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OAKLANDS FARM SOLAR PARK

Applicant: Oaklands Farm Solar Ltd

Environmental Statement

Chapter 4 – Project Description

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Planning Act 2008

Infrastructure Planning (Application: Prescribed Forms and Procedure) Regulations 2009 - 5(2)(a)

Chapter 4
Project Description

Introduction

4.1 This Chapter of the ES describes the Site[1] (**Figure 1.1**) of the Proposed Development. It describes the physical characteristics of the Proposed Development for the purpose of identifying and assessing the likely significant environmental effects resulting from the Proposed Development. It includes details about the construction, operation (including maintenance) and decommissioning of the Proposed Development. Where relevant it also provides details of industry standard mitigation measures that will apply to the Proposed Development. This information forms the basis upon which each of the technical assessments in the ES have been undertaken.

4.2 This chapter is supported by the following Figures in **Volume 2** of the ES:

- **Figure 1.1: Site Location and Order Limits**
- **Figure 1.2: Aerial View of the Order Limits**
- **Figure 1.3: Areas of the Site**
- **Figure 1.4a and b: Field Numbers**
- **Figure 1.5: Site Constraints**
- **Figure 4.1a and b: Illustrative Concept Design**
- **Figure 4.2: Work No 1 – Solar array area reference numbers**
- **Figure 4.3a: Indicative Battery Energy Storage System Arrangement**
- **Figure 4.3b: Indicative Battery Energy Storage System Section A-A**

[1] The land shown on the Work Plans within which the Proposed Development can be carried out. This is referred to as the Order Limits within the DCO.

- **Figure 4.3c: Indicative Battery Energy Storage System Section B-B**
- **Figure 4.3d: Indicative Substation Arrangement**
- **Figure 4.4: Site Access Points**
- **Figure 4.5a and b: Illustrative Drakelow Access Design**
- **Figure 4.6: Park Farm Entrance Junction Design**
- **Figure 4.7: Park Farm Exit Junction Design**
- **Figure 4.8: Rosliston Road Crossroads Design**
- **Figure 4.9: Coton Road Crossroads Design**
- **Figure 4.10a and b: Access Tracks - permanent and temporary**
- **Figure 4.11: Indicative Access Track Cross-sections**
- **Figure 4.12: Location of watercourse crossings**
- **Figure 4.13: Indicative watercourse crossing reinforcement**
- **Figure 4.14: Indicative Underground Cabling Installation**
- **Figure 4.15a and b: 132 kV Cable Trench Sections and Joint Bay Details**

4.3 This chapter is also supported by the following appendices in **Volume 3** of the ES:

- **Appendix 1.3: Work Plans**
- **Appendix 4.1: Indicative Construction Programme**
- **Appendix 4.2: Indicative Construction Resource Plan**
- **Appendix 4.3: Outline Construction Environmental Management Plan**
- **Appendix 4.4: Outline Operational Environmental Management Plan**
- **Appendix 4.5: Outline Decommissioning Environmental Management Plan**
- **Appendix 4.6: Outline Battery Storage Safety Management Plan**
- **Appendix 4.7: Detailed Site Access Engineering Drawings**
- **Appendix 4.8: Crossing Schedule**
- **Appendix 5.6: Outline Landscape and Ecological Management Plan**

Proposed Development

4.4 The Proposed Development comprises a proposed solar farm with an associated Battery Energy Storage System (BESS). The Proposed Development would have a generating capacity of over 50MW and would be situated on 191 hectares of land at Oaklands Farm to the south-east of Walton-on-Trent and to the west of Rosliston in south Derbyshire. The solar farm itself, comprising photovoltaic panel arrays, a central electricity substation and BESS together with access, landscaping and other works would be located on 135 hectares of agricultural land currently in use for arable production and grazing. A high voltage underground electricity cable would then run through land at Fairfield Farm and Park Farm to the north to connect the Proposed Development to the national grid via an electricity substation located at the former Drakelow Power Station which sits south of Burton-upon-Trent (see **Figure 1.3: Areas of the Site**). As the Proposed Development would be an onshore generating station with a generating capacity of over 50MW an application for a Development Consent Order is being made under the Planning Act 2008 to the Planning Inspectorate, for determination by the Secretary of State for Energy Security and Net Zero.

4.5 The Proposed Development for the purposes of the Development Consent Order (DCO) is split into a number of key Works within the Site including areas where ancillary works are required for the construction, operation, maintenance and decommissioning of the Proposed Development.

4.6 The Key Works pertaining to the Proposed Development are set out in **Table 4.1** below and are illustrated on the Work Plans (**Appendix 1.3**)**.** Further description as to the component parts of these Works are set out in **Table 4.2** and within the draft DCO (Document Reference 3.1).

Table 4.1 Proposed Development Works

Proposed Development Works
Work No. 1 - a ground mounted solar photovoltaic generating station
Work No. 2 - a battery energy storage system compound
Work No. 3 - works in connection with a new 132/33kV onsite substation

Proposed Development Works
Work No. 4 - works to trench and lay 132 kilovolt electrical cables connecting Work No. 3 to Work No. 5
Work No. 4A - crossing Rosliston Road with electrical cabling
Work No. 4B - temporary stopping up of water courses to trench and lay cables, installation of culverts, drainage and other features to cross watercourses
Work No. 4C - crossing Walton Road with electrical cabling
Work No. 4D - crossing Coton Road with electrical cabling
Work No. 5 - connection and installation works to the existing transmission network substation, including works to trench and lay 132 kilovolt electrical cables connecting to Work No. 4C
Work No. 5A - construction, operational maintenance and decommissioning access for Work No. 5
Work No. 5B - access to National Grid operational land for the construction, maintenance and decommissioning of Work No.5
Work No. 6 - temporary construction and decommissioning of access tracks and compounds
Work No. 7 - general works
Work No. 8 - works to facilitate access for all works excluding Work No. 5
Work No. 9 - works for areas of habitat management
Work No. 10 - works to implement new permissive path through Order limits

Rochdale Envelope and Design Parameters

4.7 Whilst the final design of the Proposed Development will not be materially different to that described in this ES, the detailed design of the development requires some flexibility at this point to allow for length of time incurred through the DCO process, discharging requirements and through to the physical construction of the development. The solar industry is progressing through a period of rapid technological development in addition to a large range of cost variables and product availability issues. Further, contractors are not yet appointed for the Proposed Development and a degree of flexibility is therefore required with respect to the precise location of plant, equipment and ancillary works; for example, the precise alignment and method for installing the necessary grid connection.

4.8 To reflect this and in accordance with the Rochdale Envelope principles as set out in Planning Inspectorate Advice Note 9, a series of maximum parameters that provide the strategic framework for the Proposed Development have been devised. These parameters are the framework on which the EIA has been undertaken and which the Proposed Development will be required to accord with when discharging requirements at the detailed design stage post granting of the DCO.

4.9 The layout parameters for the Proposed Development have been embedded into the Work Plans (**Appendix 1.3**). The Works areas defined therein present a series of 'spatial envelopes' within which the identified Works are to be located. This allows flexibility at the detailed design stage as to the precise layout and location of the relevant Works that make up the Proposed Development.

4.10 In addition to the flexibility sought for the detailed layout of the development, a degree of flexibility is required in respect of the precise dimensions of plant and equipment making up the Proposed Development and the method of installation of various Works. These Design Parameters are set out in **Table 4.2** below.

4.11 Each of the technical assessments in this ES have been undertaken using worst case assumptions about the potential impact of the Proposed Development; whether that be spatial within the limits of the Works as set out on the Work Plans or in terms of quantum and dimensions of equipment and plant or the potential installation methods for construction.

4.12 Where flexibility has 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 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 reduced environmental impacts. The draft DCO (Doc Ref. 3.1) 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.

4.13 Where the nature of an assessment requires further assumptions about the extent, form, appearance or impact related to the Proposed Development these assumptions are set out in each of the technical chapters. Further, where a specific effect theoretically resulting from constructing the Proposed Development within the maximum spatial and design parameters is to be avoided and/or mitigated, these will be expressly identified, and appropriate mitigation provided within the technical assessments. For example, the preservation of veteran trees within the Site.

4.14 The flexibility sought and the potential environmental effects of the development have been carefully considered as part of an extensive iterative process including a program of consultation. **Chapter 3: Site Selection and Design** of this ES describes this process further, including options that have been considered and discounted, and amendments made to the Proposed Development to avoid environmental effects where possible.

Table 4.2: Design Parameters used in the EIA

Scheme Component	Parameter Type	Applicable Design Parameter
Work No.1 – a ground mounted solar photovoltaic generating station – total area 113ha		
Solar PV modules	Maximum height of solar PV modules above ground level (AGL)	The maximum height of the highest part of the solar PV modules will be 2.7m AGL.

Scheme Component	Parameter Type	Applicable Design Parameter
	Minimum height of the solar PV modules AGL	The minimum height of the lowest part of the PV Panels will be 0.8m AGL.
	Slope and orientation of the solar PV modules from the horizontal	South facing (fixed) with horizontal tilting between 15 and 22 degrees.
	Module glass colour	Dark blue or black, with an anti-reflective coating.
	Frame type	Brushed aluminium/ stainless steel; bare metal in appearance.
Solar PV Module Mounting Structures	Mounting rack	Aluminium or stainless steel
	Foundation type	Steel piles rammed/pushed into the ground. Alternatives include pillars fixed to a concrete foundation. Maximum depth of piling is 2m below ground level.
	Separation distance between rows	2.5 – 3m
Inverters	Type	String Inverters
	Number	480
	Colour	White/grey
Transformer Station	Minimum/Maximum dimensions	Smaller Transformer Unit (630–1800kVA) = 2.4m x 3.4m x 2.25m (height, length, width)

Scheme Component	Parameter Type	Applicable Design Parameter
		Larger Transformer Unit (2000-3150kVA) = 3m x 4.1m x 2.9m (height, length, width)
	Number	70
	Colour	Dark Green or Recessive Grey
	Foundations	Crushed stone material foundations 0.5m below surface, with earth bunds built up around the base and 50cm wide x 5cm thick concrete paving surrounding transformer station (no concrete underneath transformer)
Low Voltage (LV) Direct Current (DC) solar PV cabling	-	Low voltage (LV) electrical cabling collects electrical output from solar PV modules, running in ducting trays fastened to underside of PV modules to the string inverters at the end of each row of PV modules.
Work No.2 - Battery Energy Storage System (BESS) compound – 0.7ha		
BESS Compound (compound to house the BESS components and the containers)	Maximum area	0.7ha
Battery Energy Storage System (BESS) Battery Containers	Maximum number	78
	Dimensions (in metres)	9.34 x 1.73 x 2.52 (length, width, height)
	Colour	Dark Green or Recessive Grey

Scheme Component	Parameter Type	Applicable Design Parameter
	Foundation	Containers will sit on concrete piles or blocks, raised to a maximum of 0.6 metres above ground level. For drainage and fire-fighting water control, a drainage and containment system will be implemented into the sub-base of the BESS compound. The worst case would be an impermeable area covering the whole BESS compound.
BESS Power Conversion System (PCS) Units	Maximum number	13
	Dimensions (in metres)	6.1 x 2.44 x 2.90 (length, width, height)
	Colour	Dark Green or Recessive Grey
	Foundation	Containers will sit on concrete piles or blocks, raised to a maximum of 0.6 metres above ground level. For drainage and fire-fighting water control, a drainage and containment system will be implemented into the sub-base of the BESS compound. The worst case would be an impermeable area covering the whole BESS compound.
BESS Auxiliary Transformer	Number	1 up to 5 Megavolt-amps (MVA)
	Dimensions (in metres)	8.5 x 4.9 x 3 (length, width, height)
	Colour	Dark Green or Recessive Grey
	Foundation	Sits on concrete pad up to 50mm thick, with suitable bund around the base for

Scheme Component	Parameter Type	Applicable Design Parameter
		containment of oil. The worst case would be an impermeable area covering the whole BESS compound.
Internal BESS Unit Fire Suppression System	Type	Built into the interior of battery container units with detection and automatic initiation. Water-based (sprinkler or mist system), or inert gas delivery system. Associated storage of water or inert gas with infrastructure for deliveries/removal, or connection to existing piped agricultural water supply. "Dry Risers Pipes" may be utilised on units which allow for injection of water into burning containers without personnel having to access.
External BESS Fire Suppression	Type	Provision for controlled burn of units is a potential option to manage fires, with fire-fighting strategy consisting of cooling surrounding components and units to prevent spread of fire (managed by spacing of units to prevent runaway/spread, containment of emissions/residues, and automatic shut-down of BESS compound). Water is to be used to 'dowse' and cool surrounding battery units to prevent spread of fire, allowing a burning battery unit to extinguish itself. Deluge system consists of water supply (tanks or piped supply), piping, nozzle/delivery components, containment of used water and contaminants via mitigation measures (bunding and/or containment

Scheme Component	Parameter Type	Applicable Design Parameter
		ponds/tanks with shut-off and separating capabilities to test water before discharging to environment).
	Number and dimensions of water storage tanks (in metres)	Up to 3 water storage tanks capable of storing c.300m^3. Water tank = 6 metre diameter, 4 metre height to achieve c.100m3
BESS Compound Access gates and palisade fencing	Type	Steel palisade security fencing with lockable double-leaf access gates
	Height	Up to 3m
Work No. 3 - Works in connection with a new 132/33kV onsite substation – 0.7ha		
Substation Compound	Maximum area	**0.7ha**
	Foundations	Parts of the compound will require an impermeable foundation. Worst case would be an impermeable area of up to 20% by area. The remainder of the compound will comprise permeable crushed stone/type 1 hardstanding.
Substation Transformer(s)	Number	2 maximum (each is 90MVA and 132kV)
	Dimensions (in metres)	7.2 x 5.3 x 3.7 (length, height, width)
	Foundations	Sunken concrete chamber up to max depth of 2 metres and 20 x 20 metre footprint, with transformer unit(s) mounted at or below

Scheme Component	Parameter Type	Applicable Design Parameter
		ground level with adequate bunding underneath the transformer unit(s).
	Concrete blast wall (in case of fire/explosion)	Concrete wall up to 0.5 metres thick sitting in between the 2 transformer units, up to 5.2 metres high above ground level
Substation Busbars and Overhead Electrical Infrastructure	Dimensions	Overhead Busbar height = 7.4m (tallest parts of substation)
Substation welfare units adjacent to substation control building	Number	1 Large or 1 Small Unit
	Dimensions of dedicated welfare units (in metres)	Large unit = 12.2 x 2.45 x 2.9 (length, width, height) Small unit = 6.1 x 2.45 x 2.9 (length, width, height)
	Foundations	Worst case – concrete pad. Dimensions of pad foundation (Large Unit) = 4.45 x 14.2 x 0.1 (width, length, thickness) Dimensions of pad foundation (Small Unit) = 4.45 x 8.1 x 0.1 (width, length, thickness)
	External appearance	Dark green or recessive grey shipping containers, with metal steps and handrails as necessary for safety
Storage containers	Number	4 storage units adjacent to substation control building
	Dimensions (in metres)	Storage unit = 12.2 x 2.45 x 2.9 (length, width, height)

Scheme Component	Parameter Type	Applicable Design Parameter
	Foundations	Concrete pad or permeable, crushed aggregate hard-standing base depending on ground conditions at time of construction. Dimensions of foundation (Storage Large Unit) = 4.45 x 14.2 x 0.1 (width, length, thickness)
	External appearance	Dark green or recessive grey metal shipping containers, with metal steps and handrails as necessary for safety
Substation control building	Dimensions (in metres)	10 x 22 x 4 (width, length, height)
	Foundations	Worst-case – concrete pad. Concrete foundation for Substation control building will be set up to 1 metre below ground, with dimensions of 11 x 23 x 1 (width, length, depth)
	External appearance	Will be constructed per relevant substation regulations and specifications. Walls made of concrete blocks, glass reinforced plastic (GRP) or steel construction with cladding. Finished in dark green or recessive grey paint. Roof could be tiled, metal or other materials depending on final design and requirements.
	Number	12

Scheme Component	Parameter Type	Applicable Design Parameter
Statcom (Static Synchronous Compensator) Units	Dimensions (in metres)	6.1 x 2.45 x 2.9 (length, width, height)
	Foundations	Worst-case – concrete pad under each container unit, up to 50mm thick with bunding for containment of oil
	External appearance	Metallic containers finished in Dark Green or Recessive Grey paint as necessary
132KV harmonic filter compound	Dimensions (in metres)	21 x 23 x 7 (width, length, height)
	Foundations	Concrete pad.
Substation Compound Fire Fighting and Water Containment	Type	Deluge system to douse transformers in case of fire. Deluge system consists of metal piping, nozzle/delivery components, containment of used water and contaminants via mitigation measures (bunding and/or containment ponds/tanks with shut-off and separating capabilities to test water before discharging to environment)
	Volume/dimensions (in cubic metres/metres)	Water tank = 6 metre diameter, 4 metre height to achieve c.100m^3
Hardstanding parking and storage areas	Type	Permeable hardstanding, crushed aggregate Type 1
Access gates and fencing	Type	Steel palisade security fencing with lockable double-leaf access gates

Scheme Component	Parameter Type	Applicable Design Parameter
	Height (in metres)	3
CCTV Cameras	Type	Remotely monitored dome cameras mounted on metal poles, placed around BESS and Substation Compound for operational Health & Safety and crime prevention.
	Number	Up to 10
	Height (in metres)	3.50
Work No. 4 - Works to trench and lay 132 kilovolt electrical cables connecting Work No. 3 to Work No. 5		
Cable laying	Type	132kv underground cable
	Number	One continuous trench (with sections of directional drilling and watercourse crossing infrastructure as necessary)
	Maximum width of trench (in metres)	3
	Maximum depth of trench (open trenching, in metres)	3
	Maximum depth of directional drilling (in metres)	20m
	Minimum depth of cable (in metres)	0.9 m (It is noted that warning tape would be placed at approximately 0.4 m depth for safety purposes, and a very thin earthing

Scheme Component	Parameter Type	Applicable Design Parameter
		cable would be placed at approximately 0.5 m depth)
	Maximum working width of cable corridor construction (in metres)	50m to facilitate storage/laydown/access and working machinery
	Associated works	Works associated with cable laying including trenching, 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	Maximum number	6
	Dimensions (in metres)	12 x 2 x 2.6 (length, depth, width)
Work No 4A – crossing Rosliston Road with electrical cabling		
Cable laying	Type	132kV below ground cable, laid either by directional drilling or trenching. With directional drilling, a pipeline would be bored under Rosliston Road to emerge at a target point on the opposite side. Location of

Scheme Component	Parameter Type	Applicable Design Parameter
		the drill bit is monitored using the Horizontal Directional Drilling (HDD) locating system. If trenching is chosen instead of directional drilling, standard trenching techniques to break open the highway to install trench and ducting for cabling will be used, per final detailed construction designs.
	Maximum depth of directional drilling (in metres)	20m
	Minimum depth of cable (in metres)	0.9 m (It is noted that warning tape would be placed at approximately 0.4 m depth for safety purposes, and a very thin earthing cable would be placed at approximately 0.5 m depth)
	Associated works	Works associated with cable laying including trenching, 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.

Scheme Component	Parameter Type	Applicable Design Parameter
Work No. 4B - Temporary stopping up of water courses to trench and lay cables, installation of culverts, drainage and other features to cross watercourses		
Culverts/watercourse crossing	Type	~~Permanent or t~~Temporary for the duration of construction then restored. Temporary culverts will be reinstated for decommissioning, then removed again. ~~Permanent would be concrete with soil or other organic material for load-bearing and to secure culvert structure. Temporary would be m~~Modular steel construction bridges for crossing water courses or box culverts.
	Number	For Haul Road (Construction Track) = 3 crossing culverts For underground 132kV cabling = 5 crossing solutions
	Dimensions (in metres)	Culvert Pipe diameter of up to ~~1m~~2m tall (from the base of the watercourse), length of crossing to be determined at construction but the maximum span required is likely less than 10m
Cable trenching	Dimensions (in metres)	Width 3m, 3m depth – rivers 2m and ditches 1.7m below bed of watercourse. ~~Unless permanent culvert in which case cabling runs through culvert structure~~
Work No. 4C – crossing Walton Road with electrical cabling		

Scheme Component	Parameter Type	Applicable Design Parameter
Cable laying	Type	132kV below ground cable, laid either by directional drilling or trenching. With directional drilling, a pipeline would be bored under Walton Road to emerge at a target point on the opposite side. Location of the drill bit is monitored using the HDD locating system. If trenching is chosen instead of directional drilling, standard trenching techniques to break open the highway to install trench and ducting for cabling will be used, per final detailed construction designs.
	Maximum width of trench (in metres) if required	3
	Maximum depth of trench (open trenching, (in metres) if required	3
	Maximum depth of directional drilling if required (in metres)	20
	Minimum depth of cable (in metres)	0.9 m (It is noted that warning tape would be placed at approximately 0.4 m depth for safety purposes, and a very thin earthing cable would be placed at approximately 0.5 m depth)

Scheme Component	Parameter Type	Applicable Design Parameter
	Associated works	Works associated with cable laying including trenching, 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.
4D - Crossing Coton Road with electrical cabling		
Cable laying	Type	33kV or less below ground cable, laid either by directional drilling or trenching. With directional drilling, a pipeline would be bored under Coton Road to emerge at a target point on the opposite side. Location of the drill bit is monitored using the HDD locating system. If trenching is chosen instead of directional drilling, standard trenching techniques to break open the highway to install trench and ducting for cabling will be used, per final detailed construction designs.
	Maximum width of trench (in metres) if required	3

Scheme Component	Parameter Type	Applicable Design Parameter
	Maximum depth of trench (open trenching, (in metres) if required	3
	Maximum depth of directional drilling if required (in metres)	20
	Minimum depth of cable (in metres)	0.7 m (It is noted that warning tape would be placed at approximately 0.4 m depth for safety purposes, and a very thin earthing cable would be placed at approximately 0.5 m depth)
	Associated works	Works associated with cable laying including trenching, 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.
Work No. 5 - connection and installation works to the existing transmission network substation, including works to trench and lay 132 kilovolt electrical cables connecting to Work No. 4C		

Scheme Component	Parameter Type	Applicable Design Parameter
Grid connection	Type	Installation of a 132kV below ground cable connecting to Point of Connection within Drakelow National Grid substation operational land. The installed trench width will be 1.5m, with a permanent easement width (including setback and access requirement) of up to 3m (1.5m either side of centreline)
	Maximum width of trench (in metres)	3m
	Maximum depth of trench (in metres)	3
	Maximum depth of directional drilling if required (in metres)	20
	Minimum depth of cable (in metres)	0.9 m (It is noted that warning tape would be placed at approximately 0.4 m depth for safety purposes, and a very thin earthing cable would be placed at approximately 0.5 m depth)
	Maximum working corridor (in metres)	Construction corridor for installing 132kv cable in Drakelow is up to 16m.
	Associated works	Works including trenching, directional drilling, clearing of vegetation and felling of trees, installation of jointing bays, fibre bays, cable ducts, cable protection, joint protection,

Scheme Component	Parameter Type	Applicable Design Parameter
		manholes, electrical kiosks/cabinets, 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, storage of equipment, plant, materials, installing drainage features, lighting, and welfare facilities, facilities for storage and removal of waste. All these works will be undertaken within the maximum parameters described above.
Work No. 5A - construction, operational maintenance and decommissioning access for Work No. 5		
■ Works to create a new permanent access junction from the public highway (as detailed on the access design drawings provided in **Figures 4.5 to 4.9**, and **Appendix 4.7: Detailed Site Access Engineering Drawings**, and install temporary traffic lights or other measures to manage traffic. ■ Works to widen and surface the public highway within the highway boundary. ■ Works to excavate and store soil, clear vegetation and fell trees, level, shape and prepare surface for construction track and permanent operational track to be installed. ■ Installation of permanent 3.5m wide track made up of 200mm of type 1 compacted stone/gravel and/or porous geotextile and stone system for operational maintenance. ■ Installation of a temporary 5m wide track to facilitate construction made up of 200mm of type 1 compacted stone/gravel and/or porous geotextile and stone system. ■ Security features such as installing fencing and gates.		

Scheme Component	Parameter Type	Applicable Design Parameter
Work No. 5B - access to National Grid operational land for the construction, maintenance and decommissioning of Work No.5		
■ Vehicular access to National Grid operational land during construction, operation and decommissioning of Work No.5		
Work No. 6 - temporary construction and decommissioning of access tracks and compounds		
Access roads, compounds and laydown areas	Maximum width of construction access track (in metres)	Up to 6m comprising either 200mm type 1 compacted stone/gravel and/or porous geotextile and stone system, or steel matt tracking, with associated drainage alongside
	Number and size of construction compounds/laydown areas	3 main construction compounds North: 1 acre (Park Farm) Central: 3 acres (Main Construction compound on Oaklands) Southern: 2 acres (Smaller, southern construction compound on Oaklands)
	Associated works	Ground levelling, installing permeable hard-standing and road surfacing, security features such as installing fencing, gates, checkpoint kiosks, signage, storage of equipment, plant, materials, installing drainage features, lighting, and welfare facilities, facilities for storage and removal of waste. (a) works to improve existing farm access from public highway, and install temporary

Scheme Component	Parameter Type	Applicable Design Parameter
		traffic lights, banksmen or other measures to manage traffic; (b) works to excavate and store soil, clear vegetation and obstacles, level, shape and prepare surface for construction track to be installed; (c) storage of equipment and materials; (d) civils investigations and works to reinforce ground with weight-bearing support infrastructure, maintain integrity of structures beneath road surface (e) creation of temporary construction access tracks, laydown and working areas; (f) works required for crossing, moving, re-routing or over/undergrounding of existing utility assets (including water, gas, sewer pipes, electricity distribution/transmission cabling, telecommunications etc.); (g) temporary stopping up of watercourses for installation of culverts, drainage and other features to cross water courses; (h) areas of hardstanding; (i) car parking; (j) site and welfare offices, canteens and workshops; (k) area to store materials and equipment;

Scheme Component	Parameter Type	Applicable Design Parameter
		(l) storage and waste skips; (m) area for download and turning; (n) security infrastructure; (o) site drainage and waste management infrastructure; and (p) electricity, water, waste water and telecommunications connections.
Work No.7 - general works		
Onsite cabling (between battery containers, Power Conversion System (PCS) units, and from PCS to transformers)	Type	Low or medium voltage
	Maximum cable trench dimensions (in metres)	Maximum dimensions: 1.5m deep and 1.2m wide.
	Minimum cable depth (in metres)	0.7 m (It is noted that warning tape would be placed at approximately 0.4 m depth for safety purposes, and a very thin earthing cable would be placed at approximately 0.5 m depth)
Onsite cabling (between the transformer stations and the Proposed	Type	Low or medium voltage
	Maximum cable trench dimensions (in metres)	Maximum dimensions: 1.5m deep and 1.2m wide.

Scheme Component	Parameter Type	Applicable Design Parameter
Development substation)	Minimum depth of cable (in metres)	0.9 m (It is noted that warning tape would be placed at approximately 0.4 m depth for safety purposes, and a very thin earthing cable would be placed at approximately 0.5 m depth)
Onsite cabling (between PV modules and inverters and from inverters to transformers)	Type	Low or medium voltage (typically electrical cabling is required to connect the inverters to the transformers onsite, this cabling runs from ducts fastened to underside of PV module mounting structure and down one of the mounting piles to ground, where it runs in trench to the nearest transformer station) Cabling between the inverters and the transformer will be buried within underground trenches.
	Maximum cable trench dimensions (in metres)	Maximum dimensions: 1.5m deep and 1.2m wide.
	Minimum depth of cable (in metres)	0.7 m (It is noted that warning tape would be placed at approximately 0.4 m depth for safety purposes, and a very thin earthing cable would be placed at approximately 0.5 m depth)
	Associated works	None
Perimeter fencing	Type and height (in metres)	Two designs: **Standard Solar 'Deer' Fencing**

Scheme Component	Parameter Type	Applicable Design Parameter
		2.1m stock wire mesh deer fencing with wooden posts piled into ground up to 2m. Including mammal gaps, and may utilise a single line of barbed wire. **Fencing When Greater Security Required** 2.1m wire mesh with steel posts piled into ground up to 2m. Including mammal gaps, and may utilise a single line of barbed wire. Temporary screening (such opaque netting attached to the deer fencing) (up to ten years) in key locations to mitigate glint and glare hazards on road users. Fencing to be removed once hedge /screening planting has matured. Approx. 11,000m of perimeter solar fencing throughout site (vast majority will be deer fencing).
Fencing (other)	Type and height (in metres)	1.5 m post and wire agricultural stock fencing
CCTV poles	Maximum height (in metres)	3.51m
	Maximum number	Up to 250 CCTV cameras around solar perimeter spaced approximately 45m apart, 15 around BESS and Proposed Development Substation compounds

Scheme Component	Parameter Type	Applicable Design Parameter
Temporary lighting columns (for construction)	Number and height (in metres)	Up to 6 per construction compound (3 main compounds for project, so up to 18 total). Maximum height 5m.
Permanent lighting	Type	Security lighting on buildings, storage and welfare units which will be downward facing.
Weather Stations	Maximum height (in metres)	Small aerials/sensors built into top of select transformer stations placed throughout site. Maximum height 1m.
	Maximum number	10.
Landscaping and biodiversity mitigation and enhancement measures including planting.	As detailed in the Outline LEMP in **Appendix 5.6**.	
Permanent internal access tracks (operational)	Width (in metres) and construction make up	3.5 – 6.0m wide made up of 200mm of type 1 compacted stone/gravel with a geotextile membrane, or mown grass corridor
Temporary internal access tracks (construction)	Width (in metres) and construction make up	3.5 – 6.0m wide made up of 200mm of type 1 compacted stone/gravel with a geotextile membrane and/or porous geotextile and stone system, mown grass corridor or metal mats/sheets.
Drainage and irrigation infrastructure	No formal surface water collection system is required for the solar panel areas (Work No. 1) and water will be allowed to percolate into the underlying soil .	

Scheme Component	Parameter Type	Applicable Design Parameter
	Work No. 2 BESS – The BESS compound surface will consist of impermeable sub-base to contain fire-water runoff or potential battery contaminants in the unlikely event of a battery fire. This will consist of drainage infrastructure built into or below a sub-base of granular material directing runoff to a containment tank/pond, with testing, flow control and pumping equipment therein to ensure the safe discharge or removal of water following a battery fire. Control valves will be engaged at the earliest detection of a fire to initiate surface and fire-water containment. The BESS units will be surrounded by suitable bunds and the containment tank/pond lined to ensure fire-fighting water and associated contaminants do not leach into the environment.. Under normal operations surface water runoff will bypass the containment tank/pond and drain to the northwest towards the existing drainage channel, ultimately discharging into watercourse approximately 300m north-west of the BESS/Proposed Development substation. Work No. 3 Proposed Development Substation – where required areas of the substation compound will be impermeable. The remaining areas will be permeable. Access tracks (Work No. 7) will be constructed of compacted gravel such that they are permeable. Each track shall be designed with a crossfall towards a gravel filled longitudinal trench into which excess water will flow. These trenches will act as attenuation and treatment prior to infiltration.	
Temporary, mobile satellite construction compounds	Maximum number	10

Scheme Component	Parameter Type	Applicable Design Parameter
Work No. 8 - works to facilitate access for all works excluding Work No. 5		
Works to create new permanent access from public highway (as detailed on the access design drawings in **Appendix 4.7**), and install temporary or permanent traffic lights, visibility splays or other measures to manage traffic. - Works to widen and surface the public highway. - Works to excavate and store soil, clear vegetation and fell trees, level, shape and prepare surface for construction track and permanent operational track to be installed. - Security features such as installing fencing and gates.		
Work No. 9 - works for areas of habitat management		
Landscape and biodiversity enhancement measures; and habitat creation and management including earthworks, landscaping, means of enclosure and the laying and construction of drainage infrastructure.		
Work No. 10 - works to implement new permissive path through Order limits		
Permissive path	Width of path	4m with associated deer fencing and hedgerow as required
	Surface type	Mown grass path. Wooden board walk may be utilised in specified location

Components of the Scheme

4.15 This section sets out further detail on the key components of the Proposed Development, their function and illustrative images as to how each physical part of the development may appear. An illustrative representation of how the equipment and infrastructure required for the Proposed Development could be built out with the spatial parameters of the Work Plans and the Design

Parameters provided in **Table 4.2** is provided as **Figures 4.1a and b: Illustrative Concept Design.**

4.16 The key components of the Proposed Development are:

- Solar PV arrays.
- Battery Energy Storage System (BESS).
- Proposed Development substation and permanent compound and welfare.
- Laying of electrical cabling.
- Grid connection to the National Grid Drakelow substation.
- Vehicular access.
- Internal access roads.
- Fencing and security.
- Landscaping including habitat creation areas.
- Drainage.
- Creation of a new permissive footpath.

Solar PV arrays

4.17 The solar PV arrays (Work No. 1) will consist of solar panels fitted to ground fixed mounting structures in a series of parallel south facing rows spaced across the Work No.1 area. Each of the solar PV array areas within the Site has been numbered for ease of reference throughout the ES (see **Figure 4.2: Work No 1 - Solar array reference numbers**).

4.1 Solar panels are made from silicon installed in a metal panel frame with a glass casing. When photons, or particles of light, hit the thin layer of silicon on the top of a solar panel they knock electrons off the silicon atoms. This creates an electrical current which is captured by the wiring in the solar panels and is connected to strategically placed string inverters mounted to the back of the solar arrays to convert the electricity from direct current (DC) to alternating current (AC) so that it can be exported to the grid. Cable trays will be located above-ground on the back of the solar panels which will provide structural metal channels that support and route the electricity via DC electrical cables to be converted to AC electricity in the inverter unit at the end of the row of panels., avoiding the need to bury low voltage cables underground. Cable trays are secure and easily accessible for managing the wiring required for the solar panels. After the inverter unit, AC cabling will be buried underground to move electricity across the Site and to the National Grid Drakelow substation. Electricity is consolidated along the way in larger cables and multiple cables will be placed in trenches and routed along the perimeter of fields – therefore only approximately 2% of the Oaklands Farm area will be affected by trenching excavations T(there will not be a cable trenchis not the requirement for underground cables along for each row of solar panels).. At the end of each row of solar panels, cable trays will end, and low / medium voltage cables will be installed underground.

4.18 As shown in ES Figure 4.14, if low / medium voltage cables are required to be installed in the same trench, they are installed on top of one another. This allows for adequate spacing between cables which results in the trench being narrower and therefore, less soil disruption during construction.

4.184.19 As shown in Figure 13.7 – Indicative Cable Trench Plan (submitted at Deadline 5), low / medium voltage cable trenches will typically run around the perimeter of the solar arrays. Unless for exceptional circumstances, there is not the requirement for underground cables along each row of solar panels.

4.194.20 With the electricity converted to AC it is still at low voltage and this must be increased for transmission to the National Grid and to match the voltage at the Point of Connection (PoC) to the electricity network (National Grid Drakelow Substation). The electricity from the solar PV arrays (or Work No. 1) and battery storage (BESS or Work No. 2) will be collected and stepped up from 33 kilovolts (kV) to 132kV in large transformer unit(s) located within a new onsite 132 kilovolt (kV) substation ('the Proposed Development substation') (Work No. 3).

4.204.21 The Proposed Development will export electricity from the Proposed Development substation (Work No.3) to the National Grid at Drakelow substation via new 132kV underground cabling, with the voltage at the point of connection being 132 kV (Work No.5).

4.214.22 Illustrative images of 'typical' solar panels, mounting structures, string inverters and transformers are provided as **Plates 1 to 3.**

Plate 1: Typical Solar Panels

Plate 2: Detailed view of typical mounting structures and string inverter

Plate 3: Typical transformer on a solar farm site

Battery Energy Storage System Compound

~~4.22~~4.23 The BESS (Work No.2) will comprise a fenced compound containing a series of batteries within containers, power conversion system units (which convert electricity between DC and AC during import or export processes), and an auxiliary transformer to provide necessary power for controls and monitoring systems. **Figure 4.3a** provides an indicative arrangement for the BESS, with sections provided in **Figures 4.3b and c**.

~~4.23~~4.24 The BESS is designed to store and discharge electricity when market conditions are favourable, and to also provide ancillary services to assist with safe operation of the electricity network. It will do this by either capturing electricity generated from the PV Panels or importing electricity from the National Grid, and storing it in the batteries in order to dispatch to the electricity grid when it is most required The BESS can also store or discharge electricity to provide ancillary and energy time-shifting services to help National Grid Electricity Transmission (NGET) manage the increasing penetration of (variable) renewable generation on the transmission network, an increasing requirement as the electricity network moves towards Net Zero. National Grid now consider BESS an essential technology that will play an increasingly pivotal role in its efficient management of supply and demand.

~~4.24~~4.25 To suppress small fires within a single battery container unit, an internal BESS fire suppression system will be built into the interior of each battery container unit with detection and automatic initiation. It will be water-based (sprinkler or mist system), or inert gas delivery system. To address the scenario of a thermal runaway incident spreading through multiple battery units, there are 2 possible solutions. One solution relies on the provision of sufficient spacing between the battery units to isolate a unit in thermal runaway and the other ensures that significant water supply and containment are provided in order to dowse the units surrounding an affected unit to control temperature in those surrounding units and prevent thermal runaway conditions arising. Provision has been made in the outline designs for significant water supply and containment as a possible BESS fire-fighting solution. The final design may however provide the appropriate (based on the manufactures specification) spacing of battery units as the preferred fire prevention solution. The final design will be confirmed at detailed design stage in consultation with relevant fire authorities, however, to ensure a robust and comprehensive approach the Applicant has included, in the assessed design, the water-based solution. This option has been included as it incorporates significant water supply as well as drainage and containment infrastructure in the sub-base of the compound to control and contain fire-fighting water for testing prior to discharge, treatment or removal from site. Further details are provided in the Outline Battery Fire Safety Management Plan (**Appendix 4.6**) produced and submitted in support of the application.

Proposed Development Substation, compound and welfare facilities

~~4.25~~4.26 The Proposed Development substation and welfare facilities compound (Work No. 3) will contain the following plant, buildings and other elements:

- Up to 2 substation transformers (132/33kV 90MVA).
- A 132kV harmonic filter.
- Substation busbars.
- A substation control building.
- Up to 12 Statcom (Static Synchronous Compensator) Units.
- A staff welfare unit.

- 4 storage units.
- Fire water storage and deluge system.
- Parking and storage areas on permeable hardstanding or crushed aggregate.
- Associate CCTV cameras, fencing and gates.

~~4.26~~4.27 The Proposed Development substation acts to manage the flow of electricity between the Proposed Development, and the National Grid via the Drakelow substation, changing voltage upwards or downwards as necessary via large 132/33kV transformer units.

~~4.27~~4.28 The welfare facilities are provided to facilitate the needs of operational and management staff throughout the lifetime of the Proposed Development. Details of the maintenance activities for the Proposed Development are provided under the relevant heading below.

~~4.28~~4.29 **Figure 4.3d** provides an indicative arrangement for the Proposed Development substation.

Electrical Cabling

~~4.29~~4.30 Low voltage electrical cabling will collect electrical output from the solar PV modules. Cabling will run in ducting trays fastened to the underside of PV modules (above ground) to the string inverters at the end of each row of PV modules converting the current from DC to AC. ~~Additional u~~Underground cabling will then transfer the electricity to the transformers within Work No.1 and then to the Proposed Development substation (Work No.3) before then being transferred to the National Grid Drakelow substation via underground 132kV cabling (Work No.5). The BESS (Work No.2) will be “charged” via electricity generated by the solar PV plant (Work No. 1), or by importing electricity from the National Grid at Drakelow via the underground 132kV cabling (Work No. 5). Cables for the earthing system and communications, and cables for the auxiliary supplies will also form part of the onsite cabling system. Low and medium ~~C~~cabling will in the main be installed by open trenching methods (see **Plate 4**), but special installation techniques such as directional drilling may be required to cross obstacles such as watercourses, utility assets, and roads.

Plate 4: Typical open trenching for low voltage electrical cable

~~4.30~~4.31 Where cables are required to cross roads or watercourses, the cables will be required to be laid across the road either via open trenching or directional drilling underneath. **Figure 4.14** shows the cable installation for the 33kV cables and a Crossing Schedule is provided at **Appendix 4.8**.

Drakelow substation grid connection

~~4.31~~4.32 The 132kV cabling between the Proposed Development substation in the south of the Site and the National Grid Drakelow substation in the north of the Site, will mainly cross agricultural land, with 2 road crossings at Rosliston Road and Walton Road, before entering National Grid land within the Drakelow substation compound where it will make a physical connection to the National Grid transmission network. This cable will remain in-situ for the duration of the Proposed Development to import and export electricity from the grid. It will be installed along the majority of its length by open trenching methods.

~~4.32~~4.33 The electrical output from the Proposed Development is delivered by a high voltage, single circuit cable of three insulated conductors, operating at 132,000 Volts (132 kV). A further fibre optic cable will be installed with the High Voltage cable for protection and communication between the substations at which the cable is terminated.

~~4.33~~4.34 It will be an insulated cable, installed underground and in cable ducts, at an approximate depth of 1000mm (1m). The depth will vary with the location however, is a significant factor for the thermal capacity and therefore the current rating of the circuit.

~~4.34~~4.35 The cable route will be an independent route laid principally in a trench up to 3m wide with a number of cable joint bays. The cable is installed in lengths from a cable drum which then in turn are joined in an underground joint bay (a delineated zone within the ground to protect and maintain the joint integrity).

~~4.35~~4.36 Where the cable route crosses other utilities, provision will be made to not interfere with their performance. The arrangements provided are dependent upon the specific location. The generation circuit will be laid below the utility, in cable ducts and with a separation distance in the ground of at least 300mm (0.3m). Where the utility requires ground stability the depth under that utility will be increased suitably for the ground conditions. Installation of the cable ducts is most likely to require directional drilling. For the cable crossing under highways directional drilling may not be practical, and a concrete or CBS (cement based sand) duct block, may be used.

~~4.36~~4.37 Where the 132KV cables crosses Walton Road and Rosliston Road, it will be laid under the road either via open trenching or directional drilling (see **Figure 4.15a: 132 kV Cable Trench Sections** and **Figure 4.15b: 132kV Joint Bay Details**).

~~4.37~~4.38 Along Walton Road between the road itself and the National Grid Drakelow Substation lies an area of woodland and scrub. An existing vehicular access to the substation lies adjacent and immediately to its east. Initial conversations with National Grid have indicated that whilst they are open to the use of the existing access for access to and maintenance of the grid connection they do not wish the grid connection route to a) use the vehicle access (I.e. be laid within or next to it) or b) use this route other than for access to National Grid's fenced operational land.

~~4.38~~4.39 To construct, install and maintain the grid connection from Walton Road to the substation therefore requires a route through National Grids non-operational land and the scrub, woodland and trees therein. At the time of writing the precise routing of the grid connection through National Grid's non-operational land has not been formally agreed upon. For the ES it has therefore been necessary to take a precautionary approach and assess the feasible worst-case route that could be taken in this regard. This was assumed to be the route that would result in the greatest loss of trees and woodland within the Tree Preservation Order in this location. This assumes a new permanent vehicle access, a 3.5m permanent track, a 5m temporary track and a 16m cable construction corridor, the spatial layout of which is shown in **Figures 4.5a and b**. On a worst-case basis, it is assumed that all trees and woodland within these areas will be lost except those with medium and high bat roost potential which will be retained. This worst-case basis is that upon which the EIA has been undertaken.

~~4.39~~4.40 Discussions with National Grid in respect of the final detailed route for the grid connection are ongoing. Should this discussion progress during the application and examination period further details with be provided. It may be that a less impactful route, working within the utility constraints of the location, can be agreed with National Grid before the determination of the DCO. In any event, the worst case route has been assessed and it is considered that any alternative route is likely to result in similar or reduced environmental effects

Crossing Methods

~~4.40~~4.41 The grid route corridor typically crosses obstacles of various nature for which special installation techniques must be considered. Each obstacle must be addressed separately, and the most suitable crossing technique chosen. The criteria for determining the most suitable crossing technique will be based on different factors, such as the total length of the crossing, access routes, ground stability and health and safety issues.

~~4.41~~4.42 Occasional minor watercourse crossings may need to be carried out using dry open cut trench methodology. The water flow will be maintained by damming and, if necessary, over pumping or using temporary 'flume' pipes installed in the bed of the watercourse.

~~4.42~~4.43 One method of crossing minor roads is to trench through them, though significant obstacles may be crossed by way of HDD to avoid any disturbance. With HDD, a pipeline is bored under the feature to be crossed (watercourse, utility asset, or road) to emerge at a target point on the opposite side. The location of the drill bit is monitored using the HDD locating system. An electronic transmitter in the drill head sends information to the locator operator's receiver. Typically, each bore will accommodate a single circuit including the three power cables laid in trefoil and the fibre optic bundle. Therefore, separate drills will likely be required for each circuit crossing. Alternatively, subject to final Contractor specification, each power core of the circuit may require a separate bore and duct, likely laid in flat formation. The length of the pipeline will determine the size and weight of the drill rig required.

Vehicular access

~~4.43~~4.44 The following tracks and access points are required during the construction phase (see **Figure 4.4: Site Access Points** for location of each numbered access point):

- A new 2km Temporary Construction Haul Road will be installed across Park Farm, Fairfield Farm, and Oaklands Farm, to allow HGVs to travel from Walton Road to the construction compounds within the Oaklands Farm area. To leave the Site, HGVs will re-trace the route to exit onto Walton Road. This Haul Road will be removed following completion of construction and reinstated for decommissioning and / or emergency.
- Access 1B - Use of an existing (but currently unused) farm access point off Walton Road into Park Farm (**Figure 4.6: Park Farm Entrance Junction Design**). This will be an entrance for HGVs and light vehicles and will not be used during operation of the Proposed Development.
- Access 1A - Use of an existing farm access point off Walton Road into Park Farm (see **Figure 4.7: Park Farm Exit Junction Design**). This will be an exit only for mostly HGV construction vehicles, with a right turn only on exit. This access will not be used during operation of the Proposed Development.
- Access 2 - A new permanent access will be created north off Walton Road into land adjacent to Drakelow substation (see **Figure 4.5a and b: Drakelow Access Design**). This will be utilised for installation and ongoing maintenance of the 132kV cabling to be laid in National Grid’s non-operational land adjacent to the Drakelow substation.
- Access 3 - Existing access into National Grid’s Drakelow substation will be used for construction and operations works associated with connection assets within National Grid’s operational compound..
- Access 4 - A new access across Rosliston Road to serve the Temporary Construction Haul Road (see **Figure 4.8: Rosliston Road Crossroads Design**) providing access north and

south only. During construction, vehicles will not be able to turn into the Site off Rosliston Road. Once construction is complete, the access on the northern side of Rosliston Road will be removed (only to be reinstated in emergency situations or at decommissioning of the Proposed Development). The access on the southern side of Rosliston Road will remain post-construction, but only as a secure gated access for response to emergency health and safety incidents.

- Access 10 - Improvements to an existing farm crossing at Coton Road (**Figure 4.9: Coton Road Crossroads Design**). HGVs will cross Coton Road heading north and south at this crossroads but will not be able to exit onto Coton Road - all HGVs will exit the Site by travelling north along the Temporary Construction Haul Road and exiting onto Walton Road at the Park Farm Exit Junction. Smaller construction vehicles will be able to enter and exit the Site off Coton Road if required. Abnormal Indivisible Loads (AILs) for deliveries of the large Proposed Development substation transformer units, will be able to access the Site at the Coton Road Crossroads from the east, turning right off Coton Road. The AILs will exit at the same point, turning left and following the same route back along Coton Road.

~~4.44~~4.45 The following permanent access points are required during the operational phase (see **Figure 4.4: Site Access Points**):

- Access 3 - Use of National Grid's existing access off Walton Road into Drakelow substation. This will be used infrequently and only to maintain connection assets within National Grid's operational land within Drakelow substation.
- Access 2 - Use of new access off Walton Road installed by the Applicant for installation of 132kV cabling across National Grid's non-operational land adjacent to Drakelow substation. This access will remain permanently, but used infrequently, to provide operations, maintenance and decommissioning access to the 132kV cabling.
- Access 4 - Use of the southern portion of the construction crossing to be installed by Applicant across Rosliston Road to provide HGV construction access. The access on the south side of Rosliston Road will be retained throughout operations as a secure gated access, for response to emergency health and safety incidents only. The portion of the Temporary Construction Haul Road and access installed on the north side of Rosliston

Road will be removed once construction is complete. (see **Figure 4.8: Rosliston Road Crossroads Design**).

- Access 10 - Use of the access off Coton Road as used during construction (**Figure 4.9: Coton Road Crossroads Design**). This will be the primary operations and maintenance access during the operational phase, and all operational vehicles will exit the Site at this location.
- Access 5 - Use of an existing farm access point off Coton Road (just north west of Oaklands Farm). This will be an entrance only junction for infrequent operations and maintenance visits by small operational vehicles only.
- Access 6, 8 and 9 – Use of existing farm access points off Coton Road (just west and north west of Lads Grave). These will be an entrance only junctions for infrequent operations and maintenance visits by small operational vehicles only.
- Access 7 - Use of an existing farm access point off Catton Lane. This will be an entrance only junction for infrequent operations and maintenance visits by small operational vehicles only.

Internal access tracks

~~4.45~~4.46 Internal access tracks for construction purposes will be 3.5 - 6.0m wide and made up of 200mm of type 1 compacted stone/gravel with a geotextile membrane or other surfacing solutions, and where appropriate, may simply be mown grass corridors. These temporary access tracks (Work No. 6 and No. 7) will be removed or reduced to 3.5m wide operations and maintenance tracks or grass corridors following construction of the Proposed Development.

~~4.46~~4.47 On entry to the Site off Walton Road (**Figure 4.6: Park Farm Entrance Junction Design**) HGVs and smaller construction vehicles will have access to a compound adjacent to the Park Farm buildings for delivery and storage of materials and equipment, to allow unloading and for vehicles to turn and exit the Site using the existing farm access point if required. HGVs taking large loads to the Oaklands Farm area will travel south along the Temporary Construction Haul Road to deliver loads to the construction compounds on the Oaklands Farm area.

~~4.47~~4.48 Once deliveries have been made to the Oaklands Farm area construction compounds, heavy vehicles will exit onto Walton Road using the existing farm access point, turning right only to travel East along Walton Road (**Figure 4.7: Park Farm Exit Junction Design**).

~~4.48~~4.49 The main solar park will require a series of permanent internal access tracks or mown grass corridors to facilitate vehicular access to operate and maintain the solar farm. These will vary in width between 3.5m to 6m and will comprise either mown grass corridors or up to 200mm of type 1 compacted stone/gravel and/or porous geotextile and stone system. Illustrative cross sections of these internal access tracks are provided in **Figure 4.11: Indicative Access Track Cross-sections. Figure 4.10a and 4.10b** show the illustrative temporary and permanent access tracks required for the Proposed Development.

~~4.49~~4.50 Where internal access tracks are required to cross a water course a ~~permanent~~ temporary culvert will be required to be installed. **Figure 4.12** shows the location of watercourse crossings and an indicative watercourse crossing reinforcement required to facilitate this (Work No. 4b) is shown in **Figure 4.13: Indicative watercourse crossing reinforcement**. The final design for watercourse crossings will be submitted prior to construction.

Landscaping including habitat creation areas

~~4.50~~4.51 An Outline Landscape and Ecological Management Plan (**Appendix 5.6**) (LEMP) has been developed to identify proposals for enhancing the Site's ecological credentials, ensuring landscape and ecological benefits are delivered. It sets out measures for protection, retention, and establishment of new habitats, with measures to protect the species associated with these habitats. These new habitats include:

- Woodland and scattered trees.
- Grassland.
- Hedgerow.
- Standing water.
- Running water.

~~4.51~~4.52 The LEMP also sets out measures for habitat management and enhancement, alongside schedules of maintenance.

Creation of a new permissive path

~~4.52~~4.53 A new permissive path (Work No.10) is proposed to connect footpath SD48/9/1 to footpath SD13/1/1, during the life of the Proposed Development. The permissive path will comprise a short mown corridor and/or wooden board walk contained by stock wire mesh deer fencing and landscaping planting.

Fencing and security

~~4.53~~4.54 The Work No.1 area will be contained by agricultural stock wire mesh deer fencing (see **Plate 5**). At the new crossroad junction off Coton Road (see **Figure 4.9: Coton Road Crossroads Design**) a metal post and mesh fence at least 2m high will be installed for additional security. A single line of barbed wire may be used where necessary. Temporary screening (such as opaque netting attached to the deer fencing) (up to ten years) in key locations to mitigate glint and glare hazards on road users. Fencing to be removed once hedge/screening planting has matured. Site access points will have a security gate installed.

~~4.54~~4.55 There will also be a series of pole mounted CCTV cameras mounted throughout the site. Both the BESS (Work No.2) and the Proposed Development substation (Work No.3) will be secured by palisade fencing.

~~4.55~~4.56 A standard manned portacabin will be installed at the Coton Road Crossroads for security.

Plate 5: Typical Deer Fencing

Drainage

~~4.56~~4.57 **Appendix 8.1: Flood Risk Assessment and Outline Drainage Strategy** sets out the drainage strategy for the Site. For the solar panels, rainfall will be allowed to percolate into the underlying soil as occurs at present. This includes rain falling on the solar panels and the supporting infrastructure, which will drain to ground. The solar PV modules contain small gaps at regular intervals up and along the arrays, and these gaps allow rainwater to disperse through the array and avoid concentrated flows landing on the ground.

~~4.57~~4.58 Runoff from the panels will therefore be intercepted and buffered by the vegetation growing underneath the panels and retained prior to infiltration as with the greenfield situation.

~~4.58~~4.59 All field access tracks will either be grass corridors or constructed of permeable, compacted gravel. Each gravel track shall be designed with a fall to direct water into a gravel filled longitudinal trench. These trenches will act as attenuation and treatment prior to infiltration.

~~4.59~~4.60 Provision has been made in the outline designs for sufficient water supply and containment as a possible BESS fire-fighting solution. The BESS compound surface will consist of an impermeable sub-base to contain fire-water runoff or potential battery contaminants in the unlikely event of a battery fire. This will consist of drainage infrastructure built into or below a sub-base of granular material directing runoff to a containment tank/pond, with testing, flow control and pumping equipment therein to ensure the safe discharge or removal of water following a battery fire. Control valves will be engaged at the earliest detection of a fire to initiate surface and fire-water containment. The containment tank/pond will be lined to ensure fire-fighting water and associated contaminants do not leach into the environment. Under normal operations surface water runoff in the BESS compound will bypass the containment tank/pond and drain to the northwest towards the existing drainage channel, ultimately discharging into the watercourse approximately 300m north-west of the BESS/Proposed Development substation.

~~4.60~~4.61 Where required, areas of the Proposed Development substation compound will be impermeable. The remaining areas will be permeable and suitable drainage included to manage surface water runoff.

~~4.61~~4.62 Where necessary, the Proposed Development substation compound will be impermeable with the remaining area being permeable.

~~4.62~~4.63 Two areas of approximately 8,000m^3 and 6,000m^3 are available within the sub-base of the BESS and Proposed Development substation compounds respectively to hold drainage volume. The sub-base of granular fill materials acts as a water storage area, and with respective depths of 0.4m and 0.3m and a void ratio of 30% within the granular fill material, a storage volume of 960m^3 and 540m^3 would be created at the BESS and substation respectively.

Construction of the Proposed Development

Construction Programme

~~4.63~~4.64 Construction of the Proposed Development is likely to take up to two years. A summary of the likely construction programme is provided below, noting that many of the phases will not occur in isolation and are likely to take place concurrently. Following DCO being granted, construction of the Proposed Development is targeted to start in 2026.

- Enabling and civil works.
- BESS construction.
- Proposed Development substation compound and welfare facilities.
- Trenching and Installation of electric cabling.
- Installation of solar panels.
- Site re-instatement and landscaping works

~~4.64~~4.65 Further details of the construction program are provided in **Appendix 4.1: Indicative Construction Programme.**

Enabling and civils works

~~4.65~~4.66 The following activities will be required as part of the site preparation and civil engineering works:

- Construction of site entrances.
- Establishment of construction compounds, which include site offices/welfare area and parking area.
- Upgrading, modification or improvement of highways where required for site construction.
- Preparation of land for construction, including localised site levelling (where required) and vegetation clearance.
- Import of construction materials, plant and equipment to site.
- Establishment of the construction area fence where required for construction works to progress (the installation of the perimeter fence will progress with site construction in each area and therefore will not be complete at the start of site construction).
- Construction of the internal access roads.
- Marking out the location of the operational infrastructure.
- Installation of site drainage.

BESS Construction

~~4.66~~4.67 The following activities will be required to construct the BESS:

- Installation of electric cabling.
- Construction of foundations.
- Import of components to site.
- Installation of batteries, auxiliary transformer and PCS units.
- Installation of perimeter fencing, gates and CCTV.
- Installation of water storage tanks and associated fire-fighting infrastructure.

Proposed Development Substation, compound and welfare facilities

~~4.67~~4.68 The following activities will be required to construct the Proposed Development substation:

- Installation of electric cabling.
- Construction of foundations.
- Import of components to site.
- Installation of transformers, harmonic filter, statcoms, control building, welfare building, and storage containers.
- Installation of perimeter fencing, gates and CCTV.
- Installation of water storage tank, deluge system and associated fire-fighting equipment.

Trenching and installation of electric cabling

~~4.68~~4.69 Cabling will in the majority be installed using open trenching methods except where required to cross watercourses, utility assets, or roads whereby directional drilling under the features may be required. Further information is provided in paragraphs 4.17 – 4.224.41 ~~to~~ and 4.30 – 4.43 4.43.

Installation of solar panels

~~4.69~~4.70 The following activities will be required to construct the solar panel array and associated plant:

- Import of components to site.
- Piling and erection of PV module mounting structures, using mobile piling rigs to install metal piles up to 2m in depth (see **Plate 6**).
- Mounting of modules to the mounting structure using hand-held power tools.
- Trenching and installation of electric cabling.
- Installation of string inverters and transformer units.
- Installation of perimeter fencing, gates and CCTV.

Plate 6: Example of a piling rig and piles

Site re-instatement and landscaping

~~4.70~~4.71 Following construction, specific elements of the Works will be removed including temporary construction access tracks (including culverts) and construction compounds and laydowns areas. These areas will be either reinstated to their use before construction began or incorporated into the proposed landscaping and ecological enhancements proposed as part of the Proposed Development.

~~4.71~~4.72 The ground under the solar panels will be planted with native grassland mix and hedgerows and trees will be planted and reinstated in strategic locations to provide visual screening.

~~4.72~~4.73 An outline Landscape and Ecological Management Plan has been prepared (**see Appendix 5.6: Outline Landscape and Ecological Management Plan**) to set out the principles for how the land will be managed throughout the operational phase following the completion of construction.

Construction Plant

~~4.73~~4.74 Typical construction plant used to construct the Proposed Development will include:

- Excavators.
- Ready mix concrete wagons.
- Concrete pumps.
- Mobile piling rigs.
- Cranes.
- Dumper trucks.
- Low loaders.
- Generators.
- Fuel and water bowsers.
- Skips.

Construction Staff

~~4.74~~4.75 Construction is expected to start no earlier than 2026, and it is estimated that an average of 114 workers will be required onsite throughout the construction period. It is expected that the peak number of workers onsite on the busiest construction day would be up to 150.

Construction Hours of Work

~~4.75~~4.76 Construction working hours on the Site will run as follows:

- 07:00 – 19:00 hours on weekdays during the summer and with reduced hours in winter months.
- 08:00 – ~~14~~13:~~00~~ 30 hours on Saturdays.
- No working on Sundays, Bank or Public Holidays unless otherwise agreed in advance with the Local Planning Authority.

Construction Traffic

~~4.76~~4.77 The transport assessment has established a worst-case assessment and examines a peak construction phase of up to 150 daily staff and 100 two-way movements per day, broken down as 28 two-way Heavy vehicle movements and 76 two-way Light vehicle movements.

~~4.77~~4.78 An outline Construction Traffic Management Plan (CTMP) (**Appendix 10.1**) has been developed to guide the delivery of materials and staff onto the Site during the construction phase and sets out the routing and management of construction vehicles. A detailed CTMP will need to be approved by the Local Highways Authority following DCO consent and prior to implementation of the permission.

~~4.78~~4.79 The CTMP will include amongst others, the following items:

- A routing strategy for construction traffic including HGVs.
- Peak time restrictions for HGVs where possible.
- Controls governing the movement of large and/or abnormal loads.

~~4.79~~4.80 Details of the potential impact of construction traffic are provided in **Chapter 10: Transport and Access**.

Construction Control Measures

Construction and Environmental Management Plan (CEMP)

~~4.80~~4.81 A Construction Environmental Management Plan (CEMP) is a working document that defines how a proposed development will avoid, reduce or mitigate its potential impacts through construction on the environment and local community. As part of good practice an Outline Construction and Environmental Management Plan has been produced to support the application and is included in **Appendix 4.3: Outline Construction Environmental Management Plan**.

~~4.81~~4.82 The detailed CEMP to be agreed prior to construction, will include:

- A table showing the objectives, expected results, activities, and responsibilities required.
- The broad plan of the phasing of the work and its context within the whole project.
- Baseline levels for noise, vibration and dust monitoring.
- Threshold and action levels for noise, vibration and dust to warn of activities that may require particular care and control.
- Details of prohibited or restricted operations (for example locations, hours of operation etc.).
- Arrangements for the implementation of the CEMP and environmental monitoring, including responsibilities, the role of environmental authorities, and participation of stakeholders.
- A monitoring and supervision plan.
- A response plan in the event of accidents or otherwise unexpected events and potential risk register.
- Locations and protocol with regard to material storage and compounds.
- Reference to ground conditions and remedial measures and/or mitigation associated with ground contamination if necessary.

~~4.82~~4.83 The outline CEMP sets out how the construction of the Proposed Development will ensure compliance with current legislation, effectively minimise any potential adverse effects and outline how site and issue specific method statements will be developed. It covers potential construction related impacts associated with the ES technical assessments and any other potential construction effects including:

- Climate Change.
- Air quality and dust.
- Noise and vibration.
- Flood risk and water quality.

- Ground conditions and contamination.
- Visual amenity and lighting.
- Transport and access.
- Biodiversity.
- Soil management.
- Waste.
- Utilities.

~~4.83~~4.84 All construction contractors will be required to ensure compliance with the CEMP.

Operation and Maintenance

~~4.84~~4.85 Once the Proposed Development has been commissioned the ongoing operation and maintenance activities required are limited and principally include:

- Equipment maintenance and servicing.
- Replacement of broken or faulty equipment.
- Ongoing monitoring of equipment performance.
- Ongoing implementation of the proposed landscaping and ecological works in accordance with the LEMP.

~~4.85~~4.86 There will be up to three permanent staff employed on Site who will be responsible for overseeing the daily operation and maintenance of the Proposed Development.

~~4.86~~4.87 The Proposed Development has been designed to have an operational lifespan of up to 40 years. An outline Operational Environmental Management Plan has been submitted in support of the application and provides further detail on how the Proposed Development will be managed over its lifetime (**Appendix 4.4: Outline Operational Environmental Management Plan**).

Decommissioning

~~4.87~~4.88 At the end of its operational life the Proposed Development will be fully decommissioned.

~~4.88~~4.89 All above ground plant, machinery and equipment will be removed together with all perimeter fencing and concrete hard standing. All internal access tracks are to be removed unless the landowner wishes them to remain. All cables will also be removed except where the impact of removal is deemed to outweigh the benefit of removal at the time of decommissioning. The land within the site will be returned to its original agricultural use after decommissioning. Areas of habitat and biodiversity mitigation and enhancement will be left in situ to avoid disturbance of established and protected species.

~~4.89~~4.90 All materials arising from the decommissioning and demolition will be recycled or disposed of responsibly and in accordance with the relevant waste management legislation in force at the time of decommissioning. A Decommissioning Environmental Management Plan, to include timescales, proposed works and methods including traffic management will be agreed in advance with the local planning authority and secured by DCO requirement (see **Appendix 4.5: Outline Decommissioning Environmental Management Plan**).

~~4.90~~4.91 The effects of decommissioning are similar to, and often of a lesser magnitude than construction effects and will be considered where possible in the relevant topic chapters of the ES. It is however noted that due to timescales there is likely to be a high degree of uncertainty regarding decommissioning as engineering approaches and technologies are likely to change over the operational life of the Proposed Development.

~~4.91~~4.92 As much as possible of the plant and equipment making up the Proposed Development will be recycled. As the majority of the equipment is classed as electrical it will fall under the Waste from Electrical and Electronic Equipment Regulations 2013 (as amended) ('WEEE') which is designed to reduce the amount of waste electrical and electronic equipment (WEEE) incinerated or sent to landfill sites. Reduction is achieved through various measures which encourage the recovery, reuse and recycling of products and components.

~~4.92~~4.93 In the United Kingdom (UK) batteries are regulated to help protect the environment through the Waste Batteries and Accumulators Regulations 2009 (as amended). These regulations make it compulsory to collect/take back and recycle batteries and accumulators and prevent batteries and accumulators from being incinerated or dumped in landfill sites.

~~4.93~~4.94 Solar panels typically consist of glass, silicon, aluminium and a small percentage of copper, tin and lead. The glass and metals are readily recycled. Recycling of silicon is an emerging market but there are already specialist companies who offer this service:

- PV Cycle (www.pvcycle.org.uk) is a global not-for-profit organization that offers waste management services for operators of solar parks. Initially set up to recycle PV solar panels it has expanded its services to include batteries and inverters. PV Cycle has achieved a 96% recycling rate for silicon based PV solar panels.
- Recycle Solar (www.recyclesolar.co.uk) is based in Scunthorpe and specialises in the recycling of PV solar panels and inverters.

~~4.94~~4.95 In respect of the BESS, there are currently no large-scale recycling facilities for recycling batteries on this scale in the UK. Such facilities do, however, exist in Europe and as the UK battery market expands and matures, particularly in the electric car industry, it is expected that UK opportunities for recycling will appear.

~~4.95~~4.96 All other components of the Proposed Development are generally recyclable and general recycling rates for electrical equipment are in excess of 90%.