Pen Caer Lan Farm Solar Project - Outline Surface Water Drainage Strategy

Version 1

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Contract

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This report describes work commissioned by Lighthouse Development Consulting on behalf of Greentech Invest UK Ltd, by an instruction dated 3rd November 2023. Charlotte Lickman of JBA Consulting carried out this work.

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Contents

List of Figures

List of Tables

1 Introduction

1.1 Terms of Reference

JBA Consulting were commissioned by Greentech Invest UK Ltd to prepare an outline surface water drainage strategy in support of a planning application for a 34ha Solar PV site at Seven Sisters, Neath. The development proposed is a Development of National Significance (DNS).

1.2 Site Description

The proposed development site is located approximately 650m to the south-west of the village of Seven Sisters, Neath. The site is currently comprised of greenfield agricultural land, set in a predominantly agricultural area with the total site area covering approximately 34ha. The boundary of the Bannau Brycheiniog National Park is approximately 2.5KM to the north of the site. Pen Cae'r Lan Farm and its associated buildings is located approximately 100m to the western boundary of the site.

Access to the site is sought via the A4109 to the south of the main site. There is an existing access road off of the A4109, which shall be further developed through the planning proposals to connect to the solar farm.

Site details are summarised in Table 1-1 and a site location plan is shown in Figure 1-1.

Table 1-1 Site summary

Site name	Pen Caer Lan Solar Farm
Site area	34ha
Existing land use	Greenfield
Proposal	Solar PV Energy Farm
OS NGR	SN 80627 08131
SuDS Approval Body	Neath Port Talbot Council
Sewerage Undertaker	Dŵr Cymru Welsh Water

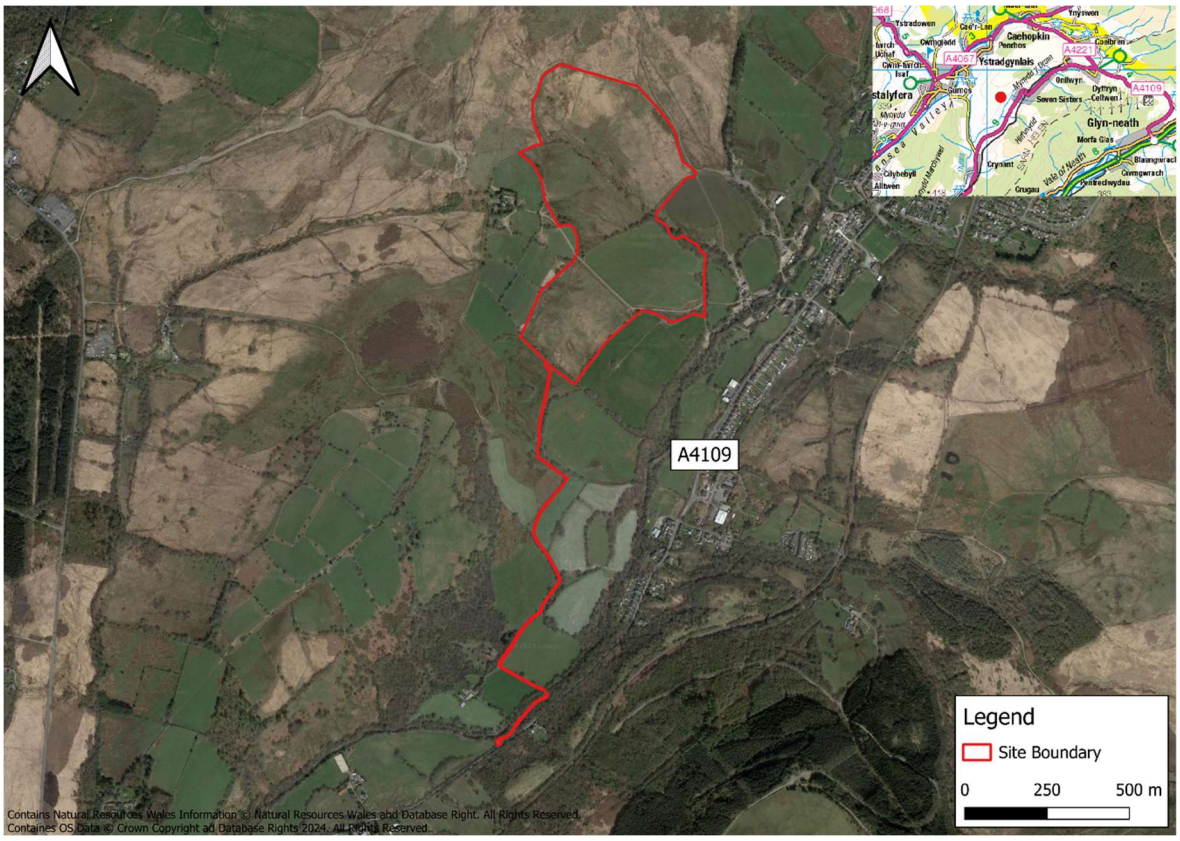


Figure 1-1 Site Location

1.3 Proposed development

The proposed development is for the installation of a solar farm comprising ground mounted solar PV panels with a generating capacity of up to 25MWp, including permanent grid connection hub, mounting framework, inverters, underground cabling, stock proof fence, CCTV, internal tracks and associated infrastructure including a Distribution Network Operator Substation compound, and landscaping.

The existing access track from the A4019 is not proposed to be altered from its current form. Only repairs are proposed to be made. Proposed access tracks across the site shall be made up of a permeable, MOT Type 1 subbase, such as crushed aggregate, and are therefore proposed to be permeable in nature.

The development proposals are contained in full in Appendix A.

1.4 Existing site topography

A topographic survey of the site was undertaken by Landmark Surveys Wales in May 2024, and is provided in Appendix B. Natural Resources Wales (NRW) open source 1m Light and Detection Ranging (LiDAR), which provides an alternative illustration of the site topography, is shown in Figure 1-2 and Figure 1-3.

Ground levels across the site are shown to fall steeply in a general south-easterly direction. Highest elevations of 214.62mAOD are shown in the north-western corner of the site, which fall to 144.97mAOD along the eastern boundary of the site.

The proposed access track has a ground level of approximately 174.88mAOD from the main site, falling to approximately 120.0mAOD where the road adjoins with the A4109.

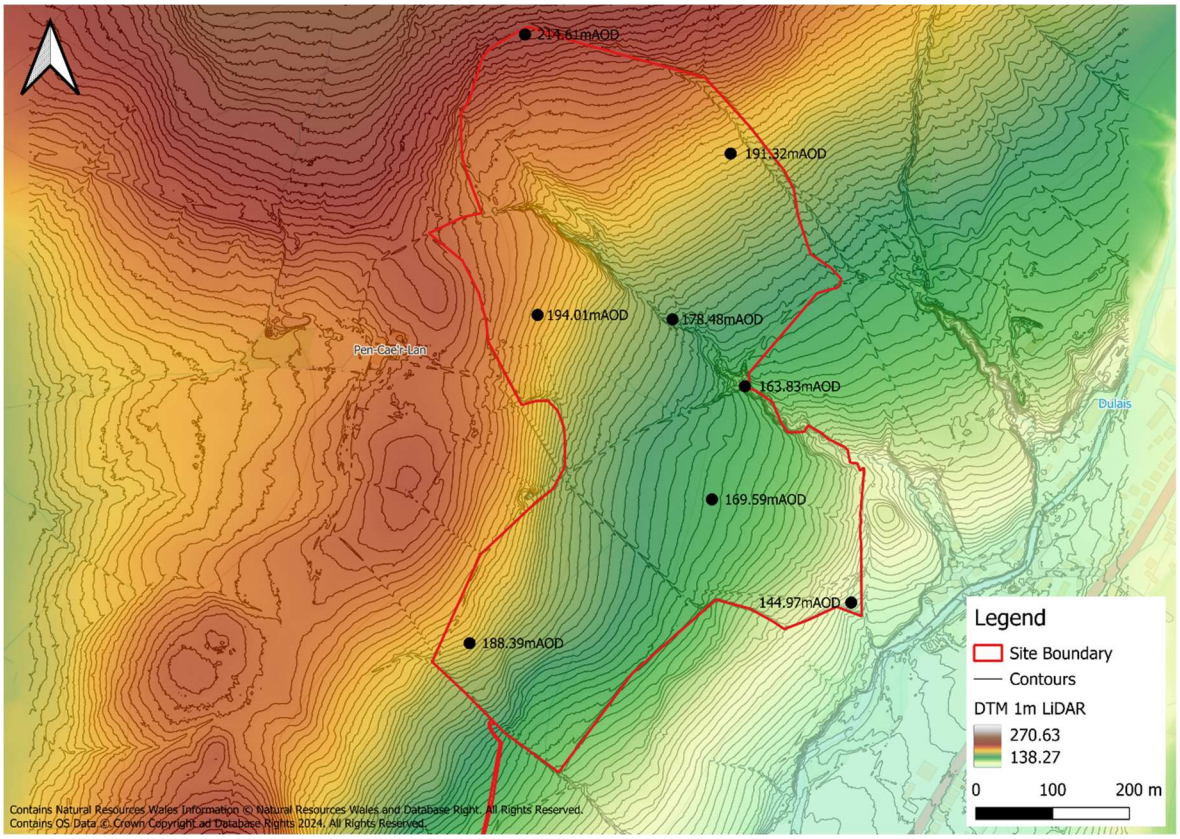


Figure 1-2 Site topography (main site)

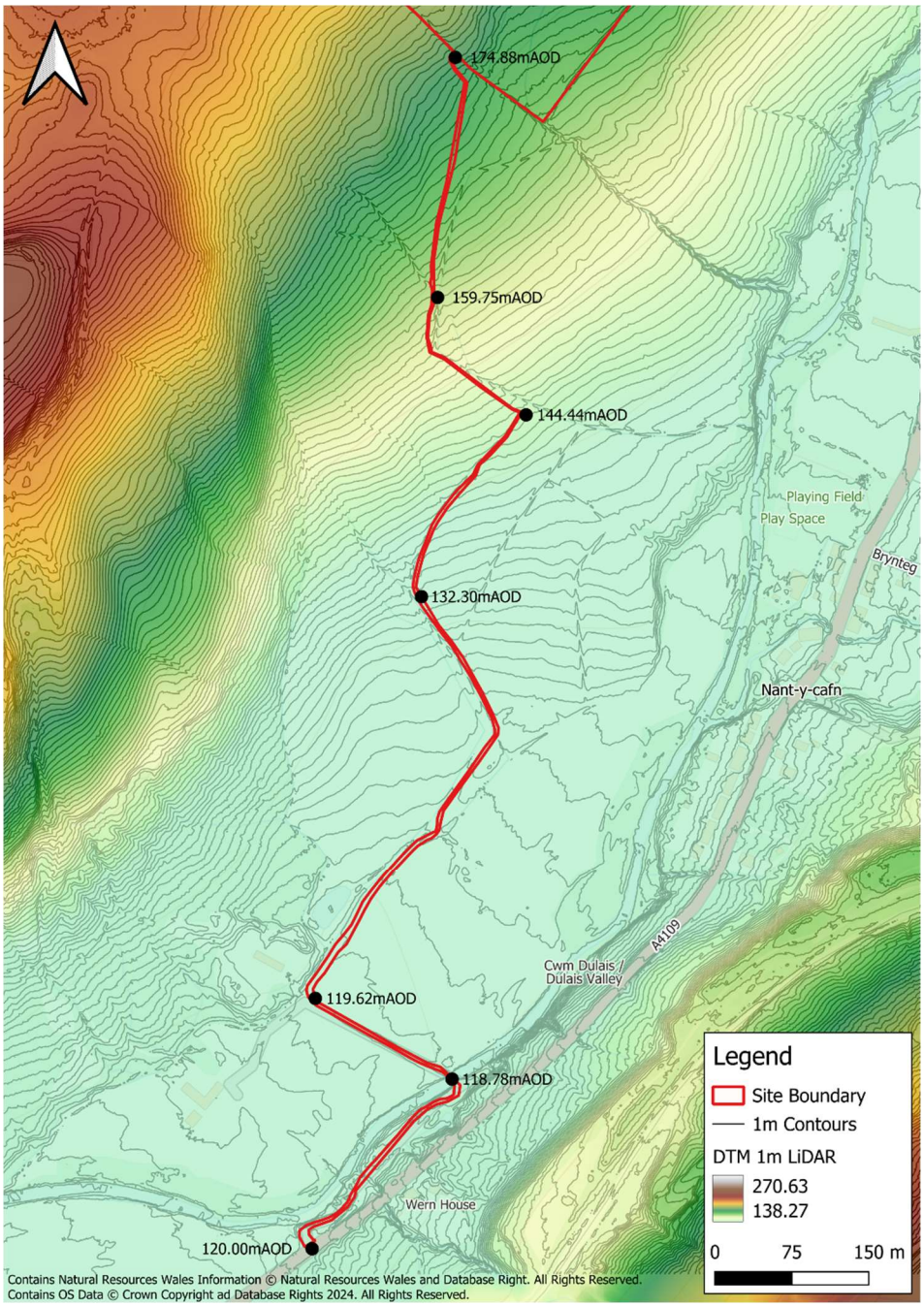


Figure 1-3 Site topography (access track)

1.5 Nearby Watercourses

The Afon Dulais, an NRW Main River, flows in a general south-westerly direction approximately 60m east of the site at its closest point, as seen in Figure 1-4.

There is a network of Ordinary Watercourses and drainage ditches which flow around and across the site, which predominantly drain into the Afon Dulais, as shown in Figure 1-4 and Figure 1-5.

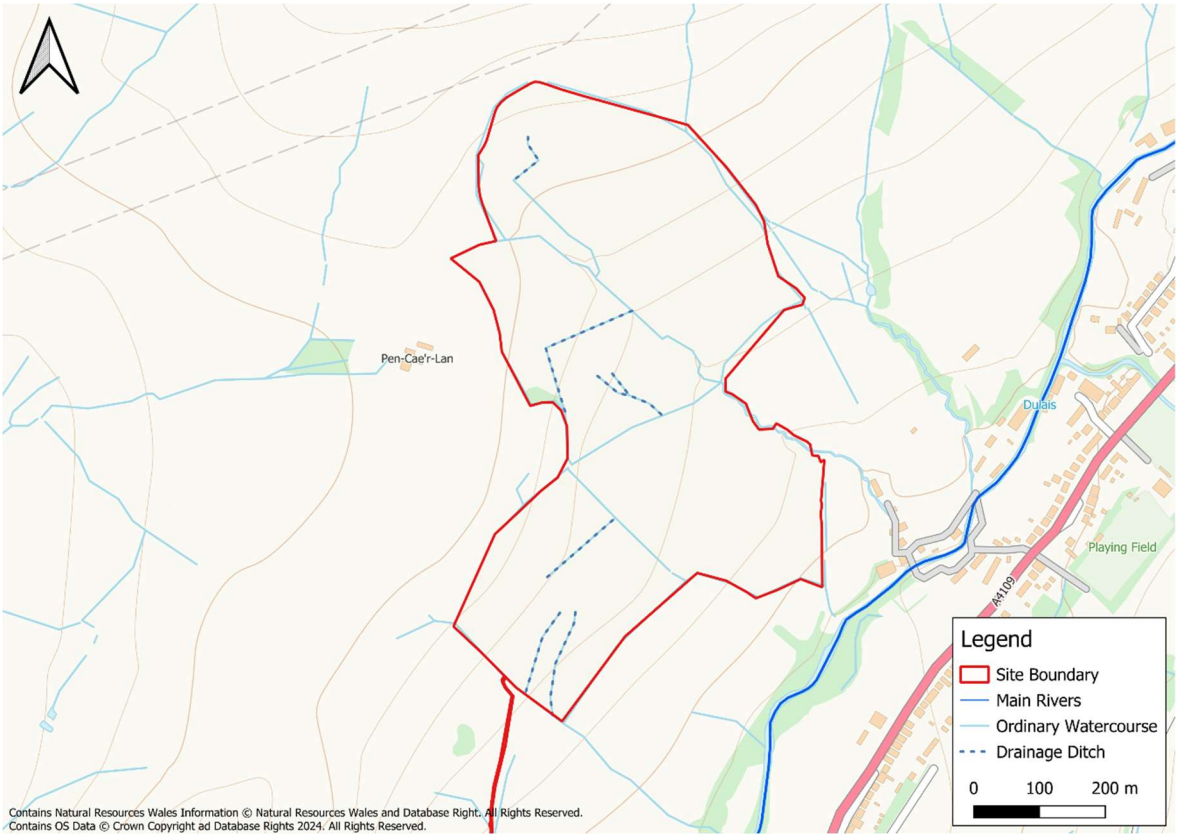


Figure 1-4 Nearby Watercourses (main site)

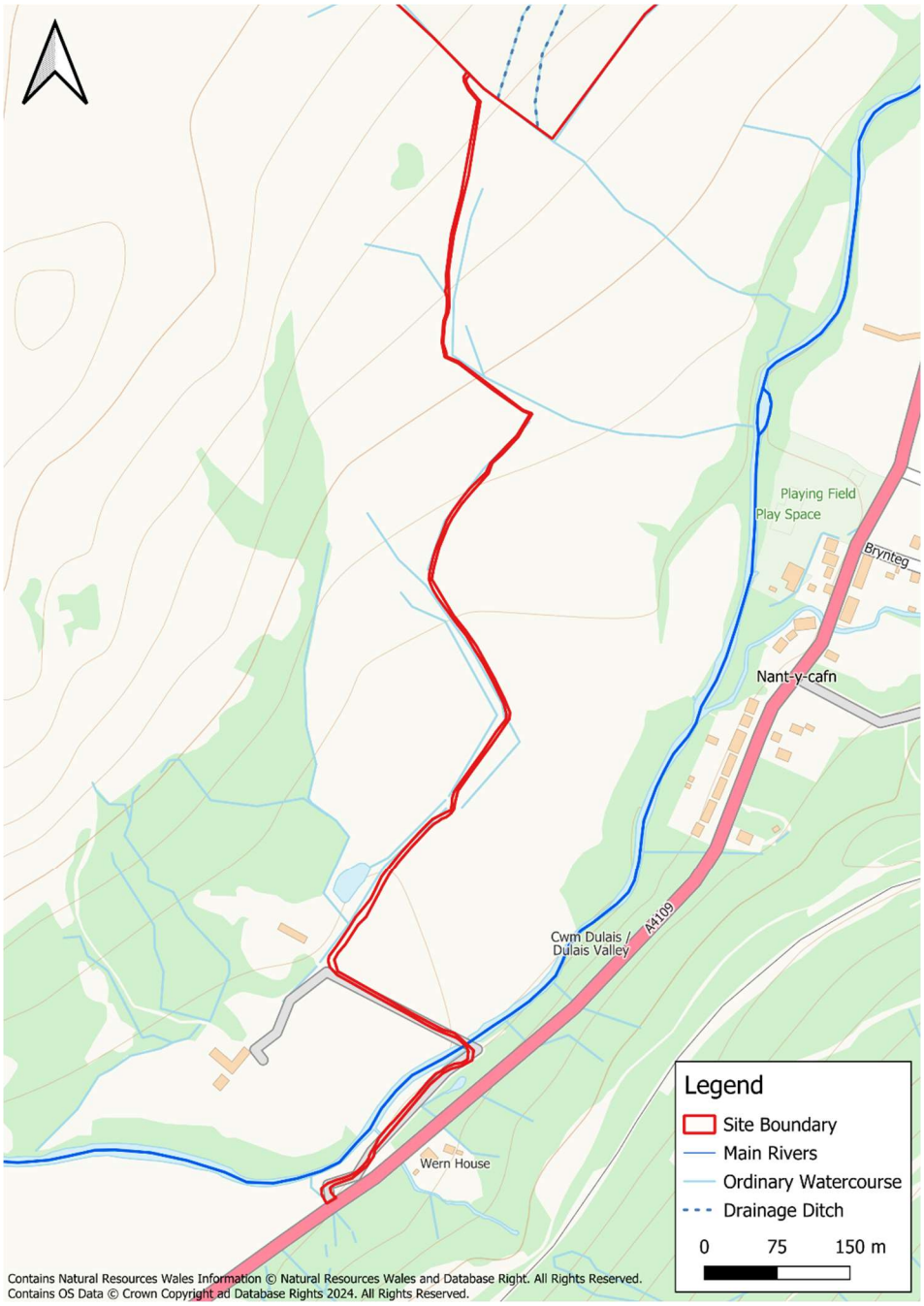


Figure 1-5 Nearby watercourses (access track)

1.6 Summary of Surface Water and Small Watercourse Flood Risk

Surface water flooding occurs when rain falling on saturated grounds flow overland, following local topography. Surface water flooding and subsequent overland flow can therefore pose a risk to both the development site and surrounding land. The overland flow may originate from the site itself or adjoining land at a higher elevation from which flow migrates onto the development.

The NRW Flood Risk Assessment Wales mapping for surface water and small watercourses, as shown in Figure 1-6, identifies the site as being predominantly at very low

risk of surface water flooding. This means that there is a less than 0.1% AEP (1 in 1000) chance of flooding in any given year.

However, several small ordinary watercourses are located within the proposed development site. Across the site, flood risk is predominantly associated with an unnamed tributary of the Afon Dulais. The watercourse corridor is shown to have a high risk of surface water flooding, which indicates a risk greater than 3.3% AEP (1 in 30).

Development proposals include a 5m buffer zone around the channel of ordinary watercourses that are present on the site.

Along the proposed access track, several areas of the road are shown to be at high risk of surface water flooding, as shown in Figure 1-7. This is predominantly associated with an unnamed tributary of the Afon Dulais which flows in a south westerly direction. NRW's Flood Hazard Mapping indicates that flood depths of up to 300mm are predicted during high-risk events.

Overall, the risk of surface water flooding across the development site is considered to be **medium - low**.

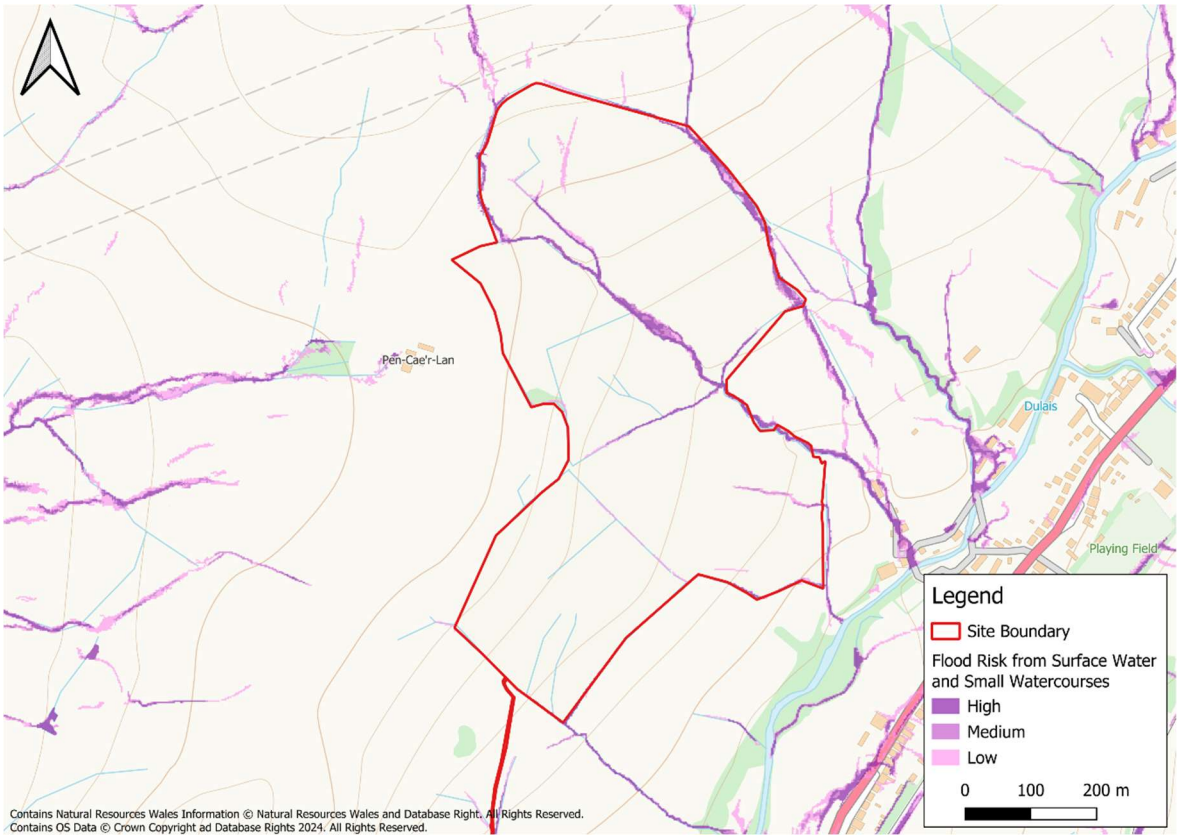


Figure 1-6 FRAW Flood Risk from Surface Water and Small Watercourses (main site)

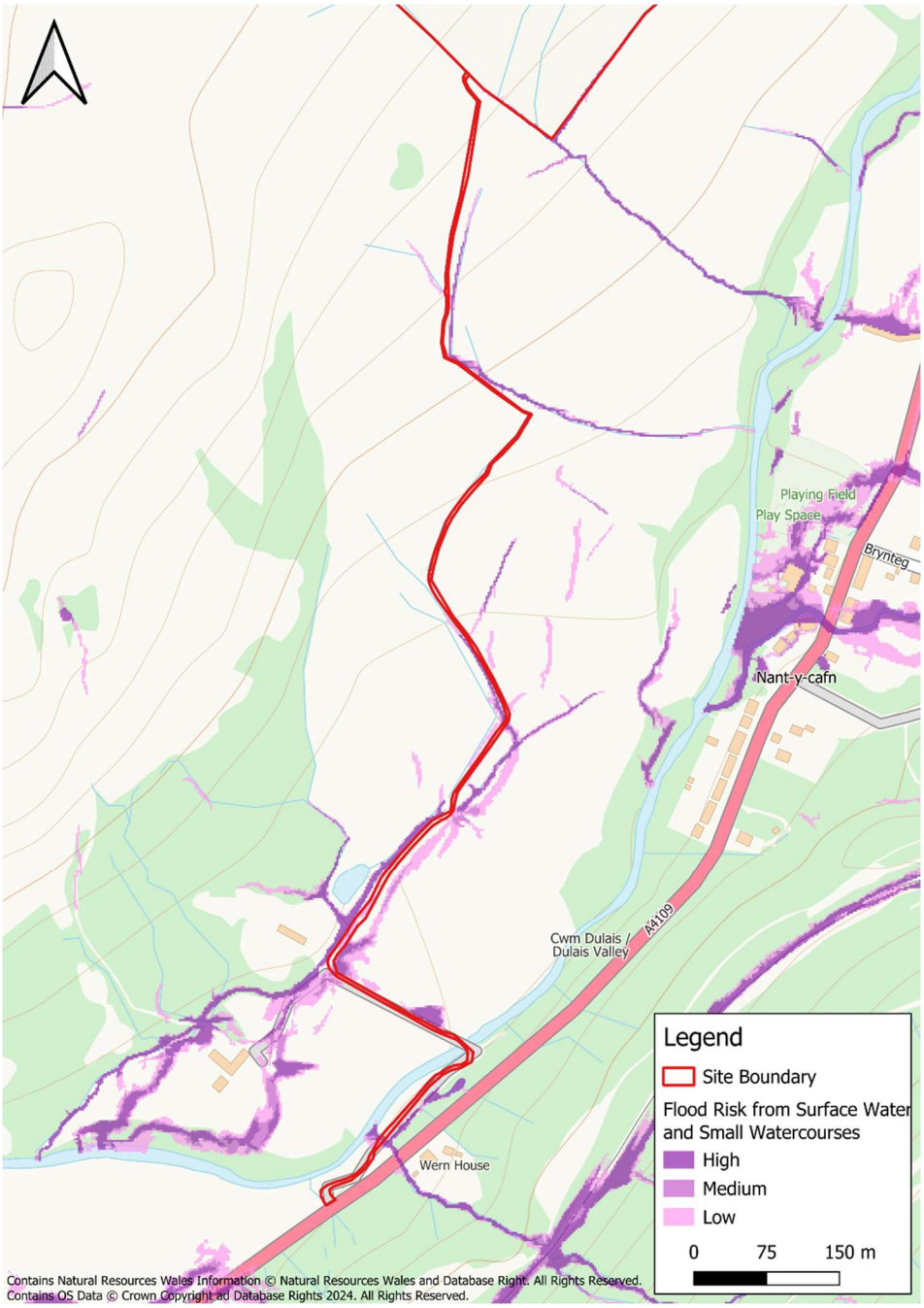


Figure 1-7 FRAW Flood Risk from Surface Water and Small Watercourses (access track)

2 Existing Surface Water Drainage Regime

2.1 Existing site geology and drainage

The geology of the site has been assessed using the British Geological Survey (BGS) GeoIndex[1] indicates that the site is underlain by South Wales Middle Coal measures Formation, comprised of mudstone, siltstone, and sandstone. Some of the site is shown to have no record of superficial deposits, with areas in the southern vicinity of the site indicated to be underlain be Devensian Till, which is a sedimentary superficial deposit.

The soils on site have been assessed on the Cranfield University Soilscape[2] viewer and are described as slowly permeable wet very acid upland soils with a peaty surface, and impeded drainage.

Given the underlying geology and assumed soil type, along with being unaware of any existing surface water drainage infrastructure across the site, it is assumed that currently surface water drains via evapo-transpiration losses, slow infiltration into the underlying soils, and runoff towards the surface water and small watercourse channels across the site, ultimately into the Afon Dulais.

2.2 Greenfield Runoff Rates

Table 24.1 of the SuDS Manual indicates that FEH methods (FEH Statistical and ReFH) should be the preferred methods for calculating peak runoff rates. This is supported by Natural Resources Wales GN008 Flood Estimation: Technical Guidance and Environment Agency research by Faulkner et al which concluded that FEH methods are applicable across a range of catchment sizes and that they should be used in place of outdated methods, such as IH124 and ADAS 345 where possible.

The UK SuDS Tool has been used to calculate Greenfield Runoff Rates for the site's developable area (34 ha) using the FEH Statistical Method, as seen in Appendix C. FEH characteristics have been downloaded for the site from the FEH Web service. The calculated Greenfield Runoff Rates are shown in Table 2-1.

Table 2-1 Greenfield runoff rates

Return period	Specific runoff (l/s/ha)	Peak runoff rate (l/s)
1	21.27	723.01
QBAR	24.16	821.60
30	43.01	1462.45
100	52.67	1791.09

1 https://www.bgs.ac.uk/map-viewers/geoindex-onshore/
2 https://www.landis.org.uk/soilscapes/

2.3 Greenfield Runoff Volumes

Runoff volumes for the wider site area were also calculated for the six-hour storm event using the FSSR16 method as shown in Equation 1 below.

Equation 1:

Runoff Volume = Site Area x Rainfall Depth x Percentage Runoff

The rainfall depths for a six-hour 100-year storm event were extracted from the FEH Web service and are summarised in Table 2-2 with the calculated Greenfield Runoff Volumes.

Table 2-2 Greenfield runoff volumes

Return period	6-hour rainfall runoff depth (mm)	Site runoff volume (m^3)	Site runoff volume (m^3/ha)
30	60.5	9450	278
100	71.7	11191	330
100 +40% CC	100.32	15667	461

3 Surface Water Management Approach

3.1 Surface Water Drainage Proposal

An outline surface water drainage proposal for the site has been developed which will manage surface water runoff without increasing flood risk to other developments or impacting on water quality downstream. The development of the drainage strategy is via a number of steps where the drainage objectives and options for SuDS features are determined. Further detailed design of the drainage scheme will be determined once an agreement in principle has been received from the SuDS Approval Body (SAB).

This outline strategy discusses each SuDS standard in turn and details the way in which the proposed surface water drainage strategy will comply with each standard.

3.2 Sustainable Drainage Systems

Sustainable Drainage Systems (SuDS) aim to mimic the natural processes of surface water drainage by allowing water to flow along the natural flow routes ensuring that runoff rates and volumes during storm events are not increased above greenfield values. SuDS also aim to provide water treatment, biodiversity, and amenity benefits within Blue and Green corridors.

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

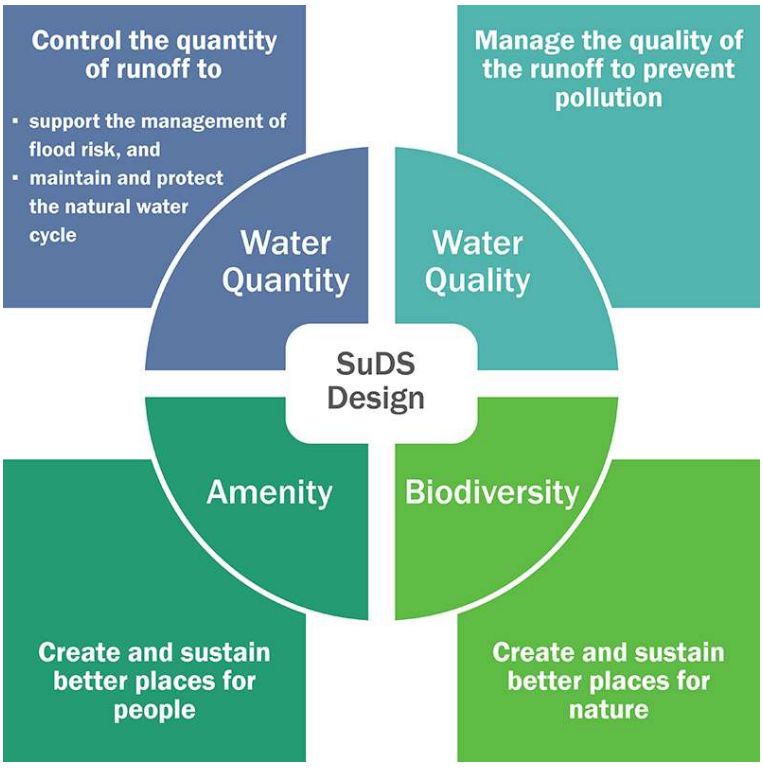


Figure 3-1 Four Pillars of SuDS Design

3.3 Design Criteria

A drainage strategy outlining the means of surface water management at the proposed development site has been produced in line with the latest guidance and design standards including:

- C753 The SuDS Manual (Ciria 2015)
- Statutory standards for sustainable drainage systems - designing, constructing, operating and maintaining surface water drainage systems (Welsh Government 2018)
- Rainfall Runoff Management for Developments - SC030219 (Environment Agency 2013)
- Planning Policy Wales (Edition 9, November 2016)
- The Building Regulations 201: Part H: Drainage and Waste Disposal

Neath Port Talbot Council does not currently have any specific guidance related to SuDS. Should guidance be developed prior to or during the detailed design stage, it should also be consulted to inform the drainage strategy.

3.4 Principles of SuDS

The proposed surface water drainage scheme complies with the standard principles of SuDS in the following way:

- Wherever possible across the site, water is managed as close to the surface as possible through the use of swales and filter strips which convey flow across the site.
- Rainwater is treated as a valuable natural resource across the site by keeping water as close to the surface as possible through the use of swales and filter strips. SuDS assets will provide amenity and biodiversity benefits across the site.
- Across the site, rainfall shall be managed to help protect from increased flood risk through the implementation of source control techniques such as filter strips.
- Rainfall will be managed across the site to ensure that the site does not flood during the 1 in 30-year event, and no buildings will flood during the 1 in 100-year event plus 40% for climate change.
- No allowance for urban creep shall be required for the site. A 40% climate change allowance will be applied to peak rainfall intensity and design inflows across the development site.
- A SuDS Management Train is included across the site as water is intercepted via filter strips and swales, before entering drainage ditches / ordinary watercourse channels across the site, and ultimately draining into the Afon Dulais. The Simple Index Approach, in line with C753, will be used to demonstrate how surface water shall be managed to ensure that the proposed development shall not have a detrimental effect on water quality.

- Biodiversity and amenity benefits are maximised across the site wherever possible. The change of land use and the proposed SuDS features will increase biodiversity by enhancing existing habitats and ecosystems.
- To ensure that the scheme performs reliably and effectively for the lifetime of the development, a maintenance plan shall be produced during detailed design stage, which shall detail the management and maintenance requirements of the system to ensure that it functions to its optimal capacity in perpetuity. Throughout the design of the system, a designer's risk assessment shall be carried out to ensure that all SuDS assets are safe and fit for purpose.
- All surface water shall be drained via gravity towards the drainage ditches and ordinary watercourses that flow through and around the site.

3.5 Proposed Surface Water Drainage Strategy

The proposed outline drainage strategy is included in Appendix D.

For the majority of the site there shall be little change to the existing surface water regime as a result of the proposed development. Solar panels are situated above ground level, resulting in little to no change to the volume or rate of runoff or surface water onto the underlying ground, effectively retaining the site in its greenfield conditions. Consequently, SuDS shall be implemented across the wider site area with the aim of slowing the flow of surface water, and providing amenity, biodiversity, and water quality benefits where possible.

Surface water will flow in a general south-easterly direction, following the natural topography of the site. Filter strips have been introduced near to existing Ordinary Watercourses to slow the flow of surface water and provide water quality benefits, before it discharges into these surface water bodies.

The proposed substation of the solar farm is located in the south-west of the site, near to the primary access point. The total impermeable footprint of the substation compound is greater than 100m² and is therefore required to be formally drained. Due to the topography of the area, it is proposed to drain the substation to an existing watercourse located to the south-west. Surface water shall be intercepted and stored within a swale and conveyed via a surface water pipe into the ordinary watercourse to the south-west of the substation. Surface water will be discharged into the ordinary watercourse at a controlled rate of 2 l/s.

The site access tracks are to be comprised of gravel and are therefore counted as permeable surface across the site.

3.6 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.

3.6.1 Priority Level 1 - Water for re-use

Given the nature of the proposal for energy storage purposes, there is no requirement for rainwater harvesting or water reuse across the site. It is envisaged that the yield to use ratio will not be sufficient to dispose of a significant volume of surface water runoff across the development site via rainwater harvesting.

3.6.2 Priority Level 2 - Infiltration

Based on the current information about underlying geology, it is considered that the potential for infiltration across the site is likely to be minimal. Infiltration testing in accordance with BRE365 shall be required prior to detailed design.

For the purpose of this report, it is assumed that infiltration is not viable.

3.6.3 Priority Level 3 - Discharge to surface water body

For the majority of the site there shall be little change to the existing surface water regime as a result of the proposed development. Solar panels are situated above ground level, resulting in little to no change to the volume or rate of runoff or surface water onto the underlying ground, effectively retaining the site in its greenfield conditions.

The proposed substation is proposed to be formally drained to an existing ordinary watercourse adjacent to the western boundary of the site, which ultimately discharges into the Afon Dulais.

As a suitable discharge location has been found, Priority Levels 4 and 5 do not need to be considered further.

3.7 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 does not occur at this frequency.

- 1 in 100-year storm event with allowances for future climate change, where runoff from the site should be controlled to the greenfield rate using SuDS attenuation features to manage flows and volumes within the extents of the development site.

3.7.1 Allowance for Climate Change

The Welsh Government has produced a Climate Change Allowance guidance which contains updated representative climate change allowances for Wales peak flows. The guidance contains indicative sensitivity ranges for peak rainfall intensity. As the site is proposed to be a solar farm, a commercial development, the assumed lifetime of development is 75 years. Therefore the 2070-2215 estimate should be used. The recommended climate change factor for small catchments using the central estimate for the 2070-2215 epoch is 20%. However, for the purpose of this report the upper estimate of 40% has been used.

3.7.2 Discharge Limits and Attenuation Storage

As discussed in Section 3.5, surface water from the development site shall be drained to existing ordinary watercourses and drainage ditches that flow across and around the site. It should be noted that the site's solar panelled areas should be regarded to as greenfield land, with only the substation requiring formal drainage.

Impermeable areas

As discussed in Section 3.6.3, the site is regarded as greenfield land, with only the substation compound requiring formal drainage. Therefore, the storage attenuation volume required for the site is based on the total impermeable area of the substation. The total impermeable area of the substation is 495m², as shown in Figure 3-2.

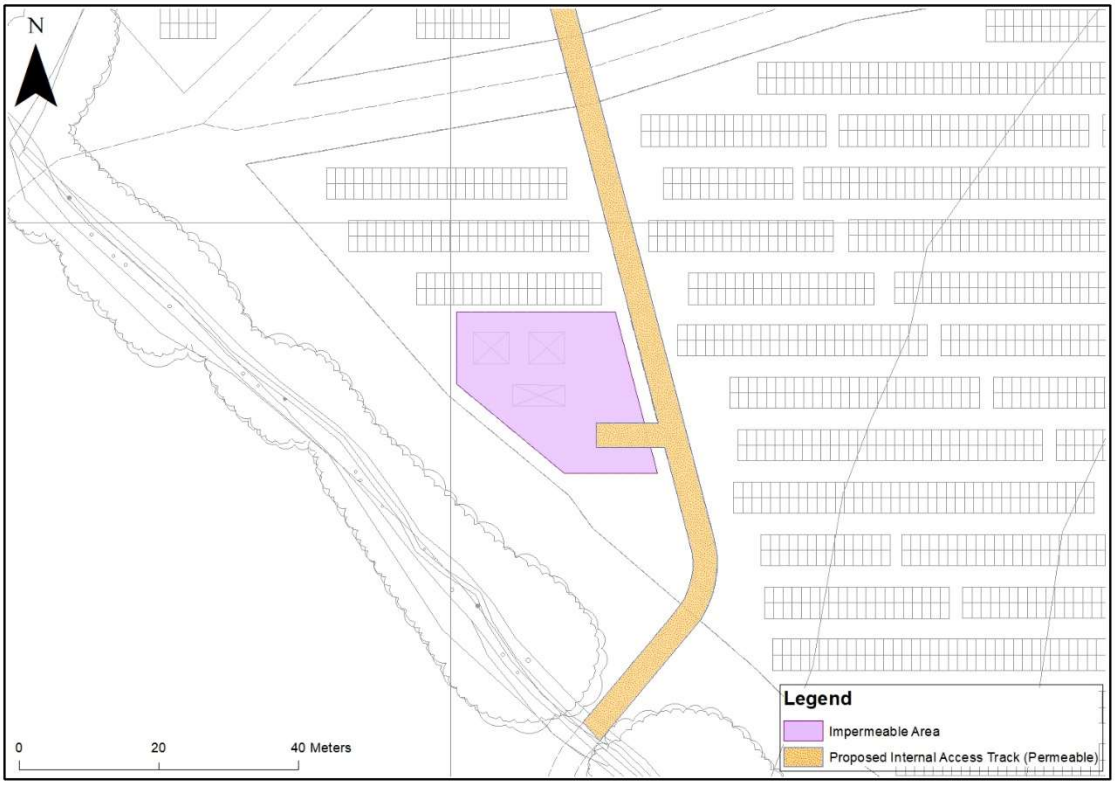


Figure 3-2 Proposed development - impermeable area

Required attenuation volume

InfoDrainage software was used to create a quick storage estimate of the proposed development in order to indicate the storage volume required at the site for the 1 in 100-year event plus 40% to account for climate change.

Catchment descriptors were extracted from the Flood Estimation Handbook Web Service. The FEH22 rainfall has been utilised for the 6 hour 100-year rainfall event.

The soil characteristics of the area are not ideal for infiltration. The CIRIA manual states *"All the runoff from the site for the 1:100-year event should be discharged at either a rate of 2l/s/ha or the average annual peak flow rate (i.e. the mean annual flood, QBAR), whichever is the greater."* This method has been adopted for sizing of the storage volume required.

The developable area is considered as all impermeable areas across the development site. A 10% allowance for urban creep has not been applied as further consideration of drainage implications will be required before further expansion would be permitted.

Table 3-1 summarises the user defined values input into the estimation tool.

Table 3-1 User defined values

Variable	Value
Site area	0.0495ha
Area of public space	0ha
Impermeable area	0.0495ha
Climate change allowance	40%
Urban creep allowance	N/A
BFI Host	0.352
SPR Host	45.93%
SAAR (mm)	1821

Using InfoDrainage, it has been calculated that 27-51m³ of storage is required for the site. An extract of the preliminary calculations are included below in Figure 3-3. A conservative approach has been carried forward, and therefore the upper estimate of 51m³ of required attenuation has been provided for the site.

The required attenuation will be provided by a swale which is 47m in length, with a 3.6m base width. The swale is proposed to have a maximum depth of 0.4m including a 0.15m freeboard, 1 in 3 side slopes. The swale will therefore provide 51m³ of storage. The outline drainage strategy, demonstrating how this attenuation volume is provided is contained in Appendix D.

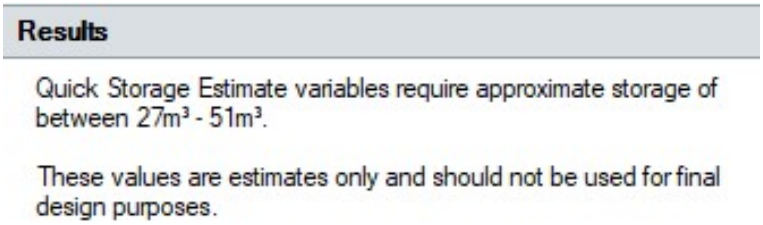


Figure 3-3 InfoDrainage quick storage estimate

3.7.3 Exceedance Events

Extreme events exceeding the design event or internal blockages / failures could occur and result in overland flows across the site. The duration of flooding, maximum depths, velocity, and route of flood flows should be established by and managed. The impact of exceedance flows onto adjacent land should also be considered.

For the proposed development site, it is envisaged that flows generated by exceedance events over land containing solar panels (greenfield land) shall be managed via the existing drainage regime, resulting in no change from greenfield conditions during an exceedance event. The substation compound will require formal drainage and therefore surface water will flow overground, towards the ordinary watercourse to the south-west.

Exceedance flow routes are detailed within the drainage strategy plans in Appendix D.

3.7.4 Interception

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. Table G2.1 of the Statutory Standards for SuDS in Wales lists the interception drainage components which have assumed compliance. The proposed swales proposed for this development site are deemed compliant as interception mechanisms, as outlined below in Table 3-2.

Table 3-2 Interception mechanisms with assumed compliance

SuDS Component	Requirement
Swales	Where the longitudinal gradient of the swale is less than 1:100, they are suitable for interception delivery for impermeable surface areas up to 5 times the base of the vegetated surface area receiving runoff.

Table 3-3 demonstrates how the proposed drainage strategy meets the requirements of interception across the development site. 100% of the impermeable area shall be intercepted by SuDS assets. At detailed design stage, and when proposed ground levels are available, it shall be important to keep surface water as close to the surface as possible to ensure that rainwater enters SuDS assets at the surface to ensure the interception benefits are achieved.

Table 3-3 Interception compliance

Impermeable area	Length of Swale	Base width of swale	Area of swale base	Permissive interception area	Impermeable area draining to swale
495m²	47m	3.6m	169.2m²	846m²	495m²

3.8 S3: Water Quality

The surface water drainage system should provide a sufficient level of water quality treatment to prevent pollution of receiving waterbodies.

Table 4.3 of the SuDS Manual advocates the use of the 'simple index approach' to determine an appropriate level of pollution mitigation for the development site. This splits pollution into three contaminant types (Total Suspended Solids, Metals, 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 a solar farm and is therefore regarded as greenfield land. It is defined as having a 'very low' pollution level classification in line with Table 26.2 of the

CIRIA SuDS Manual, as rainfall shall land on solar panels and the underlying greenfield land. Although the substation compound is regarded as impermeable, it is also defined as having a 'very low' pollution level. The 'pollution hazard indices' for a very low pollution hazard site are given in Table 3-4 below.

Table 3-4 Pollution hazard indices for the site

Total Suspended Solids	Metals	Hydrocarbons
0.2	0.2	0.5

Table 26.3 of the SuDS Manual provides indicative SuDS mitigation indices for discharges to surface water.

The proposed development will use a number of methods to manage drainage on site and mitigate the potential pollution hazards across the site, as shown in Table 3-5. Table 3-5 demonstrates sufficient mitigation of potential contaminants by each individual SuDS feature proposed for the site without the need for a treatment train and further consideration of appropriate mitigation indices.

Table 3-5 Pollution hazard indices for SuDS features

SuDS Component	Total Suspended Solids	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Swale	0.5	0.6	0.6

3.9 S4 and S5: Amenity Value and Biodiversity

The design of the surface water management system should maximise amenity and biodiversity benefits across the site whilst prioritising infiltration drainage. SuDS components can enhance the provision of high-quality, attractive public space, which can help to provide wildlife corridors and contribute to improving the climate resilience of new developments. The surface water drainage system should seek to enhance existing habitats within the area and complement neighbouring habitats.

The proposed SuDS scheme utilises filter strips and swales which will add to the climate resilience of the development.

The proposed SuDS measures will provide biodiversity benefits from the change of land use. SuDS in the form of filter strips and swales will allow long grasses and wildflowers to grow over the design life, enhancing ecosystems. This type of vegetation also provides a naturally high level of attenuation which will serve to limit the velocity of surface water flows across the site.

3.10 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.

3.10.1 Health and Safety

The surface water drainage system should be designed so that it minimises health and safety risks to those utilising the site. SuDS are sometimes perceived as unsafe features, but with the 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. A CDM Risk Assessment for the outline drainage strategy is contained in Appendix E. This should be further updated at detailed design stage.

3.10.2 Adoption and Maintenance

Schedule 3 of the Flood and Water Management Act 2010 was implemented in Wales on the 7th January 2019. Under this legislation, only 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 (LLFA) at Neath Port Talbot Council. Therefore, due to the site possessing a single landowner, the SuDS serving the site will not be adoptable and will be retained within the land ownership.

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

3.10.3 Construction Environmental Management Plan and Development Phasing

With any SAB application there is a requirement to consider development phasing and to prepare and Construction Management Plan to provide a structured approach to construction activities and temporary works for constructing SuDS, ensuring that key construction site issues such as drainage, flooding, sediment control, pollution prevention, storage of materials and existing habitats are sensitively and effectively managed until site construction is complete. Further details on Construction Management and Phasing shall be supplied at detailed stage.

4 Conclusions

JBA Consulting was commissioned by Greentech Invest UK Ltd to prepare an outline surface water drainage strategy in support of a planning application for a 34ha Solar PV site at Seven Sisters, Neath. The development proposed is a Development of National Significance (DNS).

The site is approximately 34ha in size and currently undeveloped greenfield land, used for agricultural and arable farming.

The Afon Dulais, an NRW Main River, flows in a general south-westerly direction approximately 60m east of the site at its closest point. There is a network of Ordinary Watercourses and drainage ditches which flow around and across the site, which predominantly drain into the Afon Dulais.

A topographic survey of the site was undertaken by Landmark Surveys Wales in May 2024. Ground levels across the site are shown to fall steeply in a general south-easterly direction. Highest elevations of 214.62mAOD are shown in the north-western corner of the site, which fall to 144.97mAOD along the eastern boundary of the site. The proposed access track has a ground level of approximately 174.88mAOD from the main site, falling to approximately 120.0mAOD where the road adjoins with the A4109.

The proposed development is for the installation of a solar farm comprising ground mounted solar PV panels with a generating capacity of up to 25MWp, including permanent grid connection hub, mounting framework, inverters, underground cabling, stock proof fence, CCTV, internal tracks and associated infrastructure including a Distribution Network Operator Substation compound, and landscaping.

The existing access track from the A4019 is not proposed to be altered from its current form. Only repairs are proposed to be made. Proposed access tracks across the site shall be made up of a permeable, MOT Type 1 subbase, such as crushed aggregate, and are therefore proposed to be permeable in nature, and does not require formal drainage.

The NRW Flood Risk Assessment Wales mapping for surface water and small watercourses, identifies the site as being predominantly at very low risk of surface water flooding. This means that there is a less than 0.1% AEP (1 in 1000) chance of flooding in any given year. However, several small ordinary watercourses are located within the proposed development site. Flood risk is predominantly associated with an unnamed tributary of the Afon Dulais, which is shown to have a high risk of surface water flooding, which indicates a risk greater than 3.3% AEP (1 in 30). Development proposals include a 5m buffer zone around the channel of ordinary watercourses that are present on the site.

Along the proposed access track, several areas of the road are shown to be at high risk of surface water flooding which is predominantly associated with an unnamed tributary of the Afon Dulais which flows in a south westerly direction. NRW's Flood Hazard Mapping indicates that flood depths of up to 300mm are predicted during high-risk events. Overall,

the risk of surface water flooding across the development site is considered to be medium - low.

The site is regarded as greenfield land, with only the substation compound requiring formal drainage.

Greenfield runoff rates for the site for QBAR have been calculated as 24.16 l/s/ha. It is deemed appropriate to set the discharge rate to a maximum of 2 l/s to minimise the risk of blockage to the flow control on the system.

InfoDrainage quick storage estimate tool calculates that the volume of storage required for the substation compound is 51m³. Attenuation volume calcs include a 40% climate change uplift.

Sufficient attenuation storage will be provided for the substation through the use of a vegetated swale. The swale is proposed to be 47m in length, with a 3.6m base width a maximum depth of 0.4m including a 0.15m freeboard, and 1 in 3 side slopes.

The proposed SuDS assets shall provide sufficient water quality, amenity and biodiversity benefits.

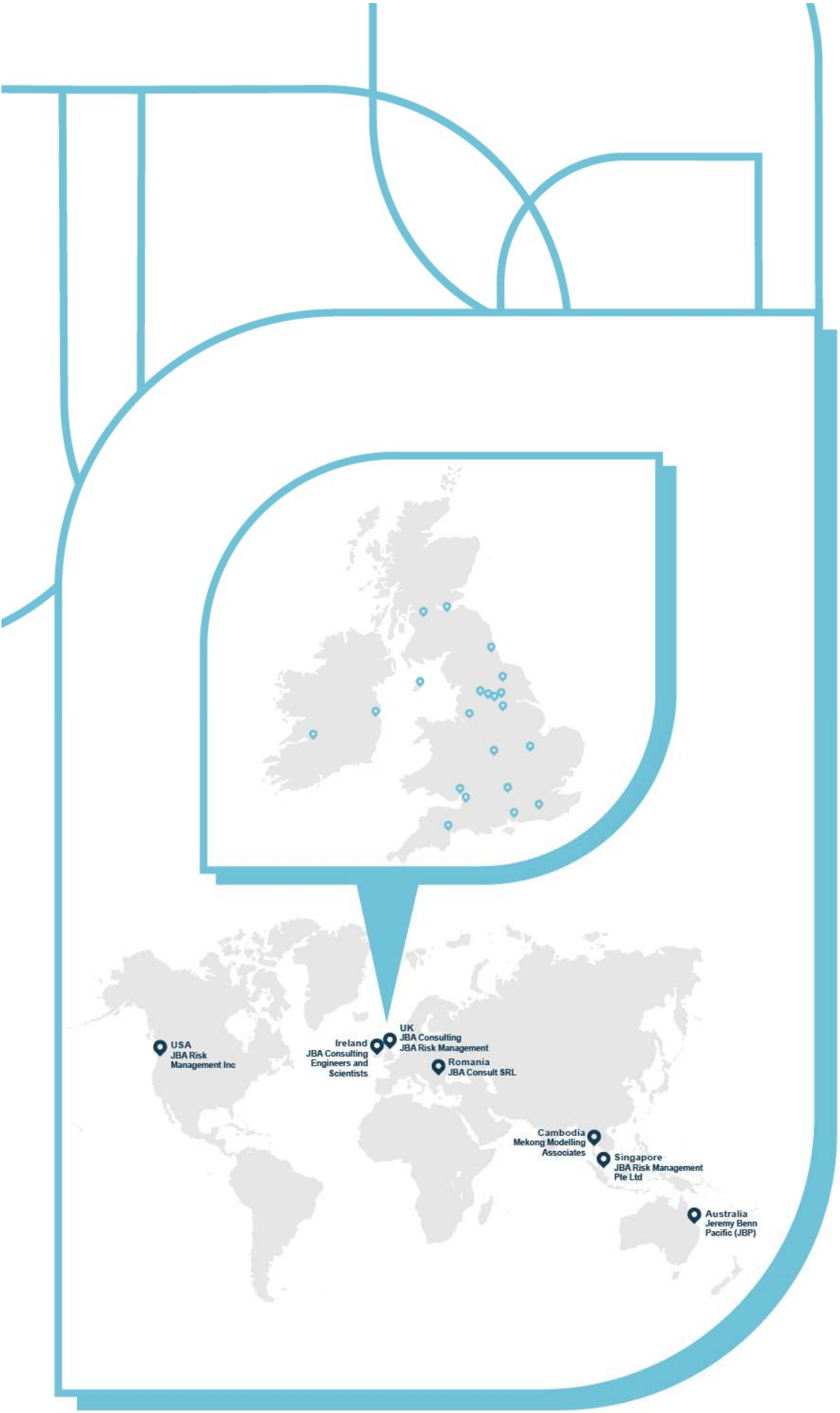
A Development Proposal

B Topographic Survey

C Greenfield Runoff Rates

D Outline Surface Water Drainage Strategy

E CDM Designers Risk Assessment



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