BATTERY STORAGE FACILITY, EAST CLAYDON

Flood Risk Assessment and Conceptual Drainage Strategy

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1 SCOPE OF WORK

Background

1.1 At the request of Statera Energy, RPS Consulting Services Limited (RPS) has prepared a site-specific Flood Risk Assessment (FRA) to support the application for the development of a Battery storage facility and associated infrastructure. The site is located north west of Hogshaw Road, East Claydon, MK18 3NU. The assessment has been undertaken in accordance with the National Planning Policy Framework (NPPF) and Planning Practice Guidance (PPG).

1.2 The key objectives of the FRA 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 and users would be acceptable;
- 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 flood risk elsewhere; and
- satisfy the requirements of the NPPF and Planning Practice Guidance which require FRAs to be submitted in support of planning applications for development over 1 ha in area.

1.3 Developments that are designed without regard to flood risk may endanger lives, damage property, cause disruption to the wider community, damage the environment, be difficult to insure and require additional expense on remedial works. Current guidance on development and flood risk identifies several key aims for a development to ensure that it is sustainable in flood risk terms. These aims are as follows:

- the development should not be at a significant risk of flooding and should not be susceptible to damage due to flooding;
- the development should not be exposed to flood risk such that the health, safety or welfare of the users of the development, or the population elsewhere, is threatened;
- normal operation of the development should not be susceptible to disruption as a result of flooding;
- safe access to and from the development should be possible during flood events;
- the development should not increase flood risk elsewhere;
- the development should not prevent safe maintenance of watercourses or maintenance and operation of flood defences;
- the development should not be associated with an onerous or difficult operation and maintenance regime to manage flood risk. The responsibility for any operation and maintenance required should be clearly defined;
- future users of the development should be made aware of any flood risk issues relating to the development;
- the development design should be such that future users will not have difficulty obtaining insurance or mortgage finance, or in selling all or part of the development, as a result of flood risk issues;
- the development should not lead to degradation of the environment; and
- the development should meet all of the above criteria for its entire lifetime, including consideration of the potential effects of climate change.

1.4 The FRA is prepared with due consideration of these sustainability aims.

Project Scope

1.5 This FRA has the following structure:

- Sections 2 and 3 identify the sources of information that have been consulted in preparation of the report;
- Sections 4 and 5 describe the site location and the existing and proposed site development layout;
- Section 6 provides a hydrological review off the site and undertakes an FRA of the proposed development scheme;
- Section 7 describes the sites vulnerability status in line with the NPPF and PPG;
- Section 8 describes the runoff characteristics and drainage of the site;
- Section 9 provides a summary and conclusion to the report.

2 SOURCES OF INFORMATION

Introduction

2.1 Table 1 below lists the information sources consulted during preparation of this report.

Table 1: Information sources consulted during preparation of the report.

Source	Data	Notes
Ordnance Survey	OS Mapping 1: 50 000	Area information, rivers and other watercourses, general site environs, built environment, catchment Information
British Geological Survey	BGS (online) Geology of Britain Viewer	Site and area geology
Environment Agency (EA)	EA data holdings, customer service and engagement team	Current flood risk, local flood defences, flood levels, supplementary geology and groundwater information
Local Planning Authority (LPA) Buckinghamshire Council (District Area: Aylesbury Vale)	Vale of Aylesbury Local Plan	Flood Zoning Local Development Framework
UK Government: Department for Communities and Local Government	NPPF Planning Practice Guidance	Flood zoning for the site as used by the EA in England

2.2 The Reports consulted during the preparation of the document are listed below:

Table 2: Reports consulted during preparation of the document

Source	Data	Information consulted/ provided
Buckinghamshire Council (District Area: Aylesbury Vale)	Buckinghamshire Council Local Flood Risk Management Strategy Aylesbury Vale Strategic Flood Risk Assessment	Current Flood Zone / risk to the site including historical flooding locations Any relevant flood modelling complete for the site
EA	Anglian: Catchment Flood Management Plan December 2009	Flood risk management policies

Legislation and Guidance

National Planning Policy Framework

2.3 The National Planning Policy Framework (NPPF) was released in March 2012 and was updated in September 2023. The document sets out Government planning policies for England and how these are expected to be applied. The framework acts as guidance for local planning authorities and decision-takers, both in drawing up plans and making decisions about planning applications.

2.4 Section 14 sets out the need for an appropriate assessment of flood risk. Guidance on the minimum requirements for such an assessment is contained in PPG ID7.

2.5 The NPPF requires the application of a sequential risk-based approach to determining the suitability of land for development in flood risk areas, and that flood risk assessment should be carried out to the appropriate degree, at all levels of the planning process.

2.6 Footnote 55 identifies that '*A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use*'.

Planning Practice Guidance

2.7 PPG ID7 Flood Risk and Coastal Change provides guidance to ensure the effective implementation of the NPPF planning policy for development in areas at risk of flooding.

Legislative background

2.8 Following the implementation of the Flood and Water Management Act 2010 local flood risk has become the responsibility of the Local Planning Authority. The Act places new duties on upper tier Councils, by designating them as Lead Local Flood Authorities (LLFAs) for the coordination of local flood risk management in their respective administrative areas.

2.9 From April 6 2015 the responsibility for drainage and surface water management design approval resides with the local planning authority and should be submitted as part of the planning process.

2.10 The local planning authority has responsibility for the approval of proposed drainage systems in new developments and redevelopments. Approval must be given before any developer can commence construction. In order to be approved, the proposed drainage system would have to meet national standards for sustainable drainage.

2.11 The local planning authority is also responsible for adopting and maintaining SuDS which serve more than one property, which they have approved. The Highways Authorities will be responsible for maintaining SuDS in public roads to National Standards.

2.12 The SuDS Manual C753 sets out the criteria by which the form of drainage appropriate to any particular site or development can be determined, as well as requirements for the design, construction, operation and maintenance of SuDS.

2.13 Additional guidance for the use of SuDS is provided via CIRIA and BRE in the following:

- C609 Sustainable drainage systems. Hydraulic, structural and water quality advice (Superseded by C697 but remains current)
- C156 Infiltration Drainage – Manual of Good practice
- BRE Digest 365 Soakaway design

Climate Change

2.14 The NPPF and supporting planning practice guidance on Flood Risk and Coastal Change explain when and how flood risk assessments should be used. This includes demonstrating how flood risk will be managed now and over the development's lifetime, taking climate change into account.

Peak River Flow Allowances

2.15 In September 2022, the EA updated advice on climate change allowances to support the NPPF. Peak river flow allowances show the anticipated changes to peak flow by management catchment. Management catchments are sub-catchments of river basin districts. Peak River Flow Allowances should be considered for locations that are currently in Flood Zone 1, but might be in Flood Zone 2 or 3 in the future.

2.16 EA guidance on the application of climate changes allowance is dependent on the proposed developments vulnerability. As the development is a Battery Storage facility this application is

deemed as Essential Infrastructure. The EA require that for Essential Infrastructure developments located in Flood Zones 2, 3a or 3b, the higher central allowance should be used to assess climate change. Battery Storage developments have a lifetime of 40 years therefore will fall into the 2060s epoch.

2.17 The proposed East Claydon site is located within the Upper and Bedford Ouse Management Catchment for which the following peak river flow allowances are applicable.

Table 3: Upper and Bedford Ouse Management Catchment Peak River Flow Allowances

Epoch	Central	Higher Central	Upper End
2020s	5%	10%	24%
2050s	4%	11%	30%
2080s	19%	30%	58%

2.18 Based on the lifetime of the development and the vulnerability classification, an allowance of 11 – 30% is appropriate. As the Peak River Flow Allowances are considered to ensure the safety of people using the development when planning safe access, escape routes and places of refuge, it is unlikely that this will be a pertinent focus for this development. However, for completeness, comment will be made on this in Section 6.

Peak Rainfall Allowances

2.19 Peak Rainfall Allowances are used to consider how increased rainfall affects surface water flood risk and the design of drainage systems to manage the increased rainfall.

2.20 New guidance requires that for developments with a lifetime of between 2061 and 2100, Flood Risk Assessments and Strategic Flood Risk Assessments should assess the central allowances for the 2070s epoch for both the 1% and 3.3% annual exceedance probability events. The proposed East Claydon site is located within the Upper and Bedford Ouse Management Catchment for which the following Peak Rainfall Allowances are applicable.

Table 4: Upper and Bedford Ouse Management Catchment Peak Rainfall Allowances

3.3% Annual Exceedance Rainfall Event		
Epoch	**Central**	**Upper**
2050s	20%	35%
2070s	25%	35%
1% Annual Exceedance Rainfall Event		
Epoch	Central	Upper
2050s	20%	40%
2070s	25%	40%

2.21 Based on the above information, an allowance of 20 - 25% is appropriate. RPS have taken a conservative approach to the design of the conceptual drainage system and added 40% to all attenuation / runoff calculations for the development to account for climate change.

Local Planning Policy

2.22 The Vale of Aylesbury Local Plan was adopted in September 2021. The Local Plan contains the following policy relating to flood risk and drainage:

Policy I4: Flooding

Management of Flood Risk

In order to minimise the impacts of and from all forms of flood risk the following is required:

a. *Site-specific flood risk assessments (FRAs), informed by the latest version of the SFRA, where the development proposal is over 1ha in size and is in Flood Zone 1, or the development proposal includes land in Flood Zones 2 and 3 (as defined by the latest Environment Agency mapping). A site-specific FRA will also be required where a development proposal affects land in Flood Zone 1 where evidence, in particular the SFRA, indicates there are records of historic flooding or other sources of flooding, e.g. due to critical drainage problems, including from ordinary watercourses and for development sites located within 9m of any water courses (8m in the Environment Agency's Anglian Region)*

b. *All development proposals must clearly demonstrate that the flood risk sequential test , as set out in the latest version of the SFRA, has been passed and be designed using a sequential approach, and*

c. *If the sequential test has been satisfied, development proposals, other than those allocated in this Plan, must also satisfy the exception test in all applicable situations as set out in the latest version of the SFRA.*

Flood Risk Assessments

All development proposals requiring a Flood Risk Assessment in (a) above will assess all sources and forms of flooding, must adhere to the advice in the latest version of the SFRA and will:

d. *provide level-for-level floodplain compensation, up to the 1% annual probability (1 in 100) flood extent with an appropriate allowance for climate change, and volume-for-volume compensation unless a justified reason has been submitted and agreed which may justify other forms of compensation*

e. *ensure no increase in flood risk on site or elsewhere, such as downstream or upstream receptors, existing development and/or adjacent land, and ensure there will be no increase in fluvial and surface water discharge rates or volumes during storm events up to and including the 1 in 100 year storm event, with an allowance for climate change (the design storm event)*

f. *not flood from surface water up to and including the design storm event, or any surface water flooding beyond the 1 in 30 year storm event, up to and including the design storm event will be safely contained on site*

g. *explore opportunities to reduce flood risk overall, including financial contributions from the developer where appropriate*

h. *ensure development is safe from flooding for its lifetime (and remain operational where necessary) including an assessment of climate change impacts*

i. *ensure development is appropriately flood resistant, resilient and safe and does not damage flood defences but does allow for the maintenance and management of flood defences*

j. *take into account all sources and forms of flooding*

k. *ensure safe access and exits are available for development in accordance with Department for Environment, Food and Rural Affairs (DEFRA) guidance 51. Access to "safe refuges" or "dry islands" are unlikely to be considered safe as this will further burden the Emergency Service in times of flood*

l. *include detailed modelling of any ordinary watercourses within or adjacent to the site, where appropriate, to define in detail the area at risk of flooding and model the effect of climate change*

m. *provide an assessment of residual flood risk*

n. *provide satisfactory Evacuation Management Plans, where necessary, including consultation with the Emergency Services and Emergency Planners*

Sustainable Drainage Systems (SuDS)

All development proposals must adhere to the advice in the latest version of the SFRA and will:

o. *Ensure development layouts are informed by drainage strategies incorporating SuDS and complete site specific ground investigations to gain a more local understanding of groundwater flood risk and inform the design of sustainable drainage components*

p. *All development will be required to design and use sustainable drainage systems (SuDS) for the effective management of surface water run-off on site, as part of the submitted planning application and not increase flood risk elsewhere, including sewer flooding. All development should adopt exemplar source control SuDS techniques to reduce the risk of flooding due to post-development runoff. SuDS design should follow current best practice (CIRIA Manual 2015 or as replaced) and Buckinghamshire Council guidance on runoff rates and volumes to deliver wider environmental benefits. Where the final discharge point is the public sewerage network the runoff rate should be agreed with the sewerage undertaker.*

q. *Where site-specific FRAs are required in association with development proposals, they should be used to determine how SuDS can be used on particular sites and to design appropriate systems*

r. *In considering SuDS solutions, the need to protect groundwater quality must be taken into account, especially where infiltration techniques are proposed in considering a response to the presence of any contaminated land. The Environment Agency need to be consulted where infiltration is proposed in contaminated land. SuDS should seek to reduce flood risk, reduce pollution and provide landscape and wildlife benefits. Opportunities will be sought to enhance natural river flows and floodplains, increasing their amenity and biodiversity value and a watercourse advice note is being prepared for further guidance*

s. *Applicants will be required to provide a management plan to maintain SuDS in new developments, and a contribution will be required for maintenance of the scheme/SuDS*

t. *Onsite attenuation options should be tested to ensure that changing the timing of peak flows does not exacerbate flooding downstream, and*

u. *Only in exceptional circumstances will surface water connections to the combined or surface water system be permitted. Applicants will need to demonstrate in consultation with the sewerage undertaker that there is no feasible alternative and that there will be no detriment to existing users.*

Applicants will be required to liaise with the lead local flood authority, Internal Drainage Boards, and the Environment Agency on any known flood issues, and identify issues from the outset via discussions with statutory bodies

Climate Change

v. *Climate change modelling should be undertaken using the relevant allowances (February 2016) for the type of development and level of risk*

w. *Safe access and egress should be demonstrated in the 1 in 100 plus climate change event, and*

x. *Compensation flood storage would need to be provided for the built footprint as well as any land-raising within the 1 in 100 plus appropriate climate change flood event. This compensation would need to be demonstrated within a Flood Risk Assessment (FRA).*

2.23 The Buckinghamshire Council Local Flood Risk Management Strategy (LFRMS) and Aylesbury Vale Strategic Flood Risk Assessment (SFRA) Identify and map flood risk from all sources as well as providing guidance on producing site specific FRAs. Relevant information from the documents has been referenced throughout this FRA report.

3 CONSULTATION

Environment Agency

3.1 The FRA has been prepared in consultation with the Partnership and Strategic Overview Team at the EA. The EA has been contacted with request for information for the flood history in the area and any other flood related issues at the site. A response was received on 20th January 2023. The EA confirmed that they do not have any detailed flood risk modelling for the site. The response is provided in Appendix A for reference.

Lead Local Flood Authority

3.2 The site is within the administrative boundary of Oxfordshire County Council, who act as the LLFA for the site. Consultation has been undertaken with the Flood Team regarding any information relating to flood risk and drainage.

3.3 The LLFA drew attention to the guidance documents available on their website. The response is provided in Appendix B for reference.

Internal Drainage Board

3.4 The site is located within the Buckingham & River Ouzel IDB District. The IDB were consulted, and a response was received on 28th March 2023. The IDB confirmed the following:

- No development shall be permitted within the Board's byelaw of 9m, measured from the bank top of any watercourse
- Any surface water discharge shall be restricted to the equivalent of 4 l/s per contributing impermeable hectare

3.5 The full response is provided in Appendix C for reference.

4 SITE SETTING

Site Location

4.1 The site is located at National Grid Reference SP 75482 25102, is irregular in shape and occupies an area of approximately 25.5 hectares (ha). The site location is presented in Figure 1.

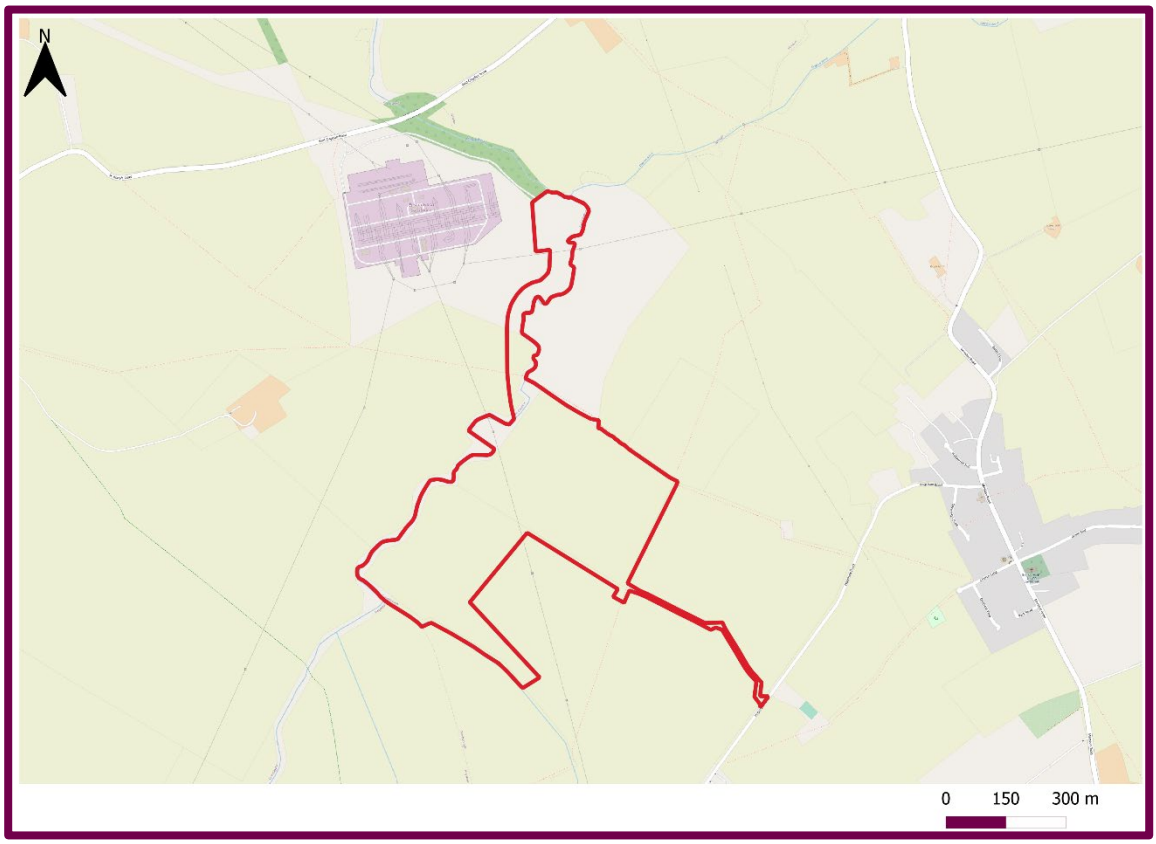


Figure 1: Site Location

4.2 The site is currently occupied by greenfield, which is used for agricultural purposes. Vehicular and pedestrian access to site is via Hogshaw Road, to the south east of the site.

Surrounding Land Uses

4.3 The site is bounded on all sides by undeveloped greenfield land. The East Claydon substation is located to the north of the site. The village of Granborough is located to the east of the site.

4.4 There are no designated sensitive areas, e.g. Special Area of Conservation (SAC), Special Protection Area (SPA) or Site of Special Scientific Interest (SSSI)) within close proximity to the site.

Topography

4.5 No site-specific topography data has been supplied. Therefore, LiDAR DTM Data was obtained for the site (dated 2020). The data indicates that in general the ground levels slope from east to west with levels recorded at approximately 98m AOD to 87m AOD respectively. It should be noted that LiDAR has an error margin of +/- 150 mm.

5 PROPOSED DEVELOPMENT

5.1 It is understood that a planning application is sought for the construction of a Battery Storage Facility with associated infrastructure consisting of:

- Substation;
- Inverters and transformers;
- Battery Containers with a loose gravel surface;
- Access roads and hardstanding for parking;
- Associated car parking and control kiosk;
- 1.5 m high Fencing; and
- Landscaping including hedgerows and woodland planting.

5.2 Development plans are shown in Appendix D.

5.3 Site access will be via a track leading to the south east of the site, onto Hogshaw Road.

5.4 The proposed use of the site is classified as 'Essential Infrastructure' within the PPG.

5.5 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).

6 FLOOD RISK ASSESSMENT

Hydrological Overview

6.1 OS Mapping indicates that the nearest surface water feature is a reach of the Claydon Brook, located immediately adjacent to the northern boundary of the site.

6.2 There are no EA statutory main rivers located within 1km of the site.

6.3 No other significant artificial watercourses / features (e.g. canals, reservoirs) have been identified within 1km of the site

Fluvial and Tidal Flooding

6.4 The EA Flood Map for Planning, which is available online, indicates that the majority of the site is located within Flood Zone 1, which is land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding. The western and southern portions of the site are located in Flood Zone 2 and 3. Flood Zone 3 is an area whereby the annual probability of flooding from fluvial sources is classified as 1 in 100 or greater. Flood Zone 2 is an area whereby the annual probability of flooding from fluvial sources is classified as between 1 in 100 and 1 in 1,000. The EA Flood Map for Planning is provided in Figure 2.

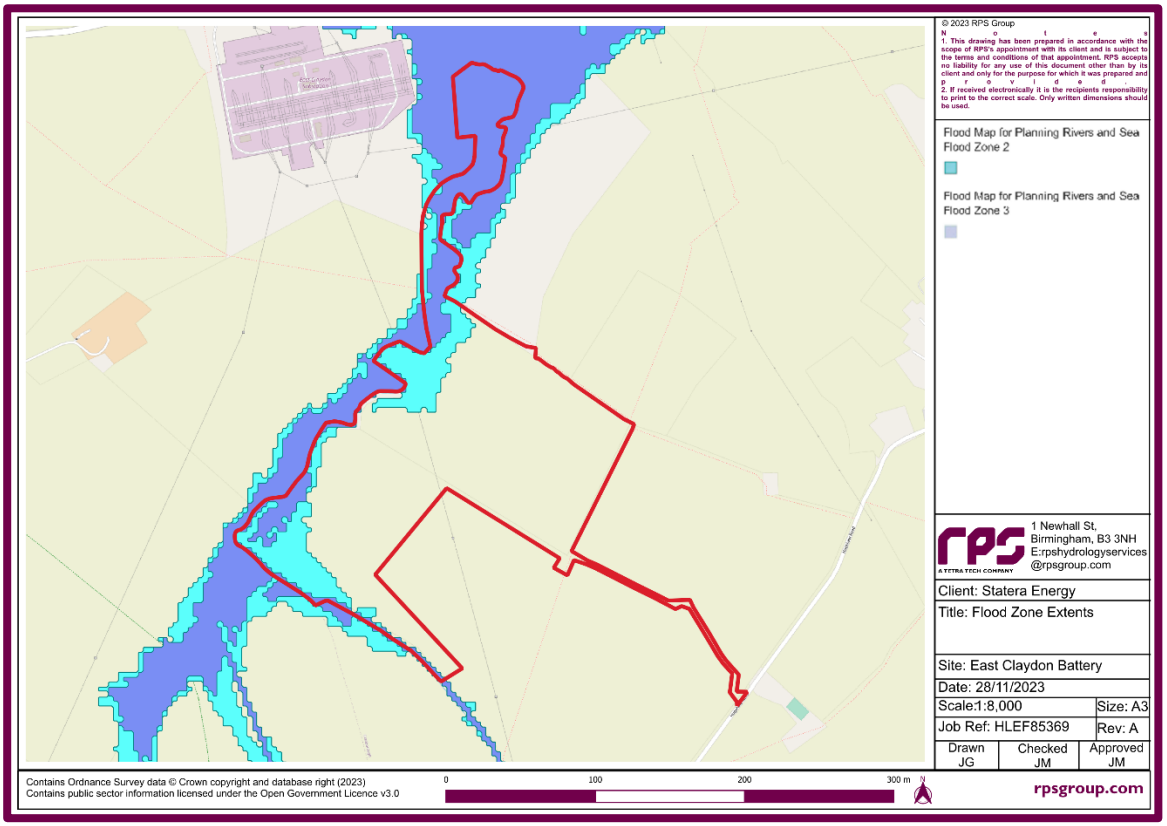


Figure 2: EA Flood Map for Planning (River and Sea)

6.5 Following a sequential approach, areas of proposed development are located within Flood Zone 1.

6.6 As the site is located a significant distance in land, the site is not considered to be at risk from tidal sources.

EA Flood Warning Area

6.7 The EA defines a Flood Warning Area 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." The site is not located in a Flood Warning Area.

Surface Water Flood Risk Classification

6.8 The EA's updated Flood Map for Surface Water, which is available online, identifies areas at risk of surface water flooding. The classification of the risk is based on the following annual probability of flooding:

- High risk; area has a chance of flooding greater than 1 in 30.
- Medium risk; area has a chance of flooding between 1 in 30 and 1 in 100.
- Low risk; area has a chance of flooding between 1 in 100 and 1 in 1000.
- Very low risk; has a chance of flooding less than 1 in 1000.

6.9 The EA surface water map indicates that the majority of the site is at a 'Very Low' risk of surface water flooding.

6.10 Areas of 'Low' to 'High' risk are identified along the northern boundary, western boundary and southern portion of the site.

6.11 Mapping for the low-risk scenario indicates that in areas adjacent to the watercourses at the site boundaries, velocities are expected to reach over 2.00 m/s and depths are expected to reach up over 1200mm. Across the wider site areas, velocities are expected to reach up to 1.00 m/s and depths are expected to reach up to 600mm.

6.12 The updated Flood Map for Surface Water is presented in Figure 3.

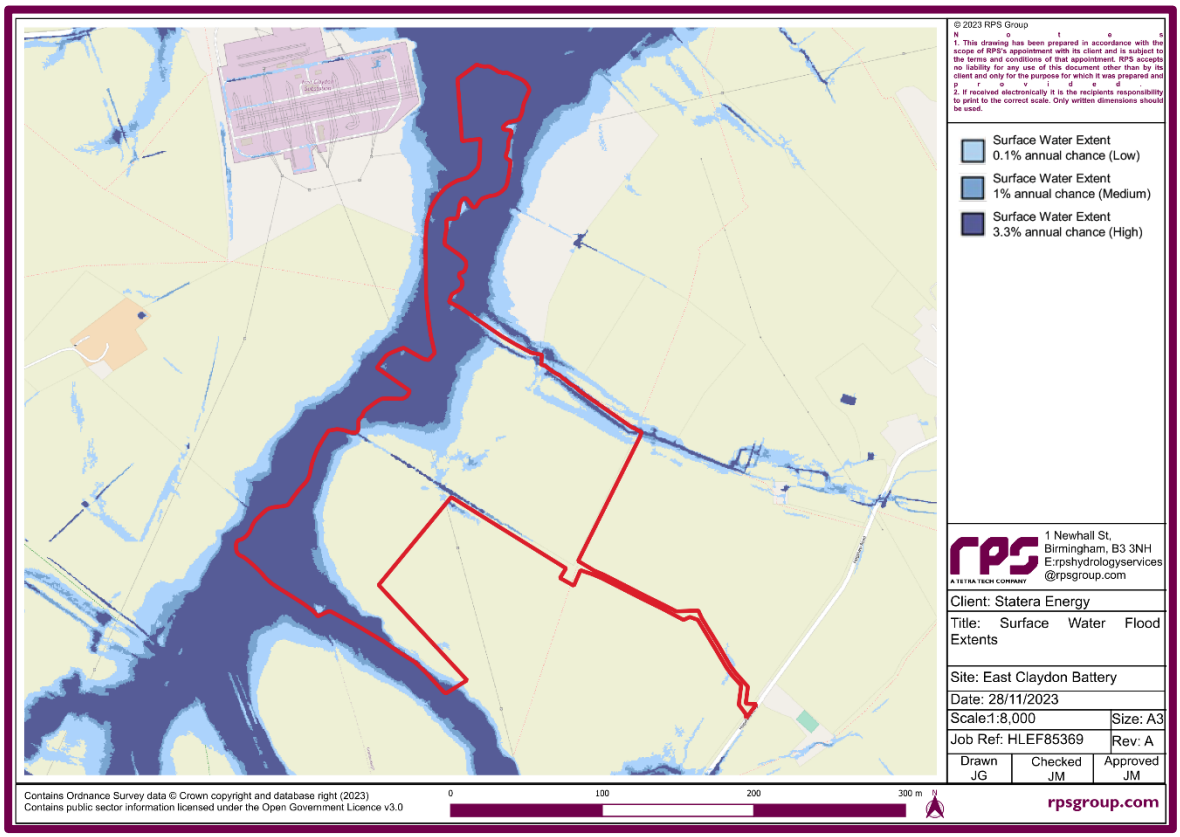


Figure 3: Flood Map for Surface Water

6.13 Following a sequential approach, areas of proposed development have been steered to areas with the lowest surface water risk. The introduction of a positive drainage system will ensure that surface water at the site and will not pose a flood risk to the proposed development.

6.14 Figure 4 below, illustrates the proposed development, alongside fluvial and surface water extents. This highlights that development has sequentially located away from flood risk.

Figure 4. Fluvial and Surface Water Flood Extents and Development Layout

Reservoir Flooding Flood Risk Classification

6.15 The Flood Risk from Reservoirs Map indicates that the site is not at risk of reservoir flooding. Reservoir regulation ensures that reservoirs are stringently inspected and supervised by qualified civil engineers and that any required maintenance or upgrade works are carried out quickly. This helps ensure that the likelihood of one of them failing remains extremely low.

Groundwater Flooding

6.16 British Geological Survey (BGS) online mapping (1:50,000 scale) indicates that the area of the site adjacent to the watercourses is located on Alluvium, comprising clay, silt, sand and gravel. There are no records of superficial deposits for the remainder of the site. The site is underlain by the Weymouth Member, comprising mudstone.

6.17 No available BGS borehole logs are located within the surrounding area.

6.18 The soils are described as 'Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils' by the National Soils Research Institute.

6.19 According to the MAGIC's Aquifer Designation Mapping, the Alluvium is classified as a 'Secondary A' aquifer. These formations are formed of permeable layers capable of supporting water supplies at a local scale, in some cases forming an important source of base flow to rivers. The Weymouth Member is classified as 'Unproductive'. These rocks have negligible. significance for water supply or baseflow to rivers, lakes and wetlands.

6.20 MAGIC's online groundwater Source Protection Zone (SPZ) mapping indicates that the site is not located within a groundwater SPZ.

Sewer/Water Main Failure Assessment

6.21 No drainage records have been provided for the site. The land is currently agricultural land and therefore it is assumed that no artificial drainage systems will be present within the site area.

6.22 It is assumed that sewer and surface water drainage will have been designed to industry standards (e.g. Sewers for Adoption). However, the most common causes of flooding from sewers are; inadequate flow capacity, blockages, pumping station failures, burst water mains, water inflow from rivers or the sea, tide locking, siltation, fats/greases, and sewer collapse. Should any of these events occur there is a risk of flooding by surcharge where the flows are in excess of the sewer capacity (usually 1 in 30 year events or greater).

6.23 Taking into account the above and absence of any historical sewer flooding the overall risk of flooding via artificial drainage system to the site has been assessed as low.

7 FLOOD RISK VULNERABILITY CLASSIFICATION

Vulnerability Classification

7.1 In accordance with the Flood Risk Vulnerability Classification in Table 2 of the Planning and Practice Guidance Flood Risk and Coastal Change, the Battery storage facility is classified as an 'Essential Infrastructure' development in flood risk terms.

7.2 The built development associated with the application site is located within an area identified as Flood Zone 1. Table 3 of Planning Practice Guidance (Table 4 of this report) indicates that all uses are acceptable for locations in Flood Zone 1 and 2. For 'Essential Infrastructure' developments, application of the Exception Test is required for developments in Flood Zone 3.

Table 5: Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability classification (see Table 3 of Planning Practice Guidance)	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	Yes	Yes	Yes	Yes	Yes
Zone 2	Yes	Yes	Exception test required	Yes	Yes
Zone 3a	Exception test required	Yes	No	Exception test required	Yes
Zone 3b Functional Floodplain	Exception test required	Yes	No	No	No

Key: Yes: Development is appropriate, No: Development should not be permitted.

7.3 For completeness, consideration of the Sequential and Exception Tests have been given in regard to the proposed development and proximity to Flood Zones 2 and 3.

Sequential Test

7.4 The NPPF requires the Local Authority to apply the Sequential Test in consideration of new development. The aim of the Test is to steer new development to areas at the lowest probability of flooding. The Sequential Test is based on the EA Flood Zones and information contained within the SFRA.

7.5 The proposed development is predominantly located Flood Zone 1, however the western and southern portions of the site are located in Flood Zones 2 and 3.

7.6 The proposed development involves the development of a Battery Storage Facility. It is considered that the vulnerability of the site will not increase as a result of the proposed works. The flood risk at the site is confined to the south west corner, which is located away from the proposed development at the site. No development is proposed in areas assessed as Flood Zone 2 and/or 3. No other significant risks have been identified in relation to any of the other sources assessed at the site. The site is therefore considered to pass the Sequential Test.

The Exception Test

7.7 The PPG advises that 'Essential Infrastructure' development can be considered appropriate in Flood Zone 3, following satisfactory application of the Exception Test. The Exception Test aims to ensure

that more vulnerable property types are not allocated to areas at high risk of flooding. For the Exception Test to be passed:

(a) it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared;

(b) a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

7.8 With reference to point (a) above, the proposed change of use will make greater use of the site.

7.9 With reference to point (b) above, this FRA demonstrates that the development will be safe, without increasing flood risk elsewhere. The vulnerability of the development will not increase as a result of the proposed works.

7.10 It is considered that the development passes the Exception Test.

8 DRAINAGE

Surface Water and Drainage Strategy

8.1 The sustainable management of surface water is an essential element of reducing future flood risk to the site and its surroundings.

8.2 Undeveloped sites generally rely on natural drainage to convey or absorb rainfall, the water soaking into the ground or flowing across the surface into watercourses.

8.3 The effect of development is generally to reduce the permeability of at least part of the site, which markedly changes the site's response to rainfall. Without specific measures to manage surface water the volume of water and peak flow rate are likely to increase. Inadequate surface water drainage arrangements can threaten the development itself and increase the risk of flooding to others.

8.4 Surface water arising from a developed site should as far as is practicable be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development while reducing the risk of flooding at the site and elsewhere, taking climate change into account.

Sustainable Drainage Options

8.5 The NPPF and associated Planning Practice Guidance ID7 and CIRIA C753 SUDS Manual (2015) promotes sustainable water management through the use of SuDS. A hierarchy of techniques is identified:

1. Prevention – the use of good site design and housekeeping measures on individual sites to prevent runoff and pollution (e.g. minimise areas of hard standing).
2. Source Control – control of runoff at or very near its source (such as the use of rainwater harvesting).
3. Site Control – management of water from several sub-catchments (including routing water from roofs and car parks to one/several large soakaways for the whole site).
4. Regional Control – management of runoff from several sites, typically in a detention pond or wetland.

8.6 The implementation of SuDS as opposed to conventional drainage systems, provides several benefits by:

- Reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream;
- Reducing the volumes and frequency of water flowing directly to watercourses or sewers from developed sites;
- Improving water quality over conventional surface water sewers by removing pollutants from diffuse pollutant sources;
- Reducing potable water demand through rainwater harvesting;
- Improving amenity through the provision of public open spaces and wildlife habitat; and
- Replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained.

Runoff Calculations

8.7 The greenfield nature of the site means that surface water will slowly soak into the ground (infiltrate), be intercepted by vegetation or run off by way of overland flow, according to the soil characteristics and following the topography of the site.

8.8 Greenfield runoff rates for the site have been calculated by way of Interim Code of Practice for Sustainable Drainage Systems (ICP SUDS). This implements a pro rata IOH124 methodology, for sites below 50ha in size. The runoff rates were calculated using the MicroDrainage software.

8.9 The following parameters were incorporated into the greenfield runoff calculations:

- Impermeable Area: 6.9 ha
- Average Annual Rainfall (SAAR): 661 mm/year
- Soil: 0.450
- Region No: 6

8.10 The calculation has been included for reference within Appendix E and outputs are summarised within Table 6.

Table 6: Greenfield Runoff (Based on a 6.9 ha area)

Return Period	Greenfield Runoff Rate (l/s)
Q1	23.6
QBar	27.8
Q30	63.0
Q100	88.7

Attenuation Requirements

8.11 The attenuation volume required to restrict the surface water runoff rate from the additional low permeable surfacing to the existing 1 in 1 rate for a 1 in 100 year rainfall event plus 40% climate change has been determined using the industry standard MicroDrainage software.

8.12 Impermeable areas for the site have been calculated allowing for the following:

- Crushed Stone Tracks
- Batteries
- Inverter Houses
- Transformers
- Control Rooms
- Spare Parts Containers
- Water Tanks
- Equipment within the Substation

8.13 An allowance has not been provided for the wider gravel areas at the site due to the coarse grade gravel used. It is considered that this gravel type has a high permeability and will not create additional areas of hardstanding.

8.14 The system was modelled within MicroDrainage as a tank/pond with controlled discharge via a Hydrobrake flow control. MicroDrainage storage calculations are provided in Appendix F for reference.

8.15 The attenuation volume required for a 1 in 100 year storm event plus a 40% allowance for climate change is approximately 5,534.3m³. This storage estimate is based on FEH rainfall data.

Proposed Surface Water Drainage

8.16 The proposed surface water drainage system was designed using current MicroDrainage analysis software, taking into account planning, LLFA and EA guidance to prevent uncontrolled flooding of the site and surrounding area.

8.17 Surface water runoff from the proposed development will be collected as follows:

- Impermeable surfaced car parking and hardstanding – lateral filter drains which will convey the run-off directly into the attenuation pond.
- Permeable gravelled areas, unbound stone access roads and hardstanding, battery container roofs – direct infiltration via granular pavement medium, allowing lateral drainage flows into lateral filter drains which will convey the run-off directly into the attenuation pond.
- Impermeable building roof areas – traditional gravity gutters and downpipes, connected via pipework into the nearest filter drain or directly into the attenuation pond.

8.18 The Indicative Drainage Layout is provided in Appendix G. Surface water runoff will be captured by a series of on-site filter drains, designed in accordance with the CIRIA C753 SuDS Manual. Each filter drain will contain a perforated pipe, which will convey surface water flows to the attenuation basins.

8.19 Prior to surface water entering the attenuation basin it will pass through a proprietary Vortex Grit Separator, to provide additional treatment of the surface water flows. The attenuation basin will provide adequate storage for all storm events up to and including the 1 in 100-year return period with an additional 40% for future climate change, based on the MicroDrainage calculations provided in Appendix F.

8.20 Discharge of surface water from the site will be controlled to the 1 in 1 rate of 23.6/s for all return periods, through the use of a vortex Hydrobrake fitted immediately upstream of the proposed site outfall to local watercourse.

8.21 The development site will be operated remotely, and so will not generate any foul drainage water. There is no requirement for any foul drainage provision on this site.

Management of Fire Water

8.22 In order to manage the risk associated with a highly unlikely fire event, the development will include both a provision for the supply of fire water via water tanks and/or hydrants, in addition containment of fire water used to supress any fire.

8.23 The fire water requirement has been based on an approximate fire duration constituting 1 hour of intense burn followed by 6 hours of slow burn, a total 7-hour fire. To quench the fire a rough water flow rate of $4m^3$/hr has been assumed for the slow burn period, doubling for the intense burn period, equating to ($4m^3$/hr * 6) + (($4m^3$/hr*2) * 1) = $32m^3$ of water required per container. As each container is situated adjacent to four other units a total of $128m^3$ of water is required. As a contingency, an additional c.122 m^3 (near double additional water volume) will be provided.

8.24 Fire water will be stored on site within the main compound in either sectional steel panel tanks or cylindrical steel panel tanks. The total fire water provision stored will total 250 m^3.

8.25 An onsite fire containment strategy will be incorporated into the overall site drainage design. It is proposed that a series of lined swales or interceptor channels will be located downgradient of battery storage units with a storage capacity of 250 m^3. In the unlikely event of a fire the unit on fire will be left to burn out, in accordance with general guidance for Battery units, whilst water will be focussed on the adjacent battery units to ensure the fire is contained. As a consequence the runoff generated is less likely to pose a contamination risk. Runoff used to cool the units will be initially intercepted by the gravel surfacing from where it will be conveyed by gravity to interceptor swales/channels and held for inspections via a penstock or similar for testing prior to release or tanking off site for treatment as appropriate.

Construction Stage Drainage

8.26 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.

8.27 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.

8.28 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.

Water Quality / Pollution Control

8.29 Surface water run-off should be managed by SuDS that are designed to attenuate flows and to avoid water quality impacts downstream. 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.

As stated in the SuDS Manual 2015 (C753), the risk posed by surface water runoff to the receiving environment is a function of:

- the pollution hazard at a particular site (i.e. the pollutant source)
- the effectiveness of SuDS treatment components in reducing levels of pollutants to environmentally acceptable levels, groundwater (i.e. the pollutant pathway)
- the sensitivity of the receiving environment (i.e. the environmental receptor).

8.30 Table 26.2 of C753 (Table 7 of this report) provides details of various land uses and the associated pollution hazard levels. While there is no one category which exactly suits this development, the proposals are industrial in nature, so it is considered that applying a High Hazard Level would be the most appropriate, if not conservative. An extract of Table 26.2 is provided below.

Table 7: Pollution hazard indices for different land use classifications

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways[1]	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1]	High	0.8[2]	0.8[2]	0.9[2]

Notes

1 Motorways and trunk roads should follow the guidance and risk assessment process set out in Highways Agency (2009).

2 These should only be used if considered appropriate as part of a detailed risk assessment – required for all these land use types (Table 4.3). When dealing with high hazard sites, the environmental regulator should first be consulted for pre-permitting advice. This will help determine the most appropriate approach to the development of a design solution.

8.31 Table 26.3 of C753 (Table 8 of this report) indicates indicative pollution hazard level mitigation indices for different SuDS measures.

Table 8: Indicative SuDS mitigation indices for discharges to surface waters

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters

	Mitigation indices[1]		
Type of SuDS component	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4[2]	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond[4]	0.7[3]	0.7	0.5
Wetland	0.8[3]	0.8	0.8
Proprietary treatment systems[5,6]	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

Notes

1 SuDS components only deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters.

2 Filter drains can remove coarse sediments, but their use for this purpose will have significant implications with respect to maintenance requirements, and this should be taken into account in the design and Maintenance Plan.

3 Ponds and wetlands can remove coarse sediments, but their use for this purpose will have significant implications with respect to the maintenance requirements and amenity value of the system. Sediment should normally be removed upstream, unless they are specifically designed to retain sediment in a separate part of the component, where it cannot easily migrate to the main body of water.

4 Where a wetland is not specifically designed to provide significantly enhanced treatment, it should be considered as having the same mitigation indices as a pond.

5 See Chapter 14 for approaches to demonstrate product performance. A British Water/Environment Agency assessment code of practice is currently under development that will allow manufacturers to complete an agreed test protocol for systems intended to treat contaminated surface water runoff. Full details can be found at: http://tinyurl.com/qf7yuj7

6 SEPA only considers proprietary treatment systems as appropriate in exceptional circumstances where other types of SuDS component are not practicable. Proprietary treatment systems may also be considered appropriate for existing sites that are causing pollution where there is a requirement to retrofit treatment. SEPA (2014) also provides a flowchart with a summary of checks on suitability of a proprietary system.

8.32 The information summarised in Table 9 below indicates that suitable pollution mitigation provision would be afforded through the use of filter drains, a grit separator and the attenuation pond.

Table 9: Summary of Pollution Hazard and Mitigation Indices for Site and Proposed SuDS components

Pollution	Pollution Hazard	SuDS Component	TSS	Metal	Hydro-carbons
Hazard Indices	High	-	0.8	0.8	0.9
SuDS Mitigation	-	Filter Drain	0.4	0.4	0.4
	-	Grit Separator*	0.5[T]	0.4 [T]	0.8 [T]
	-	Attenuation Pond	0.7[T]	0.7[T]	0.5[T]
Total SuDS Mitigation	-	-	1	0.95	1.05

* Mitigation indices have been calculated using the Advanced Hydrodynamic Vortex Separator manufactured by Hydro International.

[T] When designing in accordance with the SuDS Manual (Ciria C753), when two or more methods are used in sequence to target the same pollutant, only half of the mitigation index of the subsequent components should be allowed in the calculation.

Maintenance

8.33 The following information indicates the typical maintenance regimes, and not exhaustive, that will considered within the detailed drainage design to ensure continued satisfactory operation of the site drainage systems. The maintenance activities would be split into three categories, namely Regular, Occasional & Remedial, as detailed in Table 32.1 of C753 (Table 10 of this report).

Table 10: SuDS components operation and maintenance activities

TABLE 32.1 Typical key SuDS components operation and maintenance activities (for full specifications, see Chapters 11–23)

Operation and maintenance activity	SuDS component												
	Pond	Wetland	Detention basin	Infiltration basin	Soakaway	Infiltration trench	Filter drain	Modular storage	Pervious pavement	Swale/bioretention/ trees	Filter strip	Green roofs	Proprietary treatment systems
Regular maintenance													
Inspection	■	■	■	■	■	■	■	■	■	■	■	■	■
Litter and debris removal	■	■	■	■	□	■	■	□	■	■	■		□
Grass cutting	■	■	■	■	□	■	■	□	□	■	■		
Weed and invasive plant control	□	□	□	□		□	□		□		□	■	
Shrub management (including pruning)	□	□	□	□					□	□	□		
Shoreline vegetation management	■	■	□										
Aquatic vegetation management	■	■	□										
Occasional maintenance													
Sediment management[1]	■	■	■	■	■	■	■	■	■	■	■		■
Vegetation replacement	□	□	□	□						□	□	■	
Vacuum sweeping and brushing									■				
Remedial maintenance													
Structure rehabilitation /repair	□	□	□	□	□	□	□	□	□	□	□	□	
Infiltration surface reconditioning				□	□	□	□		□	□	□		

Key

■ will be required

□ may be required

Notes

1 Sediment should be collected and managed in pre-treatment systems, upstream of the main device.

8.34 There may also be one-off requirements sometimes referred to as “establishment maintenance”, particularly for planting (e.g. weeding and watering). Regular maintenance consists of basic tasks carried out on a frequent and predictable schedule, including inspections/monitoring, silt or oil removal (if required more frequently than once per year), vegetation management, sweeping of surfaces and litter/debris removal.

8.35 Occasional maintenance comprises tasks that are likely to be required periodically, but on a much less frequent and predictable basis that the regular tasks. Guidance on the components pertinent to this drainage proposal are detailed below.

8.36 Remedial maintenance comprises the intermittent tasks that may be required to rectify faults associated with system, although the likelihood of faults can be minimised by good design, construction and regular maintenance activities. Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events, so timings are difficult to predict.

8.37 In addition to general cleaning of roof gutters and downstream sediment traps, Tables 11 to 15 indicate the minimum required maintenance regime that needs to be implemented post construction for the SuDS elements that will comprise the bulk of the proposed drainage system, including filter drains, grit separator, attenuation pond and associated infrastructure.

Table 11: Proprietary Treatment Systems (Grit Separator) Maintenance Requirements

Maintenance schedule	Require Action	Typical Frequency
Routine Maintenance	Remove litter and debris and inspect for sediment, oil and grease accumulation	Six monthly
	Change the filter media	As recommended by manufacturer
	Remove sediment, oil, grease and floatables	As necessary – indicated by system inspections or immediately following significant spill
Remedial Actions	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	Six monthly
	Inspect filter media and establish appropriate replacement frequencies	Six monthly
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first half year of operation, then every six months

Table 12: Filter Drains Maintenance Requirements

Maintenance schedule	Require Action	Typical Frequency
Regular Maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from pre-treatment devices	Six monthly, or as required

Occasional Maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (eg NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear perforated pipework of blockages	As required

Table 13: Attenuation Pond Maintenance Requirements

Maintenance schedule	Require Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass – public areas	Monthly (during growing season)
	Cut the meadow grass	Half yearly (spring, before nesting season, and autumn)
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockage and/or physical damage	Monthly
	Inspect water body for signs of poor water quality	Monthly (May – October)
	Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options	Half yearly
	Check any mechanical devices eg penstocks	Half yearly
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1 m above pond base; include max 25% of pond surface)	Annually

Table 14: 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 15: Hydrobreak Flow Control Manhole Maintenance Requirements

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

9 SUMMARY AND CONCLUSIONS

Summary

9.1 A site-specific Flood Risk Assessment (FRA) in accordance with the NPPF and PPG ID7 has been prepared to support the application for the development of a Battery facility and associated infrastructure.

Flood Risk

9.2 EA mapping indicates that the majority of the site is located within Flood Zone 1, which is land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding. The western and southern portions of the site are located in Flood Zone 2 and 3. Flood Zone 3 is an area whereby the annual probability of flooding from fluvial sources is classified as 1 in 100 or greater. Flood Zone 2 is an area whereby the annual probability of flooding from fluvial sources is classified as between 1 in 100 and 1 in 1,000.

9.3 The EA surface water map indicates that a portion of the site is at a 'Very Low' risk of surface water flooding. Areas of 'Low' to 'High' risk are identified along the northern boundary, western boundary and southern portion of the site. Mapping for the low-risk scenario indicates that in areas adjacent to the watercourses at the site boundaries, velocities are expected to reach over 2.00 m/s and depths are expected to reach up over 1200mm. Across the wider site areas, velocities are expected to reach up to 1.00 m/s and depths are expected to reach up to 600mm.

9.4 The site susceptibility to groundwater flooding has been assessed as low.

9.5 The site is not at risk of flooding from reservoir infrastructure failure.

9.6 The proposed development type is defined as 'Essential Infrastructure' in the NPPF and PPG.

9.7 It has been demonstrated that development at the site has been sequentially located within area of Flood Zone 1 and 'Low/Very Low' surface water risk. Additionally, the introduction of a positive drainage system will ensure that surface water at the site and will not pose a flood risk to the proposed development.

9.8 There will be an increase in impermeable area and surface runoff will need to be restricted to the greenfield runoff rate of 23.6 l/s. MicroDrainage calculations indicate that the overall attenuation requirement for the development is approximately 5,534.3m³ for the 1 in 100 year storm event plus a 40% allowance for climate change.

9.9 The drainage strategy incorporates a number of surface water cleaning techniques in order that any discharges are as 'clean' as reasonably practicable.

9.10 The impacts of the increase in surface water runoff will be reduced by the incorporation of appropriate and practicable SuDS mitigations measures in the built design.

Conclusion

9.11 This FRA and supporting documentation illustrates that the development area is at low risk of flooding from all sources and meets the requirements of the NPPF and Planning Practice Guidance.

Appendix A – EA Consultation Response

Jessica Grady

From: Enquiries_EastAnglia <Enquiries_EastAnglia@environment-agency.gov.uk>
Sent: 20 January 2023 12:48
To: RPS Hydrology Services
Subject: EAn/2022/293207 Final response to your Product 4 request for Land East of East Claydon
Attachments: East_Anglian_External Climate Change Allowances Guidance_March2022.pdf

CAUTION: This email originated from outside of RPS.

Dear Jessica,

Thank you for your request of the 23 December 2022.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004.

We do not hold detailed modelling in this area. The flood map here is the best information available. The flood zones are the result of 2D modelling from the Environment Agency's Upper Ouse Broadscale Model (2012).

We have no historic flood event information for this area. It is possible that other flooding may have occurred that we do not have records for, and other organisations such as: local authorities or IDBs may have records.

There are no Environment Agency defences within or which impact upon the area of interest

Flood Map for Planning (Rivers and Sea)

The Flood Map for Planning (Rivers and Sea) can be viewed and downloaded as a PDF file on GOV.UK by following this link: **https://flood-map-for-planning.service.gov.uk**

Long Term Flood Risk Information

Long term flood risk mapping including: ***Risk of Flooding from Rivers or the Sea***, ***Flood Risk from Surface Water*** and ***Flood Risk from Reservoirs*** can be viewed on GOV.UK: **https://flood-warning-information.service.gov.uk/long-term-flood-risk/map**

Climate Change Allowances

For information on the use climate change allowances in Flood Risk Assessments, please see the attached document - **East_Anglian_External Climate Change Allowances Guidance_March2022.pdf**.

The guidance provides climate change allowances for peak river flow, peak rainfall, sea level rise, wind speed and wave height. The guidance provides a range of allowances to assess fluvial flooding, which varies depending on which management catchment a site lies within. It advises on which allowances to use for assessing the impact of climate change on fluvial flood risk based on vulnerability classification, flood zone and development lifetime.

Please refer to the Open Government Licence available here: http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ which explains the permitted use of this information.

Please get in touch if you have any further queries or contact us within two months if you would like us to review the information we have sent.

Please do contact me if I can be of further help.

Kind regards

Lisa Ecclestone
Customers & Engagement Officer, Customers & Engagement Team, East Anglia Area
Environment Agency | Iceni House, Cobham Road, Ipswich IP3 9JD
Environment Agency | Bromholme Lane, Brampton, Huntingdon, Cambridgeshire, PE28 4NE
enquiries_eastanglia@environment-agency.gov.uk
Telephone : 0203 02 55472

You can now request a Product 4 from our Flood Map for Planning website by following this link:
Flood map for planning - GOV.UK (flood-map-for-planning.service.gov.uk)

Information in this message may be confidential and may be legally privileged. If you have received this message by mistake, please notify the sender immediately, delete it and do not copy it to anyone else. We have checked this email and its attachments for viruses. But you should still check any attachment before opening it. We may have to make this message and any reply to it public if asked to under the Freedom of Information Act, Data Protection Act or for litigation. Email messages and attachments sent to or from any Environment Agency address may also be accessed by someone other than the sender or recipient, for business purposes.

Appendix B – LLFA Consultation

From:	Floodmanagement, Mailbox
To:	Jessica Grady
Subject:	RE: [EXTERNAL] Flooding Information Request: Land East of East Claydon, MK18 3NU
Date:	10 March 2023 12:56:18
Attachments:	image001.png image002.png

CAUTION: This email originated from outside of RPS.

Dear Jessica,

Thank you for your enquiry, I would like to make you aware that Buckinghamshire Council as Lead Local Flood Authority offers a charged pre-application advice service. For further information regarding this service, and to apply, please visit our website.

Please also note that the Lead Local Flood Authority has also produced guidance documents which are freely available on our website, our minor applications guidance also includes a checklist which should be submitted alongside planning applications.

If you have any other questions, please contact suds@buckinghamshire.gov.uk

Kind regards,

Isabella

Isabella Rowland
Strategic Flood Management Graduate
Climate Change and Environment
Planning, Growth & Sustainability Directorate
Buckinghamshire Council

Tel: 01296387667
E-mail: Isabella.Rowland@buckinghamshire.gov.uk
Buckinghamshire Council, Walton Street Offices, Walton Street, Aylesbury, Bucks, HP20 1UA

From: Jessica Grady <Jessica.Grady@rpsgroup.com>
Sent: 10 March 2023 09:02
To: Floodmanagement, Mailbox <floodmanagement@buckinghamshire.gov.uk>
Subject: [EXTERNAL] Flooding Information Request: Land East of East Claydon, MK18 3NU

You don't often get email from jessica.grady@rpsgroup.com. Learn why this is important

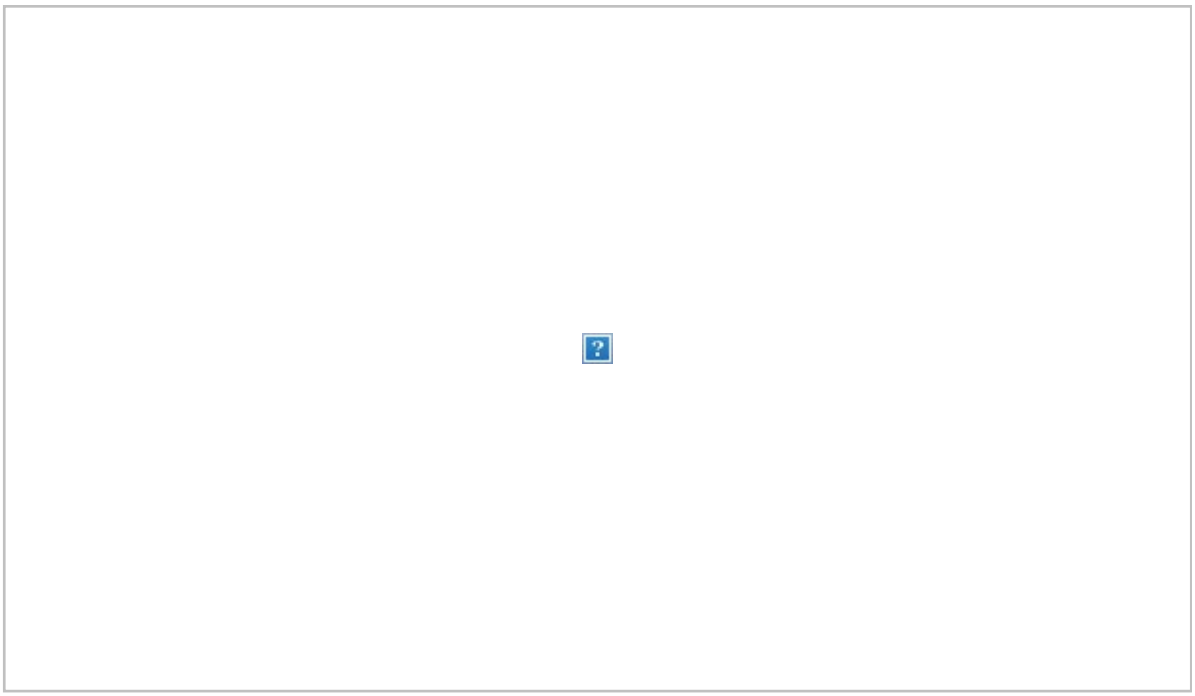
Dear Sir / Madam,

We would like to request the following flood risk and drainage information for Land East of East Claydon, MK18 3NU (GRID REF: SP 75458 25188).

Drainage
• Confirmation of drainage requirements at the site (i.e. discharge rates, climate change allowance, any know drainage constraints within the area)
• Any potential drainage consents will be required to discharge to surrounding watercourses;
• Confirmation of the minimum information requirements of Surface Water Drainage Assessment required for outline and full applications.

Flood Risk
• Flood Map confirmation
• Details of any historical flood events impacting the site
• Details of any groundwater flooding
• Details of any flood risk issues at the site.

A map with the site boundary is attached below:



Kind regards,
Jessica

Jessica Grady (She/Her)
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Digital Business Card

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Appendix C – IDB Consultation

From: Trevor Skelding
To: Jessica Grady
Subject: RE: Flood/Drainage Information Request: Land East of East Claydon, MK18 3NU
Date: 28 March 2023 09:29:50
Attachments: image006.png
image007.png
image008.png

CAUTION: This email originated from outside of RPS.

Hi Jessica,

Thanks for the clarification. Therefore, the Board's restrictions will apply.

Regards

Trevor Skelding MSc IEng MICE
Principal Engineer

Bedford Group of Drainage Boards|Vale House|Broadmead Road|Stewartby|Bedfordshire|MK43 9ND

Tel: 01234 767995 | www.idbs.org.uk

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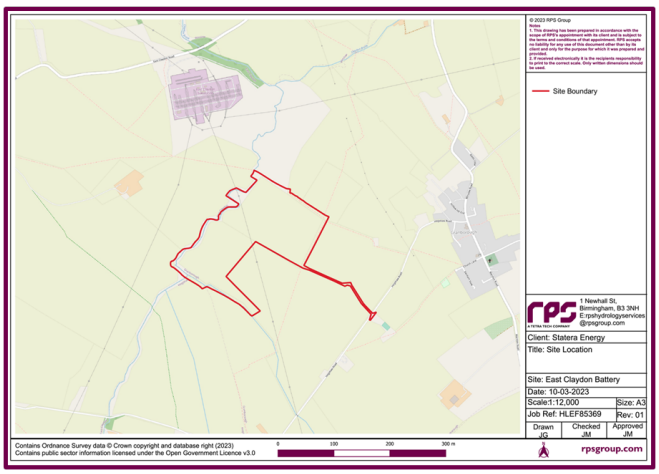
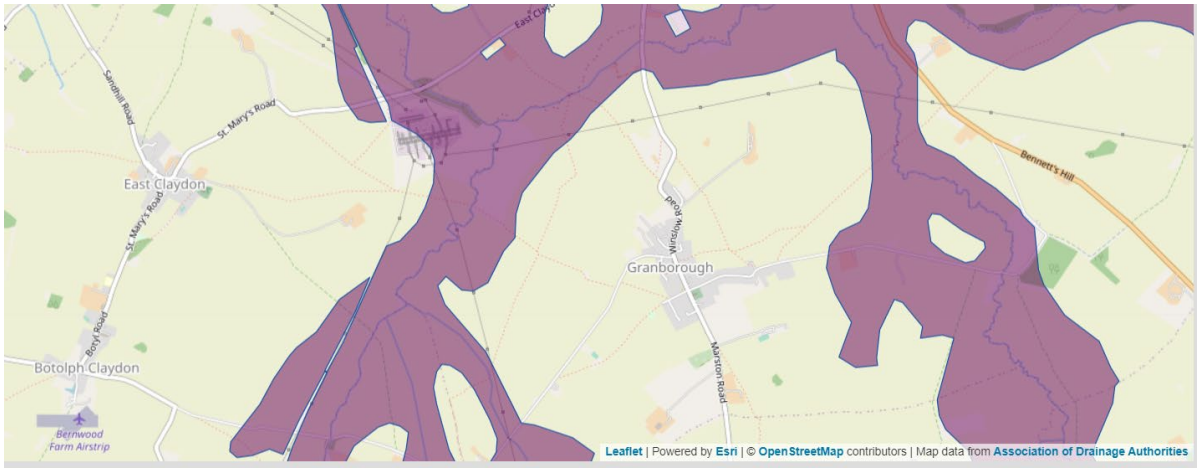
From: Jessica Grady <Jessica.Grady@rpsgroup.com>
Sent: Tuesday, March 28, 2023 9:21 AM
To: Trevor Skelding <Trevor.Skelding@idbs.org.uk>
Subject: RE: Flood/Drainage Information Request: Land East of East Claydon, MK18 3NU

Hello,

Thank you for the information provided.

Please see below for the site boundary and IDB map of the site area. The site is located at National Grid Reference SP 75482 25102.





If the above has any additional impact upon development constraints/ drainage requirements, please let me know.

Kind regards,
Jessica

Jessica Grady (She/Her)
Graduate Consultant - Hydrology
RPS | Consulting UK & Ireland
E jessica.grady@rpsgroup.com

From: Trevor Skelding <Trevor.Skelding@idbs.org.uk>
Sent: 28 March 2023 09:16
To: Jessica Grady <Jessica.Grady@rpsgroup.com>
Subject: RE: Flood/Drainage Information Request: Land East of East Claydon, MK18 3NU

CAUTION: This email originated from outside of RPS.

Hi Jessica,

It is not clear from the information provided whether this falls within the Board's district. However, if it does, no development shall be permitted within the Board's byelaw of 9m, measured from the bank top of any watercourse, and any surface water discharge shall be restricted to the equivalent of 4 l/s per contributing impermeable hectare.

Regards

Trevor Skelding MSc IEng MICE
Principal Engineer

Bedford Group of Drainage Boards|Vale House|Broadmead Road|Stewartby|Bedfordshire|MK43 9ND

Tel: 01234 767995 | www.idbs.org.uk

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From: Jessica Grady <Jessica.Grady@rpsgroup.com>
Sent: Tuesday, March 28, 2023 8:02 AM
To: Planning <Planning@idbs.org.uk>
Subject: Flood/Drainage Information Request: Land East of East Claydon, MK18 3NU

Good morning,

We are emailing in relation to a proposed development within the Buckingham & River Ouzel IDB.
The proposed development relates to Land north west of Hogshaw Road, East Claydon, MK18 3NU, and involves the development of a battery storage

site.

As part of our enquiries can I please request any information or requirements you have regarding watercourses, flood risk and drainage for new developments.

Kind regards,
Jessica

Jessica Grady (She/Her)
Graduate Consultant - Hydrology
RPS | Consulting UK & Ireland
4th Floor
1 Newhall St
Birmingham B3 3NH, United Kingdom
T +44 121 622 8520
E jessica.grady@rpsgroup.com
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Appendix D – Development Plans

Legend

Site boundary	New substation compound
Existing trees	2.5m high weld-mesh security palisade fencing
Existing hedgerows	Crushed stone access track
New woodland planting	5.5 wide crushed stone access track
Attenuation pond	Flood zone boundary
Loose permeable gravel	Proposed hedgerow planting
Wildflower grass	Public Right of Way
Overhead electricity clearance zone	Proposed trees
Inverter building (total 38)	Transformer
Battery container (total 1,204)	Storage container
Control room (total 7)	

STATERA
BALANCING THE GRID

Revision	Date	Comment
-	-	-

ON BEHALF
STATERA

PROJECT
EAST CLAYDON BESS

DATE	15 February 2023
SCALE	1 : 2,000 @ A1
DWG No	SL261__L__X__GA__1
APPROVED	CMcD

TITLE
MASTERPLAN

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Appendix E – Greenfield Runoff Rate

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	6.900	Urban	0.000
SAAR (mm)	650	Region Number	Region 6

Results l/s

QBAR Rural	27.8
QBAR Urban	27.8
Q100 years	88.7
Q1 year	23.6
Q30 years	63.0
Q100 years	88.7

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Appendix F – MicroDrainage Calculations

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	100.476	0.476	23.5	2071.0	O K
30 min Summer	100.614	0.614	23.5	2700.8	O K
60 min Summer	100.750	0.750	23.5	3336.2	O K
120 min Summer	100.879	0.879	23.5	3949.5	O K
180 min Summer	100.948	0.948	23.5	4285.7	O K
240 min Summer	100.992	0.992	23.5	4498.3	O K
360 min Summer	101.040	1.040	23.5	4734.5	O K
480 min Summer	101.061	1.061	23.5	4839.6	O K
600 min Summer	101.070	1.070	23.5	4881.7	O K
720 min Summer	101.071	1.071	23.5	4888.2	O K
960 min Summer	101.061	1.061	23.5	4838.7	O K
1440 min Summer	101.018	1.018	23.5	4628.8	O K
2160 min Summer	100.938	0.938	23.5	4236.1	O K
2880 min Summer	100.879	0.879	23.5	3950.2	O K
4320 min Summer	100.792	0.792	23.5	3537.4	O K
5760 min Summer	100.724	0.724	23.5	3216.4	O K
7200 min Summer	100.669	0.669	23.5	2955.7	O K
8640 min Summer	100.621	0.621	23.5	2735.9	O K
10080 min Summer	100.581	0.581	23.5	2549.1	O K
15 min Winter	100.531	0.531	23.5	2321.7	O K
30 min Winter	100.684	0.684	23.5	3029.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	161.878	0.0	1651.1	27
30 min Summer	105.807	0.0	1953.8	41
60 min Summer	65.729	0.0	3112.1	72
120 min Summer	39.339	0.0	3611.1	130
180 min Summer	28.756	0.0	3782.2	190
240 min Summer	22.865	0.0	3787.1	250
360 min Summer	16.368	0.0	3705.0	368
480 min Summer	12.807	0.0	3635.3	488
600 min Summer	10.550	0.0	3574.8	608
720 min Summer	8.987	0.0	3519.9	726
960 min Summer	6.956	0.0	3420.2	964
1440 min Summer	4.833	0.0	3241.7	1442
2160 min Summer	3.361	0.0	6002.9	1796
2880 min Summer	2.609	0.0	6149.9	2104
4320 min Summer	1.850	0.0	6199.9	2864
5760 min Summer	1.466	0.0	7217.9	3688
7200 min Summer	1.235	0.0	7591.9	4472
8640 min Summer	1.080	0.0	7951.5	5272
10080 min Summer	0.970	0.0	8280.2	6048
15 min Winter	161.878	0.0	1805.3	27
30 min Winter	105.807	0.0	1986.5	41

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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
60 min Winter	100.836	0.836	23.5	3743.8	O K
120 min Winter	100.979	0.979	23.5	4438.2	O K
180 min Winter	101.058	1.058	23.5	4822.0	O K
240 min Winter	101.106	1.106	23.5	5064.2	O K
360 min Winter	101.161	1.161	23.5	5335.6	O K
480 min Winter	101.186	1.186	23.5	5461.6	O K
600 min Winter	101.197	1.197	23.5	5518.0	O K
720 min Winter	101.200	1.200	23.5	5534.3	O K
960 min Winter	101.193	1.193	23.5	5498.4	O K
1440 min Winter	101.155	1.155	23.5	5309.2	O K
2160 min Winter	101.081	1.081	23.5	4937.5	O K
2880 min Winter	101.005	1.005	23.5	4565.7	O K
4320 min Winter	100.883	0.883	23.5	3969.4	O K
5760 min Winter	100.780	0.780	23.5	3476.4	O K
7200 min Winter	100.692	0.692	23.5	3063.0	O K
8640 min Winter	100.616	0.616	23.5	2709.3	O K
10080 min Winter	100.550	0.550	23.5	2406.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	65.729	0.0	3438.3	70
120 min Winter	39.339	0.0	3815.0	128
180 min Winter	28.756	0.0	3771.1	188
240 min Winter	22.865	0.0	3713.4	246
360 min Winter	16.368	0.0	3629.0	364
480 min Winter	12.807	0.0	3567.7	480
600 min Winter	10.550	0.0	3516.3	596
720 min Winter	8.987	0.0	3470.1	714
960 min Winter	6.956	0.0	3384.7	944
1440 min Winter	4.833	0.0	3226.1	1398
2160 min Winter	3.361	0.0	6592.3	2040
2880 min Winter	2.609	0.0	6629.1	2340
4320 min Winter	1.850	0.0	6400.9	3160
5760 min Winter	1.466	0.0	8086.1	4032
7200 min Winter	1.235	0.0	8505.4	4832
8640 min Winter	1.080	0.0	8913.2	5624
10080 min Winter	0.970	0.0	9293.2	6360

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 475483 225305 SP 75483 25305
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) 6.900

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	2.300	4	8	2.300	8	12	2.300

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Model Details

Storage is Online Cover Level (m) 101.510

Tank or Pond Structure

Invert Level (m) 100.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	4185.4	1.500	5281.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0206-2360-1500-2360
Design Head (m)	1.500
Design Flow (l/s)	23.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	206
Invert Level (m)	100.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	23.6
Flush-Flo™	0.457	23.5
Kick-Flo®	0.998	19.4
Mean Flow over Head Range	-	20.3

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	7.1	1.200	21.2	3.000	32.8	7.000	49.4
0.200	19.8	1.400	22.8	3.500	35.4	7.500	51.1
0.300	22.8	1.600	24.3	4.000	37.7	8.000	52.7
0.400	23.5	1.800	25.7	4.500	39.9	8.500	54.3
0.500	23.5	2.000	27.0	5.000	42.0	9.000	55.8
0.600	23.3	2.200	28.3	5.500	44.0	9.500	57.3
0.800	22.3	2.400	29.5	6.000	45.9		
1.000	19.5	2.600	30.6	6.500	47.7		

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Appendix G - Conceptual Drainage Strategy

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PRELIMINARY
SUBJECT TO DETAILED DESIGN

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 maybe 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.

KEY

- Surface Water Manhole
- Interceptor Channel
- Surface Water Headwall
- Internal Compound Surface Water Drains
- Surface Water Outfall Routes
- Vortex Grit Separator

Rev	Description	By	Ckd	Date
B	Updates to Layout	JG	JM	27.10.23
A	Conceptual Drainage Strategy	JG	JM	04.2023

A TETRA TECH COMPANY
4th Floor, 1 Newhall Street, Birmingham, West Midlands B3 3NH
T: +44 121 622 8520 E: rpshydrologyservices@rpsgroup.com

Client: Statera Energy

Project: East Claydon Battery

Title: Conceptual Drainage Strategy

Status	Scale	Date Created
Preliminary	@A0	27.10.2023

Task Team Manager	Information Author	Task Information Manager
JM	JG	JM

Document Number: D01

RPS Project Number: HLEF85369

Revision: B

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Y:\01 Projects\HLEF 85369 - East Claydon BESS\01 East Claydon Battery\01 Drawings\HLEF85369 East Claydon Drainage Route 20231027.dwg