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CONVATEC LIMITED

PEP WIND SOLAR DEVELOPMENT

FLOOD CONSEQUENCE ASSESSMENT

FEBRUARY 2024

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DATE ISSUED:	**FEBRUARY 2024**
JOB NUMBER:	**BR10167**
REPORT NUMBER:	**0010**
VERSION:	**V0.2**
STATUS:	**DRAFT**

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FLOOD CONSEQUENCE ASSESSMENT

FEBRUARY 2024

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BR10167-038-P0.01	Lidar Topography	1:5,000
BR10167-042	Indicative Surface Water Management Plan	1:1,500

1 INTRODUCTION

1.1 General

1.1.1 Wardell Armstrong LLP (WA) has been commissioned by Convatec (the Client) to prepare a Flood Consequence Assessment (FCA) for a proposed wind and solar development on land south west of Convatec Ltd, Unit 1-2, Heads Of the Valley Industrial Estate, west of the town of Rhymney, Tredegar.

1.1.2 This assessment has been conducted in accordance with guidance set out in the Welsh Government Technical Advice Note 15 'Development and Flood Risk' (TAN15).

1.2 Methodology

1.2.1 The methodology for this FCA has comprised of a desktop study and supplemented by liaison with the Lead Local Flood Authority (Caerphilly County Borough Council) and Natural Resources Wales (NRW)

1.2.2 In accordance with TAN15, the following has been conducted in preparing this assessment:

- an assessment of the consequences of flooding to the development from a range of sources;
- an assessment of the consequences of flooding from the proposed development site; and
- consideration of recommendations for the management of the identified consequences.

1.2.3 In conducting this assessment, reference has been made to relevant plans and documents, including:

- Caerphilly County Borough Council Preliminary Flood Risk Assessment, May 2011[1];
- Caerphilly County Borough Council Flood Risk Management Plan, December 2015[2].

[1] preliminary_flood_risk_assessment_report.aspx (caerphilly.gov.uk)

[2] https://www.caerphilly.gov.uk/caerphillydocs/roads-and-pavements/flood-risk-mgt-plan-dec2015.aspx

1.3 Planning Policy Wales

1.3.1 Technical Advice Note 15 (TAN15) "Development and Flood Risk" was published in July 2004 by the Welsh Assembly Government (WAG) and supplements the policy set out in Planning Policy Wales (PPW), 2024 (Edition 12). It gives guidance to planning authorities in Wales on how to respond on flood risk grounds to development proposals. TAN15 expects planning authorities to apply a risk-based approach to development planning and control through a Sequential Test involving location justification, type of development and flooding consequences.

1.3.2 In October 2017, the Welsh Government published the latest TAN15 Development Advice Maps (DAMs) which show areas potentially at risk from flood events of a 0.1% annual probability for river, tidal or coastal areas (i.e. 1 in 1,000 year). The Development Advice Maps categorise the land area of Wales into three flood risk zones. These are denoted A, B and C, with Zone C further sub-divided into Zones C1 and C2. The Flood Zones are described in further detail in Table 1 below.

Table 1: TAN15 Development Advice Map Flood Zones

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

1.3.3 Section 5 of TAN15 categorises development according to its vulnerability to flooding. There are three categories: emergency services; highly vulnerable development; and less vulnerable development. All residential premises and vulnerable industrial developments are categorised as highly vulnerable developments. Commercial, retail, and general industrial development are categorised as less vulnerable developments.

1.4 Flood Risk Vulnerability.

1.4.1 The proposed development is classified as a *'Less Vulnerable'* development (*'General industrial, employment, commercial and retail development'*) based on Section 5 of TAN15.

1.5 Justification Test

1.5.1 The Justification Test aims to direct new development away from Zone C and towards land in Zone A (or otherwise Zone B). A new *'Less Vulnerable'* development would only be permitted within Zone C if it is deemed to be justified in that location. A development would only be justified if it demonstrates that:

I. its location in zone C is necessary to assist, or be part of, a local authority regeneration initiative or a local authority strategy required to sustain an existing settlement; or

II. its location in zone C is necessary to contribute to key employment objectives supported by the local authority, and other key partners, to sustain an existing settlement or region;

AND

III. it concurs with the aims of PPW and meets the definition of previously developed land; and

IV. the potential consequences of a flooding event for the development have been considered and are found to be acceptable.

1.5.2 The 'Development Advice Map' for flood risk produced by Natural Resources Wales (see Figure 1) shows that the site is located entirely within Zone A and the Justification Test is, therefore, not required.

Caerphilly County Borough Council Preliminary Flood Risk Assessment

1.5.3 A Preliminary Flood Risk Assessment (PFRA) is a high-level screening exercise to identify areas where there is significant flood risk from local sources, namely Ordinary Watercourses, surface water runoff and groundwater. It does not directly consider flooding from main rivers or from sewers. PFRAs have been produced by Lead Local Flood Authorities (LLFAs) to fulfil statutory requirements in the Flood Risk Regulations (2009) and the Flood and Water Management Act (2010). Caerphilly County Borough Council is the LLFA for this development. A PFRA was published in 2011 with an addendum published in 2017[3].

Caerphilly County Borough Council Local Flood Risk Management Strategy

1.5.4 The Local Flood Risk Management Strategy (LFRMS) report sets out the principles, objectives, and measures for the management of local flood risk by Caerphilly County Borough Council as the LLFA (where "local flood risk" is defined as *"surface water runoff, ground water and Ordinary Watercourses and included any lake, pond or other body of water that feeds from an Ordinary Watercourse"*). The report was published in December 2015.

[3] Microsoft Word - ADDENDUM - English (caerphilly.gov.uk)

2 SITE SETTING

2.1 Site Description and Location

2.1.1 A summary of the site and its characteristics is provided in Table 2.

Table 2: Site Location Summary	
Site Name	PEP Wind Solar Development
Site Address	Land southwest of Convatec Ltd, Unit 1-2, Heads of the Valleys Industrial Estate, Rhymney, Tredegar, NP22 5RL
Site Area (ha)	25.64
National Grid Reference	SO 10043 08175
Existing Land Use	Agriculture
Proposed Land Use	Wind and Solar Development
Lead Local Flood Authority	Caerphilly County Borough Council
Local Planning Authority	Caerphilly County Borough Council
Sewerage Undertaker	Welsh Water

2.1.2 The site is located west of the town of Rhymney, South Wales. The nearest postcode to the site is NP22 5RL, and the National Grid Reference for the centre of the site is SO 10043 08175.

2.1.3 The site is approximately 25.64ha and irregular in shape, consisting of agricultural fields, along with large areas of open ground and rough vegetation. The site is bounded by further agricultural land to the north, rough open ground to the south and west, and the Heads of the Valleys Industrial Estate to the east. The site previously formed part of a larger mining area, with coal tips and coal mining infrastructure present within the site boundaries. This has all since been removed and the site restored.

2.1.4 Ordnance Survey mapping shows that ground levels fall in an easterly and north-easterly direction, from a maximum height of 390 mAOD in the south-western corner of the site, to a minimum elevation of 293 mAOD at the site entrance off the A469 in the north-eastern corner of the site. The site topography, based on LIDAR data, is shown on Drawing BR10167-038-P0.01 ‘Lidar Topography’.

2.2 Existing Watercourses and Waterbodies

2.2.1 The closest main river to the site is Rhymney River, located approximately 250 m to the east of the site at its closest point. This river flows in a southwards direction through the town on Rhymney, ultimately discharging to the Severn Estuary in Cardiff.

2.2.2 The Nant Carno (an ordinary watercourse) flows eastwards, approximately 400m from the northern boundary and discharges to the Rhymney River via culvert.

2.2.3 Land to the northeast of the site, within the landowner boundary, is crossed by a number of ordinary watercourses and land drains flowing eastwards from higher ground. These watercourses are understood to discharge to the Rhymney River via an unnamed culvert flowing eastwards beneath the industrial estate.

2.2.4 There are further watercourses located adjacent to the southern boundary that form part of a wider network of watercourses which ultimately discharge to the Rhymney River via Nant Llesg (an ordinary watercourse), to the south of the industrial estate.

2.2.5 Bute Town Reservoir is located approximately 0.5km north of the site, and Rhaslas Pond is located approximately 0.75km southwest of the site.

2.3 Ground Conditions

2.3.1 The online British Geological Survey (BGS) 'GeoIndex (Onshore)' viewer[4] shows that the bedrock geology comprises mudstone, siltstone, and sandstone of the South Wales Middle Coal Measures Formation. The online DEFRA 'Magic'[5] mapping classifies this as a 'Secondary A' aquifer, defined as *'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers'.*

2.3.2 BGS mapping shows that there are no superficial deposits underlying the majority of the site. Small areas, mostly coinciding with the western, southern, and eastern boundaries of the site are underlain by Devensian Till. DEFRA 'Magic' mapping classifies this as a 'Secondary undifferentiated' aquifer *'cases where it has not been possible to attribute either category A or B rock type due to the variable characteristics of the rock type'*.

[4] BRITISH GEOLOGICAL SURVEY *'GeoIndex (Onshore)'* Available at: https://www.bgs.ac.uk/map-viewers/geoindex-onshore/
[5] Magic Map Application (defra.gov.uk)

2.3.3 Due to the history of coal mining and subsequent restoration works within the site area and its vicinity, it is unclear how much of the superficial geology remains in situ. The GeoIndex viewer shows that 'artificial ground' may be present within all areas of the site.

2.3.4 The Landis 'Soilscapes' mapping[6] classifies the underlying soil as *'restored soils mostly from quarry and opencast spoil'*, with a loamy texture and variable drainage.

2.4 Existing Drainage

2.4.1 As the site is a restored coal mining area, it is assumed that there will be no public or private sewers within the site area, with the closest public sewers assumed to be within the industrial estate to the east of the site.

2.4.2 It is considered, therefore, that the land drains naturally via a combination of infiltration, transpiration, and evaporation. Surface water runoff exceeding the rate of infiltration will generally flow north-eastwards and eastwards, following the topography. A portion of runoff will be intercepted by the ordinary watercourses and land drainage and ultimately discharge to the Rhymney River.

[6] CRANFIELD SOIL AND AGRIFOOD INSTITUTE *'Soilscapes'* Available at: https://www.landis.org.uk/soilscapes/

3 DEVELOPMENT PROPOSALS

3.1.1 The proposed development consists of three wind turbines and ground mounted solar PV panels, along with associated infrastructure, including access tracks, construction compounds, substations, wind transformers and solar MV stations.

3.1.2 The proposed layout is shown on Drawing No. BR10167-01 'Site Layout'.

3.2 Development Advice Map

3.2.1 The 'Development Advice Map' for flood risk produced by Natural Resources Wales (see Figure 1) shows that the site is located entirely within Zone A, described in TAN15 as an area *'considered to be at little or no risk of fluvial or tidal/coastal flooding*'.

3.2.2 There is an area of Zone C2 adjacent to the northeastern boundary (site entrance). This is associated with the Nant Carno. Flood Zone C2 is defined as *'areas of flood plain without significant flood defence infrastructure*'.

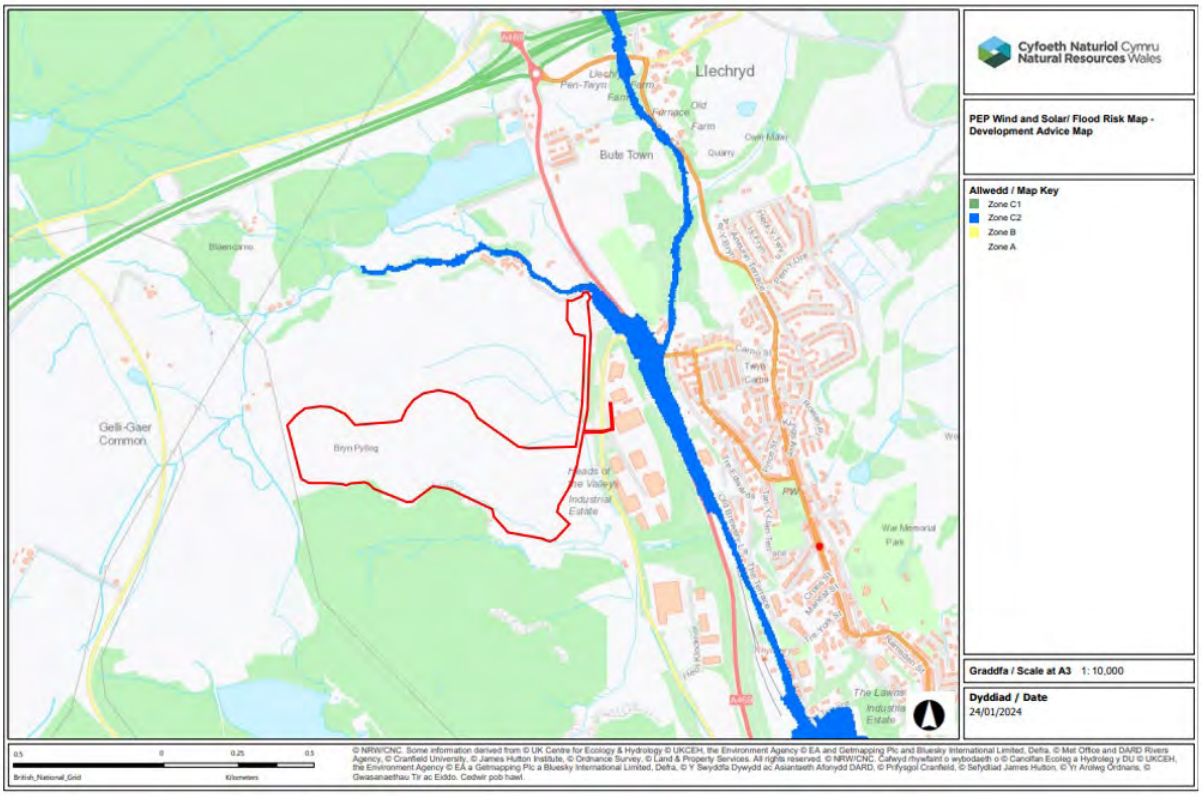


Figure 1. Natural Resources Wales; Development Advice Map

4 FLOOD CONSEQUENCE ASSESSMENT

4.1 Historical Flooding

4.1.1 The Natural Resources Wales 'Recorded Flood Extents' mapping does not show any recorded flooding events in the vicinity of the site or surrounding areas.

4.1.2 The Caerphilly County Borough Council PFRA makes no reference to any historical flooding events within the site boundary.

4.2 Consequences of Flooding to the Development

4.2.1 Flooding can occur from a range of sources including, but not limited to rivers, tidal waters and the sea, surface water runoff, groundwater, sewers and drains, and artificial sources such as canals and reservoirs. The presence of a potential flooding source does not, however, necessarily translate into a high risk of flooding. Following the source-pathway-receptor approach, flooding can only affect the site (receptor) if there is a pathway from the identified sources.

Fluvial Sources

4.2.2 The Natural Resources Wales 'Flood Risk from Rivers' map (part of the 'Flood Risk and Coastal Erosion Maps' series) assigns Low, Medium, and High risk to areas susceptible to fluvial flooding. These are defined as:

- Low – each year, these areas have a chance of flooding of between 1 in 1000 years (0.1%) and 1 in 100 (1%) in a given year;
- Medium – each year, these areas have a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%) in a given year;
- High – each year, these areas have a chance of flooding of greater than 1 in 30 (>3.3%) in a given year.

4.2.3 All other areas are considered to be at a Very Low risk (i.e. a chance of flooding of less than 1 in 1000 or 0.1% in a given year).

4.2.4 The NRW 'Flood Map for Planning' series assigns Flood Zones to areas at risk of fluvial flooding:

- Flood Zone 2 – areas with an annual probability of flooding of between 1 in 1,000 and 1 in 100 (i.e. equivalent to 'Low' risk areas)
- Flood Zone 3 – areas with an annual probability of flooding of greater than 1 in 100 (i.e. equivalent to 'Medium' and 'High' risk areas).

4.2.5 As shown in Figure 2, the site is located wholly within an area of Very Low risk from fluvial sources. The nearest area at a 'High' risk of flooding from rivers (ie Flood Zone 3) is associated with Nant Carno, to the north of the site.

4.2.6 This watercourse is at a lower elevation than the site and, therefore, there will be no pathway for flood water to enter the site area and impact the proposed development.

4.2.7 The flood risk from smaller watercourses with catchments of less than 3km^2 is not shown on the NRW 'Flood Risk from Rivers' mapping and is combined with the risk of flooding from surface water. It is assumed that the ordinary watercourses within the site have catchments of less than 3km^2 and so the risk of flooding is not shown on Figure 2. This risk of surface water flooding is discussed in further detail below.

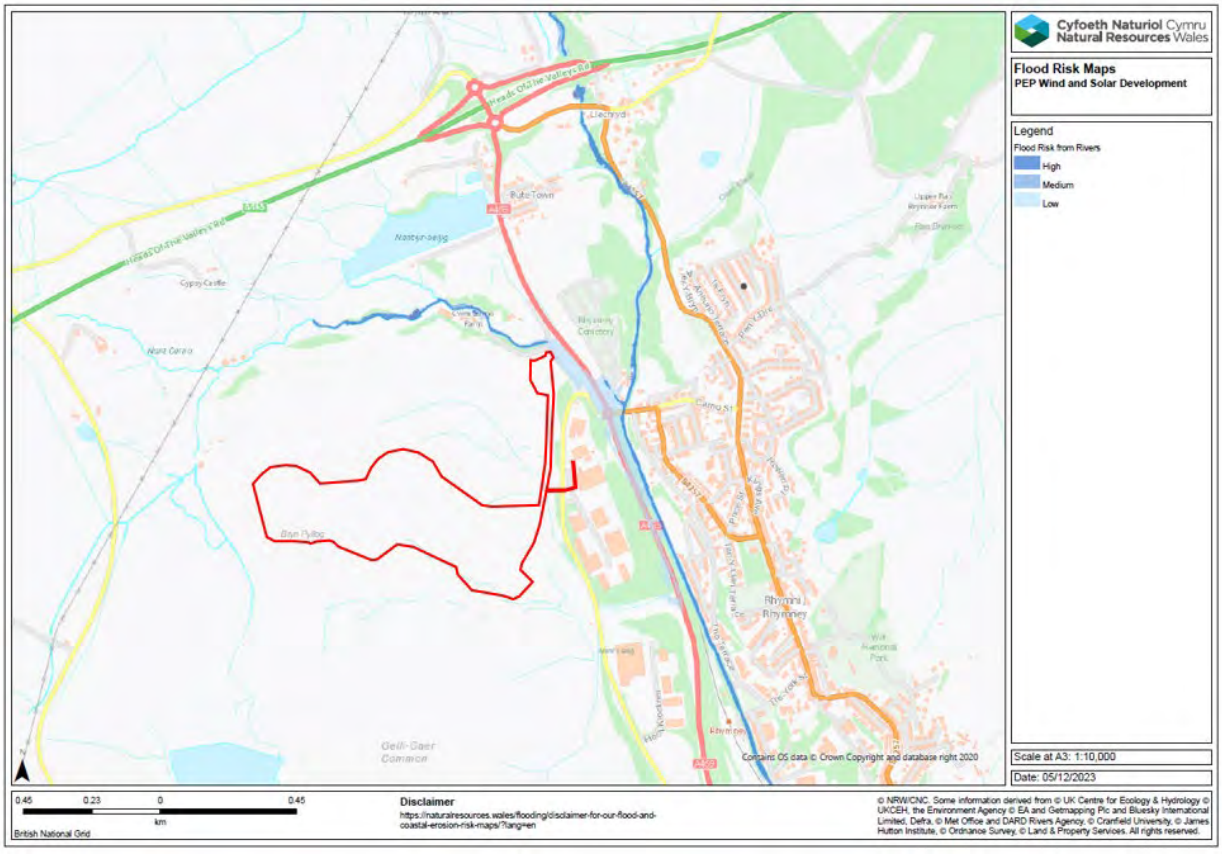


Figure 2. Natural Resource Wales 'Flood Risk from Rivers' map

Surface Water and Small Watercourse Flooding

4.2.8 Natural Resources Wales 'Surface Water and Small Watercourses' mapping (Figure 3) assigns Low, Medium, and High risk to areas susceptible to flooding from surface water runoff or watercourses with catchments of less than 3km^2. As with fluvial flooding, these are defined as:

- Low – each year, these areas have a chance of flooding of between 1 in 1000 years (0.1%) and 1 in 100 (1%) in a given year;
- Medium – each year, these areas have a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%) in a given year;
- High – each year, these areas have a chance of flooding of greater than 1 in 30 (>3.3%) in a given year.

4.2.9 All other areas are considered to be at a Very Low risk (i.e. a chance of flooding of less than 1 in 1000 or 0.1% in a given year).

4.2.10 The Flood Map for Planning also assigns Flood Zone 2 and Flood Zone 3 to areas of risk. The definition is the same as fluvial flooding with Flood Zone 2 equivalent to areas of Low risk and Flood Zone 3 equivalent to areas of Medium (and High) risk.

4.2.11 As shown in Figure 3, the majority of the site area is at a Very Low risk of flooding. There are several small overland flow routes extending along the southern site boundary at a Medium to High risk of flooding (i.e. Flood Zone 3). These are generally coincident with the route of the small unnamed watercourses flowing eastwards across low-lying ground to the south-east of the site.

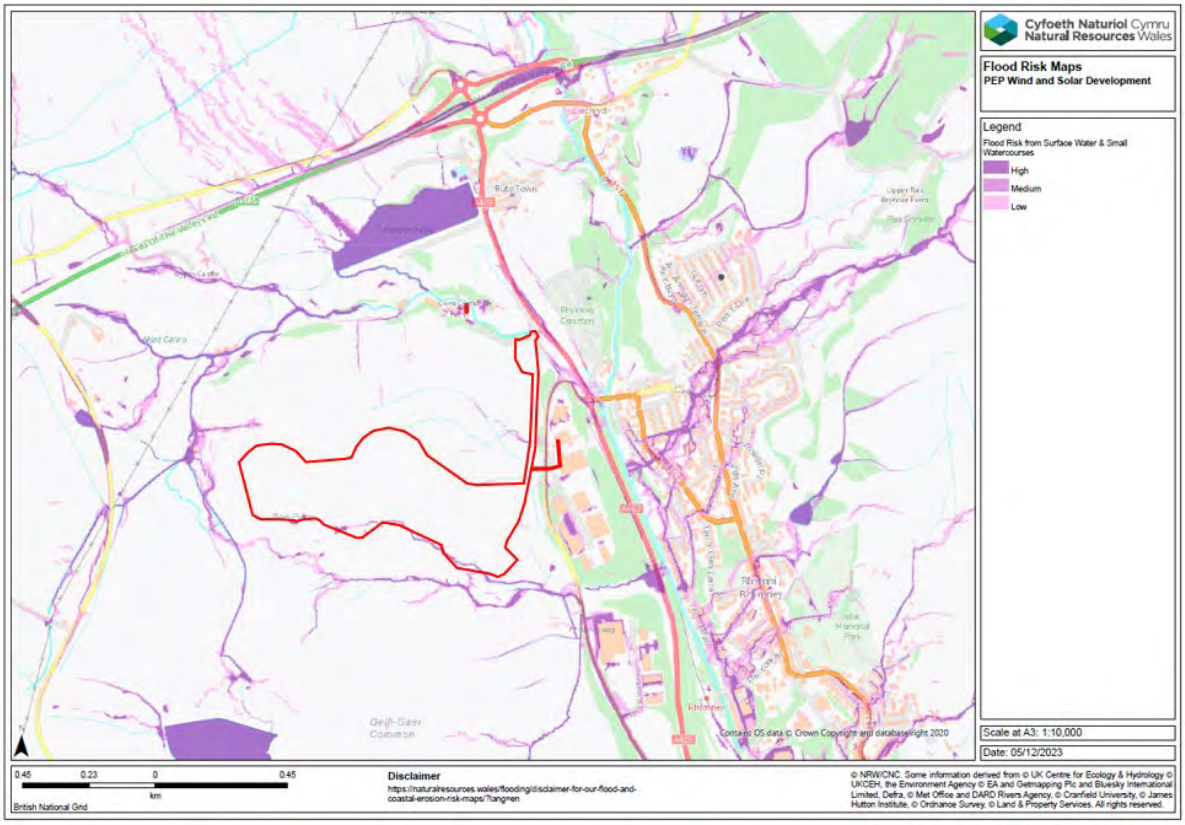


Figure 3. Natural Resource Wales: Flood Risk from Surface Water and Small Watercourses

Groundwater Flooding

4.2.12 Groundwater flooding can occur when prolonged rainfall causes the groundwater table to rise above ground level. Groundwater flooding can occur at the same time as flooding from other sources such as overland flow. It is often dependant on the underlying geology.

4.2.13 The Preliminary Flood Risk Assessment states that there are no significant historic groundwater flooding events within the Caerphilly County Borough.

4.2.14 The Local Flood Risk Management Strategy states that groundwater flooding is not considered a major problem within the Caerphilly County Borough Council area. The Flood Risk Management Strategy states, however, that since the closure of the mines in the area, the pumping of water to control groundwater levels has ceased. As a result, water occasionally discharges from old mines workings as groundwater levels increase.

4.2.15 Historical maps, accessed via the National Library of Scotland website[7], show that the area has an extensive history of mining. The Coal Authority Map (included as Appendix A) shows that there are several disused mine shafts and mine adits within the site area. There is the potential, therefore, for groundwater to emerge at the surface within the site area.

Sewer Flooding

4.2.16 Flooding could occur on site from localised, high intensity storms of a relatively short duration that might exceed the capacity of the local drainage network.

4.2.17 Due to the nature of the site it is assumed that there are no public or private sewers within the site area. The risk of sewer flooding is, therefore, discounted.

Artificial Sources

4.2.18 Artificial sources of flooding include reservoirs, canals and any other impounded water body which is elevated above the site. Flooding can occur when the impounding structures such as dams and embankments fail, when culverts become blocked, or during extreme rainfall events when the waterbodies overflow.

4.2.19 The NRW 'Flood Risk from Reservoirs' map (included as Figure 4) shows that areas on the north and south of the site area at risk of flooding from reservoirs.

[7] Side by side georeferenced maps viewer - Map images - National Library of Scotland (nls.uk)

4.2.20 Small areas at risk in the south of the site are assumed to be associated with flooding from Rhaslas Pond, located on higher ground approximately 0.75km to the south-west of the site. The flood waters would follow natural valleys northwards and eastwards potentially entering low-lying areas of the site. There would, however, be no pathway for any flooding to enter the wider site.

4.2.21 A small area adjacent to site entrance at the north-eastern of the site is also shown to be at risk. This is assumed to be the potential extent of flooding from Bute Town Reservoir, located 0.5km north of the site. This area is at a lower elevation than the majority of site areas, and there is also no pathway for flood waters to enter the site.

4.2.22 There are no canals or other impounded water bodies in the vicinity of the site that could pose a risk to the proposed development.

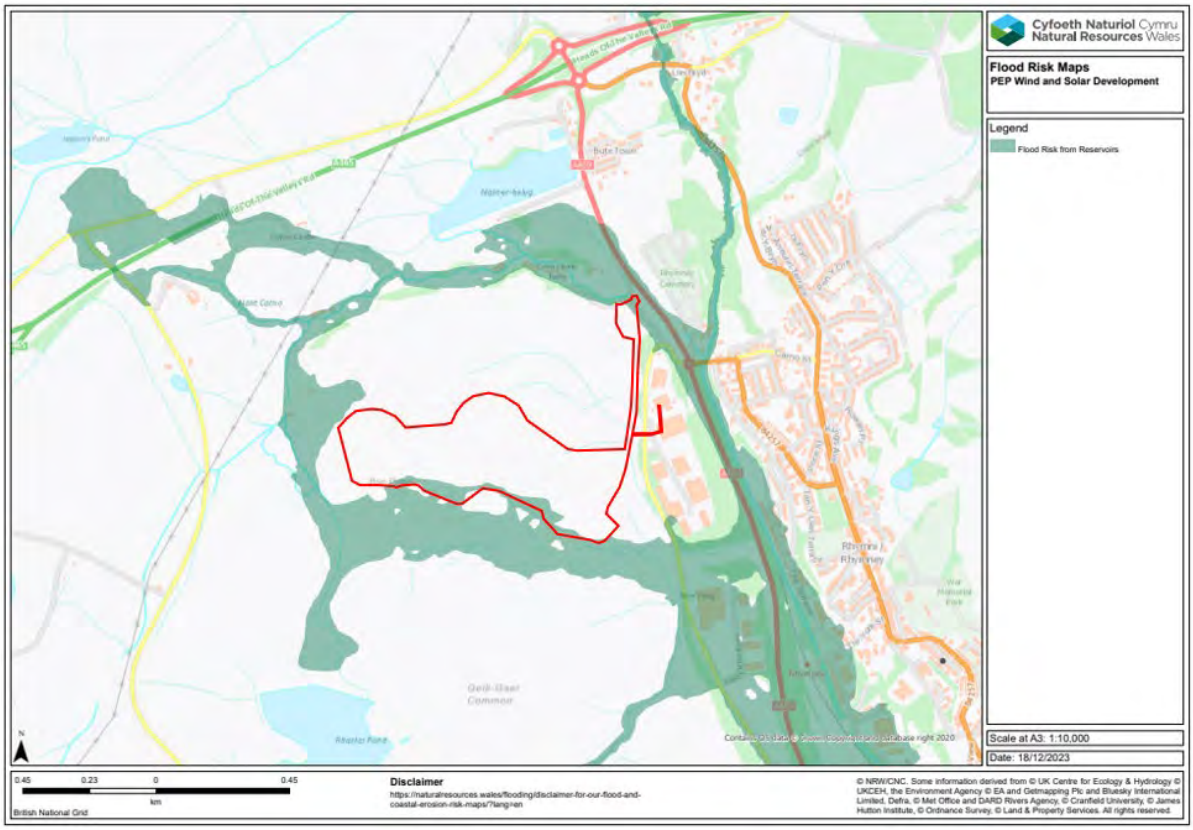


Figure 4. Natural Resources Wales: Flood Risk From Reservoirs

4.3 Risk of Flooding to the Site

4.3.1 Table 3 summarises the potential sources of flooding within the site. The risk from these sources is described in further detail in this section.

Table 3: Summary of Flood Risks

Type	Source	Pathway	Risk
Fluvial Flooding (Rivers)	Y	N	-
Tidal Flooding	N	-	-
Surface Water Runoff/Small Watercourses	Y	Y	Very Low
Groundwater Flooding	Y	Y	Very Low
Sewer/Drain Flooding	N	N	-
Artificial Flooding	Y	Y	Low

4.3.2 The potential sources of flooding with a pathway to the site are, therefore, surface water, groundwater, and reservoir flooding.

Surface Water and Small Watercourses Risk

4.3.3 Most of the site is not considered at risk of flooding from surface water or small water courses. Small pathways flow adjacent to the southern site boundary, however, in several places, coincident with the network of small water courses that flow eastwards towards Rhymney River.

4.3.4 Based on the information available, the risk of flooding is considered to be Very Low

Groundwater Flooding Risk

4.3.5 The Coal Authority Map (included as Appendix A) highlights several disused mine shafts and adits within site boundary. These are located mostly in the southeastern corner of the site, and along the southern boundary.

4.3.6 The exact depth of the groundwater table at the site is not known, however, OS maps indicates springs and marshy ground to the south of the site suggesting an emergence of groundwater at this location. This area, however, approximately 15m lower than the developable area of the site and, therefore, the site is unlikely to be affected.

4.3.7 Therefore, risk of flooding from groundwater is considered to be Very Low.

Artificial Flooding Risk

4.3.8 NRW mapping shows that areas along the southern boundary and at the site entrance in the north-eastern corner site are at risk of flooding from reservoirs. It is assumed that the source of this risk is from Rhaslas Pond and Bute Town Reservoir. The extent of the flooding from Bute Town Reservoir within the site is minimal, potentially affecting low-lying land close to the site entrance, whilst the majority of the site is situated at a higher elevation. The Rhaslas Pond, to the west of the site, is at a higher elevation, however, the general eastward fall of the land in this area means that flow paths will naturally flow parallel to the southern boundary within a natural 'valley' with few pathways into the site.

4.3.9 Based on the available information, the risk of flooding from artificial sources is considered to be Low.

5 POST-DEVELOPMENT FLOOD RISK ASSESSMENT

5.1.1 New developments can pose a risk of flooding to neighbouring properties and areas downstream of the site, often as a result of an increase in impermeable area which has the effect of increasing the rate and volume of surface water runoff. In addition, climate change can be expected to cause an increase in rainfall intensity and surface water runoff over the lifetime of a development.

5.1.2 Flood risk can also be increased as a result of new development if the development reduces the floodplain storage area or alters flood flow paths, ultimately displacing flood water and resulting in an increased risk of flooding to the surrounding area.

5.2 Fluvial Flooding

5.2.1 The site is located entirely within Flood Zone A. There will, therefore, be no loss of floodplain storage or impact on any fluvial flood flow routes as a result of the proposed development.

5.3 Surface Water Flooding (Pluvial Flooding)

5.3.1 The proposed development will not involve significant changes to the existing ground levels and solar panels will be raised on piles with overland flows able to pass beneath unrestricted.

5.3.2 To ensure that existing overland flow routes are not impeded or diverted by the proposed access tracks, these will be constructed at ground level.

5.3.3 Existing overland flow routes, will not, therefore, be impeded or diverted as a result of the proposed development and it is considered that the risk of surface water flooding will not be increased.

5.4 Surface Water Runoff

5.4.1 The existing land within the site area is considered to be wholly permeable, with any surface water runoff dispersing naturally via infiltration, evaporation or uptake by vegetation or flowing overland following the local topography to enter the network of ordinary watercourses within the site and its vicinity.

5.4.2 The proposed development will comprise three wind turbine bases, solar panels, and associated infrastructure, including access tracks, substations and transformers. There will also be two construction compounds, located in the south-eastern corner of the site and adjacent to the site entrance in the north-east.

5.4.3 The total post-development impermeable area will be approximately 2.163 ha. The rate and volume of surface water runoff generated during an extreme storm event could, therefore, potentially increase as a result of the proposed development.

5.5 Climate Change

5.5.1 It is necessary to consider an allowance for climate change for the lifetime of the development when assessing future flood risk. NRW and UK Government guidance provides predictions of anticipated changes to peak river flows and rainfall intensity for consideration on new developments. In assessing pluvial flooding from the proposed development, the climate change predictions for peak rainfall intensity for the lifetime of the development need to be accounted for.

5.5.2 An increase in rainfall intensity could increase the rate and volume of surface water generated during a storm event and this should be considered when assessing surface water flood risk. The Welsh Government 'Flood Consequences Assessment: Climate Change Allowances' report states that non-residential developments should have an assumed lifespan of 75 years and, based on Table 2 of the report (reproduced as Table 4 below), a 40% increase in rainfall intensity should be considered.

5.5.3 It is considered, therefore, that the risk of surface water flooding could increase as a result of the proposed development due to the increase of impermeable ground cover and climate change.

5.5.4 Mitigation measures will, therefore, be required to reduce the risk of surface water flooding impacting areas downstream of the site. Such mitigation measures will need to account for the predicted effects climate change on rainfall intensity, to ensure it is safe for the lifespan of the development.

Table 4: Peak Rainfall Intensity Allowances

***Allowances apply across the whole of Wales**	**'2020s' (2015 – 2039)**	**'2050s' 2040 – 2069**	**'2080s' 2070 – 2115**
Peak Rainfall Intensity – Upper End	10%	20%	**40%**
Peak Rainfall Intensity – Central	5%	10%	20%

6 FLOOD RISK MITIGATION MEASURES AND RESIDUAL RISK

6.1 Surface Water Management

6.1.1 The Flood Consequence Assessment has identified that the development proposals and climate change could result in increased surface water runoff rates and volumes, which could impact areas downstream of the site.

6.1.2 To reduce the potential increase in flood risk posed by the proposed development, it is proposed to manage and disperse surface water runoff within the proposed development with no discharge off site. Sufficient attenuation will be provided within the site for 1 in 100 year storm events including appropriate allowances for climate change.

6.1.3 The surface water management proposals are discussed in further detail below.

6.2 Residual Risk

6.2.1 There is always a possibility of a storm event that exceeds the design standards of the proposed flood risk management measures for new developments. Potential risks include the exceedance of the surface water attenuation facilities during extreme storm events.

6.2.2 Surface water attenuation features within the site will be designed to provide sufficient attenuation for the 1 in 100 year (plus climate change) storm event. If the capacity of the attenuation features is exceeded by an extreme storm event, exceedance flows will follow the existing topography with no increased risk to areas previously unaffected by surface water runoff.

7 DRAINAGE STRATEGY

7.1 Surface Water Drainage Strategy

7.1.1 The proposed surface water management plan is shown on Drawing No. BR10167-042 'Indicative Surface Water Management Plan'.

7.1.2 Standard S1 of the Sustainable Drainage Systems Standards for Wales stipulates a hierarchy for the disposal of surface water which should be followed as part of any surface water drainage design. This hierarchy is as follows:

- Priority Level 1: Surface water runoff is collected for use;
- 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.

7.1.3 Based on the nature of the proposed development, there would be few uses for recycled surface water runoff. In accordance with the hierarchy, it is proposed that SuDS features are designed to promote infiltration. The underlying soil at the site is classified as 'restored soils mostly from quarry and opencast spoil', with a loamy texture and 'variable' drainage.

7.1.4 Detailed permeability testing will be conducted at the detailed design stage in accordance with BRE Digest 365 in order to assess the permeability of the underlying ground and determine the feasibility of infiltration drainage.

7.1.5 For the purpose of this surface water management strategy, however, zero infiltration has been assumed within the calculations as a 'worst-case scenario'.

7.2 Drainage Rationale

7.2.1 In order to account for increased impermeable ground cover at the site as a result of the development, it is proposed to construct a series of vegetated swales downslope of access tracks, construction compounds and impermeable surfaces. Where the swales are coincident with the topography, they will retain surface water runoff and allow this to disperse via infiltration, evaporation, and uptake by vegetation with no formal outfall to any watercourses or other drainage systems.

7.2.2 These swales will be sufficiently sized to attenuate for the increased volume of surface water runoff generated by the proposed development compared to the existing

greenfield scenario, for all return periods up to and including the 1 in 100 year event (plus a 40% allowance for climate change).

7.2.3 Where swales are constructed on sloped ground, these will primarily function as conveyance routes to sections of swales where infiltration can take place. Check-dam structures can, however, be installed within these swales to retain a portion of the flows and provide storage.

7.3 Contributing Impermeable Area Estimates

7.3.1 Based on Drawing No. BR10167-01 'Site Layout', there will be an increase of approximately 2.163 ha in impermeable ground cover within the proposed development. This is comprised of 1.22 ha of access tracks, 0.14 ha of turbine foundations and a total of 0.78 ha of surfacing within the two construction compounds. Roof structures including the main substation, three wind transformers and four solar mv stations account for a further 280m^2 of impermeable surfacing.

7.3.2 For the purposes of this surface water management plan, the contributing areas of permeable ground cover has been split into six catchments based on the site topography.

7.3.3 Under the existing 'greenfield' scenario, a portion of rain falling onto the open ground will disperse naturally via infiltration or evaporation, with the remainder which is unable to disperse forming overland flow. The proportion of rainfall which will form surface water runoff is referred to as the 'runoff coefficient'. The runoff coefficient for all catchments, based on the current 'greenfield' ground conditions, has been calculated based on guidance in the Environment Agency 'Preliminary Rainfall Runoff Management for Developments' Report SC030219[8], at 55.98% (i.e. a runoff coefficient of 0.56). The full calculations are contained in Appendix B.

7.3.4 This method is, however, not applicable for estimating the runoff coefficient for the semi-permeable surfacing used for the access tracks and construction compounds within the proposed development.

7.3.5 In order to estimate an appropriate runoff coefficient from the access tracks and the construction compounds, the Runoff Coefficient Nomogram (taken from the Technical Management of Water in the Coal Mining Industry report[9]) was used. Whilst this

[8] DEFRA/Environment Agency 'Rainfall Runoff Management for Developments (ref: SC030219)
[9] NATIONAL COAL BOARD – MINING DEPARTMENT (1982) *Technical Management of Water in the Coal Mining Industry*

nomogram primarily applies to runoff from spoil heaps, it is considered appropriate for use on all areas of sloped open ground. The runoff coefficient is based on ground slope, vegetation cover and soil conditions. An example of the nomogram is shown as Figure 5, based on the characteristics of Catchment 1.

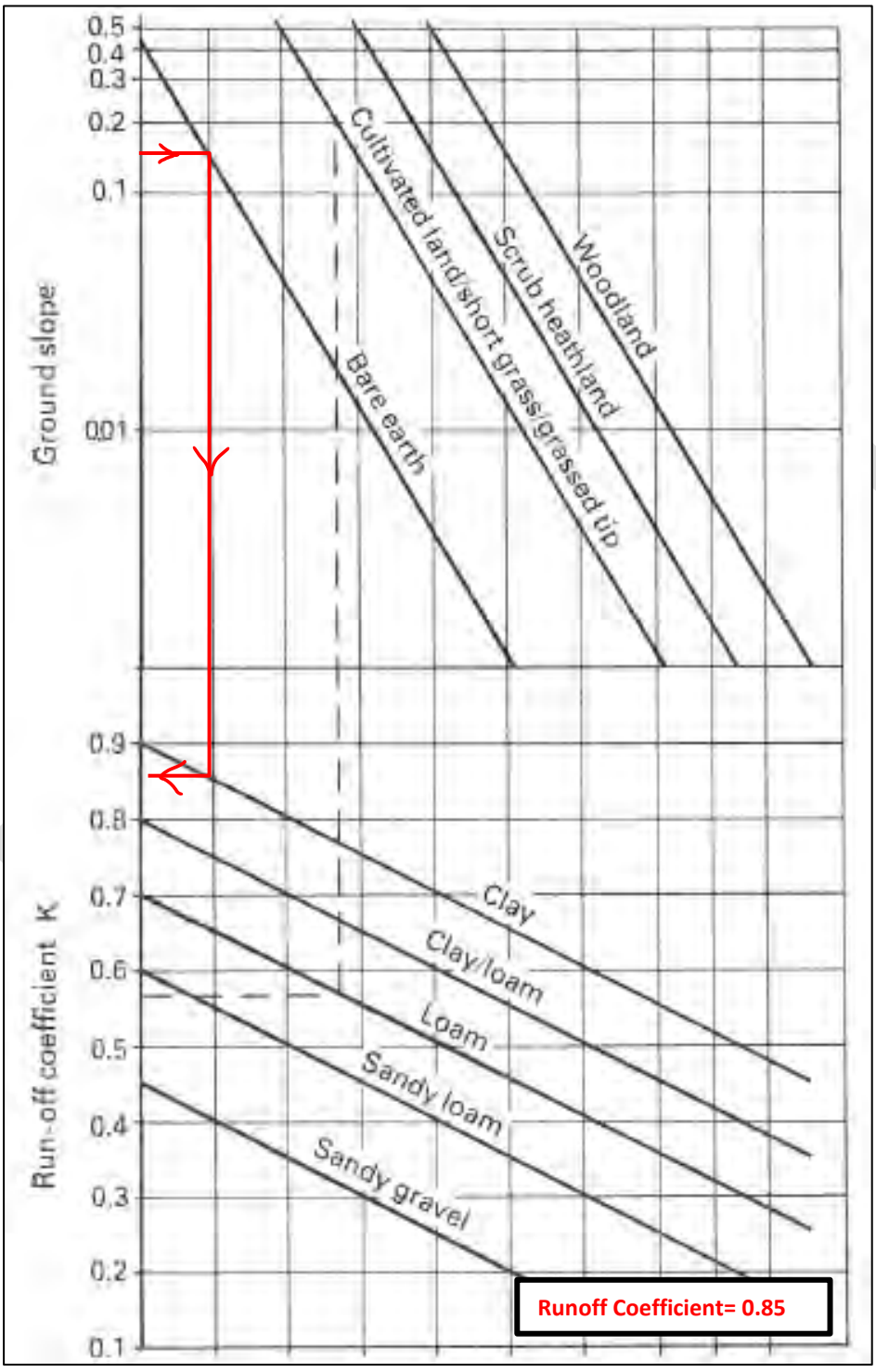


Figure 5. Runoff Coefficient Nomogram Proposed Access Tracks Catchment 1

7.3.6 The aggregate surfacing of the proposed access tracks and construction compounds is not explicitly represented as a surface or soil type on the nomogram. It is, however, considered that a clay soil type would have similar infiltration characteristics, particularly when compacted, and 'bare earth' is also considered the best representative ground cover.

7.3.7 The only factor resulting in variation in the estimated runoff coefficient between the different areas of the site is, therefore, ground slope. This was estimated based on the topography shown on Drawing No. BR10167-038-P0.01 'Lidar Topography'. The estimated runoff coefficient for the semi-permeable surfacing within each catchment is shown in Table 5.

Table 5. Runoff Coefficient for Semi-Permeable Ground Cover

Catchment	Ground Slope	Runoff Coefficient
1	0.16	**0.85**
2	0.06	**0.80**
3	0.08	**0.81**
4	0.06	**0.80**
5 (Construction Compound 1)	*0.09*	***0.82***
6 (Construction Compound 2)	*0.48*	***0.79***

Runoff coefficient based on 'Nomogram to Determine the Runoff Coefficient' taken from National Coal Board (1982) guidance.
Slope gradient based on the topographical survey (Drawing No. BR10167-038-P0.01 'Lidar Topography').
Based on 'bare earth' and 'clay' soil type

7.3.8 A 100% runoff coefficient has been applied to the roof structures and turbine foundations as a 'worst case' scenario estimate.

7.3.9 Table 6 outlines the contributing area for each catchment, based on the impermeable roof areas and the semi-permeable surfacing, with the runoff coefficient applied.

Table 6. Contributing Areas			
Catchment	**Impermeable Area (m^2)**	**Semi-Permeable Area (m^2)**	**Total Contributing Area (m^2)**
1	485	2,315	2,800
2	485	2,155	2,640
3	675	3,895	4,570
4	0	3,835	3,835
5 (Construction Compound 1)	0	4,033	4,033
6 (Construction Compound 2)	0	3,752	3,752

7.4 Surface Water Attenuation Estimates

7.4.1 The required surface water attenuation volumes within each catchment were calculated by comparing the difference in runoff volume for the existing pre-development greenfield site to the runoff volume from the developed site.

7.4.2 Attenuation volumes have been calculated using the Environment Agency 'Preliminary Rainfall Runoff Management For Developments' guidance. This has been calculated for the 1 in 100 year, 6 hour storm event (from FEH222 data) for catchments 1 to 4.

7.4.3 As the construction compounds will be temporary and in place during the construction phase only, attenuation volumes for Catchments 5 and 6 were calculated using the 1 in 30 year, 6 hour storm event as a more appropriate estimation. A climate change allowance of 40% has been applied for all catchments. The required attenuation for each area of the site is detailed in Table 7 below with full calculations provided in Appendix C.

Table 7. Required Surface Water Attenuation			
Catchment	**Pre-Development Runoff Volume (m^3)**	**Post-Development Runoff Volume (m^3)**	**Attenuation Required (m^3)**
1[1]	163.9	256.5	**92.6**
2[1]	154.6	231.0	**76.5**
3[1]	209.4	400.5	**133.0**

Table 7. Required Surface Water Attenuation			
Catchment	**Pre-Development Runoff Volume (m^3)**	**Post-Development Runoff Volume (m^3)**	**Attenuation Required (m^3)**
4[1]	224.5	320.9	**96.3**
5 (Construction Compound)[2]	194.2	291.5	**97.3**
6 (Construction Compound)[2]	180.7	261.3	**80.6**
Total	**1,128**	**1,762**	**576.3**
1. Runoff volume for 1 in 100 year (+40% climate change) event 2. Runoff volume for 1 in 30 year (+40% climate change) event			

7.4.4 The proposed swales will have a surface width (bank to bank) of 5m with a bed width of 0.5m and a depth of 0.75m. Table 8 summarises the total attenuation provided within the proposed swales in each area based on these dimensions. A full summary of the attenuation provided within the swale is provided with Drawing No. BR10167-042 'Indicative Surface Water Management Plan'.

Table 8. Swale Attenuation Estimates			
Area	**Attenuation Required (m^3)**	**Attenuation Provided (m^3)**	**Difference (m^3)**
1	**93**	**332**	+239
2	**77**	**147**	+70
3	**133**	**348**	+215
4	**96**	**351**	+255
5	**97**	**98**	+1
6	**81**	**89**	+8
Total	**577**	**1,365**	**+788**
Attenuation estimates do not include 'conveyance' swales implemented on sloped ground.			

7.4.5 As shown in Table 8, the proposed swales will provide a total of 1,365 m^3 of attenuation which significantly exceeds the required 576m^3. This will ensure that there will be no increase in the volume of surface water runoff flowing off site whilst the development is operational. The capacity of the swales will, therefore, provide an additional 788 m^3 of attenuation above the required volume which will allow a portion

of runoff from the wider site to be retained and, therefore, provide betterment to the existing scenario where surface water runoff flows off site unrestricted.

7.4.6 Along with the swales adjacent to structures, access tracks and construction compounds (summarised in Table 8 above), it is also proposed to use 'precautionary' swales at field boundaries downslope of developed areas of the site. Whilst the rate and volume of surface water runoff is not considered to increase as a result of the solar panels, the precautionary swales will provide some additional storage, providing further betterment to the existing scenario.

7.5 Surface Water Quality

7.5.1 Grass will be reinstated following construction and will intercept runoff from the solar panels, limiting the rate of erosion by reducing the kinetic energy of the runoff as it falls to the ground. The grass will also impede any overland flow, lessening any 'scouring' effect that overland flow may have. This will minimise the concentration of silt and suspended solids within the runoff. The grass cover will also filter surface water runoff removing silts and suspended solids.

7.5.2 As swales can help to retain runoff from storm events on site, this volumetric control can help to reduce the total discharges of silt and sediment off site. Swales can also treat residual runoff, by removing coarse to medium sediments and associated pollutants by filtration via surface vegetation. Fine particulates will be filtered via infiltration through underlying soil.

7.5.3 It is considered, therefore, that there will be no impact on surface water quality as a result of the proposed development.

7.6 SuDS Management and Maintenance

7.6.1 In order for the successful continued management of surface water runoff, the proposed vegetated swales must be regularly maintained. Table 9 below outlines typical maintenance requirements for these SuDS features based on guidance within the SuDS Manual.

Table 9. Operation and Maintenance Requirements for Swales (from SuDS Manual Table 17.1)

Maintenance Schedule	**Required Action**	**Typical Frequency**
Regular Maintenance	Remove litter and debris	Monthly, or as required
	Cut grass – to retain grass height within specified design range	Monthly (during growing season), or as required

Table 9. Operation and Maintenance Requirements for Swales (from SuDS Manual Table 17.1)		
Maintenance Schedule	**Required Action**	**Typical Frequency**
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets, and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48hrs	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly or 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional Maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial Actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices.	As required

7.6.2 The ideal length of grass within each swale is specified by the CIRIA SuDS manual to be in the range of 75-150mm long in order to assist proper infiltration of pollutants and sediments that may accumulate in the swale and to reduce the risk of flattening during larger events such as the 1 in 30 and 1 in 100-years storm events. Maintaining this length will require regular maintenance activities such as mowing when dry.

7.6.1 A SuDS maintenance checklist is included as Appendix C and can be used during each maintenance visit.

8 CONCLUSIONS

8.1.1 This report gives details of the Flood Consequences Assessment produced to support the planning application for the proposed Wind and Solar development on land south west of Convatec Ltd, Unit 1-2, Heads Of the Valley Industrial Estate, west of the town of Rhymney, Tredegar. This report has been conducted in accordance with TAN15.

8.1.2 The site is located entirely within Flood Zone A, described in TAN15 as an area *'considered to be at little or no risk of fluvial or tidal/coastal flooding'* on the Welsh Government's Development Advice Map.

8.1.3 The proposed development categorised as a 'Less Vulnerable' development. Based on Figure 2 of TAN15, a Less Vulnerable development is permitted in Flood Zone A. Therefore, the Justification Test is not required.

8.1.4 The proposed wind and solar development will comprise three wind turbines and ground mounted solar PV panels, along with associated infrastructure, including access tracks, construction compounds, substations, wind transformers and solar MV stations. The proposed layout is shown on Drawing No. BR10167-01 'Site Layout'.

8.1.5 The risk of surface water, and groundwater flooding are considered to be Very Low, and the risk of artificial flooding is considered to be Low. Tidal, fluvial and sewer flooding are all discounted.

8.1.6 Flood risk management measures will be implemented to ensure that the risk of flooding to areas downstream of the site is not increased as a result of the development. On-site attenuation will incorporate the use of Sustainable Drainage Systems (SuDS) features to accommodate flows in exceedance of up to and including the 1 in 100 year storm event, including an appropriate allowance for climate change.

8.1.7 As the risk of flooding to the site is generally considered to be Low to Very Low, and the risk of flooding to surrounding areas will not be increased as a result of the proposed development, it is considered that, from a flood risk and drainage perspective, the site is suitable for the type of development proposed.

APPENDICES

APPENDIX A

Coal Authority Map

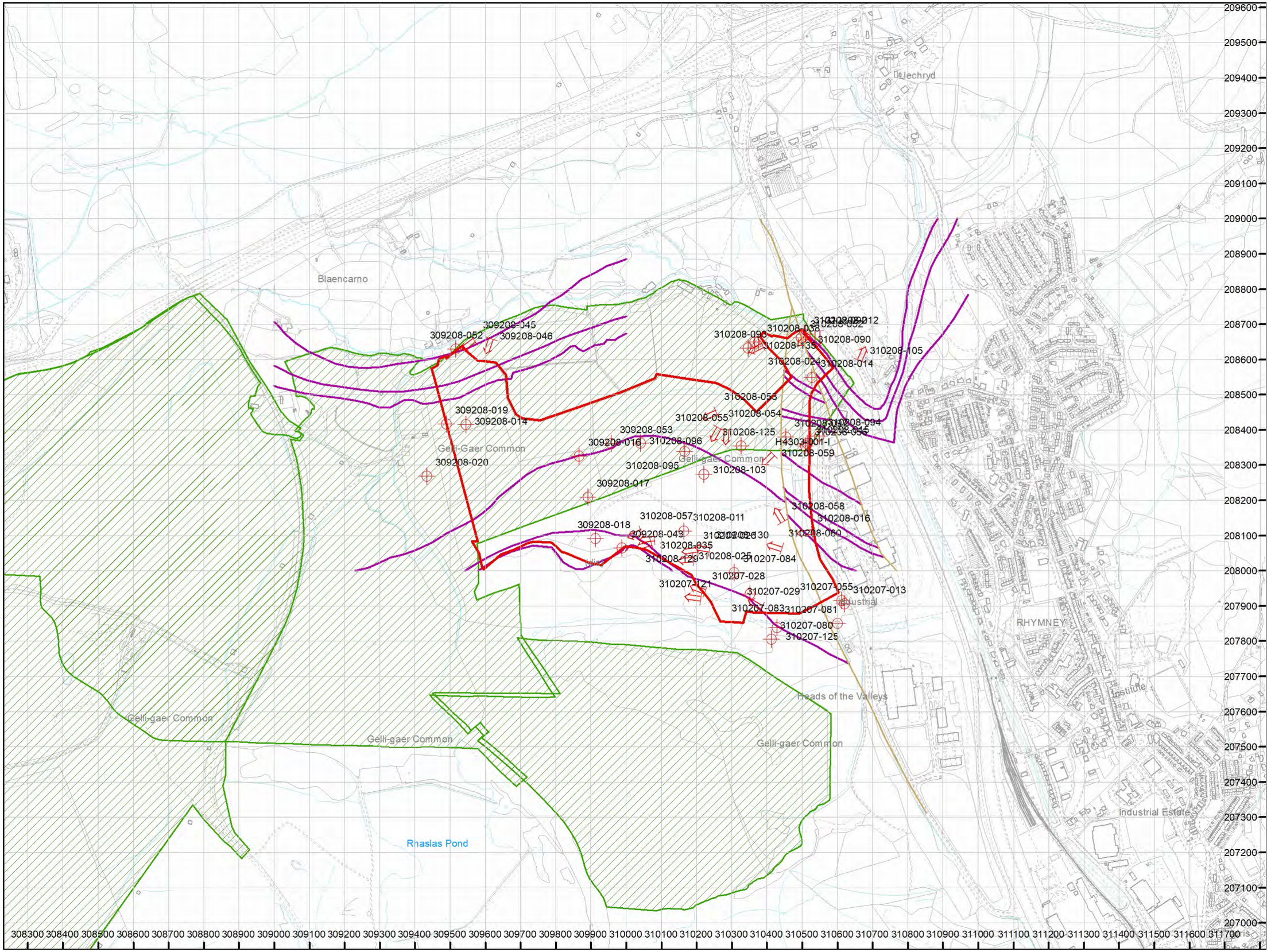
The Coal Authority

Summary of findings

The map highlights any specific surface or subsurface features within or near to the boundary of the site.

Key

- Approximate position of the enquiry boundary shown
- Disused mine shaft
- Disused adit
- Outcrop (Proven)
- Geological faults
- Unlicensed opencast site
- Remediated sites



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APPENDIX B

Greenfield Runoff Coefficient

Calculation Sheet

REF:

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Convatec	PEP Wind and Solar	BR10167	PAGE: 1 OF 1
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Greenfield Runoff Coefficient	(NAME AND SIGNATURE) H Wilson	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	DATE: 31/01/2024	DATE:	DATE:

Greenfield Runoff Coefficient= PR_{rural} (%)

$PR_{rural} = SPR + DPR_{cwi} + DPR_{rain}$

where: DPRcwi = 0.25 x (cwi -125)

and $DPR_{rain} = 0.45 \times (P-40)^{0.7}$ for P>40mm; or $DPR_{rain} = 0$ for P≤40mm

where P = rainfall depth

SAAR	1625	mm	
CWI	128	mm	*This informaiton can be obtained from Source Control*
SPR/SPR	49.84	%	*This informaiton can be obtained from Source Control*
Rainfall	74.7	mm	*Varies subject to design storm return period and duration. Obtained by the Wallingford Procedu*

Rainfall	74.70
DPR_{cwi} =	0.75
DPR_{rain} =	5.39
PR_{rural} =	**55.98%**

Greenfield Runoff Coefficient= 0.56

APPENDIX C

Runoff Volume Calculations (Catchments 1-6)

Calculation Sheet

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Convatec	PEP Wind and Solar	BR10167	PAGE: 1 OF 2
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Runoff Volume: Catchment 1	(NAME AND SIGNATURE) H Wilson	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	DATE: 29/01/2024	DATE:	DATE:

Rainfall (mm)	74.7	from FEH 2022 DDF modelling
SAAR	1625	from FEH or via UK SuDS Tools
SPRHOST or SPR (%)	49.84	SPRHOST from FEH data; SPR from (SOIL = 0.1SOIL1 + 0.3SOIL2 + 0.37SOIL3 + 0.47SOIL4 + 0.53SOIL5)
Return Period (yrs)	100	
Duration (hrs)	6	

Note: For durations shorter than 0.5hours FEH DDF should not be used.

Runoff Calculations for Existing Site

Permeable (ha)	0.28
Impermeable (ha)	0
Semi Permeable (ha)	0
Total (ha)	0.28

	Existing Permeable	Existing Impermeable	Existing Semi Permeable	
Storm duration (mins)	360	360	360	
Rainfall Return Period	100	100	100	
Rainfall Depth (mm)	74.7	74.7	74.7	
Site Area (ha)	0.28	0	0	
Site Area (km^2)	0.0028	0	0	
Total Rainfall Volume (m^3)	209.2	0.0	0	
$PR_{(RURAL)}$	55.98%	N/A	N/A	
% Runoff from paved areas	N/A	100%	85.00%	**Total**
Volume of Runoff (m^3)	**117.1**	**0.0**	**0.0**	**117.1**

Runoff Calculations for Proposed Development

Permeable (ha)	0
Impermeable (ha)	0.0485
Semi Impermeable (ha)	0.2315
Total (ha)	0.28

	Proposed Permeable	Proposed Impermeable	Proposed Semi Permeable	
Storm duration (mins)	360	360	360	
Rainfall Return Period	100	100	100	
Rainfall Depth (mm)	74.7	74.7	74.7	
Site Area (ha)	0	0.0485	0.2315	
Site Area (km^2)	0	0.000485	0.002315	
Total Rainfall Volume (m^3)	0.0	36.2	172.9305	
$PR_{(RURAL)}$	55.98%	N/A	N/A	
% Runoff from paved areas	N/A	100%	85%	**Total**
Volume of Runoff (m^3)	**0.0**	**36.2**	**147.0**	**183.2**

Calculation Sheet

Runoff Calculations for Proposed Development with Climate Change

Rainfall (mm)	74.7
Return Period (yrs)	100
Duration (hrs)	6
100y Climate Change %	40%
Rainfall + CC (mm)	104.58

	Exisiting Permeable	Exisiting Impermeable	Existing Semi Permeable	
Rainfall Depth (mm)	104.58	104.58	104.58	
Site Area (km^2)	0.0028	0	0	
Total Rainfall Volume (m^3)	292.8	0	0	
$PR_{(RURAL)}$	55.98%	N/A	N/A	
% Runoff (Urban/ImpA)	N/A	100%	85%	**Total**
Volume of Runoff (m^3)	**163.9**	**0.0**	**0.0**	163.9

	Proposed Permeable	Proposed Impermeable	Proposed Semi Permeable	
Rainfall Depth (mm)	104.58	104.58	104.58	
Site Area (km^2)	0	0.000485	0.002315	
Total Rainfall Volume (m^3)	0.0	50.7	242.1027	
$PR_{(RURAL)}$	55.98%	N/A	N/A	
% Runoff (Urban/ImpA)	N/A	100%	85.00%	**Total**
Volume of Runoff (m^3)	**0.0**	**50.7**	**205.8**	256.5

SUMMARY	
Existing Runoff	117.1
Post-Devel Runoff (present day)	183.2
Difference	***66.1***
Existing Runoff	117.1
Post-Devel runoff + CC	256.5
Difference	***139.4***
Exisitng Runoff +CC	163.9
Post-Devel +CC	256.5
Difference	**92.6**

Following the methodology set out in section 7 of the Environment Agency publication ' Preliminary Rainfall Runoff Managament for Developments' Report SC030219

Runoff Volume difference - extra runoff volume (m3) from development over Greenfield Runoff

[RD] Rainfall depth (mm)	56.37	100y 6h event, from FEH DDF
PIMP	1.191	the impermeable area as a percentage of the total area (values from 0 to 100)
[A] Site Area	2.634	the area of the site in hectares
SOIL	0.4	the "SPR" value for the relevant FSR soil type, or the SPRHOST value (values from 0.1 to 0.53) SPRHOST from FEH data; SPR from (SOIL = 0.1SOIL1 + 0.3SOIL2 + 0.37SOIL3 + 0.47SOIL4 + 0.53SOIL5)
[α] Proportion of Paved area draining to network or river	1	values from 0 to 1
[β] Proportion of Pervious Area draining to network or river	1	values from 0 to 1 (only reduce this from 1 if some pervious areas such (eg back gardens) cannot drain to the netowrk or river)
Runoff factor for contributing paved surfaces	0.8	

Volume Difference **7.07352 m^3**

$$Vol_{xx} = 10.RD.A\left[\frac{PIMP}{100}(\alpha 0.8) + \left(1 - \frac{PIMP}{100}\right)(\beta.SOIL) - SOIL\right]$$

Calculation Sheet

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Convatec	PEP Wind and Solar	BR10167	PAGE: 1 OF 2
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Runoff Volume: Catchment 2	(NAME AND SIGNATURE) H Wilson	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	DATE: 29/01/2024	DATE:	DATE:

Rainfall (mm)	74.7	from FEH 2022 DDF modelling
SAAR	1625	from FEH or via UK SuDS Tools
SPRHOST or SPR (%)	49.84	SPRHOST from FEH data; SPR from (SOIL = 0.1SOIL1 + 0.3SOIL2 + 0.37SOIL3 + 0.47SOIL4 + 0.53SOIL5)
Return Period (yrs)	100	
Duration (hrs)	6	

Note: For durations shorter than 0.5hours FEH DDF should not be used.

Runoff Calculations for Existing Site

Permeable (ha)	0.264
Impermeable (ha)	0
Semi Permeable (ha)	0
Total (ha)	0.264

	Existing Permeable	Existing Impermeable	Existing Semi Permeable	
Storm duration (mins)	360	360	360	
Rainfall Return Period	100	100	100	
Rainfall Depth (mm)	74.7	74.7	74.7	
Site Area (ha)	0.264	0	0	
Site Area (km^2)	0.00264	0	0	
Total Rainfall Volume (m^3)	197.2	0.0	0	
$PR_{(RURAL)}$	55.98%	N/A	N/A	
% Runoff from paved areas	N/A	100%	80.00%	**Total**
Volume of Runoff (m^3)	**110.4**	**0.0**	**0.0**	**110.4**

Runoff Calculations for Proposed Development

Permeable (ha)	0
Impermeable (ha)	0.0485
Semi Impermeable (ha)	0.2155
Total (ha)	0.264

	Proposed Permeable	Proposed Impermeable	Proposed Semi Permeable	
Storm duration (mins)	360	360	360	
Rainfall Return Period	100	100	100	
Rainfall Depth (mm)	74.7	74.7	74.7	
Site Area (ha)	0	0.0485	0.2155	
Site Area (km^2)	0	0.000485	0.002155	
Total Rainfall Volume (m^3)	0.0	36.2	160.9785	
$PR_{(RURAL)}$	55.98%	N/A	N/A	
% Runoff from paved areas	N/A	100%	80%	**Total**
Volume of Runoff (m^3)	**0.0**	**36.2**	**128.8**	**165.0**

Calculation Sheet

Runoff Calculations for Proposed Development with Climate Change

Rainfall (mm)	74.7
Return Period (yrs)	100
Duration (hrs)	6
100y Climate Change %	40%
Rainfall + CC (mm)	104.58

	Exisiting Permeable	Exisiting Impermeable	Existing Semi Permeable	
Rainfall Depth (mm)	104.58	104.58	104.58	
Site Area (km^2)	0.00264	0	0	
Total Rainfall Volume (m^3)	276.1	0	0	
$PR_{(RURAL)}$	55.98%	N/A	N/A	
% Runoff (Urban/ImpA)	N/A	100%	80%	**Total**
Volume of Runoff (m^3)	**154.6**	**0.0**	**0.0**	154.6

	Proposed Permeable	Proposed Impermeable	Proposed Semi Permeable	
Rainfall Depth (mm)	104.58	104.58	104.58	
Site Area (km^2)	0	0.000485	0.002155	
Total Rainfall Volume (m^3)	0.0	50.7	225.3699	
$PR_{(RURAL)}$	55.98%	N/A	N/A	
% Runoff (Urban/ImpA)	N/A	100%	80.00%	**Total**
Volume of Runoff (m^3)	**0.0**	**50.7**	**180.3**	231.0

SUMMARY	
Existing Runoff	110.4
Post-Devel Runoff (present day)	165.0
Difference	***54.6***
Existing Runoff	110.4
Post-Devel runoff + CC	231.0
Difference	***120.6***
Exisitng Runoff +CC	154.6
Post-Devel +CC	231.0
Difference	**76.5**

Following the methodology set out in section 7 of the Environment Agency publication ' Preliminary Rainfall Runoff Managament for Developments' Report SC030219

Runoff Volume difference - extra runoff volume (m3) from development over Greenfield Runoff

[RD] Rainfall depth (mm)	56.37	100y 6h event, from FEH DDF
PIMP	1.191	the impermeable area as a percentage of the total area (values from 0 to 100)
[A] Site Area	2.634	the area of the site in hectares
SOIL	0.4	the "SPR" value for the relevant FSR soil type, or the SPRHOST value (values from 0.1 to 0.53) SPRHOST from FEH data; SPR from (SOIL = 0.1SOIL1 + 0.3SOIL2 + 0.37SOIL3 + 0.47SOIL4 + 0.53SOIL5)
[α] Proportion of Paved area draining to network or river	1	values from 0 to 1
[β] Proportion of Pervious Area draining to network or river	1	values from 0 to 1 (only reduce this from 1 if some pervious areas such (eg back gardens) cannot drain to the netowrk or river)
Runoff factor for contributing paved surfaces	0.8	

Volume Difference **7.07352 m^3**

$$Vol_{xx} = 10.RD.A\left[\frac{PIMP}{100}(\alpha 0.8) + \left(1 - \frac{PIMP}{100}\right)(\beta.SOIL) - SOIL\right]$$

Calculation Sheet

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Convatec	PEP Wind and Solar	BR10167	PAGE: 1 OF 2
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Runoff Volume: Catchment 1	(NAME AND SIGNATURE) H Wilson	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	DATE: 29/01/2024	DATE:	DATE:

Rainfall (mm)	74.7	from FEH 2022 DDF modelling
SAAR	1625	from FEH or via UK SuDS Tools
SPRHOST or SPR (%)	49.84	SPRHOST from FEH data; SPR from (SOIL = 0.1SOIL1 + 0.3SOIL2 + 0.37SOIL3 + 0.47SOIL4 + 0.53SOIL5)
Return Period (yrs)	100	
Duration (hrs)	6	

Note: For durations shorter than 0.5hours FEH DDF should not be used.

Runoff Calculations for Existing Site

Permeable (ha)	0.457
Impermeable (ha)	0
Semi Permeable (ha)	0
Total (ha)	0.457

	Existing Permeable	Existing Impermeable	Existing Semi Permeable	
Storm duration (mins)	360	360	360	
Rainfall Return Period	100	100	100	
Rainfall Depth (mm)	74.7	74.7	74.7	
Site Area (ha)	0.457	0	0	
Site Area (km^2)	0.00457	0	0	
Total Rainfall Volume (m^3)	341.4	0.0	0	
$PR_{(RURAL)}$	55.98%	N/A	N/A	
% Runoff from paved areas	N/A	100%	81.00%	**Total**
Volume of Runoff (m^3)	**191.1**	**0.0**	**0.0**	**191.1**

Runoff Calculations for Proposed Development

Permeable (ha)	0
Impermeable (ha)	0.0675
Semi Impermeable (ha)	0.3895
Total (ha)	0.457

	Proposed Permeable	Proposed Impermeable	Proposed Semi Permeable	
Storm duration (mins)	360	360	360	
Rainfall Return Period	100	100	100	
Rainfall Depth (mm)	74.7	74.7	74.7	
Site Area (ha)	0	0.0675	0.3895	
Site Area (km^2)	0	0.000675	0.003895	
Total Rainfall Volume (m^3)	0.0	50.4	290.9565	
$PR_{(RURAL)}$	55.98%	N/A	N/A	
% Runoff from paved areas	N/A	100%	81%	**Total**
Volume of Runoff (m^3)	**0.0**	**50.4**	**235.7**	**286.1**

Calculation Sheet

Runoff Calculations for Proposed Development with Climate Change

Rainfall (mm)	74.7
Return Period (yrs)	100
Duration (hrs)	6
100y Climate Change %	40%
Rainfall + CC (mm)	104.58

	Exisiting Permeable	Exisiting Impermeable	Existing Semi Permeable	
Rainfall Depth (mm)	104.58	104.58	104.58	
Site Area (km^2)	0.00457	0	0	
Total Rainfall Volume (m^3)	477.9	0	0	
$PR_{(RURAL)}$	55.98%	N/A	N/A	
% Runoff (Urban/ImpA)	N/A	100%	81%	**Total**
Volume of Runoff (m^3)	**267.5**	**0.0**	**0.0**	267.5

	Proposed Permeable	Proposed Impermeable	Proposed Semi Permeable	
Rainfall Depth (mm)	104.58	104.58	104.58	
Site Area (km^2)	0	0.000675	0.003895	
Total Rainfall Volume (m^3)	0.0	70.6	407.3391	
$PR_{(RURAL)}$	55.98%	N/A	N/A	
% Runoff (Urban/ImpA)	N/A	100%	81.00%	**Total**
Volume of Runoff (m^3)	**0.0**	**70.6**	**329.9**	400.5

SUMMARY	
Existing Runoff	191.1
Post-Devel Runoff (present day)	286.1
Difference	***95.0***
Existing Runoff	191.1
Post-Devel runoff + CC	400.5
Difference	***209.4***
Exisitng Runoff +CC	267.5
Post-Devel +CC	400.5
Difference	**133.0**

Following the methodology set out in section 7 of the Environment Agency publication ' Preliminary Rainfall Runoff Managament for Developments' Report SC030219

Runoff Volume difference - extra runoff volume (m3) from development over Greenfield Runoff

[RD] Rainfall depth (mm)	56.37	100y 6h event, from FEH DDF
PIMP	1.191	the impermeable area as a percentage of the total area (values from 0 to 100)
[A] Site Area	2.634	the area of the site in hectares
SOIL	0.4	the "SPR" value for the relevant FSR soil type, or the SPRHOST value (values from 0.1 to 0.53) SPRHOST from FEH data; SPR from (SOIL = 0.1SOIL1 + 0.3SOIL2 + 0.37SOIL3 + 0.47SOIL4 + 0.53SOIL5)
[α] Proportion of Paved area draining to network or river	1	values from 0 to 1
[β] Proportion of Pervious Area draining to network or river	1	values from 0 to 1 (only reduce this from 1 if some pervious areas such (eg back gardens) cannot drain to the netowrk or river)
Runoff factor for contributing paved surfaces	0.8	

Volume Difference **7.07352 m^3**

$$Vol_{xx} = 10.RD.A\left[\frac{PIMP}{100}(\alpha 0.8) + \left(1 - \frac{PIMP}{100}\right)(\beta.SOIL) - SOIL\right]$$

Calculation Sheet

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Convatec	PEP Wind and Solar	BR10167	PAGE: 1 OF 2
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Runoff Volume: Cachment 4	(NAME AND SIGNATURE) H Wilson	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	DATE:	DATE:	DATE:

Rainfall (mm)	74.7	from FEH 2022 DDF modelling
SAAR	1625	from FEH or via UK SuDS Tools
SPRHOST or SPR (%)	49.84	SPRHOST from FEH data; SPR from (SOIL = 0.1SOIL1 + 0.3SOIL2 + 0.37SOIL3 + 0.47SOIL4 + 0.53SOIL5)
Return Period (yrs)	100	
Duration (hrs)	6	

Note: For durations shorter than 0.5hours FEH DDF should not be used.

Runoff Calculations for Existing Site

Permeable (ha)	1.894
Impermeable (ha)	0
Semi Permeable (ha)	0
Total (ha)	1.894

	Existing Permeable	Existing Impermeable	Existing Semi Permeable	
Storm duration (mins)	360	360	360	
Rainfall Return Period	100	100	100	
Rainfall Depth (mm)	74.7	74.7	74.7	
Site Area (ha)	1.894	0	0	
Site Area (km^2)	0.01894	0	0	
Total Rainfall Volume (m^3)	1414.8	0.0	0	
$PR_{(RURAL)}$	55.98%	N/A	N/A	
% Runoff from paved areas	N/A	100%	80.00%	**Total**
Volume of Runoff (m^3)	**792.0**	**0.0**	**0.0**	**792.0**

Runoff Calculations for Proposed Development

Permeable (ha)	1.5105
Impermeable (ha)	0
Semi Impermeable (ha)	0.3835
Total (ha)	1.894

	Proposed Permeable	Proposed Impermeable	Proposed Semi Permeable	
Storm duration (mins)	360	360	360	
Rainfall Return Period	100	100	100	
Rainfall Depth (mm)	74.7	74.7	74.7	
Site Area (ha)	1.5105	0	0.3835	
Site Area (km^2)	0.015105	0	0.003835	
Total Rainfall Volume (m^3)	1128.3	0.0	286.4745	
$PR_{(RURAL)}$	55.98%	N/A	N/A	
% Runoff from paved areas	N/A	100%	80%	**Total**
Volume of Runoff (m^3)	**631.6**	**0.0**	**229.2**	**860.8**

Calculation Sheet

Runoff Calculations for Proposed Development with Climate Change

Rainfall (mm)	74.7
Return Period (yrs)	100
Duration (hrs)	6
100y Climate Change %	40%
Rainfall + CC (mm)	104.58

	Exisiting Permeable	Exisiting Impermeable	Existing Semi Permeable	
Rainfall Depth (mm)	104.58	104.58	104.58	
Site Area (km^2)	0.01894	0	0	
Total Rainfall Volume (m^3)	1980.7	0	0	
$PR_{(RURAL)}$	55.98%	N/A	N/A	
% Runoff (Urban/ImpA)	N/A	100%	80%	**Total**
Volume of Runoff (m^3)	**1108.8**	**0.0**	**0.0**	1108.8

	Proposed Permeable	Proposed Impermeable	Proposed Semi Permeable	
Rainfall Depth (mm)	104.58	104.58	104.58	
Site Area (km^2)	0.015105	0	0.003835	
Total Rainfall Volume (m^3)	1579.7	0.0	401.0643	
$PR_{(RURAL)}$	55.98%	N/A	N/A	
% Runoff (Urban/ImpA)	N/A	100%	80.00%	**Total**
Volume of Runoff (m^3)	**884.3**	**0.0**	**320.9**	1205.1

SUMMARY	
Existing Runoff	792.0
Post-Devel Runoff (present day)	860.8
Difference	***68.8***
Existing Runoff	792.0
Post-Devel runoff + CC	1205.1
Difference	***413.1***
Exisitng Runoff +CC	1108.8
Post-Devel +CC	1205.1
Difference	**96.3**

Following the methodology set out in section 7 of the Environment Agency publication ' Preliminary Rainfall Runoff Managament for Developments' Report SC030219

Runoff Volume difference - extra runoff volume (m3) from development over Greenfield Runoff

[RD] Rainfall depth (mm)	56.37	100y 6h event, from FEH DDF
PIMP	1.191	the impermeable area as a percentage of the total area (values from 0 to 100)
[A] Site Area	2.634	the area of the site in hectares
SOIL	0.4	the "SPR" value for the relevant FSR soil type, or the SPRHOST value (values from 0.1 to 0.53) SPRHOST from FEH data; SPR from (SOIL = 0.1SOIL1 + 0.3SOIL2 + 0.37SOIL3 + 0.47SOIL4 + 0.53SOIL5)
[α] Proportion of Paved area draining to network or river	1	values from 0 to 1
[β] Proportion of Pervious Area draining to network or river	1	values from 0 to 1 (only reduce this from 1 if some pervious areas such (eg back gardens) cannot drain to the netowrk or river)
Runoff factor for contributing paved surfaces	0.8	

Volume Difference **7.07352 m^3**

$$Vol_{xx} = 10.RD.A\left[\frac{PIMP}{100}(\alpha 0.8) + \left(1 - \frac{PIMP}{100}\right)(\beta.SOIL) - SOIL\right]$$

Calculation Sheet

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Convatec	PEP Wind and Solar	BR10167	PAGE: 1 OF 2
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Runoff Volume: Catchment 5 (Construction Compund 1)	(NAME AND SIGNATURE) H Wilson	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	DATE: 29/01/2024	DATE:	DATE:

Rainfall (mm)	62.96	from FEH 2022 DDF modelling
SAAR	1625	from FEH or via UK SuDS Tools
SPRHOST or SPR (%)	49.84	SPRHOST from FEH data; SPR from (SOIL = 0.1SOIL1 + 0.3SOIL2 + 0.37SOIL3 + 0.47SOIL4 + 0.53SOIL5)
Return Period (yrs)	30	
Duration (hrs)	6	

Note: For durations shorter than 0.5hours FEH DDF should not be used.

Runoff Calculations for Existing Site

Permeable (ha)	0.4033
Impermeable (ha)	0
Semi Permeable (ha)	0
Total (ha)	0.4033

	Existing Permeable	Existing Impermeable	Existing Semi Permeable	
Storm duration (mins)	360	360	360	
Rainfall Return Period	30	30	30	
Rainfall Depth (mm)	62.96	62.96	62.96	
Site Area (ha)	0.4033	0	0	
Site Area (km^2)	0.004033	0	0	
Total Rainfall Volume (m^3)	253.9	0.0	0	
$PR_{(RURAL)}$	54.63%	N/A	N/A	
% Runoff from paved areas	N/A	100%	82.00%	**Total**
Volume of Runoff (m^3)	**138.7**	**0.0**	**0.0**	**138.7**

Runoff Calculations for Proposed Development

Permeable (ha)	0
Impermeable (ha)	0
Semi Impermeable (ha)	0.4033
Total (ha)	0.4033

	Proposed Permeable	Proposed Impermeable	Proposed Semi Permeable	
Storm duration (mins)	360	360	360	
Rainfall Return Period	30	30	30	
Rainfall Depth (mm)	62.96	62.96	62.96	
Site Area (ha)	0	0	0.4033	
Site Area (km^2)	0	0	0.004033	
Total Rainfall Volume (m^3)	0.0	0.0	253.91768	
$PR_{(RURAL)}$	54.63%	N/A	N/A	
% Runoff from paved areas	N/A	100%	82%	**Total**
Volume of Runoff (m^3)	**0.0**	**0.0**	**208.2**	**208.2**

Calculation Sheet

Runoff Calculations for Proposed Development with Climate Change

Rainfall (mm)	62.96
Return Period (yrs)	30
Duration (hrs)	6
100y Climate Change %	40%
Rainfall + CC (mm)	88.14

	Exisiting Permeable	Exisiting Impermeable	Existing Semi Permeable	
Rainfall Depth (mm)	88.14	88.14	88.14	
Site Area (km^2)	0.004033	0	0	
Total Rainfall Volume (m^3)	355.5	0	0	
$PR_{(RURAL)}$	54.63%	N/A	N/A	
% Runoff (Urban/ImpA)	N/A	100%	82%	**Total**
Volume of Runoff (m^3)	**194.2**	**0.0**	**0.0**	194.2

	Proposed Permeable	Proposed Impermeable	Proposed Semi Permeable	
Rainfall Depth (mm)	88.14	88.14	88.14	
Site Area (km^2)	0	0	0.004033	
Total Rainfall Volume (m^3)	0.0	0.0	355.484752	
$PR_{(RURAL)}$	54.63%	N/A	N/A	
% Runoff (Urban/ImpA)	N/A	100%	82.00%	**Total**
Volume of Runoff (m^3)	**0.0**	**0.0**	**291.5**	291.5

SUMMARY	
Existing Runoff	138.7
Post-Devel Runoff (present day)	208.2
Difference	***69.5***
Existing Runoff	138.7
Post-Devel runoff + CC	291.5
Difference	***152.8***
Exisitng Runoff +CC	194.2
Post-Devel +CC	291.5
Difference	**97.3**

Following the methodology set out in section 7 of the Environment Agency publication ' Preliminary Rainfall Runoff Managament for Developments' Report SC030219

Runoff Volume difference - extra runoff volume (m3) from development over Greenfield Runoff

[RD] Rainfall depth (mm)	56.37	100y 6h event, from FEH DDF
PIMP	1.191	the impermeable area as a percentage of the total area (values from 0 to 100)
[A] Site Area	2.634	the area of the site in hectares
SOIL	0.4	the "SPR" value for the relevant FSR soil type, or the SPRHOST value (values from 0.1 to 0.53) SPRHOST from FEH data; SPR from (SOIL = 0.1SOIL1 + 0.3SOIL2 + 0.37SOIL3 + 0.47SOIL4 + 0.53SOIL5)
[α] Proportion of Paved area draining to network or river	1	values from 0 to 1
[β] Proportion of Pervious Area draining to network or river	1	values from 0 to 1 (only reduce this from 1 if some pervious areas such (eg back gardens) cannot drain to the netowrk or river)
Runoff factor for contributing paved surfaces	0.8	

Volume Difference **7.07352 m^3**

$$Vol_{xx} = 10.RD.A\left[\frac{PIMP}{100}(\alpha 0.8) + \left(1 - \frac{PIMP}{100}\right)(\beta.SOIL) - SOIL\right]$$

Calculation Sheet

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
Convatec	PEP Wind and Solar	BR10167	PAGE: 1 OF 2
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Runoff Volume: Catchment 6 (Construction Compund 2)	(NAME AND SIGNATURE) H Wilson	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	DATE: 29/01/2024	DATE:	DATE:

Rainfall (mm)	62.96	from FEH 2022 DDF modelling
SAAR	1625	from FEH or via UK SuDS Tools
SPRHOST or SPR (%)	49.84	SPRHOST from FEH data; SPR from (SOIL = 0.1SOIL1 + 0.3SOIL2 + 0.37SOIL3 + 0.47SOIL4 + 0.53SOIL5)
Return Period (yrs)	30	
Duration (hrs)	6	

Note: For durations shorter than 0.5hours FEH DDF should not be used.

Runoff Calculations for Existing Site

Permeable (ha)	0.3752
Impermeable (ha)	0
Semi Permeable (ha)	0
Total (ha)	0.3752

	Existing Permeable	Existing Impermeable	Existing Semi Permeable	
Storm duration (mins)	360	360	360	
Rainfall Return Period	30	30	30	
Rainfall Depth (mm)	62.96	62.96	62.96	
Site Area (ha)	0.3752	0	0	
Site Area (km^2)	0.003752	0	0	
Total Rainfall Volume (m^3)	236.2	0.0	0	
$PR_{(RURAL)}$	54.63%	N/A	N/A	
% Runoff from paved areas	N/A	100%	79.00%	**Total**
Volume of Runoff (m^3)	**129.0**	**0.0**	**0.0**	**129.0**

Runoff Calculations for Proposed Development

Permeable (ha)	0
Impermeable (ha)	0
Semi Impermeable (ha)	0.3752
Total (ha)	0.3752

	Proposed Permeable	Proposed Impermeable	Proposed Semi Permeable	
Storm duration (mins)	360	360	360	
Rainfall Return Period	30	30	30	
Rainfall Depth (mm)	62.96	62.96	62.96	
Site Area (ha)	0	0	0.3752	
Site Area (km^2)	0	0	0.003752	
Total Rainfall Volume (m^3)	0.0	0.0	236.22592	
$PR_{(RURAL)}$	54.63%	N/A	N/A	
% Runoff from paved areas	N/A	100%	79%	**Total**
Volume of Runoff (m^3)	**0.0**	**0.0**	**186.6**	**186.6**

Calculation Sheet

Runoff Calculations for Proposed Development with Climate Change

Rainfall (mm)	62.96
Return Period (yrs)	30
Duration (hrs)	6
100y Climate Change %	40%
Rainfall + CC (mm)	88.14

	Exisiting Permeable	Exisiting Impermeable	Existing Semi Permeable	
Rainfall Depth (mm)	88.14	88.14	88.14	
Site Area (km^2)	0.003752	0	0	
Total Rainfall Volume (m^3)	330.7	0	0	
$PR_{(RURAL)}$	54.63%	N/A	N/A	
% Runoff (Urban/ImpA)	N/A	100%	79%	**Total**
Volume of Runoff (m^3)	**180.7**	**0.0**	**0.0**	180.7

	Proposed Permeable	Proposed Impermeable	Proposed Semi Permeable	
Rainfall Depth (mm)	88.14	88.14	88.14	
Site Area (km^2)	0	0	0.003752	
Total Rainfall Volume (m^3)	0.0	0.0	330.716288	
$PR_{(RURAL)}$	54.63%	N/A	N/A	
% Runoff (Urban/ImpA)	N/A	100%	79.00%	**Total**
Volume of Runoff (m^3)	**0.0**	**0.0**	**261.3**	261.3

SUMMARY	
Existing Runoff	129.0
Post-Devel Runoff (present day)	186.6
Difference	***57.6***
Existing Runoff	129.0
Post-Devel runoff + CC	261.3
Difference	***132.2***
Exisitng Runoff +CC	180.7
Post-Devel +CC	261.3
Difference	**80.6**

Following the methodology set out in section 7 of the Environment Agency publication ' Preliminary Rainfall Runoff Managament for Developments' Report SC030219

Runoff Volume difference - extra runoff volume (m3) from development over Greenfield Runoff

[RD] Rainfall depth (mm)	56.37	100y 6h event, from FEH DDF
PIMP	1.191	the impermeable area as a percentage of the total area (values from 0 to 100)
[A] Site Area	2.634	the area of the site in hectares
SOIL	0.4	the "SPR" value for the relevant FSR soil type, or the SPRHOST value (values from 0.1 to 0.53) SPRHOST from FEH data; SPR from (SOIL = 0.1SOIL1 + 0.3SOIL2 + 0.37SOIL3 + 0.47SOIL4 + 0.53SOIL5)
[α] Proportion of Paved area draining to network or river	1	values from 0 to 1
[β] Proportion of Pervious Area draining to network or river	1	values from 0 to 1 (only reduce this from 1 if some pervious areas such (eg back gardens) cannot drain to the netowrk or river)
Runoff factor for contributing paved surfaces	0.8	

Volume Difference **7.07352 m^3**

$$Vol_{xx} = 10.RD.A\left[\frac{PIMP}{100}(\alpha 0.8) + \left(1 - \frac{PIMP}{100}\right)(\beta.SOIL) - SOIL\right]$$

APPENDIX D

SUDS Maintenance Plan Checklist

Maintenance Inspection Checklists

Table 1: SuDS Maintenance Inspection Checklist

GENERAL INFORMATION			
Site ID			
Site Location and co-ordinates (GIS if appropriate)			
Elements forming the SuDS scheme		Approved Drawing Reference(s)	
Inspection frequency		Approved Specification Reference	
Type of development		Specific purpose of any parts of the scheme (e.g. biodiversity, wildlife and visual aspects)	

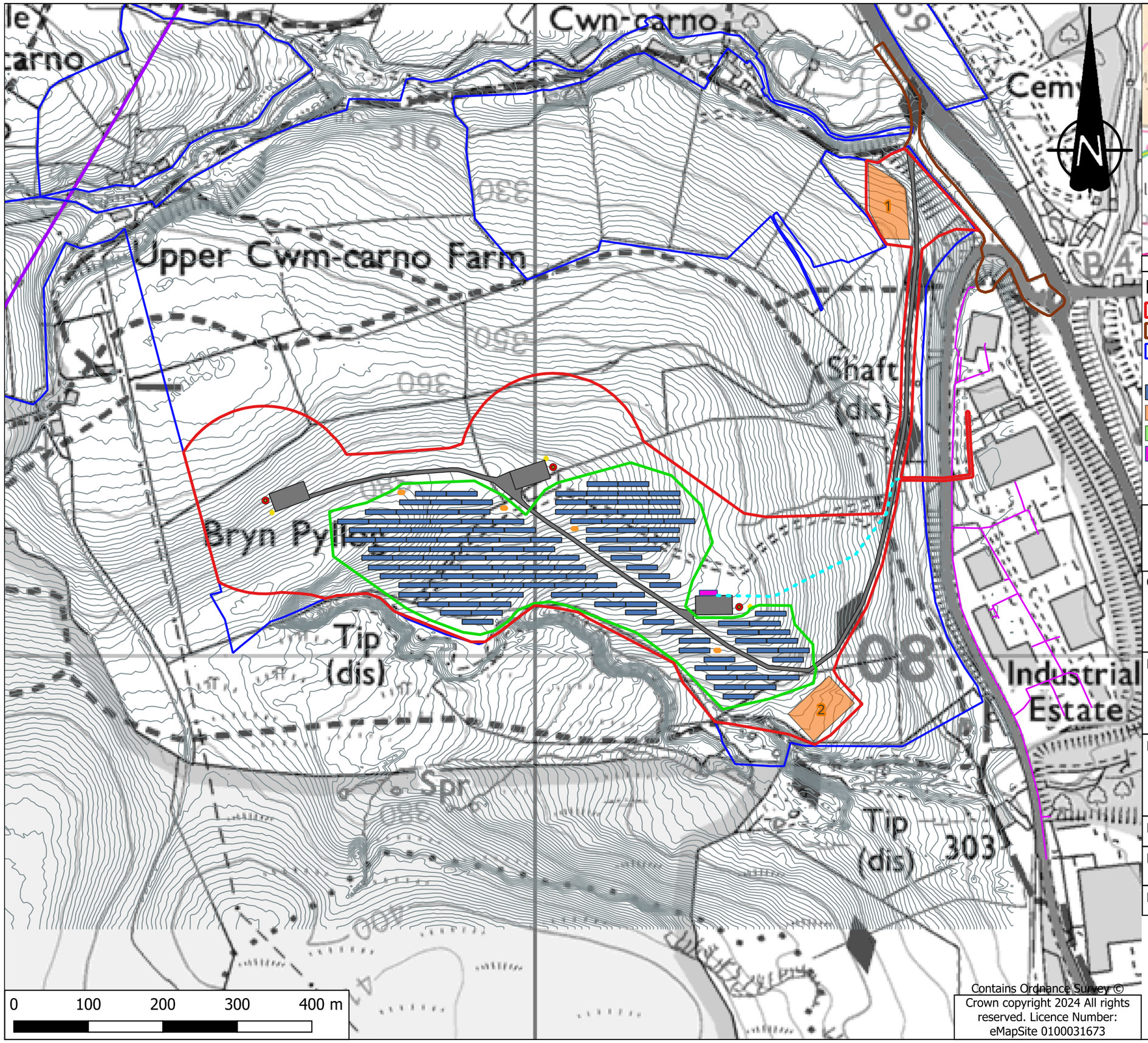
	Inspection date				**Inspection date**			
	Details	**Y/N**	**Action required**	**Date Completed**	**Details**	**Y/N**	**Action required**	**Date Completed**
GENERAL INSPECTION ITEMS								
Is there any evidence of erosion, channelling, ponding (where not desirable) or other poor hydraulic performance?								
Is there any evidence of accidental spillages, oils, poor water quality, odours, nuisance insects?								
Have any health and safety risks been identified to either the public or maintenance operatives?								

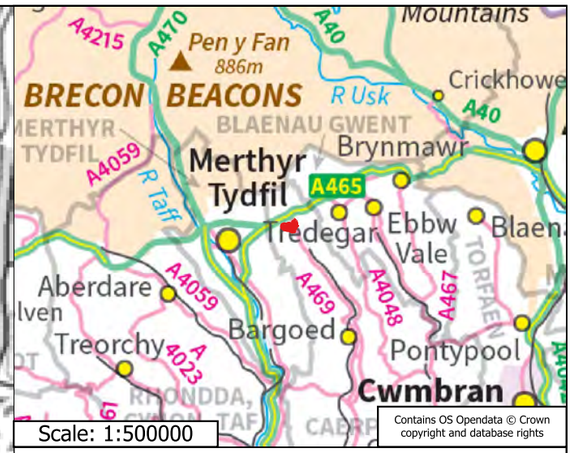
	Inspection date				Inspection date			
	Details	**Y/N**	**Action required**	**Date Completed**	**Details**	**Y/N**	**Action required**	**Date Completed**
Is there any deterioration in the surface of permeable surfaces (e.g. rutting or signs of ponding water)?								
SILT/SEDIMENT ACCUMULATION								
Is there any sediment accumulation at inlets (or other defined accumulation zones such as the surface of filter drains or infiltration basins and within proprietary devices)? If yes, state depth (mm) and extent Is removal required? If yes, state waste disposal requirements and confirm all waste management requirements have been complied with (consult Environment Agency).								
Is surface clogging visible (potentially problematic where water has to soak into the underlying construction or ground (e.g. under-drained swale or infiltration basin)?								
Does permeable or porous surfacing require sweeping to remove silt?								
SYSTEM BLOCKAGES / LITTER BUILD UP								
Is there evidence of litter accumulation in the system? If yes, is this a blockage risk?								
Is there any evidence of any other clogging/blockage of outlets or drainage paths?								

	Inspection date				Inspection date			
	Details	**Y/N**	**Action required**	**Date Completed**	**Details**	**Y/N**	**Action required**	**Date Completed**
VEGETATION								
Is the vegetation condition satisfactory (density, weed growth, coverage etc.)? (Check against approved planting regime.)								
Does any part of the system require weeding / pruning / mowing? (Check against maintenance frequency stated in approved design.)								
Is there any evidence of invasive species becoming established? If yes, state action required.								
INFRASTRUCTURE								
Are any check dams or weirs in good condition?								
Is there evidence of any accidental damage to the system (e.g. wheel ruts?)								
Is there any evidence of cross connections or other unauthorised inflows?								
Is there any evidence of tampering with the flow controls?								
Are there any other matters that could affect the performance of the system in relation to the design objectives for hydraulic, water quality, biodiversity and visual aspects? (Specify.)								
OTHER OBSERVATIONS								

	Inspection date				Inspection date			
	Details	**Y/N**	**Action required**	**Date Completed**	**Details**	**Y/N**	**Action required**	**Date Completed**
Information appended (e.g. photos)								
SUITABILITY OF CURRENT MAINTENANCE REGIME								
Continue as current Increase maintenance Decrease maintenance								
NEXT INSPECTION								
Proposed date for next inspection								

DRAWINGS





Scale: 1:500000

Legend

- On-Site Redline Boundary
- Off-Site Redline Boundary
- Landowner Boundary
- Turbine Locations
- Solar Panels
- Construction Compound
- Turbine Tower Extent
- Substation
- Tracks
- Security Fence
- Wind Transformers
- Solar MV Station
- Low Pressure Gas Mains
- Overhead Cables
- Private Cable
- Contours

Construction Compound:
Option 1: 4033 m2
Option 2: 3752 m2

CLIENT

convatec
— forever caring —

PROJECT

Rhymney Wind and Solar Development

DRAWING TITLE

BR10167 - Site Layout

DRG No. BR10167 - 01		REV: D
DRG SIZE: A3	SCALE: 1:5000	DATE: January 2024
DRAWN: JS	CHECKED BY: SA	APPROVED BY: SA

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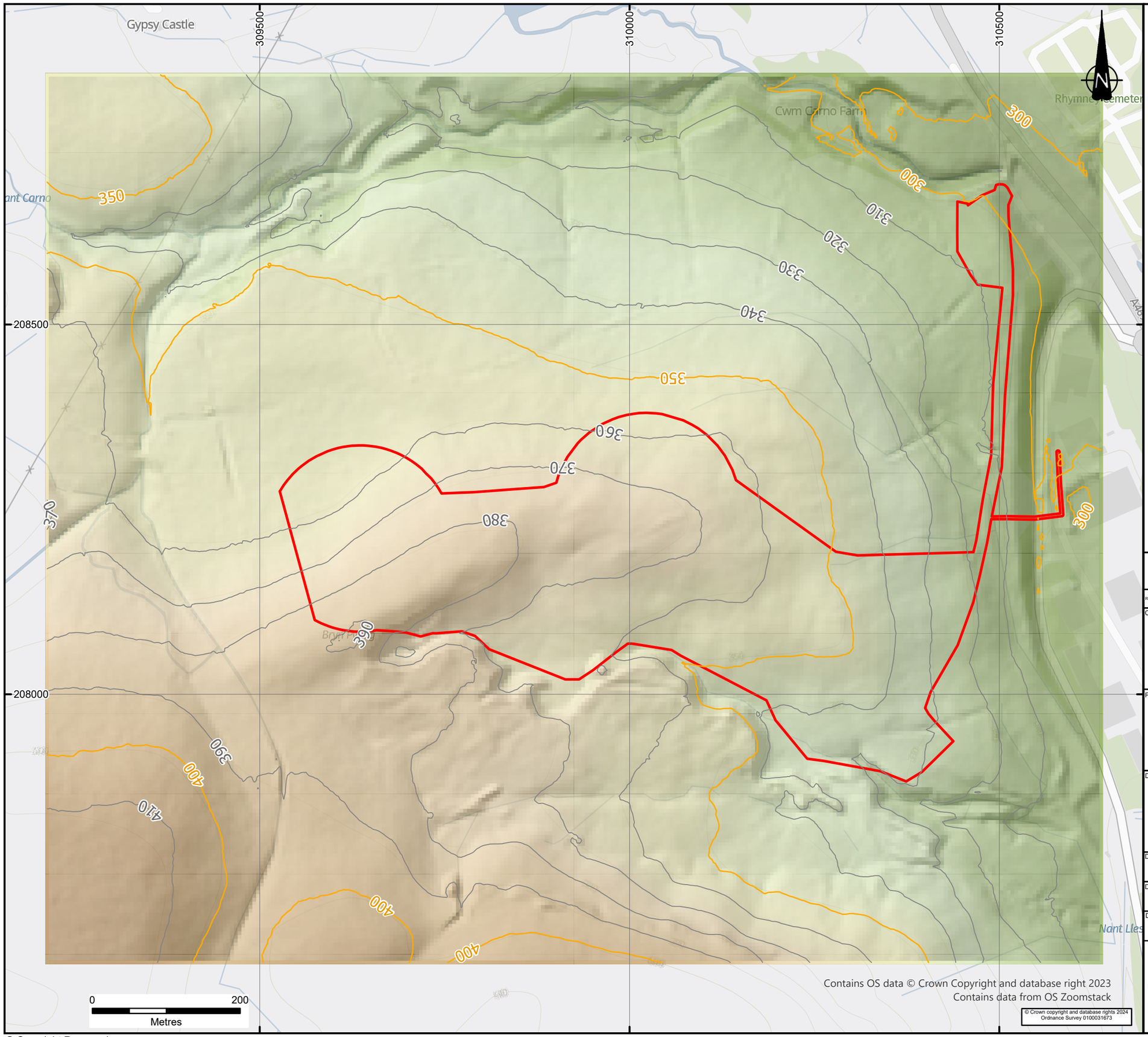

KEY

Site Boundary

Elevation (m)

419.05

289.53

Contours

50m Interval

10m Interval

Notes:

Boundaries are indicative.

REVISION	DETAILS	DATE	DRAWN	CHK'D	APP'D

CLIENT

PURE ENERGY PROFESSIONALS LIMITED

PROJECT

PEP WIND SOLAR DEVELOPMENT

DRAWING TITLE

LIDAR TOPOGRAPHY

PRELIMINARY

DRG No.	REV	SUIT. CODE
BR10167-038	P0.01	--

DRG SIZE	SCALE	DATE
A3	1:5,000	31/01/2024

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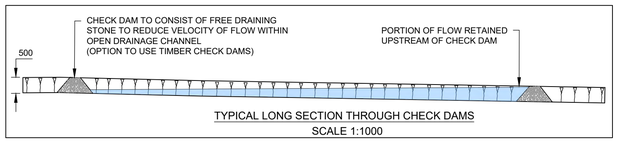
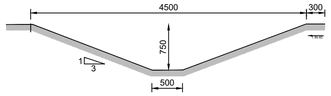


TYPICAL LONG SECTION THROUGH CHECK DAMS
SCALE 1:1000



SWALE
SCALE 1:50

Table 1: Attenuation Requirements

Catchment	Contributing Area (m^2)	Attenuation Required (m^3)
1	2800	92.6
2	2640	76.5
3	4570	133
4	3835	96.3
5 'Construction Compound 1'	*4033*	97.3
6 'Construction Compound 2'	*3752*	80.6
TOTAL	***21630***	**576.3**

Table 2: Swale attenuation Volumes

Catchment	Swale Reference:	Swale Length (m)	Attenuation (m^3)
1	Swale 1A	100	140
	Swale 1B	100	150
	Swale 1C	30	42
2	Swale 2A	40	78
	Swale 2B	65	69
3	Swale 3A	55	100
	Swale 3B	70	136
	Swale 3C	75	112
4	Swale 4A	40	50
	Swale 4B	45	77
	Swale 4C	115	120
	Swale 4D	85	90
	Swale 4E	15	14
5 'Construction Compound 1'	Swale 5A	38	75
	Swale 5B	35	23
6 'Construction Compound 2'	Swale 6A	20	18
	Swale 6B	70	37
	Swale 6C	20	20
	Swale 6D	10	14
Total		**1028**	**1365**

DO NOT SCALE FROM THIS DRAWING

NOTES

1. TO BE READ IN CONJUNCTION WITH WARDELL ARMSTRONG FLOOD RISK ASSESSMENT REPORT REF BR10167-0010.
2. SITE LAYOUT PROVIDED BY CLIENT (REF: BR10160-01 SITE LAYOUT).
3. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.
4. ALL PROPOSED DRAINAGE SHOWN ON THIS DRAWING IS INDICATIVE ONLY AND SUBJECT TO DETAILED DESIGN.
5. ALL ATTENUATION VOLUMES ARE ESTIMATES ONLY AND SUBJECT TO DETAILED DESIGN.
6. SOAKAWAY TESTING IN ACCORDANCE WITH BRE365 TO BE UNDERTAKEN AS PART OF FUTURE WORKS.
7. LAYOUT IS INDICATIVE ONLY.

KEY

- SITE BOUNDARY
- SWALE 1 — PROPOSED SWALE (FOR ATTENUATION)
- PROPOSED SWALE (CONVEYANCE ONLY)
- PROPOSED PRECAUTIONARY SWALE
- PROPOSED CHECK DAM
- PROPOSED SURFACE WATER PIPE
- PROPOSED ACCESS TRACK
- CONSTRUCTION COMPOUND
- WIND TURBINE LOCATION
- PV PANELS
- 11kV MAIN SUBSTATION
- CATCHMENT 1
- CATCHMENT 2
- CATCHMENT 3
- CATCHMENT 4
- CATCHMENT 5
- CATCHMENT 6

REVISION	DETAILS	DATE	DRAWN	CHKD	APPD
P0	PRELIMINARY ISSUE	31-01-24	DR		

CLIENT: CONVATEC LIMITED

PROJECT: PEP WIND SOLAR DEVELOPMENT

DRAWING TITLE: INDICATIVE SURFACE WATER MANAGEMENT PLAN

PRELIMINARY

DRG No.	REV	SUIT. CODE
BR10167-042	P0	

DRG SIZE	SCALE	DATE
A1	1:1500	25-01-24

DRAWN BY	CHECKED BY	APPROVED BY
DR		

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