TECHNICAL NOTE

JBA Project Code	2020s0430
Contract	Stage 1 FCA for various MCC Development Sites
Client	Monmouthshire County Council (MCC) Estate Development Team (EDT)
Date	July 2020 (minor updates August 2021)
Author	James Dunn / Steffan Howley
Reviewer	George Baker / Faye Tomalin
Subject	Bradbury Farm, Portskewett

1 Introduction

JBA Consulting was commissioned by Monmouthshire County Council to undertake a Level 1 Flood Consequence Assessment (FCA) and drainage statement for the land near Bradbury Farm, Portskewett. The assessment is to support Stage 2 of the Candidate Sites process as part of Monmouthshire County Council's ongoing review of a replacement/new Local Development Plan (LDP).

2 The Site

2.1 Site Description

The site is located near Bradbury Farm to the north of Portskewett, as shown in Figure 2-1. The site is currently used as agricultural grazing land.

The site comprises of two distinct parcels of land that converge in the south of the site. The western parcel is bound to the north by the M48 and Crick Road to the west. There are agricultural as well as commercial and leisure uses beyond Crick Road to the west of the site. The east of the site is surrounded predominantly by agricultural land. A solar farm and an area of woodland are located between the western and eastern parts of the site.

It is understood that the site is being considered for mixed residential and commercial development consisting of approximately 960 dwellings and approximately 3Ha of employment land, and 2Ha allocated to education facilities. In addition, approximately 14Ha will be utilised for green infrastructure, SuDS and Public Open Space (POS).

Figure 2-1 Site Location

2.2 Site topography

Natural Resources Wales 2m LiDAR data has been used to understand the topography of the site. The site is relatively steep and generally slopes from its highest point of approximately 48.18m AOD in the east to its lowest point in the west where ground levels are as low as 8.7m AOD. The west of the site slopes down considerably to a low-lying area from the higher ground to the east. The eastern parcel of land slopes from north east to south west more gradually as shown in Figure 2-2.

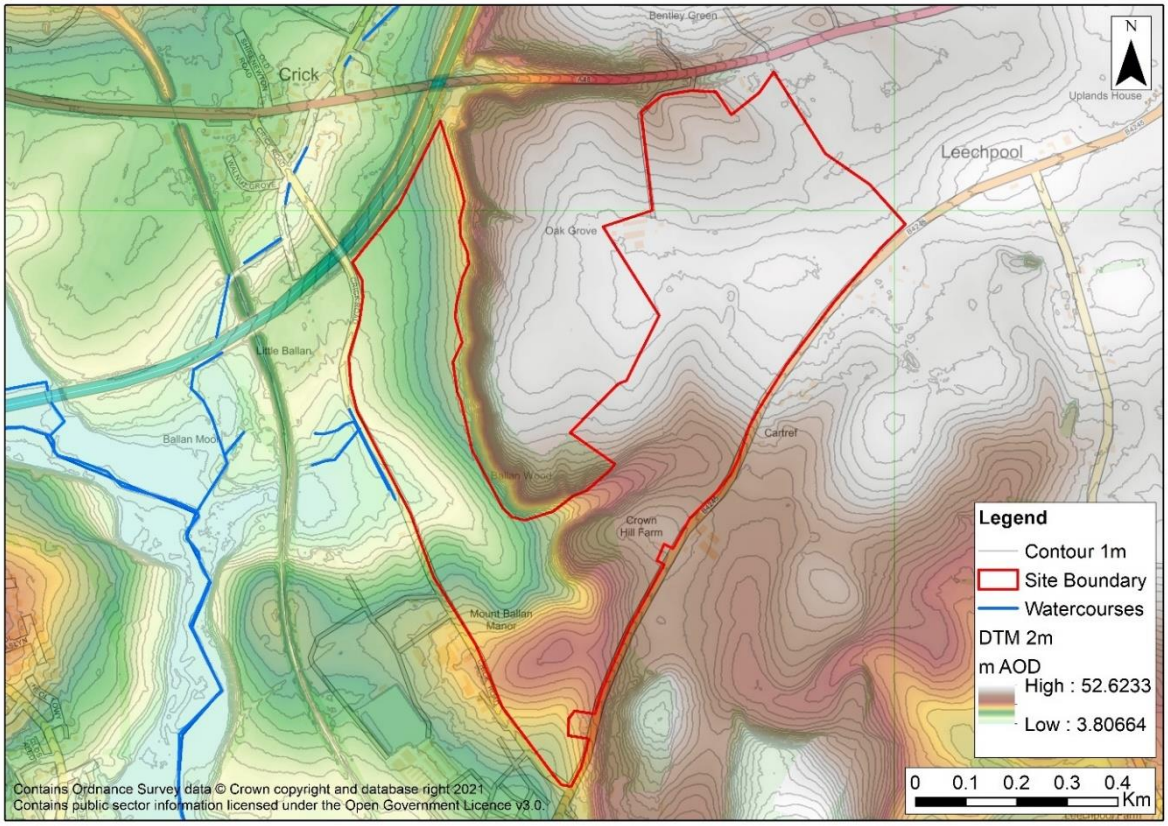

Figure 2-2 1m LIDAR DTM across the development site and surrounding area

2.3 Nearby watercourses

Nedern Brook, a designated 'Main River', is located approximately 380m to the west of the site and flows in a southerly direction.

An unnamed tributary of the watercourse flows approximately 150m to the north west of the site in a southerly direction until it meets the confluence with Nedern Brook approximately 380m to the west of the site.

There is an unnamed agricultural drainage ditch approximately 10m to the west of the site, on the opposite side of Crick Road as shown in Figure 2-3.

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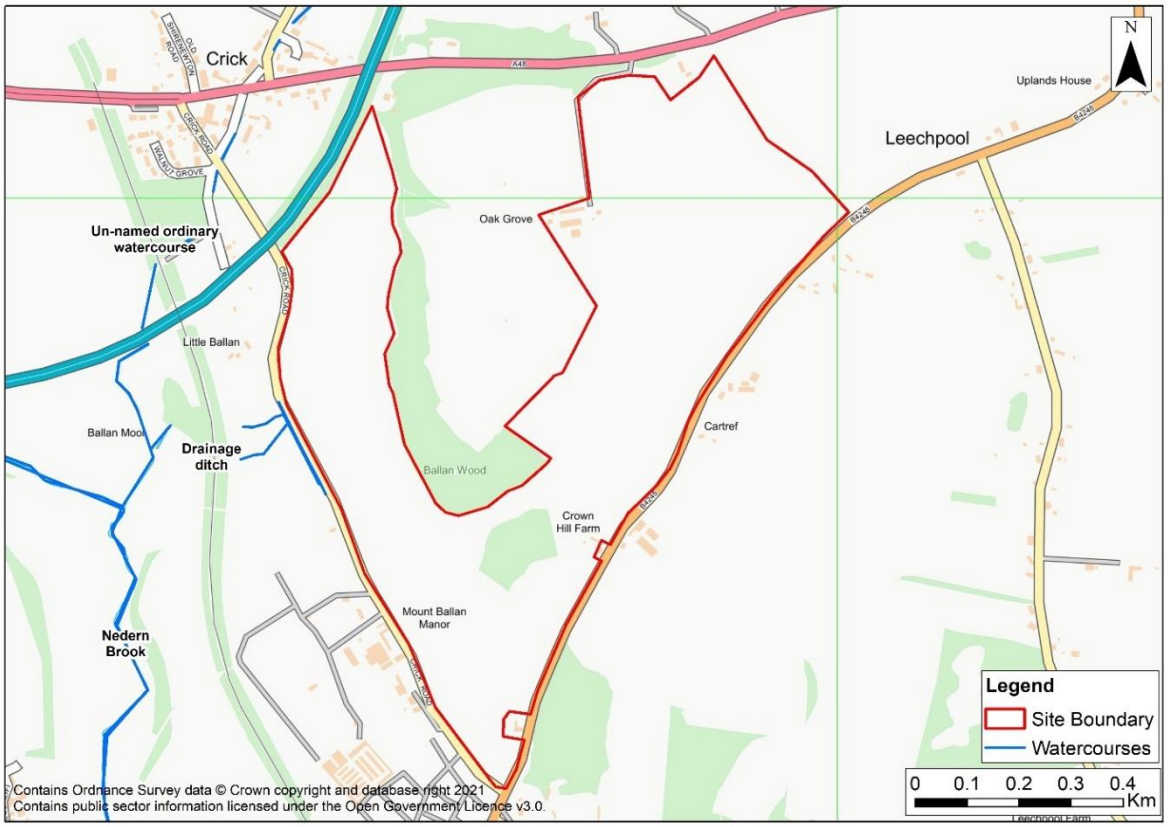


Figure 2-3 Watercourses around the site

3 Planning Policy

3.1 Monmouthshire County Council Adopted Local Development Plan (2014)

The Monmouthshire County Council Local Development Plan (LDP), adopted in 2014, sets out the council's vision and objectives for the development and use of land in Monmouthshire, together with the policies and proposals to implement them over a 10-year period to 2021.

The LDP sets out the spatial strategy and strategic policies, which have been developed to implement the plan's key objectives. Detailed development management policies are also set out, grouped by the plan's themes, against which all development proposals in the County will be assessed and provides the basis for the rational and consistent consideration of planning applications and appeals.

The LDP contains Development Management Policies SD3 Flood Risk and SD4 Sustainable Drainage. Policy SD3 details the requirements for highly vulnerable and less vulnerable development in areas at risk of flooding whilst Policy SD4 describes how proposals should incorporate sustainable drainage to prevent increasing flood risk elsewhere.

Site allocations policies are also detailed in relation to strategic/ urban and rural housing, tourism, waste and employment sites. A strategic site is identified near Crick Road approximately 50m to the south of the study site to the north west of Portskewett. The site is allocated for mixed use residential and employment development. The LDP identifies that the site is located on the Great Spring Source Protection Zone 1 (SPZ1) and that any future planning application for the site would need to be accompanied by a Preliminary Risk Assessment in relation to any potential impacts on the aquifer.

3.2 Monmouthshire County Council Strategic Flood Consequences Assessment

A Stage 1 Strategic Flood Consequences Assessment was undertaken in 2009 to provide an overview of flood risk from all sources in the MCC area.

The Level 1 SFCA identifies that there is a risk of fluvial flooding within the MCC area associated with main rivers and ordinary watercourses as well as tidal flooding and surface water flooding.

Details of historical tidal, fluvial and surface water flooding are provided within the SFCA. There are no historical flood events reported to have occurred within the site boundary.

Groundwater levels are not a significant flood risk on a strategic scale within Monmouthshire and groundwater levels are known to rise and fall slowly. There are localised areas within MCC administrative boundary where groundwater flooding has known to have occurred previously though none of these areas are located within the vicinity of the site.

No further issues have been identified within the SFCA in relation to flood risk at the site.

3.3 Planning Context

TAN-15 was introduced in 2004 by the Welsh Assembly Government. Its technical guidance relating to development planning and flood risk uses a sequential characterisation of risk based on Welsh Government's Development and Flood Risk Advice Maps (DAM). Its initial requirement is to identify the flood zone and vulnerability classifications relevant to the proposed development.

Figure 3-1 shows that the site is located entirely within Zone A of the DAM. The DAM is used to trigger different planning actions based on a precautionary assessment of flood risk. Zone A is considered to be at little or no risk of fluvial or coastal/tidal flooding and highly vulnerable and less vulnerable uses are considered acceptable in this area. A Flood Consequence Assessment (FCA) is not necessary within Zone A.

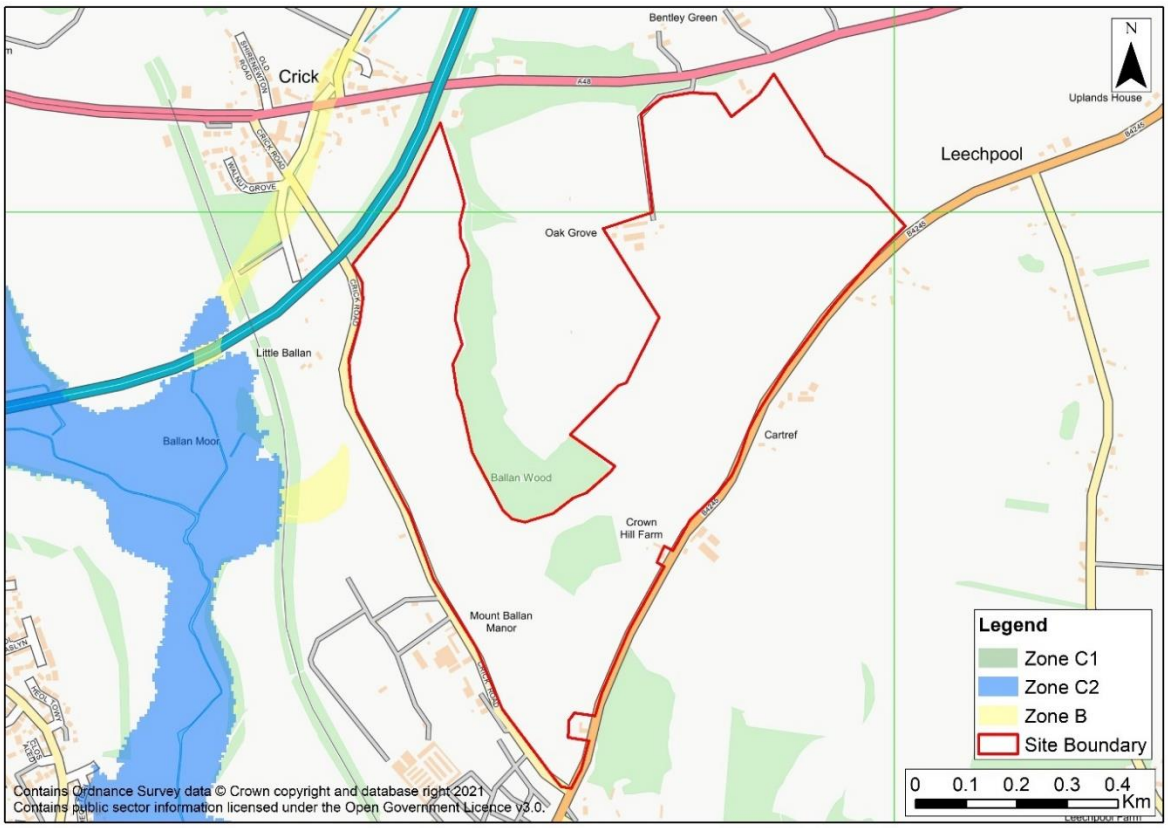


Figure 3-1 Development Advice Map

TAN-15 assigns one of three flood risk vulnerabilities to development and these are shown below in Table 3-1. It is understood that the site would be allocated for a mixture of residential and commercial development. Residential development, and public buildings such as schools, are classified as *highly vulnerable* development whilst commercial development is classified as *less vulnerable* development.

Table 3-1: Development categories defined by TAN15

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, employment**, **commercial and retail development**, transport and utilities infrastructure, car parks, mineral extraction sites and associated processing facilities, excluding waste disposal sites.

4 Assessment of Flood Risk

A review of the existing data on flood risk from all sources has been undertaken and is summarised in the table below.

Table 4-1: High level Assessment of Flood Risk

Source of Flooding	Onsite Presence	Description
Tidal	×	The site is not at risk from tidal flooding.
Fluvial	×	The site is not at risk from fluvial flooding.
Surface Water	✓	There are localised areas within the site boundary at medium to high risk of surface water flooding overall.
Reservoirs	✓	The site has a very low risk of reservoir flooding overall.
Groundwater	×	The site has a low risk of groundwater flooding overall.
Canals	×	The site is not at risk of flooding from canals.
Sewers	×	The site is not considered to be at risk from sewer flooding.

4.1 Tidal Flood Risk

The site is not considered to be at risk from tidal flooding.

4.2 Fluvial Flood Risk

The Natural Resources Wales FRAW flood risk from rivers map is shown below in Figure 4-1. The map shows that the site is at a 'very low' risk of flooding from rivers. This means that in any given year there is a risk of flooding from rivers of less than a 1 in 1000 (0.1%) chance.

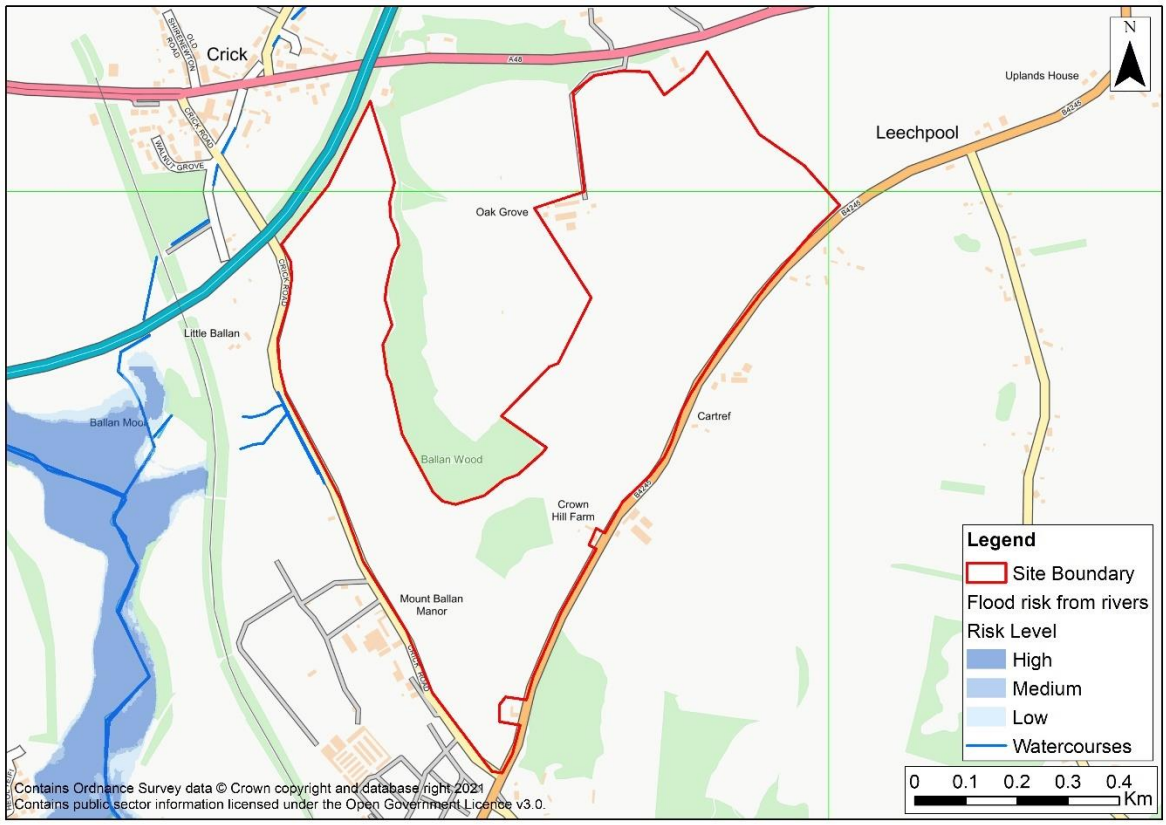


Figure 4-1 NRW Flood Risk from Rivers Map

4.3 Surface Water Flood Risk

The Natural Resources Wales FRAW surface water and small watercourses map is shown in Figure 4-2. The site is largely at 'very low' risk from surface water flooding where there is a less than 1 in 1000 (0.1%) chance of flooding in any given year.

There is a small surface water flow path through the site from high ground in the east to low-lying areas in the west where a small, localised valley is located. The risk of surface water flooding is 'medium'. A 'medium' risk corresponds with between a 1 in 100 and 1 in 30 likelihood of flooding in any given year. The flow path results in ponding at the eastern boundary where there is a high risk of flooding from surface water. A 'high' risk corresponds with between a greater than 1 in 30 likelihood of flooding in any given year.

For such a large site the level of surface water flood risk is very low with small, isolated and well-defined areas of flood risk that should be easily manageable within the master planning process.

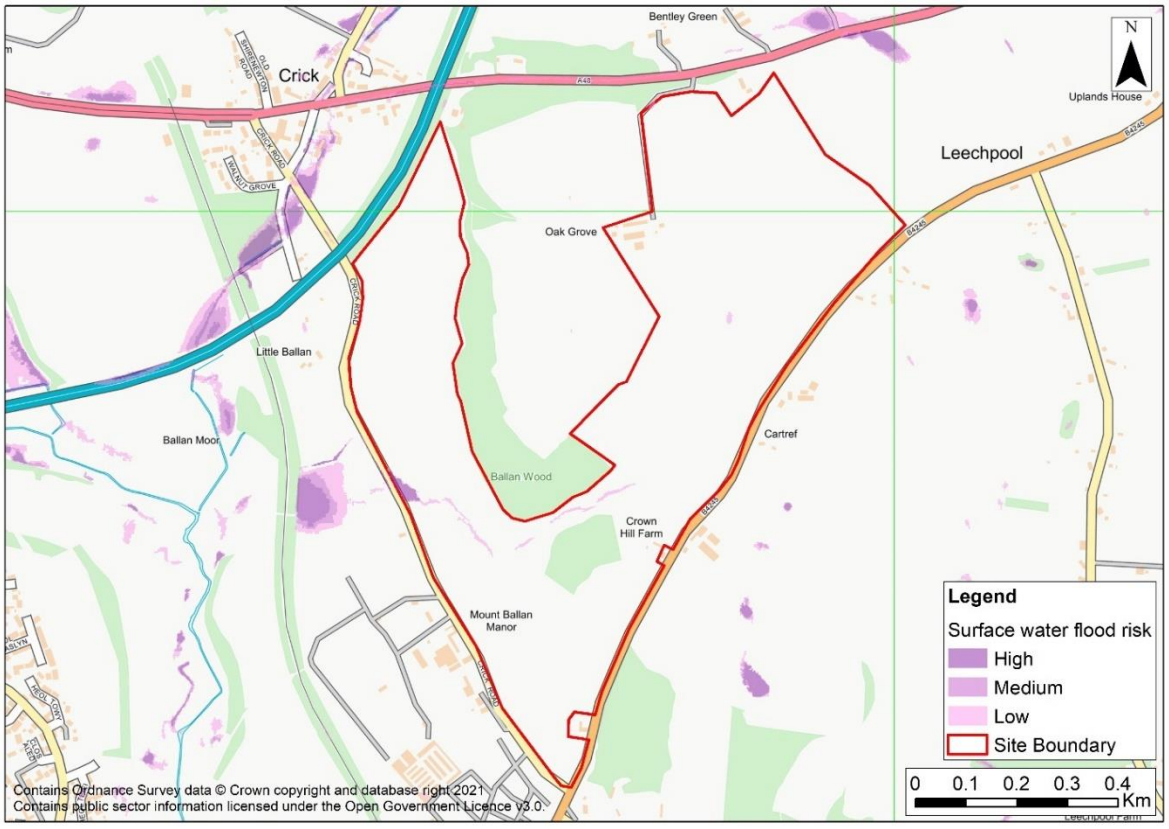


Figure 4-2 NRW Surface Water Flood Risk Map

4.4 Risk of Flooding from Reservoirs

NRW mapping indicates that only a very small peripheral area of the west of the site is at risk of flooding in the unlikely event of a breach in a reservoir structure (Wentwood Reservoir). During such an event, flood depths in this small area would be less than 0.30m and flood velocities would be between 0.0m/s and 0.5m/s.

Reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs must be inspected and supervised by reservoir panel engineers. Consequently, the risk of reservoir flooding is considered to be very low.

The risk of reservoir flooding mapping for the site and surrounding area is shown in Figure 4-2.

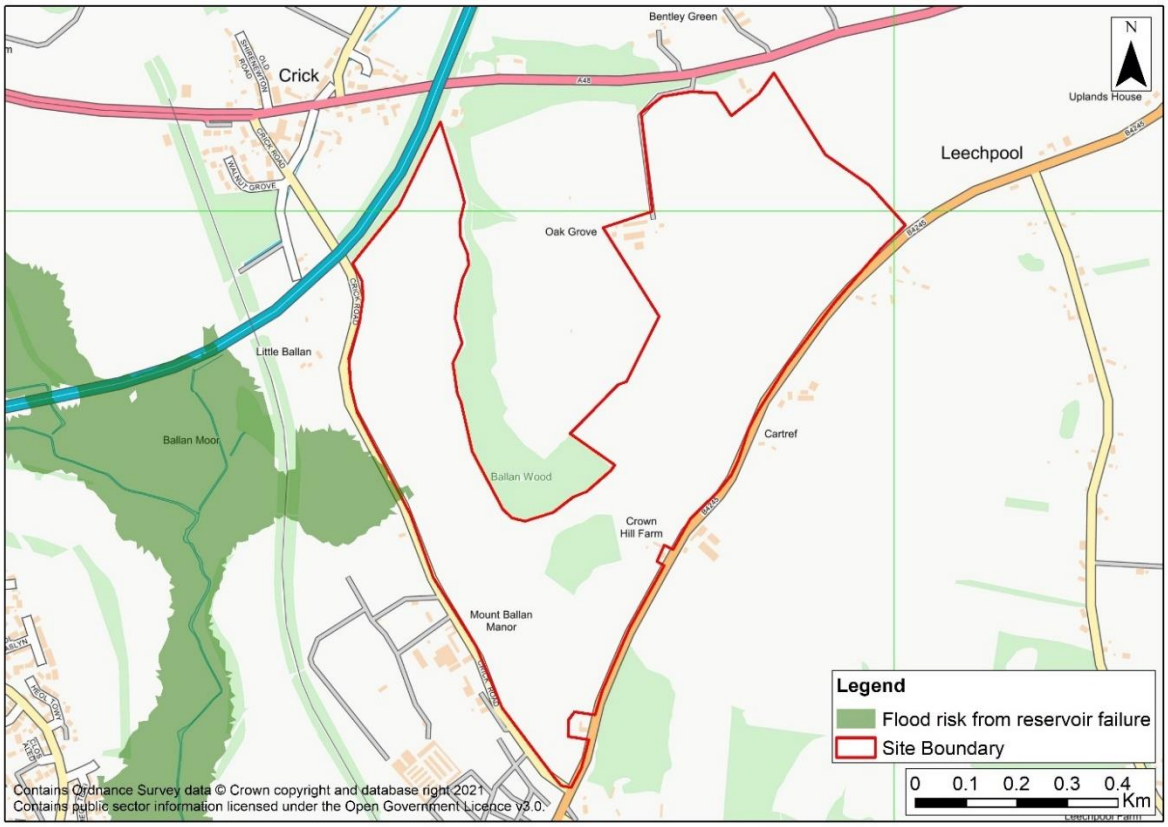


Figure 4-3 NRW Risk of Reservoir Flooding Map

4.5 Risk of Flooding from Groundwater

Groundwater flooding is cause by unusually high groundwater levels. It occurs as excess water emerging at the ground surface or within manmade structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, in some cases lasting for weeks or months, and can result in significant damage to property. The risk of groundwater flooding depends on the nature of the geological strata underlying the sites, as well as on local topography.

The British Geological Survey 1:50,000 scale Geology of Britain Viewer[1] indicates that the site is largely underlain by the Mercia Mudstone Group consisting of Mudstone. There are localised outcrops of the Hunts Bay Oolite Subgroup consisting of Limestone as well as outcrops of the Cromhall Sandstone Formation.

There are superficial deposits beneath the north west of the site in the form of River Terrace Deposits consisting of sand and gravel.

The site is located above groundwater Source Protection Zone (SPZ) 1 also known as the inner protection zone. SPZs are defined around large and public potable groundwater

[1] Geology of Britain Viewer: http://mapapps.bgs.ac.uk/geologyofbritain/home.html?

abstraction sites. The purpose of SPZs is to provide additional protection to safeguard drinking water quality through constraining the proximity of an activity that may impact upon a drinking water abstraction.

Although groundwater flooding can occur in geological settings that consist of limestone, the Monmouthshire Strategic Flood Consequences Assessment states that the risk of groundwater flooding in the study area in considered to be low and the site is not identified as an area where groundwater has occurred previously.

Overall, the risk of groundwater flooding to the proposed development site is considered to be low.

5 Existing surface water drainage regime

5.1 Existing outfall location

The British Geological Survey 1:50,000 scale mapping[1] indicates that the site is underlain predominantly by the Mercia Mudstone Group with localised areas underlain by the Oolite Subgroup consisting of Limestone.

Cranfield University Soilscapes[2] has highlighted two soil types across the site. The soils across the majority of the site are described as 'freely draining slightly acid loamy soils'. A small portion of the east of the site has soils described as 'freely draining slightly acid but base-rich soils'. Based on the ground conditions described, it is considered likely that the site primarily drains through infiltration into the ground and evapotranspiration.

As a result of the potential for infiltration across the site, it is recommended that infiltration testing is undertaken as soon as possible to inform any future outline or detailed drainage strategy for the site.

5.2 Greenfield runoff rates

Table 24.1 of the SUDS Manual[3] indicates that the FEH methods (FEH statistical and ReFH) should be the preferred methods for calculating peak runoff rates and this has been confirmed by Monmouthshire County Council.

The UK SUDS tool has been used to calculate Greenfield runoff rates for the whole site area using the FEH Statistical Method, as seen in Appendix A. The development area is 58.00 hectares. Catchment descriptors were extracted from the FEH Webservice as point data. The calculated greenfield runoff rates are shown in Table 5-1.

Table 5-1: Calculated greenfield runoff rates

Return Period	Specific Runoff (l/s/ha)	Peak Runoff Rate (l/s)
1	2.19	127
QBAR	2.49	145
30	4.44	257
100	5.43	315

5.3 Greenfield runoff volumes

Greenfield runoff volumes were calculated for a six-hour storm event at the site using the FSSR16 method as shown in Equation 1 below.

$$\text{Runoff volume} = \text{Site Area} \times \text{Rainfall Depth} \times \text{Percentage Runoff}$$

Equation 1: FSSR16 method for calculating Greenfield runoff volumes

[2] Cranfield University Soilscapes: http://www.landis.org.uk/soilscapes/

[3] The SuDS Manual (C753), CIRIA 2015. https://www.ciria.org.

Percentage runoff was calculated using the FSSR16 methodology which accounts for soil type, catchment wetness and storm intensity. The rainfall depths for a six-hour 100-year storm event were extracted from the FEH Web Service and are summarised in Table 5-2 with the calculated Greenfield runoff volumes.

Table 5-2: Greenfield rainfall depths and runoff volumes

Return Period	6-hour rainfall runoff depth (mm)	Site runoff volume (m3)
100	65.36	10,324
100 plus climate change (30%)	84.86	14,473

6 Surface water management approach

6.1 Sustainable Drainage Systems

Sustainable Drainage Systems (SuDS) aim to mimic the natural processes of Greenfield surface water drainage by allowing water to flow along natural flow routes and also aims to reduce the runoff rates and volumes during storm events, whilst providing water treatment benefits. SuDS also have the advantage of providing Blue and Green Infrastructure and ecology and recreational benefits when designed and maintained properly.

Schedule 3 of the Flood and Water Management Act 2010 was enacted in Wales in January 2019, leading to the requirement for all new developments to incorporate the four pillars of SuDS design, shown in Figure 6-1:

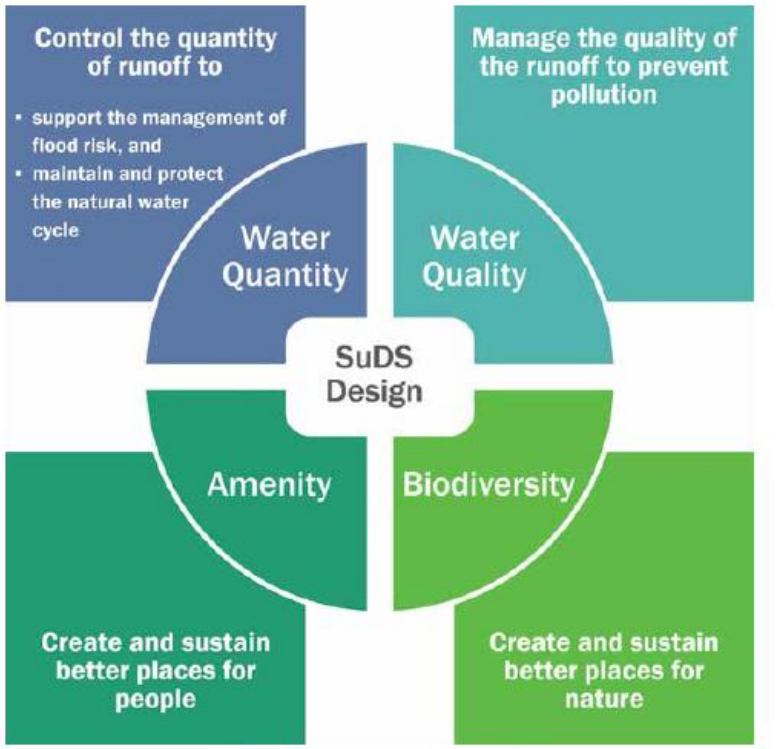


Figure 6-1 Four pillars of SUDS Design (CIRIA, 2015)

6.2 Design Criteria

The following national guidance documents and design standards have been considered when developing this outline surface water drainage strategy:

- C753 The SuDS Manual (Ciria, 2015)
- Statutory standards for sustainable drainage systems – designing, constructing, operating and maintaining surface water drainage systems (Welsh Government, 2018)
- Planning Policy Wales – Edition 10, December 2018
- The Building Regulations 2010 Part H: Drainage and Waste Disposal

- Sewers for Adoption 7th Edition

The Highways and Flood Management Team at Monmouthshire County Council have also been consulted to determine specific drainage requirements for any development at the site. The advice is detailed further below.

6.3 S1 Surface Water Runoff destination

The statutory standards for SUDS in Wales address the use of surface water by the development and where it should be discharged. It has developed a destination hierarchy which sets out the preferred routes for discharge of runoff from the site:

- Priority Level 1: Surface water runoff is collected for reuse
- Priority Level 2: Surface water runoff is infiltrated to ground
- Priority Level 3: Surface water runoff is discharged to a surface water body
- Priority Level 4: Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system
- Priority Level 5: Surface water runoff is discharged to the combined sewer

Priority Level 1 is the preferred (highest priority) and 4 and 5 should only be used in exceptional circumstances. The following outlines how the proposed development adheres to the drainage hierarchy.

6.3.1 Priority Level 1 - Water for re-use

The potential for surface water re-use within any residential development within the site may be limited, whilst opportunities for rainwater harvesting should be explored further for the commercial and educational aspects of the site. However, it is unlikely that rainwater harvesting would provide a means for disposal of surface water from the entire site area.

Where practical, water butts should be provided at residential properties to promote water re-use. However, water butts should not be included in any storage calculations for the site.

6.3.2 Priority Level 2- Infiltration

Given the underlying soil conditions, geology and bore hole records in the area there is a potential for the development site to infiltrate to the ground. It is recommended that infiltration testing is undertaken prior to any outline or detailed design to determine the best means of surface water disposal from the site. Should infiltration be viable across the site, this should be the preferred means of surface water disposal in line with the drainage hierarchy.

As the site is located within Groundwater Source Protection Zone 1, a hydrogeological risk assessment should be undertaken where infiltration SUDS are proposed for anything other than clean roof drainage, to ensure that the system does not pose an unacceptable risk to groundwater supply. This is in line with the Environment Agency's guidance to groundwater protection published in February 2018 and adopted by Natural Resources Wales.

The guidance states that, where infiltration SuDS are to be used in an SPZ for surface run-off from roads, car parking and public or amenity areas, they should:

- be suitably designed

- meet Governments non-statutory technical standards for sustainable drainage systems – these standards should be used in conjunction with the National Planning Policy Framework and Planning Practice Guidance.
- use a SuDS management treatment train – that is, use drainage components in series to achieve a robust surface water management system that does not pose an unacceptable risk of pollution to groundwater.

6.3.3 Priority Level 3- Discharge to a surface water body

Should infiltration not be viable across the site then opportunities to discharge surface water to a watercourse should be explored. The west of the site should aim to discharge to the drainage ditch along Crick Road.

No other watercourses cross the site, and therefore the remaining eastern area of the site may require an alternative means of discharge.

6.3.4 Priority Level 4- Discharge to a surface water sewer, highway drain or another drainage system

Where priority levels 1-3 are not possible, water shall be discharged to any surface water sewer or highway drain within the vicinity of the site.

Sewer plans have been obtained from Welsh Water which indicate that there is a surface water sewer located 230 metres north west of the site. This is unlikely to be a suitable discharge location as water would have to be pumped against gravity. This opposes the general principles of SuDS to drain surface water via gravity systems. The Welsh Water sewer plans are contained in Appendix B.

As discharging to a public surface water sewer is not a suitable option, discharge to a highway drain should be investigated as any other alternative discharge location is unlikely to be viable for some areas of the proposed development site. As a result of this, it is recommended that early engagement with Monmouthshire County Council Highways Authority and SuDS Approval Body (SAB) is undertaken prior to any outline drainage design for the site.

6.3.5 Priority Level 5- Discharge to a combined sewer

There are no combined sewers in the vicinity of the proposed development site.

6.4 S2: Surface Water Runoff Hydraulic Control: Proposed Discharge Rate

There are typically three design storm events which should be considered when designing the SuDS system for managing flows and volumes:

- 1 in 1-year event, on sloping sites without basements, where surcharging above soffits of any surface water drainage pipework is not permitted.
- 1 in 30-year storm event, where surface water flooding of the site is not permitted at this frequency.
- 1 in 100-year storm event with allowances for future climate change, where runoff should be managed within the extents of the development site, ensuring that it cannot affect people or properties either within the development or surrounding developments.

6.4.1 Interception of Rainfall

When rainfall takes place on Greenfield sites there is, for the majority of rainfall events, no runoff from a site due to evapotranspiration or groundwater recharge. Therefore, interception mechanisms are based on runoff volume reduction using evapotranspiration and infiltration processes. A simplified approach to interception can be used based on assumed compliance of various drainage components. Table G2.1 of the statutory standards for SUDS in Wales lists the interception drainage components which have assumed compliance.

Should infiltration be viable across the site, it is evident that the site shall comply with the requirements for interception. Should an alternative discharge point be required, further consideration shall be required on the use of SUDS to provide sufficient interception of rainfall across the site.

6.4.2 Allowance for Climate Change

The Welsh Government has produced Adapting to Climate Change guidance[4] which contains updated representative climate changes allowances for Wales for peak flows. The guidance contains indicative sensitivity ranges for peak rainfall intensity. As the site is proposed to include residential uses, the assumed lifetime of development at the site is 100 years, and as such the 2070-2115 estimate should be used. The recommended climate change factor for small catchments using the Central estimate for the 2070-2115 epoch is 20%.

However, the Highways and Flood Management Team at Monmouthshire County Council have advised that a climate change allowance of 30% should be adopted and this should be used for all drainage calculations.

6.4.3 Discharge Limits and Attenuation Volume

Should infiltration be viable across the site the discharge rate shall be dictated by the infiltration potential of the underlying soils.

Should infiltration not be viable, the discharge limit for the site should be set to the Greenfield runoff rate of 2.49 l/s/ha.

Currently, the impermeable surfaced proportion of the proposed development is unknown and so the exact required attenuation volume cannot be calculated. Due to the size of the site, a large volume of attenuation volume is likely to the required. This should be considered at all stage of master planning and site design to facilitate the implementation of SuDS across the site through Blue-Green Corridors and source control techniques wherever possible. Current proposals indicate that 14Ha of the site shall be utilised for Green Infrastructure and SuDS.

6.5 S3: Water Quality

The surface water drainage system should provide a sufficient level of water quality treatment to prevent pollution of receiving waterbodies. During the water treatment design event (5mm rainfall across the entire site) no runoff should leave the site. This is

[4] Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales: https://gov.wales/sites/default/files/publications/2019-06/adapting-to-climate-change-guidance-for-flood-and-coastal-erosion-risk-management-authorities-in-wales.pdf

usually achieved through source control techniques such as permeable pavements and rain gardens.

Table 4.3 of the SuDS Manual advocates the use of the "simple index approach" to determine an appropriate level of pollution mitigation for development sites. This splits pollution into three contaminant types (Total Suspended Solids, Metals and Hydrocarbons) and assigns a "pollution hazard index" to each type. Different SuDS features are then assigned a "SuDS Mitigation Index" and sufficient treatment is deemed to be provided if the "SuDS Mitigation Index" is equal to or greater than the "pollution hazard index" for each pollutant type. When more than one SuDS component is required a multiplication factor of 0.5 is applied to mitigation indices for secondary and tertiary components to account for reduced performance.

The proposed development is for residential and commercial uses. Low traffic roads associated with commercial development have a 'low' pollution hazard level whilst commercial yard and delivery areas have a 'medium' pollution hazard level. Should uses with a 'medium' pollution hazard be present on site, the whole development site should be assigned 'medium' hazard pollution indices.

The "pollution hazard indices" for a medium pollution hazard site are given in Table 6-1 below.

Table 6-1: Pollution hazard indices for the site

Pollution hazard level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Medium	0.7	0.6	0.7

6.6 S4: Amenity Value

The design of the surface water management system should maximise amenity benefits across the site. SuDS components can enhance the provision of high-quality, attractive public space which can help to provide health and well-being benefits, improve liveability and contribute to improving the climate resilience of new developments.

The aim of Standard 4 is to ensure that wherever possible and having regard to the need to prioritise infiltration drainage, the SuDS scheme makes the best contribution towards maximising benefits for amenity.

Across this development site, SuDS components such as rain gardens and vegetated swales/rills would provide open and accessible areas, creating a pleasant place to live and promoting the well-being of residents across the site. Rain gardens and swales would also assist in the climate resilience of the development, promoting carbon sequestration, and permeable paving would provide amenity benefits from its multifunctionality.

6.7 S5: Biodiversity

The surface water drainage system should seek to enhance existing habitats within the site and complement neighbouring habitats. The ecological potential of the SUDS system can be maximised by utilising local planting and locating SUDS adjacent to existing

features. The strategy should create a range of habitats and provide varied water depths within the SUDS features which should be sustained by ensuring that an effective management regime is implemented.

Across the development site, the use of SUDS features will help to support and protect the ecosystem services highlighted in the Monmouthshire County Borough Local Biodiversity Action Plan. SUDS features will contribute to the creation of a diverse, self-sustaining and resilient ecosystem, reconnecting the landscape to existing local habitats.

6.8 S6: Design for Construction, Maintenance and Structural Integrity

The national SuDS standards state that components must be designed to ensure structural integrity of the drainage system and any adjacent structures or infrastructure under anticipated loading conditions over the design life of the development taking into account the requirement for reasonable levels of maintenance.

6.8.1 Health and Safety

The surface water drainage system should be designed so that it minimises health and safety risk to the site occupants. SUDS are sometimes perceived as unsafe features with fears of drowning and overturning cars, but with correct design, these risks can be mitigated. A CDM Designers Risk Assessment should be undertaken demonstrating that any proposed surface water drainage system is fit for purpose, with risks designed out of the proposal, or mitigated wherever necessary.

6.8.2 Adoption and Maintenance

Schedule 3 of the Flood and Water Management Act was implemented in Wales on the 7th January 2019. Under this legislation, SUDS that serve multiple properties must be approved and adopted by the SUDS Approval Body (SAB) – a function performed by the Lead Local Flood Authority at Monmouthshire County Council.

During detailed design phase, a detailed maintenance plan should be developed to demonstrate the maintenance required to ensure the proposed drainage system functions to optimal capacity in perpetuity.

6.9 Site opportunities and constraints

A range of SUDS components should be used with the development in an interconnected system designed to manage, treat and make best use of surface water runoff. A central design concept for SUDS is the SUDS management train. This describes the use of a sequence of components that collectively provide the necessary processes to control the frequency of runoff, the flow rates and the volumes of runoff, and to reduce concentrations of contaminants to acceptable levels.

The proposed development site provides many opportunities and constraints for the disposal of surface water via the use of SuDS. Figure 6-2 shows the locations of these opportunities and constraints.

The opportunities for infiltration are likely to be limited to the east of the site where the site is underlain by Sandstone and Limestone as the west of the site is underlain by Mudstone. However, infiltration testing should be carried out across the whole site to confirm whether there are opportunities for infiltration elsewhere.

An indicative location for a green corridor is shown in Figure 6-2, which is in line with the primary surface water flow route identified in the NRW flood maps. Additional green

corridors should be used across the site to create wildlife corridors and aid habitat connectivity. The western area of the site slopes down from east to west and is likely that surface water runoff can be attenuated in cross slope features and directed to the green corridor.

There is potential for the west of the site to discharge surface water runoff to the drainage ditch located on the opposite side of Crick Road, however, further investigation on the capacity of this ditch to receive flows from the development should be carried out. There are a number of low-lying areas within the site boundary where there is potential for open attenuation areas and indicative locations for these have been given in Figure 6-2.

Surface water runoff from the southern area of the site will likely need to be attenuated separately and discharged into the highway drainage system if there are no other viable discharge locations.

Consideration should also be given to the steep topography across the site. It is likely that check dams shall be required within any swale features to reduce flow velocities and minimise the risk of erosion to SuDS features. Check dams have the potential to create varied water levels across the site, increases the provision of varied habitats and enhancing the biodiversity potential of the SuDS scheme.

Current proposals suggest that 14Ha of the site shall be utilised for green infrastructure and SuDS, with various development uses across the site, including residential, commercial and educational. Where possible, a holistic approach should be taken for the use of SuDS across the site, to maximise the potential of the scheme to provide amenity and biodiversity benefits. Surface water drainage engineers are advised to work closely with the project ecologists and landscape architects to promote a SuDS scheme which works in tandem with other aspects of green infrastructure across the site.

In addition, there is the potential for SuDS to be used as an education tool within the educational setting of the proposed development. This shall promote the use of water as a natural resource, whilst providing multifunctional benefits in terms of amenity and surface water drainage.

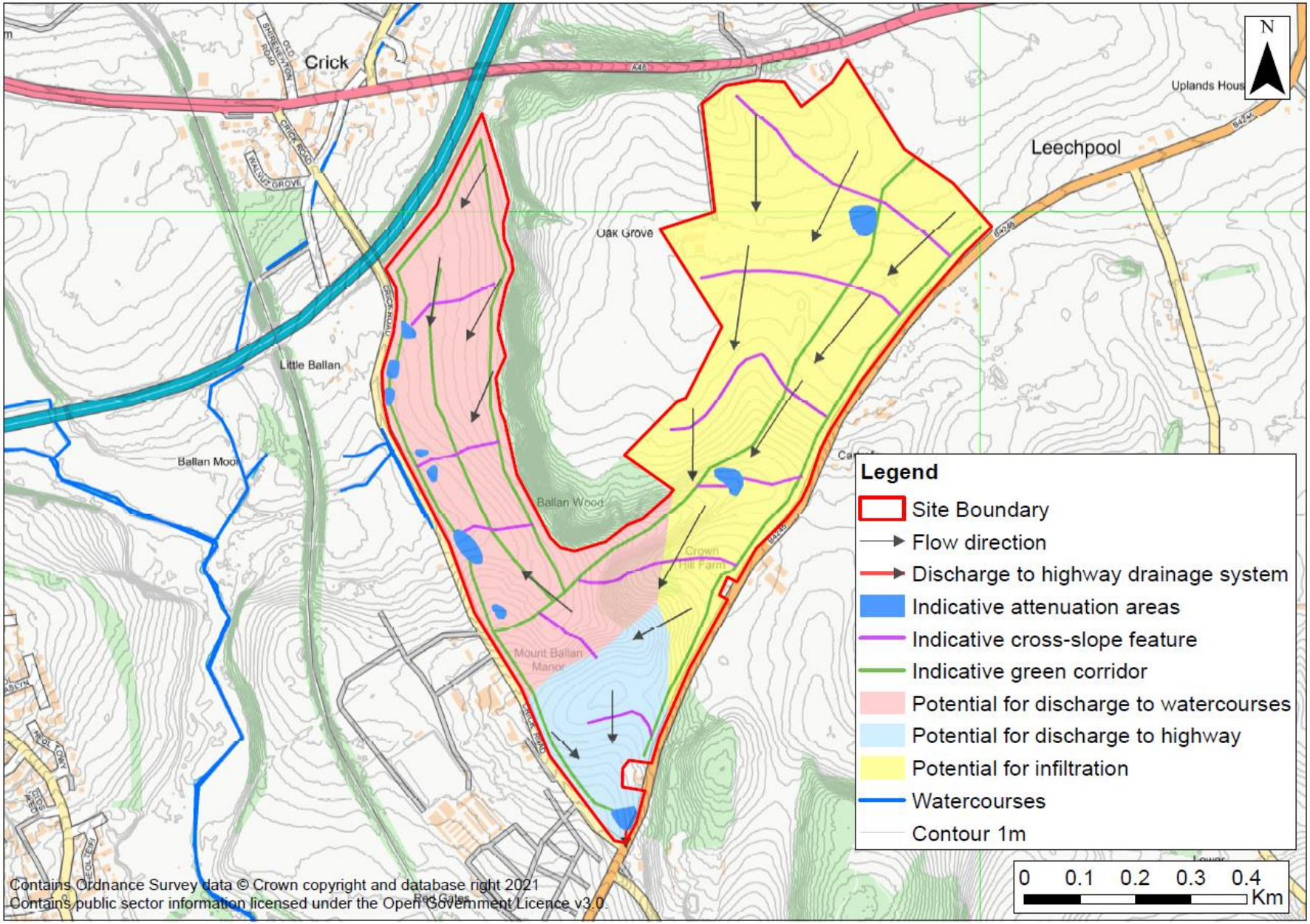


Figure 6-2 Site opportunities and constraints

6.10 Summary of SUDS viability on site

Given the design criteria above, and the opportunities and constraints across the site, consideration has been given to various SuDS components and their viability for use across the proposed development site. Table 6-2 provides a summary of the SuDS component and their viability, along with indication of the additional benefits they can provide, such as amenity, biodiversity and water quality benefits. This demonstrates that there are a wide range of SuDS options that could potentially be deployed at the site. Such SuDS options would be deployed in combination to form a SuDS 'management train' to achieve the multiple requirements and objectives of the SuDS standards.

Table 6-2 Viability of SuDS Techniques on site

SuDS Component	Site Viability	Amenity Benefits	Biodiversity Benefits	Water Quality Benefits	Comments
Rainwater harvesting	×	✓	×	×	Unlikely to establish the yield: use ratio required for residential areas but should be explored further for the educational and commercial areas of the site
Green roofs	✓	✓	✓	✓	Structural and maintenance requirements of these on dwellings to be considered though possibility on commercial/educational units
Infiltration systems and soakaways	✓	✓	✓	✓	Across site soakaway testing required to establish infiltration rates - may not be viable in westerns areas of the site
Filter strips	✓	×	×	✓	Opportunities for inclusion within Green Corridors
Filter drains	✓	×	×	✓	Beneficial for use within a treatment train
Swales	✓	✓	✓	✓	Consideration to be given to areas of steep site topography and swale gradient requirements. Existing

					overland flow paths should be retained
Bioretention systems and rain gardens	✓	✓	✓	✓	Beneficial for use within treatment trains and for implementation of SuDS at source - e.g. along highways
Pervious Pavements	✓	×	×	✓	Beneficial for use within treatment trains and for implementation of SuDS at source
Attenuation Storage Tanks	✓	×	×	×	Above ground SuDS should be considered prior to the use of below ground storage
Detention Basins	✓	✓	✓	✓	Opportunities for habitat creation and inclusion within areas of public open space
Pond and Wetlands	✓	✓	✓	✓	Opportunities to enhance biodiversity and habitat creation

6.11 Foul Drainage

6.11.1 Building Regulations 2010: Part H: Drainage and Waste Disposal

Part H of the Building Regulations 2010 state that foul drainage should be connected to the foul or combined sewer wherever this is reasonably practicable.

The Dŵr Cymru Welsh Water (DCWW) sewer map (Figure 6-3) shows that there is a private foul sewer 200 metres to the north west of the site. As a result, a pumped system is likely to be required. A pre-planning consultation request would need to be submitted to Dŵr Cymru Welsh Water (DCWW), to determine if there is sufficient capacity within the existing foul water network to receive foul flows from the proposed development site.

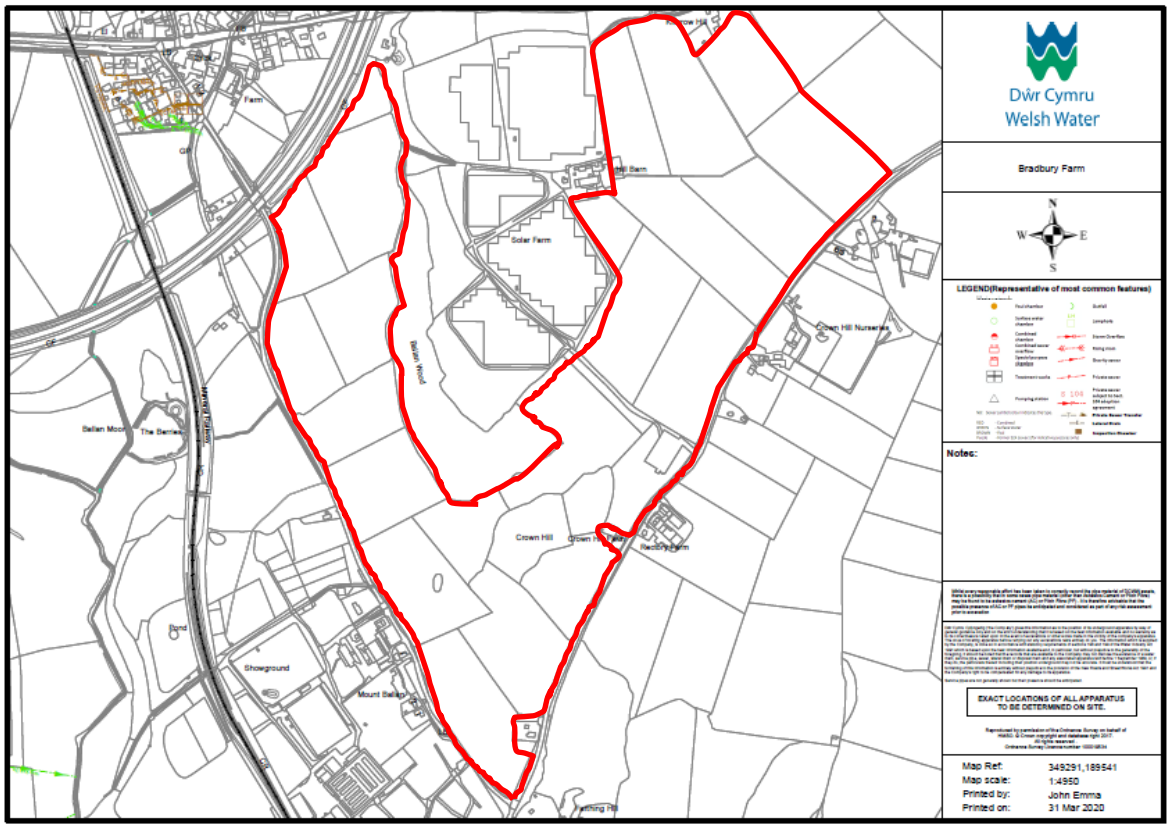


Figure 6-3 Dwr Cymru Welsh Water Sewer Map

7 Conclusions and Recommendations

- JBA Consulting was commissioned by Monmouthshire County Council to undertake a level 1 Flood Consequences Assessment and drainage statement for a proposed development site near Bradbury Farm, Portskewett.
- The development site is to be put forward as a candidate site for the revision to the Local Development Plan for Monmouthshire County Council.
- The entire development site is located in Flood Zone A where there is considered to be very little or no risk of fluvial and tidal flooding.
- The majority of the site is at very low risk from surface water flooding. There is a surface water flow route through the centre of the site from east to west.
- It is advised that existing surface water flow routes are retained where possible and incorporated within the surface water drainage strategy.
- There are two soil types beneath the site, both of which are described as freely draining. Underlying geology is comprised of mudstone and limestone.
- The proposed development should seek to dispose of surface water runoff through rainwater harvesting and infiltration where possible, before discharge to surface water body or sewer is considered. Infiltration testing will be required at detailed design stage.
- If infiltration is proposed at the site, a hydrogeological risk assessment should be undertaken to prevent pollution to the underlying groundwater Source Protection Zone.
- Greenfield runoff rates at the site have been calculated as 2.49 l/s/ha.
- The drainage system should work to provide multiple amenity and biodiversity benefits and ensure water quality is not adversely affected as a result of the development.

TECHNICAL NOTE

JBA Project Code	2020s0430
Contract	Stage 1 FCA for various MCC Development Sites
Client	Monmouthshire County Council (MCC) Estate Development Team (EDT)
Date	30/03/2020
Author	James Dunn
Reviewer	George Baker
Subject	Bradbury Farm, Portskewett

Appendix A: UK SuDS Tool: Greenfield Runoff Rates

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Steffan Howley
Site name:	Bradbury Farm
Site location:	Bradbury Farm

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.59998° N
Longitude:	2.73289° W
Reference:	919486034
Date:	Aug 25 2021 11:47

Runoff estimation approach

FEH Statistical

Site characteristics

Total site area (ha): 58

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Specify BFI manually
HOST class:	N/A
BFI / BFIHOST:	0.682
Q_{MED} (l/s):	
Q_{BAR} / Q_{MED} factor:	1.08

Hydrological characteristics

	Default	Edited
SAAR (mm):	841	841
Hydrological region:	9	9
Growth curve factor 1 year:	0.88	0.88
Growth curve factor 30 years:	1.78	1.78
Growth curve factor 100 years:	2.18	2.18
Growth curve factor 200 years:	2.46	2.46

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

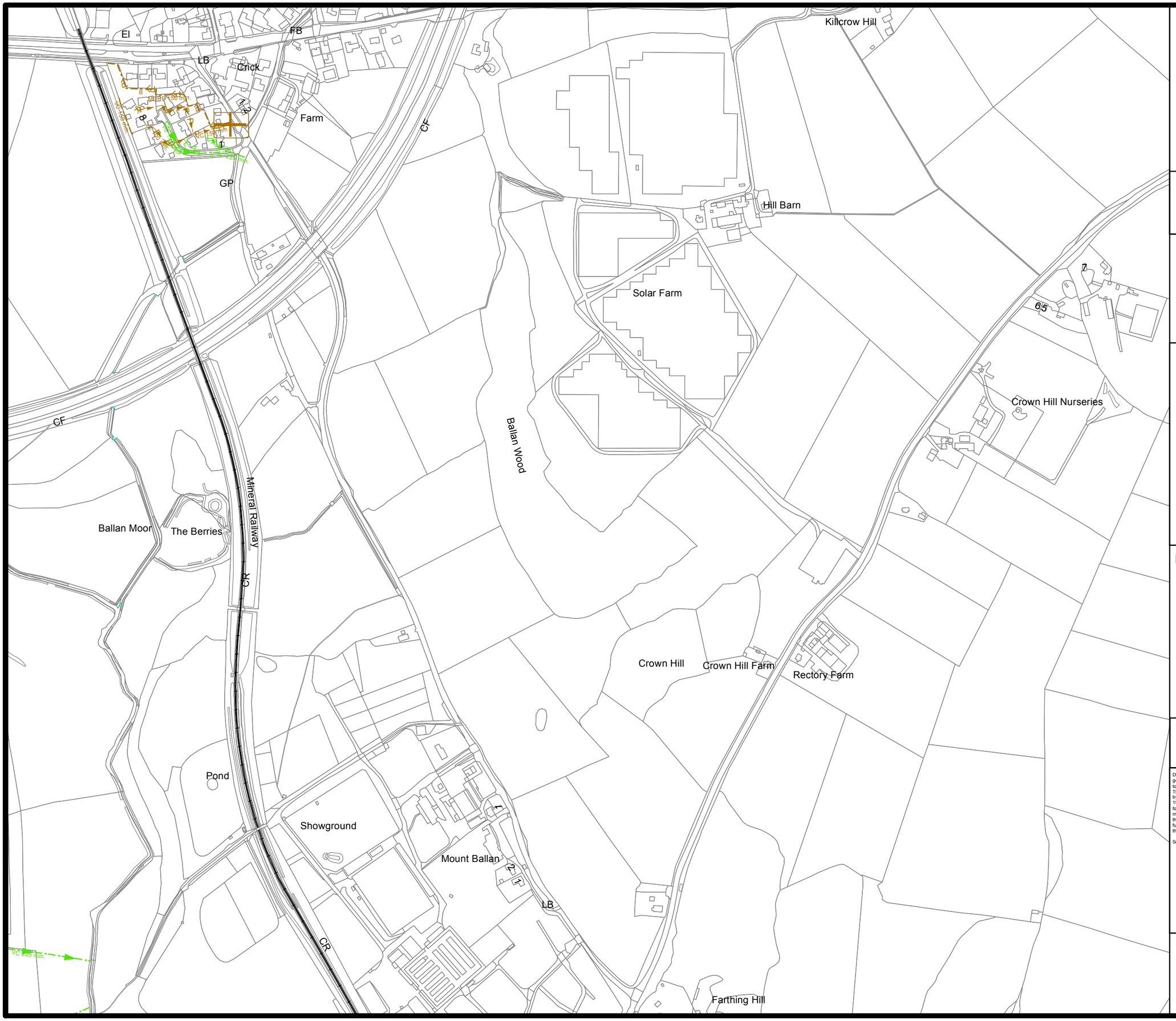
(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):		144.57
1 in 1 year (l/s):		127.22
1 in 30 years (l/s):		257.33
1 in 100 year (l/s):		315.16
1 in 200 years (l/s):		355.64

Appendix B: Welsh Water Sewer Map



Dŵr Cymru
Welsh Water

Bradbury Farm

N
W E
S

LEGEND(Representative of most common features)

Waste network:

- Foul chamber
- Surface water chamber
- Combined chamber
- Combined sewer overflow (CO)
- Special purpose chamber (SPC)
- Treatment works
- Pumping station
- Outfall
- Lamphole (LH)
- Storm Overflow
- Rising main
- Gravity sewer
- Private sewer
- Private sewer subject to Sect. 104 adoption agreement (S 104)
- Private Sewer Transfer
- Lateral Drain
- Inspection Chamber

NB: Sewer symbol colour indicates the type.

RED - Combined
GREEN - Surface Water
BROWN - Foul
Purple - Former S24 sewers (for indicative purposes only)

Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF) . It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

Map Ref:	349291,189541
Map scale:	1:4950
Printed by:	John Emma
Printed on:	31 Mar 2020