SUNNICA ENERGY FARM

EN010106

Volume 6

Environmental Statement

6.1 Chapter 3: Scheme Description

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Planning Act 2008

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

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Sunnica Energy Farm

Environmental Statement
Chapter 3: Scheme Description

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3 Scheme Description

3.1 Introduction

3.1.1 This chapter provides a description of the Scheme. The physical characteristics of the Scheme are described alongside the proposed programme of works. The key activities that would be undertaken during construction, operation (which includes maintenance), and decommissioning are included in this chapter to inform each of the technical assessments included in **Chapters 6** to **16** of this Environmental Statement **[APP-038 to APP-048]**.

3.1.2 The Scheme is defined as a Nationally Significant Infrastructure Project (NSIP), as it consists of the construction of an onshore generating station in England exceeding 50 megawatts (MW) under sections 14(1)(a) and 15(2) of the PA 2008. Associated development and other ancillary works are also proposed as part of the Scheme. The NSIP and associated development are defined in Schedule 1 of the draft Development Consent Order (DCO) **[EN010106/APP/3.1]** and explained in the Explanatory Memorandum to the draft DCO **[EN010106/APP/3.2]**.

3.1.3 This chapter is supported by the following figures provided in Volume 3 of this Environmental Statement **[EN010106/APP/6.3][APP-129 to APP-255]**:

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3.2 Scheme Update

3.2.1 To facilitate the grid connection at Burwell National Grid Substation, the Scheme needs to provide a substation or transformer capable of upgrading the voltage of the electricity generated by the Scheme to 400 kilovolts (kV). Within the application submitted in November 2021, the Scheme included two options for extending the Burwell National Grid Substation to do this. Within the application, these are called Option 1 and Option 2.

3.2.2 Through the relevant representations process, the Applicant was made aware of the representation made by National Grid Electricity Transmission (NGET). This representation stated that one of the two grid connection options, Option 1, is now considered 'not technically feasible' by NGET. Option 1 has therefore been removed from the Application.

3.2.3 Following NGET's representation, the Applicant has revisited the technical solutions available to connect the Scheme into the NGET infrastructure at Burwell to seek to minimise compulsory acquisition requirements and environmental effects.

3.2.4 This design work has resulted in the identification of an additional option for the grid connection, referred to as 'Option 3'. Option 3 involves transforming the 33 kV received from the solar stations within the PV Sites directly to 400 kV within the onsite substation at Sunnica West Site A, Sunnica East Site A and Sunnica East Site B for export to the Burwell National Grid Substation via 400kV electrical cables..

3.2.5 Option 2 has not been discounted at this stage and is retained in the application whilst discussions continue with NGET about Option 3. Once NGET have confirmed that they are content with Option 3, the Applicant would seek to remove Option 2 from the application.

3.2.6 As a result of the above, this chapter has been updated to reflect the updated Scheme Description.

3.3 Rochdale Envelope

3.3.1 The Scheme comprises an energy farm with solar PV and Battery Energy Storage System (BESS) infrastructure. Solar PV and BESS are rapidly evolving and as a result, the draft DCO **[EN010106/APP/3.1]** and supporting Works Plans **[EN010106/APP/2.2]** propose a degree of flexibility to allow the latest technology to be utilised at the time of construction.

3.3.2 The DCO and Works Plans also allow for a flexible use of space within the Scheme Sites both in terms of the type of activity that can be undertaken in a given area and in temporal terms. The flexibility sought, and how this has been accounted for in the assessment, is set out in Table 3-1 below.

Table 3-1 Flexibility sought within DCO and Works Plans

Flexibility Sought	Assessment Approach
Areas of land will be able to be used as each, or a combination of, solar PV, BESS, on-site substation and/or in some instances, as an operational compound.	Where this flexibility is sought on the Works Plans, the assessments have all taken a consistent worst case approach of assuming the maximum spatial parameters for these infrastructure elements set out in the Works Plans, this chapter and the Design Principles **[EN010106/APP/7.3]**, with a massing of BESS, and one substation, within these areas assumed as the worst case for all disciplines. Where necessary, the office compound use has also been considered where it would lead to specific effects were that use to be in place instead of other infrastructure.
Land used for temporary construction compounds during construction, including the construction car park within Sunnica West Site A will be able to be used as solar PV once its construction use is completed.	The temporary use during construction is assessed as part of the construction phase assessment. Solar PV panels have been assumed to be in place at these locations in the operational assessments.
In Sunnica East Site B, the construction car park will be able to be used as solar PV, BESS, and/or on-site substation once its construction use is completed.	The temporary use during construction is assessed as part of the construction phase assessment. The operational assessments have assumed the worst case operational use of a massing of BESS and one substation, within the maximum spatial parameters for this infrastructure element set out in the Works Plans, [this chapter and the Design Principles
Cabling will be able to take place across the Scheme Sites, including underneath landscaping and other construction and operational areas and in Sunnica East B, under grassland to be used as a stone curlew reserve.	Underground works have been assumed in all areas where this is permitted on the Works Plans and above ground works have been assumed in all areas where they are permitted on the Works Plans.

3.3.3 Given the flexibility applied for and in order to ensure a robust assessment of the likely significant environmental effects of the Scheme, the Environmental Impact Assessment (EIA) has been undertaken adopting the principles of the 'Rochdale Envelope' where appropriate, as described in the Planning Inspectorate Advice Note 9 (Ref 3-1). This involves assessing the maximum (and where relevant, minimum) parameters for the Scheme where flexibility needs to be retained, as set out above. Where specific elements of flexibility have needed to be considered by a discipline in the context of the parameters set out in this chapter, this has been confirmed within the relevant chapters of this Environmental Statement (ES). This approach sets worst case parameters for the purpose of the assessment but does not constrain the Scheme from being built in a manner that would lead to lower environmental impacts. The draft DCO secures the likely worst case parameters, providing certainty that the impacts of the Scheme will be no worse than those assessed as part of this environmental assessment.

3.3.4 Indicative timescales for the construction and operation of the Scheme that have been assumed for the purposes of the assessments are as follows:

a. It is currently anticipated that (subject to the necessary consents being granted) construction work will commence, at the earliest, in Summer 2023 and will run for 24 months (please see Section 3.7 for more information). This assumes the Scheme is built in a single phase, which is considered to give rise to the worst case scenario for the purpose of the assessment. Constructing over a single phase, rather than multiple phases spaced over longer timescales, would result in higher peak traffic volumes and a greater number of construction activities being undertaken concurrently (generating noise, dust, etc). Therefore, whilst the Scheme could be constructed over multiple phases, a single phase of construction over 24 months has been assessed in this ES as a default, unless specifically stated;
b. It is currently anticipated that the earliest the Scheme will commence commercial operation will be from Summer 2025. Depending on the final construction programme and commencement of construction, operation may overlap with the construction phase (this would be the situation where construction is undertaken in multiple phases, as referred to in (a) above, where the approach to the assessment in this respect is also explained). It is a possibility that, once the grid connection has been constructed and parts of the Scheme have been connected to the National Grid, these areas could begin operation while other parts are still being constructed and connected; and
c. The operational life of the Scheme is to be 40 years and decommissioning is therefore estimated to be no earlier than 2065. Some parts of the Scheme may be decommissioned earlier if the landowner requires it. Decommissioning is expected to take between 12 and 24 months and will be undertaken in phases. A 24 month decommissioning period has been assumed for the purposes of a worst case assessment in this ES, unless specifically stated. This is proposed to be secured via a requirement of the DCO (see draft Schedule 2 of the draft DCO **[EN010106/APP/3.1]**).

3.3.5 Construction of the Scheme is detailed in Section 3.7 of this chapter.

3.4 Design Parameters

3.4.1 The design of the Scheme is an iterative process, based on preliminary environmental assessments and consultation with statutory and non-statutory consultees. **Chapter 4: Alternatives and Design Evolution** of this Environmental Statement **[APP-036]** describes this process further, including options that have been considered and discounted or considered and amendments made to the Scheme design. The Design and Access Statement **[EN010106/APP/7.3]** also submitted with the DCO application explains the design process, rationale and solution.

3.4.2 A number of the design aspects and features of the Scheme cannot be confirmed until the tendering process for the design and construction of the Scheme has been completed. For example, the enclosure or building sizes may vary, depending on the contractor selected and their specific configuration and selection of plant.

3.4.3 Use of design parameters is therefore being adopted to present a likely worst-case assessment of potential environmental effects of the Scheme that cannot yet be fixed. Wherever an element of flexibility is maintained, the likely worst-case impacts have been reported in the ES.

3.4.4 This ES and the assessments within it are based on the works proposed in the DCO (described principally in Schedule 1, see **[EN010106/APP/3.1]**, the Works Plans, see **[EN010106/APP/2.2]** and the Design Principles as set out within Appendix B of the Design and Access Statement **[EN010106/APP/7.3]**). The maximum design parameters of the works are set out in **Table 3-2** below. Each Scheme component is described in more detail in Section 3.5. The technical chapters within this ES contain a section in the introduction setting out the relevant design parameters likely to result in the likely worst-case effects.

Table 3-2 Design parameters used for the ES assessment

Scheme Component	Parameter Type	Applicable Design Principle
Solar PV modules (One solar PV module is made up of one solar PV panel fitted to solar PV module mounting structures)[1] (Work No. 1A, 1B, 1C and 1D)	Maximum height of solar PV modules above ground level (AGL)	The maximum height of the highest part of the solar PV modules will be 2.5m AGL.
	Minimum height of the flood sensitive equipment AGL	The minimum height of the lowest part of the solar PV modules will be 0.6m AGL. In Flood Zone 3 areas, the minimum height of the lowest part of the solar PV modules will be 0.85m AGL. In swales and infiltration basins (shown in the Drainage Strategy provided in **Appendix 9C** of this Environmental Statement **[AS-007 to AS-009]**), the minimum height of the lowest part of the solar PV modules will be 0.85m AGL.
	Indicative footprint	Individual solar PV panel will be up to 2.5m length and up to 1.75m wide.
	Indicative slope and orientation of the solar PV modules from the horizontal	The solar PV modules will slope towards the south, at a fixed slope of 15 to 35 degrees from horizontal.
	Indicative module colour	The solar PV modules are likely to be either black or dark blue. This will be fixed during detailed design.

[1] One solar PV module is typically made up of a number of solar cells. One or more solar PV module typically makes up a solar PV panel. For this Scheme, one solar PV panel fitted to mounting structures will comprise one solar PV module.

Scheme Component	Parameter Type	Applicable Design Principle
	Frame type	Anodized aluminium alloy.
	Panel technology	Monofacial and/or bifacial panels.
Solar PV infrastructure (Work No. 1A, 1B, 1C and 1D)	Location	The maximum developable[2] area of solar PV infrastructure, including the solar PV modules and mounting structures, solar PV control room or container, solar stations, inverters, transformers and switchgears, but excluding the full extent of the onsite cabling is:: - Sunnica East Site A – 115 ha - Sunnica East Site B – 227 ha - Sunnica West Site A – 256 ha - Sunnica West Site B – 23 ha
Solar PV Module Mounting Structures (Work No. 1A, 1B, 1C and 1D)	Rack	Each string of modules will be mounted on a rack made with galvanised steel or other suitable design material.
	Foundations	Most likely to be galvanised steel poles driven into the ground. These will either be piles rammed into a pre-drilled hole, a pillar attaching to a steel ground screw, pillars fixed to a concrete foundation, or a pillar set in concrete in a pre-made hole in the ground (micropiled). Maximum depth of 3.5m. See Section 3.5.9 for further details.
	Indicative separation distance between rows	2m at the closest point and 11m at the furthest point. This will depend on the local ground topography.
Solar Station (a station comprising an inverter, a transformer and the switchgear) (Work No. 1A, 1B, 1C and 1D)	Type	The solar station will either comprise independent equipment ('outdoors') or will use an International Organisation for Standardisation (ISO) High-Cube Container to enclose the equipment ('indoors').
	Maximum number of solar stations	The maximum number of solar stations across the Sites is 136.
	Maximum dimensions	The maximum parameter of the solar station will be up to 17m by 6.5m footprint, and 3.5m in height for the outdoor solar station. The indoor solar station dimensions would be 15m by 5m footprint and 3.5m in height.

[2] Developable area – indicative breakdown of the Sites into individual land parcels to allow easy reference to the proposed infrastructure of each area shown on the parameter plans Figures 3-1 and 3-2

Scheme Component	Parameter Type	Applicable Design Principle
	Colour	Externally finished to be in keeping with the prevailing surrounding environment, most likely with a green, light grey or white painted finish.
	Foundations	Outdoor solar stations: a concrete foundation slab for each of the inverters and transformers and a levelling layer of thick sand with a maximum depth of 1m, with a concrete perimeter pavement for the switchgear. Indoor solar stations: a concrete foundation slab.
	Inverters (convert the direct current electricity collected by the PV modules into alternating current):	
	Type of inverter	Centralised inverters.
	Maximum dimensions of inverters	The maximum parameters of the inverters will be 9m by 6.5m in plan and 3.5m in height. These will either be standalone (outdoor stations) or sited within the maximum dimensions of the solar station (indoor stations).
	Colour of inverters	Externally finished to be in keeping with the prevailing surrounding environment, most likely with a green, light grey or white painted finish.
	Transformers (a structure containing a electrical device to transform electricity by increasing or reducing the voltage):	
	Maximum dimensions of transformers	The maximum parameters will be 5.5m by 6.5m in plan and 3.5m in height, sited within the maximum dimensions of the solar station.
	Colour of transformers	Externally finished to be in keeping with the prevailing surrounding environment, most likely with a green, light grey or white painted finish.
	Switchgear (a combination of electrical disconnect switches, fuses or circuit breakers used to control, protect and isolate electrical equipment):	
	Maximum dimensions of switchgear	The maximum footprint will be 2.5m by 6.5m in plan and a maximum height of 3.5m, sited within the maximum dimensions of the solar station.

Scheme Component	Parameter Type	Applicable Design Principle
	Colour of switchgear	Externally finished to be in keeping with the prevailing surrounding environment, most likely with a green, light grey or white painted finish.
	Solar PV control room building or container	
	Dimensions	Maximum parameters: 7.5m by 3.5m footprint and 3.5m in height.
	Maximum number of control buildings	Up to 17 control buildings across the Sites.
	Foundations	Concrete base or monolith plinth to a maximum depth of 1m.
	External finish	Externally finished to be in keeping with the prevailing surrounding environment, most likely with a green, light grey or white painted finish.
Weather Stations (Work No. 1A, 1B, 1C and 1D)	Maximum height	6m
	Maximum number	136
DC Electrical Boxes (Work No. 1A, 1B, 1C and 1D)	Type	An electrical box to join various string lines. It is formed by fuses to protect the string lines, a circuit breaker to disconnect the DC electrical box and communication equipment in order to capture information for the SCADA system.
Onsite cabling (between PV modules and inverters and from inverters to transformers) (Work No. 1A, 1B, 1C and 1D)	Type	Low voltage onsite electrical cabling is required to connect the PV modules to inverters (typically 1.5/1.8 kV cables) and the inverters to the transformers onsite (typically 0.6/1 kV cables). Cabling will be above ground level between the PV modules. These will be fixed to the mounting structure along the row of racks. Cabling between the PV modules and inverters will be buried within underground trenches.
	Maximum cable trench dimensions	Maximum dimensions: 1.1m deep and 1m wide.
Battery Energy Storage System (BESS) Battery Containers (Work No. 2A, 2B and 2C)	Dimensions	Maximum dimensions of each container: 17m by 5m footprint and up to 6m in height.
	Colour	Externally finished to be in keeping with the prevailing surrounding environment, most likely with a green, light grey or white painted finish.

Scheme Component	Parameter Type	Applicable Design Principle
	Foundation	Either a reinforced concrete base to a maximum depth of 1m, or a piling solution may be required, depending on the results of geotechnical surveys. If this is the case, piles to a maximum depth of 12m would be used. The piling solution has been assessed as the worst case scenario within **Chapter 6** to **16** of this Environmental Statement **[APP-038 to APP-048]**.
BESS Compound (compound to house the BESS components and the containers) (Work No. 2A, 2B and 2C)	Type	Three locations (shown in Figures 3-1 and 3-2). The compounds will include battery storage containers and Battery Stations (battery inverters, transformers, and switchgear). Lithium batteries will be grouped in racks, protected by structures / containers which will be located inside the compounds.
	Maximum dimensions	There are three BESS Compounds, with maximum footprints of the compounds being up to: - Sunnica East A: 66,000m^2. - Sunnica East B: 162,000m^2. - Sunnica West A: 83,000m^2.
Battery Stations (Work No. 2A, 2B and 2C)	Type	A station comprising transformers, switchgear, power conversion system (PCS) or inverter, and other ancillary equipment. These will either be located outside or housed together in a container, with a maximum height of up to 6m.
	Foundations	Either with a concrete foundation slab for each of the inverters and transformers and a levelling layer of thick sand with a concrete perimeter pavement for the switchgear when located outside, or on a concrete foundation slab when housed in a container. A piling solution may also be required for both the indoor and outdoor options, depending on the results of geotechnical surveys. If this is the case, piles to a maximum depth of 12m would be used. The piling solution has been assessed as the worst case scenario within **Chapter 6** to **16** of this Environmental Statement **[APP-038 to APP-048]**.
Monitoring and control system (Work No. 2A, 2B and 2C)	Type	The monitoring and control system will be housed in a building or container within the BESS compound and, will be up to a maximum of 6m in height.

Scheme Component	Parameter Type	Applicable Design Principle
	Design	The monitoring and control system will be housed either in an adapted container or built from glass reinforced plastic (GRP). The system will be within the same container or room as the HVAC or in its own container or control room.
Onsite cabling (between battery containers and inverters and from inverters to transformers) (Work No. 2A, 2B and 2C)	Type	Low voltage cabling between batteries and inverters will be above ground in cable trays or laid in an underground trench (Figure 3-7).
	Maximum cable trench dimensions	Maximum depth of 1.5m and 1.0m wide.
Internal BESS Fire Suppression System (Work No. 2A, 2B and 2C)	Type	Automatic sprinkler or water mist system.
	Dimensions	Water supply will be integrated into the design of each BESS container, located either internally or externally. Up to a maximum of 6m in height, if external. If external, either decentralised and located at each container or centralised and located together with pumping equipment and pipework at a central location(s).
External Fire Fighting Water Tanks (Work No. 2A, 2B and 2C)	Type	Storage will either be in one or two rectangular sectional steel panel tanks or cylindrical steel tanks within each BESS compound.
	Water storage volume per BESS Compound	Maximum of 242.5m^3
	Dimensions	Option 1: Water supply for the firefighting operations only: - Two half capacity sectional steel panel tanks with dimensions of 6m by 6m and 3m in height; or - Two half capacity cylindrical steel tanks with dimensions of 4.58m diameter and 6m in height and with a 0.3m thick concrete base. Option 2: Water supply for simultaneous operation of the water drenching system and firefighting operations: - Two half capacity sectional steel panel tanks with dimensions of 8m by 6m and 3m in height; or - Two half capacity cylindrical steel tanks with dimensions of 5.35m diameter and 6m in height and with a 0.3m thick concrete base.

Scheme Component	Parameter Type	Applicable Design Principle
Fire Fighting Water Containment (Work No. 2A, 2B and 2C)	Type	Sump integrated into each BESS container for internal fire suppression. Bunded BESS area linked to a bunded lagoon to capture fire water run-off from external fire water.
	Volume	410m^3
Onsite Substations (Work No. 3A, 3B and 3C)	Maximum dimensions	There are three proposed onsite substations, the locations of which are shown in Figures 3-1 and 3-2. Maximum parameters for the onsite substations, shunt reactor (Sunnica East Site B only, if Option 3 is taken forward), control building or container, welfare facilities, hardstanding areas and hardstanding parking areas, but excluding the full extent of the cabling are outlined below: - Sunnica East Site A: 85m by 55m footprint, 10m in height. - Sunnica East Site B: 85m by 130m footprint, 10m in height. - Sunnica West Site A: 85m by 130m footprint, 10m in height.
	Location	The substations within Sunnica East Site A, Sunnica East Site B, and Sunnica West Site A will be located within the BESS Compounds within Developable Areas E33, E18 and W17, respectively (see Figure 3-1 and 3-2). The precise location will be determined through micro-siting within the relevant Developable Area during detailed design.
	Foundations	Concrete base or monolith plinth to a maximum depth of 1m. A piling solution may be required depending on the results of geotechnical surveys. If this is the case, piles to a maximum depth of 12m would be used.
	Substation control buildings or containers	
	Dimensions	Maximum parameters: 25m by 12m footprint and 7m in height.
	Foundations	Concrete base or monolith plinth to a maximum depth of 1m.
	External finish	Externally finished to be in keeping with the prevailing surrounding environment, most likely with a green, light grey or white painted finish.

Scheme Component	Parameter Type	Applicable Design Principle
	Substation welfare facilities	
	Dimensions	The onsite facilities will be either be located within the onsite substation control building, or in a separate building within the onsite substation area with maximum parameters of 6m by 3m and up to 3.5m in height.
	Hardstanding parking areas	
	Dimensions	Up to 20 car parking places will be provided within the Sunnica West Site A onsite substation. Parking within Sunnica East Sites A and B is provided within the permanent compounds.
Burwell National Grid Substation Extension – Option 2 (5B)	Maximum dimensions	Figure 3-20 illustrates the maximum footprint of the Burwell National Grid Substation Extension – Option 2. Maximum parameters for the footprint of the substation are outlined below: - Burwell Substation Extension: 43m by 76m footprint, 12m in height, with an associated laydown area of 43m by 30m.
	Scale	All of the infrastructure associated with the Burwell National Gird Substation Extension, including the transformer compound, substation, control building, electrical bays to connect into existing network within the existing substation including disconnectors and ancillary equipment and permanent compound area will be within the footprint of Works No. 5A and 5B and the maximum parameters described above.
	Location	The location of the Burwell Substation Extension – Option 2 is within Work area 5B. This is described further in Section 3.6 and shown in Figure 3-20.
	Foundations	Concrete base or monolith plinth to a maximum depth of 1m. A piling solution may be required depending on the results of geotechnical surveys. If this is the case, piles to a maximum depth of 12m would be used.
	Type	33kV cables

Scheme Component	Parameter Type	Applicable Design Principle
Onsite cabling (between the transformers and the switchgears and from switchgears to the onsite substation) (Work No. 1, 2 and 3)	Dimensions	Maximum depth of 1.5m and 1.0m wide.
Office/warehouse buildings (Work No. 8A and 8B)	Dimensions	Maximum parameters: Sunnica East Site A: 13 x 31m and 5m height. Maximum parameters: Sunnica East Site B: 25 x 35.5m and 8m height.
	Foundations	Concrete base or monolith plinth to a maximum depth of 1m.
Permanent compounds (Work No. 8A and 8B)	Dimensions	Maximum parameters: Sunnica East Site A will be up to 12,000m^2, Maximum parameters: Sunnica East Site B will be up to 8,000m^2.
	Parking	Up to 20 car parking places will be provided within each permanent compound.
Grid Connection Routes A and B: Option 2: connecting Sites to Burwell National Grid Substation Extension and from Burwell National Grid Substation Extension to the existing substation; Or, Option 3: connecting Sites to existing Burwell National Grid Substation. (Work Nos. 4 and 5)	Type	33kV cables to export and import electricity produced at the Sites to the onsite substations. Following the removal of Option 1, there are two options for Grid Connection Routes A and B, depending on the selected substation option taken forward. **Option 2 – Burwell National Grid Substation Extension:** 132kV cables to export and import all of the electricity produced by the Scheme to the Burwell National Gird Substation Extension -Option 2. 400kV cables to export electricity from the Burwell National Grid Substation Extension – Option 2 to the existing Burwell National Grid Substation. Earthing cables and optical fibre cables. Trenches will house two circuits. Each circuit will consist of up to three sets of cables. **Option 3 – 400 kV onsite substations:** 400 kV cables to export electricity from Sunnica West Site A, Sunnica East Site A and Sunnica East Site B onsite substations to the existing Burwell National Grid Substation.

Scheme Component	Parameter Type	Applicable Design Principle
		Earthing cables and optical fibre cables. Trenches will house one circuit. Each circuit will consist of up to one set of cables.
	Maximum width of cable corridor (per trench)	3.5m except from where it meets the joining bays, where it will be up to the maximum dimensions of the jointing bays.
	Maximum depth of cable corridor (open cut trench)	2m below ground level (BGL)
	Maximum depth of cable corridor (non-intrusive techniques)	20m BGL
	Maximum working width of cable corridor construction	100m
	Associated works	Works associated with cable laying including jointing bays, fibre bays, cable ducts, cable protection, joint protection, manholes, kiosks, marker posts, underground cable marker, tiles and tape, send and receive pits for horizontal directional drilling, trenching, lighting, and a pit or container to capture fluids associated with drilling. All these works will be undertaken within the maximum parameters described above.
Jointing Bays within the cable corridor (Work No. 4)	Distance apart	Up to 2000m
	Dimensions	The dimensions are dependent on which technical substation solution is taken forward. **Burwell National Grid Substation Extension – Option 2:** The dimensions are determined by how many circuits will be in the jointing bay. Jointing bays will have two circuits each with up to three sets of three cables: - Four sets of cables (two circuits) will sit within one bay 30m in length, by 8m in width and 2.5m in depth.

Scheme Component	Parameter Type	Applicable Design Principle
		- Six sets of cables, consisting of two bays running consecutively with three sets of cables (one circuit) in each, totalling 60m in length (30m per bay), 8m in width and 2.5m depth. **Option 3 – 400 kV onsite substations:** One set of cables (one circuit) will sit within one bay 18.5m in length, by 3m in width and 2.5m in depth.
Fibre Bays within the cable corridor (Work No. 4)	Distance apart	Up to 2000m.
	Dimensions	The dimensions are dependent on which technical substation solution is taken forward. **Burwell National Grid Substation Extension – Option 2:** 1.5m by 1m and 2m in depth. **Option 3 – 400 kV onsite substations:** 1.75m by 1.75 and 2m in depth
CCTV Poles	Maximum height	5m
	Maximum number	300

3.5 Components of the Scheme

3.5.1 Development will occur at all Sites with Sunnica East Site A, Sunnica East Site B, Sunnica West Site A, and Sunnica West Site B consisting of the same principal infrastructure as described below.

3.5.2 The key Scheme components are:

a. Solar PV panel;

b. PV module mounting structures;

c. Inverters;

d. Transformers;

e. Switchgear;

f. Cabling (including high and low voltage cabling);

g. One or more BESS (expected to be formed of lithium ion batteries storing electrical energy) on Sunnica East Site A, Sunnica East Site B, and Sunnica West Site A;

h. An onsite substation comprising a substation and control building (Sunnica East Site A, Sunnica East Site B, and Sunnica West Site A only);

i. Burwell National Grid Substation Extension, should Burwell National Grid Substation Extension – Option 2 be taken forward;

j. Office/warehouse buildings (Sunnica East Site A and Sunnica East Site B only)
k. Fencing and security measures;
l. Drainage;
m. Internal access roads and car parking;
n. Landscaping including habitat creation areas; and
o. Construction laydown areas.

Solar PV infrastructure

3.5.3 Illustrative figures of the solar PV infrastructure are provided in Figures 3-3 to 3-6. Figures 3-1 and 3-2 show the layout of solar PV infrastructure throughout the Sites. The layout of the solar PV infrastructure has been determined through consultation with landowners and utilities asset owners (such as Cadent Gas). Utilities including two high-pressure gas pipelines managed by Cadent Gas and a pipeline managed by Anglian Water run beneath Sunnica East Sites A and B. Consultation with Utility companies has been undertaken throughout the design stage and appropriate easement corridors have been agreed to protect the assets from construction activities (i.e. installing the foundations and mounting structures).

3.5.4 The solar PV infrastructure will be offset from watercourses by a minimum of 10m, measured from the water margins and bank under normal flow conditions.

Solar PV modules

3.5.5 Solar PV panels convert sunlight into electrical current (as direct current (DC)). Individual panels will be up to 2.5m long and 1.75m wide. These are typically ‘monofacial’, meaning that they consist of a series of photovoltaic cells beneath a layer of toughened glass on the upper surface of the module. ‘Bifacial’ modules are a relatively new technology and 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. The Scheme may use either or a combination of both types of panels, although visually and environmentally there is negligible difference between the two. The panel frame encasing the cells is typically built from anodised aluminium. For this Scheme, a solar PV panel and its mounting structure will comprise one solar PV module.

3.5.6 To ensure that the likely significant environmental effects are properly assessed, the DCO will secure both the developable area for the modules and the parameters which the modules must comply with. This will ensure that the DCO adequately secures the EIA assumptions. Based on current technology, each panel will be made up of approximately 144 cells (**Plate 3-1**), although the number of cells will depend on the make and model of the modules being procured and may vary slightly within the module dimensions that are presented in this chapter. Based on current technology, the modules will be grouped in ‘strings’; for example, a row of 14 double stacked modules would equate to a string. Each string will run to a DC electrical box that normally sits on the back of a module (**Plate 3-2**), with up to 30 strings connecting to a DC electrical box. The DC electrical boxes then run to the inverters, with up to 20 DC electrical boxes per inverter. The above set up may be subject to change based on the most up to date technology available at the time of construction.

3.5.7 The number of modules which will make up each string is not yet known. Various factors will help to inform the number and arrangement of modules in each string, and it is likely some flexibility will be required to accommodate future technology developments. Therefore, the assessment will be based on the parameters outlined in **Table 3-2**.

Plate 3-1. Illustration of a typical 144 cell solar panel

Plate 3-2. DC Electrical Box

3.5.8 The solar PV panels will be oriented to the south at a slope of 15 to 35 degrees from horizontal (see **Plate 3-3** and Figure 3-3).

Plate 3-3. Solar panels (solar string) with south facing configuration

Module Mounting Structures

3.5.9 Each string of modules will be mounted on a galvanized steel or other material design rack. The number of strings that each rack will have is still to be determined; typically, it is two. Racks are usually supported by galvanized steel poles driven into the ground to a maximum of 3.5m depth. The most common solution for installing the steel poles on existing UK solar farms is ramming; however, depending on ground conditions and other constraints such as buried archaeology, predrilling, micro-piles, screw foundation, or concrete foundations may be utilised. A worst case assumption assessment of piles to 3.5m depth has been assessed within the ES. Between each row of racks, the separation distance will be approximately 2m to 11m, dependent upon the local ground topography, to allow for appropriate maintenance.

3.5.10 The modules will have a clearance above ground level (AGL) of approximately 0.6m (0.85m AGL in Flood Zone 3 and swales) and a maximum height of 2.5m AGL. These are maximum dimensions as the final elevations of the racks will be influenced by various design factors.

Solar Stations (Inverter, transformer and switchgear)

3.5.11 A solar station comprises an inverter, a transformer and the switchgear. These would either be standalone equipment (‘outdoor’) or they would be housed together within a container ‘(indoor’), as described below. Both options would sit on a concrete foundation slab, which in turn would sit on a thick levelling layer of sand. A reasonable worst-case scenario has been assessed based on maximum parameters as outlined in **Table 3-2**.

Solar station with independent outdoor equipment

3.5.12 As shown in **Plate 3-4**, the inverter, transformer, and switchgear are placed outdoors and independent of each other. The maximum footprint for this will be 17m by 6.5m and up to 3.5m in height.

Plate 3-4. Outdoor solar station

Indoor solar station in container

3.5.13 As shown in **Plate 3-5** and **Plate 3-6** and Figure 3-26, all equipment (inverter, transformer and switchgear) are included within a 15m ISO High-Cube Container with a footprint of 15m by 5m and a maximum height of up to 3.5m. The container will be externally finished to be in keeping with the prevailing surrounding environment.

Plate 3-5. Example of white indoor solar station exterior (*image reproduced courtesy of Power Electronics*)

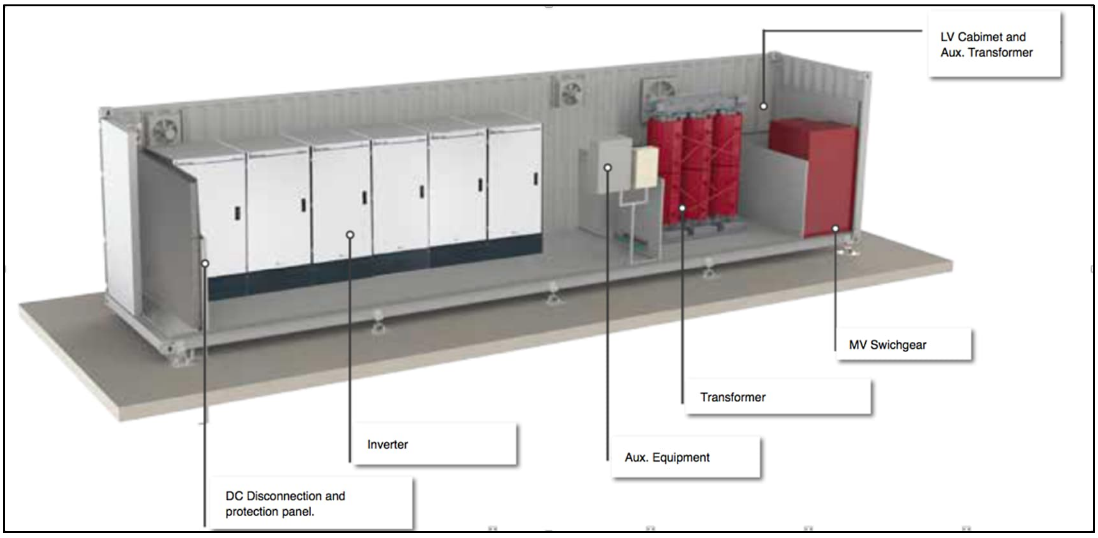

Plate 3-6. Indoor solar station interior (*image reproduced courtesy of Power Electronics*)

3.5.14 The following sections describe inverters, transformers and switchgear in more detail.

Inverters

3.5.15 Inverters are required to convert the DC electricity collected by the PV modules into alternating current (AC), which allows the electricity generated to be exported to the National Grid. Inverters are sized to deal with the level of voltage and intensity, which is output from the strings of PV modules.

3.5.16 Centralised (meaning grouped together) inverters will be used, and these will be sited at regular intervals amongst the PV modules. The inverters will be units up to 9m by 6.5m in plan and a maximum 3.5m in height. This is the most common solution used on existing UK solar PV farms. **Plate 3-7** shows an outdoor inverter. Figure 3-4 shows the illustrative layout of the centralised inverter.

Plate 3-7. Typical outdoor centralised inverter

Transformers

3.5.17 Transformers are required to control the voltage of the electricity generated across each of the Sunnica Sites before it reaches the substations. Transformer cabins will be located across the Sunnica East Site A, Sunnica East Site B, Sunnica West Site A, and Sunnica West Site B at regular intervals. The transformers will be outdoor or indoor.

3.5.18 **Plate 3-8** shows an example of an outdoor transformer. The maximum footprint will be 5.5m by 6.5m in plan and up to 3.5m in height (see Figure 3-5).

Plate 3-8. Typical outdoor transformer

Switchgear

3.5.19 Switchgear are a combination of electrical disconnect switches, fuses, or circuit breakers used to control, protect, and isolate electrical equipment. Switchgear is used both to de-energise equipment to allow work to be done and to clear faults downstream.

3.5.20 The switchgear will either be located alone in a cabin (as shown in **Plate 3-9**), with a footprint of 2.5m x 6.5m in plan and 3.5m in height (see Figure 3-6), or within the high cube container as part of the indoor solar station.

Plate 3-9. Outdoor cabin switchgear

Solar PV Control Room

3.5.21 There will be up to 17 solar PV control room buildings or containers within the Sites, which will be up to 7.5m by 3.5m and up to 3.5m in height (see Figure 3-27). These will include operational monitoring and control systems for the Sites. The control buildings will be a painted block building or glass reinforced plastic (GRP) with external colours and finishes to be confirmed prior to construction.

Weather Station

3.5.22 A weather station is up to a maximum of 6m in height and provides instruments to measure solar irradiance, ambient temperature, wind direction and wind speed (see **Plate 3-10**). A maximum of 136 weather stations will be required throughout the Sites and they will be located with inverters.

Plate 3-10. Weather Station

Battery Energy Storage System

3.5.23 The BESS is designed to provide peak generation and grid balancing services to the electricity grid by allowing excess electricity generated either from the solar PV panels, or imported from the electricity grid, to be stored in batteries and dispatched when required.

3.5.24 The Scheme is an AC-coupled system, so the BESS will be located together in three centralised areas, which can be installed, operated and maintained easily. The batteries, inverters, transformers and switchgears ('battery stations' as explained below) will be mounted on a concrete foundation in a single compound. A piling solution may be required, depending on the results of the geotechnical survey. If piling is required, it would involve piling up to 12m. Three battery compounds will be required for the Scheme, as follows:

a. Sunnica East Site A – located with Developable Area E33;

b. Sunnica East Site B – located with Developable Area E18; and

c. Sunnica West Site A – located with Developable Area W17.

3.5.25 **Plate 3-11** provides a view of a typical layout and Figures 3-1 and 3-2 show the location of the BESS compounds. The final layout of the BESS compounds will be determined during detailed design. The final layout may not utilise the whole of the Developable Areas outlined above; where this is the case PV modules may be installed within the areas not utilised by the BESS.

3.5.26 The batteries will be housed within containers, each with maximum dimensions of 17m by 5m in plan and up to a maximum 6m of height. These containers may be modular and joined depending on equipment choice to be determined at detailed design stage. **Plate 3-11** shows a typical battery storage compound configuration which includes battery containers, inverters, transformers and switchgear. For scale comparisons, this example is similar in size to the Sunnica East Site A BESS compound (Developable Area E33 in Figure 3-1).

3.5.27 The precise number of individual battery storage containers will depend upon the level of power capacity and duration of energy storage that the Scheme will require.

3.5.28 Battery stations comprising transformers, switchgear, power conversion systems (PCS) or inverters, and other ancillary equipment will be installed within the BESS compound. These will either be located outside with a concrete foundation slab for each of the inverters and transformers or housed together within a container which would also be mounted on a concrete slab. A piling solution may also be required, depending on the results of geotechnical surveys. If this is the case, piles to a maximum depth of 12m would be used.

3.5.29 Each BESS will require a heating, ventilation and air conditioning (HVAC) or liquid cooling system to ensure the efficiency of the batteries, which will be integrated into the containers or housed separately in its own container or control room. This may involve a HVAC or liquid cooling system that is external to the containerised unit located either on the top of the unit or attached to the side of the unit. If this uses air to heat and cool it will have a fan built into it that is powered by auxiliary power. The HVAC or liquid cooling system is incorporated within the maximum parameters outlined in **Table 3-2**.

3.5.30 The monitoring and control system operates, isolates, and controls the exported power from the BESS. This will comprise a building of similar dimensions to the containers; either an adapted container or built from GRP, located within the main BESS compound within the same container or room as the HVAC or liquid cooling system or in its own container or control room. This is incorporated within the maximum parameters for the BESS compound outlined in **Table 3-2**.

3.5.31 As the Scheme design develops, the likely configuration of equipment will be determined based upon environmental and technical factors. A reasonable worst-case scenario has been assessed based on maximum parameters as outlined in **Table 3-2**.

Plate 3-11. Typical battery storage compound configuration (*image reproduced courtesy of Fluence Energy*).

3.5.32 **Plate 3-12** below shows a typical battery storage unit, which shows the BESS racks and ancillary equipment.

Plate 3-12 Typical battery storage unit (*image reproduced courtesy of Sungrow*).

Onsite Cabling

3.5.33 Low voltage onsite electrical cabling is required to connect the PV modules and BESS to inverters (typically via 1.5/1.8 kV cables), and the inverters to the transformers onsite (typically via 0.6/1.0 kV cables) (Figure 3-7a). Cables for the earthing system and cables for the auxiliary supplies will also form part of the onsite cabling system. The dimension of the trenches will vary depending on the number of ducts they contain. The trenches for the onsite cabling between battery containers and inverters will be up to 1m in width and up to 1.5m in depth. The trenches for the onsite cabling between PV modules and inverters will be up to 1m in width and up to 1.1m in depth. Illustrative cross sections are shown in Figure 3-7a.

3.5.34 Higher rated (high voltage) cables, 33 kV, are required between the transformers and the switchgears and from switchgears to the onsite substation. The dimension of the trenches will vary depending on the number of ducts they contain but will typically be up to 1.0m in width and up to 1.5m in depth. Illustrative cross sections are shown in Figure 3-7a.

3.5.35 Cabling between PV modules will be above ground level (along a row of racks), fixed to the mounting structure, and then underground between racks and inverters. Low voltage cabling between batteries and inverters will be above ground in cable trays or laid in an underground trench. All other onsite cabling will be underground, unless an underground solution is not possible, in these cases the cable will be above ground in cable trays.

3.5.36 Data cables will also be installed, typically alongside electrical cables in order to allow for the monitoring during operation, such as the collection of solar data from pyranometers [3].

Fire Management

3.5.37 The Outline Battery Fire Safety Management Plan **[APP-267]** provides the requirements for the BESS in the event of an unplanned fire. It outlines the requirement for two sources of firefighting water:

a. Internal automated sprinkler or water mist system; and
b. Firefighting water for the Fire and Rescue team.

3.5.38 Each BESS container will be fitted within an automatic sprinkler or water mist system for fire suppression in the event of an unplanned fire. The water supply for this system will be integrated into the design of each BESS container and located either internally or externally (centralised or decentralised) to each BESS. The containment of this water would be within a sump integrated into the BESS container.

3.5.39 Each BESS area requires a maximum of 242.5m^3 of water storage for use by fire fighters in case of an unplanned fire in the BESS compound. Water would be stored in either two half capacity sectional steel panel tanks or two half capacity cylindrical steel panel tanks. If the water storage containers are to be used for both fire fighting and the drenching system these will be a larger dimensions than if it was for fire fighting only. The maximum possible dimensions for each half capacity sectional steel panel tank would be 8m in length by 6m width with a height of 3m. Should a cylindrical steel tank design be used, the maximum dimensions for each half capacity tank would be 5.35m diameter and a height of 6m.

3.5.40 Each BESS area would be lined with a bunded impermeable surface to prevent water used during firefighting operations infiltrating into the soils underlying the BESS area. Surface water would run from the impermeable surface to a bunded lagoon capable of capturing 242.5m^3 of fire water. The lagoon would have a volume of approximately 410m^3, which would allow the water to be stored following an emergency event and removed from site if contaminated.

[3] An instrument used for measuring solar irradiance on a planar surface.

Operational Offices/Warehouses and Permanent Compounds

3.5.41 Two operational office/warehouse blocks and permanent compounds will be provided during operation within Developable Area E33 on Sunnica East Site A and within Developable Area E18 in Sunnica East Site B. The precise location within the Developable Areas will be determined through micro-siting during detailed design following granting of the DCO consent. The Sunnica East Site A office/warehouse will be up to 13m by 31m and 5m height and the Sunnica East Site B office/warehouse will be up to 25m by 35.5m and 8m height (see Figures 3-12a and 3-12b).

3.5.42 The compounds will contain offices, mobile welfare units, a canteen, storage and waste skips, parking areas (up to 20 parking spaces at each), and warehouse facilities for the storage for spare parts.

3.5.43 The permanent compounds for Sunnica East Site A will be up to 12,000m^2, Sunnica East Site B will be 8,000m^2.

Fencing, Security and Lighting

3.5.44 A security fence will enclose the operational areas of the Sunnica East Site A, Sunnica East Site B, Sunnica West Site A, and Sunnica West Site B. The fence will be a ‘deer fence’, up to 2.5m in height (see **Plate 3-13**). Pole mounted internal facing closed circuit television (CCTV) systems will be deployed around the perimeter of the operational areas of each Site. It is anticipated that these will be 5m high. CCTV cameras will have fixed view sheds and will be aligned to face along the fence, utilising infra-red lighting to avoid the need for permanent lighting at the Scheme boundary.

Plate 3-13. Typical deer security fence

3.5.45 Temporary solid hoarding up to 2.5m in height and 300m in length will be provided, along the Sunnica West Site A boundary, see **Plate 16-2** in **Chapter 16: Other Environmental Topics** of this Environmental Statement **[APP-048]**. The hoarding will be secured through the OLEMP (**Appendix 10I** of this Environmental Statement **[APP-108]**).

3.5.46 If outdoor transformers are used, they will be surrounded by a secure wire mesh fence, to comply with British Standard (BS) EN 62271-1:2017 (Ref 3-

2), as shown in **Plate 3-14**. This fence is will be a maximum of 2.5m in height.

Plate 3-14. Typical transformer compound fencing

3.5.47 Fencing around the BESS, the onsite substations and Burwell National Gird Substation Extension- Option 2, if required will be standard palisade fencing up to 2.5m in height, see **Plate 3-15**.

Plate 3-15. Standard palisade fencing

3.5.48 During winter months, mobile lighting towers with a power output of 8kVAs will be used to assist construction works. During operation, permanent lighting with motion sensors will be installed within the substations and BESS compounds, providing a maximum of 50 lux. Any night works required on the solar panels during operation will use mobile lighting towers.

Site Access and Access Tracks

3.5.49 The Sites will have two main access points: one on Sunnica East Site B and one on Sunnica West Site A. During construction, all small vehicles will access the Sites at these locations and park in the centralised car parks. Staff will then be distributed to the working area via minibus, or similar using internal tracks within the Order limits. Sunnica East Site B will be accessed via the A11 and B1085 and the access to Sunnica West Site A will be via the Chippenham junction of the A11, to the north of junction 38 of the A14.

3.5.50 A number of secondary access points have been provided to enable access to all individual land parcels within the full Order limits. Secondary access points for Sunnica East Sites A and B will be from Elms Road southeast of the main access, Newmarket Road (south of Worlington), Golf Links Road, Newmarket Road (between A11 and Golf Links Road), Freckenham Road, Beck Road and Ferry Lane (see Figure 3-13 and 13-4). Secondary access points for Sunnica West A and B will be from Chippenham Road, Dane Hill Road, and Snailwell Road (see Figure 3-14 and 13-5). The secondary access points also provide an alternative access for the BESS compounds, in case of emergency. The Framework Construction Traffic Management Plan (CTMP) and Travel Plan (TP) in **Appendix 13C** of this Environmental Statement **[EN010106/APP/6.2],** provides further information.

3.5.51 Access to Burwell National Grid Substation Extension will be provided from Weirs Drove and access to Burwell National Grid Substation Extension - Option 2 will be provided from Newnham Drove. A further 18 access points will be provided along Grid Connection Route A and Grid Connection Route B. These are shown on Figures 3-25a to d and further details are provided in **Appendix 13C** of this Environmental Statement **[EN010106/APP/6.2]**.

3.5.52 A number of the access roads within the Order limits are single carriageways; therefore, hedgerows may need to be cut back and the access points may need to be widened/upgraded to assist with any wide loads, as described in the Transport Assessment in **Appendix 13C** of this Environmental Statement **[EN010106/APP/6.2]**. The need to remove vegetation to facilitate access has been assessed within **Chapter 8: Ecology and Nature Conservation [APP-040]**and **Chapter 10: Landscape and Visual Amenity [APP-040]** of this Environmental Statement.

3.5.53 The majority of the access arrangements to each of the Sites is expected to remain consistent through construction, operation and decommissioning activity. These are shown in Figures 3-14 and 3-15. However, the following access will only be used during specific phases:

a. Sunnica East A:

   i. Access K will only be utilised during construction and decommissioning by cranes and the access will be retained during operation for use by emergency vehicles only to provide two accesses for the BESS area, in the event of a fire.

b. Sunnica East B:

i. Access A will be utilised for construction and decommissioning and the access will be retained during operation for use by emergency vehicles only to provide two accesses for the BESS area, in the event of a fire;

ii. Access H will only be used during construction and decommissioning and will not be used during operation. An alternative operational access will be provided off Golf Links Road, Access J during operation only; and

iii. Access I will only be used during construction and decommissioning and will not be used during operation.

iv. Access J will only be used during operation.

3.5.54 The Burwell National Grid Substation Extension – Option 2 access, , will be utilised during all Scheme phases, should this be the option taken forward for the Scheme. The access locations across Grid Connection Route A and B will be re-instated to their condition prior to the construction phase; however, the rights to utilise these access points will be retained during operation and secured through the DCO to allow access for maintenance, if required.

3.5.55 It will be necessary for cranes to be moved to the Sites for the purposes of construction and consideration of the crane routes from the Strategic Road Network (SRN) to the required site accesses has been undertaken. The proposed crane access points are:

a. Sunnica West Site A: Site Access A on La Hogue Road;
b. Sunnica East Site A: Site Access K on Beck Road;
c. Sunnica East Site B: Access A on Elms Road; and
d. Burwell Substation Extension or Newnham Drove (Option 2).

3.5.56 The work undertaken included swept path analysis of a 1000T, 650T and 400T crane to/from the Site accesses. The swept path analysis has identified a need to temporarily remove street furniture and potentially prune one tree (Junction of Church Lane and The Street in Freckenham) within the highway corridor along the crane access routes at the following discrete locations:

a. Junction of Mildenhall Road and an unnamed road (that connects with Beck Road) east of Freckenham;
b. Junction of Church Lane and The Street in Freckenham;
c. Part of Elms Road near the A11;
d. Junction of B1085 Chippenham Road and B1104 in Chippenham;
e. Junction of La Hogue Road and A11;
f. Junction of Newmarket Road and B1102 (Isaacson Road) in Burwell;
g. Junction of Swan Lane and Oxford Street in Exning; and
h. Junction of Fordham Road and Windmill Hill in Exning

3.5.57 The above locations have been included in the Order limits to enable the proposed street works to be undertaken and this is shown on the **Works Plans [EN010106/APP/2.2]**. Further details on the crane access review can be found in **Appendix 13C** of this Environmental Statement **[EN010106/APP/6.2].**

3.5.58 Additional swept path analysis of a 16-Axle Girder Trailer (Abnormal Indivisible Load (AIL)), has been undertaken as a result of the changes to the Application as outlined in Section 3.2 above. The swept path analysis has identified where the AIL will oversail the road and require the temporary removal of street furniture or the potential need to prune vegetation at the following discrete locations:

a. La Hogue Road / A11 Junction;

b. A11 off-slip / B1085 Junction;

c. 'S'-Bend on B1085;

d. Bend on B1085 / Parkside Road;

e. Bend on B1102 The Street / Mildenhall Road;

f. 1102 Mildenhall Road / Unnamed Road Junction;

g. Unnamed Road / Beck Road Junction;

h. A11 / Elms Road Junction;

i. B1103 Newmarket Road / B1102 Isaacson Road Junction;

j. B1103 Swan Lane / Oxford Street Junction;

k. B1103 Reach Road / Weirs Drove Junction;

l. 'S'-Bend on Weirs Drove; and

m. Weirs Drove / Newnham Drove Junction.

3.5.59 The AIL will remain within the bounds of the highway at all of the above discrete locations, except for the 1102 Mildenhall Road / Unnamed Road Junction where the trailer will oversail a small section of private land. Further details of the swept path analysis can be found in Appendix 13C of this Environmental Statement [EN010106/APP/6.2].

3.5.60 In addition, to the removal of street furniture, minor road widening works are required along Burwell Drove, Newnham Drove and Elms Road to facilitate access. All road widening is within the Order limits, further information is provided in **Appendix 13C** of this Environmental Statement **[EN010106/APP/6.2]**.

3.5.61 Access tracks will be constructed within each of the Sites. These will be compacted stone tracks up to 3.5m wide with 1:2 gradient slopes on either side (see **Plate 3-16** and **Plate 3-17**). The primary access points and crane access points will be wider, minimum of 6m to facilitate two-way HGV traffic, and passing bays will be provided along internal access roads to ensure traffic does not impact the local highway network.

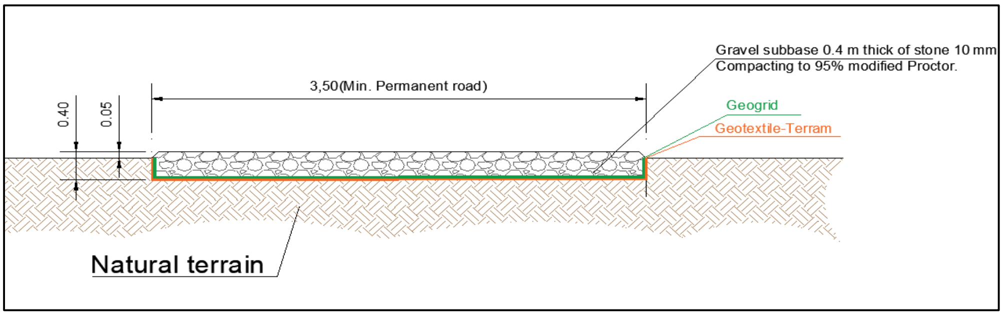

Plate 3-16. Cross section of access track.

Plate 3-17. Example of an access path.

Surface water drainage

3.5.62 The new drainage system will comprise of a series of interconnected swales and infiltration ponds. The design will ensure that any effects from the new infrastructure (i.e. access tracks, cable trenches, hardstanding) on surface water drainage are mitigated. Figures 3-15 and 3-16 show the indicative drainage design system for the Sunnica East Sites A and B and Sunnica West Sites A and B, respectively.

3.5.63 The detailed operational drainage design will be carried out pre-construction with the objective of ensuring that the existing level of drainage of the land is maintained. Infiltration drainage design will be in accordance with Building Research Establishment (BRE) Digest 365: Soakaway Design and Sewers for Adoption (Ref 3-3).

3.5.64 The majority of the Sunnica East Site A, Sunnica East Site B, Sunnica West Site A, and Sunnica West Site B are in Flood Zone 1. However, some areas are Flood Zones 2, 3a and 3b. These fluvial risk locations are in proximity to main rivers; the River Lark, Lee Brook and River Snail, as well as an ordinary watercourse running to the east of Chippenham.

3.5.65 **Chapter 9: Flood Risk, Drainage and Water Resources** of this Environmental Statement **[APP-041]** provides a description of the flood risk and drainage design.

3.5.66 As discussed in Section 3.5.40, an impermeable surface with drainage to a bunded lagoon would be required at each BESS compound in order to capture fire water in the event of fire. The bunded lagoon would be approximately 410m^3 in volume.

Permissive Paths

3.5.67 Incorporated into the Scheme design are three permissive routes which are illustrated on Figure 3-1 (indicative location shown, the final location subject to landowner agreement). These permissive paths will enable increased public access across the landscape of the local area and thus respond positively to local Green Infrastructure Strategies and local planning policies relating to rights of way. The paths proposed are:

a. A new permissive path adjacent to Beck Road at Sunnica East Site A increasing the recreational value across Sunnica East Site A and providing increased connectivity between Freckenham and the southern edge of Isleham;
b. A new permissive path across Sunnica East Site B, to provide access from the existing unclassified road (U6006) across the north of Sunnica East Site B to connect with Golf Links Road; and
c. A new permissive path adjacent to Elms Road and around the perimeter of Sunnica East Site B, which will connect U6006 with PRoW W-257/003/0 which runs to Red Lodge.

3.5.68 The design and implementation of the permissive paths is proposed to be secured through **Appendix 10I: Outline Landscape and Ecology Management Plan** of this Environmental Statement **[APP-108]**.

3.6 Electricity Export Connection to National Grid

Substations

Onsite substations

3.6.1 Three onsite substations will be located alongside the BESS at the Sunnica East Site A, Sunnica East Site B and Sunnica West Site A. The onsite substations will be sited within Developable Area E33 (Sunnica East Site A), Developable Area E18 (Sunnica East Site B), and Developable Area W17 (Sunnica West Site A) (see Figures 3-1 and 3-2 for Developable Area locations). The precise location will be determined through micro-siting during detailed design following the granting of the DCO.

3.6.2 As outlined in Section 3.2, to facilitate the grid connection at Burwell National Grid Substation, the Scheme needs to provide a substation or transformer capable of upgrading the voltage of the electricity generated by the Scheme to 400 kV. As a result the onsite substation will consist of electrical infrastructure such as the transformers, switchgear and metering equipment required to facilitate the export of electricity from each respective

Site at either 132 kV or 400 kV, depending on the option taken forward. The dimensions of each onsite substation area are outlined below:

a. Sunnica East Site A – 85m by 55m;

b. Sunnica East Site B – 85m by 130m; and

c. Sunnica West Site A – 85m by 130m.

3.6.3 Each substation will be up to 10m in height. Figures 3-9 (a and b), 3-10 (a and b) and 3-11 (a and b) illustrate the dimensions for 132 kV solution and Figures 3-28 (a and b), 3-29 and 3-30 (a and b) illustrate the dimensions for 400 kV onsite substations.

3.6.4 The onsite substations will each include a control building, which will be up to 25m by 12m in plan, and up to 7m in height. These would be located within Developable Areas E33 and E18 for Sunnica East Site A and Sunnica East Site B respectively and Developable Area W17 for Sunnica West A. This will include office space and welfare facilities and may also include operational monitoring and maintenance equipment (operational monitoring equipment could be housed separately in its own container). The control buildings will be a painted block building with external colours and finishes to be confirmed prior to construction. Hardstanding will be provided at each substation and parking spaces for up to a maximum of 20 cars will be provided within the substation in Sunnica West Site A and Sunnica East Site A. Permanent parking for Sunnica East Site A and B is provided within the permanent compounds discussed above.

Option 2 - Burwell National Grid Substation Extension ~~– Option 2~~

3.6.5 The Burwell National Grid Substation Extension – Option 2 is to the north of the existing substation approximately 450m from Burwell. This substation will be required, to transform the 132 kV export voltage from the Sites to the National Grid 400 kV connection voltage, should this option be taken forward.

3.6.6 The substation extension compound will have a footprint of up to 43m by 76m footprint, 12m in height, with an associated laydown area of 43m by 30m, as shown in Figure 3-18a and 3-18b. The area identified for the substation is larger than the required footprint due to the need for flexibility to allow micro-siting during detailed design following granting of the DCO consent. The area is currently agricultural fields (see Figure 3-20). The Burwell National Grid Substation Extension – Option 2 would include a transformer compound, substation, control building, underground and above ground electrical cables connecting to the existing substation, electrical bays to connect into existing network within the existing substation including disconnectors and ancillary equipment, security and site lighting infrastructure, including cameras, perimeter fencing, and flood protection measures.

~~3.6.6~~3.6.7 Option 3 does not require any extension works to the Burwell National Grid Substation.

Substation summary

~~3.6.7~~3.6.8 As outlined above the Application includes two options for connecting into Burwell National Grid Substation at 400 kV; however, only one of which would ever be implemented. The Applicant and NGET are negotiating the amendment of the connection agreement between the parties and those negotiations are ongoing. It is for this reason that Option 2 remains within the Application.

~~3.6.8~~3.6.9 Both options to connect into Burwell National Grid Substation at 400 kV have been assessed within the relevant technical chapters of the ES.

Grid Connection Route

~~3.6.9~~3.6.10 The Burwell National Grid Substation is approximately 5.5km to the west of the Sunnica West Site B. A 132kV (Option 2) or 400 kV (Option 3) cable will be installed to connect Sunnica East Site A, Sunnica East Site B, and Sunnica West Site A onsite substations to Burwell National Grid Substation. The total length of the cable run for Grid Connection Route A will be approximately 7km, and 13km for Grid Connection Route B.

~~3.6.10~~3.6.11 The cable will also run within the Sites, the indicative alignment of which is shown in Figures 3-17a to d. Two options are proposed for high voltage cables to export the electricity produced by Sunnica East Site A, Sunnica East Site B, Sunnica West Site A, and Sunnica West Site B to the Burwell National Grid Substation:

a. A 132 kV cable would be required for Burwell National Grid Substation Extension – Option 2. Figure 3-7b illustrates the cross sections of the trenches required along the cable route. Figure 3-8 presents cross sections of non-intrusive cable crossings; and
b. A 400 kV cable would be required for Option 3 – 400 kV onsite substations. Figure 30 illustrates the cross sections of the trenches required along the cable route and of non-intrusive cable crossings.

~~3.6.11~~3.6.12 Burwell National Grid Substation – Option 2 will require two circuits comprised up to three sets of cables[4] per circuit. The number of sets of cables per circuit will depend on several factors: the conductor material (copper or aluminium), the soil thermal resistivity, and the total capacity of the Scheme. Option 3 – 400 kV onsite substations will require one circuit comprised of one set of cables[4].

~~3.6.12~~3.6.13 The cables for both Option 2 and Option 3 will be combined either in a single trench with a maximum width of up to 3.5m and a maximum depth of 2m for open cut trenches or in two (or more) trenches when crossing roads or other constraints with specific technical engineering challenges such as Network Rail. Maximum parameters for trenchless crossings are outlined below in 3.6.22. The working width which is required for material laydown and construction equipment is expected to be 30m across the majority of the cable corridor; however, the working width increases to 50m and 100m along limited sections of the cable corridor where particular environmental and engineering constraints exist.

[4] A set of cables comprises three cables.

~~3.6.13~~3.6.14 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.

~~3.6.14~~3.6.15 Jointing bays will be required every 500m to 2km to join sections of cable together. At this stage, a maximum of 90 jointing bays are anticipated. The dimensions of these are determined by how many sets of cables will be in the jointing bay. Should Burwell National Substation Extension – Option 2 be taken forward, it is likely that each jointing bay will have up to four sets of cables with dimensions of up to 30m by 8m and a depth of 2.5m. If six sets of cables are required, two jointing bays will be aligned consecutively along the cable route with three sets of cables in each. Should Option 3 – 400 kV onsite substations be taken forward, the dimensions of the jointing bay will be up to 18.5m in length, by 3m in width and 2.5m in depth. The distance between jointing bays will be determined through the design process and is dependent on existing infrastructure along the cable route, cable specification and cable delivery limitations. 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. The cables will be laid across the sandbags and space around and immediately above the cables will be filled with sand and stokbord[5]. The excavated soil will then be backfilled on top. Figure 3-24 and Figure 3-32 shows the proposed layout of the jointing bays proposed for both options.

~~3.6.15~~3.6.16 Up to 30 fibre bays will be provided up to every 2000m. Should Burwell National Substation Extension – Option 2 be taken forward, the external dimensions will be approximately 1.5m by 1m and 2m deep. The STAKKAbox™[6] system or similar will be used with an access hatch from the surface. Should Option 3 – 400 kV onsite substations be taken forward, the external dimensions will be approximately 1.75m by 1.75 and 2m in depth, these will be constructed from brick or concrete. These will be located in hard surface or at edges of fields with the final location to be determined at detailed design.

~~3.6.16~~3.6.17 The cable route will need to cross a range of existing infrastructure such as major roads, minor roads and tracks, PRoW, existing buried/underground utilities (such as medium and high-pressure gas mains), a railway, rivers, field drains and main drains. Open cut trenching will be primarily utilised for crossings.

~~3.6.17~~3.6.18 The open cut technique may require the temporary closure of PRoWs, and minor roads and tracks. All temporary closures of PRoWs will be avoided as far as possible, if closure of routes are required then as a worst-case scenario it is assumed the PRoWs are closed for up to three weeks. The PRoWs that will be affected during construction are:

a. W-257/002/X

[5] Stokbord® is a versatile and durable board made from 100% recycled plastic.
[6] STAKKAbox™ is a range of modular and structural preformed access chambers that provide a modern alternative to traditionally brick built chambers.

b. W-257/007/0

c. W-257/003/0

d. W-257/002/0

e. 49/7

f. 204/1

g. 92/19

h. 35/10

~~3.6.18~~3.6.19 The following minor roads and tracks along the cable route would be closed for a maximum of seven days for the cable route construction and construction of the accesses within the Order limits:

a. Weirs Drove

b. Newnham Drove

c. Little Fen Drove

d. First Drove

e. Broads Road

f. Chippenham Road

g. La Hogue Road

h. B1085

i. Elms Road

j. Beck Road

k. Isleham Road

l. B1102 Freckenham Road

m. Newmarket Road between (Worlington and Red Lodge)

n. U6006

~~3.6.19~~3.6.20 The CTMP and TP in **Appendix 13C** of this Environmental Statement **[EN010106/APP/6.2]** provides further detail regarding closure of PRoWs and minor roads and tracks.

~~3.6.20~~3.6.21 Trenchless techniques, such as boring[7], micro-tunnelling[8] or moling[9] methods will be undertaken where the EIA or design concludes the need for an alternative to open trenching. There is a potential that an alternative to open trenching will be required in up to 27 locations (refer to **Table 3-3** and Figure 3-23) across the Scheme, however this will depend on the results ground investigations and the final detailed design.

[7] Boring is the process of enlarging a hole that has already been drilled (or cast) by means of a single-point cutting tool (or of a boring head containing several such tools), such as in boring a gun barrel or an engine cylinder.
[8] Micro-tunnelling is a digging process that uses a remotely controlled microtunnel boring machine (MTBM) combined with the pipe jack-and-bore method to directly install pipes underground in a single pass.
[9] During the moling process, a pneumatically-driven machine known as a mole forces its way through the soil along the desired path of the pipe.

Table 3-3 Potential locations of Trenchless Crossings along Cable Route

Crossing ID (Refer to Figure 3-23)	Site/ Grid Connection Route	Crossing	Indicative National Grid Ref.
W1	East A	Kennet-Lee Brook	TL 66131 73742
W2	East A	Kennet-Lee Brook	TL 66219 73348
W3	Connection Route A	River Kennet	TL 68546 70413
W4	West B	Brook	TL 64239 68929
W5	West B	Brook	TL 63908 69017
W6	West B	River Snail	TL 63455 68938
W8	Connection Route B	Drain	TL 62455 69142
W9	Connection Route B	Brook	TL 62158 69043
W10	Connection Route B	New River	TL 61586 68802
W11	Connection Route B	Brook	TL 61374 68646
W12	Connection Route B	Brook	TL 60923 68386
W15	Connection Route B	Drain (into Catch Water Drain)	TL 59165 68849
W16	Connection Route B	Catch Water Drain	TL 59187 68804
W17	Connection Route B	Brook	TL 58901 68748
W18	Connection Route B	Black Lake Drain	TL 58753 68508
W19	Connection Route B	Brook	TL 58592 68467
W20	Connection Route B	Brook	TL 58439 68445
W21	Connection Route B	Drain along Factory Road	TL 58351 68229
W22	Connection Route B	Drain along Factory Road	TL 58346 68204
W23	Connection Route B	Burwell Lode Canal	TL 58258 67875
W24	Connection Route B	Brook	TL 58114 67602
W25	Connection Route B	Drain	TL 58190 67221
T1	Connection Route B	Railway	TL 62455 69060
R8	Connection Route B	A142	TL 62306 69279
R10	Connection Route B	Broads Road	TL 59259 68762

Crossing ID (Refer to Figure 3-23)	Site/ Grid Connection Route	Crossing	Indicative National Grid Ref.
IRC R3	High Voltage Cable	A11	TL 67972 67534
IRC R4	High Voltage Cable	A11	TL 68156 67797

~~3.6.21~~3.6.22 Trenchless techniques will require a launch pit to be excavated at the starting point for the machinery to drill from and a reception pit to be excavated at the end point where the machinery will drill to. These launch pits and reception pits will be up to 2m deep, 8m in length and 4m wide. Both launch and reception pits will be a minimum distance of 10m from a watercourse and will be backfilled and reinstated following installation of the cables. The precise location and dimensions of the launch and reception pits will be determined during detailed design. Maximum depths of drilling for trenchless techniques could be up to 20m.

~~3.6.22~~3.6.23 The Network Rail crossing may require up to six sets of cables, each spaced up to 9m apart from one another.

~~3.6.23~~3.6.24 The cable route within Grid Connection Route A and Grid Connection Route B, shown in Figures 3-17a to 3-17d, is subject to an iterative design process. A range of constraints will determine the final optimal cable route within the cable corridor. The final cable route will be determined at detail design.

3.7 Construction

3.7.1 Subject to development consent being granted, the earliest construction will start is Summer 2023. Connection to the National Grid is governed by a grid connection agreement with National Grid.

3.7.2 A construction programme of approximately 24 months will take place if the Scheme is built in one continuous phase. This has been assessed within the ES, as it is considered to be a worst case in terms of environmental effects, although technical topics will consider if there are any additional implications if the construction period is slightly longer or constructed in phases. The final programme will be dependent on the final Scheme design and potential environmental constraints on the timing of construction activities. A Framework Construction Environmental Management Plan (CEMP) has been prepared to accompany this ES. This describes the framework of mitigation measures to be followed, to be carried forward to a detailed CEMP prior to construction (refer to **Appendix 16C** of this Environmental Statement **[EN010106/APP/6.2]**) refer to paragraph 3.7.52.

3.7.3 The Scheme would be split into construction zones which are illustrated on Figures 3-21a and 3-21b (the Sites) and Figures 3-22a and 3-22b (cable route). The indicative timescale for the construction of each zone is provided below, followed by the indicative programme for the cable route and substations. At the time of writing the ES, it is understood that the cable route and substations would be constructed early in the 24 month programme; however, the final programme will be determined by the appointed contractor.

3.7.4 Sunnica East Site A:

a. Sunnica East Zone 1: Total duration of 12 months, to be split as follows:

   i. Enabling works, compound set-up, construction of internal roads and installation of concrete foundations: months 1 to 5
   ii. Trenching for internal cabling: months 2 to 7
   iii. Structure works (e.g. installation of PV structures and modules): months 3 to 10
   iv. Electrical works, such as installation of the cabling, inverters and transformers, as well as connection of PV modules and CCTV installation: months 2 to 12.

b. Sunnica East Zone 2: 24 months

   i. Enabling works, compound set-up, construction of internal roads and installation of concrete foundations: months 1 to 7
   ii. Trenching for internal cabling: months 3 to 16
   iii. Structure works (e.g. installation of PV structures and modules): months 3 to 20
   iv. Electrical works, such as installation of the cabling, inverters and transformers, as well as connection of PV modules and CCTV installation: months 3 to 24

3.7.5 Sunnica East Site B:

a. Sunnica East Zone 3: 24 months

   i. Enabling works, compound set-up, construction of internal roads and installation of concrete foundations: months 1 to 7
   ii. Trenching for internal cabling: months 3 to 16
   iii. Structure works (e.g. installation of PV structures and modules): months 3 to 20
   iv. Electrical works, such as installation of the cabling, inverters and transformers, as well as connection of PV modules and CCTV installation: months 3 to 24
   v. Commissioning: Month 24

b. Sunnica East Zone 4: 9 months

   i. Enabling works, compound set-up, construction of internal roads and installation of concrete foundations: months 1 to 5
   ii. Trenching for internal cabling: months 2 to 7
   iii. Structure works (e.g. installation of PV structures and modules): months 3 to 9
   iv. Electrical works, such as installation of the cabling, inverters and transformers, as well as connection of PV modules and CCTV installation: months 2 to 9
   v. Commissioning: Month 9

c. Sunnica East Zone 5: 13 months

i. Enabling works, compound set-up, construction of internal roads and installation of concrete foundations: months 1 to 6
ii. Trenching for internal cabling: months 2 to 10
iii. Structure works (e.g. installation of PV structures and modules): months 3 to 10
iv. Electrical works, such as installation of the cabling, inverters and transformers, as well as connection of PV modules and CCTV installation: months 2 to 13
v. Commissioning: Month 13

d. Sunnica East Zone 6: 12 months

i. Enabling works, compound set-up, construction of internal roads and installation of concrete foundations: months 1 to 5
ii. Trenching for internal cabling: months 2 to 7
iii. Structure works (e.g. installation of PV structures and modules): months 3 to 10
iv. Electrical works, such as installation of the cabling, inverters and transformers, as well as connection of PV modules and CCTV installation: months 2 to 12
v. Commissioning: Month 12

3.7.6 Sunnica West Site A:

a. Sunnica West Zone 2: 24 months

i. Enabling works, compound set-up, construction of internal roads and installation of concrete foundations: months 1 to 7
ii. Trenching for internal cabling: months 3 to 16
iii. Structure works (e.g. installation of PV structures and modules): months 3 to 20
iv. Electrical works, such as installation of the cabling, inverters and transformers, as well as connection of PV modules and CCTV installation: months 3 to 24
v. Commissioning: Month 24

b. Sunnica West Zone 3: 10 months

i. Enabling works, compound set-up, construction of internal roads and installation of concrete foundations: months 1 to 4
ii. Trenching for internal cabling: months 2 to 5
iii. Structure works (e.g. installation of PV structures and modules): months 3 to 9
iv. Electrical works, such as installation of the cabling, inverters and transformers, as well as connection of PV modules and CCTV installation: months 3 to 10
v. Commissioning: Month 10

3.7.7 Sunnica West Site B:

a. Sunnica West Zone 1: 7 months

i. Enabling works, compound set-up, construction of internal roads and installation of concrete foundations: months 1 to 4
ii. Trenching for internal cabling: months 2 to 5
iii. Structure works (e.g. installation of PV structures and modules): months 3 to 7
iv. Electrical works, such as installation of the cabling, inverters and transformers, as well as connection of PV modules and CCTV installation: months 2 to 7
v. Commissioning: Month 7

3.7.8 At this stage, a total construction period of 50 weeks is anticipated for the construction of the three onsite substations and the Burwell National Grid Substation Extension. The construction will be concurrent, albeit with a staggered start date. The duration of construction works at each individual site is expected to be as follows:

a. Sunnica West Site A: 50 Weeks

b. Sunnica East Site A: 50 Weeks

c. Sunnica East Site B: 50 Weeks

d. Burwell National Grid Substation Extension: ~~50~~ 24 Weeks

3.7.9 The construction of the cable route corridor will be undertaken in two concurrent phases over a 50 week period. The first phase will run from the Burwell National Grid Substation to the onsite substation within Sunnica West Site A and the second will run from the substation in Sunnica West Site A to the substation in Sunnica East Site A.

3.7.10 For the purposes of construction, the cable route has been split up into 15 sections (see Figures 3-22a and 3-22b).

3.7.11 Where trenchless techniques are required these will be scheduled individually within the overall programme envelope to ensure that the works are completed in the most efficient manner possible. This will be determined at the detailed planning and pre-construction phase.

3.7.12 Cable installation will follow behind excavation in the same sequence. There will be an overlap of up to two weeks between sections as individual jointing bays become available and completed bays are backfilled and reinstated.

Construction Activities

3.7.13 The construction activities that are likely to be required are outlined below. It is likely that a number of these activities will run in parallel with works being undertake on all sites at the same time.

Site Preparation and Civil Engineering Works

3.7.14 The following activities would be required as part of these works:

a. Preparation of land for construction, including localised site levelling (where required). The land level changes will be localised, and will not be noticeable;
b. Import of construction materials, plant and equipment to site;
c. Establishment of the perimeter fence;
d. Establishment of the construction compounds;
e. Construction of the internal access roads; and
f. Marking out the location of the Scheme infrastructure.

3.7.15 Temporary construction compounds will be established throughout the Sites for the construction phase. One will be located within Sunnica East Site A, five within Sunnica East Site B, three will be located Sunnica West Site A and one within Sunnica West Site B. Temporary construction compounds in Sunnica East Sites A and B will consist of the following:

a. areas of hardstanding;
b. car parking;
c. site and welfare offices and workshops;
d. security infrastructure, including cameras, perimeter fencing and lighting;
e. site drainage and waste management infrastructure (including sewerage); and
f. electricity, water, waste water and telecommunications connections.

3.7.16 Temporary construction compounds in Sunnica West Sites A and B will consist of the following:

a. areas of hardstanding;
b. car parking;
c. security infrastructure, including cameras, perimeter fencing and lighting;
d. site drainage and waste management infrastructure (including sewerage); and
e. electricity, water, waste water and telecommunications connections.

3.7.17 A number of construction laydown areas will be required for the construction of the cable route. The number of construction laydown areas will be defined during detailed design; however, there will be a maximum of 15, one per construction zone. These will consist of the following:

a. areas of hardstanding, compacted ground or track matting;
b. car parking;
c. area to store materials and equipment;
d. site and welfare offices and workshops;
e. security infrastructure, including cameras, perimeter fencing and lighting;

f. safety infrastructure to warn and manage traffic when crossing roads or other obstacles;

g. site drainage and waste management infrastructure (including sewerage); and

h. electricity, water, waste water and telecommunications connections.

3.7.18 There will be one laydown area for the Burwell National Grid Extension, this will be located within the Order limits, either within Option 1 or 2 area. This will consist of the following:

a. areas of hardstanding, compacted ground or track matting;

b. car parking;

c. area to store materials and equipment;

d. site and welfare offices and workshops;

e. security infrastructure, including cameras, perimeter fencing and lighting;

f. site drainage and waste management infrastructure (including sewerage); and

g. electricity, water, waste water and telecommunications connections.

Solar PV Array Construction

3.7.19 The following activities would be required to install the solar PV modules:

a. Import of components to site;

b. Ramming and erection of module mounting structures, with foundations to a maximum depth of 3.5m (see **Plate 3-18**);

Plate 3-18. Ramming of module mounting structures.

c. Mounting of modules. This will be undertaken by hand (see **Plate 3-19**);

Plate 3-19. Construction staff mounting solar PV modules by hand.

d. Trenching and installation of electric cabling;

e. Transformer, inverter and switchgear foundation excavation and construction;

f. Installation of transformers, inverters and switchgear. Cranes will be used to lift equipment into position; and

g. Installation of control systems, monitoring and communication.

Construction of Onsite Electrical Infrastructure

3.7.20 The following activities would be required to construct the onsite electrical infrastructure, including the Burwell National Grid Substation Extension:

a. Site preparation;

b. Excavation and construction of the concrete foundations. Piling may be required for foundations;

c. Construction of the reinforced concrete pads supporting the external electrical equipment.

d. Installation of electric cabling;

e. Import of components to site. Mobile cranes will be used to lift the components into position The lift height will be dependent on the weight of the transformers and the lift distance; however, it is not expected that the height would be more than 30m; and

f. Installation of the substations and battery, transformers, inverters and switchgear for the three onsite BESS areas.

Construction of Cable Routes

3.7.21 The following activities would be required to construct the cable routes:

a. Site preparation and appropriate searches;

b. Excavation will be undertaken using an appropriately sized tracked excavator, excavation will normally be carried out in layers;

c. Topsoil will be segregated and stored on site to be reused;

d. The trench will be cleared and bottomed out, ensuring there are no hard protrusions;

e. Sand bedding will be installed at the bottom of the trench; and

f. Cable installation will follow behind excavation in the same sequence. However, it is not expected that cable installation will be continuous. Cables will be installed in groups or sections to ensure that works are completed in the most efficient manner possible.

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

Construction of Jointing bays

3.7.23 The following activities would be required to construct the Jointing bays:

a. Excavation activities will be as listed above in section 3.7.21;

b. Jointing bay locations will be re-measured to verify their position before excavation commences; and

c. Jointing bay excavation will be coordinated with the cable pulling programme to ensure that jointing bays are not left open for longer than necessary.

Trenchless cabling

3.7.24 The following activities would be required:

a. Site preparation and appropriate searches;

b. Launch and reception pits will be excavated using a suitable excavator, with any required shoring or battering installed. Plant and spoil will be placed a safe distance away from the edge of the excavation so as to minimise the risk of the trench sides collapsing;

c. Once the launch pit has been excavated, work will then commence on the initial drill (the 'pilot bore').

d. Upon completion of the pilot bore the drill head will be removed and a reamer will be attached to the drill string, this will be carried out until the bore is of an acceptable size to accept the duct;

e. Once the bore is enlarged to the required size the product pipe will then be connected to the reamer[10] via a swivel for installation.

3.7.25 If field conditions are not suitable to track plant and equipment to the launch and reception pits, trackway or similar will be employed to facilitate access and egress. An area of hardstanding of up to 30m by 30m will be required at the launch pit and the reception pit. The area of hardstanding will be removed and the area reinstated following construction.

3.7.26 It is anticipated that water-based drilling and bentonite will be utilised. During drilling operations the fluids pumped through the drill string will be closely monitored by checking volume of returns flowing back to the launch

[10] Definition: A reamer is a type of rotary cutting tool used in metal working.

pit and visual checks across the drill line. If required the pumping activities will be stopped until any issues are rectified.

Testing and Commissioning;

3.7.27 Commissioning of the Scheme will include testing and commissioning of the Scheme equipment. Commissioning of the PV infrastructure will involve mechanical and visual inspection, electrical and equipment testing, safety testing, and commencement of electricity supply into the grid.

Landscaping and Habitat Creation

3.7.28 See paragraphs 3.7.56 to 3.7.58 for details.

Construction Staff

3.7.29 At the peak of construction, which is expected to be in month 9, an estimated average 1,393 staff per day will be required to work across the Scheme. This number will be less at other times of the construction phase and if the construction period is extended more than the assumed 24 months.

Construction Hours of Work

3.7.30 Working hours onsite will run from 7am until 7pm Monday to Saturday. Working days will be one 12-hour shift.

3.7.31 No works will be undertaken within fields W03 and W05 on Sunnica West Site A prior to 10am to limit disruption to the 'The Gallops' and the associated horse training activities.

Construction Traffic, Plant and Site Access

3.7.32 An Access Strategy has been prepared to determine appropriate access, as shown in the CTMP and TP in **Appendix 13C** of this Environmental Statement **[EN010106/APP/6.2]** and section 3.5.49 above for further information.

3.7.33 **Table 3-4** summarises the anticipated vehicle movements during the construction phase across the Order limits.

Table 3-4 Total construction phase traffic estimates

Purpose	Vehicle Type	Number of movements (Two-way movements)
Total construction HGVs	HGV	**Solar PV construction:** - Peak 162 movements per day in month 2 (86 per day at Sunnica East Sites A and B and 76 per day at Sunnica West Sites A and B). - An average of 93 movements per day (51 per day at Sunnica East Sites A and B and 42 per day at Sunnica West Sites A and B).

Purpose	Vehicle Type	Number of movements (Two-way movements)
		Construction of the three substations and the Burwell National Grid Substation Extension: An estimated worst-case average of 42 (64 maximum) HGV movements per day will be required to construct the three substations and the Burwell National Grid Substation Extension. Should the Burwell National Grid Substation Extension - Option 2 not be required, there will be fewer HGV movements required. **Cable route construction:** An estimated average of 90 (92 maximum) HGV movements per day will be required.
Personnel transportation	Light vehicle	**Solar PV construction:** - Peak 1,874 movements per day across the Sites. - Average 1,242 movements per day across the Sites. **Construction of the three substations and the Burwell National Grid Substation Extension:** An estimated worst-case average of 164 (maximum 254) movements per day will be required. Should the Burwell National Grid Substation Extension - Option 2 not be required, there will be fewer movements required. **Cable route construction:** An estimated average of 8 (maximum 10) movements per day will be required over the 30-week construction period.
Personnel transportation	Mini-bus	Peak 118 movements per day Average 54 movements per day

3.7.34 **Table 3-5** summarises the anticipated ancillary vehicle movements during the construction phase. These are included in the total movements provided in **Table 3-4**.

Table 3-5 Breakdown of ancillary construction traffic estimates

Purpose	Vehicle Type	Number of movements (Two-way movements)
Fuel delivery	HGV	**Solar PV construction:** 454 movements over the entire construction period, which is an average of 18 per month during construction. **Construction of the four substations:** An estimated total of 197 movements will be required over the 50 week construction period. **Cable route construction:** An estimated total of 106 movements will be required over the 50 week construction period.
Water delivery (industrial use)	HGV	**Solar PV construction:** 268 movements over the entire construction period, an average of 12 per month during construction. No water for industrial use is expected to be delivered for the construction of the four substations or the cable route.

Water delivery (potable)	HGV	**Solar PV construction:** 268 movements over the entire construction period, an average of 12 per month during construction. **Construction of the four substations across the:** An estimated total of 196 movements will be required over the 50 week construction period. **Cable route construction:** An estimated total of 53 movements will be required over the 50 week construction period.
Waste collection (general waste, hazardous waste and recyclables)	HGV	**Solar PV construction:** 2,072 movements over the entire construction period, which is an average of 86 per month during construction. **Construction of the four substations across the:** An estimated total of 588 movements will be required over the 50 week construction period. **Cable route construction:** An estimated total of 4,550 movements will be required over the 50 week construction period.
Sewage and greywater collection	HGV	**Solar PV construction:** 468 movements over the entire construction period, which is an average of 20 per month during construction. **Construction of the three substations and the National Grid Substation extension across the:** An estimated total of 197 movements will be required over the 50 week construction period. It is expected that welfare vans will be provided for workers along the cable route. Therefore there would be no requirement for collection of sewage and greywater during the construction of the cable route.
Craneage	80 Tonne, 400 Tonne and 1000 Tonne cranes	An estimated total of 54 crane movements would be required during the construction of the three substations and Burwell National Grid Substation Extension– Option 2. Should the Burwell National Grid Substation Extension -Option 2 not be required, there will be fewer movements required..
Low Loader	STGO CAT 2 and 3	An estimated total of 48 low loader movements would be required during the construction of the three substations and the Burwell National Grid Substation Extension– Option 2. Should the Burwell National Grid Substation Extension - Option 2 not be required, there will be fewer movements required.

3.7.35 **Table 3-6** summarises the anticipated plant and machinery required during the construction phase for the Sites.

Table 3-6 Construction plant and machinery numbers and type required for construction of the Sites.

Plant and machinery	Number required	
	Sunnica East Site A and B	Sunnica West Site A and B
Compact excavator	21	21
Mobile crane	7	5
Crawled Dozer	6	3
Excavator	13	11
Mini Excavator	5	4
Push press piling rig	12	12
Power generator	6	4
Telehandler	18	17
Truck	18	15
Vibrating roller	5	2
Wheeled Excavator	5	4
Compact excavator	21	21

3.7.36 **Table 3-7** summarises the anticipated plant and machinery required during the construction phase for the three substations and Burwell National Grid Substation Extension – Option 2.

Table 3-7 Construction plant and machinery numbers and type required for the substation construction

Plant and machinery	Number required across all three substations and Burwell National Grid Substation Extension
80 Tonne Mobile Crane	2
400 Tonne Mobile Crane	1
1000 Tonne Mobile Crane	1
Telehandler	5
Generator	5

Plant and machinery	Number required across all three substations and Burwell National Grid Substation Extension
Skip Loader, 18 Tonne	2
Tanker (Water)	2
Tanker (Fuel)	2
Tracked Excavator	5
Mini Excavator	5
Vibrating Roller	5
Ready Mix Concrete Wagon, 6M / 32 Tonne	16
HGV Low Loader / Sliding Body	20
Rigid HGV / HIAB	25
Truck, 7.5 – 20 Tonne	35
Van (e.g. Transit / Sprinter)	35

3.7.37 **Table 3-8** summarises the anticipated plant and machinery required during the construction phase for the cable route.

Table 3-8 Construction plant and machinery numbers and type required for the cable route construction

Plant and machinery	Number required for construction of the cable route
Groundhog Portable Welfare Unit	3
Fuel Bowser	2
HGV Materials Delivery Vehicle	3
HGV Beavertail	2
Drilling Rig	1

Plant and machinery	Number required for construction of the cable route
Forklift / Telehandler	1
HGV Water Tanker	2
HGV Low Loader	2
Tracked Excavator	2
Mini Excavator	2
Dumper	2
Truck, 7.5 – 18 Tonne	2
Rigid HGV HIAB (Grab)	6
Truck Mounted Hot Box - 18 Tonne	1
Cable Winch	1
Cable Transport Vehicle	2
Van (e.g. Transit / Sprinter)	10

3.7.38 Noise levels for equipment are provided in **Chapter 11: Noise and Vibration** of this Environmental Statement **[APP-043]*.***

3.7.39 Two car parks will be provided close to the strategic road network for construction workers (see Figure 3-19a and 3-19b). Construction workers will then be transported around site via mini-bus, or similar.

3.7.40 A Framework CTMP and TP has been developed as part of the EIA which will guide the delivery of materials and staff onto the Scheme during the construction phase. This is presented in **Appendix 13C [EN010106/APP/6.2]** for further details on construction traffic movement. It will be secured by requirement in the DCO.

3.7.41 A self-contained wheel wash will be installed at each of the Sites to be used by vehicles prior to exiting the Site onto the public highway if there is mud or debris on the construction site. For loads unable to use the fixed wheel wash, a localised wheel washing would be set up to cater for these individually and as required to ensure no detrimental effect to the highway.

Construction Compounds

3.7.42 Construction compounds will be located within Sunnica East Site A, Sunnica East Site B, Sunnica West Site A, and Sunnica West Site B, as shown in Figures 3-19a and 3-19b. All compounds will be located within the Order limits. The compounds will be approximately 6,000m^2 and will contain offices, mobile welfare units, canteens, storage and waste skips, parking areas and space for storage, download and turning area. These construction compounds will also be used as compounds during the construction of the cable route corridor. However, a up to 15 temporary laydown areas will be provided along the cable corridor, the location of which will be determined prior to construction. In addition, there will be a construction compound for Burwell National Grid Extension – Option 2, should this option be taken forward. Following construction, the temporary compounds within the Sites will be built out with solar PV.

Storage of Construction Plant and Materials

3.7.43 No long-term onsite storage of materials is required during the construction phase. Materials will be delivered via HGVs at regular intervals to the construction compounds and transported directly to where it is required within the Order limits using smaller LGVs.

3.7.44 Short term storage of materials and plant can be accommodated within the construction compound until it is required.

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

Spoil Management

3.7.46 For the Sites, there will be no site wide reprofiling required; however, there may be a need to flatten areas within the Sites. This is unlikely to create excess spoil and it is not expected that this would need to be removed from the Sites. Spoil material is only expected to be generated from cable trenches, temporary and permanent compounds, internal roads, BESS and substation compounds, and solar stations. During construction the spoil will be stored temporarily within designated areas adjacent to the cable route and within the construction compounds. The spoil resulting from the construction of the Sites will be utilised to backfill the cable trenches, reinstate the temporary construction compounds and any temporary access roads.

3.7.47 During the construction of the cable route, the total volume of excess spoil arising from earthworks is anticipated to be 45,470 tonnes. This is the volume to be displaced by the cables themselves, so will be removed from site and disposed of at an appropriate waste facility. The removal of waste from the cable corridor has been assessed within **Chapter 13: Transport and Access [APP-045]** and **Chapter 16: Other Environmental Topics [APP-048]** of this Environmental Statement.

Construction Lighting

3.7.48 During winter months, mobile lighting towers with a power output of 8kVAs will be used during construction.

Energy Consumption

3.7.49 A total estimated 312,500 litres (L) of fuel will be required during construction of the Sites. An estimated 37,500L of fuel would be required during construction of the cable route. Fuel for machinery and generators will be delivered to site by a fuel truck and stored in an above ground fuel storage tank of 4–6 m³ capacity. The fuel storage tank will be sheltered, secured from unauthorised access and equipped with a spill protection bund capable of holding 110% of the volume of the tank. Spill kits will be available at the fuelling point and other strategic locations of the construction site to allow for prompt clean up to limit soil and water contamination. Construction workers will be trained in spill kit use.

Water Consumption

3.7.50 An estimated 156,250L of water will be required per day during construction of the Sites to support welfare facilities onsite and other uses. An estimated 25,000L for potable water usage and 120,000L for trenchless cabling will be required for the cable route. The water will be transported to Site by road from an existing nearby licenced water abstraction source and stored on site in a tank of 5–10 m^3 capacity.

Waste

3.7.51 Solid waste materials generated during construction of the Sites will be segregated and stored onsite in containers of 30m^3 capacity prior to transport to an approved, licensed third party landfill and recycling facilities. Estimated waste arisings are summarised in **Table 3-9**.

Table 3-9 Estimated waste arisings during construction.

Waste	Management
Hazardous waste	
Paint	Approximately 1000kg
Solvents	Approximately 500kg
Chemical cans and containers, oily rags	Approximately 1000kg
Non-hazardous waste	
Paperboard	Approximately 21,094m^3, 703 containers
Wood	Approximately 28,125m^3, 938 containers
Plastic	Approximately 2,813m^3, 94 containers

3.7.52 The removal of waste from the cable corridor has been assessed within **Chapter 13: Transport and Access [APP-045]** and **Chapter 16: Other Environmental Topics [APP-048]** of this Environmental Statement .

Construction Environmental Management Plan and Construction Resource Management Plan

3.7.53 A Framework Construction Environmental Management Plan (CEMP) has been prepared to accompany this ES. This describes the framework of mitigation measures to be followed, to be carried forward to a detailed CEMP prior to construction (refer to **Appendix 16C** of this Environmental Statement **[EN010106/APP/6.2]**). The aim of the CEMP is to reduce nuisance impacts from:

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

3.7.54 The detailed CEMP will be produced by the appointed construction contractor following granting of the DCO and prior to the start of construction (as part of a Requirement included in Schedule 2 of the DCO). The CEMP will identify the procedures to be adhered to and managed by the contractor throughout construction.

3.7.55 Contracts with companies involved in the construction works will incorporate environmental control, health and safety regulations, and current guidance and will ensure that construction activities are sustainable and that all contractors involved with the construction stages are committed to agreed best practice and meet all relevant environmental legislation including: Control of Pollution Act 1974 (COPA) (Ref 3-4), Environment Act 1995 (Ref 3-5), Hazardous Waste Regulations 2005 (as amended) (Ref 3-6) and the Waste (England and Wales) Regulations 2011 (as amended) (Ref 3-7).

Site Reinstatement and Habitat Creation

3.7.56 Following construction, a programme of site reinstatement and habitat creation will commence. Areas under the solar panels and areas outside of the Developable Areas will be planted with native grassland mix, and hedgerows and woodland will be planted and re-instated in strategic locations to provide visual screening, as shown on Figure 3-1 and 3-2.

3.7.57 Across the Order limits, the following approximate areas will be planted for habitat creation, landscaping and visual screening:

a. Native grassland planting: 208 ha
b. Native wetland planting: 26 ha
c. Woodland planting and infilling of existing vegetation: 58 ha
d. New hedgerow planting and infilling of existing hedgerows (length): 7.4 km

3.7.58 Offsetting provisions have been embedded within the Scheme design for Stone-curlew (refer to Offsetting Habitat Provision for Stone-curlew Specification **[APP-258]** for further information), this includes:

a. Nesting Plots: A maximum of ten 2ha plots will be created across Sunnica East Sites A and B, in fields where Stone-curlew have been recorded during surveys; and

b. Foraging habitat: Approximately 108ha of predominantly arable farmland have been embedded within the Scheme for reversion to grassland, specifically managed to create a close-cropped sward, suitable for Stone-curlew.

3.7.59 The need for the Scheme to include the offsetting habitat provision for Stone-curlews is secured in a requirement of the draft DCO.

3.7.60 An Outline Landscape and Ecology Management Plan has been prepared to accompany (**Appendix 10I** of this Environmental Statement **[APP-108]**). This document sets out the principles for how the land will be managed throughout the operational phase, following the completion of construction. A detailed Landscape and Ecology Management Plan will be produced following the granting of the DCO and prior to the start of construction (this will be secured by a Requirement attached to the DCO).

3.8 Operational and Maintenance Activities

3.8.1 During the operational phase, activity within the Scheme will be minimal and will be restricted principally to vegetation management, equipment maintenance and servicing, replacement of any components that fail, and monitoring. It is anticipated that maintenance and servicing would include the inspection, removal, reconstruction, refurbishment or replacement of faulty or broken equipment to ensure the continued effective operation of the Scheme and improve its efficiency.

3.8.2 Along the cable route, operational activity will consist of routine inspections (schedule to be determined) and any reactive maintenance such as where a cable has been damaged.

3.8.3 It is anticipated that there will be up to 17 permanent staff onsite during the operational phase during a single shift, with staff working on a three shift pattern. There will also be a requirement for additional staff to attend the Sites when required for maintenance and cleaning activities. Based on an occupancy of 1.5 persons per car as outlined in **Chapter 13: Transport and Access** of this Environmental Statement **[APP-045]**, it is expected that there will be approximately 11 vehicles travelling to the Sites on a daily basis.

3.8.4 A Framework Operational Environmental Management Plan (OEMP) has been prepared (**Appendix 16F** of this Environmental Statement **[APP-126]**)

3.9 Decommissioning

3.9.1 The Scheme will be required to be decommissioned after 40 years of operation. For the purposes of the ES, decommissioning is assumed to begin no earlier than 2065, although some parts of the Scheme may be decommissioned earlier if the landowner requires it. Decommissioning is expected to take between 12 and 24 months and will be undertaken in phases.

3.9.2 A Framework Decommissioning Environmental Management Plan (DEMP) has been prepared (**Appendix 16E** of this Environmental Statement **[APP-125]**).

3.9.3 When the operational phase ends, the Scheme will require decommissioning. All above ground equipment, BESS, and onsite substations will be removed and recycled or disposed of in accordance with good practice and market conditions at that time. Onsite cabling and piling below a depth of 1m, will remain in situ following decommissioning. In addition, the cables along the cable route and the Burwell National Grid Substation Extension – Option 2, if taken forward, will remain *in-situ* following decommissioning. Full details of the decommissioning will be detailed within the detailed DEMP.

3.9.4 The effects of decommissioning are similar to, or often of a lesser magnitude than construction effects and will be considered in the relevant sections of the ES. However, there can be a high degree of uncertainty regarding decommissioning as engineering approaches and technologies are likely to change over the operational life of the Scheme.

Waste

3.9.5 The estimated types and volumes of waste during decommissioning is summarised in **Table 3-10** below. The cable route would remain in place and would not be decommissioned, therefore the numbers below are for the Sites and solar infrastructure only.

Table 3-10 Estimated waste arisings during decommissioning.

Waste	Management
BESS Equipment	Approximately 17,550m^3, 585 containers
Electrical works	Approximately 10,380m^3, 346 containers
Solar PV Equipment	Approximately 12,060m^3, 402 containers
Modules	Approximately 110,400m^3, 3,680 containers
Steel	Approximately 44,850m^3, 1,495 containers
Plastic	Approximately 3,105m^3, 104 containers

Land Reinstatement

3.9.6 The land within the Order limits shown on the Works Plans (Works Nos. 1, 2, 3, 7, and 8) **[EN010106/APP/2.2]** will be returned to its original use after decommissioning; however, it is anticipated that all areas of habitat and biodiversity mitigation and enhancement (Works No 6 and 10) will be left *in-situ* given they could contain protected species and so relevant licences at the time would be required for any changes. In addition, extension to access provision (Works No.9) and the cable corridor (Work No. 4) would be left *in-situ*. The future of the substation and control building (Work No. 5) will be agreed with the relevant Local Planning Authority prior to commencement of decommissioning.

3.9.7 A Decommissioning Plan, to include timescales and transportation methods, is proposed to be secured by requirement of the draft DCO **[EN010106/APP/3.1]** and will be agreed in advance with the relevant Local Planning Authorities.

3.10 References

Ref 3-1 Planning Inspectorate (2018); Advice Note 9: Using the Rochdale Envelope.

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

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

Ref 3-4 HMSO (1974); Control of Pollution Act 1974.

Ref 3-5 HMSO (1995); Environment Act 1995.

Ref 3-6 HMSO (2016); The Hazardous Waste (Amendment) Regulations 2016.

Ref 3-7 HMSO (2014); Waste (England and Wales) (Amendment) Regulations 2014.