Cardiff Park and Ride East, Pentwyn, Cardiff Environmental Statement

Chapter 9: Water Environment and Flood Risk

WSP on behalf of Curtis Hall Ltd

November 2025

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Level 1 Flood Consequences Assessment

PROJECT NUMBER	7008-2841
DATE	November 2025
PROJECT NAME	Pentwyn P&R – Data Centre
CLIENT	Curtis Hall Ltd
DOCUMENT REFERENCE	2841-WSP-XX-XX-MO-C-007

INTRODUCTION

WSP (UK) Ltd has been appointed by Curtis Hall Ltd to undertake a Level 1 Flood Consequences Assessment screening study (FCA) to support the Pre-application Consultation of the proposed development at the existing Cardiff Park and Ride East site. This Flood Consequences Assessment has been undertaken in accordance with Technical Advice Note 15 (TAN15) and is based on data provided by the client and available online.

To help ensure that the level of detail of an FCA is proportionate to the degree of flood risk, the Construction Industry Research and Information Association (CIRIA) has defined a tiered three-level approach to flood risk assessment as follows:

- Level 1 Screening study to identify whether there are any flooding issues related to a development site which may warrant further consideration.
- Level 2 Scoping study to be undertaken for each potential flood risk issue that is identified as being associated with a site during a Level 1 FCA. A Level 2 FCA involves a qualitative assessment of the flood risk to the site, and the impact of the site on flood risk elsewhere; and
- Level 3 Detailed study to be undertaken if the Level 2 study concludes that quantitative analysis is required to assess flood risk issues related to the development site.

In the case of the currently proposed development site, a Level 1 study is considered sufficient to support the Pre-application Consultation.

LIMITATIONS

WSP has prepared this report in accordance with the instructions of their client, Curtis Hall Ltd, for their sole and specific use relating solely to the above site. Any person who uses any information contained herein does so at their own risk and shall hold WSP harmless in any event. Whilst this report was prepared using the reasonable skill and care ordinarily exercised by engineers practicing under similar circumstances and reasonable checks have been made on data sources and the accuracy of the data, WSP accepts no liability in relation to the report should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP. In any event, WSP shall not be liable for any loss or damages arising under or in connection to the use of this report.

Site Location

The site comprises of approximately 23.4ha of land at the existing Cardiff Park and Ride East within the administrative boundary of Cardiff City Council. The existing Park and Ride contains a hard-surfaced area of 4.9 ha with approximately 900 car parking spaces, as well as bus drop-off and pick-up points, an office/amenity building and various compounds. The site is accessed from the A48, Eastern Avenue.

In addition to the Park and Ride, the Site features areas of woodland and scrub land with public rights of way and informal footpaths. The total developed site area would comprise 7.4 ha (including the park and ride facility). The Rhymney River runs along the southern boundary of the Site, with the Rhymney Trail running parallel to the river. The Rhymney Trail crosses the river via an existing footbridge to the south of the Site.

The site is not shown on the Council's adopted proposals map to be allocated for any specific use. However, in terms of other planning designations, the Site features an area of ancient woodland to the north and a small area to the south, in addition to a number of TPO trees. The north of the Site and a corridor along the river Rhymney are located in an area of high flood risk from rivers with the remaining areas of the site designated as low flood. The Site lies within the River Rhymney river corridor.

Immediately to the north-west lies the dual carriageway (A48) which extends to the south towards Cardiff City centre. Beyond this lies the residential area of Pentwyn, while to the east lies the residential area of Llanrumney. To the south, on the opposing side of the river, planning permission for a residential scheme of 98 residential units has been permitted (ref:18/02594/MJR). Construction on that site has been largely completed.

The site is bound to the east by the Rhymney River (Afon Rhymni), a main river flowing north to south past the site, and to the west by the A48/Eastern Avenue. It is noted that the site slopes generally from the west to the east, towards the river, with a high point of approximately 17.0 m AOD along the boundary of the A48 and a low point of approximately 9.0 m AOD along the edge of the river. In the wider hydrographic environment, there are three watercourses flowing west to east:

- The Nant Pontprennau a main river which passes under the A48 and confluences with the Rhymney River 50 m to the north of the site boundary,
- An unnamed water feature that historic mapping suggests may arise in Cross Covert and may be culverted under the A48,
- The Nant Glandulas a main river which passes under the A48 and confluences with the Rhymney River on the southern edge the site.

Additionally, the site is circa 5.4 km, following the path of the Rhymney River, from its outfall into the Severn Estuary.

The site location plan is shown in Figure 1 below.

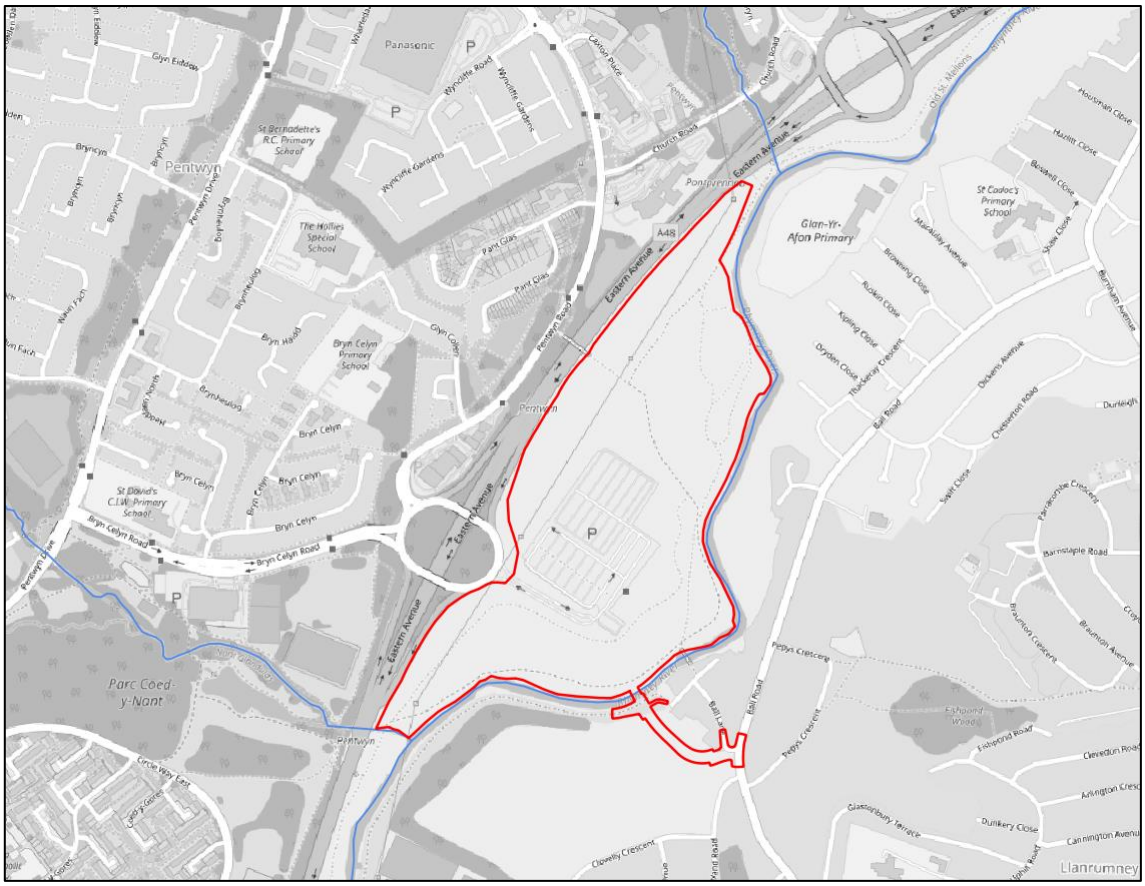


Figure 1: Site Location Plan

Previous Studies of Interest

A previous planning application at this location (22/02673/FUL) which was granted in June 2024 is of particular interest to this scheme. Familiarity with that application is presumed by this document and in particular this document should be read with reference to its associated Hydraulic Modelling (2841-WSP-XX-XX-RP-C-02), FCA (2841-WSP-XX-XX-RP-C-01) and the Water Resources chapter of the associated Environmental Statement.

PROPOSED DEVELOPMENT

Development proposals comprise of general commercial/retail elements as defined under TAN15 'Less Vulnerable' and a new bridge crossing the river, to connect with the community of Llanrumney. The new bridge crossing is proposed to cross the Rhymney River in a clear 27.8 m span across the main river channel, with three further clear spans circa 20 m across the floodplain on the northern bank. In addition, an underpass has been designed to accommodate the continuation of the Rhymney Trail beneath the proposed highway embankment to the south of the river. The formal definition for the purposes of the planning application is:

> *'Hybrid Planning Application (part full/part outline) for the demolition of existing structures and redevelopment of the site to provide a data centre and associated buildings and structures, associated car parking and access roads, a bridge across the Rhymney River, site wide landscaping and associated works.'*

An illustrative masterplan layout and red line boundary are replicated in Figure 2 below.

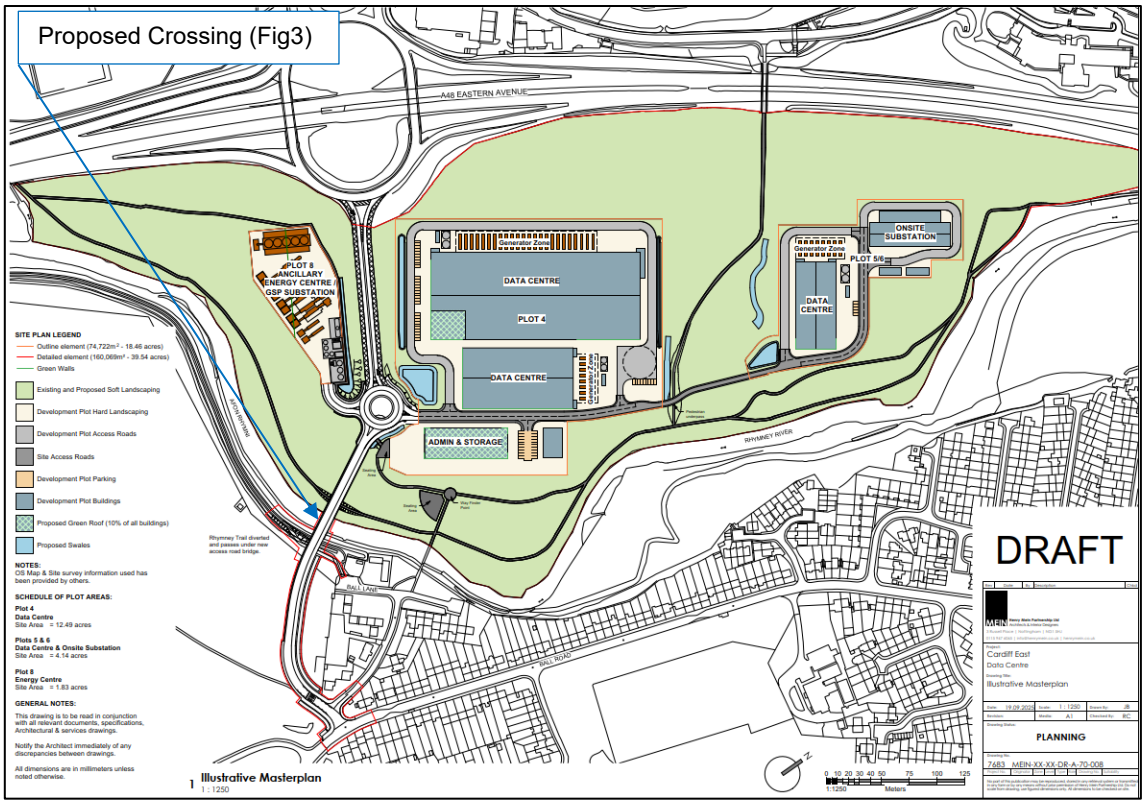


Figure 2: Proposed Layout & Redline Boundary

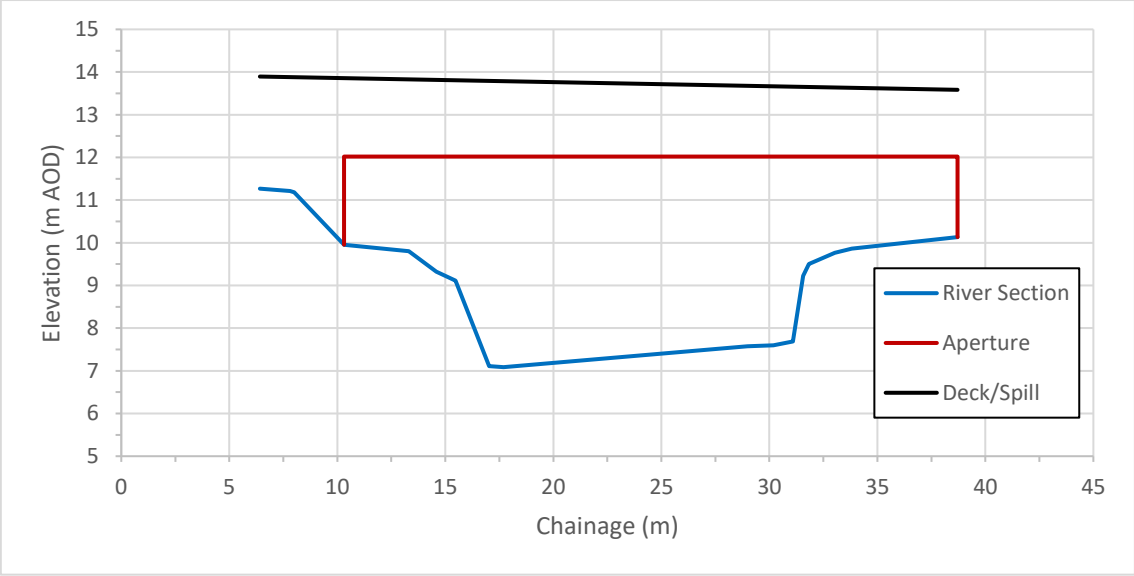


Figure 3: Proposed Rhymney River Crossing (Facing Downstream)

CURRENT UNDERSTANDING OF FLOOD RISK

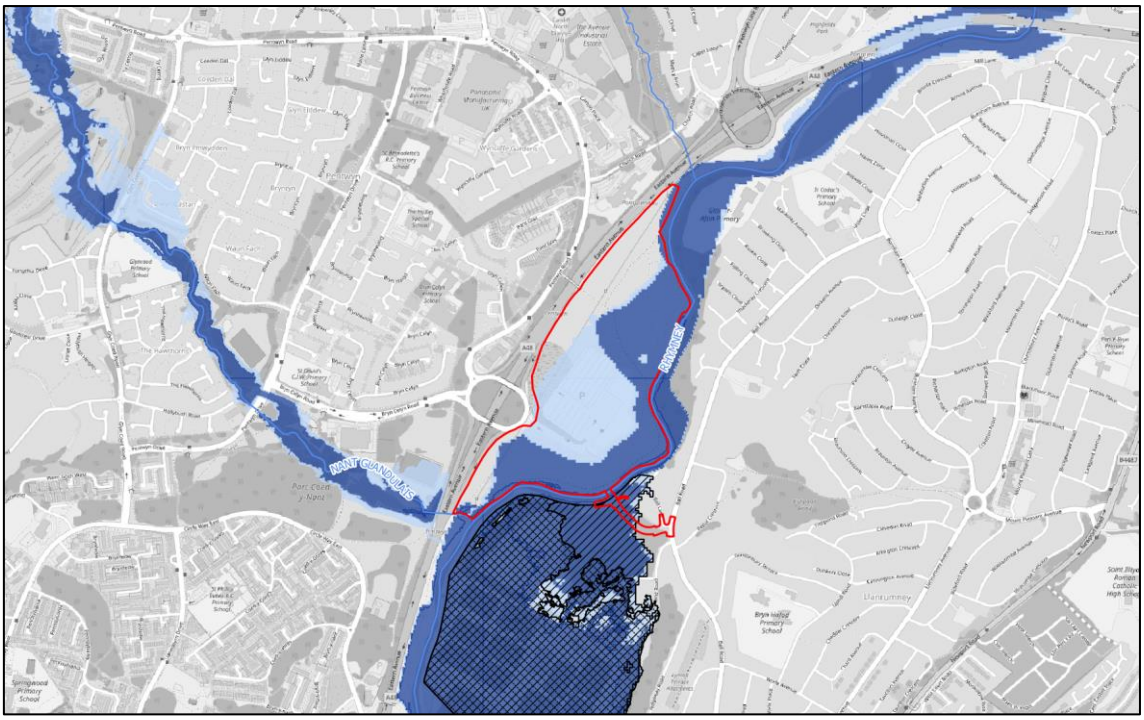
The majority of the site is considered to have an elevated risk of flooding, emanating from the Rhymney River on its eastern boundary. This section first considers the key online flood maps[1], followed by an assessment against the current TAN15.

Reference to the NRW Flood Zone Map, below, shows that the proposed development currently lies mostly within Flood Zones 2 and 3, with limited areas along the north-west site boundary within Flood Zone 1. Flood Zone 3 is the area that NRW envisage would flood with an annual probability of greater than 1% from fluvial sources with an allowance for climate change. Flood Zone 2 classifies areas outside of Flood Zone 3, which NRW predict would flood with an annual probability of greater than 0.1% from either fluvial, tidal sources or both sources with an allowance for climate change. Flood Zone 1 defines areas typically considered as having an annual probability of flooding of less than 0.1% from either fluvial, tidal or both sources with an allowance for climate change. This indicates that the site is currently at a medium to high risk of flooding from the nearby main river, the Rhymney River, which borders the site to the east.

Due to the site's close proximity to the Rhymney River, it may be reasonable to assume that flood levels along the eastern boundary of the site would be dominated by the level of the main river. The area identified as Flood Zone 2 is broadly consistent with the extents of the existing Park and Ride development.

The NRW Flood Zone Map is replicated in Figure 4 below.

[1] Contains Natural Resources Wales information © Natural Resources Wales and database right. All rights reserved. Some features of this information are based on digital spatial data licensed from the UK Centre for Ecology & Hydrology © UKCEH. Defra, Met Office and DARD Rivers Agency © Crown copyright. © Cranfield University. © James Hutton Institute. Contains OS data © Crown copyright and database right.



Flood Zone 3 (>1% chance of flooding, including climate change)

Flood Zone 2 (>0.1% chance of flooding, including climate change)

Flood Zone 1 (<0.1% chance of flooding, including climate change)

Areas Benefitting from Flood Defences (Rivers)

Areas Benefitting from Flood Defences (Sea)

Areas Benefitting from Flood Defences (Rivers and Sea)

Figure 4: NRW Flood Zone Map

Main Rivers

The Rhymney River / Afon Rhymni is a main river, works effecting its main channel and its floodplain will, other than for specific exemptions, require an environmental permit from NRW, this typically requires a standard easement from the top of the riverbank for maintenance (approximately 8 m).

As identified earlier in this document, the eastern site boundary runs parallel to the bank of the River Rhymney, which is classified as a main river. Due to this close proximity, the majority of the site is currently shown to be at medium – high risk of flooding from the Rhymney River, located within Flood Zones 2 and 3. The topography of the land within the site boundary is such that it slopes from the western boundary of the A48 to the bank of the Rhymney River along the eastern boundary of the site. There are areas along the western boundary of the site that are shown within Flood Zone 1, at very low risk of fluvial flooding.

BLOCKAGES

Hydraulic modelling undertaken for the previous planning application considered blockages at the proposed structure, given the changes in the proposed development these will need to be re-simulated and the results analysed. At this stage the required simulations are not anticipated to require revision (excepting the inclusion of climate change in line with the new TAN15) and the resultant effects are also anticipated to be of a similar nature. This will be reported following the conclusion of the ongoing flood study.

ORDINARY WATERCOURSES

There is a surface water feature within the development site. Historic maps reviewed to date appear to suggest that this locally arises from Cross Covert. It is likely that this feature is considered to be an Ordinary Watercourse. Ordinary Watercourses are the responsibility of the Lead Local Flood Authority (LLFA), however as there is a general presumption against culverting, these should be kept open except in the case of access. Works effecting ordinary watercourses typically require an ordinary watercourse consent from the LLFA. The design should also include, where possible, a suitable buffer to reduce the impact of localised flooding from these features, allow adequate maintenance, and also to provide opportunity for ecological and water quality improvements. NRW's surface water flood maps suggest that these features do not pose a significant risk to the site.

EXISTING (FLUVIAL) FLOOD DEFENCES

It is understood that the existing flood defences on the southern bank of the river may be subject to a potential managed realignment (south of Llanrumney Fields) which is under active consideration by Cardiff Council and NRW. The intent of this scheme would be to potentially provide space for salt marsh to develop over the medium to long-term. Should this managed realignment progress, it may provide additional floodplain capacity and, if any effect is anticipated for the development site, it is likely to be a reduction in flood risk.

On review of the details of the existing defences along the southern bank (left hand) of the river, it is understood that alongside the site, their design standard of protection (SoP) is the 75 year return period (1.3 % AEP) and they are considered to be in Fair condition, based on data dated 2017. They are not understood to provide any direct benefit to the site.

Tidal & Overtopping

Currently, the southern end of the site is shown to be marginally encroached by the extreme flood area (Flood Zone 2) identified to be at risk of tidal flood risk within the Natural Resources Wales Flood Map for Planning. It is unlikely, given the proposed levels of this portion of the site that there is a significant risk of flooding from this source. Given the nature of tidal water it is unlikely that any significant displacement of flood water would result from any ground raising in this area. It is noted that the Shoreline Management Plan (SMP) policy is to hold the line across all epochs.

Pluvial & Surface Water Risk

The NRW Flood Risk Assessment Map, for 'Flood Risk from Surface Water and Small Watercourses', identifies the proposed development area to be located largely in a low surface water flood risk zone, as shown in Figure 5 below. The mapping shows that there are limited areas at risk of surface water flooding within the site, all of which are locally arising. Due to the fact that these areas comprise minor, isolated pockets of flood risk, it may be reasonable to assume that these are not consistent with significant overland flow paths on site and these areas are a result of low spots of topography where surface water ponding occurs. The potential exception to this is the surface water risk around the southern approach of the proposed viaduct at Ball Lane.

Whilst the surface water risk could be amplified due to the proposed increase in impermeable areas, the drainage strategy/design will address the residual risk of surface waters arising on site. It will ensure that there is no unacceptable increase in risk to users of the site or third parties and to support this will identify the post development surface water exceedance pathways. Over the east bank of the Rhymney River a surface water flowpath is observed (on the NRW mapping) emanating from Fishpond Wood, this flowpath

mostly follows an existing minor watercourse which is understood to be culverted under Pepys Crescent which appears to have been excluded from the mapping. Therefore, based on the available information, this assessment of flood risk is likely to be significantly overestimated. It is noted however that the works associated with the bridge approach could intercept this flowpath were it to establish and would divert it away from the Cardiff Living Scheme and either into its associated riparian buffer feature or via the proposed approach road's land drainage system into the Rhymney River at the controlled discharge rate. In this case, assuming the acceptability of the drainage strategy report to the Sustainable Drainage Systems Approving Body (SAB) and the Lead Local Flood Authority and noting the pluvial and surface water risk is separate from Ordinary Watercourses, the risk from this source may be considered low.

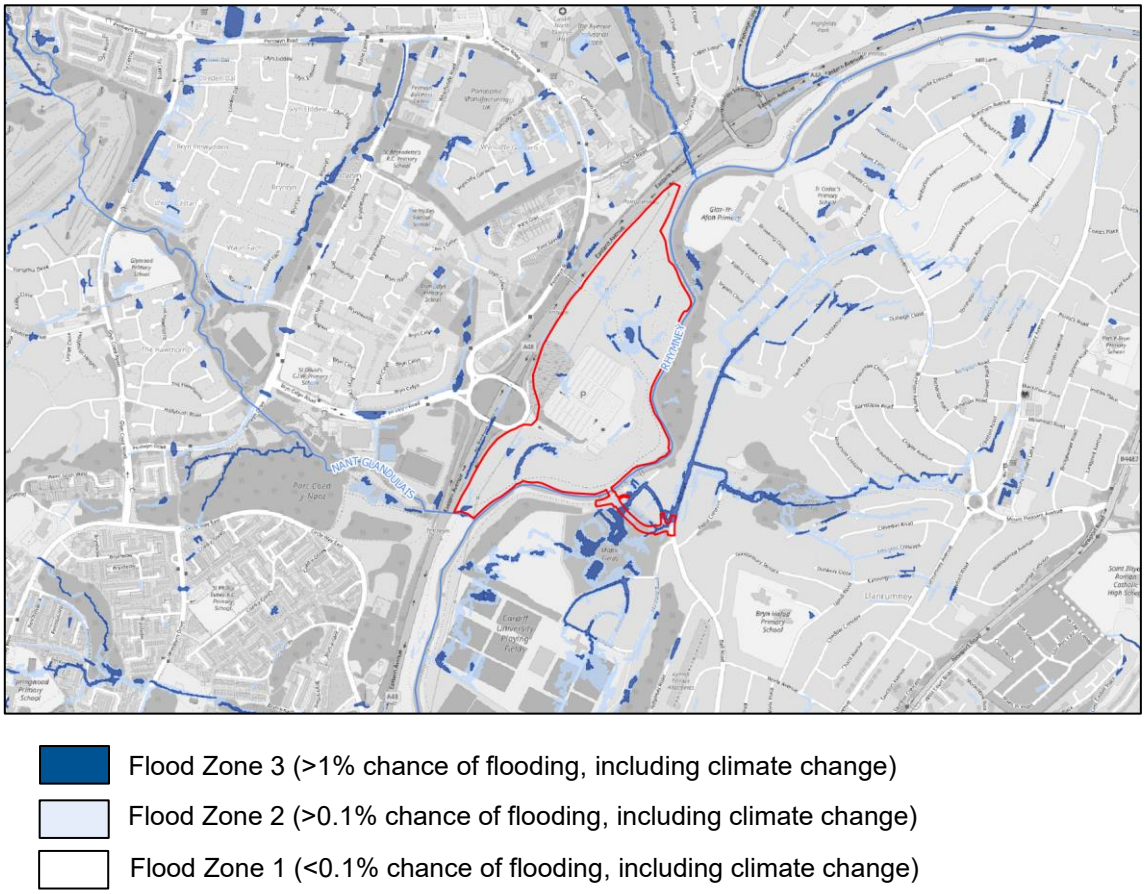


Figure 5: NRW Risk of Flooding from Surface Water and Minor Watercourses

Access & Egress

Safe access and egress are typically required for developments. Given the design intent is to raise the access above the design and extreme fluvial event it may be considered that access and egress will not be unacceptably compromised. This is subject to the findings of an ongoing flood study which will analyse the access during the extreme (0.1% annual exceedance probability event with allowance for climate change) in suitable detail.

Flood Compensation & Third-Party Effects

The existing site is at risk of fluvial flooding and as such any increase in footprint or ground raising could displace flood water. Based on the findings of the ongoing flood study, ground levels will be raised to reduce

flooding to a manageable level. Without mitigation this would consequently increase flood levels locally; however, following proposed mitigation measures currently being explored such as a cantilever on Plot 8 (southern area) and ground lowering west of, but not on, the plot containing the proposed onsite substation, alongside the results from the previous flood model study it is anticipated that any detriment to flood risk will (as previously identified in the prior planning application) occur within land under the ownership of Cardiff Council and may therefore be considered suitable if they consider that the change in risk is acceptable. This will need to be evidenced to the satisfaction of NRW and reported in an updated Hydraulic Modelling Report.

Despite the fact that there is a large area of existing hardstanding surface within the site boundary, the proposals will result in an increase of impermeable area; however, SuDS features included within the Drainage Strategy will ensure no unacceptable increase in runoff rates and will convey surface water flows safely around the site.

Groundwater Flood Risk

The site is not within a groundwater source protection zone. The Cardiff Flood Risk Management Plan[2] identifies that: '*There is no information on historic groundwater flooding which suggests that the risk of groundwater flooding is low in Cardiff.*' Similarly, the Catchment Flood Management Plan[3] provides additional information on groundwater flood risk: 'We do not consider sewer flooding or groundwater flooding as significant catchment-scale issues in the Eastern Valleys, but may be significant at a local scale.' and:

> *'In South Wales, groundwater flooding is usually associated with rising minewater in areas where the coal measures have been worked. We believe that the worked coal measures within the Eastern Valleys catchments are completely recovered with no significant areas of rising minewater.*
>
> *The information available on groundwater movement in Wales is sparse but taking into account the underlying geology, we do not consider groundwater flooding as a large enough risk in the Eastern Valleys to warrant further consideration in the CFMP.'*

The groundwater table would be anticipated to be dominated locally by the Rhymney River. The proposed development does not include any basements or sublevels. Therefore, the risk of groundwater flooding is considered minimal, particularly given the elevated Finished Flood Levels (FFLs) which will be set to protect against both fluvial flooding and the surface water exceedance flow routes through the site. This conclusion should, however, be revisited should any ground investigation works undertaken as part of the design process contradict them and additional mitigation included if necessary.

Reservoir & Infrastructure Flood Risk

The NRW Detailed Flood Risk Map (Reservoir Flood Risk) illustrates that the proposed development lies partially within the zone of influence from nearby reservoirs. The mapping data suggests that the Nant Glandulas and thence the Rhymney River act as a conveyance channel in the event of reservoir flooding from the nearby Llanishen Reservoir, which is located approximately 2.3 km north-west of the site boundary, due to the fact that the flood zone follows the route of the river.

It is noted that a flood event will only occur as a result of the failure or breach of the reservoir, resulting in flows connecting into the Rhymney River. Whilst this is noted as a risk, given the legally required inspection and maintenance regime for reservoirs in the UK, the risk is considered residual and, unless there are any known issues with this reservoir, is usually considered to be acceptable.

[2] Brain, D et al (Dec 2015) *Cardiff Flood Risk Management Plan*, Cardiff Council, Cardiff UK. Ref: 5138009/DG01
[3] Environment Agency Wales (March 2009) *Eastern Valleys Catchment Flood Management Plan* Environment Agency Wales, Cardiff UK.

LAKES & PONDS

Based on a review of mapped data the site is not expected to be at any significant risk of flooding from ponds, lakes or other such bodies of water. Lakes are identified upstream of the site on the Nant Mwlan and also at Cefn Mably and Rhymney Valley Nursery; however, given their size and distance from the site they are not anticipated to contain a sufficient volume of water in comparison to the design flows of the Rhymney River that they would pose a significant risk. Similarly, a number of ponds are located further upstream within the Rhymney catchment but given the increasing distance would have to be considered as reservoirs in order to retain sufficient water to be considered as a risk.

CANALS

There are no known canals within the vicinity of the site and therefore flood risk from canals is concluded to be negligible.

SEWERS

Residual risks of flooding from artificial flooding remain as subject to detailed design there may be a risk of flooding from a burst water main / foul sewer, although this would be mitigated by the fluvial mitigation requirements as well as the drainage strategy and its exceedance flowpaths. Once the foul and surface water Drainage Strategy is approved by the SAB and statutory undertakers this risk can be considered residual.

COMPLIANCE WITH TAN15

Under TAN15, general commercial developments are classified as Less Vulnerable, that notwithstanding, given the site's proposed use, the development will target a lower level of flood risk than is typically required for this category.

The Flood Map for Planning, on which TAN15 is founded, shows that the site is located within Flood Zone 3. Key items for such a development include:

- Should not:
  - Flood in the design event (TAN15 Figure 5)
  - reduce the area's ability to absorb flood water, nor
  - cause problems with flooding elsewhere.
- Consider a range of climate change allowances (TAN15 ¶4.3)
- Will include flood resilience
- Will meet tolerable conditions (TAN15 §11)
- Considered essential to the Development Plan Strategy to regenerate an existing settlement or achieve key economic or environmental objectives.

N.B. Tolerable conditions are for the extreme event. This is the event with a 0.1% chance of flooding, including climate change and may include consideration of infrastructure failure or blockages, to the satisfaction of NRW, as considered appropriate for the site and development.

Tolerable Conditions are:

- Flood depths are < 600 mm in the extreme event
- Flood Velocities are < 0.3 m/s for less vulnerable development

Discussing each item in turn:

- Should not Flood in the design event

Similar to the previously referenced planning application, the proposed development is predicted to remain dry in the design flood event.

- Should not reduce the area's ability to absorb flood water

As part of the redevelopment of the site, a surface water drainage strategy for the site is being defined, this will manage the risk of surface water flooding. Please refer to the Drainage Strategy Report (ref: TBC).

- Should not cause problems with flooding elsewhere.

The surface water drainage strategy will ensure that there is no unacceptable increase in surface water runoff. The proposed development footprint, could displace a volume of water; however, it is noted that proposed mitigation measures currently being explored such as a cantilever on Plot 8 (southern area) and ground lowering west of the onsite substation, alongside the results from the previous flood model study it is anticipated that any detriment to flood risk will occur within land under the ownership of Cardiff Council and may therefore be considered suitable if they consider that the change in risk is acceptable. This will need to be evidenced to the satisfaction of NRW and reported in an updated Hydraulic Modelling Report.

- Should consider a range of climate change allowances (TAN15 ¶4.3)

The ongoing flood model study will consider and report on both the central estimate and upper end estimates of climate change for fluvial flooding.

- Will include flood resilience

A Level 3 FCA will be produced following the conclusion of the hydraulic modelling study, it will include a number of flood resilience measures for consideration in the design, as appropriate.

- Will meet tolerable conditions (TAN15 §11)

Assuming a Less Vulnerable development and given the proposals, in the extreme fluvial event (clear defended) it is anticipated that the development will meet tolerable conditions. This will be confirmed following the conclusion of the flood modelling study.

- Considered essential to the Development Plan Strategy to regenerate an existing settlement or achieve key economic or environmental objectives.

The development proposal could be considered as supporting the Cardiff Local Development Plan by providing infrastructure and evidenced economic needs as set out in KP9 especially with regards to ICT being considered as a key market sector. This will be explored further as required to support the development but is considered as sufficiently justified at this stage.

ENVIRONMENTAL STATEMENT

Until the conclusion of the hydraulic modelling study currently being undertaken for the site the effects and potential impacts of the scheme cannot be fully assessed. It is noted however, that the Environmental Statement for the prior planning application was able to find that the effects were likely acceptable, a similar approach will be followed and concluded for this development, however the findings of the flood study cannot be pre-empted.

CONCLUSIONS & RECOMMENDATIONS

This Level 1 Flood Consequence Assessment indicates that the proposed development could be developed safely, subject to the findings of the ongoing hydraulic model study, without exposing the development to an unacceptable degree of flood risk or increasing the flood risk to non-consenting third parties. This assessment indicates that the proposed development may be considered to be in an appropriate location for the proposed land uses in accordance with the vulnerability classifications of TAN15.

The previous sections of this FCA describes the work to be undertaken and the mitigation that needs to be embedded within the scheme to ensure that it is compliant with TAN15, these mitigation measures are:

- The proposed development consists solely of Less Vulnerable development classifications. Furthermore, the scheme does not include any basements or sub-levels.
- All proposed building units and the majority of the proposed development area is not predicted to flood in the design event (1%CE AEP) due to raised ground levels.
- The development footprint is proposed to be raised such that it meets the acceptability criteria set out the extreme flood event (0.1%CE AEP).
- Mitigation measures over and above the raised footprint should be considered to reduce both the risk and the impact of flooding, where appropriate, with passive measures considered preferentially over active measures. A flood exclusion strategy up to a depth of 600 mm is recommended for consideration in exceedance events beyond the extreme flood event (0.1%CE AEP). Additional measures could include but are not limited to:
  - Flood-proof doors or inbuilt demountable defence attachment/anchor points,
  - Ventilation should be sealable or self-sealing up to the extreme event plus freeboard,
  - Non-return valves fitted to drains and water in/outlet pipes as appropriate,
  - Ground floor walls dry lined using lime based plaster and draining cavities as appropriate,
  - Ground floors to be tiled / hard flooring as opposed to fitted carpets,
  - Ground floors to include raised electrical sockets,
  - Vulnerable equipment kept above the extreme flood level with a freeboard allowance.
  - The structural and façade design of the whole development should suitably account for the predicted depths external to the building footprint.
- The surface water drainage strategy will be developed to the satisfaction of the SAB and will ensure that the continued conveyance of surface water runoff including from Cross Covert is accommodated without increasing the risk of flooding.
- The foul water strategy will be developed to ensure that there is no undue risk of flooding from this source.
- The Developer will obtain the appropriate consents and permits that will be required from NRW, the SAB and the Lead Local Flood Authority.
- A site specific Flood Action Plan should be developed. This should include clear responsibilities and chain of command including procedures for confirming actions and coping with absences. It should give due consideration to evacuation and safe reoccupation. It is suggested that warning notices should describe flood the risk and any flood access constraints.
- Anyone responsible for the site, the business(es) or employees should be encouraged to sign up to flood warnings direct.
- The WFDa will need to be written to support the full application.
- The Environmental Statement will need to be written following the conclusion of the hydraulic modelling study and based on its findings.
- The hydraulic modelling study will need to conclude to the satisfaction of NRW and conclude whether the proposed development can be made acceptable under TAN15, this will require a Level 3 FCA and Hydraulic Modelling Report.
- The economic justification for locating the proposed development in Flood Zone 3 should be developed.