Fosse Green Energy

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EN010154

6.1 Environmental Statement

Chapter 3: The Proposed Development

VOLUME

6

Planning Act 2008 (as amended)

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

18 July 2025

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Fosse Green Energy

Development Consent Order 202[ ]

6.1 Environmental Statement

Chapter 3: The Proposed Development

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3. The Proposed Development

3.1 Introduction

3.1.1 This chapter provides a description of the physical characteristics of Fosse Green Energy ('the Proposed Development'), the proposed programme of works, and the key activities that would be undertaken during the site preparation and construction, operation, and decommissioning stages. The description contained within this chapter informs each of the technical assessments provided in **Chapters 6** to **14** of this Environmental Statement (ES) **[EN010154/APP/6.1]**.

3.1.2 The Proposed Development is defined as a Nationally Significant Infrastructure Project (NSIP), as it consists of the construction of an onshore generating station in England exceeding 50 megawatts (MW) and therefore is designated an NSIP under sections 14(1)(a) and 15(2) of the Planning Act (PA) 2008. Associated development and other ancillary works are also proposed as part of the Proposed Development and are subject to the application for development consent for the Proposed Development ('the DCO'). The NSIP and associated development are described in this chapter and defined in Schedule 1 of the **Draft Development Consent Order (DCO) [EN010154/APP/3.1]** and explained in the **Explanatory Memorandum to the Draft DCO [EN010154/APP/3.2]**.

3.1.3 In this chapter and throughout the ES the following definitions are used to describe the key areas of the Proposed Development shown in **Figure 1-2 [EN010154/APP/6.2]**:

a. **The DCO Site** – the maximum extent of land required for the construction, operation (including maintenance), and decommissioning of the Proposed Development. The DCO Site comprises the Principal Site and the Cable Corridor. The boundary of the DCO Site is referred to as the DCO Site Boundary. The total area of the DCO Site is 1,368 hectares (ha).

b. **Principal Site** – the area of the DCO Site covered by the ground-mounted solar photovoltaic (PV) panels, Solar Stations, Battery Energy Storage System (BESS), Onsite Substation, planting and mitigation areas, an Interconnecting Cable Corridor (comprising interconnecting cables between solar PV areas), and associated infrastructure. The total area of the Principal Site is approximately 1,070ha.

c. **Cable Corridor** – the area of the DCO Site in which the 400 kilovolt (kV) and associated cables (the Grid Connection Cables) will be installed between the Onsite Substation and proposed National Grid substation near Navenby. The proposed National Grid substation near Navenby is subject to a separate application and does not form part of the Proposed Development. The Cable Corridor partly overlaps with the Principal Site, whereby the Cable Corridor covers approximately 351ha in total, overlapping approximately 53ha of the Principal Site (which covers approximately 1,070ha) at its south-eastern extent, resulting in a total DCO Site area of approximately 1,368ha.

3.1.4 A glossary and list of abbreviations for the ES is provided in **Chapter 0: Table of Contents, Glossary and Abbreviations** of this ES **[EN010154/APP/6.1]**.

3.1.5 This chapter is supported by the following figures **[EN010154/APP/6.2]**:

a. **Figure 3-1: Construction Compound and Access Locations**;
b. **Figure 3-2A: Indicative Fixed South Facing Site Layout Plan**;
c. **Figure 3-2B: Indicative Single Axis Tracker Site Layout Plan**;
d. **Figure 3-3: Proposed Permissive Path Plan**;
e. **Figure 3-4: Indicative Solar Station and BESS Elevation**;
f. **Figure 3-5: Indicative Centralised BESS Layout**;
g. **Figure 3-6A: Indicative On-Site Substation Layout**;
h. Figure 3-6B: Indicative On-Site Substation Elevation;
i. Figure 3-7: Indicative PV Array Cross-Sections;
j. Figure 3-8: Site Access Location Plan;
k. Figure 3-9: Principal Site Internal Cable Route Corridor;
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m. Figure 3-11: Typical Trenched Crossings Cross Sections;
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o. Figure 3-13: Typical Trenchless Crossings Cross Sections;
p. Figure 3-14: Typical 400kV Jointing Bay;
q. Figure 3-15: Solar Perimeter Fencing;
r. Figure 3-16: Typical 400kV Cable Cross Section; and
s. Figure 3-17: Maximum Vegetation Removal Plan.

3.2 Design Parameters

3.2.1 The Proposed Development will comprise the construction, operation (including maintenance), and decommissioning of a ground-mounted solar PV generating station with battery storage, Onsite Substation, and associated infrastructure to generate and export/import electricity.

3.2.2 The Proposed Development will have the ability to export and import electricity to/from the national electricity transmission network. The associated development to the solar PV generating station includes, but is not limited to, access provision, BESS, underground cabling in Interconnecting Cable Corridors between the solar PV array areas, areas of landscaping and biodiversity enhancement, and a 400kV underground Grid Connection Cable of approximately 10km length connecting to the national electricity transmission network at a proposed National Grid substation near Navenby.

3.2.3 A number of the precise details for design aspects and features of the Proposed Development cannot be confirmed until the tendering process for design and construction has been completed, at the post consent stage – for example, the enclosure or building sizes may vary, depending on the contractor selected and their specific configuration and selection of plant. As such, the assessments presented within this ES adopt a 'Rochdale Envelope' approach where relevant, as discussed further below.

3.2.4 The technology for solar PV and BESS continues to evolve rapidly; for example, solar PV panels are becoming increasingly powerful year on year and better at minimising shading losses, which affects how developers space the rows of solar PV and the amount of land needed to achieve the proposed export capacity. As a result, the design parameters maintain some degree of flexibility to allow the most appropriate technology to be utilised at the time of construction.

3.2.5 To ensure a robust assessment of the likely significant environmental effects, the Environmental Impact Assessment (EIA) has been undertaken adopting the principles of the 'Rochdale Envelope', as described in the Planning Inspectorate Advice Note Nine (Ref 3-1). The Rochdale Envelope involves assessing the maximum (and where relevant, minimum) parameters, including the limits of deviation (e.g., development extents or specific maximum heights) as relevant, for the Proposed Development where flexibility needs to be retained. Where this approach is applied to the specific aspects of the EIA, this has been confirmed within the relevant chapters of this ES (**Chapters 6–14**, **[EN010154/APP/6.1]**). This approach sets worst-case parameters for the purpose of the assessment but does not constrain the Proposed Development from being built in a manner that would lead to lesser environmental and social impacts. The use of 'design parameters' is therefore adopted to present a likely worst-case assessment of potential environmental effects of elements of the Proposed Development that require flexibility. The Draft DCO secures these worst-case parameters via **Works Plans [EN010154/APP/2.2]**, **Streets, Rights of Way and Access Plans [EN010154/APP/2.3]**, **Design Approach Document Appendix A - Design Commitments [EN010154/APP/7.3]** and the **Proposed Development Parameters [EN010154/APP/7.4]**, providing certainty that the impacts of the Proposed Development will be no worse than those assessed as part of the EIA. The Draft DCO has been submitted with the DCO to the Secretary of State. -

3.2.6 The design of the Proposed Development has been developed on the basis of an iterative process, based on preliminary environmental assessments and consultation with statutory and non-statutory consultees. **Chapter 4: Alternatives and Design Evolution** of this ES **[EN010154/APP/6.1]** describes this process further, including options that have been considered and discounted or amendments made to the Proposed Development design.

The **Design Approach Document [EN010154/APP/7.3]** submitted with the DCO also explains the design process, rationale and solution.

3.2.7 Each component of the Proposed Development is described in more detail in Section 3.3 of this chapter. Each technical chapter within this ES (**Chapters 6–14**, **[EN010154/APP/6.1]**) has assessed the design considered to be the likely worst-case scenario for that discipline to determine the significance of effect.

3.2.8 This ES and the assessments within it are based on the works proposed in the DCO (described principally in Schedule 1 of the **Draft DCO [EN010154/APP/3.1]**, the **Works Plans [EN010154/APP/2.2]**, **Streets, Rights of Way and Access Plans [EN010154/APP/2.3], Design Approach Document Appendix A - Design Commitments [EN010154/APP/7.3]** and the **Proposed Development Parameters [EN010154/APP/7.4]**). The maximum design parameters and design principles/commitments of the works which are relevant to the ES assessments are set out in this chapter. It should be noted that this ES chapter is not intended to be an exhaustive description of the works presented in Schedule 1 of the **Draft DCO [EN010154/APP/3.1]**. Works that are minor or ancillary in nature are discussed elsewhere in other DCO application documents, where necessary. In addition, the technical chapters within this ES (**Chapters 6–14**, **[EN010154/APP/6.1]**) contain a section setting out the relevant design parameters relevant to the particular assessment that are likely to result in the worst-case effects.

3.2.9 The DCO application allows for the selection of either fixed south facing or single axis tracker arrangement panels, and for the selection of either a distributed or centralised BESS arrangement, all of which is discussed more in Section 3.3 of this chapter. Where there is a difference between the parameters for these arrangements, this is noted in the section below.

3.3 Components of the Proposed Development

3.3.1 The Proposed Development will consist of the principal infrastructure described in the following sections. To ensure that the likely significant environmental effects of the Proposed Development are not worse than those assessed in the EIA and the effect of the Proposed Development has been robustly assessed, the parameters set out in this chapter are the basis upon which the Proposed Development has been assessed in **Chapters 6** to **14** of this ES **[EN010154/APP/6.1]**.

3.3.2 As the Proposed Development design develops, the configuration of the Proposed Development components will be determined based upon environmental and technical factors. The use of the Rochdale Envelope approach ensures that the likely significant effects of the Proposed Development do not exceed the reasonable worst-case scenario presented in this ES.

3.3.3 The Proposed Development components comprise:

a. Solar PV panels (also known as ‘modules’);

b. PV panel mounting structures;

c. BESS;

d. Inverters;

e. Transformers;

f. Switchgear;

g. An Onsite Substation and control buildings;

h. Onsite cabling;

i. Ancillary infrastructure (e.g. combiner boxes, weather stations);

j. Electricity export and import via high-voltage Grid Connection Cable and connection to the National Electricity Transmission System;

k. Fencing and security;

l. Access tracks; and

m. Landscaping, permissive paths and biodiversity mitigation and enhancement areas.

3.3.4 During the construction phase, one main construction compound and several secondary compounds will be created, as well as temporary roadways to facilitate access to all land within the Principal Site. The construction compounds will be 'built-out', being gradually replaced by the solar PV arrays as the construction progresses. The indicative location and maximum footprint of the construction compounds are illustrated on **Figure 3-1 [EN010154/APP/6.2]**.

Solar PV Panels

3.3.5 Solar PV panels (also known as 'modules') convert sunlight into electrical current (as direct current (DC)). Currently individual panels are typically up to 2.4m in height by 1.3m in width and consist of a series of PV cells beneath a layer of toughened glass with an anti-reflective coating (as shown in **Plate 3-1** and **Plate 3-2**, which are two common panel arrangements). Other PV technologies are developing rapidly and may be available at the time of construction, and therefore to allow flexibility for future module technology to be larger, the maximum solar PV table (i.e. solar PV panels fixed to the mounting structures) height parameter considered within this ES is 3.5m above ground level (AGL). The panel frame is typically built from anodised aluminium. The PV panels will typically be dark grey/blue or black in colour.

3.3.6 Each panel would likely have a DC generating capacity of between 400 and 850 watts (W), or potentially more depending on advances in technology at the time of construction. The illustrative design currently assumes 670W panels. The panels are fixed to a mounting structure in groups known as 'strings' (see **Figure 3-7 [EN010154/APP/6.2]**). Various factors will help to inform the number and arrangement of panels in each string, and it is likely some flexibility will be required to accommodate future technology developments; the illustrative design assumes 30 panels make up each string.

3.3.7 The number of PV panels that will make up each PV table (group of PV panels within a string) is not yet known. Various factors will help to inform the number and arrangement, and it is likely some flexibility will be required to accommodate future technology developments. For this reason, the assessment will be based on the parameters outlined in **Table 3-1**. **Table 3-1** outlines the minimum and maximum parameters that are material to the EIA (in line with the Rochdale Envelope approach discussed in **Chapter 5: EIA Methodology** of this ES **[EN010154/APP/6.1]**), and it also provides indicative parameters which are subject to final design but which are not material to the assessment.

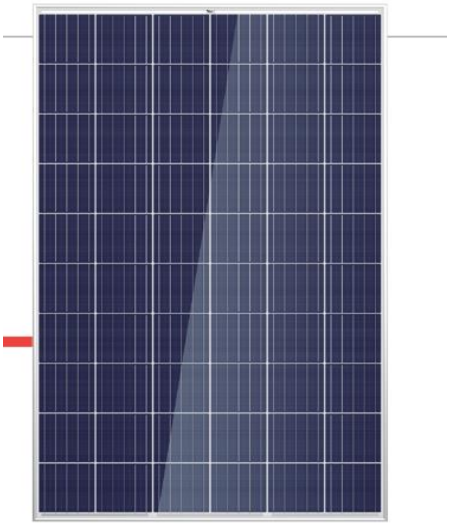

Plate 3-1: 60 Cells Solar Panel

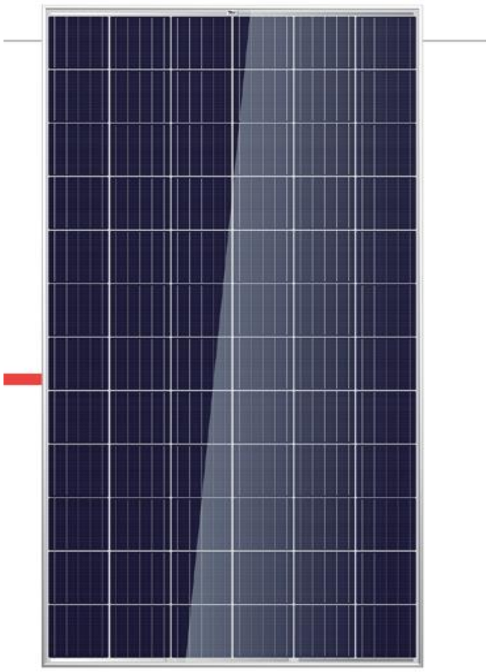

Plate 3-2: 72 Cells Solar Panel

3.3.8 The Proposed Development and assessments presented in this ES (**Chapters 6–14**, **[EN010154/APP/6.1]**) allows for the installation of fixed south facing or single axis tracker configurations.

Fixed South Facing Configuration

3.3.9 For a fixed south facing configuration, the PV tables would be aligned east to west with the panels sloping towards the south at a fixed angle of 5 to 45 degrees from horizontal. The indicative fixed south facing layout shown in **Figure 3-2A [EN010154/APP/6.2]** is based on the 20-degree tilt as the most likely option.

3.3.10 **Appendix 14-C: Glint and Glare Assessment [EN010154/APP/6.3]** assessed a tilt of 5 degrees and 45 degrees from horizontal in order to capture the worst-case maximum and minimum tilt options and considers the total glare per year at each receptor

Single Axis Tracker Configuration

3.3.11 For a single axis tracker configuration, the strings of PV will be secured on single axis tracker mounting structures that are configured in rows generally orientated north south and which will track the position of the sun. The panels will therefore move from east to west during the course of the day operated by a small motor, so that they are most angled (up to 60 degrees) at the start of the day facing east, moving gradually into a flat, horizontal position when the sun is at its highest point in the sky for the day, and then gradually turning to an angle closer to the vertical (up to 60 degrees) facing west at the end of the day. The panels will then reverse this process at the end of each day, returning to a horizontal position where they remain overnight. Each string of panels is fitted with a light meter which dictates the pace of movement; the strings across the Principal Site therefore move at slightly different times throughout the day. The noise from each string's tracker motor will be less than 40db at a 1m distance. Indicative conservative calculations indicate that a tracker motor operates for a total of 20 minutes during the daytime period, in episodes of 2 minutes, plus 2 episodes of 6 minutes during the early morning and early evening periods to move from and to the stow position respectively. The indicative single axis tracker layout is shown in **Figure 3-2B [EN010154/APP/6.2]**.

3.3.12 **Appendix 14-C: Glint and Glare Assessment [EN010154/APP/6.3]** assessed each angle across the day to capture the change in the panel tilt as it tracks the sun. The assessment considered the panel movement at each receptor throughout the day and considered a panel angle of +60 degrees in the morning and then track through the day to -60 degrees at night in the same way the tracker panels will work.

Table 3-1: Design Parameters for the Solar PV Infrastructure

Proposed Development Component	Parameter Type	Applicable Design Parameter
PV tables (i.e. the mounting structure) and PV panels	Maximum height of solar PV panels (also known as modules) above ground level (AGL)	The maximum height of the highest part of the PV panel will be 3.5m AGL.
	Minimum height of the solar PV panels	The minimum height of the lowest part of the PV Panel will be 0.8m AGL.
	Indicative slope and orientation of the PV Tables from the horizontal	Fixed south facing: The PV tables will slope towards the south, at a fixed angle of between 5 and 45 degrees from horizontal. Single axis tracker: The solar PV tables will be secured on single axis trackers that are configured north south with varying azimuths (azimuth between -40° degrees and 40° degrees) and will track +/-60 degrees from horizontal, where the panels will turn from east to west during the course of the day.
	Indicative number of panels	Fixed south facing: ~575,000 panels Single axis trackers: ~510,000 panels
	Indicative panel dimensions	2.4m x 1.3m
	Indicative panel generating capacity	670W
	Frame type	Typically, anodised aluminium.
	PV mounting structure	Mounting structure will be galvanised steel frames.
	PV foundation	Typically, will be galvanised steel piles driven or screwed into the ground. Indicative maximum depth of 2m for fixed south facing strings and indicative maximum depth of 4m for single axis tracker strings depending upon ground conditions and subject to archaeological and geotechnical surveys.

Proposed Development Component	Parameter Type	Applicable Design Parameter
		In archaeologically sensitive areas solar PV panels may be mounted on concrete blocks, subject to further archaeological investigation and agreement with the relevant stakeholders.
Solar PV Array Area	Location	The proposed area for the Solar PV Array (**Figure 3-2A [EN010154/APP/6.2]** and **Figure 3-2B [EN010154/APP/6.2]**).
	Indicative separation distance between rows of PV Tables	2–7m

Panel Mounting Structures

3.3.13 Each string of PV panels will be mounted on an anodised aluminium frame. In all fixed panel options, the frames are usually supported by galvanised steel poles typically driven 1m–2m into the ground, extending up to 4m depth for the single axis tracker configuration depending upon ground conditions and subject to archaeological and geotechnical surveys. This is the most common solution on existing UK solar farms.

3.3.14 In archaeologically sensitive areas solar PV panels may be mounted on concrete blocks, subject to further archaeological investigation and agreement with the relevant stakeholders. This is expected to be in small, discrete areas, if required.

3.3.15 The PV panels across the Principal Site would be mounted on structures with a minimum clearance above ground level of 0.8m. This enables sheep grazing to be delivered within the Principal Site as a natural grass mowing solution. The final elevations of the frames will be influenced by various design factors such as local topography, flood risk, drainage design and configuration, however the upper edge of the panels will be no taller than 3.5m AGL as stated in **Table 3-1**.

Fixed South Facing Configuration

3.3.16 The separation distance (inter-row distance) between each row of frames would be a minimum 2m for a fixed south facing configuration, dependent upon angle and length of slope, to allow for appropriate maintenance and to minimise inter-row shading.

3.3.17 A photograph of a typical fixed south facing configuration is provided in **Plate 3-3**. See **Figure 3-7 [EN010154/APP/6.2]** for further detail on the PV panel mounting and orientation.

Plate 3-3: Solar Panels with Fixed South Facing Configuration

Single Axis Tracker Configuration

3.3.18 For a single axis tracker arrangement, indicative minimum and maximum design parameters are shown in **Table 3-2** and illustrated on **Plate 3-4** (which identifies each item with the corresponding ID).

Table 3-2: Indicative Parameters for Single Axis Tracker Configuration

ID	Item	Minimum Value	Maximum Value
A	Pitch (m)	4.0	6.0
B	Interrow distance (m)	2	7
C	Clearance at maximum tilt (m)	0.8	1.4
D	Height of upper edge of panels at maximum tilt (m)	2.9	3.5
E	Axis height (m)	1.9	2.5
F	Ground penetration (m)	N/A	4.0
G	Tilt (°)	0° (horizontal)	+/-60° (east and west)

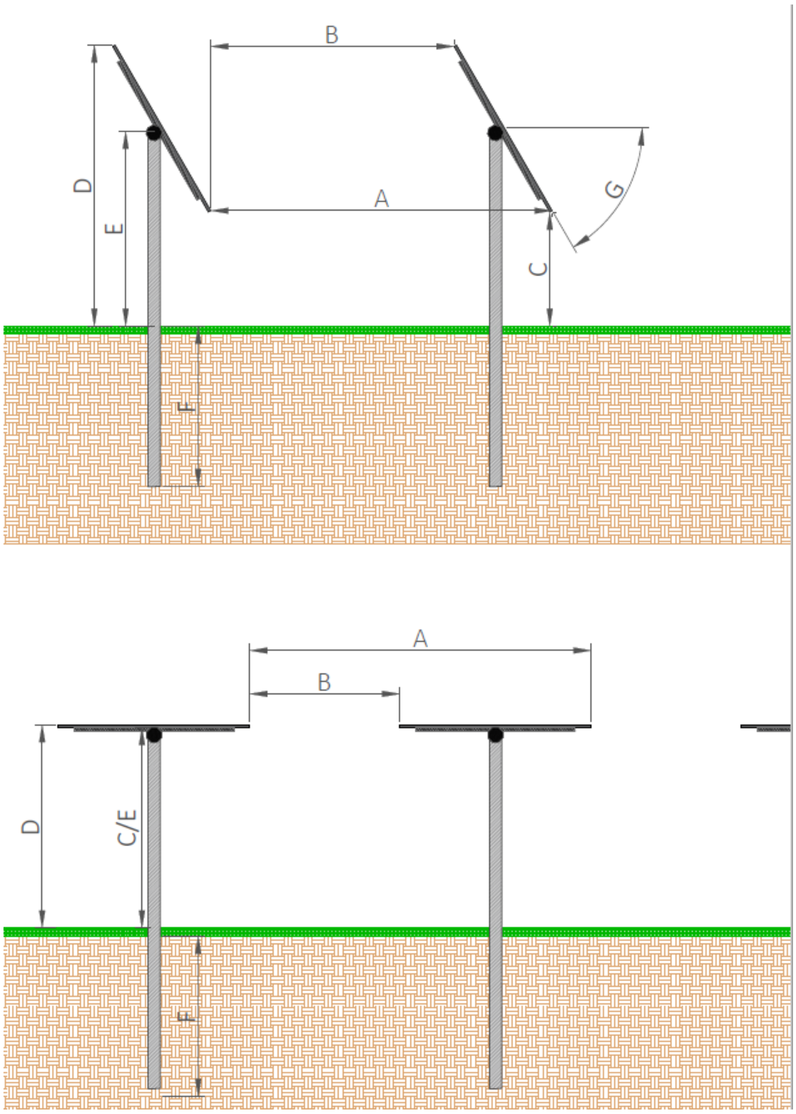

Plate 3-4: Illustrative Section of PV Strings

Supporting Infrastructure (Inverters, Transformers, and Switchgear)

3.3.19 The supporting infrastructure comprises inverters, transformers, and switchgear, which will be mounted on concrete foundations. This infrastructure is commonly grouped together and termed ‘Solar Stations’. They fulfil a number of functions, namely converting the direct current to alternating current (inverters) and stepping up the voltage (transformers), as well as containing isolators (switchgear) and monitoring equipment. An indicative Solar Station is illustrated on **Figure 3-4 [EN010154/APP/6.2]**.

3.3.20 A Solar Station typically comprises the inverter, transformer, and switchgear (although the inverters can alternatively be located at the PV panels rather than in this centralised configuration, as described further below). These components may be located next to one another individually or enclosed together in a single container, as illustrated in **Plate 3-5** and **Plate 3-6**. The containers are typically externally finished in keeping with the prevailing surrounding environment. The containers would typically be mounted on adjustable legs on an area of hardstanding. Areas where Solar Stations will be located within the Principal Site are referred to as Solar Station Compounds.

3.3.21 The indicative layouts presented in **Figure 3-2A [EN010154/APP/6.2]** and **Figure 3-2B [EN010154/APP/6.2]** show that there would be approximately 84 Solar Station Compounds located throughout the Principal Site. A Solar Station Compound will comprise up to two inverters, a transformer, and switchgear which can be grouped together or distributed throughout the Principal Site.

3.3.22 A reasonable worst-case scenario has been assessed based on the maximum parameters outlined in **Table 3-3**. It is anticipated that Solar Stations would be installed on compacted gravel and concrete bases.

Plate 3-5: Enclosed Solar Station Compound

Solar Station Housed in One Unit – Exterior

Solar Station Housed in One Unit – Interior

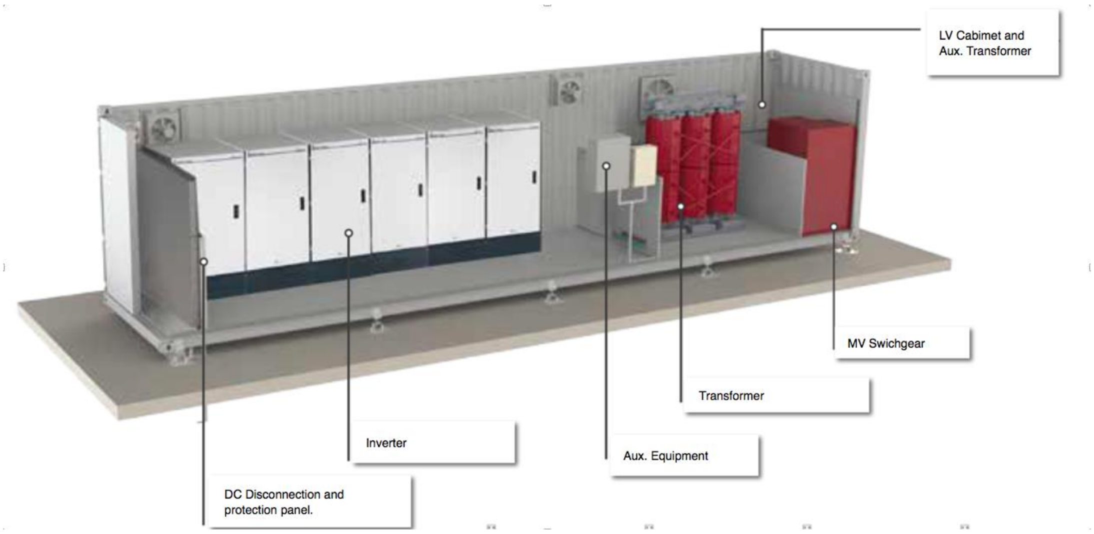

Plate 3-6: Solar Station Housed in One Unit

(Image reproduced courtesy of Power Electronics)

Inverters

3.3.23 The inverters convert the DC current to AC current, which is the format used by the national transmission and distribution network. There are two options for solar farms: a central inverter as part of the Solar Station, or string inverters, which are described further below.

3.3.24 String inverters are connected to the rear of the solar PV tables for fixed south facing configurations, as shown on **Plate 3-7**, and may be protected by wire mesh if sheep are grazing in the fields. For single axis tracker panels, the string inverters would be attached to a separate, parallel metal frame located behind each string of panels.

Plate 3-7: Typical string inverter

(Image reproduced courtesy of Huawei)

3.3.25 Where central inverters are used instead, as part of Solar Stations, these are larger and fewer of them are required. They would be located at regular intervals amongst the PV arrays. The Proposed Development will require approximately 168 central inverters (i.e., two at each Solar Station), each measuring up to 6m x 2.5m and up to 3m in height. The containers are typically externally finished in keeping with the prevailing surrounding environment. The containers would typically be mounted on adjustable legs on an area of hardstanding.

3.3.26 The design parameters are outlined in Table 3-3.

Transformers

3.3.27 Transformers are required to step up the voltage of the electricity generated before it reaches the Onsite Substation. It is anticipated that there will be approximately 84 transformers.

3.3.28 The footprint of the transformers will be up to 12.5m x 2.5m, and 3m in height. An example transformer cabin is shown in **Plate 3-8**, although these are typically externally finished in keeping with the prevailing surrounding environment, often with a grey or green painted finish.

3.3.29 The design parameters are outlined in Table 3-3.

Plate 3-8: Typical transformer cabin (including switchgear)

(Image reproduced courtesy of Selma)

Switchgear

3.3.30 Switchgear are the combination of electrical disconnector switches, fuses or circuit breakers used to control, protect and isolate electrical equipment. They are used to de-energise equipment to allow work to be done and to clear faults downstream.

3.3.31 Switchgear are typically housed within a container with a footprint of up to 6.5m x 2.5m, and 3m in height. Switchgear containers will be located either adjacent to the transformer containers or contained within the central inverter container. It is anticipated that approximately 300 switchgears could be located within the Principal Site, with two to four switchgear located at each Solar Station. Switchgear are typically externally finished in a colour in keeping with the prevailing surrounding environment, often grey.

3.3.32 The design parameters are outlined in Table 3-3.

Table 3-3: Design Parameters for the Supporting Infrastructure (Inverters, Transformers, and Switchgear)

Proposed Development Component	Parameter Type	Applicable Design Parameter
Solar Station	Type	A Solar Station will comprise two inverters (unless string inverters are used), a transformer, and up to four switchgear, which can be grouped together or distributed throughout the Principal Site.
	Indicative number of Solar Stations	Approximately 84 (maximum of up to 100), subject to detailed design.
	Indicative dimensions	The Solar Stations as described above will be located within the Solar Station Compounds measuring approximately 33m x 27m (0.09ha) to allow for appropriate spacing between components to comply with requirements of the local fire service.
	Foundations	Concrete base or monolith plinth. Maximum depth of 1m. Depending on ground conditions, a pile foundation may be required with a maximum depth of 3m.
Inverters (these convert the direct current electricity collected by the PV panels into alternating current)	Type of inverter	Central or string inverters. The former is located at the Solar Stations, whereas the latter are located next to each PV row or attached to the rear of the PV tables.
	Indicative dimensions of inverters	For central inverters the maximum parameters will be 6m by 2.5m and up to 3m in height. For string inverters, the maximum parameters will be 1.5m length by 0.5m width by 1m in height. For the fixed south facing arrangement these are small enough to be mounted underneath the panels. For the single axis tracker arrangement these would be fitted on a parallel structure behind the panels.
Transformers (these control the voltage of the electricity generated before it reaches the Onsite Substation)	Type of transformer	Transformers may be standalone units or pre-assembled with inverters and switchgear to form a single contained unit (i.e. enclosed).
	Indicative dimensions of transformers	The footprint of the transformers will be up to 12.5m x 2.5m and 3m in height.

Proposed Development Component	Parameter Type	Applicable Design Parameter
Switchgear (this is a combination of electrical disconnect switches, fuses or circuit breakers used to control, protect and isolate electrical equipment)	Type of switchgear	The switchgear may be an individual standalone unit within its own enclosure or may be pre-assembled with transformers and inverters to form a single contained unit.
	Indicative dimensions of switchgear	Maximum footprint of up to 6.5m x 2.5m and 3m in height.

Battery and Energy Storage System

3.3.33 The Proposed Development will include an associated Battery and Energy Storage System (BESS). The BESS will allow the storage of energy generated by the solar panels at times of low demand and export to the grid at times when demand is high or when solar irradiance is lower, known as load shifting. The BESS will also have the ability to import power from the grid directly to allow the BESS system to help support the grid through grid balancing mechanisms.

3.3.34 The precise number of individual battery storage containers will depend upon the duration of required energy storage; however, it is expected that there would be approximately 480 megawatt hours (MWh) of BESS capacity, which equates to approximately 328 batteries either distributed throughout the Principal Site (referred to as 'distributed BESS' arrangement) and located alongside the Solar Stations, or located at a single BESS Compound (referred to as 'centralised BESS' arrangement). The 480MWh BESS capacity would be fully charged by 2 hours of peak production of the Proposed Development.

3.3.35 The dimensions of the battery containers would measure up to 6.5m x 2.5m, and 3m in height (same for either distributed or centralised BESS arrangements). The containers would be located on areas of hard standing, with a minimum clearance of 0.1m beneath the container and the hardstanding. The battery containers have been spaced with a minimum 3m clearance from each other in the centralised BESS arrangement and with 6m spacing in the distributed BESS arrangement (although a minimum 3m spacing is allowed by the design parameters for the distributed BESS). The indicative centralised BESS arrangement is illustrated on **Figure 3-5 [EN010154/APP/6.2]**.

3.3.36 The BESS switchgear and control room would be located alongside the battery containers and will have a maximum dimension up to 4.5m in height, and 12.5m by 2.5m footprint.

3.3.37 The containers are typically externally finished in keeping with the prevailing surrounding environment, often utilising a green painted finish. The switchgear and control room are typically finished in white, green or grey.

3.3.38 In case of a distributed BESS option, the battery containers will be co-located with the Solar Station Compounds, with up to four BESS containers per Solar Station Compound. In the event that the distributed BESS is constructed, the BESS Compound area shown on **Figure 3-2A [EN010154/APP/6.2]** and **Figure 3-2B [EN010154/APP/6.2]** could be filled with PV panels.

3.3.39 In the centralised BESS arrangement option, all battery containers and the inverters, transformers, and switchgear associated with the BESS will be located within the BESS Compound, while the inverters, transformers and switchgear associated with the PV panels will be located within the Solar Station Compounds.

3.3.40 Emergency fire water would be stored within onsite water tanks with appropriate allowance for fire water storage provided. Water storage will either be in sectional steel panel tanks, or cylindrical steel tanks, above or below ground. A **Framework Battery Safety Management Plan (FBSMP) [EN010154/APP/7.17]** has been prepared to support the DCO application. This sets out the parameters for the management of fire risk associated with the BESS. This management plan will form the basis for the preparation of a fully detailed fire safety management plan at a later stage to ensure the delivery of a robust fire safety strategy in relation to the BESS and will be secured by Requirement 7 of the **Draft DCO [EN010154/APP/3.1]**. The key principles with respect to the approach to risk mitigation contained within the FBSMP are as follows:

a. Fire safety design measures incorporated into the Proposed Development.

b. Guards and protective devices such as BESS disconnection and shutdown controls.

c. Information and training for end users.

d. Risk mitigation and control measures including cell manufacturing, transport, installation and decommissioning, fire compartmentation and fire service accessibility, fire detection, fire suppression, ventilation, cooling and heating and drainage.

3.3.41 The design parameters for the BESS are outlined in **Table 3-4**.

Table 3-4: Design Parameters for the Battery Energy Storage System

Proposed Development Component	Parameter Type	Applicable Design Parameter
Battery Energy Storage System	Type and indicative dimensions	Distributed BESS arrangement option: the BESS units will be next to the Solar Stations, in a common compound each of which will be approximately 33m by 27m (0.09ha) in footprint. Centralised BESS arrangement option: the BESS containers will be located in a centralised BESS Compound. The BESS Compound footprint will be approximately 315m by 165m.
	Foundations	Concrete base or monolith plinth. Maximum depth of 1m. Depending on ground conditions, a pile foundation may be required with a maximum depth of 3m.
Battery Energy Storage System (BESS) Battery Containers	Dimensions	The dimensions of the battery containers would measure up to 6.5m x 2.5m and 3.5m in height. The containers would be located on areas of hardstanding, with a minimum clearance of 0.1m beneath the container and the hardstanding.
	Heating, ventilation, and air conditioning (HVAC)	Integrated into BESS container.
	Fire Management	Integrated into BESS container.
	Foundation	Concrete base or monolith plinth. Maximum depth of 1m.
Battery Energy Storage System (BESS) Switchgear and Control Room	Dimensions	Maximum dimensions: Up to 4.5m in height, 12.5m by 2.5m footprint.

Onsite Cabling

3.3.42 Low voltage cabling between PV panels and the inverters (typically via 1.5/1.8kV cables) will typically be located above ground level (along a row of racks), fixed to the mounting structure, and then underground (between solar PV array tables and in the central inverters and or transformer input). Medium voltage cables (around 33kV) are required between the transformers, switchgear and the Onsite Substation. These buried interconnecting cables will be located within the Solar PV Array Areas and within the Interconnecting Cable Corridors between the Solar PV Array Areas. The trench will typically be up to 1m wide with a maximum depth of 1.2m and will be dependent on the method of installation, ground conditions and number of cables laid in parallel. A minimum backfill of 0.8m will be on top of the cable.

3.3.43 Horizontal directional drilling (HDD) within the Principal Site will be required for the onsite cabling to cross under the A46 and the River Witham. A minimum depth of 5m below the bed of the River Witham, and a minimum of 2m below minor/ordinary watercourses (except where minor/ordinary watercourses have minimal or no water flow and water management is easily managed), will be implemented. Should the detailed design route any cables through trees or woodland that are being retained, they will be installed via HDD at least 2m beneath the ground surface in order to protect the tree roots. Launch and reception pits will have maximum parameters of 8m in length x 4m width and 1m depth. The minimum depth beneath the A46 is dependent on the road makeup, and will align with the minimum depth required by the asset owner. A figure indicating the current assumptions for the location of trenchless crossings is included in **Figure 3-12** of this ES **[EN010154/APP/6.2]**. Typical trenched and trenchless crossing cross-sections are illustrated on **Figure 3-11** and **Figure 3-13 [EN010154/APP/6.2]** respectively.

3.3.44 Data cables will be required throughout the Principal Site to allow for the monitoring and control during operation, such as the collection of data on solar irradiance from pyranometers. The data cables would typically be installed within the same trench and alongside the electrical cables.

3.3.45 The existing above ground powerlines across the Principal Site are not proposed to be altered by the Proposed Development, and the appropriate offsets from the above ground infrastructure will be maintained. This includes an offset of 10m from the centre line of the power lines for infrastructure, and maintaining the required safety clearance where access or cabling under power lines is undertaken.

3.3.46 In identified archaeologically sensitive areas, cables will be installed to avoid or minimise disturbance below ground level, in accordance with the mitigation measures set out in **Chapter 7: Cultural Heritage** of this ES **[EN010154/APP/6.1]**.

3.3.47 The design parameters are outlined in Table 3-5.

Table 3-5: Design Parameters for the Onsite Cabling

Proposed Development Component	Parameter Type	Applicable Design Parameter
DC cabling	Type	DC cabling connect the panels to the Solar Stations. They will be secured to the back of the PV array tables and will be gathered in DC combiner boards before being routed to the local Solar Stations where they will be connected to the inverters.
Medium Voltage Distribution Cables (Interconnecting cables)	Type	Medium voltage cables, which transmit electricity from the Solar Stations or BESS to the Onsite Substation. All cable circuits will be routed underground in trenches via the interconnecting corridors to the Onsite Substation.
	Indicative cable trench dimensions	Maximum dimensions: 0.8–1.2m depth, and 1.2–5m wide depending on the number of cables within the trench. For HDD, a minimum 5m depth under watercourses subject to design and ground conditions. Launch and reception pits will have maximum parameters of 8m in length x 4m width and 1m depth. The minimum depth beneath the A46 is dependent on the road makeup, and will align with the minimum depth required by the asset owner.

Onsite Substation

3.3.48 A new Onsite Substation will be located within the Principal Site which will include transformers, air insulated switchgear (AIS) and metering equipment required to facilitate the import and export of electricity to the national transmission network. The indicative Substation layout and elevation are illustrated on **Figure 3-6A** and **Figure 3-6B [EN010154/APP/6.2]** respectively.

3.3.49 The Onsite Substation would have up to three transformers. The Onsite Substation compound would have a maximum footprint of up to 155m x 105m in plan (1.63ha) and up to 13.5m in height at the tallest point (the height would vary, as illustrated in the indicative cross section drawings on **Figure 3-6B [EN010154/APP/6.2]**).

3.3.50 The Onsite Substation compound would also include a warehouse and storage building with a maximum footprint of 36m by 15m and a height of 7.2m and a control building, which would be up to 20m x 20m in plan, and up to 6m in height. This will include office space and welfare facilities as well as operational monitoring and maintenance equipment.

3.3.51 The concrete foundation depth for the Onsite Substation will be a maximum of 3m BGL.

3.3.52 The design parameters are outlined in Table 3-6.

Table 3-6: Design parameters for the Onsite Substation

Proposed Development Component	Parameter Type	Applicable Design Parameter
Onsite Substation	Indicative dimensions	The substation would have up to three transformers and would have a maximum footprint of up to 155m x 105m in plan (or up to 1.63ha) and up to 13.5m in height.
	Location	As shown in **Figure 3-6 [EN010154/APP/6.2]**.
	Foundation	Concrete foundation depth up to a maximum of 3m BGL.

3.3.53 The Onsite Substation will be connected to the Solar Stations and BESS via Interconnecting Cables in order to collect electricity (at 33kV) from those components of the Proposed Development. The Onsite Substation will convert the electricity to 400kV for onward transmission to the point of connection at the proposed National Grid substation near Navenby via the Grid Connection Cable. The Onsite Substation will also be able to import excess electricity from the grid for storage within the BESS and subsequent export into the grid when there is a need for electricity.

Electricity Export and Point of Connection to the National Electricity Transmission System

3.3.54 The electricity generated by the Proposed Development is expected to be exported via a 400kV Grid Connection Cable between the Onsite Substation and a proposed National Grid substation near Navenby (not part of this DCO application). There would be one single circuit comprising three cables, as well as a communications cable, laid in trefoil formation in a trench of up to 4.5m wide. Subject to ground conditions, separate trenches could be required. A typical cross-section of the 400kV cable is provided in **Figure 3-16** of this ES **[EN010154/APP/6.2]**.

3.3.55 The Grid Connection Cable will be installed using an open trench method requiring a 30m to 40m working width, including both the permanent installation area and temporary working area, with trench widths approximately 3m wide and up to 3m deep. Where other specific techniques are required, such as micro-tunnelling, boring, or HDD, wider working areas (up to 60m wide) may be required, for example to avoid a sensitive watercourse. In terms of installation, the three single-core cables will either be laid directly into trenches or into ducting that will be installed with the cables pulled through the ducting. It is anticipated that the cable temporary working area will be narrowed to approximately 10m where the cable passes through hedgerows and trees to reduce the loss of vegetation, where possible. New land drains 300mm either side of the cable trench (or repair of existing drains where relevant) within the Cable Corridor will be implemented - the only exception to this is at HDD locations, where the land drains would terminate.

3.3.56 The Cable Corridor will be further refined during detailed design post consent of the DCO to take account of any unexpected, localised issues, including but not limited to archaeological finds, implications with respect to protected species and reducing impacts upon trees and hedgerows, for example.

3.3.57 The Cable Corridor crossing of the River Brant and Broughton Lane will be implemented using HDD. A minimum depth of 5m below the bed of the River Bramt, and a minimum of 2m below minor/ordinary watercourses (except where minor/ordinary watercourses have minimal or no water flow and water management is easily managed), will be implemented. Launch and reception pits will have maximum parameters of 8m in length x 4m width and 1m depth. A figure indicating the current assumptions for the location of trenchless crossings is included in **Figure 3-12** of this ES **[EN010154/APP/6.2]**. Typical trenched and trenchless crossing cross-sections are illustrated on **Figure 3-11** and **Figure 3-13 [EN010154/APP/6.2]** respectively.

3.3.58 The current proposed Cable Corridor is shown in **Figure 1-2 [EN010154/APP/6.2].** The Cable Corridor has been subject to an iterative design process, as set out in **Chapter 4: Alternatives and Design Evolution** of this ES **[EN010154/APP/6.1]**. A range of likely constraints have determined the final optimal cable routing.

3.3.59 As part of the cable route construction, a maximum of seven temporary Construction compounds will be required along the Cable Corridor. Cable drums will be delivered to these compounds to be laid along the route, these are illustrated on **Figure 3-1 [EN010154/APP/6.2]**.

3.3.60 Jointing bays will be required up to 1,000m apart to join sections of cable together. The dimensions of the jointing bay would be up to 21m in length by 3m in width by 2.5m in depth, see **Figure 3-14 [EN010154/APP/6.2]**. A link box pit of up to 2m in length by 2m in width would also be required situated within a few metres of the joint bay. The distance between jointing bays will be determined through the detailed design process and is dependent on existing infrastructure along the Cable Corridor, the cable specification and cable manufacturing length limitations.

3.3.61 The design parameters for the Cable Corridor are outlined in **Table 3-7**.

Table 3-7: Design parameters for the Cable Corridor

Proposed Development Component	Parameter Type	Applicable Design Parameter
Grid Connection (from Onsite Substation to National Grid Connection at Navenby substation)	Max width (construction)	The approximate 10km cable corridor is expected to require a 30m to 40m wide working area for the purposes of construction with a small number of wider areas up to 60m width for example at the location of any required HDD entry and exit pits. The cable route will be located within the Cable Corridor described below.

Proposed Development Component	Parameter Type	Applicable Design Parameter
	Max depth (construction)	For open trench excavation, up to 3m below ground level subject to design and ground conditions, with a minimum cover of 0.9m for the cable. For HDD, a minimum 5m depth under main watercourses subject to design and ground conditions.
	Location	As shown in **Figure 3-2A [EN010154/APP/6.2]** and **Figure 3-2B [EN010154/APP/6.2]**.
National Grid Connection	Point of Connection	At the proposed National Grid substation near Navenby.
Jointing Bays	Location and Dimensions	Jointing bays will be required up to 1,000m apart to join sections of cable together. The dimensions of the jointing bay would be up to 21m in length by 3m in width by 2.5m in depth. A link box pit of up to 2m in length by 2m in width would also be required situated within a few metres of the jointing bay.

Fencing, Security, Lighting and Ancillary Infrastructure

3.3.62 A fence will enclose the operational areas of the Proposed Development – the Solar PV Array Areas, the Onsite Substation, and the BESS Compound. A figure illustrating the solar perimeter fencing design is provided in **Figure 3-15 [EN010154/APP/6.2]**.

3.3.63 The fence is likely to be a stock proof mesh-type security fence with wooden posts and up to 2m in height. Pole mounted inward facing closed circuit television (CCTV) systems installed at a height of up to 3.5m are also likely to be deployed around the perimeter of the operational areas facing along the fence line and into the Principal Site, as illustrated in **Plate 3-9**. Access gates will be of similar construction and height as the perimeter fencing. Clearances above ground or mammal gates will be included to permit the passage of wildlife.

3.3.64 To comply with British Standard (BS) EN 62271-1:2017 (Ref 3-2) applicable to the Proposed Development, if non-enclosed transformers are used, they will be surrounded by a secure wire mesh fence or metal palisade fence. These will only be located in Solar Station Compounds. This fence is likely to be from 1.8m, up to a maximum 2.5m, in height. In addition, the Onsite Substation and the BESS Compound would be surrounded by a secure metal palisade fence up to 2.5m in height.

3.3.65 The inward facing CCTV cameras would use infra-red night-vision technology with a 50m range, which would be monitored remotely and minimise the need for night-time lighting. No areas of the Proposed Development are proposed to be continuously lit. For security requirements, operational lighting would include Passive Infra-red Detector (PID) systems which would be installed around the perimeter of the Proposed Development.

Plate 3-9: Example of mesh stockproof fencing and a metal perimeter CCTV pole

3.3.66 The lighting of the Onsite Substation would be in accordance with health and safety requirements, particularly around any emergency exits where there would be motion sensor triggered lighting, similar to street lighting, that would operate from dusk. There would be low level lighting on specific operational units that would operate, when triggered by motion sensors, from dusk. All lighting would seek to limit any impact on sensitive receptors following guidance from the Bat Conservation Trust among others.

3.3.67 Lighting sensors for security purposes would be implemented on other critical electrical infrastructure. No areas are proposed to be permanently lit.

3.3.68 The design parameters are outlined in Table 3-8.

Table 3-8: Design Parameters for the Fencing, Security and Ancillary Infrastructure

Proposed Development Component	Parameter Type	Applicable Design Parameter
Fencing and security	Maximum Height	Solar perimeter fencing surrounding the Principal Site will be up to a maximum of 2m in height. If non-enclosed transformers are used, Solar Station Compounds will be surrounded by a secure wire mesh fence or metal palisade fence, up to a maximum 2.5m in height.
Control building and Office	Dimensions	Maximum parameters: 20m by 20m footprint and 6m height, within the footprints of the Onsite Substation and BESS Compound.
	Materials	It is assumed the control building and office would be constructed with brick facades.
	Foundations	<2m below ground level
Warehouse and storage building	Dimensions	Maximum parameters: 36m by 15m and 7.2m in height.
	Materials	It is considered these buildings could have brick or sheet metal facades.
	Foundations	<2m below ground level

Site Access and Access Tracks

3.3.69 During construction there will be nineteen site access points across the DCO Site which would provide access to an internal network of access tracks enabling access to each field parcel. During operation there will be seven operational access points across the Principal Site. In addition, during operation there will be three dedicated emergency accesses into the Principal Site. **Figure 3-8 [EN010154/APP/6.2]** illustrates the site access points across the DCO Site, which are further described in **Appendix 13-E: Transport Assessment Note [EN010154/APP/6.3]**.

3.3.70 The internal access tracks would be constructed across the Principal Site and are shown on **Figure 3-2A [EN010154/APP/6.2]** and **Figure 3-2B [EN010154/APP/6.2]**. These would typically be 5m wide with passing bays provided as required. Initially at each of the main access points, access tracks would be required to be 6m wide on approach to the construction compounds to facilitate two-way Heavy Goods Vehicle (HGV) traffic. The internal access tracks will likely be constructed of compacted stone or gravel with excavation kept to a minimum, or for secondary tracks left as grass. Where drainage is required a ditch or a swale may be located downhill of the internal access track to control any potential for surface water run-off.

3.3.71 The **Framework Construction Traffic Management Plan (CTMP) [EN010154/APP/7.18]** sets out the Applicant's proposals to manage construction traffic and staff vehicles within the vicinity of the Proposed Development along the local highway network during the construction period of the works, in order to limit any potential disruptions and implications on the wider transport network.

3.3.72 In terms of operational access, activity on-site during the operational phase will be principally routine maintenance, servicing, repairs, replacement of components such as PV Panels and BESS, as well as monitoring to ensure the continued effective operation of the Proposed Development.

Highways Works and Road Closures

3.3.73 The following highways works are proposed as part of the Proposed Development:

a. Within the DCO Site Boundary:

   i. Street works to facilitate cable installation works;

   ii. The alteration of road layout, including management of verge side vegetation and removal of hedgerows to facilitate safe access and egress into the Proposed Development.

   iii. The construction of new or upgraded existing access points to facilitate access during the construction, operation and decommissioning of the Proposed Development.

   iv. The closure of existing field access locations during the construction and operation of the Proposed Development. The closure of these access locations is deemed necessary to co-ordinate with the Proposed Development layout, whereby secure fencing will render these access points being unable to be utilised. Following decommissioning of the Proposed Development, these access points can return to operational use to meet the needs of the existing landowner.

   v. Alteration of road layouts, including modifications to road markings and temporary removal of signage to facilitate abnormal load manoeuvres;

   vi. Any repairs to existing carriageway surfacing as agreed with the Local Highways Authority.

   vii. The installation of temporary traffic signage to provide advance warning to local road users of construction works or any temporary traffic signals that will be in place to facilitate the construction of the Proposed Development.

b. Off-site:

viii. Implementation of local off-site highway improvements to accommodate abnormal loads travelling to the Principal Site, e.g. pavement protection, temporary removal of street furniture, vegetation clearance including overhanging trees and lifting overheard cables, as required.

3.3.74 Further details of the road works within the DCO Site are included on the **Streets, Rights of Way and Access Plans [EN010154/APP/2.3]** and **Draft DCO** Schedules 4 to 7 inclusive **[EN010154/APP/3.1]**.

3.3.75 To facilitate the construction of each access to the Proposed Development and their use during the construction stage. Temporary single or full closures of the carriageway will to safely manager construction and local road traffic to ensure the safety of construction personnel undertaking works. The details of those roads which will be subject to either single or full closures is contained within Schedule 6 Part 1 of the **Draft DCO [EN010154/APP/3.1]**. The location of any access points for the proposed development, and any management controls which may be required to ensure the safe access and operation off the local road network can be found in the **Streets, Rights of Way and Access Plans [EN010154/APP/2.3]** and the **Framework CTMP [EN010154/APP/7.18])** respectively.

Public Rights of Way Works

3.3.76 The Principal Site has been designed to fit within the network of Public Rights of Way (PRoW) and existing permissive paths in the area, with 9.5km of additional permissive paths proposed to further enhance the local connectivity. There are 36 PRoW within the Principal Site and five PRoW within the Cable Corridor (see **Figure 2-2 [EN010154/APP/7.2]**). These PRoW will be impacted during the construction phase of the Proposed Development, with three PRoW sections (TOTH/13/1, THUN/2/1 and AUBO/10/1) within the Principal Site diverted permanently once the Proposed Development is operational. There are seven existing permissive paths within the Principal Site.

3.3.77 Table 3-9 provides a summary of the PRoW within the DCO Site and the proposed management approach, as detailed in Schedule 13 of the Draft DCO [EN010154/APP/3.1], Streets, Rights of Way and Access Plans [EN010154/APP/2.3], the Framework CTMP [EN010154/APP/7.18] and the Framework PRoW Management Plan [EN010154/APP/7.14].

3.3.78 As shown in in **Figure 7.15-1** of the **Framework Landscape and Ecological Management Plan (LEMP) [EN010154/APP/7.15]**, the Proposed Development includes two new proposed private access tracks to link the Cathedral View Holiday Park and Field Farm House with proposed permissive paths.

Table 3-9: PRoW within the DCO Site and Proposed ManagementLocal Authority	Public Right of Way	Management Approach
Lincolnshire County Council	LL|TOTH|5/1 LL|TOTH|6/1 LL|TOTH|6A/1 LL|TOTH|6/2 LL|TOTH|6/3 LL|TOTH|7/1 LL|TOTH|7/2 LL|TOTH|7/3 LL|TOTH|11/1 LL|TOTH|11/2 LL|TOTH|12/1 LL|TOTH|12/2 LL|TOTH|12/3 LL|TOTH|13/2 LL|TOTH|15/1 LL|TOTH|21/1 LL|Aubo|8/1 LL|Aubo|9/1 LL|Aubo|12/1 LL|Aubo|11/1 LL|Aubo|11/2 LL|Aubo|12/2 LL|Aubo|13/1 LL|Aubo|13/2 LL|Bass|21/2 LL|Bass|21/3 LL|ThuN|1/1 LL|ThuN|5/1 LL|NoDi|1/1 LL|NoDi|1/2 LL|NoDi|4/1 LL|Swdb|4/1 LL|Swdb|5/1	Minimal impacts expected, to remain open and to be managed using a banksman or similar.
	LL|Aubo|10/1	Permanent diversion required, with an additional length of journey for users proposed to be approximately 100m.
	LL|ThuN|2/1	Permanent diversion required - 292m in length, approximately 8m shorter than original route and diversion follows path commonly used by PRoW users so in practice is no different from existing route.

Table 3-9: PRoW within the DCO Site and Proposed ManagementLocal Authority	Public Right of Way	Management Approach
	LL|TOTH|13/1	Permanent diversion required, with an additional length of journey for users proposed to be under 10m.

Surface Water Drainage

3.3.79 The **Framework Surface Water Drainage Strategy** (refer to **Appendix 9-D** of this ES **[EN010154/APP/6.3]**) has been informed by the findings of a **Flood Risk Assessment** (refer to **Appendix 9-C** of this ES **[EN010154/APP/6.3]**) and available online geological mapping. The design will ensure compliance with planning policy with the Proposed Development draining to greenfield run-off rates and accommodating allowances for climate change. Surface water is proposed to be directed to and captured within swales before discharging to Ordinary Watercourses (field ditches). Where possible, surface water will drain from the Proposed Development's swale-based drainage system to local receiving watercourses via a new ditch, or the piped section will be shortened and the last 10m section of the outfall route will be open ditch unless this affects maintenance of the channel by the Internal Drainage Board.

3.3.80 In terms of potential polluted runoff associated with a fire event, the principles of this are outlined within the **FBSMP [EN010154/APP/7.17]** and within the **Framework Surface Water Drainage Strategy** (refer to **Appendix 9-D** of this ES **[EN010154/APP/6.3]**) where the proposed management, capture and testing of fire water runoff is discussed. The FBSMP requires a fire water management plan to be developed including the containment, monitoring and disposal of contaminated fire water where the runoff will be contained and tested/treated before being discharged to local watercourses. It is proposed to contain the fire water runoff within swales surrounding the BESS. The swales will be used for firewater storage as well as surface water storage. The Outline Surface Water Drainage Strategy has been developed in consultation with the Lead Local Flood Authorities, Internal Drainage Boards and the Environment Agency, as appropriate.

3.3.81 A detailed Surface Water Drainage Strategy will be designed and implemented in accordance with the **Framework Surface Water Drainage Strategy** (**Appendix 9-D** of this ES **[EN010154/APP/6.3]** prior to the commencement of development. Where potential infiltration is proposed, infiltration drainage design will be in accordance with Building Research Establishment (BRE) Digest 365: Soakaway Design (Ref 3-3).

3.3.82 The detailed Surface Water Drainage Strategy will be secured through a Requirement of the **Draft DCO [EN010154/APP/3.1]**.

3.3.83 During construction, an adequate temporary drainage system will be in place and maintained throughout the construction phase, as described in the **Framework Construction Environmental Management Plan (CEMP) [EN010154/APP/7.7]**.

3.3.84 The majority of the Principal Site and Cable Corridor is located within Flood Zone 1 with areas of Flood Zone 2 and 3 at the extents associated with the Upper Witham and Lower Brant Main Rivers and the Witham Washlands Flood Storage Area. Only access tracks and the Interconnecting Cable Corridor will be located within Flood Zone 3a, only solar PV panels will be located in Flood Zone 2, with the more sensitive elements of the Proposed Development, such as substations, Solar Stations and BESS, to all be located within Flood Zone 1.

3.3.85 **Chapter 9: Water Environment** of this ES **[EN010154/APP/6.1]** provides a description of the flood risk and drainage design and associated figures.

Biodiversity and Landscaping

3.3.86 The Proposed Development will involve new planting, field boundary enhancement and planting of seed mixes within the Solar PV Array Areas and within the wider Principal Site. Planting will also be used to provide screening for visual and glint and glare mitigation, mitigation for wildlife, and habitat enhancement, as illustrated in **Plate 3-10**. Further information is provided within **Chapter 8: Ecology and Nature Conservation** of this ES **[EN010154/APP/6.1]**, **Chapter 10: Landscape and Visual Amenity** of this ES **[EN010154/APP/6.1]**, the **Biodiversity Net Gain Report [EN010154/APP/7.12]** and **Appendix 14-C: Glint and Glare Assessment [EN010154/APP/6.3]**.

3.3.87 The planting would increase biodiversity and contribute to the Proposed Development achieving Biodiversity Net Gain (BNG) in line with the principles in the Environment Act 2021, National Planning Policy Framework and local planning policy: Central Lincolnshire Local Plan (Ref 3-9). As set out in the **Biodiversity Net Gain Report [EN010154/APP/7.12]**, the Applicant has committed to deliver a minimum of 30% biodiversity net gain in habitat units, 50% biodiversity net gain in hedgerow units and 10% biodiversity net gain in watercourse units using DEFRA's Statutory Biodiversity Metric (SBM) (Version 1.0.4) for the Proposed Development.

3.3.88 

Plate 3-10: Image showing enhanced planting surrounding the boundary of a solar PV farm

(AECOM, 2021)

3.4 Construction

Construction Programme

3.4.1 The construction phase is anticipated to take 24 months if multiple construction teams are mobilised simultaneously, or up to 30 months if it is built out sequentially. Subject to being granted development consent, construction is anticipated to start in 2031 to enable completion for the agreed connection date of 2033. As discussed in **Chapter 5: EIA Methodology** of this ES **[EN010154/APP/6.1]**, the assumed 2031 construction start date for the purposes of assessment within this ES is based upon information currently available, including the construction of the proposed National Grid substation near Navenby, which allows for the connection of the Proposed Development to the national electricity transmission network. If construction of the proposed National Grid substation near Navenby is progressed quicker than anticipated, the Proposed Development construction may commence sooner. The potential for an earlier start date would be discussed with National Grid following receipt of development consent, in the event National Grid can facilitate connection earlier than the currently offered date.

3.4.2 The construction period utilised within this ES allows for worst-case assumptions in the technical assessments presented in **Chapters 6** to **14** **[EN010154/APP/6.1]**, as discussed in **Chapter 5: EIA Methodology** of this

ES **[EN010154/APP/6.1]**, for example by maximising predicted daily traffic flows and the amount of construction activity occurring at any given time. An exception to this is where the use of a shorter-duration construction period may over-estimate the number of jobs during peak construction; however, as explained in **Chapter 12: Socio-Economics and Land Use** of this ES **[EN010154/APP/6.1]**, the overall amount of construction activity over the construction period and therefore the associated employment and spending benefits of the Proposed Development overall would remain unchanged. The technical chapters of this ES (**Chapters 6** to **14 [EN010154/APP/6.1]**) each provide clarification of the construction period utilised for the purpose of assessment and justification on approach as relevant.

Construction Activities

3.4.3 The following construction activities would be required to deliver the Proposed Development:

a. Site preparation:
   i. Delivery of construction materials, plant and equipment;
   ii. The establishment of the temporary construction compound(s), as shown on **Figure 3-1 [EN010154/APP/6.2]**;
   iii. The establishment of the perimeter fence;
   iv. The upgrade of existing tracks and access roads and construction of new tracks required;
   v. The upgrade or construction of crossing points (including bridges and potential culvert extensions, subject to detailed design) over drainage ditches (note, no new culverts are proposed); and
   vi. Marking out location of the Proposed Development infrastructure.
b. Principal Site construction:
   i. Delivery of construction materials, PV panels, BESS, cabling, plant and equipment;
   ii. Erection of panel mounting structures;
   iii. Mounting of panels;
   iv. Installation of electric cabling;
   v. Installation of transformer containers;
   vi. Installation of battery storage units;
   vii. Construction of substation compound; and
   viii. Construction of onsite electrical infrastructure to facilitate the import and export of generated electricity.
c. Testing and commissioning; and
d. Reinstatement, landscaping, planting and habitat creation.

Principal Site Construction

3.4.4 The following activities will be undertaken to install the solar PV panels:

a. Import of components to the Principal Site to compound areas shown on **Figure 3-1 [EN010154/APP/6.2]**;

b. Piling and erection of panel mounting structures (some panel may be mounted on concrete blocks subject to archaeological survey and agreement with the relevant stakeholders), with the panel struts/frames rammed/piled to a maximum depth of 4m;

c. Mounting of panels (this will be undertaken by hand);

d. Installation of Solar Stations and BESS (distributed BESS arrangement option) (cranes will be used to lift equipment into position);

e. Installation of DC cables between Solar Arrays and Solar Stations;

f. Trenching and installation of Interconnecting Cables; and

g. Site reinstatement, mitigation planting and habitat creation.

400kV Cable Connection to Proposed National Grid Substation Near Navenby

3.4.5 The following activities will be undertaken to construct the 400kV cable connection:

a. The establishment of mobilisation areas and running tracks;

b. The establishment of temporary construction compounds, as indicatively shown on **Figure 3-1 [EN010154/APP/6.2]**;

c. Stripping of topsoil in sections;

d. Trenching in sections;

e. Appropriate storage and capping of soil;

f. Appropriate construction drainage with pumping where necessary;

g. Sectionalised approach of duct installation;

h. Installation of new land drains 300mm either side of cable trench (or repair of existing drains where relevant);

i. Excavation and installation of jointing pits (areas where sections of cable are joined together);

j. Cable joint installation;

k. Cable pulling;

l. Implementation of crossing methodologies for watercourses, infrastructure (including roads and rail), and sensitive habitats (e.g. HDD, cable bridging);

m. Testing and commissioning; and

n. Site reinstatement.

3.4.6 The construction of the Cable Corridor will be undertaken in four concurrent phases over the assumed 24-month programme. It is anticipated that each phase would have a dedicated team for the trenched cable element and there would be an additional two teams dedicated to construction of the trenchless crossings. The detailed sequencing will be determined by the Principal Contractor, once appointed, however, it is anticipated that one team would start at the proposed National Grid substation near Navenby and one at the Onsite Substation within the Principal Site, with the other two starting at separate points along the cable corridor. The individual cable route teams will travel to construction compounds within their dedicated works area and therefore, there will be limited overlap of construction traffic along the local highway network by the four construction teams. The only overlap of teams along the local highway network would be where two work areas join. It is anticipated that this would not be for more than 2 months.

3.4.7 It is anticipated that the primary construction activities along the Cable Corridor will progress at approximately 100m per day. Cable installation and cable jointing bays will follow behind excavation in the same sequence. The construction compounds, as shown on **Figure 3-1 [EN010154/APP/6.2]**, are designed to be sufficiently separated along the Cable Corridor so that any one access would only be utilised for up to 2 months for the primary construction activities, excluding cabling and jointing bays activities. Therefore, impacts for sensitive receptors along the local highway network would only be experienced for a maximum of 2 months as a result of the primary construction activities (excluding cabling and jointing bays).

Onsite Substation and Centralised BESS Compound

3.4.8 The following activities will be undertaken to construct the Onsite Substation and BESS Compound (centralised BESS arrangement option):

a. Topsoil strip and ground levelling;

b. Groundworks including piling and drainage installation;

c. Construction of foundations;

d. Installation of electric cabling;

e. Import of components to site;

f. Installation of busbar, circuit breaker, isolators, earthing switch and transformers at the Onsite Substation;

g. Installation of batteries, transformers, inverters and switchgear at the BESS Compound;

h. Installation of office, storage areas and warehouse; and

i. Site reinstatement and mitigation planting.

Testing and Commissioning

3.4.9 Commissioning of the Proposed Development will include testing and commissioning of the process equipment, including the PV and BESS infrastructure. Commissioning of the solar PV infrastructure will involve mechanical and visual inspection, electrical and equipment testing, followed by commencement of electricity supply into the grid. Individual sub-systems will be commissioned separately, with each having its own procedures and prerequisite lines, and it may be necessary to commission these elements separately or at the same time, depending on the end technology utilised at the time of construction.

3.4.10 The 400kV cable system will also require testing and commissioning. For the circuit testing, a mobile transformer will be required at one end of each circuit to carry out the High Voltage power testing. In addition, access to the link box pits situated at the joint bay will be required for the duration of the tests.

3.4.11 This process will take place prior to operation of the Proposed Development which is anticipated to commence in 2033.

Construction Staff

3.4.12 At the peak of construction, which is currently expected to be during 2032, it is estimated that a maximum of up to 600 workers will be required on site per day. On average the construction is anticipated to require 350 workers per day, with 25 allocated to the works on the Grid Connection Cable. This number will be less at other times of the construction phase and if construction is carried out over a slightly longer period than the anticipated 24 months.

Construction Hours of Work

3.4.13 Core construction working hours on-site will be as follows:

a. Monday to Friday: 07:00 to 19:00 – all activities. Any percussive piling works within 400m of residential properties will only occur for two periods of four hours (between 08:00 to 18:00) with at least one hour break between the two periods;

b. Saturday: 09:00 to 13:00 – all activities, except percussive piling within 400m of residential properties;

c. Saturday: 13:00 to 18:00 – all activities, except for HGV deliveries, works likely to generate substantial levels of noise (defines as activities generating more than 45dB L_{Aeq} at neighbouring dwellings), and percussive piling (unless agreed with the relevant local authority); and

d. Sundays, Bank Holidays and outside of the construction hours noted above (including nights): no activities except for HDD drilling which could be required subject to the restrictions stated in the **Framework CEMP [EN010154/APP/7.7]**, future detailed CEMP(s), and any other restrictions agreed with the relevant planning authorities pursuant to the consent process under section 61 of the Control of Pollution Act 1974 (Ref 3-5).

3.4.14 Additionally, quiet non-intrusive works such as the installation of PV panels may take place over longer periods during the high summer and other quiet non-intrusive works such as electrical testing, commissioning and inspection may take place over longer periods throughout the year.

3.4.15 Measures to control the routing and timing of staff vehicles are set out in the **Framework CTMP [EN010154/APP/7.18]**.

3.4.16 HGV movements will be restricted to certain routes and times of day (outside of the network morning and afternoon peak periods) as outlined within the **Framework CTMP [EN010154/APP/7.18]** to reduce the impact on the local high network. In addition, a Delivery Management System will be implemented to control the bookings of HGV deliveries from the start of the construction period. This will be used to regulate the arrival times of HGVs via timed delivery slots, as well as to monitor compliance with HGV routing (see **Figure 13-4: Heavy Good Vehicle Routing [EN010154/APP/6.2]**). The Proposed Development will also implement a monitoring system to record HGVs travelling to and from the Proposed Development, to record any non-compliance with the agreed routing plan/delivery hours and to communicate any issues to the relevant suppliers to ensure the correct routes are followed.

Security

3.4.17 Site security during construction will be managed by the Principal Contractor(s). A security perimeter fence will be implemented early in the construction phase to secure the Principal Site. The DCO Site security fencing will remain in place throughout the duration of the construction period. Any storage of materials will be kept secure to prevent theft or vandalism. A safe system for accessing the materials storage areas would be implemented by the contractor(s).

3.4.18 There will be designated security staff during construction who will manage the DCO Site Boundary and patrol the perimeter.

Construction Traffic

3.4.19 It is expected that during the construction phase there will be a peak of around 50 HGV deliveries per day (100 HGV movements per day) across the regional road network attributed to the Principal Site, with an average of 35 HGV deliveries per day (70 HGV movements per day) throughout the duration of the construction phase. For the Grid Connection Cable, there is anticipated to be eight HGV deliveries per day (16 HGV movements per day), occurring at the same time as the deliveries for the Principal Site.

3.4.20 It is also anticipated that there would be two to three abnormal indivisible loads (AIL) deliveries in total to deliver the transformers for the Onsite Substation, and possibly also the 400kV cable drum. These vehicles will be distributed across the local road network. Further detail on assumed AIL routes, accesses and construction vehicle movements (including how the construction traffic data utilised within this ES, as relevant, has been prepared) are provided in the **Framework CTMP [EN010154/APP/7.18]**.

3.4.21 Further detail on daily HGV and LGV movements are provided within **Chapter 13: Traffic and Transport** of this ES **[EN010154/APP/6.1]**.

3.4.22 The Principal Site will include provision for a maximum 225 car parking spaces based on a peak number of 600 construction staff, for works related to the Principal Site. Further details on construction traffic movements are provided in the **Framework CTMP [EN010154/APP/7.18]**.

3.4.23 Construction workers will then be transported around the Proposed Development via shuttle buses (if required). In addition, an average construction staff vehicle occupancy of 1.3 persons per vehicle is assumed for the purposes of this assessment and will be managed by the Contractor. Car sharing will be encouraged to reduce the number of construction staff cars travelling to/from the DCO Site.

3.4.24 A total of 15 cycle parking spaces will also be provided within the construction compounds of the Principal Site, to accommodate any trips made to the Principal Site via sustainable modes of travel.

3.4.25 No car parking spaces will be provided for construction workers within the construction compounds serving the Cable Corridor, as staff will be transferred to and from this portion of the Site via a shuttle bus service. All construction workers associated with working along the Cable Corridor will park within the construction compounds associated with the Principal Site access C-009, as set out in the **Framework CTMP [EN010154/APP/7.18]**.

3.4.26 The **Framework CTMP [EN010154/APP/7.18]** ensures the proper management of construction related vehicles across the Proposed Development. This includes:

c. Lift-Sharing;

d. Staff Routeing;

e. Staff Arrival and Departure Times;

f. Car parking strategy and parking permit scheme;

g. Mini-Buses/coaches; and

h. Cap on Vehicle Numbers.

Wheel Wash Facilities

3.4.27 A self-contained wheel wash will be installed near the DCO Site exits onsite to be used by vehicles prior to exiting the DCO Site onto the public highway. For loads unable to use the fixed wheel wash, localised wheel washing would be set up to cater for these individually and as required to prevent detrimental effect to the highway.

Construction Compounds

3.4.28 There will be one main construction compound, located west of Haddington Lane south of the A46, and several secondary compounds, with indicative locations shown in **Figure 3-1 [EN010154/APP/6.2]**. The main compound would be up to 100m x 200m and the secondary compounds will be up to 100m x 100m and will contain a site office, mobile welfare units, canteen facility, a fenced area for storage and waste skips and space for short-term parking, storage, download and a turning area. The compounds will be converted to solar PV or landscaping and mitigation/enhancement planting at the end of their use.

3.4.29 In addition to the main compound and the secondary compounds, smaller short-term use construction compounds will be located across the DCO Site including the Cable Corridor. The indicative location of the temporary construction compounds for the Cable Corridor are shown in **Figure 3-1 [EN010154/APP/6.2]**. The temporary construction compounds proposed to be located on either side of the River Brant (illustrated on **Figure 3-1 [EN010154/APP/6.2]**), will be smaller 'HDD Camps'. These HDD Camps will be located within around 20 – 40m from the HDD entry and exit points and will be specifically for the HDD activities; they will be smaller in size and shorter in duration (set up, used and demobilised again within 2-4 days).

3.4.30 Design parameters for the construction compounds are shown in **Table 3-10**.

Table 3-10: Design parameters for the construction compounds

Proposed Development Component	Parameter Type	Applicable Design Parameter
Construction compounds within the DCO Site	Number of compounds	There is proposed to be one main construction compound near the A46, there will be several smaller construction compounds around the Principal Site that would be intended to be temporary laydown areas for the construction of the solar array in that area.
	Size of compounds	The main compound would be up to 100m x 200m and the secondary compounds will be up to 100m x 100m
Construction compounds within the Cable Corridor	Number of compounds	There are proposed to be up to nine construction compounds within the Cable Corridor. The temporary construction compounds proposed to be located on either side of the River Brant, will be smaller HDD Camps. These HDD Camps will be located around 20 – 40m from the HDD entry and exit points and will be specifically for the HDD activities.

Storage of Plant and Materials

3.4.31 No long-term onsite storage of materials is required during the construction phase. Materials will be delivered via HGVs at regular intervals to the construction compounds and transported directly to where they are required within the DCO Site using smaller LGVs.

3.4.32 Short term storage of materials and plant will be accommodated within the construction compounds until required.

3.4.33 Topsoil, spoil, and other construction materials will be stored outside of the 1 in 100-year floodplain extent and only moved to the temporary works area immediately prior to use.

Spoil Management

3.4.34 There will be no site wide reprofiling required; however, there will be a need to level areas in a number of locations including the Onsite Substation and BESS Compound. This is unlikely to create excess spoil and it is not expected that this would need to be removed from the DCO Site. Spoil material is only expected to be generated from cable trenches, temporary construction compounds, internal roads, BESS, and the Onsite Substation. This will be minimal relative to the size of the DCO Site and will be distributed over a wide area to avoid substantial local changes in topography.

3.4.35 During construction of the Grid Connection Cable, spoil will be stored temporarily within designated areas adjacent to the cable route and within the construction compounds. The spoil will be utilised to backfill the cable trenches, reinstate the temporary construction compounds and any temporary access roads. Any excess spoil will be utilised or distributed across the DCO Site without creating substantial changes in local topography. It is not anticipated that any spoil will be removed from the DCO Site.

Construction Lighting

3.4.36 During winter months, mobile lighting towers with a power output of 8kVA may be used during construction in isolated work areas. There will also be lighting at the main construction compounds while construction is underway.

Onsite Fuel

3.4.37 Fuel for machinery and generators will be delivered to the DCO Site by a fuel truck and stored in above ground fuel storage tanks of 10–36 m^3 capacity. The fuel storage tank will be sheltered, secured from unauthorised access, and equipped with a spill protection bund capable of holding 110% of the volume of the tank. Spill kits will be available at the fuelling point and other strategic locations of the construction site to allow for prompt clean up to limit soil and water contamination (as noted in the **Framework CEMP [EN010154/APP/7.7]**). Construction workers will be trained in spill kit use.

Utilities

3.4.38 It is expected that an electricity connection to the local electrical distribution network can be obtained for the temporary construction compounds to avoid the requirement for diesel generators.

3.4.39 During construction it is envisaged that a temporary potable water supply will be provided. There would be a requirement for 23m^3 per day of clean water for approximately 600 staff. The average number of workers on site during construction is assumed to be 350, which would have a demand of an average 13m^3/day. This equates to an assumed maximum of 12,264m^3 over the 30 month construction period.

Waste

3.4.40 Solid waste materials generated during construction will be segregated and stored onsite in containers of up to $30m^3$ capacity prior to transport to approved, licensed third party landfill and recycling facilities. During construction, removal of waste is estimated to require up to a maximum of 400 HGV loads over a period of 12 months, which equates to an average of just over 1 HGV load per day (2 HGV movements). This will fluctuate with the largest waste numbers being the removal of pallets and recyclable cardboard during delivery of the PV panels.

3.4.41 All management of waste will be in accordance with the relevant regulations and waste will be transported by licensed waste hauliers to waste management sites which hold the necessary regulatory authorisation and/or permits for those wastes consigned to them.

Construction Environmental Management Plan

3.4.42 A **Framework CEMP [EN010154/APP/7.7]** has been prepared to accompany the DCO. This describes the framework of mitigation measures to be followed, to be carried forward to a detailed CEMP prior to construction. The **Framework CEMP [EN010154/APP/7.7]** will be secured through a Requirement of the DCO.

3.4.43 The aim of the CEMP is to avoid and/or reduce environmental impacts from:

a. Use of land for compounds;
b. Construction traffic (including parking and access requirements) and changes to access and temporary road or footpath diversions (if required);
c. Noise and vibration;
d. Utilities diversion;
e. Dust generation;
f. Soil removal;
g. Lighting; and
h. Waste generation.

3.4.44 The CEMP will be produced by the Applicant following granting of the DCO and prior to the start of construction. The CEMP will identify the procedures to be adhered to and managed by the Applicant and its contractors throughout construction.

3.4.45 Contracts with companies involved in the construction works will incorporate environmental control, health and safety regulations, and current guidance and will ensure that construction activities maximise opportunities for the incorporation of sustainability principles and that all contractors involved with the construction stages are committed to agreed best practice and meet all relevant environmental legislation including: Control of Pollution Act 1974 (COPA) (Ref 3-5, Environment Act 1995 (Ref 3-6), Hazardous Waste (England

and Wales) Regulations 2005 (Ref 3-7) and the Waste (England and Wales) Regulations 2011 (Ref 3-8).

3.4.46 Records will be kept and updated regularly, ensuring that all waste transferred or disposed of has been correctly processed with evidence of signed Waste Transfer Notes (WTNs) that will be kept onsite for inspection whenever requested. Furthermore, all construction works will adhere to the Construction (Design and Management) Regulations 2015 (CDM) (Ref 3-4).

Vegetation Removal

3.4.47 Localised areas of vegetation removal and trimming are required to facilitate the construction of the Proposed Development, for example where hedgerow trimming and removal is required to allow for site access. The maximum extent of vegetation removal required is illustrated on **Figure 3.17 [EN010154/APP/6.2]**.

3.4.48 During construction the retained vegetation and trees will be protected as set out in the **Arboricultural Impact Assessment** (**Appendix 10-H** of this ES **[EN01054/APP/6.3]**), the **Framework LEMP [EN010154/APP/7.15]**, and **Framework CEMP [EN010154/APP/7.7]**. Measures to be employed will include the use of clearly defined stand-offs, managing the structure and integrity of the retained vegetation, and undertaking any pruning outside of the bird breeding season and in accordance with hedgerow regulations.

3.4.49 Removal of existing trees will only occur where access is required. These crossings will, wherever possible, be located at current field access locations or in areas where there are existing gaps in the hedgerow and no trees. For information on location of vegetation to be removed, see **Landscape Mitigation Plan** in **Figure 7.15-1** of the **Framework LEMP [EN010154/APP/7.15]**.

3.4.50 No veteran or ancient trees or ancient woodland are to be removed. No trees subject to Tree Preservation Order (TPO) or within a Conservation Area (CA) are to be removed, as set out in the **Arboricultural Impact Assessment** (**Appendix 10-H** of this ES **[EN01054/APP/6.3]**) and the **Framework LEMP [EN010154/APP/7.15]**.

Site Reinstatement and Habitat Creation

3.4.51 Prior to and during the construction phase, and following construction, a programme of site reinstatement and habitat creation will be implemented.

3.4.52 The Proposed Development has been designed to integrate with and, where practicable, enhance the local green infrastructure network, improving ecological connectivity across the Principal Site. The proposed planting design shown in the **Landscape Mitigation Plan** presented in **Figure 7.15-1** within the **Framework LEMP [EN010154/APP/7.15]** has responded to the varied character by allowing views to remain open, where tall screening would not be appropriate. Based on the indicative layout of the Principal Site, new planting would include, in addition to hedgerow enhancement, gapping up and infill planting, and grassland under the panels and along perimeter buffers:

a. Approximately 16km of new native hedgerows;

b. Over 200 new trees;

c. Approximately 20ha of species rich grassland (outside of Solar PV areas);

d. Approximately 83ha of permanent grassland for bird mitigation purposes; and

e. Approximately 1.8ha of community orchard1.

3.4.53 Offsetting provisions have been embedded within the Proposed Development design for mitigating the loss of arable farmland and providing habitat for ground nesting birds, in particular Skylark and Lapwing. As set out in **Chapter 8: Ecology and Biodiversity** of this ES **[EN010154/APP/6.1]**, a minimum of 64ha of permanent grassland will be delivered to support ground nesting breeding birds, along with a minimum 181ha of managed arable land created in general alignment with the **Framework LEMP [EN010154/APP/7.15]** to mitigate for the loss of nesting habitat for ground-nesting birds.

3.4.54 The Applicant is committed to delivering biodiversity net gain in accordance with the requirements of the **Draft DCO [EN010154/APP/3.1]**. A **Biodiversity Net Gain Report [EN010154/APP/7.12]**, has been prepared to inform the ES and submitted as part of the DCO application. The Applicant has committed to deliver a minimum of 30% biodiversity net gain in habitat units, 50% biodiversity net gain in hedgerow units and 10% biodiversity net gain in watercourse units using DEFRA's Statutory Biodiversity Metric (SBM) (Version 1.0.4) for the Proposed Development.

3.4.55 A **Framework LEMP [EN010154/APP/7.15]** has been prepared to support the DCO application. This document sets out the principles for how the land will be managed throughout the operational phase, following the completion of construction. The detailed LEMP will be produced following the granting of the DCO and prior to the start of construction and will be secured as a Requirement attached to the DCO.

3.5 Operational Activities

3.5.1 During the operational phase, activity on the Principal Site will be limited and would be restricted principally to vegetation management, equipment maintenance and servicing, periodic replacement of components, periodic fence inspection, and monitoring to ensure the continued effective operation of the Proposed Development. It is anticipated that maintenance and servicing would include the inspection and, if required, renewal and removal, reconstruction, refurbishment or replacement of faulty or broken equipment, but not the removal, reconstruction or replacement of Work No. 1 (as defined in Schedule 1 of the **Draft DCO [EN010154/APP/3.1]** at the same time. If full panel and BESS replacement is required at some point during the lifetime of the Proposed Development, activity would be phased and would therefore be considerably less intensive than during construction and is anticipated to generate approximately 40% of the HGV activity and approximately 10% of

[1] The purpose of the community orchard is for use by local residents and the community to enable open access to the area, enjoyment of the space and to allow residents and the community to pick fruit from the trees grown within this orchard.

the daily car/LGV movements estimated to be generated during peak construction of the Proposed Development. Further discussion on operational transport movements is presented in **Chapter 13: Traffic and Transport** of this ES **[EN010154/APP/6.1]**.

3.5.2 With regards to operational jobs, as set out in **Chapter 12: Socio-Economics and Land Use [EN010154/APP/6.1]**, it has been confirmed by all landowners that there is expected to be no job losses resulting from the removal of agricultural land. It is expected that when the rent revenues from the land start, there will be additional jobs created on their farms offsite as landowners diversify their land further with the underlying financial stability of the rental income.

3.5.3 **Table 3-11** summarises the indicative design life of the key equipment of the Principal Site. **Chapter 14: Other Environmental Topics** of this ES **[EN010154/APP/6.1]** includes an assessment of the likely impact of component replacement (e.g. panels, batteries) and outlines the measures that will be put in place to ensure that these components are able to be diverted from the waste chain.

Table 3-11: Indicative Design Life of the Key Equipment of the Proposed Development

Equipment	Indicative design life
Solar PV panels	25–40 years
Inverters	15–20 years
Transformers	30-40 years
Batteries	10–15 years
Onsite Substation equipment	30-40 years

3.5.4 During operation, some of the construction access points will continue to be used in addition to the dedicated operational accesses. Furthermore, there will be three separate accesses for emergency services. Access proposals are shown in **Figure 3-1**, **Figure 3-2A** and **Figure 3-2B [EN010154/APP/6.2]**, the **Streets, Rights of Way and Access Plans [EN010154/APP/2.3]**, and further described in **Appendix 13-E: Access Appraisal Report [EN010154/APP/6.3]**.

3.5.5 Fire suppression water at the BESS will be provided from water storage tanks onsite. The **FBSMP [EN010154/APP/7.17]** further describes the management of firefighting water.

3.5.6 During the operational phase, the Proposed Development will be serviced by a nominal number of staff (up to four permanent staff per day), predominantly undertaking day-to-day maintenance tasks. In addition, there is expected to be around two visitors per week. Staff vehicles and those used for maintenance will primarily be four wheeled drive vehicles and vans, with HGVs rarely accessing the DCO Site during the majority of the operational phase.

3.5.7 Furthermore, it is anticipated there will be additional staff attending the Principal Site when required for maintenance, the replacement of solar infrastructure, and cleaning; up to a total of 20 staff per day (in addition to the four permanent staff undertaking day-to-day maintenance). It is anticipated that this would be infrequently throughout the operational life of the Proposed Development, with the frequency of maintenance activities undertaken likely ranging from monthly to annually in line with operation and maintenance best practice guidelines (Ref 3-11). When maintenance and equipment replacement activities are required, they are expected to generate in the order of 20 HGV deliveries (or 40 two-way HGV movements) per day and up to 20 staff car trips (40 two-way movements) per day. It is not anticipated that any AILs will be required during operation.

3.5.8 The operational life of the Proposed Development will be 60 years from the point of commissioning of the entirety of the Proposed Development.

3.5.9 A **Framework Operational Environmental Management Plan (OEMP)** has been produced as part of the DCO application **[EN010154/APP/7.8]** to demonstrate how any mitigation and management measures will be implemented. It also sets out the monitoring and auditing activities designed to ensure that such mitigation measures are carried out, and that they are effective. In addition, landscaping will be managed in accordance with the **Framework LEMP [EN010154/APP/7.15]**. Operational safety risks will be managed in accordance with the **FBSMP [EN010154/APP/7.17]**. These plans will be secured by a requirement attached to the DCO.

Cleaning of Panels

3.5.10 In the UK climate solar panels are largely self-cleaning and deterioration in PV system output due to dust or dirt is generally low. The requirement for, and the frequency of, cleaning of the solar PV panels due to the build-up of dust and dirt varies depending upon site specific conditions.

3.5.11 The cleaning requirements for the Proposed Development can only be accurately determined once operational, therefore, to present a worst case for the assessments presented in this ES, a two-year cleaning cycle is assumed.

3.5.12 This ES assumes that a tractor mounted system (currently the system typically used on UK solar farms) will be used. This also allows the water usage to be determined based on current schemes using this technology (**Chapter 9: Water Environment [EN010154/APP/6.1]**).

3.5.13 A tractor mounted cleaning system uses a rotating ‘car-wash’ type brush. It is anticipated that water would be brought to the DCO Site in 1m^3 (one tonne/1,000 litres (l)) intermediate bulk containers (IBCs). Individual IBCs would be mounted on the rear of the tractor to provide water supply during cleaning. Based upon cleaning water usage on similar schemes it is estimated that the cleaning of each panel will require 250 millilitres (ml) of water and that, assuming cleaning of all panels is required, the total volume of cleaning water per cleaning cycle would be 200,000 litres (200m^3).

3.5.14 Panels would be cleaned when they are cool, as applying cold water to warm panels can lead to thermal shock and the risk of micro-cracks to the panel surface. As the use of cleaning products (chemicals) can damage panels and void manufacturer's warranties, no cleaning products would be used, only water. If required, a water softener would be added to prevent wash-residue forming on the panels, this would be biodegradable and would have no impact to the environment. Panels would be cleaned on two yearly cycles (once every 24 months) as a worst case (although the period between cleaning can be much longer).

3.5.15 Dry-cleaning would not be employed as the action of the dry brush and any dust present on the panel surface would likely result in the formation of micro-scratches. Such scratches would likely attract/harbour more dirt on the panel surface decreasing efficiency and also potentially voiding manufacturer's warranties.

Grazing

3.5.16 Grazing by sheep is the Applicant's preferred option for the management of the grassland created within the Solar PV Array Areas of the Principal Site. This option is therefore being explored and there are no known landowner restrictive covenants or other reasons that would prevent such use. Should grazing not be possible in some or all areas of the Solar PV Array Areas, grassland will instead be mowed.

3.5.17 Sheep grazing on solar PV facilities is successfully used in the UK and carries with it multiple benefits such as soil health improvement and biodiversity enhancement. Sheep can move safely between and under the PV panels, and shelter under the PV panels from sun or rain.

3.5.18 As grazing achieves an essential maintenance function (maintaining the grass at a low level) without the need for/cost of machinery, it is possible for solar farms to use less agriculturally productive breeds (such as heritage breeds) and to graze at a lower density than might be required if the sole aim of grazing was a high level of agricultural productivity/revenue.

3.5.19 The grazing flock would be of a suitable density for the land available, rotated as required to ensure that no areas were overgrazed and that the land being currently grazed was sufficiently dry to support them thereby avoiding potential damage to soil structure.

3.6 Decommissioning

Design Life and Decommissioning Activities

3.6.1 The operational life of the Proposed Development is 60 years with decommissioning to start 60 years after commercial operation date; the operational life of the Proposed Development is currently anticipated to be 2033 to 2093. Decommissioning is expected to take between 12 and 24 months and would be undertaken in phases.

3.6.2 When the operational phase ends, the Principal Site will require decommissioning. All PV panels, Onsite Substation, mounting structures, inverters, transformers and BESS would be removed and recycled or disposed of in accordance with good practice and market conditions at the time. Buried cables would either be removed or left in situ. The current practice is to remove cables (leaving the ducting in place) and recycle the metals within them.

3.6.3 The majority of the Principal Site would be returned to the landowner after decommissioning and will be available for its original use. Areas of landscape and biodiversity mitigation and enhancement, as well as permissive paths delivered as part of the Proposed Development, would remain up until the land is returned to the previous landowners. Following this, the landowners would choose how the land is to be used and managed.

3.6.4 The drainage of the land within the Principal Site will be checked after decommissioning. Should any agricultural drains be altered or removed, they will be restored such that agricultural activities could continue after decommissioning of the Proposed Development.

3.6.5 A **Framework Decommissioning Environmental Management Plan (DEMP) [EN010154/APP/7.9]** has been prepared and submitted with the DCO application. This Framework DEMP sets out the general principles to be followed in the decommissioning of the Proposed Development, including demonstrating how the mitigation measures will be implemented and outlining the monitoring and auditing activities designed to ensure that such mitigation measures are carried out, and that they are effective. A detailed DEMP will be prepared and agreed with the relevant authorities at that time of decommissioning, in advance of the commencement of decommissioning works, and would include timescales and transportation methods.

3.6.6 The effects of decommissioning are often similar to, or of a lesser magnitude, than construction effects, and are considered in **Chapters 6** to **14** of this ES **[EN010154/APP/6.1]**. The specific method of decommissioning the Proposed Development at the end of its operational life is uncertain at present as the engineering approaches to decommissioning will evolve over the operational life of the Proposed Development.

Waste

3.6.7 The wastes generated at decommissioning will primarily be the electrical components of the Principal Site, the solar PV frames, and fencing. Wastes will be managed, recycled or disposed of in accordance with the relevant legislation and guidance at the time. Current UK-based recycling technology allows for 90% of the glass and 95% of the semiconductor materials to be extracted from waste solar PV panels for use in new solar PV panels. Wastes will be safely and securely stored at all times. At the time of writing there are three UK solar recycling facilities, and it is expected that these will expand over the next six decades ahead of the decommissioning of the Proposed Development.

3.6.8 Removal of waste is estimated to require approximately 1,300 HGV loads over a period of 12 months, which equates to an average of eight HGV loads per day.

3.6.9 At this time, it is not possible to identify either the waste management routes or specific facilities that would be used, as these are liable to change over such a timescale. The waste types generated, and effects of decommissioning are likely to be similar or of a lesser magnitude than the construction effects.

3.6.10 All management of waste will be in accordance with the relevant regulations and waste will be transported by licensed waste hauliers to waste management sites which hold the necessary regulatory authorisation and/or permits for those wastes consigned to them.

3.6.11 The removal of waste from the Proposed Development has been assessed within **Chapter 13: Traffic and Transport** and **Chapter 14: Other Environmental Topics** of this ES **[EN010154/APP/6.1]**.

Solar PV Array Areas

3.6.12 It is anticipated that some areas of habitat and biodiversity mitigation and enhancement within the Solar PV Array Areas may be left in-situ given they could contain protected species and so relevant licences at the time would need to be obtained for any changes.

3.6.13 It is anticipated, however, that the majority of the Solar PV Array Areas will be returned to their original use and condition after decommissioning. This would include the removal of hard standing and reinstatement of the soil profile in areas where topsoil was removed. Application of measures set out in Defra's code of practice (Ref 3-10) will ensure that the restored soils are appropriately managed allowing their quality and function to be retained upon reinstatement and that any agricultural land is restored to the same quality (ALC grade) as prior to construction. The undisturbed soils within the Solar PV Array Areas will have been removed from intensive agriculture for a long period and are expected to have achieved improvements in soil structure and carbon sequestration over that time.

Cables

3.6.14 The mode of cable decommissioning for the Grid Connection and Interconnecting Cables will be dependent upon government policy and best practice at that time. Currently, the most environmentally acceptable option is sometimes considered to be leaving the cables in situ, as this avoids disturbance to overlying land and habitats and to neighbouring communities; developers therefore currently install cables in plastic ducting so that they can be pulled back through the ducting at the end of the project and recycled (leaving the ducting in place). Alternatively, the ducting or cables can be removed by opening up the ground at regular intervals and pulling the cable through to the extraction point, avoiding the need to open up the entire length of the cable route.

3.7 Proposed Navenby Substation

3.7.1 The Proposed Development will connect to the national electricity transmission network at the proposed National Grid substation near Navenby. The proposed National Grid substation near Navenby is subject to a separate planning application by the National Grid (not submitted at the time of writing the ES) and does not form part of the Proposed Development.

3.7.2 The DCO Site Boundary includes the area of land where the proposed National Grid substation near Navenby would be constructed. At the proposed Navenby substation location the Proposed Development includes minor modifications to the future substation bay to allow for connection of the 400KV Grid Connection Cable, which will come above ground within the proposed National Grid substation near Navenby.

3.8 References

Ref 3-1 Planning Inspectorate (2018). Nationally Significant Infrastructure Projects - Advice Note Nine: Rochdale Envelope. Available at: https://www.gov.uk/government/publications/nationally-significant-infrastructure-projects-advice-note-nine-rochdale-envelope/nationally-significant-infrastructure-projects-advice-note-nine-rochdale-envelope

Ref 3-2 British Standards Institute (BSI) (2017) BS EN 62271-1:2017 High-voltage switchgear and controlgear. Common specifications for alternating current switchgear and controlgear. Brussels: BSI.

Ref 3-3 Building Research Establishment (BRE) (2012) Digest 365: Soakaway Design and Sewers for Adoption (7th Edition). Watford: BRE.

Ref 3-4 HMSO (2015) Construction (Design and Management) Regulations 2015. Available at: http://www.legislation.gov.uk/uksi/2015/51/pdfs/uksi_20150051_en.pdf

Ref 3-5 HMSO (1974); Control of Pollution Act 1974. Available at: https://www.legislation.gov.uk/ukpga/1974/40/pdfs/ukpga_19740040_en.pdf.

Ref 3-6 HMSO (1995); Environment Act 1995. Available at: https://www.legislation.gov.uk/ukpga/1995/25/pdfs/ukpga_19950025_en.pdf.

Ref 3-7 HMSO (2016); The Hazardous Waste (Amendment) Regulations 2016. Available at: http://www.legislation.gov.uk/uksi/2016/336/made

Ref 3-8 HMSO (2014); Waste (England and Wales) (Amendment) Regulations 2014. Available at: https://www.legislation.gov.uk/uksi/2014/656/contents/made

Ref 3-9 Lincolnshire County Council, "Central Lincolnshire Local Plan 2012-2036," Lincolnshire County Council, Lincoln, 2017.

Ref 3-10 DEFRA (2009) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/716510/pb13298-code-of-practice-090910.pdf

Ref 3-11 Solar Power Europe (2021) Operation and Maintenance: Best Practice Guidelines (Version 5). Available at: https://www.solarpowereurope.org/insights/thematic-reports/o-and-m-best-practice-guidelines-version-5-0