TECHNICAL NOTE

JBA Project Code	2020s0430
Contract	Stage 1 FCA for various MCC Development Sites
Client	Monmouthshire County Council
Date	May 2020 (Minor updates August 2021)
Author	Clare Burnell
Reviewer / Sign-off	Faye Tomalin
Subject	Raglan Enterprise Park

1 Introduction

JBA Consulting were commissioned by Monmouthshire County Council to undertake a Level 1 Flood Consequence Assessment and Outline Drainage Statement for Raglan Enterprise Park, Raglan. The assessment is to support Stage 2 of the Candidate Sites process as part of Monmouthshire County Council's ongoing review of a replacement Local Development Plan (LDP).

2 The Site

2.1 Site Description

The 12.8 hectare site is located in Raglan, Monmouthshire and is currently used for agricultural purposes, as shown in Figure 2-1. The site is located in a predominantly rural area, with agricultural land surrounding the site in all directions. The site is bound to the east by Chepstow Road and to the north by the Nant Y Wilcae which flows in an easterly direction. At the eastern boundary, on the opposite side of the highway (Chepstow Road), there is a drainage ditch which conveys water into the Nant Y Wilcae.

It is understood that the site is being considered for a 6.59MW solar farm and expansion of the existing industrial estate.

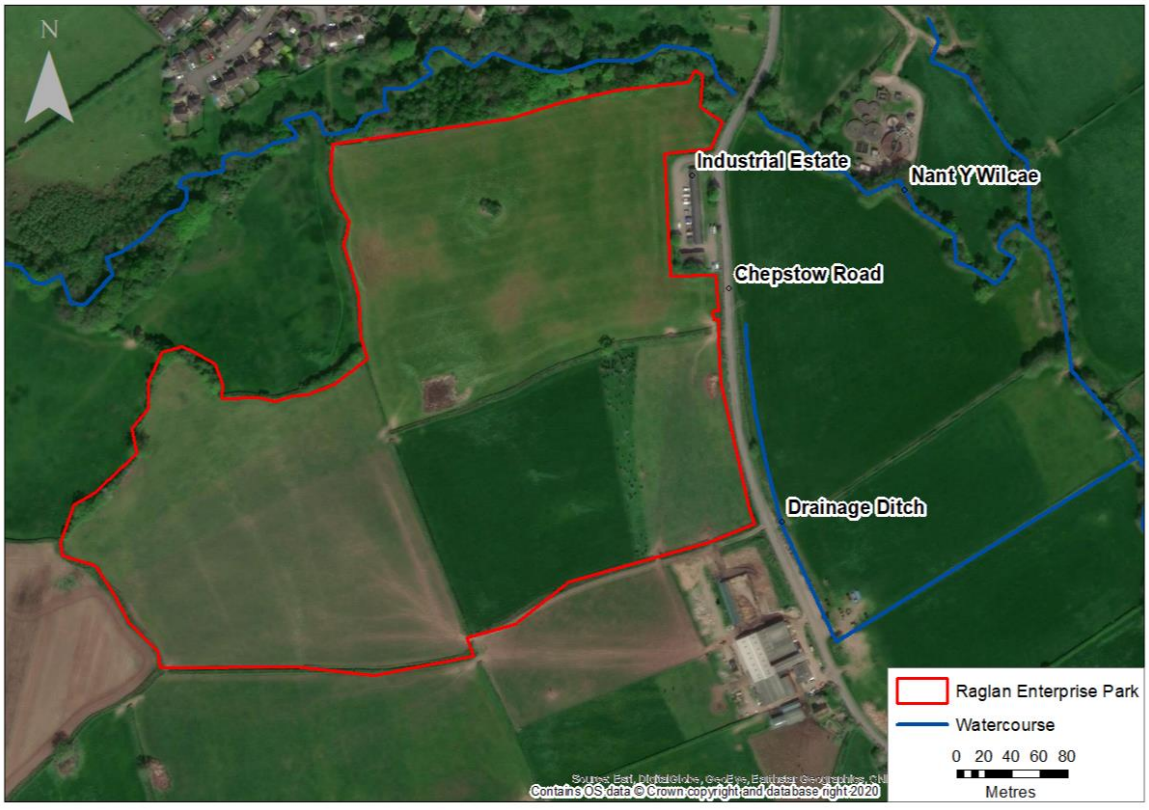


Figure 2-1: Site Location

2.2 Site Topography

Natural Resources Wales 2m LiDAR data has been used to understand the topography of the site. The site slopes from its highest level of approximately 56.9m AOD in the western and central areas of the site to its lowest level in the north and east, approximately 38.0m AOD, as shown in Figure 2-2.

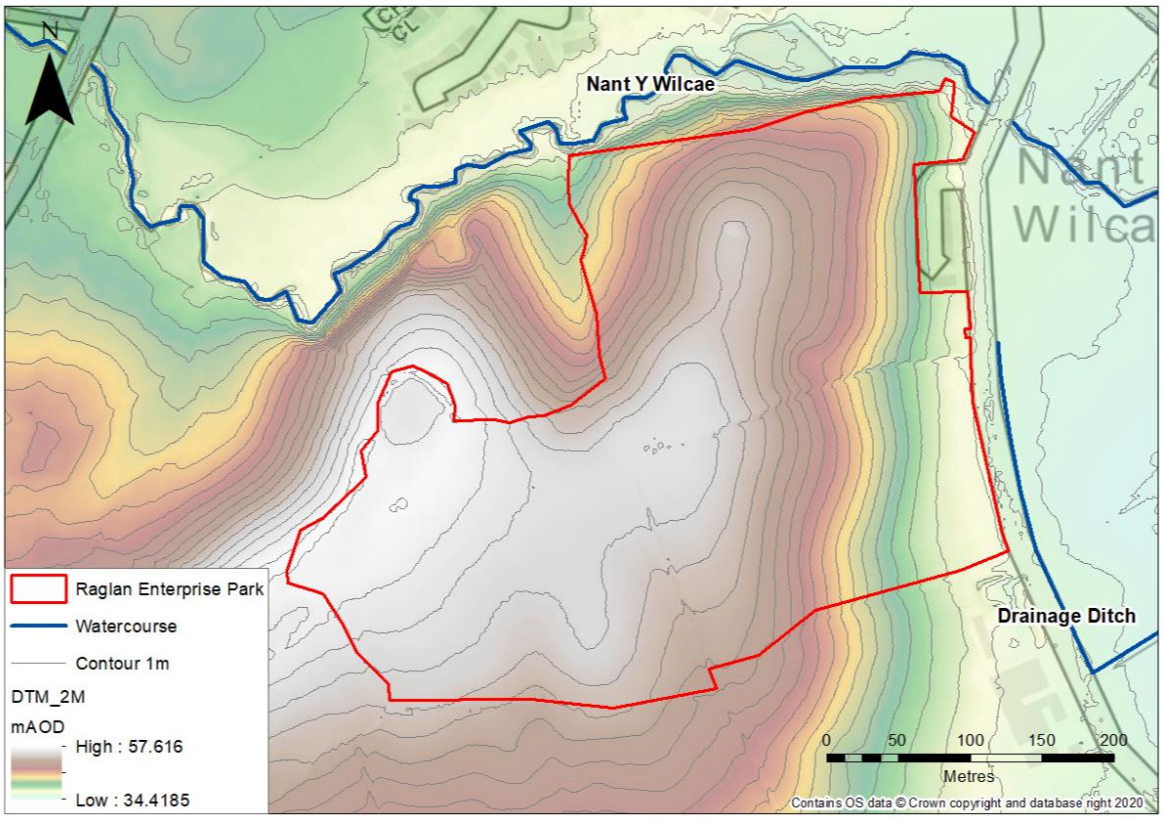


Figure 2-2: 2m LIDAR DTM

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.

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.

The site is not located within a Groundwater Source Protection Zone where groundwater levels are more likely to fluctuate.

No further issues have been identified within the SFCA in relation to flood risk at the development 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 and 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 zones and vulnerability classification relevant to the proposed development, based on an assessment of current and future conditions.

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 B on the edge of the development boundary indicates areas that have flooded historically. Zone A and B are considered to be at little or no risk of fluvial or coastal/tidal flooding and highly vulnerable uses are considered acceptable in this area.

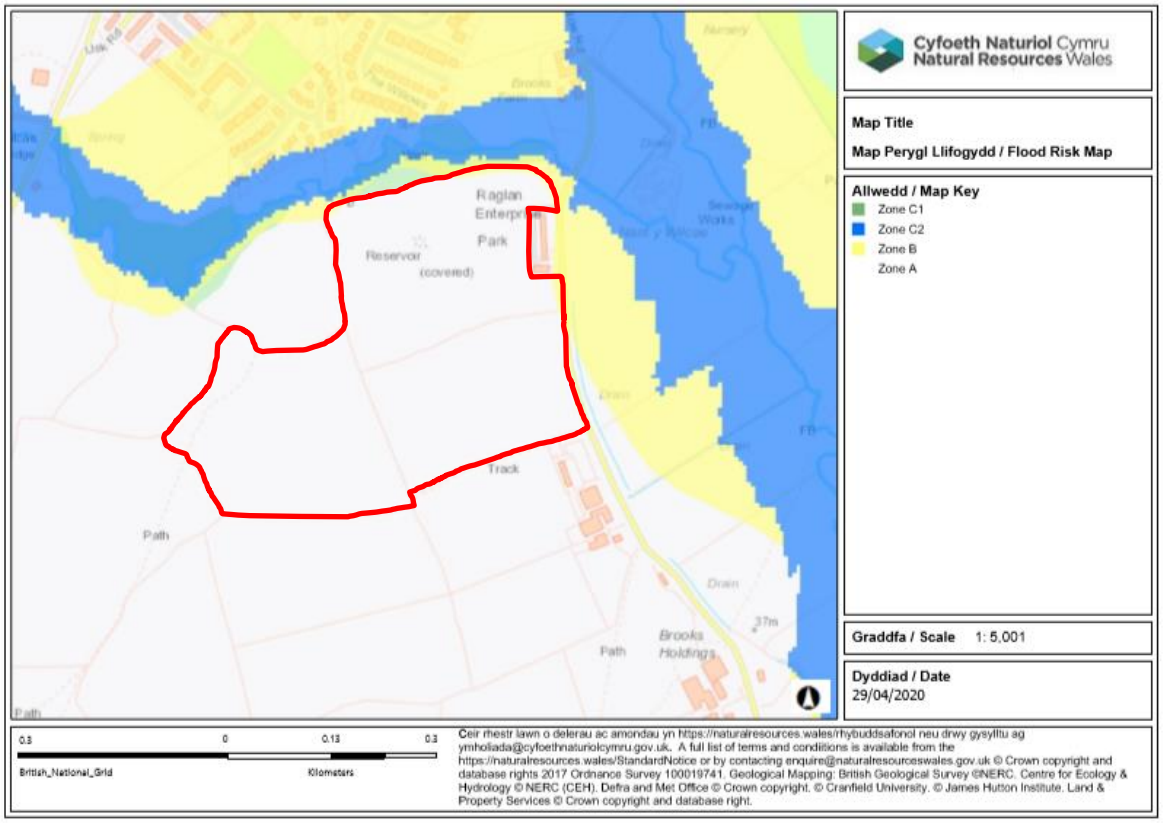


Figure 3-1: Development Advice Map

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 renewable energy (possibly a solar farm) and the expansion of the existing industrial estate. Renewable energy and industrial development would be 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 4-1 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	×	The site is predominantly at 'very low' risk from surface water flooding.
Reservoirs	×	The site is not at risk of flooding as a result of a breach in a reservoir structure.
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 DAM shows that the site is located entirely within Flood Zone A and therefore the risk of fluvial flooding is considered to be low.

4.3 Surface Water Flood Risk

The Natural Resources Wales flood map for surface water is shown in Figure 4-1. The site is predominantly at 'very low' risk from surface water flooding where there is a less than 1 in 1000 chance of flooding in any given year.

There is one localised area in the west of the site where there is a 'low' risk from surface water flooding. Areas at 'low' risk of surface water flooding have between a 1 in 1000 and 1 in 100 chance of flooding in any given year. This flooding is within a topographic depression on the site and should be easily manageable within the master planning process.

It is recommended that essential infrastructure associated with a renewable energy development such as inverter stations or substations avoid areas at risk of surface water flooding.

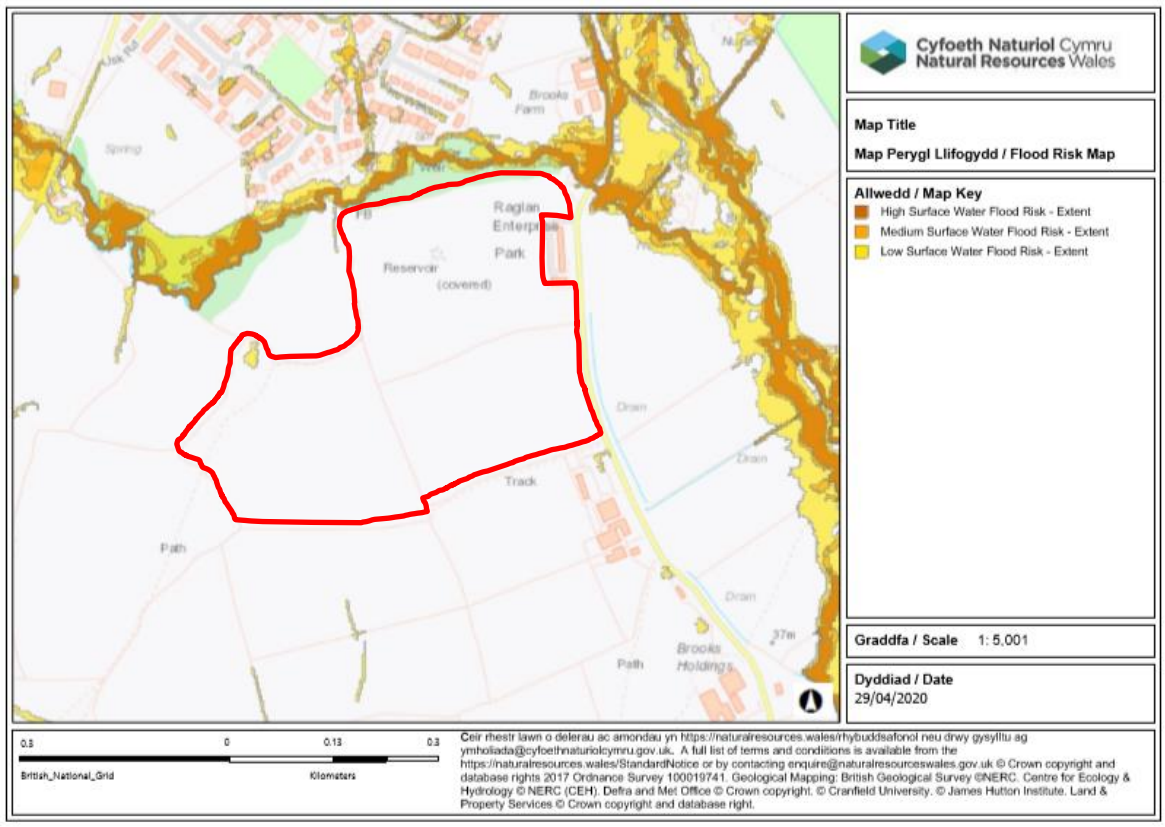


Figure 4-1: Natural Resources Wales Flood Risk Map for Surface Water

4.4 Risk of Flooding from Reservoirs

The site is not a risk of flooding as a result of reservoir failure.

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.

British Geological Survey 1:50,000 scale Geology of Britain Viewer[1] indicates that the site is largely underlain by the Raglan Mudstone Formation consisting of Mudstone and Siltstone.

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

The Monmouthshire Strategic Flood Consequences Assessment states that the risk of groundwater flooding in the study area in considered to be low. Furthermore, the site is not identified as an area where groundwater flooding 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 indicates that the site is underlain predominantly by the Raglan Mudstone Formation consisting of Mudstone and Siltstone.

Cranfield University Soilscapes[2] describes the soils in the north of the site as 'Loamy and clayey floodplain soils with naturally high groundwater'. In the west and south of the site the soils are described as 'Freely draining slightly acid loamy soils'. Based on a desktop survey of the site, infiltration is considered unlikely.

Although infiltration across the site is unlikely, it is recommended that infiltration testing is undertaken prior to detailed design stage to inform any future 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 shown in Appendix A. The development area is 12.8 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	4.2	54.3
QBAR	4.8	61.6
30	8.6	109.7
100	10.5	134.4

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 separately from the FEH Web Service for the proposed solar farm and industrial estate. These values are summarised in Table 5-2 with the calculated Greenfield runoff volumes.

Table 5-2: Greenfield runoff volumes and rainfall depths

Site	Return Period	6-hour rainfall runoff depth (mm)	Site runoff volume (m3)
Industrial Estate (0.7ha)	100	67.8	166
	100 plus climate change (30%)	88.1	229
Solar Farm (12.1ha)	100	67.8	2864
	100 plus climate change (30%)	88.1	3954

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:

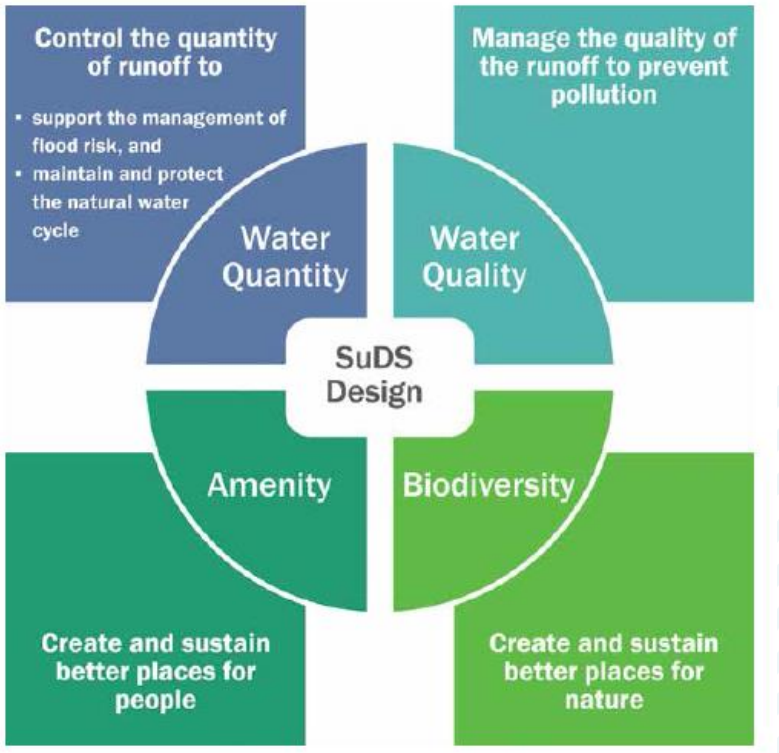


Figure 6-1: Four pillars of SUDS Design (CIRIA, 2015)

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. Their 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 renewable energy development is likely to be very limited but there are some opportunities in the industrial areas of the site. For example, water butts could be provided to the industrial units 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 geology, there may be limited potential for the development site to infiltrate to the ground. However, it is recommended that infiltration testing is undertaken at the site prior to any detailed design to demonstrate whether infiltration is feasible at 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. For the purposes of this report, infiltration is considered unlikely at the site.

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 nearest watercourse, the Nant Y Wilcae, is located on the northern boundary of the site and would be a suitable surface water discharge location. At the eastern boundary of the site, on the opposite side of the highway (Chepstow Road), there is a drainage ditch which conveys water into the Nant Y Wilcae which would also be a suitable

discharge location. Further investigation should be undertaken to determine whether discharging to the drainage ditch would be viable.

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 within the vicinity of the site.

Sewer plans have been obtained from Welsh Water and indicate that a surface water sewer is present 30m to the north of the site, on the opposite bank of the Nant Y Wilcae. As the Nant y Wilcae is located at the boundary of the site, it is considered that a discharge to this surface water sewer shall be unnecessary.

6.3.5 Priority Level 5- Discharge to a combined sewer

If all of the above options have been exhausted, the final option is to discharge surface water to a combined sewer 40m north east of the 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.

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

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

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

The discharge limit for the site shall be set to the Greenfield runoff rate of 4.8 l/s/ha.

Currently, the finalised impermeable surfaced proportion of the proposed development is unknown and so the exact required attenuation volume cannot be calculated. Whilst a holistic approach to a surface water scheme should be considered for the site, it is acknowledged that the solar farm area of the site will not cause a great increase in impermeable areas, with the exception of access tracks and sub-station infrastructure whilst the industrial estate expansion is likely to have larger areas of hardstanding. As a result, attenuation should be considered at all stages 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.

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 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 likely to be for renewable energy and industrial use. Whilst the solar panels would have a Very Low Pollution Hazard, the low traffic roads associated with the development have a 'low' pollution hazard level. As a result, the higher classification of a 'Low Pollution Hazard' should be used within the Simple Index approach methodology for the solar farm.

The industrial development area of the site would have a 'Medium Pollution Level' classification due to the proposed business/ commercial use of the site.

Given the mostly Greenfield nature of the solar farm proposal, it is likely that runoff will flow over ground, following the existing drainage regime for the most part. As a result, it is likely that minimal surface water treatment shall be required for the site. The industrial estate area of the site shall require the implantation of sufficient assets to suitably consider the effect of the development on the receiving watercourses. As a

result, the "pollution hazard indices" for both areas of the site are given in Table 6-1 below.

Table 6-1 Pollution hazard indices for the site

Area of site	Pollution hazard level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Solar Farm	Low	0.5	0.4	0.4
Industrial Development	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 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 vegetated swales would provide open and accessible areas, creating a pleasant place to work and promoting the wellbeing of site employees. Swales would also assist in the climate resilience of the development, promoting carbon sequestration, and permeable paving would provide amenity benefits from its multifunctionality.

It is recognised, that the solar farm area of the development is likely to be low-use and the use of SuDS in this area is likely to be minimal. However, amenity benefits of any SuDS included in a drainage scheme for the site should maximise the amenity potential of the site.

Rain gardens and bioretention areas, along with permeable paving should be considered for the industrial area of the proposed development site. These assets will capture surface water at source whilst providing multiple amenity benefits for employees in the area.

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.

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. Given the largely renewable energy use of the site, it is likely to remain in the ownership of a single company. As a result, it is unlikely that the SuDS system shall be adopted by the SAB.

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, which includes indicative areas for the industrial development and solar farm. Once a site plan has been finalised during the outline drainage strategy stage these areas should be amended appropriately.

The SUDS that are utilised at the site are likely to depend on the purpose of each area of the development. For the solar farm area of the site the increase in impermeable surfaces as a result of such a development are unlikely to be significant. However, features such as solar panels can direct runoff to the ground in such a way that results in the formation of eroded gullies which is particularly likely to be the case if natural infiltration is limited at the site and can lead to more overland flow occurring within the site. Cross-slope features could be included within the development layout to intercept overland flow and direct it towards green corridors where runoff can be attenuated in

swale features. Green corridors should be used across the site to create wildlife corridors and aid habitat connectivity.

If required, detention/ infiltration basins should be sited at the lowest points of the site, prior to surface water being discharged to the Nant Y Wilcae or the drainage ditch on Chepstow Road. Cross-slope features, such as linear swales should provide additional attenuation features across the site if required.

Any roads and areas of hardstanding within the development should be constructed of permeable materials where possible to reduce the area of impermeable surfaces introduced to the site.

In the industrial areas of the site, water butts and SuDS planters should be used to attenuate rainwater from any buildings in the industrial area. A swale between the industrial area and solar farm could also help to convey surface water to the Nant Y Wilcae before it is discharged. The use of a blue green roof on buildings across the industrial estate should be considered to capture surface water at source. Permeable paving in car parking areas should also be considered as a source control technique, whilst providing a multi-functional use to the site.

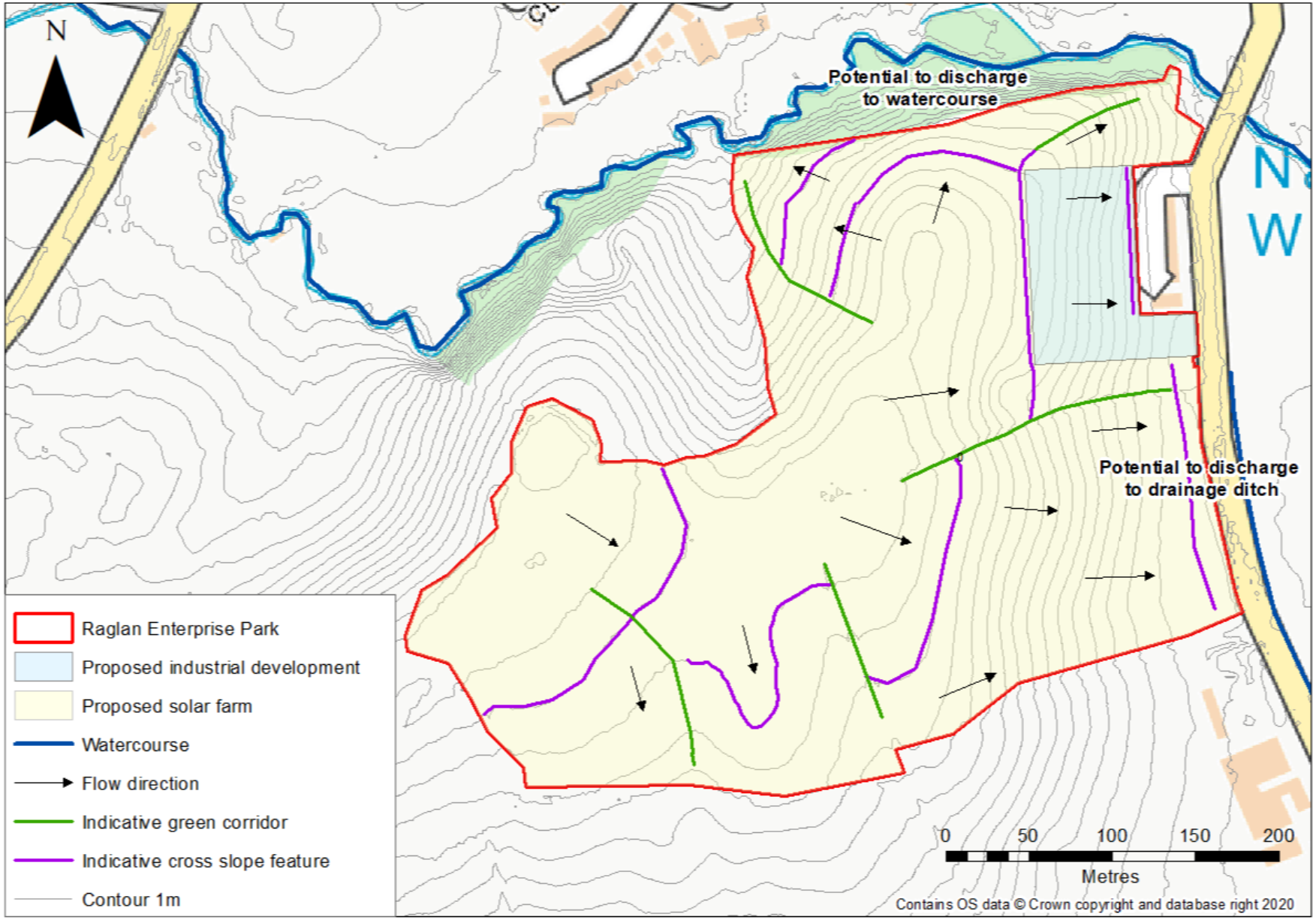


Figure 6-2 Opportunities and constraints on site

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 be viable for this site due to the nature of the proposals
Green/Blue roofs	✓	✓	✓	✓	Potential to be applied to any industrial buildings on site
Infiltration systems and soakaways	✓	✓	✓	✓	Infiltration across the site is unlikely, though testing should confirm this.
Filter strips	✓	×	×	✓	Opportunities for siting this at the base of solar panel to filter water across the site
Filter drains	✓	×	×	✓	Provides water treatment and possibilities for conveying flow across the site if required
Swales	✓	✓	✓	✓	Potential to create cross-contour features and green corridors

					throughout the site whilst conveying flow
Bioretention systems and rain gardens	✓	✓	✓	✓	Opportunities for inclusion in the industrial area of the site
Pervious Pavements	✓	×	×	✓	Possible inclusion for access track in the solar farm development, if required, or in car parking areas of the industrial site expansion
Attenuation Storage Tanks	✓	×	×	×	Above ground SuDS should be considered prior to the use of below ground storage
Detention Basins	✓	✓	✓	✓	Opportunities for habitat creation and attenuating flow across the site, if required
Pond and Wetlands	×	✓	✓	✓	Opportunities for habitat creation and attenuating flow in lower areas of the site, if required

7 Foul Drainage

7.1 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 7-1) shows that there is a foul sewer 95 metres north of the site. 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.

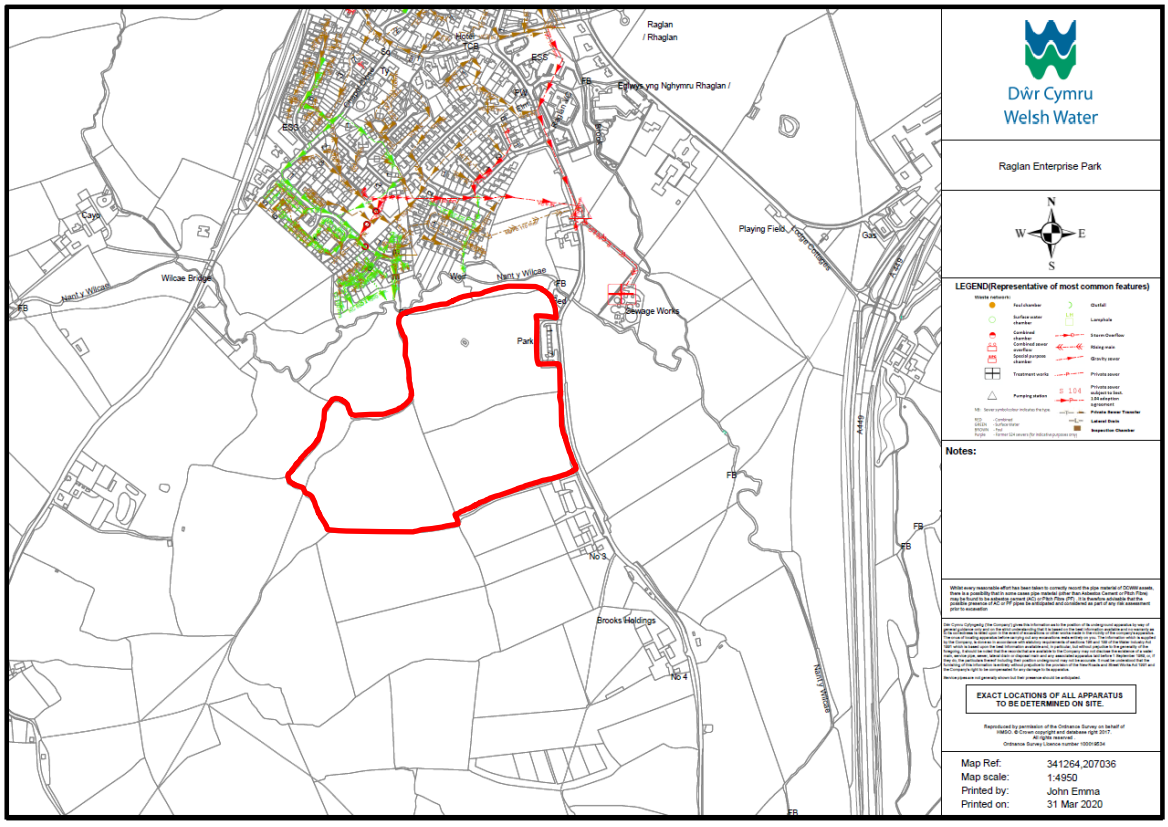


Figure 7-1 Dwr Cymru Welsh Water Sewer Map

8 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 at Raglan Enterprise Park, Raglan.
- 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. NRW mapping shows that the site is at very low risk from surface water flooding apart from one localised areas in the west of the site where there is a 'low' risk from surface water flooding.
- The soil types beneath the site are described as freely draining in the south and west of the site and loamy and clayey in the north. The underlying geology is comprised of Mudstone and Siltstone. As a result, the site is unlikely to have sufficient infiltration rates to remove surface water from the site via infiltration. However, infiltration testing will be required at detailed design stage.
- The proposed development should seek to remove surface water runoff through discharge to the Nant Y Wilcae and drainage ditch on Chepstow Road.
- Should the site be developed into a solar farm it is unlikely that there will be a significant increase in impermeable areas of the site. Solar panels may impact the way rainfall reaches the ground and may increase overland flow and this should be managed appropriately.
- Swales, filter strips and other cross contour features should convey surface water across the solar farm development to the north and east of the site before it is discharged into the Nant Y Wilcae and drainage ditch on Chepstow Road.
- For the expansion of the industrial site area, the use of blue green roofs, permeable paving and bioretention areas should be considered.
- Greenfield runoff rates at the site have been calculated as 4.8 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.

Appendix A: UK SuDS Tool: Greenfield Runoff Rates

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Clare Burnell
Site name:	Raglan Enterprise Park
Site location:	Raglan

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:	51.75995° N
Longitude:	2.85161° W
Reference:	4140207214
Date:	Apr 17 2020 15:04

Runoff estimation approach

FEH Statistical

Site characteristics

Total site area (ha): 12.8

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Specify BFI manually
HOST class:	N/A
BFI / BFIHOST:	0.544
Q_{MED} (l/s):	
Q_{BAR} / Q_{MED} factor:	1.08

Hydrological characteristics

	Default	Edited
SAAR (mm):	887	887
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.

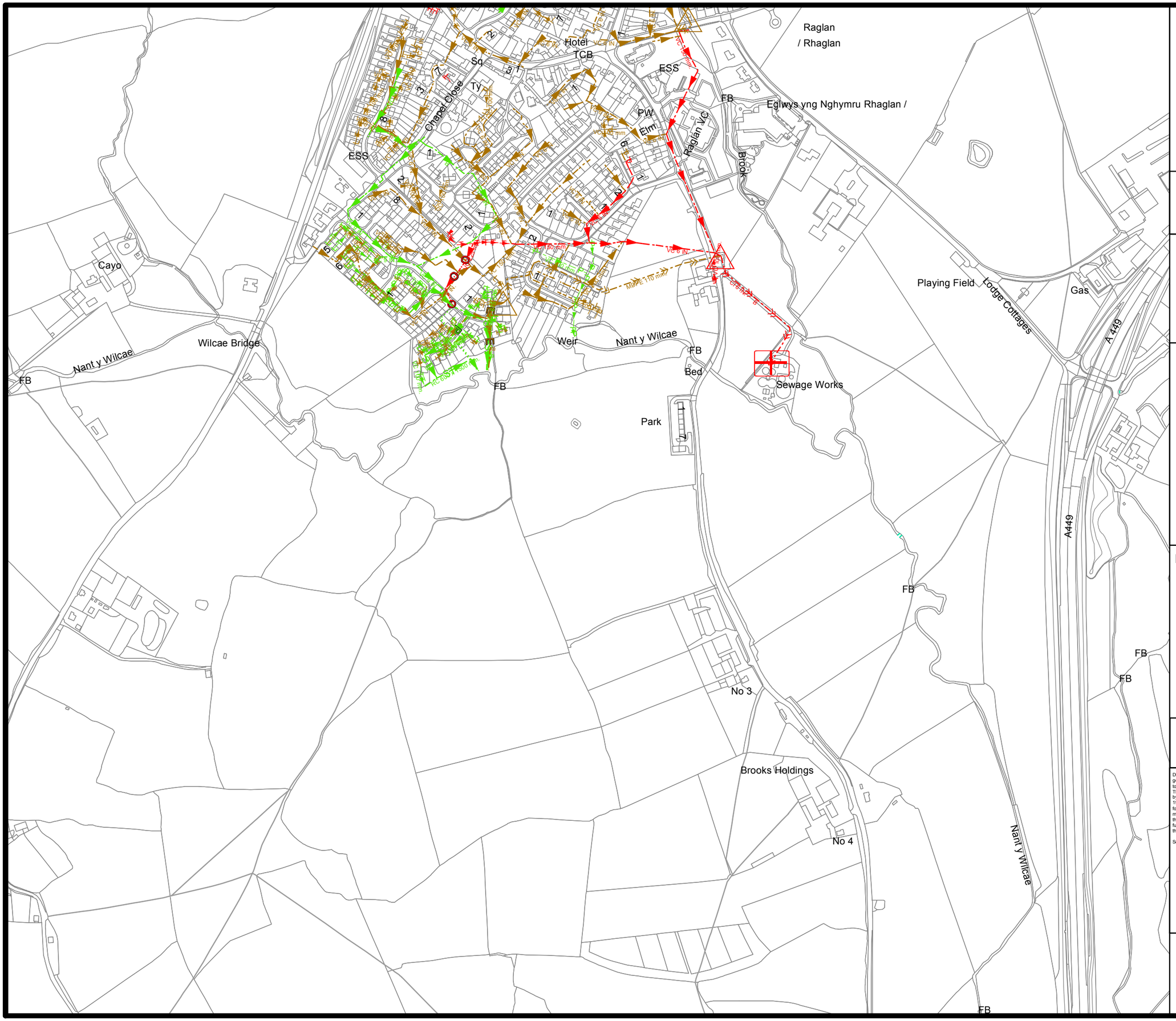
(3) Is SPR/SPRHOST ≤ 0.3?

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):		61.64
1 in 1 year (l/s):		54.25
1 in 30 years (l/s):		109.72
1 in 100 year (l/s):		134.38
1 in 200 years (l/s):		151.64

Appendix B: Welsh Water Sewer Map



Dŵr Cymru
Welsh Water

Raglan Enterprise Park

N
W E
S

LEGEND(Representative of most common features)

Waste network:

- Foul chamber
- Surface water chamber
- Combined chamber
- Combined sewer overflow
- Special purpose chamber
- Treatment works
- Pumping station
- Outfall
- Lamphole
- Storm Overflow
- Rising main
- Gravity sewer
- Private sewer
- Private sewer subject to Sect. 104 adoption agreement
- 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:	341264,207036
Map scale:	1:4950
Printed by:	John Emma
Printed on:	31 Mar 2020