Swansea North Battery Energy Storage System,
East of the Existing Swansea North Substation, Morriston

Flood Consequence Assessment and Drainage Strategy

For

Statkraft UK LTD

motion

Document Control Sheet

Swansea North Battery Energy Storage System,

East of the Existing Swansea North Substation, Morriston

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This document has been issued and amended as follows:

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Contents

Appendices

1.0 Introduction

1.1 Motion has been commissioned by Statkraft UK Ltd to undertake a Flood Consequence Assessment (FCA) and prepare a Drainage Strategy to support a full planning application for a Battery Energy Storage System (BESS) to the east of the existing Swansea North substation, Morriston. The development proposals will comprise of energy storage equipment, along with associated infrastructure, landscaping and access. The proposed site layout and location plans can be seen in Appendix A.

1.2 This FCA and Drainage Strategy will discuss the risks to the proposed development from all sources of flooding. This report will also define how the site will manage foul and surface water so the development does not increase flood risk in the area or to neighbouring properties.

1.3 Flood risk in Wales is currently assessed, for planning purposes, with the Development Advice Map (DAM) and associated planning policy Technical Advice Note 15: Development and Flood Risk dated July 2004 (current TAN 15). The DAM was due to be replaced by the Wales Flood Map for Planning (FMfP) and an updated Welsh Government Technical Advice Note 15 Development, flooding and coastal erosion dated 1st December 2021 (new TAN 15). However, since the soft launch, some Local Authorities have raised concerns about the proposed new policy advice and map. The advice in the new TAN 15 was based on a FMfP that included projections showing future flood risk areas as a result of climate change. The inclusion of such projections caused some significant increases in the extent of the highest risk flood zones, including some city and town centres.

1.4 Therefore, to allow local planning authorities to fully consider the impact of the climate change projections on their respective areas, the coming into force of the new TAN 15 and FMfP has been suspended and the current TAN 15 and DAM still form the basis for the assessment of flood risk for planning purposes.

1.5 Notwithstanding this, in a communication from Natural Resources Wales (NRW) to Lead Local Flood Authorities (LLFA's) on 24th December 2021, they advised that:

"*On the 15 December the Welsh Government issued a letter providing further clarifications to planning authorities. In the letter the Welsh Government advised that "the FMfP remains publicly accessible and provides better and more up to date information than the DAM. The FMfP holds no formal weight as it is not yet national policy, but best available information may be regarded as a material consideration."*

1.6 Consequently, this FCA will refer to the DAM as it forms the basis of flood risk assessed for planning policy, but the "*best available information*" in the FMfP will also be used to assess flood risk.

1.7 This FCA and drainage strategy follows the guidance set out in:

- Planning Policy Wales (PPW)
- Current TAN 15 (2004)
- New TAN 15 (2021)
- National Strategy for Flood and Coastal Erosion Risk Management in Wales (2020)
- Statutory Standards for Sustainable Drainage Systems Wales (2018)
- CIRIA C753 SuDS Manual 2015 (CIRIA SuDS Manual)

1.8 This FCA and drainage strategy pertains only to the design of the drainage system for the built site. It does not provide details of how the site will be drained during the construction phase.

1.9 This report does not provide information on how the drainage infrastructure will be protected during the construction phase of the project.

2.0 Site Description

Table 2.1 – Site Summary

Site Name	Swansea North Battery Energy Storage System,
Location	East of the Existing Swansea North Substation, Morriston
Grid Reference	265422, 201008
Site Area	6.40 Ha
Development Type	Battery Energy Storage System
Environment Agency (EA) Flood Zone	The proposed development site area is located within Flood Zone 1.
Surface Water Flood Risk	Surface water flooding will not be a constraint on the site as the development will either be outwith the surface water flood risk areas; or where overflow from the ordinary watercourse that flows towards the southwest approximately 30m west of the proposed development site area is indicated, the V-Ditch approved as part of the SAB application referenced 2024/0015/SFA will now intercept the overflow; or, where the development encroaches on the ordinary watercourse that flows along the northern boundary of the site, it is a requirement of this report that the proposed development site layout is 7m from the ordinary watercourse top of bank.
Local Water Authority	Welsh Water.
Local Planning Authority	City and Council of Swansea Council (SC).
Lead Local Flood Authority	City and Council of Swansea Council (SC).

Site Location and Description

2.1 The site is pasture land used for grazing livestock; is approximately 100m south of a grid balancing equipment development approved as part of SC planning application 2023/0889/FUL; and is approximately 110m east southeast of the Existing Swansea North Substation, Morriston.

2.2 The site is bounded to the north, east and south by pasture land used for grazing livestock and is accessed via a gravel vehicle access track also approved as part of SC planning application 2023/0889/FUL.

2.3 The nearest postcode is SA6 6NX and the grid reference is 265422, 201008.

2.4 Reference to the OS Six Inch 1830s-1880s (county layers), OS 25 Inch 1892-1914 and OS 1:1,250/1:2,500 1944-1974 map series available to view on the National Library of Scotland Side by Side Georeferenced Maps Viewer Website[1] show the site to be open space.

[1] https://maps.nls.uk/geo/explore/side-by-side/#zoom=17.2&lat=51.69198&lon=-3.95004&layers=173&right=ESRIWorld

Topography

2.5 A topographical survey of the site, including part of the gravel vehicle access track from which the proposed development site area will be accessed, has been provided by the client. The outputs can be seen in Appendix B. The topographical survey shows the site slopes from a high point of around 89.64m Above Ordnance Datum (AOD) at the northern red line planning site boundary. The proposed development site area slopes both to the southwest and southeast. The site slope to the southwest is estimated to be around 1 in 50, and the site slope to the southeast is estimated to be around 1 in 40. The low point of the proposed development site area is around 78.77m AOD at the southeast corner of the site.

Geology

2.6 The British Geological Survey (BGS) online 1:50,000 GeoIndex[2] mapping identifies that:

- the underlying superficial geology is TILL, DEVENSIAN - DIAMICTON[3]; and,
- the underlying solid geology is GROVESEND FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE, which is 'Predominantly argillaceous, comprising mudstones and siltstones, with well developed coals; minor lithic ("Pennant") sandstones; locally developed red mudstones'[4].

2.7 Intrusive ground investigations were carried to the north of the site in May and June 2023 by WSP UK Limited to inform the grid balancing equipment development in the form of trial pits to a maximum depth of 4.00m below ground level (bgl); boreholes to a maximum depth of 10.16m bgl; Dynamic Cone Penetrometer Tests to a maximum depth of 0.77m bgl; and Dynamic Probes to 6.00 m bgl. The ground conditions encountered confirmed the presence of the BGS online 1:50,000 GeoIndex mapping geology i.e. Cohesive or Granular Till overlying the Grovesend Formation Mudstone at depth. Groundwater seepages were encountered, the shallowest being 1.20m in DP118, rising to 1.02m after 20 minutes.

Infiltration Testing

2.8 The BGS online 1:50,000 GeoIndex mapping and intrusive ground investigations carried to the north of the site indicate an infiltration coefficient of around 3×10^{-9} - 3×10^{-6} based on the till soil type in Table 25.1 of the CIRIA SuDS Manual at the site.

2.9 The CIRIA SuDS Manual states 'Infiltration viability should be given full consideration where rates of 10^{-6} m/s or greater exist on the site (subject to geotechnical and contamination considerations). Where rates are less than that, the soils can still usefully be used for Interception delivery, but disposal of significant volumes of runoff may not be cost-effective or appropriate, unless there is a large area of land available for this purpose'.

Hydrogeology

2.10 Defra's Magic Map application indicates that the bedrock geology is designated a 'Secondary A' aquifer.

Hydrology and Existing Drainage Regime

2.11 Reference to the OS Six Inch 1830s-1880s (county layers), OS 25 Inch 1892-1914 and OS 1:1,250/1:2,500 1944-1973 map series available to view on the National Library of Scotland Side by Side Georeferenced Maps Viewer Website[5] do not show any watercourses crossing the site or bounding the site.

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[2] https://www.bgs.ac.uk/map-viewers/geoindex-onshore/
[3] https://webapps.bgs.ac.uk/lexicon/lexicon.cfm?pub=TILLD
[4] https://webapps.bgs.ac.uk/lexicon/lexicon.cfm?pub=GDB
[5] https://maps.nls.uk/geo/explore/side-by-side/#zoom=15.2&lat=54.70785&lon=-1.54657&layers=257&right=ESRIWorld

2.12 The NRW Statutory Main River Map[6] shows an ordinary watercourse issuing to the east northeast of site and flowing towards the Afon Llan Main River. Please see Figure 2.1 below.

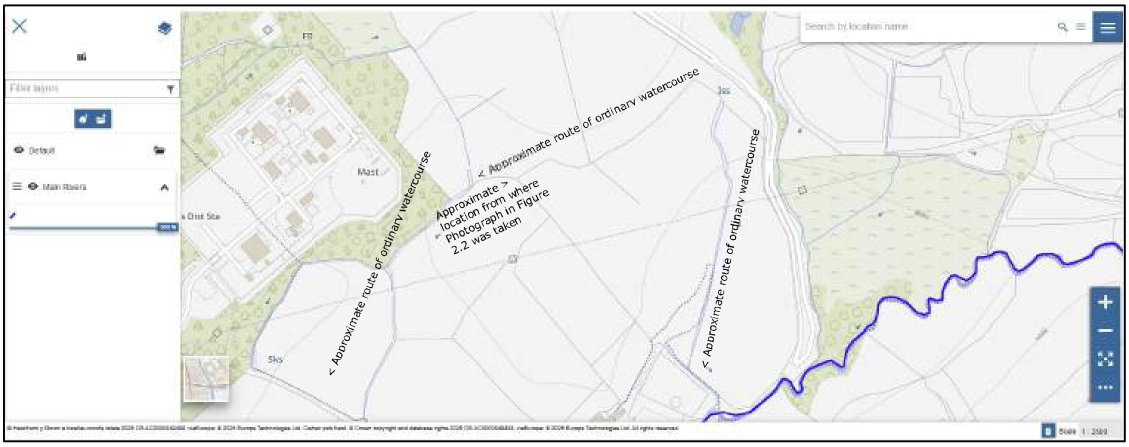

Figure 2.1 - Ordinary Watercourses in the Site Location

2.13 The topographical survey of the site in Appendix B shows an ordinary watercourse along the northern boundary of the site. During a site visit undertaken in February 2024, the photograph in Figure 2.2 was taken that shows water flowing from this watercourse via a culvert under what is now the gravel vehicle access track from which the proposed development site area will be accessed. Figure 2.1 shows the approximate location from where Figure 2.2 was taken.

Figure 2.2 - Ordinary Watercourse Along the Northern Boundary of the Site in the Background

2.14 Lastly, also with reference to Figure 2.1, the NRW Statutory Main River Map also shows an ordinary watercourse that flows towards the southwest approximately 30m west of the proposed development site area.

[6] https://datamap.gov.wales/maps/new?layer=inspire-nrw:NRW_MAIN_RIVERS#/

3.0 Legislative and Policy Framework

Flood and Water Management Act

3.1 The Flood and Water Management Act 2010 (FWMA) received Royal Assent on 8th April 2010. The Act was introduced to enforce some of the key proposals set out within UK Government flood and water strategies along with UK Government's response to the Sir Michael Pitt's Review of the summer 2007 floods.

3.2 LLFA's, including SC, have a responsibility under the FWMA to develop, maintain, apply and monitor the application of a strategy for local flood risk in their area. Local flood risk is defined as flood risk arising from surface run-off, groundwater and ordinary watercourses (i.e. non main rivers). NRW plays a role in managing the watercourses designated as 'main rivers'.

The National Resources Wales Development Advice and Flood Risk Assessment Wales Maps

3.3 The DAM and current TAN 15 is the framework for assessing flood risk to and from new development. The DAM is used as a screening tool by Local Authorities to understand where further assessment of flooding may be needed.

3.4 The DAM was due to be replaced by the FMfP as of 1st December 2021. However, since the soft launch, some Local Authorities have raised concerns about the proposed new policy advice and map. The advice in the new TAN 15 was based on a FMfP that included projections showing future flood risk areas as a result of climate change. The inclusion of such projections caused some significant increases in the extent of the highest risk flood zones, including some city and town centres.

3.5 Therefore, to allow local planning authorities to fully consider the impact of the climate change projections on their respective areas, the coming into force of the new TAN 15 and FMfP has been suspended.

3.6 This means that the DAM should still form the basis of any assessment of flood risk to and from new development. Notwithstanding this and the fact that the FMfP has no official status for planning purposes, the data within it is considered as the 'best available information' on flood risk to inform planning advice.

3.7 Communication from NRW to LLFA's on 24th December 2021, as discussed in the introduction of this report, states that the "*best available information may be regarded as a material consideration. The best available information we hold in relation to flood risk to the site is provided on our FMfP*".

3.8 Therefore, following the advice of the NRW, this study will reference the detailed view of the FMfP in this assessment of flood risk and consequence because it is the most accurate source of flood risk information.

3.9 The FMfP provides information on river, sea and surface water flood risk, among other information.

3.10 Table 3.1 below lists the FMfP flood zone categories for river and sea flooding and explains the flood risk probabilities they represent. Table 3.2 lists the FMfP flood zone categories for surface water flooding and explains the flood risk probabilities they represent.

Table 3.1 - FMfP Combined River & Sea Flood Risk Categories

Flood Zone	Definition
Flood Zone 1 (Low Risk)	Land having less than a 1 in 1,000-year annual probability of flooding (land outside of any shaded areas on the Flood Map)
Flood Zone 2 (Medium Risk)	Land having a combined 1 in 1,000-year annual probability of flooding including the effects of climate change (land shaded light blue on the Flood Map)

Flood Zone 3 (High Risk)	Land having a combined 1 in 100-year annual probability of flooding including the effects of climate change (land shown in dark blue on the Flood Map)

Table 3.2 - FMfP Surface Water Flood Risk Categories

Flood Zone	Definition
Flood Zone 1 (Low Risk)	Land having less than a 1 in 1,000-year annual probability of surface water flooding (land outside of any shaded areas on the Flood Map)
Flood Zone 2 (Medium Risk)	Land having between a 1 in 100 and 1 in 1,000-year annual probability of surface water flooding including the effects of climate change (land shown in pink on the Flood Map)
Flood Zone 3 (High Risk)	Land having greater than a 1 in 100-year annual probability of surface water flooding including the effects of climate change (land shown in magenta on the Flood Map)

Planning Policy Wales and TAN 15

3.11 TAN 15 is one of a number of 'Technical Advice Notes' that supplement PPW. Current TAN 15 was published in July 2004 and the new TAN 15 was published in December 2021.

3.12 TAN 15 provides technical guidance that supports and expands on the policy set out in PPW in relation to development and flooding.

3.13 The general approach of PPW, supported by TAN 15, is to advise caution in respect of new development in areas at high risk of flooding by setting out a precautionary framework to guide planning decisions. The overarching aim of the precautionary framework is to direct new development away from those areas that are at high risk of flooding.

3.14 In terms of the FMfP, any development in Flood Zone 3 should be steered towards Flood Zone 2 or 1 and development in Flood Zone 2 should look for alternative sites within Flood Zone 1.

3.15 The following section of this report will assess whether the proposed development is at risk of flooding, from all sources, and determine whether the development is appropriate in that location in relation to the Flood Zones as set out in the FMfP.

4.0 Current Flood Risk

4.1 Flooding can arise from a variety or combination of sources. These may be natural or artificial and may be affected by climate change. These are discussed, in the following two sections and summarised in the next chapter. The probability of any likely impacts is also assessed.

Flooding from Rivers and the Sea

4.2 The NRW DAM[7] shows the site is predominantly located in Zone A i.e. Considered to be at little or no risk of fluvial or coastal/tidal flooding, including all of the proposed development site area. Please see Figure 4.1 below.

4.3 The eastern red line planning site boundary interacts with the ordinary watercourse shown to issue to the east northeast of site in the NRW Statutory Main River Map. The NRW DAM in Figure 4.1 below shows the ordinary watercourse is located in Zone B i.e. Areas known to have flooded in the past. However, the proposed development site area is estimated to be around 24m from Zone B at its closest point.

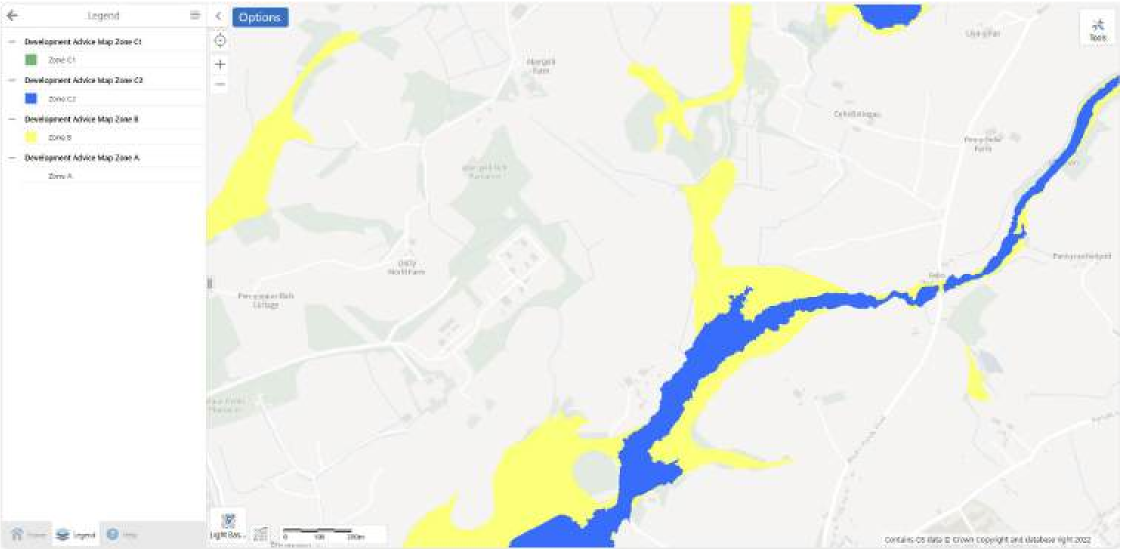

Figure 4.1 - NRW DAM

4.4 The FMfP: River Flood Zones Dataset published by NRW on 28 November 2024 has been downloaded and is included in the Proposed Drainage Strategy in Appendix E. The site is located in Flood Zone 1. This means that in any year the site has a less than 1 in 1000 chance of flooding from rivers. However, based on the DAM, this may be because the ordinary watercourse that issues to the east northeast of site has not been modelled. Therefore, it is proposed to use the Surface Water and Small Watercourses Flood Zone 2 - i.e. Area with 1 in 1000 to 1 in 100 chance of flooding from surface water and/or small watercourses in a given year, including the effects of climate change – as a proxy for Rivers – Flood Zone 2 – i.e. Areas with 1 in 1000 to 1 in 100 chance of flooding from rivers in a given year, including the effects of climate change. The proposed development site area is around 14m from Surface Water and Small Watercourses Flood Zone 2 at its closest point. Please also see the Surface Water Flooding Section of this assessment of flood risk and consequence below.

4.5 The proposed use of the site is classified as 'Essential infrastructure' development under the PPW and is appropriate in Flood Zone 1. Therefore, the development is appropriately located.

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7 https://gisgeoext.cyfoethnaturiolcymru.gov.uk/Geocortex/Viewers/Html5Viewer_4145/index.html?viewer=FloodRisk

Surface Water Flooding

4.6 Surface water, or pluvial flooding, results from rainfall-generated overland flow, where rainwater has not yet reached a watercourse or sewer and where the local drainage systems become overwhelmed. Pluvial flooding often occurs during short, very intense storms, but can also occur during longer periods of rainfall when the ground is already saturated, or where land has low permeability due to development.

4.7 In these conditions surface water can build up where the topography allows it to converge or pond. Where it gathers it will travel down prevailing gradients. Pluvial flooding then occurs at locations where significant surface water flow paths converge, at localised low points and/or due to overland obstructions. In urban areas pluvial flooding often occurs where the built environment channels overland flow routes (down roads that are bounded by kerbs, for example) or where there are obstacles to the natural overland flow routes. Boundary walls and buildings are often the main causes and, hence, the likelihood of pluvial flooding to impact property and gardens.

4.8 Pluvial flooding is exacerbated in many cases by the mistreatment or failure of the below ground infrastructure (including partial or full blockages of gullies and/or within the combined sewers and the accumulation of fats, oils and greases within the sewer networks).

4.9 Generally speaking, pluvial flooding is less of an issue in rural areas. This is partly because the natural 'greenfield' state of land allows for the interception of rainfall and the slowing down of overland flow, so the accumulation of surface water is less likely. It is also because there are much less 'receptors' of surface water flooding in rural areas and many incidences of surface water flooding in rural areas go unnoticed or unreported as they are of no consequence.

4.10 The FMfP: Surface Water and Small Water Courses Flood Zones Dataset published by NRW on 28 November 2024 has been downloaded and is included in the Proposed Drainage Strategy in Appendix E.

4.11 The proposed development site area is predominantly located in the 'low' surface water flood risk category - less than 1 in 1000 chance of flooding each year. The dataset does show the proposed development site interacts with a comparatively small Surface Water and Small Water Courses Flood Zone 2 Area - with 1 in 1000 to 1 in 100 chance of flooding from surface water and/or small watercourses in a given year, including the effects of climate change. It appears this area of surface water flood risk relates to overflow from the ordinary watercourse that flows towards the southwest approximately 30m west of the proposed development site area in NRW Statutory Main River Map. With reference to Section 2.2, the site is accessed by a gravel vehicle access track, approved as part of SC planning application 2023/0889/FUL. The V-Ditch Layout approved as part of the subsequent SAB application referenced 2024/0015/SFA in Appendix C indicates overflow from the ordinary watercourse will now be intercepted by the v-ditch, therefore no longer interact with the proposed development site. Nevertheless, as part of a development, it is a requirement of this report that site levels remain as existing in this area of the site to ensure surface water runoff remains as existing, and the surface of the proposed development site area should finish a minimum of 150mm below any buildings and equipment. Therefore, this isolated area of surface water flood risk will be dealt with through the site's levels design.

4.12 With reference to Section 2.13, it is also noted that the development encroaches on the ordinary watercourse along the northern boundary of the site. Policy RP4: Water Pollution and the Protection of Water Resources of the Swansea Council's Local Development Plan 2010-2025 states that 'watercourses will be safeguarded through green corridors/riparian buffers' and the Local Development Plan also states 'In accordance with Policy RP 4 any development in the riverside corridor should incorporate a riparian corridor with a buffer of up to 7 metres adjoining both banks. This will allow for necessary maintenance by NRW and will protect and encourage local *biodiversity*'. It is a requirement of this report that the proposed development site layout is 7m from the ordinary watercourse top of bank.

4.13 Surface water flooding will not be a constraint on the site as the development will either be outwith the surface water flood risk areas; or where overflow from the ordinary watercourse that flows towards the southwest approximately 30m west of the proposed development site area is indicated, the V-Ditch approved as part of the SAB application referenced 2024/0015/SFA will now intercept the overflow; or, where the development encroaches on the ordinary watercourse that flows along the northern boundary of the site, it is a requirement of this report that the proposed development site layout is 7m from the ordinary watercourse top of bank.

4.14 As the proposed development will manage and discharge surface water generated in line with appropriate guidance, there will be a low risk of surface water flooding to the proposed development on site, and no increased risk of surface water flooding off site.

Groundwater Flooding

4.15 The risk of groundwater flooding is dependent on local geological and hydrogeological conditions at any given time. Groundwater levels rise during wet winter months and fall again in the summer when rainfall is low and extractions are higher. In very wet winters, rising groundwater levels can reactivate flow in ephemeral streams that only flow for part of the year or even lead to the flooding of normally dry land.

4.16 With reference to Section 2.7, groundwater seepages were encountered, the shallowest being 1.20m in DP118, rising to 1.02m after 20 minutes, during intrusive ground investigations carried to the north of the site in May and June 2023 to inform the grid balancing equipment development.

4.17 On the basis the intrusive ground investigations indicate low permeability ground conditions, it is concluded that groundwater in the subsoil is likely to be of limited volume, and the likelihood of groundwater flooding is low.

Flooding from Infrastructure Failure

4.18 Sewer flooding can occur when the capacity of the infrastructure is exceeded by excessive flows, or because of a reduction in capacity due to collapse, siltation, blockage, or if the downstream system becomes surcharged. This can lead to the sewers flooding onto the surrounding ground via manholes and gullies, which can generate overland flows.

4.19 Typically, sewer systems are constructed to accommodate rainstorms with a 30-year return period or less, depending on their age. Consequently, rainstorm events greater than 1 in 30-years would be expected to result in surcharging of some parts of the sewer system. In fact, due to most gullies being poorly maintained and often partially blocked with silt, leaves and other debris, their capacity is often estimated to be closer to the 1 in 10-year storm.

4.20 During construction of the development foul water will be disposed of via ‘Port-a-loo’ type facilities and disposed of via a licenced waste carrier.

4.21 During the operational phase the Development is to be primarily unmanned, with ad-hoc maintenance checks being the only time in which the Site will accommodate staff. As such there will be minimal foul water discharge from the site and no foul water drainage systems are deemed necessary other than ‘Port-a-loo’ type facilities with waste disposed of via a licenced waste carrier.

4.22 There are no known drains or sewers in the vicinity of the site. Therefore, the site is considered to be at low risk of flooding from infrastructure failure.

Flooding from Artificial sources

4.23 There are no canals in the site area to create flood risk.

The NRW Flood Map for Planning[8] indicates that the site is not in an area at risk of reservoir flooding.

[8] https://flood-map-for-planning.naturalresources.wales/

5.0 Future Flood Risk & Climate Change

5.1 PPW and the supporting Technical Guidance sets out how flood risk should be considered over the lifetime of a development. This requires an increase in flood risk due to climate change to be taken into account. Both peak river flows and rainfall intensity should be assessed.

Peak River Flows

5.2 Please see Sections 4.2-4.5.

Peak Rainfall Intensity

5.3 The site is currently pasture land used for grazing livestock which can be described as greenfield. The proposed development will increase the impermeable areas on site and, therefore, will increase the quantity of surface water runoff from rainfall.

5.4 With climate change it is becoming more common to see rainfall events of higher intensity. Increased rainfall intensity affects river levels and drainage systems, with the result being an increase in surface water flooding and sewerage surcharge.

5.5 The development site lies within the Western Wales River Basin District[9]. In this catchment, the upper end climate change allowance for the 3.3% AEP and 1% AEP rainfall events is 40%. Therefore, the development can expect peak rainfall increases of this magnitude and should use these percentage increases in the assessment of future surface water flood risk.

5.6 It is important that:

- Any changes to the land in this area must remain sensitive to the local surface water flood risk. This will ensure that any natural overland flow routes and surface water pathways will remain the same and the conveyance of surface water is not impeded.
- The surface water strategy for the site takes the latest climate change predictions into account, so as not to increase flood risk on- or off-site.

Residual Flood Risk

5.7 It is important to recognise that flood risk can never be fully mitigated and there will always be a residual risk of flooding. The residual risk is associated with several potential risk factors, including (but not limited to):

- A flood event that exceeds that for which the local flood defences or local drainage system has been designed to withstand.
- A residual danger posed to property and life because of flood defence failure through overtopping or structural collapse.
- General uncertainties inherent in the prediction of flooding.

5.8 Modelling of flood events is not an exact science. Therefore, there is an inherent uncertainty in the prediction of flood levels and extents used in the assessment of flood risk. NRW's FMfP is largely based upon detailed modelling within the area. However, other mapping products require numerous assumptions to be made. Whilst they all provide a good depiction of flood risk for specific modelled conditions, all modelling requires the making of core assumptions, and these might not occur in the open and dynamic environment of a flood event. Also, the NRW's FMfP and other flood modelling is updated

[9] https://www.gov.wales/climate-change-allowances-and-flood-consequence-assessments

regularly. Interested parties are recommended to keep abreast of this so that a significant change or increase in flood risk can be determined.

5.9 It is a requirement of this report that site levels remain as existing in the area of the site that interacts with the comparatively small Surface Water and Small Water Courses Flood Zone 2 Area to ensure surface water runoff remains as existing, and the surface of the proposed development site area should finish a minimum of 150mm below any buildings and equipment.

5.10 It is also a requirement of this report that that the proposed development site layout is 7m from the ordinary watercourse top of bank.

Table 5.1 – Residual Flood Risk

Flood Source	Risk Level				Comment
	High	Medium	Low	Very Low	
River				X	The proposed development site area is located within Flood Zone 1.
Sea				X	Sea Flood Zone 1, far inland
Surface Water			X		Surface water flooding will not be a constraint on the site as the development will either be outwith the surface water flood risk areas; or where overflow from the ordinary watercourse that flows towards the southwest approximately 30m west of the proposed development site area is indicated, the V-Ditch approved as part of the SAB application referenced 2024/0015/SFA will now intercept the overflow; or, where the development encroaches on the ordinary watercourse that flows along the northern boundary of the site, it is a requirement of this report that that the proposed development site layout is 7m from the ordinary watercourse top of bank.
Groundwater			X		On the basis the intrusive ground investigations indicate low permeability ground conditions, it is concluded that groundwater in the subsoil is likely to be of limited volume, and the likelihood of groundwater flooding is low.
Infrastructure Failure			X		There are no known drains or sewers in the vicinity of the site. Therefore, the site is considered to be at low risk of flooding from infrastructure failure.

Canals				X	There are no canals in the vicinity.
Reservoirs				X	The NRW Flood Map for Planning indicates that the site is not in an area at risk of reservoir flooding.
Increase due to Climate Change			X		Increased peak rainfall intensities[10] are expected to affect surface water flood risk and infrastructure. This has been taken into account in the proposed surface water drainage strategy.

5.11 This assessment of flood risk and consequence indicates the site lies within Flood Zone 1 - i.e. land assessed as having less than a 1 in 1000 chance of river and sea flooding occurring each year - and the assessment indicates a low risk of flooding from all sources both now and in the future.

[10] https://www.gov.wales/climate-change-allowances-and-flood-consequence-assessments

6.0 Surface Water Drainage Strategy

Proposed Surface Water Drainage Strategy

6.1 Current planning policy and guidance requires developments to employ SuDS (Sustainable Drainage Systems) techniques wherever feasible. Careful design of SuDS features can ensure that a development's surface water drainage closely reflects the natural hydrology of the pre-developed site.

6.2 SuDS will attenuate and treat surface water run-off quantities at the source (source control) in line with NRW policies.

6.3 Source control systems treat surface water close to the point of origin, in features such as soakaways, permeable paving and swales, to name a few.

6.4 As stated in Sections 2.1 and 2.2, the site is pasture land used for grazing livestock and the site is accessed by a gravel vehicle access track approved as part of SC planning application 2023/0889/FUL. On the basis the route of the gravel vehicle access track will continue to drain as shown in Appendix C, the proposed additional impermeable area will be the proposed development site, and the proposed development will increase the impermeable area of the site by 1.905 ha.

Greenfield Runoff Rate

6.5 On the basis the FEH Rainfall method has been applied to the MicroDrainage calculations, the FEH QMED Method has been used to derive a QMED value of 12.74 l/s for the additional permanent impermeable area for the development i.e. 1138.5 / 89.375 x 1.905 = 12.74 (Appendix D).

6.6 The QMED value will be used to guide the appropriate surface water discharge rate from the development. The drainage strategy in Appendix E of this report proposes a last Hydro-Brake flow control manhole close to the red line planning application boundary that will control discharge to 12.7 l/s for the 100 year + 40% climate change critical rainfall event to the ordinary watercourse issuing to the east northeast of site and flowing towards the Afon Llan Main River.

The Drainage Hierarchy

6.7 The drainage hierarchy is a sequential check that intends to ensure that all practical and reasonable measures are taken to manage surface water as high up the hierarchy (with '1' being the highest) as possible, and that the amount of surface water managed at the bottom of the hierarchy is minimised.

6.8 The drainage hierarchy presents only four tiers of drainage options. This has been expanded on and adopted by others and now can be viewed as the following:

1. Store rainwater for later use
2. Use infiltration techniques, such as porous surfaces in non-clay areas
3. Attenuate rainwater in ponds or open water features for gradual release
4. Attenuate rainwater by storing in tanks or sealed water features for gradual release
5. Discharge rainwater direct to a watercourse
6. Discharge rainwater to a surface water sewer/drain
7. Discharge rainwater to the combined sewer.
8. Discharge rainwater to the foul sewer.

6.9 The first two tiers of the drainage hierarchy ensure that surface water is retained within the site boundary and does not increase flood risk to others. This is always the most preferable method of surface water management.

6.10 The next six tiers of the hierarchy provide regional control, but with decreasing levels of pollution removal and reduced potential for amenity and habitat creation with each tier of the drainage hierarchy.

6.11 Within the lower six tiers of the drainage hierarchy, there must be some form of flow restriction, so that off-site surface water discharge resembles greenfield runoff rates, as much as is reasonably practicable. This requires on-site storage facilities, which may include ponds, swales, subsurface storage tanks and System C (non-infiltration) pervious pavements with flow control devices. Again, methods that provide the most potential for amenity and pollution removal should be favoured.

6.12 Each tier of the drainage hierarchy has been considered for the surface water drainage for the development site. In order of preference, the outcome of these considerations is below.

Tier 1 - Store rainwater for later use

6.13 The site has limited opportunities to use water reuse and recycling techniques. However, waterbutts could be considered.

Tier 2 - Use Infiltration techniques, such as porous surfaces in non-clay areas

6.14 As detailed in Chapter 2 infiltration techniques are not viable on site.

Tier 3 - Attenuate rainwater in ponds or open water features for gradual release

6.15 Ponds and open water features are SuDS features that offer surface water attenuation, pollution mitigation and amenity and biodiversity benefits.

The attenuation basin will cover an area of 811m^2 and will have an attenuation depth of 1.00m.

Tier 4 - Attenuate rainwater by storing in tanks or sealed water features for gradual release

6.16 Type C No Infiltration Pervious Pavements comprising of a 25mm pervious surface layer and 475mm type 3 subbase with 30% void ratio will provide around 1188m^3 attenuation storage. The pervious pavements will connect to the main drainage network via 150mm diameter piped outlets located at the low points of the pervious pavements to maximise the attenuation storage in the pervious pavement sub base during extreme rainfall events.

6.17 The proposed pervious pavement areas are characterised by gently sloping topography, whereby slopes with <5% grade are achievable, which is suitable for pervious pavements. The Interpave document Guide to the Design, Construction and Maintenance of Concrete Block Permeable Pavements edition 6 states 'Concrete block permeable pavements reduce the volume of rainfall that flows out from them significantly and the time it takes for the water to flow out is much longer than for conventional drainage systems. Studies reported in CIRIA report C 582 (CIRIA, 2001) have shown that some 11% to 45% of rainfall flows out from the pavement during a rainfall event. Subsequently over the 2 to 4 days after an event, more water flows out to give a total outfall of between 55% and 100%'. On this basis, it is concluded that the long-term storage volumes provided by the approximately 0.794 Ha area of proposed pervious pavements are likely to be more than what is indicated by the half drain times in the hydraulic calculations.

Tier 5 - Discharge rainwater direct to a watercourse

6.18 As discussed above, the drainage strategy in Appendix E of this report proposes a last Hydro-Brake flow control manhole close to the red line planning application boundary that will control discharge to 12.7 l/s for the 100 year + 40% climate change critical rainfall event to the ordinary watercourse issuing to the east northeast of site and flowing towards the Afon Llan Main River.

Tier 6 - Discharge rainwater to a surface water sewer/drain

6.19 This tier of the drainage hierarchy will not be needed for surface water discharge.

Tier 7 - Discharge rainwater to the combined sewer

6.20 This tier of the drainage hierarchy will not be needed for surface water discharge.

Tier 8 - Discharge rainwater to the foul sewer

6.21 This tier of the drainage hierarchy will not be needed for surface water discharge.

MicroDrainage Hydraulic Modelling

6.22 The drainage system outlined above has been tested in the MicroDrainage Source Control hydraulic modelling module.

6.23 The results of the MircoDrainage hydraulic modelling for the proposed development can be seen in Appendix F.

6.24 The total impermeable area in the hydraulic model is 1.905 ha.

6.25 The results of the hydraulic modelling show that the drainage strategy as outlined above can attenuate and discharge surface water generated in the 1 in 100-year + 40% rainfall event with no flooding. This manages flood risk on- and off-site and reduces overall local flood risk.

6.26 Therefore, this proposal is considered appropriate because the surface water drainage system manages flood risk on- and off-site and reduces overall local flood risk for the 1 in 100-year + 40% cc critical rainfall event.

7.0 Foul Water Drainage Strategy

Proposed Foul Water Drainage Strategy

7.1 During construction of the Development foul water will be disposed of via ‘Port-a-loo’ type facilities and disposed of via a licenced waste carrier.

7.2 During the operational phase the Development is to be primarily unmanned, with ad-hoc maintenance checks being the only time in which the Site will accommodate staff. As such there will be minimal foul water discharge from the site and no foul water drainage systems are deemed necessary other than ‘Port-a-loo’ type facilities with waste disposed of via a licenced waste carrier.

8.0 Surface Water Runoff Quality

8.1 The development should not have a detrimental impact on the environment, including the water environment.

8.2 The CIRIA SuDS Manual provides guidance on the treatment of surface water runoff. With regards to the proposed development, Table 4.3 of the CIRIA SuDS Manual rates the pollution hazard from roof water runoff as 'very low'. The only requirement for roof water runoff is the removal of gross solids and sediments, which would be achieved using catchpits and silt traps.

8.3 With regards to the proposed development site area, Table 4.3 of the CIRIA SuDS Manual rates the pollution hazard from roads and shared car parking as 'low'. To mitigate a 'low' pollution hazard, the CIRIA SuDS Manual recommends using a simple index approach in line with Section 26.7.1. This is discussed, below.

8.4 Table 26.2 of the CIRIA SuDS Manual provides pollution hazard indices for different land use classifications. The land use classifications that require consideration for the proposed development site are in Table 8.1 below.

Table 8.1: Excerpt from Table 26.2 of CIRIA SuDS Manual

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydro-Carbons
Individual property driveways, residential car parks, low traffic roads (e.g. cul-de-sacs, homezones and general access roads) with less than 300 traffic movements per day.	Low	0.5	0.4	0.4

8.5 To deliver adequate pollution treatment and mitigation, the CIRIA SuDS Manual recommends using a SuDS component that has a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index (for each contaminant type).

8.6 Table 26.3 of the CIRIA SuDS Manual provides indicative SuDS mitigation indices for each SuDS type when discharging to surface water. Table 8.2, below, which is an excerpt from Table 26.3, shows the mitigation indices for a detention basin, permeable pavement and swale.

Table 8.2: Pollution Mitigation Indices for a Detention Basin, Permeable Pavement and Swale

Type of pollution removal component	Total Suspended Solids (TSS)	Metals	Hydro-Carbons
Detention Basin	0.5	0.5	0.6
Permeable Pavement	0.7	0.6	0.7
Swale	0.5	0.6	0.6

8.7 The mitigation indices for a detention basin, permeable pavement and swale are the same or exceed those of the highest pollution hazard index figures from Table 8.1 for the low pollution hazard level.

8.8 The above evidence shows the proposed development site will provide sufficient pollution mitigation prior to discharge to surface water.

8.9 Lastly, a Purpose Designed Water Pollution Containment Device Chamber will be installed downstream of the last attenuation basin to contain site runoff such as fire water in an emergency.

9.0 Summary and Conclusion

9.1 Motion has been commissioned by Statkraft UK Ltd to undertake a FCA and prepare a Drainage Strategy to support a full planning application for a BESS to the east of the existing Swansea North substation, Morriston. The development proposals will comprise of energy storage equipment, along with associated infrastructure, landscaping and access.

9.2 The intrusive ground investigations carried out to the north of the site in May and June 2023 to inform the grid balancing equipment development indicate that infiltration SuDS will not be possible for the proposed development site on the basis water will not empty via infiltration.

9.3 The NRW Statutory Main River Map shows an ordinary watercourse issuing to the east northeast of site and flowing towards the Afon Llan Main River. Please see Figure 2.1. The topographical survey of the site in Appendix B also shows an ordinary watercourse along the northern boundary of the site. During a site visit undertaken in February 2024, the photograph in Figure 2.2 was taken that shows water flowing from this watercourse via a culvert under what is now the gravel vehicle access track from which the proposed development site area will be accessed. Lastly, also with reference to Figure 2.1, the NRW Statutory Main River Map also shows an ordinary watercourse that flows towards the southwest approximately 30m west of the proposed development site area.

9.4 The assessment of flood risk and consequence indicates the site is in an area at low risk from all sources of flooding both now and in the future. However, it is a requirement of this report that site levels remain as existing in the area of the site that interacts with the comparatively small Surface Water and Small Water Courses Flood Zone 2 Area to ensure surface water runoff remains as existing, and the surface of the proposed development site area should finish a minimum of 150mm below any buildings and equipment. It is also a requirement of this report that that the proposed development site layout is 7m from the ordinary watercourse top of bank.

9.5 As stated in Sections 2.1 and 2.2, the site is pasture land used for grazing livestock and the site is accessed by a gravel vehicle access track approved as part of SC planning application 2023/0889/FUL. On the basis the route of the gravel vehicle access track will continue to drain as shown in Appendix C, the proposed additional impermeable area will be the proposed development site, and the proposed development will increase the impermeable area of the site by 1.905 ha.

The attenuation basin will cover an area of 811m^2 and will have an attenuation depth of 1.00m.

9.6 Type C No Infiltration Pervious Pavements comprising of a 25mm pervious surface layer and 475mm type 3 subbase with 30% void ratio will provide around 1188m^3 attenuation storage. The pervious pavements will connect to the main drainage network via 150mm diameter piped outlets located at the low points of the pervious pavements to maximise the attenuation storage in the pervious pavement sub base during extreme rainfall events.

9.7 The proposed pervious pavement areas are characterised by gently sloping topography, whereby slopes with <5% grade are achievable, which is suitable for pervious pavements. The Interpave document Guide to the Design, Construction and Maintenance of Concrete Block Permeable Pavements edition 6 states 'Concrete block permeable pavements reduce the volume of rainfall that flows out from them significantly and the time it takes for the water to flow out is much longer than for conventional drainage systems. Studies reported in CIRIA report C 582 (CIRIA, 2001) have shown that some 11% to 45% of rainfall flows out from the pavement during a rainfall event. Subsequently over the 2 to 4 days after an event, more water flows out to give a total outfall of between 55% and 100%'. On this basis, it is concluded that the long-term storage volumes provided by the approximately 0.794 Ha area of proposed pervious pavements are likely to be more than what is indicated by the half drain times in the hydraulic calculations.

9.8 The drainage strategy in Appendix E of this report proposes a last Hydro-Brake flow control manhole close to the red line planning application boundary that will control discharge to 12.7 l/s for the 100 year

+ 40% climate change critical rainfall event to the ordinary watercourse issuing to the east northeast of site and flowing towards the Afon Llan Main River.

9.9 The results of the MicroDrainage Source Control hydraulic modelling show that the drainage strategy as outlined above can attenuate and discharge surface water generated in the 1 in 100-year + 40% rainfall event with no flooding. This manages flood risk on- and off-site and reduces overall local flood risk.

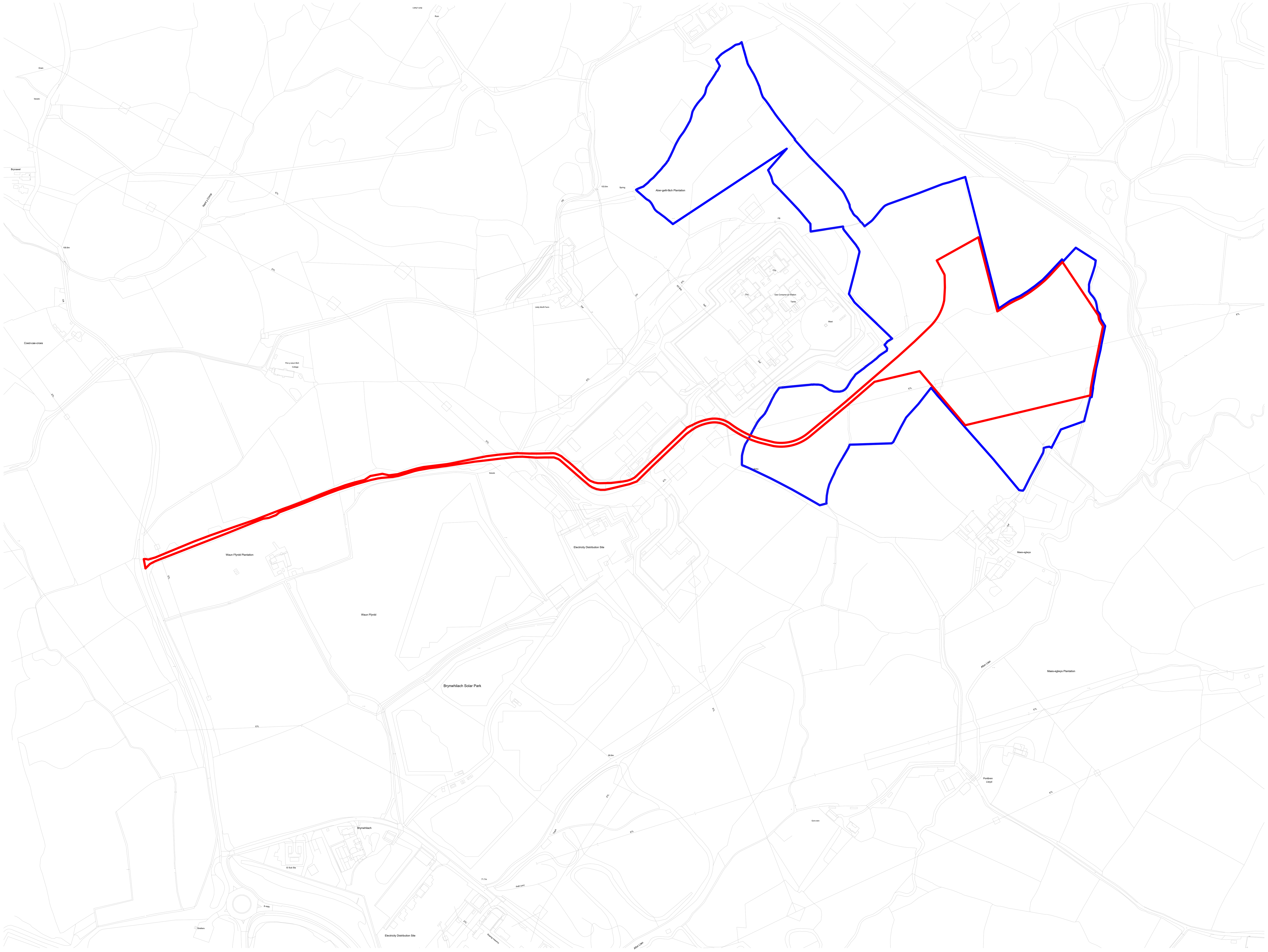
9.10 Section 7.0 shows how the proposed SuDS will provide sufficient pollution mitigation, prior to discharge to surface water, for the proposed development site area.

9.11 A Purpose Designed Water Pollution Containment Device Chamber will be installed downstream of the last attenuation basin to contain site runoff such as fire water in an emergency.

9.12 In conclusion, the site is within an area at low risk from all sources of flooding both now and in the future and the surface water drainage system can manage flooding for the 1 in 100-year + 40% cc critical rainfall event. As such, flood risk and surface water management should not form an impediment to the progress of the planning application for the proposed development.

Appendix A

Proposed Site Layout and Location Plans



Scale: 1: 2,500 Metres 0 50 100 150 200 250 300 350 400 450 500 550 600

Statkraft

LEGEND :

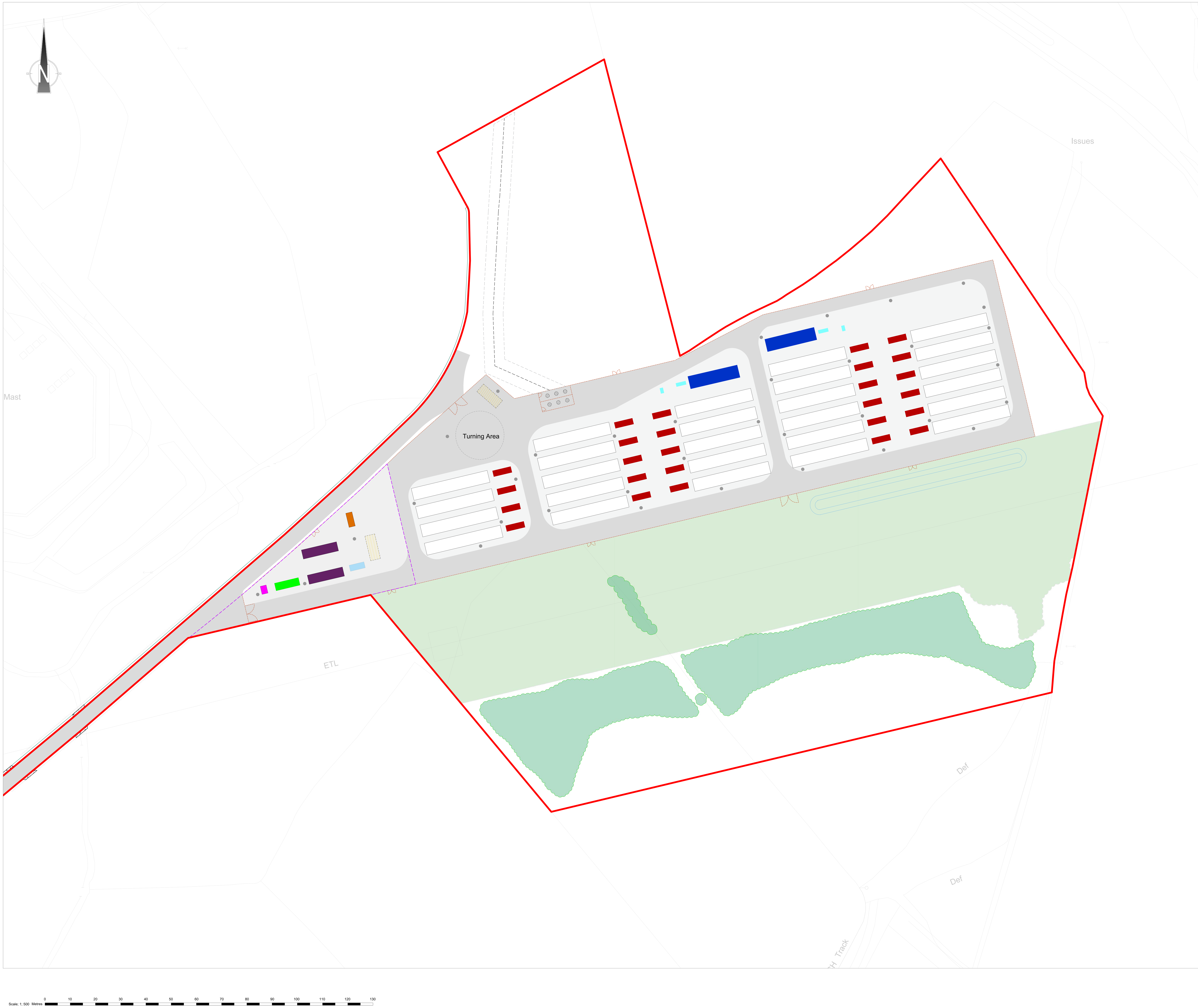
APPLICATION SITE BOUNDARY (6.4 ha)

LAND WITHIN THE CONTROL OF THE APPLICANT

Site Location Plan

Project Name: Swansea BESS

Scale: 1:2500	Page size: A0	Revision no. 01
Drawn by: RC	Check by: WK, JT	Date: 21/01/2025



Statkraft

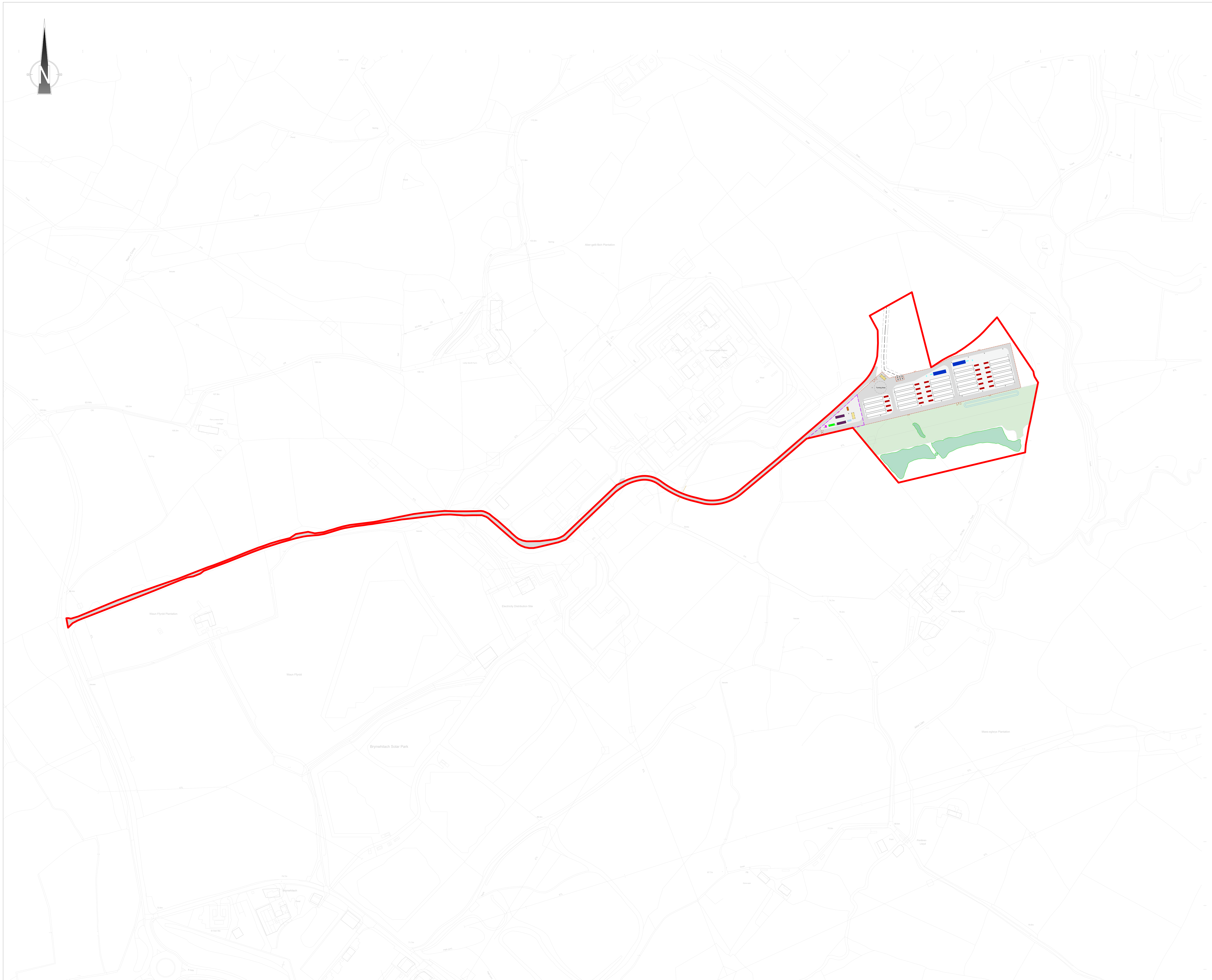
LEGEND (L x W x H m):

- APPLICATION SITE BOUNDARY (6.4 ha)
- BATTERIES CONTAINERS (29.3 x 2.15 x 2.6)
- INVERTER SKID (8.95 x 2.05 x 3.75)
- CONTROL CONTAINERS (12.20 x 2.5 x 2.6)
- AUXILARY KIT (3.9 x 1.4 x 2.5)
- OPERATIONS ROOM (14.1 x 3.7 x 5.55)
- STORES (6.0 x 2.4 x 2.6)
- WELFARE & OFFICE (9.75 x 3.05 x 2.75)
- AUX TRANSFORMER (3.3 x 2.4 x 2.5)
- DIESEL GENERATOR (6.2 x 3.1 x 3.5)
- ABOVE GROUND WATER TANKS (10.0 X 4 X 3)
- PROPOSED OPERATIONAL ACCESS
- INDICATIVE TREE & WOODLAND MIX (to be provided by TGP)
- INDICATIVE WILDFLOWER MIX (to be provided by TGP)
- AIR-CORED REACTORS (1.5 diameter)
- PERIMETER FENCE (3.4 H)
- SECURITY GATES (6.73 W x 3.4 H)
- PEDESTRIAN ACCESS GATES (3.0 W x 3.4 H)
- SUDs BASIN (to be provided by Motion)
- CABLE ROUTE & 4m BUFFER ZONE EITHER SIDE
- CONSTRUCTION COMPOUND
- LIGHTING COLUMNS (6.0 H)

Proposed Site Layout

Project Name: Swansea BESS

Scale: 1:500	Page size: A0	Revision no. 06
Drawn by: RC	Check by: MG	Date: 29/01/2025



Scale: 1: 2,000 Metres 0 50 100 150 200 250 300 350 400 450 500

Statkraft

LEGEND (L x W x H m):

- APPLICATION SITE BOUNDARY (6.4 ha)
- BATTERIES CONTAINERS (29.3 x 2.15 x 2.6)
- INVERTER SKID (8.95 x 2.05 x 3.75)
- CONTROL CONTAINERS (12.20 x 2.5 x 2.6)
- AUXILARY KIT (3.9 x 1.4 x 2.5)
- OPERATIONS ROOM (14.1 x 3.7 x 5.55)
- STORES (6.0 x 2.4 x 2.6)
- WELFARE & OFFICE (9.75 x 3.05 x 2.75)
- AUX TRANSFORMER (3.3 x 2.4 x 2.5)
- DIESEL GENERATOR (6.2 x 3.1 x 3.5)
- ABOVE GROUND WATER TANKS (10.0 X 4 X 3)
- PROPOSED OPERATIONAL ACCESS
- INDICATIVE TREE & WOODLAND MIX (to be provided by TGP)
- INDICATIVE WILDFLOWER MIX (to be provided by TGP)
- AIR-CORED REACTORS (1.5 diameter)
- PERIMETER FENCE (3.4 H)
- SECURITY GATES (6.73 W x 3.4 H)
- PEDESTRIAN ACCESS GATES (3.0 W x 3.4 H)
- SUDs BASIN (to be provided by Motion)
- CABLE ROUTE & 4m BUFFER ZONE EITHER SIDE
- CONSTRUCTION COMPOUND
- LIGHTING COLUMNS (6.0 H)

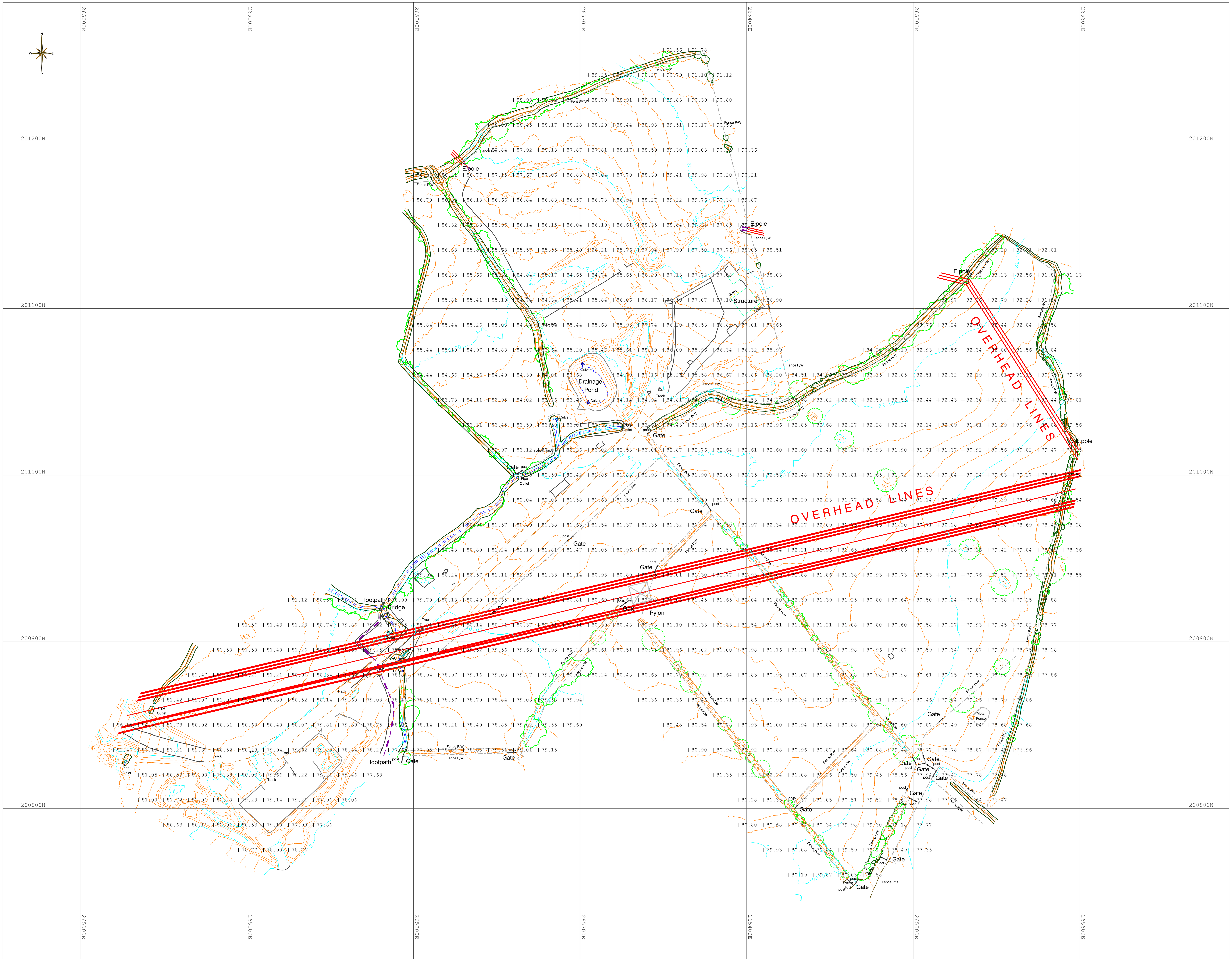
Proposed Site Layout

Project Name: Swansea BESS

Scale: 1:2000	Page size: A0	Revision no. 06
Drawn by: RC	Check by: MG	Date: 29/01/2025

Appendix B

Topographical Survey



LEGEND

Notes:

Survey related to "OS Net" using
real time correction with Trimble VRS Now.

Levels related to GPS Orthometric height,
converted to MSL (Newlyn) by OSGM02.

Every effort has been made to
identify all visible above
ground features. However, bare
in mind that at the time of
survey, some featues may have
been obscured.

Treat levels in Dense vegetation with caution.
Treat levels in water with caution.

Visible features detailed on
the survey may not represent
the legal ownership boundries.

Rev. Suffix	Date	Details

SITE

Swansea pt2

Felindre

SA5 7LU

TITLE

Topographical Survey

with 500mm Contour interval

and 15m Spot levels

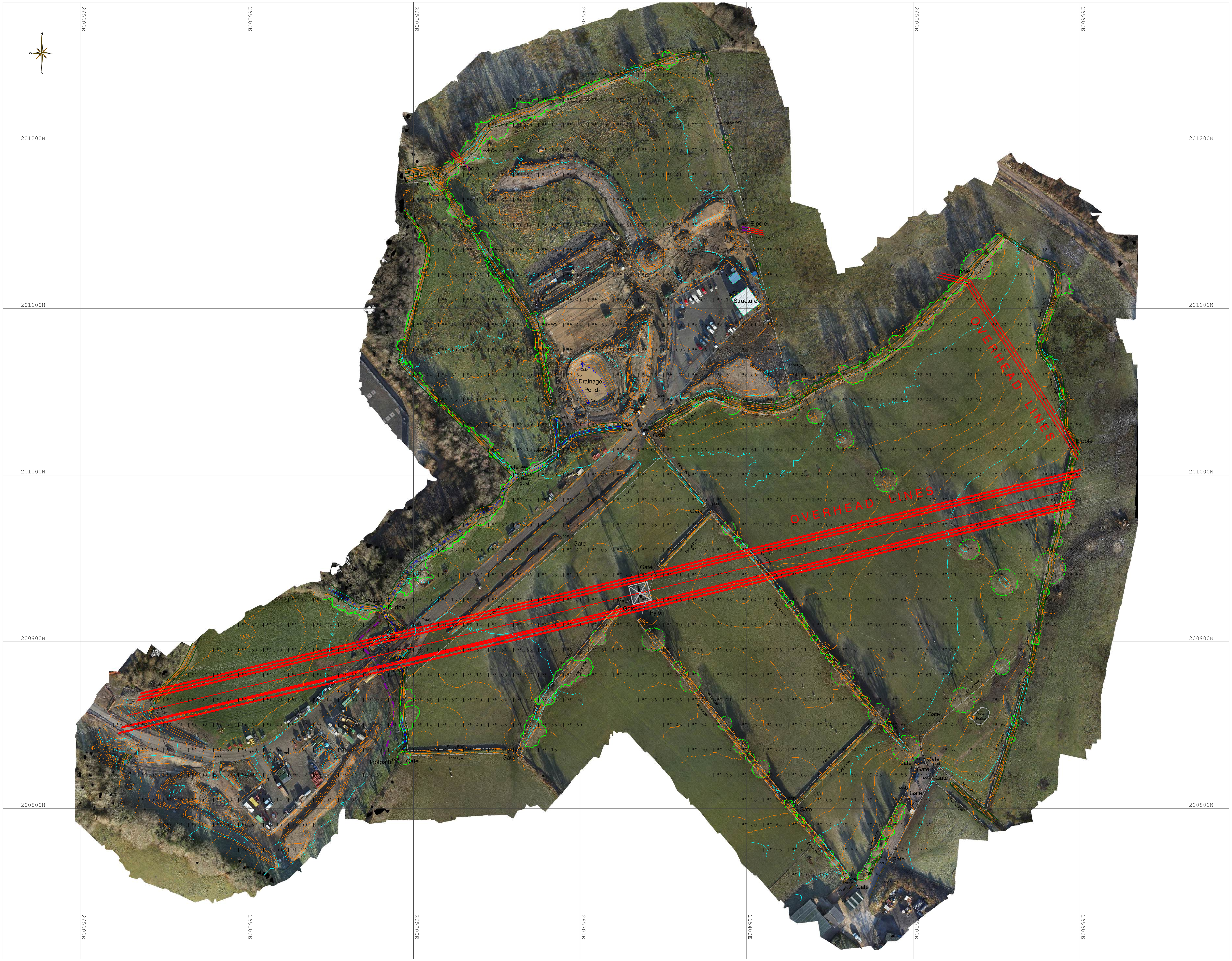
To OS Grid and Datum

DWG. No.	REV
Spt2/DWD/HV/002	

SCALE	DATE
1:1000-A1	09/01/25
DRAWN	**STATUS**
H.vaughan	Draft

AERIAL INSPECTION & MAPPING SURVEYS LTD

3 The Bridge Business Centre, Beresford Way, Chesterfield,
Derbyshire S41 9FG
Tel: 01246 268444



LEGEND

Approximate Water Level	Inspection Cover
Barrier	Interior Wall
Bench	Ladder
Bollards	Lamp Post
Bottom of Bank	Marker Post
Brick Path	Metal Fence
Bottom of Kerb	Paving Slab
Bridge	Pegoda
Building	Post
Catch Pit	Pylon
Channel	Ridge
Child Play Equipment	Ridge and Eave Heights ##.##
Chimney	Road Barrier
Cobbled Path	Road Marking
Column Base	Roof
Communication Tower	RSJ Column
Concrete Column	Ruins
Concrete Pole	Sign
Conductor Lines	Signal Light
Contours-Normal ##.##	Sill
Contours-Prominent ##.##	Spot Level ##.##
Conveyor Beam	Stay
Corrugated Sheet	Steel Column
Culvert	Steelwork
Door	Steps
Drain	Stockpile
Eaves	Stone Bollard
Edge of Concrete	Structure
Edge of Grass	Tank/Silo
Edge of Road	Top of Bank
Edge of Tarmac	Temporary Fence
Edge of Track	Top of Kerb
Edging strip	Tree
Electric Box	Tree Canopy
Electricity Pole	Tree Trunk
Fence Chain and Link	Vegetation
Fence Post and Board	Walkway
Fence Post and Panel	Wall
Fence Post and Wire	WC
Footpath	Well
Gate	Window
Gate opening	
Gulley	
Hedge	

Notes:

Survey related to "OS Net" using real time correction with Trimble VRS Now.

Levels related to GPS Orthometric height, converted to MSL (Newlyn) by OSGM02.

Every effort has been made to identify all visible above ground features. However, bare in mind that at the time of survey, some featues may have been obscured.

Treat levels in Dense vegetation with caution.
Treat levels in water with caution.

Visible features detailed on the survey may not represent the legal ownership boundries.

Rev. Suffix	Date	Details

SITE

Swansea pt2

Felindre

SA5 7LU

TITLE

Topographical Survey

with 500mm Contour interval

and 15m Spot levels

To OS Grid and Datum

DWG. No.	REV
Spt2/DWD/HV/001	

SCALE	DATE
1:1000-A1	09/01/25

DRAWN	STATUS
H.vaughan	Draft

AIMS
AERIAL INSPECTION & MAPPING SURVEYS LTD
3 The Bridge Business Centre, Beresford Way, Chesterfield, Derbyshire S41 9FG
Tel: 01246 268444

Appendix C

Gravel Vehicle Access Track V-Ditch Layout Approved as Part of SAB Application

DO NOT SCALE FROM THIS DRAWING. USE FIGURED DIMENSIONS IN ALL CASES. VERIFY DIMENSIONS ON SITE AND REPORT ANY DISCREPANCIES TO THE DESIGNERS IMMEDIATELY.
THIS DRAWING TO BE READ IN CONJUNCTION WITH THE DESIGNERS SPECIFICATION.

NOTE:

1. ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL RELEVANT SPECIFICATIONS, BILLS OF QUANTITIES, ARCHITECTURAL, SERVICES AND ENGINEERING DRAWINGS.
2. ALL LEVELS ARE IN METRES RELATED TO ORDNANCE DATUM NEWLYN.
3. ANY DISCREPANCIES BETWEEN THESE DRAWINGS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER.
4. DRAWINGS ARE NOT TO BE SCALED.
5. ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS NOTED OTHERWISE.
6. DRAWINGS TO BE READ IN CONJUNCTION WITH THE EARTHWORKS SPECIFICATION GB1044-MWP-XX-XX-RP-C-6001 AND DRAINAGE DRAWINGS.

LEGEND

- PLANNING APPLICATION BOUNDARY
- LAND OWNERSHIP LINE
- SECURITY FENCE
- STOCK FENCE
- TIMBER POSTS WITH REFLECTORS AT 10m C/C
- SINGLE LEVEL ARMCO BARRIERS
- 900mm x 900mm FRENCH DRAIN WITH PERFORATED DRAINAGE PIPE
- 600mm DIAMETER CULVERT. SEPARATE DUCTS FOR ANIMALS TO BE ADVISED BY OTHERS FOR ECOLOGICAL PURPOSES.
- PROPOSED ACCESS ROAD
- CELLPAVE 50
- PROPOSED COMPOUND
- PROPOSED VERGE
- FILL SLOPE 2:1
- CUT SLOPE 2:1
- TEMPORARY ACCESS ROAD
- RIPARIAN BUFFER (7m)
- PROPOSED 1200m x 600mm DRAINAGE DITCH

REV	DATE	DESCRIPTION	BY	APP
P01	22.05.2024	ISSUED FOR INFORMATION	PB	PB

PROJECT:
SWANSEA GREENER GRID PARK

TITLE:
V-DITCH LAYOUT

CLIENT:
H&MV ENGINEERING
High Voltage Specialists

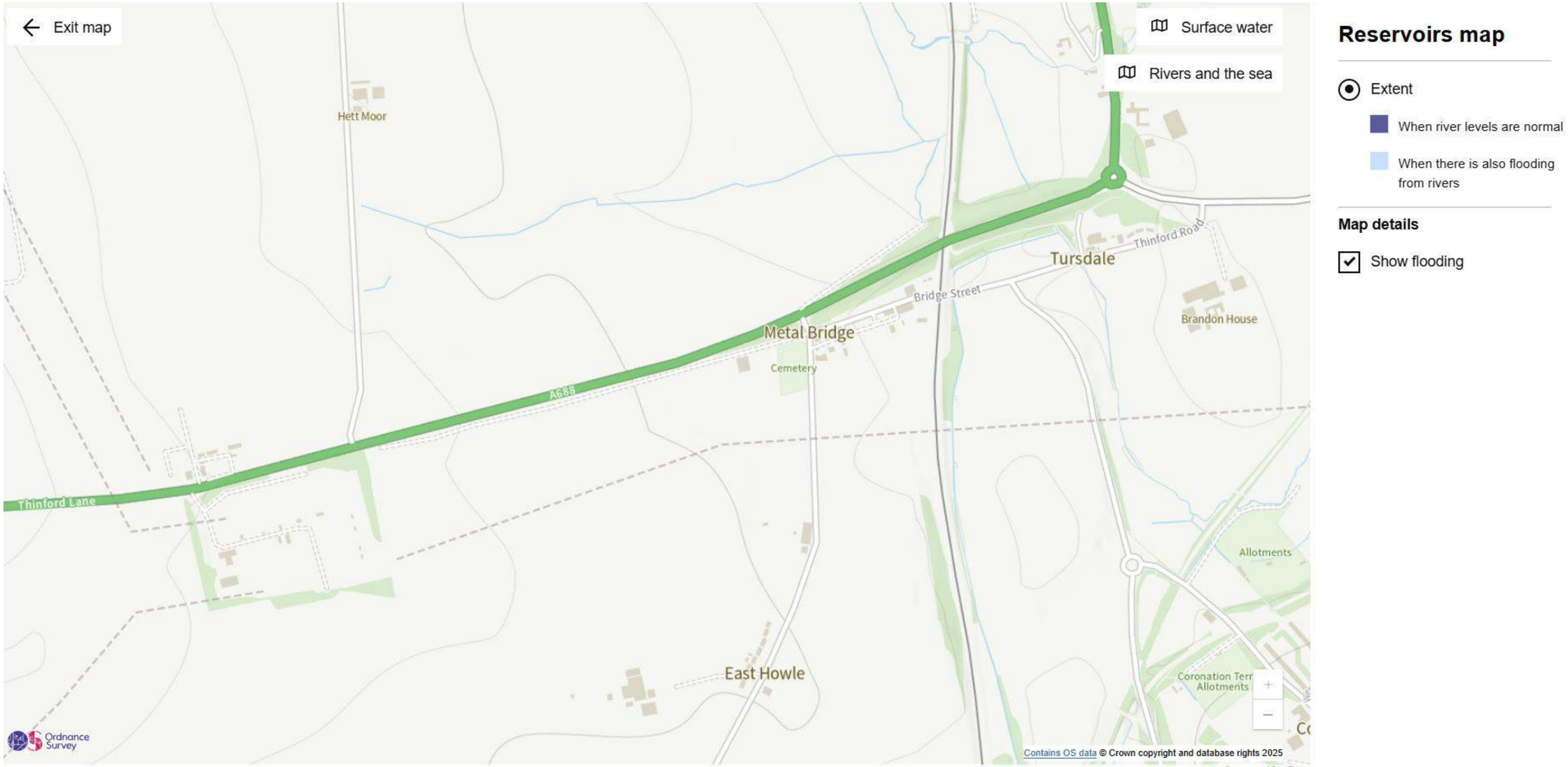
MWP
ENGINEERING AND ENVIRONMENTAL CONSULTANTS
CORK | TRALEE | LONDON | LIMERICK
mwp.ie

DRAWN:	CHECKED:	APPROVED:
P.V.	P.B.	P.B.
PROJECT NUMBER: 24333	DATE: MAY 2024	SCALE @ A1: 1:1000

STATUS DESCRIPTION: FOR INFORMATION
STATUS: S2

DRAWING NUMBER: GB1044 - MWP -XX-XX-DR-C-0410
REV: P01

Reservoir Flooding



Surface Water Flood Risk (Depth)

Surface Water Flood Risk (Depth)

Surface water map

Yearly chance of flooding

- Extent
- Depth

Yearly chance of flooding between 2040 and 2060

- Extent
- Depth (selected)

High chance
More than 3.3% chance each year

Medium chance
Between 1% and 3.3% chance each year

Low chance
Between 0.1% and 1% chance each year

Very low chance
Less than 0.1% chance each year

Map details

- [x] Show flooding

Appendix D

Greenfield Runoff Calculation

FEH Mean Annual Flood

Input

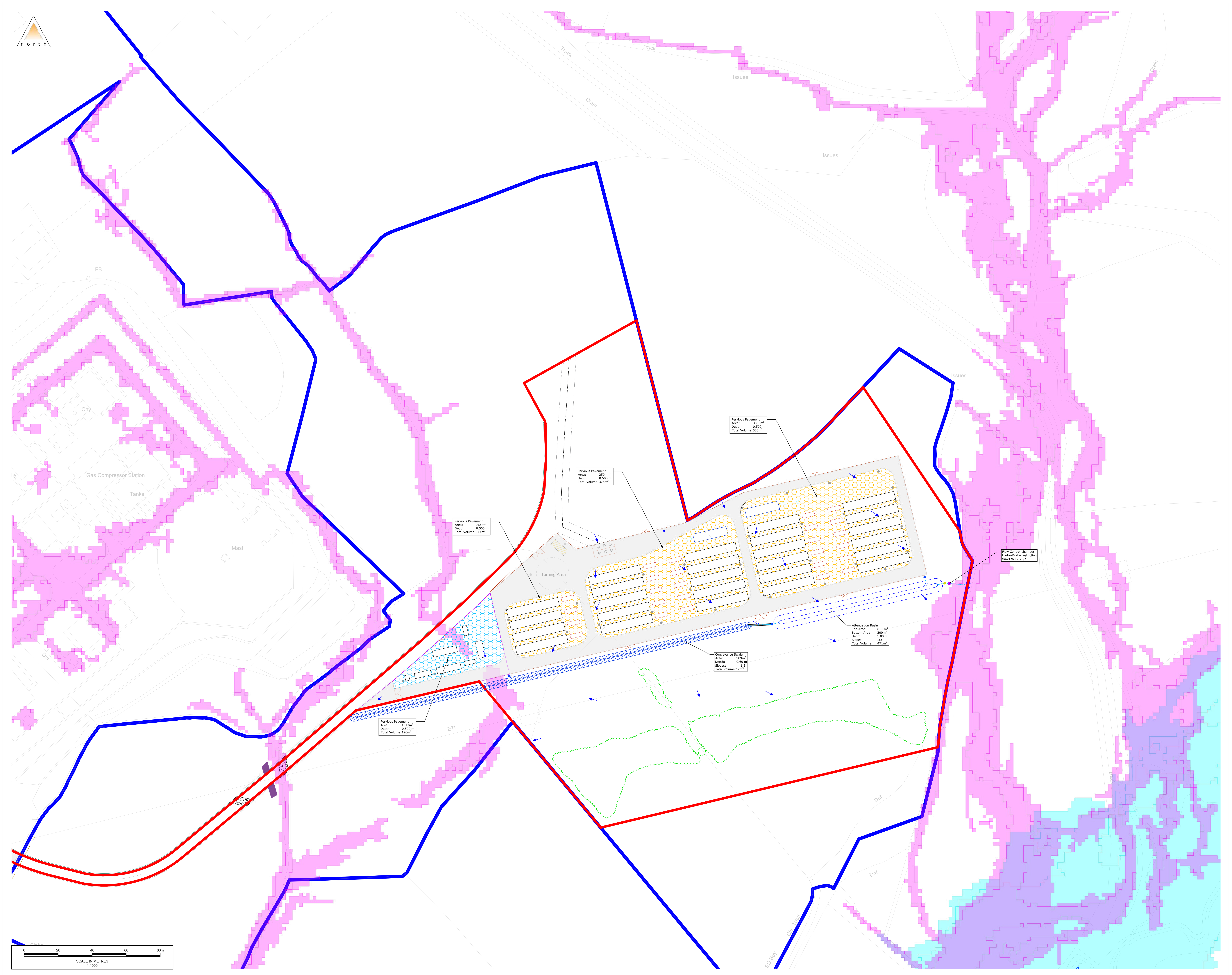
QMED Method	2008	SAAR (mm)	1446	BFIHOST	0.440
Site Location	GB 474700 227450 SP 74700 27450	URBEXT (2000)	0.0000	FARL	1.000
Area (ha)	89.375	SPRHOST	45.140		

Results

QMED Rural (l/s) 1138.5 QMED Urban (l/s) 1138.5

Appendix E

Proposed Drainage Strategy



Notes

1. All levels and dimensions are to be checked on site before any work commences. All dimensions are in metres unless stated otherwise.
2. Any discrepancies shall be reported to the engineer immediately, so that clarification can be sought prior to the commencement of works.
3. This drawing shall be read in conjunction with all other relevant engineering details, drawings and specification.
4. The contractor is to keep a record of any variations made on site, including the relocation of sewers or drains, for their "as built" drawings to be prepared upon project completion.
5. All works to adopted systems are to be carried out in accordance with Sewerage Sector Guidance Appendix C, Approved Version 2.1, 25 May 2021. All works to private drainage systems are to be in accordance with the Building Regulations Approved Document Part "H" 2015 edition.
6. 900mm min cover to be provided for private pipes laid beneath agricultural land and public open space unless not practicable. 1200mm min cover to be provided for highways and parking areas with unrestricted access to vehicles with a gross vehicle weight in excess of 7.5 tonnes unless not practicable. Where unachievable, shallow private drains may require protection using concrete surround or paving slabs bridging the trench, subject to the NHBC inspector's requirements.
7. All pipes shall be laid soffit to soffit with outgoing pipes unless otherwise stated.
8. Manholes situated within areas accessible to motor vehicles are to be fitted with suitable strength covers and frames. Please refer to the manhole schedule for guidance on this.
9. This drawing has been based upon survey information supplied by AIMS and Motion cannot guarantee the accuracy of the data provided.
10. Adjacent areas of hardstanding will comply with building regulations and divert water away from the buildings.
11. The top surface of the pervious pavement should finish at least 150mm below any adjoining DPC level. Advice should always be sought from the manufacturer.
12. The surface of the proposed main development site should finish minimum of 150mm below any buildings and equipment.
13. The Drainage Strategy is based on preliminary levels and is subject to detailed design.
14. The exact location of all private rainwater pipes are to be confirmed with the architect details prior to commencement of works.
15. Check Dams may be required for the pervious pavement sub-bases to maximise attenuation. Spacing and construction details to be provided at the detailed design stage.
16. The Type C no infiltration pervious pavement sub-base will drain to underlying surface water perforated collector pipes or diffuser units. Construction details are to be provided at the detailed design stage.
17. A Purpose Designed Water Pollution Containment Device Chamber will be installed downstream of the last attenuation basin to contain site runoff such as fire water in an emergency.

Legend

- Planning Site Boundary
- Proposed Type C No Infiltration Pervious Pavement
- Proposed Type C No Infiltration Pervious Pavement Lined with Impermeable Separating Geomembrane at the Sides and Base
- New Surface Water Gravity Pipe
- New Surface Water Catchpit Chamber
- New Surface Water Linear Drainage with Sump Unit
- Exceedance flow route
- MH1 — MicroDrainage MH No.
- Proposed Attenuation Basin
- New Surface Water Hydro-Brake Flow Control Chamber - Refer to MicroDrainage Calculations for 100 + 40% climate change critical flow rate
- Proposed Headwall
- Indicative Extent of Natural Resources Wales Flood Map For Planning Rivers Flood Zone 2 - chance of flooding in any year of between 1 in 100 and 1 in 1000 extent - Last Updated 28 November 2024)
- Indicative Extent of Natural Resources Wales Flood Map For Planning Surface Water and Small Watercourse Flood Zone 2 - chance of flooding in any year of between 1 in 100 and 1 in 1000 extent - Last Updated 28 November 2024)
- New Purpose Designed Water Pollution Containment Device Chamber
- Proposed Conveyance Swale
- Protection using concrete surround or paving slabs bridging the trench, subject to the NHBC inspector's requirements

Rev.	Description	Drn	Chk	App	Date
P02	Second Issue	ST	CG	JM	13/02/2025
P01	First Issue	ST	ST	JM	04/02/2025

Drawing Status:

DRAFT
NOT FOR CONSTRUCTION

motion
Guildford - Reading - London
www.motion.co.uk

Client: Statkraft

Project: Swansea North Battery Energy Storage System

Title: Proposed Drainage Strategy

Scale: 1:1000 (@ A1)

Drawing: 2303083-0500-01

Revision: P02

Appendix F

MicroDrainage Model Results

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 984 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.558	0.558	0.0	12.7	12.7	325.8	O K
30 min Summer	0.613	0.613	0.0	12.7	12.7	483.6	O K
60 min Summer	0.678	0.678	0.0	12.7	12.7	675.3	O K
120 min Summer	0.727	0.727	0.0	12.7	12.7	821.7	Flood Risk
180 min Summer	0.759	0.759	0.0	12.7	12.7	916.5	Flood Risk
240 min Summer	0.781	0.781	0.0	12.7	12.7	983.7	Flood Risk
360 min Summer	0.808	0.808	0.0	12.7	12.7	1067.3	Flood Risk
480 min Summer	0.824	0.824	0.0	12.7	12.7	1116.6	Flood Risk
600 min Summer	0.834	0.834	0.0	12.7	12.7	1145.3	Flood Risk
720 min Summer	0.838	0.838	0.0	12.7	12.7	1160.3	Flood Risk
960 min Summer	0.842	0.842	0.0	12.7	12.7	1170.0	Flood Risk
1440 min Summer	0.840	0.840	0.0	12.7	12.7	1165.9	Flood Risk
2160 min Summer	0.828	0.828	0.0	12.7	12.7	1129.2	Flood Risk
2880 min Summer	0.813	0.813	0.0	12.7	12.7	1081.2	Flood Risk
4320 min Summer	0.776	0.776	0.0	12.7	12.7	969.3	Flood Risk
5760 min Summer	0.743	0.743	0.0	12.7	12.7	868.1	Flood Risk
15 min Winter	0.574	0.574	0.0	12.7	12.7	371.1	O K
30 min Winter	0.635	0.635	0.0	12.7	12.7	548.8	O K
60 min Winter	0.709	0.709	0.0	12.7	12.7	765.6	Flood Risk
120 min Winter	0.764	0.764	0.0	12.7	12.7	933.4	Flood Risk
180 min Winter	0.801	0.801	0.0	12.7	12.7	1044.0	Flood Risk
240 min Winter	0.827	0.827	0.0	12.7	12.7	1123.9	Flood Risk
360 min Winter	0.860	0.860	0.0	12.7	12.7	1227.0	Flood Risk
480 min Winter	0.881	0.881	0.0	12.7	12.7	1291.8	Flood Risk
600 min Winter	0.894	0.894	0.0	12.7	12.7	1333.7	Flood Risk
720 min Winter	0.903	0.903	0.0	12.7	12.7	1360.3	Flood Risk
960 min Winter	0.910	0.910	0.0	12.7	12.7	1384.0	Flood Risk
1440 min Winter	0.906	0.906	0.0	12.7	12.7	1369.7	Flood Risk
2160 min Winter	0.888	0.888	0.0	12.7	12.7	1314.0	Flood Risk
2880 min Winter	0.863	0.863	0.0	12.7	12.7	1235.8	Flood Risk
4320 min Winter	0.804	0.804	0.0	12.7	12.7	1052.7	Flood Risk
5760 min Winter	0.747	0.747	0.0	12.7	12.7	882.3	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	106.008	0.0	337.7	26
30 min Summer	76.160	0.0	502.6	41
60 min Summer	52.668	0.0	711.3	70
120 min Summer	32.683	0.0	891.6	128
180 min Summer	24.864	0.0	1022.4	188
240 min Summer	20.489	0.0	1126.5	246
360 min Summer	15.533	0.0	1285.0	364
480 min Summer	12.763	0.0	1410.0	484
600 min Summer	10.958	0.0	1514.6	602
720 min Summer	9.674	0.0	1605.2	720
960 min Summer	7.948	0.0	1757.9	854
1440 min Summer	6.007	0.0	1870.8	1114
2160 min Summer	4.494	0.0	2236.0	1516
2880 min Summer	3.650	0.0	2415.6	1936
4320 min Summer	2.715	0.0	2681.2	2768
5760 min Summer	2.221	0.0	2912.0	3576
15 min Winter	106.008	0.0	383.1	26
30 min Winter	76.160	0.0	567.7	40
60 min Winter	52.668	0.0	801.6	70
120 min Winter	32.683	0.0	1003.6	126
180 min Winter	24.864	0.0	1150.2	184
240 min Winter	20.489	0.0	1266.9	242
360 min Winter	15.533	0.0	1444.5	358
480 min Winter	12.763	0.0	1584.6	474
600 min Winter	10.958	0.0	1701.5	586
720 min Winter	9.674	0.0	1802.4	698
960 min Winter	7.948	0.0	1944.5	916
1440 min Winter	6.007	0.0	1895.4	1174
2160 min Winter	4.494	0.0	2513.3	1628
2880 min Winter	3.650	0.0	2715.9	2104
4320 min Winter	2.715	0.0	3016.0	2992
5760 min Winter	2.221	0.0	3277.7	3864

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 265650 201000 SN 65650 01000	Shortest Storm (mins)	15
Data Type	Catchment	Longest Storm (mins)	5760
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.905

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.635	4	8	0.635	8	12	0.635

Model Details

Storage is Online Cover Level (m) 1.000

Complex Structure

Tank or Pond

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	200.0	1.000	811.0

Swale

Infiltration Coefficient Base (m/hr)	0.00000	Invert Level (m)	0.400	Slope (1:X)	40.0
Infiltration Coefficient Side (m/hr)	0.00000	Base Width (m)	0.5	Cap Volume Depth (m)	0.000
Safety Factor	2.0	Length (m)	288.0	Cap Infiltration Depth (m)	0.000
Porosity	1.00	Side Slope (1:X)	3.0		

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	0.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	0.500	Depression Storage (mm)	5
Max Percolation (l/s)	2200.3	Width (m)	89.0	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	89.0	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0162-1270-1000-1270	Sump Available	Yes
Design Head (m)	1.000	Diameter (mm)	162
Design Flow (l/s)	12.7	Invert Level (m)	0.000
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	225
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	12.7	Kick-Flo®	0.692	10.7
Flush-Flo™	0.315	12.7	Mean Flow over Head Range	-	10.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.8	0.600	11.8	1.600	15.8	2.600	20.0	5.000	27.3	7.500	33.2
0.200	12.2	0.800	11.4	1.800	16.8	3.000	21.4	5.500	28.6	8.000	34.3
0.300	12.7	1.000	12.7	2.000	17.6	3.500	23.0	6.000	29.8	8.500	35.3
0.400	12.6	1.200	13.8	2.200	18.4	4.000	24.5	6.500	31.0	9.000	36.3
0.500	12.3	1.400	14.9	2.400	19.2	4.500	26.0	7.000	32.1	9.500	37.3