# Meridian Solar Farm

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Other **Documents**

7.**4** Design Parameters (Rev 2) (Clean)

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# 1. Introduction

## 1.1. Overview

1.1.1. This Design Parameters Document has been prepared to accompany the Development Consent Order (DCO) Application for the Meridian Solar Farm ('the Scheme'). It provides the key maximum and minimum parameters with which the detailed design of the Scheme must comply, as secured in Schedule 2, requirement 5 (detailed design approval) of the **Draft DCO** (Doc Ref. 3.1).

1.1.2. Finalising the detailed design post-consent is necessary to achieve technological and design flexibility for the Scheme, particularly where technology is rapidly evolving, and where final minor changes may be necessary once matters of procurement and construction are confirmed.

1.1.3. That necessary flexibility has been facilitated by the adoption of the 'Rochdale Envelope' approach in the Environmental Statement (ES) which is explained in **ES Chapter 2: The Scheme** (Doc Ref. 6.1). The Rochdale Envelope approach ensures the maximum parameters and realistic worst case has been assessed, and that envelope is defined by the design parameters set out in this document. Therefore, by requiring that the detailed design of the Scheme must be in accordance with the design parameters, there can be confidence that the environmental effects will be the same as or no worse than those assessed and reported in the ES.

## 1.2. Design Parameters

1.2.1. The Scheme is described in Schedule 1 of the **Draft DCO** (Doc Ref. 3.1) where the different components of the Scheme are divided into works which correspond with the work number areas shown on the **Works Plans** (Doc Ref. 2.3). For the purposes of the Environmental Impact Assessment (EIA), the Scheme is described in **ES Chapter 2: The Scheme** (Doc Ref. 6.1).

1.2.2. The design parameters which apply to the Scheme for the Works are set out in Table 1. Further associated development in connection with the above works (as listed in the final paragraph of Schedule 1 to the **Draft DCO** (Doc Ref. 3.1)) may be necessary across the Order limits and will also be subject to the design parameters where they are applicable.

1.2.3. Construction, operation and decommissioning activities will also be subject to the controls included in detailed management plans.

1.2.4. These documents and plans are secured by requirements in the **Draft DCO** (Doc Ref. 3.1). The controls in these outline documents and plans are therefore not duplicated in this Design Parameters document.

**Table 1 – Design Parameters**

| Scheme Component | Parameter / Principle | Parameter / Principle Description |
|---|---|---|
| **Solar Development Area** | | |
| Solar panels[1] fitted to mounting structures (Work No. 1(a)) | Maximum height of solar PV arrays above ground level | At the greatest inclination of 25 degrees, 4.3m. |
| | Orientation and slope from horizontal of solar PV modules | South orientated, tilted at a fixed angle in the range of between 10 to 25 degrees from horizontal. |
| | Minimum height of the lower edge of the solar PV module above ground level | 0.8m (with the exception of the areas requiring flood risk mitigation, as set out below). |
| | Flood risk mitigation measures | The minimum height above ground of the lower edge of the solar PV modules would be raised 0.3m above the 0.1% Annual Exceedance Probability (AEP) flood level with 28% climate change allowance for the River Welland breach and Postland Catchment and 13% climate change allowance for South Holland Main Drain Catchment modelling, up to 1.3m above ground. |
| | Glint and glare mitigation | Anti-reflective coating will be applied to reduce the reflective properties of the panels. |
| | Foundations | Module mounting structures would either be mounted via galvanised steel poles driven into the ground, or on 'feet' supported on concrete footings, |

[1] Also referred to as solar PV modules. Solar PV arrays comprise of individual solar PV panels or modules.

| Scheme Component | Parameter / Principle | Parameter / Principle Description |
|---|---|---|
| | | in areas where steel poles cannot be used (such as adjacent to existing utilities).<br><br>If via poles driven into the ground, this would be to a depth up to 3.5m, depending on ground conditions.<br><br>If on feet, concrete pads would be installed at a depth below ground level up to 0.3m. No concrete footings will be installed in areas of Flood Zone 3a and 3b. |
| Solar stations (inverters, transformers and switchgear) (Work No. 1(b)) | Maximum height above ground level | 4.3m, except for Parcel D-1, where maximum height will be 4.85m. |
| | Maximum dimensions | 3.5m wide, 3.5m in height, and 16m in length, representing a maximum total footprint of 56m$^2$. |
| | Flood risk mitigation measures | No solar stations would be located in areas of Flood Zone 3a or Flood Zone 3b, except for the Gotts catchment in Parcel D-1.<br><br>In areas affected by the 0.1% AEP flood level with 28% climate change allowance for the River Welland breach and Postland Catchment and 13% climate change allowance for South Holland Main Drain Catchment modelling, the following design principles apply:<br><br>- Flood protection would be provided in the form of plinths, a bund or a flood protection wall. |

| Scheme Component | Parameter / Principle | Parameter / Principle Description |
|---|---|---|
| | | - The maximum height of any plinths used to raise solar stations above flood depths would be 0.8 m, except for Parcel D-1, where the maximum height of plinths can be up to 1.35m.<br><br>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 0.3 m freeboard, they are to have a flood defence wall or bund for protection. Any flood defence wall or a bund provided may be up to a maximum height of 2.3m above ground level. The maximum width of a bund may be up to 21m. This is with the exception of Parcel D-1, where the maximum height of plinths can be up to 1.35m and 0.6m freeboard would be provided for any solar stations located within the South Holland Main Drain Catchment Flood Zone 3b extent. |
| | Location | No solar stations would be located within 250m of residential properties. |
| | Foundations | Concrete foundation slab with a maximum depth of 2m, or piles to a maximum depth of 4m. |
| On-Site 400kV Substation and BESS Compound (Work No. 2 and 3A) | Maximum height above ground level | 20m (without the lightning arresters, maximum height is 16m). |
| | Maximum On-Site 400kV Substation and BESS Compound footprint | A maximum area of 160m x 255m for the BESS compound. |

| Scheme Component | Parameter / Principle | Parameter / Principle Description |
|---|---|---|
| | | A maximum area of 230m x 170m for the 400kV substation area. |
| | Flood risk mitigation measures | A bund or a flood protection wall and gate would be provided, to a maximum height of 2.6m Above Ordnance Datum (AOD) (1.7m above ground level). |
| | BESS Technology | The BESS would comprise a lithium-ion battery system. |
| | BESS Unit dimensions | BESS Units would be located within enclosures with maximum dimensions of 8m in length, 2m in width and 4m in height. |
| | BESS Unit foundations | Concrete foundation slab for each unit, with a maximum depth of 2m, or piles to a maximum depth of 4m. |
| | BESS Unit fire suppression system | Water storage tanks and hydrants would be provided to allow a discharge rate of firewater of approximately 1,500 litres per minute for 4 hours. |
| | On-Site 400kV Substation foundation | Structural components would each be sited on a concrete foundation slab with a foundation depth up to approximately 2m, or piles to a maximum depth of 12m. |
| On-Site 132kV Substation Compounds (Work No. 3B) | Maximum height above ground level | 20m (without the lightning arresters, maximum height is 16m). |
| | Maximum On-Site 132kV Substation compound footprint | • Land Parcel A: 120m x 80m;<br>• Land Parcel C: 120m x 115m; and |

| Scheme Component | Parameter / Principle | Parameter / Principle Description |
|---|---|---|
| | | • Land Parcel D: 120m x 125m. |
| | Flood risk mitigation measures | A bund or a flood protection wall and gate would be provided, to a height of:<br>• 132kV Substation on Parcel A: 2.5mAOD (2.2m above ground level);<br>• 132kV substation on Parcel C: 2.4mAOD (1.1m above ground level).<br>No substation infrastructure would be located within the 0.1% AEP with 13% climate change allowance for South Holland Main Drain flood modelling extent in Land Parcel D. |
| | Foundation | Structural components would each be sited on a concrete foundation slab with a foundation depth up to approximately 2m, or piles to a maximum depth of 12m. |
| On-Site Cabling (Work No. 5(a)) | Configuration | Low and medium voltage on-site cabling. Cabling between solar PV modules would be above ground, fixed to solar PV module mounting frames. Cabling between PV modules, solar stations and On-Site Substation and BESS Compounds would be via buried underground trenches. |
| | Trench dimensions | Up to 2m wide and 2m deep. The cable duct would have a minimum depth of cover of 0.9m. |

| Scheme Component | Parameter / Principle | Parameter / Principle Description |
|---|---|---|
| | Trenchless crossings | Trenchless crossings would have a maximum depth of 7m and a minimum depth of 3m below watercourses (subject to the below).<br>Trenchless crossings under the South Holland Main Drain would have a maximum depth of 7m and a minimum depth of 5m below the watercourse. |
| | Climate resilience mitigation | Waterproof insulation to be used on all underground cabling. |
| Solar Development Area Perimeter Fence (Work No. 5(g, h) and 7(e)) | **Type** | Deer wire mesh and wooden post security perimeter fence. |
| | Installation | Fencing would be directly driven into the ground using a standard post driver with no excavation of foundations. 'Concreting in' of posts would be used in limited circumstances such as tension posts and/or corners. |
| | Height | Maximum height of 2m. |
| On-Site Substation and BESS Compounds Fence (Work No. 5(g) and 7(e)) | Type | Metal palisade type fencing. |
| | Height | Up to 2.5m in height. Further fencing up to 3m in height may be required to enclose electrical equipment within each compound. |

| Scheme Component | Parameter / Principle | Parameter / Principle Description |
|---|---|---|
| Security measures (Work No 5(h)) | Lighting | Security lighting activated by motion detectors is proposed at the On-Site Substation and BESS Compounds. |
| | CCTV system | A closed-circuit television (CCTV) camera system would be deployed around key infrastructure and the perimeter of the operational area of the Solar Development Area. CCTV cameras would be mounted on posts with a height up to 5m. |
| Solar Development Area Access Tracks (Work No. 5(i), (j), Work No 6, Work No 7(d) | Access Track Design | Maximum 6m wide road (8m at passing places). Access points from the public highway and bends in the track would be wider to accommodate turning space. Permeable paving would be provided for operational access tracks. |
| | Bridges | Where new watercourse crossings in the form of bridges or upgrades to existing bridges are required, these would follow the below design principles:<br>• Soffit height of the bridge must be a minimum of 0.6m above the 0.1% AEP with climate change allowance flood level;<br>• All abutments must be set back a minimum 1m from the top of bank;<br>All parapets and railings need to be permeable and open as possible with a minimum 100mm spacing. |

| Scheme Component | Parameter / Principle | Parameter / Principle Description |
|---|---|---|
| | Culverts | Where new watercourse crossings in the form of culverts or upgrades to existing culverts are required, the least impacting design that is reasonably practicable is proposed (e.g. arch rather than box culverts, and box culverts in preference to pipes etc.). The crossings will be sized at detailed design in order to not impact on flow conveyance and be sized to ensure capacity for the peak flow rate. Also to be considered at detailed design stage is that the crossing is perpendicular to the flow, and ensure connectivity is maintained for aquatic species and riparian mammals, with a mammal ledge if there is sufficient room. Perched inverts that create a drop from the structure to the downstream bed level will be avoided. |
| **Underground Inter-Array Connection** | | |
| Underground Inter-Array Connection (Work No. 4) | Configuration | 132kV single circuit cable |
| | Trench dimensions | Up to 2m wide and 2m deep. The cable duct would have a minimum depth of cover of 0.9m. |
| | Trenchless crossings | Trenchless crossings would have a maximum depth of 7m and a minimum depth of 3m below watercourses. |
| | Climate resilience mitigation | Waterproof insulation to be used on all underground cabling. |
| **Overhead Electric Line Inter-Array Connection** | | |
| | Overhead electric line configuration | 132kV single circuit overhead electric line. |

| Scheme Component | Parameter / Principle | Parameter / Principle Description |
|---|---|---|
| 132kV Overhead Electric Line Inter-Array Connection between Land Parcel C and D (Work No 8) | Overhead electric line height | Up to 15m above ground level. A statutory minimum clearance of 6.7m above ground from the overhead electric line would be maintained. |
| | Foundation | The poles would be installed to a maximum depth of 2.5m. The diameter of the poles would be up to 500mm. |
| **Grid Connection Route** | | |
| Grid Connection Route 400kV Overhead Electric Line (Work No 9, 13, 14 and 15) | Overhead electric line configuration | 400kV single circuit overhead electric line. |
| | Overhead electric line height | In accordance with the preliminary design, the pylon heights vary between 44.5m and 58.6m above ground. A 7.4m vertical limit of deviation has also been set. As such, the maximum pylon height above ground would not exceed 66m.<br>A minimum vertical clearance of 8.1m above open ground from the overhead electric line will be maintained |
| | Foundation | Each leg of the pylon would be supported by foundations. Depending on ground conditions, this may comprise either a pad and column foundation or a piled foundation. Pad and column foundations would have a depth up to 4.8m, piled foundations would be up to 20m in depth. |
| | Bird Diverters | Bird diverters would be installed in areas identified as having increased risk of collision, as shown on Figure 5 |

| Scheme Component | Parameter / Principle | Parameter / Principle Description |
|---|---|---|
| | | of **ES Appendix 9-14: Habitat Regulations Assessment** (Doc Ref. 6.3). |
| Cable Sealing End Compounds (CSECs) (Work No 10, 12, 14 and associated development) | Maximum CSEC compound footprint | 46m x 46m. |
| | Flood risk mitigation measures | A bund or a flood protection wall and gate would be provided around the CSEC South, to a height of 1.3m above ground level.<br><br>A bund or a flood protection wall and gate would be provided around any CSEC within the Work No 14 area, to a maximum height of 2.3m above ground level, subject to detailed hydraulic modelling at detailed design stage. |
| | Foundation | Structural components would each be sited on a concrete foundation slab with a foundation depth up to approximately 2.5m, or piles to a maximum depth of 12m. This is with the exception of the foundations for the terminal pylon and gantries, for which design parameters are set out above under Grid Connection Route 400kV Overhead Electric Line. |
| | Fencing | Metal palisade type fencing. Up to 2.5m in height. Further fencing up to 3m in height may be required to enclose electrical equipment within each compound. |
| | Lighting | Security lighting with motion detectors is proposed at the CSECs. |

| Scheme Component | Parameter / Principle | Parameter / Principle Description |
|---|---|---|
| | CCTV system | A CCTV camera system would be deployed around CSECs. CCTV cameras would be mounted on posts with a height up to 5m. |
| Underground transmission electrical cables (between CSECs and to connect to the National Grid Substation, if required) (Work No 11 and 14) | Underground cable configuration | 400kV single circuit cable |
| | Trench dimensions | Up to 1.5m wide and 5m deep. The cable duct would have a minimum depth of cover of 0.9m. |
| | Trenchless crossings | Trenchless crossings would have a maximum depth of 7m and a minimum depth of 3m below watercourses. |
| | Climate resilience mitigation | Waterproof insulation to be used on all underground cabling. |