Great North Road Solar and Biodiversity Park

Environmental Statement

Volume 2 – Chapters

Chapter 5 – Development Description

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Contents

5.1 INTRODUCTION

1. This chapter of the ES describes the Development. It provides a description of the existing Development site and the physical characteristics of the Development for the purpose of identifying and assessing the likely significant environmental effects resulting from the Development, more detail on which is provided in the other DCO chapters. It also describes the proposed programme of site preparation, construction and decommissioning works for the Development and the key activities that would be undertaken during the works to inform the prediction of likely significant environmental effects set out in the technical chapters.

2. This chapter is supported by the following figures provided in Volume 3:

- Figure 5.1: Works Areas [EN010162/APP/6.3.5.1];
- Figure 5.2: Masterplan [EN010162/APP/6.3.5.2];
- Figure 5.3: Constraints within Work Area 1, 2 and 3 [EN010162/APP/6.3.5.3];
- Figure 5.4: Illustrative Design [EN010162/APP/6.3.5.4];
- Figure 5.5 Illustrative Construction Infrastructure [EN010162/APP/6.3.5.5];
- Figure 5.6 Typical Solar Array Plan, Elevation and Cross-Section [EN010162/APP/6.3.5.6];
- Figure 5.7: Typical CCTV pole [EN010162/APP/6.3.5.7];
- Figure 5.8: Typical Access Track Cross-Section [EN010162/APP/6.3.5.8];
- Figure 5.9: Typical Cable Trench Cross-Section [EN010162/APP/6.3.5.9];
- Figure 5.10: Typical Inverter, Transformer Elevations [EN010162/APP/6.3.5.10];
- Figure 5.11: Typical Fence and Gate Elevations [EN010162/APP/6.3.5.11];
- Figure 5.12: Typical Substation Layout [EN010162/APP/6.3.5.12];
- Figure 5.13: Typical Construction Compound Layout [EN010162/APP/6.3.5.13];
- Figure 5.14: BESS Elevations [EN010162/APP/6.3.5.14];
- Figure 5.15: PCS Elevations [EN010162/APP/6.3.5.15];
- Figure 5.16: 132kV Substation Elevation [EN010162/APP/6.3.5.16];
- Figure 5.17: 400kV Substation Elevation [EN010162/APP/6.3.5.17];
- Figure 5.18: 132kV and 400kV relay and control room [EN010162/APP/6.3.5.18];
- Figure 5.19: Lighting for inverters, BESS, 400kV and 132kV compounds [EN010162/APP/6.3.5.19]; and
- Figure 5.20: Construction Lighting Illustrative Elevations [EN010162/APP/6.3.5.20].

3. This chapter is also supported by the following Technical Appendices (TAs) provided in Volume 4:

- TA A5.1: Outline Landscape and Ecological Management Plan (LEMP) [EN010162/APP/6.4.5.1);
- TA A5.2: Outline Construction Traffic Management Plan (CTMP) [EN010162/APP/6.4.5.2];
- TA A5.3: Outline Construction Environmental Management Plan (CEMP) [EN010162/APP/6.4.5.3];
- TA A5.4: Outline Fire Safety Management Plan (FSMP) [EN010162/APP/6.4.5.4];
- TA A5.5: Outline Operation Environmental Management Plan [EN010162/APP/6.4.5.5]; and
- TA A5.6: Outline Decommissioning and Restoration Plan [EN010162/APP/6.4.5.6].

4. The area within the Development site has been divided using existing physical features such as hedges, ditches and overhead powerlines into smaller areas referred to as fields and numbered, as shown in Figure 5.1 [EN010162/APP/6.3.5.1]. This numbering may not be sequential and has no significance; it is for referencing purposes only.

5.2 EXISTING DEVELOPMENT SITE DESCRIPTION

5.2.1 Site Context

5. The Development would be located to the northwest of Newark, in the Newark and Sherwood district, Nottinghamshire, East Midlands. The Development would be within an area bound by the Order Limits. The Order Limits are to the west of the A1, north of the A617, east of Eakring, and south of Egmanton, to the north and north-west of Staythorpe. The Development essentially consists of discrete land parcels proposed to be occupied by solar PV panels and connected by cable route areas. The eastern side of the Development runs from the north of North Muskham to Egmanton in the north. The western side of the Development runs north-west from Staythorpe Power Station and then splits at Maplebeck, with spurs running to Eakring in the north-west and Kneesall to the north-northeast, then connecting with the eastern side of the Development.

6. The Order Limits are shown on Figure 1.1: Development Location [EN010162/APP/6.3.1.1].

5.2.2 Existing Development Site

7. The wider area within and surrounding the Order Limits are generally composed of agricultural land, interspersed by occasional woodlands. Surrounding villages and hamlets are connected by rural roads and public rights of way. Smaller fields and tree cover are more common close to the villages and along water courses, with larger and more open fields set further away. The total area of the Development Site is approximately 1,765 hectares (ha), the majority of which is currently used for arable crops or is otherwise down to pasture.

5.3 THE ROCHDALE ENVELOPE

8. It is essential to provide flexibility in the Development Description chapter of this ES and in the DCO, to allow for the most efficient technology possible to be utilised by the Development at the point of construction. The rapid improvement of technology in the solar photovoltaic (PV) and energy storage industry, means that in some cases, the Development could utilise the latest technology.

9. To address this, a Rochdale Envelope approach is used. The principles and justification for this approach are set out in section 2.3.1 of Chapter 2: EIA [EN010162/APP/6.2.2] of this ES.

10. In order to establish parameters within the Rochdale Envelope for assessment, the Development Description chapter follows a two-tier approach by establishing:

- Parameter ranges that specify the limits for this Development; and
- Illustrative design – a realistic and buildable design for which each parameter is within the allowed range for that parameter.

11. An example of this is the total area of solar PV modules. The Rochdale Envelope specifies that the Development would have a total area of solar PV modules within a specified range, but for the purposes of illustration, a specific total area of modules would be used.

12. The illustrative design parameters generally, but not necessarily always, represent the maximum value allowed by the range, and the maximum may be not the worst-case scenario for a given assessment. For example, the maximum battery energy storage capacity would not be the worst case for the climate change assessment, where battery energy storage capacity has a positive effect on the climate.

13. For environmental impact assessment purposes, each technical assessor has determined which value within the parameter range (where relevant to the assessment) represents the realistic worst-case in the context of their assessment. This is set out in each technical chapter and the assessment of environmental effects is then based on that determination.

14. Following this method ensures suitability of the findings of this ES for the final design of the Development as-built, as the effects should be no worse than predicted.

5.3.1 Defining the Detailed Design

15. Following consent and final detailed design, a final build plan will be submitted to Newark and Sherwood District Council (NSDC) for approval. The purpose of this submission will be to:

- Comply with the requirements included in the DCO; and
- Demonstrate that the final as-built design remains within the parameters of the Rochdale Envelope considered by the EIA.

5.4 DEVELOPMENT DESCRIPTION AND ILLUSTRATIVE DESIGN

5.4.1 Summary of the Development

16. The Development will comprise an array of solar PV modules, energy storage and associated development infrastructure, together with biodiversity enhancements including 64,500 trees and 50 km of new hedgerow. The general flow of electricity across the Development will be as set out in this Section, 5.4.1, explaining at high level the linkage and function of the principal electrical components of the solar park. The habitat changes are described in Chapter 8, Ecology and Biodiversity [EN010162/APP/6.2.8] and specified in the Outline LEMP [EN010162/APP/6.4.5.1]. In addition, 28 new permissive routes are proposed, comprising 22 footpaths and 6 bridleways, totalling 34.8 km of new recreational routes. These are shown on Figure 5.2, Masterplan [EN010162/APP/6.3.5.2] and assessed in Chapter 18, Recreation [EN010162/APP/6.2.18].

5.4.1.1 Solar PV Modules

17. Solar PV modules convert irradiation from the sun into electrical energy through the photovoltaic effect.

18. Solar PV modules are installed on a metal framework with an inclination calculated according to the energy production study. The mounting framework is broken into discrete units (often referred to as “tables”) which typically correspond to the PV module wiring configuration. A typical fixed-tilt layout is based around a standard table with a small number of shorter tables as required to avoid modules being too close or too far from the ground due to steep slopes over short distances. The distance of this equipment from the ground must be sufficient to avoid contact with flooded areas (in principle, although areas at risk of flooding have been avoided in Development design) and to preserve the natural terrain by preventing vegetation from growing over the surface of the modules. The distance will also be sufficient for sheep to be able to move under the panels, to facilitate sheep grazing.

5.4.1.2 Strings

19. The connection in series of a set of solar modules (usually called a string) allows the voltage to be increased thereby reducing electrical losses and improving both operational and construction efficiency. The voltage limit for these devices is currently 1500 V. Connecting them in series will keep the string currents at the original current values of the modules.

5.4.1.3 Combiner Boxes

20. The purpose of Combiner Boxes (CB) is to aggregate the output from the strings while maintaining the string voltage and thereby reduce the number of inputs required in the central inverter.

21. In addition to grouping the currents of the various strings on a single busbar and output, this box can also contain a general disconnect switch, current and voltage metering equipment, as well as surge protectors and fuses to protect the strings.

22. They are located close to the modules, usually fixed to the piles of the structure that supports them or to concrete bases set in the ground.

5.4.1.4 Central Inverters

23. The inverters' function is to convert direct current (DC) into alternating current (AC) making the installation compatible with the parameters of the electrical network. Other functions include protection of the installation and monitoring of operational parameters.

24. Central inverters are strategically located in the park to minimise energy losses.

25. The Illustrative Design locates the inverters further away from residential properties to help to minimise the noise impact on the population. Locating them on higher ground and close to existing access tracks and reducing the creation of new access tracks will reduce impacts on local hydrology. This will be finalised at detailed design stage, post consent.

26. Central inverters are often of similar size and outline to a shipping container, with each serving a large number of PV modules. The cables from the PV arrays are routed via DC switchgear and cables either ducted or direct buried below the surface of the ground to the central inverter; inverter stations are generally built off-site as prefabricated substations but can be constructed and maintained in situ. Inverters output AC electricity to a transformer which would be part of the containerised central inverter.

5.4.1.5 Transformer Stations (TS)

27. Transformer units, commonly known as Transformer Stations (TS), are implemented to step up the voltage to, typically, 33 kV, to reduce energy losses throughout the installation. These technical units combine the inputs from the inverters with a step-up transformer and medium voltage (MV) switchgear, allowing the installation to be subdivided and protected at higher voltage levels.

28. The TS are typically prefabricated metal assemblies with dimensions like shipping containers and can also accommodate the inverters.

5.4.1.6 Intermediate Substations

29. The intermediate substations would combine the electricity from all Transformers Stations (TS) and increase the voltage to 132 kV through transformers. This would be transmitted via cable either ducted or direct buried below the surface of the ground, to the BESS/400 kV compound.

30. The Intermediate Substations will also include:

- 33 kV and 132 kV switchgear;
- Cable sealing ends;
- Overhead busbars and associated supports and equipment; and
- Associated auxiliary LV underground cables, for control, communication and protection.

5.4.1.7 BESS/400 kV Substation

31. The BESS/400 kV compound would include transformers and other electrical equipment to combine the electricity from the Intermediate Substations, potentially storing it temporarily in the batteries that comprise the BESS. Electricity would be transmitted from the compound (either directly from the solar panels or via storage in the batteries) at 400 kV along a cable either ducted or direct-buried below the surface of the ground.

32. Two alternative options are proposed to connect the 400 kV cable to the National Grid Staythorpe Substation:

- Connect via the substation associated with a consented grid support BESS on land immediately to the west of the existing National Grid Staythorpe Substation. This grid support BESS has been granted planning consent (Newark and Sherwood District Council, planning reference 22/01840/FULM); or
- Connect the 400 kV cable to connect directly to the National Grid Staythorpe Substation.

33. The need for these alternative options results from the grid support BESS not having yet been constructed. If this were to be constructed in time for the Development, then connecting via its substation allows for a shared connection, which is resource efficient and cost effective. Alternatively, the 400 kV cable could run directly to the same connection point at the existing National Grid Staythorpe Substation. Both of these options are assessed within the DCO to allow for this flexibility.

34. At the existing National Grid Staythorpe Substation, the electricity would pass through new metering equipment and be connected to the existing 400 kV electrical infrastructure within the compound. This new equipment and connection would either be installed as part of the Consented Staythorpe BESS or for the Development (if it isn't installed as part of the Consented Staythorpe BESS).

35. The BESS/400 kV Substation will also include:

- 33 kV, 132 kV and 400 kV switchgear;
- Cable sealing ends;
- Overhead busbars and associated supports and equipment; and
- Associated auxiliary LV underground cables, for control, communication and protection.

5.4.1.8 Additional Components

36. In addition to the electrical infrastructure as set out above, the Development will include control buildings, environmental mitigation and enhancement measures and minor alterations to the local transport network to facilitate vehicular access to the site.

5.4.2 Overview of the Development Areas

37. The areas within the Order Limits are described as being one of the following:

- Work no. 1: Solar PV;
- Work no. 2: Cables;
- Work no. 3: Mitigation/enhancement;
- Work no. 4: Intermediate substations;
- Work no. 5a: BESS;
- Work no. 5b: 400 kV compound;
- Work no. 6: National Grid Staythorpe Substation and connection point;
- Work no. 7: Consented Staythorpe BESS and Connection; and
- Work no. 8: Access Works

38. The areas above are shown on Figure 5.1: Works Areas [EN010162/APP/6.3.5.1]. The principal activities that may take place in each of the above areas are described in the sections below.

5.4.2.1 Work no. 1: Solar PV

39. Solar PV areas may contain the following principal Development components/activities:

- Site preparation and/or clearance;
- Solar PV panels and mounting structure and poles;
- DC switchgear and similar distribution assemblies;
- Inverters and associated controls/monitoring equipment;
- Transformers and associated switchgear and control equipment;
- Local MV substations / switchrooms and auxiliary equipment;
- Local LV / auxiliary switchrooms and associated equipment
- LV and MV underground cabling between the above and linking to an intermediate substation;
- HV and EHV underground cables linking the intermediate substations to the 400 kV compound;
- Underground earthing conductors/cables, buried vertical electrodes and test points;
- Access tracks;
- Asphalt/tarmac roads linking the adopted highway and any Work no. 4, Intermediate Substation areas;
- Laying down of permissive paths and bridleways, signage and information boards;
- Temporary Public Rights of Way diversions (during the construction and decommissioning phases);
- Permanent[1] Public Rights of Way diversions (during the operational phase and thereafter);
- Earthworks;
- Fencing/gates;

[1] The Decommissioning and Restoration Plan (see Section 5.7) discusses the potential for changing the routes of Public Rights of Way at the time of decommissioning.

- Security cameras;
- SuDS measures;
- Parking and laydown facilities where required;
- Operating staff welfare and office facilities;
- Equipment storage containers;
- Monitoring, control and communication buildings, kiosks and equipment;
- Planting and vegetation management, and other mitigation/enhancement measures, such as permissive paths and bridleways, signage and information boards; and
- Enabling works, including horizontal directional drilling (HDD) compounds and (separate) construction compounds, for the above and/or for adjacent Works (e.g., an intermediate substation).

40. Work no. 1 Solar PV areas are largely free of physical and environmental constraints but not entirely absent of them. Table 5.1 below sets out which constraints may occur within Work no. 1 Solar PV areas, as shown on Figure 5.3 [EN010162/APP/6.3.5.3], and how these will be treated in the detailed design of the Development. Other, non-spatial, constraints may also apply, such as to ensure compliance with noise limits or to mitigate potential dust or glint and glare effects, for example; these are set out in the relevant ES technical chapters.

Table 5.1: Solar PV Work Areas – Internal Design Constraints

Constraint type shown on Figure 5.3 [EN010162/APP/6.3.5.3]	**Detailed Design Requirement**	
	Generation infrastructure (solar PV panels, inverters, transformers, etc.)	**Other ancillary infrastructure (tracks, cables, fences, CCTV, etc.)**
11 kV electricity lines (above ground and buried)	Not permitted within 3.0 m of the nearest conductor.	Avoid physical structures. Follow asset specific design guidance and consider operator’s legal access rights.
33 kV electricity lines (above ground and buried)	Not permitted within 3.0 m of the nearest conductor.	Avoid physical structures. Follow asset specific design guidance and consider operator’s legal access rights.
132 kV electricity lines	Not permitted within 3.6 m of the nearest conductor.	Avoid physical structures. Follow asset specific design guidance and consider operator’s legal access rights.
275 kV and 400 kV electricity transmission lines	Not permitted within 30 m radius of towers and enable operator’s legal access rights.	Avoid physical structures. Follow asset specific design guidance and consider operator’s legal access rights.

Constraint type shown on Figure 5.3 [EN010162/APP/6.3.5.3]	Detailed Design Requirement	
	Generation infrastructure (solar PV panels, inverters, transformers, etc.)	Other ancillary infrastructure (tracks, cables, fences, CCTV, etc.)
Gas pipelines	Not permitted within 10 m of pipeline.	Avoid physical structures. Follow asset specific design guidance and consider operator's legal access rights.
Areas of potential archaeological interest	Avoid where possible. May be suitable subject to further archaeological investigations.	Avoid where possible. May be suitable subject to further archaeological investigations.
Permissive paths (except for Permissive Footpath 22), permissive bridleways and diverted public rights of way	Not permitted within 10 m of the centre of the route	Above-ground components not permitted within 10 m of the centre of the route, except features that are part of the route, e.g., gates, stiles, bridges, information boards, etc.
Root Protection Areas – trees and hedgerows	May be suitable subject to consideration of the specific receptor (type of tree or hedgerow) and a corresponding method statement, based on the Arboricultural Impact Assessment (AIA; TA A8.12 [EN010162/APP/6.4.8.12]).	May be suitable, subject to AIA, ecological assessment and suitable mitigation.
Waterbodies and watercourses	Not permitted within 10 m of the bank top.	May be suitable subject to further assessment and appropriate design mitigation.

41. Construction compounds in Work no. 1, Solar PV areas, will not be located within 300 m of residential properties.

5.4.2.2 Work no. 2: Cables

42. Work no. 2, Cable Areas, is shown as a "corridor" 60 m wide, typically – this is much larger than is expected to be needed but is the corridor within which the cable route is expected to be located, to give flexibility for the designer post-consent. Actual widths of the cable trench will vary, depending on the number and voltage of cables at a given location, and on their arrangement within the trench. The width of the working area and trench is expected to be

a maximum of 30 m (up to a 12 m trench, plus 9 m working corridor on either side).

43. It should be noted that the cables are also allowed within Work no. 1, Solar PV areas, and Work no.s 4-7 (substations and BESS areas).

44. Cable areas may contain the following principal Development components/activities:

- Site preparation and/or clearance;
- MV underground cables linking the Solar PV areas to intermediate substations;
- HV underground cables linking the intermediate substations to the BESS/400 kV substation compound;
- EHV underground cables linking the BESS/400 kV substation compound to the existing National Grid Staythorpe Substation;
- Associated auxiliary LV underground cables, for control, communication and protection and similar purposes;
- Auxiliary kiosks or buried equipment associated with the cables, including link/transposition boxes and communication links, and, where necessary, protective barriers/fences;
- Underground earthing conductors/cables, buried vertical electrodes and test points;
- Buried cable warning posts / markers;
- Access tracks;
- Temporary bridges over watercourses, where required to access the cables;
- Laying down of permissive paths and bridleways, signage and information boards;
- Temporary Public Rights of Way diversions (during the construction and decommissioning phases);
- Permanent[2] Public Rights of Way diversions (during the operational phase and thereafter);
- Archaeological investigations;
- Planting and vegetation management, and other mitigation/enhancement measures, such as permissive paths and bridleways, signage and information boards;
- Enabling works, including HDD compounds and construction compounds, for the above; and
- Any works specified for Work no. 8, Access Works.

45. Work no. 2, Cable Areas, are largely free of physical and environmental constraints but not entirely absent of them. The table below sets out which constraints may occur within Work no. 2, Cables, as shown on Figure 5.3 [EN010162/APP/6.3.5.3], and how these will be treated in the detailed design of the Development. Other, non-spatial, constraints may also apply,

[2] The Decommissioning and Restoration Plan (see Section 5.7) discusses the potential for changing the routes of Public Rights of Way at the time of decommissioning.

such as to ensure compliance with noise limits or to mitigate potential dust effects, for example; these are set out in the relevant ES technical chapters.

Table 5.2: Cable Areas – Internal Design Constraints

Constraint type shown on Figure 5.3 [EN010162/APP/6.3.5.3]	Detailed Design Requirement
11, 33, 132 and 400 kV electricity lines (above ground and buried)	Avoid physical structures. Follow asset-specific design guidance and consider operator's legal access rights.
Gas pipelines	Avoid physical structures. Follow asset-specific design guidance and consider operator's legal access rights.
Areas of potential archaeological interest	Avoid where possible. May be suitable subject to further archaeological investigations.
Areas within the extent of the 1:100-year flood event (30% climate change factor applied)	Above-ground water-sensitive electrical equipment and connections will be placed outside these areas.
Root Protection Areas – trees and hedgerows	May be suitable, subject to Arboricultural Impact Assessment (AIA), ecological assessment and suitable mitigation.
Waterbodies and watercourses	May be suitable subject to further assessment and appropriate design mitigation.

46. Construction compounds in Work no. 2, Cable Areas, will not be located within 300 m of residential properties.

5.4.2.3 Work no. 3: Mitigation/Enhancement

47. Mitigation/Enhancement Areas may contain the following principal Development components/activities:

- Site preparation and/or clearance;
- Access tracks;
- Fencing/gates;
- Archaeological investigations;
- SuDS measures;
- Planting and vegetation management, and other mitigation/enhancement measures;
- Laying down of permissive paths and bridleways, signage and information boards;
- Temporary Public Rights of Way diversions (during the construction and decommissioning phases);

- Permanent[3] Public Rights of Way diversions (during the operational phase and thereafter); and
- Enabling works, including construction compounds, for the above.

48. Work no. 3, Mitigation/Enhancement Areas, are largely free of physical and environmental constraints but not entirely absent of them. The table below sets out which constraints may occur within Work no. 3, Mitigation/Enhancement, as shown on Figure 5.3 [EN010162/APP/6.3.5.3], and how these will be treated in the detailed design of the Development. Other, non-spatial, constraints may also apply, such as to ensure compliance with noise limits or to mitigate potential dust effects, for example; these are set out in the relevant ES technical chapters.

Table 5.3 Mitigation/Enhancement Areas – Internal Design Constraints

Constraint type shown on Figure 5.3 [EN010162/APP/6.3.5.3]	**Detailed Design Requirement**
11, 33, 132 and 400 kV electricity lines (above ground and buried)	Avoid physical structures. Follow asset-specific design guidance and consider operator's legal access rights.
Gas pipelines	Avoid physical structures. Follow asset-specific design guidance and consider operator's legal access rights.
Areas of potential archaeological interest	May be suitable. May be subject to further archaeological investigations.
Root Protection Areas – trees and hedgerows	May be suitable, subject to Arboricultural Impact Assessment (AIA), ecological assessment and suitable mitigation.
Waterbodies and watercourses	May be suitable subject to assessment and appropriate design mitigation.

5.4.2.4 Work no. 4: Intermediate Substations

49. Up to four 'intermediate' substations are expected to be required for the Development. Locations for these have been identified within the Order Limits.

50. The areas identified as being potential locations for intermediate substations are generally larger than the actual substations will be. The areas identified provide flexibility and allow for refinement to the location and layout of a substation within a substation area.

51. The principal Development elements that the Intermediate Substations would contain are:

- Site preparation and/or clearance;

[3] The Decommissioning and Restoration Plan (see Section 5.7) discusses the potential for changing the routes of Public Rights of Way at the time of decommissioning.

- MV underground cabling linking the transformer stations (in Work no. 1, Solar PV Areas) to an intermediate substation;
- HV underground cables linking the Intermediate Substations to Work no. 5, BESS/400 kV Compound;
- Earthing conductors/cables, buried vertical electrodes and test points;
- Fencing/gates;
- Acoustic fencing where necessary;
- Transformers;
- Control rooms with welfare facilities;
- Outdoor switchgear and associated busbars and equipment;
- Indoor MV switchgear;
- Electrical cabling;
- Security cameras/lighting;
- SuDS measures;
- Access tracks and/or asphalt/tarmac roads and limited car parking;
- At least 2 electric vehicle charging points in each Intermediate Substation (not for public use);
- Planting and vegetation management, and other mitigation/enhancement measures; and
- Enabling works, including construction compounds, for the above.

52. Land within Work no. 4, Intermediate Substation Areas, which is not used for a substation would be used in the same way as Work no. 1 (Solar PV), Work no. 2 (Cables) or Work no 3 (Mitigation/Enhancement).

5.4.2.5 Work no. 5a: BESS

53. The BESS area may contain some or all of the following principal Development components/activities:

- Site preparation and/or clearance;
- High voltage underground cables linking the intermediate substations to the BESS/400 kV substation compound;
- Indoor MV switchgear;
- Containerised batteries;
- Inverter stations;
- Auxiliary control and LV switchrooms;
- First responders' information / notification kiosk(s);
- Underground cabling linking the batteries, inverters, transformers and substation;
- Access tracks (likely asphalt) and limited car parking;
- Fencing/gates;
- Sustainable Drainage Systems (SuDS) measures;
- Water tanks (if required);
- Security cameras/lighting;
- Acoustic fencing where necessary;
- Planting and vegetation management, and ecological mitigation/enhancement measures; and
- Enabling works, including construction compounds, for the above.

54. Measures to manage safety associated with the BESS will be set out in a Fire Safety Management Plan (FSMP). An outline FSMP has been developed and included in Technical Appendix A5.4 [EN010162/APP/6.4.5.4]. Following consent and final detailed design, a final FSMP will be submitted to NSDC for approval, and this will be implemented.

55. Land within Work no. 5a, BESS, which is not used for the above would be used in the same way as Work no. 1 (Solar PV), Work no. 2 (Cables) or Work no 3 (Mitigation/Enhancement).

5.4.2.6 Work no. 5b: 400 kV Compound

56. The 400 kV Compound area may contain some or all of the following principal Development components/activities:

- Site preparation and/or clearance;
- High voltage underground cables linking the intermediate substations to the 400 kV compound;
- High voltage underground cables linking the 400 kV compound to Work no. 6 or Work no. 7;
- Outdoor switchgear and associated busbars and equipment;
- Indoor MV switchgear;
- Auxiliary control and LV switchrooms;
- First responders' information / notification kiosk(s);
- A substation compound, including electrical infrastructure such as transformers, switchgear, gantries, control rooms and electrical cabling;
- Underground cabling linking the BESS and 400 kV Compound;
- Access tracks (likely asphalt) and limited car parking;
- At least 2 electric vehicle charging points (not for public use);
- Fencing/gates;
- Sustainable Drainage Systems (SuDS) measures;
- Security cameras/lighting;
- Acoustic fencing where necessary;
- Planting and vegetation management, and ecological mitigation/enhancement measures; and
- Enabling works, including HDD compounds and construction compounds, for the above.

57. Land within Work no. 5b, 400 kV Compound, which is not used for the above would be used in the same way as Work no. 1 (Solar PV), Work no. 2 (Cables) or Work no 3 (Mitigation/Enhancement).

5.4.2.7 Work no. 6: National Grid Staythorpe Substation connection

58. Modification works would be required at the existing National Grid Staythorpe Substation. This area may contain the following principal electrical components (in addition to the existing equipment):

- Site preparation and/or clearance;
- EHV underground cables linking to the BESS/400 kV Compound and/or the Consented Staythorpe BESS connection;
- Switchgear;
- Cable sealing ends;

- Overhead busbars and associated supports and equipment;
- Current Transformer/Voltage Transformer (CT/VT) units;
- Earthing;
- Associated auxiliary LV underground cables, for control, communication and protection and similar purposes;
- HDD compounds; and
- Protection modifications to accommodate the Development electricity generation.

5.4.2.8 Work no. 7: Consented Staythorpe BESS connection

59. Modification works would be required at the operational Staythorpe BESS installation (NSDC planning application reference numbers 22/01840/FULM and 24/01261/FULM). This area may contain the following principal components (in addition to the existing equipment):

- EHV underground cables linking to the BESS/400kV Compound;
- Switchgear;
- Cable sealing ends;
- Overhead busbars and associated supports and equipment;
- Current Transformer/Voltage Transformer (CT/VT) units;
- Associated auxiliary LV underground cables, for control, communication and protection and similar purposes;
- HDD compounds; and
- Upgrades to access and drainage where necessary.

5.4.2.9 Work no. 8: Access Works

60. The Access Works area would contain some or all of the following principal Development components/activities:

- Site preparation and/or clearance;
- Creation of accesses from the public highway;
- Road works, including temporary changes to street furniture, road widening, installation of passing places, maintenance of visibility splays;
- Temporary Public Rights of Way diversions (during the construction and decommissioning phases);
- Permanent[4] Public Rights of Way diversions (during the operational phase and thereafter); and
- Planting and vegetation management and other mitigation/enhancement measures.

5.4.3 Design Parameters

61. Solar PV technology is rapidly evolving. In order to maintain flexibility, allowing the latest technology to be utilised at the time of construction, the parameters describing the maximum, or worst-case (for the purposes of environmental assessment), extents or designs of the proposed

[4] The Decommissioning and Restoration Plan (see Section 5.7) discusses the potential for changing the routes of Public Rights of Way at the time of decommissioning.

infrastructure will need to remain flexible throughout the evolution of the Development design.

62. The following subsections outline the likely design parameters for each of the principal Development components/activities.

5.4.3.1 Solar PV Modules

Table 5.3 Solar PV Modules Design Parameters

Parameter	Illustrative Design	Design Limitations
Nominal direction in which the solar PV modules face	South	Up to 10º (E/W) maximum deviation from south orientation in specific cases
Total area of solar PV modules	442 ha	Up to 550 ha
Slope of Solar PV Modules from Horizontal	20°	10 to 35°
Minimum height of Solar PV modules above ground level (AGL)[5]	0.8 m	0.50 m
Maximum height of Solar PV modules AGL	2.47 m	3.5 m
Maximum height of weather stations AGL Note: these are collections of devices that are used to measure solar irradiance, ambient temperature, wind speed etc. They are small and typically mounted onto the frame of the arrays or adjacent on freestanding poles.	2.80 m	4 m

5.4.3.2 Module Mounting Structures

63. Each row of modules would be mounted on a frame supported by galvanised steel poles driven into the ground. Various foundation solutions are available, however, driving poles into the ground is the method most likely to be used for the majority of the Site. Between each row of panels there would be a separation distance to facilitate construction and maintenance and reduce loss of energy by shading of one row by another row.

[5] In interpreting the term "AGL", ground level is taken to be the highest ground under the solar PV table in a north-south plane.

Table 5.4 Module Mounting Structure Design Parameters

Parameter	Illustrative Design	Constraint
Table width (north to south)	4.8 m	3.5 – 7.5 m
North/south distance between tables	3.5 m	2.5 m – 10 m
Mounting structure material	Galvanised steel, anodised aluminium or Magnelis (zinc, aluminium and magnesium alloy)	Galvanised steel, anodised aluminium or Magnelis (zinc, aluminium and magnesium alloy)
Minimum distance between boundary fence and table areas	5 m Larger where practicable and at turning areas	3 m
Depth of piles below ground level	1.5 m	0.5 – 2 m

5.4.3.3 Inverter Stations / PCS

64. References to Inverter / Power Converter Stations (PCS) include inverter / power converter(s), LV power switchgear, LV/MV transformer, MV switchgear and associated connections, controls, housing, and structural support.

65. The illustrative design assumes factory-assembled central inverter stations which are delivered as a single unit on a skid or similar. The final design may incorporate a central inverter station partially or completely assembled on site.

66. Dimensions below exclude associated small control panels, kiosks, stop buttons, heat exchangers, ventilation cowlings, aerials etc erected in the vicinity of the station.

67. PV and BESS inverters from the same manufacturer can be visually similar. For the illustrative design this is the case. However, it may be that engineering or economic reasons result in a different product range or manufacturer being used.

68. Where the inverter station is elevated above ground level (e.g., areas of higher flood risk or where access is needed to cabling), gantries will be erected at the effective floor level of the station. Gantries may be erected on some or all sides of the station, to suit the design and maintenance requirements, and will extend no more than 2 m from the station footprint. Gantries will be lightweight constructions of plain galvanised steel and glass-reinforced plastic. Gantries will include handrails and steps to ground level and will be supported by the station foundation and/or surface pads. The inverter and transformer station may be mounted on adjustable legs or metal skids on concrete pad, steel piles or concrete columns surrounded by permeable hardstanding.

Table 5.5 Inverter and Transformer Station Design Parameters

Parameter		Illustrative Design	Design Limitations
Central inverter and transformer station dimensions	Length	12.2 m	Up to 15 m
	Width	2.5 m	Up to 3 m
	Height AGL	2.9 m	Up to 3.5 m
Station foundations	Type	Concrete strip	Steel piles, concrete strip or concrete slab/raft
External colour		RAL 6005 Moss Green	Whites, greys, (dark) blues or greens

5.4.3.4 Onsite Cabling

69. In general, existing above-ground power lines would not be altered as part of the Development. It is possible that some existing above-ground wooden-pole lines (11 or 33 kV) that cross solar areas may be re-routed around the edges of fields and underground, to maximise solar electricity generation from the field and reduce visual effects from existing overhead lines. Agreements and specific proposals for these have not been finalised at the time of production of this ES, so these remain as flexibility within the Development design. The worst-case scenario is assumed to be that the wooden-pole lines remain as they are currently, with no diversions or undergrounding.

70. Data cables would also be installed as part of the infrastructure, typically alongside electrical cables, in order to allow for the monitoring of the Development during operation, e.g., such as the collection of solar data from pyranometers.

71. Electrical cabling will typically be buried at a depth 0.6 to 1.5 m depending on the method of installation and ground conditions.

72. Electrical cabling will be required to connect the solar PV areas located to the east of the East Coast Main Line to an Intermediate Substation which is located to the west of the East Coast Main Line railway. Two methods are being considered for crossing the East Coast Main Line railway:

- Horizontal Directional Drilling (HDD) underneath the East Coast Main Line railway; and
- Cables would be run through the existing brick culverts underneath the East Coast Main Line railway.

5.4.3.5 Fencing and Security Measures

73. A fence would enclose the operational areas of the Development for security and public safety. The fence is placed at a distance from surrounding features (including ditches, hedges and solar PV modules).

74. Pole mounted internal facing closed-circuit television (CCTV) systems are also likely to be deployed around the perimeter of the operational areas of

the Development. Software masking of public areas will be applied where necessary to ensure privacy of the public.

75. It is likely that movement-triggered lighting and passive infra-red sensors would be deployed for security purposes in Work No.s 4, 5a and 5b and potentially at any other pieces of critical infrastructure and construction compounds.

76. Mammal access points will be included within the fence boundaries to permit access where practicable (i.e., as long as there are not lambs being contained by the fence, within the fence). These could be simple holes or badger gates (which could be locked when lambs are present), and are referred to as “mammal gates”, below.

Table 5.6 Fencing and Security Design Parameters

Parameter		Illustrative Design	Design Limitations
Fencing: Solar park	Fence Type:	Deer Fence (timber and wire)	Deer fence (timber and wire)
	Fence Height (AGL)	1.8 m	1.6 - 2.1 m
	Fence length	113 km	140 km
	Mammal gate frequency	One every 200 m	At least one every 200 m
	Mammal gate width	25 cm	20 – 25 cm
	Mammal gate height	25 cm	25 – 30 cm
Fencing: BESS compound and high-value auxiliary buildings	Length of perimeter fencing	2.1 km	Site perimeter, up to 2.5 km in total
	Fence Height (AGL)	2.1 m	2.1 – 4 m
	BESS Fence Type	Mesh fence	Site perimeter, up to 2.5 km in total
		Acoustic fence	Acoustic fence, if required
Fencing: 132 kV and 400 kV substations	Length of perimeter fencing	2 km	Site perimeter, up to 2.75 km in total
	Fence Type:	Powder-coated paladin fence with electrified inner leaf / topping	Paladin or palisade with electrified inner leaf / topping
		Acoustic fence	Acoustic fence, if required
	Fence Height (AGL)	3.5 m	3 – 4 m

Parameter		Illustrative Design	Design Limitations
Closed-circuit television (CCTV) cameras	Support column details	Pole mounted	Pole mounted and/or on nearby structures
	Camera height (AGL)	3 m	2 – 3.5 m
Lighting (operational phase)	Solar PV field transformers/inverter stations and auxiliary buildings	PIR motion sensor activated security infra-red lighting (non-visible)	No visible lighting
	Intermediate substations and BESS/400 kV compound	Manually operated lighting. Passive infra-red (PIR) motion sensor activated security / emergency lighting	No areas of the Development are proposed to be continuously lit

5.4.3.6 Access Routes, Points and Tracks

77. Due to the layout of the Development and the fact that it is divided by several public roads, several access points will be required from the public roads into the Development site. Wherever viable, existing access points will be utilised.

78. Where appropriate, any unsurfaced access tracks that run through the Development would be utilised in preference to the installation of new access tracks, to minimise land disturbance and environmental effects.

79. Access to the majority of the PV strings during operation will be via grassed tracks. The Intermediate Substations would require accesses to be constructed of asphalt/tarmac. Access to construction compounds would likely be made of compacted stone that can readily be taken up and the land reinstated following completion of their use.

80. Depending on weather conditions during construction, temporary roadways (e.g., plastic matting) may be utilised to access parts of the Development site during construction to avoid excessive soil disturbance or compaction.

Table 5.7 Access Track Design Parameters

Parameter		Illustrative Design	Design Limitations
Access Routes, Points and Tracks	Length of new tarmac road created	2.0 km	Up to 3 km
	Width of new tarmac road	4.5 m nominal	4.0 – 5.0 m
	Length of new stone road created	43.0 km	Up to 50 km
	Width of new stone road	4 m nominal	3.0 – 4.0 m

5.4.3.7 Culverts

81. New and upgraded existing culverts will be required to facilitate safe access to parts of the Development site during construction and operation. There are existing culverts across the Development site, and these have been utilised within the design where practicable. It has been assumed as a worst case that where existing culverts provide access to fields, these will need to be upgraded, however at the start of construction each culvert proposed to be used will be surveyed and only culverts that require upgrading will be upgraded.

82. There are three different types of culverts, all of which could be new or upgraded depending on the location:

- Access road crossing;
- Perimeter fence crossing; and
- Field access.

83. Mammal-friendly box-section culverts will be utilised for new and upgraded culverts.

84. A watercourse crossing inventory is provided in Technical Appendix A5.3 Outline Construction Environmental Management Plan [EN010162/APP/6.4.5.3].

5.4.3.8 Construction Compound Areas

85. The construction compounds are likely to be typically 1-2 ha each, in area. Construction compounds would contain enabling facilities for construction of the nearby elements of the Development, including:

- Hardstanding comprising a type 1 or 2 surface and/or temporary steel or plastic trackway surfaces;
- Temporary office space with welfare facilities;

- Storage facilities and areas;
- Bunded area for limited oil/fuel/chemical storage;
- Security cameras/lighting; and
- Access tracks and car parking.

86. Construction compounds would typically be installed temporarily, for the duration of construction works in the area served by a given construction compound, which would be typically six to nine months (see Section 5.5.1). The location of these compounds will be over 300 m from nearby residential receptors. Following this, the compound infrastructure would be removed. Land within a construction compound area that is not used for this purpose or following completion of its use as a construction compound, would be used for the underlying Works purpose, as described above. Otherwise, the area would be restored to its former condition.

5.4.3.9 Intermediate Substations

87. Each Intermediate Substation would consist of electrical infrastructure such as transformers and switchgear equipment. Each of the Intermediate Substations will include a control building which would include office space and welfare facilities as well as operational monitoring and maintenance equipment. The Intermediate Substation areas may also include a compound to facilitate maintenance of the Development during its operational phase.

Table 5.8 Intermediate Substation Design Parameters

Parameter			Illustrative Design	Design Limitations
Compound	Dimensions	Area	4,086 m^2	3,000 – 5,000 m^2
Electrical infrastructure	Maximum height		6.3 m	4.0 – 7.5 m
Buildings				
Site office, storage and welfare building	Number (per compound)		1	0 to 5
	Dimensions	Length	6.1 m	5 – 14 m
		Width	2.5 m	2.5 – 3.5 m
		Height	3.0 m	2.5 – 3.5 m
Foundations				
Type and material			Concrete	Concrete, pile or footing

5.4.3.10 BESS

88. The BESS will consist of electrical equipment to service a series of battery units.

Table 5.9 BESS Design Parameters

Parameter		Illustrative Design	Design Limitations
Battery Containers	Number of containers	704	Up to 754
	Approximate total energy storage capacity	4 MWh per container	At least 2 MWh per container
	HVAC - Heating / Cooling System	Liquid-cooled with internal heat exchanger	Air cooled or liquid cooled
	Height	3.5 m	Up to 4 m
	Foundation Type	Concrete strip	Steel piles, concrete strip or concrete slab/raft

5.4.3.11 400 kV Compound

89. The 400 kV Compound will consist of a 400 kV substation with electrical equipment to combine the electricity from the 132 kV cables and output the electricity at 400 kV.

90. The 400 kV Compound will include a control building which would include office space and welfare facilities as well as operational monitoring and maintenance equipment.

Table 5.10 400 kV Substation Design Parameters

Parameter			Illustrative Design	Design Limitations
Compound	Area		23,500 m^2	20,000 – 30,000 m^2
Electrical infrastructure	Maximum height: Busbar/bushings		13m	14 m
	Maximum height: Transformer		6m	7 m
Buildings				
Site office, storage and	Number		3	3 to 5
	Dimensions	Length	22 m	8 – 30 m
		Width	11 m	3 – 15 m

Parameter			Illustrative Design	Design Limitations
welfare building		Height	4 m	3 – 6 m
Foundations				
Type and material			Concrete pad/column, potentially in conjunction with piles/screw piles	Concrete pad/column, potentially in conjunction with piles/screw piles

5.4.3.12 Existing National Grid Staythorpe Substation

91. The existing National Grid Staythorpe Substation has available capacity for the Development to connect directly into the United Kingdom transmission network.

92. It is not anticipated that any additional external plant or equipment requiring consents will be required to facilitate this connection if the Staythorpe BESS project is completed as planned.

93. If this situation should change, or if the Staythorpe BESS project is not constructed or is delayed, any new plant, equipment or buildings will be of a similar design envelope to that already present.

5.4.3.13 Drainage Features

94. Sustainable Drainage Systems (SuDS) will be designed to capture the run-off from all new areas of hardstanding formed as part of the Development. Commentary on the design and parameters of these are set out in the Flood Risk Assessment, which is provided as TA A9.1 [EN010162/APP/6.4.9.1] of this ES.

5.4.3.14 Foundations

95. Foundations required to support structures in the substation compounds and elsewhere across the Site will be designed, at detailed design stage, post-consent, to be suitable for the structures they’re supporting, given the ground conditions at that location. For the purposes of assessment of environmental effects, a depth of 2.5 m has been assumed for all foundations, with commentary provided on whether effects might be different if the required foundation was deeper than this. Generally (e.g., for buildings), foundations will be shallower than this.

5.5 CONSTRUCTION

5.5.1 Phasing

96. The construction is likely to be undertaken in at least five phases:

- Phase one would include the construction of approximately a quarter of the solar area, one intermediate substation, the 400 kV substation, works at the existing National Grid Staythorpe Substation and/or the Consented Staythorpe BESS and cabling in between these;
- Phases two to four would each include the construction of approximately a quarter of the solar area, one intermediate substation and cabling including connection to the 400 kV substation; and
- Phase five would include the construction of the BESS.

97. It is likely that the main elements of construction activity (i.e., excluding enabling works/site clearance, re-instatement and landscaping) would be underway on a maximum of half the proposed solar area at any one time. In practice it is likely to be much less than this, but the above has been used for assessment purposes as a worst-case.

98. The worst-case estimate of the construction programme, with the minimum anticipated phasing, as used for assessment in the EIA, is provided in Table 5.11. It should be noted that, although Table 5.11 shows 5 phases, the separation between phases is spatial but not necessarily temporal, with phases 1 and 3 being concurrent and 2, 4 and 5 being concurrent. This is equivalent, therefore, to two temporal phases with two or three construction teams operating concurrently.

Table 5.11 Construction Phasing

Construction Activity		**Month**																							
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Phase one	Site access points	■	■	■																					
	Roads and tracks		■	■	■																				
	Construction compounds			■	■																				
	Fencing and CCTV				■	■	■	■	■	■	■	■	■												
	Solar PV poles, modules, inverters and transformers				■	■	■	■	■	■	■	■	■												
	Cabling				■	■	■	■	■	■	■	■	■												
	Intermediate substation								■	■	■	■	■											■	■
	BESS/400 kV compound								■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Connection to the transmission network at the existing National Grid Staythorpe Substation																							■	■
	Mitigation/enhancement planting				■	■	■	■	■	■	■	■	■											■	■
Phase two	Site access points													■	■	■									
	Roads and tracks														■	■	■								
	Construction compounds															■	■								
	Fencing and CCTV																■	■	■	■	■	■	■	■	■
	Solar PV poles, modules, inverters and transformers																■	■	■	■	■	■	■	■	■
	Cabling																■	■	■	■	■	■	■	■	■
	Intermediate substation																				■	■	■	■	■
	Mitigation/enhancement planting																■	■	■	■	■	■	■	■	■

Construction Activity		**Month**																							
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Phase three	Site access points																								
	Roads and tracks																								
	Construction compounds																								
	Fencing and CCTV																								
	Solar PV poles, modules, inverters and transformers																								
	Cabling																								
	Intermediate substation																								
	Mitigation/enhancement planting																								
Phase four	Site access points																								
	Roads and tracks																								
	Construction compounds																								
	Fencing and CCTV																								
	Cabling																								
	Solar PV poles, modules, inverters and transformers																								
	Intermediate substation																								
	Mitigation/enhancement planting																								
Phase five	Battery installation																								

5.5.2 Landscape and Ecological Management

99. An outline Landscape and Ecological Management Plan (oLEMP) is included in this ES as TA A5.1 [EN010162/APP/6.4.5.1]. Following consent and final detailed design, a final LEMP will be submitted to Newark and Sherwood District Council (NSDC) for approval, and this will be implemented.

100. The LEMP will cover landscape and biodiversity management through the operational phase as well as the construction phase.

101. Changes to vegetation may be proposed to enhance the landscape and/or biodiversity, and/or as mitigation for visual effects and potential effects on protected or sensitive species. The oLEMP describes proposed changes to vegetation, such as where new planting or habitat is proposed, and how those changes will be implemented and overseen, to ensure their successful establishment. The oLEMP includes provision for planting of 64,500 trees and 50 km of new hedgerow, as well as other habitat enhancements.

5.5.3 Transport

102. Measures to control construction traffic will be set out in a Construction Traffic Management Plan (CTMP).

103. An outline CTMP is included in this ES as TA A5.2 [EN010162/APP/6.4.5.2]. Following consent and final detailed design, a final CTMP will be submitted to NSDC for approval, and this will be implemented.

5.5.4 Construction Environmental Management

104. Measures to control the environmental impacts of construction activities will be set out in a Construction Environmental Management Plan (CEMP).

105. An outline CEMP is included in this ES as TA A5.3 [EN010162/APP/6.4.5.3]. Following consent and final detailed design, a final CEMP will be submitted to NSDC for approval, and this will be implemented.

5.5.5 Steel for the Solar PV Mounting Structures

106. Steel for the solar PV mounting structures is expected to be manufactured in the UK in electrical ‘arc’ furnaces. This would support UK manufacturing, have a lower carbon footprint of manufacturing and transportation, require fewer vehicles to transport it to Site, and the sheet steel would be manufactured into the mounting structures on Site, powered by renewable energy generated on Site. An alternative is that the mounting structures are imported, ready-made, from abroad. A worst-case basis for assessment purposes has been used in each of the technical assessments set out in ES chapters 7-19 [EN010162/APP/6.2.7-19], as appropriate.

5.5.6 Earthworks and Waste

107. Earthworks onsite (e.g., transformer foundation excavations) may result in a small surplus of material in areas of the Development site. This material will be reused in landscaping and restoration of the Development site during and after construction. If there remains a surplus post construction, small mounds of site won material of up to 3 m in height may be formed in vacant areas of the Development site to provide a range of habitats for certain

species, to be agreed with habitat management consultees in advance, through implementation of TA A5.1: Outline LEMP [EN010162/APP/6.4.5.1].

108. Given the nature of the Development and the construction process, no significant quantities of waste are anticipated. The majority of construction equipment will be delivered to site for assembly and installation (mounting structures) and connection (solar panels).

109. The principal waste streams and quantities anticipated are set out in Section 16.7, Waste, of Chapter 16, Miscellaneous [EN010162/APP/6.2.16].

110. A Site Waste Management Plan (SWMP) will be agreed as part of the CEMP prior to the commencement of construction, with an outline CEMP included as TA A5.3 [EN010162/APP/6.4.5.3].

5.6 OPERATION

5.6.1 Lifetime

111. The operational life of the Development is expected to be 40 years. The 40 years would start at the sooner of:

- When full operation (maximum electrical export) is first achieved; or
- Three years (36 months) from when electricity is first exported from the Development.

112. This allows for phasing of commissioning, whilst also limiting the duration of the phasing.

5.6.2 Operation Phase Activities

113. During the operation phase of the Development, day-to-day activity would be minimal, being principally: vegetation management; equipment maintenance and servicing; replacement of any sufficiently degraded or failed components; and monitoring to ensure the continued effective operation of the Development.

114. The land underneath and around the PV modules could be managed through a combination of sheep grazing and/or cutting in order to maintain the field vegetation during the operation phase of the Development. The management of the mitigation and enhancement areas will be undertaken in accordance with the Landscape and Ecological Management Plan (LEMP) (see TA A5.1; [EN010162/APP/6.4.5.1]).

115. The performance of the Development components will be monitored continually through the operational phase. Should the performance of an individual component fall below standards acceptable for the operation of the Development, they will be removed and, most likely, replaced. For the purposes of assessment, the BESS components have been assumed to be replaced on average 1.5 times over the 40 years, and the solar PV modules 0.1 times (i.e., 10% of modules would be replaced).

116. Operational and maintenance activities will be undertaken in accordance with an Operation Environmental Management Plan (OEMP), an outline of which is provided in this ES as TA A5.5 [EN010162/APP/6.4.5.5]. Following consent and final detailed design, a final OEMP will be submitted to NSDC, and this will be implemented.

5.6.3 Waste

117. Any materials, including solar and BESS equipment, which requires replacement during the operational period will be disposed of following the waste hierarchy, with materials being reused or recycled wherever possible. Any electrical waste will be disposed in accordance with the Waste from Electrical and Electronic Equipment (WEEE) regulations, minimising the environmental impact of the replacement of any elements of the Development. The management of waste will be set out as part of the OEMP described in section 5.6.2.

118. The principal waste streams and quantities anticipated are set out in Section 16.7, Waste, of Chapter 16, Miscellaneous [EN010162/APP/6.2.16].

5.6.4 Transport

119. During the operational phase of the Development, onsite activities would include routine servicing, maintenance and replacement of solar equipment as and when required, as well as management of vegetation.

120. It is anticipated that there would typically be c. 30 staff onsite during the operation phase of the Development, including for maintenance of solar and electrical equipment and vegetation management, and 40 back office staff.

121. In the event of the need to replace any of the operational equipment, there may be a level of HGV activity for a short period in one part of the Development site, as required. This is not expected to be frequent.

5.7 DECOMMISSIONING

122. At the end of the operational phase, the Development would be decommissioned. A Decommissioning and Restoration Plan (DRP) will be prepared to describe the activities taking place during this phase and specify any controls required. An Outline DRP is included in this ES as TA A5.6 [EN010162/APP/6.4.5.6]. Prior to decommissioning commencing, a final DRP will be submitted to NSDC for approval, and this will be implemented.

123. Decommissioning is expected to take between 18 and 24 months.

124. Substations are potentially valuable pieces of infrastructure, and a decision on whether to remove any/all of these will be made at decommissioning stage and set out in the final DRP. As an approach that is generally expected to lead to worst-case environmental effects, in this ES, they have been assumed to remain in situ.

125. The decommissioning is assumed to include the removal of any permissive paths and potential reversion of grassland underneath the PV Arrays. The routes of Public Rights of Way through the Site would be reviewed during the preparation of the final DRP and applications made to the relevant authority for any agreed changes to these. Woodland and hedgerows (except those created to form a second hedge alongside a permissive route) will be retained, as will the community orchard (as detailed in the Outline LEMP, TA A5.1 [EN010162/APP/6.4.5.1]). It is likely that access tracks and new access points would also be left in situ, though this depends on landowner preferences at that time.

5.7.1 Waste

126. All solar PV array infrastructure including solar PV modules, mounting structures, cabling, inverters and transformers would be removed from the Development site and recycled or disposed of in accordance with good practice and market conditions at that time, following the waste hierarchy, with materials being reused or recycled wherever possible. All waste will be disposed of in accordance with the legislation at the time of decommissioning and provision for this is included in the Outline DRP.

127. It is anticipated that all PV modules, mounting poles, cabling, inverters and transformers would be removed and recycled. The future of the substations (main and intermediate) and the control buildings would be agreed with NSDC as part of the DRP, prior to the commencement of decommissioning.

128. The principal waste streams and quantities anticipated are set out in Section 16.7, Waste, of Chapter 16, Miscellaneous [EN010162/APP/6.2.16].

5.7.2 Transport

129. The Outline DRP includes provision for a Decommissioning Traffic Management Plan, to include timescales and transportation methods, will be submitted to NSDC in advance of the start of decommissioning and then implemented. It will be subject to environmental controls and legislation extant at the time and details would be set out in the final DRP.

5.8 RELEVANT DRAFT DCO REQUIREMENTS

130. Requirements, set out in the draft DCO, that are relevant to commitments made in this chapter are:

- Construction phasing – Requirement 3;
- Detailed design – Requirement 6;
- FSMP – Requirement 7;
- LEMP – Requirement 8;
- Fencing – Requirement 9;
- Surface water drainage – Requirement 10;
- CEMP – Requirement 12;
- OEMP – Requirement 13;
- CTMP – Requirement 14;
- Recreational enhancements and routes – Requirement 18; and
- 40-year lifetime and DRP – Requirement 19.