Proposed Solar PV Development

Preliminary Environmental Information Report Chapter 2 The Proposed Development

Byers Gill Solar

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JBM Solar
33 Broadwick St
London
W1F 0DQ
United Kingdom
www.jbm-solar.com

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2.1 Introduction

2.1.1 This chapter of the PEIR provides an overview of the site location and context together with a detailed description of the Proposed Development (Section 2.3). It also outlines details of environmental mitigation measures (Section 2.6), the construction, operation and long-term management (Section 2.7), and the decommissioning (Section 2.8), of the Proposed Development. This information is used to inform the technical assessments within Chapters 5 – 12 of this PEIR.

2.1.2 The Site Area of the Proposed Development and the use of the 'Rochdale Envelope' approach for assessment purposes is discussed in Section 2.2 and shown in Figure 1.2.

2.1.3 The following figures have been produced to illustrate the Proposed Development:

- Figure 2.1 presents an overview of the Proposed Development including Panel Areas (groups of solar PV modules);
- Figure 2.2 presents the layout of the Proposed Development, including other supporting solar infrastructure;
- Figures 2.3 – 2.8 present the preliminary design of each Panel Area;
- Figure 2.9 presents key environmental designations;
- Figure 2.10 presents the layout of the proposed cable routes;
- Figure 2.11 presents the typical layout of access and supporting infrastructure;
- Figure 2.12 presents the preliminary landscaping and ecological enhancements for the Proposed Development; and
- Figure 2.13 presents the indicative cross sections of likely views to the Proposed Development.

2.2 The Order Limits

2.2.1 The Site Area for the Proposed Development, which considers the maximum area of land potentially required for the construction, operation and decommissioning of the Proposed Development is shown in Figure 1.2.

2.2.2 The Proposed Development is subject to ongoing design development and the Site Area will be refined in response to environmental and technical factors as identified as part of the EIA process, as well as consultation responses.

2.2.3 The preferred cable route option for both the 33kV and 132kV cables is still being assessed and surveyed. The preferred cable route option will be confirmed as part of the ES.

The Rochdale Envelope and the use of design parameters

2.2.4 The design of the Proposed Development will evolve throughout the EIA process through the use of iterative design. The iterative design process will take into account comments made during consultation, including in response to this PEIR, and the ES will describe how the design of the Proposed Development has been influenced by such comments.

2.2.5 Several technical parameters have yet to be finalised for the Proposed Development. The Applicant is therefore proposing to use design parameters which will fix a worst-case scenario for any element of the design which is not fixed, dependent on the receptor in question. In order to present a worst-case scenario to inform the PEIR and statutory consultation, the smallest spacing between solar PV modules has been presented, alongside the greatest possible height of solar PV modules dependant on emerging technology. This is a theoretical design, as the maximum panel height presented would require greater spacing between the panels. Both of these parameters have been assessed in order to provide a worst-case scenario for the Proposed Development.

2.2.6 It is therefore the intention of the Applicant to implement the advice within PINS Advice Note Nine: Using the 'Rochdale Envelope' [1] regarding the degree of flexibility that may be considered appropriate with an application for development consent under the Act.

2.2.7 In particular, the Advice Note outlines that:

- the DCO application documents should explain the need for, and the timescales associated with, the flexibility sought, and this should be established within clearly defined parameters;
- the clearly defined parameters established for the Proposed Development must be sufficiently detailed to enable a proper assessment of the likely significant environmental effects and to allow for the identification of necessary mitigation, if necessary, within a range of possibilities;
- the assessments in the ES should be consistent with the clearly defined parameters and ensure a robust assessment of the likely significant effects;
- the DCO must not permit the Proposed Development to extend beyond the clearly defined parameters which have been requested and assessed. The SoS may choose to impose requirements to ensure that the Proposed Development is constrained in this way; and
- the more detailed the DCO application is, the easier it will be to ensure compliance with the Regulations.

2.2.8 The Advice Note also acknowledges that there may be aspects of the design that are not yet fixed, resulting in the need for the EIA to assess likely worst-case variations to

ensure that all foreseeable significant environmental effects of the Proposed Development are assessed.

2.2.9 This is of particular importance to maintain due to the ever-evolving technology and speed of product development within solar PV module and energy storage technology markets. This Rochdale Envelope approach is being followed in this PEIR, and will be followed in the ES.

2.3 Description of the Proposed Development

2.3.1 The Proposed Development would comprise of the following key infrastructure (as shown in Figures 2.2 – 2.8, 2.10 and 2.11):

- solar photovoltaic (PV) modules and associated mounting structures;
- on-site supporting equipment including inverters, transformers, and switchgears;
- Battery Energy Storage Systems (BESS);
- on-site substation to connect the Panel Areas to the national grid;
- underground cables; 33kV underground cabling within the Panel Areas and connecting the Panel Areas to the on-site substation, and a 132kV underground cable connecting this substation to the National Grid substation at Norton; and
- supporting infrastructure including access tracks, security measures, fencing, lighting, and mitigation and enhancement measures.

Design parameters

2.3.2 Due to rapidly changing and evolving solar and energy storage technology markets, the Proposed Development parameters are designed to maintain flexibility to allow the latest technology to be installed at the time of construction.

2.3.3 The following sections provide a description of the different elements of the Proposed Development along with the design parameters that have been assessed within this PEIR. Each environmental topic has assessed the design considered to be the likely worst-case scenario for that discipline to determine the potential for significant effects and identify suitable mitigation measures, and the ES will follow the same approach.

Solar panels

2.3.4 Solar panels generate electrical power by using a solar PV module to convert sun light into direct current (DC) electricity. Individual solar PV modules, more commonly known as solar panels, contain several PV cells wired and encapsulated by tempered glass. Solar PV modules are sealed for weatherproofing and held together by a metal frame in a mountable unit.

2.3.5 Individual solar PV modules are typically 2m by 1m in width and depth and can vary in height. However, as solar PV modules are rapidly developing due to innovation in technology and processing techniques for the PV cells, the dimensions of the solar PV modules available at the time of construction may vary. The ES will therefore consider a height parameter which represents the worst-case scenario in terms of identifying potential environmental effects.

2.3.6 Solar PV modules are fixed to mounting structures in groups known as 'strings'. The exact number and arrangement of modules depends on a range of factors including the size of the system, its location, and the direction in which the panels are installed. As technology and equipment is evolving, some flexibility in design will be required to accommodate technology advances.

2.3.7 It is possible to install the solar PV modules as fixed arrays, or as tracking arrays which adjust the position of the solar PV modules to track the sun throughout the day. Table 2-1 below presents a summary of the difference between the two types of solar PV modules, and the design parameters used for this PEIR.

Table 2-1 Overview of types of Solar PV modules

Type of Solar PV Module	Fixed	Tracking
Description	Rows of Solar PV modules aligned in East-West rows with panels facing South	Rows of Solar PV modules mounted on a metal tracking system aligned in North-South rows with panels rotating East-West
Angle	+/- 10° to 30°	+/- 60°
Orientation	South	East - west
Separation distance	Approximately 4 – 12m between rows	Approximately 4 – 6m between rows
Height[1]	▪ Maximum height of up to 3m ▪ Minimum height of the lowest part of the panel would typically be between 0.8m-1m	▪ Maximum height of 4.35m, which would vary throughout the day ▪ Minimum height of the lowest part of the panel would typically be between 0.35m-1m
Mounting structure	The mounting structure for the solar PV modules is a metal frame (usually anodised aluminium alloy) securely fixed to the ground and supported by galvanized steel poles which are typically driven into the ground to a depth of approximately 1m. Where the assessment has identified the need for archaeological protection, alternative mounting structure designs will be considered.	

Cabling within Panel Areas

2.3.8 Low voltage cabling within the Panel Areas would be required to connect solar PV modules and the BESS to inverters where the voltage is transformed from the lower voltage to 33kV. Cabling from the solar PV modules to the inverters would typically be

[1] The maximum and minimum height dimensions are indicative at this stage as the final elevation of the solar PV modules will be influenced by design factors such as local topography, configuration and mitigation proposals.

installed above ground, fixed to the mounting structure of the modules, with a small section placed underground where it leaves the solar PV modules and connects to the inverters.

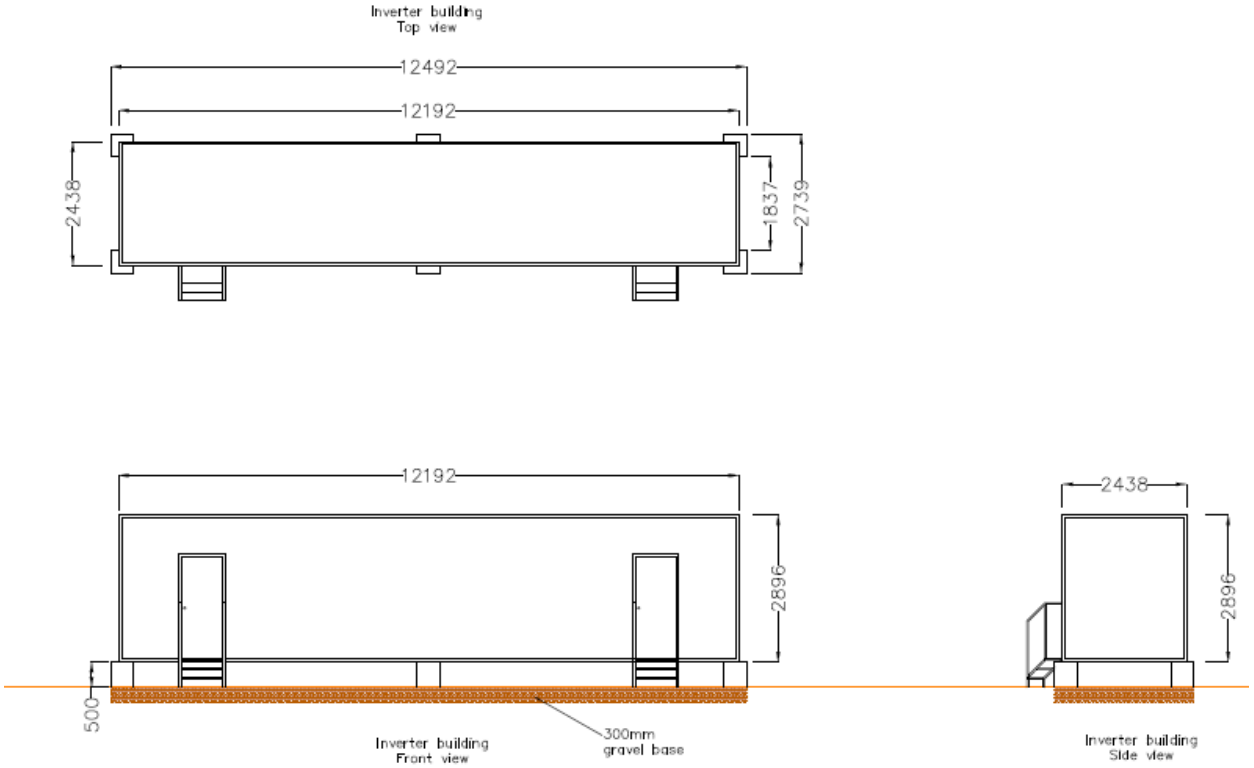
On-site supporting equipment

2.3.9 A range of equipment is required to support the solar PV modules in order to convert the electrical power generated, manage this power and export power onto the national grid. The electrical output from the solar PV modules would be exported by low voltage cabling to shipping container style storage units which would contain an inverter, transformer and BESS. The function of each of these elements are as follows:

- inverters convert the DC generated by the solar PV modules into alternating current (AC) that can be exported to the national grid;
- transformers monitor, increase and control the voltage of the electricity produced before it reaches the on-site substation. The transformers would be located adjacent to the inverters; and
- BESS would comprise of containerised battery storage systems, DC-DC converter boxes and ancillary equipment (see paragraphs 2.3.14-2.3.16).

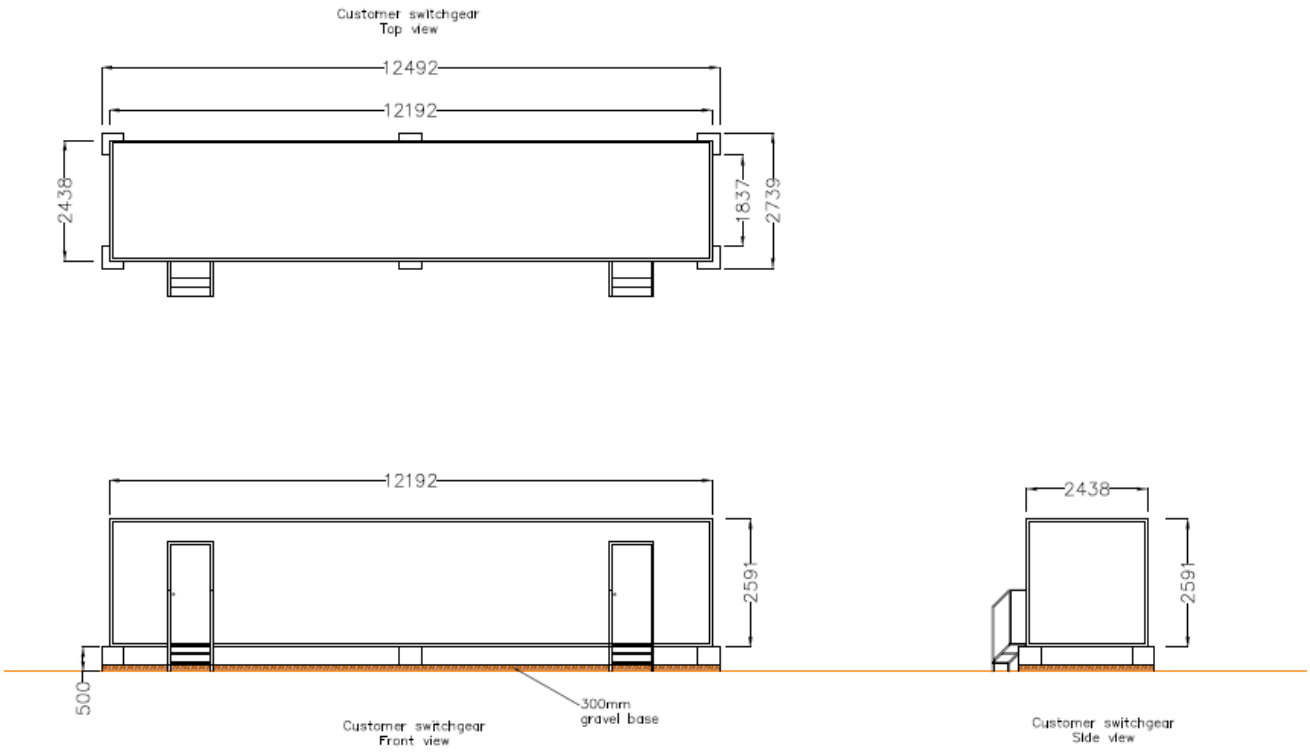
2.3.10 The inverters, transformers and BESS would be arranged together across the Site Area. At this stage, it is anticipated that there would be up to 53 hybrid containers (which include an inverter and BESS) and up to 44 inverter containers located across the Proposed Development. These would be placed on a concrete pad foundation and would measure approximately 3m in height, 2.5m in width and 12m in length, as shown in Plate 2-1 below.

Plate 2-1 Typical Shipping Container Style Unit



2.3.12 The Proposed Development would utilise five switchgears to control, protect and isolate electrical currents and equipment. Switchgears allow parts of the solar PV system to be de-energised safely, allowing for routine maintenance or faults to be identified and work undertaken. A typical switchgear of the style likely to be used on the Proposed Development is shown in Plate 2-2 below.

Plate 2-2 Typical Switchgear



2.3.13 Each Panel Area would also contain a communications and weather mast, which would be up to 5m in height.

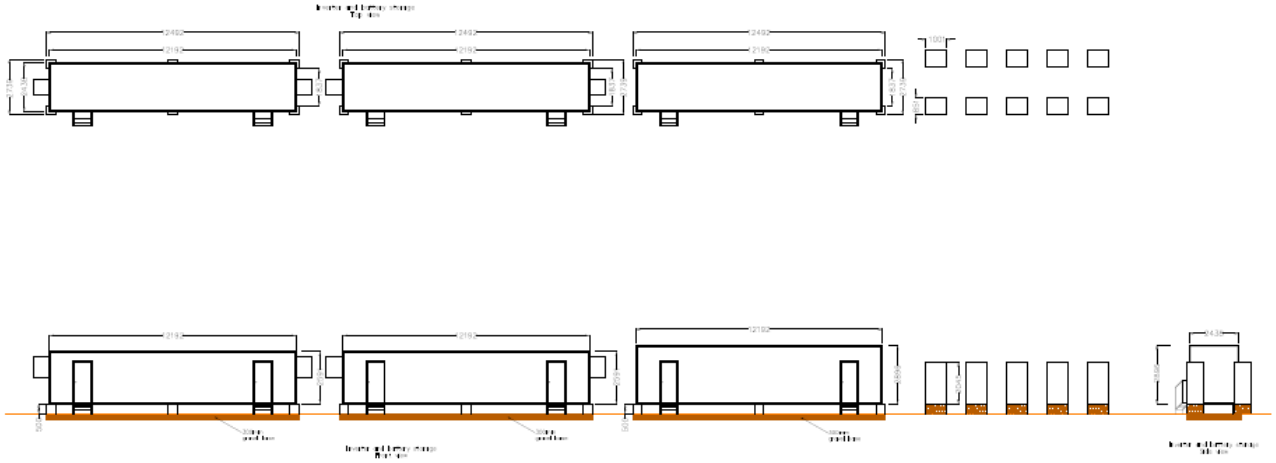
Battery Energy Storage System (BESS)

2.3.14 The BESS is likely to consist of lithium-ion batteries and will allow energy to be stored on site to ensure that there is an equal distribution of electricity across the Grid, providing a balance in services where surplus electricity is produced.

2.3.15 BESS will be included as part of the hybrid containers, and the typical external appearance is shown in Plate 2-3.

2.3.16 The BESS would require associated heating, ventilation and cooling (HVAC) systems to ensure efficiency of the batteries and these systems would be integrated within the individual containers.

Plate 2-3 Typical Hybrid Container



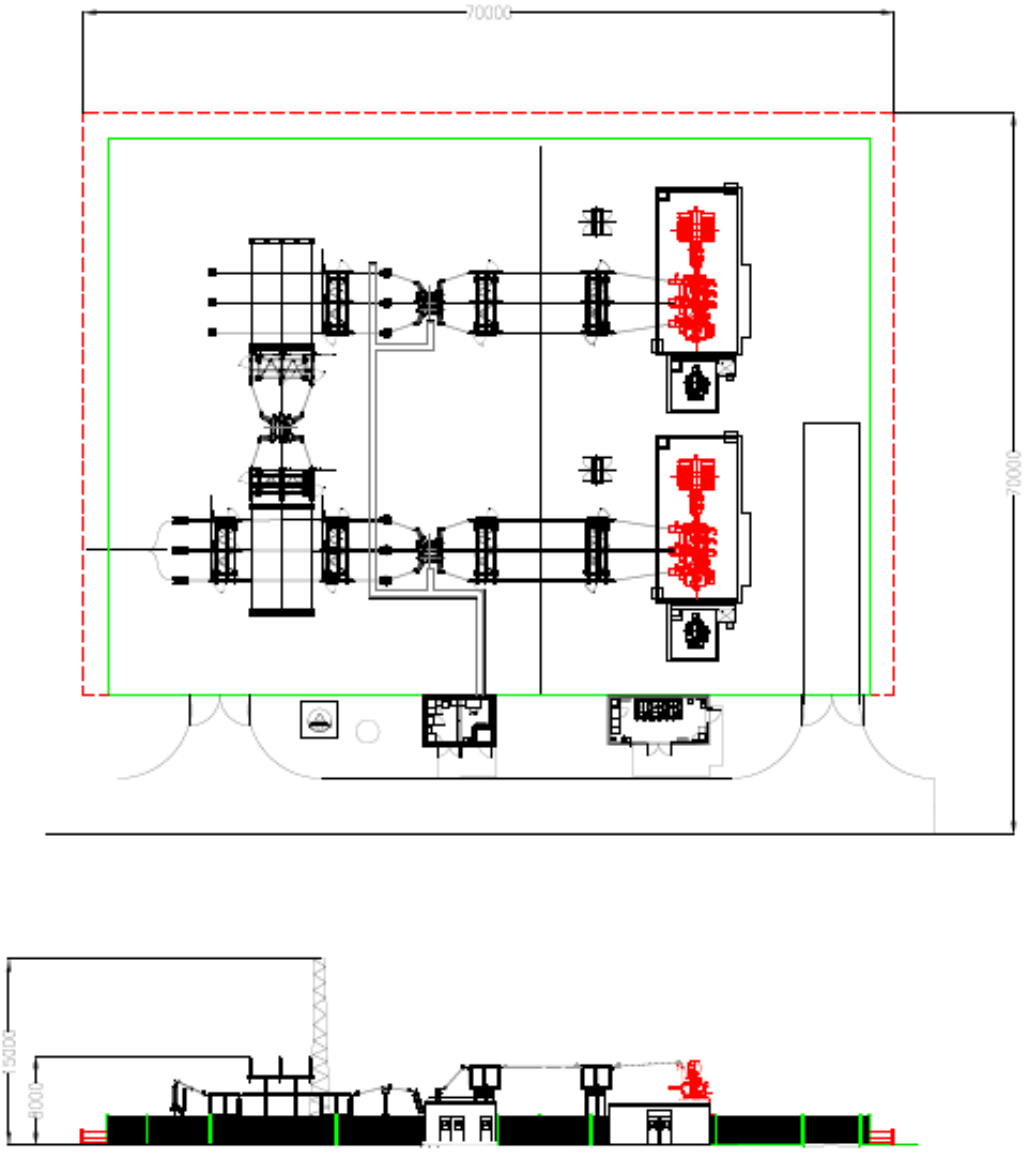
On-site substation

2.3.17 A substation would be required for the Proposed Development to connect the Panel Areas to distribution and transmission networks. The substation would also house other electrical equipment such as transformers, switchgear, and metering equipment.

2.3.18 The purpose of this on-site substation is to convert low voltages from electricity generation to high voltages, or vice versa, using power transformers. The on-site substation would be located in Panel Area C. The substation compound would be 70m in length, 70m in width with a 30m x 70m parking and turning area. The equipment within would have a maximum height of 15m (which would only relate to a communications tower, with the highest electrical equipment being 8m).

2.3.19 A typical substation is shown in Plate 2-4 below.

Plate 2-4 Typical Substation



Underground Cabling

2.3.20 Underground cables would be required for connection of the solar PV modules to the on-site transformers, switchgear, and BESS, as well as from the Panel Areas to the on-site substation, and onwards to the National Grid substation at Norton.

Underground cabling between the Panel Areas

2.3.21 Higher voltage cables (33kV) of approximately 21km are required to connect the inverters and switchgears, and to connect the switchgears to the on-site substation. These are shown on Figure 2.10.

2.3.22 Where 33kV cables are outside of the Panel Areas the preference is to use off-road routes. These routes are currently under discussion with relevant landowners. On-

road routes for 33kV cables are included in the Site Area and are subject to consultation. Cable routes (on- road or off-road) will be confirmed following the consultation and subject to negotiations with landowners.

2.3.23 At this stage, it is anticipated that underground cables would be installed using a cable plough, wherever possible. This is considered to be the most efficient and least impactful method of cable installation, causing minimal disruption to the ground, by cutting, installing and back-filling in one operation.

2.3.24 In instances where the cable plough cannot be used, alternative methods, such as horizontal directional drilling, would be considered and assessed within the ES.

Underground cabling from the on-site substation and Norton Substation

2.3.25 The Proposed Development would connect to the existing National Grid substation at Norton, located within the eastern extent of the Site Area, by underground cabling. It is anticipated that 10km of underground 132kV cabling would be required to connect the Proposed Development from the on-site substation to the substation at Norton. The maximum dimension of the cable trench would be 1600mm depth x 2000mm wide.

2.3.26 Where the 132kV cable is outside of the Panel Areas the preference is to use off-road routes. These routes are currently under discussion with relevant landowners. On-road routes for 132kV cables are included in the Site Area and are subject to consultation. Cable routes (on-road or off-road) will be confirmed following the consultation and subject to negotiations with landowners. The works would likely be carried out by the Distribution Network Operator (DNO).

2.3.27 It is anticipated that a cable plough would be used to install the 132kV cables, but it is likely that some horizontal directional drilling would be required in more constrained locations. The method of cable installation will be fully assessed as part of the ES.

2.3.28 A new 132kV circuit breaker and associated switchgear equipment will be installed at the Norton Substation by the DNO as the asset owner of the substation. This will enable the connection between the substation and the Proposed Development. These works form part of the Proposed Development and will be assessed as part of the ES.

Other infrastructure

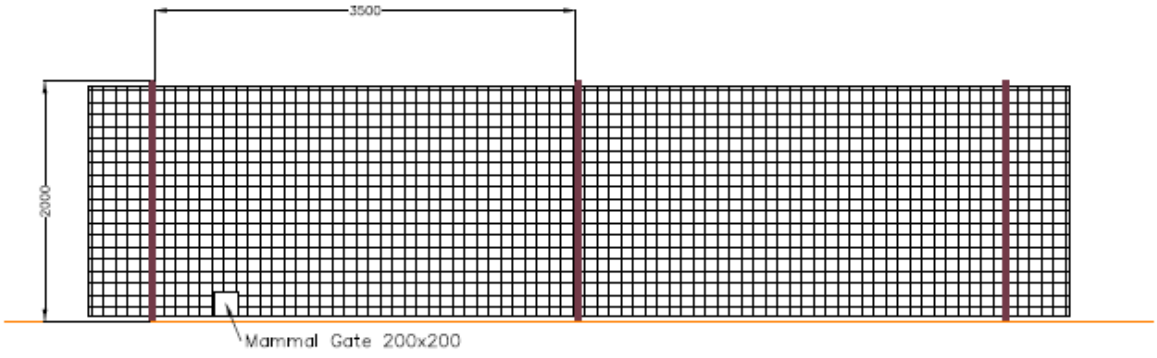
2.3.29 Additional infrastructure would be required to support the operation of the Proposed Development. The following equipment would be installed across the Site Area as follows:

- Fencing and Gates – A perimeter security fence would be installed to enclose the operational areas of the Proposed Development. The fence is likely to be either a wire-mesh or deer fence (if required) and measure between 2m and 3m in height. The fence would be designed in such a way to allow small animals to pass through

the Site Area and would also be gated to allow access to and from the Site Area. Typical fencing is shown in Plate 2-5;

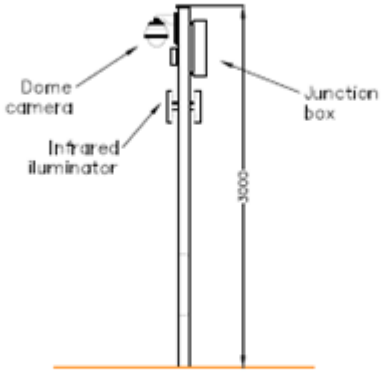
- CCTV – Pole-mounted, infra-red security detection cameras would be mounted on poles of approximately 5m in height located within the perimeter fence. It is anticipated that these cameras would have motion detection technology for recording, and would be pointed directly within the Site Area and away from any land outside of the Site Area. A typical CCTV pole is shown in Plate 2-6;
- Lighting – In general, it is anticipated that the Proposed Development would not be lit, however, infrared security lighting would be required around key electrical infrastructure. This lighting would be sensor triggered and therefore not continuous;
- Access tracks – Access to the Proposed Development during operation would be required for maintenance. A series of access tracks are proposed within the Site Area and further detail on access points onto the local highway network is provided in Table 2-3. Access tracks would be permeable to allow water to filtrate through and maintain greenfield runoff rates. A cross section for a typical access track is shown in Plate 2-7;
- Drainage – The detailed operational drainage design for the Proposed Development will be undertaken prior to construction. The overarching principle of the drainage strategy for the Proposed Development is to provide sustainable drainage solutions (SuDS) at source, ensuring that surface water run-off is managed as per existing site conditions. Further detail on the drainage strategy is provided in Appendix 10.1; and
- Storage Containers – It is anticipated that nine additional storage containers would be installed on site to contain extra equipment to support maintenance activities.

Plate 2-5 Typical Fencing



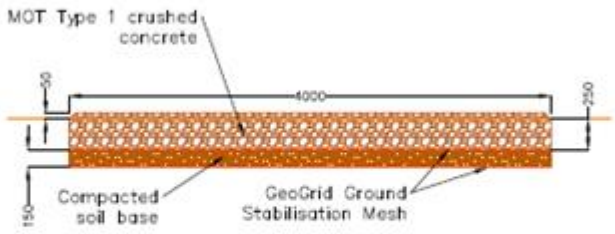
Timber post & wire fence

Plate 2-6 Typical CCTV pole



CCTV pole

Plate 2-7 Cross-section of a typical Access Track



Access track cross section

2.4 Location of the Proposed Development

2.4.1 The Proposed Development covers an area of approximately 563 ha and is located between Darlington and Stockton-on-Tees in North East England in an area of undulating mixed farmland with a network of local roads and Public Rights of Way (PRoW) and a mix of dispersed settlements, small villages and hamlets.

2.4.2 The majority of the Proposed Development, including the solar PV modules, on-site substation, Norton Substation and BESS are located within the administrative boundaries of Darlington Borough Council. The eastern part of the cable routes crosses into the administrative boundary of Stockton-on-Tees Council. The northern extent of the Site Area borders Durham County Council's administrative area. The Site Area for the Proposed Development is shown in Figure 1.2.

2.4.3 The areas surrounding the Site Area comprise of agricultural fields, interspersed with individual trees, hedgerows, farm access tracks, woodlands and local farm holdings. There are several local villages located within close proximity to the Proposed

Development, including Brafferton, Newton Ketton, Great Stainton, Bishopton and Old Stillington village to the north.

2.4.4 A detailed description of the design of the Proposed Development and environmental mitigation is located in Sections 2.3 and 2.6 of this chapter.

2.5 Existing conditions

2.5.1 The purpose of this section is to provide an overview of the Site Area and surrounding area. Where relevant, further information relating to each of the environmental topics is provided in the relevant topic chapters, as well as the supporting figures and appendices.

Overview

2.5.2 For the purposes of the PEIR, the Site Area has been split into eight distinct components, as presented in Table 2-2.

Table 2-2 Components of the Proposed Development

Component	Size	Local Authority
Panel Area A: Brafferton	114.32 ha	Darlington Borough Council
Panel Area B: Hauxley Farm	52.34 ha	
Panel Area C: Byers Gill Wood	110.89 ha	
Panel Area D: Great Stainton	87.90 ha	
Panel Area E: West of Bishopton	26.64 ha	
Panel Area F: North of Bishopton	104.94 ha	
Norton Substation	11.20	Stockton-on-Tees Borough Council
Underground cables	54.52 ha	▪ Darlington Borough Council ▪ Stockton-on-Tees Borough Council ▪ Durham County Council

2.5.3 The Site Area includes the maximum extent of land that would be included within the DCO application for Proposed Development and considers land required for the substation, solar PV modules, hybrid and inverter containers, underground cables, connection to Norton Substation, and associated infrastructure, as well as mitigation measures including biodiversity net gain, PRoW and landscape design.

Statutory and non-statutory nature conservation designations

2.5.4 There are ten statutory designated sites within 10km of the Site Area comprising two Local Nature Reserves (LNR), one proposed Ramsar site, one Ramsar site, one Special

Area of Conservation (SAC), one Special Protection Area (SPA) and four Sites of Special Scientific Interest (SSSI). There are two non-statutory designated sites and no ancient woodland within 1km of the Proposed Development. The nearest designated site is Newton Ketton SSSI located 100m west of Panel Area C.

2.5.5 For further information on statutory and non-statutory nature conservation designations, please refer to Chapter 6 Biodiversity.

Landscape designations

2.5.6 The nearest national landscape designations are Registered Parks and Gardens located approximately 5km from the Site Area. The nearest Area of Outstanding Natural Beauty (AONB) and National Parks are located more than 20km from the Proposed Development.

2.5.7 There are two Areas of High Landscape Value (AHLV) within 2km of the Site Area. The Elstob AHLV is located approximately 30m north of the Panel Area B, and the Bradbury, Preston and Mordon Carrs AHLV is located approximately 1.1km north of Panel Area A.

2.5.8 The Site Area is located within two local landscape character areas. Panel Areas A-D are within 6: Great Stainton Farmland and Panel Areas E-F are within 7: Bishopton Vale. Woodland, hedgerows and hedgerow trees are relatively frequent in this area and along with the undulating landform serves to constrain visibility, though there are some more elevated and open locations with wider views. The lower lying and flatter area to the east has more arable farming and is less vegetated, leading to more open views.

2.5.9 The potential cable route options connecting the on-site substation with the Norton Substation pass through character areas within the Stockton-on-Tees Borough Council Area: 1 West Stockton Rural Fringe and 3 Billingham and Thorpe Becks.

2.5.10 For further information, please refer to Chapter 7 Landscape and Visual.

Scheduled monuments, listed buildings and conservation areas

2.5.11 There are five Scheduled Monuments within 2km of the Site Area, the closest is Motte and Bailey castle, 400m south east of Bishopton (1008668). There are two Grade I Listed buildings and one Grade II* listed building within 5km, and sixty-seven grade II listed buildings within 2km. There is also potential for as yet unknown various archaeological remains within the Site Area.

2.5.12 Three Conservation areas are located within 2km of the Site Area, including Coatham Mundeville, Bishopton and Sadberge.

2.5.13 For further information, see Chapter 8 Cultural Heritage and Archaeology.

Public Rights of Way / Recreational resources

2.5.14 The Site Area and its surrounds host a network of PRoW and permissive trails with other recreational and community land uses, such as golf clubs and woodland areas within the surrounding areas.

2.5.15 There are no National Cycle Network routes through the Site Area, but the local road network is known to be used for recreational cycling.

2.5.16 For further information, see Chapter 9 Land Use and Socio-economics.

Flood zones

2.5.17 The Proposed Development is located within the Tees catchment in North-East England. As the Site Area drains to the River Tees through two main river systems; via the River Skerne to the west and the Newton Beck to the east. The topography in this area is fairly undulating, meaning the land drains to the north, south and west.

2.5.18 The Site Area is located mostly within Flood Zone 1, with two small areas located within Flood Zone 3 associated with Little Station Beck and Bishopton Beck in Panel Areas D and F. Flood Zone 3 is defined as an area having less than a 1 in 100 annual exceedance probability of flooding from main rivers. The flood extent associated with the Bishopton Beck is immediately adjacent to the proposed solar PV modules in Panel Area F. The Flood Zone for Little Stainton Beck indicates the flooding occurs at a sharp turn in the watercourse.

2.5.19 For further information see Chapter 10 Hydrology and Flood Risk.

Noise Sensitive Receptors

2.5.20 The Proposed Development is in a rural area of generally low population density, except for individual settlements such as Brafferton, Great Stainton and Bishopton; and Redmarshall and Carlton to the east. Potential noise-sensitive dwellings are located within these settlements or as more isolated properties or farms.

2.5.21 For further information see Chapter 11 Noise and Vibration.

Transport Network

2.5.22 There are a number of national, regional and local roads located within 1km of the Site Area.

2.5.23 The closest part of the Strategic Road Network (SRN) is the A1(M) to the west of Site Area, and the A66 to the south. The Proposed Development could also be accessed via the SRN from the A19(T) to the east. The road network within and immediately adjacent to the Proposed Development consists of more local, rural roads.

2.5.24 Stockton Rail Station is approximately 3.6 km east from the Site Area. Teesside International Airport is located within 15km south of the Site Area.

2.5.25 For further information see Chapter 12 Traffic and Transport.

Land quality

2.5.26 A Phase 1 Environmental and Geotechnical Desk Study, with site walkover, has been carried out for the Proposed Development. The assessment found that the Site Area currently predominantly comprised of agricultural land and an electrical sub-station, consisting of buildings, hardstanding, and electricity infrastructure, located in the eastern extent (the existing Norton substation). The Site Area has historically been occupied by agricultural land, with the development of the electrical sub-station noted from 1938.

2.5.27 The Site Area is predominantly underlain by Devensian Till, with Superficial Deposits in the form of Alluvial Deposits, Head Deposits, Glaciofluvial Deposits and Lacustrine Deposits are underlying the Site Area. The bedrock stratum underlying most of the Site Area comprises is dolomitised limestone and dolomite of the Zechstein Group. A Secondary Undifferentiated and Secondary A aquifer has been identified within the superficial deposits, with the bedrock beneath the Site Area classified as a Principal, Secondary A and Secondary B aquifer.

2.5.28 The preliminary assessment has not identified any potentially complete pollutant linkages comprising of organic and inorganic contaminants, and the report has identified the risk at the site to be Very Low to Low with recommended mitigation measures.

2.5.29 The full Phase 1 Environmental and Geotechnical Desk Study can be found in Appendix 2.1.

2.6 Environmental mitigation design measures

2.6.1 The design of the Proposed Development has emerged as part of an iterative design process between the engineering and environmental assessment teams, as well as through proactive engagement with statutory consultees, key stakeholders, and the community.

2.6.2 Throughout this design process, changes have been made and implemented into the design of the Proposed Development to avoid or reduce adverse environmental effects and to make the Proposed Development fit better into the wider landscape. These measures and changes are considered essential to the Proposed Development and are termed as ‘embedded mitigation’.

2.6.3 A Landscape Concept Masterplan has been prepared for statutory consultation and is included in Figure 2.12. It incorporates landscape, biodiversity, and cultural heritage mitigation and enhancements to create a coordinated design for the Proposed

Development. In addition, a Solar Photovoltaic Glint and Glare Study has been prepared and is included as Appendix 2.2. Mitigation emerging from the assessment will be reviewed as part of the ES and will be reflected in the final Landscape Concept Masterplan and Landscape and Ecology Management Plan (LEMP).

Embedded mitigation

Biodiversity

2.6.4 Embedded design measures are needed to successfully integrate the Proposed Development within the context of the existing landscape and prevent or reduce any adverse effects on ecological features.

2.6.5 The Proposed Development has been designed so that impacts upon important habitats (comprising woodland, field margins, hedgerows and ponds) are avoided where reasonably practicable, and compensated for where not, through the retention of existing habitat and the creation or replacement of habitat.

2.6.6 Proposed embedded design measures which will be secured via the Construction Environmental Management Plan (CEMP) and Landscape and Ecology Management Plan (LEMP) are likely to include the following:

- revised layout avoids some areas where nesting lapwing and curlew were recorded and areas where geese were recorded in the winter;
- allocation of discrete areas that will remain free of solar panels to provide continued availability of habitat for ground nesting birds;
- revised layout enabling the retention of woodland and the majority of hedgerows and associated trees;
- where cabling works need to cross hedgerow where possible and practical horizontal directional drilling (HDD) will install the cables under hedgerows;
- maintenance of appropriate buffers between solar panels and riparian boundaries and watercourses;
- maintenance of appropriate buffers between solar PV modules and larger hedges with trees and woodland edges to retain foraging and commuting corridors for bats; and
- maintenance of appropriate buffers between solar PV modules and trees with potential bat roost features to retain bat roosting habitat across the Site Area.

2.6.7 For further information on mitigation measures, please refer to Chapter 6 Biodiversity.

Landscape and visual

2.6.8 Embedded design measures are needed to successfully integrate the Proposed Development within the context of the existing landscape and prevent or reduce any

adverse effects the landscape. Detailed mitigation design and landscape management measures will be developed as part of the final design of the Proposed Development and outlined in the LEMP for submission with the DCO Application.

2.6.9 At the present stage in design, the precise location and extent of the application of these measures is yet to be developed. A 'design palette' of measures to be taken into the final design of the Proposed Development, which could be applied to mitigate effects, has been developed alongside of the PEIR. These measures are shown as follows:

- Figure 2.12 Landscape Concept Masterplan details the proposed planting and landscaping for the Proposed Development; and
- Figure 2.13 Indicative Cross-Sections presents the indicative cross sections of likely views to the Proposed Development.

2.6.10 Proposed embedded design measures which will be secured via the LEMP include the following;

- Limiting the height of the solar PV modules to 4.35m in height;
- Excluding solar PV modules from areas close to homes to mitigate potential effects on residential visual amenity and from some parts of the Panel Areas in order to mitigate effects on the views from and character of Brafferton, Bishopton and Great Stainton;
- Ensuring that fencing would be either a wire-mesh or deer fence (if required) and it would measure between 2m and 3m in height in order to present an appearance that is appropriate to the rural context;
- CCTV columns would be placed between the fencing and the solar PV modules, and oriented to look along the gap rather than beyond the Panel Areas. These CCTV columns would be no more than 5m in height;
- Access tracks and cable routes would be located to pass through existing gates and gaps in hedgerows where feasible, to avoid the need for removal of trees of hedges;
- Inverters and batteries would be approximately 3m in height and would be finished in grey; these would be located amongst the solar PV modules throughout the Panel Areas. Each Panel Area would also include a 5m weather mast; and
- The substation would be no more than 8m in height with the exception of the communications mast which would be up to 15m. It would be screened by Square Wood and proposed planting as shown in Figure 2.12.

2.6.11 Components of the Proposed Development required for the operation of the Proposed Development, including access tracks, would be removed during decommissioning. Changes to the routes of Public Rights of Way would not be time limited and would remain in place post-operation. Permissive rights of way and vegetation within the Panel Areas would revert to the management of the landowner.

2.6.12 For further information on mitigation measures, please refer to Chapter 7 Landscape and Visual.

Cultural heritage and archaeology

2.6.13 For cultural heritage and archaeology, the primary design consideration for physical impacts to any known or potential archaeological remains is avoidance. This principle has been applied across the Site Area which included the alteration of the redline boundary to avoid impacts.

2.6.14 Embedded design measures are also needed to prevent or reduce any adverse effects on cultural heritage and archaeology.

2.6.15 A flexible design process will be applied to the design for the Proposed Development. This response is required in response to the nature of archaeological remains and the possibility for either known or unknown remains to be of sufficient heritage significance to warrant preservation in situ. For example, this process can involve application of above ground foundations to reduce substantially any below ground intrusion from the construction works. The application of these methods will be considered, and potentially applied, through a balanced decision based on the sum of environmental factors and from a development viability perspective, and agreed in consultation with the relevant statutory consultees.

2.6.16 Where such methods are to be applied, these can be included within the Outline Written Scheme of Investigation (WSI) if the parameters are known for the production of the final Environmental Statement, or as part of a later detailed WSI guided by an appropriately worded requirement in the DCO.

2.6.17 In relation to potential indirect impacts to designated heritage assets through a change in setting, the design process has been collaborative across the environmental disciplines to ensure a joined up and holistic approach to minimising, and removing entirely where possible, any adverse environmental effects.

2.6.18 For cultural heritage, this has been concentrated on the enhancement of field boundaries which provide screening between the Proposed Development and the surrounding landscape. In collaboration with the landscape and visual impact assessment team, where existing boundaries are less than complete these have been noted for enhancement while where large gaps have been identified, these are proposed to be filled with new planting.

2.6.19 Tree and hedgerow planting will be used across the Site Area which will significantly reduce ground level visibility of any panels, although this cannot provide full screening of the Proposed Development across the entire landscape and some visibility will remain.

2.6.20 For further information on mitigation measures, please refer to Chapter 8 Cultural Heritage and Archaeology.

Land Use and socio-economics

2.6.21 The Proposed Development has been designed to avoid, eliminate or reduce potential impacts wherever possible, with certain mitigation embedded into the design. That mitigation has therefore been considered as part of this assessment.

2.6.22 As part of this assessment it is particularly important to highlight the proposed addition of permissive trails throughout the Proposed Development's boundary, enabling a more cohesive PRoW network.

2.6.23 Additionally, built structures such as access tracks, substations and compounds that would require soil stripping and disturbance have been directed toward the lower quality land available (that in Subgrade 3b quality), in order to avoid potential compaction or physical contamination of any BMV quality agricultural land.

2.6.24 For further information on mitigation measures, please refer to Chapter 9 Land Use and Socio-Economics.

Hydrology and flood risk

2.6.25 Mitigation measures have been designed into the Proposed Development to reduce effects in relation to hydrology and flood risk, and a number construction and operation mitigation measures have been considered. These are as follows:

- An 8m buffer zone has been designed around the perimeter of watercourses within the Site Area for pollution and erosion control. Vegetation that will grow around this perimeter zone will increase infiltration, act to slow down surface water runoff and filter out sediment;
- Where possible, building in areas at a fluvial flood risk has been avoided and critical infrastructure (including substation and electrical switchgear) has been located outside of flood zones. Where tracks are located within the fluvial flood zone they will remain at grade to ensure there is no loss of flood plain and panels will be raised above the 1 in 1000 year flood depth. No buildings such as the BESS, inverters, transformers, and sub-station have been situated within the fluvial flood zones so there has been no loss of flood storage; and
- All access tracks will be permeable to allow water to filtrate through and to maintain greenfield runoff rates. The small impermeable areas will have an apron of clean crushed stone to promote natural land drainage conditions in the vicinity of the structures. The apron will be at least 1m wide beyond the structure footprint with a depth of at least 300mm consisting of 40-70mm crushed stone. This is common practice for solar farm developments across the UK and deemed an appropriate measure to account for the introduction of a small impermeable area in a rural location.

2.6.26 For further information on mitigation measures, please refer to Chapter 10 Hydrology and Flood Risk.

Noise and vibration

2.6.27 Inverters and any other sources of noise associated with the operational phase of the Proposed Development have been located as far as reasonably possible from existing sensitive receptors, within the design, to minimise potential noise levels at the receptors. The inverters will also be housed within containers which will further reduce the noise levels at source. Best practicable measures will be employed during the construction phase to ensure construction noise is kept to a minimum.

2.6.28 For further information on mitigation measures, please refer to Chapter 11 Noise and Vibration.

Traffic and transport

2.6.29 There are no proposed embedded design measures. The access locations into the fields will utilise established vehicular access locations off the adopted highway, and the development does not propose to alter the existing highway.

2.6.30 For further information on mitigation measures, please refer to Chapter 12 Traffic and Transport.

2.7 Construction and Operation

2.7.1 This section of the PEIR considers the potential methodologies to construct and operate the Proposed Development.

Construction Programme

2.7.2 The construction of the Proposed Development, comprising installation of the solar PV modules and cabling, is proposed to be over a period of approximately 12 months. Subject to the grant of a DCO, construction would commence following the discharge of DCO Requirements.

2.7.3 See paragraphs 2.7.29 to 2.7.33 for information on Construction Environmental Management.

2.7.4 The installation of solar PV modules does not involve any complex construction process or practices and therefore risk of delay beyond the programme is to be included within the ES and would largely be driven by adverse weather conditions. Many component parts of the Proposed Development would arrive on-site ready to be installed and it is not anticipated that any Abnormal Indivisible Loads (AILs) would be required to enable construction.

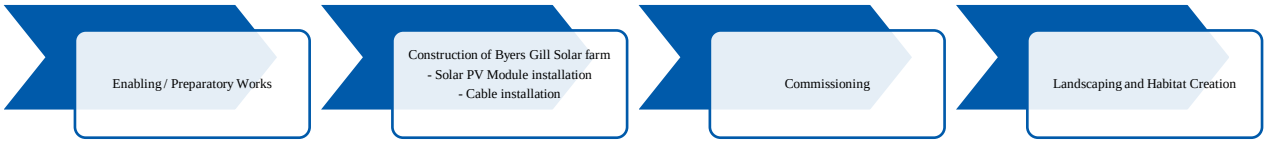
Construction Activities

2.7.5 The activities that are likely to be required for the construction of the Proposed Development are outlined below and it is anticipated that these activities would take place over several key phases, as shown in Plate 2-8.

2.7.6 It is likely that a number of these activities and phases will run in parallel with works being undertaken on all Panel Areas at the same time.

2.7.7 The ES will provide further details of the proposed construction activities for the Proposed Development, including their anticipated duration and a programme of each phase of the work.

Plate 2-8 Phases of Construction for the Proposed Development



Construction Staff and hours of work

2.7.8 Working hours during the construction phase would be 08:00 – 20:00 Monday – Sunday.

Plant and site access

2.7.9 It is anticipated that the principal plant required to install the solar PV modules would include:

- Excavator;
- Mobile crane;
- Crawled Dozer;
- Push press piling rig;
- Power generator;
- Telehandler;
- Truck; and
- Vibrating roller.

2.7.10 Access into each of the Panel Areas would be required to facilitate construction, as well as allowing ongoing maintenance access from the local highway network. Access points are proposed from existing accesses wherever possible as shown in Figure 12.1 and summarised in Table 2-3 below:

Table 2-3 Proposed Access Points

Panel area	Access Points
Panel Area A: Brafferton	High House Lane
Panel Area B: Hauxley Farm	Salters Lane Unnamed farm tracks off Lodge Lane
Panel Area C: Byers Gill Wood	Yarm Road / Bishopton Lane / Elstob Lane
Panel Area D: Great Stainton	Elstob Lane Unnamed road off Green Lane
Panel Area E: West of Bishopton	Unnamed road off Green Lane
Panel Area F: North of Bishopton	Unnamed road off Green Lane and existing farm tracks Mill Lane from Bishopton
Norton Substation	Existing access from Letch Lane
Underground cables	To be accessed from within Panel Areas and work undertaken along the cable route. Ongoing access would only be required should a problem occur.

Construction compounds

2.7.11 It is currently proposed to include one compound in each Panel Area, with access via the access tracks as detailed in Table 2-3. This would mean that construction activities and the use of the compound in each Panel Area is kept to a shorter period of time when compared to all construction activities being based from a single, main compound. A plan which presents the access tracks and construction compounds is provided in Chapter 12, Figure 12.1.

2.7.12 Compounds would typically measure 60m in length and 30m in width. A 'Durabase Mat System' or a similar non-ground penetrating mat system would be used within the compounds.

2.7.13 The temporary construction compounds would contain construction worker welfare facilities, a site office, limited parking, wheel wash area, plant and machinery storage, Heavy Goods Vehicle (HGV) / delivery turning area and waste storage areas.

2.7.14 For security and safety purposes, any live construction areas would be closed to the public throughout the construction phase. Site security staff would patrol the site in addition to hazard warning signs and CCTV.

Waste Management

2.7.15 The Proposed Development is likely to generate waste comprising of general construction waste, including packaging waste from materials, and construction materials from access roads and supporting infrastructure. During operation, it is anticipated that waste generation would be minimal. Waste from the decommissioning

of the Proposed Development would be disposed of responsibly and undertaken in alignment with the future principles of recycling available at that time. Construction, operation and decommissioning of the Proposed Development is therefore expected to generate minimal waste arisings.

2.7.16 An assessment of likely waste arisings from the Proposed Development is provided in Appendix 2.3. Measures to reduce impacts from waste management will be included within the Outline EMP, submitted with the DCO application.

Construction lighting and energy use

2.7.17 Temporary construction lighting would be intermittently used throughout the construction phase for select operations in isolated locations only at the construction compounds. Construction lighting may be used within the Panel Areas during night time hours in the winter if works require this.

Preparatory Works

2.7.18 Preparatory works would be the first phase of construction and includes activities to enable and prepare the site for the construction of the Proposed Development. At this stage in design, it is anticipated that works undertaken during this phase are likely to include:

- establishment of and / or works to site access point(s);
- installation of any temporary / permanent culverts under water courses / ditches;
- ground clearance activities;
- construction of any access tracks and laydown areas with the Site Area;
- establishment of construction compounds at each Panel Area;
- establishment of mobilisation areas, running tracks and temporary construction compounds for cable installation;
- erection of security fencing around the site perimeter, as well as access gates;
- installation of security measures such as CCTV;
- delivery of plant and machinery to site; and
- delivery of materials to enable first phases of construction.

2.7.19 There are multiple utilities crossing the Site Area, including high pressure gas mains, water pipes, telecoms cables, electrical cables and drainage. Prior to construction, the design team and Principal Contractor will review the utilities plans and use them to inform the plans for the proposed works to ensure all known utilities are avoided. Necessary offsets to known assets have been taken into account within the current design. An assessment of impacts on utilities will be included within the ES.

Construction of Byers Gill Solar

2.7.20 Following the preparatory works, construction of the Proposed Development would commence. The ES will provide further details of the proposed construction activities, their anticipated duration, along with an indicative programme for construction.

2.7.21 At this stage in design development, it is anticipated that the following types of construction activities may be required:

- solar PV module installation;
- installation of solar PV module support structures;
- mounting of solar PV modules;
- installation of supporting infrastructure, such as inverters, transformers, battery stations and switchgear;
- installation of the BESS;
- construction of the on-site substation;
- installation of storage containers;
- cable installation;
- site clearance activities such as stripping of topsoil, trenching (if required), storage and capping of soil;
- installation of construction drainage with pumping (if required);
- installation of cabling across the solar PV module areas and connection to the inverters; and
- installation of cables between inverter platforms, transfer stations and collecting stations and onto the point of connection and the National Grid substation.

Panel Areas installation & Supporting Infrastructure

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

- import of components to the Site Area;
- site preparation and civils for the onsite substation;
- piling and erection of solar PV module support structures, with foundations to a depth of circa 1m;
- mounting of solar PV modules – this would be undertaken by hand;
- trenching and installation of electric cabling;
- transformer, inverter and switchgear foundation excavation and construction;
- installation of transformers, inverters and switchgears. Cranes would be used to lift equipment into position;

- installation of the substation; and
- installation of control systems, monitoring and communication.

Cable installation

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

- site preparation;
- trenching and installation of electric cabling; and
- reinstatement works where necessary.

Norton substation

2.7.24 The following activities would be required within the Norton substation in order to allow the Proposed Development to connect:

- Supply and installation of a new 132kV circuit breaker and associated switchgear equipment on the 132kV switchboard.

2.7.25 It is anticipated that these works would be undertaken by the DNO as the asset owner of the substation.

Commissioning

2.7.26 Following construction, the Proposed Development would go through a stage of testing prior to being commissioned and the first electricity generated and supplied to the national grid. This is likely to involve mechanical and visual inspection of the Proposed Development, as well as electrical and equipment testing.

Site Reinstatement and Habitat Creation

2.7.27 The management of the landscape and ecological features will be undertaken in accordance with a LEMP that will be secured via a requirement of the DCO. Figure 2.12 Landscape Concept Masterplan presents the landscape, biodiversity, and cultural heritage mitigation and enhancements to create a coordinated design for the Proposed Development.

2.7.28 A programme of landscape and habitat reinstatement and creation will commence during the construction phase. It is anticipated that areas under the solar PV modules 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 and ecological habitats.

Construction Environmental Management

2.7.29 An Outline Environmental Management Plan ('EMP') will be produced as part of the DCO application, and will set out the measures, commitments and actions identified in the ES to manage environmental effects during construction. These measures, commitments and actions would be carried forward to a CEMP to be approved under a DCO requirement.

2.7.30 The CEMP would be produced by the appointed construction contractor and agreed with the relevant local planning authorities prior to construction.

2.7.31 In addition, the EMP produced as part of the DCO application will also include supplementary outline management plans which would later be included in full within the CEMP. These include the following:

- Outline Construction Traffic Management Plan (CTMP);
- Outline Health and Safety Plan (H&SP);
- Outline Materials Management Plan (MMP);
- Outline Pollution Response Plan;
- Outline Site Waste Management Plan (SWMP);
- Outline Soil Resources Management Plan (SRMP); and
- Outline Spillage Emergency Response Plan (SERP).

2.7.32 A draft Outline EMP has been prepared for consultation and is included as Appendix 2.4.

Construction traffic

2.7.33 An Outline CTMP including details on construction logistics and construction worker travel will be submitted in support of the DCO Application that will include information to guide the delivery of material, plant, equipment and staff during the construction phase.

Operational activities

2.7.34 The design life of the Proposed Development is expected to be at least 40 years.

2.7.35 During the operational phase of the Proposed Development, on-site activities would be limited and restricted to maintenance activities, replacement of any components that fail, monitoring activities and vegetation management. The Panel Areas would be surrounded by a 2m to 3m high security fence. In addition, the Proposed Development would be monitored with pole-mounted CCTV cameras along the perimeter fencing.

2.7.36 Access to the Proposed Development during operation for maintenance activities would include the access points as set out in Table 2-3.

Operation Environmental Management

2.7.37 An Outline Battery Safety Management Plan (oBSMP) will be submitted with the DCO application as a standalone document. The scope of the oBSMP will cover the regulatory guidance, safety standards and protection requirements of the BESS. The oBSMP will identify the structures and processes that would be used to manage and control any safety risk during construction, operation and decommissioning.

2.7.38 It is expected that the BSMP would be produced by the operator of the Proposed Development, in liaison with the equipment suppliers and agreed with the relevant local planning authorities, ahead of operation.

2.7.39 An assessment of the risk of fire from battery safety elements will be provided with the ES.

2.7.40 Any solar equipment that requires to be replaced during the operational phase would be disposed of following the waste hierarchy, with materials being reused of recycled wherever possible. Any electrical waste would be disposed of 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. An assessment of likely waste arisings from the Proposed Development is provided in Appendix 2.3.

2.8 Decommissioning

2.8.1 As previously outlined, the design life of the Proposed Development is expected to be least 40 years.

2.8.2 Following operation, the Proposed Development would require decommissioning. The process of decommissioning would involve the removal of all solar infrastructure, including the solar PV modules, cabling and on-site supporting equipment, from the site to be recycled or disposed of in accordance with good practice and processes at that time. Any requirements to leave certain infrastructure, for example access tracks, would be discussed and agreed with landowners as part of the decommissioning process.

2.8.3 The Site Area would be returned to its original use as far as possible and practical with areas of established mitigation left in situ where possible and in agreement with the landowner.

2.8.4 In addition, up to 99% of materials in a solar PV module are recyclable, with organisations around the UK specialising in solar panel recycling in line with the WEEE Regulations. For further information, see Appendix 2.3.

2.8.5 Decommissioning is expected to take between of 6 to 12 months and could be undertaken in phases.

2.8.6 The effects of decommissioning are often similar to, or to a lesser magnitude, than the construction effects. The assessment undertaken as part the ES will be based on assumptions as to how decommissioning would take place and these assumptions are likely to change over time as practices for decommissioning evolve.

2.8.7 An Outline Decommissioning Environmental Management Plan (DEMP), which will set out the general principles to be followed in the decommissioning of the Proposed Development, will also be produced as part of the DCO application. These measures, commitments and actions would be carried forward to a detailed DEMP.

2.8.8 It is expected that the Outline DEMP would include details regarding:

- arboricultural management;
- traffic management;
- materials management; and
- waste management.

2.8.9 The DEMP would be prepared and agreed with relevant authorities at the time of decommissioning, in advance of the commencement of decommissioning works and would include timescales and methods for transportation of materials. It is expected that the requirements of the DCO would commit to its production.

2.9 Detailed management plans

2.9.1 Several detailed management plans will be produced and submitted as standalone as part of the DCO application which will include measures across the Construction, Operation and Decommissioning phases. These include:

- Arboricultural Impact Assessment (AIA);
- LEMP; and
- Outline PRoW Management Plan.

Arboricultural Impact Assessment (AIA)

2.9.2 An Arboricultural Impact Assessment (AIA) will accompany the DCO application that will set out the impacts on trees, woodlands and hedges and set out the protection measures to be implemented during the construction phase, including activity supervision by a suitably qualified arboriculturist where appropriate. The AIA has been prepared for statutory consultation and is included as Appendix 7.6 of Chapter 7 Landscape and Visual.

Landscape and Ecology Management Plan

2.9.3 The management of the landscape and ecological features will be undertaken in accordance with a LEMP that will be secured via a requirement of the DCO.

Outline PRoW Management Plan

2.9.4 An Outline PRoW Management Plan will be submitted with the DCO application, to describe where PRoWs would be crossed by the Proposed Development and how PRoWs would be managed to ensure they remain safe to use, and disruption to users of the PRoW is minimised.

Bibliography

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