

FLOOD CONSEQUENCE ASSESSMENT

GOLDBOROUGH ROAD BATTERY ENERGY STORAGE SYSTEM
LAND SOUTH OF GOLDBOROUGH ROAD, HUNDLETON, PRMBROKE, NEAR SA71 5SH
P16-01-FCA FEBRUARY 2024

REPORT

Quality Management

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1 SCOPE OF WORK

1.1 Background

1.1.1 At the request of Pembroke Green Limited, RPS Consulting Services Ltd (RPS) has prepared a site-specific Flood Consequence Assessment (FCA) and Sustainable Drainage Strategy for a site on land south of Goldborough Road, Hundleton, Pembroke, SA71 5SH, in relation to the proposed development of a Battery Energy Storage System (BESS) and associated Cable Route Corridor that terminates at Pembroke Substation. The key objectives of the FCA are:

- To assess the flood risk to the Proposed Development and to demonstrate the feasibility of appropriately designing the development such that any residual flood risk to the development would be acceptable;
- To assess the potential impact of the Proposed Development on flood risk elsewhere and to demonstrate the feasibility of appropriately designing the development such that the development would not increase surface water on Site or elsewhere; and
- To assess potential drainage strategies to minimise flood risk and surface water flooding due to the implementation of the proposed development.

1.2 Project Scope

1.2.1 The report has been produced in accordance with the guidance detailed in Planning Policy Wales and Technical Advice Note 15 (TAN15): Development and Flood Risk. Reference has also been made to local flood risk documents and provides an outline of the potential flood risk and hydrological constraints to the site.

1.3 Limitations

1.3.1 The report is based on publicly available hydrological and flood risk data extracted from the National Resources Wales website (Lle A Geo-Portal for Wales). The report, therefore, provides a desktop assessment of information available and is up to date at the time of report issue.

2 SOURCES OF INFORMATION

2.1 Introduction

2.1.1 Information sources consulted during preparation of this report are listed in Table 1 below.

2.1.2 Table 1 below lists the reports consulted during the preparation of this report.

Table 1. Reports consulted during preparation of the document

Reports Consulted		
Source	Data	Information consulted/provided
Pembrokeshire County Council	Local Development Plan (2013)	The document outlines local planning policies.
Pembrokeshire County Council	Preliminary Flood Risk Report (2011)	The document identifies areas where there is significant flood risk from local sources.
Pembrokeshire County Council and Carmarthenshire County Council	Strategic Flood Consequence Assessment (2019)	The document identifies flood risk and sources at borough scale.
Pembrokeshire County Council	Local Flood Risk Management Strategy (2015)	The document identifies sources of flooding and mitigation measures to reduce their impact.
Pembrokeshire County Council	Surface Water Flooding Report	The document assesses the risk of surface water flooding within Pembroke

2.2 Legislation and Guidance

Planning Policy Wales Edition 11, 2021

2.2.1 Planning Policy Wales Edition 11 sets out the land use planning policies of the Welsh Government. Chapter 13 'Minimising and Managing Environmental Risk and Pollution' outlines the Welsh Government's objectives in terms of addressing flood risk.

2.2.2 Section 13.4 of Planning Policy Wales states:

"Development proposals in areas designed as being of high flood hazard should only be considered where:

New development can be justified in that location, even though it is likely to be at risk from flooding; and

The development proposal would not result in the intensification of existing development which may itself be at risk; and

New development would not increase the potential adverse impacts of a flood event."

2.2.3 Planning Policy Wales is supplemented by a series of Technical Advice Notes (TAN). TAN15 provides technical guidance on development and flood risk.

Technical Advice Note (TAN) 15: Development and Flood Risk

- 2.2.4 TAN 15 provides technical guidance to supplement the policy set out within Planning Policy Wales in relation to development and flooding. The guidance relates to sustainability principles and provides a framework to allow risks arising from river flooding, coastal flooding and additional run off from developments to be assessed.
- 2.2.5 In relation to flood risk, TAN 15 indicates that the Assembly has a duty to ensure that development is sustainable and does not create problems for future generations. Managing flooding has an important role to ensure sustainable development by: guiding developments to locations with little or no risk from river, tidal or coastal flooding, managing consequences of flooding where developments can be justified and making provision for climate change.
- 2.2.6 TAN 15 confirms that each planning authority in Wales must prepare a Development Plan for its area. The development plans provide locational guidance for development, detailed site-specific policies, and identification of proposals for development. Catchment Flood Management Plans aim to take a holistic approach to flood management at a catchment scale and can provide guidance on managing risk to future developments. The information provided in local development plans and catchment flood management plans will aid with the application of the Justification Test.

Requirements of TAN 15

- 2.2.7 A Flood Consequence Assessment, to support a development application, should be proportionate to the risk and appropriate to the scale, nature and location of the development. The following will need to be considered;
- The consequences of flooding on the development, the consequences of the development on flood risk elsewhere and if appropriate mitigation measures can be incorporated into the design.
 - Mechanisms of flooding, including sources of floodwater, how floodwater enters and flows across a site, height, and speed of floodwaters.
 - Uncertainties in estimating flood events including use of historical records and forecasting.
 - Security of Proposed Developments over their lifetime and ensuring those using the development have an awareness of the potential risks from flooding.
 - Description of consequences under a range of extreme events including: mechanisms, sources, depths, speed, rate of rise, overland flood routes, velocity, access and egress, impacts on natural heritage, impact on flood risk in surrounding areas.
 - Structural adequacy of defences to contain flows and withstand overtopping and if required the suitability of implementing a buffer zone adjacent to defences.
 - Measures required to ensure flooding is managed to acceptable levels and ensure that the impact upon flood risk elsewhere in the flood plain is managed.

TAN15 updates

- 2.2.8 Updates to TAN15 will come in to force in 2024. These include updated modelling to incorporate the risk of climate change in Fluvial/Tidal Flood Zones. As well as the addition of Surface Water and Small Watercourses Flood Zones which also incorporate climate change.
- 2.2.9 This update takes precedent over current guidance as it provides more recent modelling, and the guidance will be in force following completion of the development. Therefore, although current guidance is referenced the updated guidance has been followed within this report.

2.3 Local Planning Policy

Pembrokeshire Local Development Plan

- 2.3.1 The Pembrokeshire Local Development Plan (up to 2021) was adopted in 2013, it contains the following Policies relating to flood risk and drainage:

Policy SP11 – Waste

- 2.3.2 Site allocations have taken into account deliverability and have been informed by Dwr Cymru Welsh Water and Environment Agency advice on infrastructure, water resources, surface water drainage and flood risk, to ensure that development is directed to settlements where capacity is available or is likely to be made available in the Plan period with some allocations phased to take account of current infrastructure constraints. [...]

Policy GN.2- Sustainable Design

- 2.3.3 Where there are concerns that a proposal would cause harm to health and safety through contamination, adverse impact on air quality, land instability, flooding or erosion, professional advice will be sought from the relevant authority. Where such concerns relate to fluvial or coastal flooding and / or erosion, the provisions of the relevant Shoreline Management Plan and / or Catchment Flood Management Plan will inform consideration of the health and safety issues.
- 2.3.4 Designs will need to incorporate responses to the likely impact of climate change in relation to increased temperatures via natural shading, cooling and ventilation and the implications of storms and flooding.
- 2.3.5 New development proposals will be expected to incorporate sustainable drainage systems and, where appropriate, the use of recycled construction materials, including secondary aggregates.

Policy GN.3 - Infrastructure and New Development

- 2.3.6 Requirements for contributions could include affordable housing, transportation, physical infrastructure, flood alleviation schemes, Sustainable Drainage Systems (SuDS)
- 2.3.7 This policy allows for the relocation of critical infrastructure, such as roads, electricity substations, pumping stations and waste water treatment facilities, as an exception, where this is either adversely affected by fluvial or coastal flooding and / or erosion or identified as extremely vulnerable in the relevant plan.

Preliminary Flood Risk Report

- 2.3.8 A Preliminary Flood Risk Report (PFRR) was produced in 2011 for Pembrokeshire County Council. The PFRR is aimed at providing high level overview of flood risk from all sources of flooding within the local area, including consideration of surface water, groundwater and ordinary watercourses. Relevant information has been referenced throughout this report.

Local Flood Risk Management Strategy

- 2.3.9 A Local Flood Risk Management Strategy (LFRMS) was produced in 2015 by Pembrokeshire County Council as the Lead Local Flood Authority (LLFA). The LFRMS aims to understand the risks of various flooding sources that the local area may face, take proactive steps to mitigate these risks.

raise awareness across communities and prepare for any such event. Local flood risk is any flood risk that derives from surface runoff, groundwater, or ordinary watercourses. Relevant information has been referenced throughout this report.

Strategic Flood Consequence Assessment

- 2.3.10 The Pembrokeshire County Council and Carmarthenshire County Council SFCA (2019) identifies and maps flood risk from all sources at a borough-wide scale as well as providing guidance on producing site specific FRAs. Relevant information from the SFCA has been referenced throughout this FCA report.

Assessment of Surface Water Flooding

- 2.3.11 The Assessment of Surface Water Flooding Report to support the Local Development Plan was adopted in 2021. This report assesses the risk of surface water flooding within Pembrokeshire and identifies options to manage risk to acceptable level. Any relevant information from the report has been reproduced throughout this FCA report.

2.4 Climate Change

- 2.4.1 TAN15 states that when considering new development proposals, it is necessary to take account of the potential impact of climate change over the lifetime of development. Battery Energy Storage System (BESS) developments are assumed to have a lifetime of 40 years. To ensure future development can provide a safe and secure living and /or working environment throughout its lifetime, national planning policy requires proposals in areas of high flood risk to be accompanied by an assessment of flooding consequences to and from the development, taking into account the impacts of climate change.
- 2.4.2 In line with TAN15, the climate change allowances have been informed by latest available information on climate change projections and different scenarios of carbon dioxide (CO₂) emissions to the atmosphere. Allowances are provided for different epochs (periods) of time over the next century. This guidance will be reviewed when more up-to-date climate change research is available.
- 2.4.3 Both the central and upper end allowances should be assessed to understand the range of impact. As a minimum, proposals should be assessed against the central allowance to inform design levels. It is recommended that the 2080s changes are used when considering any time beyond 2115.

Table 2 below presents the anticipated increase in peak river flows for the Western Wales River Basin, and

- 2.4.4 Table 3 presents the expected change to Extreme Rainfall Intensity. The climate change allowances are based on UKCP09 and emerging UKCP18 research data.

Table 2. Peak River Flow Allowances by River Basin District (use 1961 to 1990 baseline)

River Basin District	Allowance Category	Total potential change anticipated for '2020s' 2015-2039)	Total potential change anticipated for '2050s' (2040-2069)	Total potential change anticipated for the '2080s' (2070-2115)
West Wales	Upper Estimate	25%	40%	75%
	Central Estimate	15%	25%	30%

Table 3. Change to Extreme Rainfall Intensity Compared to a 1961-90 Baseline

Change to Extreme Rainfall Intensity			
Applies across all of Wales	Total potential change anticipated for '2020s' (2015- 2039)	Total potential change anticipated for '2050s' (2040- 2069)	Total potential change anticipated for the '2080s' (2070-2115)
Upper Estimate	10%	20%	40%
Central Estimate	5%	10%	20%

- 2.4.5 The Guidance recommends that the climate estimate, or change factor, for the 2080s for the relevant river basin district and peak rainfall intensity should be used to assess the potential impact of climate change as part of a flood consequence assessment.
- 2.4.6 Climate change allowances are also used within drainage strategy calculations. Drainage systems should be designed so there is no increase in site runoff when assessed against the upper estimate. As such, a 40% climate change uplift is to be incorporated within drainage strategy calculations.
- 2.4.7 The allowances are consistent with the A1B (medium) emissions scenario derived from latest research projects and converted into regionalised data of climate change on flood flows for the 2020s, 2050s and 2080s time-horizon, and for the B1 (low) and A1F1 (high) emissions scenarios for the 2080s time-horizon.

Sea Level Allowances

- 2.4.8 The science behind climate change projections for sea level rise has changed substantially in recent years. The guidance was updated in September 2021 to reflect the higher central allowance (70th percentile) and upper end allowance (95th percentile) of RCP28.5. This reflects an increase in global mean surface temperature of around 4.30C) by 2100.
- 2.4.9 Table 4 displays the estimates of cumulative uplift for sea level rise for Pembrokeshire local authority area to 2100 and 2120 (to reflect the 100yr lifetime of development for residential development). The allowances are derived using the UKCP18 2100 dataset.

Table 4. Estimated mean sea level rise (in metres)

Pembrokeshire	Allowance Percentile	Mean sea level rise (metres) by 2100 (UKCP18 baseline 1981-2000)	Mean sea level rise (metres) by 2120 (UKCP18 baseline 1981-2000)
	70 th	0.83	0.99
	95 th	1.10	1.31

- 2.4.10 Guidance states that development proposals should be assessed against the relevant regional 70th percentile to inform design levels. An assessment should also be made against the 95th percentile to inform mitigation measures, access and egress routes and emergency evacuation plans.

3 SITE SETTING

3.1 Site Location

3.1.1 The BESS is located near Hundleton. To the south of Pembroke Power Station. (National Grid Reference SM 92722 01142). The nearest postcode being SA71 5SH. The BESS is irregular in shape and occupies an area of approximately 3.3 hectares (ha). The Cable Route Corridor is located to the east of the BESS and commences at National Grid Reference SM 92858 01122 and terminates at SM 93596 02305 upon the southern boundary of Pembroke Substation.

3.1.2 The site location and cable route are presented in Figure 1.

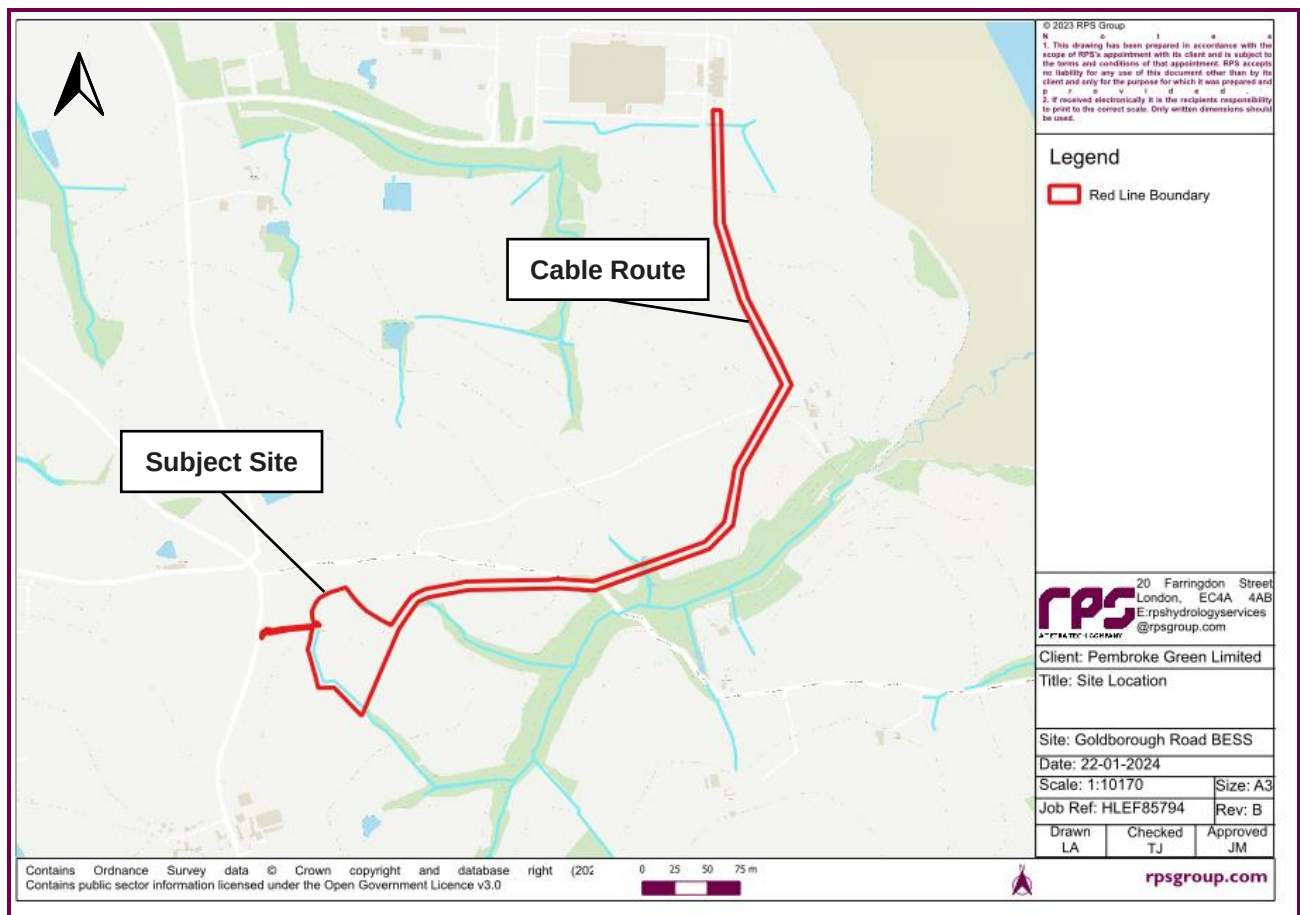


Figure 1 Site Location

3.2 Existing Land Use

BESS

- 3.2.1 The BESS is currently arable land.
- 3.2.2 Vehicular access to the site is from the west via an existing farm track, adjoining to an unnamed road running north to south.
- 3.2.3 Currently the entire BESS Site is vegetated with no building cover or hardstanding structures.

Cable Route Corridor

- 3.2.4 The Cable Route Corridor passes through the generally rural areas and to the west of Wallaston Green. Then makes it way northwards towards Pembroke Substation.
- 3.2.5 The Cable Route Corridor passes under two unnamed ordinary watercourses at grid reference SM 93402 01264 and SM 93402 01264, discussed in greater detail within Section 5.
- 3.2.6 The Cable Route Corridor also crosses Goldborough Road, at grid reference SM 93295 01235.

3.3 Surrounding Land Uses

BESS

- 3.3.1 Surrounding the site to the north and west are two roads; Goldborough Road and an unnamed road, respectively. Beyond these are farmland, also found to the east and south of the BESS. Located approximately 400m west of the BESS there is a Solar farm with isolated settlement adjoined. Located approximately 220m north of the BESS lies Green Hill Reservoir.
- 3.3.2 The BESS is not located within a designated site. The nearest Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI) is located approximately 1.3km to the north east. There are no Special Protection Areas (SPA) within proximity to the BESS.

Cable Route Corridor

- 3.3.3 The surrounding land of the Cable Route Corridor is mainly agricultural and arable land. The route travels 500 metres eastwards through agricultural land before crossing Goldborough Road. The route then continues Eastwards passing 300 metres south of Greenlink Converter Station, before travelling approximately 700 metres northwards before terminating at Pembroke Substation.
- 3.3.4 The Cable Route Corridor is not located in an SAC. However, located approximately 800 metres to the east of the site is the Limestone Coast of South West Wales.
- 3.3.5 The Cable Route Corridor is not located within an SSSI, however to the south east approximately 400m is the Gweunydd Somerton Meadows. Additionally, Milford Haven is located approximately 100m to the east of the Cable Route Corridor. The Cable Route Corridor is not located within 1km of any SPA's.

3.4 Topography

Current Topography

- 3.4.1 A topographic survey was completed by Survey Solutions on 31/01/22, reference 46854CVLS-01. The topographic survey is located in Appendix B The survey indicates that the site levels fall from north to south / south west, with the highest level surveyed in the northern extent of the site at 64.3mAOD, decreasing in the in the south to 51.7mAOD. The cable route travels eastwards and then northwards, and overall, the elevation declines towards the north.

Proposed Topography

- 3.4.2 The BESS development area will be reprofiled using the cut and fill method to provide a suitable development platform for the battery units and associated infrastructure. The cut and fill method takes the unwanted topsoil or earth from one area of the site to another to reprofile the topography. The BESS area will have an elevation of 60.75mAOD in the north of the site and 58.75mAOD in the south of the site, indicating the site will have a gentle slope from north to the south of the site. The BESS compound area is indicated to have a gradient of 1 in 40. The area in which the substation is located is indicated to have a flat plateau level of 61.07m AOD.

- 3.4.3 Due to the cut and fill method, at the edge of the compound area there will be a south bank facing upwards and a north bank facing downwards. The bank located to the south of the site will have approximately a 1 in 3 slope.
- 3.2 The proposed development levels for the cut and fill are included within Development Plans, in Appendix C.

4 PROPOSED DEVELOPMENT

- 4.1.1 The proposed development is the instalment of a BESS to be connected to Pembroke Substation via a Cable Route Corridor. The BESS compound area is to be reprofiled using the cut and fill method, to provide a suitable development platform, shown in Appendix C. Development plans are shown in Appendix D.
- 4.1.2 The following elements would be included in the proposed development:
- No.96 Battery Units
 - No.48 Inverter and Transformer Units
 - No.1 132kV Substation
 - No.1 Switch room
 - No.1 Control Room
 - Gated Area
 - Access Road
 - Cable Route Corridor
 - Groundworks
- 4.1.3 Vehicular access to the site will be via an unnamed road running adjacent to the west of the site.
- 4.1.4 The proposed development consists of approximately 26% hardstanding and 74% soft landscaping.
- 4.1.5 The potential to provide surface water attenuation, including the use of Sustainable Drainage Systems (SuDS), has been considered as part of the preliminary design process (see Section 10 – Surface Water Management).

5 HYDROLOGICAL SETTING

5.1 Nearby Watercourses

- 5.1.1 OS Mapping indicates that the nearest surface water feature is an ordinary watercourse rising on the central western boundary of the BESS. The watercourse conveys flow to the south east along site's the south western boundary and eventually outfalls into the Pembroke River 1.3km north east of the site.
- 5.1.2 The Cable Route Corridor passes under two unnamed ordinary water crosses, one within the southern extent of the route and a second located within the route's northern extent. An additional watercourse is located approximately 8m east of the Cable Route Corridor and also conveys flow to the south east.
- 5.1.3 Green Hill Reservoir is an artificial water feature located approximately 220m north of the site, beyond this at 900m lies another unnamed reservoir.
- 5.1.4 Located to the north-east of the site at approximately 500m and 800m are some unnamed ponds. Additionally, along the Cable Route Corridor, there have been three identified water springs.
- 5.1.5 No other significant watercourses or artificial features have been identified within 1km of the site. Hydrological features are presented within Figure 2.

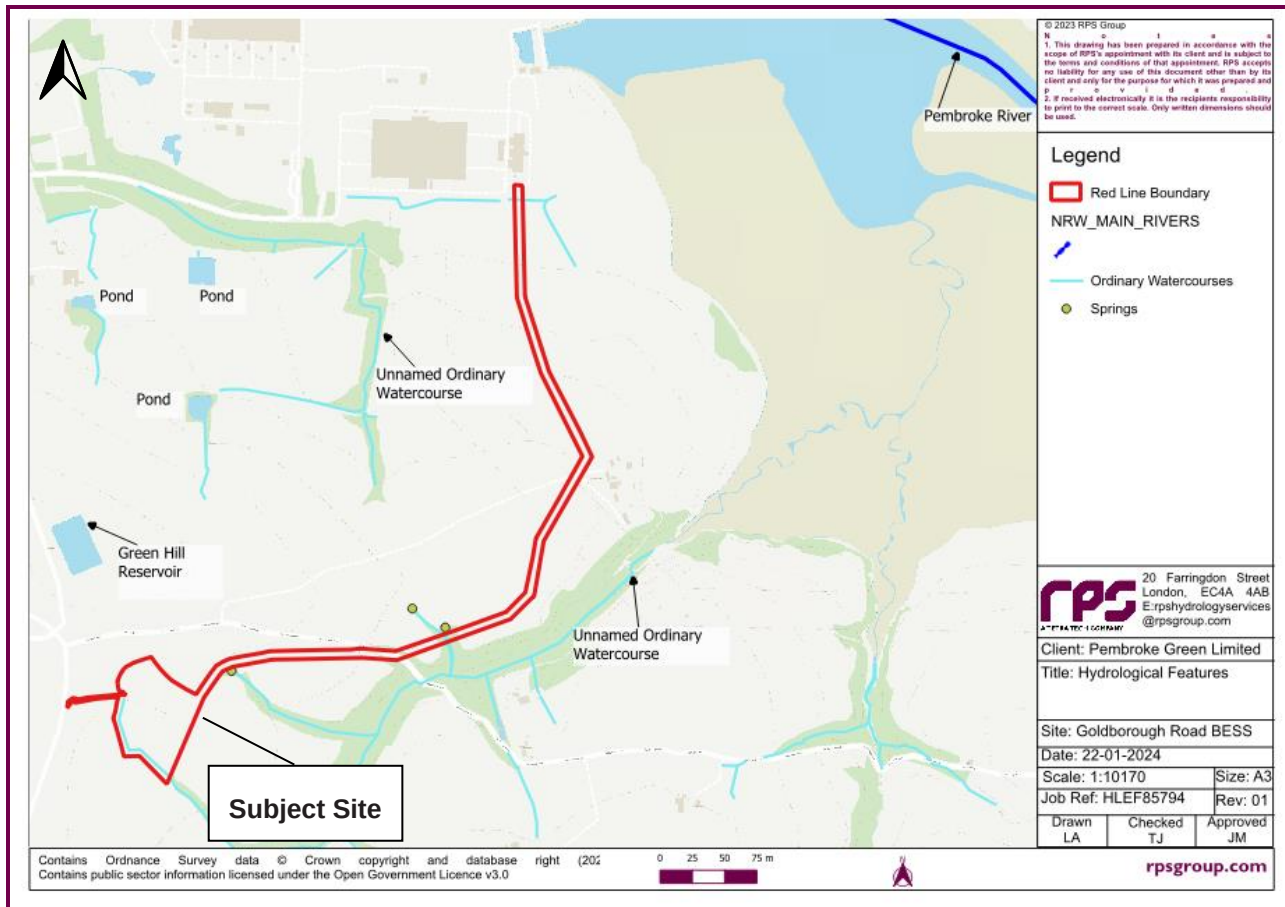


Figure 2. Hydrological Features

5.2 Fluvial Flood Risk Classification

Development Advice Mapping

- 5.2.1 The Welsh Assembly Government produces Development Advice Maps (DAM) to accompany TAN 15. These maps show the degree of flood risk which is to be applied to the Site for the planning process and thus establish the suitability of the Site for development. These maps are based upon the Natural Resource Wales flood maps and similarly they can be modified through the presentation of data (i.e. hydraulic modelling) to illustrate that a Site is within a different flood zone. The development advice zones are listed below, alongside their attributed planning actions:
- 5.2.2 The development advice zones are listed below, alongside their attributed planning actions:
- **Zone A:** Areas considered to be at little or no risk of fluvial or tidal/coastal flooding. Flood risk within this zone does not need to be considered further.
 - **Zone B:** Areas known to have been flooded in the past evidenced by sedimentary deposits. Areas within this zone are further checked against the 0.1% flood level.
 - **Zone C1:** Based on Environment Agency 0.1% flood outline and are areas of the floodplain developed served by significant flood defence infrastructure.
 - **Zone C2:** Based on the Environment Agency 0.1% flood outline and areas of the floodplain without significant flood defence infrastructure.
- 5.2.3 The Development Advice Map for the site is presented in Figure 3 and indicates that the battery site is located wholly within Zone A. The majority of the cable route corridor is located within Zone

A, however a portion of the underground cable route to the north is located within Zone C2 and Zone B.

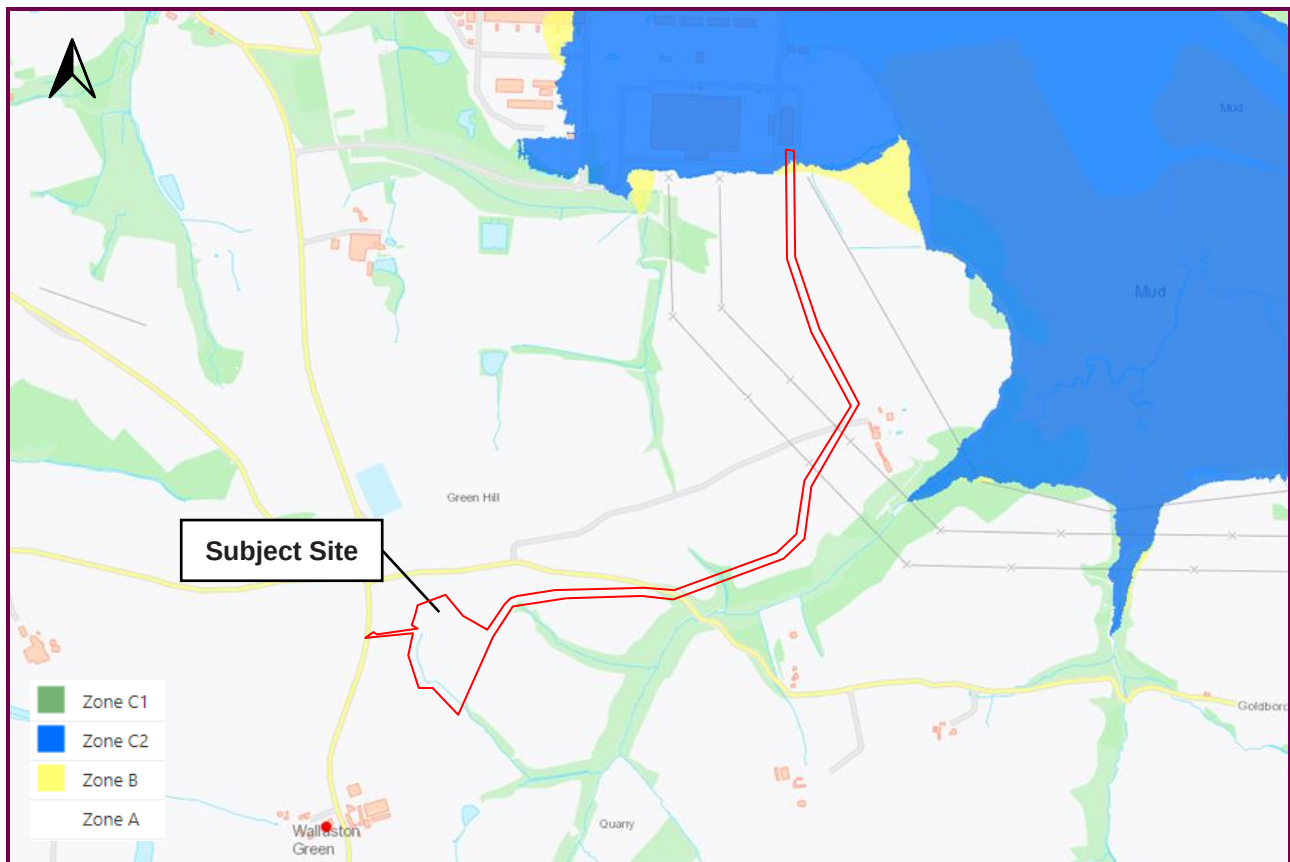


Figure 3. NRW Development Advice Map

5.2.1.2 TAN15 Updates

- 5.2.1 RPS notes a revised TAN15 is due to be implemented in 2024. This will be supported by the new Flood Map for Planning, which includes climate change information to show how this will affect flood risk extents over the next century. It shows the potential extent of flooding assuming no defences are in place.
- 5.2.2 The Flood Map for Planning has no official status for planning purposes until the revised TAN 15 is implemented. However, given the completion of the development is likely to extend beyond this date and it provides more up to date assessment of the risk it takes precedent over current guidance. As such mitigation has been referenced in line with the findings of this data.
- 5.2.3 The climate change data is taken from the 'central estimate' epochs and as such is considered an appropriate assessment of future risk for 'essential infrastructure' developments in line with TAN15 guidance.
- 5.2.4 The Flood Zones are divided into the following categories:
- **Flood Zone 1 (Rivers)** are areas with a less than 0.1% (1 in 1000) chance of flooding from rivers each year, including the effects of climate change.
 - **Flood Zone 2 (Rivers)** are areas with 0.1% to 1% (1 in 1000 to 1 in 100) chance of flooding from rivers each year, including the effects of climate change.
 - **Flood Zone 3 (Rivers)** are areas with more than 1% (1 in 100) chance of flooding from rivers each year, including the effects of climate change.

- 5.2.5 The NRW Flood Zones are presented within Figure 4 and show that the BESS is wholly located in Flood Zone 1. The majority of the Cable Route Corridor is in Flood Zone 1, however the northern most boundary of the underground Cable Route Corridor is located within land classified as Flood Zone 3.



Figure 4. NRW Flood Map for Planning (Rivers and Sea)

NRW National Flood Maps

- 5.2.6 Flood Risk from Rivers mapping is further used to assess flood risk to the site accounting for defences in the wider area, with risk of flooding divided into the following categories:
- High risk: The area has a chance of flooding of greater than 1 in 30 (3.3%) each year.
 - Medium risk: The area has a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%) each year.
 - Low risk: The area has a chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%) each year.
 - Very low risk: The area has a chance of flooding of less than 1 in 1000 (0.1%) each year.
- 5.2.7 The current NRW Flood Risk from Rivers map, presented within in 5 shows the site has a very low risk of flooding from Rivers.

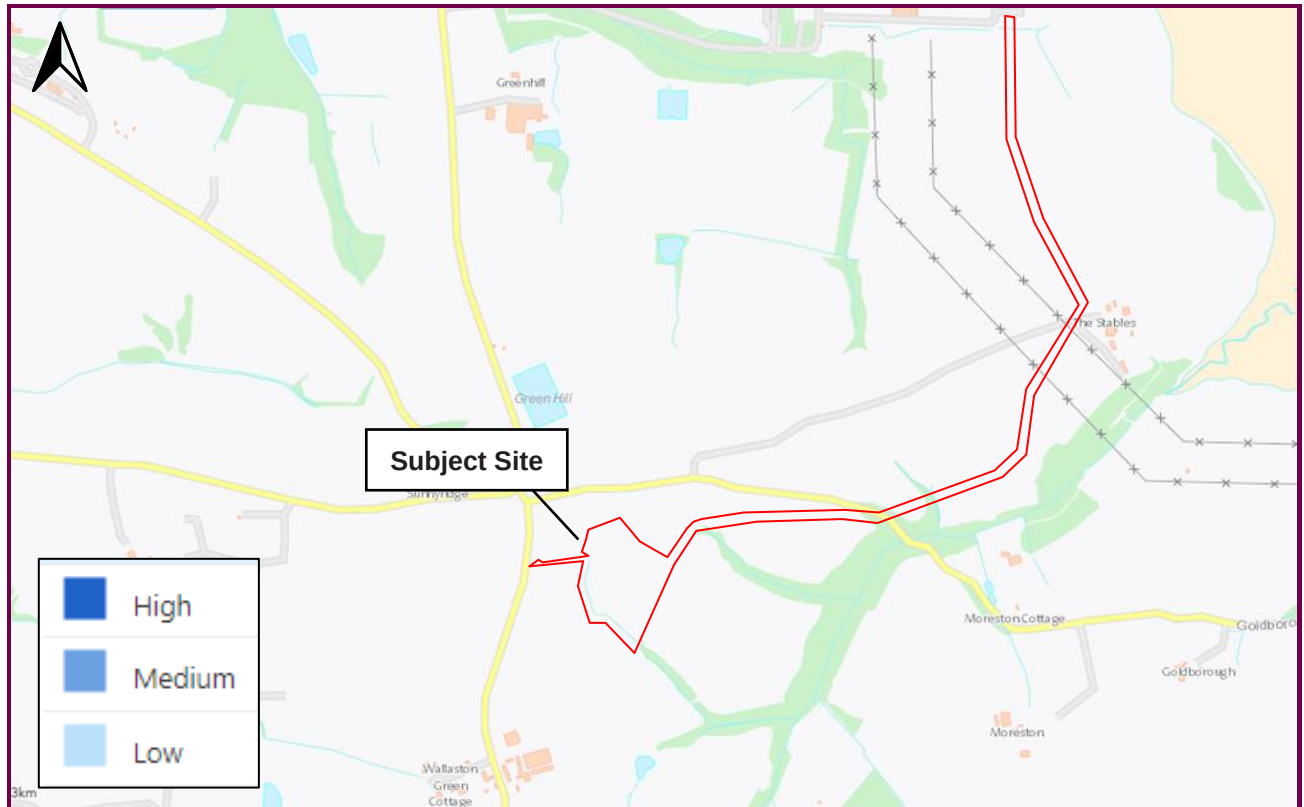


Figure 5. Natural Resources Wales Flood Risk from Rivers Map

Flood Warnings

- 5.2.8 A Flood Warning Area is defined as “geographical areas where we expect flooding to occur and where we provide a Flood Warning Service. They generally contain properties that are expected to flood from rivers or the sea and in some areas, from groundwater.”
- 5.2.9 As the site is not located in a Flood Alert or Flood Warning area.

Flood Defences

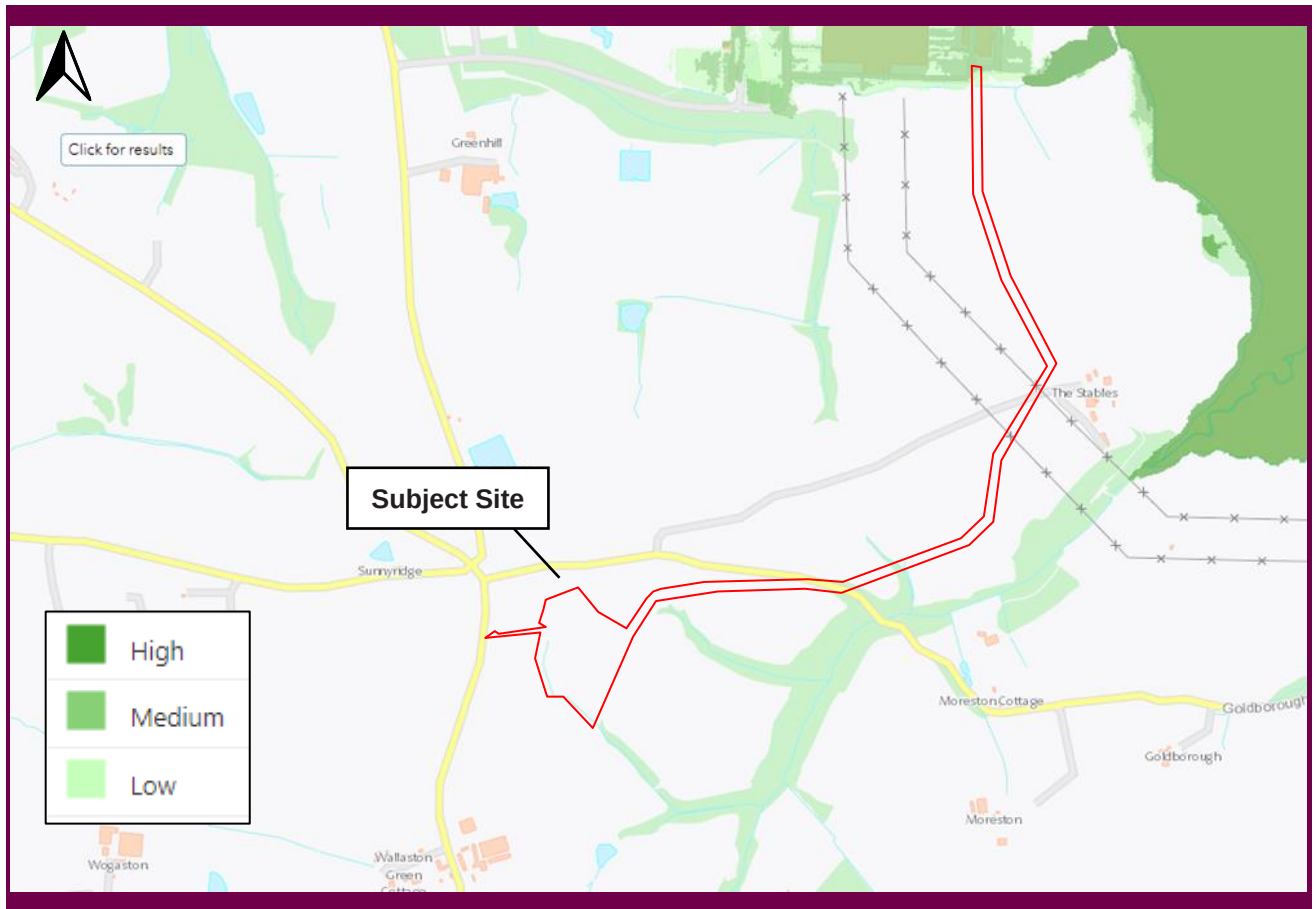
- 5.2.10 The NRW Flood Risk from River’s map indicates no flood defences present in close proximity of the site.

Historical Flood Events

- 5.2.11 NRW Recorded flood extents mapping does not show any recorded flood events within the Site or to its immediate proximity.
- 5.2.12 The Pembrokeshire County Council Local Flood Risk Management Strategy (LFRMS) was published in 2015 and outlines the assets within the county that are at risk of different types of flooding and what long term solutions may be available to mitigate the impact.

5.3 Sea/Tidal Flood Risk Classification

- 5.3.1 The current NRW flood risk from the Sea Map indicates that the majority of the site is considered at very low risk of flooding from the sea. However, the northern most boundary of the underground Cable Route Corridor is located within an area classed as low risk of flooding from the sea.
- 5.3.2 The NRW Flood map from the Sea is located in figure 6.



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Figure 6. NRW Flood Risk from the Sea map

5.4 Surface Water Flood Risk Classification

NRW Flood Risk

- 5.4.1 The NRW Flood Risk from Surface Water and Small Watercourses Map is presented within Figure 5 and demonstrates the site has a predominantly 'very low' risk of flooding from surface water, with a chance of flooding of less than 0.1% each year.
- 5.4.2 The risk classifications correspond to the following return periods:
- High risk – areas which have a chance of flooding greater than 1 in 30 year (3.3%);
 - Medium risk – areas which have a chance of flooding between 1 in 100 year (1%) and 1 in 30 (3.3%);
 - Low risk – areas which have a chance of flooding between 1 in 1000 year (0.1%) and 1 in 100 year (1%); and,
 - Very low risk – areas which have a chance of flooding less than 1 in 1000 year (0.1%).
- 5.4.3 Located to the east and south of the site there are two defined flow paths containing areas of 'low' and 'medium' risks of flooding. Depths along this flow path are predicted to reach over than 0.9m in an around the centre of the site. Flow velocities are predicted to be between less than 1 and up to 3m/s.

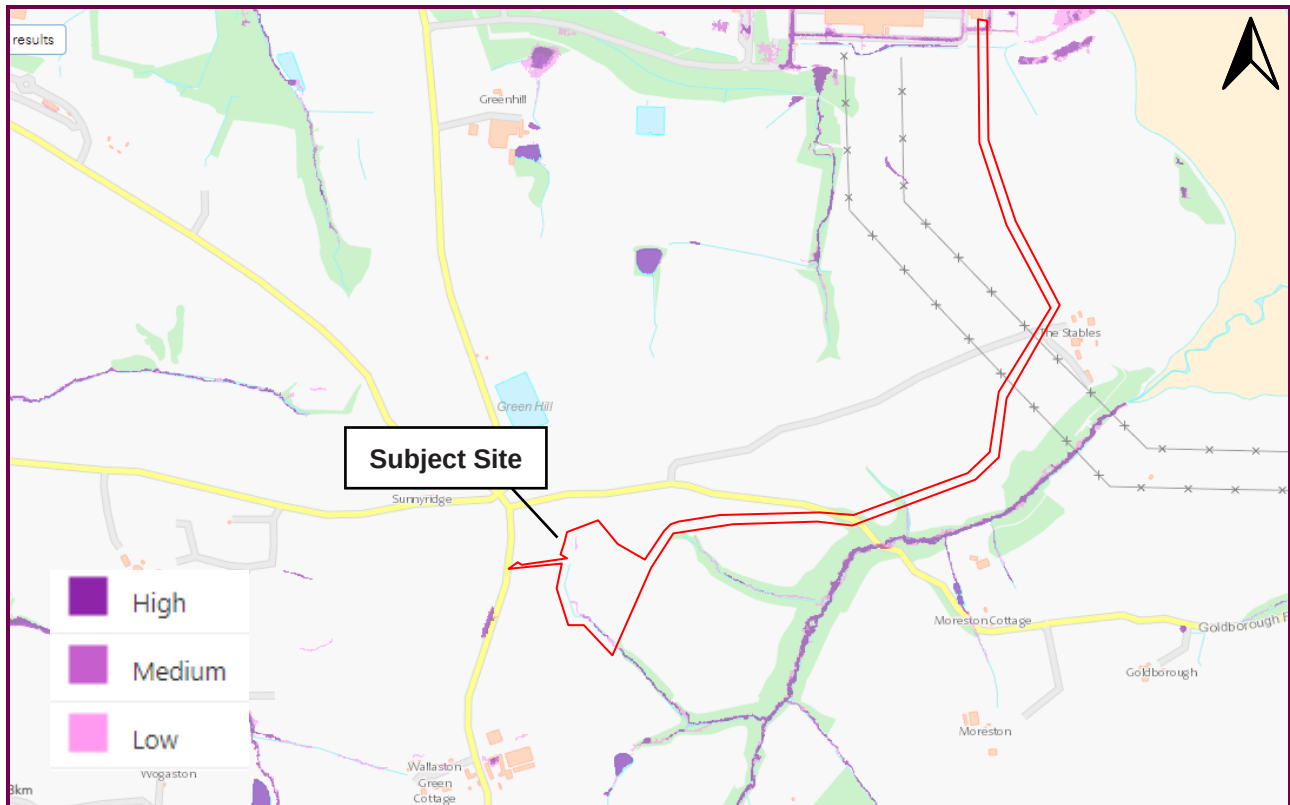
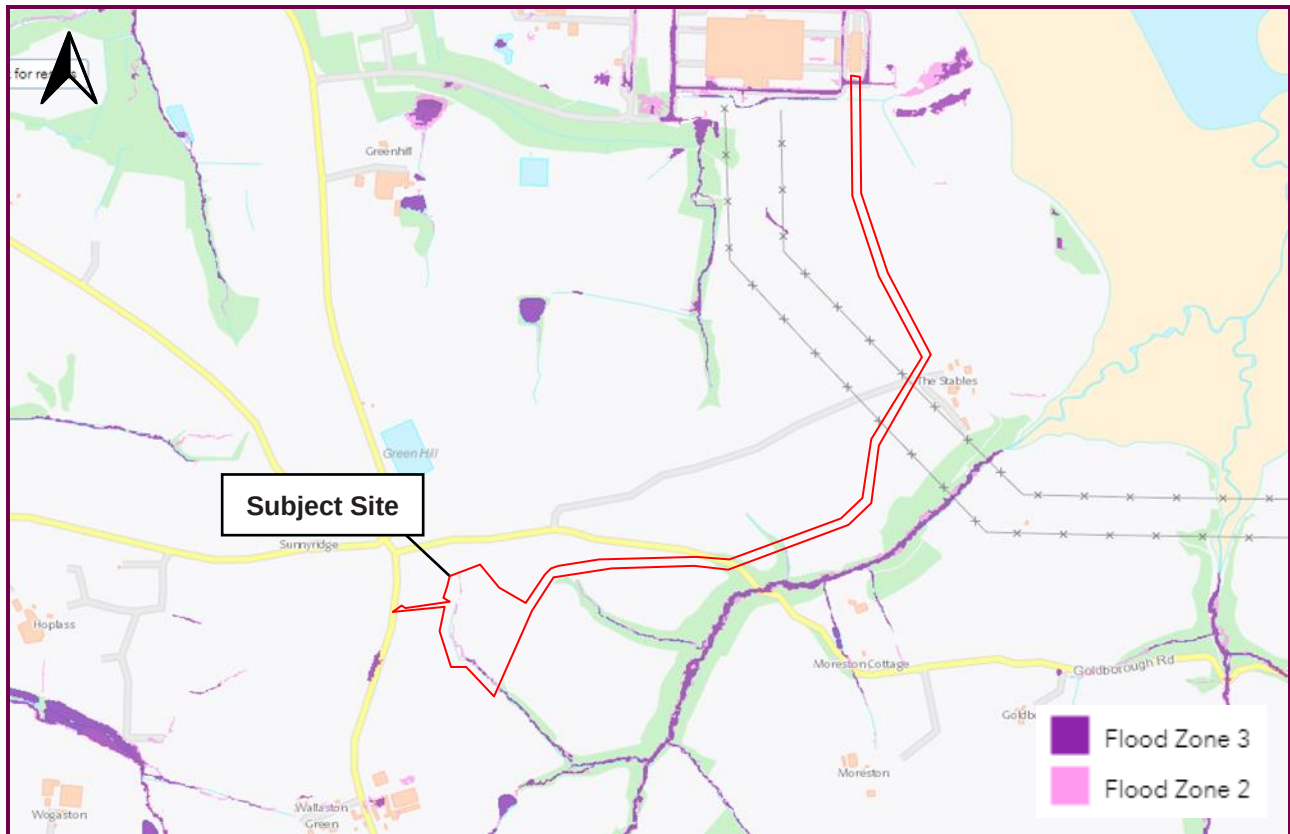


Figure 7. NRW Surface Water Flood Risk Map

TAN15 Future Risk

- 5.4.4 The NRW's new Flood Map for Planning includes Flood Zones for surface water and small watercourses with consideration for climate change and how it will affect flood risk extents over the next century. As stated, the Flood Map for Planning has no official status for planning purposes until January 2024.
- 5.4.5 However, the risk has been displayed in Figure 6 to show how the new modelling work undertaken and how climate change risk may impact the site in the future.
- 5.4.6 The risk extent has increased slightly within the site and has been classified as being within Flood Zone 2 and is likely to be associated with topographical levels.
- 5.4.7 Some locations along the flow paths east and south of the site are classified as Flood Zone 3. These are associated with the ordinary watercourses as denoted in the hydrological mapping in Figure 2.
- 5.4.8 A small proportion of the main road adjoined to the access road to the site is classified as Zone 3.



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Figure 8. Flood Map for Planning Surface Water and Small Watercourses (Updated TAN15 mapping)

Reservoir Flooding

- 5.4.9 The NRW's Reservoir Flood Map indicates the site is at no risk of flooding from reservoirs. The nearest reservoir flood extent is approximately 1.3km to the east of the site and is associated with the Mill Pond Reservoir.

Local SFCA

- 5.4.10 The Pembrokeshire County Council SFCA was published in 2019, it provides an overview of flood risk from various sources within the county. There were no site-specific details relevant to the site included in the assessment.
- 5.4.11 Southwest Wales Stage 1 Strategic Flood Consequences Assessment, Final Report was produced in November 2022. A copy of the report has been requested and is currently awaited.

6 HYDROGEOLOGICAL SETTING

6.1 Geological setting

BESS

- 6.1.1 The BGS Geology Viewer (1:50,000 scale) indicates that the bedrock geology varies across the site. The northern extent of the site is comprised of a Ridgeway Conglomerate Formation (conglomerate). The southern extent of the site comprises Milford Haven Group (argillaceous rocks and sandstone, interbedded).
- 6.1.2 The BESS is shown not to be underlain by superficial deposits and no borehole records are present within the BESS or its proximity.

Cable Route Corridor

- 6.1.3 The BGS Geology Viewer (1:50,000 scale) indicates that the cable corridor is situated on a variety of intermittent bed rock geology, consisting of the following:
- Milford Haven Group – Argillaceous rocks and sandstone, interbedded.
 - Ridgeway Conglomerate Formation - Conglomerate.
 - Skrinkle Sandstone Formation – Sandstone.
 - Avon Group - Limestone and mudstone, interbedded.
 - Avon Group - Limestone and mudstone, interbedded (borders this)
- 6.1.4 The northern extent of the Cable Route Corridor is underlain by superficial deposits of alluvium, (clay, silt, sand and gravel). Several borehole records are present within the vicinity of the northern extent of the Cable Route Corridor however are unavailable for viewing.

6.2 Aquifer Designation

- 6.2.1 BGS Aquifer Designation mapping shows bedrock deposits for the site are categorised as Secondary A Aquifers which generally support water supply and base river flow on a more local scale, in some cases forming an important source of base flows to rivers.

6.3 Surface Protection Zones

- 6.3.1 The NRW natural environment mapping shows the site is located within an area of high groundwater vulnerability and is not located within a Source Protection Zone.

6.4 Soils Classification

- 6.4.1 The National Soils Research Institute Soilscales viewer classifies soils underlying the BESS as freely draining slightly acid loamy soils.
- 6.4.2 Soils within the Cable Route Corridor are described as the following:
- Northern section: Freely draining slightly acid but base-rich soils
 - Southern section: Freely draining slightly acid loamy soils

6.5 Existing Drainage

- 6.5.1 The site and the Cable Route Corridor is located within rural settings which are not served by sewer infrastructure.

7 FLOOD RISK VULNERABILITY CLASSIFICATION AND JUSTIFICATION TEST

- 7.1.1 In accordance with TAN15 in Table 5, battery storage developments are classified as ‘highly vulnerable’ and cable routes are classified as ‘less vulnerable.’ The battery site is located within DAM Zone A / Flood Zone 1 whilst the Cable Route Corridor is located predominantly within DAM Zone A / Flood Zone 1 and marginally within DAM Zone B and C2 / Flood Zone 2 and 3. The cables are buried underground.
- 7.1.2 In line with TAN1 all types of development are considered acceptable within Zone A and B. Whilst less vulnerable development, including the cable route, can be considered within Zone C1 and C2, the justification test will be applicable to the proposed cable route.

Table 5. Flood Risk Vulnerability and Zone Compatibility

DAM Zone	Vulnerability Classification		
	Emergency Services	Highly Vulnerable	Less Vulnerable
Zone A	Permitted	Permitted	Permitted
Zone B	If site levels are greater than flood levels, no need to consider risk further	If site levels are greater than flood levels, no need to consider risk further	If site levels are greater than flood levels, no need to consider risk further
Zone C1	Yes – if justification test applied	Yes - if justification test applied	Yes - if justification test applied
Zone C2	Not permitted	Not permitted	Yes - if justification test applied

7.2 Justification Test

- 7.2.1 TAN 15 technical guidance states a requirement for any proposed development within Zone C1 and Zone C2 to be subject to the Justification Test, including acceptability of consequences. The following must be demonstrated in order to justify development within Zone C:
- “Development within zone C is necessary to assist, or be part of, a local authority regeneration initiative or a local authority strategy required to sustain an existing settlement; or,
 - Development within zone C is necessary to contribute to key employment objectives supported by the local authority, and other key partners, to sustain an existing settlement or region;
- And
- Development concurs with the aims of PPW and meets the definition of previously developed land; and,
 - The potential consequences of a flooding event for the particular type of development have been considered, and in terms of the criteria contained in sections 5 and 7 and appendix 1 found to be acceptable.”

BESS

- 7.2.2 The BESS is classified as highly vulnerable and is located within Zone A. As such, development is not subject to the Justification Test.

Cable Route Corridor

- 7.2.3 The proposed development will contribute towards meeting the UK Government's targets for generating energy from a renewable energy source; it will generate employment during its construction and operation. Part ii of the justification test is therefore considered to be satisfied.
- 7.2.4 The proposed development includes the installation of a below ground cable route and can be classified as 'less vulnerable'. DAM mapping shows the majority of the Cable Route Corridor is located within Zone A and B, with the far northern extent of the cable route located within Zone C2. The Cable Route Corridor will connect the battery storage to the Pembroke Substation and therefore, is unable to be routed without crossing areas within Zones C2. Part iii of the justification test is therefore considered to be satisfied.
- 7.2.5 In regard to part iv of the justification test, potential consequences of a flood event have been undertaken regarding development taking place within C2 in line with Appendix 1 of TAN 15.
- 7.2.6 The far northern extent of the below ground Cable Route Corridor located within Zone C2 and is associated with coastal flooding and is covered by the Pembrokeshire Coast Flood Alert area.
- 7.2.7 During the construction phase the site manager will sign up to the Flood Warning Service and will be alerted by a phone call or text when a Flood Warning becomes active. The flood warning will be applied to the Cable Route Corridor within Zone C2 to enable site personnel to be evacuated from the site in a timely manner prior to a flood event occurring.
- 7.2.8 The installation of below ground cables will be temporary in nature with no permanent above ground structures proposed. The majority of the construction works are not within previously developed land however, there will be no changes to existing land use. The Cable Route Corridor does not increase flood risk to the surrounding area and has negligible risk of flooding to and from the development.
- 7.2.9 Any structures to be located within Zone C2 during construction are expected to be limited to temporary office units and welfare facilities. Given the temporary nature of the buildings, flood resistant design is not considered to be appropriate.
- 7.2.10 Any alterations in the existing surface water drainage regime associated with the installation of the below ground cables are expected to be only during the construction stage and thus temporary in nature. Any increase in run-off from the cable route construction will be managed through control principals set out in the Code of Construction Practise that will be revised and submitted to PCC for approval with consultation with NRW prior to the commencement of works.
- 7.2.11 On this basis, the Justification Test is determined to be passed.

8 FLOOD RISK AND MITIGATION

- 8.1.1 The key sources of flooding that could potentially impact the site are discussed below:

8.2 Fluvial and Sea Flooding

Battery storage

- 8.2.1 In accordance with the Development Vulnerability Categories in Figure 15 of TAN15, BESS developments are classified as 'Highly Vulnerable'.
- 8.2.2 The BESS and associated access roads are located entirely within Zone A and Flood Zone 1. The NRW Flooding from Rivers and Sea mapping shows the BESS to be at very low risk of flooding from these sources.
- 8.2.3 All types of development are considered acceptable within Zone A.

Cable route

- 8.2.4 In accordance with the Development Vulnerability Categories in Figure 15 of TAN15, the Cable Route Corridor is classified as 'Less Vulnerable'. The majority of the cable route is located with Zone A and B / Flood Zone 1. The northern extent of the Cable Route Corridor is located within Zone C2 / Flood Zone 3.
- 8.2.5 The NRW Flooding from Rivers map considers the Cable Route Corridor to be at very low risk of flooding from these sources.
- 8.2.6 The NRW Flooding from the Sea map considers majority of the Cable Route Corridor to be at 'very low' risk, however the northern extent of the Cable Route Corridor is located in an area at 'low risk'.
- 8.2.7 Whilst all types of development are considered acceptable within Zone A, the Justification Test is required for development proposed within Zone C2. The Cable Route Corridor is unable to be routed to Pembroke Substation without crossing areas within Zones C2 and will provide sustainability benefits. As such, the Justification Test is considered to be passed.

Flood Mitigation Measures

- 8.2.8 The site has a very low risk of fluvial and sea flooding; thus, no mitigation is proposed.

8.3 Surface Water Flooding and Ordinary Watercourses

BESS

- 8.3.1 The NRW Flood Risk from Surface Water and Small Watercourses mapping indicates the majority of the BESS is located at very low risk of flooding, with a very minimal isolated section being at low risk of surface water flooding.
- 8.3.2 The BESS development area is to be reprofiled as part of the development, Cut and fill plans have been provided in Appendix C. The BESS will be reprofiled to have a development platform of between 60.55 and 58.78mAOD with a 1 in 40 slope in the BESS development area. Due to the area being at 'very low risk' the cut and fill process is not anticipated to increase the surface water risk.
- 8.3.3 A 1 and 3 slope from the BESS area to surrounding ground levels will ensure any surface water is expected to flow away from the development, with the proposed conceptual drainage strategy

capturing water and discharging it in a south easterly direction to the attenuation pond detailed in Section 10 of the report.

- 8.3.4 The extents of risk are similar in the Flood Map for Planning with a very small, isolated proportion of the site being located in Flood Zone 2.

Cable Route Corridor

- 8.3.5 The NRW Flood Risk from Surface Water and Small Watercourses mapping indicates that the majority of the Cable Route Corridor is at a very low risk of surface water flooding. The northern extent where the cable route adjoins there is an area of low risk of flooding.
- 8.3.6 The extents of risk are similar in the Flood Map for Planning with majority of the route being located in Flood Zone 1, with the small area of the northern extent being located in Flood Zone 2/3.

Flood Mitigation Measures

- 8.3.7 As the main site for battery storage is located at very low- low risk of surface water flooding, no mitigation is proposed. The cable route will be situated below ground, and as such no further mitigation is proposed.

8.4 Groundwater flooding

BESS

- 8.4.1 BGS Geology Viewer indicates that the bedrock geology, in the northern extent of the site is comprised of a Ridgeway Conglomerate Formation (Sedimentary). In the southern land parcel, argillaceous rocks and sandstone (interbedded) belonging to the Milford haven Group make up the bedrock geology.
- 8.4.2 BGS Aquifer Designation mapping shows bedrock deposits are categorised as Secondary A Aquifers.
- 8.4.3 BGS Geology of Britain mapping shows no borehole records for the battery site. The nearest boreholes are over 1km north however access to their records is restricted. Therefore, no further details have been obtained.

Cable route Corridor

- 8.4.4 British Geological Survey (BGS) online mapping (1:50,000 scale) indicates that the cable route is situated on superficial deposits of alluvium. The route is underlaid by a bedrock geology of Milford Haven Group, Ridgeway Conglomerate Formation, Skrinkle Sandstone Formation and Avon Group.
- 8.4.5 BGS Aquifer Designation mapping shows bedrock deposits are categorised as Secondary A Aquifers.
- 8.4.6 BGS Geology of Britain mapping shows no borehole records for the Cable Route. The nearest boreholes are over 1km north however access to them is restricted. Therefore, no further details have been obtained.

8.5 Other Sources

- 8.5.1 Green Hill reservoir is located north of the site; however, it poses no risk to the site so no mitigation measures to this source are needed.

- 8.5.2 Due to the agricultural nature of the ground at the site, it is assumed there are no complex drainage systems and sewer flooding does not pose a risk to the site meaning no mitigation measures need to be taken.

9 POTENTIAL IMPACTS

9.1 Impermeable areas

Ancillary Features

Battery Units

- 9.1.1 96no. of battery units will be located across the site. The battery units are to have a length of 12.2m and a width of 2.4m, with a total area of approximately 29.28 m². Therefore, the battery units will create a total of 2810.880m² of new impermeable areas within the site.

Inverters/Transformers

- 9.1.2 48no. Inverter/Transformers will be located across the site. The units are to have a length of 6m and width of 2.4m, with each individual unit having an approximate area of 14.4m². Therefore, the Inverters/Transformers will create a total of 696.96 m² of new impermeable area across the site.

132kV Substation

- 9.1.3 1no. 132kV Substation will be located in a gated area to the north of the site. The area is to have a length of 54.88m and a width of 30m, having an approximate area of 1646.4m². Therefore, the Substation area will create a total of 1646.4m² of new impermeable area across the site. The whole of the gated area in which the substation is located has been used as a conservative measure. In reality a proportion of this area will remain permeable.

Control Room

- 9.1.4 1 no. Control Room will be located at the site. The Control Room is to have a length of 6m and width of 2.9m, with each individual unit having an approximate area of 17.4m². Therefore, the Control Room will create a total of 17.4 m² of new impermeable area at the site.

Switchroom

- 9.1.5 1 no. Switchroom will be located at the site. The Switchroom is to have a length of 11.7m and width of 4m, with each individual unit having an approximate area of 46.8m². Therefore, the Switchroom will create a total of 46.8 m² of new impermeable area at the site.

Access Tracks

- 9.1.1 It is proposed that the internal access tracks will be comprised of gravel and fully permeable with no tarmac or other hardstanding type surface. Most will follow existing farm tracks so would not even be new access routes. As such they will have no impact with respect to surface water drainage. Geotextile membrane layers will help to secure the aggregate to prevent it sinking into the soil and this will help prevent ground compaction.
- 9.1.2 After the construction of the solar farm the heaviest vehicles likely to use the tracks are occasional van or 4x4 type vehicles. There will be less intensive traffic around the Site compared to existing farm use. This means there is low risk of over-use causing compaction that could compromise permeability. Despite this, it will be reasonable to include monitoring and maintenance of the internal accesses over the lifetime of the solar farm.
- 9.1.3 In construction there will be no HGVs using the internal access tracks around the Site except from the highway into the Site. All HGVs making deliveries to the Site for construction will drop off in temporary construction compounds at the access point, to be shown on design and layout drawings. Materials will then be delivered around the Site by tractor-trailer type vehicles which are the same as vehicles that currently use these routes around the working farm. This means there is low risk of

traffic/vehicles causing excess soil compaction either in construction or during operation which could limit the efficacy of the tracks' permeability.

9.1.4 Therefore, for the purpose of a conservative approach we have considered the tracks as impermeable within the report.

9.2 Summary

9.2.1 The proposed impermeable surface areas within the site will create approximately 0.81 ha (8,055.16 m²) and is presented within **Table 6**.

Table 6. Impermeable Areas

Development	Area (m ²)
Battery Container	2810.88
Inverters/Transformers	696.96
132kV Substation	1646
Control Room	17.40
Switchroom	46.86
Access Roads	2,837.06
Total	8,055.16

10 SURFACE WATER MANAGEMENT

10.1 Introduction

- 10.1.1 Ancillary Features are to be placed across the site and will result in an additional potential impermeable area of 0.81 ha (8,055.16m²).
- 10.1.2 The SuDS strategy for these features is what is proposed in the as-is application, with recommendations that planning conditions be utilised to secure hydrological interests in the construction and operational stages.
- 10.1.3 The SuDS scheme for Goldborough Road BESS will provide attenuation for the battery units and the ancillary features to ensure that the resulting development provides a betterment to pre-existing conditions.
- 10.1.4 The creating of battery storage is to have cut and filling of ground levels, as such this has been outlined in the conceptual surface water strategy as seen in Appendix F.
- 10.1.5 Surface water arising from a developed site should as far as is practicable be managed in a sustainable manner to mimic the natural hydrology of the site while reducing the risk of flooding and elsewhere, taking climate change into account.
- 10.1.6 Generally, this type of development is considered to have an approximate design life of 40 years. Therefore, for the purposes of this assessment, taking into account NRW climate change allowances a 40% increase in peak rainfall intensity has been included as climate change allowance, which caters up to the year 2115. No climate change guidance is available beyond 2115.

10.2 Existing Surface Water Runoff Rates

Greenfield Runoff Rate

- 10.2.1 Runoff rates have been determined using the current 'industry best practice' guidelines as outlined in the SuDS Manual (C753) (CIRIA, 2015) and the non-statutory technical standards for sustainable drainage systems (Defra, 2015). The Defra recommended methodology for sites up to 50ha is the Institute of Hydrology Report 124 method (Institute of Hydrology, 1994).
- 10.2.2 For catchments smaller than 50ha the equivalent runoff from a 50ha site must be calculated using IH124, it is then possible to pro-rata this value to give the runoff for the smaller site. Interim Code of Practice (ICP) SuDS calculation automatically carries out the pro rata conversion reducing the possibility of human error. The runoff rates were calculated using the MicroDrainage software suite and are present within Table 7.
- 10.2.3 Due to small nature of the site and the location of the features. It is proposed the runoff rate calculations is undertaken for the total impermeable area. Therefore, the following parameters were incorporated into each substation calculation:
 - Area: 0.81ha
 - Standard-period Average Annual Rainfall: 1000 mm/yr
 - Soil (global soils index): 0.300
 - Region number: 9 (catchment based on Flood Studies Report Figure I.2.4.)

Table 7. Existing Surface Runoff Rates

Return period (years)	Runoff rate (l/s)
1 in 1	2.0
QBAR*	2.2
1 in 30	4.0
1 in 100	4.9

*Mean Annual Flood

- 10.2.4 The presence of battery units and associated ancillary buildings will result in total potential new impermeable surface area of 0.81 ha (8,055.16m²).

Proposed Runoff Discharge Rates

- 10.2.5 Surface water runoff is proposed to be restricted to the QBAR greenfield runoff rate of 2.2 litres/second (l/s). In order to achieve this restriction approximately 783.4m³ of attenuation would need to be provided for all events up to and including the 1 in 100 year plus 40 % climate change event.

Consideration of Drainage Hierarchy

- 10.2.6 The PPG advises of the following hierarchy for the disposal of surface water;

1. Infiltration;
2. To a surface water body;
3. To a surface water sewer, highway drain or another drainage system; or
4. To a combined sewer.

- 10.2.7 The drainage hierarchy has been considered as follows:

Infiltration

- 10.2.8 BGS bedrock geology mapping records the site indicate that there are no records of superficial deposits. The site is underlain by a bedrock geology of Ridgeway Conglomerate Formation (Sedimentary) in the north. In the south the site is underlain by argillaceous rocks and sandstone (interbedded) belonging to the Milford haven Group make up the bedrock geology.
- 10.2.9 Soakaway testing in accordance with BRE 365 has yet to be undertaken within the site to establish infiltration rates within the site, and may be undertaken at a later stage of the planning process to inform detailed design.

To a Surface Water Body

- 10.2.10 If discharge to ground is unfeasible, discharging to a surface water body is considered as the next option in the hierarchy. An ordinary watercourse is present along the southern boundary of the site. It is understood that the brook is located within the land ownership boundary of the site and as such a connection to the ordinary watercourse will be feasible. Appropriate consent will be required for surface water discharge into the ordinary watercourse.

Conceptual Drainage Strategy

- 10.2.11 A conceptual surface water drainage strategy has been included within Appendix F and the Pre and Post Flow Conveyance Plan is included in Appendix G and H, respectively.

Attenuation Basin

- 10.2.12 Water will be attenuated by an attenuation pond (basin) in the southeast of the site which will provide storage of 783m³. The basin will be 1.5m deep with a 300mm freeboard allowance. Flows are to be discharged at the QBAR greenfield runoff rate (2.2 l/s) via an appropriate flow control device to the ordinary watercourse present along the southern boundary of the site.
- 10.2.13 The basin will allow peak flow rates to be reduced and enable flows to be limited to the QBAR greenfield runoff rate prior to discharge to the ordinary watercourse. These SuDS features are also useful in providing water treatment predominantly through the settlement of silts and suspended sediments. The basin will take the form of a depression within the application site and can be landscaped to provide aesthetic and amenity value. Planting can be used to improve biodiversity and attract wildlife.
- 10.2.14 To demonstrate that surface water arising from the development will be appropriately treated prior to discharge, the Simple Index Approach, as outlined within the SuDS Manual (CIRIA C753) has been followed.
- 10.2.15 Overall, the proposed development will meet local and national planning requirements.

Event Exceedance

- 10.2.16 The proposed indicative surface water drainage concept provides attenuation of water up to the 1 in 100 year plus 40% climate change event. A 300mm freeboard has been applied to the basin storage.
- 10.2.17 In an event exceeding this magnitude, detailed drainage design will identify mitigation measures to ensure that the resulting above-ground flooding will be confined to temporary shallow flooding of the on-site road network and will not affect the buildings on site or significantly increase flood risk to offsite locations.

10.3 Further Benefits of SuDS Measures

Water Quality

- 10.3.1 The attenuation pond will be lined with a geotextile impermeable membrane. This will ensure that the typical pollutants present in runoff, for example hydrocarbons and chlorides, will not infiltrate into the underlying geology and some will be removed through the slowing of flows and settlement within the pond.

Environmental Benefits

- 10.3.2 The SuDS measures have benefits in effective flood risk reduction. The attenuation pond provides a significant volume of storage capable of storing runoff from a large rainfall event. Large rainfall events can be destructive and currently contribute to pollution flowing into the surrounding rivers. In addition, the attenuation pond will also have benefits in biodiversity and contribute to varying the land use.

Social Benefits

- 10.3.3 Attenuation ponds have good long-term physical and chemical stability, requiring low maintenance. These characteristics help SuDS measures to be a cost-effective solution in capital and operational

terms, which has benefits in social provision by not disproportionately raising the price of new commercial units. In addition, such features will help to maintain the required flow rate from the site for rainfall events up to the 1 in 100 year plus 40% climate change event and will significantly contribute to reducing the potential for surface water flooding within the catchment.

Pollution Mitigation

- 10.3.4 The CIRIA SuDS Manual (2015) provides pollution hazard indices from an assortment of land uses and the pollution mitigation indices for a number of SuDS techniques, including attenuation ponds, swales and permeable paving. It is noted that the pollution hazard indices are not cumulative, and that the mitigation should be designed to the maximum pollutant use. Furthermore, it is not anticipated that there would be coarse sediments for removal at the site, therefore specific design for this purpose would not be required.
- 10.3.5 The SuDS Manual also notes that in systems where multiple SuDS features are incorporated, the subsequent treatment stages are considered to perform at 50% of their optimum pollution mitigation, due to the reduced inflow concentrations. The maximum pollution mitigation indices have been included for each SuDS feature below, followed by an evaluation of the total mitigation provided by the treatment stages, taking into account the 50% efficiency of the second and tertiary stages. Finally, mitigation indices are limited to a maximum value of >0.95.
- 10.3.6 The proposed access roads within the site are anticipated to have less than 5 traffic movements per month from maintenance and site operatives, therefore, it is classified as low traffic roads.
- 10.3.7 It can be seen from Table 8 below that the proposed attenuation pond will provide mitigation that combined exceeds the maximum pollution hazard indices generated by the structures on site and the internal road network, thereby sufficiently treating the runoff that will be generated post-development prior to discharge into the fluvial network.

Table 8. Pollution Hazards and Mitigation Indices

Pollution	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Proposed Land Uses			
BESS structures	0.3	0.2	0.05
Individual property driveways, residential car parks, low traffic roads	0.5	0.4	0.4
Mitigation			
Attenuation Basin	0.7	0.7	0.5

10.4 Management of Fire Water

- 10.4.1 In order to manage the risk associated with a highly unlikely fire event, the development will include a provision for the supply of fire water via water tanks.
- 10.4.2 An on-site fire containment strategy will be incorporated into the overall site drainage design at detailed design stage.

10.5 Construction Stage Drainage

- 10.5.1 During construction of the development, the building contractor will be responsible for management and disposal of rainwater runoff generated from the site in its temporary condition.
- 10.5.2 The contractor shall develop a formal site management plan, which will address pollution management and control in relation to site plant and vehicles, raw materials storage and waste generation, to ensure that all surface water runoff generated in the temporary condition will be free of contamination.
- 10.5.3 The site will be subject to topsoil strip and bulk earthworks to prepare the site to the correct level for development. The contractor shall provide temporary drainage measures to contain runoff within the development site boundary ensuring that this is sized appropriately, and that means to remove excess surface water are available for use at all times.

10.6 SuDS Maintenance

- 10.6.1 Table 9, Table 10 and Table 11, below shows a typical drainage maintenance plan suitable for attenuation basin and headwall maintenance requirements (extracted from SuDS Manual C753).

Table 9. Attenuation Basin Maintenance Requirements

Maintenance schedule	Require Action	Typical Frequency
Regular Maintenance	Remove litter, debris and trash	Monthly
	Cut grass – for landscaped areas and access routes	Monthly (during growing season) or as required
	Cut grass – meadow grass in and around basin	Half yearly: spring (before nesting season) and autumn
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
Occasional Maintenance	Reseed areas of poor vegetation growth	Annually, or as required
	Prune and trim trees and remove cuttings	As required
	Remove sediment from pre-treatment system when 50% full	As required
Remedial Actions	Repair erosion or other damage by reseeding or returfing	As required
	Realign the rip-rap	As required
	Repair or rehabilitate inlets, outlets and overflows	As required
	Rehabilitate infiltration surface using scarifying and spiking techniques if performance deteriorates	As required
	Relevel uneven surfaces and reinstate design levels	As required
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect infiltration surfaces for compaction and ponding	Monthly

Table 10. Inlet and Outlet Headwalls Maintenance Requirements

Maintenance schedule	Require Action	Typical Frequency
Regular Maintenance	Litter removal	As required
	Inspect vegetation above and around headwall and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from aprons	Annually
	Flap valves and grilles: Check for and clear obstructions	Quarterly
Remedial Actions	Repair of erosion or other damage around headwalls	As required
Monitoring	Inspect structures for evidence of poor operation	Monthly/after large storms
	Inspect structures, pipework etc. for evidence of physical damage	Monthly/after large storms
	Inspect silt accumulation rates and establish appropriate removal frequencies	Half yearly
	Check flap valves	Half yearly

Table 11. Flow Control Manhole Suggested Maintenance Schedule

Maintenance schedule	Require Action	Typical Frequency
Regular Maintenance	Inspect vegetation above and around flow control chamber and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Remove sediment from flow control chambers	Annually
	Flow control devices: Check for and clear obstructions	Quarterly
Remedial Actions	Repair of Penstock and flow control device	As required
Monitoring	Inspect structures for evidence of poor operation	Monthly/after large storm
	Inspect structures, flow control and pipework etc. for evidence of physical damage	Monthly/after large storm
	Inspect silt accumulation rates and establish appropriate removal frequencies	Half yearly

11 SUMMARY AND CONCLUSIONS

- 11.1.1 A site-specific Flood Consequence Assessment following the guidance of the Planning Policy Wales and TAN 15 has been undertaken for a Battery Energy Storage Site on land south of Goldborough Road, Hundleton, Pembroke, SA71 5SH,

11.2 Flood Risk Appraisal

- 11.2.1 The land in which the BESS units and associated ancillary features will be situated completely within Zone A. The majority of the cable route is located within Zone A, however the northern extent of the below ground cable adjoins Zone B and Zone C. The TAN15 map indicates that the battery site is entirely located within Flood Zone 1. The cable route is predominantly located within Flood Zone 1, however the northern extent of the below ground cable route which adjoins the substation is located within Zone B and C2.
- 11.2.2 The Justification Test has been applied to proposed development for the battery site development located within Zone A and is considered to be passed. As the cable route is unable to be routed without crossing areas within Zones C2. Part iii of the justification test for the cable route is considered to be acceptable.
- 11.2.3 The NRW Flood Risk from Surface Water Map demonstrates the Site has a predominantly 'very low' risk of flooding from surface water. The NRW Surface Water Map for Planning indicates that majority of the site is located within Flood Zone 1 however there is a small area of Flood Zone 2. The cable route is deemed to have a very low risk of flooding and is primarily located with Flood Zone 1.

11.3 Surface Water and SuDs Measures

- 11.3.1 The Proposed Development is expected to increase impermeable areas within the site by 0.81 ha (8,055.16m²). A SuDS strategy has been produced to incorporate appropriate management techniques that will mitigate potential increase in runoff from the Proposed Development.
- 11.3.2 SuDS techniques include an attenuation basin provided up 783m³ of storage to help attenuation for the proposed infrastructure and ancillary features. Access tracks will be constructed out of permeable materials.
- 11.3.3 The surface water and soil management measures incorporated within the Proposed Development will ensure that there is negligible alteration to local drainage patterns, flow directions and will manage suspended sediments from entering the drainage channels.

11.4 Conclusion

- 11.4.2 The FCA demonstrates the site has been assessed to have a low risk of flooding from all assessed sources. The site is not assessed to be at risk from sea flooding. The following conclusions can also be made:
- Development will be restricted to areas at a very low and low risk of flooding.
 - The Proposed Development will neither exacerbate existing flooding problems nor increase the risk of flooding on Site or elsewhere.
 - Surface water runoff will be mitigated by maintenance of a vegetation cover and SuDS features; and

- With appropriate surface water and soil management measures there is negligible alteration to local drainage patterns direction within the Site.

11.4.3 The residual effect of the development on flood risk is therefore considered to be negligible. The BESS site will be safe for its lifetime, taking account of the limited number of users of the Site with no increase in flood risk elsewhere.

11.4.4 Additionally, the Proposed Development provides significant sustainability benefits including the significant provision of stored electricity for the National Grid.

APPENDICES

Appendix A

NRW Response

Louisa Anscomb

From: Data Distribution <datadistribution@cyfoethnaturiolcymru.gov.uk>
Sent: 03 October 2023 10:36
To: Louisa Anscomb
Subject: ATI-25976a -: Flood Information Data Request/SA71 5SH/HLEF 85794

CAUTION: This email originated from outside of RPS.

Good morning,

Unfortunately, the flood map in this area is based on a nationally generated FRAW model, this was last updated in 2020. FRAW modelling uses LIDAR data to generate flood outlines with assumptions made about the channel capacity. This modelling was carried out for the production of flood extents only and is not suitable for detailed site specific assessments, therefore we are not able to provide any flood products for your site.

Please see the links below that may be of some use,

[Recorded Flood Extents | DataMapWales \(gov.wales\)](#)

[Areas Benefiting from Flood Defences | DataMapWales \(gov.wales\)](#)

[Flood Defence Structures | DataMapWales \(gov.wales\)](#)

Kind Regards

Owen Jones

Swyddog Trwyddedu Data / Data Licensing Officer

Cyswllt Cyfoeth / Customer Hub

Cwsmeriaid, Cyfathrebu a Masnach / Customer, Communications and Commercial Directorate



Croesewir gohebiaeth yn Gymraeg a byddwn yn ymateb yn Gymraeg, heb i hynny arwain at oedi.

Correspondence in Welsh is welcomed, and we will respond in Welsh without it leading to a delay.



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Cymru
Natural
Resources
Wales**

**Byd natur a phobl
yn ffynnu gyda'n gilydd**

**Nature and people
thriving together**



**cyfoethnaturiol.cymru
naturalresources.wales**

From: Louisa Anscomb <Louisa.Anscomb@rpsgroup.com>
Sent: 11 September 2023 11:28
To: Data Distribution <datadistribution@cyfoethnaturiolcymru.gov.uk>
Subject: Flood Information Data Request/SA71 5SH/HLEF 85794

Rhybudd: Deilliodd yr e-bost hwn o'r tu allan i'r sefydliad. Peidiwch â chlicio dolenni nac atodiadau agored oni bai eich bod yn cydnabod yr anfonwr ac yn gwybod bod y cynnwys yn ddiogel.

Caution: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Good Morning,

We wish to enquire with you regarding the flood information for a site near Goldborough Road, Hundleton, Pembroke, SA71 5SH.

Could we please request the following information if available:

- Modelled flood levels and depths or all modelled scenarios including climate change.
- Flood Hazard Mapping
- Historic Flood outlines
- Details of nearby flood defences, the type of defence, condition of the defences and level of protection they provide to the site
- Flood defence breach mapping

Please let me know if you require any further information.

Please find site location attached for your reference.

Kind regards,

Louisa



Louisa Anscomb (She/Her)
Graduate Consultant
RPS | Consulting UK & Ireland
20 Farringdon Street
London, EC4A 4AB, United Kingdom

T +44 20 3691 0500
E louisa.anscomb@rpsgroup.com



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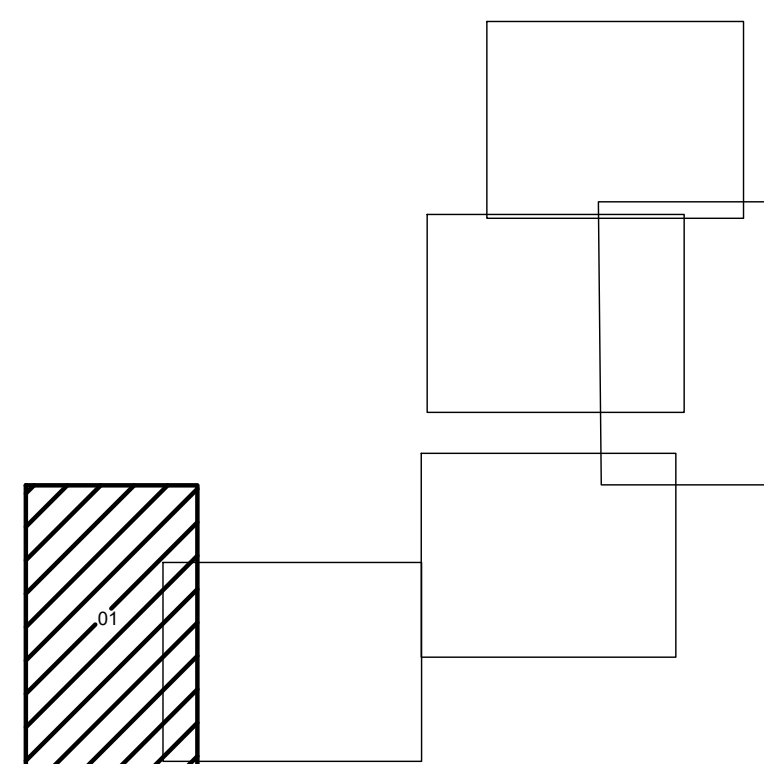
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RPS Group Limited web link: <http://www.rpsgroup.com>

Appendix B

Topographic Survey



ABBREVIATIONS & SYMBOLS

[illegible]

DRAWING NOTES

Topographical Surveys

Topographical Surveys

Trees are drawn to scale showing the average canopy spread. Descriptions and heights should be used as a guide only.

All building names, descriptions, number of storeys, construction type including roof line details are indicative only and taken externally from ground level.

Detail, services and features may not have been surveyed if obstructed or not reasonably visible at the time of the survey.

Detail, services and features may not have been surveyed if obstructed or not reasonably visible at the time of the survey.

Measured Building Surveys

Measurements to internal wall above the floor level and the

above the floor level and the wall assumed to be vertical.

Cill heights are measured as floor to the cill and head heights are measured from cill to the top of window.

General

The contractor must check and verify all site and building dimensions, levels, utilities and drainage details and connections prior to commencing work. Any errors or discrepancies must be notified to Survey Solutions immediately.

The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated.

The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated.

The survey control listed is only to be used for topographical surveys at the stated scale. All control must be checked and verified prior to use.

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SURVEY CONTROL CO-ORDINATES				
STATION	EASTINGS	NORTHINGS	LEVEL	DESCRIPTION
S101	120297.613	123267.489	66.916	PK NAL
S102	120254.104	123269.680	70.616	PK NAL
S103	120269.557	123264.660	67.252	PK NAL
S104	120272.288	123271.314	66.581	PK NAL
S105	120368.057	123242.049	42.787	PK NAL
S106	120346.074	123258.932	57.242	Peq & NAL
S107	120352.147	123258.932	45.972	PK NAL
S108	120334.997	123259.770	31.660	PK NAL
S109	120368.343	123181.215	29.569	Peq & NAL
S110	120279.920	123127.464	66.955	PK NAL
S111	120347.248	123139.259	39.369	PK NAL
S1203	120393.548	124259.712	64.754	PK NAL
S1204	120389.464	124259.731	59.209	PK NAL
S1205	120310.244	124222.617	46.674	PK NAL
S1206	120366.700	124040.719	33.558	Peq & NAL
S1207	120316.491	124088.825	28.313	Peq & NAL
S1208	120351.020	124055.865	23.334	Peq & NAL
S1209	120368.071	124050.935	10.871	PK NAL
S111	120357.063	124256.363	5.394	Peq & NAL

SURVEY GRID AND LEVEL DATUM
The coordinate system established for this survey is related to Ordnance Survey (OS) national grid at a single point using Smartnet, then orientated to grid north with a scale factor of 1.000.

The level datum established for this survey is related to Ordnance Survey (OS) using GPS Smartnet.

To avoid discrepancies any coordinated data used in conjunction with this survey must be derived directly from this control data.

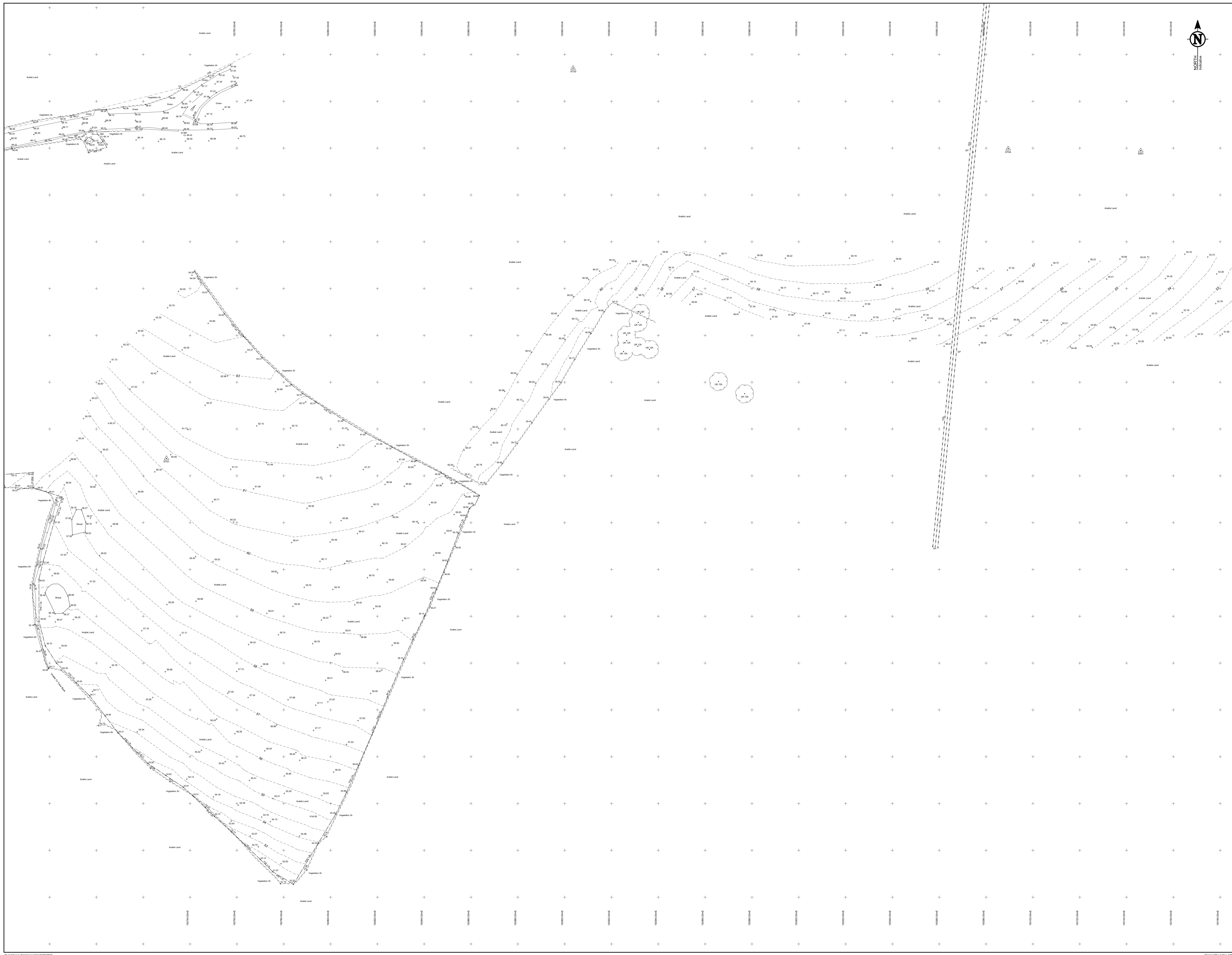
A horizontal number line with a vertical line at the left end. There are 11 tick marks along the line, representing integers from 0 to 10. The tick marks are evenly spaced.

REV	DESCRIPTION	DRAWN	APPR	DATE
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PROJECT TITLE			
GOLDBOROUGH ROAD, HUNDELTON, PEMBROKE, SA71 5SH			
DRAWING DETAIL			
TOPOGRAPHICAL SURVEY			
Sheet 1 of 6			
CLIENT			SCALE
RICHARD MOORE			1:500
SURVEYOR	SURVEY DATE	CHECKED BY	APPROVED BY
AJC	23/01/2022	JH	MM
DWG STATUS			FINAL
DRAWING NUMBER		REVISION	ISSUE DATE
46854CVLS-01			30/01/22





TOPOGRAPHICAL & MEASURED BUILDING SURVEYS

ABBREVIATIONS & SYMBOLS			
AA	Air-hold height	ER	East Road
AB	Arch	EX	EX-Transformer
ABR	Arch Bridge	FL	Flow
AC	Air Valve	FLB	Flow Break Direction
AD	Arch Dam	FLD	Flow Direction
BS	Bore Hole	FLF	Flow Level
BSH	Bore Hole	FLH	Flow Height
BSL	Bore Hole	FLM	Flow Meter
BSR	Bore Hole	FLN	Flow Net
BSU	Bore Hole	FLP	Flow Pipe
BSV	Bore Hole	FLQ	Flow Quantity
BSW	Bore Hole	FLR	Flow Rate
BSX	Bore Hole	FLS	Flow Station
BSY	Bore Hole	FLT	Flow Test
BSZ	Bore Hole	FLU	Flow Unit
BSA	Bore Hole	FLV	Flow Velocity
BSB	Bore Hole	FLW	Flow Width
BSH	Bore Hole	FLX	Flow X
BSI	Bore Hole	FLY	Flow Y
BSK	Bore Hole	FLZ	Flow Z
BSL	Bore Hole	FLA	Flow Area
BSM	Bore Hole	FLB	Flow Break Direction
BSN	Bore Hole	FLC	Flow Control
BSO	Bore Hole	FLD	Flow Direction
BSR	Bore Hole	FLF	Flow Level
BSU	Bore Hole	FLG	Flow Level
BSV	Bore Hole	FLH	Flow Height
BSW	Bore Hole	FLI	Flow Interval
BSX	Bore Hole	FLJ	Flow Interval
BSY	Bore Hole	FLK	Flow Interval
BSZ	Bore Hole	FLM	Flow Meter
BSA	Bore Hole	FLN	Flow Net
BSB	Bore Hole	FLP	Flow Pipe
BSH	Bore Hole	FLQ	Flow Quantity
BSI	Bore Hole	FLR	Flow Rate

DRAWING NOTE:

Topographical Survey

Trees are drawn to scale showing the average canopy spread. Descriptive heights should be used as a guide only.

All building names, descriptions, number of storeys, construction type in roof line details are indicative only and taken externally from ground level.

All below ground details including drainage, voids and services have been identified from above ground and therefore all details relating to these features including: sizes, depth, description etc will be approximate only. All critical dimensions and connections should be checked and verified prior to start work.

Detail, services and features may not have been surveyed if obstructed or reasonably visible at the time of the survey.

Surveyed physical features may not necessarily represent the legal boundary line.

Measured Building Surveys

Measurements to internal walls are taken to the wall finishes at approx. 1 m above the floor level and the wall assumed to be vertical.

Cill heights are measured as floor to the cill and head heights are measured from cill to the top of window.

General

The contractor must check and verify all site and building dimensions, level, utilities and drainage details and connections prior to commencing work. Any errors or discrepancies must be notified to Survey Solutions immediately.

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STATIONS	EASTINGS	NORTHINGS	LEVEL	DESCRIPTION
S101	120697.613	120767.498	65.916	PK Nail
S102	120541.104	120329.609	70.616	PK Nail
S103	120541.104	120329.609	67.262	PK Nail
S104	120742.298	120217.318	66.581	PK Nail
S105	120869.657	120624.699	42.787	PK Nail
S401	10146.074	120528.932	57.242	Peq & Nail
S402	10146.074	120528.932	49.072	Peq & Nail
S403	103334.967	120512.931	31.660	PK Nail
S101	120697.613	120767.498	21.569	Peq & Nail
S102	120541.104	120329.609	60.955	Peq & Nail
S103	120541.104	120329.609	67.262	Peq & Nail
S104	120742.298	120217.318	64.754	Peq & Nail
S105	120869.657	120624.699	42.787	PK Nail
S106	120707.244	120729.960	38.615	Peq & Nail
S107	120686.790	120140.719	41.568	Peq & Nail
S108	120615.491	120188.825	26.373	Peq & Nail
S109	120611.405	120255.965	23.334	Peq & Nail
S110	120611.405	120255.965	10.871	Peq & Nail
ST11	120597.063	120393.863	5.394	Peq & Nail

SURVEY GRID AND LEVEL DATUM

The coordinate system established for this survey is related to Ordnance Survey (OS) national grid at a single point using Smartnet, then orientated to grid with a scale factor of 1.000.

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REV	DESCRIPTION	DRAWN	APPR
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PROJECT TITLE
GOLDBOROUGH ROAD, HUNDLETON, PEMBROKE,
SA71 5SH

DRAWING DETAIL

TOPOGRAPHICAL SURVEY
Sheet 2 of 6

CLIENT	SCALE
RICHARD MOORE	1:500

SURVEYOR	SURVEY DATE	CHECKED BY	APPROVED BY	DWG 3
AJC	23/01/2022	JH	MM	FINAL

DRAWING NUMBER 46584CVLS-02	REVISION	ISSUE 30/0
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[illegible]

Topographical Surveys

Trees are drawn to scale showing the average canopy spread. Description heights should be used as a guide only.

All building names, descriptions, number of storeys, construction type and roof line details are indicative only and taken externally from ground level.

All below ground details including drainage, voids and services have been identified from above ground and therefore all details relating to these features including; sizes, depth, description etc will be approximate only. All critical dimensions and connections should be checked and verified prior to start of work.

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Measured Building Surveys

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Cill heights are measured as floor to the cill and head heights are measured from cill to the top of window.

General

The contractor must check and verify all site and building dimensions, level, utilities and drainage details and connections prior to commencing work. A signed and stamped verification must be notified to Suncoast Solutions immediately.

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SURVEY CONTROL CO-ORDINATES					
STATION	EASTINGS	NORTHINGS	LEVEL	DESCRIPTION	
S101	102607.613	102167.498	65.916	Pk Nail	
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S103	102647.604	102147.604	67.816	Pk Nail	
S104	102672.208	102173.318	66.581	Pk Nail	
S105	102689.667	102164.609	42.787	Pk Nail	
S106	102616.074	102555.632	47.872	Peg & Nail	
S402	102352.147	101234.779	45.972	Pk Nail	
S403	102333.997	102106.079	31.660	Pk Nail	
S107	102679.343	102181.215	29.969	Peg & Nail	
S108	102729.620	102181.215	36.355	Pk Nail	
ST02	102652.242	102163.509	66.989	Pk Nail	
ST03	102620.598	102124.182	64.675	Pk Nail	
S104	102608.444	102129.731	69.209	Pk Nail	
ST04	102652.242	102172.224	68.754	Pk Nail	
ST05	102665.790	102460.719	33.558	Peg & Nail	
ST08	102615.491	102188.825	28.813	Peg & Nail	
ST09	102611.410	102195.865	23.334	Peg & Nail	
ST10	102611.977	102195.865	23.334	Peg & Nail	
ST11	102570.063	102256.363	5.994	Peg & Nail	

The coordinate system established for this survey is related to Ordnance Survey (OS) national grid at a single point using Smartnet, then orientated to grid north with a scale factor of 1.000.

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REV	DESCRIPTION	DRAWN	APPR	CHECKED
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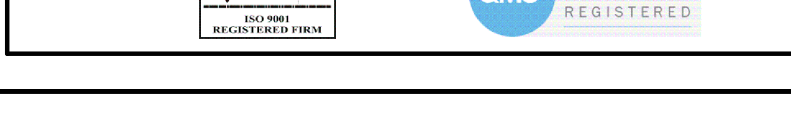
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GOLDBOROUGH ROAD, HUNDLETON, PEMBROKE.

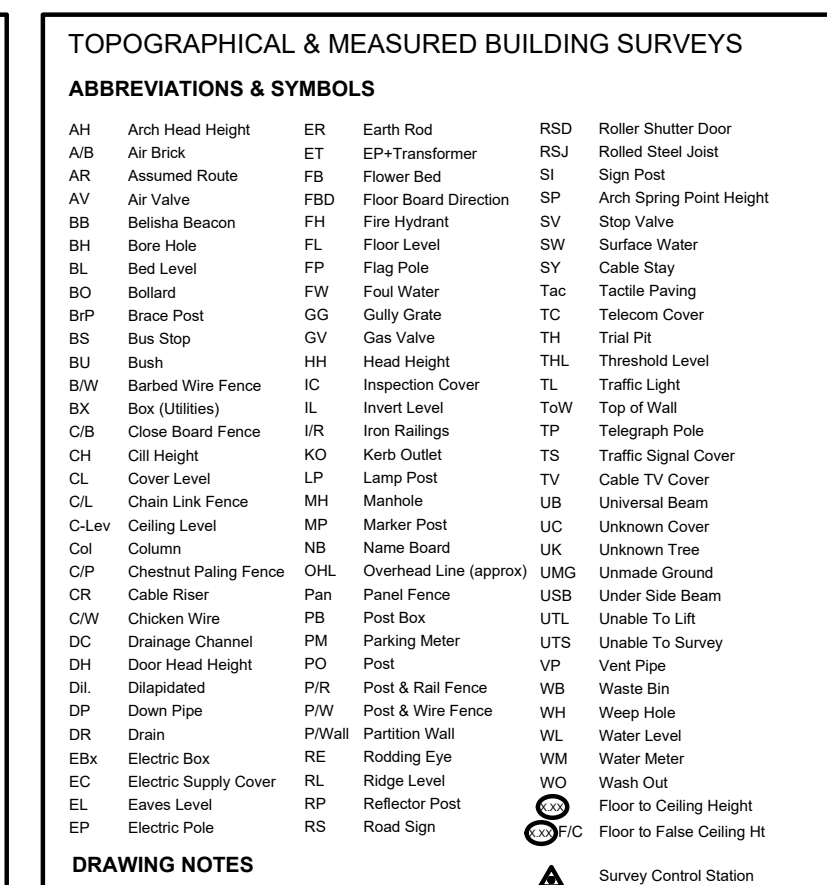
SA71 5SH
DRAWING DETAIL

TOPOGRAPHICAL SURVEY
Sheet 3 of 6

CLIENT RICHARD MOORE				SCALE 1:500
SURVEYOR AJC	SURVEY DATE 23/01/2022	CHECKED BY JH	APPROVED BY MM	DWG ST FINAL
DRAWING NUMBER 46854CVLS-03			REVISION	ISSUE D 30/01/2022







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SURVEY GRID AND LEVEL DATUM

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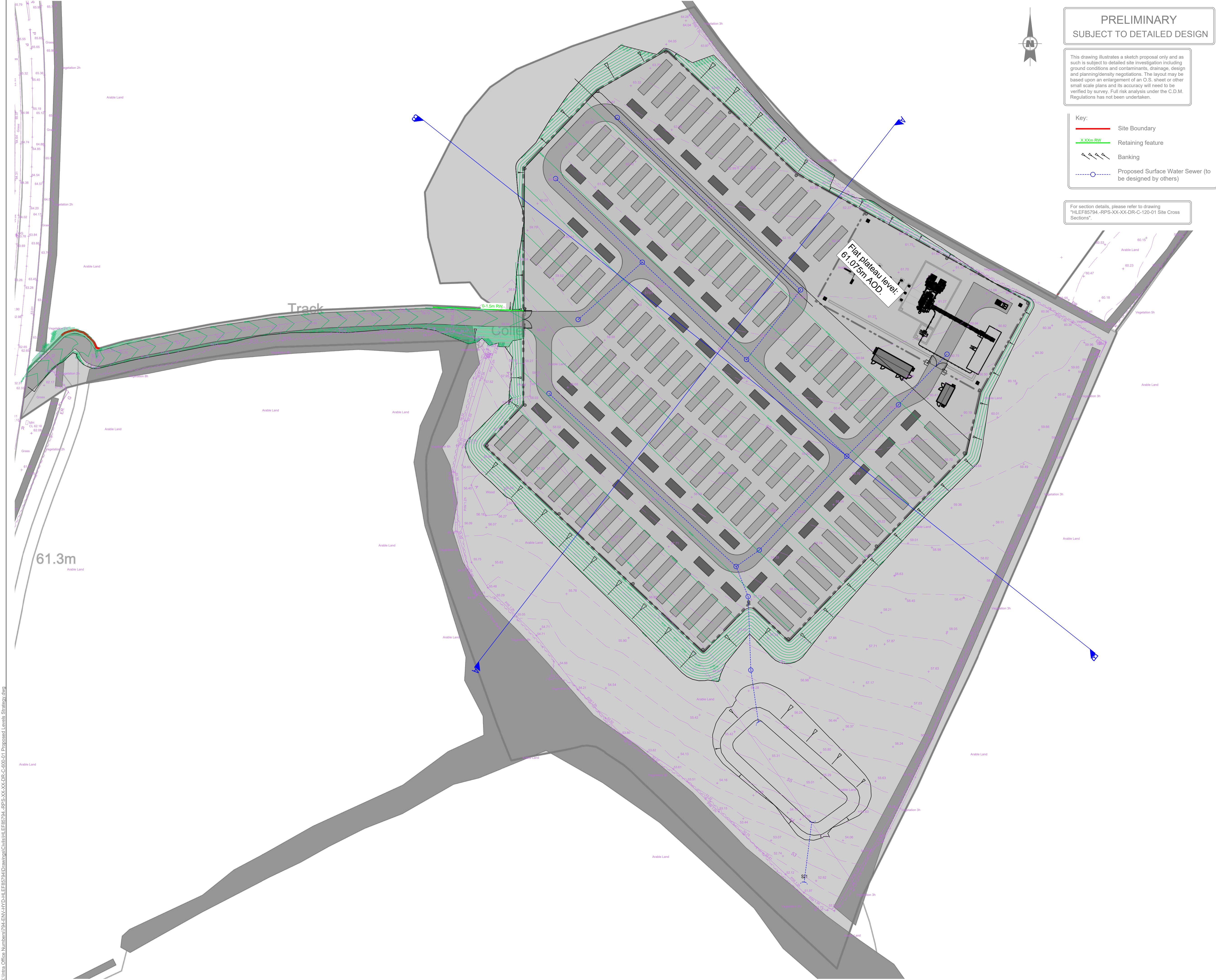
The level datum established for this survey is related to Ordnance Survey (OS) using GPS Smartnet.

To avoid discrepancies any coordinated data used in conjunction with this survey must be derived directly from this control data.

Appendix C

Proposed Development Levels

K:\Info Office Numbers\5794-ENV-ENV-H\EF85794-Drawings\Cals\HLEF85794-RPS-XX-XX-DR-C-600-01 Proposed Levels Strategy.dwg



PRELIMINARY
SUBJECT TO DETAILED DESIGN

This drawing illustrates a sketch proposal only and as such is subject to detailed site investigation including ground conditions and contaminants, drainage, design and planning/density negotiations. The layout may be based upon an enlargement of an O.S. sheet or other small scale plans and its accuracy will need to be verified by survey. Full risk analysis under the C.D.M. Regulations has not been undertaken.

- Key:
- Site Boundary
 - Retaining feature
 - Banking
 - Proposed Surface Water Sewer (to be designed by others)

For section details, please refer to drawing "HLEF85794.-RPS-XX-XX-DR-C-120-01 Site Cross Sections".

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- Notes
- This drawing has been prepared in accordance with the scope of RPS's appointment with its client and is subject to the terms and conditions of that appointment. RPS accepts no liability for any use of this document other than by its client and only for the purposes for which it was prepared and provided.
 - If received electronically it is the recipient's responsibility to print to correct scale. Only written dimensions should be used.
 - This drawing should be read in conjunction with all other relevant drawings and specifications.

P02	Latest site boundary and layout added.	CG	CG	07.12.23
P01	First Issue	CG	AG	28.11.23
Rev	Description	By	Ckd	Date



MAKING
COMPLEX
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4th Floor, 1 Newhall Street, Birmingham,
West Midlands B3 3NH
T: +44 121 622 8520 E: rpswlv@rpsgroup.com

Client **Enso Energy**

Project **Goldborough Road BESS - Pembroke**

Title **Proposed Contour Level Plan**

Status	Scale @ A1	Date Created
Preliminary	1:500	28.11.2023
Task Team Manager	Information Author	Task Information Manager
AG	CG	AG

Document Number
HLEF85794.-RPS-XX-XX-DR-C-600-01
Project Code - Originator - Zone - Level - Type - Role - Drawing Number

RPS Project Number	Suitability	Revision
HLEF85794.	S4	P02

rpsgroup.com

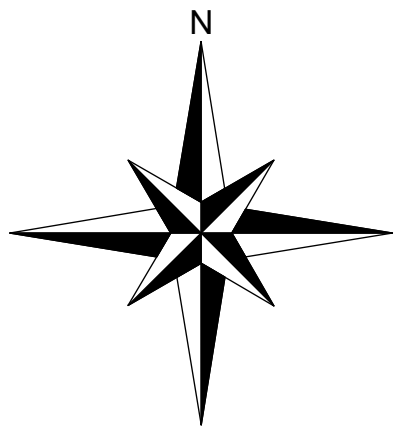
Appendix D

Development Plans



KEY

Site Boundary



Revisions:
First Issue- 06/12/2022 JS
01 - (25/10/2023 JS) New mapping
02 - (05/12/2023 AH) Revised site boundary
03 - (02/02/2024 AH) Revised Cable Route

ALL DIMENSIONS TO BE CHECKED ON SITE WORK
TO FIGURED DIMENSIONS ONLY REPORT
DISCREPANCIES TO THE GFP AT ONCE BEFORE
PROCEEDING COPYRIGHT ACT APPLIES.

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Tetbury Road, Cirencester, GL7 6JJ
Tel: 01452 764685 Email: enquiries@ensoenergy.co.uk

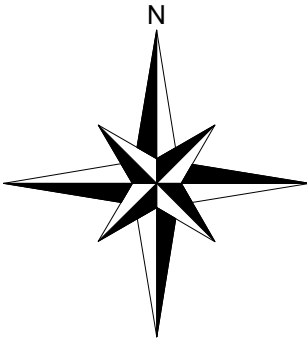
Project Title:
Goldborough Road BESS

Drawing Title:
Site Location Plan

DRWG No: PE-01-P01	Rev: 03	Sht no: -
Drawn by : AH	Checked by: RM	
Scale: 1:2500 @ A1	Date: 02/02/2024	



- KEY**
- Site Boundary
 - Existing Grassland
 - Existing Vegetation
 - Gravel
 - Control Room
 - Switchroom
 - Battery Container
 - Inverter/Transformer
 - Access Road
 - Gate
 - Security Fence
 - CCTV Camera



Revisions:
First Issue- 25/10/2023 JS
Rev 01 (05/12/2023 AH) Revised site boundary

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DIMENSIONS ONLY REPORT DISCREPANCIES TO THE GFP AT
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Project Title: Goldborough Road BESS		
Drawing Title: Proposed Site Layout		
DRWG No: PE-01-P02	Rev: 01	Sht no: -
Drawn by : AH	Checked by: RM	
Scale: 1:1000 @ A2	Date: 05/12/2023	

Appendix E

MicroDrainage Greenfield Runoff Rates

RPS Group				Page 1	
Unit 7, Woodrow Business Centre		HLEF04201			
Woodrow Way		Pembroke			
Manchester, M44 6NN		Attenuation Required			
Date 13/11/2023		Designed by LA			
File Attenuation required v4...		Checked by AM			
Innovyze		Source Control 2020.1			
Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	8.930	0.430	1.8	193.0	O K
30 min Summer	9.055	0.555	1.8	264.5	O K
60 min Summer	9.184	0.684	1.8	347.1	O K
120 min Summer	9.271	0.771	1.8	407.2	O K
180 min Summer	9.326	0.826	1.8	447.3	O K
240 min Summer	9.366	0.866	1.8	477.6	O K
360 min Summer	9.422	0.922	1.8	521.7	O K
480 min Summer	9.460	0.960	1.8	552.8	O K
600 min Summer	9.489	0.989	1.8	576.5	O K
720 min Summer	9.511	1.011	1.8	595.2	O K
960 min Summer	9.544	1.044	1.9	623.6	O K
1440 min Summer	9.578	1.078	1.9	653.5	O K
2160 min Summer	9.588	1.088	1.9	662.0	O K
2880 min Summer	9.579	1.079	1.9	654.0	O K
4320 min Summer	9.555	1.055	1.9	633.3	O K
5760 min Summer	9.539	1.039	1.9	618.8	O K
7200 min Summer	9.534	1.034	1.9	614.7	O K
8640 min Summer	9.535	1.035	1.9	615.9	O K
10080 min Summer	9.541	1.041	1.9	621.1	O K
15 min Winter	8.972	0.472	1.8	216.4	O K
30 min Winter	9.107	0.607	1.8	296.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	129.989	0.0	147.7	27	
30 min Summer	89.174	0.0	142.2	42	
60 min Summer	58.744	0.0	277.3	72	
120 min Summer	34.818	0.0	270.2	130	
180 min Summer	25.737	0.0	267.9	190	
240 min Summer	20.794	0.0	268.3	250	
360 min Summer	15.403	0.0	274.5	370	
480 min Summer	12.438	0.0	281.0	488	
600 min Summer	10.538	0.0	285.5	608	
720 min Summer	9.203	0.0	288.7	728	
960 min Summer	7.442	0.0	292.6	966	
1440 min Summer	5.496	0.0	294.0	1444	
2160 min Summer	4.026	0.0	573.1	2160	
2880 min Summer	3.226	0.0	574.6	2688	
4320 min Summer	2.361	0.0	559.7	3416	
5760 min Summer	1.907	0.0	1083.9	4160	
7200 min Summer	1.637	0.0	1068.9	4984	
8640 min Summer	1.458	0.0	1035.6	5880	
10080 min Summer	1.332	0.0	1016.0	6752	
15 min Winter	129.989	0.0	148.0	27	
30 min Winter	89.174	0.0	135.6	41	
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RPS Group				Page 2	
Unit 7, Woodrow Business Centre Woodrow Way Manchester, M44 6NN		HLEF04201 Pembroke Attenuation Required			
Date 13/11/2023 File Attenuation required v4...		Designed by LA Checked by AM			
Innovyze		Source Control 2020.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	9.246	0.746	1.8	389.3	O K
120 min Winter	9.339	0.839	1.8	457.2	O K
180 min Winter	9.398	0.898	1.8	502.8	O K
240 min Winter	9.442	0.942	1.8	537.3	O K
360 min Winter	9.503	1.003	1.8	588.2	O K
480 min Winter	9.545	1.045	1.9	624.4	O K
600 min Winter	9.577	1.077	1.9	652.3	O K
720 min Winter	9.602	1.102	1.9	674.7	O K
960 min Winter	9.639	1.139	1.9	709.3	O K
1440 min Winter	9.681	1.181	2.0	748.6	O K
2160 min Winter	9.700	1.200	2.0	766.7	O K
2880 min Winter	9.698	1.198	2.0	765.3	O K
4320 min Winter	9.671	1.171	2.0	738.9	O K
5760 min Winter	9.651	1.151	1.9	720.7	O K
7200 min Winter	9.642	1.142	1.9	711.7	O K
8640 min Winter	9.638	1.138	1.9	707.7	O K
10080 min Winter	9.638	1.138	1.9	708.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	58.744	0.0	272.9	70	
120 min Winter	34.818	0.0	268.8	130	
180 min Winter	25.737	0.0	271.0	188	
240 min Winter	20.794	0.0	276.9	246	
360 min Winter	15.403	0.0	286.8	364	
480 min Winter	12.438	0.0	293.0	482	
600 min Winter	10.538	0.0	297.2	598	
720 min Winter	9.203	0.0	300.0	716	
960 min Winter	7.442	0.0	303.3	950	
1440 min Winter	5.496	0.0	303.3	1414	
2160 min Winter	4.026	0.0	598.7	2096	
2880 min Winter	3.226	0.0	598.4	2744	
4320 min Winter	2.361	0.0	581.9	3636	
5760 min Winter	1.907	0.0	1132.0	4440	
7200 min Winter	1.637	0.0	1108.2	5400	
8640 min Winter	1.458	0.0	1096.5	6320	
10080 min Winter	1.332	0.0	1080.6	7264	
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RPS Group		Page 3
Unit 7, Woodrow Business Centre Woodrow Way Manchester, M44 6NN	HLEF04201 Pembroke Attenuation Required	
Date 13/11/2023 File Attenuation required v4...	Designed by LA Checked by AM	
Innovyze Source Control 2020.1		

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 192719 201043 SM 92719 01043
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.800

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)	From: To:	(ha)
0 4	0.267	4 8	0.267	8 12	0.267

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RPS Group		Page 4
Unit 7, Woodrow Business Centre Woodrow Way Manchester, M44 6NN	HLEF04201 Pembroke Attenuation Required	
Date 13/11/2023 File Attenuation required v4...	Designed by LA Checked by AM	
Innovyze	Source Control 2020.1	

Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 8.500

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	360.3	1.500	1164.1	1.501	1164.8

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0064-2200-1500-2200
Design Head (m)	1.500
Design Flow (l/s)	2.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	64
Invert Level (m)	8.500
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	2.2
Flush-Flo™	0.279	1.8
Kick-Flo®	0.571	1.4
Mean Flow over Head Range	-	1.7

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)
0.100	1.5	1.200	2.0	3.000	3.0	7.000	4.5
0.200	1.7	1.400	2.1	3.500	3.2	7.500	4.6
0.300	1.8	1.600	2.3	4.000	3.5	8.000	4.8
0.400	1.7	1.800	2.4	4.500	3.7	8.500	4.9
0.500	1.6	2.000	2.5	5.000	3.8	9.000	5.1
0.600	1.5	2.200	2.6	5.500	4.0	9.500	5.2
0.800	1.7	2.400	2.7	6.000	4.2		
1.000	1.8	2.600	2.8	6.500	4.3		

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RPS Group		Page 1
Unit 7, Woodrow Business Centre Woodrow Way Manchester, M44 6NN	HLEF85794 Pembroke Imperneable Area Runoff	
Date 23/10/2023 File Whole Site Greenfield R...	Designed by LA Checked by FC	
Innovyze Source Control 2020.1		

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.300
Area (ha)	0.800	Urban	0.000
SAAR (mm)	1000	Region Number	Region 9

Results 1/s

QBAR Rural	2.2
QBAR Urban	2.2
Q100 years	4.8
Q1 year	1.9
Q30 years	3.9
Q100 years	4.8

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Appendix F

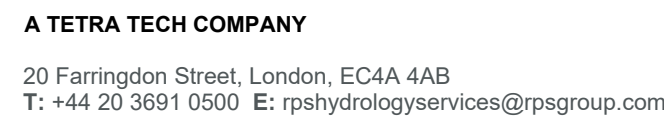
Conceptual Water Drainage Strategy

This drawing illustrates a sketch proposal only and as such is subject to detailed site investigation including ground conditions/contaminants, drainage, design and planning/density negotiations. The layout may be based upon an enlargement of an OS sheet or other small scale plans and its accuracy will need to be verified by Survey. Full risk analysis under the CDM Regulations has not been undertaken.

Surface Water Manhole

Surface Water Drainage

Surface Water Headwall



Title	Conceptual Drainage Strategy
-------	------------------------------

JM LA TJ

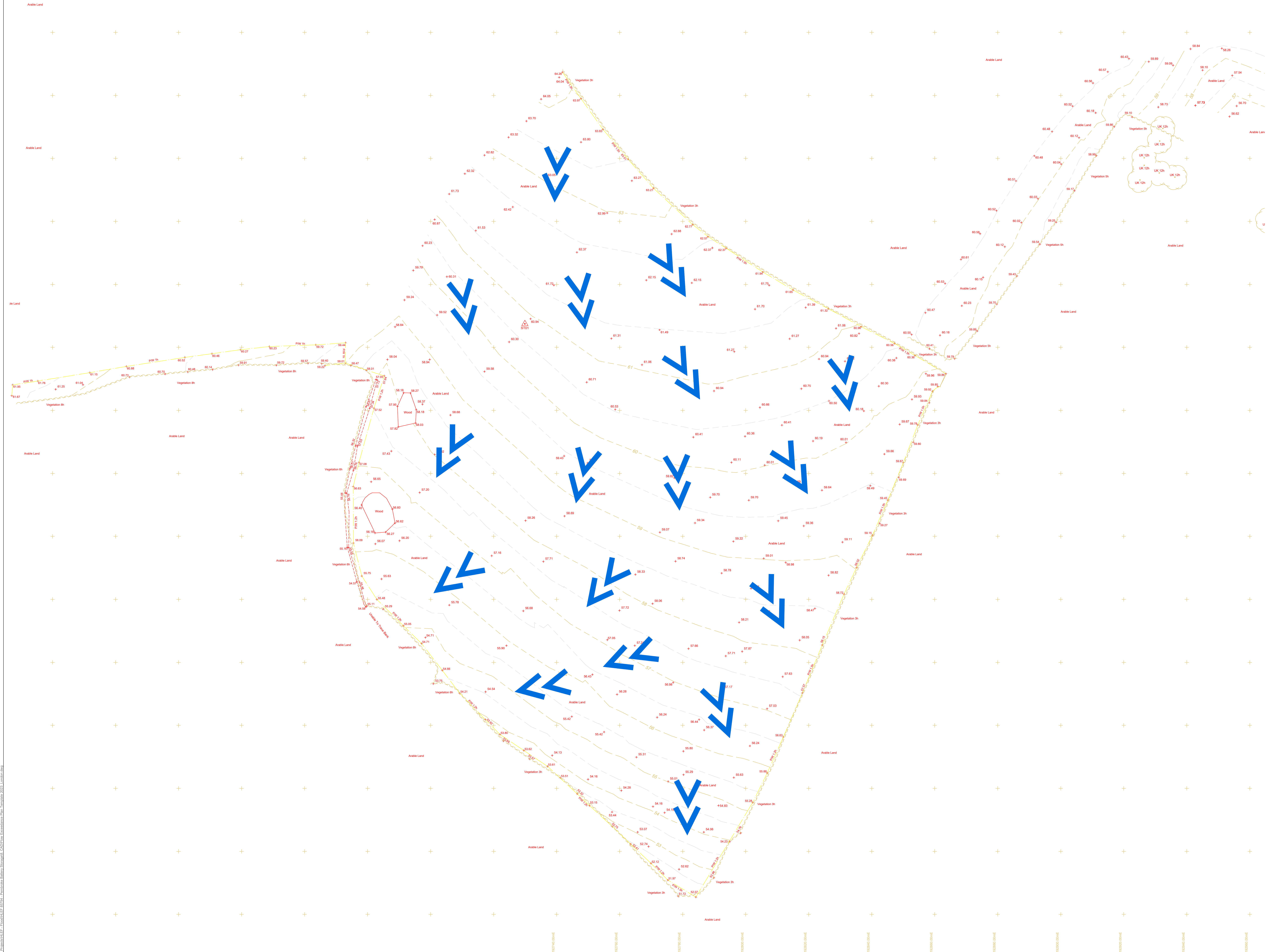
HLEF85796-RPS-ConceptualDrainage-2-231121

Revisi

Appendix G

Pre-Development Flow Conveyance Plan

O:\Environment\01_Projects\HLEF - Flood\HLEF-85794 - Pembroke Battery Storage\6_CAD\Flow Exceedance Plan_Timetable 2023_1 London Data



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- Notes
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 2. If received electronically it is the recipient's responsibility to print to correct scale. Only written dimensions should be used.
 3. This drawing should be read in conjunction with all other relevant drawings and specifications.

KEY

Indicative overland flow
exceedance route



A	Draft	LA	TJ	21-11-23
Rev	Description	By	Chk	Date

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Client **ENSO Energy**

Project **Pembroke Battery Site**

Title **Flow Exceedance Plan**

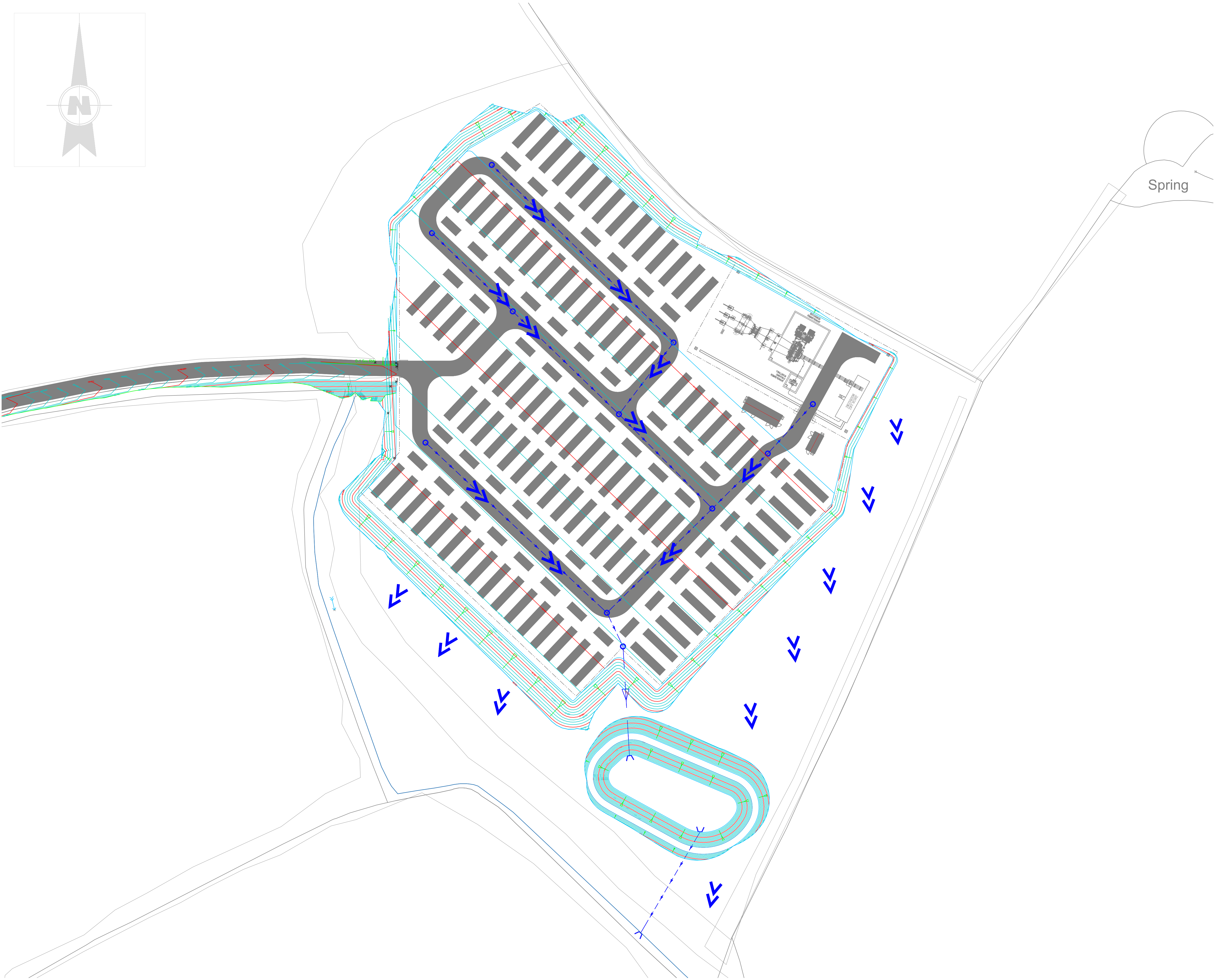
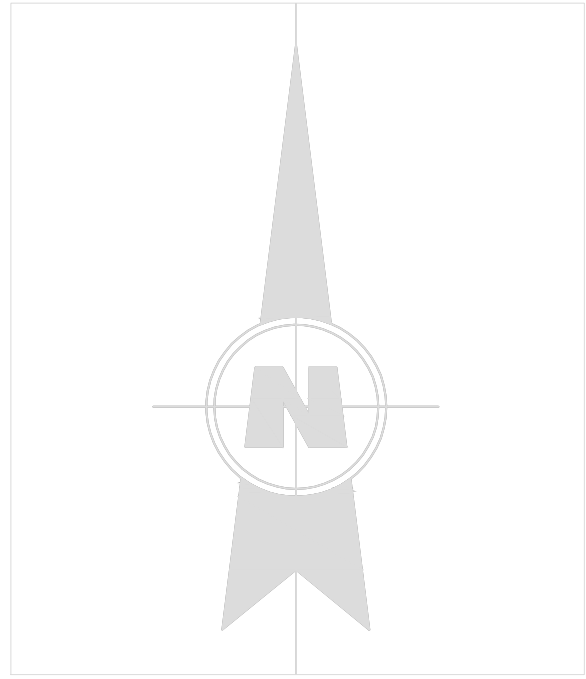
Status Draft	Scale 1:1 @A0	Date Created 16.11.2023
Task Team Manager JM	Information Author LA	Task Information Manager JM
Document Number DM02		

RPS Project Number
HLEF85794
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Revision
A

Appendix H

Post-Development Flow Conveyance Plan



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PRELIMINARY SUBJECT TO DETAILED DESIGN

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KEY

Indicative overland flow
exceedance route



B	Second Issue	LA	TJ	18.01.24
A	First Issue	LA	AM	31.10.23
Rev	Description	By	Ckd	Date



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Client ENSO Energy

Project Goldborough Road BESS

Title Flow Exceedance Plan Post
Development

Status	Scale	Date Created
Preliminary	1:x @A1	18.01.24
Task Team Manager	Information Author	Task Information Manager
JM	LA	JM
Document Number		
D01		

RPS Project Number	Revision
HLEF85794	B
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