

SITE 5A, WREXHAM

Flood Risk Assessment Report

Clywedog Road South, Wrexham, LL13 9XS

S5A-BML-XX-XX-RP-C-0500

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1. Introduction

1.1 Project Background

Barnsley Marshall Ltd was appointed by FI Real Estate Management to provide a Flood Consequences Assessment & SuDS Drainage Strategy for the proposed development of 1 industrial unit on 3.0Ha of land off Clywedog Road South, Wrexham, postcode LL13 9XS.

The report provides an assessment of flood risk from various sources on the proposed development based on Government and local authority guidance with regard to flood risk assessments.

The report is based on currently available information and preliminary discussions.

Proposals contained or forming part of this report represent the design intent and may be subject to alteration or adjustment in completing the detailed design for this project. Where such adjustments are undertaken as part of the detailed design and are deemed a material deviation from the intent contained in this document, prior approval shall be obtained from the relevant authority in advance of commencing such works.

Where the proposed works to which this report refers are undertaken more than twelve months following the issue of this report, Barnsley Marshall shall reserve the right to re-validate the findings and conclusions by undertaking appropriate further investigations at no cost to Barnsley Marshall.

1.2 Scope of Flood Risk Assessment

The assessment is to be undertaken in accordance with the standing advice and requirements of the Planning Policy Wales – Technical Advice Note - 15 (TAN 15) Development and Flood Risk as outlined in the Communities and Local Government Planning Policy Guidance to the Planning Policy Wales and Sustainable Drainage (SuDS) Statutory Guidance - Wales.

The 3.0Ha development site is off Clywedog Road South in Wrexham, with this road and existing industrial offices on the west, an existing housing community on the east, and NU Instruments on the north. Following scrutiny of the Natural Resources Wales Flood Maps it has been identified that the existing site lies within an area classified as Flood Zone A or B in accordance with TAN15 (Flood Zone 1 in accordance with Environment Agency Flood Maps) indicating that the risk of flooding from rivers and sea is low, with an Annual Exceedance Probability of flooding of less than 0.1%. The site is however within 250m of an area at risk from extreme flooding from rivers and sea without defences and therefore a Flood

Consequences Assessment (equivalent to a Flood Risk Assessment) would be advisable to check flooding effects on the site.

The assessment has been undertaken in accordance with the standing advice and requirements of the Natural Resources Wales for Flood Risk Assessments as outlined in TAN 15.

The assessment has:

- Investigated all potential risks of current or future flooding to the site
- Considered the impact the development may have elsewhere with regards to flooding risk
- Considered design proposals to mitigate any potential risk of flooding determined to be present
- Determine any constraints to be imposed on the development layout or drainage systems

2. Existing Site Details

2.1 Location and Description

The proposed development is located off Clywedog Road South, Fen Drayton, Wrexham, LL13 9XS. The site is approximately 3.6km east of Wrexham city centre and is located in the South West area of Wrexham Industrial Estate. An unnamed stream / large ditch borders the north-east edge of the site flowing in a north-easterly direction. The watercourse is a tributary to the Redwither Brook that drains into River Clywedog, located approximately 530m to the South of the site. Another unnamed stream / large ditch borders the south east of the site, flowing in a south-westerly direction. The watercourse is a tributary to the River Clywedog. The site is currently a greenfield site that can be accessed from Clywedog Road South, refer to **Figure 1**.

Refer to **Appendix A** for the site location plan and proposed masterplan.



Figure 1: Development Site showing site boundary in red

(Source: Google Maps, 2021-09-16, 1200hrs)

2.2 Topography

The site generally slopes north-to-south towards the existing ditch and River Clywedog. The north-western corner of the site has an existing level of 37.500mAOD, and the southmost tip of the site has an existing level of 34.500mAOD, giving a fall of 3m over a distance of 320m, which approximates to a 1% longitudinal fall.

Two ditches border the site one along the south eastern edge and the other along the north eastern edge.

Refer to **Appendix B** for the site topography.

2.3 Existing Watercourses

An unnamed stream / large ditch borders the north-east edge of the site flowing in a north-easterly direction. The watercourse is a tributary to the Redwither Brook that drains into River Clywedog, located approximately 530m to the south of the site. Another unnamed stream / large ditch borders the south east of the site, flowing in a south-westerly direction. The watercourse is a tributary to the River Clywedog.

2.4 Existing Public Drainage

There are no adopted sewers on site; the nearest existing public drainage are two Welsh Water combined public sewers and a DN150 surface water sewer (starting from the north-west corner of the site and flowing north-east) along Clywedog Road South on the western edge of the site,

From the provided Welsh Water sewer maps (refer to **Appendix C**), it can be seen that the two existing sewers are situated in the centre of Clywedog Road South.

The postcode of the site falls within a region supplied by Dwr Cymru Welsh Water.

2.5 Existing Private Drainage

There is no existing private drainage on site. A detailed CCTV & Drainage Survey shall be commissioned to determine whether sewers are on site, and propose remedial works if required to ensure continuity of the sewers during and after construction.

2.6 Site Geology

No Ground Investigation Survey had been carried out at the time this report was compiled. A search on British Geological Survey online showed that the nearest boreholes logs dated April 1981 with references SJ34NE70 (Grid Reference: Easting:337070, Northing:348890) located to the south and SJ34NE69 (Grid Reference: Easting:337140, Northing:349060) are located close to the eastern edge of the site, and gave the information on **Table 1**.

Table 1: Geological Information from BGS

From	To	Description
SJ34NE69		
Ground Level	0.75m below ground	Fill-Brown clay with traces of tree roots
0.75m below ground	4.5m below ground	Clay - brown with streaks of grey silt and occasional pebbles to 10mm. Firm to stiff
4.5m below ground	9.5m below ground (bottom of pit)	Silt – Brown with some fine-grained sand, saturated and soft
SJ34NE70		
Ground Level	0.5m below ground	Fill Brown clay, soft
0.5m below ground	3.0m below ground	Clay – Brown with streaks of grey silt. Firm to stiff with occasional sandy seams which are soft to firm
3.0m below ground	6.5m below ground (bottom of pit)	Silt – Brown, Sandy, saturated, soft

(Source: British Geological Survey, Accessed on 2021-09-16, 1600hrs)

A copy of the borehole results is contained in **Appendix D**.

The soil profile from the three boreholes indicate that the soil is predominantly clay for depths of more than 3m from the surface and would not support drainage via infiltration. However due to the dated nature of the boreholes, BRE Digest 365 Soakaway Tests shall be conducted at a number of locations across the site, and if infiltration is found to be possible, the proposed Geo-cellular Storage Tank and Ponds shall be designed as infiltration features, and the controlled outflows to the ditches shall be reduced, or if infiltration is good enough, there shall be no outfall from the ponds to the existing ditches.



(Source: British Geological Survey, Accessed on 2021-09-16, 1600hrs)

3. Policy and Guidance

3.1 Planning Policy Wales (PPW), Welsh Assembly Government (WAG), March 2002

Land use planning policies of the Welsh Assembly Government are set out in Planning Policy Wales (PPW). The principle purpose of PPW is to reconcile the needs of development and conservation, securing economy, efficiency, and amenity in the use of land, protecting natural resources and the historic environment, thereby contributing to sustainable development.

In relation to flood risk, PPW aims to minimise the risks posed by, or to, development on, or adjacent to land liable to flooding. PPW recognises that the impacts of future climate change effects should be considered when planning development in flood prone coastal areas and floodplains. The likely impact to frequency and severity of floods expected during the lifetime of development must be addressed. More detailed guidance relating to development and flood risk is provided in Technical Advice Note 15: Development and Flood Risk (TAN15).

3.2 Technical Advice Note 15: Development and Flood Risk (TAN15), Welsh Assembly government (WAG), July 2004

The guidance in TAN 15 aims to direct new development away from areas of high flood risk. Where development in these areas can be justified, the guidance states that the risk of and consequences of flooding should be managed to an acceptable level.

TAN 15 guidance requires the assessment of consequence based on the consideration of whether flooding would be acceptable for the particular type of development under consideration. The justification test, as outlined in Section 6 of TAN 15, indicates that development can be justified if it can be demonstrated that:

- Its location in Zone C is necessary to assist, or be part of, a local authority regeneration initiative or a local authority strategy required to sustain an existing settlement, or,
- Its location in Zone C is necessary to contribute to key employment objectives supported by local authority and other key partners, to sustain an existing settlement or region; and,
- It concurs with the aims of PPW and meets the definition of previously developed land; and
- The potential consequences of a flooding event for the particular type of development have been considered and in terms of the criteria contained in Section 5 and 7 and Appendix 1 (TAN15) found to be acceptable.

TAN 15 states that any new development on the floodplain will generally result in additional flood risk. The guidance indicates that the main criteria for determining whether such a development is acceptable will depend on whether additional flood

risk can be effectively managed. The guidance states that the objectives of the Flood Consequence Assessment are to develop a full appraisal of:

- The consequences of flooding on development;
- The consequences (i.e. overall impacts) of the development on flood risk elsewhere within the catchment for a range of potential flooding scenarios up to that flood having a probability of 0.1% and,
- The assessment can be used to establish whether appropriate mitigation measures can be incorporated within the design of the development to ensure that the development minimises risk to life, damage to property and disruption to people living and working on the site or elsewhere in the floodplain.

3.3 Flood Zone Classification

TAN 15 Figure 1 describes the composition and use of flood zones to control and manage development. The figure enables identification of the amount of effort required to conduct flood risk assessment based on the flood zone in which the development falls. **Table 2** is a copy of TAN 15 Figure 1.

The 3.0Ha development site is off Clywedog Road South in Wrexham, with this road and existing industrial offices on the west, an existing housing community on the east, and NU Instruments on the north. Following scrutiny of the Natural Resources Wales Flood Maps it has been identified that the existing site lies within an area classified as Flood Zone A or B in accordance with TAN15 (Flood Zone 1 in accordance with Environment Agency Flood Maps) indicating that the risk of flooding from rivers and sea is low, with an Annual Exceedance Probability of flooding of less than 0.1%. The site is however within 250m of an area at risk from extreme flooding from rivers and sea without defences and therefore a Flood Consequences Assessment (equivalent to a Flood Risk Assessment) would be advisable to check flooding effects on the site. Hence the decision to include this section (Chapter 3) in the report.

Table 2: Flood Zone Classification

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

(Source: TAN 15 Figure 1)

3.4 Flood Risk Vulnerability Classification

In accordance with TAN 15, 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 in Figure 2. **Table 3** is a copy of TAN 15 Figure 2.

Table 3: Flood Vulnerability Classification

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.

(Source: TAN 15 Figure 2)

4. Development and Flood Risk

4.1 Proposed Development Vulnerability Classification

The 3.0Ha development site is off Clywedog Road South in Wrexham, with this road and existing industrial offices on the west, an existing housing community on the east, and NU Instruments on the north. Following scrutiny of the Natural Resources Wales Flood Maps it has been identified that the existing site lies within an area classified as Flood Zone A or B in accordance with TAN15 (Flood Zone 1 in accordance with Environment Agency Flood Maps) indicating that the risk of flooding from rivers and sea is low, with an Annual Exceedance Probability of flooding of less than 0.1%. The site is however within 250m of an area at risk from extreme flooding from rivers and sea without defences and therefore a Flood Consequences Assessment (equivalent to a Flood Risk Assessment) would be advisable to check flooding effects on the site. Hence the decision to include this section (Chapter 3) in the report.

In accordance with TAN 15 Figure 2 (**Table 3** in this report), Site 5A Wrexham is a **Less Vulnerable Development**.

In accordance with TAN 15 Chapter 9: *Summary of Policy Requirements*, a Less Vulnerable Development in Flood Zone A is **acceptable with no constraints** relating to river or coastal flooding, other than to avoid increasing risk elsewhere, and the Justification Test is not applicable.

The following sections investigate the probability of flooding from various sources as a precautionary measure.

4.2 Flood Risk from Rivers and the Sea

The Natural Resources Wales Long Term Flood Map provides basic flood mapping data as a general guide to whether a site is at risk of flooding from various sources including rivers and seas for Flood Zoning classification.

This mapping indicates that the site is wholly located within an area with an undefended risk of flooding from rivers and the sea of less than 0.1% (or the 1 in 1000-year event), classified as Flood Zone 1 (Zone A in accordance to TAN 15). The development site is therefore at **Very Low Risk** of flooding from rivers and the sea. The development is however approximately 200m from the TAN 15 Flood Zone C, caused by River Clywedog to the south of the site.

Figure 3 shows the flood extents 200m to the east of the site.



Figure 3: Flood Risk from Rivers and the Sea

(Source: <https://maps.cyfoethnaturiolcymru.gov.uk/> , Accessed on 2021-09-16, 1825hrs)

4.3 Historic Flooding

There is no evidence or data to report any historic flooding within the site bounds. The site is bounded by an existing conveyance ditch along the north-eastern and east edges which shield the site from inundation via runoff to River Clywedog. The site itself generally slopes north-to-south towards the existing ditch and River Clywedog. The north-western corner of the site has an existing level of 37.500mAOD, and the southmost tip of the site has an existing level of 34.500mAOD, giving a fall of 3m over a distance of 320m, which approximates to a 1% longitudinal fall.

4.4 Flood Defences

There are no formal flood defences recorded on the Natural Resources Wales Flood Map in the immediate vicinity of the site. The site is also not indicated as being used for flood storage, therefore, the flood risk to the development from failed or breached flood defences is considered to be **Low Risk**.

4.5 Flooding induced by Climate Change

The nearest Flood Zone C (Flood Zone 2 in accordance with Natural Resources Wales Long Term Flood Map) is approximately 200m to the south of the site and is associated with the maximum flood extents of River Clywedog. The ground levels at the flood extents caused by River Clywedog (33.500mAOD) are approximately 1.0m lower than southmost tip of the site which has an existing level of 34.500mAOD. The 1m level buffer should provide significant flood resilience of the site against flooding effects due to climate change. Flood risk to the development due to climate change effects is therefore considered to be **Low Risk**.

4.6 Flooding from Groundwater

There are two historical boreholes within the site on British Geological Survey maps. Both boreholes indicate a depth of water table of around 3mbgl. The soil stratum shows clays down to a depth of 4.5mbgl underlain by silty sandy saturated soil, refer to **section 2.6** of this report. This soil stratum, together with the existing ground slope towards the south, implies that any groundwater will be prevented from rising to the surface by the clay layer and forced to flow below ground towards the existing ditches and River Clywedog. It is therefore unlikely that any seasonal rise in water table would result in surface flooding of the site, therefore the flood risk due to groundwater is **Low**.

4.7 Flooding from Adopted Sewers

There are no adopted sewers on site; the nearest existing public drainage are two Welsh Water combined public sewers and a DN150 surface water sewer (starting from the north-west corner of the site and flowing north-east) along Clywedog Road South on the western edge of the site, therefore the flood risk due to groundwater is **Low**.

4.8 Flooding from Private Drainage

There is no existing private drainage on site. A detailed CCTV & Drainage Survey shall be commissioned to determine whether sewers are on site, and propose remedial works if required to ensure continuity of the sewers during and after construction.

4.9 Flooding from Surface Water and Small Watercourses

The Natural Resources Wales Flood Map was consulted to check the risk of site flooding from surface water and small watercourses; an extract from the map is presented in **Figure 4**. The figure indicates that after severe or prolonged storms especially during the wet season, runoff turns to accumulate within the conveyance ditches that run along the north-eastern and south-eastern edges of the site, with the ditches running full for short periods, but site is not flooded by water from the ditches. Nevertheless, all finished floor levels shall be at **least 150mm above surrounding ground levels**. Flood risk to the development due to surface water is therefore considered to be **Very Low Risk**.

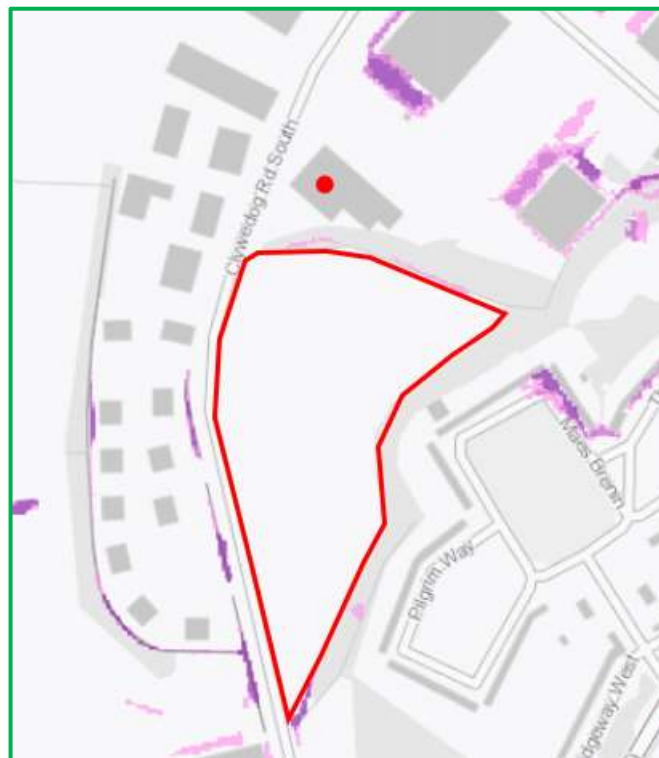


Figure 4: Flood Risk from Surface Water – Flood Extents

(Source: <https://maps.cyfoethnaturiolcymru.gov.uk/>, Accessed on 2021-09-17, 1100hrs)

4.10 Flooding from Reservoirs, Canals and Artificial Sources

The Natural Resources Wales Long Term Flood Map was consulted to check the risk of site flooding from reservoirs and it was found to be safe from such flooding effects because River Clywedog is far from the site (approx. 480m to the south of the site).

4.11 Overall Flood Risk

In accordance with TAN 15 Chapter 9: *Summary of Policy Requirements*, a Less Vulnerable Development in Flood Zone A is **acceptable** with '*no constraints relating to river or coastal flooding, other than to avoid increasing risk elsewhere*', and the Justification Test is not applicable.

The site is therefore suitable for the type of development proposed.

5. Drainage Strategy

5.1 Recommended Surface Water Drainage Strategy

The proposed development has a plan area of 3.019Ha. The IH124 method was used to estimate the greenfield runoff rates from the site since the site is less than 200Ha. Because the site is also less than 50ha, the ICP SUDS tool in Micro-drainage Source Control module was used to calculate the greenfield runoff rates. The tool uses the IH124 approach to calculate the greenfield runoff for 50ha, then linearly interpolate to get the flows for smaller catchments. The 1-year, 30-year, and 100-year Greenfield runoff rates were found to be 12.9 l/s, 30.4 l/s, and 39.8 l/s respectively, refer to **Appendix E**.

Qbar is 15.5 l/s for both rural and urban.

It is recommended that, to prevent increased flows post-development and offer an improvement to existing downstream flash flooding, runoff from the development shall be controlled to the 1-year Greenfield Runoff Rate of 12.9 l/s maximum for all storm events up to and including the 100-year + 40% CC storm event.

Details of proposed SuDS-based drainage layout for the development are given in **S5A-BML-XX-XX-RP-C-0501 Drainage Strategy Report**.