



Flood Consequence Assessment for Planning

Prepared for:

Bangor on Dee Community Council

March 2019

Our reference:

88158-Dewey-BangorOnDee

Location:

Land To The West Of Friars Court

Bangor-On-Dee

Wrexham

LL13 0BU



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Document Issue Record

Project: Flood Consequence Assessment for Planning
Client: Bangor on Dee Community Council
Location: Land To The West Of Friars Court, Bangor-On-Dee, Wrexham, LL13 0BU
Application: Conversion of an existing dwelling for use as a holiday cottage
Our reference: 88158-Dewey-BangorOnDee
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Lead Consultant: Mrs Emma Jeffery
Amended: Mrs Emma Jeffery
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Key Facts

Flood Risk Posed:

- The site is shown to be within Flood Zone C1.
- Site entirely outside modelled 1:100 year (plus climate change) and 1:1000 year defended modelled maximum flood extents, but is within the undefended modelled flood extents.
- The site is defended from flooding from the River Dee to the 1:100 year standard.
- The risk of flooding posed to the site by groundwater and sewer surcharge would appear to be low.
- The Natural Resources Wales Risk of Flooding from Reservoirs Map suggests that the site lies within the "Maximum extent of flooding" from reservoir failure.
- The EA has confirmed that in 1964 the area flooded when the River Dee overtopped its defences. The site is shown to be within the historic flood extent from 1964, but outside of the historic extents from 2000, and 2009.

Flood Risk Management:

- A flood warning and evacuation plan will be implemented post development.
- Only 2 burials per year proposed.
- Minimal traffic generation (up to 2 vehicles, twice a year).
- Since the anticipated number of funerals is so low, the chances of one occurring when the river levels are high is considered to be very low. In the unlikely event of the two coinciding, the internment would be delayed.

Assuming accordance with these flood risk management measures, Unda Consulting Limited consider the proposed application to be suitable in flood risk terms.

Introduction

Unda Consulting Limited have been appointed by Bangor on Dee Community Council (hereinafter referred to as “the applicant”) to undertake a Site Specific Flood Consequence Assessment (FCA) for Planning at Land To The West Of Friars Court, Bangor-On-Dee, Wrexham, LL13 0BU (hereinafter referred to as “the site”). The FCA has been undertaken in accordance with Technical Advice Note 15 (TAN 15) and the associated technical guidance.

The site appears to be located within Flood Zone C1 as defined by Natural Resource Wales (NRW) on their Development Advice Map. Under Technical Advice Note 15 (TAN 15), a FCA is required if a proposed development:

- includes building or engineering works in Flood Zone C1, C2 or B;
- includes building or engineering works on land classified as having critical drainage problems;
- changes the use of land or buildings in a location at risk of flooding from rivers or the sea, or with critical drainage problems;
- changes the use of land or buildings in a way that increases the flood vulnerability of the development where it may be subject to other sources of flooding;
- site is larger than 1 hectare.

Given that the proposed application site is located within Flood Zone C1: (Areas of the floodplain which are developed and served by significant infrastructure, including flood defences.) and includes building work, the applicant is required to submit a FCA under TAN 15. The assessment should demonstrate to the Local Planning Authority (LPA) and NRW how flood risk will be managed now and over the development's lifetime, taking climate change into account, and with regard to the vulnerability of its potential users.

The objectives of a FCA to support a planning application are to establish:

- whether the proposed development is likely to be affected by current or future flooding from any source;
- whether it will increase flood risk elsewhere;
- whether the measures proposed to deal with these effects and risks are appropriate.

Existing Situation

Site Usage:

The site is a plot of land approximately 250m north west of Bangor bridge, and immediately north of Bridgeman House. It adjoins existing open space / public garden.

The area of land is approximately 2500m².



Figure 1: Aerial view of the site and immediate surrounding area (Source: Google Earth)

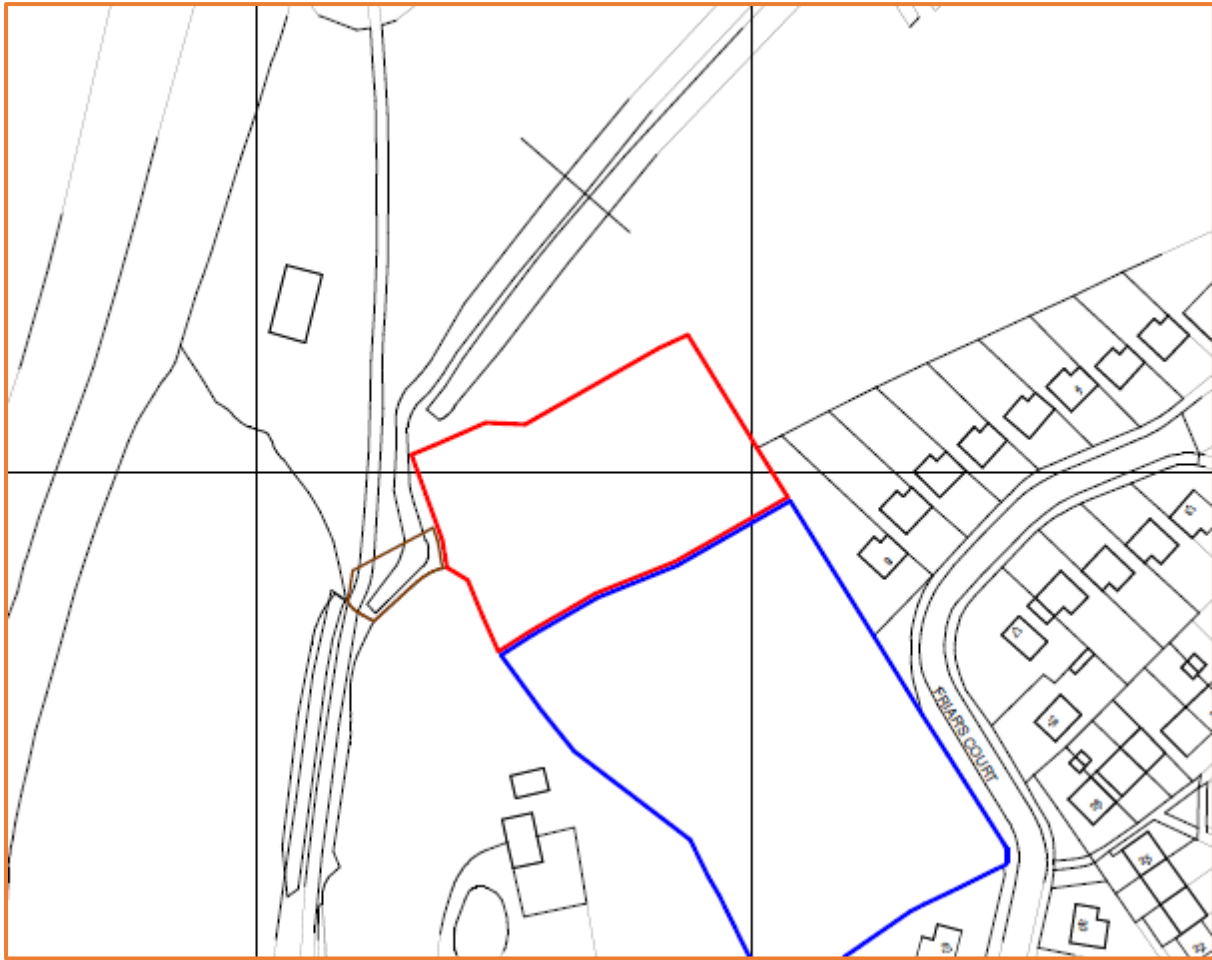


Figure 2: Site location plan (Source: Bob Dewey Planning)

Topography:

The River Dee is approximately 50m to the west of the site at its closest proximity.

Environment Agency LiDAR has been used to assess the topography across the site and wider area. Light Detection and Ranging (LIDAR) is an airborne mapping technique, which uses a laser to measure the distance between the aircraft and the ground surface. Up to 100,000 measurements per second are made of the ground, allowing highly detailed terrain models to be generated at high spatial resolutions. The EA's LiDAR data archive contains digital elevation data derived from surveys carried out by the EA's specialist remote sensing team. Accurate elevation data is available for over 70% of England. The LiDAR technique records an elevation accurate to +/-5cm to 15cm with spatial resolutions ranging from 25cm to 2 metres. This dataset is derived from a combination of the EA's full dataset which has been merged and re-sampled to give the best possible coverage. The dataset can be supplied as a Digital Surface Model (DSM) produced from the signal returned to the LIDAR (which includes heights of objects, such as vehicles, buildings and vegetation, as well as the terrain surface) or as a Digital Terrain Model (DTM) produced by removing objects from the Digital Surface Model. 2.0 horizontal resolution DTM LiDAR data has been used for the purposes of this study.

Data suggests that the topography on site ranges between approximately 14.40mAOD and 15.00mAOD.

Geology and Soil:

The British Geological Survey (BGS) Map indicates that the bedrock underlying the site is Kinnerton Sandstone Formation - Sandstone.

The superficial deposits underlying the site comprises of Alluvium – Clay, Silt, Sand and Gravel.

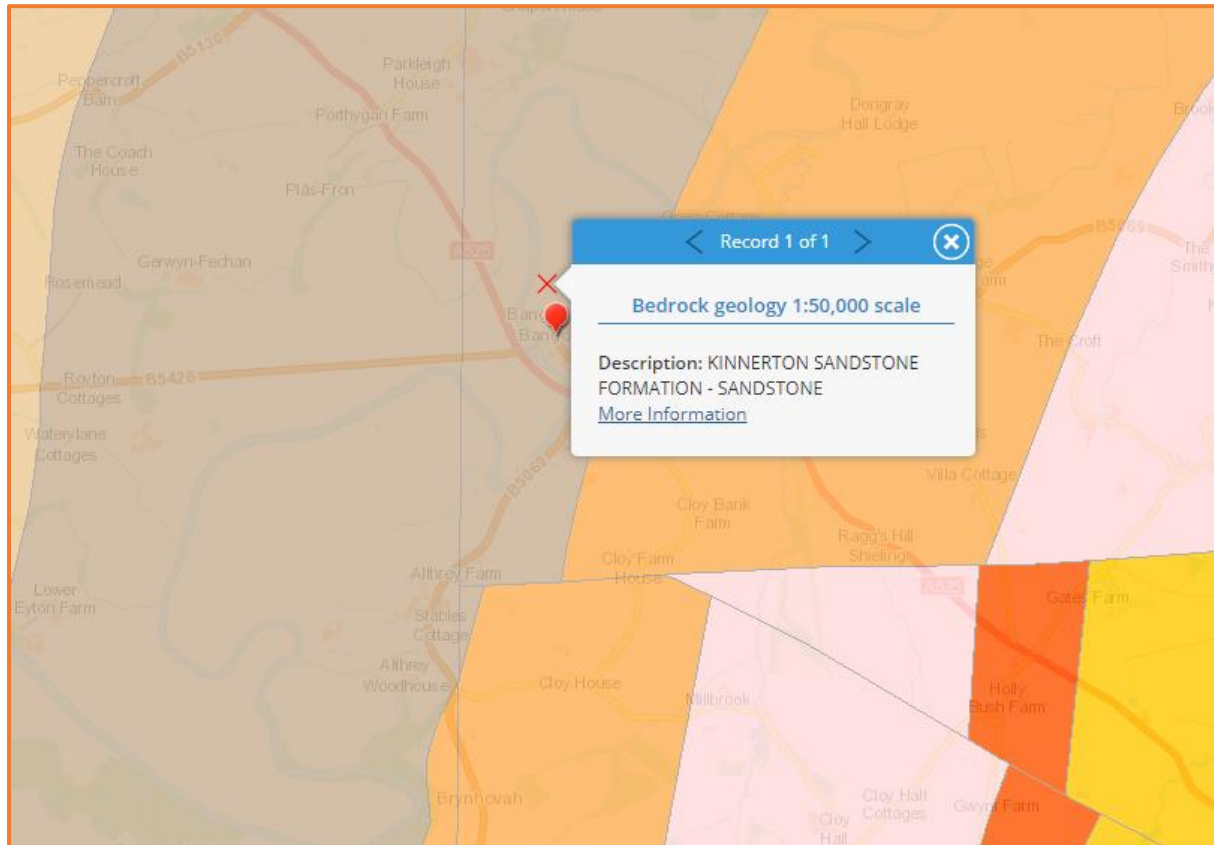


Figure 3: Local bedrock geology (Source: BGS)

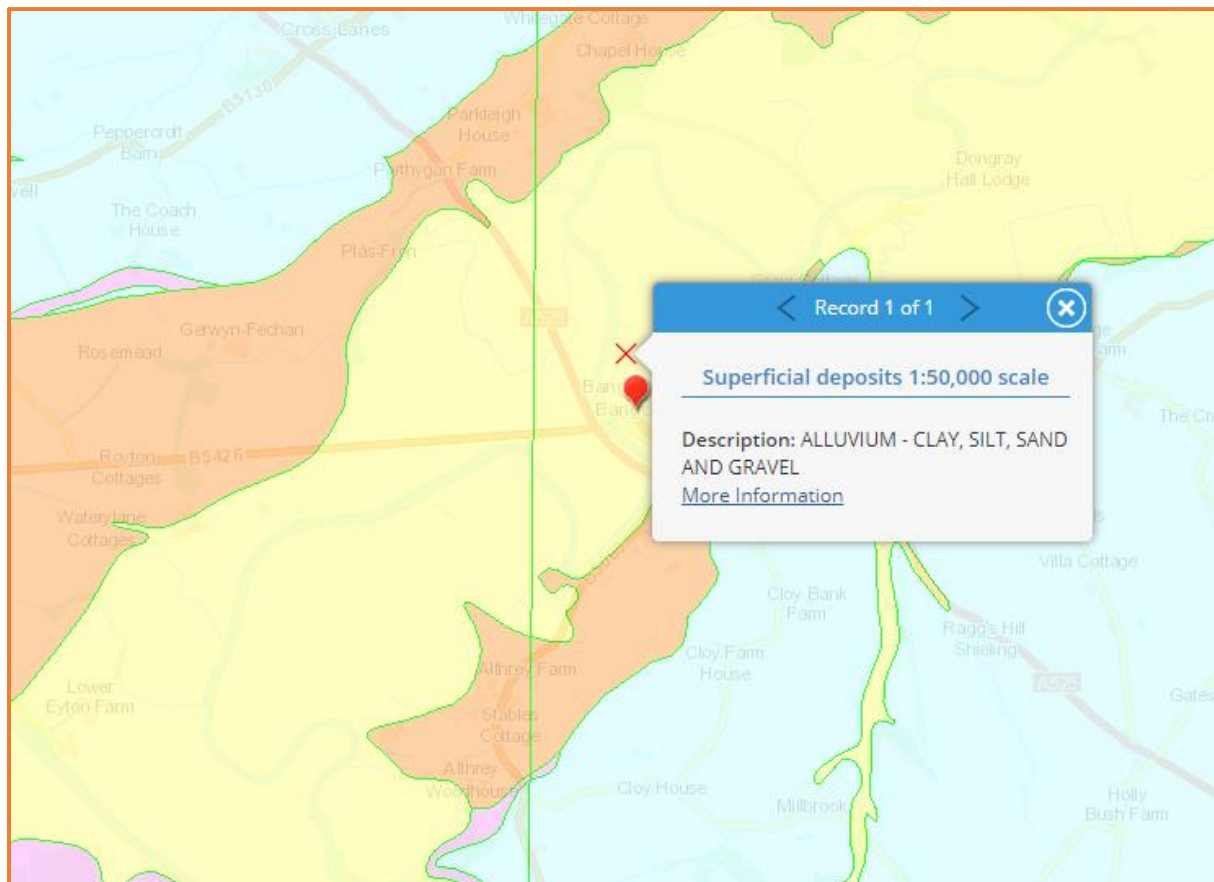


Figure 4: Local superficial geology (Source: BGS)

The soil type on site, taken from the UKSO data, is deep soils from Riverine Clay, Sands and Gravels parent material with a Clay to Sandy Loam texture.

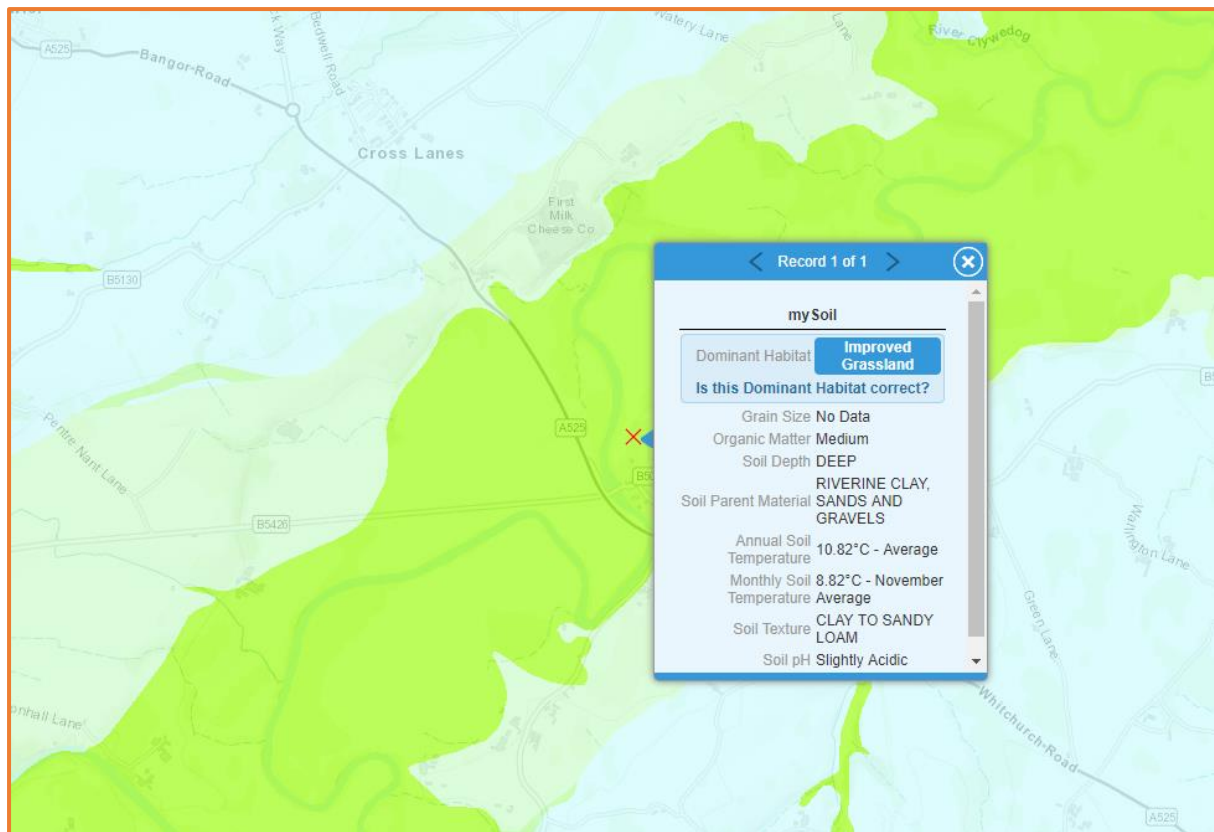


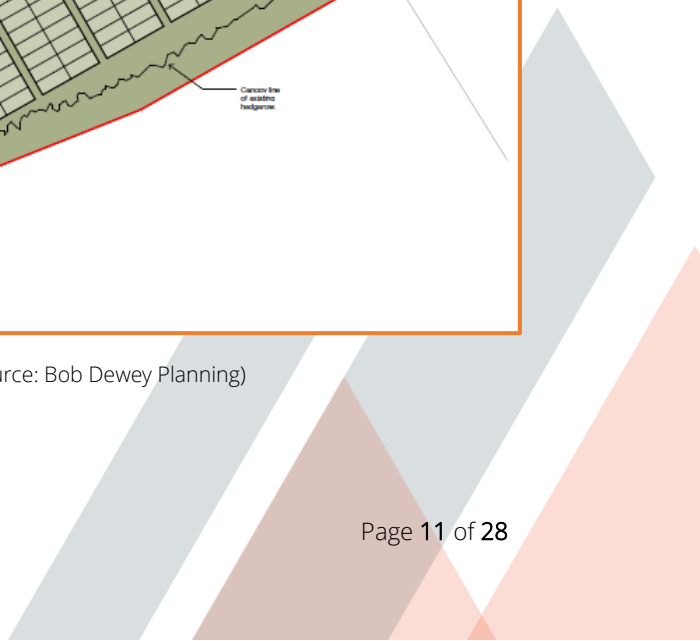
Figure 5: Local soil types (Source: UKSO)

Proposed Development

The proposed planning application is for the development of a cemetery. It is anticipated that approximately 200 burial plots would become available, with approximately 2 burials per year proposed.

The existing cemetery, which adjoins the parish church, is reaching capacity and the Community Council wishes to ensure provision for the future is available when needed.

Detailed site plans are provided in the report Appendix.



Commercial in Confidence

Assessment of Flood Risk

Flood Zones:

Within planning, Flood Zones refer to the probability of river and sea flooding. They are shown on the Natural Resource Wales Development Advice Map, available on Natural Resource Wales' web site.

Description of Zone	Zone Name	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 1: Flood Zones

The Flood Zones shown on the Natural Resource Wales Development Advice Map do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding.

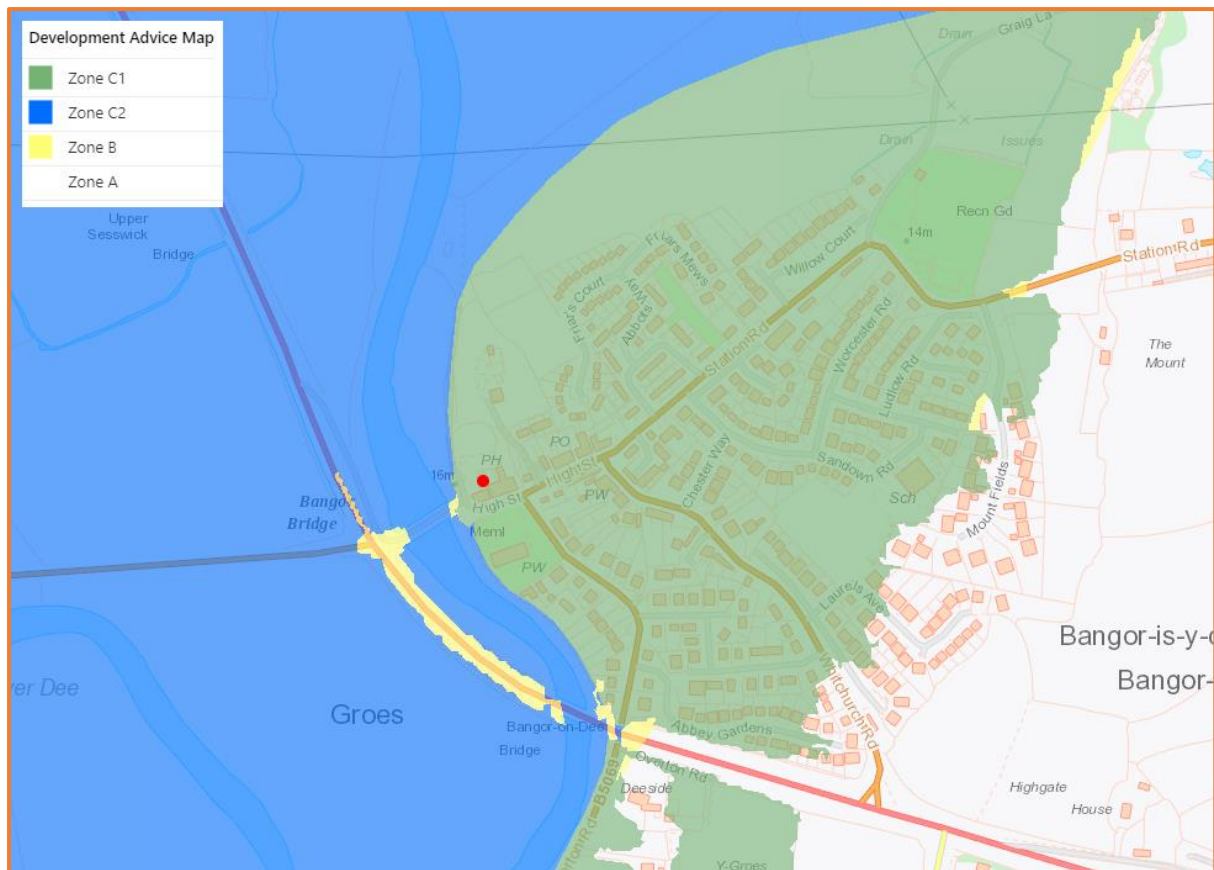


Figure 7: Development Advice Map

The Flood Zones shown on the Natural Resource Wales Development Advice Map do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding.

The entire site is shown to be within Flood Zone C1.

The risk would appear to be predominantly fluvial, from the River Dee which is approximately 50m to the west of the site at its closest proximity.

Fluvial (River Dee):

The River Dee (Welsh: Afon Dyfrdwy) is a river of both Wales and England, forming part of the border between the two countries. The river rises in Snowdonia, Wales, flows east via Chester, England, and discharges to the sea in an estuary between Wales and the Wirral Peninsula in England. It has a total length of 110km.

Modelled flood levels and extents:

Modelled fluvial flood levels and flood extents have been requested from the NRW as part of a flood data request (ref: AT115452a). NRW have provided data from the River Dee at Bangor on Dee Flood Risk Mapping Study, May 2012.

Modelled flood levels and extents have been provided for the defended and undefended scenarios.

	1:100 year		1:100 year + climate change		1: 1000 year	
	Depth (m)	Velocity (m/s)	Depth (m)	Velocity (m/s)	Depth (m)	Velocity (m/s)
Defended	Outside	Outside	Outside	Outside	Outside	Outside
Un defended	0.60m	0.41m/s	0.69m	0.67m/s	1.40m	0.73m/s

Table 2: Maximum modelled flood depths and flood velocities at the site (Source: NRW, River Dee at Bangor on Dee Flood Risk Mapping Study, May 2012)

The modelled results show that the site is entirely outside of the modelled defended extent for all the modelled return periods (including the 1:100 year plus climate change and 1:1000 year events).

For the modelled undefended scenarios, the maximum depth of flooding on site is shown to be 0.69m for the 1:100 year event with allowance for climate change, and 1.40m for the 1:1000 year event.

It should be noted that the River Dee at Bangor on Dee Flood Risk Mapping Study includes a 20% increase in flows as an allowance for climate change. The updated Flood Consequence Assessments: Climate Change Allowances (December 2016) uses a 20% allowance for the Dee catchment for the 2080's (Change factor / central estimate). As such, the climate change allowances used in the study are still current and applicable.

Flood defences:

The River Dee is defended by a flood defence embankment, built in 2003, and is a trapezoidal clay embankment maintained by Natural Resources Wales. The crest level varies between 15.8mAOD and 16.63mAOD, with the condition 3 – Fair to 4 – Poor. The standard of protection offered by this is 1:100 year.

The access to the site would be from the highway close to Bangor river bridge and immediately opposite the parish church and along the top of the flood defence.

Funerals are most likely to be held in the parish church, and the site is as close as possible to the church. Mourners will be able to walk from the service to the internment – approximately 300m. Access for the hearse and one of the funeral cars will be by way of an established right of way along the existing track on top of the flood defence bank. This embankment is intended to permit access to the flood defence by vehicles and heavy machines operated by NRW to maintain the defences.

Minimal traffic generation (up to 2 vehicles, twice a year), which would complete their slow trip along the bank in a matter of minutes, and would then enter the site, park and turn there, would be considered unlikely to significantly impact on the embankment (Source: Bob Dewey Planning).

Given the location of the site and access, flood defence consent will be required from NRW to secure future maintenance and liability and demonstrate no impacts to the top of the embankment, maintenance requirements, not precluding any future upgrade and avoid any damage to crest height.

Residual risk (breach or overtopping of flood defences):

Breaching of flood defences can cause rapid inundation of areas behind flood defences as flow in the river channel discharges through the breach. A breach can occur with little or no warning, although they are much more likely to concur with extreme river levels or tides when the stresses on flood defences are highest. Flood water flowing through a breach will normally discharge at a high velocity, rapidly filling up the areas behind the defences, resulting in significant damage to buildings and a high risk of loss of life. Breaches are most likely to occur in soft defences such as earth embankments although poorly maintained hard defences can also be a potential source of breach.

Overtopping of flood defences occurs when water levels exceed the protection level of raised flood defences. The worst case occurs when the fluvial or tidal levels exceed the defence level as this can lead to prolonged flooding.

Less severe overtopping can occur when flood levels are below defence levels, but wave action causes cyclic overtopping, with intermittent discharge over the crest level of the defence. Flood defences are commonly designed with a freeboard to provide protection against overtopping from waves. The risk from overtopping due to exceedance of the flood defence level is much more significant than the risk posed by wave overtopping. Exceedance of the flood defence level can lead to prolonged and rapid flooding with properties immediately behind the defences at highest risk.

The site is protected from direct inundation from the River Dee to the 1:100 year standard, by a flood defence embankment. In the event of breach (failure) or overtopping (exceedance) of the flood defence embankment in place, the site may be risk of inundation.

Historical flood events:

The EA has confirmed that in 1964 the area flooded when the River Dee overtopped its defences. The site is shown to be within the historic flood extent from 1964, but outside of the historic extents from 2000, and 2009.

Pluvial (Surface Water):

Pluvial (surface water) flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead.

In 2013 the EA and NRW, working with Lead Local Flood Authorities (LLFAs), produced an updated Flood Map for Surface Water. It is considered to represent a significant improvement on the previous surface water flood maps available, both in terms of method and representation of the risk of flooding. The modelling techniques and data used and considerably improved, and also incorporated locally produced mapping where this is available to represent features best modelled at a local scale.

The Flood Map for Surface Water assesses flooding scenarios as a result of rainfall with the following chance of occurring in any given year (annual probability of flooding is shown in brackets):

- 1:30 (3.3%)
- 1:100 (1%)
- 1:1000 (0.1%)

The mapping below shows the Risk of Flooding from Surface Water centred on the site. Please note that NRW do not consider this information suitable to be used to identify the risk to individual properties or sites. It is useful to raise awareness in areas which may be at risk and may require additional investigation.

The Natural Resources Wales Surface Water Flood Map suggests that the site lies predominantly within areas of "Very Low" to "Low" risk of flooding from surface water.

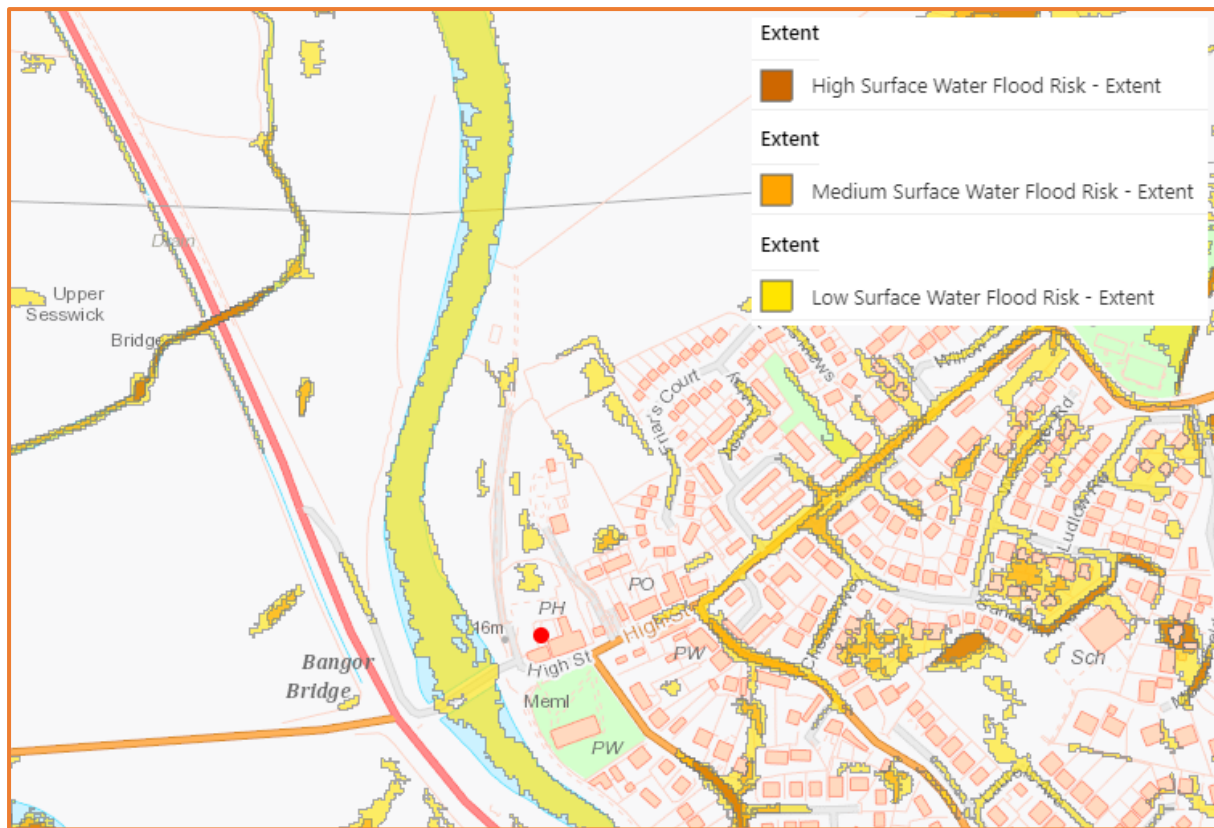


Figure 8: Extract from Natural Resources Wales Surface Water Flood Map (Source: NRW)

Groundwater:

Groundwater flooding occurs as a result of water rising up from the underlying rocks or from water flowing from abnormal springs. This tends to occur after much longer periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. Groundwater tends to flow from areas where the ground level is high, to areas where the ground level is low. In low-lying areas the water table is usually at shallower depths anyway, but during very wet periods, with all the additional groundwater flowing towards these areas, the water table can rise up to the surface causing groundwater flooding.

Groundwater flooding is most likely to occur in low-lying areas underlain by permeable rocks (aquifers). These may be extensive, regional aquifers, such as chalk or sandstone, or may be localised sands or river gravels in valley bottoms underlain by less permeable rocks. Groundwater flooding takes longer to dissipate because groundwater moves much more slowly than surface water and will take time to flow away underground. No information has been provided to suggest that the site is susceptible to groundwater flooding.

No information has been provided to suggest that the site is susceptible to groundwater flooding.

NRW have commented that due to the low burial rate of 2 burials per year, the overall risk scoring is low.

Sewer Surcharge:

Sewer flooding occurs when the sewer network cannot cope with the volume of water that is entering it. It is often experienced during times of heavy rainfall when large amounts of surface water overwhelm the sewer network causing flooding. Temporary problems such as blockages, siltation, collapses and equipment or operational failures can also result in sewer flooding.

All Water Companies have a statutory obligation to maintain a register of properties/areas which have reported records of flooding from the public sewerage system, and this is shown on the DG5 Flood Register. This includes records of flooding from foul sewers, combined sewers and surface water sewers which are deemed to be public and therefore maintained by the Water Company. The DG5 register records of flood incidents resulting in both internal property flooding and external flooding incidents. Once a property is identified on the DG5 register, water companies can typically put funding in place to address the issues and hence enable the property to be removed from the register. It should be noted that flooding from land drainage, highway drainage, rivers/watercourses and private sewers is not recorded within the register.

No information has been provided to suggest that the site is susceptible to sewer surcharge flooding.

Other Sources:

The Natural Resources Wales Risk of Flooding from Reservoirs Map suggests that the site lies within the “Maximum extent of flooding” from reservoir failure.

The site is shown to be at potential risk from the Alwen Reservoir, Llyn Tegid (Bala Lake) Breach 2, Llyn Brenig and Llyn Celyn

The Natural Resources Wales also advise on their website that reservoir flooding is extremely unlikely. All major reservoirs have to be inspected by specialist dam and reservoir Engineers. These inspections are monitored and enforced by the Natural Resources Wales themselves. The risk to the site from reservoir flooding is therefore minimal and is far lower than that relating to the potential for fluvial flooding to occur.

There do not appear to be any further artificial (man-made) sources of flood risk (such as raised canals) in the vicinity of the site.

Flood Risk Management Measures

Vulnerability to flooding:

TAN15 classifies property usage by vulnerability to flooding.

Post development, the development will be classified as “less vulnerable” throughout.

Particular flooding consequences may not be acceptable for particular types of development. For example, allowing residential development in areas which are subject to high risks of flooding can result in a traumatic impact on people's lives. The precautionary framework identifies the vulnerability of different land uses to flooding, and for this purpose, development has been subdivided into three categories:

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: Vulnerability to flooding categories

The Emergency Services category describes facilities which need to be operational and accessible at all times. Highly vulnerable development describes development where the ability of occupants to decide on whether they wish to accept the risks to life and property associated with flooding, or be able to manage the consequences of such a risk, is limited. It also includes those industrial uses where there would be an attendant risk to the public and the water environment should the site be inundated. Less vulnerable development describes development where the ability of occupants to decide on whether they wish to accept such risks is greater than that in the highly vulnerable category. The vulnerability attributed to a mixed use proposal will be defined by the most vulnerable use.

There are uses which are considered to be exceptions to the general rule, and have not been classified above, because they are required in a fluvial, tidal or coastal location by virtue of their nature. These include boatyards, marinas, essential works required at mooring basins, and development associated with canals.

Physical Design Measures:

In accordance with section A1.14 of TAN15 there is a frequency threshold of flooding below which flooding of development should not be allowed. The following table, taken from TAN15, provides indicative guidance as to what the frequency threshold could be for different types of development in terms of annual probability of occurrence:

Type of development	Threshold frequency	
	Fluvial	Tidal
Residential	1%	0.5%
Commercial / retail	1%	0.5%
Industrial	1%	0.5%
Emergency services	0.1%	0.1%
General infrastructure	1%	0.5%

Table 3: TAN15 Flood frequency thresholds

The modelled results show that the site is entirely outside of the modelled defended extent for all the modelled return periods (including the 1:100 year plus climate change and 1:1000 year events).

For the modelled undefended scenarios, the maximum depth of flooding on site is shown to be 0.69m for the 1:100 year event with allowance for climate change, and 1.40m for the 1:1000 year event.

No structures are proposed on the cemetery, and the site will be unmanned.

Since the anticipated number of funerals is so low, the chances of one occurring when the river levels are high is considered to be very low. In the unlikely event of the two coinciding, the internment would be delayed.

In addition, the site is defended from flooding from the River Dee to the 1:100 year standard and is shown to be entirely outside of all the modelled defended flood extents.

Safe Escape:

TAN 15 requires a route of safe escape for all residents and uses to be provided from new properties in Flood Zone C. The site is located within Flood Zone C1, but is defended to the 1:100 year standard, and is shown to be entirely outside of all the modelled defended flood extents (including the 1:100 year with allowance for climate change, and 1:1000 year).

Type of development	Maximum depth of flooding (mm)	Maximum rate of rise of floodwaters (m/hr)	Maximum speed of inundation of flood risk area (hrs)	Maximum velocity of floodwaters (metres/sec)
	Property Access			Property Access
Residential (habitable rooms)	600 600	0.1	4	0.15 0.3
Commercial & Retail	600 600	0.3	2	0.15 0.3
Industrial	1000 1000	0.3	2	0.3 0.45
Emergency Services	450 600	0.1	4	0.15 0.3
General Infrastructure	600 600	0.3	2	0.3 0.3

Table 4: TAN15 table A1.15

A cemetery does not fit within the development types within TAN15, however the closest general industrial usage will be used to assess the potential modelled flood depths for the 1:100 year event including climate change – as required under TAN15. An Industrial type of development is most applicable because the cemetery is unmanned, no structures are proposed on the site, the anticipated usage of the site (only 2 burials per year proposed and minimal traffic generation (up to 2 vehicles, twice a year)) and there are no facilities on site.

On site, a maximum depth of flooding of 1000mm and velocity of 0.3m/s is allowable for the 1:100 year event with allowance for climate change.

The figures below show the maximum flood depth and velocity, with a flood depth below 1000mm shaded blue, and a flood velocity below 0.45m/s shaded blue.

The maximum flood depths on site do not exceed 1000mm on site.

The maximum flood velocities on site are shown to exceed 0.3m/s however this is to the rear (east) of the site, where burial spaces (and pedestrian access) only are proposed. All car parking a vehicular access is to the west (front) of the site – where flood velocities are below 0.3m/s and flood depths are below 1000mm.

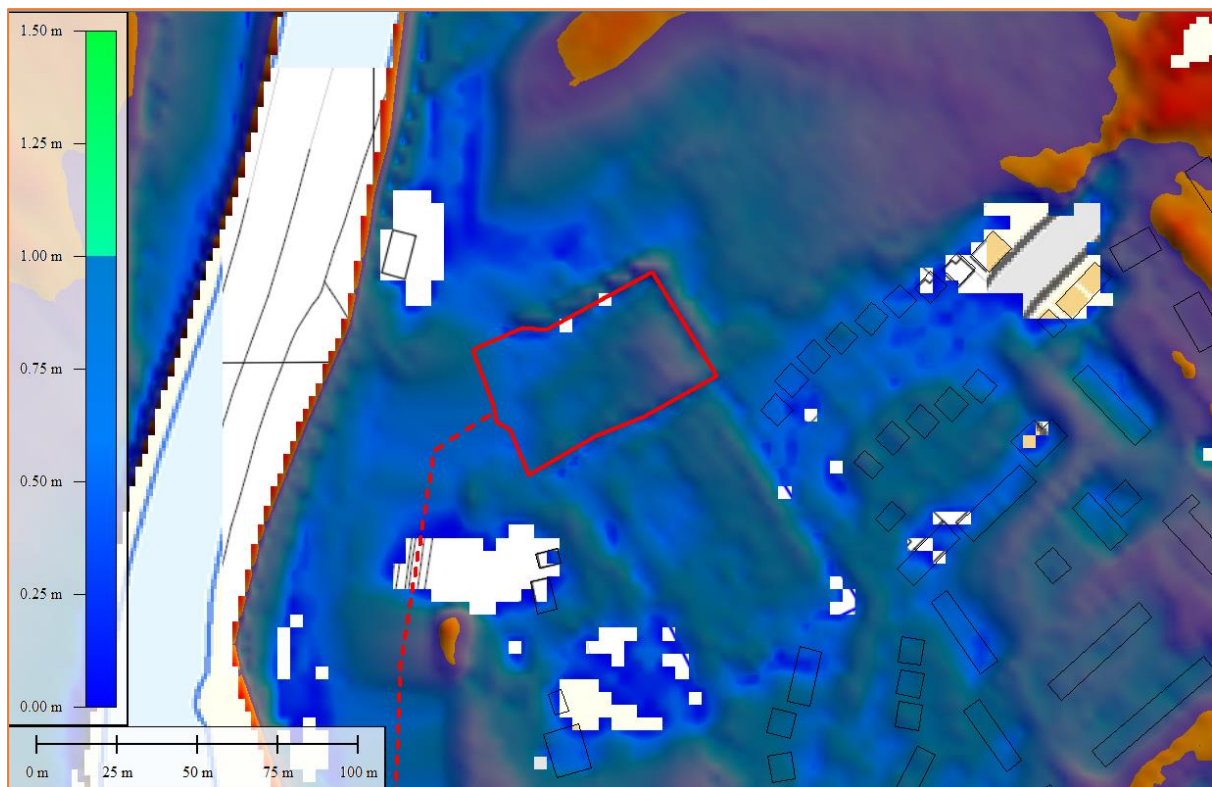


Figure 9: Modelled Undefined maximum 1:100 year flood depths including an allowance for climate change. Depths below 1000mm shaded blue (Source: NRW, OS Mapping)

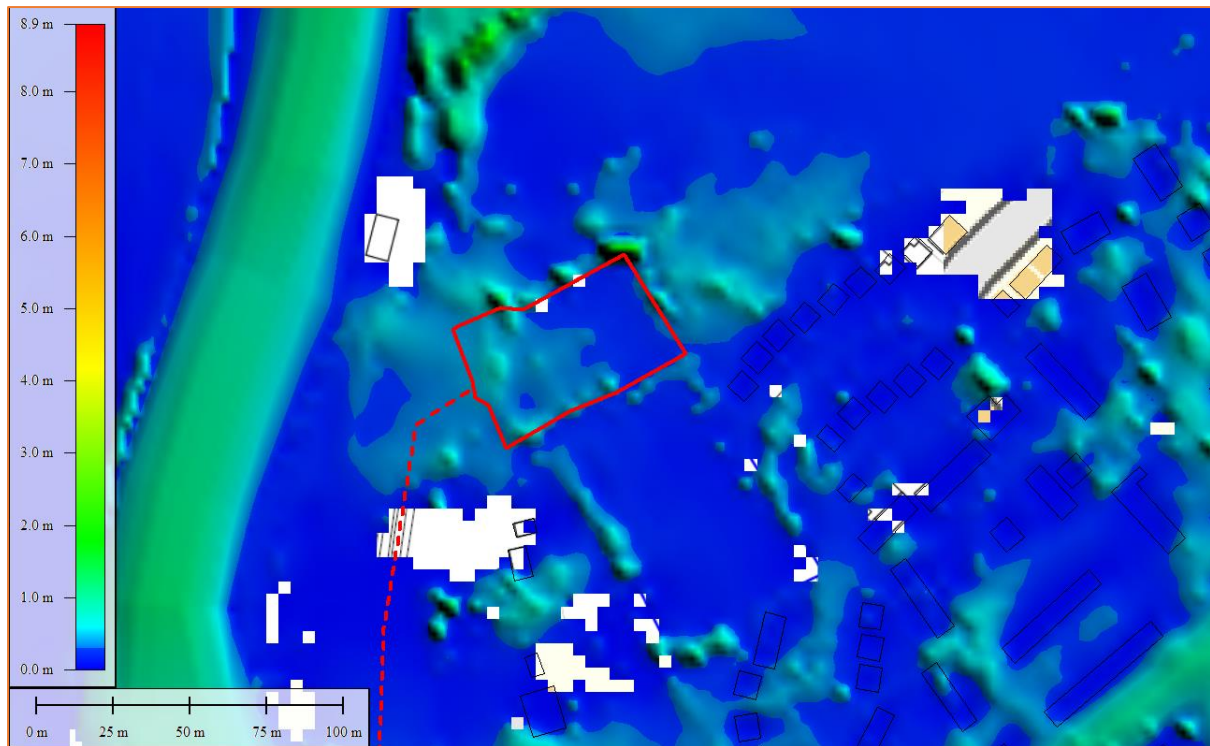


Figure 10: Modelled Undefended maximum 1:100 year flood velocities including an allowance for climate change. Velocities below 0.3m/s shaded blue (Source: NRW, OS Mapping)

A maximum depth of flooding of 1000mm and velocity of 0.45m/s is allowable along the site access/egress route under TAN15.

The maximum flood depths for the 1:100 year event with allowance for climate change do not exceed 600mm along the entire escape route. The maximum flood velocities for the 1:100 year event with allowance for climate change do not exceed 0.45m/s along the entire escape route.

Safe escape as per the specifications of TAN15 can therefore be provided.

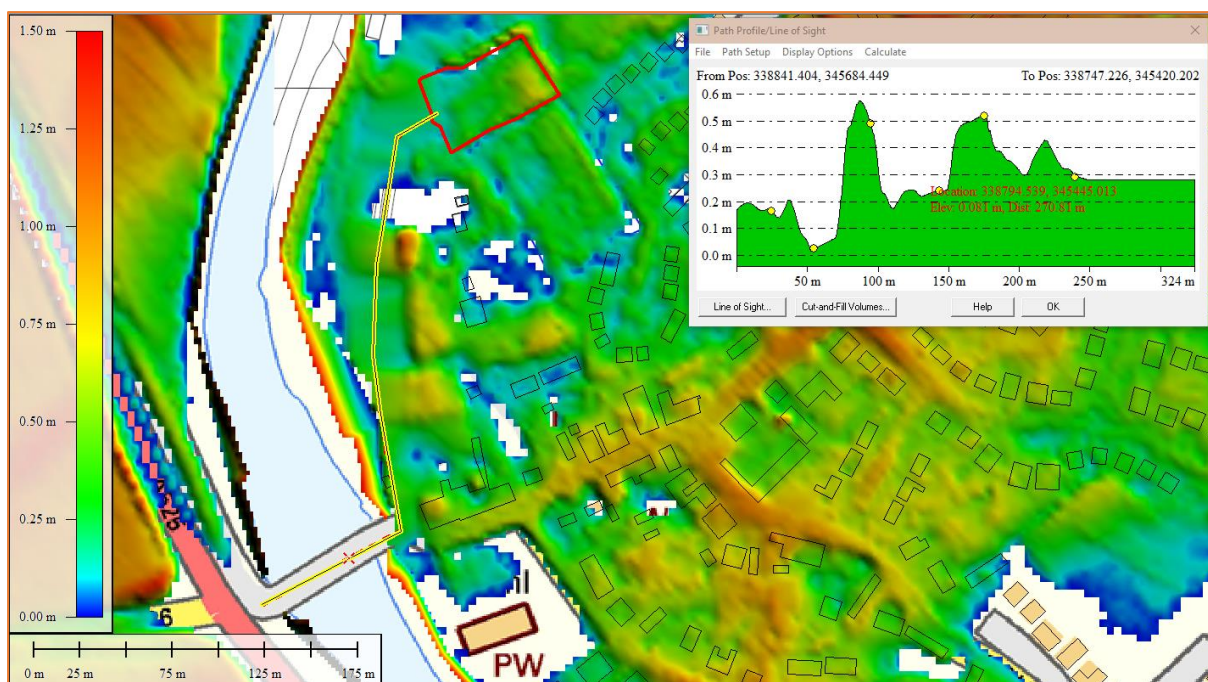


Figure 11: Modelled Undefended maximum 1:100 year flood depths including an allowance for climate change. Flood depths along the escape route are shown in the transect inset (Source: NRW, OS Mapping)

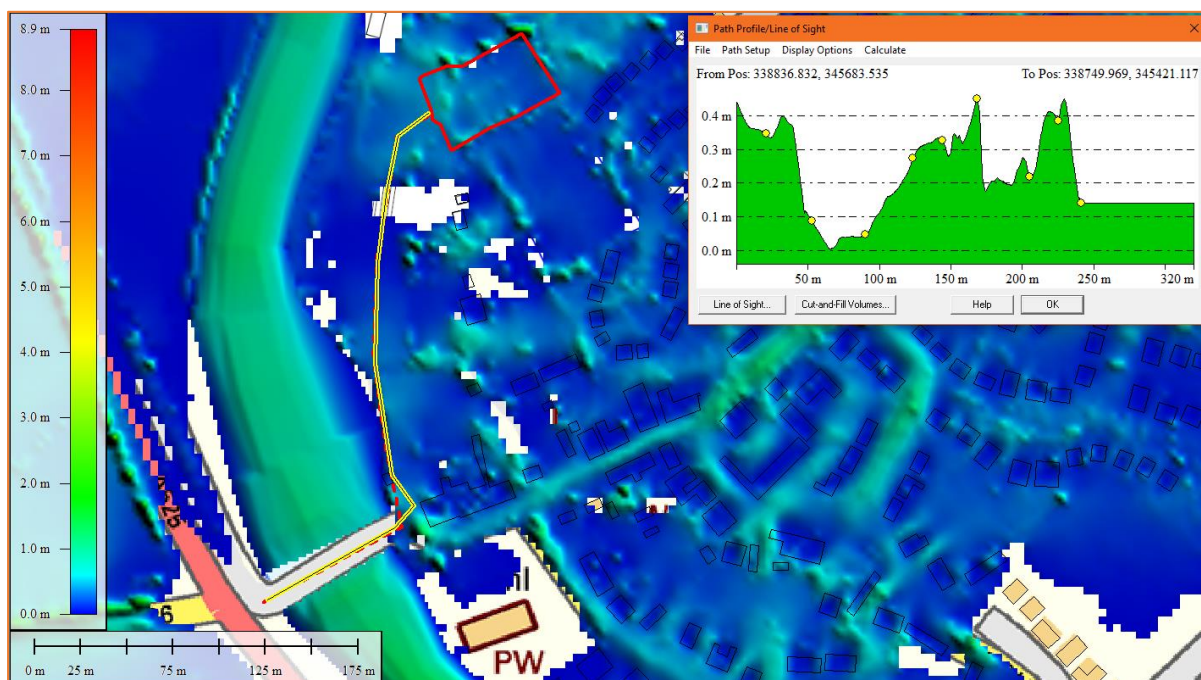


Figure 12: Modelled Undefended maximum 1:100 year flood velocities including an allowance for climate change. Flood velocities along the escape route are shown in the transect inset (Source: NRW, OS Mapping)

The modelled results show that the site is entirely outside of the modelled defended extent for all the modelled return periods (including the 1:100 year plus climate change and 1:1000 year events).

Flood Alert/Warnings:

NRW is responsible for issuing flood warnings. Flood warnings are issued to the emergency services and local authorities. Both private individuals and organisations can sign-up to receive warnings via phone, text or email. This system of receiving warnings is currently voluntary.

Advice regarding severe flood warnings will generally be given during weather forecasts on local radio and TV. In the case of extreme events, warnings can also be disseminated via door to door visits by the police or locally appointed flood wardens.

The applicant has agreed to implement a flood warning and evacuation plan post development, and subscribe to the NRW's flood warning service.

The NRW issue flood warnings to specific areas when flooding is expected. It is recommended that the applicant registers online with the free NRW Floodline Warnings Direct service to receive flood warnings by phone, text or email.

The site is within the Community or Bangor on Dee flood warning area.

Flood Warning:

The flood warning service has three types of warnings that will help you prepare for flooding and take action:

Flood Warning	Flood Alert	Flood Warning	Severe Flood Warning
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What it means?	Flooding is possible. Be prepared.	Flooding is expected. Immediate action required.	Severe flooding. Danger to life.
When it's used?	Two hours to two days in advance of flooding.	Half an hour to one day in advance of flooding.	When flooding poses a significant threat to life.
What to do?	Be prepared to act on your flood plan. Prepare a flood kit of essential items. Monitor local water levels and the flood forecast on our website.	Move family, pets and valuables to a safe place. Turn off gas, electricity and water supplies if safe to do so. Put flood protection equipment in place.	Stay in a safe place with a means of escape. Be ready should you need to evacuate from your home. Co-operate with the emergency services. Call 999 if you are in immediate danger.

Table 5: Flood Warnings

Flood Plan:

It is recommended that the applicant and future owners, occupiers and Landlords of the Farmhouse and the proposed properties prepare a flood plan to protect life and property during a flood event:

Before a flood:

- Find out if you are at risk of flooding.
- Find out if you can receive flood warnings.
- Prepare and keep a list of all your important contacts to hand or save them on your mobile phone.
- Think about what items you can move now and what you would want to move to safety during a flood such as pets, cars, furniture, and electrical equipment.
- Know how to turn off gas, electricity and water supplies.
- Prepare a flood kit of essential items and keep it handy. It can include copies of important documents, a torch, a battery-powered or wind-up radio, blankets and warm clothing, waterproofs, rubber gloves and a first aid kit including all essential medication.
- Consider buying flood protection products such as flood boards and airbrick covers to help reduce flood water getting into your property.

During a flood:

- Tune into your local radio station on a battery or wind-up radio.
- Fill jugs and saucepans with water.
- Grab your flood kit - if you have prepared one.
- Collect blankets, torch, first aid kit, medication and food.
- Move important documents, personal items, valuables, and lightweight belongings upstairs or to high shelves.
- Raise large items of furniture, or put them in large bags if you have them.
- Move people, outdoor belongings, cars and pets to higher ground.
- Switch off water, gas and electricity at mains when water is about to enter your home. Do not touch sources of electricity when standing in water.

- Fit flood protection products, if you have them, for example flood boards, airbrick covers, sandbags.
- Put plugs in sinks and baths. Weigh them down with a pillowcase or plastic bag filled with soil.
- If you do not have non-return valves fitted, plug water inlet pipes with towels or cloths.
- Move your family and pets upstairs or to a high place with a means of escape.
- Listen to the advice of the emergency service and evacuate if told to do so.
- Avoid walking or driving through flood water. Six inches of fast-flowing water can knock over an adult and two feet of water can move a car.

After a flood:

- If you have flooded, contact your insurance company as soon as possible.
- Take photographs and videos of your damaged property as a record for your insurance company.
- If you don't have insurance, contact your local authority for information on grants and charities that may help you.
- Flood water can contain sewage, chemicals and animal waste. Always wear waterproof outerwear, including gloves, wellington boots and a face mask.
- Have your electrics, central heating and water checked by qualified engineers before switching them back on.

Off-Site Impacts

Floodplain storage:

TAN15 requires that where development is proposed in undefended areas of floodplain, which lie outside of the functional floodplain, the implications of ground raising operations for flood risk elsewhere needs to be considered. Raising existing ground levels may reduce the capacity of the floodplain to accommodate floodwater and increase the risk of flooding by either increasing the depth of flooding to existing properties at risk or by extending the floodplain to cover properties normally outside of the floodplain. Flood storage capacity can be maintained by lowering ground levels either within the curtilage of the development or elsewhere in the floodplain, in order to maintain at least the same volume of flood storage capacity within the floodplain.

In undefended tidal areas, raising ground levels is unlikely to impact on maximum tidal levels so the provision of compensatory storage should not be necessary.

For development in a defended flood risk area, the impact on residual flood risk to other properties needs to be considered. New development behind flood defences can increase the residual risk of flooding if the flood defences are breached or overtopped by changing the conveyance of the flow paths or by displacing flood water elsewhere. If the potential impact on residual risk is unacceptable then mitigation should be provided.

No structures are proposed on the cemetery and as such there will be no loss of flood storage post development.

Conclusion

Unda Consulting Limited have been appointed by Bangor on Dee Community Council to undertake a Site Specific Flood Consequence Assessment (FCA) for Planning at Land To The West Of Friars Court, Bangor-On-Dee, Wrexham, LL13 0BU. The FCA has been undertaken in accordance with Technical Advice Note 15 (TAN 15) and the associated technical guidance.

The proposed planning application is for the development of a cemetery. It is anticipated that approximately 200 burial plots would become available, with approximately 2 burials per year proposed.

The existing cemetery, which adjoins the parish church, is reaching capacity and the Community Council wishes to ensure provision for the future is available when needed.

The site is shown to be located within Flood Zone C1 (Areas of the floodplain which are developed and served by significant infrastructure, including flood defences.)

Modelled fluvial flood levels and flood extents have been requested from the NRW as part of a flood data request (ref: AT115452a). NRW have provided data from the River Dee at Bangor on Dee Flood Risk Mapping Study, May 2012.

Modelled flood levels and extents have been provided for the defended and undefended scenarios.

The modelled results show that the site is entirely outside of the modelled defended extent for all the modelled return periods (including the 1:100 year plus climate change and 1:1000 year events).

For the modelled undefended scenarios, the maximum depth of flooding on site is shown to be 0.69m for the 1:100 year event with allowance for climate change, and 1.40m for the 1:1000 year event.

Safe escape as per the specifications of TAN15 can therefore be provided.

No structures are proposed on the cemetery, and the site will be unmanned.

Since the anticipated number of funerals is so low, the chances of one occurring when the river levels are high is considered to be very low. In the unlikely event of the two coinciding, the internment would be delayed.

In addition, the site is defended from flooding from the River Dee to the 1:100 year standard.

The risk would appear to be predominantly fluvial, from the River Dee which is approximately 50m to the west of the site at its closest proximity.

The Natural Resources Wales Surface Water Flood Map suggests that the site lies predominantly within areas of "Very Low" to "Low" risk of flooding from surface water.

The risk of flooding posed to the site by groundwater and sewer surcharge would appear to be low.

The Natural Resources Wales Risk of Flooding from Reservoirs Map suggests that the site lies within the "Maximum extent of flooding" from reservoir failure.

In summary:

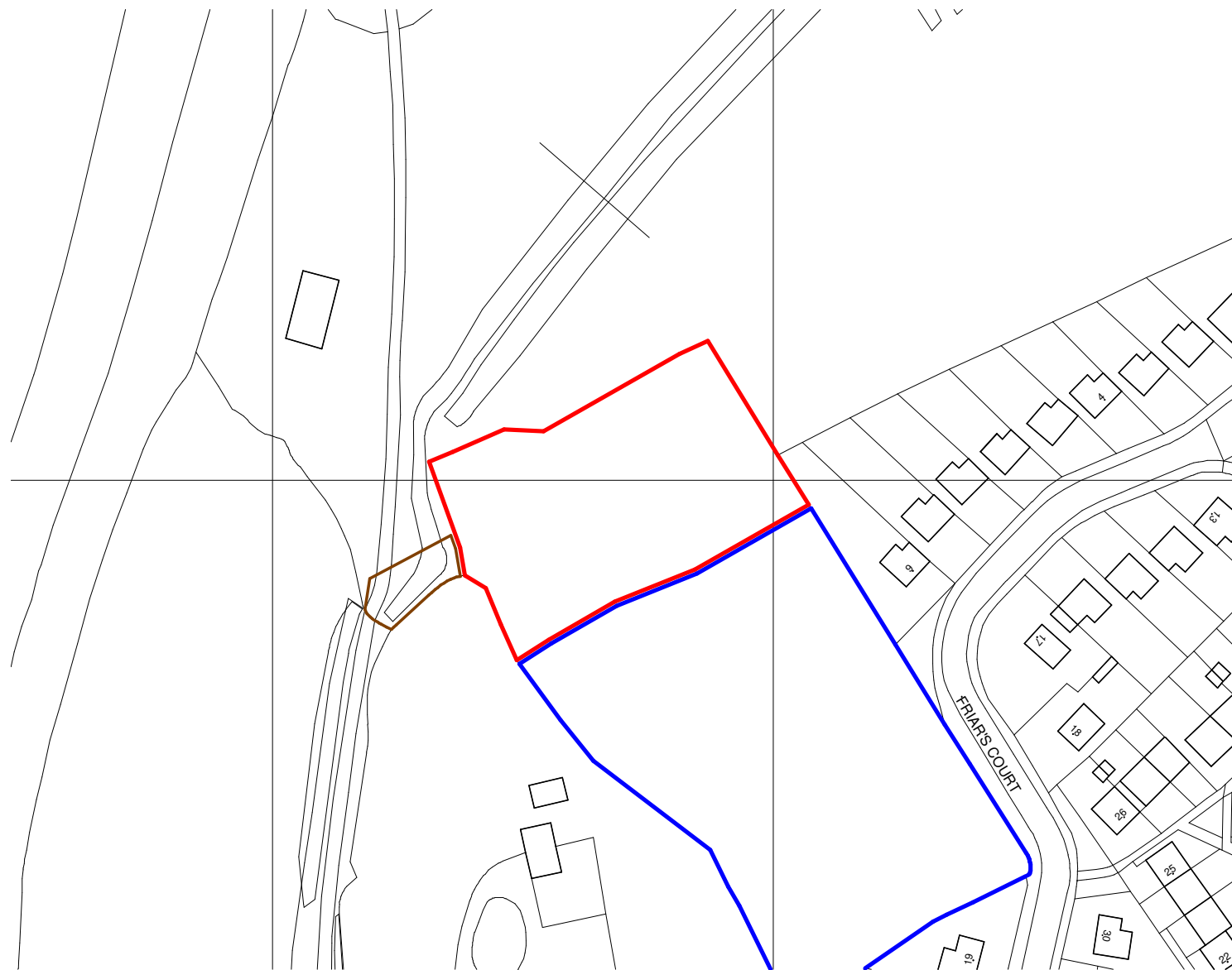
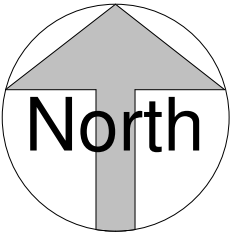
- The site is shown to be within Flood Zone C1.
- Site entirely outside modelled 1:100 year (plus climate change) and 1:1000 year defended modelled maximum flood extents, but is within the undefended modelled flood extents.
- The site is defended from flooding from the River Dee to the 1:100 year standard.
- The risk of flooding posed to the site by groundwater and sewer surcharge would appear to be low.
- The Natural Resources Wales Risk of Flooding from Reservoirs Map suggests that the site lies within the "Maximum extent of flooding" from reservoir failure.

- A flood warning and evacuation plan will be implemented post development.
- Only 2 burials per year proposed.
- Minimal traffic generation (up to 2 vehicles, twice a year).
- Since the anticipated number of funerals is so low, the chances of one occurring when the river levels are high is considered to be very low. In the unlikely event of the two coinciding, the internment would be delayed.

Assuming accordance with these flood risk management measures, Unda Consulting Limited consider the proposed application to be suitable in flood risk terms.

Appendix

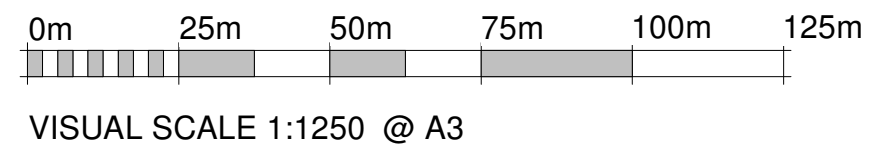
- Site location, Existing and Proposed Plans
- NRW Flood Data.



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Location Plan

1 : 1250



Rev.	Revision description	Drawn	Checked	Date
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Project

Bangor-on-Dee Community Council

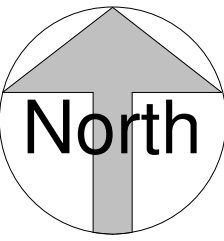
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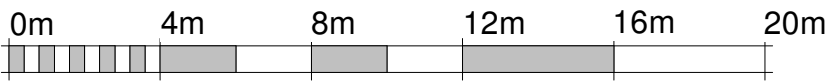
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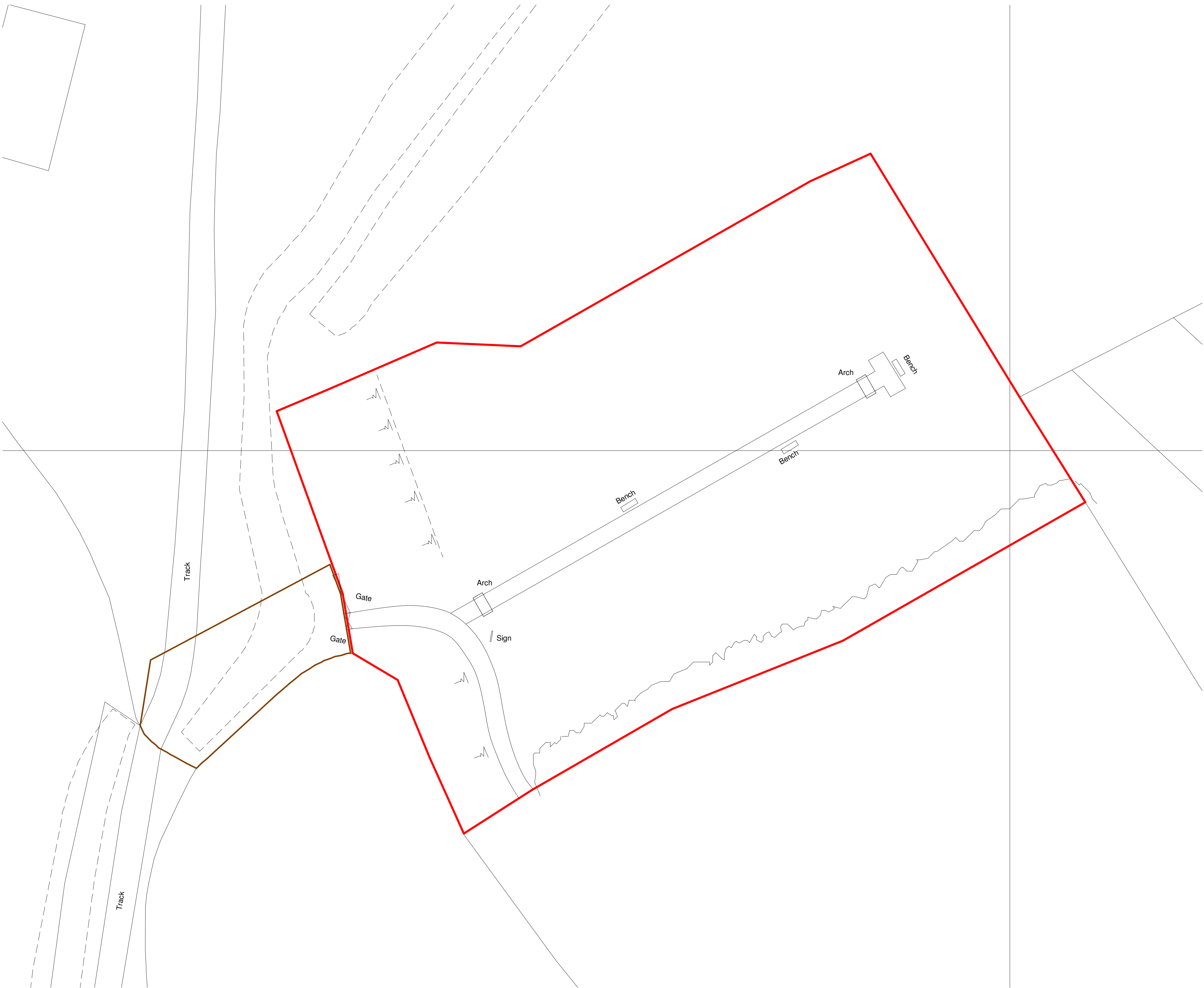
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Existing Site Plan
1 : 200



VISUAL SCALE 1:200 @ A1



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Rev.	Revision description	Drawn	Checked	Date

Project
**Bangor-on-Dee
Community Council**

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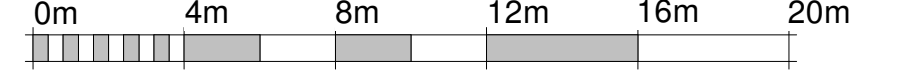
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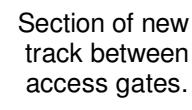
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VISUAL SCALE 1:200 @ A1



Rev.	Revision description	Drawn	Checked	Date
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Project **Bangor-on-Dee
Community Council**

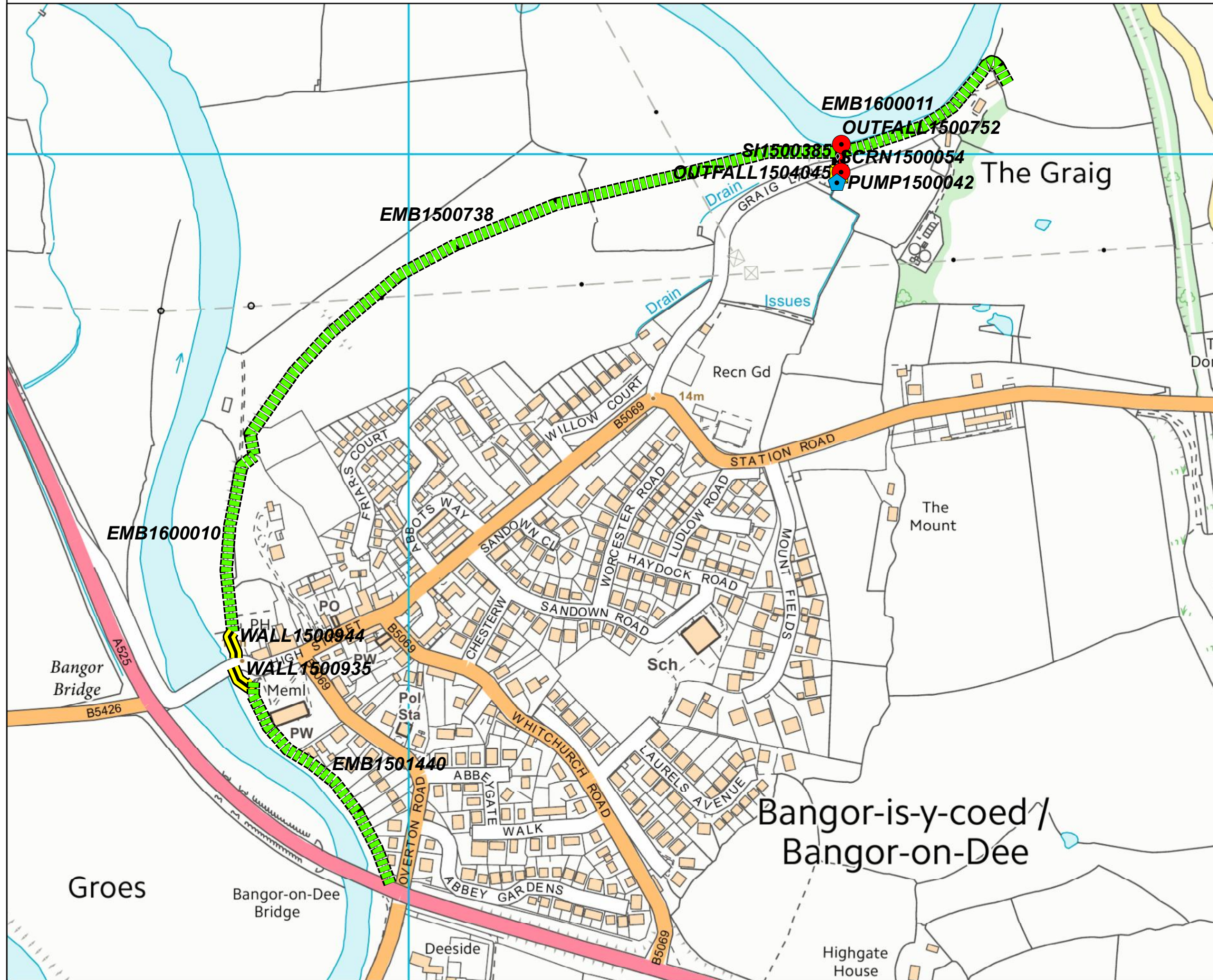
Title

Proposed Site Plan

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	Job No.	Sheet No.	Rev.
Drawing Number	18-01	A101	A



Legend

SUBTYPE, ASSETMAINT

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- Outfall, Natural Resources Wales
- Pump House, Natural Resources Wales
- Screen, Natural Resources Wales
- Weir, Natural Resources Wales

SUBTYPE, ASSETMAINT

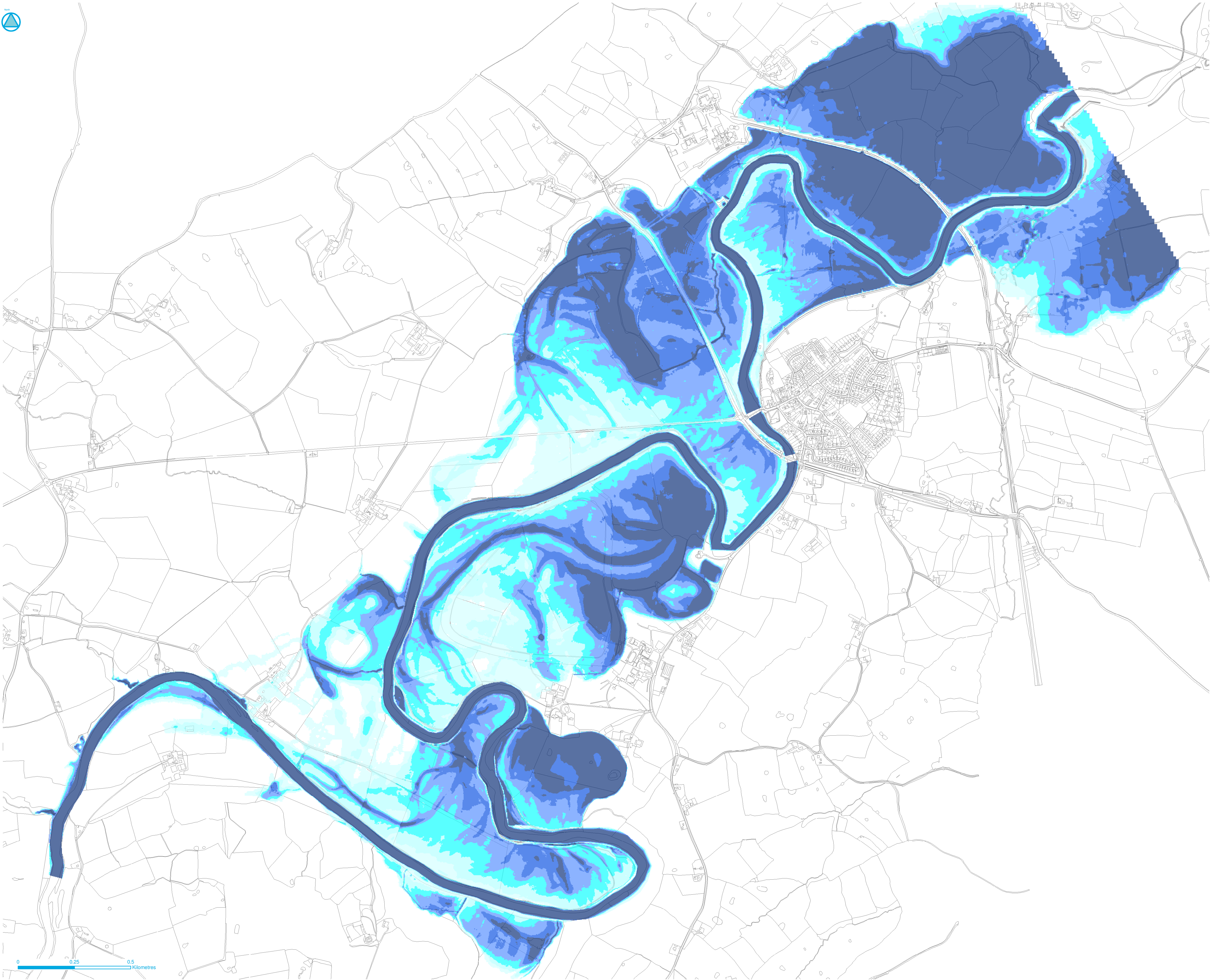
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- Simple Culvert, Natural Resources Wales
- Wall, Natural Resources Wales

1:4,000

Meters

0 80 160

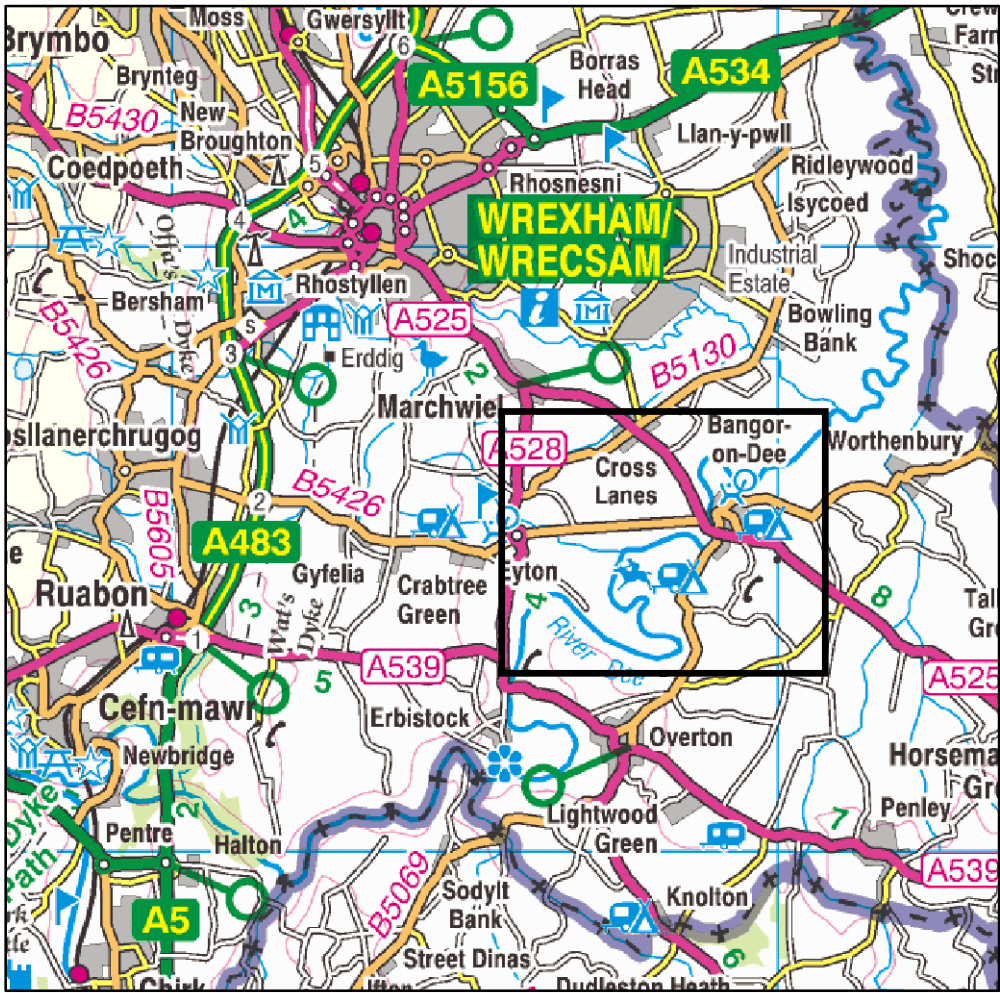
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User Notes
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When in doubt the Environment Agency should be consulted.

Technical Notes
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Key Plan



Predicted Peak Flood Depths

- 0 - 0.3m
- 0.3 - 0.6m
- 0.6 - 0.9m
- 0.9 - 1.2m
- 1.2 - 1.5m
- Above 1.5m



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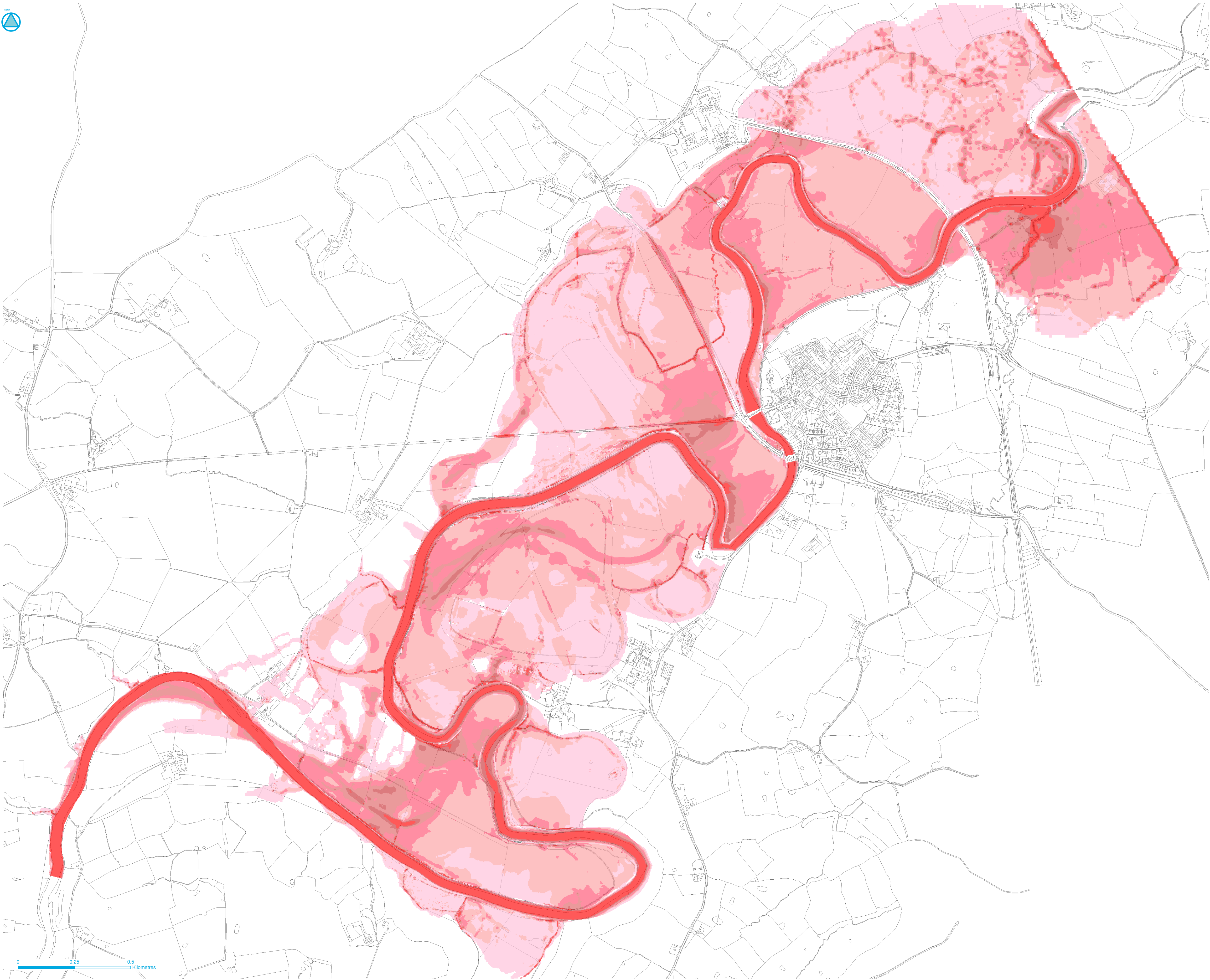
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Environment
Agency Wales

Other offices at Atherstone, Doncaster, Edinburgh, Newcastle upon Tyne, Northallerton, Skipton, Tadcaster & Wallingford

for
RIVER DEE AT BANGOR ON DEE
FLOOD RISK MAPPING STUDY

1% AEP Event Defended Flood Depth

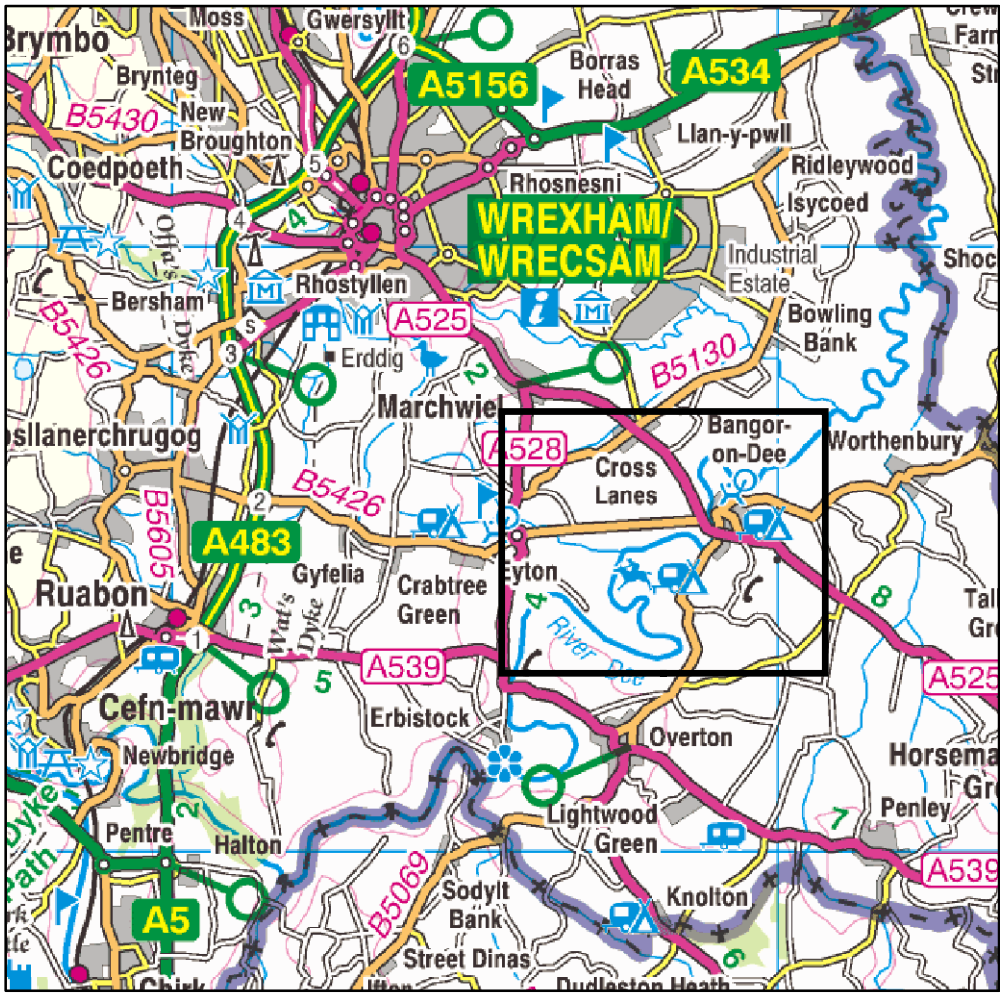
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Checked by:	Krista Davies	Date:	May 2012	
Approved by:	Krista Davies	Date:	May 2012	
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Drawing Number:			Status:	
20115194 Bangor on Dee Flood Depth			Final	Original @ A1



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Key Plan



Predicted Peak Flood Velocity

- 0 - 0.2m/s
- 0.2 - 0.4m/s
- 0.4 - 0.6m/s
- 0.6 - 0.8m/s
- 0.8 - 1m/s
- Above 1m/s



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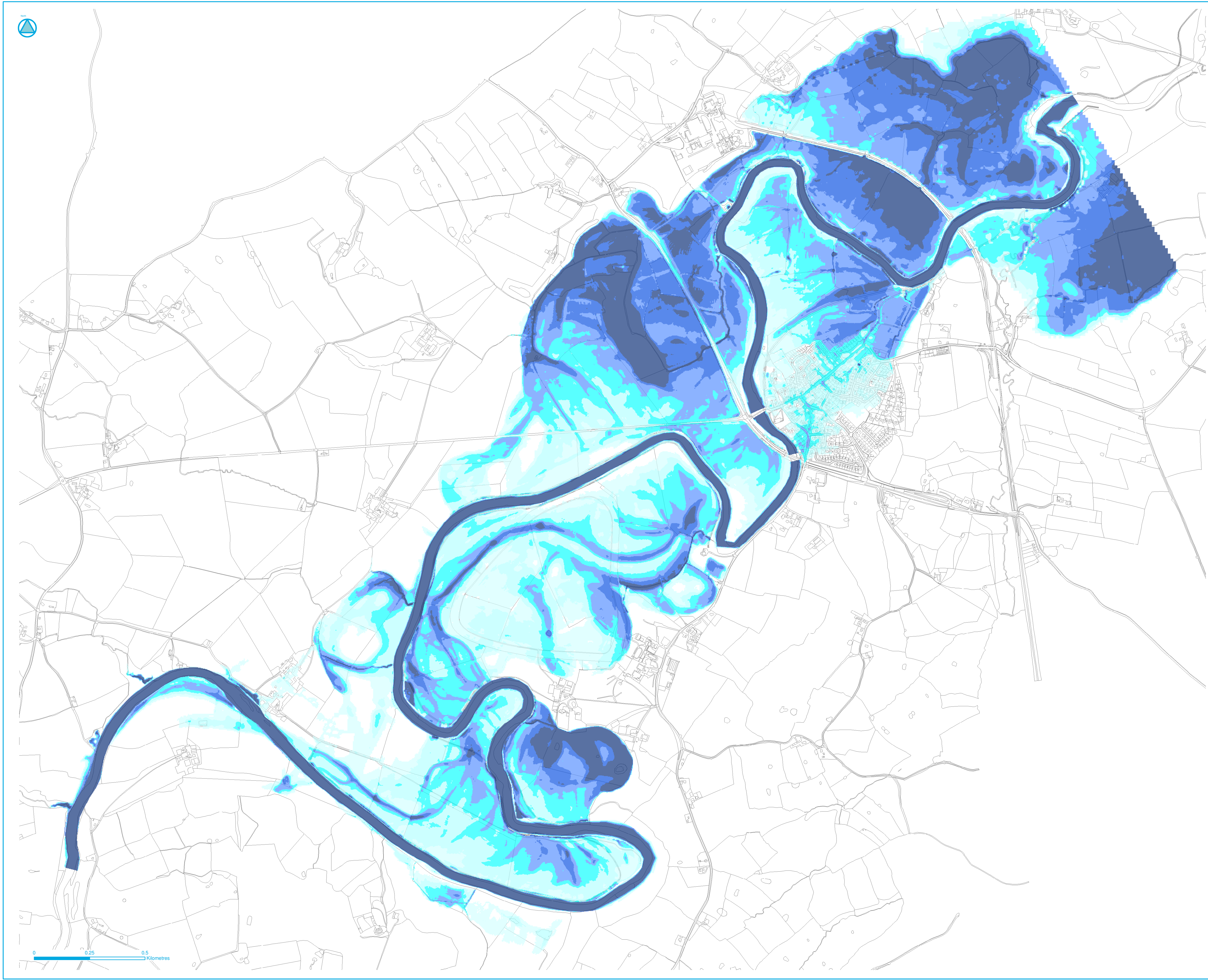
RIVER DEE AT BANGOR ON DEE FLOOD RISK MAPPING STUDY

1% AEP Event Defended Flood Velocity

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Checked by:	Krista Davies	Date:	May 2012	
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Drawing Number:			Status:	
20115194 Bangor on Dee Flood Velocity			Final	

Original @ A1

Original @ A1



Technical Notes

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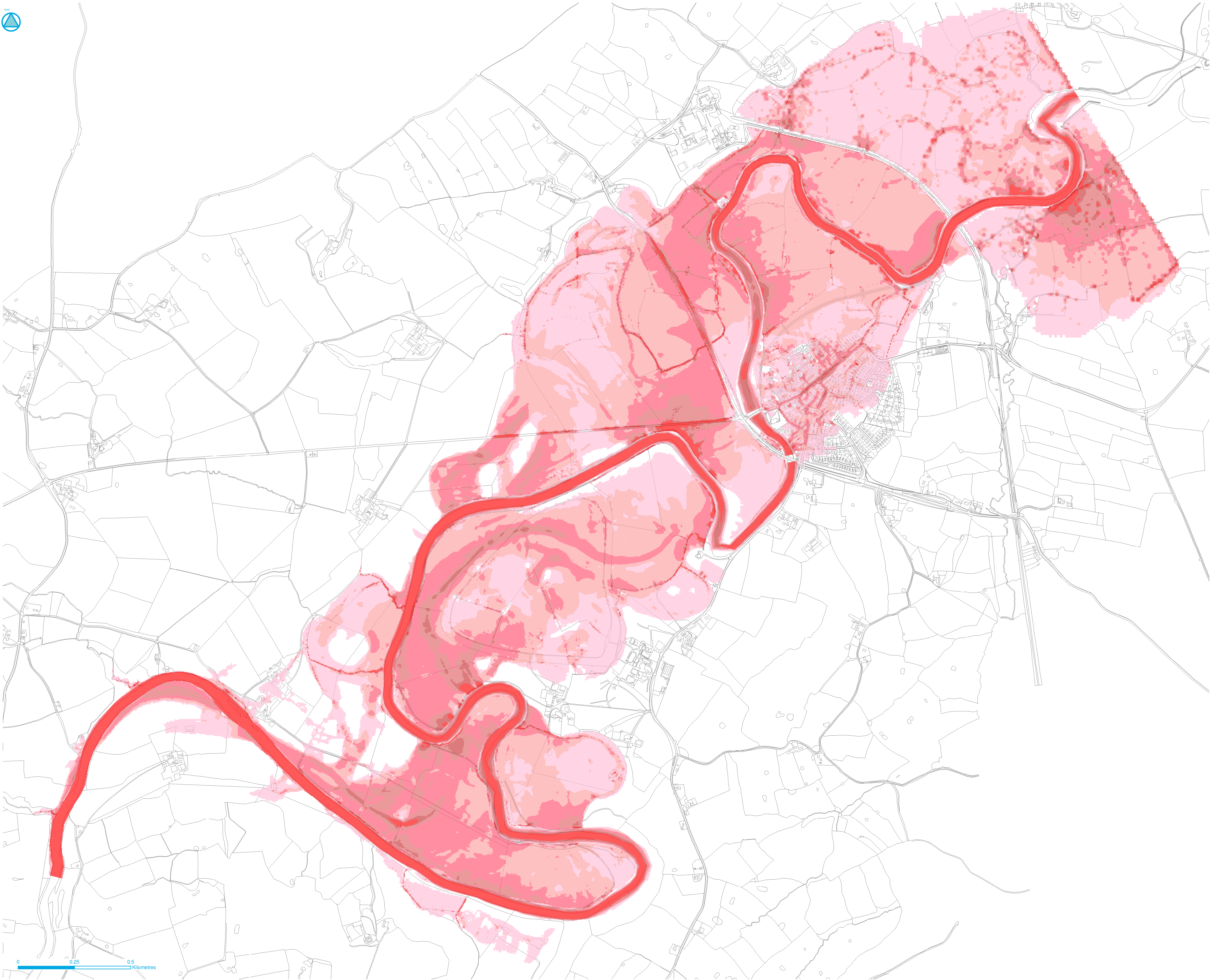
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 0.3 - 0.6m
 0.6 - 0.9m
 0.9 - 1.2m
 1.2 - 1.5m
 Above 1.5m



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1% AEP Event Undefended Flood Depth

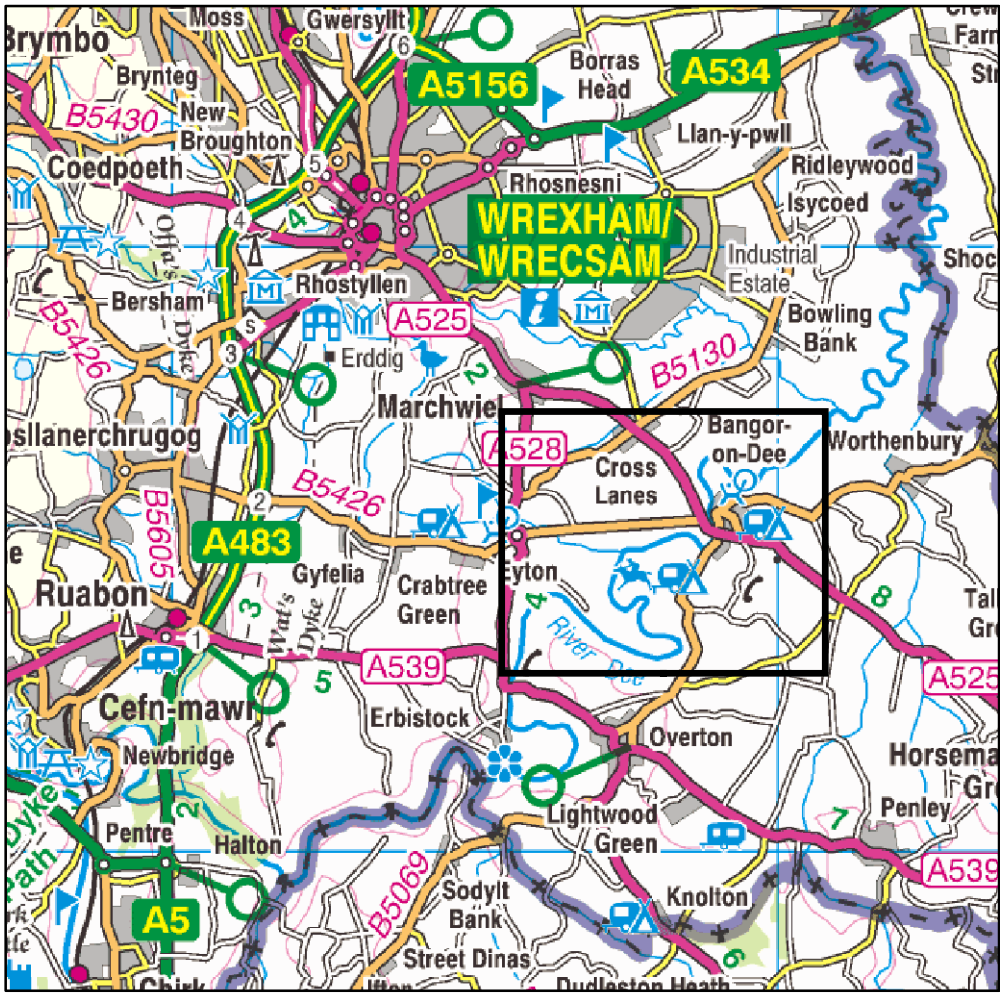
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Key Plan



Predicted Peak Flood Velocity

- 0 - 0.2m/s
- 0.2 - 0.4m/s
- 0.4 - 0.6m/s
- 0.6 - 0.8m/s
- 0.8 - 1m/s
- Above 1m/s



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RIVER DEE AT BANGOR ON DEE FLOOD RISK MAPPING STUDY

1% AEP Event Undefended Flood Velocity

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201151194 Bangor on Dee Flood Velocity			Final	Original @ A1