



# Meridian Solar Farm

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Volume 6

Environmental Statement

6.3 ES Appendix 11-4:  
Outline Drainage Strategy

APFP Regulation 5(2)(a)

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# 1. Executive Summary

- 1.1.1. Meridian Solar Farm Limited (hereafter referred to as 'the Applicant') has prepared this Environmental Statement ('ES') as part of its application for a Development Consent Order ('the DCO Application') for the construction, operation and decommissioning of the proposed Meridian Solar Farm ('the Scheme'). This Outline Drainage Strategy forms a technical appendix to **ES Chapter 11: Hydrology and Flood Risk** (Doc Ref. 6.1).
- 1.1.2. The Scheme comprises the Solar Development Area, Inter-Array Connections and the Grid Connection Route. This Outline Drainage Strategy report covers the design of drainage for the Solar Development Area during the operational phase. No drainage design is proposed for the Inter-Array Connections, as the Underground Inter-Array Connection would have no above ground infrastructure and the Overhead Inter-Array Connection timber poles would have minimal footprint and, therefore, would not contribute to an increase in surface water runoff. The drainage strategy for the Grid Connection Route is available in Annex E of this report. Surface water runoff during the construction and decommissioning of the Scheme is to be managed by the contractor, as set out within the **Outline Construction Environmental Management Plan (OCEMP)** (Doc Ref. 7.10) and the **Outline Decommissioning Environmental Management Plan (ODEMP)** (Doc Ref. 7.12).
- 1.1.3. This Drainage Strategy has been prepared in accordance with the requirements of the Overarching National Policy Statement (NPS) for Energy (EN-1)<sup>1</sup>, the NPS for Renewable Energy Infrastructure (EN-3)<sup>2</sup>, the NPS for Electricity Networks Infrastructure (EN-5)<sup>3</sup> and the National Planning Policy Framework (NPPF)<sup>4</sup>. The proposed use of the Scheme would be classed as 'Essential Infrastructure' in accordance with Annex 3 of NPPF.
- 1.1.4. This report should be read in conjunction with the Flood Risk Assessment (FRA) presented in **ES Appendix 11-3: Flood Risk Assessment** (Doc Ref. 6.3).

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<sup>1</sup> Department for Energy Security and Net Zero (December 2025 Overarching National Policy statement for Energy (EN-1). Available at: [Overarching National Policy Statement for Energy \(EN-1\) - December 2025](#) [Accessed 10 January 2025]

<sup>2</sup> Department for Energy Security and Net Zero (December 2025). National Policy Statement for Renewable Energy Infrastructure (EN-3). Available at: [National Policy Statement for Renewable Energy Infrastructure \(EN-3\)](#) [Accessed 10 January 2025]

<sup>3</sup> Department for Energy Security and Net Zero (December 2025). National Policy Statement for electricity networks infrastructure (EN-5). Available at: [National Policy Statement for Electricity Networks Infrastructure \(EN-5\) - December 2025](#) [Accessed 10 January 2025]

<sup>4</sup> National Planning Policy Framework (March 2012, updated February 2025). Available at: [https://assets.publishing.service.gov.uk/media/669a25e9a3c2a28abb50d2b4/NPPF\\_December\\_2024.pdf](https://assets.publishing.service.gov.uk/media/669a25e9a3c2a28abb50d2b4/NPPF_December_2024.pdf) [Accessed 10 January 2025]

- 1.1.5. The full drainage strategy will be designed to ensure there will be no increase in the risk of flooding within or outside of the Site boundary. Surface water runoff from the Scheme will be captured with the use of Sustainable Drainage Systems (SuDS) techniques: swales and basins to mimic existing drainage conditions and accommodate the 1 in 100-year return period storm event plus a 40% increase allowance for climate change.
- 1.1.6. When considered within the context of national, regional and local planning policy in respect of development and flood risk, the assessment concludes that the Site of the Scheme remains safe from this perspective, does not increase flood risk elsewhere and fulfils the Government's wider criteria for sustainable development.

## 2. Introduction

- 2.1.1. The Scheme would comprise the construction, operation (including maintenance) and decommissioning of a solar PV electricity generating station with associated infrastructure, including co-located Battery Energy Storage System (BESS), Inter-Array Connections to link the land parcels that form the Solar Development Areas, and an up to 13km overhead line Grid Connection (with one short undergrounded section) which would run north towards a point of connection (PoC) at the proposed Weston Marsh B National Grid Electricity Transmission (NGET) substation, to the north of Weston.
- 2.1.2. The Solar PV generating station, associated BESS, on-site substations and other associated infrastructure would be located within four land parcels (A, B, C and D) referred to collectively as the Solar Development Area, as shown in **ES Figure 1-1** (Doc Ref. 6.2).
- 2.1.3. The Inter-Arrays would be the areas within which 132kV connection cables (the 'Inter-Array Connections') would link the land parcels of the Solar Development Area. The configuration of the Inter-Array Connections (132kV) would comprise underground cabling between Land Parcels A and B ('the Underground Inter-Array') and an overhead line between Land Parcels C and D ('the Overground Inter-Array').
- 2.1.4. The Grid Connection Route would be the area between the Solar Development Area and the National Grid Weston Marsh B Substation in which a 400kV overhead line (the 'Grid Connection') would be located. There is one section where the Grid Connection would route underground to avoid conflicts with an existing 132kV overhead line. Cable Sealing End Compounds (CSECs) would join the proposed underground cable at that section with the proposed overhead line.
- 2.1.5. The Scheme spans approximately 1,616 hectares (ha) of land. The Solar Development Area is approximately 1,067ha, comprised predominantly of agricultural land.
- 2.1.6. The design life of the Scheme will be 40 years and decommissioning is expected to commence thereafter.
- 2.1.7. The part of the Scheme within the Solar Development Area will consist of:
  - Solar PV Infrastructure, including:
    - Solar PV modules; and
    - Module mounting structures.
  - Solar PV Supporting Infrastructure within solar stations, including:

- Inverters;
- Transformers; and
- Switchgears.
- BESS Compound;
- On-site electrical compounds comprising of substation(s) and control buildings;
- On-site cabling and cabling between Solar Development Area land parcels;
- Fencing and security measures;
- Temporary construction compounds, access tracks and potential minor works on local road network;
- Permanent access tracks; and
- Landscaping and biodiversity enhancements.

2.1.8. The Inter-Array Connection between Parcels A and B will comprise underground cabling with no above ground infrastructure. Wooden H-poles are proposed within the Inter-Array Connection between Parcel C and D; as such they have minimal footprint, and, therefore, are not anticipated to have any increases in contributing areas beyond existing during the operational phase. The operational infrastructure within the Grid Connection Route will comprise steel pylons and CSECs.

2.1.9. The main land use across the Site is agricultural. The landscape features within the vicinity consist of a low-lying, flat landscape with drainage ditches, dykes and rivers. The steep man-made agricultural drainage ditches typically border arable field boundaries with isolated pockets of plantation. The area within and surrounding the Scheme is described in more detail in **ES Chapter 2: The Scheme** (Doc Ref. 6.1).

2.1.10. This Drainage Strategy solely relates to the outline drainage design of the Solar Development Area of the Scheme, with regards to handling surface water generated by new impermeable areas within the Site. It will therefore only consider the drainage of the Solar Development Area during operation of the Scheme. The drainage strategy for the Grid Connection Route can be found in Annex E - Grid Connection Route Outline Drainage Strategy of this report.

2.1.11. The **Outline Construction Environment Management Plan (OCEMP)** (Doc Ref. 7.10) provides requirements for the management of surface water runoff during the construction phase. During decommissioning, measures for the management

of surface water runoff are set out within the **Outline Decommissioning Environmental Management Plan (ODEMP)** (Doc Ref. 7.12).

2.1.12. The following stakeholders have been consulted in producing this strategy:

- The Environment Agency;
- South Holland Internal Drainage Board; and
- North Level District Internal Drainage Board.

2.1.13. A meeting was held with the IDB stakeholders listed above on 9 and 20 October 2025, and with the Environment Agency on 20 January 2026 to discuss the proposed drainage strategy for both the Solar Development Area and the Grid Connection Route. During the meeting, no comments were raised by the stakeholders on the proposed drainage strategy.

### 3. Solar Development Area Design Assumptions

3.1.1. The following design assumptions have been used to produce this strategy:

- Permanent infrastructure has been moved out of Flood Zone 3a and 3b of the Postland flood extents, except for Solar PV panels in some instances, and out of the South Holland Main Drain Flood Zone 3a and 3b extents, except within Parcel D-1.
- The solar PV panels will be mounted from the ground by a minimum of 0.8m, allowing rainfall/runoff to infiltrate into the ground beneath the panels. Therefore, the solar PV panels will not lead to a substantial increase in impermeable area within the Site. The drainage regime of the solar PV panel areas is therefore assumed to remain consistent with its pre-developed state.
- New operational access roads will be permeable. Therefore, the Site's access roads will not lead to an increase in impermeable area. The drainage regime of the access roads is therefore assumed to remain consistent with its pre-developed state.
- Solar Station Compounds distributed throughout the Solar Development Area are considered to be 100% impermeable as a worst-case scenario. It has also been assumed 100% of the runoff from these areas will contribute to the drainage system, and therefore a Volumetric Runoff Coefficient (Cv) of 1 has been used.
- In the case of the 132kV substations and the 400kV Substation and BESS compound, it is reasonably assuming a lined gravel build up will be used and

will capture and evaporate some of the runoff before it enters the drainage system, a Volumetric Runoff Coefficient (Cv) of 0.85 has been used, due to the anticipated absorption and evaporation within the gravel subbase.

- The drainage system for new impermeable areas has been designed to accommodate the 1 in 100-year storm, plus a 40% allowance for an increase in peak rainfall intensity due to climate change.
- The discharge of surface water for new impermeable areas via infiltration will not be prioritised. However, when it is required and there is no viable discharge to nearby watercourse, infiltration will be used. This will be confirmed with on-site ground investigation works during detailed design post-consent.
- Flood Estimation Handbook (FEH)<sup>5</sup> 2022 rainfall data have been used for this assessment

## 4. Supporting Information

### 4.1. Flood Risk

- 4.1.1. The potential flood risk to the Scheme is summarised in Table 4-1 below. For further detail of the Scheme’s flood risk, refer to the FRA that is included in **ES Appendix 11-3: Flood Risk Assessment** (Doc Ref. 6.3).

**Table 4-1: Scheme Flood Risk Summary**

Flood Risk Source	Pre-Development Flood Risk Level	Post-Proposed Development Flood Risk Level	Comments
Fluvial	High	High	<u>River Welland</u> The 400kV Substation and BESS in Land Parcel B and two of the 132kV Substations in Land Parcel A and C lie within Flood Zone 2 and 3a, according

<sup>5</sup> Ceh.ac.uk. (2013). Home Page - FEH Web Service. [online] Available at: <https://fehweb.ceh.ac.uk/>. [Accessed 02/10/2025].

Flood Risk Source	Pre-Development Flood Risk Level	Post-Proposed Development Flood Risk Level	Comments
			<p>to Flood Map for Planning. However, the Scheme benefits from flood defences up to the 1 in 1000 (0.1% AEP plus climate change) year event with a low residual risk from a breach of the River Welland; therefore, there is a low residual risk of fluvial flooding to the Scheme from the River Welland. Substations and BESS that sit within the breach extents are bunded with 300mm freeboard to ensure it will remain operational in times of flood.</p> <p><u>Postland Catchment</u></p> <p>All infrastructure other than solar PV panels are located outside of the Flood Zone 3b extents. Mitigation for solar stations and substations within the Postland catchment is provided for the breach scenario of the River Welland. Modelled flood extents of the Postland catchment during pump failure are significantly shallower and to a lesser flood extent than the breach of the River Welland. No additional mitigation is required for the Postland catchment.</p> <p><u>South Holland Main Drain (SHMD)</u></p> <p>Hydraulic modelling indicates Gotts Fen includes areas of Flood Zone 3b and 3a. Fleet Fen and Wisemans catchments are not impacted by Flood Zone 3a or 3b (flows remain in channel, including for climate change). The 0.1%</p>

Flood Risk Source	Pre-Development Flood Risk Level	Post-Proposed Development Flood Risk Level	Comments
			<p>AEP plus 28% climate change extent from pump failure extends across all SHMD catchments. However, where the SHMD shares its catchment with the River Welland breach extents, mitigation is already provided for infrastructure, above the 1 in 1000-year (0.1% AEP plus climate change) depth of the SHMD.</p> <p>The 132kV Substation in Parcel D is located outside of the flood extents during the pump failure scenario, with no additional mitigation required. Mitigation required for PV panels and solar stations is discussed below.</p> <p><u>PV Panels / Solar Stations</u></p> <p>The lower edge of solar PV panels will have a minimum height above ground of 0.8m to remain operational in times of flood, and will be raised up to 1.3m above ground to ensure upper panels will remain operational in times of flood.</p> <p>Other than in the Gotts Catchment which includes the northern most fields within Land Parcel D, all solar stations have also been located outside of Flood Zone 3b extents. The maximum height of any plinths used to raise solar stations above flood depths will be 0.8m (0.5m plus 0.3m freeboard). Where solar stations are located within</p>

Flood Risk Source	Pre-Development Flood Risk Level	Post-Proposed Development Flood Risk Level	Comments
			<p>the flood extents and the plinths do not raise the solar stations above the worst-case flood depths and provide 0.3m freeboard, they are to have a flood defence wall or bund for protection. As requested by the EA during a meeting with them in January 2026, solar stations within Land Parcel D-1 that are located in Flood Zone 3b extents would be provided freeboard of up to 0.6m, and therefore the maximum height of any plinths used to raise solar stations above flood depths in Land Parcel D-1 would be 1.35 (0.75m plus 0.6m freeboard), resulting in a maximum height of 4.85m above the ground for solar stations raised on plinths.</p> <p>Fluvial floodplain volume loss from infrastructure has been assessed in <b>ES Appendix 11-3: Flood Risk Assessment</b> (Doc Ref. 6.3).</p>
Tidal	Low	Low	<p>The EA has been contacted to obtain product data, which confirmed that tidal flood risk is low across all land parcels within the Site. The River Welland is a tidal river that flows west of the Scheme. This river is defended by the Crowland-Cowbit Washes and embankments. Land parcels A, B and C are protected against a flood event with a 1 in 1000 year chance of occurring in any year (0.1% AEP plus</p>

Flood Risk Source	Pre-Development Flood Risk Level	Post-Proposed Development Flood Risk Level	Comments
			climate change). Review of the River Nene model shows the River Nene tidal flood risk or extreme overtopping during a in 1000 year (0.1% plus climate change) does not encroach into the Order Limits.
Pluvial	Low-High	Low-High	The EA 'Flood Risk from Surface Water' Map <sup>6</sup> shows areas that may be susceptible to surface water flooding following an extreme rainfall event. The mapping shows that the majority of the Solar Development Area is at a 'Very Low' risk of surface water flooding. Only isolated and localised areas are shown to be at high, medium and low risk of surface water flooding. Flooding is generally very localised. Risks range from low chance to high chance. The areas of risk are likely areas of low topography where surface water sits and pools rather than draining away.
Groundwater	Low	Low	The South East Lincolnshire Strategic Flood Risk Assessment (SFRA) <sup>7</sup> and online data has been reviewed to try and establish the existing groundwater risk. The GOV website for long term

<sup>6</sup> Environment Agency (2025). Learn more about flood risk. [online] check-long-term-flood-risk.service.gov.uk. Available at: <https://check-long-term-flood-risk.service.gov.uk/map> . [Accessed 10/10/2025].

<sup>7</sup> South East Lincolnshire Joint Strategic Planning Committee (2017) South East Lincolnshire Strategic Flood Risk Assessment. Available at: [https://www.sholland.gov.uk/media/7937/South-East-Lincolnshire-Strategic-Flood-Risk-Assessment-Report-March-2017-including-guidance-on-applying-the-Sequential-Test-for-planning-applications/pdf/SE\\_Lincolnshire\\_SFRA\\_2017\\_v6.pdf?m=1607959961710](https://www.sholland.gov.uk/media/7937/South-East-Lincolnshire-Strategic-Flood-Risk-Assessment-Report-March-2017-including-guidance-on-applying-the-Sequential-Test-for-planning-applications/pdf/SE_Lincolnshire_SFRA_2017_v6.pdf?m=1607959961710) [Accessed: 10/10/2025].

Flood Risk Source	Pre-Development Flood Risk Level	Post-Proposed Development Flood Risk Level	Comments
			flood risk <sup>8</sup> was used to obtain information regarding ground water flooding in the Site. These data sources show that flooding from groundwater is unlikely in this area. Groundwater risk will be mitigated by discharging surface runoff to watercourses and using shallow swales, therefore, not increasing risk of groundwater flooding. Platform levels will be set above the fluvial flood risk levels by at least 0.3m which will mitigate against groundwater emergence.
Sewers	Low	Low	The Scheme has no proposed connection to public foul or surface water sewers. No change to flood risk level.
Artificial Sources	High	High	The EA reservoirs map <sup>9</sup> shows the Site is seen to be at risk of flooding from reservoirs, apart from the east of the Site boundary, which shows no risk of flooding. This is due to the nearby reservoirs, Eyebrook Reservoir and Rutland Water that are located far west of the Scheme.

<sup>8</sup> GOV.UK (2023). Check the long term flood risk for an area in England. [online] GOV.UK. Available at: <https://www.gov.uk/check-long-term-flood-risk>. [Accessed: 10/10/2025].

<sup>9</sup> Environment Agency (2019). Learn more about flood risk. [online] check-long-term-flood-risk.service.gov.uk. Available at: <https://check-long-term-flood-risk.service.gov.uk/map>. [Accessed: 10/10/2025].

## 4.2. Existing Surface Water Drainage

- 4.2.1. The main land use across the Site is agricultural. The landscape features within the vicinity consist of steep man-made agricultural drainage ditches typically bordering arable field boundaries. Vegetation is minimal and small groups of woodland are scattered within the Site. Trees are present individually in some areas, as well as in rows and within small woodland areas. The principal watercourses in and surrounding the Site are the River Welland (to the west of the Scheme) and the River Nene (to the east), whilst the South Holland Main Drain crosses the north of the Solar Development Area, through Land Parcel B and Land Parcel D.
- 4.2.2. The Site boundary extends across areas administered by the South Holland Internal Drainage Board (SHIDB) and the North Level District Internal Drainage Board (NLDIDB). The South Holland Main Drain falls within the area administered by the SHIDB. The land is characterised by several ditches and drains, with water levels across the area are generally managed via pumping.
- 4.2.3. There is no known formal piped drainage system within the Site. Much of the Site is currently in agricultural use and therefore comprises permeable surfaces, such that for low intensity rainfall events, surface water run-off generally infiltrates into the ground or is routed to the various ditches/drains that bisect the site. For rainfall events where rainfall intensity exceeds the local rate of infiltration, it is assumed that runoff generated would either discharge to local watercourses via overland flow paths or pond in topographical low spots within the Site and slowly drain to the underlying strata over time.
- 4.2.4. A temporary drainage system will be developed to prevent runoff contaminated with fine particulates from entering surface water drains without treatment. This will include identifying all land drains and water features in the Order Limits and ensuring that they are adequately protected.
- 4.2.5. The Principal Contractor will coordinate drainage surveys to establish the existing drainage position and these will be marked where encountered. The Principal Contractor shall record the location, condition and characteristics of drains cut or disturbed by construction of the Scheme.
- 4.2.6. If any existing field drainage systems found in the Site are damaged during construction and result in a negative impact off-site, they will be repaired as far as reasonably practicable to their existing operational capacity to ensure flood risk is not increased.

### 4.3. Geology and Hydrogeology

- 4.3.1. A desktop assessment has been completed to determine bedrock and superficial geology within the Site boundary.
- 4.3.2. British Geological Survey<sup>10</sup> information records the bedrock geology of a Site. Most of the bedrock geology in the western half of Site (Land Parcels A, B and C) is the Oxford Clay Formation, while the eastern side of the Site (land parcel D) is the West Walton Formation. Superficial deposits of Tidal Flats (clay and silt) are recorded to overlie the entire Site, including the Solar Development Area and the Inter-Array Area.
- 4.3.3. The online “Landis SoilScape” map viewer<sup>11</sup> was used to gather more information about the soils that underlay the Site and describes the soils beneath the Site as ‘a loamy and clayey soil of coastal flats with naturally high groundwater’ with ‘naturally wet’ drainage properties, meaning it will ‘drain to local groundwater’.

## 5. Proposed Solar Development Area Surface Water Drainage Strategy

### 5.1. Contributing Areas

- 5.1.1. The new impermeable areas within the Solar Development Area are related to the proposed single On-Site 400kV Substation and BESS Compound, the three On-Site 132kV Substations and the solar stations.
- 5.1.2. One of the three 132kV Substations is located in land parcel A, one substation in land parcel C, and one substation in land parcel D. The proposed impermeable areas associated with the land parcel A substation is 0.96ha, land parcel B substation is 0.96ha, land parcel D 0.96ha, and the impermeable area for the 400kV substation and BESS is approximately 11.44ha. The combined area of these four substations is 14.28ha.
- 5.1.3. Solar Station Compounds distributed throughout the Solar Development Area are considered to be 100% impermeable as a worst-case scenario. It has also been assumed 100% of the runoff from these areas will contribute to the

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<sup>10</sup> British Geological Survey (2023). BGS Geology Viewer. [online] British Geological Survey. Available at: <https://www.bgs.ac.uk/map-viewers/bgs-geology-viewer/>. [Accessed: 10/10/2025].

<sup>11</sup> Land Information Systems Soilscales soil types viewer (online). Available at: <https://www.landis.org.uk/soilscales/> [Accessed 09/10/2025]

drainage system, and therefore a Volumetric Runoff Coefficient (Cv) of 1 has been used.

- 5.1.4. In the case of the 132kV substations and the 400kV Substation and BESS compound, it is reasonably assuming a lined gravel build up will be used and will capture and evaporate some of the runoff before it enters the drainage system, a Volumetric Runoff Coefficient (Cv) of 0.85 has been used, due to the anticipated absorption and evaporation within the gravel subbase.

## 5.2. Overview

- 5.2.1. As the Solar Development Area is considered a greenfield site, it is assumed that rainfall currently permeates into the ground where it falls, and that any runoff generated within arable fields where direct infiltration does not occur, it collects in local low spots where it then naturally infiltrates to ground or enters a watercourse or other water body.
- 5.2.2. An Outline Drainage Strategy has been prepared as part of the DCO Application, in compliance with national and local planning policy and guidance.
- 5.2.3. The proposed solar PV panels will be mounted a minimum of 0.8m above ground level, typically on narrow sectional area piled legs, with two sets of legs per panel. This prevents sealing the ground with an impermeable surface beneath the solar panels with minimal ground disturbance, allowing rainfall/runoff to infiltrate to ground throughout the Site. This height also allows the PV panels to remain operational in the event of a flood. Therefore, the PV panels will not lead to an increase in impermeable area within the Site. The drainage regime of the PV panel areas is therefore assumed to remain consistent with its pre-developed state.
- 5.2.4. New operational access roads will be permeable. Therefore, the Solar Development Area's access roads will not lead to an increase in impermeable area. The drainage regime of the access roads is therefore assumed to remain consistent with its pre-developed state.
- 5.2.5. The Site contains three 132kV substations and a 400kV substation and BESS compound. Solar stations (inverters, transformers, and switchgears), the On-Site 400kV Substation and BESS compound, and the 132kV On-Site Substations are considered to be 100% impermeable as a worst-case scenario.
- 5.2.6. Solar Station Compounds distributed throughout the Solar Development Area are considered to be 100% impermeable as a worst-case scenario. It has also been assumed 100% of the runoff from these areas will contribute to the

drainage system, and therefore a Volumetric Runoff Coefficient (Cv) of 1 has been used.

- 5.2.7. In the case of the 132kV substations and the 400kV Substation and BESS compound, it is reasonably assuming a lined gravel build up will be used and will capture and evaporate some of the runoff before it enters the drainage system, a Volumetric Runoff Coefficient (Cv) of 0.85 has been used, due to the anticipated absorption and evaporation within the gravel subbase.
- 5.2.8. Despite not contributing towards the impermeable areas, in order to limit the potential for channelisation from rainfall dripping off the end of the PV panels, the areas between, under and surrounding the solar PV panels will be planted with suitable planting such as native grassland and wildflower mix (noting that planting types are described within the **Outline Landscape and Ecology Management Plan** (OLEMP) (Doc Ref. 7.16)). This planting will intercept and absorb rainfall running off the panels, preventing it from concentrating and potentially forming channels in the ground. Further details of the solar PV panel design can be found in **ES Chapter 2: The Scheme** (Doc Ref. 6.1).
- 5.2.9. Attenuation will be required within the Site to temporarily store surface water runoff generated from the BESS Compound before it is discharged to the closest water course at an agreed rate with the LLFA. The BESS and 400kV substation will discharge to separate attenuation basins, in order for the BESS to capture firewater runoff in a lined basin, with a penstock to enable isolation in the event of a fire. The 400kV substation basin will be unlined with a flow control to discharge to the closest watercourse, with no requirement for isolation.
- 5.2.10. The surface water runoff will flow to the basin via gravity from the BESS Compound due to the decrease in surface elevations from the BESS Compound to the basin. The basin will collect surface water before it discharges to the adjacent watercourse. Ditch outfall levels from the proposed attenuation basin was assessed to check whether drainage via gravity was achievable. Outfall from the attenuation basin was seen to have a cover level of 0.6m, where water would flow through a 0.3m diameter pipe and discharge into the nearest ditch at a cover level of approximately 1.6m. These levels show that drainage via gravity is feasible, and therefore the BESS Compound will not need to be raised. This information will be provided in more detail in the detailed design phase, post - consent. It is anticipated that the basin would be located north of the 400kV substation and BESS Compound. The basin located north of the On-Site 400kV Substation and BESS Compound will also collect firewater runoff, where it will be captured and removed off site by a tanker to an accredited lab for testing or disposal.

- 5.2.11. In order to protect the On-Site 400kV Substation and BESS Compound from any fluvial flooding, it will be bunded. Further detail on the bunding is provided below in paragraph 5.2.19.
- 5.2.12. Solar stations are also assumed to be 100% impermeable. The maximum height of any plinths used to raise solar stations above flood depths will be 0.8m (except for Parcel D-1, where the maximum height of plinths will be 1.35m). Where solar stations are located within the flood extents and the plinths do not raise the solar stations above the worst-case flood depths and provide 0.3m freeboard (0.6m freeboard in the case of Parcel D-1), they are to have a flood defence wall or bund for protection. The detailed design of these features will be provided at detailed design, post DCO consent.
- 5.2.13. In order to drain surface water from the proposed impermeable areas, it is proposed to construct a swale around the Solar Stations, the BESS Compound, with swales or filter drains around the On-Site 400kV and 132kV substations to capture any minor increases in runoff. The swales will collect and treat surface water before discharge. Paragraph 056 of the Planning Practice Guidance for Flood Risk and Coastal Change<sup>12</sup> states that the surface water should be discharged in the following hierarchy:
- Into the ground (infiltration);
  - To a surface water body;
  - To a surface water sewer, highway drain, or another drainage system;
  - to a combined sewer.
- 5.2.14. Due to the current understanding of the ground conditions within the Solar Development Area, it is preferred, where possible, to utilise surface water bodies to discharge runoff from the Solar Stations, BESS Compound and On-Site Substations. Therefore, surface water runoff from the swales to intercept runoff from impermeable areas is proposed to be prioritised to local watercourses; the discharge to these watercourses from these swales will be maintained at existing greenfield runoff rates by restricting rates using a flow control. The discharge to these watercourses will be via pipe outfall; however, where possible, surface water will drain from the Solar Development Area's swale-based drainage system

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<sup>12</sup> Ministry of Housing, Communities and Local Government, Ministry of Housing, Communities & Local Government (2018 to 2021) and Department for Levelling Up, Housing and Communities (2014, updated August 2025) National Planning Practice Guidance: Flood Risk and Coastal Change. Available online: <https://www.gov.uk/guidance/flood-risk-and-coastal-change>. [Accessed 10/10/2025].

to local receiving watercourses via a new open green ditch. If a piped system is required, the piped section will be shortened and the last 10m section of the outfall route will be open green ditch wherever possible, unless this affects maintenance of the watercourse by the Internal Drainage Board (IDB). A minimum 0.05m orifice plate will be used as flow control to reduce peak flows. For BESS, which requires firewater runoff control, refer to Section 5.8 of this report for detail.

- 5.2.15. With the negligible increase in surface water runoff associated with the Solar Development Area, the proposed swales will aid in discharging surface water runoff to the closest watercourse via a piped outfall. Any swales not near a watercourse, and therefore having no viable discharge location, will utilise infiltration, mimicking the existing drainage conditions of the existing Site.
- 5.2.16. The proposed attenuation basin located in the BESS Compound will be lined with an impermeable membrane or similar impermeable barrier to prevent any pollution associated with fire water runoff from entering the ground.
- 5.2.17. Swales will also be proposed adjacent to access tracks where runoff may not drain to a field swale.

### Substation Flood Risk and required mitigation

- 5.2.18. As part of the drainage strategy for the Scheme, an assessment of flood risk to on-site infrastructure has been undertaken (refer to the **ES Appendix 11-3: Flood Risk Assessment** (Doc Ref. 6.3)). Assessment for the four substations was carried out, as they are critical infrastructure that require protection against fluvial flooding. To ensure resilience, the design incorporates bunding around each substation, with heights informed by flood level analysis.
- 5.2.19. Calculations were undertaken to provide an estimate for the bund height for the 132kV substations and the 400kV substation and BESS Compound in order to prevent flood impact to the infrastructure. Bund heights were determined by combining the ground level at the substation site from the topographical survey, the maximum flood depth at that location, and an additional 0.3m freeboard. The table below provides the bund height for each substation:

**Table 5-1: Substation Bund Heights (Including 0.3m freeboard)**

Substation and Land Parcel	Bund Height Above Ground Level (m)	Bund Height (m AOD)
132kV substation in land parcel A	2.2	2.5

Substation and Land Parcel	Bund Height Above Ground Level (m)	Bund Height (m AOD)
132kV substation in land parcel C	1.1	2.4
400kV substation and BESS compound in land parcel B	1.7	2.6

### 5.3. Greenfield Runoff Rates

5.3.1. Planning policy aims to achieve greenfield discharge rates for all sites, for either redeveloped or pre-developed sites, where possible. To develop a robust Drainage Strategy, the greenfield runoff rates have been calculated using HR Wallingford's UK SuDS Greenfield Runoff Rate Estimation tool<sup>13</sup> based on the area of the single BESS Compound and 400kV Substation (which has an area of 11.4ha). The FEH method has been used for this drainage strategy as it is widely recognised, and an accepted approach commonly recommended by regulatory bodies such as the EA.

5.3.2. Greenfield rates have been calculated for the Site, as if it were entirely undeveloped. Table 5-2 below provides the Greenfield discharge rates, refer to Annex B – Greenfield Runoff Rates for further details:

**Table 5-2: Greenfield Discharge Rates for a single On-Site 132kV Substation (0.96ha)**

Return Period (years)	Discharge Rate (l/s)
1	0.6
30	1.2
100	2.5
Qbar (mean annual flood flow from a rural catchment)	0.71

<sup>13</sup> HR Wallingford (2025). Greenfield runoff rate estimation | UK SuDS. [online] [www.uksuds.com](http://www.uksuds.com). Available at: <https://www.uksuds.com/tools/greenfield-runoff-rate-estimation>. [Accessed 10 October 2025]

**Table 5-3: Greenfield Discharge Rates for the single On-Site 400kV Substation and BESS Compound (11.4ha)**

Return Period (years)	Discharge Rate (l/s)
1	7.3
30	20.5
100	29.7
Qbar	8.36

## 5.4. Proposed Attenuation

- 5.4.1. Attenuation will be required within land parcel B to temporarily store surface water runoff generated from the On-Site 400kV Substation and BESS Compound and the three 132kV substations before it is discharged at the Qbar rate. Attenuation will be provided in the form of a basin located near the On-Site 400kV Substation and BESS Compound.
- 5.4.2. In order to calculate the attenuation requirements for the compound, the rainfall data to be used needs to be defined. Flood Estimation Handbook (FEH) 2022 rainfall data has been used.
- 5.4.3. Based on the online climate change allowances for rainfall, both Nene Management Catchment and Welland Management Catchment (which are both contained within the Site) require a 40% uplift for rainfall intensity associated with the 1 in 100-year event based on using the upper end allowance. Therefore, the basin for the On-Site 400kV Substation and BESS Compound and three 132kV substations have been sized to accommodate the 1 in 100-year event plus a 40% allowance for climate change.
- 5.4.4. The discharge from the basin has been restricted with the use of an orifice plate to the greenfield Qbar rate. The required storage volume was determined using the InfoDrainage 'Quick Storage Estimate' tool<sup>14</sup>. The 'Quick Storage Estimate' tool provides an estimate for the attenuation volume required for the On-Site 400kV Substation and BESS Compound and the three 132kV substations. The volume requirements are detailed in Table 5-4 below.

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<sup>14</sup> Autodesk Infodrainage 2025.3 Software

- 5.4.5. In addition to the attenuation requirements for regular surface water runoff during normal operation, the basin will also be required to store fire water runoff in the event of a fire. The impact on attenuation requirements as a result of fire water runoff storage are discussed further in the Fire Water Runoff section (Section 5.8) of this Drainage Strategy.

**Table 5-4: Attenuation volume requirements**

Feature	Impermeable Area (ha)	Allowable discharge rate (l/s)*	Total Attenuation Volume Required (m <sup>3</sup> )	Attenuation Volume proposed (m <sup>3</sup> )**
BESS compound	2.66	2.0	1625	2848
400kV Substation	3.32	2.4	2113	3681
132kV substation Parcel A	0.96	2.0	916	1619
132kV substation Parcel C	0.96	2.0	916	1619
132kV substation Parcel D	0.96	2.0	916	1619

\*- Where the discharge rate is less than 2l/s for Qbar, a rate of 2l/s has been applied to account for an acceptable orifice plate size.

\*\* - Volume includes freeboard volume on top of required attenuation volume

- 5.4.6. In the land parcels where the PV panels and 132kV Substations are located, attenuation in the form of basins will be proposed in order to divert the surface water runoff from the Solar Development Area into a nearby watercourse via a piped outfall with a minimum 50mm orifice plate to reduce peak flows from them.
- 5.4.7. However, the 132 kV substation within Land Parcel A does not have a suitable watercourse in proximity for the discharge of surface water. Accordingly, the proposed attenuation will rely on infiltration to ground as the primary means of drainage. The attenuation volumes presented in Table 5-4 have been derived on the basis of zero infiltration, representing a conservative worst-case design condition. Furthermore, a freeboard allowance of approximately 700 m<sup>3</sup> (76% additional volume) has been incorporated to provide additional resilience. Given this allowance, it is considered unlikely that two storm events of equivalent magnitude would occur within the timeframe required for the basin to fully

infiltrate and drain down to ground and the system will drain effectively without overtopping.

- 5.4.8. The swales will be approximately 0.6m deep with 1 in 3 side slopes. The location of the swales and the outline design is shown in the Drainage General Arrangement drawing in Annex D.
- 5.4.9. All but 15 swales will discharge into a nearby watercourse via piped outfall. The 15 swales that do not have a nearby watercourse will intercept runoff and will infiltrate the Solar PV field runoff volume to ground.
- 5.4.10. Access tracks are assumed to be permeable, however, any potential excess of surface water runoff will be captured by the edge swales.

## 5.5. Water Quality

- 5.5.1. To assess the water quality risk to receiving watercourses, an assessment has been undertaken of the proposed surface water drainage system in accordance with the Simple Index Approach as detailed within CIRIA C753 The SuDS Manual<sup>15</sup>. This method determines the pollution hazard level of the land use proposed and then assesses the level of treatment the proposed drainage system will provide to ensure it provides sufficient water quality mitigation. In order to pass the Simple Index Approach the following condition must be met for each of the three pollutants (Total Suspended Solids, Metals and Hydrocarbons) considered in this approach:

**Total SuDS Mitigation Index  $\geq$  Pollution Hazard Index**

- 5.5.2. The impermeable areas within the Site consist of the On-Site 400kV and BESS Compound, On-Site 132kV Substations and the Solar Stations. In accordance with the SuDS Manual this land use is best defined as 'commercial/industrial' roofs. Table 5-5 below details the pollution hazard indices associated with this land use. Table 5-6 below lists the mitigation indices associated with the swales. These values demonstrate the Simple Index Approach (SIA) condition is met for each of the pollutants as the mitigation indices are higher than the hazard indices. Therefore, the proposed swales surrounding the proposed infrastructure are sufficient to treat the runoff from these areas, as noted in the following tables.

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<sup>15</sup> CIRIA (2015) Report C753 The SuDS Manual, version 6. Available at: [https://www.ciria.org/CIRIA/Books/Free\\_publications/C753F.aspx](https://www.ciria.org/CIRIA/Books/Free_publications/C753F.aspx) [Accessed 10 October 2025]

**Table 5-5: Pollution Hazard Indices for 400kV Substation and BESS Compound and On-Site 132kV Substations**

Land Use	Pollution Hazard Indices			
	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Other roof (typically commercial/industrial roofs)	Low	0.3	0.2	0.05

**Table 5-6: Mitigation Indices for the Solar Development Area**

Type of SuDS Component	Pollution Hazard Indices		
	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Swales (for the PV fields)	0.5	0.6	0.6
Basin	0.5	0.5	0.6
Additional mitigation - Infiltration with suitable depth of filtration material underlain by 300 mm minimum depth of soils with good contamination attenuation potential	0.4	0.4	0.4
Combined Mitigation	0.95	1.05	1.1

- 5.5.3. The combined mitigation above is sufficient to treat surface water runoff from the Site.
- 5.5.4. Firefighting water, and its potential contaminants, is not included in this section as any fire water applied to the BESS Compound would be contained within the attenuation basin where it will be captured and removed off site by a tanker to an accredited lab for testing or disposal. The 400kV Substation and BESS Compound will be underlain with a plastic liner to prevent fire water from entering and infiltrating to ground (see Section 5.8 on Fire Water Runoff for further details).

## 5.6. Exceedance Flows

- 5.6.1. The proposed surface water drainage arrangement has been designed to accommodate runoff from all storms up to and including the 100 year +40% return period. A freeboard of 0.3m has been integrated in the design of the basin and the swales in accordance with the SuDS manual to accommodate for additional surface water runoff in the event of an extreme storm to prevent overflow.

## 5.7. Amenity and Ecological Value of SuDS Features

- 5.7.1. SuDS features will not be on publicly accessible land. Consequently, the potential amenity benefit provided by the proposed drainage is not considered relevant to the design. The design of the drainage, however, will be discrete so that it does not hinder the aesthetic value of the Site.
- 5.7.2. Incorporating swales within the Site provides an opportunity to add ecological value to the Scheme.

## 5.8. Fire Water Runoff

- 5.8.1. The risk of fire within the battery storage enclosures must be considered. The BESS Compound requires access to water to suppress a fire, should one break out.
- 5.8.2. Fire water runoff may contain particles from a fire. In the unlikely event of fire water being discharged, the runoff will need to be contained so it can be sampled and tested by a UKAS accredited lab. A separate storage mechanism is therefore required within the Site. In order to contain the external fire water runoff, a basin is proposed to be located north of the 400kV Substation and BESS Compound, where it can be captured and removed off site by tanker to an appropriately licenced facility for disposal. The basin will then be cleaned of all contaminants. The fire water basin will be underlain with an impermeable liner to prevent any contaminants entering the ground via infiltration. **Outline Battery Safety Management Plan (OBSMP)** (Doc Ref. 7.18) discusses fire risk management in more detail.
- 5.8.3. The firewater basin will be controlled by a penstock valve that can be closed before a fire is put out. The penstock valve will be located in proximity to the access road so they can be easily reached in the event of a fire. The system will include a manual backup redundancy for the automated controls linked to the fire detection systems, allowing personnel to manually override the valve in the event of an automation failure.

- 5.8.4. The NPPF Planning Practice Guidance<sup>16</sup>; Renewable and low carbon energy was revised in August 2023 to include discussions on BESS within Paragraphs 032 to 036 inclusive. Paragraph 034 notes the requirement for applicants to consider the National Fire Chiefs Council (NFCC) Guidance, and Paragraph 035 notes that local planning authorities should consider the NFCC guidance when determining applications.
- 5.8.5. To determine the volume storage of firewater runoff, NFCC guidance<sup>17</sup> has been used which states firefighting supplies 'should be capable of delivering no less than 1,500 litres per minute for at least 2 hours'. However, applying a conservative assessment of firewater runoff, as noted in **OBSMP** (Doc Ref 7.18), it is proposed to retain sufficient firewater for 4 hours of use. This equates to approximately 360m<sup>3</sup>. This is based on the likely scenario that, in the unlikely event of a fire, only one BESS would be on fire at the any given time. Section 1.4.3 of the OBSMP stipulates: *Final BESS design and site layout will have been validated through Large Scale Fire Testing (LSFT) mandated in NFPA 855 (2026) and rigorous consequence modelling to minimise the requirement for any Lincolnshire Fire and Rescue (LFR) intervention in a thermal runaway incident. LSFT must validate minimum safe equipment spacing distances to demonstrate there is no fire propagation to adjacent BESS enclosures or ESS equipment. LFR intervention in worst case scenarios would typically be limited to boundary cooling of adjacent BESS and Energy Storage System (ESS) units to prevent the fire from spreading. This strategy will be finalised with LFR and be clearly communicated in the Emergency Response Plan (ERP).*
- 5.8.6. An allowance has also been made that a 1 in 2 year event could occur at the same time as a fire. Therefore, the basin will need to contain the 1 in 2 year event plus the fire water storage runoff volume. In order to determine the attenuation volume required, a storage estimate calculation was made on InfoDrainage based on the 1 in 2 year event (see Annex C). The results are shown in Table 5-7.

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<sup>16</sup> Ministry of Housing, Communities and Local Government, Ministry of Housing, Communities & Local Government (2018 to 2021) and Department for Levelling Up, Housing and Communities (2015, updated August 2023) National Planning Practice Guidance: Renewable and low carbon energy. Available at: <https://www.gov.uk/guidance/renewable-and-low-carbon-energy> [Accessed 10/10/2025].

<sup>17</sup> Guidance for FRS<sup>2</sup>, 2025 - Grid scale energy storage system planning - Guidance for fire and rescue services . Available at: [Grid scale energy storage system planning - Guidance for fire and rescue services - NFCC .](#) [Accessed 26 February 2026].

**Table 5-7: Attenuation Storage for Firewater Runoff**

Feature	1 in 2 year event (m <sup>3</sup> )	Firewater Storage (m <sup>3</sup> )	Total (m <sup>3</sup> )
BESS basin	787	360	1,147

- 5.8.7. The firewater basin is expected to have an exceedance level of 1.35mAOD and a minimum invert level of 0.4m AOD; including a design, a depth of 0.9m, including a freeboard of 0.3m. Once the firewater has been tested and is free from fire water contaminants, it will discharge from the basin into a nearby watercourse or taken off site by a tanker. If the fire water is contaminated it will be retained until it can be removed off-site via tanker.
- 5.8.8. The storage volume detailed in Table 5-7 has been provided in a basin as part of the drainage design for the Site, and does not exceed the volume required to attenuate the 1 in 100 year plus 40% climate change event for the BESS drainage basin. The location of the basin is shown in the Drainage General Arrangement drawing in Annex D.

## 5.9. Proposed Foul Water Drainage Strategy

- 5.9.1. Once the Solar Development Area is operational, foul water drainage will only be required for the staffed control buildings within the On-Site Substation Compounds. These buildings will only be used by a small number of staff (estimated 10 operational employees); therefore, the anticipated foul flows from the building will be low. Review of utility records indicates that there are no public sewers 30m of the On-Site Substation Compounds. The Environment Agency has advised 30m as a minimum distance to provide a public sewer connection instead of a septic tank arrangement on previous solar schemes, for example Tillbridge Solar and Fosse Green Solar.
- 5.9.2. As such, the foul water flows will be dealt with via a sealed cesspit, i.e. with no overflow to ground pipe system.

## 5.10. Adoption and Maintenance

- 5.10.1. The proposed Outline Drainage Strategy is secured by a requirement of the **Draft DCO** (Doc Ref. 3.1) and will be maintained by the Undertaker of the DCO. All proposed drainage features would be maintained according to standard practice. The drainage and treatment system for the construction phase of the Solar Development Area must be managed and monitored at all times and particularly

after heavy rainfall events. The drainage and treatment system will be regularly inspected and maintained to ensure that any failures are quickly identified and repaired so as to prevent water pollution. A programme of inspection and maintenance will be designed by the contractor and dedicated construction personnel assigned to manage this programme. A checklist of the inspection and maintenance control measures will be developed by the contractor and records kept of inspections and maintenance works. These drainage controls should be kept in place including the operational phase of the Scheme until the vegetation is re-established.

- 5.10.2. Following a fire event, any gravel or soil identified as contaminated will be excavated and removed from site. The affected areas will then be reinstated with new inert material, installed to the same specification and standard as the original as-built material. The impermeable lining will be overlaid by a minimum 300mm of soil. Any vegetation in swales will be shallow rooted fine-growing grasses and mixtures of perennial ryegrass and fescues, to avoid the potential for roots compromising the integrity of the lining. In the event this vegetation or soil needs to be removed during the operational phase, this would be carried out using hand dig techniques to ensure the integrity of the impermeable lining would not be damaged. Regular maintenance inspections will be carried to remove weeds, control plant growth, and check the swale lining.
- 5.10.3. This checklist would include the following:
- Condition of attenuation basins and swales;
  - Removal of silt from attenuation basins and swales;
  - Erosion concerns; and
  - Blockages of cross-drains, outfalls and watercourse crossings.
- 5.10.4. The final surface water discharge from basins and swales shall be regularly inspected for issues. Where necessary, surface water may require pumping on a temporary basis for maintenance purposes. Any pumping activities shall be supervised and authorised by the Principal Contractor.
- 5.10.5. Treated water shall be discharged with care in accordance with the following principles:
- Use of many small/mid diameter outlets, rather than collecting larger volumes of drainage flows to discharge to a smaller number of larger capacity outlet points;

- Not allowing direct, contaminated ditch discharge into watercourses or other potentially sensitive receptors; and
- Not diverting natural flows, unless under prior agreement with the relevant statutory authority (e.g. Lincolnshire County Council, South Holland IDB, North Level IDB and the Environment Agency).

5.10.6. A detailed drainage strategy will be produced in the next stage of the design process in substantial accordance with this document.

## 6. Grid Connection Route Drainage Strategy

6.1.1. The drainage strategy for the Grid Connection Route can be found in Annex E - Grid Connection Route Outline Drainage Strategy of this report.

6.1.2. The report in Annex E states that surface water runoff from the proposed permanent impermeable surfaces will be restricted to the calculated greenfield runoff rate, or the lowest feasible rate when applying a 75mm orifice restriction. Surface water runoff from the CSEC compounds will be intercepted by a gravel trench prior to storage with a detention basin and subsequent restricted discharge to Delgate Drain. In order to maintain a restricted discharge rate, a detention basin for each CSEC compound will need to provide 209m<sup>3</sup> surface water storage during the 1 in 100-year (1% AEP) rainfall event with a 40% allowance for climate change. The operational access roads will drain surface water runoff to a suitably sized unlined swale, promoting infiltration, with a secondary discharge to Delgate Drain. These measures ensure that water treatment criteria are met while ensuring the existing risk of flooding downstream is reduced, providing betterment.

