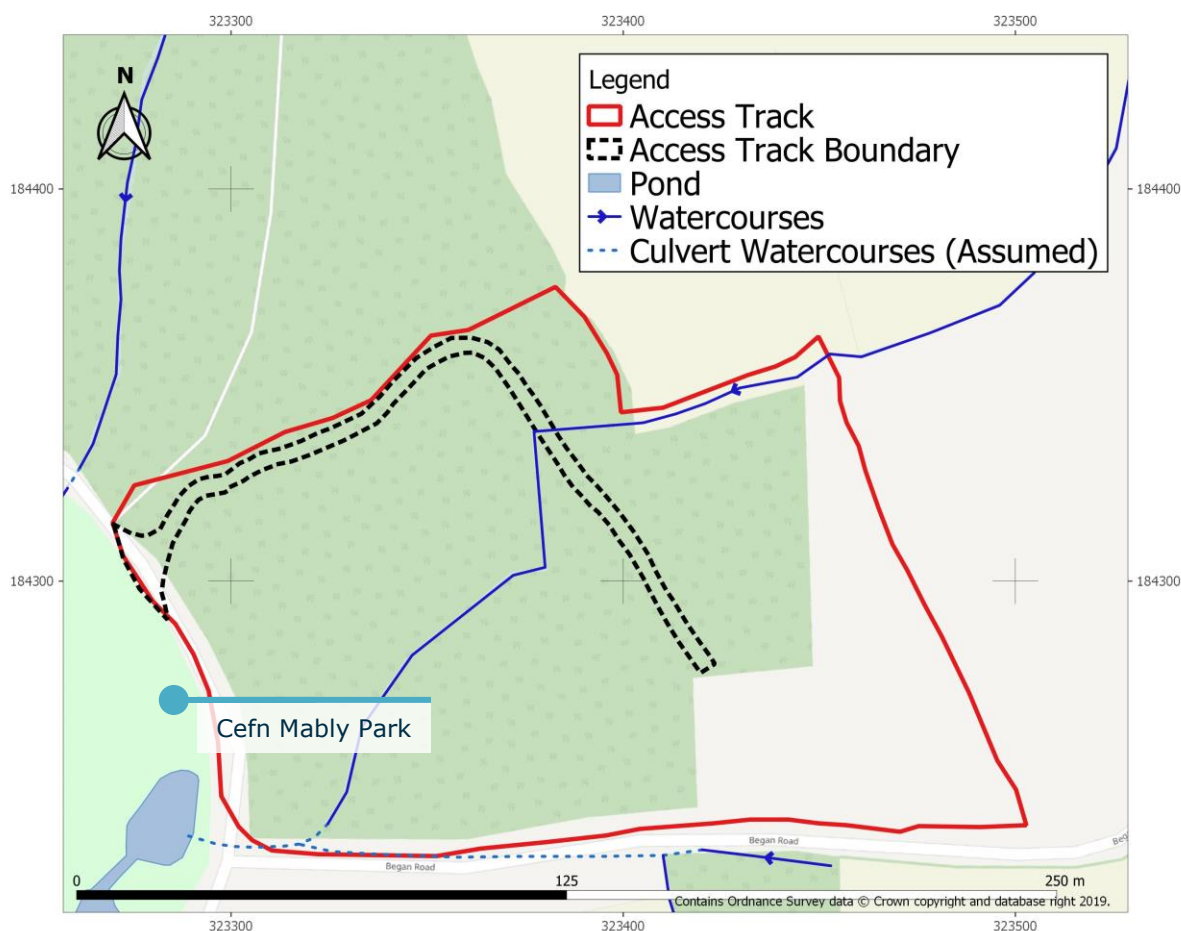


Figure 1 - Site Layout

2.2 Topography

The site lies on a slope with the western downhill boundary of the site being situated on the level river flood plain. The rest of the site slopes upwards and climbs steeply towards the east. According to LiDAR data the levels of the track range from 22.04mAoD at the bottom of the track to 28.56mAoD at the top of the track. The topography of the site can be seen in Figure 2.

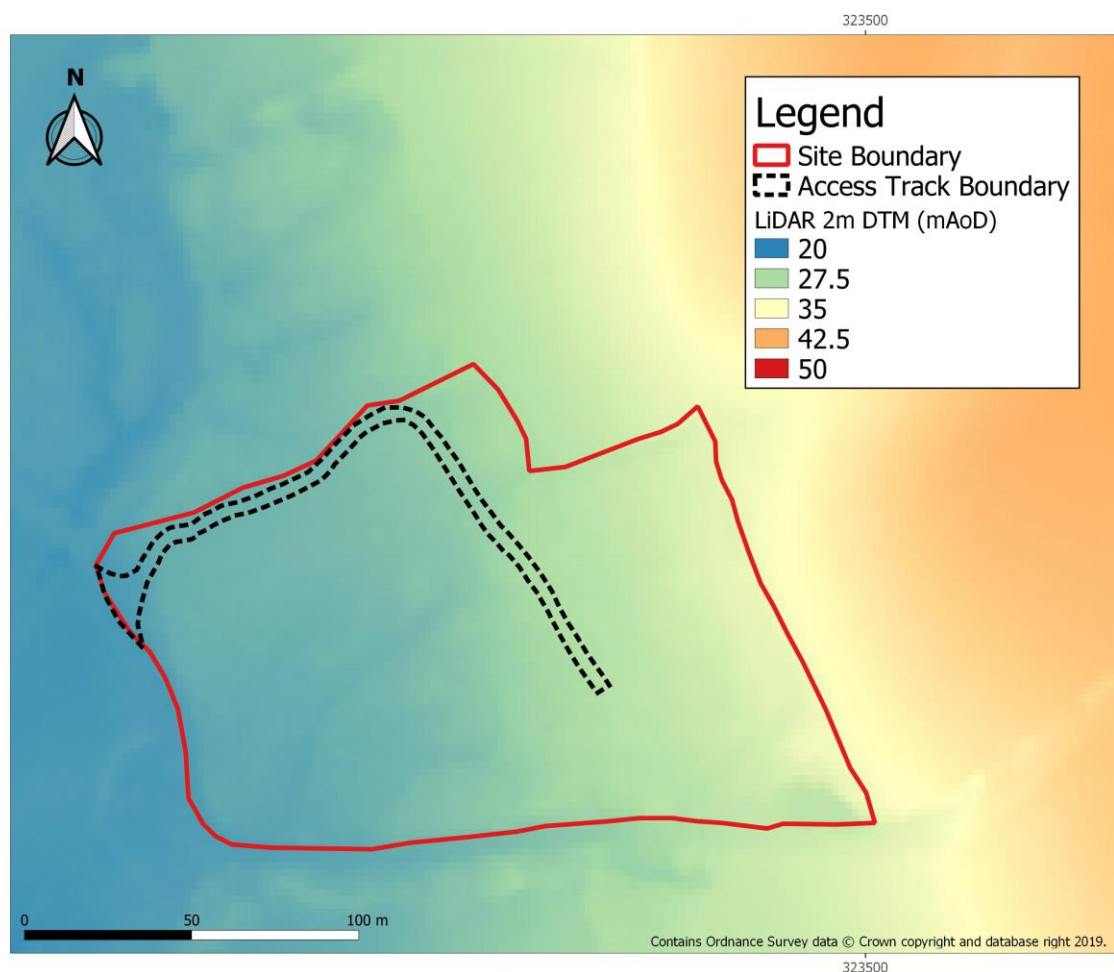


Figure 2 - Topography around the site

2.3 General Arrangement

The development seeking permission is a crushed aggregate access track designed to act as an alternative route from the farm at the top of the hill and the road junction at the bottom of the hill. The 210m long track is 150-200mm higher than surrounding ground in uneven areas. The site is a single-road track up to 3m wide. A circular culvert 4m long and 300mm in diameter has been installed where the watercourse crosses the track. Please see Appendix 2 for photos.

3 Flood Risk

3.1 NRW Flood Map

The NRW Fluvial flood Maps, shown in Figure 3, note that only the eastern lower tip of the access track is in Flood Zone 2. This means the majority of the site is free from flooding in the 1-in-1000-year event. The dominant source of flood risk to the site is fluvial risk from the River Rhymney.

The small watercourse which runs through the site is not represented within the NRW flood maps due to its small size. The risk of flooding from them is considered within section Section 3.4 of this FCA.

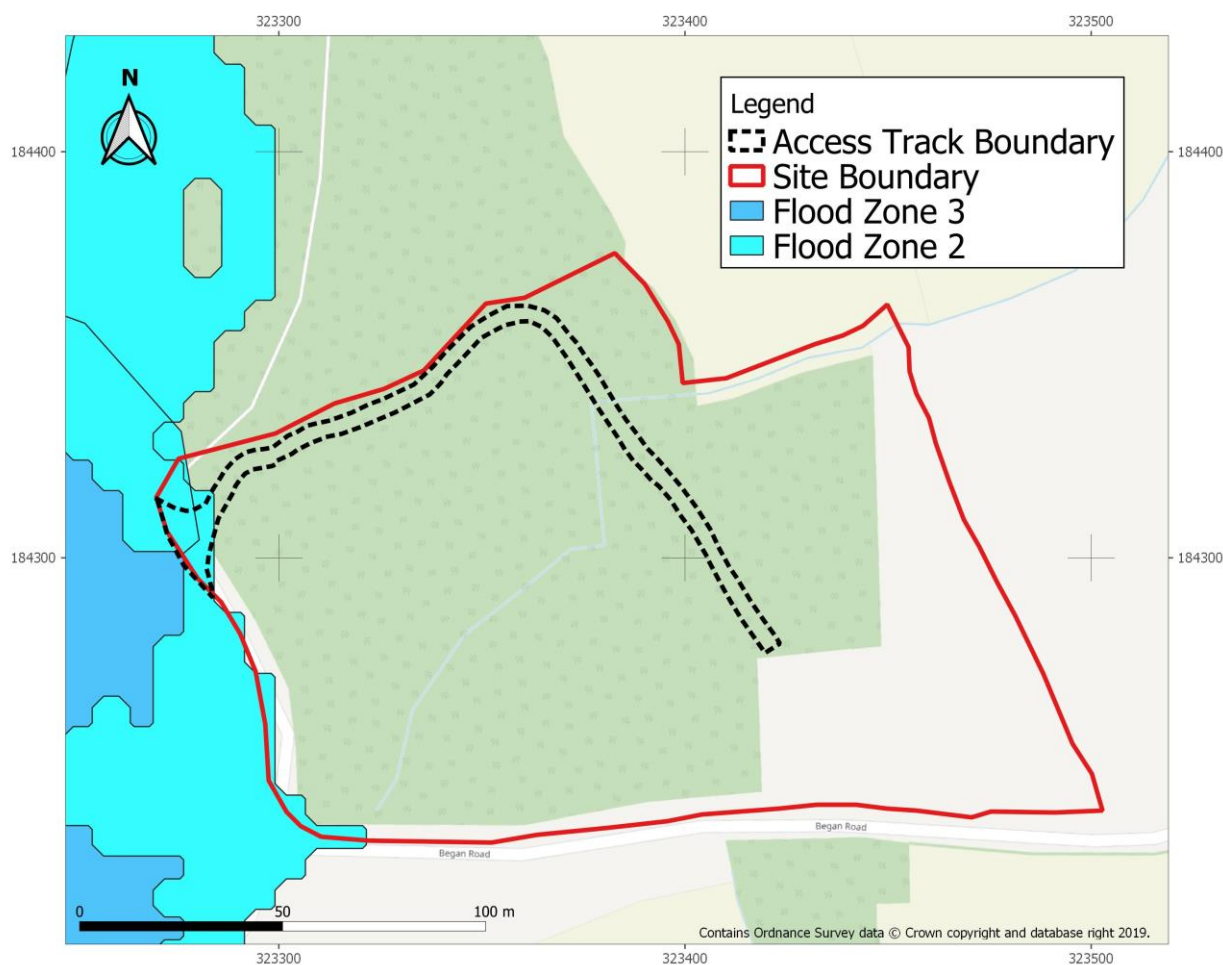


Figure 3 - Flood Zone designation of the site from NRW Fluvial Flood Mapping

3.2 DAM Flood Map

The western fringe of the site lies within Zone C2 according to the NRW's Development Advice Map (DAM) indicating that it is within areas of floodplain not served by significant flood defence infrastructure. As this development is classed as transport infrastructure and 'less vulnerable development' it can be considered in this Zone C2. The majority of the site and access track is located in Zone A, defined as areas outside of the main river floodplain. The classification is shown in Figure 4.

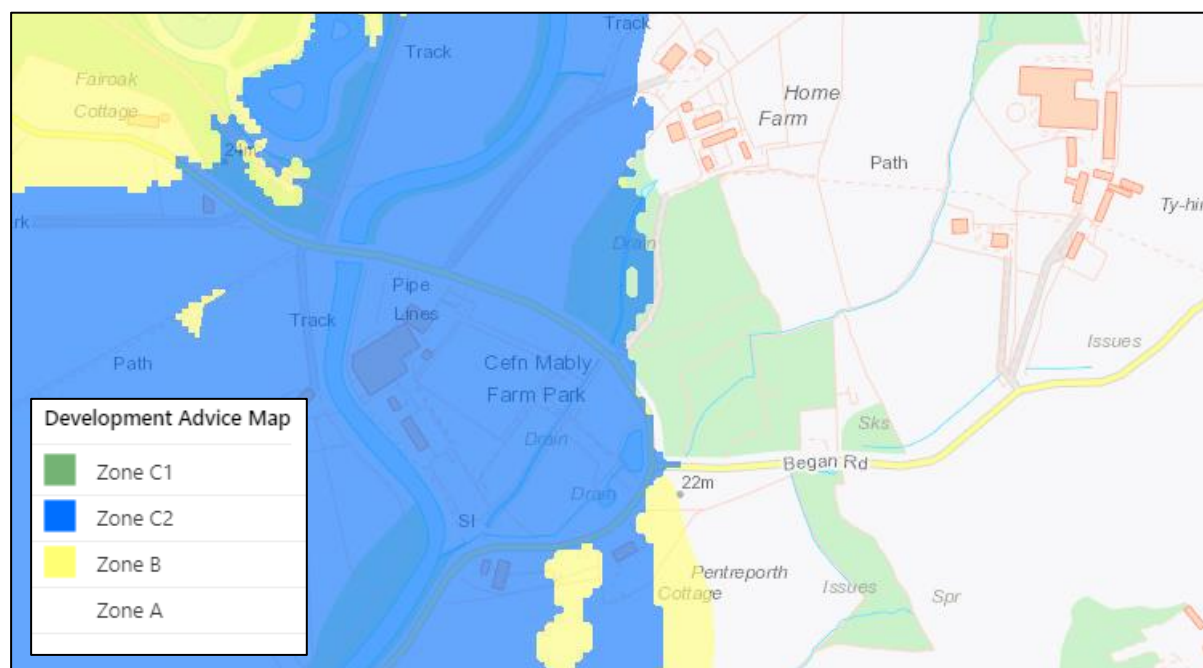


Figure 4 - NRW's Development Advice Map's Zone C2 classification

3.3 Modelled Flood Depths

To refine understanding of fluvial flood risk to the access track the Llanederyn hydraulic model for the River Rhymney has been obtained. Liaison with NRW has confirmed there may be some uncertainty in site-specific values due to the proximity of the site to the upstream model boundary. Detailed hydraulic modelling is not deemed to be appropriate considering the “less vulnerable” nature of the development (see Section 4) and so the as-built 2013 Llanederyn model has been used to inform this FCA. The results from the model have been obtained under a product 6 data request and used in this FCA and assessed for both the defended and undefended scenarios. The defended scenario includes the effects of the flood defence along the eastern riverbank continuing ~2km along to the Cardiff Golf Centre, south of the M4. This model also includes the influence of the Began Road bridge. The results of the modelling to the site are presented below for both scenarios and provide the most-refined indication of flood risk to the site that is currently available.

3.3.1 1000-Year Event

Undefended Scenario

The results in Figure 5 do not include the effects of the flood defence on the eastern bank.

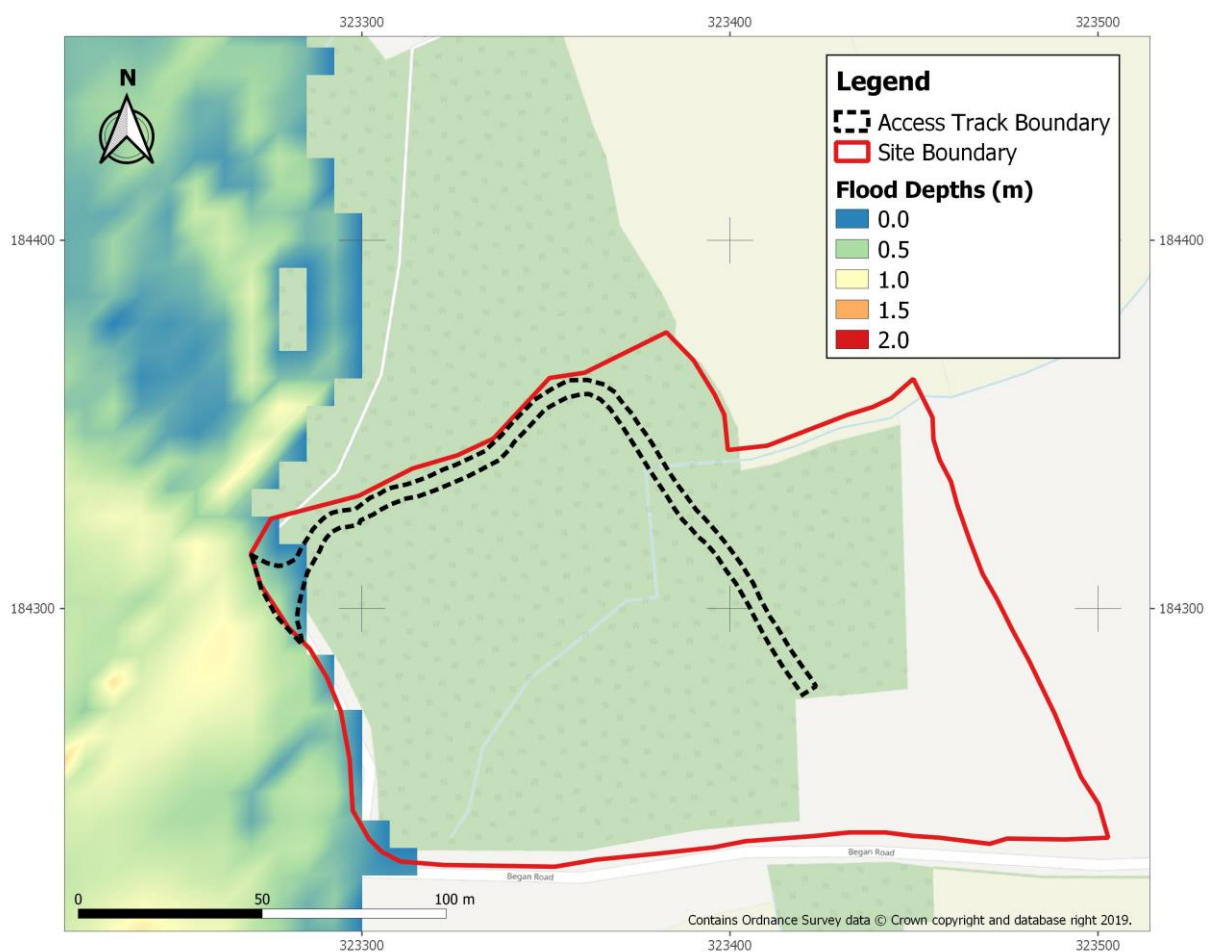


Figure 5 - Results of the 1 in 1000-year flood event for the undefended scenario

The results show flood waters inundating the western fringes of the site to a maximum depth of 0.45m with maximum velocities of 0.29ms^{-1} , the speed of onset is 9:30 hours. Flood water is confined by the topography of the wider site and the majority of the access track is free from flooding during this event. Overall whilst flood hazard at the western extent of the access track is moderate there is significant warning time which should allow for the flood risks to be adequately managed (see section 4).

Defended Scenario

The results in Figure 6 include the effects of the flood defences on the eastern bank.

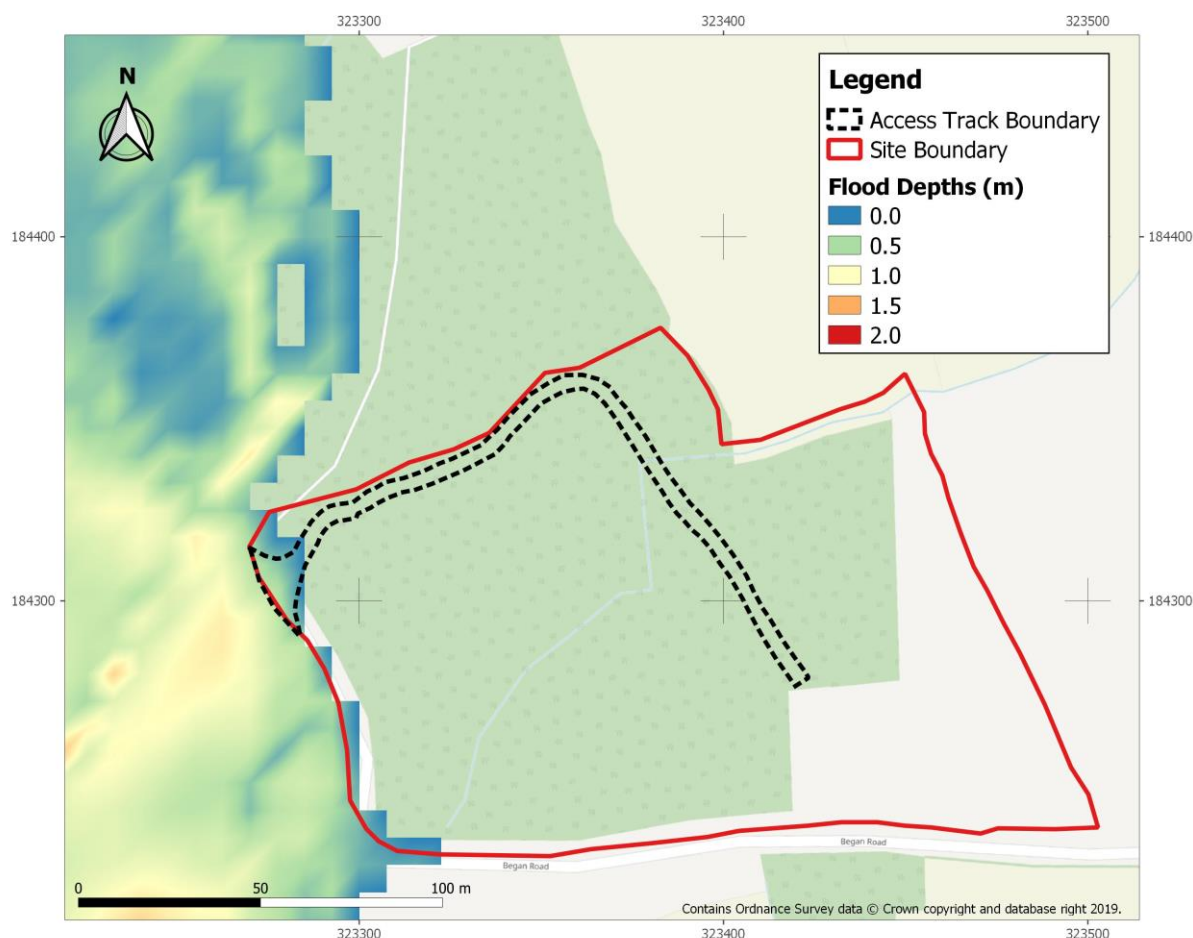


Figure 6 - Results of the 1 in 1000-year flood event for the defended scenario

The results show flood waters inundating the western fringes of the site to a maximum depth of 0.64m with maximum velocities of 0.19ms^{-1} . The time of onset remains the same at 9:30 hours.

The defended results show greater depths and lower velocities across the site due to the defensive flood wall along the eastern bank of the Rhymney, this prevents flood waters from a northern overland flow route from returning to the river which leads to a subsequent increase in water levels. Once again the majority of the access track is flood free.

Overall whilst flood hazard at the western extent of the access track is moderate there is significant warning time which should allow for the flood risks to be adequately managed (see section 4).

3.4 Surface Water Flooding

The NRW surface water flood map has been reviewed to identify the risk of pluvial flooding at the site (see Figure 7). A small section of the access track is observed to be at risk of pluvial flooding in the 1-in-100-year event and in the 1-in-1000-year event. This is deemed to be associated with the small ordinary watercourse which crosses the track in this location. Elsewhere the access track is flood free.

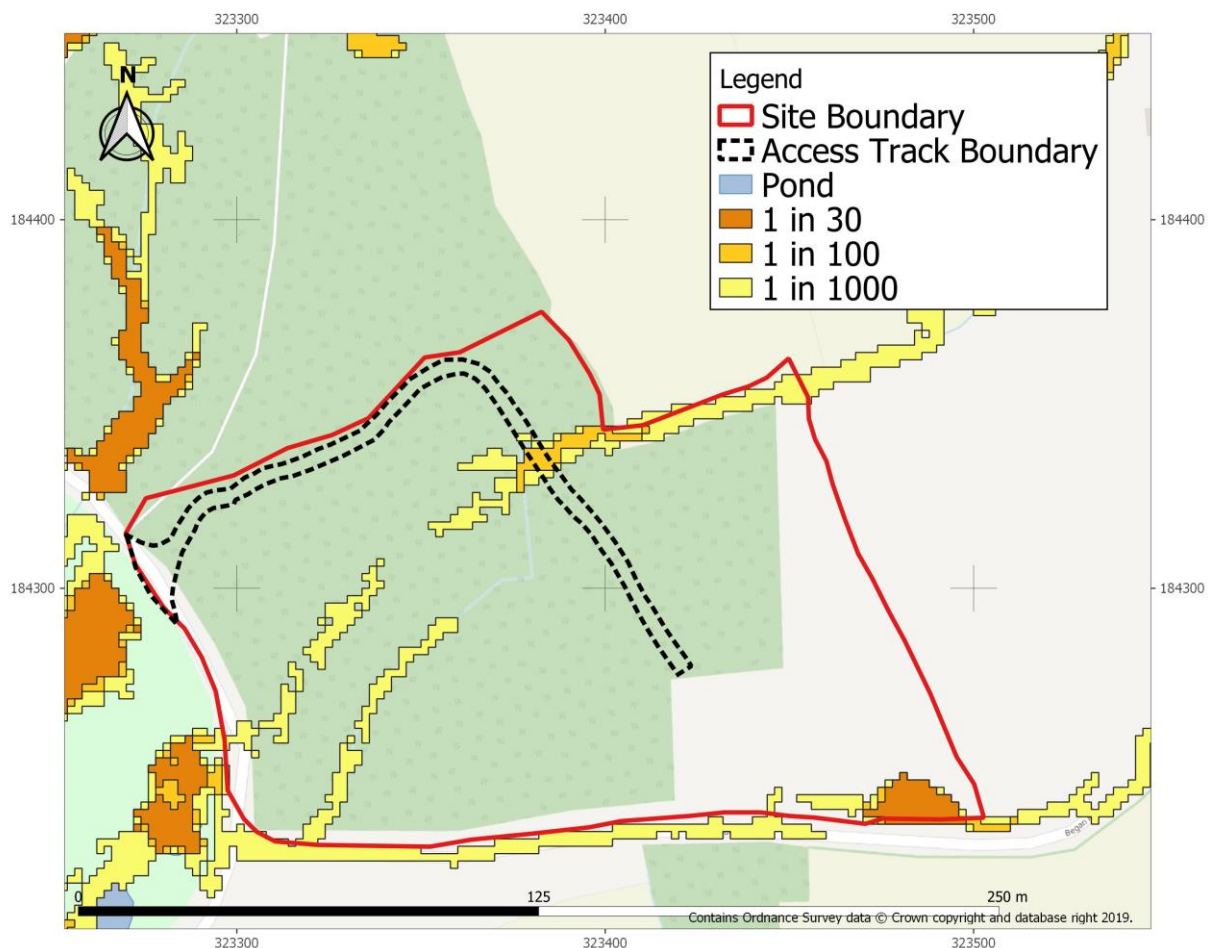


Figure 7 - Surface water flood risk

3.5 Historical Flooding

There is historical flooding indicated by NRW records on the River Rhymney as shown in Figure 8. The Began flood was a one-day event which inundated the eastern fringe of where the access track is situated on the 27th December 1979. The flooding is confined to a region between the M4 1.3km to the south of the site and a location 0.8km to the north of the site. Flood depths and velocities are not available for this event.

Following this event flood defences were installed on the eastern bank of the river and around Cefn Mably Farm Park. Based on anecdotal evidence and a previous FCA³ (Appendix 3) completed for the site there have been no flood events at this site since.



Figure 8 - Historical Flood Extents of the 1979 Began Flood Event

3.6 Groundwater Flooding

Groundwater flooding is defined as the emergence of groundwater at ground level, or the rising of groundwater into man-made locations that exceed the normal range of groundwater. A review of Soilscape's online mapping service has indicated that the site lies across two soil types in the flat flood plain and on the hill slopes.

The lower section of the access track is situated on freely draining floodplain soils, comprised of sand and gravel and underlain by interbedded mudstone and sandstone rocks. For these soils it is concluded groundwater flooding is not a risk posed to this site.

The soils located on the sloped sections are comprised of slightly acidic loamy and clayey soils. These likely have impeded drainage, however given the site's topography, any ground water should flow away from the site towards the River Rhymney. It can be concluded the site is not at risk of groundwater flooding.

³ FCA by Peter Brett Associates – August 2013

4 Flood Consequence Assessment

This FCA is retrospective and serves to quantify the current level of risk posed with regards to the development's use and its effects on the wider region.

4.1 Planning Policy

TAN 15 outlines the requirements for planning policy in Wales in relation to development and flooding. TAN 15 requires that the development site will remain safe over its lifetime and will not increase flood risk elsewhere while ensuring minimal risk to life for site users.

The proposed access track is shown to lie partially within Flood Zone C2 according to the Development Advice Map. The nature of the development can be classed as "less vulnerable" due to being transport infrastructure as per paragraph 5.1 in TAN15. The development is subject to the justification test in paragraph 6.

This section demonstrates that the risks and consequences of flooding have been considered, with particular regard to flood risk impacts on 3rd party land.

4.2 Justification for Development

This access track is built on private land with the main purpose of allowing movement between a quarry facility (323439, 184274) and Began Road. This provides an alternative access route to the existing public roads and avoids congestion.

As mentioned, the nature of the development is classed as "less vulnerable" and the access track is built on an already operational farm with established development where the majority of the land is outside of the floodplain. Furthermore, the site is not developed densely, therefore repair and maintenance costs in the event of flooding should be manageable and relatively inexpensive when compared to other types of development.

4.3 3rd Party Flood Impacts

The development is perceived to potentially affect two aspects of flood risk both at the site and to surrounding land. These affects are upon;

- Conveyance
- A loss of flood plain storage

4.3.1 Watercourse Conveyance

A minor watercourse is culverted beneath the access track. This culvert dimensions are 300mm wide and 4m long and so does not constrict flows of up to 0.28 cumecs in size, its maximum capacity. The culvert will cause a backwater effect, however given the size of its aperture (900mm) and the sloping nature of the site any effect on levels is expected to be small and localised. It is recommended that the culvert be regularly maintained to safeguard against blockages and preserve its capacity.

4.3.2 Floodplain storage

The risk of displaced water affecting third party sites downstream of this site have been considered in this FCA. A conservative calculation of flood risk has been calculated to show how small the loss of floodplain storage is.

This calculation has been undertaken using the area of the access track inundated the 1-in-1000-year event (190.2 m²) and the upper value by which the track protrudes from the surrounding ground level, 0.2m. This yields a volume of 38.04m³ which is negligible in comparison to the wider

topographical setting. The fact that the track is located on the edge of Flood Zone 2, also means that the displacement of floodwater should be relatively short lived occurring at the peak of the 1000-Year event and not having any impact in lower order events, where the track should be flood free..

4.4 Flood Warnings

Based on BGS maps the River Rhymney catchment is underlain by a combination of Mudstone, Siltstone and Sandstone which is relatively porous and permeable. This is overlain by freely draining floodplain soils according to the Landis soils map. The permeability of the catchment promotes baseflow which should increase catchment lag and serve to provide some additional time for warnings and preparation in an extreme flood event. This is supported by the Llanederyn hydraulic model which shows speed of inundation values of 9:30 hrs for the design event, this is above the indicative threshold value for infrastructure development of 2.00 hrs provided in table A1.15 in TAN15.

NRW also operate a robust Flood Warning Service in the Lwyd catchment. There are 10 Flood Warning Areas (FWAs) within the catchment, with flood alerts and warnings for these areas updated every 15 minutes. The FWAs rely on three flood warning stations, the Waterloo Bridge gauge, the Bargoed gauge, and the Tredegar Newydd gauge. The site is within the River Rhymney at Began FWA, which lies downstream of all of these gauges. This in turn affords additional time with regard to flood warning at the site, helping to aid safe operation and closure further.

It is suggested that if required any residual risk is managed with a comprehensive Emergency Flood Plan. Such a plan would enable track users to take the appropriate course of action during a potential extreme fluvial flood event in the River Rhymney, ensuring that the site is evacuated before Began Road is flooded. All personnel who work on the site should be made aware of the plan and be briefed or trained accordingly.

5 Conclusion

This retrospective FCA has provided a robust understanding of flood risk at the site and is considered to have fulfilled the requirements of TAN15. The following key points have been identified and discussed during this FCA:

- The western extent of the access track lies partially in Flood Zone 2 with the remainder in Flood Zone 1 according to the NRW fluvial flood map, which is based on undefended scenarios.
- The western extent of the access track lies partially in DAM zone C2 with the remainder in DAM Zone A.
- The Llanederyn hydraulic model (2013) has been used to inform this FCA, which includes detailed fluvial inundation modelling of the River Rhymney at Began.
- In the 1000-Year undefended scenario flood depths and velocities peak at 0.45m and 0.29ms⁻¹ respectively. Whilst flood hazard is significant at the peak of the event, the speed of onset values are 9:30 Hrs allowing time for safe evacuation.
- It is concluded that the majority of access track is at low risk of flooding from surface water sources and the ordinary watercourse which crosses the site. Only a small section of the track is shown to be at risk during the 100-Year and 1000-Year events.
- In terms of groundwater flood risk given the sloping nature of the site the risk of groundwater flooding is considered to be low.
- It is concluded that the principal flood risk mechanism at the site is from an extreme fluvial event in the River Rhymney.

- The development and flood risk have been reviewed against the requirements of TAN15.
- There may be some uncertainty regarding flood model output due to the proximity of the site to the model upper boundary. This is deemed acceptable due to the “less vulnerable” nature of the development and hydraulic modelling for this type of development being over-prescriptive.
- The access track diverts traffic that would otherwise use and potentially congest public roads.
- The 3rd party impacts associated with the development are considered insignificant, the new culvert should only have a localised impact on conveyance.
- Parts of the existing the site are at risk of flooding during the 1 in 1000-Year, however, is flood free for the 1 in 100-Year event.
- The risk of flooding to the site and its access route is considered manageable, given the storm runoff response and flood warning infrastructure within the Rhymney catchment upstream of the site.
- The nature of the development is also classed as “less vulnerable” in this way its continuous operation is not essential, with it possible to close the farm park during flood warning conditions.
- It is suggested that if required any residual risk is managed with an Emergency Flood Plan.

Appendix 1 – NRW Planning Application Response

Appendix 2 – Photos of the Access Track & Culvert

Appendix 3 – Peter Brett Associates FCA August 2013