Mallard Pass
Solar Farm

Mallard Pass Solar Farm

Environmental Statement Volume 1
Chapter 5: Project Description

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5.0 Project Description

5.1. Introduction

5.1.1. This chapter provides a description of the Proposed Development. The physical characteristics of the Proposed Development are described alongside the proposed construction, operation and decommissioning activities that have informed each of the technical assessments included in ***Chapters 6 to 15***.

5.1.2. The Proposed Development comprises the construction, operation and maintenance, and decommissioning of a solar photovoltaic (PV) array electricity generating facility with a total capacity exceeding 50 megawatts (MW) and export connection to the National Grid. The Proposed Development will be located within the 'Order limits' (the land shown on the Works Plans **[EN010127/APP/2.2]** within which the Proposed Development can be carried out).

5.1.3. The location of the Proposed Development is shown in ***Figure 3.1*** and described in ***Chapter 3: Description of Order limits***, with consideration of alternatives described in ***Chapter 4: Alternatives and Design Evolution***, of this ES **[EN010127/APP/6.1].** The extent of the Order limits is shown on the Location, Order Limits and Grid Coordinates plans **[EN010127/APP/2.6].**

5.1.4. The area subject to the DCO Application comprises the Solar PV Site, the Grid Connection Corridor, the Highways Works Site, and Mitigation and Enhancement Areas of which the principal components comprise the following:

a. PV Modules;

b. Mounting Structures;

c. Inverters;

d. Transformers;

e. Switchgears;

f. Onsite Substation and Ancillary Buildings;

g. Low Voltage Distribution Cables;

h. Grid Connection Cables;

i. Fencing, security and ancillary infrastructure;

j. Access tracks; and

k. Green Infrastructure (GI).

5.2. Project Parameters and Rochdale Envelope

5.2.1. The development of the design of the Proposed Development has been an iterative process, based on preliminary environmental assessments and consultation with statutory and non-statutory consultees.

5.2.2. It is important to note that the exact design details of the Proposed Development cannot be confirmed until the tendering process for the design has been completed and the detailed design has been approved by the local planning authorities in advance of the Proposed Development commencing (or phase thereof). This is to allow for flexibility to accommodate changes in technological advancements. For example, the enclosure or building sizes may vary depending on the contractor selected and their specific configuration and selection of plant.

5.2.3. In order to maintain flexibility in the design and layout at this stage in the process, the assessment of the Proposed Development in this Environmental Statement will adopt the Rochdale Envelope approach, as described in the PINS Advice Note 9 **[Ref 5-1]**. This involves specifying parameter ranges, including details of the maximum, and where relevant the minimum, size (footprint, width, and height relative to above ordnance datum (AOD)), technology, and locations of the different elements of the

Proposed Development, where flexibility needs to be retained. The use of the Rochdale Envelope approach has therefore been adopted to present a likely worst-case assessment of the potential environmental effects of the Proposed Development. The list of parameters for each of the Works described below are presented in tabular form in Appendix 5.1, which can be read alongside the Works Plans, which set the spatial extent of each Work.

5.2.4. To assist with the interpretation of the Rochdale Envelope, Illustrative Layout Designs have been created to provide a visual representation of the PV Arrays, within each individual field, within the Order limits in accordance with the parameters set out within this chapter. The Illustrative Designs have been provided for illustration purposes only. It is the establishment of the maximum parameters which enables a robust assessment of likely significant effects to be undertaken within this ES, for topics where the nature of the assessment requires a specific level of details, such as maximum heights, massing or noise levels and thus form the basis of assessment. The parameters that have been used for the purpose of the assessment are set out in Appendix 5.1 and on the Works Plans. The illustrative layouts for Fixed South Facing and Single Axis Tracking, are provided at Figures 5.1(a), (b) (c) and (d). The illustrative layouts are also provided within **[EN010127/APP/2.3]**.

5.2.5. To further assist with the assessment, Design Guidance and Design Principles have been developed that will guide (within the parameters) the size, type and colour of elements of the Proposed Development. The Design Guidance and Design Principles will help secure design mitigation and has taken account of mitigation that has been identified through the EIA process. For example, the Solar Stations will be located 50m away from Public Rights of Way. Further information on how the Design Guidance and Design Principles have been established and how it will be used within the design process can be found within the ***Design and***

Access Statement **[EN010127/APP/7.3]**. Where descriptive information that is an expression of the design guidance has been provided within the tables presented in this chapter, the relevant Design Guidance reference has been also been stated.

5.2.6. The following sections provide a description of the different elements of the Proposed Development along with the details to aid with the understanding of the design of each element. Each section, along with ***Appendix 5.1***, set out the maximum parameters that have been assessed within this ES. The Works Plans **[EN010127/APP/2.2]** show the spatial extent within which each of the different elements described below can be located. Each environmental topic has assessed the maximum parameters within the Rochdale Envelope to determine the potential for significant effects and identify suitable mitigation measures.

5.3. Components of the operational development

5.3.1. The Order limits comprises 852.07ha and includes the following components. The Proposed Development is also described in Schedule 1 of the draft DCO **[EN010127/APP/3.1]** where the "authorised development" is divided into works packages. The works numbers for those packages are identified below and are referred to throughout this ES. Note that there is overlap of Work Areas in some locations, and so the sum of the Order limits is not the total of these areas:

a. Work No. 1: A ground mounted Solar Photovoltaic Generating Station;

b. Work No 2: Onsite Substation;

c. Work No 3: Grid Connection Route (Work No 3A) including access tracks (Work No 3Aii) and temporary construction laydown areas (Work No. 3B);

d. Work No. 4: Electrical cables and communication cables connecting to Work 1 and Work 2;

e. Work No. 5: temporary construction and decommissioning laydown areas;

f. Work No. 6: works to facilitate access to Works Areas 1 to 5;

g. Work No. 7: works to create, enhance and maintain green Infrastructure.

5.3.2. The DCO also allows for the following works to take place within each and all of the works areas referred to above. This has been taken into account in the assessments undertaken in this Environmental Statement:

a. fencing, gates and boundary treatment;

b. drainage;

c. security and monitoring measures such as CCTV columns, lighting columns and lighting, cameras, lightning protection masts;

d. improvement, maintenance and use of existing tracks

e. new internal access tracks, signage and information boards;

f. permissive paths

g. temporary footpath diversions;

h. landscaping;

i. earthworks.

5.4. Works No. 1

5.4.1. The Solar PV Site (Work No. 1) includes the following elements:

PV Modules and Arrays

5.4.2. The Proposed Development would consist of PV Modules placed on Mounting Structures arranged in rows (known as PV Tables). The PV Array is a distinct group of PV Tables which are grouped together to form a PV Array Area. A PV Array Area represents a parcel of land within the Solar PV Site where PV Arrays may be installed.

5.4.3. Individual PV Modules consist of a series of bifacial, mono-crystalline cells. PV Modules convert sunlight into electrical current (as Direct Current (DC)).

5.4.4. The DC generating capacity of each PV Module will depend on advances in technological capabilities at the time of construction. A group of PV Modules that are connected to one another are known as 'PV Strings'.

5.4.5. The DCO Application will seek to allow for flexibility that allows for different configurations of PV Modules. The final elevations of the PV Modules will be influenced by various design factors such as local topography, and selection of PV Module type and configuration. The gap between the rows of PV Tables will vary responding to local topography, but will have a minimum separation distance of 2m, which is a parameter, to minimise effects of shadowing and to ensure optimal efficiency. The indicative elevations for Fixed South Facing and Single Axis Trackers are shown on ***Figure 5.2***.

5.4.6. The total number and arrangement of PV Modules will depend on the available technology at the time of construction. For the purposes of enabling an assessment, this ES has assumed 530,303 panels would be required to deliver approximately 350MW of installed DC capacity, as described within the Grid Connection Statement **[EN010127/APP/7.4]**.

5.4.7. The maximum total land area occupied by Works No 1 is 419.38ha, for the ease of referencing this is referred to as 420ha within the remainder of the ES. The area beneath the PV Arrays will be converted from arable land to grassland.

5.4.8. At the detailed design stage, subject to the chosen technology / configuration / topography etc it may transpire that the full extent of the land, as shown as Works No 1, is not required. If this is the case, then any areas of Works No 1 that are surplus to requirements will remain in

agricultural use and / or will be used for additional habitat creation. This would be confirmed through the production of the detailed LEMPs, secured by DCO Requirement.

PV Mounting Structures

5.4.9. There are two options for the Mounting Structures which have been considered and assessed within this ES, and which are described below:

a. Fixed South Facing (FSF) Arrays; and

b. Single Axis Tracker (SAT) Arrays.

5.4.10. The indicative elevations for Fixed South Facing and Single Axis Trackers are shown on ***Figure 5.2***.

Fixed South Facing (FSF) Arrays

5.4.11. Individual panels consist of a series of bifacial, mono-crystalline cells which make up an individual PV Module. The Mounting Structures will be orientated east / west and would be installed between 18 and 25 degrees to the horizontal, facing south to optimise daylight absorption.

5.4.12. The FSF Arrays will have a maximum height of 3.3m above ground level (AGL) at the rear, regardless of tilt angle, and a clearance of 0.8m at the front so as not to restrict the movement of animals such as sheep.

Single Axis Tracker (SAT) Arrays

5.4.13. The Mounting Structures will be orientated north / south and would operate between 60 degrees from the horizontal (facing east in the morning) moving toward 0 degrees (horizontal) at midday, and up to 60 degrees from the horizontal (facing west in the evening). The PV Tables would track from east to west throughout the day and would return to their resting position 60 degrees (facing east) overnight. The limit of rotation will be

determined by the SAT PV Module configuration to ensure compliance with the height parameters.

5.4.14. The SAT Arrays will have a maximum height of 3.3m above ground level (AGL), regardless of tilt angle, and a clearance of 0.8m at the front.

Mounting Structure Foundations

5.4.15. The frames upon which the PV Modules will be mounted will be pile driven or screw mounted into the ground to a maximum depth of 2.5m, subject to ground conditions. The option to install concrete blocks known as "shoes" may also be considered, avoiding the need for driven and screw anchored installation, therefore minimising ground disturbance. The Mounting Structure would likely be made of either anodised aluminium alloy or galvanised steel and would have a rough matt finish.

5.4.16. **Table 5-1** provides the basis of assessment for the PV Modules and Mounting Structures.

Table 5-1 Solar PV Module and PV Module Mounting Structures

Solar PV Module		**Parameter or Design Guidance**
Indicative Module Type	Bifacial, mono-crystalline	Design Guidance (C1.1)
Module Colour	The PV Modules are likely to be either black or dark blue.	Design Guidance (PL3.11)
PV Module Mounting Structure		
Minimum Height of Lowest Modules (agl)	FSF: max. 800mm SAT: max. 800mm	Parameter

Solar PV Module		Parameter or Design Guidance
Maximum Height of Highest Modules (agl)	FSF: max. 3300mm SAT: max. 3300mm	Parameter
Indicative Slope of PV modules from the horizontal	FSF: Between 18 – 25 degrees facing south; SAT: between 60 degrees (facing east in morning) and 60 degrees (facing west in evening)	Parameter
Mounting Structure Material	Anodised aluminium alloy or galvanised steel with rough matt finish	Design Guidance (PL3.12)
Foundation Type	Pile driven, screw mounted or concrete shoes	Design Guidance (PL5.2)
Maximum Depth of Piles	2.5m	Parameter

5.4.17. In order for the energy produced by the PV Modules to be delivered to the Onsite Substation, supporting infrastructure is required in the form of inverters, transformers and switchgear. These individual elements are described below and where the infrastructure is grouped together within the PV Arrays, this is referred to as a Solar Station. A Solar Station can consist of different configurations of the infrastructure described below depending on the particular technology chosen at the detailed design stage.

Inverters

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

5.4.19. The ES has assessed two options for inverters, to maintain flexibility within the DCO Application:

a. String Inverters; or

b. Central Inverters.

String Inverters

5.4.20. String Inverters are small enough to be mounted to the Mounting Structures underneath the PV Modules. A String Inverter is required for every PV String and will be sited within the footprint of the PV Tables.

5.4.21. **Table 5-2** provides provide the basis of assessment for the string inverters.

Table 5-2 String Inverter Design Guidance

String Inverter - (these convert the direct current electricity collected by the PV modules into alternating current)		**Parameter or Design Guidance**
Mounting	Mounted to Mounting Structures below the PV Modules.	Design Guidance (PL3.10)

Plate 2 – Example image of string inverters mounted to Mounting Structures beneath the PV Modules

Central Inverters

5.4.22. Central inverters will either be housed within a container measuring up to 6m x 2.5m and 3.2m or within a smaller outdoor cabinet. The container or cabinet will be externally finished to be in keeping with the prevailing surrounding environment, often utilising a green painted finish. The container or cabinet would be mounted directly or on adjustable legs on to an area of hardstanding. The central inverter would be co-located with the transformer and switchgear, referred to as a Solar Station. The transformer and switchgear would either be within the same the container or would be housed in individual outdoor cabinet, which would be smaller in scale and located within a secure perimeter fence.

5.4.23. **Table 5-3** provides the basis of assessment for central inverters

Table 5-3 Central Inverter Parameters

Central Inverter (including transformer and switch gear)			Parameter or Design Guidance
Type of central inverter	A pre-assembled container that houses Inverter, transformer and switch gear in a single contained unit(s). OR A pre-assembled cabinet that houses the central inverter		Design Guidance (C1.1)
Maximum container/cabinet dimensions	Length (m)	6.1	Parameter
	Width (m)	2.5	
	Height (m) (agl)	3.2	
Indicative mounting / foundations	Mounted on adjustable legs or metal skids on concrete pad or concreate columns surrounded by permeable hardstanding		Design Guidance (PL3.9)
Indicative Colour	In keeping with prevailing surrounding environment, painted dark green / light grey		Design Guidance (PL3.6)

5.4.24. A plan showing an illustrative elevation of the central inverters, within the maximum parameters, is provided at ***Figure 5.3***.

Transformers

5.4.25. Transformers are required to step up the voltage of the electricity generated by the PV Modules before it reaches the Onsite Substation. If String Inverters are used, String Transformers are required which are typically housed indoors within a container and will be distributed throughout the Solar PV Site. Where Central Inverters are used the transformer can be housed within the same container as the Central

Inverter or within a separate outdoor cabinet, which would be smaller in scale, within the Solar Station.

5.4.26. The dimensions of the String Transformers will be up to 6.5m x 2.5m and 3.2m in height. Transformer containers or cabins are typically externally finished in keeping with the prevailing surrounding environment, often utilising a green painted finish.

5.4.27. **Table 5-4** provides the basis of assessment for the transformers.

Table 5-4 : String Transformer Parameters

Transformer (these control the voltage of the electricity generated before it reaches the primary substation)			**Parameter or Design Guidance**
Maximum Transformer Dimensions	Length (m)	6.5m	Parameter
	Width (m)	2.5m	
	Height (m) (agl)	3.2m	
Indicative mounting / foundations	Mounted on adjustable legs or metal skids on a concrete pad or concrete columns surrounded by permeable hardstanding		Design Guidance (PL3.9)
Indicative colour	In keeping with prevailing surrounding environment, painted green		Design Guidance (PL3.6)

5.4.28. A plan showing illustrative elevations of the string transformers, within the maximum parameters, is provided at ***Figure 5.4***.

Plate 3: Example of Solar Station located within a PV Array

Switchgears

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

5.4.30. Switchgears with either be housed indoors within the same container as the String Transformer or the Central Transformer, or within separate cabinets, integrated with other components within the Solar Station. The Maximum Parameters assessed assumes a footprint of up to 6.5m x 2.5m and 3.2m in height.

5.4.31. **Table 5-5** provides the basis of assessment for the switchgear containers.

Table 5-5 : Switchgear

Switchgear - (this is a combination of electrical disconnect switches, fuses or circuit breakers used to control, protect and isolate electrical equipment)			**Parameter or Design Principle?**
Type	The switchgear may be an individual standalone unit within its own enclosure or may be pre-assembled within the same container as the string transformers or central inverters.		Design Principle (C1.1)
Maximum dimensions of switchgear	Length (m)	6.5	Parameter
	Width (m)	2.6	
	Height (m) (agl)	3.2	
Indicative mounting / Mounting	Mounted on concrete pad or concrete columns surrounded by permeable hardstanding		Design Principle (PL3.9)
Indicative Colour	In keeping with prevailing surrounding environment, painted light grey / dark green		Design Principle (PL3.6)

5.4.32. A plan showing illustrative elevations, within the Parameters, of the containers housing the switchgear is provided at ***Figure 5.3***.

Plate 4 - Example of Solar Station located on a concrete pad surrounded by permeable hardstanding

Storage

5.4.33. Storage containers will be distributed throughout the Solar PV Site. The storage containers will be co-located with the Solar Stations and will be used to store spare electrical parts for periodic maintenance of the PV Arrays and Solar Stations.

5.4.34. **Table 5-6** provides the basis of assessment for storage containers distributed throughput the Solar PV Site.

Table 5-6: Storage Container Parameters

Storage Containers			Parameter or Design Guidance
Number of Storage Containers	1 Container per 30MW of installed capacity located at a Solar Station		Design Guidance (PL4.7)
Maximum dimensions of storage container	Length (m)	6.5	Parameter
	Width (m)	2.6	Parameter
	Height (m) (agl)	3.2	Parameter
Indicative mounting / Mounting	Mounted on permeable hardstanding		Design Principle (PL3.9)
Indicative colour	In keeping with prevailing surrounding environment, painted light grey / dark green		Design Guidance (PL3.6)

5.5. Works No 2 Onsite Substation and Ancillary Buildings

5.5.1. There will be a new single Onsite Substation (400/33KV) located near the existing National Grid Ryhall Substation, set back from Uffington Lane, within Work No 2. The Onsite Substation will comprise electrical infrastructure such as the transformers, switchgear, Control Buildings and metering equipment as required to facilitate the export of electricity from the Proposed Development to the National Grid. The Onsite Substation will also include Ancillary Buildings which will include office space and welfare facilities as well as operational monitoring and maintenance equipment. The size of the substation compound is 100m x 200m, with a maximum height parameter being 13m that allows for the Onsite Substation and

associated electrical control buildings & workshop buildings and Site office, storage and welfare building. The majority of the components will be up to 6m in height, with the exception of the Harmonic Filters which will be up to 12.5m in height and the lightening/surge protection masts which will be up to 13m.

5.5.2. It is not anticipated that a connection to the public sewer network would be required.

5.5.3. **Table 5-7** provides the basis of assessment for the electrical infrastructure and ancillary buildings within the Onsite Substation compound.

Table 5-7: Substation and Ancillary Buildings Parameters

Onsite Substation Compound					
Item	**Quantity**	**Length**	**Width**	**Height (agl)**	**Parameter or Design Guidance**
Onsite Substation compound & perimeter fence	1	100m	200m	2.6m	Parameter
Electrical Infrastructure					
Lightning / Surge Protection Mast – located on top of sensitive electrical buildings within the Onsite Substation		N/A	N/A	13m	Parameter
400/30kV transformer	1	14m	8.5m	10.5m	Parameter
Cable Support Structure	1	1.3	15.5	10.65	Parameter

Onsite Substation Compound					
Harmonic Filters	No more than 3 areas	30m	30m	12.5m	Parameter
Auxiliary Transformer	1	3m	4m	3m	Parameter
Ancillary Buildings					
33kV Electrical compound control building, Plant storage building, Back-up power, Welfare/Site Office and Workshop/Store, Control Room/Permit Room and PRR/Battery/LVAC	1 of each	Variable dimensions within the footprint on the Onsite Substation Compound		6m	Parameter

5.5.4. A plan showing the illustrative layout of the Onsite Substation is provided at ***Figure 5.5***.

5.6. Works No 3 Grid Connection Corridor and Point of Connection to the National Electricity Transmission System

5.6.1. The electricity generated by the Proposed Development is to be exported via a 400kV connection between the Onsite Substation and the existing National Grid Ryhall Substation at Uffington Lane which is a National Grid Electricity Transmission (NGET) substation. The grid connection cables to the National Grid Ryhall Substation will comprise 400kV cables buried within a trench, up to 2m in depth. The cables within the trench will have a minimum separation distance of 500mm between them. The trench will also include a fibreoptics communications cable connecting the Onsite Substation with the Ryhall National Grid Substation.

5.6.2. The burial of electrical cables will be undertaken in accordance with the following British Standard and National Grid boundary recommendations.

a. BS EN 62271-1, 2017+A1:2021; High-voltage switchgear and control gear: Common specifications for alternating current switchgear and control gear;

b. BS 7375, 2010, Code of practice for distribution of electricity on construction and building sites;

c. BS 7671, 2018, Requirements for electrical installations. IEE Wiring Regulations. Seventeenth edition;

d. BS EN 61000, 2009, Electromagnetic compatibility;

e. National Grid Substation design. Technical specification February 2018;

f. The Grid Code Issue 6 revision 12 09/03/22, 2021 Copyright owned by National Grid Electricity System Operator Limited; and

g. National Grid Substations Technical Specification NGTS 2.1 Issue 2 May 1995.

5.6.3. These guidelines set out the recommended separation depths to minimise the risks of magnetic field effects on relevant receptors.

5.6.4. The Grid Connection Route will cross underneath Uffington Lane and connect into the National Grid Ryhall Substation as shown on ***Figure 5.7***.

5.7. Works No 4 Electrical Cables

5.7.1. Low Voltage Distribution Cabling between PV Modules and the String Inverters will typically be located above ground level fixed to the Mounting Structure, and then trenched underground between the PV Tables and the Solar Station. The dimensions of trenching will vary subject to the number of underground cables and the number of ducts they contain but will

typically be up to 1.5m wide with a maximum depth of 1.3m and will be dependent on the method of installation and ground conditions.

5.7.2. Combiner boxes may also be required to rationalise cabling between the PV Strings and the Inverters / Transformers. If required, these would be similar in size to string inverters and would be mounted on the Mounting Structures beneath the PV Modules.

5.7.3. Higher rated voltage cables (33kV) are required between Solar Stations and the Onsite Substation. The 33kV cables will be buried underground in a trench. A plan showing the illustrative section of the cable trenches connecting the Solar Stations and the Onsite Substation is provided at ***Figure 5.6***. The electrical design of the Proposed Development will be fixed at the detailed design stage, but it is anticipated that the 33kV cables will run alongside the internal access tracks to the access point onto the adopted highway. From that point, the cables would be located within the adopted highway and/or agricultural land within the extents of Work No. 4 in order to connect back to the Onsite Substation. Any cables that are located within the adopted highway would be located within the carriageway and/or verge so to avoid the loss of boundary hedgerows or trees. The cables would be contained within Work No 4 as shown on the Works Plan **[EN010127/APP/2.2].** The flexibility to locate electrical and other cables within Work No 4 is required to ensure that the Proposed Development can be implemented as efficiently as possible.

5.7.4. Cables will cross existing below ground utility infrastructure at 90 degrees (perpendicular) to the alignment of the utility infrastructure. The cable crossings will be at least 600mm above or below the existing below ground utility infrastructure, in line with National Grid guidance[1]. There may be a

[1] National grid T/SP/SSW/22

requirement for horizontal directional drilling within the Works No. 4 to cross beneath existing below ground utility infrastructure.

5.7.5. Data cables will be required throughout the Solar PV Site to allow for the monitoring during operation, such as the collection of data on solar irradiance from pyranometers. The data cables would be installed within the same trench as the electrical cables.

5.7.6. The existing above and below ground utilities across the Solar PV Site are not proposed to be altered by the Proposed Development. The offsets to these assets have been discussed with the Statutory Undertakers as part of the design process and are accounted for within Work No 1, as set out on the Works Plans **[EN010127/APP/2.2].**

5.7.7. Electrical cabling will be required to connect the Solar Stations located to the east of the East Coast Main Line to the Onsite Substation which is located to the west of the East Coast Main Line. Three cable routes / methods are being considered for crossing the East Coast-Mainline railway, the location of which are shown on ***Figure 5.8***:

a. Option 1 - cables would be run through the existing brick culverts underneath the East-Coast mainline and Horizontal directional drilling (HDD) underneath the West Glen River;

b. Option 2 - HDD underneath the East Coast mainline and the West Glen River; or

c. Option 3 - cables to be routed within the adopted highway and over the railway bridge within Essendine.

5.7.8. At this stage, all three options are still being considered and therefore each of the environmental assessments have considered the environmental impacts of all three options.

5.7.9. **Table 5-8** provides the basis of assessment for the onsite cabling.

Table 5-8: Onsite Cabling Parameters

Onsite Cabling			
Electrical cables	Cable trench dimensions	Depth	Max. depth 1.3m
		Width	Up to 1.5m
East Coast Main Line Electrical Cable Crossing			
	Electrical Cable route options	Option 1	Cables would be located within a trench(s) through the existing brick culverts underneath the East Coast Mainline Railway in accordance with Network Rail and Cadent Gas requirements.
		Option 2	Cables would run through ducts that have been horizontal directionally drilled underneath the East Coast Mainline Railway.
		Option 3	Cables to be routed within the bridge deck of the adopted highway along the A6121.

5.8. Work No.5 Temporary Construction Compound

5.8.1. During the construction phase, a primary construction compound will be located onsite with temporary secondary construction compound(s) provided at different locations throughout the Solar PV Site. The locations of the primary and secondary construction compounds are shown within Work No 5, on the Works Plans [**EN010127/APP/2.2**] and indicatively on ***Figure 5.12***.

5.8.2. Once the construction works have been completed, the location of the temporary secondary construction compounds can be used for Solar PV Arrays and/or the routing of cabling, as set out on the Works Plans.

5.8.3. The Primary Construction Compound is co-located with the Onsite Substation as there is potential for the footprint of the Onsite Substation compound to be partially used as the Primary Construction Compound subject to phasing. Once construction has been completed, the footprint of the Primary Construction Compound outside of the Onsite Substation Compound will be established as Green Infrastructure as shown on the Works Plans and in accordance with the measures set out within the ***oLEMP.***

5.8.4. Temporary construction compounds have been located within the Solar PV Site at or close to access points within the Order limits, to minimise the extent of ground disturbance outside of the Solar PV Site.

5.8.5. **Table 5-9** provides the basis of assessment for the primary and secondary construction compounds.

Table 5-9: Primary and Secondary Construction Compound Parameters

Construction Compounds			
Primary Construction Compound	1 primary construction compound located to the east of Uffington Lane directly opposite National Grid Ryhall Substation		
	Indicative dimensions	Length (m)	200
		Width (m)	200
	Footprint	Area (ha)	4ha
	Material	Crushed stone	

Construction Compounds			
	Drainage	Infiltration or attenuated	
Secondary compounds	Up to 7 which would contain laydown area and staff welfare facilities		
	Indicative dimensions	Length (m)	100
		Width (m)	100
	Footprint	Area (ha)	1ha
	Material	Crushed stone	

5.9. Works No. 6 Highways Works

5.9.1. The primary point of access to the Solar PV Site will be from Uffington Lane, opposite the existing access to the National Grid Ryhall Substation, with vehicles approaching from the A6121 Stamford Road to the north. This point of access would provide access to the Onsite Substation and Ancillary Buildings and the primary construction compound. The primary point of access will be 10.2m wide in order to enable two-way access for construction vehicles at the access, as well as ensuring the kerb radii are suitable to allow for construction vehicles to travel in either direction from the primary compound to the secondary compounds.

5.9.2. Up to eight secondary points of access to the PV Arrays have been identified in order to access the Solar PV Site, which are shown on ***Figure 5.10***. Each access track leading to a secondary compound will be 6.5m wide, with a gate located 20m from the edge of the public highway, to enable vehicles to pull off the public highway and wait before entering the Solar PV Site. These secondary access points, along with a network of internal access tracks, will provide operational access to the Solar Arrays and Solar Stations for the purposes of management and maintenance.

5.9.3. The primary and secondary points of access will be taken from existing agricultural tracks and field entrances, with the exception of the new point of access along the B1176, Carlby Road and Main Street (leading to Carlby). In order to create the points of access, vegetation will need to be removed to either widen an existing field access or create a new point of access. The vegetation either side of the point of access will need to removed or managed to create visibility splays. Where vegetation removal/pruning is required for access and/or visibility splays, the works should be limited to that amount required to achieve the appropriate access / visibility required. Pruning of vegetation will be preferred over removal wherever possible, further details can be found in the ***oLEMP*** **[EN010127/APP/7.9].** A plan showing the locations of the primary and secondary access points is provided at ***Figure 5.10***.

5.9.4. To facilitate the movement of HGVs along Uffington Lane during the construction phase, temporary passing bays will be established. The passing bays will be temporary, with the verges reinstated and managed to support the ecological designations during the operational phase as described within the ***oLEMP***. If during the operational phase HGVs are required to access the Proposed Development, this will be managed through the use of temporary traffic management measures, as described within the ***oCTMP*** **[EN010127/APP/7.11].**

5.9.5. To facilitate the movement of Abnormal Indivisible Loads (AIL) which are required to transport components of the Onsite Substation, temporary works are required within Great Casterton and Ryhall, as shown on the Works Plans **[EN010127/APP/2.2].** These temporary works will include the reinforcement of kerbs and the relocation of street furniture and will be reinstated after the AIL movements have been completed.

5.10. Works No 7 Green Infrastructure

5.10.1. The existing hedgerows, woodland, ditches, ponds and field margins will be retained within the Order limits, with the exception of small breaks and/or crossings required for new access tracks, security fencing, cable routes and new access junctions. Any hedgerow or ditch crossings will be designed to use existing agricultural gateways/tracks or gaps in field boundaries and the width of any new crossings kept to a minimum. Where a cable crosses a hedgerow, the hedgerow will be reinstated post construction.

5.10.2. The minimum offsets from the security fencing, as set out in **Table 5-10**, have been incorporated within the extent of Work No. 1 and/or will be applied at the detailed design stage. The offsets will apply to existing features within the Order limits with the exception of where access tracks, security fencing and/or cable routes are required to cross an existing feature. These offsets have been established as a minimum distance based on best practice and guidance and will be used to deliver additional planting of diverse habitats to either increase habitat connectivity and structural diversity through combinations of hedgerow, scrub, grass / wildflower planting.

Table 5-10: Minimum Offsets to Landscape and Ecological Features and Designations

Landscape / Ecological Feature & Designations	Minimum Offset to Solar Infrastructure*	Parameter of Design Guidance
Woodland	15m	Design Guidance (V5.5)
Veteran Trees	15 times the width of the stem diameter	Design Guidance (V5.13)
Site boundary hedgerows	10m	Design Guidance (V5.7)
Internal hedgerows	10m	Design Guidance (V5.7)
Main river	10m	Design Guidance (V5.6)
Ditches	6m	Design Guidance (V5.6)
Local Wildlife Site	15m	Design Guidance (V5.8)
Site of Special Scientific Interest	15m	Design Guidance (V5.8)
Public Rights of Way	15m	Design Guidance (V5.3)

Landscape / Ecological Feature & Designations	Minimum Offset to Solar Infrastructure*	Parameter of Design Guidance
Ponds	10m	Design Guidance (V5.6)
Main badger setts	30m	Design Guidance (V5.9)
* with the exception of where access tracks and/or cable routes are required to cross an existing feature; however, these will be kept to a minimum and restored where practical.		

5.10.3. The existing Public Rights of Way (PRoW) that cross the Order limits have been retained and incorporated within multifunctional green corridors. At this stage the exact construction phasing and methodology are not known and therefore there may be requirements to temporarily divert PRoWs for a period during the construction phase. The Access and Rights of Way Plans **[EN010127/APP/2.4]** show the locations of where existing routes may be affected. Measures will be implemented to maintain public safety, the details of which are set out within the outline Construction Environmental Management Plan **[EN010127/APP/7.6]**.

5.10.4. The Mitigation and Enhancement Areas as identified on **Figure 4.3** will provide areas for green infrastructure, including the creation of grassland with wildflowers and scattered wet woodland adjacent to the West Glen River, and grassland with calcareous species within the valley in the north-west of the Order limits, amounting to approximately 165ha.

5.10.5. Within the Mitigation and Enhancement Areas, a total 19 fields (either fully or partial) totalling approximately 239ha will continue to be farmed under

arable rotation with additional measures to support skylarks. Further details on the location and specification of the measures to support skylark are set out within the ***oLEMP*** **[EN010127/APP/7.9]**.

5.10.6. The Green Infrastructure strategy within the Mitigation and Enhancement Areas will be used to deliver a minimum 10% net gain in biodiversity. This is enhanced through the planting of approximately 7,500m of structural tree planting, and approximately 14,000m of structural hedgerow planting.

5.10.7. A Biodiversity Net Gain (BNG) report **[EN010127/APP/6.3]**, using the DEFRA Metric 3.1, has been carried out which concludes that the Proposed Development can demonstrate a 72% net gain in biodiversity across the Order limits.

5.11. Works in Connection with and in addition to Work Nos. 1 to 7 Fencing, Security & Ancillary Infrastructure

5.11.1. A fence will enclose the PV Arrays located within Works No 1. The fence will to be a 'deer fence' (wooden posts and metal wire mesh) and will be up to 2m in height. Pole mounted internal facing closed circuit television (CCTV) systems will be installed at a height of up to 3.5m around the perimeter of the PV Arrays. Access gates will be of similar construction and height as the perimeter fencing. Clearances above ground, or the inclusion of mammal gates will be included to permit the passage of wildlife.

5.11.2. CCTV cameras would use night-vision technology, which would be monitored remotely and avoid the need for night-time lighting. No areas of the PV Arrays are proposed to be continuously lit. For security requirements, Passive Infra-red Detector (PID) systems (or similar) will be installed around the perimeter of the PV Arrays to provide night vision functionality for the CCTV.

5.11.3. The lighting of the Onsite Substation would be in accordance with Health and Safety requirements, particularly around any emergency exits where there would be lighting, similar to street lighting that operates from dusk. Otherwise, lighting sensors for security purposes will be implemented around the Onsite Substation.

5.11.4. The lighting design would seek to limit any impact on sensitive receptors by directing lighting downward and away from the Order limit boundaries and existing vegetation. During operation, no part of the Proposed Development would be continuously lit; manually operated and motion-detection lighting would be utilised for operational and security purposes within the Onsite Substation.

Plate 5: Example of security fencing and monitoring cameras

5.11.5. **Table 5-11** and **Table 5-12**, provides the basis of assessment for fencing and security CCTV.

Table 5-11: Parameters for Fencing

Fencing Parameters		Parameter or Design Guidance?
Fence Type (Solar PV Site)	Deer fence (wooden or metal pole with wire mesh fence)	Design Guidance (PL3.5)
Fence Post Height	2.1m	Parameter
Fence Height	2m	Parameter
Indicative depth of fence pole (bgl)	600mm	Parameter
Mammal gates	Included	Design Guidance (V5.12)
Fence Type (Onsite Substation)	Palisade fence (metal)	Design Guidance (PE4.6 and PL3.13)
Palisade Fence Height	Up to 3m	Parameter

Table 5-12 : CCTV Parameters

CCTV Parameters		Parameter or Design Guidance?
Type	Night-vision technology	Design Guidance (PL3.7)
Support Column	Wooden Pole	Design Guidance (PL3.5)
Camera Height	Up to 3.5m	Parameter
Depth of CCTV pole (bgl)	1m	Parameter
Camera Position	Pole mounted internal facing	Design Guidance (PE4.7)

CCTV Parameters		Parameter or Design Guidance?
CCTV /Lighting	Passive Infra-red Detector (PID) around PV Arrays. Lighting sensors implemented around Onsite substation.	Design Guidance (PL3.7)

5.11.6. A plan showing an illustration of the proposed elevation of the fencing and access gates, within the maximum parameters, is provided at ***Figure 5.9***.

Plate 6 – Example image of a security fence, access gate, CCTV camera, internal access track.

5.12. Onsite Access Tracks

5.12.1. Onsite access tracks will follow the alignment of the existing agricultural tracks, where possible, limiting the requirement for new drainage ditch crossings, disturbance to soils and habitat removal. New internal access tracks will be up to 5m wide, passing bays will be provided along the internal access tracks. Where an access track crosses an existing hedgerow or ditch the maximum width of the crossing will be 3.5m.

5.12.2. The internal access tracks will be constructed of compacted stone with excavation kept to a minimum.

5.12.3. Where drainage is required, a ditch or a swale, with check dams, may be located downhill of the internal access track to control any potential for surface water run-off.

5.12.4. **Table 5-13** provides the basis of assessment for permanent internal access tracks.

Table 5-13: Permanent Internal Access Track Parameters

Internal Access Road		
Maximum internal width	5m	Parameter
Material	Permeable material e,g Compacted stone	Design Principle (PL3.9)
Drainage	Permeable hardstanding located impermeable surfaces	Design Principle (PL3.9)

5.12.5. A plan showing an illustrative section of an internal access track is provided at ***Figure 5.11***.

5.13. Construction

Construction Programme

5.13.1. The construction phase is anticipated to take 24 months and subject to being granted consent the earliest construction is anticipated to start is Summer 2026. The final programme will be dependent on the detailed layout design and potential environmental constraints on the timing of construction activities.

Construction Activities

5.13.2. The construction activities will be undertaken in accordance with the principles set out within the outline Construction Environmental Management Plan **(EN010127/APP/7.6).** The indicative construction activities likely to be required as provided below (not necessarily in order):

a. Site preparation:

i. Delivery of construction materials, plant and equipment (Plate 7)

ii. The establishment of site fencing (Plate 8)

iii. The establishment of the primary and secondary temporary construction compound(s) (Plate 9)

iv. The upgrade of existing tracks and construction of new tracks required (Plate 10)

v. The upgrade or construction of crossing points (bridges/culverts) over drainage ditches and below ground utility infrastructure

vi. Marking out location of Mounting Structures (Plate 11a)

vii. Advanced habitat creation

b. Solar PV Site construction:

i. Delivery of Proposed Development components

ii. Erection of Mounting Structures (Plates 11a-d)

iii. Mounting of PV Modules (Plate 12)

iv. Installation of electrical cables

v. Installation of Transformers and Inverters

vi. Construction of Onsite Substation

vii. Construction of onsite electrical infrastructure to facilitate the export of generated electricity.

c. Testing and commissioning

d. Habitat creation and reinstatement and in accordance with the principles set out within the ***oLEMP*** **[EN010127/APP/7.9].**

Plate 7: Delivery of construction materials, plant and equipment to Site

Plate 8: Establishment of Site fencing

Plate 9: Establishment of the temporary construction compound(s)

Plate 10: Internal access track and crossing of underground utilities

Plate 11a: Marking out location of the infrastructure and installation of Mounting Structures (1 of 4)

Plate 11b: Installation of Mounting Structures (2 of 4)

Plate 11c: Installation of Mounting Structures (3 of 4)

Plate 11d: Installation of Mounting Structures (4 of 4)

Plate 12: Mounting of PV Modules

Construction Access

5.13.3. The construction access strategy will require construction vehicles to arrive from the Strategic Highway Network via Route 1 and depart to the Strategic Highway via Route 3. Routes 1 and 3 are described below:

a. Route 1 proposes to access the Solar PV Site from the A1, which forms part of the SRN via the B1081 Old Great North Road, Ryhall Road, the A6121 Essendine Road and Uffington Road to the ~~Onsite~~ Primary Construction Compound.

b. Route 3 proposes to depart the Solar PV Site via Uffington Road, the A6121 Stamford Road, West Road, Raymond Mays Way (south of Bourne), A15 and the A47.

5.13.4. Previously considered Route 2 was discounted for use by HGV's following the PEIR production in response to stakeholder feedback, although a summary of this option is included within ***Chapter 4: Alternatives and Design Development***, of this ES.

5.13.5. It is expected that a large transformer (in excess of 100 tonnes) will be required. Route 1 is the preferred entry and exit route for AIL and segments of this route have been included within the redline boundary extents as initial swept path analysis along this route has identified the potential need for temporary localised road widening, temporary adjustments to the highway arrangement and/or street furniture, or other highway improvements between the A1 and the Solar PV Site.

5.13.6. It is anticipated that the construction phase will require an average of between 100 - 150 workers onsite with a maximum of up to 400 construction staff at the peak construction period.

5.13.7. **Table 5-14** provides the assessed parameters for construction staff. Details of the anticipated abnormal indivisible loads (AILs) and construction equipment and parameters are provided in **Table 5-15.**

Table 5-14: Construction Staff

Construction Staff & Parking	
Number of construction staff	Average of 100 – 150. Peak of 400
Dedicated construction car park	Construction workforce car parking co-located with primary construction compound. Workers shuttled to temporary construction compounds
Construction Hours	7am until 7pm Monday to Saturday. Working days will be one 12-hour shift.

5.13.8. Core construction hours will run from 07:00 to 19:00 Monday to Saturday, and no working on Sundays or Bank Holidays. Heavy Goods Vehicle (HGV) deliveries to the Order limits, would be limited to daytime hours of 07:00 to 19:00 during weekdays or Saturday mornings (until 13:00 hours), unless otherwise agreed with the local authorities. In addition to the timing restrictions noted above, in order to further mitigate the impact of HGVs on local sensitive receptors including the schools within Great Casterton, HGV deliveries will be restricted to avoid school start and end time. HGVs will therefore only deliver to the primary construction compound between the hours of 09:00 to 15:00, giving an effective six-hour window for HGV deliveries to take place.

5.13.9. Working days will be one 12-hour shifts, with employees travelling to and from the Order limits an hour either side of these times (i.e. between 06:00 and 07:00, and 19:00 and 20:00). Where onsite works are to be conducted outside the core working hours, they will comply with the restrictions pursuant to the consenting process.

Table 5-15: AIL and Large Construction Equipment details

AILs and construction equipment	
Details of large construction equipment and AIL's	80 tonne crane 400 tonne crane 1000 tonne crane STGO CAT 2 Low Loader (AIL) STGO CAT 3 Low Loader (AIL)
Details of crane for unloading at secondary construction compounds.	80 tonne crane
Construction Vehicles	Excavators, cranes, ramming machines, telehandlers, cable layers, cable pullers, trenching machines, loaders, graders, compactors, forklifts, tractor/trailer.
Internal construction movements	Deliveries made to primary construction compound, unloaded and then transferred to secondary construction compounds.

5.14. Construction Reinstatement and Habitat Creation within the Solar PV Site

5.14.1. A programme of landscape and habitat reinstatement and creation will commence during the construction phase. Areas under the PV Arrays and the landscape buffers will be planted with a combination of native grassland mix, wildflower mixes, scrub and hedgerows. Woodland blocks and belts will be planted in strategic locations to provide visual screening, ecological habitats in order to achieve a minimum 10% biodiversity net gain. The landscape and habitat reinstatement and creation will be undertaken in accordance with the principles set out in the ***oLEMP*** **[EN010127/APP/7.8]**.

5.15. Construction Environmental Management

5.15.1. An Outline Construction Environmental Management Plan ***(oCEMP)*** **[EN010127/APP/7.6]** has been prepared to support the DCO Application. The ***oCEMP*** sets out legislation, guidance, best practice guidance and the mitigation measures identified through the EIA process to be employed during construction phase, such as construction lighting avoiding ecological sensitive habitats. The ***oCEMP*** will form the framework for a detailed CEMP that will be agreed with the local planning authority prior to construction.

5.16. Construction Traffic Management

5.16.1. An Outline Construction Traffic Management Plan ***(oCTMP)*** **[EN010127/APP/7.11]** including details on construction logistics and construction worker travel has been prepared in support of the DCO Application that includes information to guide the delivery of material, plant, equipment and staff during the construction phase.

5.17. Operation

5.17.1. The operational life of the Proposed Development is not proposed to be specified in the DCO and the Applicant is not seeking a time limited consent. The EIA has been carried out on the basis that the Proposed Development is permanent, to ensure a worst-case assessment of likely significant effects.

5.17.2. During the operational phase of the Proposed Development, onsite activities would include routine servicing, maintenance and replacement of solar equipment as and when required, as well as management of vegetation. Any solar equipment that requires to be replaced 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 Proposed Development.

5.17.3. It is anticipated that there would typically be up to four permanent staff onsite during the operational phase of the Proposed Development, with additional staff attending when required for maintenance, replacement of solar equipment and cleaning, up to a total of 20 staff per day.

5.17.4. In the event of the need to replace any of the operational equipment of the Proposed Development, there may be a level of HGV activity required to replace equipment within the Order limits. However, this will be on an ad-hoc, low frequency basis only to replace broken or faulty equipment.

5.17.5. The land underneath and around the PV Arrays could be managed through a combination of sheep grazing and/or hay/silage production in order to maintain the field vegetation during the operational phase of the Proposed Development. The management of the Green Infrastructure and Mitigation and Enhancement Areas will be undertaken in accordance with the outline Landscape and Ecological Management Plan ***(oLEMP)*** **[EN010127/APP/7.9]**.

5.17.6. The operational and maintenance activities will be undertaken in accordance with the Outline Operational Environmental Management Plan (oOEMP) **[EN010127/APP/7.7]**. The oOEMP includes measures that control the following type of activities:

a. Working hours;

b. Lighting;

c. Parking;

d. Security;

e. Monitoring and maintenance of electrical equipment and drainage;

f. Storage of materials;

g. Vegetation management;

h. Management of permissive paths;

i. Noise limits; and

j. Management of waste.

5.17.7. **Table 5-16** summaries the anticipated number of staff and associated vehicle type required for the operation of the Proposed Development.

Table 5-16: Staff numbers and type of vehicle

Operation	
Typical Number of Staff onsite	4 –with additional staff attending when required for maintenance and cleaning, up to a total of 20 staff per day.
Type of vehicle	LGV & HGV

5.18. Decommissioning

5.18.1. The Applicant is not seeking a time limited consent. The operational life of the Proposed Development has not been specified within the DCO Application. However, it is recognised that the electrical infrastructure will have an operational lifespan. As such, for the purposes of assessing decommissioning with the ES, it has been assumed that the Proposed Development has a 40-year operational life span to enable an assessment of decommissioning to be carried out. The operation assessment does not assume that the operational phase will be limited to 40 years as the solar infrastructure may continue to be operating successfully and safely beyond this period.

5.18.2. Temporary Decommissioning Compounds would be created to house necessary plant and equipment and provide areas for parking for site staff. These would be removed upon completion of the decommissioning phase.

5.18.3. All the solar infrastructure including PV modules, mounting structures, cabling on or near the surface, inverters, transformers, switchgear, fencing and ancillary infrastructure and the Onsite Substation would be removed and recycled or disposed of in accordance with good practice 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.

5.18.4. The Solar PV Site would be reinstated in accordance with a Decommissioning Environmental Management Plan (DEMP). The DEMP will be required to be in accordance with the outline Decommissioning Environmental Management Plan (oDEMP) **[EN010127/APP/7.8]** which has been prepared to support the DCO Application.

5.18.5. The DEMP will be subject to the approval of the local planning authorities. The decommissioning would include the removal of any permissive paths and potential reversion of grassland underneath the PV Arrays. Any landscape structural planting, such as tree planting, hedgerows, scrub etc created to deliver biodiversity mitigation and enhancement associated with the Proposed Development would be left in-situ when the Site is handed back to landowners.

5.18.6. Decommissioning is anticipated to take approximately six to twelve months.

5.18.7. The effects of the decommissioning phase are often similar to, or of a lesser magnitude than the effects generated during the construction phase and have been considered in the relevant sections of the ES. However, there can be a high degree of uncertainty regarding decommissioning as engineering approaches and technologies evolve over the operational life of the Proposed Development, and assumptions have therefore been made, where appropriate.

5.19. References

Ref 5-1 PINS Advice Note 9 (2018)