FLOOD RISK ASSESSMENT & SURFACE WATER DRAINAGE STRATEGY

Fairgreen BESS

Land North of Rayleigh Spur Roundabout, Basildon, SS12 9SN

On behalf of RES Ltd

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Document Management

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Contents

Figures

Tables

Appendices

List of abbreviations

AEP	Annual Exceedance Probability
BBC	Basildon Borough Council
BGS	British Geological Survey
CFMP	Catchment Flood Management Plans
EA	Environment Agency
ECC	Essex County Council
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
FSR	Flood Studies Report
Ha	Hectare
IDB	Internal Drainage Board
LiDAR	Light Detecting And Ranging
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NPPF	National Planning Policy Framework
NPPFTG	National Planning Policy Framework Technical Guidance
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems

1. Introduction

Background

1.1. Pegasus Group has been appointed by RES Ltd to undertake a Flood Risk Assessment (FRA) and Surface Water Drainage Strategy for a proposed development seeking full planning permission for the redevelopment of agricultural land into a BESS with associated infrastructure and access roads.

1.2. The site is currently greenfield agricultural land.

1.3. The site is located at NGR TQ 77616 90623. A site location plan can be found in Section 2, Figure 2.1.

1.4. This assessment considers the risk of flooding from all sources, including tidal, fluvial, surface water, historic, groundwater, sewer, and artificial sources.

Table 1.1 – Key Stakeholders

Stakeholder	**Discipline**
Applicant	RES Ltd
Planning Consultant	Pegasus Group
Hydrology, Flood Risk and Drainage	Pegasus Group
Topographical Survey	Three Sixty Group
Local Lead Flood Authority	Essex County Council
Environmental Flood Mapping	Environment Agency

National and Local Policies

1.5. Both the National Planning Policy Framework (NPPF) and the Lead Local Flood Authority – Essex County Council (LLFA - ECC) state that a site-specific Flood Risk Assessment will be required for proposals:

- In Flood Zones 2 or 3 including minor development and change of use
- In Flood Zone 1 where:
    - Site is more than 1 hectare (Ha)
    - Land 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.
    - Land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

1.6. The site is approximately 17.74Ha in area and is located predominantly within Flood Zone 1, with areas to the north located within Flood Zones 2 and 3. As such, a site-specific Flood Risk Assessment will be required.

1.7. As of April 2015, the legislation for dealing with FRAs changed, with additional emphasis placed on the use of Sustainable Drainage Systems (SuDS) within drainage schemes for new developments. The Basildon Adopted Local Plan 2007 has no mention of sustainable drainage or flood risk in its Core Policies; as such, the drainage strategy has been developed with industry best practices in mind as laid out by the CIRIA C753 SuDS Manual.

1.8. In February 2016, the Environment Agency (EA) introduced new guidance relating to the climate change allowances that must be considered within an FRA. Since 2016, the allowances for sea level rise, peak river flow and peak rainfall have each been updated. In March 2025, the EA updated the flood mapping which has been considered in this FRA.

1.9. Given the above, any new planning application that requires an FRA will also require a surface water drainage strategy to be submitted. The drainage strategy must demonstrate the use of SuDS within the design and should be in line with the requirements as set out within the National Planning Policy Framework Technical Guidance (NPPFTG). The drainage strategy must also account for climate change over the lifetime of the development, in accordance with the climate change allowances published by the EA.

1.10. In addition to the requirements from the NPPF and EA, as discussed above, this assessment has also reviewed the information and requirements included in the Basildon Borough Council (BBC) SFRA (2024).

1.11. The purpose is to assess the effects of all potential flood sources on development and develop a sustainable drainage strategy that mitigates post development flood risk. The drainage strategy sets out how post development surface flows will be managed, to sustainably mitigate flood risk.

2. Existing Site & Hydrology

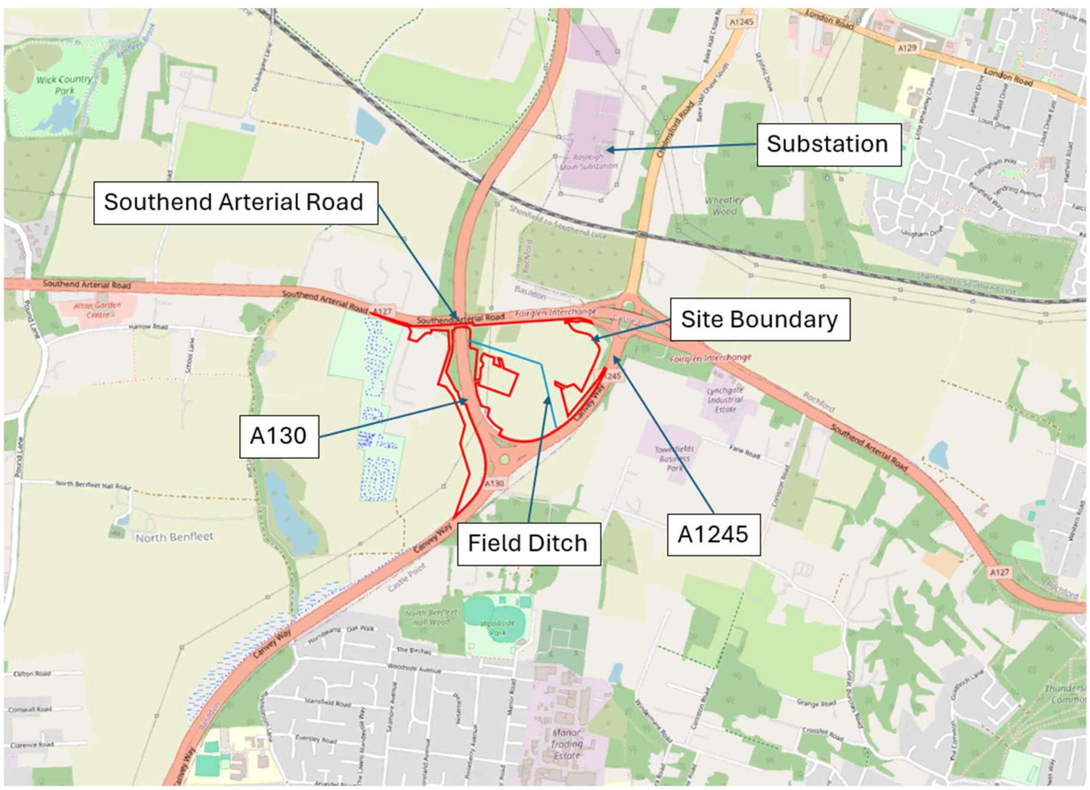
Site Location & Existing Conditions

2.1. The site is 17.74Ha in size and is entirely comprised of agricultural greenfield land.

2.2. The site sits to the south of the Southend Arterial Road and is surrounded by the A130 and the A1245.

2.3. The Environment Agency flood map shows the largest part of the site to be within Flood Zone 1 (<1 in 1000-year probability of flooding) with a section of land to the north of the site in Flood Zone 2 (1 in 100 - 1 in 1000-year probability of flooding) and Zone 3 (>1 in 100-year probability of flooding).

Figure 2.1 - Site Location Plan



2.4. A topographical survey of the site was conducted by Three Sixty Group in March 2025, a pdf of which is included in **Appendix A1.** The topographical survey shows that the site generally slopes north towards the Southend arterial road. The highest point of the site can be found along the southern boundary at an elevation of 21.44mAOD. The lowest point of the site sits around 12.69mAOD along the northern boundary of the site. Overall, the site tends to fall towards the area within Flood Zone 2 and 3.

Existing Drainage and Hydrology

2.5. There is a field ditch located within the site boundary, which crosses the site east to west to an outfall in the west (see figure 2.1).

2.6. There is an existing water mains present on the site, situated near the location of the field ditch (see Appendix E1).

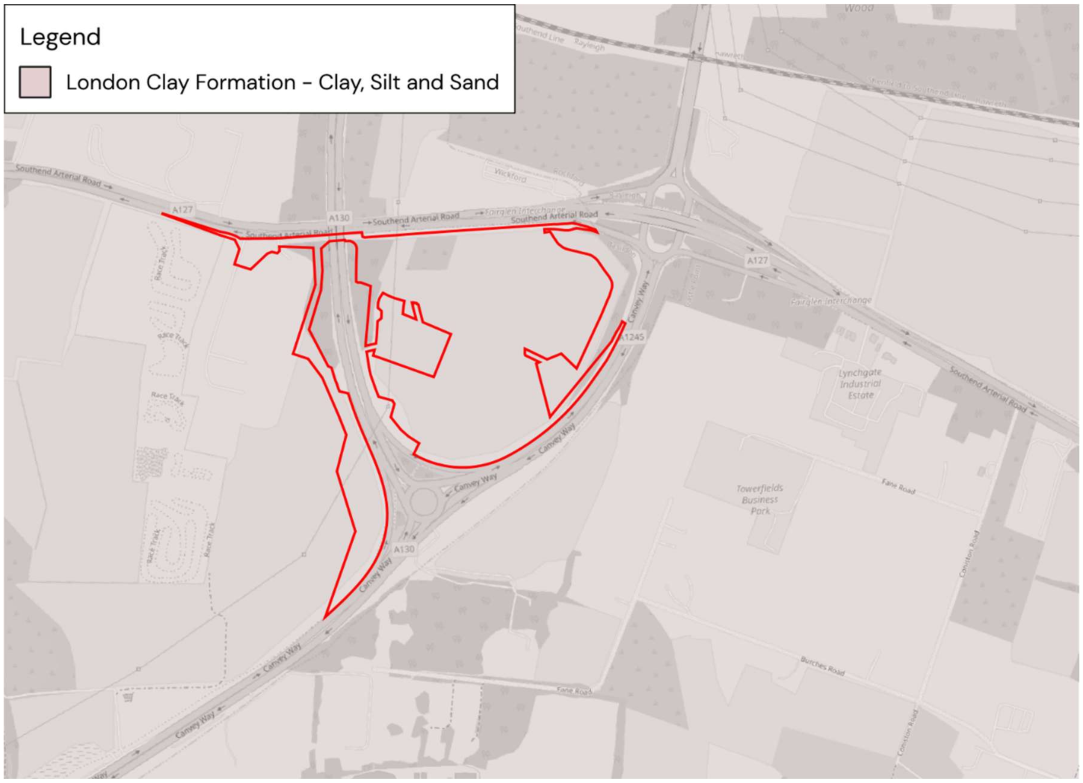
2.7. Soilscapes data shows the site to be underlain by "Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils".

2.8. Geological bedrock data from the British Geological Survey (BGS) shows that the entire site is underlain by "London Clay" Formation with clay, sand and silt. There are no superficial deposits present on site, but BGS data records head clay superficial deposits to the east.

2.9. The hydrogeology aquifer classification defines the site's bedrock to have "rocks with virtually no groundwater" present.

Figure 2.2 – BGS Superficial Deposit Data

Figure 2.3 – BGS Bedrock Data



3. Development Vulnerability & Flood Zone Classification

Statutory Requirements

3.1. Local Planning Authorities, (LPA) have a statutory obligation to consult the Environment Agency (EA) on all applications in the Flood Zones. The EA will consider the effects of flood risk in accordance with the NPPF (including 2024 update).

3.2. The NPPF (2024) requires the following as part of the planning process:

- A 'site specific' Flood Risk Assessment will be undertaken for any site that has a flood risk potential.
- Flood risk potential is minimised by applying a 'sequential approach' to locating 'vulnerable' land uses.
- Sustainable drainage systems are used for surface water management where practical.
- Flood risk is managed using flood resilient and resistant techniques.
- Residual risk is identified and safely managed.

3.3. Table 1 of the Guidance for Flood Risk and Coastal Change, published by the Ministry of Housing, Communities and Local Government defines each Flood Zone based on the probability of river and sea flooding in that area, as summarised below:

- Zone 1 : Low probability (< 1 in 1000 years)
- Zone 2 : Medium probability (1 in 1000 - 1 in 100 years for fluvial events and 1 in 1000 – 1 in 200 years for tidal events)
- Zone 3a : High probability (> 1 in 100 years for fluvial events and > 1 in 200 year for tidal events)
- Zone 3b : The functional floodplain (>1 in 30 years)

3.4. The NPPF sets out a matrix which indicates the types of development that are acceptable in different Flood Zones (see Table 3.1). The proposal is for the development of greenfield agricultural land into a BESS with associated utilities. Under NPPF classification, this falls under Essential Infrastructure.

Table 3.1 – NPPF Guidance

Flood Zones	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test Required	✓	✓	✓
Zone 3a	Exception Test Required	✗	Exception Test Required	✓	✓
Zone 3b	Exception Test Required	✗	✗	✗	✓

<u>Sequential Test</u>

3.5. A sequential approach has been undertaken when designing the site layout, meaning that all water sensitive infrastructure has been situated within Flood Zone 1. Less sensitive infrastructure has been situated in Flood Zones 2 and 3 where necessary.

3.6. Please refer to the Planning Note for details on the Sequential Test.

<u>Exception Test</u>

3.7. Please refer to the Planning Note for details on the Exception Test.

4. Site Specific Flooding Issues and Existing Flood Records

National Planning Policy Framework (NPPF)

4.1. In accordance with the National Planning Policy Framework, this Flood Risk Assessment considers all sources of flooding including:

a) Tidal Flooding – from the sea;

b) Fluvial Flooding – from rivers and streams;

c) Surface Water Flooding – from overland surface water flow and exceedance;

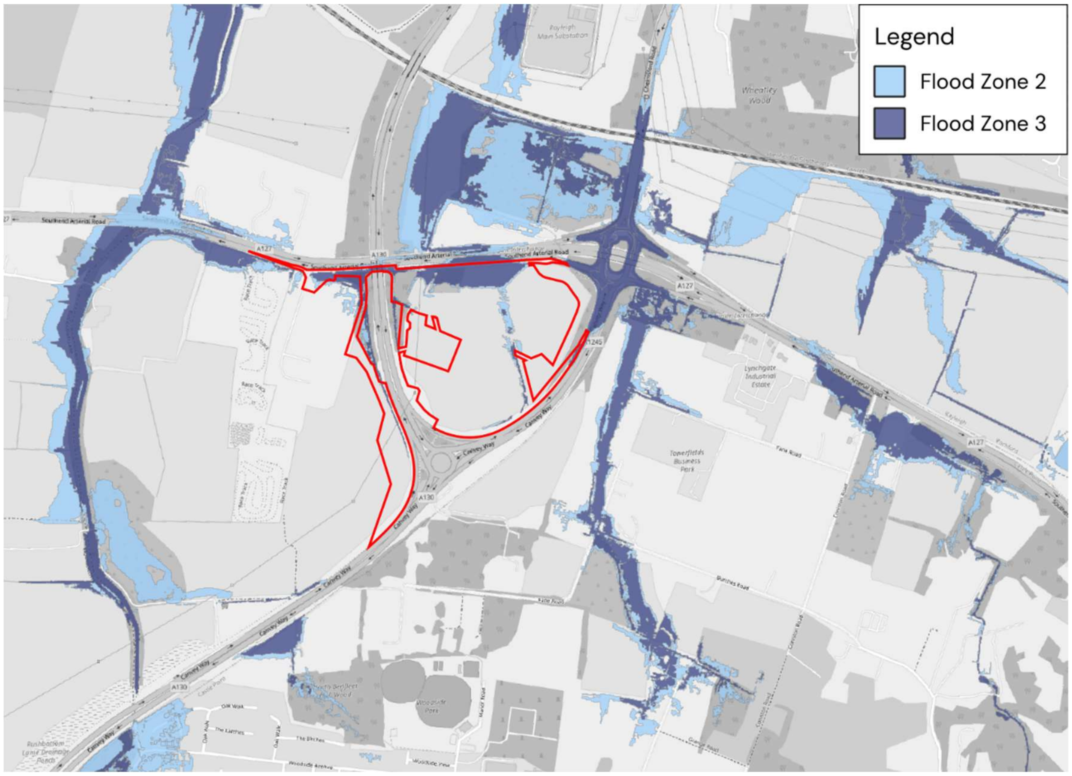
d) Historic Flooding – known historic flooding issues;

e) Groundwater Flooding – from elevated groundwater levels or springs;

f) Flooding from Sewers – exceedance flows from existing sewer systems; and

g) Artificial Sources – reservoirs, canals etc.

Figure 4.1 – Flood Map for Planning



<u>Coastal Flooding (Tidal)</u>

4.2. The site is located inland, approximately 9km southwest of the nearest estuary.

4.3. The only references to tidal flooding in the BBC SFRA refer to the River Crouch, which forms part of the tidal estuary located 9km to the northeast of the site. The closest section of the River Crouch is within 3km of the site, but this section is assumed to not be affected by tidal flooding as it is significantly inland.

4.4. Overall, the tidal flood risk to the site is considered **Very Low**.

<u>Fluvial Flooding (Rivers)</u>

4.5. The Flood Map for Planning (see Figure 4.1) defines the largest part of the site (around 80% of the site area) to be within Flood Zone 1 (less than a 1 in 1000-year probability) with the northern sections (around 20% of the site area) lying within Flood Zone 2 (between 1 in 100 and a 1 in 1000-year probability) and Flood Zone 3a (greater than a 1 in 1000-year probability).

4.6. The areas of the site within Flood Zones 2 and 3 are considered to be at high risk of flooding, however these areas only contain access tracks, which are not water sensitive infrastructure. The battery storage units and other critical infrastructure is located in the area of Flood Zone 1, which is considered to be at low risk of flooding.

4.7. Overall, the fluvial flood risk to the development is low, as the risk is low in areas containing water sensitive equipment.

Surface Water Flooding

Figure 4.2 – RoFSW Extents

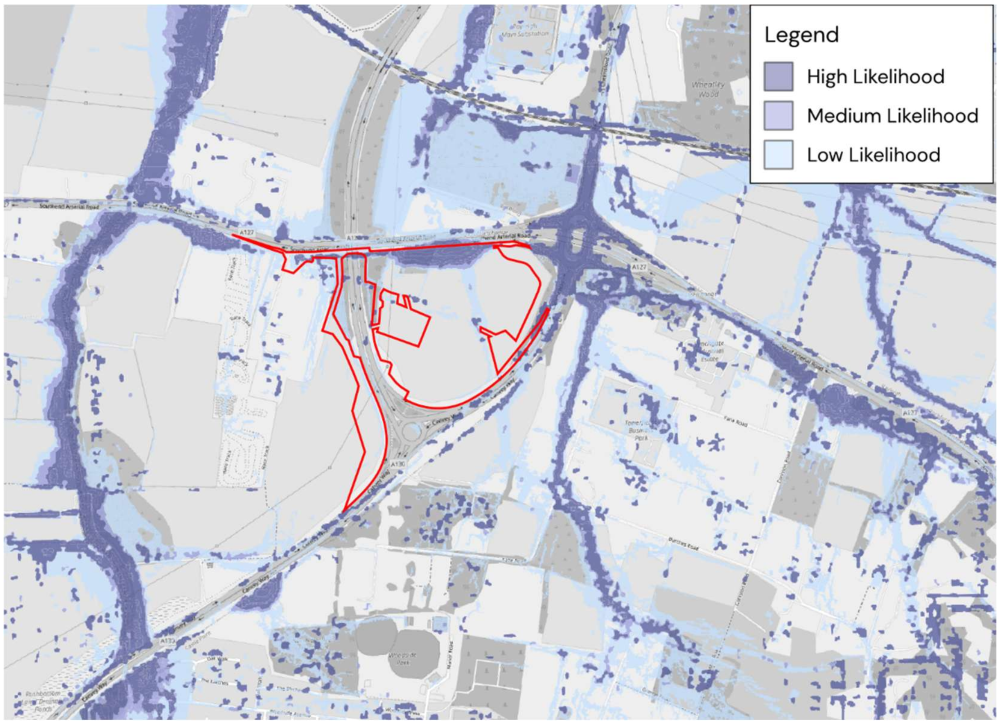


Figure 4.3 – RoFSW 0.2m Depths

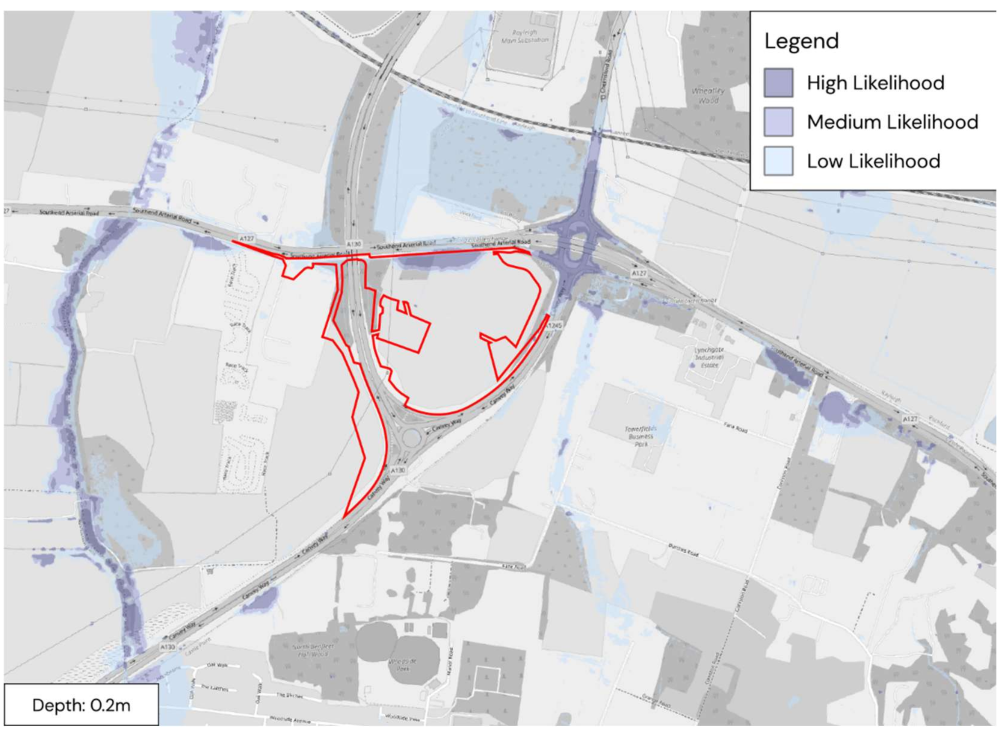


Figure 4.4 – RoFSW 0.3m Depths

Figure 4.5 – RoFSW 0.6m Depths

Figure 4.6 – RoFSW 0.9m Depths

4.8. There is a large area of surface water flooding along the north of the site, in the location of a localised depression. The maximum depth of flooding is 0.9m, though this is localised to a small area. The average depth of flooding is 0.1-0.3m.

4.9. It is envisaged that earthworks will be required to create the access road, development platform and associated infrastructure. This will require the site to be regraded to achieve gradients/falls to the proposed surface water drainage system.

4.10. There is no risk of surface water flooding in the areas of the site that are proposed to contain critical infrastructure.

4.11. Overall, the site is considered to be at **Medium** risk of flooding from surface water.

Figure 4.7 - Historic Flooding

4.12. The EA's Historic Flood Map has no recorded flooding on site.

4.13. The closest historical flooding events occurred in greenfield land located around 950m to the north of the site.

4.14. Overall, the historic flood risk to the site is **Very Low**.

Groundwater Flooding

Figure 4.8 – Aquifer Classification

4.15. The hydrogeology aquifer classification defines the site's bedrock to comprise "London Clay Formation", with " rocks with virtually no groundwater" present.

4.16. It is also likely that the overlying soils consist of clays with impeded drainage potential, meaning groundwater will be unlikely to permeate up through the ground. This is conducive of a low risk from groundwater flooding.

4.17. The overall risk of groundwater flooding to the new development is **Very Low.**

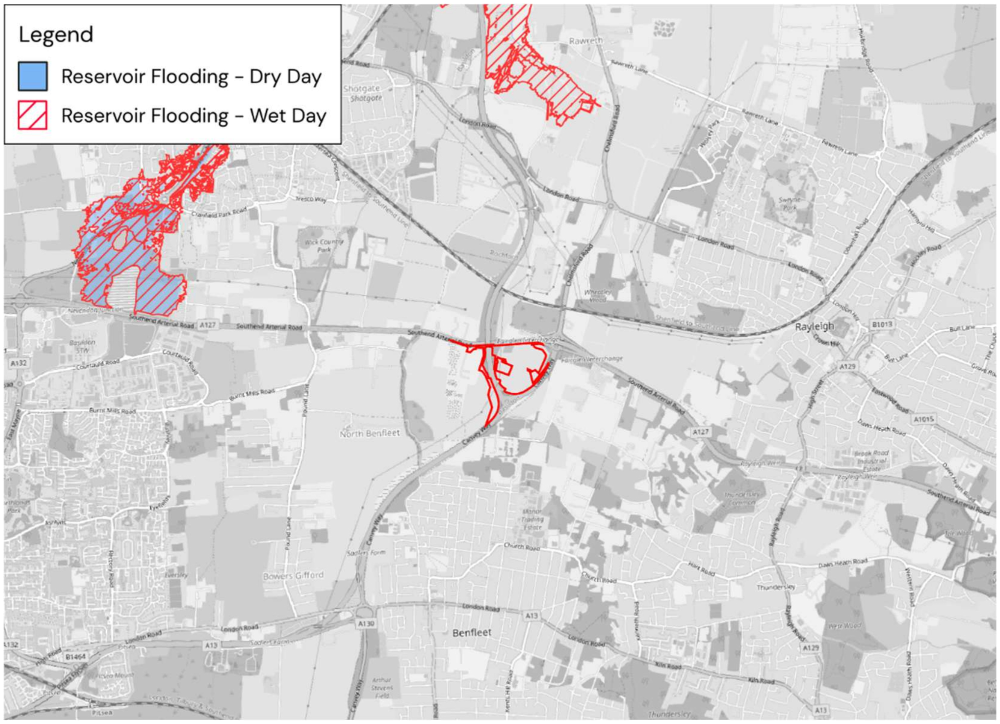
Flooding from Sewers

4.18. From an analysis of Essex and Suffolk Water asset plans, there are no foul sewers located within or around the site (see Appendix E1). The proposed development will not require connection to the foul sewer system.

4.19. The risk of flooding from sewers to the site is **Very Low.**

Flooding from Artificial Sources

Figure 4.9 – Reservoir Flooding Extents



4.20. The Reservoirs Act 1975 requires that all reservoirs are inspected regularly by competent persons to assess the likelihood of failure. The likelihood of reservoir failure is therefore considered minimal.

4.21. The EA's reservoir flood extents data shows that the site is largely not predicted to be at risk should a catastrophic breach occur during a dry or wet day. The closest main breach risk zone is located about 1.5km north away from the site.

4.22. The site is therefore considered to be at **Very Low** risk of flooding from artificial sources.

Post Development Flood Risk Summary

4.23. The risk of flooding to the site from all sources has been assessed above, with the conclusions summarised in Table 4.1:

Table 4.1 – Flood Risk Summary

Flood Source	Flood Risk	Mitigation/Comments
Tidal	Very Low	• The site is 9km away from the nearest tidal source.

Fluvial	Medium	• Majority of the site is located within Flood Zone 1 with the northern area being within Flood Zones 2 and 3a. • Critical infrastructure is located within Flood Zone 1
Surface Water	Low	• Majority of the site is not at risk of surface water flooding • The main area of surface water flooding is to the north of the site, in the area of a localised depression. The maximum flood level is 0.9m, but the most significant flood depths are between 0.1-0.3m • Surface water flooding arising within the site boundary will be managed by the proposed surface water drainage strategy, which will include regrading/earthworks
Historic	Very Low	• The EA's Historic Flood Map shows no recorded flooding events within the site. • The closest historical flooding events are located 950m along the River Broach.
Groundwater	Very Low	• BGS record the site to be underlain by London Clay which is assumed to have a low permeability. • The hydrogeology aquifer classification defines the bedrock on site to have "bedrock with virtually no groundwater" present.
Sewers	Very Low	• There are no foul water sewers present on site •The nature of the development is not expected to increase the risk of sewer flooding.
Artificial	Very Low	• The EA's Reservoir Flood Extents data shows that the site is largely not predicted to be at risk should a catastrophic breach occur during a dry or wet day. The closest main breach risk zone is located about 1.5km away from the site.

<u>Access & Egress</u>

4.24. The site access is subject to consultation with highways officers; as such, multiple access points are shown on the masterplan.

4.25. Some areas of the access tracks within the site sit within the flood zone (see appendix D1), however these instances are within Flood Zone 2, which is at a medium risk of flooding and predicted to flood during a 1 in 100 and 1 in 1000-year event. Considering the lifetime of the proposed development, it is unlikely that these areas will experience flooding. Furthermore, flooding depths in these areas are around 0.1m deep, which will not impede vehicular access or impact people.

4.26. The southeastern access option is also located within flood zone 1.

4.27. The site naturally slopes towards a localised depression, located in the north of the site. The proposed drainage strategy seeks to recreate the existing drainage patterns of the site and allow impervious runoff to discharge to this depression at a greenfield rate. Despite earthworks proposed to take place, the existing flow routes will be maintained, as shown in the drainage strategy drawing found in Appendix C1.

4.28. Overall, access and egress are not predicted to be impeded during an extreme flood event.

5. Proposed Surface Water Drainage Strategy

5.1. This drainage strategy has been developed with consideration to the CIRIA SuDS Manual guidance and the requirements of the NPPF. It is intended that the sustainable drainage strategy proposed in the following sections is robust and takes account of the environmental and technical considerations discussed in the previous sections.

5.2. Under development proposals, the agricultural land would be developed into a BESS site with associated infrastructure. The site proposal can be found in **Appendix B1.**

5.3. Infiltration is the preferred method for the sustainable management of post development surface water, however, as set out in earlier sections, this is not viable due to the presence of clay deposits throughout the site. Therefore, the next best option is to discharge runoff into the existing field ditch at a predevelopment restricted rate.

5.4. The total site area is 17.74Ha, of which 2.895Ha would be comprised of impervious areas for the battery storage compounds.

5.5. Greenfield runoff rates for the impervious areas of the Site have been calculated to be 7.4l/s QBar based off the FEH statistical method of calculating the runoff of the Site.

<u>Drainage Strategy</u>

<u>Surface Water Management</u>

5.6. The SuDS hierarchy demands that surface water run off should be disposed of as high up the following list as practically possible:

• Into the ground (infiltration) and re-use, or then;

• To a surface water body, or then;

• To a surface water sewer, highway drain or another drainage system, or then;

• To a combined sewer.

Technical and Environmental Considerations

5.7. Asset plans from Essex and Suffolk Water show no public surface water sewers within the vicinity of the proposed site, see **Appendix E1.** There is a field ditch that runs through the site west to east. The existing overland flow routes are proposed to be maintained as much as possible.

SuDS Strategy

5.8. Under development proposals, the agricultural land would be developed into a BESS site with associated infrastructure as indicated on the master plan, **Appendix B1.**

5.9. Currently, the site consists of fields. There are two main areas for development, one to the south of the field ditch and one to the north. These areas would consist of an impervious hardstanding – the area to the north being 0.664Ha in size and the area to the south being 2.231Ha.

5.10. Runoff from these impervious areas would be collected by linear drainage channels strategically positioned across the hardstanding areas as shown in Appendix C1. The hardstanding areas would be graded to naturally allow runoff to flow towards the linear drains. The linear drains would convey runoff towards the proposed outfall locations via a piped network, wherein hydrobrakes would restrict discharge rates to that of greenfield runoff rate for the Qbar rainfall event (pro-rated for the served area).

5.11. Attenuation crates would be installed with a sufficiently sized pipe to allow the restricted runoff to back up into the crates, preventing the system from flooding for the 1 in 100-year critical duration rainfall event +45% CC.

5.12. For the southern area, the restricted runoff would be discharged into an attenuation basin, located to the south of the existing ditch. This basin serves to clean the water from particulates and other pollutants before discharging into the ditch via a 225mm pipe.

5.13. For the northern area, the topography of the site does not allow for runoff to be discharged into the existing ditch. Therefore, restricted runoff would be discharged into a constructed ditch along the 14.00mAOD contour to the west, which is at the edge of the flood plain. This ditch would have a lower bank on the northern side, allowing runoff to overtop into the existing area of surface water flooding at greenfield Qbar rate, thus replicating the existing drainage regime.

Hydraulic Assessment

5.14. The proposed compound areas have been split into three catchments to allow for phased construction. Table 5.1 below breaks down the catchment areas and the equivalent flow restriction to be applied to the runoff from each.

Table 5.1 – Discharge rates per catchment

Catchment Name	Catchment Area (Ha)	Discharge Rate equivalent to Greenfield Qbar (l/s)
Catchment 1	1.097	2.8
Catchment 2	1.134	2.9
Catchment 3	0.664	1.7
Total	**2.895**	**7.4**

5.15. Catchment 1 and 2 both outfall to the attenuation basin, so the discharge into the ditch would be less than 5.7l/s total. To replicate the existing overland flow routes for the northern parcel (catchment 3), flows would be discharged into the constructed ditch at 1.7l/s and allowed to overflow into the existing area of surface water flooding. Total flows will not exceed 7.4l/s.

5.16. Attenuation for restricted flows would be provided by attenuation crates, constructed beneath the hardstanding areas. Dimensions for the attenuation storage areas are shown below in table 5.2.

Table 5.2 – Attenuation volumes required

Attenuation Storage	Served Catchment	Dimensions	Storage Volume
Cellular Storage A	Catchment 1	26.4m length x 27.6m width x 1.38m Depth	977m3
Cellular Storage B	Catchment 2	81.6m length x 9m width x 1.38m depth	984m3
Cellular Storage C	Catchment 3	29m length x 29m width x 0.75m depth	600m3

5.17. Each cellular storage would be connected to the system with an outfall pipe, to allow the cellular storage to work at full capacity.

5.18. The proposed ditch would be 1m depth with a top width of 2.3m and a base width of 0.3m, and 1:1 side slopes. The ditch is 120m long and provides 156m3 of attenuation. As the ditch is acting to limit the discharge rate into the existing area of surface water flooding, the additional attenuation storage provided acts as betterment for the site conditions.

5.19. The proposed basin would be 1.35m deep with 1:3 side slopes, providing a total attenuation volume of 162.4m3.

5.20. These drainage elements allow the site to accommodate a 1 in 100-year rainfall event, with an allowance of 45% to account for climate change. The network has also been sized to accommodate a 30-year rainfall event without manhole flooding (see Appendix D1).

5.21. For the drainage modelling, "dummy" manholes have been added to replicate the linear drainage channel functionality. These manholes are labelled as (PX.XXX Mid X) in the calculations shown in appendix D1.

5.22. The access tracks present around the site are proposed to be formed of pervious material, such as type 3 sub-base or reinforced grass. The access tracks will not provide any attenuation storage for runoff but will allow for rainfall to be slowed and treated before following the natural drainage paths of the site and entering the watercourse/surface water flooding area.

5.23. It is good practice to design for exceedance events. The site naturally slopes towards the northern boundary and is intersected by the field ditch that runs through the centre of the site. The proposed development would seek to replicate the existing drainage regime, and as such runoff would either continue to discharge into the drainage ditch or would collect in the localised depression to the north of the site.

Pollution Mitigation and Maintenance

5.24. The SuDS Manual (CIRIA C753) states that the design of surface water drainage should consider minimising contaminants in surface water runoff discharged from the site. The level of treatment required depends on the proposed land use, according to the pollution hazard indices as taken from table 26.2 in the C753 SuDS Manual (2015).

Table 5.3 – Pollution Hazard Indices

Pollutant	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Low traffic roads	Low	0.5	0.4	0.4
Total pollution hazard indices	**Low**	**0.5**	**0.4**	**0.4**

5.25. The proposed land use is predicted to only consist of low traffic roads, as the site is proposed to be largely unoccupied except for a single operator occupying the DNO building.

5.26. Table 5.4 shows the pollution mitigation indices for the SuDS features, as taken from table 26.3 of the C753 SuDS Manual (2015). It is shown that each individual pollution mitigation indices exceeds the proposed development pollution indices.

5.27. Following guidance from the SuDS manual, in instances where multiple SuDS measures are used in tandem, a secondary component factor of 0.5 must be applied to the lower mitigation value when calculating the total pollution mitigation. From the table below, the mitigation measures are deemed adequate for the site.

Table 5.4 – Indicative SuDS Mitigation Indices

Type of SuDS component	Total suspended solids (TSS)	Metals	Hydrocarbons	Secondary Component Factor
Ditch	0.5	0.6	0.6	1
Basin	0.5	0.5	0.6	0.5
Total Mitigation Indices **(The mitigation indices are acceptable since they are higher than the hazard indices)**	**0.75**	**0.85**	**0.9**	

5.28. From the hydrological analysis, implementing the proposed mitigation measures would ensure that potential flood risk resulting from post development runoff can be managed as sustainably as possible, ensuring that there is no risk to the development or downstream catchments.

5.29. It is proposed that the following schedule of inspections and maintenance operations are undertaken. The schedule is based on current best practice as set out in the 2015 SuDS (see table 5.5 and 5.6) and a detailed management plan will be developed as the design evolves.

5.30. The following table sets out the maintenance requirements for each of the elements forming the SuDs system.

Table 5.5 - Maintenance Requirements for Ditches, CIRIA SuDs Manual 2015

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly, or as required
	Cut grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

Table 5.6 - Maintenance Requirements for Basins, CIRIA SuDs Manual 2015

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways 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)
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (as set out in Chapter 23)
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

5.31. Additionally, hydrobrakes would require inspection on a monthly basis, and cleared of debris when required to maintain efficient operation.

5.32. Linear drainage features would also require inspection on a monthly basis and cleared of debris when required.

5.33. The existing culvert along the site boundary which the ditch outfalls to would be fitted with a trash screen to ensure the ditch does not lose capacity and cause flooding on-site during higher intensity storm events. The screen would require inspecting monthly for any blockages and clearing when necessary

5.34. The on-site drainage would not be offered up for adoption and would instead be maintained by a management company. By implementing regular inspections and undertaking maintenance as required, it is envisaged that the SuDs system would perform its intended water management function for the lifetime of the development.

Fire Suppression Water

5.35. It is also a requirement to consider firefighting for BESS sites. In the event of a fire, water used to fight the spread of the fire could become contaminated due to the chemicals within the batteries. The drainage strategy must demonstrate a sufficient method of ensuring this contaminated water would not end up discharging to local watercourses or contaminating future rainfall runoff from the site.

5.36. The compound areas would be constructed from impervious surfacing, ensuring that all used water is diverted into the proposed linear drainage channels.

5.37. In the event of a fire, there are penstock valves positioned at key locations around the site, which would allow water to be diverted into dedicated storage tanks instead of discharging to the proposed outfalls. Water in these tanks can then be tested to determine the best disposal technique.

5.38. These storage tanks are proposed to be constructed of geocellular crates to provide a capacity of 228m3 in each tank, in accordance with National Fire Chiefs Council "Grid Scale Battery Storage System planning – Guidance for FRS". The locations of these tanks are shown in Appendix D1.

6. Exceedance Routes

6.1. The attenuation features have been designed for the critical duration 1 in 100-year storm, with an allowance of 45% to cater for the predicted increase in rainfall intensities resulting from climate change.

6.2. It is also a requirement to consider the effects of run off resulting from storm events greater than the design event. In this scenario, overland flows follow the existing topography and discharge into the existing field ditch or collect in the existing localised depression. This replicates the existing drainage conditions.

6.3. As mentioned in previous sections, access to the site is to be determined at a later date following consultation with the Highways Authority. Of the proposed access tracks, the tracks that sit within Flood Zones 2 and 3 are only predicted to become inundated with less than 300mm of standing water.

6.4. The southeastern access option is located within flood zone 1.

6.5. The battery storage compounds are proposed to be raised above the existing ground level and graded towards the existing field ditch or flood plain, respectively.

7. Foul Drainage

7.1. The DNO Switchroom building is proposed to contain welfare facilities, with a predicted usage rate of one maintenance visit once a month by one person.

7.2. Due to the lack of nearby foul sewers, a septic tank has been proposed to be positioned to the west of the switchroom building. The septic tank has a capacity of 1.6m3, sized to have the capacity to hold up to 10 months' worth of wastewater, assuming a conservative estimate of wastewater production rate of 150l/day with the predicted usage rate.

7.3. Treatment and discharge of the foul water is deemed unsuitable, due to the low impermeability of the surrounding soils and the switchroom being located downhill from the closest watercourse. Therefore, a vehicle will be required to empty the septic tank every 10 months and take the water away to be treated.

8. Conclusion

8.1. This report has assessed the flood risk to the proposed redevelopment of a of agricultural land into a BESS with associated infrastructure and access roads.

8.2. In accordance with the technical guidance set out in the NPPF, all potential sources of flooding have been considered, and a sustainable drainage strategy developed which will mitigate post development flood risk; and enable the facility to operate safely, without increasing flood risk to the site, or downstream catchments.

8.3. In accordance with Table 3.1 of the NPPF, BESS sites are critical infrastructure and are therefore permitted in Flood Zone 1 and permitted in Flood Zones 2 and 3a following a sequential and exception test.

8.4. Hardstanding areas would be constructed of an impervious surface and will be graded to convey runoff towards linear drainage channels, which would convey flows to attenuation features and proposed outfalls via SuDS features and flow controls.

8.5. Discharge into existing drainage features would be restricted to greenfield runoff rate for the Qbar storm event. Hydrobrakes would be installed at the locations shown in appendix C1 to restrict discharge to set rates, as laid out in table 5.1.

8.6. Geocellular attenuation crates would be situated adjacent hydrobrakes with a pipe connections to allow for water to back up into the storage area and be attenuated. See table 5.2 for geocellular storage volumes.

8.7. For the southern catchment area, runoff is conveyed to an attenuation basin, which would collect water before discharging to the existing field drain. This attenuation basin also provides pollutant mitigation measures.

8.8. For the northern catchment area, runoff is conveyed to a proposed ditch, excavated around the edge of the existing flood plain. Runoff would be discharged into this ditch at the existing greenfield rate and allowed to overflow into the area of existing surface water flooding when capacity is exceeded. This replicates the existing drainage regime and provides betterment by adding additional attenuation storage.

8.9. Attenuation storage features have been sized to accommodate the 1 in 100-year rainfall event, with an allowance of 45% to account for climate change. Manholes and pipes have been sized to accommodate a 1 in 30-year rainfall event without flooding.

8.10. Regular maintenance would be undertaken to all drainage infrastructure with regular inspections and maintenance activities undertaken in accordance with the maintenance plan / CIRIA 753.

8.11. Penstock valves and hydrobrakes would allow for contaminated water to be diverted into water storage tanks in the event of a fire. Contaminated water would then be tankered off-site to be treated.

8.12. Foul wastewater is proposed to be attenuated in a small septic tank located adjacent the DNO switchroom and emptied when full by a foul waste collection vehicle.

8.13. Implementation of the recommendations set out in this assessment would ensure that flood risk can be managed sustainably, without increasing flood risk to site users or adjacent catchments.

8.14. In summary, the proposed development would mitigate the increased surface water runoff to that of greenfield rate, which would prevent the flood risk from increasing as a result of the proposed development.

Appendix A1: Topographic Survey

Appendix B1: Site Masterplan

Appendix C1: Drainage Strategy

Appendix C2: Catchment Plan

Appendix D1: Info Drainage Calculations

Appendix D2: Greenfield Runoff Rate Calculations

Appendix E1: Essex and Suffolk Water - Sewer Assets

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