Awel y Môr Offshore Wind Farm

Proposed Substation Flood Consequences Assessment: Appendix A - Proposed Substation Preliminary Outline Drainage Strategy

Deadline 1

Date: 24 October 2022

Revision: C

Document Reference: 1.43 Appendix A

PINS Reference: N/A

Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm

REVISION	DATE	STATUS/ REASON FOR ISSUE	AUTHOR:	CHECKED BY:	APPROVED BY:
A	August 2021	PEIR	SLR	SLR/GoBe	RWE
B	March 2022	ES	SLR	SLR/GoBe	RWE
C	October 2022	Deadline 1	SLR	SLR/GoBe	RWE

www.awelymor.cymru

RWE Renewables UK Swindon Limited

Windmill Hill Business Park
Whitehill Way
Swindon
Wiltshire SN5 6PB
T +44 (0)8456 720 090
www.rwe.com

Registered office:
RWE Renewables UK Swindon Limited
Windmill Hill Business Park
Whitehill Way
Swindon

Awel Y Môr Offshore Wind Farm

Proposed Substation Preliminary Outline Drainage Strategy

October 2022

Mott MacDonald
10 Temple Back
Bristol BS1 6FL
United Kingdom

T +44 (0)117 906 9500
mottmac.com

Awel Y Môr Offshore Wind Farm

Proposed Substation Preliminary Outline Drainage Strategy

October 2022

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
01	26/10/2020	O. Dawes	T. North	M. Barton	First Issue
02	29/01/2021	L. Warren	A. Lee / T. North	M. Barton	Second Issue
03	05/10/2021	L. Warren	T. North	S. Anantharam	Updated outfall positions and foul drainage alignment.
04	28/01/2022	L. Warren	A. Lambourne	S. Anantharam	Southern construction compound and northern access road removed and client comments addressed.
05	09/03/2022	L. Warren	A. Lambourne	S. Anantharam	Figures updated with new mitigation zone.
06	11/10/2022	L. Warren	T.North	S. Anantharam	Updated following planning inspectorate comments
07	21/10/2022	L. Warren	T.North	S. Anantharam	Updated following client comments

Document reference: | AYM-MOT-V0-XX-RP-C-0042 | 07

Contents

1 Introduction

1.1 Scope

Mott MacDonald has been appointed by RWE to provide engineering design services for a new onshore electrical substation, for the Awel y Môr Offshore Wind Farm, buildings and associated infrastructure, near St Asaph, Denbighshire.

The purpose of this report is to present the preliminary outline drainage strategy, based on the Site Layout drawing (AYM-MMD-V7-XX-DR-C-0005). The scope of this report is to provide a preliminary drainage strategy for the preferred site.

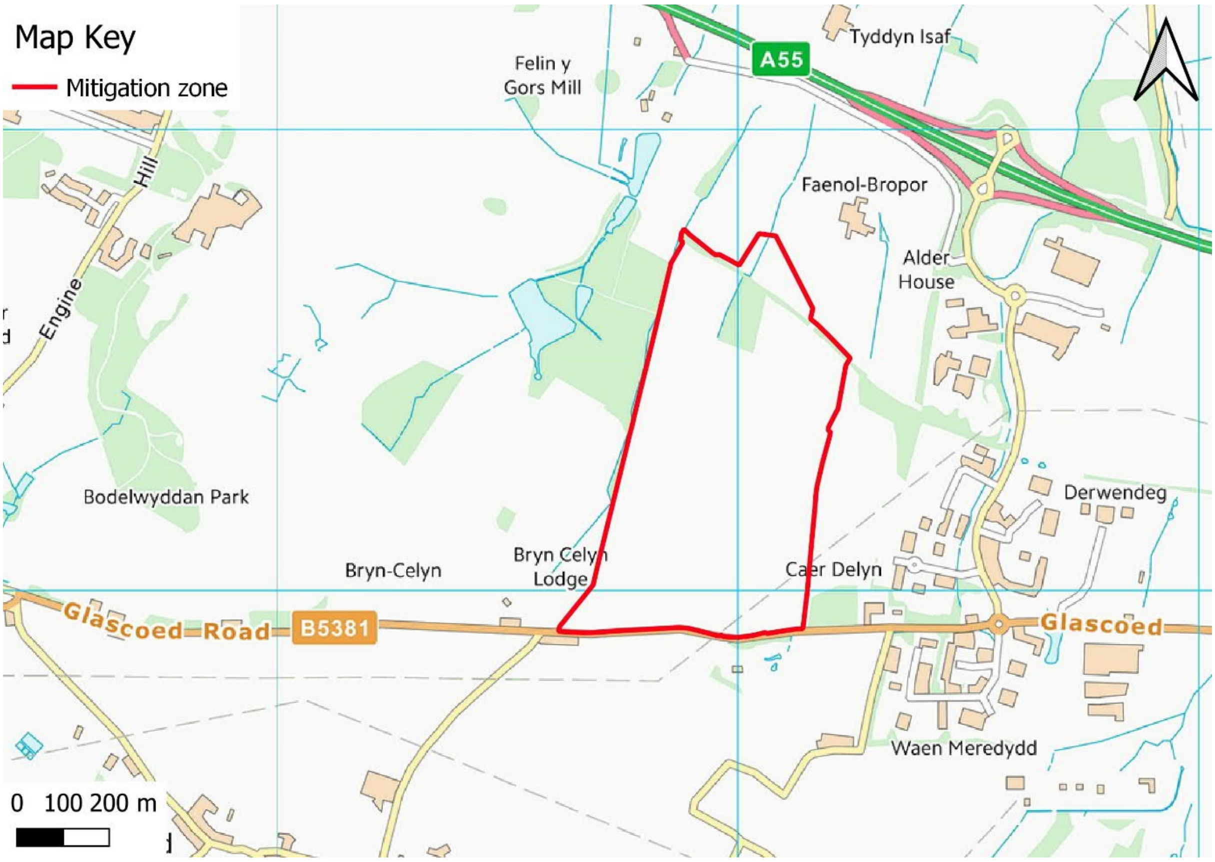
The information presented is dependent upon the accuracy and reliability of the information, correspondence and data available to Mott MacDonald at the time of writing. Any party developing the drainage design should not rely on the assumptions made in this report but should satisfy themselves in that regard.

Mott MacDonald has followed accepted procedure in providing the services but given the residual risk associated with any prediction and the variability which can be experienced in flood conditions, Mott MacDonald takes no liability and gives no warranty against actual flooding of any property (client's or third party) or the consequences of flooding in relation to the performance of the service. This report has been prepared as part of the DCO application for the Awel Y Môr Offshore Wind Farm development only. Allowance for climate change is in accordance with recommendations in place at the time of this assessment.

1.2 Site location and description

The development (hereafter referred to as "the site") is centred at National Grid Reference SJ 00971 74274, in agricultural land west of St Asaph Business Park. It is bounded to the south by the B5381 Glascoed Road, with Bodelwyddan Park and a wooded area to the west and north. The land slopes at approximately 4% from south west to north east. Within the site are field drains and two ponds, and some field boundaries which contain un-named small watercourses which act as drainage ditches. The site will be accessed via a private access road. The site location is shown in Figure 1.1.

Figure 1.1: Site location with assessment area outlined in red



Source: Mott MacDonald, Contains Ordnance Survey data © Crown copyright and database right 2022

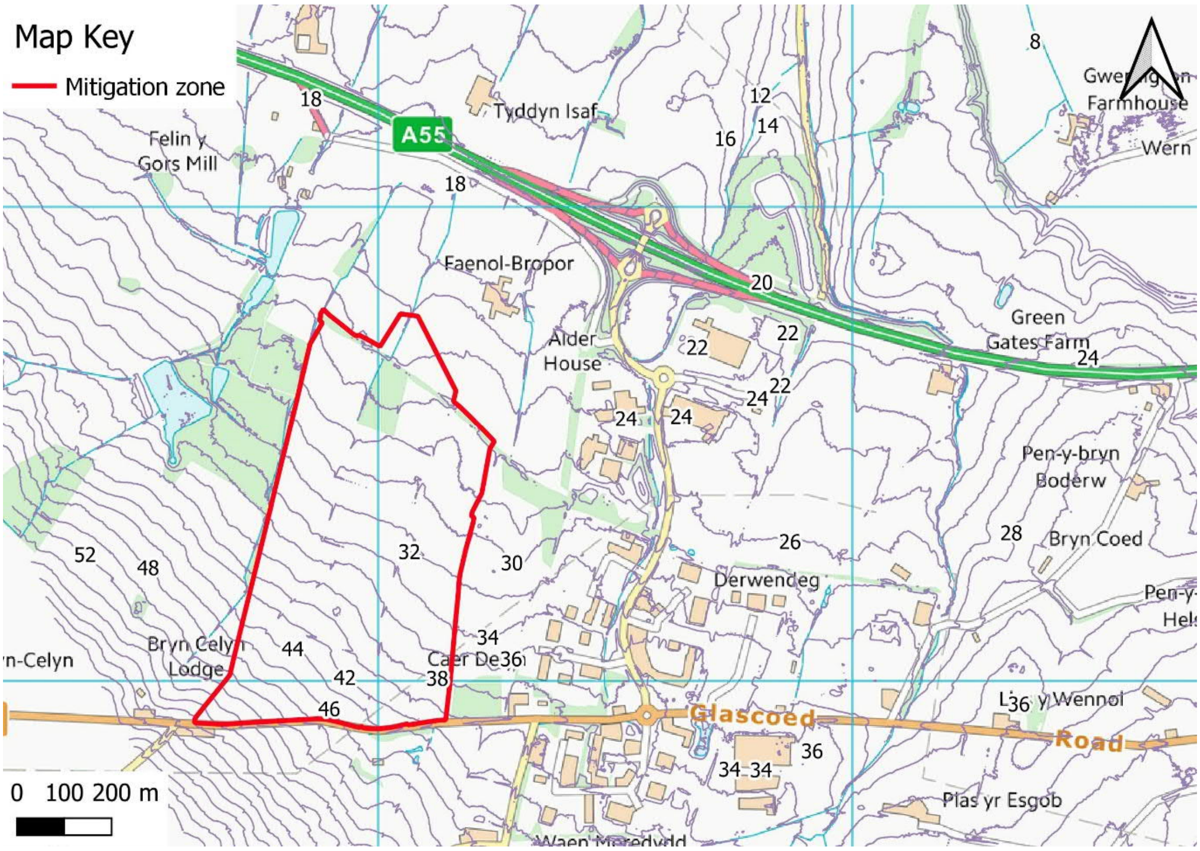
1.3 Local hydrological features and site topography

The following water bodies have been identified in the vicinity of the proposed site:

The River Elwy is located approximately 2.5km from the site at the nearest point. The River Elwy flows north and converges with the River Clwyd, which flows into the Irish Sea. The Rivers Elwy and Clwyd are designated main rivers.

There are a number of small un-named watercourses which appear to form more substantial open channels to the north of the B5381. These small watercourses are indicated on NRW's Flood Map for Planning (Natural Resources Wales, 2022), and will need to be accounted for when developing the surface water drainage strategy. The majority of these watercourses/drains follow the topography of the site, which is shown in Figure 1.2. The site slopes from a high point of 58mAOD in the South West corner down to a low point of 22mAOD in the North East corner of the assessment area.

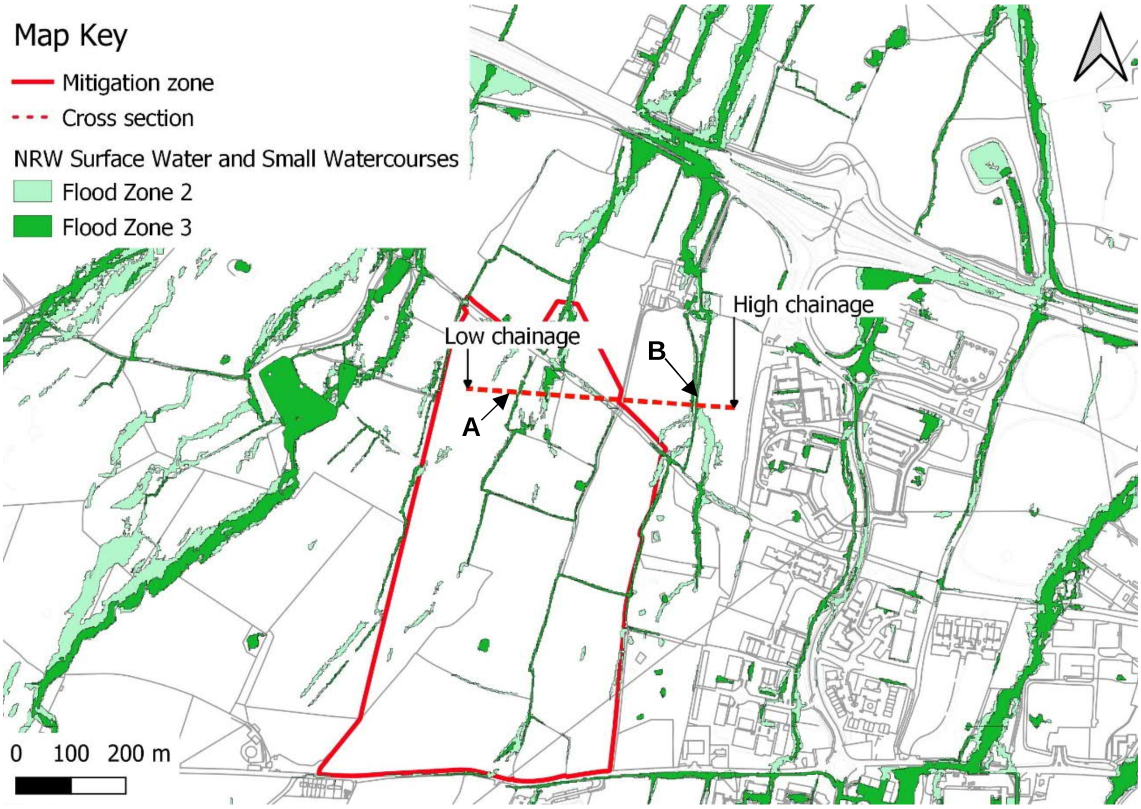
Figure 1.2: Site layout with 2m contours (from Lidar)



Source: Mott MacDonald, Contains Ordnance Survey data © Crown copyright and database right 2022

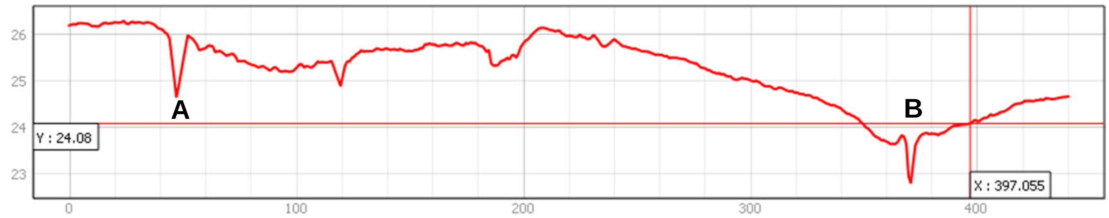
As the site drains to the north, a cross section has been taken across the north of the site to assess the suitability of the marked un-named watercourses to be used as outfalls. The cross section and corresponding levels are shown in Figure 1.3.

Figure 1.3: Site map with surface water flood risk indicated



Source: Mott MacDonald, with information from NRW and OS Background Mapping © Crown copyright and database rights 2022. Ordnance Survey 0100031673. Contains Natural Resources Wales information © Natural Resources Wales and Database Right. All rights Reserved. Some features of this information are based on digital spatial data licensed from the Centre for Ecology & Hydrology © NERC (CEH). Defra, Met Office and DARD Rivers Agency © Crown copyright. © Cranfield University. © James Hutton Institute. Contains OS data © Crown copyright and database right 2015. Land & Property Services © Crown copyright and database right

Figure 1.4: Terrain profile of cross section from Figure 1.3



Source: Mott MacDonald, 2022

The terrain profile shows that there are two distinctive watercourse channels, A and B which are at approximate chainages 50m and 365m respectively. These align with the OS mappings indication of watercourses. Channel A runs towards the A55, appears to be culverted underneath the road, and continues past Tyddyn Isaf, a property of unknown classification. The channel then becomes more open and it appears that the water flows through a network of un-named watercourses until it is discharged into the River Elwy just north of Rhuddlan. Similarly channel B appears to be culverted under the A55 and then flows towards the River Elwy.

1.4 Local ground conditions

The Pre-Desk Study Geotechnical Review produced by Mott MacDonald (2020), found that the BGS GeoIndex indicates the Clwyd Limestone Group bedrock to be a Principal Aquifer and the Warwickshire Group bedrock to be a Secondary A Aquifer. The overlying superficial Glacial Till is classified a Secondary Aquifer. The Glacial Till is likely to have low permeability which means infiltration drainage is unlikely to be unsuitable for the site. No intrusive ground surveys have been undertaken.

There are a number of small un-named watercourses and ponds shown on the OS mapping within or along the boundary of the site, which indicates the groundwater level is high. There is no recorded history of significant groundwater flooding on the site (Denbighshire County Council, 2009).

1.5 Relevant legislation and policy

1.5.1 Flood and Water Management Act 2010

The proposed Awel y Môr Offshore Wind Farm (AyM OWF) comprises an offshore generating station with a capacity of greater than 100 MW and therefore is a Nationally Significant Infrastructure Project (NSIP), as defined by Section 15(3) of the Planning Act 2008. As such, there is a requirement to submit an Application for a Development Consent Order (DCO) to the Secretary of State.

In Wales all new developments where the construction area is 100 square meters or more (such as the onshore elements of the AyM OWF), will require SuDS for surface water. The SuDS must be designed and built in accordance with Statutory SuDS Standards published by the Welsh Ministers and SuDS Schemes must be approved by the local authority acting in its SuDS Approving Body (SAB) role before construction work begins.

RWE notes that schedule 3 paragraph 7 to the Flood and Water Management Act 2010 contains the requirement for approval, from the relevant approval body, of the SuDS prior to construction of the development. However, para 7(3) contains an exemption for "work requiring development consent under section 31 of the Planning Act 2008" (I.e. nationally significant infrastructure projects). This is confirmed in the relevant statutory guidance under exemptions from the need for SAB approval. It is therefore our intention that relevant SuDS principles will be applied to the substation development and secured through a requirement of the DCO. Discharge of the DCO Requirement would require review and approval of SuDS details by DCC post-consent and before the commencement of works rather than in parallel to the planning application.

1.5.2 The Statutory Standards for SuDS

The Statutory Standards for SuDS document includes a list of principles which underpin the design of surface water management schemes. The principles form the objectives for applying the six standards, which are as follows:

- Standard S1: Surface water runoff destination;
- Standard S2: Surface water runoff hydraulic control;
- Standard S3: Water quality;
- Standard S4: Amenity;
- Standard S5: Biodiversity; and
- Standard S6: Design of drainage for construction, operation, and maintenance.

1.5.3 The Principles of SuDS

The Statutory Standards for SuDS states that schemes should aim to implement SuDS in order to:

- manage surface water on or as close to the source of the runoff as possible;
- treat rainfall as a valuable natural resource;
- ensure pollution is prevented at source;
- manage rainfall to help protect people from increased flood risk;
- take account of likely future pressures on flood risk, the environment and water resources such as climate change and urban creep;
- use the SuDS Management Train, using drainage components in series across a site to achieve a robust surface water management system;
- maximise the delivery of benefits for amenity and biodiversity;
- seek to make the best use of available land through multifunctional usage of public spaces and the public realm;
- perform safely, reliably and effectively over the design life of the development taking into account the need for reasonable levels of maintenance;
- avoid the need for pumping where possible; and be affordable, taking into account both construction and long-term maintenance costs and the additional environmental and social benefits afforded by the system.

2 Flood Risk

This section of the report summarises the flood consequences to the proposed site. For more information refer to the Awel y Môr Offshore Wind Farm Flood Consequences Assessment (Mott MacDonald, 2022).

2.1 Flood risk from rivers and the sea

The NRW Flood Map for Planning (Natural Resources Wales, 2022) shows flood risk from rivers and the sea. This data indicates that the site is within Sea and River Flood Zone 1 and therefore the risk of onsite flooding from Rivers and the sea is predominately very low (less than 1 in 1000 annual probability including an allowance for climate change).

2.2 Flood risk from surface water

The NRW Flood Map for Planning (Natural Resources Wales, 2022) shows flood risk from surface water and small watercourses. This data indicates that the majority of the site is in Flood Zone 1 for Surface Water and Small Watercourses and the risk of flooding from surface water is predominately very low (less than 1 in 1000 annual probability including an allowance for climate change), with some areas in Flood Zone 2 and 3 at high risk (greater than 1 in 100 year annual probability including an allowance for climate change). The areas of Zone 2 and 3 are predominately associated with water flow within the un-named watercourses/drains which is shown to be contained within their respective channels.

2.3 Historic flooding and flood risk from other sources

The NRW Flood Map for Planning (Natural Resources Wales, 2022) shows 'Recorded Flood Extents'. This data indicates that there have been no recorded incidents in the past of flooding from rivers, the sea or surface water. There is also no recorded history of significant groundwater flooding on the site (Denbighshire County Council, 2009). Which suggests the risk of groundwater flooding is low.

Other sources of flooding have been investigated, namely from reservoirs, canals and sewers and it has been concluded that the site is at low risk of flooding from these sources.

2.4 Future risk

The predicted effects of climate change indicate that peak rainfall intensities will increase over the lifetime of the development, and thus increase the risk of surface water flooding at the site. Table 3 of Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales (Welsh Government, August 2022), and Table 2 of Flood Consequences Assessments: Climate change allowances (Welsh Government, 2021) both recommend a national precautionary sensitivity of between 20% (central estimate) and 40% (upper end estimate) for peak rainfall intensity for the time horizon of the year 2070 to 2115 and between 5% (central estimate) and 10% (upper end estimate) for 2015 to 2039. These allowances are based on UK Climate Projections 2018 data (MET Office, 2018). It is recommended that peak rainfall intensities used should be increased in line with this guidance for between 2015 and 2039 for the temporary works, and between 2070-2115 for the permanent works. Although an indicative operational project lifetime of 25 has been used widely in project assessments, an assessment period of 40 years has been used in this document to allow for increases in the proposed operational life of the substation, and therefore the 2070-2115 timescale has been used.

The increase in peak rainfall intensities as a result of the predicted effects of climate change will cause an increase in surface water flows at the site. Based on a review of the 'Long Term Flood Risk Maps' (Natural Resources Wales, 2021) it is deemed likely to result in only a small increase in flood extent. This suggests that the site is not significantly at risk from the effects of climate change.

2.5 Potential constraints at the site

It is expected that risk of surface water flooding to the development can be adequately managed using an appropriately designed and constructed surface water drainage system, in conjunction with carefully considered ground levels. The design of the site surface water drainage system should make allowance for existing watercourses/drains and for the predicted effects of climate change.

3 SuDS Opportunities and Constraints

The Statutory Standards for SuDS sets out six standards which must be complied with when designing surface water drainage systems.

Opportunities and constraints for SuDS to be incorporated into the proposed development are discussed with reference to each of the Standards.

The aims of SuDS are to reduce the quantity of surface water runoff, improve the quality of surface water runoff, and provide an amenity and biodiversity value. SuDS seek to mimic natural drainage systems and retain water on or near to the site, when and where rain falls. SuDS offer significant advantages over conventional drainage systems in relation to flood risk by reducing the quantity of surface water runoff from a site and the speed at which it reaches water courses promoting groundwater recharge and improving water quality and amenity.

The range of potential SuDS that can be selected for use within the development will largely be dependent upon special constraints, provision of space for permeable development and the composition and permeability of ground conditions.

3.1 SuDS Components

Table 3.1 of The SuDS Manual (CIRIA, 2015) provides a summary of the types of SuDS components that are available to a designer. Table 3 lists these components and provides a summary of their suitability for the proposed site, based on the guidance set out in The SuDS Manual 2015, the assessment of the SuDS pillars, currently available information, and potential disposal options.

Table 3.1: SuDS Components

SuDS Component	Commentary
Rainwater harvesting systems	The need for non-potable water within any site buildings will be minimal and as such this is likely to be an inappropriate use of resources on this site, although further design development will be required to inform this decision.
Green roofs	Due to the small amount of roof space it is unlikely that green roofs will be utilised as part of the drainage strategy
Infiltration systems	The Pre-Desk Study Geotechnical Review produced by Mott MacDonald Ltd (2020) suggests that the ground is Glacial Till which is unsuitable for infiltration, therefore infiltration systems will not be utilised
Proprietary treatment systems	Proprietary oil separator treatment systems are likely to be required to treat run-off from bunded transformer bays, where SuDS systems are not feasible to treat surface water draining to watercourses.
Filter strips	The requirements of the development and spatial constraints are unlikely to allow the use of filter strips in the surface water drainage scheme.
Filter drains	It is likely that the majority of the site (excluding footpaths and access roads) will be surfaced using a permeable stone surface. This permeable surface area can be designed to treat run-off from roads in the same way filter drains treat run-off. Filter drains are likely to be used to drain the access roads.
Swales	There is potential for swales to be used to act as drainage for the access track and along the construction and operational compounds.
Bioretention systems	The requirements of the development and spatial constraints are unlikely to allow the use of bioretention systems in the surface water drainage scheme.
Pervious pavements	The geotechnical constraints are unlikely to allow the use of pervious paving for direct infiltration due to the low permeability of the ground.
Attenuation storage tanks	Below ground attenuation storage tanks could be constructed to reduce the rates of surface water discharge, when used in conjunction with a flow control

SuDS Component	Commentary
	device. An attenuation storage tank could be placed under a car parking area or under an access road to provide temporary storage so that the runoff can discharged at a controlled rate into a watercourse or sewer.
Detention basins	There is potential for detention basins to be used for water storage within the site
Ponds and wetlands	There is potential for ponds to be used for water storage within the site

3.2 Standard S1: Surface water runoff destination

Standard S1 of the Statutory Standards for SuDS is set out as a hierarchy of discharge destinations. Guidance on Standard S1 includes that "as much of the runoff as possible (subject to technical or cost constraints) should be discharged to each destination before a lower priority destination (level) is considered". Standard S1 prioritises the destinations of surface water discharge in the following order:

- 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; and
- Priority Level 5: Surface water runoff is discharged to a combined sewer.

3.2.1 Priority Level 1: Surface water runoff is collected for use

Standard S1 states that, "rainwater should be collected (harvested) for non-potable use where practicable", and that this "not only reduces potable water demand, but it can also reduce the volume of surface water runoff requiring disposal".

There may be potential for rainfall runoff to be collected and harvested for re-use but it is unlikely that there will be enough demand on this development. The potential re-use of rainwater for non-potable use could be explored during design development.

The principles section of the Statutory SuDS Standards states that the need for pumping should be avoided where possible. Therefore, gravity RWH systems would be preferred over pumped systems (i.e. below ground storage tanks). Gravity RWH systems are designed so that rainfall runoff is collected and stored at elevation so that it can be supplied by gravity. If RWH systems are implemented, careful consideration shall be given to the key design constraints as set out in The SuDS Manual (CIRIA, 2015).

- the structural capacity of the building to store the water at an elevated location;
- the collection of sufficient water from the roof, at sufficient height, that will allow subsequent supply based on a gravity-only process;
- the limiting operating pressure;
- the temperature of stored water; and
- the presence of contaminants in the runoff.

3.2.2 Priority Level 2: Surface water runoff is infiltrated to ground

Standard S1 states that "surface runoff not collected for use in accordance with Level 1 should be discharged by infiltration (a process that allows water to percolate into the ground) to the maximum extent possible at any location across the site".

Infiltration SuDS features include pervious pavements, soakaways, swales, infiltration basins, and filter drains. However, the proximity of buildings and structures and the limited green space within the site will limit the implementation of some features.

A lower priority destination should only be used for any residual runoff that cannot be served by infiltration provided one or more of the following exception criteria can be demonstrated:

- Permeability: the use of infiltration drainage is not practicable due to the lack of permeability of the soil for disposing of runoff;
- Ground Instability: the use of infiltration drainage would result in a risk of instability through ground movement or subsidence; or
- Pollution of groundwater or receiving surface waters: the use of infiltration drainage would pose an unacceptable risk of pollution of groundwater or surface water bodies.

The guidance to Standard S1 states that the "disposal of significant events using solutions such as soakaway units or infiltration basins usually requires infiltration rates of the order of 1×10^{-5} m/s or higher", but that "effective infiltration can be achieved with lower rates [less than 1×10^{-5} m/s] under units such as permeable pavements due to the large storage and infiltrating surface area available and the removal of sediment which would otherwise blind the infiltration surface".

Pedestrian footpaths, access roads and parking bays could incorporate permeable paving depending on results of soakaway testing and ground conditions.

Due to the low permeability of the glacial till it is anticipated that infiltration will not be a suitable solution for the site.

3.2.3 Priority Level 3: Surface water runoff is discharged to a surface water body

Standard S1 states that "surface runoff not collected for use in accordance with Level 1 or discharged to ground in accordance with Level 2 should be discharged to a receiving surface water body".

The closest watercourses are the River Elwy, located to the East of the proposed site, and a number of smaller un-named watercourse/drains within close proximity of the site. Discharging surface water to the River Elwy would require the construction of a carrier/outfall pipe crossing existing 3rd party land and highways, potentially requiring pumping if a gravity sewer is not practicable. The river is over 2km away from the site and lies on higher ground. As such, it is expected that discharge to the River Elwy will be inappropriate and require extensive consultation with local landowners and statutory bodies.

Discharging surface water run-off into existing small watercourses/drains within the site may be an effective solution. It is intended that surface water from the site will drain into a new pond, and then be discharged at a controlled rate into one of the watercourses highlighted in Figure 1.3. This is subject to detailed survey confirming connectivity and capacity of the watercourses. It is also likely to require consultation with statutory bodies and potentially further investigation/modelling into the potential capacity for increased flows.

Due to the low permeability of the underlying glacial till, infiltration is unlikely to be an effective drainage solution at the site. It is proposed that a new pond is constructed and utilised as a sustainable attenuation feature.

3.2.4 Priority Level 4: Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system

Standard S1 states that Priority Level 4 should only be used where certain exception criteria are met, and that only if runoff cannot be discharged in accordance with Levels 1, 2, or 3, should the runoff be discharged to a surface water sewer or a highway drain.

The proposed site is located adjacent to the B5381. The surface water runoff from this road is drained into an existing highway drainage system. Therefore, there may be an opportunity to drain to this existing drainage system, and at a reduced rate and volume due to the use of SuDS.

3.2.5 Priority Level 5: Surface water runoff is discharged to a combined sewer

Standard S1 states that “there is a strong presumption against a discharge to combined sewer”, and that “runoff not discharged in accordance with Levels 1 to 4 may be discharged to a public combined sewer with the agreement of the sewerage undertaker”.

3.3 Standard S2: Surface water runoff hydraulic control

The guidance to Standard S2 states that its aim is to “manage the surface water runoff from and on a site to protect people on the site from flooding from the drainage system for events up to a suitable return period, to mitigate any increased flood risk to people and property downstream of the site as a result of the development, and to protect the receiving water body from morphological damage”.

Standard S2 states that:

1. Surface water should be managed to prevent, so far as possible, any discharge from the site for the majority of rainfall events of less than 5mm.
2. The surface water runoff rate for the 1 in 1 year return period event (or agreed equivalent) should be controlled to help mitigate the negative impacts of the development runoff on the morphology and associated ecology of a receiving surface water body.
3. The surface water runoff (rate and volume) for the 1% (1 in 100 year) return period event (or agreed equivalent) should be controlled to help mitigate negative impacts of the development on flood risk in a receiving water body.
4. The surface water runoff for events up to the 1% (1 in 100 year) return period (or agreed equivalent) should be managed to protect people and property on and adjacent to the site from flooding from the drainage system.
5. The risks (both on site and off site) associated with the surface water runoff for events greater than the 1% (1 in 100 year) return period should be considered. Where the consequences are excessive in terms of social disruption, damage or risk to life, mitigating proposals should be developed to reduce these impacts.
6. Drainage design proposals should be examined for the likelihood and consequences of any potential failure scenarios (e.g. structural failure or blockage), and the associated flood risks managed where possible.

Standard S2 applies primarily to discharges to surface water bodies, surface water sewers, or combined sewerage systems (i.e. Priority Levels 3, 4, or 5 of Standard S1, as described above).

Hydraulic control measures including rain gardens and tree pits could potentially reduce the risk of surface water and sewer flooding both on site and elsewhere. Potential measures are summarised below for the proposed development to intercept rainfall and surface water runoff, remove a proportion of its volume (through evapotranspiration), and attenuate its flow before it reaches an existing drainage system, thereby providing betterment to existing conditions:

- Tree pits – positively drained tree pits positioned within external areas of the surrounding site (subject to constraints) to intercept rainfall and drain surface water runoff. These could incorporate modular pits with engineered soils, and in-built irrigation, aeration, and root management systems.
- Pervious pedestrian and shared use pavements with either total or partial infiltration to drain, treat, attenuate, and infiltrate surface water runoff.
- Filter drain material – positively drainage shallow filter material with land drains to intercept, treat, attenuate and potentially infiltrate surface water runoff.

Surface water discharge volumes and peak discharge rates should be controlled so as not to exceed, and where practicable reduce, the existing run-off rates. This could be achieved by using flow control devices in conjunction with attenuation storage.

3.3.1 Control of surface water runoff

The proposed development will result in an increase in permanent impermeable area of approximately 10,390m^2. This area consists of the access road and buildings on site. It is likely that the LLFA and SAB will require the scope of this project to reduce surface water runoff where practicable.

To achieve Standard S2, the runoff from the site will need to be managed and controlled in order to limit the rate and volume of runoff that is discharged to the small watercourses, and to mitigate flood risk to people and property. Further surveys will be required to confirm the small watercourses are suitable for discharging into.

This may be achieved using interception and other SuDS storage and flow control devices such as: swales, detention basins and ponds. Due to site constraints and available space any large structures should be carefully designed to optimise the use of space. Existing land drainage on site will be retained where possible or routes diverted where practicable. Proposed land drainage diversion routes have been shown indicatively on the drainage layout drawings (AYM-MMD-V0-XX-DR-D-0065 and AYM-MMD-V0-XX-DR-D-0066).

The relative advantages and disadvantages of each type of SuDS are set out in The SuDS Manual (CIRIA, 2015). An assessment should be made by the designer of the relative merits of each device, as a standalone or in combination with other devices, to satisfy all the Statutory SuDS Standards within the constraints of the development. Some devices, either alone or in combination with others, will contribute to meeting other statutory standards (e.g. water quality, amenity, and biodiversity).

The consequences of any potential failure scenarios (e.g. structural failure or blockage) may be mitigated by (for example) providing overflows from preferred/primary surface water discharge points such that an alternative destination for discharge is available.

It should be noted that while the benefits of certain SuDS in controlling surface water runoff through evapotranspiration are widely recognised, this benefit cannot yet be accurately modelled or reliably estimated.

An initial sizing of the volume of permanent attenuation required has been carried out based on the 1 in 100-year event in accordance with standards. Future sensitivity analysis will be conducted on the performance of the drainage system using the 1 in 1,000 year rainfall event (as required by NG standard 2.10.13). It is approximated that during the 1 in 100 rainfall event with the upper climate change sensitivity of 40% 1,100m^3 of attenuation will be required to manage the surface water runoff from the operational platform and southern access road. This is likely to be provided by an attenuation pond which would discharge into an existing surface water drainage ditch with the outfall constrained to the greenfield run-off rate of the site.

During construction there will be further requirements for attenuation due to the impermeable areas of the construction compound and haul roads. For the construction compound it is approximated that the temporary attenuation required will be 1,300m^3 based on a 1 in 10 rainfall event with the upper climate change sensitivity of 10%. This attenuation will be provided by a swale along the length of the compound. This attenuation volume is based on discharge being limited to greenfield runoff rates, which needs to be confirmed with the LLFA/SAB.

3.3.2 Climate change

The guidance to Standard S2 also states that "consideration should be given to likely future pressures on the site drainage system in accordance with current guidance, such as increasing intensity of rainfall due to climate change". Guidance provided on Standard S4 in the Statutory Standards for SuDS, states that SuDS should contribute towards reducing hazards from climate change.

This could be achieved by including an allowance for climate change in the design of the SuDS. It is recommended that peak rainfall intensities should be increased in line with Table 3 of Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales (Welsh Government, 2021).

3.4 Standard S3: Water quality

Standard S3 of the Statutory Standards for SuDS requires that treatment be provided to "prevent negative impacts on the receiving water quality and/or protect downstream drainage systems, including sewers".

The generic design process for pollution control for a particular site is to provide a SuDS management train comprising:

- pollution prevention (removing the causes of pollution);
- interception (preventing runoff); and
- treatment (treating runoff).

Where practicable, surface water runoff from impermeable areas shall require varying levels of treatment, depending on the use and potential for contamination. Areas at risk of contamination, such as the transformer bays are likely to require surface water run-off to flow through an oil separator.

Chapter 4.3 of the SuDS Manual (CIRIA, 2015) outlines two standards of good practice related to interception and treatment.

3.4.1 Water quality standard 1: Prevent runoff from the site to receiving surface water for the majority of small rainfall events

Interception is the capture and retention of the first 5mm of rainfall events. This mimics greenfield hydraulic response characteristics where small rainfall events do not generally produce any runoff and will provide both water quantity and water quality benefits. Therefore, no runoff should be discharged from the site to receiving surface waters or sewers for the majority of small rainfall events (i.e. the first 5mm for rainfall).

The runoff from small rainfall events can pose problems for water quality in the receiving surface waters because it contains the initial flush of pollutants that have built up on surfaces during the dry period and, due to the greater occurrence of smaller events over larger ones, there is frequent flushing of pollutants from surfaces. Additionally, the combined volume of runoff from all small rainfall events amounts to a significant proportion of the total runoff volume in any given period, and combined with the frequent flushing of pollutants, the total pollutant loadings from the site over a specified time period can be higher due to these smaller events.

Opportunities to incorporate these options into the proposed development should be explored during design development.

3.4.2 Water quality standard 2: Treat runoff to prevent negative impacts on the receiving water quality

Runoff should be adequately treated to protect the receiving water body from:

- Short-term acute pollution that may result from accidental spills or temporary high pollution loadings within the catchment area; and
- Long-term chronic pollution from the spectrum of runoff pollutant sources within the urban environment.

The extent of treatment required will depend on the land use, the level of pollution prevention in the catchment, and for groundwater the natural protection afforded by underlying soil layers. The sensitivity of the receiving waterbody should also be considered as some waterbodies are protected, for example those designated for drinking water abstraction or for other environmental reasons.

Table G3.1 in Standard S3 shows that, based on the proposed development use, the Pollution Hazard Level of the site could be considered to be ‘High’. This Pollution Hazard Level requires discharges may require an environmental licence of permit. Secure pre-permitting advice first from NRW and a risk assessment is likely to be required. As recommended by Standard S3, design should follow the approach explained the SuDS Manual (CIRIA, 2015) Chapter 26, which outlines a robust pollutant removal strategy referred to as a SuDS Management Train.

Table G3.3 in Standard S3 summarises the indicative suitability of a range of SuDS components to provide treatment within the SuDS management train. Opportunities to incorporate one or more of these options into the proposed development should be explored during design development.

3.5 Standard S4: Amenity

Standard S4 of the Statutory Standards for SuDS states that “the design of the surface water management system should maximise amenity benefits”.

The design of SuDS components should ensure that, where possible, they enhance the provision of high quality, attractive public space which can help provide health and wellbeing benefits, improve liveability for local communities and contribute to improving the climate resilience of new developments.

The guidance to Standard S4 explains how SuDS can add amenity value by contributing towards:

- making sites pleasant places to live or work;
- reducing hazards from climate change;

- creation of amenity space - contributing to green space accessibility standards; and
- promoting the well-being of site users.

The SuDS Manual (CIRIA, 2015) defines amenity as “a useful or pleasant facility or service” which includes both tangible and intangible benefits.

The SuDS Manual also details a range of SuDS components which provide designers with flexibility to integrate surface water management within design and provide benefits for amenity.

Using land for SuDS that also has another purpose will usually deliver more cost-effective and viable development outcomes. There is a potential opportunity to use pervious pavements in proposed hardstanding locations to provide amenity value in the form of car parking, pedestrian or open spaces, as well for controlling and treating runoff.

The opportunity to plant vegetation and trees within or near to the site could be explored to enhance visual character and biodiversity, as well as contributing to the control, interception, and treatment of runoff.

SuDS have the potential to be selected to help protect and enhance the environment by adding beauty and character to the urban landscape, moderating the local climate, filtering harmful pollutants in the air, reducing noise pollution, and absorbing atmospheric carbon dioxide.

As well as the aforementioned amenity value brought by using specific planting mixes in specific areas of the scheme, there is a series of other general health and wellbeing benefits that tree pits, rain gardens, and other soft landscaping features will bring to what is currently an almost entirely hard landscaped environment.

Planting, and particularly of shrubs and trees, can reduce the negative effects of noise and air pollution associated with developments. Not only do they provide a physical barrier to noise through the absorption and reflection of sound waves, but they can also mask it, e.g. rustling of grasses, wildlife, etc, and even simply detract from it by providing a visual barrier to the source of the noise. Through the natural processes of evapotranspiration and photosynthesis, plants help moderate the local climate, filter harmful pollutants from the air, and replace atmospheric carbon dioxide with oxygen.

3.6 Standard S5: Biodiversity

Standard S5 of the Statutory Standards for SuDS states that “the design of the surface water management system should maximise biodiversity benefits”.

The aim is to ensure that, where possible, SuDS are designed to take advantage of opportunities to create ecologically rich green spaces/ corridors within the proposed development and enrich biodiversity value by linking networks of habitats and ecosystems together.

A green space is defined by The SuDS Manual (CIRIA, 2015) as an area of grass, trees, or other vegetation set apart for recreational or other aesthetic purposes in an otherwise industrial environment. A green corridor is defined as a strip of land in an urban area that can support habitats and allows wildlife to move along it.

Depending on specific constraints, SuDS can be designed to provide benefits in terms of runoff control, water quality, amenity, and biodiversity.

3.7 Standard S6: Design for construction, operation, and maintenance

Standard S6 of the Statutory SuDS Standards requires that:

- All elements of the surface water drainage system should be designed so that they can be constructed easily, safely, cost-effectively, in a timely manner, and minimising embedded carbon;
- All elements of the surface water drainage system should be designed so that maintenance and operation can be undertaken easily, safely, cost-effectively, in a timely manner, and minimising embedded carbon; and
- The surface water drainage system should be designed to ensure structural integrity of all elements over the design life.

The surface water drainage system will be designed and detailed in accordance with current best practice and guidance to meet this standard.

It is likely that operator will be responsible for maintaining the SuDS within the development. Section 32.4 of the SuDS Manual categorises maintenance work as follows:

- Regular maintenance – includes basic tasks which should be carried out to a frequent and predictable schedule.
- Occasional maintenance – includes tasks that are likely to be required on a regular basis but at a less frequent rate compared to regular maintenance.
- Remedial maintenance – includes tasks that may be required to rectify faults associated with the system. Although the amount of remedial maintenance can be reduced via good design and construction, unforeseen issues can occur. Remedial maintenance may be required due to site specific characteristic or unforeseen events.

As part of the design of the SuDS, a SuDS Asset Maintenance Plan will need to be developed that sets out the regime for their maintenance and a schedule for each of the maintenance tasks.

3.8 Summary of the Outline Drainage Strategy for the Management of Surface Water

When considering the site characteristics, proposed use, and site constraints, SuDS are likely to be incorporated via a combination of the following components, but will need to be investigated further during design development:

- Tree pits – positively drained tree pits positioned within or external areas of the site (subject to constraints) to intercept rainfall and drain surface water runoff. These could incorporate modular pits with engineered soils, and in-built irrigation, aeration, and root management systems
- Swales may be utilised as drainage for the access road and construction and operational compound
- Attenuation storage tanks - Below ground attenuation storage used in conjunction with a flow control device to reduce the rates of surface water discharge. An attenuation storage tank could be placed under a car parking area or under an access road to provide temporary storage so that the runoff can discharged at a controlled rate into a watercourse or sewer
- Ponds to act as storage during high intensity rainfall events
- Oil separators to treat runoff from transformers bays, prior to discharge to the storage/infiltration tank or pond.

The proposed surface water management solution shall be designed so that: runoff is completely contained within the designated drainage system for all events up to the 1% (1 in 100 year) return period storm event (with an allowance for climate change). Drainage design proposals shall also consider:

- Surface water should be managed to prevent, so far as possible, any discharge from the site for the majority of rainfall events of less than 5mm.
- The risks (both on site and off site) associated with the surface water runoff for events greater than the 1% (1 in 100 year) return period. Where the consequences are excessive in terms of social disruption, damage or risk to life, mitigating proposals should be developed to reduce these impacts.
- Drainage design proposals should be examined for the likelihood and consequences of any potential failure scenarios (e.g. structural failure or blockage), and the associated flood risks managed where possible.

There is a potential for relatively large areas of sub-surface attenuation storage being required, due to restricted discharge flows from the site.

The potential to discharge surface water run-off to either a watercourse or public sewer will need to be investigated further during design development.

The proposed SuDS should consider and aim to provide benefits in terms of:

- Hydraulic control – surface water runoff interception, peak flow control, and volume control;
- Water quality – filtration of sediment and fine particulates, and the removal of pollutants by filtration and phytoremediation;
- Amenity – improved health and wellbeing of those who live, commute, and work in the area, and improved resilience to the predicted effects of climate change; and
- Biodiversity – linking of existing and creation of new habitats in a densely populated urban area.

The surface water drainage system shall be designed and detailed in accordance with current best practice and guidance, and a SuDS Asset Maintenance Plan shall be developed that sets out the regime for the maintenance of the SuDS and a schedule for each of the maintenance tasks.

4 Management of Foul Water

4.1 Disposal Options

Planning Policy Wales (PPW) guidance on Water Supply, Wastewater, and Water Quality states that foul water should be discharged into a public sewer to be treated at a public sewage treatment works, and consultation with the local sewerage undertaker should be undertaken in order to assess their requirements (Welsh Government, 2021).

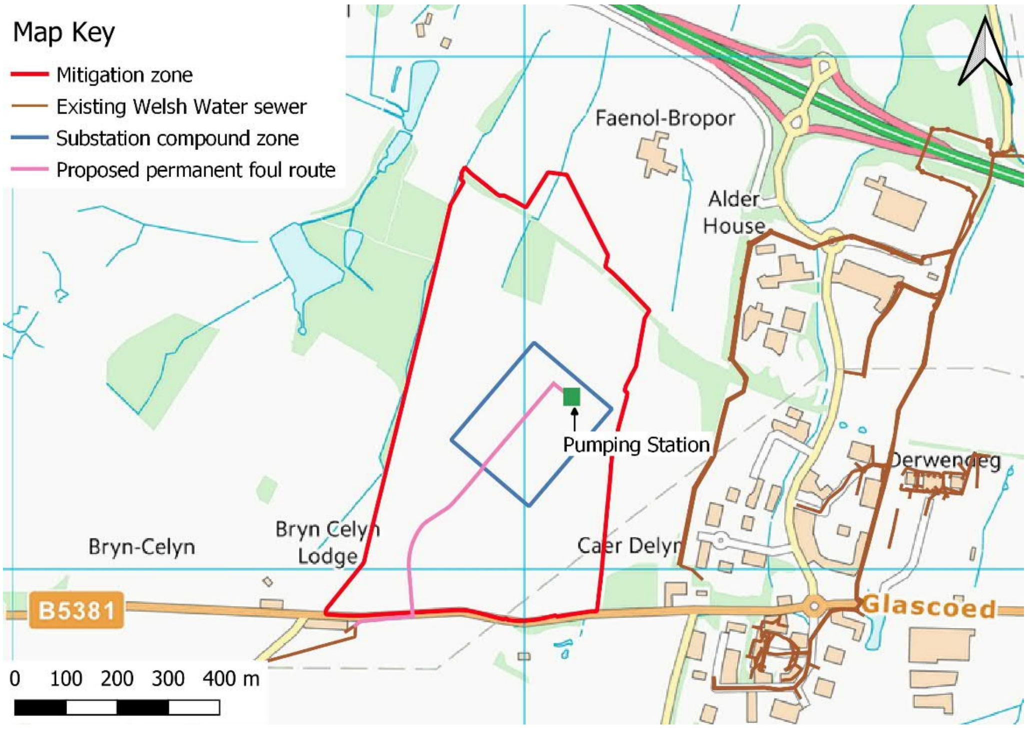
Both the temporary construction compound and permanent operational compound will require foul drainage. In the temporary case there will be a large number of workers on site therefore a connection into a public sewer is likely to be required. The C2 utility search confirms that a local public sewer runs along the B5381 to the South of the site as shown in Figure 4.1. The B5281 is at a higher elevation than the substation site therefore a pumping station will be required to raise foul flows through a rising main, prior to a short gravity connection into a public sewer manhole. During the operational phase the worst case has been considered which would be having foul flow rates high enough to require a new foul connection via a package pumping station and rising main rather than an onsite storage and tankering solution. It is proposed that his temporary foul drainage connects from the operational compound into the existing public foul sewer which runs along the highway to the south of the site as shown in Figure 4.2.

PPW guidance states that a lack of capacity or plans to improve capacity in the public sewer is not a valid reason to refuse connection. During design development, DCWW should be requested to assess the impact of additional development flows upon the downstream sewerage infrastructure and determine, if required, any necessary improvements.

Figure 4.1: Route of temporary foul sewerage connection

Source: Mott MacDonald, with information from NRW and OS Background Mapping © Crown copyright and database rights 2022 Ordnance Survey 0100031673

Figure 4.2: Route of permanent foul sewerage connection



Source: Mott MacDonald, with information from NRW and OS Background Mapping © Crown copyright and database rights 2022 Ordnance Survey 0100031673

The length of any new sewer connection outside the site will be offered for adoption by Welsh Water under a S104 Agreement (UK Government, 1991), and so will be designed to comply with the mandatory standards set by Welsh Water in The Welsh Ministers' Standards for Gravity Sewers and Lateral Drains. The extent of foul drainage network within the site boundary, including any pumping station, will be owned and maintained by RWE.

4.2 Potential Constraints to Development

It is envisaged that the topography of the site and likely invert levels of public sewer connection points will likely require foul water to be pumped off site. The location/proximity of DCWW assets will be reviewed within the Optioneering Report. DCWW will need to be consulted in order to agree potential connection points and levels in order to determine the requirement for a foul water pumping station or stations.

5 Bibliography

CIRIA. (2015). *The SuDS Manual.*

Denbighshire County Council. (2009). *Preliminary Flood Risk Assessment Flood Risk Regulations.*

MET Office. (2018, October 8th). *UKCP Data*. Retrieved from https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/data/index

Mott MacDonald. (2020). *Pre-Desk Study Geotechnical Review (Doc ref: AYM-MOT-VO-XX-RP-G-0021).*

Mott MacDonald. (2022). *Flooding Consequences Assessment (Doc ref: AYM-MOT-V0-XX-RP-C-0043).*

Natural Resources Wales. (2021). *Flood Risk Assessment Wales Map.*

Natural Resources Wales. (2021). *Long Term Flood Risk Maps.*

Natural Resources Wales. (2022). *Flood Map for Planning.*

UK Government. (1991). *Water Industry Act 1991.*

Welsh Government. (2021). *Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales.*

Welsh Government. (2021). *Flood Consequence Assessments: Climate change allowances.*

Welsh Government. (2021). *Planning Policy Wales.*

Welsh Government. (August 2022). *Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales.*

mottmac.com

Fferm Wynt Alltraeth
AWEL Y MÔR
Offshore Wind Farm

RWE Renewables UK Swindon Limited

Windmill Hill Business Park
Whitehill Way
Swindon
Wiltshire SN5 6PB
T +44 (0)8456 720 090
www.rwe.com

Registered office:
RWE Renewables UK Swindon Limited
Windmill Hill Business Park
Whitehill Way
Swindon