FLOOD CONSEQUENCE ASSESSMENT

216-XOS-XX-XX-RP-C-5000

Wrexham Maelor Hospital, Croesnewydd Road, Wrexham, LL13 7TD

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Report Limitation

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1 SYNOPSIS

The site would be expected to remain dry in all but the most extreme conditions. Providing the recommendations made in this Flood Consequence Assessment (FCA) are instigated, flood risk from all sources would be minimised, the consequences of flooding are acceptable and the development would be in accordance with the requirements of Technical Advice Note 15 Development and Flood Risk (TAN15).

This FCA demonstrates that the proposed development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of TAN15. The development should not therefore be precluded on the grounds of flood risk.

2 BRIEF

This Flood Consequence Assessment (FCA) has been prepared by XOsquare Limited at the request of Betsi Cadwaladr University Health Board for the proposed development at Wrexham Maelor Hospital, Croesnewydd Road, Wrexham, LL13 7TD. This FCA has been carried out in accordance with guidance contained in the Technical Advice Note 15 Development and Flood Risk (TAN15) and associated Flood Map for Planning.

2.1 Scope of Works

This FCA identifies and assesses the risks of all forms of flooding to and from the development and demonstrates how these flood risks will be managed so that the development remains safe throughout the lifetime, taking climate change into account.

It is recognised that developments which are designed without regard to flood risk may endanger lives, damage property, cause disruption to the wider community, damage the environment, be difficult to insure and require additional expense on remedial works. The development design should be such that future users will not have difficulty obtaining insurance or mortgage finance, or in selling all or part of the development, as a result of flood risk issues.

2.2 Technical Advice Note 15 (TAN15)

One of the key aims of TAN15 is to ensure that flood risk is taken into account at all stages of the planning process; to avoid inappropriate development in areas at risk of flooding and to direct development away from areas of highest risk.

It advises that where new development is exceptionally necessary in areas of higher risk, this should be safe, without increasing flood risk elsewhere, and where possible, reduce flood risk overall. A risk-based approach is adopted at stages of the planning process, applying a source pathway receptor model to planning and flood risk. To demonstrate this, an FCA is required and should include:

- whether a proposed development is likely to be affected by current or future flooding from all sources;
- whether it will increase flood risk elsewhere;
- whether the measures proposed to deal with these effects and risks are appropriate; and
- satisfy the justification test, including the acceptability of consequences.

A revised TAN15 has recently been implemented. This is supported by the new Flood Map for Planning (FMfP), which includes climate change information to show how this will affect flood risk extents over the next century. It shows the potential extent of flooding assuming no defences are in place.

2.3 Report Structure

This FCA has the following report structure:

- Section 3 describes the location area and the existing and proposed development;
- Section 4 outlines the flood risk to the existing and proposed development;
- Section 5 outlines mitigation measures used to reduce the overall level of flood risk;
- Section 6 provides details of the Acceptability Criteria; and
- Section 7 presents a summary and conclusions.

3 LOCATION & DESCRIPTION

3.1 Site Location

The site is located at Wrexham Maelor Hospital, Croesnewydd Road, Wrexham, LL13 7TD (see Figure 1). The National Grid Reference (NGR) of the site is 332535, 350269.

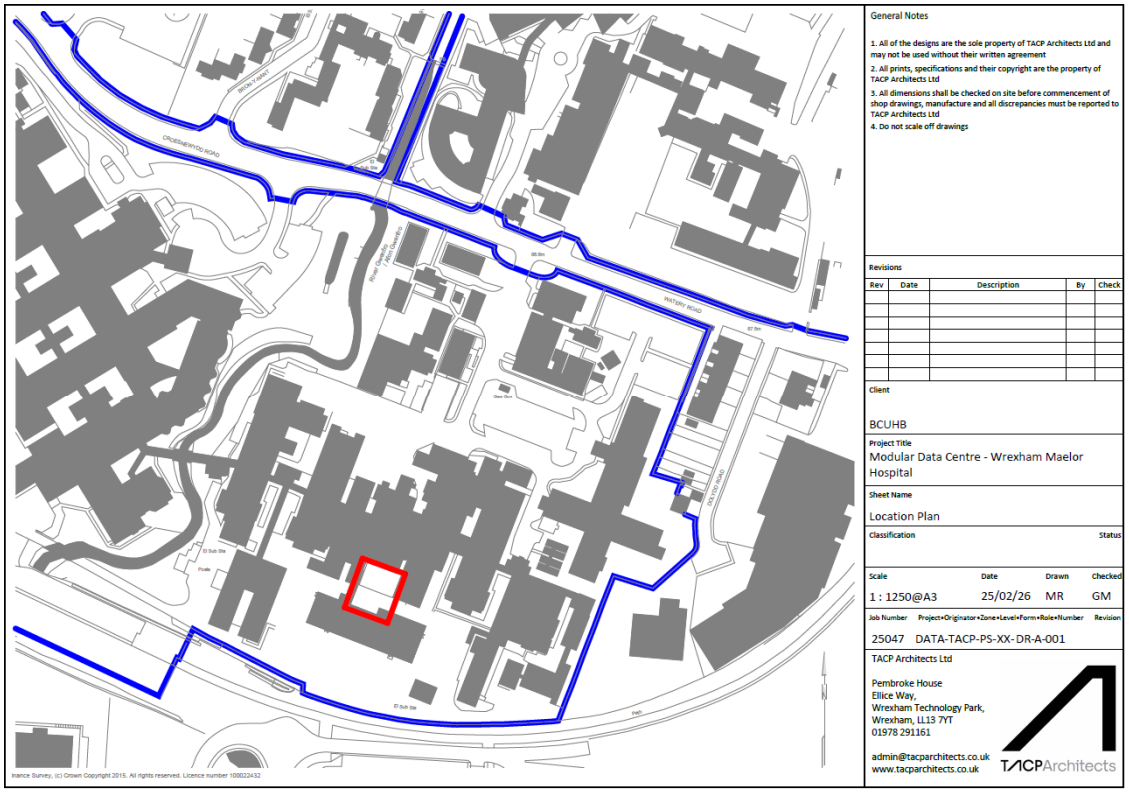


Figure 1 – Site Location

3.2 Existing Development

The site is currently predominantly a grassed area with a walkway between buildings (see Appendix A).

3.3 Proposed Development

The proposals are for a modular building to be used as a data centre and the installation of a covered walkway (see Appendix A). The building will be raised a minimum of 150mm above the existing ground levels. The building will not be permanently occupied and will be a temporary structure.

3.4 Ground Levels

The site is relatively level with a ground level of 87.68mAOD.

3.5 Catchment Hydrology

The River Gwenfro is located approximately 80m to west of the site flowing in a northerly direction

3.6 Ground Conditions

The British Geological Survey (BGS)[1] map shows that the bedrock deposits consist of the Pennine Lower Coal Measures Formation and Pennine Middle Coal Measures Formation (Undifferentiated) - mudstone, siltstone and sandstone. These sedimentary rocks are fluvial, palustrine and shallow-marine in origin. They are detrital, forming

[1] https://geologyviewer.bgs.ac.uk/?_ga=2.66736489.617109230.1694767835-1467391725.1694767835

deposits reflecting the channels, floodplains and deltas of a river in a coastal setting (with periodic inundation from the sea). The superficial deposits consist of Glaciofluvial sheet deposits, Devensian - sand and gravel. These sedimentary deposits are glaciofluvial in origin. They are detrital, generally coarse-grained, they form beds, channels, plains and fans associated with meltwater.

Information from the National Soil Resource Institute[2] details the site area as being situated on freely draining slightly acid loamy soils.

[2] https://www.landis.org.uk/soilscapes/

4 FLOOD RISK

4.1 Sources of Flooding

All sources of flooding have been considered, these are; fluvial (river) flooding, tidal (coastal) flooding, groundwater flooding, surface water (pluvial) flooding, sewer flooding and flooding from artificial drainage systems/infrastructure failure.

4.2 Natural Resources Wales

Information regarding the current flood risk at the application site, local flood defences and flood risk has been obtained from Natural Resources Wales, which is the most up to date at the time of this FCA. Natural Resources Wales has provided modelled results from the River Gwenfro Model Update Final Report December 2016 which was undertaken on behalf of Wrexham Borough Council.

4.3 Climate Change

Projections of future climate change, in the UK, indicate more frequent, short-duration, high intensity rainfall and more frequent periods of long duration rainfall. Guidance included within TAN15 recommends that the effects of climate change are incorporated into FCA. Recommended precautionary sensitivity ranges for peak rainfall intensities, peak river flows and sea level rise are outlined in the following documents CL-03-16 - Climate Change Allowances for Planning Purposes[3], Flood Consequence Assessments: Climate change allowances[4] and Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales[5].

The 9th of January 2014 Welsh Government letter to all Chief Planning Officers (CPO) in Wales and CL-03-16 - Climate Change Allowances for Planning Purposes clarifies and refers to the Natural Resources Wales recommendations that the lifetime of development for residential development is 100 years, and for other development it is considered to be 75 years. Table 1 show the peak river flow allowances by river catchment therefore, the fluvial design event is the 1 in 100 year (+25%) event.

Table 1 – Peak River Flow Allowances by River Catchment

Catchment	Allowance Category	2020s	2050s	2080s
Dee	Upper	+15%	+30%	+50%
	Central	+10%	+15%	+25%

Projections of relative mean sea level rise for each epoch (period of time) is provided for the Welsh coastline in Table 2. These projections are consistent with the latest global predictions for sea level rise therefore, the tidal design event is the 1 in 200 year in 2101 event.

Table 2 – Sea Level Rise by River Catchment

Period	Allowance (percentile)	Mean Sea Level Rise (m) by 2100	Mean Sea Level Rise (m) by 2130
Denbighshire	95th	1.05	1.55
	70th	0.78	1.13

4.4 Natural Resources Wales Flood Map for Planning

The FMfP represents the best available information on flood risk. The FMfP shows that the site is located within the following flood zones:

- Rivers: Flood Zone 2 (see Figure 2).

[3] https://gov.wales/sites/default/files/publications/2018-11/cl0316-climate-change-allowances.pdf
[4] https://gov.wales/sites/default/files/publications/2018-11/flood-consequence-assessments.pdf
[5] https://gov.wales/sites/default/files/publications/2021-09/adapting-to-climate-change-guidance-for-flood-and-coastal-erosion-risk-management-authorities-in-wales.pdf

- Sea: Flood Zone 1 (see Figure 2).
- Surface water and small watercourses: Flood Zones 1 and 3 (see Figure 3).

Table 3 provides details of the FMfP Flood Zones. The proposed development is appropriate for this location.

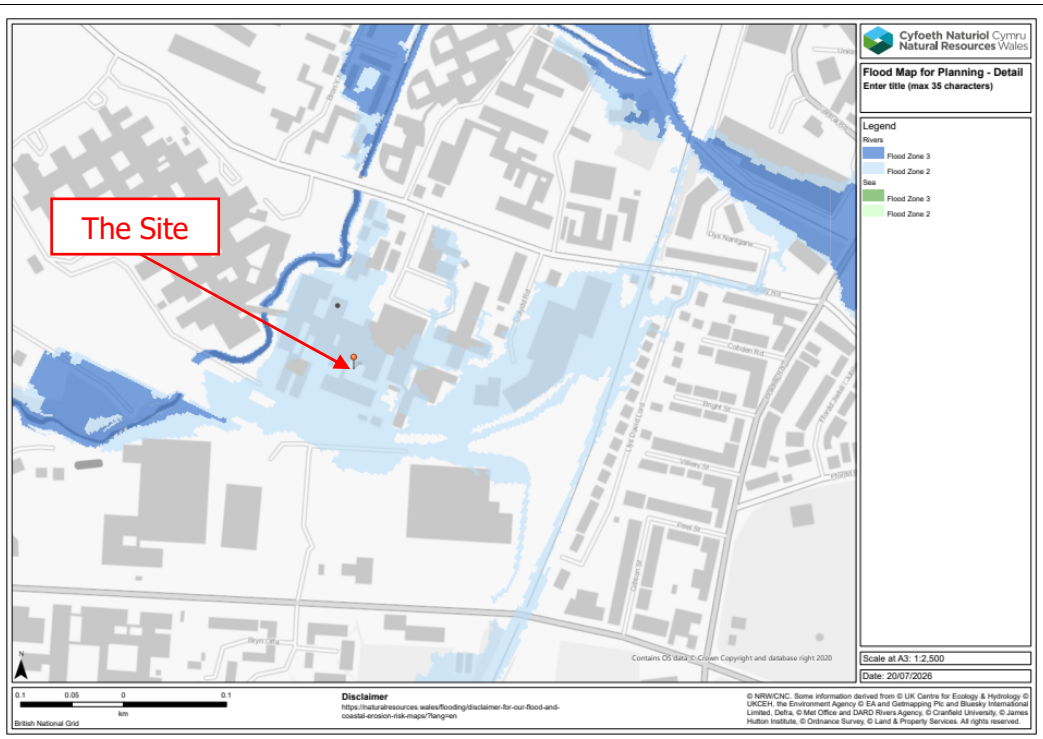


Figure 2 – Flood Map for Planning: Rivers & Sea

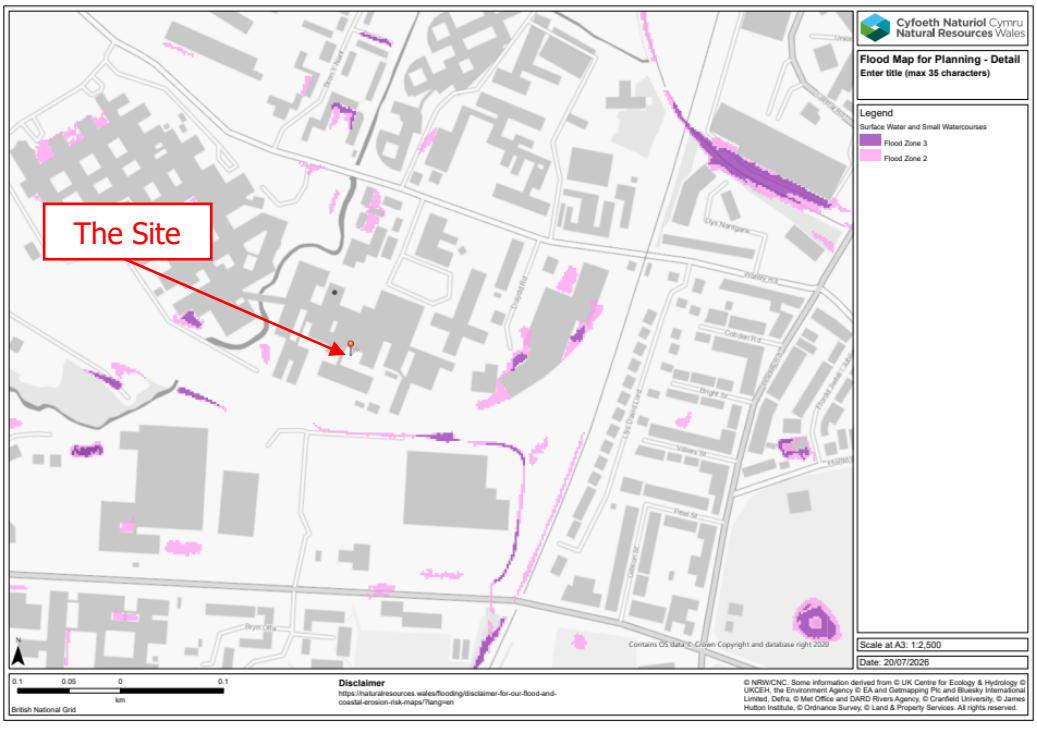


Figure 3 – Flood Map for Planning: Surface Water & Small Watercourses

Table 3 – Flood Map for Planning Flood Zones

Flood Zone	Explanation
Rivers - Flood Zone 2	Areas with 0.1% to 1% (1 in 1000 to 1 in 100) chance of flooding from rivers in a given year, including the effects of climate change.
Rivers - Flood Zone 3	Areas with more than 1% (1 in 100) chance of flooding from rivers in a given year, including the effects of climate change.
Sea - Flood Zone 2	Areas with 0.1% to 0.5% (1 in 1000 to 1 in 200) chance of flooding from the sea in a given year, including the effects of climate change.
Sea - Flood Zone 3	Areas with more than 0.5% (1 in 200) chance of flooding from the sea in a given year, including the effects of climate change.
Surface Water and Small Watercourses - Flood Zone 2	Areas with 0.1% to 1% (1 in 1000 to 1 in 100) chance of flooding from surface water and/or small watercourses in a given year, including the effects of climate change.
Surface Water and Small Watercourses - Flood Zone 3	Areas with more than 1% (1 in 100) chance of flooding from surface water and/or small watercourses in a given year, including the effects of climate change.

4.5 Flood Vulnerability

The proposals are for a modular building to be used as a data centre and the installation of a covered walkway. The building will not be permanently occupied and will be a temporary structure. Applying the Flood Risk Vulnerability Classification in Figure 4 of TAN15, the proposed use of the site is classified as 'less vulnerable'. Whilst the site lies within FMfP Flood Zone 2 for rivers, this FCA demonstrates that the consequences of flooding can be managed to an acceptable level for the proposed 'less vulnerable' use. Subject to the mitigation and management measures identified, the development is considered compliant with TAN15.

4.6 Existing and Planned Flood Defence Measures

The site is not protected against flooding by existing flood defence measures (see Figure 4). .

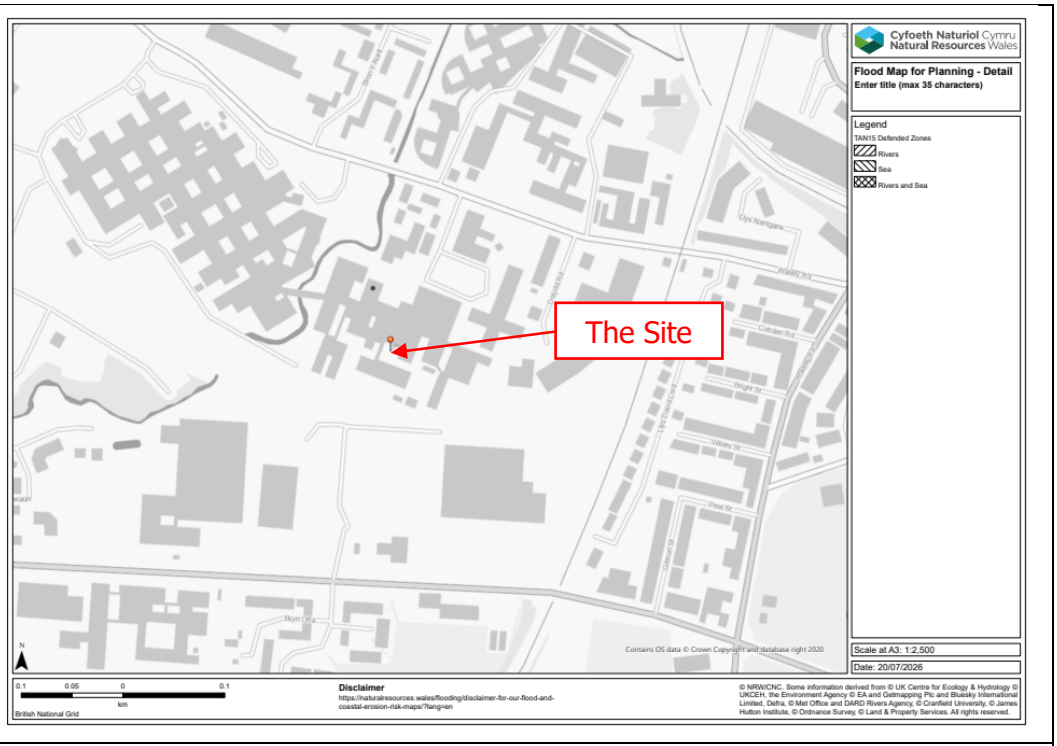


Figure 4 – TAN15 Defended Zones

4.7 Historic Flooding

The Natural Resources Wales historic flood map shows that the site has not historically flooded (see Figure 5). The British Hydrological Society "Chronology of British Hydrological Events[6]" has no information on flooding within the vicinity of the site. No other historical records of flooding for the site have been recorded. Therefore, it has been concluded that the site has not historically flooded in the recent past.

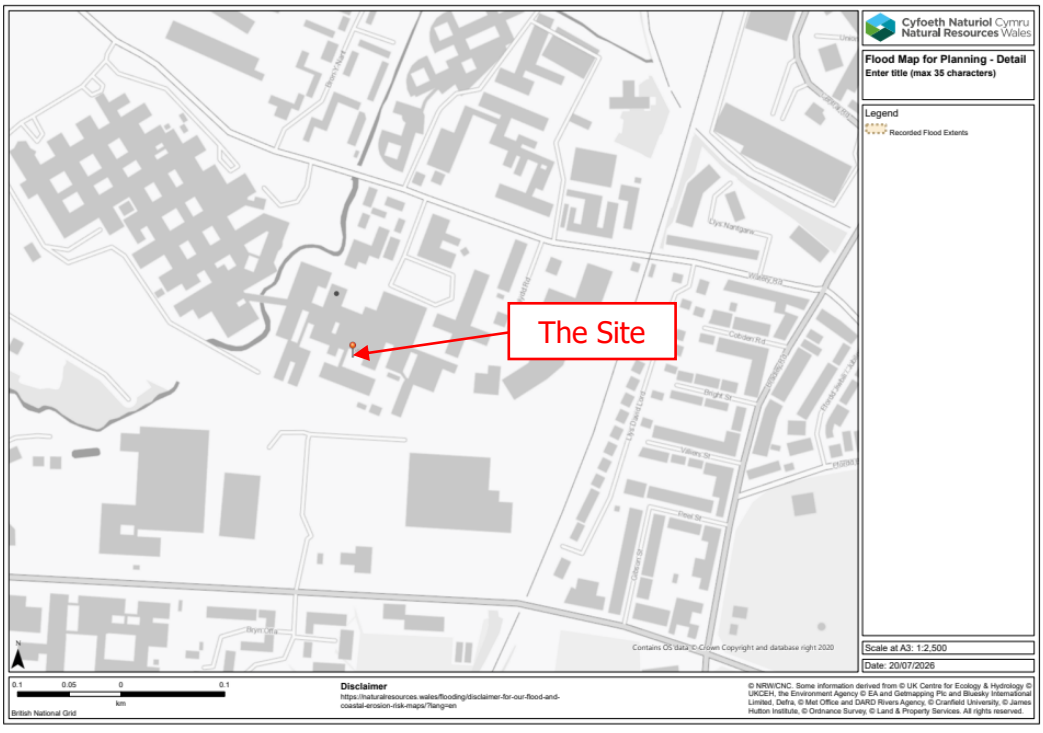


Figure 5 – Natural Resources Wales Historic Flood Map

4.8 Fluvial (river) Flooding

Fluvial flooding from the River Gwenfro poses the primary flood risk to the site.

Actual Existing Risk

Modelling undertaken for the River Gwenfro shows that the site will not be inundated with floodwater for all events up to and including the existing 1 in 100 year (+45%) and 1 in 1000 year events, as shown in Table 4, Figures 6 and 7. When taking into consideration events of a greater magnitude such as the existing 1 in 1000 year (+20%) event, analysis of the modelled data shows the site may be inundated with floodwater, to a water depth of 0.10m, as shown Figure 8.

These scenarios are considered to represent conservative, low-probability events and provide confidence in the existing situation. However, consistent with TAN15, the potential consequences of undefended and blockage scenarios are considered further as part of the residual assessment of flood risk set out below.

[6] https://cbhe.hydrology.org.uk/

Table 4 – Existing River Gwenfro Modelled Data

Return Period (years)	Water Level (mAOD)	Water Depth (m)	Water Velocity (m/s)	Hazard Rating
100	Dry	Dry	Dry	Dry
100 (+20%)	Dry	Dry	Dry	Dry
100 (+45%)	Dry	Dry	Dry	Dry
1000	Dry	Dry	Dry	Dry
1000 (+20%)	87.78	0.10	0.02	0.58

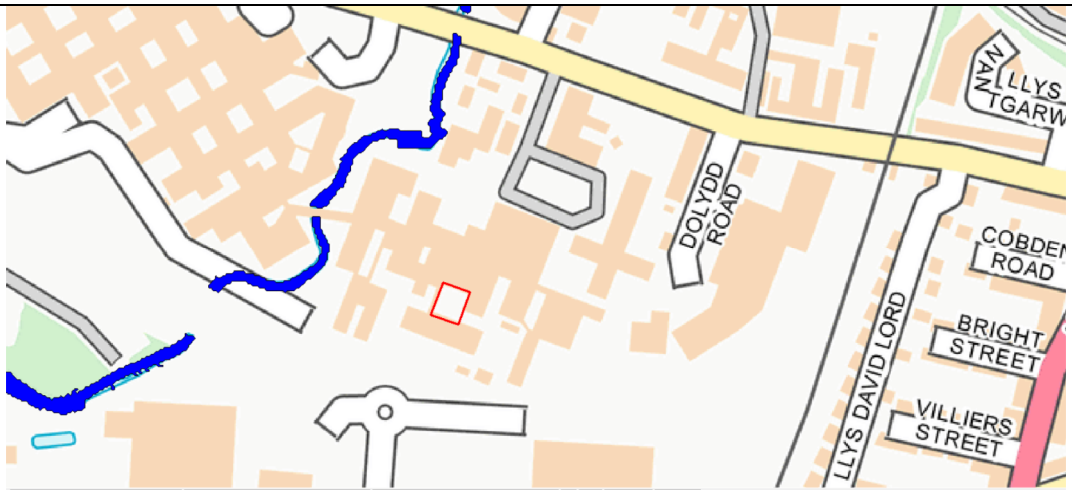


Figure 6 – As Existing 1 in 100 Year (+45%) Flood Extent



Figure 7 – As Existing 1 in 1000 Year Flood Extent

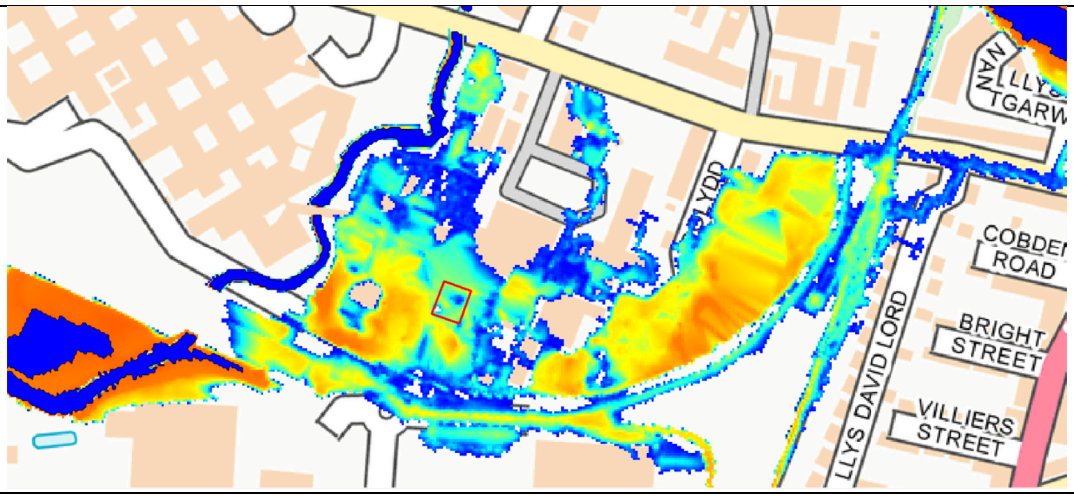


Figure 8 – As Existing 1 in 1000 Year (+20%) Flood Extent

Residual Undefended Risk

Modelling undertaken for the River Gwenfro shows that the site will not be inundated with floodwater for all events up to and including the undefended 1 in 100 year (+45%) and 1 in 1000 year events, as shown in Table 5, Figures 9 and 10. The site will be flood free during the undefended 1 in 100 year (+25%) event, which is the design event for the site. When taking into consideration events of a greater magnitude such as the undefended 1 in 1000 year (+20%) event, analysis of the modelled data shows the site may be inundated with floodwater, to a water depth of 0.10m, as shown Figure 11.

These scenarios are considered to represent conservative, low-probability events and provide confidence in the undefended situation. However, consistent with TAN15, the potential consequences of blockage scenarios are considered further as part of the residual assessment of flood risk set out below.

Table 5 – Undefended River Gwenfro Modelled Data

Return Period (years)	Water Level (mAOD)	Water Depth (m)	Water Velocity (m/s)	Hazard Rating
100	Dry	Dry	Dry	Dry
100 (+20%)	Dry	Dry	Dry	Dry
100 (+45%)	Dry	Dry	Dry	Dry
1000	Dry	Dry	Dry	Dry
1000 (+20%)	87.78	0.10	0.02	0.58

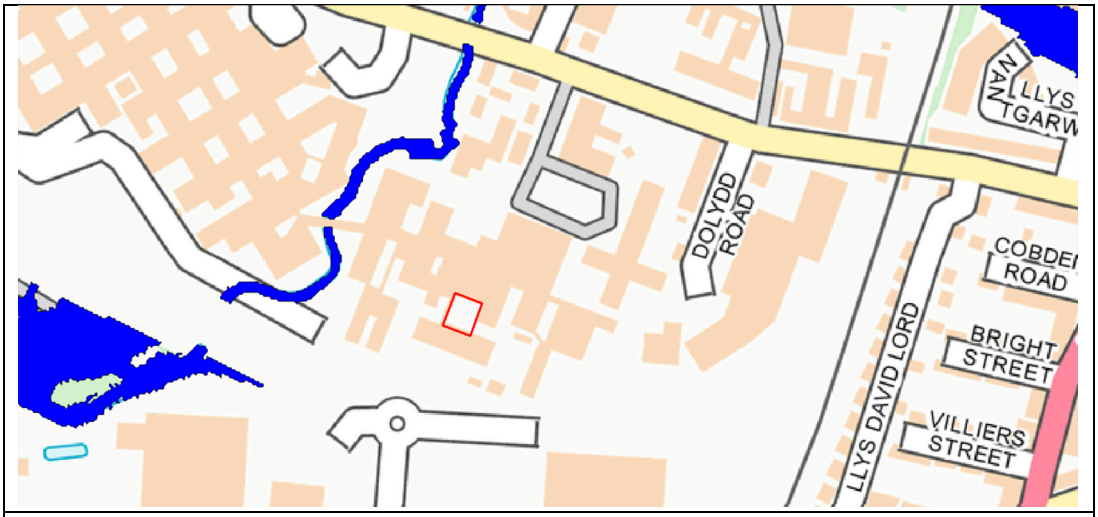


Figure 9 – Undefended 1 in 100 Year (+45%) Flood Extent

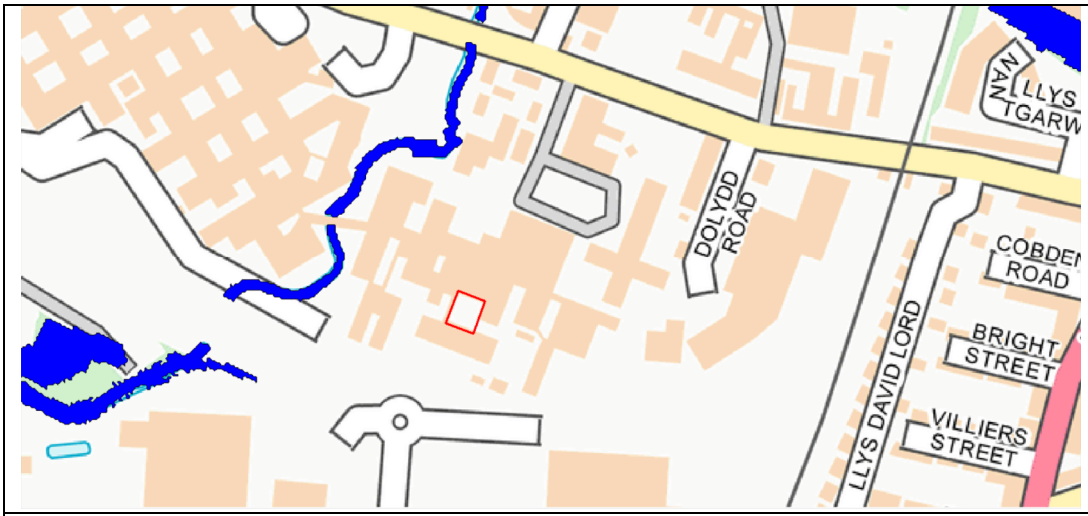


Figure 10 – Undefended 1 in 1000 Year Flood Extent

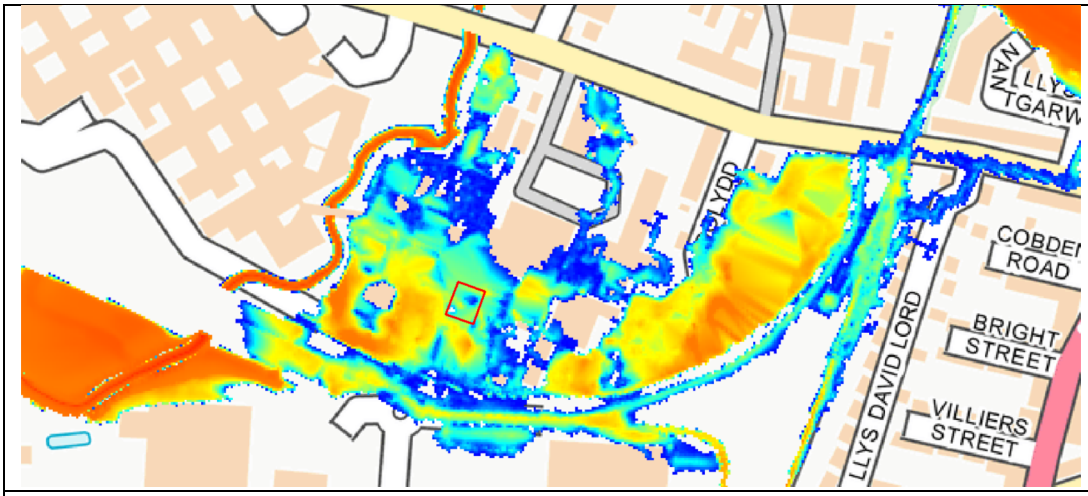


Figure 11 – Undefended 1 in 1000 Year (+20%) Flood Extent

Residual Blockage Risk

Modelling undertaken for the River Gwenfro shows that the site may be affected by a blockage of the hospital culvert (BLK3), as shown in Table 6, Figures 12 to 17. Analysis of the modelled data shows the site may be inundated with floodwater to low water depths with a maximum of a water depth of 0.33m. These scenarios are considered to represent conservative, low-probability events and provide confidence in the blockage situation.

Table 6 – Blockage Hospital Culvert River Gwenfro Modelled Data

Return Period (years)	Blockage Value	Water Level (mAOD)	Water Depth (m)	Water Velocity (m/s)	Hazard Rating
100 (+20%)	30%	87.70	0.07	0.07	0.53
1000	30%	87.84	0.21	0.07	0.60
100 (+20%)	67%	87.87	0.24	0.07	0.62
1000	67%	87.92	0.29	0.07	1.15
100 (+20%)	100%	87.93	0.30	0.07	1.16
1000	100%	87.96	0.33	0.10	1.18



Figure 12 – Blockage Low (30%) 1 in 100 Year (+20%) Flood Extent

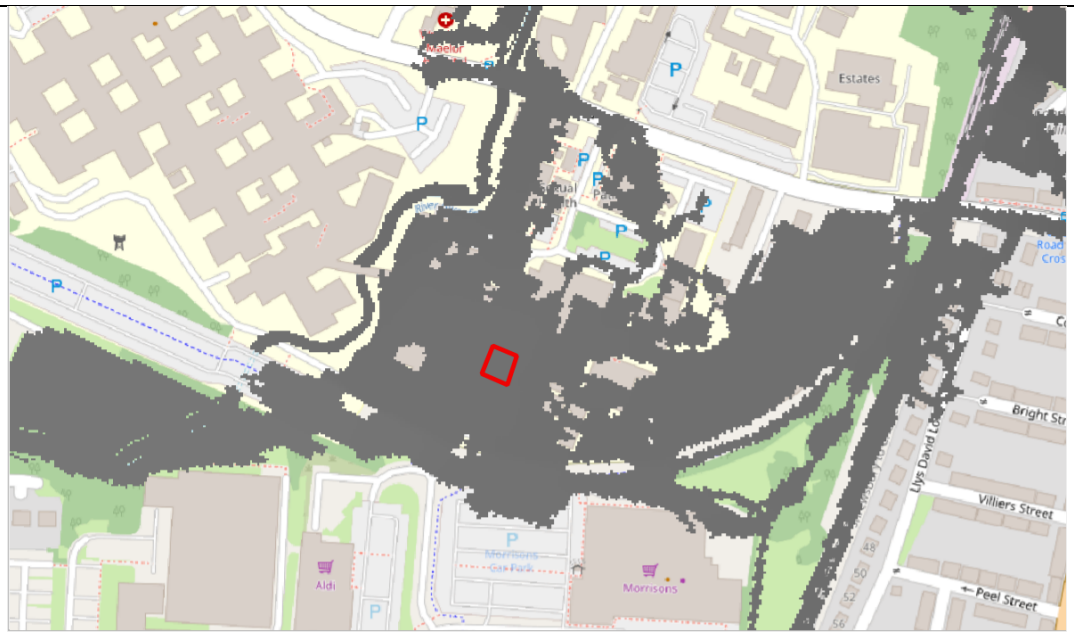


Figure 13 – Blockage Low (30%) 1 in 1000 Year Flood Extent



Figure 14 – Blockage Medium (67%) 1 in 100 Year (+20%) Flood Extent



Figure 15 – Blockage Medium (67%) 1 in 1000 Year Flood Extent



Figure 16 – Blockage High (100%) 1 in 100 Year (+20%) Flood Extent



Figure 17 – Blockage High (100%) 1 in 1000 Year Flood Extent

Summary

Fluvial flood risk at the Site is influenced by local topography. Any overbank flow would be expected to follow surrounding ground contours, with floodwaters routing across lower-lying areas of the floodplain rather than preferentially towards the site. Based on available flood mapping, historical records, and observed flood behaviour, inundation of the site would be expected to occur later than surrounding low-lying floodplain areas during extreme fluvial events.

The site is located within an area where the onset of fluvial flooding is typically gradual, consistent with the characteristics described in *Flood Risk Assessment Guidance for New Development – Phase 2 (FD2320/TR2)*. Flooding within the catchment is generally associated with low-intensity, long-duration rainfall events linked to frontal weather systems, typical of this region. As a result, the rate of floodwater rise is expected to be relatively slow.

Taking account of the scale and nature of the proposed development, the characteristics of the fluvial flooding source, and the findings of the modelling and historical evidence, fluvial flooding represents a material source of flood risk at the site. It is concluded that the risk of flooding from fluvial sources is considered to be of a low significance and the consequences will be acceptable for 'less vulnerable' development in accordance with TAN15. The flood risk from all sources will be further mitigated by using a number of risk management measures to manage and reduce the overall flood risk at the Site (see Section 5).

4.9 Tidal (coastal) Flooding

The site is not located within the vicinity of tidal flooding sources (see Figure 2) and the risk of tidal flooding is considered to be not significant.

4.10 Groundwater Flooding

Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

Groundwater flooding tends to occur sporadically in both location and time. When groundwater flooding does occur, it tends to mostly affect low-lying areas, below surface infrastructure and buildings (for example, tunnels, basements and car parks) underlain by permeable rocks (aquifers).

Site ground conditions suggest a low potential for groundwater flooding. The site is not located within an area of

elevated groundwater emergence potential, and the bedrock geology does not suggest susceptibility to groundwater flooding. The risk of flooding from groundwater flooding is considered to be not significant.

4.11 Surface Water (pluvial) Flooding

The site is not situated near to large areas of poor permeability which may result in surface water flooding. The FMfP shows that the site is located within Flood Zone 1 with less than a 1 in 1000 (0.1%) annual probability of flooding from surface water and/or small watercourses in a given year, including the effects of climate change (see Figure 3). Therefore, the risk of surface water flooding is considered to be not significant.

4.12 Sewer Flooding

Sewer flooding occurs when urban drainage networks become overwhelmed and maximum capacity is reached. This can occur if there is a blockage in the network causing water to back up behind it or if the sheer volume of water draining into the system is too great to be handled. Sewer flooding tends to occur sporadically in both location and time such flood flows would tend to be confined to the streets around the development.

It has been assumed that there are existing sewers located within the vicinity of the site and these will inevitably have a limited capacity so in extreme conditions there would be surcharges, which may in turn cause flooding. Flood flows could also be generated by burst water mains, but these would tend to be of a restricted and much lower volume than weather generated events and so can be discounted for the purposes of this assessment.

Given the design parameters normally used for drainage design in recent times and allowing for some deterioration in the performance of the installed systems, which are likely to have been in place for many years. The provision of adequate level difference between the ground floors and adjacent ground level would reduce the annual probability of damage to property from this source to 1 in 100 years or less. Taking the above into consideration, the fact that there have been no infrastructure failure flooding events in the site area and the site's topography it can be concluded that the risk of flooding is very low. There are no records of sewer flooding in the vicinity of the site, the site is not identified as being at risk of having historically flooded due to sewer overloading and in the absence of confirmed DG5 entries, sewer flood risk is considered very low. It can therefore be concluded that the risk of sewer flooding is not significant.

4.13 Flooding from Artificial Drainage Systems/Infrastructure Failure

There are no nearby artificial water bodies, water channels, reservoirs and artificial drainage systems that could be considered a flood risk to the site. The Natural Resources Wales Reservoir flood map shows that the site is not at risk of reservoir flooding (see Figure 18). The risk of flooding from artificial drainage systems/infrastructure failure is considered to be not significant.

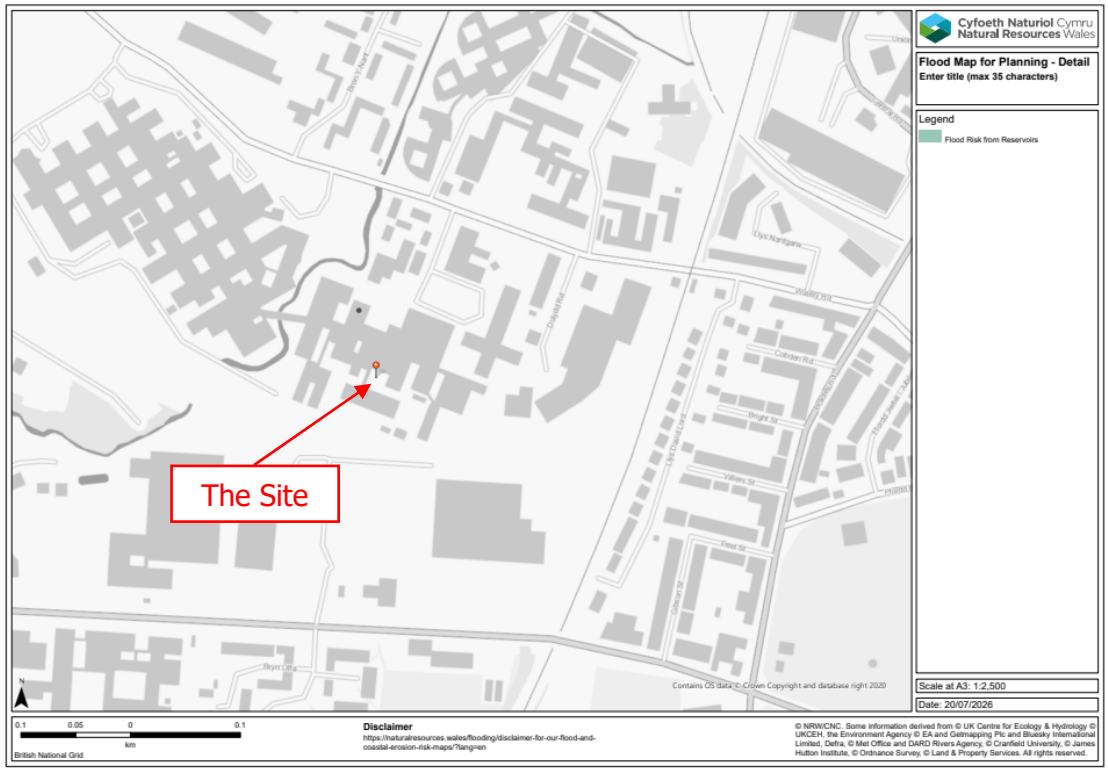


Figure 18 – Natural Resources Wales Reservoir Flood Map

4.14 Effects of the Development on Flood Risk

The overall direction of the movement of water will be maintained within the developed site and surrounding area. The conveyance routes (flow paths) will not be blocked or obstructed. There will be no increase in the floodwater levels due to the proposed development. There will be no loss in flood storage capacity and no change in the on-site and off-site flood risk.

4.15 Summary of Site-Specific Flood Risk

A summary of the sources of flooding and a review of the risk posed by each source at the site is shown in Table 7.

The site is unlikely to flood except in extreme conditions. The primary, but unlikely, flood risk to the site is from fluvial flooding from the River Gwenfro. The site is located within FMfP Flood Zone 2 for rivers however, it should be noted that there is no history of flooding at the site. Modelling confirms that the site remains flood free during existing and undefended 1 in 100 year (+45%) and 1 in 1000 year events. The site will be flood free during the existing and undefended 1 in 100 year (+25%) event, which is the design event for the site. When taking into consideration events of a greater magnitude such as the existing and undefended 1 in 1000 year (+20%) events, analysis of the modelled data shows the site may be inundated with floodwater, to a water depth of 0.10m.

Modelling shows that the site may be affected by a blockage of the hospital culvert (BLK3) and analysis of the modelled data shows the site may be inundated with floodwater to low water depths with a maximum of a water depth of 0.33m.

Taking account of the scale and nature of the proposed development, the characteristics of the fluvial flooding source, and the findings of the modelling and historical evidence, fluvial flooding represents a material source of flood risk at the site. It is concluded that the risk of flooding from fluvial sources is considered to be of a low significance and the consequences will be acceptable for 'less vulnerable' development in accordance with TAN15. The flood risk at the site will be further mitigated by using a number of risk management measures to

manage and reduce the overall flood risk at the site (see Section 5.0).

The overall direction of the movement of water will be maintained within the developed site and surrounding area. The conveyance routes (flow paths) will not be blocked or obstructed. There will be no increase in the floodwater levels due to the proposed development. There will be no loss in flood storage capacity and no change in the on-site and off-site flood risk.

In conclusion, the flood risk to the site can be considered to be very limited and the site is unlikely to flood except in very extreme conditions.

Table 7 – Risk Posed by Flooding Sources

Sources of Flooding	Potential Flood Risk	Potential Source	Probability/Significance
Fluvial (river) Flooding	Yes	River Gwenfro	Low
Tidal (coastal) Flooding	No	None Reported	Not significant
Groundwater Flooding	No	None Reported	Not significant
Surface Water (pluvial) Flooding	No	None Reported	Not significant
Sewer Flooding	No	None Reported	Not significant
Flooding from Artificial Drainage Systems/Infrastructure Failure	No	None Reported	Not significant

5 RISK MANAGEMENT

5.1 Introduction

In this flood zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout, form of the development and the use of flood mitigation measures. The flooding sources will have to mitigated on the site by using a number of techniques, and mitigation strategies to manage and reduce the overall flood risk at the site. These will be used to ensure the development will be safe and there is:

- Minimal risk to life;
- Minimal disruption to people living and working in the area;
- Minimal potential damage to property;
- Minimal impact of the proposed development on flood risk generally; and;
- Minimal disruption to natural heritage.

5.2 Finished Floor Levels

Modelling confirms that the site remains flood free during existing and undefended 1 in 100 year (+45%) and 1 in 1000 year events. Furthermore, the building will be raised a minimum of 150mm above the existing ground levels which also provides protection against the low blockage (30%) 1 in 100 year (+20%) event.

It is recognised however that owing to limited headroom constraints, massing, planning policy and Building Regulations it is considered impractical to raise the finished floor levels further. A combination of resistance (proofing) and resilience measures will be included to provide further protection. This is discussed below.

5.3 Flood Resilience and Resistance

The development of the layout should always consider that the site is potentially at risk from an extreme event and as such the implementation of flood resilience and resistance methods should be assessed. Relatively simple measures such as raising utility entry points, using first floor or ceiling down electrical circuits and sloping landscaping away from properties can be easily and economically incorporated into the development of the site.

5.4 Access and Egress

The surrounding area is located within FMfP Flood Zone 1 with less than a 1 in 1000 (0.1%) annual probability of flooding from sea, river and surface water flooding in a given year, including the effects of climate change therefore a safe and dry access can be maintained.

5.5 Residual Risk

The site can be justified in accordance with TAN15 as it can be demonstrated that the consequences of flooding can be managed down to a level which is acceptable for the nature and type of site. The mitigation measures detailed above show that the flood risk can be effectively managed and therefore the consequences of flooding are acceptable.

6 JUSTIFYING THE LOCATION OF THE DEVELOPMENT

6.1 Assessment Framework

TAN15 seeks to avoid development within areas at highest flood risk. However, it recognises that development within the FMfP Flood Zone 2 may be acceptable where it can be demonstrated, through a site-specific FCA, that the consequences of flooding are acceptable and can be effectively managed.

Section 11 of TAN15 requires consideration of flood consequence indicators including:

- Flood depth
- Flood velocity
- Rate of onset
- Duration of flooding
- Access and egress arrangements
- Vulnerability of receptors

These indicators are applied holistically and are not intended to operate as absolute thresholds. The objective is to determine whether risks to life and property can be managed to an acceptable level over the lifetime of the development. The proposed development complies with Figures 5 and 6 of TAN15.

6.2 Application to the Proposed Development

The proposals are for a modular building and the installation of a covered walkway. The building will be raised a minimum of 150mm above the existing ground levels. Accordingly:

- Baseline floodplain conditions remain unchanged;
- There is no increase in flood levels on-site or elsewhere;
- There is no loss of floodplain storage;
- There is no obstruction to flood conveyance routes.

Fluvial flooding represents the primary source of risk. Modelling confirms that the site remains flood free during existing and undefended 1 in 100 year (+45%) and 1 in 1000 year events. The building will be raised a minimum of 150mm above the existing ground levels which also provides protection against the low blockage (30%) 1 in 100 year (+20%) event. In more extreme existing, undefended, and blockage scenarios, inundation may occur. However, the character of flooding at this location is:

- Gradual in onset;
- Forecast-led;
- Associated with long-duration rainfall events.

This flood behaviour significantly reduces the life-safety consequences associated with extreme events.

6.3 Risk Management Measures

The acceptability of development within Flood Zone 2 depends not on whether flooding can occur in extreme scenarios, but whether the consequences of flooding are manageable.

In this context, risk to life is managed through early warning, managed evacuation and the raising of the finished floor levels by a minimum of 150mm above the existing ground levels. The nature of the flood mechanism, combined with the management measures identified, ensures that life-safety consequences remain acceptable in accordance with TAN15.

Having regard to the indicators set out in Section 11 of TAN15, including flood depth, hazard, rate of onset,

duration, vulnerability and access arrangements, the consequences of flooding associated with the proposed development are considered acceptable in planning terms.

On this basis, and subject to implementation of the identified mitigation measures, the development satisfies the requirements of TAN15.

7 SUMMARY AND CONCLUSION

7.1 Introduction

This report presents an FCA in accordance with TAN15 for the proposed development at Wrexham Maelor Hospital, Croesnewydd Road, Wrexham, LL13 7TD.

This FCA identifies and assesses the risks of all forms of flooding to and from the development and demonstrates how these flood risks will be managed so that the development remains safe throughout the lifetime, taking climate change into account.

7.2 Flood Risk

The site is unlikely to flood except in extreme conditions. The primary, but unlikely, flood risk to the site is from fluvial flooding from the River Gwenfro. The site is located within FMfP Flood Zone 2 for rivers however, it should be noted that there is no history of flooding at the site. Modelling confirms that the site remains flood free during existing and undefended 1 in 100 year (+45%) and 1 in 1000 year events. The site will be flood free during the existing and undefended 1 in 100 year (+25%) event, which is the design event for the site. When taking into consideration events of a greater magnitude such as the existing and undefended 1 in 1000 year (+20%) events, analysis of the modelled data shows the site may be inundated with floodwater, to a water depth of 0.10m.

Modelling shows that the site may be affected by a blockage of the hospital culvert (BLK3) and analysis of the modelled data shows the site may be inundated with floodwater to low water depths with a maximum of a water depth of 0.33m.

Taking account of the scale and nature of the proposed development, the characteristics of the fluvial flooding source, and the findings of the modelling and historical evidence, fluvial flooding represents a material source of flood risk at the site. It is concluded that the risk of flooding from fluvial sources is considered to be of a low significance and the consequences will be acceptable for 'less vulnerable' development in accordance with TAN15. The flood risk at the site will be further mitigated by using a number of risk management measures to manage and reduce the overall flood risk at the site.

The overall direction of the movement of water will be maintained within the developed site and surrounding area. The conveyance routes (flow paths) will not be blocked or obstructed. There will be no increase in the floodwater levels due to the proposed development. There will be no loss in flood storage capacity and no change in the on-site and off-site flood risk.

In conclusion, the flood risk to the site can be considered to be very limited and the site is unlikely to flood except in very extreme conditions.

7.3 Risk Management

The flooding sources will be managed on the site by using a number of mitigation strategies to manage and reduce the overall flood risk at the site and will ensure the development will be safe. Measures used:

Finished Floor Levels: Modelling confirms that the site remains flood free during existing and undefended 1 in 100 year (+45%) and 1 in 1000 year events. Furthermore, the building will be raised a minimum of 150mm above the existing ground levels which also provides protection against the low blockage (30%) 1 in 100 year (+20%) event.

It is recognised however that owing to limited headroom constraints, massing, planning policy and Building Regulations it is considered impractical to raise the finished floor levels further. A combination of resistance (proofing) and resilience measures will be included to provide further protection. This is discussed below.

Flood Resilience and Resistance: The development of the layout should always consider that the site is potentially at risk from an extreme event and as such the implementation of flood resilience and resistance methods should be assessed. Relatively simple measures such as raising utility entry points, using first floor or ceiling down electrical circuits and sloping landscaping away from properties can be easily and economically incorporated into the development of the site.

Access and Egress: The surrounding area is located within FMfP Flood Zone 1 with less than a 1 in 1000 (0.1%) annual probability of flooding from sea, river and surface water flooding in a given year, including the effects of climate change therefore a safe and dry access can be maintained.

7.4 Justifying the Location of the Development

The development proposals should be considered by the LPA to satisfy the Acceptability Criteria as set out in TAN15.

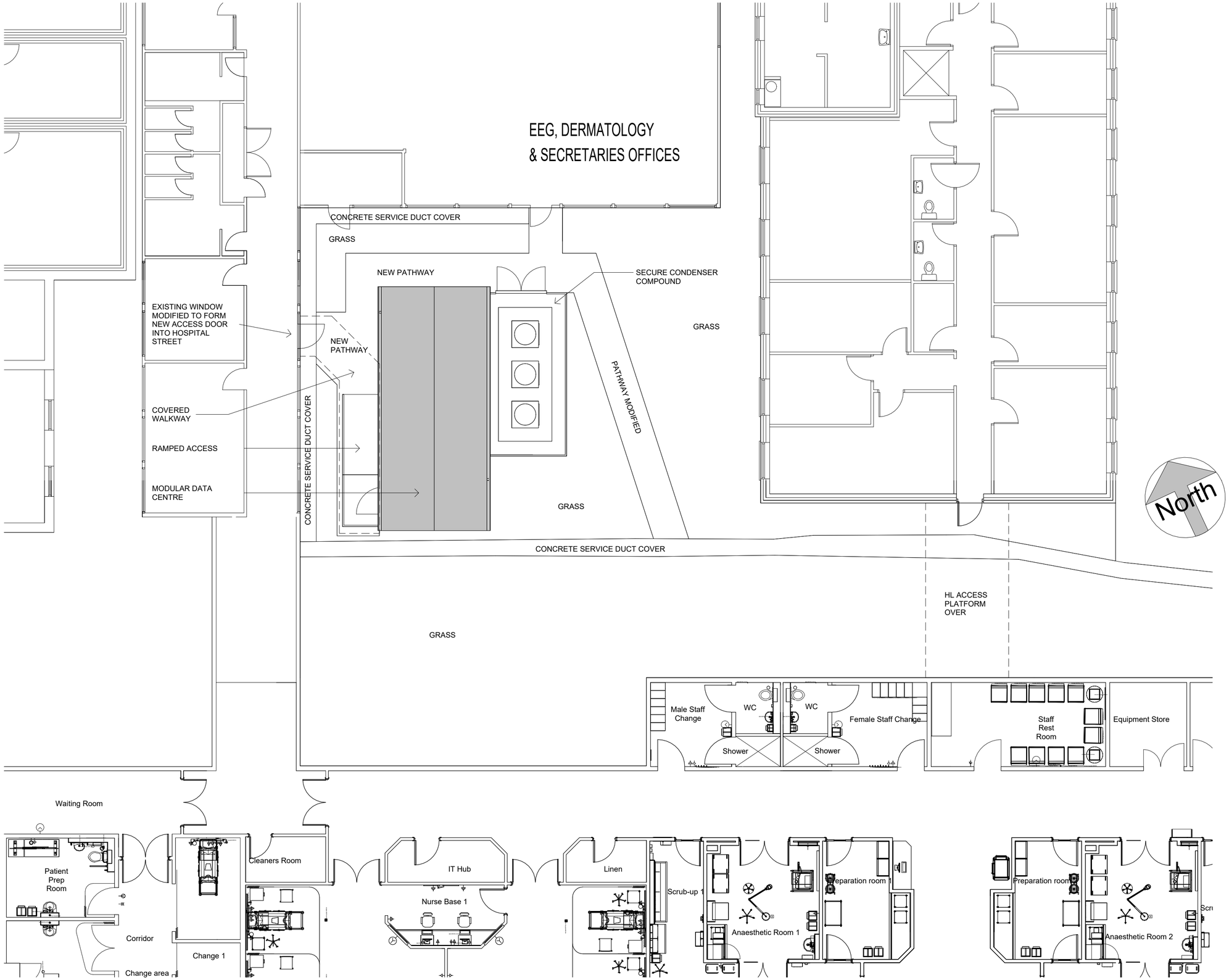
7.5 Conclusion

In conclusion, the proposed development would be expected to remain dry in all but the most extreme conditions. Providing the recommendations made in this FCA are instigated, flood risk from all sources would be minimised, the consequences of flooding are acceptable and the development would be in accordance with the requirements of TAN15.

This FCA demonstrates that the proposed development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of TAN15. The development should not therefore be precluded on the grounds of flood risk.

APPENDIX A – Site Masterplan

Drawing/ Document	Link
Site Masterplan	



General Notes

1. All of the designs are the sole property of TACP Architects Ltd and may not be used without their written agreement
2. All prints, specifications and their copyright are the property of TACP Architects Ltd
3. All dimensions shall be checked on site before commencement of shop drawings, manufacture and all discrepancies must be reported to TACP Architects Ltd
4. Do not scale off drawings

Revisions

Rev	Date	Description	By	Check

Client

BCUHB

Project Title

Modular Data Centre - Wrexham Maelor Hospital

SheetName

Proposed Site Plan

Classification

Status

Scale	Date	Drawn	Checked
1 : 100@A2	25/02/26	MR	GM

Job Number Project•Originator•Zone•Level•Form•Role•Number Revision

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