East Pye Solar

Environmental Statement

Volume 1: Chapter 4 – The Scheme

Revision 2

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APFP Regulation 5(2)(a)

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Schedule of Changes

Reference	Page	Description of Changes	Reason for Revision
Environmental Statement Volume 1, Chapter 4 – The Scheme **Revision 2**	2	Amended to confirm that the BESS will be located within the BESS Site	In response to BEPS-PDA-009
	8, 9, 10, 11, 12, 13	Amendments to Table 4.1	In response to Issue Specific Hearing 1 action point 14, and for consistency with the Design Principles, Parameters, and Commitments.
	13, 18, 24, 25	Additional references to Appendix 4.1 Illustrative Technical Information	In response to Issue Specific Hearing 1 action points 10, 13, and 22, and ExAQ1 Q.1.2.4.
	25	Additional detail regarding link boxes	In response to ExAQ1 Q.1.2.4.
	42	Clarification on Laydown Areas / Construction Compounds	In response to the Examining Authority's written question Q1.2.8

4 The Scheme

4.1 Introduction

4.1.1 This chapter of the Environmental Statement (ES) provides a description of the physical characteristics of the Scheme and the activities that would be undertaken during the construction, operation and maintenance, and decommissioning phases. The description contained within this chapter informs each of the technical assessments within **ES: Chapter 6 to Chapter 18 [EN0110014/APP/6.1.6 to 6.1.18]**.

4.1.2 This chapter is supported by the following figures in **ES Volume 2**:

- **Figure 4.1: Indicative Masterplan [EN0110014/APP/6.2.4.1];** and
- **Figure 4.2: Indicative Temporary Construction Compound Locations [EN0110014/APP/6.2.4.2].**
- **Figure 4.3: Key Construction Phase Features [EN0110014/APP/6.2.4.3]**

4.1.3 This chapter should be read alongside the following Development Consent Order (DCO) plans:

- **Location Plan [EN0110014/APP/2.1];**
- **Land Plans [EN0110014/APP/2.2];**
- **Works Plan [EN0110014/APP/2.3];**
- **Streets Plan [EN0110014/APP/2.6];** and
- **Access and Public Rights of Way Plan [EN0110014/APP/2.7].**

4.2 Description of the Scheme

The Scheme

4.2.1 The Scheme comprises the construction, operation and maintenance, and decommissioning of a solar photovoltaic (PV) electricity generating station with a total capacity exceeding 100 megawatts (MW) and associated development including a Battery Energy Storage System (BESS), up to three 132 kV Project Substations and up to three 400kV Project Substations, Grid Connection Infrastructure and a new National Grid Substation.

4.2.2 The Solar PV electricity generating stations are located across Sites 1, 2, 3, 4, 5, 7, 8, 9 and 10 of the Scheme. Site 6 does not contain an electricity

generation station, instead being retained for habitat management (**ES: Figure 4.1 Indicative Masterplan [EN0110014/APP/6.2.4.1]**).

4.2.3 Cable Route Corridors 1-14 are the areas in which export connection cables would be located to connect the Sites to the new National Grid Substation.

4.2.4 Highway Works are sections of the highway network that will contain localised improvements, such as improvements to deteriorated road edges or temporary highway and traffic works required to safely accommodate the Abnormal Indivisible Load (AIL) deliveries to construct the Scheme (**ES: Figure 4.1 Indicative Masterplan [EN0110014/APP/6.2.4.1]**). These areas will support the movement of construction vehicles on narrower sections of the local highway networks within parts of the construction vehicle routes to the Order Limits (**ES: Chapter 11 Transport and Access [EN0110014/APP/6.1.11]**).

Work Areas

4.2.5 The Scheme is described in Schedule 1 of the **draft DCO [EN0110013/APP/3.1]**, where the 'authorised development' is divided into Works Areas. The work numbers for those areas are summarised below and referred to throughout this chapter. Note that the work package areas can and do overlap.

Work No.1

4.2.6 A ground mounted solar photovoltaic generating station with a gross electrical output capacity of over 100 megawatts including:

- Solar modules fitted to mounting structures;
- DC electrical cabling and combiner DC boxes;
- 33 KV sub-distribution switch rooms, conversion units including inverters, transformers, switchgear, and monitoring and control systems; and
- Electrical and communications cabling connecting work no. 1(c) to work nos. 3a and 3b.

Work No.2

4.2.7 The energy storage facility comprising the BESS compound contained within the BESS Site , including access.

Work No.3

4.2.8 Works in connection with 132 kV and 400 kV Substations comprising:

- Work No. 3A – up to three substations up to 400 kV; and
- Work No. 3B – up to three substations up to 132 kV.

Work No.4

4.2.9 Works in connection with the new National Grid Substation including:

- Work No. 4A – a new National Grid Substation;
- Work No. 4B – landscaping, a sustainable drainage system and biodiversity mitigation and enhancement measures including planting; and
- Work No. 4C – temporary construction compound and access.

Work No. 5

4.2.10 Works relating to Grid Connection Infrastructure associated with the existing overhead transmission line including:

- Work No. 5A – works to modify, reconfigure, construct and install a new overhead transmission electric line;
- Work No. 5B – landscaping and biodiversity mitigation and enhancement measures including planting;
- Work No. 5C – works in relation to the existing overhead transmission electric line including the realignment of existing gantries, the modification of existing pylons and temporary construction compounds; and
- Work No. 5D – dismantling, modifying and removal of existing overhead transmission electric line and pylons including foundations.

Work No. 6

4.2.11 Works associated with laying electrical cables up to 132 kV and 400 kV including access, temporary construction and decommissioning areas, tunnelling and supporting cabling infrastructure.

Work No.7

4.2.12 Works including fencing, security and monitoring measures, landscaping and biodiversity mitigation, access and footpath diversions, earthworks, sustainable drainage systems (SuDS), acoustic barriers, electricity and telecommunication connections and construction and decommissioning laydown areas.

Works No. 8

4.2.13 Temporary construction and decommissioning laydown areas.

Work No. 9

4.2.14 Works to facilitate access including creation of access from the public highway, temporary alteration of streets and highways and offsite works adjacent to highways land.

Work No. 10

4.2.15 Works to create and maintain habitat management areas.

Work No. 11

4.2.16 Creation of permissive paths.

Associated Development

4.2.17 The Scheme includes associated development in connection with Work No. 1 to No. 11 including fencing, gates, boundary treatment and other means of enclosure; bunds; embankment; trenching and swales; irrigation systems; drainage systems; services and utilities connections; means of access; security and monitoring measures; improvement, maintenance and use of existing private tracks; landscaping and related works; habitat creation and enhancement; site establishment and preparation works; earthworks and excavations; works for the protection of buildings and land; tunnelling, boring and drilling works; and other works to mitigate any likely significant adverse effects from the construction, operation and maintenance, or decommissioning phases of the Scheme.

The Rochdale Envelope

4.2.18 The design of the Scheme is an iterative process based on environmental assessment and consultation with statutory and non-statutory consultees. **ES: Chapter 5 Reasonable Alternatives and Design Evolution [EN0110014/APP/6.1.5]** describes this process further, including options that have been considered and discounted or amendments made to the Scheme design to date. The design of the Scheme has been developed within the framework provided by the **Design Principles, Parameters and Commitments [EN0110014/APP/7.18]**. The **Design Approach Document [EN0110014/APP/7.17]** describes the design evolution of the Scheme within this framework.

4.2.19 The EIA presented within this ES has been undertaken adopting the principles set out in the Planning Inspectorate's Advice Note Nine: Rochdale Envelope (Ref 4-1) which provides guidance regarding the degree of flexibility that may be considered appropriate within an application for development consent under the Planning Act 2008 (Ref 4-9). The advice note acknowledges there may be aspects of the Scheme design that are not yet fixed and, therefore, it may be necessary for the EIA to assess likely worst-case variations to ensure all foreseeable significant environmental effects of the Scheme are considered.

4.2.20 Aspects of the Scheme that require design flexibility include, but are not limited to, the arrangement of the:

- Solar PV Panels and panel type/specification;
- Conversion Units/33 kV Sub-distribution Switch Rooms;
- Associated Development such as the BESS Compound, 132 kV Substations, 400 kV Substations and new National Grid Substation; and
- Grid Connection Infrastructure.

4.2.21 It is necessary that there will be some flexibility built into the design of the Scheme when submitting the DCO Application so that the detailed design of the Scheme can be informed by technical considerations, post-consent work, and take advantage of innovations in technology. This is of particular importance in order to maintain flexibility due to the rapid pace of change in Solar PV and BESS technology, whilst maintaining a robust and comprehensive assessment of potential effects.

4.2.22 The technical assessments, therefore, asses an 'envelope' within which the works would take place (the Rochdale Envelope). As such, the DCO Application and EIA are based on maximum and where relevant, minimum parameters. These parameters are considered in detail by the technical authors as part of the EIA to ensure the realistic worst-case effects of the Scheme are assessed for each potential receptor. The Scheme parameters are set out in tabular form below and can be read alongside the **ES: Figure 4.1 Indicative Masterplan [EN0110014/APP/6.2.4.1]** which sets out the indicative spatial extent of the Scheme components. How the Rochdale Envelope has been considered within each of the technical studies is set out in **ES: Chapter 2 EIA Methodology [EN0110014/APP/6.1.2]** with further details given within each of the technical chapters where relevant **ES: Chapter 6 to Chapter 18 [EN0110014/APP/6.1.6 to 6.1.18].**

Scheme Parameters

4.2.23 Table 4.1 sets out the parameters that have been assessed within this ES. Each Scheme component is described in more detail within Section 4.3. Each technical chapter has assessed the design identified to be the likely worst-case scenario for that discipline in order to determine effect significance. Where necessary and appropriate, the technical chapters also set out mitigation measures that would be implemented as part of the Scheme.

4.2.24 In addition to Table 4.1, design parameters are also detailed in the **Design Principles, Parameters and Commitments [EN0110014/APP/7.18]** document submitted in support of the DCO Application. This document provides the principles and maximum parameters for the detailed design of the Scheme and is secured by requirement in the **draft DCO [EN0110013/APP/3.1]**. When the detailed design for the Scheme is

submitted for approval to the relevant planning authorities, those details must accord with the **Design Principles, Parameters and Commitments [EN0110014/APP/7.18]**. This ensures that the environmental effects of the detailed design would be the same as or no worse than those assessed and report in the ES.

Table 4.1: Scheme Parameters Used for the Environmental Statement

Scheme Component	Parameter Type	Maximum Design Parameter
Solar PV Arrays		
Option A: Single-Axis Tracker Panels (Tracker Panels)	Maximum Height of solar panels above ground level (AGL)	Maximum height at greatest inclination: 4.5m. Maximum height at horizontal alignment: 2.5m.
	Minimum height of lowest part of solar panel above the ground	Minimum height/clearance above ground level (at greatest inclination): 0.4m.
	Indicative orientation	The Single Axis Tracker panels will be aligned in north south rows, and incline to the east or west up to a maximum inclination of 60 degrees from horizontal.
	PV mounting structure	Anodised aluminium alloy or galvanised steel structures secured via piled mounting structure up to 4m below ground level. Alternatively, in areas of archaeological protection concrete feet or other non-ground penetrative techniques will be used to secure the Mounting Structures. All electrical infrastructure associated with the panels (excluding cabling) will be elevated by the Mounting Structures so that it is no less than 300mm above the 1 in 100 (1%) Annual Exceedance Probability (AEP) flood level; or, where this is not possible, as high as practicable.
	Solar Panel Type	The Solar PV Panel technology will be bifacial panels. The Solar PV Modules will be a dark colour, for example, either black or dark blue. All Solar PV Panels will be per-and polyfluoroalkyl substances (PFAS) free.
	Separation distance between rows	Minimum separation distance between solar modules of 2.5m. Maximum 15m between solar module centrelines.
Option B Fixed South Facing PV Arrays (Fixed Panels)	Height of all panels (maximum above ground level)	Maximum height of solar module: 3.5m.
	Minimum height of lowest part of the solar panel above the ground:	Minimum height/clearance above ground level: 0.4m.
	Indicative Orientation	The Fixed panels will be aligned in east west rows, and slope towards the south at a fixed slope of 10 to 35 degrees from horizontal.
	PV mounting structure	Anodised aluminium alloy or galvanised steel structures secured via piled mounting structure up to 4m below ground level. Alternatively, in areas of archaeological protection concrete feet or other non-ground penetrative techniques will be used to secure the Mounting Structures. All electrical infrastructure associated with the panels (excluding cabling) will be elevated by the Mounting Structures so that it is no less than 300mm above the 1

Scheme Component	Parameter Type	Maximum Design Parameter
		in 100 (1%) Annual Exceedance Probability (AEP) flood level; or, where this is not possible, as high as practicable.
	Solar Panel Type	The Solar PV Panel technology will be bifacial panels. The Solar PV Modules will be a dark colour, for example, either black or dark blue. All Solar PV Panels will be per-and polyfluoroalkyl substances (PFAS) free.
	Separation distance between rows	Minimum of 2.5m between rows of tracking panels. Maximum 14m between solar module centrelines.
Fencing and Security	Perimeter fencing	Deer fencing with a 2.5m maximum height.
	CCTV	CCTV camera poles with a maximum height of 3m.
Standalone Conversion Units		
Standalone Conversion Units (comprising inverters, transformer and switchgear)	Maximum dimensions	The maximum parameters of an Inverter will be 9m in length by 6.5m in width and 3.5m in height. The maximum parameters of a Transformer will be 6.5m in length by 5.5m in width and 3.5m in height. The maximum parameters of a Switchgear will be 6.5m in length by 2.5m in width and 3.5m in height. A concrete foundation slab, strips or footings for each of the conversion units and a levelling layer of aggregate with a maximum depth of 1m or a concrete plinth set atop the topsoil where non-ground-penetrative works are necessary.
Integrated Conversion Units/33 kV Sub-distribution Switch Rooms		
Integrated Conversion Units/33 kV Sub-distribution Switch Rooms	Maximum compound area	Maximum dimensions of 18m by 5m.
	Maximum height	3.5m
	Compound perimeter	3m high palisade fencing around the compound.
Substations		
132kV Project Substations	Maximum compound area	Project Substation in Sub-Site 4B: maximum compound area up to 0.5ha. Project Substation in Sub-Site 7F: maximum compound area up to 0.75ha. Project Substation in Sub-Site 10C: maximum compound area up to 0.5ha.
	Maximum height	7m to the top of the busbars (a bar or strip of metal used to transport electric current from one location to another with minimal energy loss).

Scheme Component	Parameter Type	Maximum Design Parameter
	Relay and Control Rooms – maximum dimensions	Maximum dimensions of 7m by 19m and maximum height of 4.2m.
400kV Project Substation in BESS Site	Compound perimeter	3m high palisade fencing around the compound and 2.5m high deer-type wire mesh and wooden post fencing outside the palisade fencing.
	Access	Maximum 6m wide, constructed of hardcore or gravel over a levelling layer of substrate.
	Relay and Control Room – maximum dimensions	Maximum dimensions of 7m by 19m and maximum height of 4.2m.
	33Kv Switch Room	Maximum dimensions of 7m by 19m and maximum height of 4.2m.
	Foundations	Onsite infrastructure will be mounted on a concrete base or monolith plinth to a maximum depth of 1m. If a piling solution is required, piles to a maximum depth of 12m would be used.
	Maximum compound area	3ha
	Maximum height	13m to the top of the busbars.
400kV Project Substation in Sub-Site 5A	Compound perimeter	3m high palisade fencing around the compound and 2.5m high deer-type wire mesh and wooden post fencing outside of the palisade fencing.
	Access	Maximum 6m wide, constructed of hardcore or gravel over a levelling layer of substrate.
	Relay and Control Room – maximum dimensions	Maximum dimensions of 7m by 19m and maximum height of 4.2m.
	33Kv Switch Room	Maximum dimensions of 7m by 19m and maximum height of 4.2m.
	Foundations	Onsite infrastructure will be mounted on a concrete base or monolith plinth to a maximum depth of 1m. If a piling solution is required, piles to a maximum depth of 12m would be used.
	Maximum compound area	3.5ha
	Maximum height	13m to the top of the busbars.
400kV Project Substation in Sub-Site 1B	Compound perimeter	3m high palisade fencing around the compound and 2.5m high deer-type wire mesh and wooden post fencing outside of the palisade fencing.
	Access	Maximum 6m wide, constructed of hardcore or gravel over a levelling layer of substrate.

Scheme Component	Parameter Type	Maximum Design Parameter
	Relay and Control Room – maximum dimensions	Maximum dimensions of 7m by 19m and maximum height of 4.2m.
	33Kv Switch Room	Maximum dimensions of 7m by 19m and maximum height of 4.2m.
	Maximum compound area	1.1 ha
	Maximum height	13m to the top of the busbars.
National Grid Substation	Compound perimeter	3m high palisade fencing around the compound.
	Access track	Maximum 8m wide.
	Relay and control Rooms – maximum dimensions	Maximum dimensions of 7m by 19m and maximum height of 4.2m.
	Foundations	Depending on ground conditions, either a raft foundation or piles to a maximum depth of 12m below ground level with a 1m pile cap.
	Maximum compound area	6 ha
	Maximum height	15m to the top of the busbars.
Electricity Pylons	Number	Up to four new pylons (of which three would be associated with the repositioning of existing pylons and up to 1 new pylon).
	Height	Up to 61m above ground level.
Battery Energy Storage System		
BESS	BESS Enclosure dimensions	Up to a maximum height of 3.5m.
	Maximum compound area	6.5 ha
	Compound perimeter	3m high palisade fencing around the compound. CCTV cameras to be installed, with the exact numbers to be confirmed.
	BESS Control building dimensions	The BESS Control Building will be up to a maximum 6m in length, 2.5m in width and maximum heights of 3.5m.
	Access	Access required for permanent operation and maintenance access will be a minimum of 4.5m in width up to a maximum of 6m in width. The maximum width of BESS access will be 8m at passing places.
	Foundations	The foundations for the BESS enclosures will either be a reinforced concrete base to a maximum depth of 1m, or, if a piling solution is required, piles to a maximum depth of 12m below ground level with a 1m pile cap.
	Surfacing	The BESS compound surfacing will include a levelled platform where the BESS equipment will be placed on. Each unit will sit on a concrete base.

Scheme Component	Parameter Type	Maximum Design Parameter
Electrical Cabling		
Electrical Cabling	Electrical Cabling (up to 400kV) Trenches	Maximum width of trenches: 7m (except at joint bays (see parameters for joint bays) or approach to trenchless crossing sections). Maximum depth of trenches: 2m (except where required for crossings of existing buried utilities or apparatus). Minimum cable depth of 1.2m below ground level (where unconstrained by an obstacle) where fields returned to agricultural use. Maximum trench depth below existing buried utilities or apparatus: 2m below existing apparatus. Construction working width of 25m, demarcated by temporary (heras style) fencing, where required. This will be widened in places to accommodate required operations (such as the crossing of watercourses, roads, utilities etc.) and narrowed in others, for example, to minimise impacts on hedgerows, trees and ponds.
	Electrical Cabling (up to 400kV) Trenchless	Individual trenchless bores with a maximum diameter of 1m. Individual trenchless bores with a maximum depth of 12m below ground level, dependent on ground conditions and/or Asset Owner requirements. Minimum cable depth beneath main rivers of 5m below the surveyed bed of main rivers.
	Electrical Cabling (up to 132kV) Trenches	Maximum width of trenches: 7m (except at joint bays (see parameters for joint bays) or approach to trenchless crossing sections). Maximum depth of trenches: 2m (except where required for crossings of existing buried utilities or apparatus). Minimum cable depth of 1.2m below ground level (where unconstrained by an obstacle) where fields returned to agricultural use. Maximum trench depth below existing buried utilities or apparatus: 2m below existing apparatus. Construction working width of 25m, demarcated by temporary (heras style) fencing, where required. This will be widened in places to accommodate required operations (such as the crossing of watercourses, roads, utilities etc.) and narrowed in others, for example, to minimise impacts on hedgerows, trees and ponds.
	Electrical Cabling (up to 132kV) Trenchless	Individual trenchless bores with a maximum diameter of 1m.

Scheme Component	Parameter Type	Maximum Design Parameter
		Individual trenchless bores with a maximum depth of 12m below ground level (except if peat encountered). Minimum cable depth beneath main rivers of 5m below the surveyed bed of main rivers.
	Low voltage (DC electrical cables, communication cables and low voltage AC cables) cable trench dimensions	Maximum width of trenches: 1.6m. Maximum depth of trenches: 1.2m.
	Interconnecting cable (high voltage cables between 33kV and 400kV) trench dimensions	Maximum width of trenches: 7m. Maximum depth of trenches: 2m.
	HDD Drilling Pits	Maximum dimensions of directional drilling pit will be 25m by 25m. Maximum height of equipment and structures of directional drilling pit: 6m. Both launch and reception pits will be a minimum distance of 10m from the bank of main rivers, watercourse or ditch (including IDB drains), 10m from hedgerows, 15m of individual trees and groups of trees and 30m from County Wildlife Sites.
	Joint Bays	Joint bays will link sections of underground cables. These will be a minimum of 250m to a maximum of 500m apart. The dimensions of these will be determined by how many electrical circuits will be in the joint bay. A joint bay would be up to 20m long and up to 7m wide and 3m deep.
	Link Boxes	Link boxes, where required, will be to a minimum depth of 1.2m below ground level. Where manhole covers are required, these will be up to 0.2m above ground. Access, if required, would be via a manhole cover, which would measure up to 2m by 2m.

4.3 Components of the Scheme

4.3.1 Table 4.1 above describes the design parameters of the Scheme. Further detail of the role and function of the Scheme components are presented below.

Solar PV Infrastructure (Work No.1)

Panels

4.3.2 The Solar PV Panels will convert sunlight/daylight into electrical current. They are made up of a series of photovoltaic cells beneath a layer of toughened glass. Other PV technology is developing rapidly and may be available at the time of construction. The Scheme will utilise bifacial panels, which have PV cells and toughened glass on both the upper and lower surface, allowing sunlight to be converted to electricity on both sides of the panel.

4.3.3 Each Solar PV Panel will have a direct current (DC) generating capacity which will be converted to AC. As detailed below, Inverters are required to convert the DC electricity generated by the Solar PV Panels to AC.

4.3.4 The Solar PV Panels will be attached to mounting structures, which form PV tables arranged in rows. Collectively, these are referred to as Solar PV Arrays. There are currently two options for the mounting structures which are being considered, as described below.

4.3.5 Various factors (such as electrical design) inform the number and arrangement of PV Panels in each table. Flexibility is required to accommodate future technology developments at the detailed design stage, as referenced above.

4.3.6 The Applicant does not propose a limit on the generating capacity of the Scheme in the DCO Application as the environmental effects associated with the Scheme are determined by the relevant design parameters and not capacity.

Mounting Structures

4.3.7 Each Solar PV Panel would be mounted on a metal rack, known as a Mounting Structure. The most common installation solution on existing UK solar farms is to drive the piles directly into the ground without the need for excavation for foundations and avoiding disturbance to the surrounding land surface (soils). This installation method, to a maximum depth of 4m (dependent on ground conditions), will be used other than in areas where archaeological protection is required, where concrete feet or other non-ground penetrative techniques will be used to secure the Mounting Structures. Illustrative details of concrete feet are provided in **ES Volume 3, Appendix 4.1 – Illustrative Technical Information [APP-117].**

4.3.8 The Scheme would utilise either Single-Axis Tracker Panels (Option A) and/or Fixed Panels (Option B).

4.3.9 For the purposes of the EIA, technical topics have assessed either Option A or Option B dependent on which option assumes a worst-case scenario.

Option A: Single-Axis Tracker Panels

4.3.10 Solar PV Panels, which are fixed to the mounting structures, will be aligned in north south rows, and incline to the east or west up to a maximum inclination of 60 degrees from horizontal. The modules would track from east to west throughout the day and would return to their resting position 60 degrees (facing east) over night. The Solar PV Panels would have a maximum height of 4.5m (shown on **Image 4.1** below).

4.3.11 The 4.5 m tracker panel maximum envelope has been sought to provide better solar generation throughout the day, across different seasons, especially in the early morning and late afternoon. This leads to improved generation efficiency, delivering more energy from the same land footprint per MW than the 3.5 m envelope and other solar technologies.

4.3.12 This height also helps reduce shading losses and makes it easier to combine the array with ecological or agricultural uses underneath.

Image 4.1: Typical Single Access Tracker Panels

Option B: Fixed South Facing PV Arrays

4.3.13 Fixed South Facing Arrays are the most common approach for ground mounted solar PV facilities in the UK to date. The Fixed panels will be aligned in east west rows, and slope towards the south at a fixed slope of 10 to 35 degrees from horizontal. An example of fixed south facing arrangement is presented in **Image 4.2** below.

4.3.14 Fixed south facing Arrays may be utilised at an individual field level where practical and/or environmental constraints prevent the use of Tracking Solar PV Tables.

Image 4.2: Fixed South Facing PV Arrays

Solar PV Mounting Structure

4.3.15 The Mounting Structures would likely be made of either anodised aluminium alloy or galvanised steel and would have a rough matt finish.

4.3.16 If archaeological protection is required, concrete feet or other non-ground penetrative techniques will be used to secure the Mounting Structures.

4.3.17 All electrical infrastructure associated with the panels (excluding cabling) will be elevated by the Mounting Structures so that it is no less than 300mm above the 1 in 100 (1%) Annual Exceedance Probability (AEP) flood level; or, where this is not possible, as high as practicable. The specific piling methodology will be informed by relevant surveys and assessment, including ground conditions and archaeological surveys.

Conversion Units / Inverters

4.3.18 Conversion Unit is a collective term used for the combination of electrical components including Inverters, Transformers and Switchgear, which are required to manage the electricity generated by the Solar PV Panels. These components may be housed ('integrated') together within a container as shown in **Image 4.3** below.

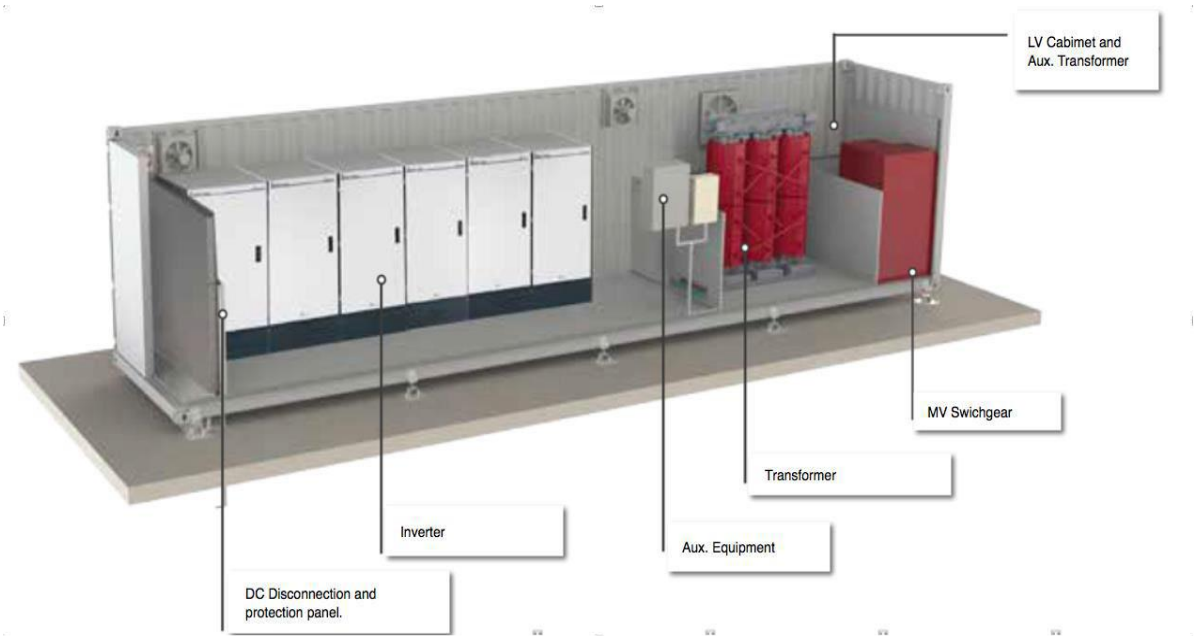


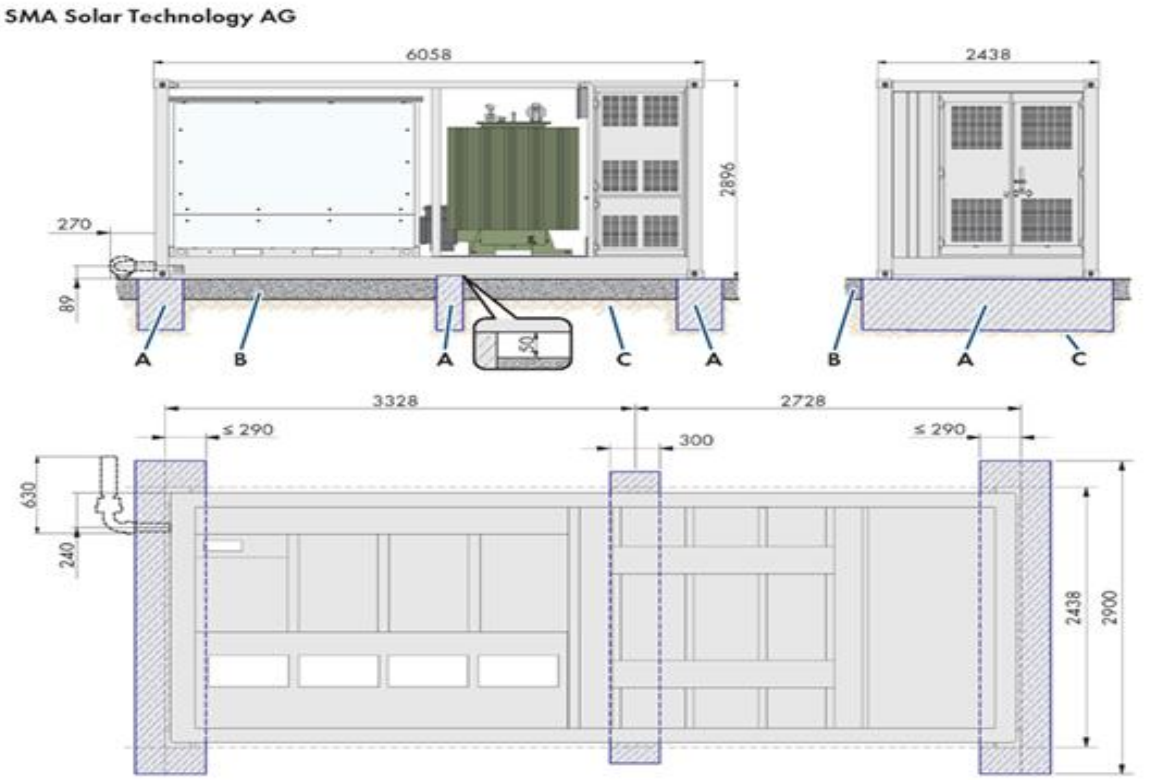
Image 4.3: Integrated Conversion Unit

4.3.19 An alternative option would be for the individual electrical components to be housed in standalone cabinets (see illustration in **Image 4.4** below). If the Conversion Unit is configured as standalone cabinets, the Conversion Unit compound would be surrounded by palisade fencing, with integrated gates for access. The compound will be levelled and covered in a layer of gravel, with the equipment mounted on a concrete base or monolith plinth.

Image 4.4: Typical Standalone Conversion Unit

4.3.20 The external finish will be in keeping with the prevailing surrounding environment. The exact colour will be subject to manufacturer specifications and agreed with the relevant planning authority prior to construction but will be carefully selected in subdued, non-reflective tones to sit as discreetly as practicable within the landscape. The configuration of equipment within the Conversion Unit compounds will depend on technical and environmental factors.

4.3.21 Inverters (typical Inverter Unit shown in **Image 4.5** below) convert DC electricity collected by the Solar PV Panels into AC electricity to allow electricity generated to be exported to the National Grid. Inverters are sized to deal with the level of voltage and intensity of the energy, which is the output from the Solar PV Arrays.



Position	Designation
A	Strip foundation
B	Pea gravel ground
C	Solid ground, e.g., gravel

Image 4.5: Typical Inverter Unit

33kV Sub-distribution Switch Rooms

4.3.22 33kV Sub-distribution Switch Rooms would be located throughout the Order Limits to collect the generated power and manage its delivery to the substations. The 33kV Sub-distribution Switch Rooms would be similar in appearance to the Conversion Units and be contained within the same design parameters. An illustrative drawing of a Switch Room is provided in **ES Volume 3, Appendix 4.1 – Illustrative Technical Information [APP-117].**

Image 4.6: Typical Conversion Unit / 33kV Sub-distribution Switch Room

Cabling

4.3.23 Low voltage distribution cabling between Solar PV Arrays and the Conversion Units/33kV Sub-distribution Switch Rooms will typically be fixed to the mounting structure (above ground), and then underground between mounting structures and the Conversion Units/33kV Sub-distribution Switch Rooms. High voltage cables (33kv, 132kV and 400kV) are required between the Conversion Units/33kV sub-distribution Switch Rooms, 132kV Substations, BESS and the 400kV Substations (including the 400kv National Grid Substation). Additional low voltage auxiliary cabling would supply the CCTV and monitoring equipment.

4.3.24 In identified archaeologically sensitive areas, cables will be installed to avoid or minimise disturbance below ground level.

4.3.25 The dimensions of trenching for the cabling will vary subject to the voltage of the underground cabling and the associated number of ducts they contain and will be dependent on the method of installation and ground conditions.

Battery Energy Storage System (Work Package 2)

4.3.26 The BESS is proposed to be located at the BESS Site as shown on the Indicative Masterplan (refer to **ES: Figure 4.1 Indicative Masterplan**

[EN0110014/APP/6.2.4.1]) and will not exceed the maximum area defined in Table 4.1. The size and number of individual battery storage enclosures will depend upon the level of power capacity and duration of energy storage.

4.3.27 The BESS would collect energy produced by the Solar PV Panels and store the energy using battery storage technology. The BESS will be designed to provide peak generation and grid balancing services to the National Grid. The use of BESS means that that the Scheme can contribute to national electricity supplies even when there is no sunlight while, at the same time, they support the National Grid by levelling out electricity load, balancing functions in energy demand and reducing congestion on the grid. This contributes to improvements in power quality by smoothing out voltage fluctuations.

4.3.28 The BESS is likely to comprise batteries which would be housed in enclosures mounted on a reinforced concrete foundation slab or concrete piling. The battery enclosures will be separated from each other and surrounding infrastructure by a minimum distance that complies with any relevant National Fire Chief's Council (NFCC) and / or the National Fire Protection Association (NFPA) guidelines at the time of detailed design.

4.3.29 The BESS will require heating, ventilation and cooling systems to ensure the efficiency of the technology. These features are integrated into the enclosures within which they are housed. The battery system will comprise bi-directional AC/DC inverters to control the charge of the batteries from the solar PV energy output or the charge of the batteries when drawing energy from the grid.

4.3.30 The BESS is required by The Batteries Regulation (Regulation (EU) 2023/1542) (Ref 4-3) to be safe during operation and use. The BESS will include safety systems such as thermal monitoring systems, fire and gas detection systems, and fail-safe battery liquid cooling systems.

4.3.31 The BESS compound would also include other apparatus such as water storage and/or fire suppression systems, access tracks, CCTV, hard standing and palisade fencing. A typical BESS is illustrated in **Image 4.7** below.

Image 4.7: Typical Battery and Energy Storage System

Substations (Work No. 3)

4.3.32 A substation is a part of an electrical generation, transmission and distribution system. Substations transform voltage from high to low, or low to high, or perform any of several other important functions necessary for the energy generation process. Between the generating station and consumer, electric power may flow through several substations at different voltage levels. The Scheme will utilise both 132kV and 400kV different Substations, which are outlined below.

132kV Substations

4.3.33 Up to three 132kV Substations will be located across the Order Limits to collect energy from the Solar PV Arrays and convert the energy to 132kV. An example of a 132kV Substation is shown in **Image 4.8** below. Substations comprise electrical infrastructure such as the Transformers, Switchgear and control equipment required to facilitate the export of electricity. The Transformers associated with the 132kV Substations will either be single or dual.

Image 4.8: 132/33kV Substation (Single Transformer)

400kV Substations

4.3.34 There will be up to three 400kV Project Substations located within the Order Limits (i.e. not including a new National Grid Substation). Details of each are outlined below (details in relation to the new National Grid Substation provided in the separate section below):

- Project Substation in BESS Site comprising electrical infrastructure such as the Transformers (**Image 4.9** below), Switchgear and control equipment required to facilitate the export of electricity from the Scheme to the new National Grid Substation; and
- Project Substation in Sub-Site 5A comprising electrical infrastructure such as the Transformers, Switchgear and control equipment required to facilitate the export of electricity from the Scheme to the new National Grid Substation; and
- Project Substation in Sub-Site 1B comprising electrical infrastructure such as the Transformers, Switchgear and control equipment required to facilitate the export of electricity from the Scheme to the to the new National Grid Substation.

4.3.35 These Substations will include office space and welfare facilities as well as operational monitoring and maintenance equipment.

4.3.36 The 400kV Substations will either be gas insulated switchgear substations; or air insulated switchgear substations (**Image 4.10** below).

Image 4.9: Typical 400kV Power Transformer

Image 4.10: Air Insulated Substation

Transformers

4.3.37 Transformers are required to increase and decrease the voltage of the electricity generated by the Solar PV Arrays before it reaches the Substations. A standalone transformer option may be required due to an increase in the generation of electricity needed to be converted.

Switchgears

4.3.38 Switchgears are the combination of electrical disconnect switches, fuses or circuit breakers used to control, protect and isolate electric equipment. Switchgears are used both to de-energise equipment to allow work to be done and to clear faults downstream of their location.

National Grid Substation (Work No. 4) and Grid Connection Infrastructure (Work No. 5)

4.3.39 A new National Grid Substation will be required at the Point of Connection ("PoC") (within Sub-Site 1B) to connect the 400kV Project Substation to the National Grid Substation will monitor and manage the export of electricity and will be operated by National Grid Electricity Transmission plc (NGET).

4.3.40 The National Grid Substation compound has been assumed to have a footprint of up to 6 ha. It is likely to contain Switchgear, a control building housing equipment and car parking. The National Grid Substation would be enclosed by a palisade fence in line with National Grid standards and include typical Air insulated substation equipment. The indicative zone for the National Grid Substation is shown **Figure 4.1: Indicative Masterplan [EN0110014/APP/6.2.4.1].** An illustrative drawing of the National Grid Substation is provided in **ES Volume 3, Appendix 4.1 – Illustrative Technical Information [EN0110014/APP/6.3.4.1].**

4.3.41 Grid Connection Infrastructure will be required between the National Grid Substation and the existing 400kV overhead line (Norwich Main – Bramford). An illustrative drawing of the grid connection infrastructure is provided in **ES Volume 3, Appendix 4.1 – Illustrative Technical Information [APP-117].**

4.3.42 The Scheme proposes diverting the existing dual circuit 400kV overhead line (OHL) (Work No 5) into a newly constructed double busbar substation (i.e. the National Grid Substation). The works will be delivered in carefully planned stages to maintain safety, minimise disruption, and ensure continuity of supply throughout.

4.3.43 Before any electrical work begins, up to 4 new pylons will be built along the proposed diversion route leading into the new National Grid Substation. These pylons will eventually carry the circuits away from the old alignment and into the new infrastructure. Temporary pylons may also be installed to help maintain the flow of electricity during the transition. This ES assumes one temporary pylon is required to facilitate the replacement of Tower 4YN148.

4.3.44 Where the route crosses public roads, footpaths, or rights of way, scaffolding and protective netting will be erected to ensure public safety during overhead works. Fibre optic cables will be rerouted or extended to match the new alignment.

4.3.45 The Applicant has developed a design that would divert both of the 400kV circuits along the proposed alignment of the new pylons so to allow for a double turn in of both circuits into the National Grid Substation, located within Sub-Site 1B.

4.3.46 The Applicant has developed a double circuit turn in solution as this enhances the operational efficiency and resilience of the transmission network and delivers long term maintenance benefits whilst also allowing for the decommissioning and removal of the existing section of overhead line, thereby reducing long term visual and environmental impacts on the local area.

Cable Route Corridor (CRC) (Work No 6)

4.3.47 The exact location of the Grid Connection Cables within the Cable Route Corridor will be determined at the detailed design stage. For assessment purposes, the placing of the cable anywhere within the Cable Route Corridor has been considered unless detailed otherwise. The construction working width will typically be 25 m wide and will narrow at hedgerow crossings.

4.3.48 The voltage of the cables and the number of circuits will affect the width and number of the cable trenches required. The width and spacing of the cable trenches will depend on environmental constraints, engineering requirements, or crossing third party apparatus. This includes separation distances where multiple cables are running in parallel within the same trench or within multiple trenches.

4.3.49 In terms of installation, the cables will be laid directly into the trenches, or ducting will be installed, and the cables pulled through the ducting. Where the cable route encounters obstacles such as tree root systems, the width of the cable route (both permanent and temporary) may change locally. Jointing bays (a typical jointing bay is shown in **Image 4.11** below) will be a minimum of 250m to a maximum of 500m apart. The dimensions of these are determined by how many sets of cables will be in the jointing bay. A joint bay would be approximately 20m long and 7m wide and approximately 3m deep. The base of the joint bay must be level and a concrete pad installed (approximately 150mm thick with light reinforcement) as a working surface. The sides of the excavation will be shored to prevent collapse.

4.3.50 Link boxes would be located at joint bays to help safely connect and operate the cable system. They will be to a minimum depth of 1.2m below ground level. Where manhole covers are required, these will be up to 0.2m above ground. Access, if required, would be via a manhole cover, which would measure up to 2m by 2m. An illustrative section drawing of a typical link box is shown in **ES Volume 3, Appendix 4.1 – Illustrative Technical Information [APP-117]**

Image 4.11: Typical Joint Bay

4.3.51 The base of the jointing bays will be lined with a concrete floor and sandbags will be stacked above this to support the cables where required. Excavated soil will then be backfilled on top of the installed cables.

4.3.52 Fibre communications chambers will be provided between every 500m to 2,000m and would be up to 0.2m above ground. Fibre communications chambers would be 1.5m in length, 1m wide and 1.5m deep. The appearance is provided in **Image 4.12** below.

Image 4.12: Fibre Chambers (Construction and External Appearance)

4.3.53 The cable route will need to cross a range of existing infrastructure such as roads and tracks, PRoW, existing buried/underground utilities (such as gas pipelines) and water courses. Open cut trenching will be primarily utilised for crossings. The open cut technique may require the temporary closure of PRoWs, minor roads and tracks. Temporary closures of PRoWs will be

avoided as far as possible. The management of PRoWs during construction (and the operational and decommissioning phases) will be in accordance with the **Outline Public Rights of Way and Permissive Paths Management Plan [EN0110014/APP/7.8]**.

4.3.54 There will be a need for trenchless crossings for the underground cabling at some locations within the Site, for example, to cross beneath existing buried utilities or watercourses. Trenchless crossings could be undertaken, for example, using the HDD method. These are set out in the **Outline Cable Route Construction Statement [EN0110014/APP/7.21]**.

4.3.55 HDD will require a launch pit to be excavated at the starting point for the machinery to drill from, to a 'reception pit' to be excavated at the end point where the machinery will drill to. These launch pits and reception pits will likely require an area of up to 25m by 25m. Both launch and reception pits will be a minimum distance of 10m main rivers, watercourse or ditch (including IDB drains), 10m from hedgerows, 15m of individual trees and groups of trees and 30m from County Wildlife Sites.

4.3.56 Land will be required in the CRC for access, temporary construction compounds and 'lay down' areas. The indicative locations of the temporary construction locations within the CRC are shown in **ES: Figure 4.2 Indicative Temporary Construction Compound Locations [EN0110014/APP/6.2.4.2]**.

4.3.57 Following installation of the cable route, the temporary construction compounds will be removed, and the area would be reinstated.

Green Infrastructure and Mitigation and Enhancement Areas (Works No 10)

4.3.58 The Order Limits currently comprise predominantly land in agricultural use. There are features within the Order Limits that are considered to have ecological value. As a general principle, the ongoing design process will look to retain existing features, where possible. Additionally, areas within the Order Limits that will not be developed with infrastructure will be used to provide appropriate mitigation and enhancement measures, wherever practicable.

4.3.59 The project level draft design principles for the Scheme are set out in the **Design Principles, Parameters and Commitments [EN011014/APP/7.18]** document which includes a series of environmentally led design principles, including in relation to green infrastructure, landscape and biodiversity.

4.3.60 The following ecological mitigation and enhancement measures have been considered as part of the Scheme:

- Land between and under the Solar PV Arrays sown as a diverse range of grassland mosaics, managed with limited cutting and a mix of some areas being potentially grazed and others not;

- Reinforcement of existing field boundaries, where appropriate through a combination of underplanting, new planting and/or hedge laying;
- New soft landscape planting and features to provide visual screening, break up the extent of visible infrastructure, and link existing habitats to provide enhanced green infrastructure and biodiversity opportunities;
- Creating new woodland belts and tree planting;
- Creation of areas of new habitat to accommodate species such as skylark;
- Invertebrate boxes/towers, artificial otter holt(s), and hedgehog houses; and
- Installing bird nest and bat boxes on trees located around the Order Limits to provide opportunities for a range of species recorded within the local area.

4.3.61 The Scheme will seek to increase the green infrastructure connectivity and access to the countryside, with consideration to be given to creating new permissive paths. Where practicable, PRoWs will remain open during construction, operation and decommissioning. However, there may be short periods of temporary closure or diversions to PRoW.

4.3.62 The level and type of mitigation and enhancement will be subject to further environmental surveys and assessment and design evolution.

4.3.63 Prior to the commencement of any part of the authorised development, a Landscape Ecological Management Plan (LEMP) will be prepared and submitted to and approved by the relevant planning authority. This will be secured by a requirement in Schedule 2 of the DCO and be substantially in accordance with an **Outline LEMP [EN0110014/APP/7.4]**. This will ensure the likely significant effects are minimised and that, where practicable, opportunities for connecting existing ecological and green infrastructure networks and beneficial effects are secured as part of the Scheme.

4.3.64 **Table 4.2** sets out the minimum offsets/buffers that have been embedded within the design of the Scheme (and will be kept under review as the project progresses) and are secured through the **Design Principles, Parameters and Commitments [EN0110014/APP/7.18]**, with the exception of where access tracks, perimeter fencing and/or cable routes are required to cross an existing feature:

Table 4.2: Minimum Offsets/Buffers from Existing Features

Criteria Where Buffer Applied	Buffer Size
Main river, watercourse or ditch (including IDB drains)	10m
All badger setts	30m
Hedgerows	10m

Criteria Where Buffer Applied	Buffer Size
Individual trees, groups of trees and non-Ancient Woodland	15m
Veteran and ancient trees:	15x width of tree stem diameter or 5 metres from the edge of the tree's canopy, whichever is greater
Ancient Woodland	30m
Ponds (no Great Crested Newts (GCN))	30m
Ponds (with GCN)	50m
Ancient Woodland	30m
Sites of Special Scientific Interest	30m
County Wildlife Sites	30m
Curtilage of residential properties	Minimum of 50m but case by case for residential properties.
PRoW	15m

Scheme-wide Design Components

4.3.65 Set out here are those components of the Scheme that feature across multiple Work Packages or otherwise apply across the Order Limits.

Fencing and Security

4.3.66 Perimeter fencing for the Solar PV Arrays will be a 'deer fence' consisting of wire mesh and wooden or metal posts, at a maximum height of 2.5m (shown on **Image 4.13** below). It is expected that the final location of the fencing will be finalised as part of the detailed design which would be secured through a requirement in Schedule 2 of the DCO.

Image 4.13: Typical Deer Fencing

4.3.67 The Conversion Units/33kV Sub-distribution Switch Rooms, BESS Compound, Project Substation compounds and National Grid Substation would be surrounded by palisade fencing (**Image 4.14** below), at a maximum height of 3m.

Image 4.14: Steel Palisade Fence

4.3.68 Pole-mounted, internal-facing CCTV systems will be installed around the perimeter of the Sites (illustrated on **Image 4.15** below). It is anticipated that these would be galvanised steel poles and will be externally finished to be in keeping with the prevailing surrounding environment, with a maximum height of 3m, with the exception of the National Grid Substation which has a maximum height of 4.2m.

Image 4.15: Pole-mounted Security Camera (unpainted)

Lighting

4.3.69 Lighting is not required within the Solar PV Arrays for the operational phase. The lighting of the Project Substations, National Grid Substation and BESS would be in accordance with health and safety requirements, particularly around any emergency exits where there would be lighting, similar to street lighting that operates from dusk. All lighting would seek to limit any impact on sensitive receptors through the implementation of standard good practice measures.

4.3.70 Motion sensing lighting will be implemented in the National Grid Substation, Project Substations and BESS and other critical electrical infrastructure to be used only for maintenance and security purposes.

4.3.71 Temporary on-Site lighting will be required during construction and decommissioning to enable safe working in hours of darkness, within the agreed working hours. This lighting will be suitably designed as far as reasonably practicable to not cause nuisance and would accord with good practice measures to minimise light spill and glare.

Site Access

4.3.72 Wherever practicable, existing field access will be utilised for construction access to the Site. If a suitable field access does not exist, for example, due to poor highway visibility or because of environmental sensitivities, a new access would be constructed. Access would be designed to make sure there are no loss of veteran or protected trees, however, there may be localised

removal of sections of hedgerows as required, for access and visibility splays.

4.3.73 Access points into each Site or Sub-Site will be designed to accommodate an articulated HGV for maintenance purposes. These will have a maximum length of 16.5m. Visibility splays have been included and based on the recorded speed of the vehicles on the road network (85th percentile speeds) to ensure safety. There may be some variation on visibility splays based on site specific conditions.

4.3.74 A number of deliveries within the Order Limits during the construction phase would be Abnormal Indivisible Loads (AILs). An AIL is where the vehicle exceeds 44 tonnes, the width is over 2.9 m or the length is more than 18.65 m. These are likely to include deliveries of transformers and cable drums. A separate standalone AIL assessment has been undertaken as part of the DCO application and is appended to the **Outline Construction Traffic Management Plan [EN0110014/APP/7.6]**.

Access Tracks

4.3.75 It is anticipated that on-site access routes will follow the alignment of existing agricultural tracks where practicable. New internal access tracks are a maximum of 6m wide and constructed of hardcore or gravel over a levelling layer of substrate. This will be a permeable surface allowing percolation into the substrate and ground below.

4.3.76 The movement of vehicles within the Sub-Sites will be limited to lighter vehicles where practicable, with HGVs typically making deliveries to the temporary construction compounds and laydown areas. However, HGVs may utilise some access tracks as internal haul routes.

4.3.77 During the Scheme's operational phase, vehicular movements are likely to be by small van or 4x4 type vehicle. Visits would be for maintenance and monitoring purposes. There could also be access by HGV for operations such as equipment replacement, particularly during the panel replacement phase.

4.3.78 The permanent access will be designed to accommodate HGVs allowing them to enter and exit in forward gear.

Drainage

4.3.79 **ES Chapter 9 – Water Environment [EN0110014/APP/6.1.9]** and the appended **Flood Risk Assessment (FRA) (ES Volume 2, Appendix 9.1 [EN0110014/APP/6.3.9.1])** identify how the Scheme will manage flood risk and surface water across the Order Limits so as to not increase flood risk on-site or off-site.

4.4 Construction Phase

Construction Programme

4.4.1 Subject to being granted development consent and following a final investment decision, the construction of the Scheme is anticipated to commence in 2028 for a period of approximately 24 months. On this basis, it is expected that the Scheme could be completed by the end of 2030 and energised in 2031. However, the construction period will vary depending on detailed layout design and potential environmental constraints on the timing of construction activities. Additionally, the construction period may vary across the Order Limits as larger Sub-Sites will have multiple construction activities overlapping at the same time.

Construction Activities

Grid Connection Infrastructure

4.4.2 The following is an indicative step-by-step process undertaken during construction for the Grid Connection Infrastructure of the Scheme:

- Step 1: Pre-Outage Works Installation of new towers along the diversion route. Fibre optic bypasses and joint boxes will be prepared, and access routes will be set up to support construction activities.
- Step 2: Temporary Diversion of Circuit 2 will be temporarily taken out of service and rerouted via a temporary tower (4YM148T) positioned to the east of the existing line. This allows a bypass of tower 4YM148 while keeping the circuit live. Once the diversion is complete, Circuit 2 will be re-energised.
- Step 3: Outage and Tower Replacement on Circuit 1 which will be de-energised. Removal of existing tower 4YM148 and installation of replacement tower (4YM148R) in the new position to the north east of the tower. Conductors will then be transferred to the new towers and connected into the National Grid Substation. On the eastern side of the substation the cables will be transferred across to 4YM150B. Circuit 1 will then be brought back online via the new route.
- Step 4: Final Transfer of Circuit 2. Circuit 2 will be de-energised again to enable the removal of the temporary diversion and connection to the new permanent route into the National Grid Substation. Once complete, Circuit 2 will also be re-energised.

Post-Diversion Works

4.4.3 With both circuits now running through the new National Grid Substation, the existing towers between 4YM149 and 4YM150 may be dismantled and the

land reinstated. Any temporary towers used during the works will also be removed.

Tower Construction Overview

4.4.4 Each new 400kV tower is built in several stages:

- Foundations: Reinforced concrete footings are poured for each tower leg or Piles are used where required;
- Steelwork: The steel lattice structure is assembled on-site by specialist teams;
- Lifting: Cranes are used to lift and position tower sections into place;
- Fittings: Insulators, arcing horns, and other accessories are installed to support the conductors;
- Fibre Optics: Joint boxes are mounted where fibre optic cables are required; and
- Earthing: An earth mat is installed to safely dissipate fault currents into the ground.

Conductor Stringing Overview

4.4.5 Once the towers are in place, the conductors are installed using a carefully controlled process:

- Pilot Wires: Lightweight pilot wires are pulled through the insulators first;
- Main Conductors: These are then pulled through using the pilot wires, under controlled tension to avoid sagging or damage;
- Tensioning: Conductors are adjusted to meet exact clearance and performance requirements;
- Clamping: Once in position, the conductors are clamped to the insulators and terminated at the appropriate towers;
- Accessories: Vibration dampers, spacers, and arcing horns are added to protect the system and ensure long-term reliability; and
- Fibre Optics: the Fibre Optical Wire is strung in a similar way, usually at the top of the tower.

Site Preparation and Enabling/Civil Engineering Works for the Sites

4.4.6 The following activities would be required as part of the site preparation and civil engineering works:

- Preparation of land for construction, including localised and minor site levelling where required;
- Import of construction materials, plant and equipment to Site;
- Establishment of perimeter fence;
- Establishment of construction laydown areas;
- Construction of the internal access roads; and
- Marking out the location of the Scheme infrastructure.

4.4.7 The following activities would be required as part of the enabling works (not necessarily in order):

- Construction of site entrance and construction vehicle delivery holding area;
- Establishment of the temporary construction compounds, which includes site offices, welfare area and parking area;
- Upgrade, modification or improvement of highways where required for Scheme construction;
- Preparation of land for construction, including localised site levelling (where required) and vegetation clearance;
- Import of construction materials, plant and equipment to Site;
- Establishment of the construction area fence where required for construction works to progress (the installation of the perimeter fence would progress with Scheme construction in each area and therefore would not be complete at the start of construction;
- Construction of the internal access roads; and
- Marking out the location of the operational infrastructure.

Installation of Solar PV Panels

4.4.8 The following activities would be required to install the Solar PV Panels:

- Import of components to site;
- Piling and erection of PV mounting structures;
- Mounting of modules using hand-held power tools;
- Trenching and installation of electric cabling;

- Transformer, inverter and switchgear foundation excavation and construction;
- Installation of transformers, inverters and switchgears. Cranes would be used to lift equipment into position; and
- Installation of control systems, monitoring and communication.

Construction of Electrical Infrastructure

4.4.9 The following activities would be required to construct the on-site electrical infrastructure comprising the cables, 33 kV sub-distribution Switch Room /Conversion Units and the Project and National Grid Substations:

- Site preparation, piling and civils for the on-Site substations and control buildings;
- Trenching and installation of electric cabling;
- Pouring of the concrete foundations and plinths for the electrical equipment;
- Import of components to Site;
- Cranes used to list the components into position; and
- Installation of the 33 kV Sub-distribution Switch Room / Conversion Units, 132 kV and 400 kV Substations.

Construction of Electrical Cables

4.4.10 For cables between the 33 kV Sub-distribution Switch Room/Conversion Units and the substations within the Solar PV Sites, the following methodology and works description applies:

- Interconnecting Cables, including High Voltage power cables laid to provide a link between Solar PV arrays, the Conversion Units and the Project Substations where the main switchgear panels are located. There would also be interconnecting cables from the BESS Site to the National Grid Substation;
- Generally on-Site cables, including Low Voltage cables would be laid underground in excavated trenches adjacent to on-Site trackers where practicable and between the rows of Solar PV Panels. They would be laid at a suitable depth and distance to ensure Solar PV Mounting Structures have area for future repair or maintenance. Some sections of cable may be installed in ducting if required to provide additional protection or where other infrastructure such as roads and hardstanding would be built over the top;

- Where practicable, trenching would be carried out using a trapezoidal bucket to ensure bucket to ensure stability during installation. Trenching and cable laying would be carried out progressively across the Order Limits and be phased to not interfere with other construction operations, such as piling, Solar PV Mounting Structure assembly or Solar PV Panel installation; and

- Care would be taken to ensure cable trench excavation can be managed and backfilled in a timely manner to avoid collapse. Trenching may be curtailed in periods of wet weather to avoid collapse of trenches of excess contaminated run off.

Energy Storage Construction

4.4.11 The following activities would be required to construct the BESS Area:

- Installation of electric cabling;
- Construction of foundations;
- Import of components to Site;
- Installation of transformers;
- Installation of batteries, inverters and switchgear; and
- Installation of fire safety measures.

Fencing and Security

4.4.12 The permanent deer fence and security system would be established during the construction phase. The fencing would be installed early on in the works where practicable to reduce the amount of temporary fencing needed. Where required, temporary fencing would be installed to secure work areas not naturally contained by existing hedgerows or fencing.

Cable Route Corridor Construction

4.4.13 The following activities would be required to construct the Interconnecting Cables Grid Connection Cables:

- Site preparation and appropriate surveys;
- Haul road construction;
- Excavation would be undertaken using an appropriately sized tracked excavator and carried out in layers;
- Topsoil would be segregated and stored on-site to be reused;

- The trench would be cleared and bottomed out, ensuring no hard protrusions;
- Sand bedding would be installed at the bottom of the trench; and
- Cable installation will be conducted once joint bay locations have been established. However, it is not expected that cable installation would be continuous. Cables would be installed in groups or sections to ensure that works are completed in the most efficient manner practicable.

4.4.14 Aggregates would be stored within the temporary construction laydown areas, while cables and ducts would be stored at the secure compound area.

4.4.15 To construct the joint bays in the Cable Route Corridor:

- Excavation activities would be as listed above;
- Joint bay locations would be re-measured to verify their position before excavation commences;
- A joint bay would be up to 20m long and up to 7m wide and 3m deep; and
- Joint bay excavation would be coordinated with the cable pulling programme to ensure that jointing bays are not left open for longer than necessary.

4.4.16 Where the need for trenchless technologies has been identified at crossing points or avoidance areas, feasibility studies will be carried out to identify the appropriate technology. Trenchless Technologies may include tunnelling, HDD, Pipe Jacking and Horizontal Auger Boring. Of the trenchless technologies which could be selected, HDD is considered to be a reasonable worst-case scenario and is assumed for the purposes of assessment. HDD Construction activities would be as follows:

- Site preparation and appropriate surveys;
- Launch and reception pits would be excavated using a suitable excavator, with any required shoring or battering installed. Plant and spoil would be placed a safe distance away from the edge of the excavation to minimise the risk of the trench sides collapsing;
- Once both the launch and receive pits has been excavated, work would then commence on the initial drill, referred to as the pilot bore;
- Upon completion of the pilot bore connecting the launch and reception pits, the drill head would be removed from the drill string, and a reamer would be attached. Reamers would be used to widen the bore until it is an acceptable size to accept the duct; and

- Once the bore is enlarged to the required size, the product pipe would be connected to the reamer via a swivel for installation.

4.4.17 If field conditions are not suitable to track plant and equipment to the launch and reception pits, 'trackway' or similar ground protection mats would be employed to facilitate access and egress. An area of up to 25m by 25m would be required at the launch pit and the reception pit.

4.4.18 During drilling operations, the fluids pumped through the drill string would be closely monitored by checking volume of returns flowing back to the launch pit. Visual checks would also be carried out across the drill line. If a leak of drilling fluid is identified, the pumping activities would be stopped and appropriate control measures will be actioned.

Testing and Commissioning

4.4.19 Commissioning of the Scheme would include testing and commissioning of the process equipment. Commissioning of the Solar PV Panels, BESS Containers and associated infrastructure would involve mechanical and visual inspection, electrical and equipment testing, and commencement of electricity supply into the National Grid. Individual sub-systems would 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.

4.4.20 This process would take place prior to the operational phase of the Scheme.

Construction Staff

4.4.21 For purposes of assessment, it is assumed that the construction of the Scheme elements would happen concurrently, maximising the estimated potential numbers of construction staff working on the Scheme.

4.4.22 Based on the phasing assumptions and the Applicant's experience of other similar sized solar projects, it is currently estimated that the Scheme would support an average of 278 workers per day, which is equivalent to 233 full-time equivalent (FTE) jobs during the construction phase. The size of the workforce is based on the activities required and would fluctuate during the construction phase.

Construction Hours of Work

4.4.23 The core construction working hours (not including start-up and shut-down works) are defined as:

- Monday to Friday from 07:00 to 18:00 (daylight hours permitting)
- Saturday from 08:00 to 13:30 (daylight hours permitting); and

- No Sunday or Bank Holiday working unless crucial to construction (for example, for HDD which must be continuous activity) or in an emergency.

4.4.24 Where practicable, construction deliveries would be coordinated to avoid HGV movements during the traditional peak morning (08:00 to 09:00) and peak afternoon (17:00 to 18:00) hours.

4.4.25 Some activities may be required outside of these times such as the delivery of abnormal loads, concrete pours for foundations, night working for cable construction works in public highways and/or HDD activities.

Construction Traffic and Access to the Order Limits

4.4.26 Construction traffic and access to the Order Limits is discussed further in **ES: Chapter 11 Transport and Access [EN0110014/APP/6.1.11].**

4.4.27 The construction traffic associated with the Scheme will be subject to measures and procedures defined within a Construction Traffic Management Plan (CTMP). This will be secured by a requirement in Schedule 2 of the DCO and prepared substantially in accordance with an **Outline CTMP [EN0110014/APP/7.6].** This defines information such as the routes that construction traffic must take and the measures that will be implemented to reduce the effect of the traffic on the local highway network.

4.4.28 A Construction Worker Travel Plan (CWTP) will be contained within the CTMP and set out proposed measures, including establishing a car share scheme and shuttlebuses for construction workers, identifying cycle and bus routes to the Order Limits, and appointing a Travel Plan Coordinator. Construction workers will also be encouraged to travel outside of peak highway network hours and use electric vehicles, where practicable. This aims to minimise the impact on the strategic and local highway network.

4.4.29 Vehicle access to the Order Limits during the construction phase of the Scheme will be taken from multiple access points across Sub-Sites. Potential HGV access routes and points of access are highlighted below in **Table 4.3**.

Table 4.3: HGV Access Routes to the Sub-Sites

Site Group	Accesses Used	Proposed Access Route
1A-D and BESS	*A01*, *A02*	**From A140/B1134 roundabout**: westbound on B1134, northbound on *A01/A02*. Depart on same route in reverse.
2A-C	*A07*, *A08*, *A10*	**From A140 (for vehicles from south)**: northbound on A140, access on *A07/A08/A10* via existing laybys. Depart site: northbound on A140, execute u-turn on roundabout at Long Stratton Bypass / Parker's Lane, southbound on A140. **From A140 (for vehicles from north)**: southbound on A140 Norwich Road, execute u-turn on A140/B1134 roundabout, northbound on A140, access on *A07/A08/A10* via existing laybys. Depart travelling northbound on A140.

Site Group	Accesses Used	Proposed Access Route
3	*A34*	**From B1332**: westbound on B1527, southbound on Alburgh Road and Spring Lane, west onto *A34*.
4A	*A19*	**From Hempnall Roundabout**: south-west off exit of roundabout onto *A19*. Depart on same route in reverse.
4B	*A20*	**From Hempnall Roundabout**: eastbound on B1527, south onto *A20*. Depart on same route in reverse.
5A-B	*A23*, *A24*, *A25*, *A26*	**From Hempnall Roundabout**: eastbound on B1527, south onto *A23/A24*, for *A25/A26* continue eastbound on B1527, southbound on The Street and west onto *A25/A26*. Depart on same route in reverse.
7A-F	*A28*, *A29*, *A30*, *A40*, *A42*	**From A140**: south on Hempnall Roundabout onto Site 4A via *A19*, *await call-forward to site*, eastbound on Hempnall Roundabout and B1527, northbound on The Krons, westbound on Fairstead Lane, north onto *A29/31*. Internal haul route to Sites 7A-F – cross Broaden Lane via *A40* for access to 7E-F. For southern portion of 7D, southbound on Broaden Lane and west onto *A42*. Depart on same route in reverse.
7G-H	*A44*, *A45*, *A57*	**From B1332**: westbound on B1527, northbound on Shotesham Road and Woodton Road, west onto *A57*, internal haul route through 7K and 7J, exit on *A45*, southwest on Fylands Road, Bussey's Loke east/west on *A44*. Depart on same route in reverse.
7I-J	*A45*, *A57*	**From B1332**: westbound on B1527, northbound on Shotesham Road and Woodton Road, west onto *A57*, internal haul route through 7K and 7J, cross on *A45* for access to 7I. Depart on same route in reverse.
7K-L	*A57*, *A58*	**From B1332**: westbound on B1527, northbound on Shotesham Road and Woodton Road, west onto *A57/A58*. Depart on same route in reverse.
8A-B	*A52*, *A50*, *A49*	**From B1332**: westbound on B1527, northbound on Shotesham Road and Woodton Road, westbound on Heath Road, southbound on Baxter's Lane, west on *A52*. For access to 8A, west on internal haul route through 8B, exit off *A50* onto Market Lane, south onto *A49*. Depart on same route in reverse
9	*A56*	**From B1332**: westbound on Littlebeck Lane, north onto *A56*. Depart on same route in reverse.
10A-E	*A61*, *A62*, *A65*	**From B1332**: eastbound on Harvey Lane, south onto *A61/A62*, for *A65* continue eastbound on Harvey Lane, northbound on Seething Road, west onto *A65*. Depart on same route in reverse.

4.4.30 It is expected that there will be a relatively flat profile of deliveries throughout the construction phase. Therefore, an average number of deliveries per day has been calculated based on the length of the construction phase. Notwithstanding this, it is acknowledged that there will be small peaks throughout the construction phase, especially during set up. To account for this, a 50% uplift has been applied for the purposes of assessment. At this stage, the following is anticipated for the Sites:

- Average HGV arrivals per day – 47 (94 movements); and
- Peak HGV arrivals per day – 69 (138 movements).

4.4.31 At this stage, it is anticipated that there will be an average of 116 vehicle arrivals (232 movements) and a peak of 205 arrivals (410 movements)

associated with cars, LGVs and shuttles transporting construction workers to and from the solar sites.

4.4.32 To prevent nuisance and potential obstruction/restriction of free traffic flows caused by vehicles parked around the Order Limits, car parking to accommodate construction staff would be provided within the Order Limits. Parking on public roads within a defined radius of the Order Limits would not be permitted. These measures are secured in the **Outline CTMP [EN0110014/APP/7.6]**.

Cable Route Corridor Access

4.4.33 The proposed construction vehicle routeing for access to the CRC temporary construction compounds is summarised in **Table 4.4**.

Table 4.4: HGV Access Routes to the Cable Route Corridors

CRC Compound	Accesses Used	Proposed Access Route
Compound 1: A140	*A09*	**From A140 (for vehicles from south)**: northbound on A140, execute u-turn on roundabout at Long Stratton Bypass / Parker's Lane, southbound on A140, east onto *A09*. Depart travelling southbound on A140. **From A140 (for vehicles from north)**: southbound on A140, east onto *A09*. Depart travelling southbound on A140, execute u-turn on A140/B1134 roundabout, northbound on A140.
Compound 2: Hall Lane	*A14*	**From Ipswich Road**: eastbound on Hall Lane, south onto *A14*. Depart on same route in reverse.
Compound 3: B1527	*A37*, *A38*	**From B1332**: westbound on B1527, north onto *A37A38*. Depart on same route in reverse.

4.4.34 There is anticipated to be the following trip generation associated with the CRC:

- Average HGV arrivals per day – 15 (30 movements); and
- Peak HGV arrivals per day – 33 (66 movements).

4.4.35 It is anticipated that there will be a peak of 30 car, LGV and shuttle arrivals per day (60 movements) associated with transporting staff to and from the CRC compounds.

Temporary Construction Compounds

4.4.36 The Works No's as set out in the **Draft DCO [AS-032]** make provision for temporary construction laydown areas. In this document and other application documents these are sometimes referred to as temporary construction compounds. Construction laydown areas and construction compounds are interchangeable. The **Design Principles, Parameters and Commitments document [APP-213]** sets out the parameters of the various laydown areas.

4.4.37 Temporary construction compounds would be established in the locations set out in **ES: Figure 4.2 Indicative Temporary Construction Compound Locations [EN0110014/APP/6.2.4.2]**). The temporary construction compounds would comprise:

- Areas of hardstanding;
- Car parking;
- Site and welfare offices and workshops;
- Security infrastructure, including cameras, perimeter fencing and lighting;
- Area to store materials and equipment;
- Site drainage and waste management infrastructure (including sewerage); and
- Electricity, water, waste water and telecommunications connections.

4.4.38 There will be temporary secondary construction laydown areas established within the Order Limits as part of Work No.7. The parameters for secondary construction laydown areas are set out in the **Design Principles, Parameters, and Commitments [EN0110014/APP/7.18].** The purpose of each one will be able to service the local works. This includes storage for materials, fuel, equipment needed for works, welfare facilities and office space. Office space will be required to avoid unnecessary internal movement of personnel over long distances. The temporary laydown areas will typically be set up ahead of the installation of the Solar PV modules, electrical components and cabling and will be decommissioned as the relevant works in their locality progress and become completed.

4.4.39 It is anticipated that goods would be delivered by HGV to the construction compound and then distributed to the point of need within the Order Limits using lighter vehicles (e.g. tractor and trailer) as required.

4.4.40 Temporary construction compounds will also be required for the Grid Connection Infrastructure and the substations (refer to **ES: Figure 4.2 Indicative Temporary Construction Compound Locations [EN0110014/APP/6.2.4.2]**) along with laydown areas. The laydown areas will allow construction vehicles to turn off the public highway and park safely. The areas will be secured using Heras fencing and security camera. Upon completion of construction, the compound and laydown areas will be removed and land reinstated.

Construction Environmental Management Plan

4.4.41 An **Outline Construction Environmental Management Plan (CEMP) [EN0110014/APP/7.1]** has been prepared to support the **draft DCO** Application. The Outline CEMP describes the framework of mitigation measures to be followed and to be carried forward to a detailed CEMP prior

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

- Use of land for temporary laydown areas, accommodation, etc;
- Construction traffic (including parking and access requirements) and any changes to access and temporary road or footpath closure;
- Noise and vibration;
- Utilities diversion;
- Dust generation;
- Handling of soil resources;
- Spillage of oil and other chemicals;
- Run off and drainage;
- Lighting; and
- Waste generation.

4.4.42 The detailed CEMP would be approved by Norfolk County Council following the grant of the DCO prior to the start of construction. It would identify the procedures to be adhered to and managed by the contractor throughout construction and would clearly define roles and responsibilities. Production of the detailed CEMP is secured through a requirement in Schedule 2 of the **draft DCO [EN0110013/APP/3.1]**.

4.4.43 Contracts with companies involved in the construction works would incorporate environmental control, health and safety regulations and current guidance. This would ensure that construction activities are sustainable and that all contractors involved within the construction phase are committed to agreed good practice and meeting all relevant environmental legislation including:

- Control of Pollution Act 1974 (Ref 4-4);
- Environment Act 2021 (Ref 4-5);
- Hazardous Waste (England and Wales) Regulations 2005 (as amended) (Ref 4-6); and
- Waste (England and Wales) Regulations 2011 (Ref 4-7).

4.4.44 Records would be kept and updated regularly, ensuring that all waste transferred or disposed of has been appropriately processed with evidence of signed Waste Transfer Notes (WTNs) that would be kept on-Site for inspection whenever requested. Furthermore, all construction works would

adhere to the Construction (Design and Management) Regulations 2015 (CDM) (Ref 4-8).

Construction Plant and Machinery

4.4.45 **Table 4.5** summarises the plant and machinery that is likely to be required during the construction phase. It should be noted that these would not all be in use for the duration of the construction phase; there would be a variation in construction works activities and locations across the Scheme.

Table 4.5 Plant and Machinery Likely to be Required During the Construction Phase

Accesses Used Proposed Access Route	
Tracked excavator	Cement mixer truck (discharging)
Wheeled loader	Dumper
Wheeled mobile telescopic crane	Wheeled backhoe loader
Dump truck (tipping fill)	Vibratory roller
Telescopic handler	Directional drill (generator)
Articulated dump truck	Water pump
Diesel generator	Drilling rig
Piling Rig for Solar PV Ground Mounting	Cement mixer truck (discharging)

4.4.46 Non-Road Mobile Machinery (NRMM) could be used throughout the Order Limits. However, the main activities during which NRMM would be used are as follows:

- Construction of the BESS, Inverters, and Transformers;
- Construction of Solar PV Panels which would likely include the use of push press piling rigs and excavators;
- Construction of the National Grid Substation and Project Substations;
- Trenching and installation of the Grid Connection Cables and Interconnecting Cables, which would include the use of both above-ground means (i.e excavators and dozers) and trenchless techniques such as Horizontal Directional Drilling (HDD), if required.

Construction Lighting

4.4.47 Temporary site lighting would be used during construction to enable safe working in hours of darkness or where natural light is unable to reach. Mobile lighting towers with a power output of 8 kilo volt-amperes (kVa) would be used for construction work, along with lighting at the construction compounds while construction is underway.

4.4.48 All construction lighting will be deployed in accordance with the following recommendations to prevent or reduce the impact on human and ecological receptors:

- The use of lighting will be minimised to that required for safe site operations;
- Lighting will utilise directional fittings to minimise outward light spill and glare (e.g. via the use of light hoods/cowls which direct light below the horizontal plane, preferably at an angle greater than 20° from horizontal); and
- Lighting will be directed towards the middle of the Order Limits rather than towards the boundaries.

4.4.49 Additional measures to control lighting are set out in the **Outline CEMP [EN0110014/APP/7.1]**.

Spoil Management

4.4.50 There will be no site wide reprofiling required, however there may be a need to level areas within the Order Limits. Topsoil, subsoil and spoil material is only expected to be generated from cable trenches, temporary and permanent compounds, internal access tracks, the BESS Compound, 132 kV and 400 kV Substations, National Grid Substation and supporting infrastructure.

4.4.51 During construction of the Cable Route Corridor, spoil will be stored temporarily within designated areas adjacent to the cable route and within the construction compounds. The soil will be utilised to backfill the cable trenches, HDD launch and exit pits, reinstate the temporary construction compounds and add any temporary access roads. Should contaminated spoil be identified during construction, this would be transported off-site to a licensed waste facility for treatment.

4.4.52 Measures to manage soil are set out in the **Outline Soil Resources Management Plan [EN0110014/APP/7.9]**.

Waste

4.4.53 Solid waste materials generated during construction would be segregated and stored on-Site in containers prior to transport to approved, licensed third party waste management facilities. This would primarily comprise packaging associated with the electrical items. During construction, the removal of waste has been accounted for in the estimated HGV deliveries a day.

4.4.54 Waste is considered further in **ES: Chapter 18 - Other Environmental Matters [EN0110014/APP/6.1.18]**. The construction of the Scheme will be subject to measures and procedures defined within a detailed CEMP. These measures will include the implementation of industry standard practice and

control measures for material and waste management on-Site. These measures are set out in the **Outline CEMP [EN0110014/APP/7.1]** submitted with the DCO Application.

Fuel

4.4.55 Fuel for machinery and generators would be delivered by a fuel bowser as required and stored in integrally bunded above ground fuel storage tanks (cubes) which comply with the Oil Storage Regulations (Ref 4-9). The fuel storage tanks would be sheltered, secured from unauthorised access, and equipped with integral bunding capable of holding 110% of the volume of the tank (i.e. it would have 10% more capacity than needed). Spill kits would be carried by all plant and would be available at the fuelling point and other strategic locations of the Order Limits to allow for prompt clean up. All construction workers would be trained in pollution prevention and spill kit use. Oil storage areas would not be created in areas susceptible to flooding.

Water

4.4.56 An estimated 16,872.2 m^3 total of water would be required during construction to support welfare facilities on-Site and other uses.

4.4.57 Tankering is considered to be the main option for potable water. Contact with tankering supplies is currently being undertaken during the production of this report. However, given the potable quantities of water required (max 13.97 m3/d), a storage option within the Order Limits should also be considered in conjunction to reduce the number of tankers needed to drive to Site..

4.4.58 During construction self-contained portable welfare units which store foul/wastewater for collection/emptying by specialist licenced contractors would be used.

Surface Water Drainage

4.4.59 The **Outline CEMP [EN0110014/APP/7.1]** describes water management measures to control surface water run-off and drain hardstanding and other structures during the construction of the Scheme.

Power Supply

4.4.60 To facilitate construction, connection to existing overhead power lines will be considered to provide power to the construction compounds where feasible. Compounds will be equipped with diesel generators where connection to power lines cannot be made.

Site Reinstatement, Biodiversity and Landscaping

4.4.61 Following construction, a programme of site reinstatement will commence. Embedded mitigation measures for soil management are set out in the

Outline CEMP [EN0110014/APP/7.1] and the **Outline Soil Management Plan [EN0110014/APP/7.9]** including measures such as construction and exclusion zones in relation to retained vegetation, ensuring a tidy and neat working area, covering stockpiles and storing topsoil in accordance with good practice measures.

4.4.62 An **Outline Landscape and Ecology Management Plan (LEMP) [EN0110014/APP/7.4]** accompanies the DCO Application. This document sets out the principles for how the land will be managed throughout the operation phase, following the completion of construction. Should the DCO be granted, a detailed LEMP will be produced prior to the start of construction.

4.5 Operation and Maintenance Phase

4.5.1 The Applicant is seeking a time-limited consent with respect to the operation of the Scheme, which will start from the date of the final commissioning phase of the Scheme. The operational life of the Scheme is anticipated to be 60 years.

4.5.2 During the operation phase, two scenarios have been considered within the ES:

- General operational maintenance activities; and
- Programme of replacement activities.

General Operational Maintenance

Operational Activities

4.5.3 During operation, other than in the context of a programme of replacement, activity on the Sites would be restricted principally to vegetation management, equipment maintenance and servicing, ad hoc replacement and renewable of any components that fail or reach the end of their lifespan, periodic fence inspection, vegetation management along accesses, premisses paths and landscape ecological mitigation maintenance, and monitoring to ensure the continued effective operation of the Scheme.

4.5.4 Along the Grid Connection Infrastructure, operational activity may consist of routine inspections and any reactive maintenance from National Grid.

4.5.5 The frequency of regular maintenance visits would reasonably be expected to be limited to no more than five visits per month to the Sites. Limited use of HGVs may be required for the ad-hoc replacement of components.

4.5.6 The **Outline Operational Environmental Management Plan (OEMP) [EN0110014/APP.7.2]** sets out the environmental principles to be followed during the operation of the Scheme. The Outline OEMP will be used as the

basis for a detailed OEMP to be prepared prior to commencement of operation.

Operational Staff

4.5.7 No permanent on-Site staff will be required to operate the Scheme. There will be limited staff facilities located in the control room associated with the 132 kV and 400 kV Substations. Equipment for monitoring the Sites will be located in the Relay and Control Rooms. Whilst this would typically be accessed remotely, it would be available for occasional physical access during routine visits. If a full replacement of all of the solar panels were required an average of 129 workers, with a peak of 240 workers at any one time with further ad hoc limited maintenance roles are anticipated to be required during this 12-24 month replacement period. Operational Traffic and Access to the Order Limits

4.5.8 During operation, other than the operational replacement of Solar PV Panels, there will be a small number of daily vehicle trips, with additional staff attending when required for maintenance and cleaning activities.

4.5.9 Those arriving to undertake general operational maintenance activities would generally be expected to travel by car, approximate 4x4 type vehicle or light van. The frequency of maintenance visits would reasonably be expected to be up to five visits per month to any of the Sites. HGVs may be required for the ad-hoc replacement of batteries, inverters and transformers associated with the Project Substations and the National Grid Substation and BESS.

Operational Lighting

4.5.10 Lighting is not required within the Sites during the operational phase of the Scheme. All routing maintenance activities would be schedule for daylight hours as is practicable. Focussed task specific lighting would only be required in the event of emergency works or equipment failure requiring night-time working.

4.5.11 Motion sensing security lighting would be provided within the 132 kV Substations, 400 kV Substations, National Grid Substation and within the BESS Compound to maintain safe working conditions in winter months, for security purposes and for maintenance activities.

4.5.12 The lighting commitments for the operational and maintenance phase are set out in the **Outline OEMP [EN0110014/APP/7.2]**, including details on lighting design to minimise light spill.

Operational Waste

4.5.13 Solid waste materials generated during Scheme operation and maintenance would primary be general (Household type) waste form the staff visiting site. However, there would be a limited volume of packaging waste associated with the delivery of spare components. In accordance with legislation and

guidance applicable at the time, all general packaging type waste would be segregated prior to transport to an approved, licensed third party landfill and recycling facilities.

4.5.14 Additionally, any waste components such as damaged PV Panels, batteries, cables, connectors and mounting structures, would also be removed and recycled as far as practical and in accordable with legislation and guidance applicable at the time.

4.5.15 The anticipated design life and replacement frequency for the main elements of the Scheme (PV Panels, BESS, etc) are estimated based on other similar Nationally Significant Infrastructure Project (NSIP) schemes.

4.5.16 Waste is discussed further in **ES: Chapter 18 Other Environmental Matters [EN0110014/APP/6.1.18]**.

4.5.17 The operation of the Scheme will be subject to measures and procedures defined within an OEMP secured by a requirement in Schedule 2 of the DCO. The detailed OEMP will include the implementation of industry standard practice and control measures for material and waste management on-Site. These measures are set out in the **Outline OEMP [EN0110014/APP/7.2]** submitted with the DCO Application.

Water Supply

4.5.18 During the operation and maintenance phase, self-contained portable welfare units which store foul and waste water for collection and emptying by specialist licenced contractors would be deployed on an ad hoc basis (e.g. if required by maintenance crews).

4.5.19 Water supply for operational staff facilities would be transported to the Order Limited by road. Welfare facilities will be required at the substations. Any wastewater will be removed via tanker to local licenced wastewater treatment works.

4.5.20 The volume of stored fire water will be maintained to ensure there is sufficient water for firefighting purposes. Details of fire water supply and storage are provided within the **Outline Battery Safety Management Plan (BSMP) [EN0110014/APP/7.5]** which supports the DCO Application.

Surface Water Drainage

4.5.21 The detailed operational drainage design would be prepared pre-construction with the objective of ensuring that drainage of the land to the present level is maintained. It would follow either the design of a new drainage system taking into account the proposed new infrastructure, such as access tracks, cable trench and structure foundations, to be constructed. If during the construction of any infrastructure there is interruption to existing schemes of land drainage, new sections of drainage would be constructed.

4.5.22 The design of new drainage systems would be based on the **Design Principles, Parameters and Commitments [EN0110014/APP/7.18]** and hydrological assessment undertaken as part of the ES.

4.5.23 Management of fire water is further described in **ES: Chapter 9 Water Environment [EN0110014/APP/6.1.9]**.

Cleaning of Panels

4.5.24 Due to the wet UK climate, Solar PV Panels are largely self-cleaning and deterioration in PV system output due to dust or dirt is generally low. The requirement and frequency of cleaning Solar PV Panels is due to the build-up of dust and dirt varies depending upon site specific conditions. For example, the presence of fine dust emitters such as quarries, agricultural operations (harvesting), coastal salt water and nearby woodlands can all impact the level of dust deposition. However, the main factor influencing cleaning requirements in the UK is lichen growth, which is also influenced by site and climate factors.

4.5.25 The requirement for cleaning due to loss of output is balanced against cost of the cleaning operation. Some sites can operate without the need to be cleaned, whereas some sites require cleaning annually. The cleaning requirements for the Scheme can only be accurately determined once operational. Therefore, to present a worst case for the assessments presented in the ES, a two-year cleaning cycle is assumed.

4.5.26 The Solar PV Panels would be cleaned using water only. Up to 7,136 m^3 would be required to clean the panels once every year. Deionised water will be transported to the Order Limits by tanker. No chemical cleaning products would be used, instead stubborn dirt would be brushed or wiped off the panels.

Grazing

4.5.27 For the purposes of assessment and reporting of effects, as a reasonable worst case, it is assumed that vegetation will be managed with machinery and there will be no grazing at the Sites during the operation and maintenance phase.

4.5.28 However, should consent be granted, grazing by sheep will be explored, noting that there are no known landowner restrictive covenants or other reasons that would prevent such use.

Operational Programme of Replacement Activities

4.5.29 During the anticipated 60-year operational life of the Scheme, it is expected that there will be a requirement for the periodic replacement of some of the electrical infrastructure.

4.5.30 It is not expected than an extensive replacement of all components will be required across the entirety of the Scheme during one period. The programme for replacement of equipment across the Scheme is anticipated to be staged to maintain the electrical export to the National Grid. However, in order to maximise the flexibility for how a programme of replacements may be conducted, each ES Chapter has considered the relevant worst-case scenario as set out below.

4.5.31 The assessment in the ES Chapters confirm that the replacement activity would be considerably less intensive than during construction. Any environmental effects identified will be appropriately mitigated with similar measures to those identified for the construction of the Scheme.

4.5.32 The following assumptions have been made for the programme of replacement activities:

- It is assumed that the operational life of Solar PV Panels is 40 years and that all Solar PV Panels will be replaced once during the operational phase and this will take a maximum period of 24 months. This is separate to the ad-hoc replacement of Solar PV Panels that may occasionally be required due to damage, for example;
- It is expected that the BESS could be replaced up to five times during the operational phase;
- Access to the Sites will be via the access routes defined for the construction phase. If any AILs are required for replacement of equipment, consultation will be carried out and approvals will be sought from the relevant local planning and highway authorities;
- Components such as Solar PV Mounting Structures, 132kV Project Substations, 400kV Project Substations, National Grid Substation and BESS Compound buildings are not anticipated to be replaced during the operational phase. No intrusive ground works are anticipated in the replacement of Solar PV Panels or BESS Containers;
- It is estimated that an average of 129 workers would be required for the replacement activities, with a peak of 240 workers at any one time; and
- Transformers are assumed to have a design life of 30 years and as such may require replacement once during the lifetime of the Scheme, however replacement will only be carried out if required for performance or health and safety reasons.

4.5.33 The programme of replacement activities is assessed in the technical chapters of the ES. The assessments in these chapters have considered a worst case scenario for operational replacement with regard to frequency and duration of replacement activities. Where a shorter or longer operational replacement programme is anticipated, the reasonable worst case programme has been assessed for the purposes of the assessment of that

topic. Mitigation measures associated with the programme of replacement activities will be outlined within the **Outline OEMP [EN0110014/APP/7.2]**.

4.6 Decommissioning

4.6.1 Decommissioning is expected to occur after the 60-year design life of the Scheme in 2091 and take between 12 and 24 months. A requirement to decommission the Scheme is secured via a requirement in Schedule 2 of the **draft DCO [EN0110013/APP/3.1]**.

4.6.2 An **Outline Decommissioning Environmental Management Plan [EN0110014/APP/7.3**] has been prepared and submitted with the DCO Application. This sets out the general principles to be followed in the decommissioning phase of the Scheme. The **draft DCO [EN0110013/APP/3.1]** includes a requirement that a detailed Decommissioning Strategy would be prepared substantially in accordance with the **Outline Decommissioning Environmental Management Plan [EN0110014/APP/7.3**] and approved by the relevant authorities at the time of decommissioning, in advance of the commencement of decommissioning works and would including timescales and transportation methods. The detailed Decommissioning Strategy will ensure that decommissioning is undertaken safely with regard to the environmental legislation at the time of decommissioning, including relevant waste legislation.

4.6.3 When the operation and maintenance phase ends, the Sites would be decommissioned and the land returned to the landowner (the National Grid Substation and the Grid Connection Infrastructure would remain in situ). All infrastructure, including Solar PV Panels, Mounting Structures, above ground cabling, Conversion Units / 33 kV sub-distribution Switch Rooms, Project Substations and BESS would be removed from within the Sites and recycled or disposed of in accordance with good practice and market conditions at that time. This will include the areas of agricultural land and established habitats where the soil health, quality and structure may have improved. Foundations and other below ground infrastructure will be cut to 1.2 m below the surface to enable future ploughing.

4.6.4 The National Grid Substation and the Grid Connection Infrastructure would remain in situ. Mitigation planting specifically required to support the location of the National Grid Substation, as identified on **ES: Figure 4.1 Indicative Masterplan [EN0110014/APP/6.2.4.1]**, would be handed over to National Grid who would be responsible for its maintenance and management.

4.6.5 Post-decommissioning, the landowners would chose how the land is to be used and managed, with the exception of the National Grid Substation and the Grid Connection Infrastructure. The landowner may return all of the land to agricultural use, although it is likely that established habitats such as hedgerows and woodland would be retained, given their potential benefits to agricultural land and the wider farming estate. Permissive paths would be removed during decommissioning, with the precise timing to be determined by the contractor(s) and communicated to Norfolk County Council in

accordance with the **Outline Decommissioning Environmental Management Plan [EN0110014/APP/7.3]**.

4.6.6 The mode of removing the cabling would be dependent upon government policy and good practice at the time. Currently, leaving the cables in situ is seen as the most environmentally acceptable option as it avoids disturbance to overlying land, habitats and neighbouring communities. Alternatively, the cables can be removed by opening up the ground at regular intervals and pulling the cable through the extraction point, leaving the ducting and jointing bays in place. This would avoid the need to open up the entire length of the cable route.

4.6.7 Some soil profiling may be required during the decommissioning phase of the Scheme. If so, the land will be countered in accordance with the **Outline Decommissioning Environmental Management Plan [EN0110014/APP/7.3**], approximately similar to the current topography. Excavations will be backfilled, using appropriate imported soil if required, otherwise with soil sourced on Site, using appropriate soil management techniques as set out in the Decommissioning Strategy. Areas where grass does not exist because of the footprint of the previous infrastructure shall be reseeded with suitable native species, in liaison with the landowner and in accordance with the Decommissioning Strategy in order to integrate the newly-restored soil into agricultural use.

4.6.8 The effects of decommissioning are expected to be similar or of a lesser magnitude than construction effects, and are considered in the relevant sections of this ES. The specific method of decommissioning in the Scheme at the end of its design life is uncertain at present, as the engineering approaches to the decommissioning would evolve over the design life of the Scheme. Therefore, assumptions have been made where appropriate in the impact assessment in technical chapters of the decommissioning phase.

Waste from Decommissioning

4.6.9 The waste generated at decommissioning would primarily be from the Solar PV Sites, including electrical components, the Solar PV Mounting Structures and fencing. Waste would be managed in accordance with the relevant legislation and guidance at the time and in accordance with the **Outline Decommissioning Environmental Management Plan [EN0110014/APP/7.3**]. Waste would be safely and securely stored. It is anticipated that waste would either be segregated and stored on-Site in containers or would be stored within secure storage buildings prior to transport to an approved, licensed third party landfill and recycling facilities.

4.6.10 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. Other than the Scheme elements, the waste types generated and effects of decommissioning are likely to be similar to or lesser than the construction effects.

References

Ref 4-1 The Planning Inspectorate (2018) *Nationally Significant Infrastructure Projects - Advice Note Nine: Rochdale Envelope.*

Ref 4-2 UK Government (2008) *The Planning Act 2008*.

Ref 4-3 European Parliament and Council (2023) *The Battery Regulation (EU) 2023/1542*

Ref 4-4 UK Government (1974) *Control of Pollution Act 1974*.

Ref 4-5 UK Government (2021) *Environment Act 2021*.

Ref 4-6 UK Government (2016) *Hazardous Waste (England and Wales) Regulations 2005 (as amended)*.

Ref 4-7 UK Government (2011) *The Waste (England and Wales) Regulations 2011*.

Ref 4-8 UK Government (2015) *Construction (Design and Management) Regulations 2015 (CDM)*.

Ref 4-9 UK Government (2001) *The Control of Pollution (Oil Storage) (England) Regulations 2001.*