Frodsham Solar

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Chapter 2: The Proposed Development

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2.0 THE PROPOSED DEVELOPMENT

2.1 Introduction

2.1.1 This chapter provides an overview of the Proposed Development, setting out the Order Limits (also referred to as 'the Site'), the key components of the operational development, and the activities associated with the construction, operational and decommissioning phases of the works. The chapter also describes the design parameters used within the assessment.

2.1.2 The description of the Proposed Development provided in this chapter has been used to inform the environmental assessments which are detailed in the in **ES Vol 1: Chapter 5 to 12 [EN010153/DR/6.1]**.

2.1.3 As set out briefly in **ES Vol 1: Chapter 1.0 Introduction [EN010153/DR/6.1]**, the Proposed Development comprises a new ground-mounted solar energy generating station with a total capacity exceeding 50 megawatts and an associated on-site Battery Energy Storage System (BESS) on land at Frodsham Marsh, Frodsham, Cheshire West and Chester. The Proposed Development also includes the associated infrastructure for connection to the local electricity distribution network, as well as a private wire electricity connection that would provide the opportunity to supply renewable energy generated by the Proposed Development directly to nearby businesses.

2.1.4 The design life of the Proposed Development is 40 years, with decommissioning to commence 40 years after final commissioning.

2.1.5 This chapter is supported by the following appendices in **ES Vol 2 [EN010153/DR/6.2]**:

i) Appendix 2-1: Indicative Watercourse Crossing Schedule (inc. figures)
ii) Appendix 2-2: Indicative Construction Phasing and Resource Schedule

2.1.6 This chapter is supported by the following figures in **ES Vol 3 [EN010153/DR/6.3]**:

i) Figure 2-1: Indicative Construction Site Layout
ii) Figure 2-2: Indicative Operational Site Layout;
iii) Figure 2-3(a-e): Illustrative Environmental Masterplan;
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2.1.7 In addition to the above appendices and figures, the following outline management plans have been prepared to support the application and are referenced throughout the ES where these documents are used to control the impacts of the Proposed Development:

i) **Outline Construction Traffic Management Plan [EN010153/DR/7.4]**
ii) **Outline Construction Environmental Management Plan [EN010153/DR/7.5]**
iii) **Outline Operational Environmental Management Plan [EN010153/DR/7.6]**
iv) **Outline Decommissioning Environmental Management Plan [EN010153/DR/7.7]**
v) **Outline Battery Safety Management Plan [EN010153/DR/7.8]**
vi) **Outline Public Rights of Way Management Plan [EN010153/DR/7.9]**

vii) **Outline Soils Management Plan [EN010153/DR/7.10]**

viii) **Outline Skills, Supply Chain and Employment Plan [EN010153/DR/7.11]**

ix) **Outline Landscape and Ecological Management Plan [EN010153/DR/7.13]** which includes at **Appendix B** the **Outline Non Breeding Bird Mitigation Strategy (oNBBMS)**

2.2 The Order Limits

2.2.1 As the Proposed Development would have an electrical generating capacity in excess of 50MW it is defined as a Nationally Significant Infrastructure Project (NSIP) under S.14(1)(a) and S.15(2) of the Planning Act 2008[i], necessitating the submission of a Development Consent Order (DCO) application to the Secretary of State for the Department for Energy Security and Net Zero (the 'SoS'). Accordingly, the application boundary, which sets the maximum area of land potentially required for the Proposed Development, is referred to as the 'Order Limits'.

2.2.2 The Order Limits are illustrated on **ES Vol 3 Figure 1-1: Site Location [EN010153/DR/6.3]** and cover all land expected to be required for the construction, operation and maintenance, and decommissioning of the Proposed Development. This includes land required for both temporary and permanent uses. The entirety of the Order Limits fall within the administrative area of Cheshire West and Chester Council (CWaCC).

2.2.3 Identifying the Order Limits has been the subject of ongoing design, consultation, appraisal and assessment work that began with the site origination exercise (which is summarised in **ES Vol 1 Chapter 3**: **Alternatives and Design Evolution [EN010153/DR/6.1]**), and has continued with the EIA process to refine the area for development in accordance with the mitigation hierarchy.

2.2.4 As set out in **ES Vol 1: Chapter 1.0 Introduction [EN010153/DR/6.1]** there are a number of distinct development areas within the Order Limits which are referred to within this chapter. These are:

i) Solar Array Development Area (SADA) that would include solar photovoltaic (PV) modules and support frames, internal access tracks, cabling, inverters, transformers, the solar array substation (known as the 'Frodsham Solar Substation) and the BESS;
ii) Main Site Access route;

iii) SPEN Grid Connection linking Frodsham Solar Substation to the SP Energy Networks (SPEN) Frodsham Substation
iv) SPEN / National Grid Substation and access to the substation compound
v) Private Wire Connection to local businesses
vi) Non Breeding Bird Mitigation Area (NBBMA)
vii) Skylark Mitigation Area

2.2.5 These areas are defined within **ES Vol 1: Chapter 1.0 Introduction [EN010153/DR/6.1]** and illustrated on **ES Vol 3 Figure 1-2: Proposed Development Areas [EN010153/DR/6.3]**.

2.3 Rochdale Envelope and Design Parameters

2.3.1 The design of the Proposed Development is an ongoing iterative process which has responded to the outcomes of the EIA process and engagement with stakeholders, including members of the local community.

2.3.2 The technology associated with solar development is advancing rapidly, and it is anticipated that this technological progression will continue at pace over the coming years, as current research and development in the manufacturing sector yields new technologies. The design and construction contractor for the Proposed Development has also not been appointed. As such, the precise layout of the Proposed Development and equipment selection has not been finalised. It is therefore essential to provide a degree of flexibility within the DCO to allow the detailed design to react to these variables. This provides the opportunity for the most efficient scheme to be constructed at the point the project is implemented.

2.3.3 The Planning Inspectorate's Advice Note 9: 'Rochdale Envelope'[ii] ('Advice Note 9') provides guidance regarding the degree of flexibility that may be considered appropriate within an application for development consent under the Planning Act 2008. The advice note acknowledges that there may be aspects of the Proposed Development that are not yet fixed prior to the DCO being granted, and therefore, it may be necessary for the EIA to assess likely worst-case variations to ensure that all reasonably foreseeable likely significant environmental effects of the Proposed Development are assessed.

2.3.4 It is therefore necessary for the technical assessments to assess an 'envelope' within which the works will take place, defined using a parameter-based approach. As such, the DCO application and EIA is based upon maximum and, where relevant, minimum parameters and defined work areas where the types of development can take place. The parameters set out in this chapter, hereafter referred to as 'the Design Parameters' are based on industry knowledge and best practice such that a sufficient degree of flexibility is provided within the DCO. These parameters are considered in detail in this chapter and across the individual assessments to ensure the reasonable worst-case effects of the Proposed Development are assessed for each potential receptor. This ensures the ‘likely significant effects’ are identified.

2.3.5 The key elements of Advice Note 9 in relation to the Proposed Development are defined below:

i) The application should acknowledge the need for details of a project to evolve, within clearly defined parameters;
ii) The EIA should take account of the need for evolution within those parameters, and reflect the likely significance of such a flexible project in the ES;
iii) Within those defined parameters, the level of detail of the proposals must be sufficient to enable a proper assessment of the likely significant environmental effects and the identification of mitigation measures, if necessary, considering a range of possibilities: “*the assessment may conclude that a particular effect may fall within a fairly wide range. In assessing the ‘likely’ effects, it is entirely consistent with the objectives of the Directive to adopt a ‘worst case’ approach. Such an approach will then feed through into the mitigation measures envisaged. It is important that these should be adequate to deal with the worst case, to optimise the effects of the development on the environment”*; and
iv) It is for the decision maker in granting consent, to impose requirements to ensure that the process of evolution remains within the parameters applied for and assessed.

2.3.6 The flexibility afforded by the DCO would be controlled by the **Works Plans ES Vol 1: Chapter 1.0 Introduction [EN010153/DR/2.3]** (which will limit the spatial extent of the types of development), the Design Parameters set out within this Chapter, the **Design Principles** set out in section 3.0 of the **Design Approach Document [EN010153/DR/5.8]** and other certified documents and plans such as the **Outline Landscape and Ecological**

Management Plan [EN010153/DR/7.13] which have been submitted with the DCO application.

2.4 Key Components of the Proposed Development

Design Approach

2.4.1 Government guidance regarding the pre-application stage for NSIPs[iii] defines good design as follows:

"Good design is not simply about the look of a project; it is about the whole process of putting a project together so that it achieves the elements of good design including choice of location, vision, narrative, design principles and consultation programme.

Applicants should involve a diverse range of people including where appropriate, planners, environmental specialists, landscape architects, architects, engineers and community groups in informing the project vision, narrative, design principles, and project design process to support delivery of the outcomes of the project.

Applicants should explain how the design responds to the National Infrastructure Commission (NIC) design principles for national infrastructure: climate, people, places and value".

2.4.2 The DCO application is supported by a **Design Approach Document [EN010153/DR/5.8]** which explains the design process that has been followed for the Proposed Development. It sets out how the project has been designed to achieve the Design Vision for the Proposed Development, which is:

"To deliver a substantial amount of renewable energy to the electricity distribution network and directly to local businesses, to conserve and enhance the local environment, and to be a responsible neighbour to local people".

2.4.3 In order to achieve the Design Vision, a series of Design Principles (referred to in the PEIR as Design Objectives) were created early in the early stages of the project development. These principles have been influenced by feedback provided from the public engagement activities in Summer 2023 and subsequent dialogue with community organisations and statutory and non-statutory consultees, including the statutory consultation undertaken in Winter 2024 and workshops with the following bodies in January 2025:

i) Frodsham Town Council
ii) Cheshire Wildlife Trust
iii) BTO Wetland Bird Survey
iv) Cheshire and Wirral Ornithological Society
v) Festival of Walks
vi) Cycling North Cheshire
vii) Ramblers Association
viii) Cheshire West and Chester planning, landscape, ecology and public rights of way officers

2.4.4 As part of the process the Applicant invited officers at CWaCC to contribute to the Design Principles.

2.4.5 The following Design Principles have been used to guide and shape the approach to the design of the Proposed Development:

i) Principle 1: Renewable Energy - Delivery of a significant amount of affordable, renewable energy to support policy objectives and national targets for reducing carbon emissions to net zero by 2050.
ii) Principle 2: Landscape and Views - Develop the proposals in a manner sensitive to their landscape setting, reducing visual impacts from nearby properties, recreational routes and key viewpoints
iii) Principle 3: Biodiversity and Green Infrastructure - Protect and enhance green infrastructure within the Order Limits and in doing so create the conditions for enhanced biodiversity locally
iv) Principle 4: Public Access and Recreation - Retain, enhance and encourage public access through the life of the proposals, including during construction and decommissioning where feasible.
v) Principle 5: Flooding - Safeguard the surrounding hydrological systems, ensure the Proposed Development is resilient to flooding and will not

increase flood risk elsewhere, taking account of the impacts of climate change.

vi) Principle 6: Cultural Heritage: Develop the proposals so that they are sensitive to the presence of heritage assets, their settings, and the wider historic environment.

vii) Principle 7: Amenity - Develop all elements of the proposals, including during construction and decommissioning so that they do not adversely affect the amenity or safety of local residents and users of public rights of way.

viii) Principle 8: Traffic and Transport - Vehicular access to the Order Limits will be safe and will not adversely affect the local highways network, or the local public rights of way network.

2.4.6 More detailed design measures have then been developed to sit beneath the Design Principles, these are set out in the **Design Approach Document [EN010153/DR/5.8].**

Work Packages

2.4.7 The **draft DCO [EN010153/DR/3.1]** which accompanies the application divides the Proposed Development into a series of 'Work Packages'. The work numbers for those packages are identified below and are referred to throughout this ES.

2.4.8 The Proposed Development has been divided into the following Work Packages, or 'Works' as follows:

i) Work No. 1 – a ground mounted solar photovoltaic generating station;

ii) Work No. 2 – a Battery Energy Storage System (BESS);

iii) Work No. 3 – an on-site substation (Frodsham Solar Substation);

iv) Work No. 4a – an electrical connection from Frodsham Solar Substation (Work No. 3) to Frodsham SPEN Substation including

v) Work No 4b - a direct private wire connection from Frodsham Solar Substation (Work No. 3) to nearby businesses;

vi) Work No. 5 - works including electrical cables and communication cables connecting Work No. 1 to Work No. 3; Work No. 1 to Work No. 2; and, Work No. 2 to Work No. 3;

vii) Work No. 6a - works to create, enhance and maintain green infrastructure;

viii) Work No. 6b - works to create skylark plots to provide skylark foraging habitat;

ix) Work No. 6c – the creation and management of a Non Breeding Bird Mitigation Area.;

x) Work No. 7 - construction and decommissioning compounds; and

xi) Work No. 8 – works for the improvement, maintenance, repair and use of existing streets, private tracks, public rights of way and access roads.

2.4.9 The Proposed Development description also sets out the elements of work that are ancillary to Works No 1 – 8, which are required to facilitate their construction and enable the ongoing operation and maintenance of the Proposed Development.

2.4.10 The Indicative Construction Site Layout (including the compound and access track layout) is illustrated on **ES Vol 3 Figure 2-1: Indicative Construction Site Layout [EN010153/DR/6.3]**, and the Indicative Operational Site Layout is illustrated on **ES Vol 3 Figure 2-2: Indicative Construction Site Layout [EN010153/DR/6.3]**. These provide illustrative layouts associated with the above Works Packages and take account of the Design Parameters and Design Principles described in this chapter. As set out previously, the final design may be different to that which has been illustrated on Figures 2-1 and 2-2. However, where possible the figures illustrate a reasonable worst-case layout e.g. they maximise the development footprint based on the parameters described within this chapter. It should be noted that Figures 2-1 and 2-2 focus on the SADA and the SPEN Grid Connection. Development within the NBBMA is described under Work No. 6c and the indicative proposals for this area are shown on **ES Vol 3 Figure 2-3(a-e): Illustrative Environmental Masterplan [EN010153/DR/6.3]**, with details contained in **ES Vol 1 Chapter**

8.0: Ornithology [EN010153/DR/6.1] and the Outline LEMP [EN010153/DR/7.13]. The extent of the Main Site Access route and the underground Private Wire Connection to local businesses is illustrated on Figure 1-2. No construction works are proposed along the access road leading to the SPEN / National Gird Substation.

2.4.11 Where necessary, and in order to provide a full consideration of reasonable worst-case effects, the technical chapters describe how variations within the design, which accord with the parameters set out, could result in a different magnitude of effect.

2.4.12 The following sections summarise the key components of each Work Package, along with the relevant Design Parameters that have been assessed within this ES. Where relevant methods involved in the construction of the Works are described.

Work No. 1 – a ground mounted solar photovoltaic generating station

2.4.13 Work No. 1 comprises a ground mounted solar photovoltaic generating station, consisting of:

i) solar PV modules fitted to mounting structures and associated foundations;
ii) inverters;
iii) transformers;
iv) switchgear; and
v) electrical and communication cables.

Solar PV Modules and Mounting Structures

2.4.14 The Proposed Development comprises the installation of solar PV modules which convert sunlight into direct current (DC) electricity. Solar PV modules consist of a series of photovoltaic cells beneath a layer of toughened glass. Solar PV modules are also often referred to as solar PV panels. Multiple solar PV models are connected together to form a solar PV array. The Proposed

Development comprises a number of solar PV array areas, these areas are labelled on **ES Vol Figure 2-1: Indicative Construction Site Layout [EN010153/DR/7.13]**.

2.4.15 It is possible to install the solar PV models as either 'fixed' arrays, where the angle of the solar PV models is fixed, or 'tracker' arrays, where the angle of the solar PV models can change to follow the sun at different times of the year. The Proposed Development would use 'fixed' arrays.

2.4.16 The solar PV models are installed on support frame mounting structures which would be arranged into rows on an east-west axis facing south, typically set approximately 3 to 4m apart. The maximum height of the solar PV models would be 4.0m above existing ground levels (AEGL), and the minimum height along the bottom edge of the solar PV models would typically be 0.8m above existing ground levels.

2.4.17 As described in **ES Vol 1 Chapter 1.0: Introduction [EN010153/DR/6.1]**, parts of the Site lie within Flood Zone 3a. Flood risk modelling (see **ES Vol 2 Appendix 9-1: Flood Risk Assessment [EN010153/DR/6.2]**) has been undertaken to establish a flooding design level, above which key items of infrastructure would be raised. All electrical infrastructure within Flood Zone 3 (Solar PV Array Areas B01– B18, C01 – C06 as shown on **ES Vol 3 Figure 2-2: Indicative Operational Site Layout [EN010153/DR/6.3]**) which would be vulnerable to flooding would be raised to a height of 6.52m AOD[1]. This includes the Power Conversion Units (PCUs), standalone Inverters and Transformers, String Inverters and Junction Boxes. The base of the modules would therefore be raised to a height of approximately 2.0m above ground level, raising all of the electrical infrastructure above the design flood level and therefore enabling the Proposed Development to be resilient in the event

[1] The base height has been set as relative to Ordnance Datum to reflect the findings of the flood risk modelling – refer to **ES Vol 1 Chapter 2.0: Proposed Development [EN010153/DR/6.1]** and **ES Vol 2 Appendix 9-1: Flood Risk Assessment [EN010153/DR/6.2]**. As the Site is relatively level this equates to an approximate height above ground level, which has also been stated.

of a ‘design’ flood. The maximum height of the solar PV modules in the Flood Zone 3 (Solar PV Array Areas B01-– B18, C01 – C06 **ES Vol 3 Figure 2-2: Indicative Operational Site Layout [EN010153/DR/6.3]**) would be 4.0m above ground. In the other areas of the Site the maximum height of the panels would be 3.5m above ground level.

2.4.18 In the scenario where an extreme flood event is predicted to occur, which would lead to flooding across the aforementioned areas of the Site, then the electrical infrastructure would be capable of continuing to operate as the infrastructure has been raised above the design flood level. However, the scheme would be designed to allow the area of the Site within Flood Zone 3 (to the east of Brook Furlong) to be electrically isolated should this be considered necessary.

2.4.19 The solar PV module support frame structures would likely consist of uprights and cross bars. There are three principal types of piled foundation used in solar development: driven, screw and helical piles. The precise method used would depend on detailed geotechnical investigation. However, all three would have a pile depth of 1.5m to 5.0m below ground level (BGL).

2.4.20 Driven piles are typically used in competent cohesive soils. Unsuitable conditions include shallow bedrock or regions of frequent obstructions (e.g. boulders).

2.4.21 Ground screws are steel shafts with a shallow threaded profile welded along its external length. The screw profile provides additional shear resistance and so are suitable for use in less competent soils. They can be screwed into the ground using excavators or other equipment using auger attachments.

2.4.22 Helical piles are steel shafts with a one or more large split discs/helical plates welded close to their pointed ends/along their length. They are designed so that when the shaft is rotated, the split disc/helical plate cuts into the ground as the pile descends into the strata, similar to a screw pile. Helical piles are often used in poorer ground conditions which are not very cohesive, so the mass of soil reacting against the split disc/helical plate increases pullout resistance.

2.4.23 All three methods do not generate significant arisings and are not considered to represent a significant geo-environmental risk as they do not introduce a new significant pathway for vertical or lateral transmission of contamination.

2.4.24 If intrusive piling techniques are deemed unsuitable due to ground conditions or presence of below ground obstructions / utilities, surface mounted solar PV module support frames would be used. In these locations the piled support posts would be replaced by pre-fabricated concrete blocks set directly on the topsoil without excavation, or shallow cast in-situ foundations, on which mounting posts would be fixed.

2.4.25 Once the founding posts are installed, the rest of the solar PV module support frame is fitted to the posts to create angled support tables ready for solar PV module installation.

2.4.26 The solar PV modules would be mounted on the pre-constructed support frames. The individual solar PV modules would typically comprise dark blue, dark grey or black photovoltaic cells. The Proposed Development would use monofacial or bifacial solar PV modules with anti-reflective coating. A monofacial solar PV module only absorbs sunlight from the front surface of the solar PV module, which generally tends to be direct sunlight. A bifacial solar PV module features solar cells on both sides. This enables electricity to be generated from diffuse sunlight that is reflected off the ground onto the back surface of the solar PV module. However, bifacial solar PV modules are more expensive to manufacture.

2.4.27 PV technologies are evolving and it is not possible to specify the precise solar PV module type, as this will depend on the competitive procurement process and the best technology available at the time of construction. However, **ES Vol 3 Figure 2-5a: Indicative Solar PV Modules [EN010153/DR/6.3]** presents an indicative section drawing of the solar PV modules, with the typical mounting structure posts shown. Image 2-1 below provides an illustration of a typical solar PV module configuration.

Image 2-1: Illustrative solar PV module (monofacial) on a mounting structure.

2.4.28 The layout of the SADA has been influenced by a number of factors including environmental features across the Site and the presence of utilities (described in **ES Vol 1 Chapter 1.0**: **Introduction [EN010153/DR/6.1]**) which have required specific easements to be applied.

2.4.29 In addition to the utility easements, which are described further in Section 2.5 below, the following buffers would be adopted where practicable, secured via the **oLEMP [EN010153/DR/7.13].** These buffers have been applied to the indicative layout.

i) A 10m buffer between fencing surrounding solar PV modules and non-tidal watercourses;
ii) An 8 m buffer surrounding retained ponds and reedbeds;
iii) A 16m buffer between fencing surrounding solar PV modules and tidal watercourse defence structures;
iv) A 6m buffer between fencing surrounding solar PV modules and hedgerows / areas of substantial vegetation;

v) A 10m buffer between fencing surrounding solar PV modules and public rights of way; and
vi) A 10m buffer from the toe of existing earth bunds surrounding the MSC Dredging Deposit Ground cells to safeguard the stability of these structures.

2.4.30 The majority of the solar PV modules would be orientated with an azimuth angle of 180 degrees i.e. facing directly south. However, in order to minimise the potential for reflections to affect drivers on the M56 motorway, the azimuth angle of the solar PV modules has been adjusted in some of the Solar PV Array Areas to 200 degrees (B15.2 and B15.3[2]), 205 degrees (C02.1, C02.2, C04 and C06[2]) and 210 degrees (B18.1 and B18.2[2]). It is also proposed to use an anti-reflective coating on the modules, which is a common approach taken to reduce the potential for reflections. The Applicant has been engaging with National Highways and it has agreed the proposed changes to the panel angles would provide suitable mitigation to road users.

2.4.31 The tilt or slope of the solar PV modules will be set to maximise the energy production from the array. The modules would be constructed at a fixed angle of 10 to 35 degrees from horizontal. However, the angle of some of the panels will be set to a specific angle to ensure that there are no unacceptable effects on aviation receptors – see Table 2-1 below.

2.4.32 **ES Vol 2 Appendix 4-3: Glint and Glare Assessment [EN010153/DR/6.2]** sets out the assessment of effects on road users, aviation receptors and other potentially sensitive receptors to glint and glare and how this has influenced the design.

2.4.33 The modules would be set at a minimum height of 0.8m above ground level to facilitate sheep grazing, the preferred method to manage grassland within the solar PV array areas. Sheep grazing on solar farms is successfully used

[2] *Refer to Figure 2-2 Indicative Operational Site Layout* ***[EN010153/DR/6.3]***

in the UK and carries with it multiple benefits such as maintaining agricultural output from the land, soil health improvement and providing appropriate stocking levels are maintained, biodiversity benefits. Sheep can move safely between and under the solar PV modules, and shelter under them from sun or rain.

2.4.34 Table 2-1 sets out the design parameters for the solar PV modules and mounting structures used within the technical assessments.

Table 2-1: Solar PV Modules and Mounting Structures Design Parameters

Component of Proposed Development	Parameter Type	Applicable Design Parameter
Solar PV Modules and mounting structure	Scale	The maximum height of the highest part of the solar PV modules would be 4m AEGL within Solar PV Array Areas B01 – B018, and C01 – C06 and 3.5m AEGL within Solar PV Array Areas A01 – A06 (see ***ES Vol 3 Figure 2-1***)
	Scale	The minimum height of the lowest part of the PV modules would be 0.8m AEGL. Within Solar PV Array Areas (see ***ES Vol 3 Figure 2-1***) B01 – B018, and C01 – C06 the minimum height of the lowest part of the PV modules would be set at 6.52mAOD.
	Design	The solar PV modules will slope towards the south, at a fixed angle of 10 to 35 degrees from horizontal. The solar PV modules within Solar PV Array Areas A02, A04, and the western section of A05 will slope towards the south at a fixed angle that differs by +/- five degrees from the angle of the panels in Areas A01, A03, A06, and the eastern extent of A05. (see ***ES Vol 3 Figure 2-1****for Solar PV Array Areas and* ***ES Vol 2 Appendix 4-3: Glint and Glare Assessment [EN010153/DR/6.2]*** *in relation slope of panels).*
	Design	The solar PV modules would be orientated with an azimuth angle of between 180° and 210°. The angle would be up to 200° within Solar PV Array Areas B15.2, B15.3 and C05; 205° within Solar PV Array Areas C02, C04, C06; and 210° within Solar PV Array Area B18 (see ***ES Vol 3 Figure 2-1***). In

Component of Proposed Development	Parameter Type	Applicable Design Parameter
		the remaining Solar PV Array Areas the solar PV modules would be orientated with an azimuth angle of between 180°.
	Design	The solar PV modules would be monofacial or bifacial.
	Design	The solar PV modules will have an anti-reflective coating.
	Design	The mounting structure for the solar PV modules would be a metal frame.
	Scale	The minimum spacing gap between consecutive rows of solar PV modules would be 2m.
	Design	The mounting structures will either be piled into the ground or fixed to concrete footings. The maximum depth of concrete footings or piles would be 5m BGL existing.

Inverters

2.4.35 Inverters convert the direct current (DC) electricity produced by the solar PV modules into alternating current (AC), enabling the electricity to be exported to the electricity distribution network.

2.4.36 Within the PV industry, there are typically two approaches to inverters: smaller decentralised inverter units, referred to as String Inverters, that link to separate standalone transformers and switchgear units, or Centralised Inverters which are co-located with transformer units and switchgear, often referred to as Power Conversion Units (PCUs).

2.4.37 String inverters are typically attached to the mounting frames of solar PV modules and are connected together by the wiring from multiple solar PV modules for conversion to AC. They are distributed across the solar arrays, generally alongside site tracks at the end of rows of solar PV modules. They have the advantage of being relatively small and easy to mount onto the solar PV module support frames. For a scheme of the scale proposed it is envisaged that up to 520 string inverters would be required.

2.4.38 **ES Vol 3 Figure 2-5b: Indicative String Inverter [EN010153/DR/6.3]** presents an indicative drawing of a string inverter. Image 2-2 below provides an illustration of a typical string inverter.

Image 2-2: Illustrative String inverter.

Transformers

2.4.39 Transformers are used to increase the voltage of the generated electricity before it reaches the on-site substation. As set out above, separate standalone transformers are required when a project utilises string inverters. The standalone transformers are typically mounted on a ‘skid’ or housed in containers that also include switchgear. Switchgear include a range of electrical switches, fuses, and breakers that control, protect and isolate the electrical circuits and equipment.

2.4.40 Standalone transformers would be installed on a concrete foundation slab or, if ground conditions require, on a series of concrete pile foundations to a depth of up to 4m BGL.

2.4.41 Where possible transformers would be installed outside the area of the Site vulnerable to flooding. However, it will still be necessary to locate some transformers within the flood risk zone for operational purposes. In these locations the equipment would be raised above the design flood level of 6.52mAOD. To facilitate this, the concrete pile foundations would be extended to the flood design level.

2.4.42 Image 2-3 below provides an illustration of a standalone Transformer Station.

Image 2-3: Illustrative Standalone Transformer Station.

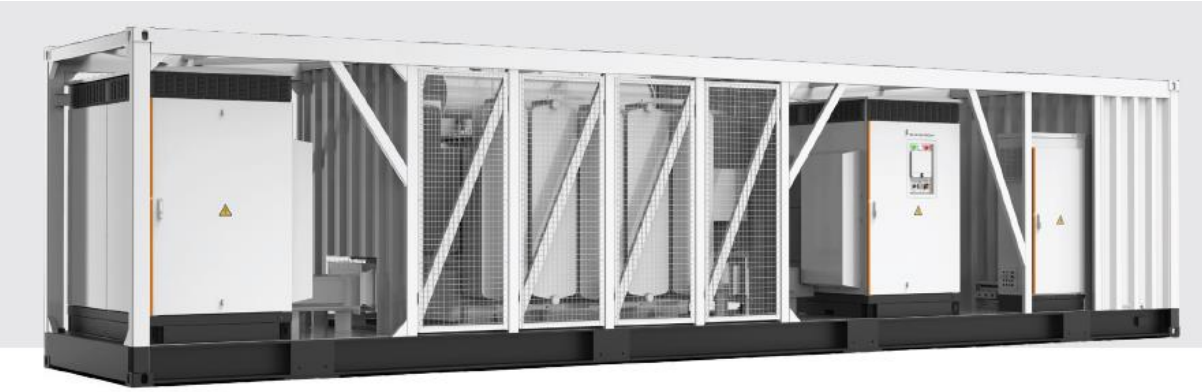
Centralised Inverters / Power Conversion Units (PCUs)

2.4.43 Centralised Inverters service a greater number of solar PV modules and so are larger than string inverters. Centralised inverters would be mounted within a container type housing / on a metal ‘skid’, along with a transformer unit and associated switch gear. The three combined items of plant are known as a Power Conversion Unit (PCU).

2.4.44 As with a standalone transformer, a PCU would be installed on a concrete foundation slab or, if ground conditions require, on a series of concrete pile foundations. The length of which would vary depending on whether the PCU is located within or outside the flood zone.

2.4.45 An indicative drawing of a PCU is shown on **ES Vol 3 Figure 2-5c: Indicative Power Conversion Unit (PCU) [EN010153/DR/6.3]**. Image 2-4 below provides an illustration of a PCU.

Image 2-4: Illustrative PCU



2.4.46 The key differences between string inverters and centralised inverters are that:

i) String inverters can be mounted directly to the solar PV module support frames and do not require foundations– centralised inverters do require foundations;
ii) String inverters are more expensive to install than centralised inverter;
iii) String inverters can be more efficient and can result in lower downtime losses; and
iv) String inverters have a lower sound power level – centralised inverters have a higher sound power level.

2.4.47 The Applicant has not decided on the type of technology to be utilised in the Proposed Development, with a final decision expected to be made at the detailed design stage following a grant of development consent. This will enable the Applicant to select the most efficient and economic technology at the time. As such, the assessments in this ES have accounted for both inverter options to assess the 'worst case' scenario relevant to each topic.

2.4.48 The Indicative Operational Layout shown on the **ES Vol 3 Figure 2-2: Indicative Operational Site Layout [EN010153/DR/6.3]** illustrates the use of centralised inverters within PCUs.

Table 2-2: Inverter, Transformer and Switchgear Design Parameters

Component of Proposed Development	Parameter Type	Applicable Design Parameter
String Inverters	Design	String inverters mounted to the rear of solar PV modules on the solar PV module support frames.
	Scale	For string inverters, the maximum parameters would be 1.5m length x 1m high x 0.5m deep.
	Design	Mounted to sit a minimum height of 0.8m AEGL. Within Solar PV Array Areas (see ***ES Vol 3 Figure 2-1***) B01 – B018, and C01 – C06 the minimum height of the lowest part of the string inverters would be 6.52m AOD.
Transformers/d Switchgear and Containerised Inverters (if not combined into PCU)	Design	Containerised standalone transformer/ switchgear and standalone inverter containers
	Scale	Max footprint of 6.5m by 2.5m and a max height of 3m Within Solar PV Array Areas (see ***ES Vol 3 Figure 2-1***) B01 – B018, and C01 – C06 the floor of the electrical units supporting the transformers / switchgear and inverters would be no lower than 6.52m AOD.
	Design	The maximum depth of foundations and any below ground components would be 4m
Combined Power Conversion Unit (PCU) comprising inverter, transformer and switchgear	Design	Combined PCU within a single housing comprising a combination of an inverter, transformer and switchgear.
	Scale	Max footprint of 12.2m by 2.5m and a max height of 3.0m Within Solar PV Array Areas (see ***ES Vol 3 Figure 2-1***) B01 – B018, and C01 – C06 the floor of the PCU would be no lower than 6.52m AOD.

	Design	The maximum depth of foundations and any below ground components would be 4m.

Low Voltage Cabling

2.4.49 Low Voltage (LV) Cabling (carrying 1.0kV or less) would be used to connect solar PV modules together into 'strings'. LV cables would then connect the solar PV strings to the selected inverter system i.e. either string inverters or centralised inverters. Where string inverters are employed, LV cabling would link the inverters to the standalone transformers. Medium voltage (MV) cables (carrying 33kV) would link the transformers to the Frodsham Solar Substation and BESS and are described in Work No. 5 below.

2.4.50 Combiner Boxes may be used to combine LV cabling from multiple PV strings to reduce the cabling required. Combiner boxes would have a maximum dimension of 0.55m x 0.65m x 0.26m and would be installed onto the PV mounting structure.

2.4.51 The LV cabling would typically be attached to the rear of the solar PV modules or laid in shallow trenches. A typical cross-section through a buried LV cabling trench is shown on **ES Vol 3 Figure 2-5h: Indicative Cable Trench Cross Sections [EN010153/DR/6.3]**.

2.4.52 Inverters convert the DC electricity produced by the solar PV modules into alternating current (AC) that can be exported to the electricity distribution network.

Table 2-3: Low Voltage Cabling Design Parameters

Component of Proposed Development	Parameter Type	Applicable Design Parameter
Onsite cabling (between PV modules and inverters)	Design	Low voltage onsite electrical cabling is required to connect the PV modules to inverters (typically 1.5/1.8 kV cables) and the inverters to the transformers onsite (typically 0.6/1 kV cables). Cabling would be above ground level between the PV modules. These would be fixed to the mounting

		structure along the row of racks. Cabling between the PV modules and inverters would be buried within underground trenches.
	Scale	Maximum dimensions of underground trenches would be 1.2m deep and 1.2m wide.
Combiner boxes	Scale	The maximum parameters would be 0.55m x 0.65m x 0.26m and would be installed onto the solar PV module mounting structure

Work No. 2 – a Battery Energy Storage System

2.4.53 Work No. 2 comprises a Battery Energy Storage System (BESS), consisting of:

i) battery storage units (BSU);
ii) transformer / power conversion system (PCS) units and ancillary equipment;
iii) switchgear and control room;
iv) reinforced concrete foundation slab;
v) concrete piling;
vi) car parking and access roads;
vii) works for the provision of security and monitoring measures such as CCTV columns, cameras, lighting columns and lighting, weather stations, communication infrastructure, perimeter fencing; and
viii) drainage infrastructure including bunds and firewater storage and suppression systems.

2.4.54 The BESS would be an integral element of the Proposed Development, used to store electricity generated by the solar PV modules at times of low demand and release the electricity at times of peak demand. BESSs are needed for renewable electricity generating systems such as wind and solar due to their weather dependency and intermittent nature of their electricity generation.

2.4.55 In addition to its function as an essential part of the Proposed Development, the BESS would also be available for grid-balancing services. By importing excess electricity from the grid and storing it, the BESS would be capable of capturing electricity that would otherwise be lost / unutilised. During situations when generating stations are interrupted, the BESS can also be used to bridge the gap in production, thus avoiding potential blackouts. It should be noted that the UK electricity network is interconnected and issues in one geographic location can have far reaching implications on the network. Accordingly, BESS offer additional capacity to deal with system stress and any variations in grid frequency at both a local and national level.

2.4.56 The BESS would be constructed within a compound located centrally within the Site. Two possible compound locations are proposed, illustrated on **ES Vol 3 Figure 2-2: Indicative Operational Site Layout [EN010153/DR/6.3]**. Both are located on the former MSC Dredging Deposit Ground cells which are raised to approximately 7m AOD. As described within **ES Vol 1 Chapter 4: Alternatives and Design Evolution [EN010153/DR/6.3]**, these areas have been selected as they are not located in an area at risk of flooding and they are therefore sequentially preferable to other locations in the east of the Site, which would be closer to the SPEN substation. The location has also been informed by modelling undertaken to ensure the development does not present unacceptable risks to human health or other infrastructure, as set out the Outline Battery Safety Management Plan **[EN010153/DR/7.8]**.

2.4.57 Only one of the two options illustrated would be constructed. It is proposed that solar PV modules would be erected on the area where the BESS compound is not developed. The decision of which location to bring forward as the BESS compound would be determined during the detailed design phase.

2.4.58 The two locations are relatively close to one another, as such the environmental effects of developing in one location or the other are likely to be very similar. Nonetheless, the technical assessments within the ES have considered both locations, and both are deemed to be feasible. Where differences in levels of effect are material, these have been reported.

BESS Compound

2.4.59 The BESS would be located within a fenced compound, which would be separate to the Frodsham Solar Substation Compound. The compound would comprise a hard surfaced internal access road and a series of concrete hardstanding plinths on which plant and equipment would be mounted. Loose stone, laid on an impermeable geomembrane, would surround the access road and concrete equipment plinths. Palisade style fencing up to 2.4m in height would surround the compound.

2.4.60 In order to provide safe access and necessary circulation around the compound by emergency vehicles, there would be more than one point of access to the BESS, as illustrated on **ES Vol 3 Figure 2-5d: Indicative BESS and Frodsham Substation Layout [EN010153/DR/6.3]**. A circulatory road would also be provided within the compound. The internal roads to the BESS would be constructed of tarmac, concrete or similar to allow for heavier vehicles during construction, and safe access for fire services in emergency situations.

2.4.61 The National Fire Chiefs Councill (NFCC) guidance for BESS notes that consideration should be given within the design to the management of water run-off such that in an emergency situation, where polluted water may run-off from the facility this can be safely contained and treated, rather than risking pollution of groundwater or local watercourses.

2.4.62 In normal operation the stoned areas of the compound would allow rainwater to be captured, attenuated to a greenfield runoff rate and then drain to a nearby watercourse. In an emergency where firefighting water was required, a valve would be automatically engaged to isolate the compound and prevent any run-off draining from the Site.

2.4.63 The BESS compound design would include a dedicated pipe network which would enable firewater from an affected Battery Storage Unit to be piped to a dedicated firewater collection lagoon. During a firefighting event, the valve from the lagoon would be shut and firewater held, tested and either removed from Site via tanker to a suitable disposal / treatment facility, or treated onsite and reused as firewater provision. The lagoon and drainage system would be cleaned before the valve from the firewater lagoon is reopened.

2.4.64 Lighting would be provided for security purposes and for maintenance undertaken in periods of low light. The lighting would not be switched on routinely and would be operated using infrared motion detectors or switched on manually for maintenance purposes. Further information on lighting and security is provided below.

2.4.65 An indicative layout of the BESS compound is shown on **ES Vol 3 Figure 2-5d: Indicative BESS and Frodsham Substation Layout [EN010153/DR/6.3].**

Battery Storage Units and Transformer / Inverter Containers

2.4.66 Battery storage is a developing market and the most economic size of the Battery Storage Units (BSUs) at the point the Proposed Development is constructed is uncertain. The Proposed Development has been based on a peak output of 100MW per hour and a storage capacity of 400MWh using containerised units. This means the proposed BESS could export its maximum power (100 MW) for 4 hours to the grid. Once fully depleted, the BESS would take 4 hours at full import power rate to reach full state of charge. The optimal specification for the BESS would be informed by market conditions at the point of detailed design. The indicative design assumes 188 BSUs.

2.4.67 The BSUs are containers not dissimilar in size and appearance to shipping containers. The BSUs are likely to contain lithium-ion battery modules along with control and monitoring systems, fire suppression systems, and cabling. A Heating, Ventilation and Air Conditioning (HVAC) or liquid cooling system would be integrated within the containers to manage the internal temperature of each BSU.

2.4.68 The chemistry of the lithium-ion battery modules has not yet been fixed and is unlikely to be fixed as part of the application for development consent. The final decision on the chemistry of the battery modules would be made at the procurement stage based on the safest, most efficient, and most economic technology available on the market at the time. At this stage it is reasonable to assume that Lithium-Iron-Phosphate (LFP) batteries would be used as they have a high thermal runaway threshold and therefore provide optimum safety. This chemistry has therefore been selected for the purposes of assessment.

2.4.69 An internal fire suppression system would be built into the interior of each battery container unit with detection and automatic initiation. It would be water-based (sprinkler or mist system), or inert gas delivery system. This is described in further detail below.

2.4.70 Each BSU would be connected to a transformer Power Conversion System (PCS). The PCS is used to convert power between the DC battery system and the AC line which import/exports electricity to the BSU. The transformer would step up the voltage of the electricity to the required voltage for the BSU. The PCS/transformer unit is required for power to flow both ways, to charge and discharge the BSU safely. Multiple BSUs would be connected to each PCS/transformer unit. The indicative layout used for the ES assumes eight BSUs would be connected to each PCS/transformer unit.

2.4.71 Each BSU and PCS/transformer unit would be located on a concrete slab foundation or a concrete piled foundation, depending on ground conditions. The foundation methods would be decided at the detailed design stage. Piles would be up to a maximum of 4m bgl.

2.4.72 An indicative drawing of a BSU and associated PCS/transformer unit is shown on **ES Vol 3 Figure 2-5f: Indicative BESS Container and PCS / Transformer Unit [EN010153/DR/6.3]**. Image 2-5 below provides an illustration of a typical BSU and PCS/transformer unit.

Image 2-5: Illustrative Battery Storage Unit (top) and Power Conversion System (bottom)

Switchgear / Control Building

2.4.73 The compound would also contain a switchgear / control building. This would contain all the necessary monitoring and telemetry equipment to enable the BESS to be operated. It would contain the necessary electrical disconnect switches, fuses, and circuit breakers used to control, protect, and isolate electrical equipment.

Fire Suppression System

2.4.74 A comprehensive fire risk management strategy would be developed at the detailed design stage for the BESS in liaison with Chesire Fire and Rescue and in line with National Fire Chiefs Council's (NFCC) recommendations. The key principles of this strategy are set out in the **Outline BESS Battery Safety Management Plan [EN010153/DR/7.8]**. A summary of anticipated site-wide fire safety provisions are as follows:

i) The BESS would be designed, selected and installed in accordance with international guidance, good practice, and related standards.
ii) Risk assessments would be carried out for the entire system and elements across the project lifecycle.
iii) Separation distances between components would be selected to minimise the chance of fire spread based on best practice.
iv) All equipment would be monitored, maintained, and operated in accordance with manufacturer instructions.
v) A 24h monitoring system for the BESS would be in place and would automatically alert the local fire authority in the event of an incident.
vi) Emergency plans with credible plant failure scenarios would be developed in consultation with the local fire authority.

2.4.75 Each BSU would have an integrated cooling system. The methods employed can vary depending on the manufacturer, but a liquid cooling system using 50% ethylene glycol aqueous solution and a bi-directional flow to enhance uniform heat dissipation is envisaged.

2.4.76 In terms of separation between units, the configuration of the BSU would be determined by the BESS supplier. The written advice is under regular review, and distances between storage containers can vary from 2.0m to 7.0m. However, industry guidance for the type of system envisaged indicates a separation distance of 3.0m is a common approach to finding an optimal balance between footprint reduction, fire safety and O&M activities.

2.4.77 The measures to suppress fire would depend on the type of BESS that is selected and so the precise details would be determined at the detailed design stage. However, guidance has been published by the National Fire Chiefs Council (NFCC) on the design and layout of BESS which includes a recommendation that an on-site water supply is provided in the event of a fire. The recommendation is that the on-site water supply should be capable of delivering no less than 1,900 litres per minute for at least two hours (a total of 228,000 litres). Following initial discussions with Cheshire Fire and Rescue Service it was determined that on-site water storage tanks would be provided to meet this need.

2.4.78 There are two water storage tanks proposed and capable of storing a minimum of 228,000 litres of water. The tanks would be located in close proximity to the points of access into the BESS.

Table 2-4: Battery Energy Storage System Design Parameters

Work No. 2 - works in connection with a Battery Energy Storage System (BESS) including **a. battery storage units (BSU);** **b. transformer / power conversion system (PCS) units and ancillary equipment;** **c. switchgear and control room;** **d. reinforced concrete foundation slab;** **e. concrete piling;** **f. car parking and access roads;** **g. works for the provision of security and monitoring measures such as CCTV columns, cameras, lighting columns and lighting, weather stations, communication infrastructure, perimeter fencing; and** **h. drainage infrastructure including bunds; and** **i. firewater storage and suppression systems.**		
Battery Energy Storage System (BESS) compound	Scale	The BESS compound will include up to a maximum 200 battery storage containers, 25 transformer / power conversion system (PCS) units, switchgear room, firewater storage tank or tanks and ancillary infrastructure including access tracks and parking.
	Scale	No component of the BESS compound will exceed 4.5m in height AEGL.
Battery Storage Units	Scale	Dimensions of each BSU will have a maximum footprint of 12.5 m by 3.5 m and a maximum height of 3 m.
Transformer / power conversion system (PCS)	Scale	Dimensions of transformer / power conversion systems (PCS) unit will have a maximum footprint of 12.5 m by 3.5 m and a maximum height of 3 m.
Switchgear and Control Room	Scale	Dimensions of the switchgear room will have a maximum footprint of 20 m x 4.5 m and a maximum height of 3 m.

Fire suppression system	Scale	The BESS will incorporate fire detection and suppression measures including adequate provision for water storage to provide a minimum supply of 1,900 litres per minute for 2 hours. This may comprise tanks up to 4.5m in height.
Foundations	Design	The foundations for structures within the BESS compound will comprise a concrete base or monolith plinth with a maximum depth of 4m.
Onsite cabling (between battery containers and inverters)	Design	Cabling between batteries and inverters would be above ground in cable trays or laid in an underground trench.
	Scale	Maximum dimensions of underground trenches would be 1.2m deep and 1.2m wide.

Work No. 3 – an on-site substation (Frodsham Solar Substation)

2.4.79 Work No. 3 comprises an on-site substation referred to as the Frodsham Solar Substation, consisting of:

i) substation;
ii) switch room buildings;
iii) electrical control equipment;
iv) control building;
v) storage areas;
vi) welfare facilities;
vii) offices;
viii) workshop;
ix) store;
x) car parking and access roads;
xi) works for the provision of security and monitoring measures such as CCTV columns, cameras, lighting columns and lighting, weather stations, communication infrastructure, perimeter fencing; and
xii) drainage infrastructure including bunds and firewater storage and suppression systems.

2.4.80 The Frodsham Solar Substation is an essential element of the Proposed Development, used to control and operate the solar PV arrays, and to step up the voltage from the solar PV transformer stations / PCUs (33 kV) to the voltage at the SPEN Substation (132 kV), which is the Proposed Development's point of connection.

2.4.81 The Frodsham Solar Substation would be split into two sections / feeder bays: one to facilitate connection to the SPEN Frodsham Substation (132 kV), which is the Proposed Development's point of connection to the electricity distribution network; and a second section to provide for the proposed private wire, facilitating a future connection to nearby businesses.

2.4.82 The Frodsham Solar Substation would be located adjacent to the BESS. As with the BESS, two potential locations are proposed, as illustrated on **ES Vol 3 Figure 2-2: Indicative Operational Site Layout [EN010153/DR/6.3]**. Only one of these locations would be constructed. It is proposed that solar PV modules would be erected on the land associated with the option not taken forward. The decision of which location to bring forward would be determined during the detailed design phase.

2.4.83 The substation compound would comprise a hard surfaced internal access road and a series of concrete hardstanding plinths on which plant and equipment would be mounted. Loose stone, laid on an impermeable geomembrane, would surround the access road and concrete equipment plinths. Palisade style fencing up to 2.4m in height would surround the compound.

2.4.84 Similar to the BESS compound, in normal operation the stoned areas of the compound would allow rainwater to be captured, attenuated to a greenfield runoff rate and then drain to a nearby watercourse. In an emergency situation a valve would be automatically engaged to isolate the compound and prevent any run-off for a period of time. This would allow the run-off to be collected and treated in an appropriate way.

2.4.85 Lighting would be provided for security purposes and for maintenance undertaken in periods of low light. The lighting would not be switched on routinely and would be operated using infrared motion detectors or switched on manually for maintenance purposes. Further information on lighting and security is provided below.

2.4.86 **ES Vol 3 Figure 2-5e: Indicative Substation Elevation [EN010153/DR/6.3]** provides an illustrative layout of Frodsham Solar Substation, including indicative elevations.

Control Buildings

2.4.87 Control buildings would be provided within the substation compound which would house indoor 33 kV electrical switchgear with incoming connections from each of the transformers / PCUs distributed throughout the solar PV array. The control buildings would include monitoring and control rooms, office space and welfare facilities. These would be utilised by the Frodsham Solar operatives.

2.4.88 Separate control buildings may be required for the connection to the SPEN Frodsham Substation (132 kV) and the private wire connection, as illustrated on **ES Vol 3 Figure 2-5e: Indicative Substation Elevation [EN010153/DR/6.3]**. Alternatively, it may be possible to combine this into a single building. This would be subject to detailed operational requirements.

2.4.89 An independent control room within the substation compound would be required for SPEN.

2.4.90 An operations / spares building would also be provided as part of the substation compound. This may be a standalone building or annexed to one of the control buildings. It would contain changing rooms and welfare facilities for site operatives, offices and storage areas for spare parts and maintenance equipment.

2.4.91 The buildings would most likely be constructed as brick structures with pre-fabricated composite insulated panels.

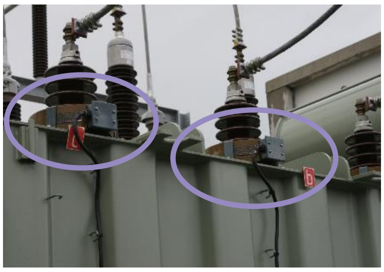
Electrical Equipment

2.4.92 A range of different electrical plant and equipment would be located within the substation compound. It would include two 132 kV / 33 kV Transformers along with busbars, disconnectors, circuit breakers, surge arresters and insulators, above-ground cabling, lightning protection, and gantries. Indicative images of this equipment are shown in Table 2-5 below.

2.4.93 SF6-free electrical components will be prioritised wherever feasible to eliminate emissions from gas-insulated switchgear and transformers. For any equipment that uses SF6, only sealed-for-life components with extremely low leakage rates will be used to minimise fugitive emissions.

Table 2-5: Frodsham Substation Electrical Equipment

Equipment	Function	Indicative Image
Power Transformer	Transformer that increases the voltage levels from 33kV to 132kV	
Disconnector	Opens the electrical circuit and completely isolates certain system components from the rest of the installation	
Earthing Switches	It prevents danger from occurring through the charge processes	

Equipment	Function	Indicative Image
Current and Potential Transformers	MV Current measurement	
High Voltage (HV) Circuit Breaker	Transformer protection (default opening)	
Surge Arrester	Visual insulation of Transformer (no default opening). Limit over-voltages or surges	
Busbars	Busbars connect the different switchgear bays and take care of power transmission within the substation	

Equipment	Function	Indicative Image
Lightning conductor mast	To protect devices against lightning strikes	
Portal	To support the tubular busbars	

Table 2-6: Frodsham Solar Substation Design Parameters

Work No.3 – works in connection with an onsite substation including— **a. substation;** **b. switch room buildings;** **c. electrical control equipment;** **d. control building;** **e. storage areas;** **f. welfare facilities;** **g. offices;** **h. workshop;** **i. store;** **j. car parking and access roads;** **k. works for the provision of security and monitoring measures such as CCTV columns, cameras, lighting columns and lighting, weather stations, communication infrastructure, perimeter fencing; and** **l. drainage infrastructure including bunds.**		
Frodsham Solar Substation (overarching parameters)	Scale	The maximum footprint of the Frodsham Solar Substation would be a maximum of 1.5ha.

Buildings	Scale	The maximum footprint of the ancillary buildings (i.e. a structure with a roof and wall) which form part of the Frodsham Solar Substation would be 950m^2 with a maximum height of 8m AEGL.
Electrical equipment	Scale	The maximum height of the electrical infrastructure which form part of the Frodsham Solar Onsite Substation would be 13m AEGL.
Foundations	Design	The foundations for structures which form part of the Frodsham Solar Substation will comprise a concrete base or monolith plinth with a maximum depth of 3.5m.

Work No. 4 – works to provide an electrical connection from Frodsham Solar Substation to Frodsham SPEN Substation and to facilitate a direct private wire connection to nearby businesses

2.4.94 Work No.4 comprises works to provide an electrical connection from Frodsham Solar Substation to Frodsham SPEN Substation and facilitate a potential direct connection to nearby businesses. Work No.4 has been split into Work 4a and 4b as follows:

i) Work No.4a – an electrical connection from Frodsham Solar Substation (Work No. 3) to Frodsham SPEN Substation including:
   a) Above ground and below ground 132kV electrical cables connecting Work No. 3 to the Frodsham SPEN Substation;
   b) pylons, joint bays, link boxes, cable ducts, cable protection, joint protection, manholes;
   c) marker posts, underground cable markers, tiles and tape, communications chambers, fibre optic cables and lighting and other works associated with cable laying; and
   d) works to the SPEN Frodsham substation to facilitate connection of the authorised development to the SPEN Frodsham substation

ii) Work No.4b – a direct private wire connection from Frodsham Solar Substation (Work No. 3) to nearby businesses including:
   a) Underground 132/33kV electrical cables to facilitate a direct connection from Work No. 3 to nearby businesses;

b) joint bays, link boxes, cable ducts, cable protection, joint protection, manholes; and

c) marker posts, underground cable markers, tiles and tape, communications chambers, fibre optic cables, lighting and other works associated with cable laying.

2.4.95 It should be noted that there will be no requirement to extend Frodsham SPEN Substation, as the connection links into existing bays within the substation.

2.4.96 The electricity generated by the solar PV modules and the electricity imported and exported from the BESS facility would be transferred to and from the Frodsham Solar Substation via two 132kV electrical cable connections.

2.4.97 The first 132kV electrical connection would link the Frodsham Solar Substation to the SPEN Frodsham Substation located to the north of the River Weaver (the ‘SPEN Grid Connection’). The second 132/33kV electrical connection would provide a link from the Frodsham Solar Substation to the west of the Site, providing an opportunity for the Proposed Development to supply electricity directly to nearby businesses (the ‘Private Wire Connection’). The voltage of the connection would depend on user requirements.

SPEN Grid Connection

2.4.98 The Frodsham Solar Substation would connect to the SPEN Frodsham Substation via overhead 132kV cables. The connection would be a single 132kV circuit comprising three sets of cables and a fibreoptic link approximately 2km in length.

2.4.99 The overhead lines would be supported on wooden poles/pylons, referred to as Trident poles. The poles would be constructed from pressure impregnated softwood, treated with a preservative to prevent damage to structural integrity. New poles would be dark brown and gradually weather to light grey. Single and double ‘H’ poles would be used. H poles are typically required where the route of the cable changes angle or at terminal ends of the connection, metal cable stays are required to provide support to H poles, and occasionally for single poles. The image presented in Figure 2-6 below illustrates a representative example of a standard Trident pole.

2.4.100 Wooden poles have a recommended span of 100-130m but can reach up to 200m in certain cases. Poles are typically 10-12m in height, including steel work, mounting and insulators fixed to the top of the poles. This height can be adjusted to accommodate specific clearances as required.

2.4.101 The SPEN Grid Connection would cross the River Weaver. No specific clearance heights are specified for the River Weaver at this location. The closest structure that limits headroom above the water is a Bailey bridge approximately 260m downstream of the proposed SPEN Grid Connection crossing point. The planning drawings for this bridge indicate a clearance above water level of 40 ft (12.2m). The cable crossing would therefore provide a minimum clearance of 12.2m.

2.4.102 The overhead line installation typically involves:

i) Excavation of foundation (typically 3 x 3m up to 3m deep)
ii) Installation of pole brace block and/or steel foundation braces
iii) Erection of pole and fixture into foundation using a 360 degree tracked excavator
iv) Stringing of conductors

2.4.103 A construction area of approximately 30m x 15m is required around a pole location to provide sufficient working room and area to layout the pole and associated equipment. Access for the poles erected within the SADA would be taken via the internal access tracks and across the fields. It would not be necessary to undertake any physical works within the river. However, navigation would be temporarily prevented whilst the cables are being strung across the river. This would be for a maximum period of two weeks and is likely to be substantially shorter, possibly completed in days. Further detail on the management of river users is provided at paragraph 2.5.43.

2.4.104 Access for the two poles proposed on the northern side of the River Weaver would be via existing access corridors used for the construction and maintenance of existing electrical infrastructure surrounding the SPEN / National Grid Substation. These existing access routes may need to be improved by laying and compacting loose aggregate or alternatively laying temporary matting to enable construction plant to access the pole locations.

2.4.105 The foundation solution for the poles located within the SADA is likely to be as outlined above i.e. pole brace block and/or steel foundation braces. However, on the land adjacent to the SPEN / National Grid Substation it may be necessary to utilise an alternative foundation depending on the ground conditions identified at the point of detailed design. The foundation solution in this location could be:

i) Pole brace block and/or steel foundation braces;
ii) Soil mixing with a cementitious product;
iii) Concrete mass foundation (with pole fixed to the foundation block); or
iv) Piled concrete slab (with pole fixed to the concrete slab).

Image 2-6: Illustrative Trident Single (left) and H Poles (right)

2.4.106 At the terminal ends of the connection i.e. the connection into the Frodsham Solar Substation and the SPEN Frodsham Substation, the electrical cables would be ducted down the poles and a short underground section would provide the final connection into the substation equipment. **ES Vol 3 Figure**

2-5h: Indicative Cable Trench Cross Sections [EN010153/DR/6.3] illustrates a typical high voltage cable trench.

2.4.107 At the Frodsham SPEN Substation, the cable would connect into an existing circuit breaker bay within the substation. It would be necessary to equip the bay with new circuit breaker / disconnectors, a voltage transformer Supervisory Control and Data Acquisition (SCADA) systems. This equipment would all be accompanied in the current compound.

2.4.108 At the Frodsham Solar Substation, the cables would route below ground into the equipment described under Work No 3 above.

Private Wire Connection

2.4.109 A 132/33kV underground electrical connection is proposed, which would provide a potential link from Frodsham Solar Substation to businesses located to the west of the Site. The Private Wire Connection would run from the Frodsham Solar Substation west along existing tracks used to access Frodsham Wind Farm, terminating on the eastern side of Hoolpool Gutter. The connection would be a single 132/33kV circuit comprised of three sets of cables and a fibreoptic link.

2.4.110 The land to the west of Hoolpool Gutter includes a range of existing industrial facilities, many of which have a high-power demand, for example, the Encirc glass manufacturing plant. The area is also subject to an existing large strategic development allocation within the CWaCC Local Plan, known as Protos (formally Ince Resource Recovery Park), which has the potential to accommodate power users. The former CF Fertiliser plant, which is undergoing decommissioning works at present, also offers an opportunity for future redevelopment, this has recently been acquired by Peel NRE Ltd, who have described the site as an opportunity to develop a hub for decarbonised industrial uses to boost Cheshire’s low-carbon economy. Peel NRE Ltd is also the landowner of Protos, and it has made representations to CWaCC to expand the existing allocation as part of the evolving Local Plan process. As such, it is considered that there is significant opportunity to deliver renewable energy directly to local businesses from the Proposed Development.

2.4.111 As such, there are significant opportunities for Frodsham Solar to provide a ‘private wire’ arrangement to businesses to the west of the Site, where renewable energy can be delivered directly to a customer from a renewable energy generating station. The principle of this element of the Proposed Development is local electricity generation meeting local demand, reducing transmission losses and further supporting grid capacity by taking load of the transmission network.

2.4.112 The proposed Private Wire Connection included within the DCO application does not run directly to a business or substation. However, the proposed Private Wire Connection is considered to be an important enabler to facilitate a direct link from Frodsham Solar to nearby businesses. The onward connection from the proposed termination point by Hoolpool Gutter would be subject to a separate planning permission at the point a final user was identified and a Power Purchase Agreement was entered into.

2.4.113 The route of the proposed Private Wire Connection is shown on **ES Vol 3 Figure 2-2: Indicative Construction Site Layout [EN010153/DR/6.3]** and a typical cross section of the trench is shown on **ES Vol 3 Figure 2-5h: Indicative Cable Trench Cross Sections [EN010153/DR/6.3]**. The length of the proposed connection is approximately 4km.

2.4.114 Cable Jointing Chambers would be located along the Private Wire Connection at distances of between 300m and 1000m. The Cable Jointing Chambers would be constructed of concrete and would be sealed and buried below ground at a depth sufficient that the existing land use can be instated above them following construction.

2.4.115 Table 2-7 identifies the relevant design parameters for the proposed electrical connection from Frodsham Solar Substation to Frodsham SPEN Substation and nearby businesses.

Table 2-7: Electrical Connection Design Parameters

<table>
<tr><th colspan="3">Work No.4a – an electrical connection from Frodsham Solar Substation (Work No. 3) to Frodsham SPEN Substation including:
a. above ground and below ground 132kV electrical and communication cables connecting Work No. 3 to the Frodsham SPEN Substation;
b. pylons; and
c. works to the Frodsham SPEN Substation to facilitate connection of the authorised development to the Frodsham SPEN Substation.

Work No.4b – works to lay underground 132/33kV electrical and communication cables from Frodsham Solar Substation (Work No.3) to nearby businesses.</th></tr>
<tr><td rowspan="3">Work No 4A - 132kV electrical cables to facilitate a connection from Work No. 3 to nearby businesses</td><td>Design</td><td>The cables would be laid below ground.</td></tr>
<tr><td>Scale</td><td>Maximum dimensions of underground trenches would be 1.2m deep and 1.2m wide.</td></tr>
<tr><td>Scale</td><td>The 132/33kV Jointing Chambers would be up to 5m in length, by up to 3m in width x 3.5m in depth.</td></tr>
<tr><td rowspan="4">Work No.4B - 132kV electrical cables connecting Work No. 3 to Frodsham Substation</td><td>Design</td><td>The cables would be above ground supported on wooden poles up to 200m apart and below ground at the terminal connections to the substations.</td></tr>
<tr><td>Design</td><td>New electrical infrastructure associated with the Frodsham SPEN Substation would be located within the boundary of the existing compound and would not exceed the height of existing equipment located within the Frodsham SPEN Substation.</td></tr>
<tr><td>Scale</td><td>Pylons will have a maximum height of 15m.</td></tr>
<tr><td>Scale</td><td>Maximum dimensions of underground trenches would be 1.2m deep and 1.2m wide.</td></tr>
</table>

Work No. 5 - works including electrical cables and communication cables connecting Work No. 1 to Work No. 3 and Work No. 2 to Work No. 3 and Work No. 1 to Work No. 2.

2.4.116 Medium voltage (MV) cables (carrying 33kV) are required to connect the PCUs or standalone Transformer Stations (Work No. 1) to the Frodsham Solar Substation (Work No. 3). The cabling would be below ground and typically laid in parallel circuits, a fibre optic link would also be provided.

2.4.117 A typical 33kV MV cable trench would be up to 1.2m deep, the width would vary depending on the number of cables it contains but would be up to 1.2m wide. A typical cross section of a 33kV MV trench is shown on **ES Vol 3 Figure 2-5h: Indicative Cable Trench Cross Sections [EN010153/DR/6.3]**.

2.4.118 The trenches would be installed using an open trench method, typically mechanically excavated, hand digging may be required in proximity to services and utilities. Cables would either be laid directly into trenches or into ducting (that would be installed into the trench with the cables pulled through later).

2.4.119 Cable trenches would typically run alongside access roads. 33 kV MV cabling would be required to cross ditches and field boundaries. Where cables are required to cross ditches they would be integrated into the proposed vehicle access crossings described below.

2.4.120 **ES Vol 2 Appendix 2-1: Indicative Watercourse Crossing Schedule [EN010153/DR/6.2]** provides a schedule of indicative crossing points, as well as figures showing their locations, required to deliver the Indicative Operational Site Layout. Whilst the precise locations of these may be subject to change at the detailed design stage, the indicative layout and crossing points are typical of the ditches and field boundaries present across the Site so have enabled likely significant environmental effects of the Proposed Development to be established.

2.4.121 Where cables are required to cross existing utilities or services, the construction methodology would be undertaken in accordance with the statutory undertaker requirements. It is possible that, in order to avoid impacts on existing services or utilities, a trenchless technique would be used.

2.4.122 These techniques use a machine to drill or ‘bore’ a hole through the ground from one side of the utility to the other, beneath the utility. Typically, a pit is dug at either end of the trenchless section where the drilling or boring machinery will be located, creating an entrance and exit pit. A duct would be pulled through the hole as it is drilled / bored. The cables would then be pulled through the ducting. All entrance and exit pits will be returned to their original use following completion of the construction process. Given the nature of the potential obstructions on the Site these are likely to be shallow and relatively small scale operations.

Table 2-8: Works including electrical cables and communication cables connecting Work No. 1 to Work No. 3 and Work No. 2 to Work No. 3orks to facilitate Work No.1 to Work No.4 Design Parameters

Work No. 5 - Works including electrical cables and communication cables connecting Work No. 1 to Work No. 3 and Work No. 2 to Work No. 3.		
Electrical cables and communication cables	Design	The cables will be laid below ground.
	Scale	Maximum dimensions of underground trenches will be 1.2m deep and 1.2m wide.

Work No. 6 – works to create, enhance and maintain green infrastructure including the creation of Skylark Mitigation Plots and a Non Breeding Bird Mitigation Area

2.4.123 Work No.6 comprises works associated with the retention of existing green infrastructure and creation of new green infrastructure across the Proposed Development. Work No.6 has been split into Work 6a, 6b and 6c as follows and they comprise:

i) Work No. 6a - works to create, enhance and maintain green infrastructure, including:

a. planting of native species hedgerows, individual trees and grassland;
b. creation of open water habitats and reedbeds;
c. improvements to existing public rights of way;
d. creation of skylark habitat;
e. creation of permissive paths;
f. fencing, gates, boundary treatment and other means of enclosure;
g. laying down of internal access tracks;
h. improvement, maintenance, repair and use of existing streets and private tracks;
i. car park;
j. signage and information boards;
k. bird hides and screens;
l. benches;

m. [viewing areas; and
n. bike stands.

ii) Work No. 6b - works to create skylark habitat; and

iii) Work No. 6c - Creation and management of a Non Breeding Bird Mitigation Area including:

a. earthworks including bunds, embankments, ground reprofiling, infilling of voids;
b. creation of scrapes and waterbodies;
c. water level management systems including sluices, pipework, pumps and associated control equipment;
d. use of geotextiles or clay liners to retain water; and
e. installation of predator control fencing.

Work No. 6a - works to create, enhance and maintain green infrastructure

2.4.124 An Indicative Environmental Masterplan is provided as **ES Vol 3 Figure 2-3 (a-e) Illustrative Environmental Masterplan [EN010153/DR/6.3]**. The landscape design has been developed in response to the Design Principles for the Proposed Development as set out earlier in this chapter. The **Outline LEMP [EN010153/DR/7.13]** describes how the green infrastructure shown on the Indicative Environmental Masterplan would be delivered and managed through the life of the Proposed Development. Post-consent, this outline plan will be developed into a full plan which must be in substantial accordance with the outline and will require approval by CWaCC. The Proposed Development must be undertaken in accordance with the approved plan. This is secured via a Requirement in Schedule 2 of the **draft DCO [EN010153/DR/3.1]**.

2.4.125 In summary, new planting across the Site includes the following approximate areas of habitat:

i) Approximately 36.1 ha of public access/biodiversity enhancement zones, comprising enhancement of existing vegetation (trees and scrub, grassland and wetland) and provision of new vegetation.

ii) Creation/enhancement of approximately 132 ha of other neutral grassland.
iii) Creation of approximately 75.7 ha of modified grassland.
iv) Specific habitat creation and enhancement measures within Items i-iii above including:
   a) Approximately 2.2 ha of new native woodland.
   b) Approximately 0.87 ha of new native mixed scrub, and enhanced management of approximately 1.43 ha of existing scrub.
   c) Enhancement of approximately 6.4km of existing hedgerows and hedgerow with trees.
   d) Approximately 2.5km of new native hedgerow, and approximately 5km of new belts of native trees and shrubs.
   e) Approximately 1 ha of new ponds, approximately 335m of new ditches, and approximately 2.1 ha of new reedbed. Enhanced management of approximately 0.9 ha of existing ponds, approximately 10.9km of existing ditches and approximately 12.1 ha of existing reedbed.
v) NBBMA including:
   a) Approximately 53.51 ha suitable for new and enhanced habitats (wetland and other neutral grassland) to benefit wetland birds.
   b) Approximately 13.19 ha of additional grassland habitat.
vi) Skylark Mitigation Plot, comprising 5.58 ha of other neutral grassland creation.

2.4.126 As set out in **ES Vol 1 Chapter 1.0**: **Introduction [EN010153/DR/6.1]** there are a number of PRoW which cross the Site (see **ES Vol 3 Figure 1-5: Public Rights of Way [EN010153/DR/6.3]**). The local community highlighted the value of these PRoW during the non-statutory public engagement exercise undertaken in Summer 2023, the Statutory Consultation undertaken in Winter 2024 and a series of design workshops undertaken with local community interest groups and CWaCC in January 2025. However, it was noted that the condition of some of the routes was poor. The community also questioned if improved access could be provided as part of the Proposed Development.

2.4.127 In response, a series of permissive paths across the Site have been proposed. These are illustrated on Existing and Proposed PRoW and Permissive Paths (**ES Vol 3 Figure 2-4: Existing and Proposed PRoW and Permissive Paths [EN010153/DR/6.3]**) and the Indicative Environmental Masterplan (**ES Vol 3 Figure 2-3 (a-e) Illustrative Environmental Masterplan [EN010153/DR/6.3]**). They have been located to provide enhanced views of the Mersey Estuary and River Weaver, and also to offer linking paths between the existing PRoW to create a network of routes of differing lengths within the Site. In addition to providing new walking routes, it is also proposed to provide additional cycling and horse riding opportunities on selected sections of the permissive paths. These would link to existing Restricted Byways. Some sections of the existing public footpath network and cycleway network (National Cycle Route 5) lie within the Site. Where the condition of these routes is substandard, improvements would be made to enhance user experience. In respect of the section of NCN5 that runs through the Site, this would be improved at the end of the construction period to repair damage and potholes. However, these sections would not be subject to maintenance throughout the lifetime of the Proposed Development as these sections are not being permanently acquired and are used by vehicles out of the control of the Applicant. The **oLEMP [EN010153/DR/7.13], Design Approach Document [EN010153/DR/5.8] and the Outline Public Rights of Way Management Plan (oPROWMP) [EN010153/DR/7.9]** describe how improvements to access across the Site will be delivered and managed.

2.4.128 The Applicant has also proposed the potential construction of a visitors' car park on land to the north of Moorditch Lane. The car park would be permeable, formed of compacted crushed stone on a geomembrane. The car park will only be provided should the proposed access enhancements result in a demonstrable increase in cars informally parking along Moorditch Lane, and if this causes access/egress issues for other users of Moorditch Lane. Its provision will be agreed with CWaCC. The Applicant commits to addressing any unforeseen access/egress issues on Moorditch Lane that are caused by the Proposed Development, either by constructing the car park or via alternative measures. If delivered, the car park will include security features (e.g. height-restricting barriers and a lockable gate), and the Applicant reserves the right to remove the car park later, if it gives rise to persistent anti-social behaviour. Suitable evidence of such behaviour would first be presented to CWaCC and potential solutions discussed. The proposed location of the potential car park is indicated on ES Vol 3 Figure 2-3: (a-e) Illustrative Environmental Masterplan [EN010153/DR/6.3].

2.4.129 Site reinstatement and landscaping would commence following completion of the construction works. Advance planting and habitat creation, prior to the commencement of construction, would be undertaken in some locations e.g. NBBMA and hedgerow screen planting along the southern boundary of the Site.

2.4.130 The proposed landscaping and ecological scheme would deliver a quantifiable increase of at least 10% in both habitat and hedgerow units across the Site and no net loss in watercourse units. A Biodiversity Net Gain (BNG) Report assessment has been provided with the application **BNG Report [EN010153/DR/7.13]** to demonstrate the level of net gain achieved across the habitat types. This is described further in **ES Vol 1 Chapter 7.0**: **Terrestrial Ecology [EN010153/DR/6.1]**

Work No. 6b - works to create skylark plots to provide skylark foraging habitat

2.4.131 The breeding bird surveys for the Site identified the presence of skylark, a species included on the Red List under Birds of Conservation Concern and a Priority Species within England under the Natural Environment and Rural Communities Act 2006.

2.4.132 Wildflower grassland created as part of the Proposed Development would provide foraging opportunities for Skylark. However, the development of solar arrays across the Site has the potential to reduce the suitability of these areas for nesting, and so, in accordance with best practice, additional foraging habitat is proposed to support the local skylark population.

2.4.133 Accordingly, the Order Limits include land to the immediate south of Moorditch Lane, which would be used for this purpose. This land is shown on **ES Vol 3 Figure 1-2: Proposed Development Areas [EN010153/DR/6.3]** and **ES Vol 3 Figure 2-3(a-e): Illustrative Environmental Masterplan [EN010153/DR/6.3]** and further detail is provided in **ES Vol 1 Chapter 8.0**: **Ornithology [EN010153/DR/6.1].**

Work No. 6c - Creation and management of a Non Breeding Bird Mitigation Area

2.4.134 The Applicant has recognised from the outset that the Proposed Development has the potential to impact on 'Functionally Linked Land' (FLL) associated with the Mersey Estuary SPA through:

i) Displacement of Mersey Estuary SPA wetland bird species due to the presence of solar PV modules and other infrastructure; and
ii) Increased disturbance to Mersey Estuary SPA wetland bird species, during construction or operation of the Proposed Development.

2.4.135 As such, the Proposed Development includes the creation of the NBBMA on one of the former MSC Dredging Deposit Ground cells (Cell 3) and the adjacent ponds and grassland. The location of the NBBMA is shown on **ES Vol 3 Figure 1-2: Proposed Development Areas [EN010153/DR/6.3]** and **ES Vol 3 Figure 2-3(a-e): Illustrative Environmental Masterplan [EN010153/DR/6.3].**

2.4.136 The NBBMA covers an area of approximately 64ha and includes land which currently forms part of the Frodsham Wind Farm mitigation area. Details of the NBBMA are provided in **ES Vol 1 Chapter 8.0**: **Ornithology [EN010153/DR/6.1] and Appendix B of the oLEMP [EN010153/DR/7.13],** which provides the Non Breeding Bird Mitigation Strategy. In summary, Cell 3 would be re-engineered to deliver the following components:

i) Existing scrapes which have been created as part of the Frodsham Windfarm mitigation works would be temporarily removed and then re-instated as part of a wider network of wetland features.

ii) Additional scrapes would be created, substantially increasing the amount of 'muddy edge' to provide foraging habitat for SPA species.

iii) Islands would be created to provide safe roosting locations for SPA species and nesting birds.

iv) The entire area of Cell 3 would be managed as grassland, with approximately 9.5 ha of managed wet grassland created in the centre of the cell by lowering ground levels so that the necessary conditions to allow wet grassland to establish are created.

v) The entire mitigation area would be predator fenced with the aim of assisting breeding wader productivity.

2.4.137 To create the NBBMA it would be necessary to undertake an earthworks operation on Cell 3. This would involve excavating soils within the central area of Cell 3. These soils would either be placed within the ponds to the north of Cell 3, creating an additional area of grassland or the soils would be reprofiled across the remaining area of Cell 3, directing surface water towards the central area and thereby helping to maintain a wet grassland habitat. Both options deliver the same extent of wet grassland and scrapes and so neither are more or less preferable from an ecological mitigation perspective. Detailed design considerations and Environmental Permitting requirements would determine the approach taken. The selected method would be confirmed in the final LEMP (and the associated Non Breeding Bird Mitigation Strategy), which would be subject to approval pursuant to a Requirement of the DCO.

2.4.138 If the ponds to the north of Cell 3 are infilled, a new pond would be created in this area that would act as a reservoir to help manage water levels within the NBBMA. If soils are not placed in the ponds, the existing ponds would be treated to control the spread New Zealand Pigmy Weed[3], and then used to manage water levels in the NBBMA. A network of pipes and sluices would direct water from the ponds into the NBBMA.

2.4.139 For both options, it would be necessary to put in place a New Zealand Pigmy Weed control strategy, which would be implemented as part of the CEMP. NZPW is notoriously hard to manage, but there are a number of documented methods for its control[iv]. A likely methodology would involve the controlled draining of the ponds and filtering of drained water through geotextile baffles and filtering silt bags to capture and prevent the spread of the NZPW. This process would also involve a Fish Rescue Plan. Once drained the base and sides of the ponds would be treated with herbicide. The surface materials would be scraped into the central area of the ponds and buried with material excavated from Cell 3. Alternatively, if materials are retained and re-engineered in Cell 3, then the treated soil from the ponds would be buried within Cell 3 to a depth of at least 20cm following treatment with herbicide .

2.4.140 The requirement for the New Zealand Pigmy Weed control strategy, as well as a Fish Rescue Plan, is documented within the **outline Construction Environmental Management Plan (oCEMP) [EN010153/DR/7.7]**.

2.4.141 The NBBMA would be managed for the lifetime of the Proposed Development, to deliver a series of target habitats via management measures such as controlled grazing, grassland management and manipulation of hydrological conditions. The **oLEMP [EN010153/DR/7.13]** describes the various management prescriptions and habitat management objectives which would need to be delivered in order to achieve the aims for NBBMA. The approach adopted to the management of the area would be agreed prior to the commencement of the development. However, the Applicant envisages that the NBBMA would be managed by, or under the supervision of, an

[3] *New Zealand Pigmy Weed is an invasive species listed under Schedule 9 to the Wildlife and Countryside Act 1981 As such, it is an offence to plant or otherwise cause this species to grow in the wild.*

organisation experienced in stewardship of wetland reserves, such as the Local Wildlife Trust or the RSPB. All costs associated with on-going management would be borne by the Applicant.

2.4.142 The NBBMA is anticipated to take six months to construct and would be created and functional in advance of construction of the western Solar PV Array Areas on the former MSC Dredging Deposit Ground cells, as these are the areas of the SADA most commonly used by wetland birds. This would ensure that displaced (bird) populations have alternative areas of habitat available during the construction of the NBBMA. Construction in other areas of the Site may be undertaken at the same time as the creation of the NBBMA. Construction of the NBBMA would also be timed to be undertaken outside of the core non-breeding bird period, November to February inclusive.

2.4.143 The proposal to create the NBBMA represents an ambitious conservation strategy. It would not only provide mitigation for the Proposed Development, but will also deliver benefits to multiple wetland bird species over a 40-year period, and which is in clear addition to existing measures implemented as part of the Frodsham Wind Farm.

2.4.144 It is noted that the presence of wetland areas near airfields poses a potential hazard due to increased bird strike risk. The NBBMA is located approximately 6km to the south of Liverpool John Lennon Airport on the opposite side of the estuary. It is considered that the proposed habitat improvements at the NBBMA would not lead to a significant increase in bird strike risk for several reasons. In the context of the Mersey Estuary as a whole, the habitat created at the NBBMA is relatively small. It is located close to the estuary, where large numbers of wading birds are already present. While the NBBMA will offer a valuable additional improved habitat that would benefit birds of the Mersey Estuary SPA, it would not introduce a completely new habitat that would materially increase the number of birds in the vicinity of the airport.

2.4.145 The Liverpool John Lennon Airport Wildlife Hazard Management Plan[v] has been reviewed. This includes a methodology for establishing a ‘risk rating’ for species to determine whether specific management actions are required for that species. All species which fall within the ‘rejected’ category must have targeted management action to reduce the risk. All species of birds that flock are rejected unless the species fits within the ‘very low’ category for severity of strikes.

2.4.146 The NBBMA is being created to benefit several non-breeding bird species, particularly Golden Plover, Curlew, and Lapwing. According to the bird strike records in the Liverpool John Lennon Airport Wildlife Hazard Management Plan, these species fall into the ‘very low’ category for severity of strikes. The likelihood rating for Curlew is moderate, while for Lapwing, it is low. There were no recorded strikes of Golden Plover. Based on this information, the risk is classified as low / minimal, and no further action is deemed necessary for these species.

2.4.147 Regarding off-aerodrome risks, the Liverpool John Lennon Airport Wildlife Hazard Management Plan identifies twelve bird attractant sites, all located north of the Mersey Estuary. The list does not include the existing Frodsham Marsh area and the extensive saltmarsh on the southern boundary of the estuary. It is clear that the distance of the Site from the airfield, along with its position on the southern side of the estuary, minimises the risk posed by birds. Additionally, it is important to note that the flight path of birds travelling between the estuary and the NBBMA would not result in birds flying toward or across the aerodrome. Given these factors, it is concluded that the NBBMA does not pose a risk to the safety of aircraft operating at Liverpool John Lennon Airport. Airport.

2.4.148 On decommissioning the landscaping works associated with the NBBMA would be left in place and the land handed back to the landowner. The management of these habitats beyond the lifetime of the Proposed Development cannot be predicted with any certainty.

2.4.149 The design and layout of the green infrastructure summarised above would be in accordance with the oLEMP, which will be submitted as part of the DCO application and secured through a DCO Requirement.

Work No. 7 – construction and decommissioning compounds

2.4.150 Work No. 7 comprises construction and decommissioning compounds, consisting of:

i) areas of hardstanding;
ii) car park;
iii) site and welfare offices, canteens and workshops;
iv) area to store materials and equipment;
v) storage and waste skips;
vi) area for download and turning;
vii) security infrastructure, including cameras, perimeter fencing and lighting;
viii) site drainage and waste management infrastructure (including sewerage); and
ix) electricity, water, waste water and telecommunications connections.

2.4.151 Six potential compound locations have been identified to construct the development within the SADA. This comprises two main construction compounds and four smaller secondary compounds. All compounds would provide parking areas, welfare and laydown. However, the two main compounds would include office space, additional welfare facilities such as drying rooms and additional parking, laydown and storage. Two additional compounds have been identified for the construction works on the northern side of the River Weaver associated with the connection works to the Frodsham SPEN Substation. The compounds are illustrated on **ES Vol Figure 2-1: Indicative Construction Site Layout [EN010153/DR/7.13]**.

2.4.152 Construction compounds would be fenced with temporary (Heras or similar) fencing where required. The compounds would be lit during periods of low light during construction working hours, 08.00 to 18.00hrs Monday to Friday and 08:00 to 13:00hrs Saturday. Outside these times lighting would only be switched on for security breaches or in the event of an emergency. CCTV cameras would operate at the compounds.

2.4.153 A compound would also be located within Cell 3 for the NBBMA works (labelled as West Compound 3 on Figure 201). This would be located on the south western section of Cell 3, as this has been identified as the area which would have the least impact on the wetland bird species of the SPA currently using Cell 3, and is the closest point to the access road.

Table 2-9: Construction and decommissioning compounds Design Parameters

Work No.7 - Works for the creation of construction and decommissioning compounds including: **a. areas of hardstanding;** **b. car park;** **c. site and welfare offices, canteens and workshops;** **d. area to store materials and equipment;** **e. storage and waste skips;** **f. area for download and turning;** **g. security infrastructure, including cameras, perimeter fencing and lighting;** **h. site drainage and waste management infrastructure (including sewerage); and** **i. electricity, water, waste water and telecommunications connections.**		
Construction Compound	Design	Compounds constructed from compacted stone over an appropriate geotextile.
	Scale	Compounds up to 7500m^2 in area

Work No. 8 – works for the improvement, maintenance, repair and use of existing streets, private tracks, public rights of way and access roads.

2.4.154 Work No. 8 covers the existing roads and tracks within the Site which may be used by motorised vehicles, non-motorised vehicles and for public access and could be subject to some form of development to improve the surfacing.

2.4.155 Work No. 8 encompasses the existing roads and pathways within the Site that may be utilised by motorised vehicles, non-motorised vehicles, and for public access, and it could be subject to some form of development, including the following:

i) Resurfacing works to improve, maintain or repair

ii) Widening and improvement of verges

iii) Buried service and utilities works

iv) Creation of new accesses

v) Work to provide new or enhanced public access

2.4.156 The Main Site Access is from the west, leading from Pool Lane roundabout. Vehicles accessing the Site would turn onto Grinsome Road (a private road) from Pool Lane roundabout and travel east towards Protos for approximately 1.5 km, routing north at Grinsome Road Roundabout, along Road 1 of Protos. Vehicles would then turn east along Marsh Lane, which provides access to Frodsham Wind Farm. The Frodsham Wind Farm access tracks provide access to the SADA. There would be no access to the Site from Frodsham during construction, operation or decommissioning, other than for emergency vehicles, and access to the proposed new public car parking area on Moorditch Lane, via Brook Furlong.

2.4.157 No new access points, improvement of surfaces or widening would be required on the roads leading to Marsh Lane as these are of a suitable standard to accommodate HGVs, including abnormal loads (having been used to provide access for the construction and maintenance of Frodsham Wind Farm). As such the development authorised by Work No. 8 relates to other existing roads and pathways within the Order Limits to the east of, and including, Marsh Lane.

2.4.158 There would be no new access points created from any adopted highway. However, in order to facilitate access into the Solar PV Array Areas new and improved access would be required from private access tracks, which also include PRoW including Restricted Byways. The majority of the new access points would be required to access the Solar PV Array Areas. There would also be a new access to the proposed potential new public parking area on Moorditch Lane.

2.4.159 Where access needs to be taken from established tracks used for vehicular access i.e. from the Frodsham Wind Farm access track, Moorditch Lane, Brook Furlong, Alder Lane and Weaver Lane, this will be either from existing access points into adjacent land or newly created access points. To create the access points, it will be necessary to remove vegetation to either widen an existing field access or create a new access point. The vegetation on both sides of the access point must be removed or managed to ensure adequate visibility splays. In instances where vegetation removal or pruning is needed for access and/or visibility splays, the vegetation removal would be confined to the minimum required to achieve suitable access and visibility.

2.4.160 The majority of the existing access tracks within the Site are composed of unbound materials. In certain locations, the roads have deteriorated, with the presence of ruts and potholes. These access roads will undergo a survey and be repaired as deemed necessary. This process is likely to involve the filling of damaged areas with crushed stone and the compaction of the materials to enhance the integrity of the track surface.

Further ancillary or related development within the Order Limits in connection with the delivery of Work Nos 1 – 8

2.4.161 In connection with and in addition to Work Nos. 1 to 6, further associated development within the Order Limits may be required, including:

i) laying down of internal access tracks, temporary footpath diversions, ramps, means of access, carparks, crossing of watercourses and roads;
ii) improvement, maintenance, repair and use of existing streets, private tracks, public rights of way and access roads;
iii) sustainable drainage systems including runoff outfalls, general drainage and irrigation infrastructure, systems and improvements or extensions to existing drainage and irrigation systems;
iv) works for the provision of security and monitoring measures such as CCTV columns, cameras, lighting columns and lighting, weather stations, perimeter fencing;
v) construction and decommissioning compounds, including site and welfare offices and areas to store materials and equipment.

Internal Access Tracks

2.4.162 Internal access tracks would be required for the construction and operation of the Proposed Development. In the western half of the SADA, several of the existing Frodsham Wind Farm access tracks would be utilised. Where necessary, these would be improved prior to the start of construction through the laying of stone to repair potholes and provide a suitable running surface.

2.4.163 The indicative Operational Layout figure (see ***ES Vol 3 Figure 2-2***) illustrate the indicative locations of proposed permanent access tracks. The tracks would be constructed of permeable compacted aggregate, laid on a geotextile membrane. The tracks would have a width of up to 6.5m and a depth of up to 0.75m. Passing places would be constructed to assist in the flow of construction traffic, these are typically required where single lengths of road exceed 350m. If considered necessary at the detailed design stage, lateral ditches / swales would be provided adjacent to the roads to control any surface water runoff.

2.4.164 Where possible access tracks would utilise existing ditch crossing points, some of which may need to be upgraded or widened. Where new or upgraded crossings are proposed, these would be constructed as open span crossings. A typical watercourse crossing is illustrated on **ES Vol 3 Figure 2-5j: Indicative Permanent Watercourse Vehicular Crossing [EN010153/DR/6.3]**.

2.4.165 New crossings over Main Rivers within the SADA would be designed so the soffit levels of bridges would be raised 600mm above the design flood level of the watercourse it is crossing. There are two new crossings and one replacement crossing proposed over ditches with Main River status. For new crossings over Ordinary Watercourses (the drainage ditches across the land to the east of Brook Furlong) the new crossing would be designed so the bridge soffit would be set above watercourse bank levels. Further information on the approach to crossing design is provided within ***ES Vol 2 Appendix 9-1 Flood Risk Assessment and Drainage Strategy.***

2.4.166 If it is impossible to construct the ditch crossing without compromising the banks of the ditch, and therefore affecting the bed of the watercourse, the crossing would most likely be constructed using a 'dry construction technique'. This involves temporarily damming the ditch upstream and downstream of the crossing, typically using sandbags or straw bales, and pumping water out of the section where the construction is taking place. In many instances the drainage ditches across the Site do not have any noticeable flow within them. As such, where there is no discernible direction of flow, over pumping of water from the upstream side to the downstream side would not be required. However, where there is flow, over pumping would be undertaken. Pumps would be equipped with appropriately sized mesh filters to avoid entrapment of any fish / eels that may be present.

2.4.167 The section of water between the dams would be inspected for fish and other aquatic life such as eels. As set out in the **oCEMP [EN010153/DR/7.7]** a Fish Rescue Plan would be implemented for any works where fish / eels could be present.

2.4.168 Once the crossing section has been pumped free of water the construction works would be undertaken. Aquatic vegetation would be placed on the ditch bank, outside the section of the cable crossing, to allow invertebrates to return to the riparian habitat. Spoil and watercourse bed material would be excavated and stockpiled separately for reuse following the laying of the cables.

2.4.169 On completion of the construction works, the sandbags / straw bales would be gradually removed to reduce the potential for any scouring of the bed material.

2.4.170 **ES Vol 3 Figure 2-5i: Indicative Ditch Cable Crossing Construction Layout [EN010153/DR/6.3]** illustrates a dry construction technique.

2.4.171 Some temporary access tracks, in addition to the permanent access tracks described above, may be required during construction and decommissioning of the Proposed Development. Temporary access tracks would either be constructed from stone, in a similar manner to the permanent tracks, or using temporary road matting. There may also be a requirement to provide temporary ditch crossings. These would be created by using prefabricated bridges which can be erected/dismantled in sections.

2.4.172 **ES Vol 2 Appendix 2-1: Indicative Watercourse Crossing Schedule [EN010153/DR/6.2]** provides a full schedule of potential crossing points. The final location of crossing points will be determined at the detailed design stage which will be post-consent.

Drainage

2.4.173 The solar PV modules would be elevated above the ground on steel support frames, ensuring the ground beneath each solar PV module remains permeable. The solar PV modules would be laid in rows with 'rainwater' gaps between the rows which will allow water to drain to the permeable ground beneath.

2.4.174 The transformer / PCU stations would cover a small footprint, and runoff from the structures would drain to localised filter drains / stoned surrounds that would allow percolation to the surrounding land. The access tracks would comprise porous material, as described above a lateral drain / swale would be provided to capture flow where detailed design considers this necessary.

2.4.175 As described above, the proposed BESS compound and Frodsham Solar Substation compound would be formally drained. It is proposed to discharge surface water from the BESS compound and Frodsham Solar Substation to an adjacent watercourse limited to greenfield runoff rate. Additional details on the proposed drainage arrangements are provided in ***ES Vol 2 Appendix 9-1 Flood Risk Assessment and Drainage Strategy***.

Fencing

2.4.176 The operational areas of the SADA would be enclosed by fencing which would comprise a 2.0m high wire-mesh deer fence. The fencing would be supported on wooden poles. Depending on the insurer's requirements, it may also be necessary for the fences to be topped with barbed wire as an additional security measure. These fences would be erected at the start of the construction works. Public safety signage would be installed.

2.4.177 The gauge of the fencing would allow small mammals to pass. Surveys undertaken as part of the EIA have identified the presence of badgers on the Site. As such, pre-construction surveys would be undertaken to identify additional measures (e.g. mammal gates) to allow larger mammals, such as badgers, to pass through the Site. Metal gates of a similar height as the perimeter fencing would be provided at access points.

2.4.178 Additional security fencing, weldmesh or palisade, up to 2.4m in height, would surround the Frodsham Solar Substation and BESS. Gates at the Frodsham Solar Substation and BESS Facility would typically be 6m wide double swing gates or automated sliding gates.

2.4.179 Wire mesh fencing may also be required along the easement line of some utilities that cross the Site. This would be subject to agreement with the various undertakers.

2.4.180 The fencing proposed across the Site is illustrated on **ES Vol 3 Figure 2-5g: Figure 2-5g Indicative Fencing and CCTV [EN010153/DR/6.3]**. Image 2-7 below provides images of typical fencing.

Image 2-7: Illustrative boundary fencing around Solar Array Areas

2.4.181 Temporary fencing (Heras or similar) may be required during construction to protect sensitive ecological or hydrological features. Public Rights of Way cross the Site, as described below, and as many of these as possible would be kept open during the construction period. Temporary fencing may therefore be required to protect users of Public Rights of Way.

CCTV

2.4.182 Post-mounted internal facing closed-circuit television (CCTV) systems would be installed around the perimeter fence. The CCTV cameras, that would incorporate daytime and night-vision cameras, as well as Perimeter Intrusion Detection Systems, would be mounted on posts up to 4 m high and would be set back from the perimeter fence. No lighting would be required across the SADA. The CCTV poles would be fixed to a concrete foundation.

2.4.183 The CCTV cameras would have fixed, inward-facing viewsheds and would be aligned to capture only the perimeter fence and the area inside the fence, thereby not capturing publicly accessible areas. CCTV systems would be installed up to every 50m and at angle changes of the perimeter fence line. The CCTV installations are illustrated on **ES Vol 3 Figure 2-5g: Indicative Fencing and CCTV [EN010153/DR/6.3]**.

2.4.184 Additionally, dome security cameras would be installed at the Frodsham Solar Substation, and the BESS compound, as well as at every entrance point to the Site potentially used to access the Site. Dome cameras may also be installed adjacent to the PCU stations.

2.4.185 The cabling for the CCTV would typically share trenches with the onsite cabling linking the solar PV modules to the Field Stations.

Lighting

2.4.186 The SADA would not be artificially lit, save as described below. Temporary mobile task lighting may be required for maintenance during periods of low light. However, this would be brought onto Site for short periods of time and would not be used routinely.

2.4.187 The Frodsham Solar Substation and the BESS compounds would have inward-facing security lighting installed. This would be operated with passive infrared (PIR) detectors or would be turned on manually for maintenance in low light conditions or in the event of an emergency.

2.4.188 Lighting will be directional and designed in line with the guidance and principles set out in ILP GN01/2021 'Reduction of Obtrusive Light'. This will include use of appropriate luminaires and lighting levels for the purpose of the lighting, and hoods and cowls to reduce light spill beyond the area targeted for lighting.

Table 2-10: Further associated development within the Order Limits in connection with the delivery of Work Nos 1 – 8 Design Parameters

Further associated development within the Order Limits in connection with the delivery of Work Nos 1 – 8 including – **a. laying down of internal access tracks;** **b. temporary footpath diversions;** **c. ramps, means of access, carparks;** **d. crossings of watercourses and roads;** **e. improvement, maintenance, repair and use of existing streets, private tracks, public rights of way and access roads;** **f. sustainable drainage systems including runoff outfalls, attenuation areas, general drainage and irrigation infrastructure, systems and improvements or extensions to existing drainage and irrigation systems;** **g. works for the provision of security and monitoring measures such as CCTV columns, cameras, lighting columns and lighting, weather stations, communication infrastructure, perimeter fencing;**

h. construction and decommissioning compounds, including site and welfare offices and areas to store materials and equipment; **i. joint bays, link boxes, cable ducts, cable protection, joint protection, manholes, marker posts, underground cable markers, tiles and tape, communications chambers, fibre optic cables and other works associated with cable laying;** **j. foundations for structures, buildings, plant and machinery;** **k. works to alter the course of, or otherwise interfere with, non-navigable rivers, streams or watercourses;** **l. electrical, gas, water, foul water drainage and telecommunications infrastructure connections, diversions and works to, and works to alter the position of, such services and utilities connections; and** **m. earthworks, site establishments and preparation works including site clearance (including vegetation removal, demolition of existing buildings and structures); earthworks (including soil stripping and storage and site levelling) and excavations.**		
Access tracks	Design	Internal access tracks would be compacted stone over an appropriate geotextile.
	Scale	Internal access tracks would have a maximum width of 6.3m.
Electrical cables and communication cables	Design	The cables will be laid below ground.
	Scale	Maximum dimensions of underground trenches will be 1.2m deep and 1.2m wide.
Fencing	Design and Scale	The Frodsham Solar Substation and BESS would be securely fenced with galvanised palisade security fencing. The fencing would be at a maximum height of 2.4 m.
	Design and Scale	Fencing around the Solar Array would be a stock proof mesh-type security fence with wooden posts up to 2.0 m in height, topped with barbed wire.
	Design and Scale	Standalone transformers and inverters would be surrounded by a secure wire mesh fence. This fence would be up to 2.4 m in height.
CCTV and lighting	Design	CCTV lighting will be infrared (not visible) during hours of darkness.
	Design	No lighting will be permanently operated. If required, any visible lighting will be operated by a manual switch or by a motion detection system and only used in fault or emergency situations.
	Scale	CCTV towers will not exceed 4m in height.
	Scale	Lighting towers will not exceed 4m in height.
Ditch crossings	Design	New and improved ditch crossings would use an open span construction.
	Design	New crossings over Main Rivers designed so the soffit levels of bridges would be raised 600mm above the design flood level for the watercourse it

		is crossing. New crossings over Ordinary Watercourses would be designed so the bridge soffit would be set above watercourse bank levels.
	Scale	The maximum width of new crossings would be 6m, the maximum extension of an existing ditch crossing culvert will be 2m.

2.5 Construction Phase

Construction Programme

2.5.1 The Construction Phase is expected to last for approximately 30 months, based on the experience of constructing other similar-scale installations. Subject to securing a Development Consent Order in Summer 2026 it is anticipated that works would start on Site in January 2028 and be completed in mid 2030, with partial commissioning and power export scheduled from mid-2029[4].

2.5.2 It is possible that the Construction Phase could be slightly shorter or longer than stated; however, for the purposes of this ES, a 30-month programme has been assessed. The final programme would depend on the detailed design once any DCO Requirements have been discharged.

2.5.3 The construction of the Proposed Development is likely to be split into different sub-projects / packages to enable to development to be delivered in the most efficient manner. In relation to the solar PV array areas, this is likely to be split into two main sub-projects; the western array area and the eastern array area. The western array area would comprise the solar PV array areas to the west of Brook Furlong i.e. the fields on the former MSC Dredging Deposit Ground (Solar PV Array Areas A01 to A06). The eastern array would comprise the solar PV array areas to the east of Brook Furlong i.e. the agricultural land on the Frodsham Marshes area of the Site (Solar PV Array Areas B01 to B18, and C01 to C06). There are also likely to be separate work packages for the Substation and BESS, the 132kV connection to the SPEN Frodsham Substation and the 132kV Private Wire connection. The sub-projects / packages would likely be managed such that they are happening in a staggered overlapping programme in order to build out the Proposed Development in the most efficient way possible. **ES Vol 2 Appendix 2-2:**

[4] *Throughout the technical assessments, construction is assumed to be undertaken over a 30-month period from January 2029 to June 2030 in order to provide a robust assessment.*

Indicative Construction Phasing and Resource Schedule [EN010153/DR/6.2] illustrates the indicative phasing envisaged for the purposes of the EIA.

2.5.4 The construction of the NBBMA would be undertaken at the beginning of the development programme.

2.5.5 As set out above NBBMA is anticipated to take 6 months to construct and would be created and functional in advance of construction of the western Solar PV Array Areas on the former MSC Dredging Deposit Ground cells, as these are the areas of the SADA most commonly used by wetland birds. This would ensure that displaced (bird) populations have alternative areas of habitat available during the construction of the NBBMA. Construction in other areas of the Site may be undertaken at the same time as the creation of the NBBMA. It should be noted that the buildings at Marsh Farm, to the east of the NBBMA, would be retained for agricultural use.

2.5.6 The primary construction stages for the Proposed Development are set out below. The activities within each key phase are described in an approximate sequential order. However, many of the activities would occur in parallel due to the scale of the project, as illustrated in Appendix 2-2, and this is what has been assumed for the assessments within the ES as a reasonable worst case scenario.

vi) **Construction of the NBBMA**

vii) **Enabling Works**

a. Establishment of temporary welfare facilities within construction compound(s);
b. Liaison with key utility companies to implement necessary safeguarding measures;
c. Set up of any temporary Public Right of Way Management requirements; and
d. Improvement works to Main Site Access route from Grinsome Road/Marsh Lane;

viii) **Construction of the Eastern Array;**

a. Establishment of construction compounds and car parking;
b. Construction of internal access roads, crossings, fencing and surfacing;
c. Undertake necessary earthworks to create development platforms;
d. Delivery of solar PV modules and structures
e. Erection of solar PV mounting structures;
f. Installation of the solar PV modules and associated cabling;
g. Construction of the PCU foundations;
h. Interconnecting 33kV trenching works and cabling;
i. PCU Installation;
j. Commissioning works; and
k. Establishment of other minor ancillary works and landscaping.

ix) **Construction of the Western Array;**

a. Establishment of construction compounds and car parking;
b. Construction of new, and improvement of existing, internal access roads, crossings, fencing and surfacing;
c. Undertake necessary earthworks to create development platforms;
d. Delivery of solar PV modules and structures
e. Erection of solar PV mounting structures;
f. Installation of the solar PV modules and associated cabling;
g. Construction of the PCU foundations;
h. Interconnecting 33kV trenching works and cabling;
i. PCU Installation;
j. Commissioning works; and
k. Establishment of other minor ancillary works and landscaping.

x) **Construction of the BESS and Frodsham Solar Substation;**

a. Establish construction compound and welfare facilities;
b. Construction of internal access roads, fencing and surfacing;
c. Construction of foundations and drainage works;
d. Erection of buildings;
e. BESS container and balance of plant installation;
f. Cabling;
g. HV equipment installation works;
h. Testing and commissioning; and
i. Establishment of other minor ancillary works e.g. lighting, security systems, final external works and landscaping.

xi) **Construction of the 132 kV SPEN Substation Grid Connection;**

a. Establish construction compound and welfare facilities;
b. Trident pole foundations and erection;
c. Trenching works on terminal ends of 132kV Frodsham SPEN Substation connection;
d. Stringing of 132kV on Trident poles;
e. HV equipment installation in SPEN Substation; and
f. Testing and commissioning.

xii) **Construction of the 132 kV Private Wire Grid Connection;**

a. Excavation of trench in sections;
b. Excavation and construction of Jointing Chambers in sections;
c. Cable pulling between Jointing Chambers;
d. Connecting of cables within Jointing Chambers; and
e. Testing and commissioning of grid connection.

Permitted Preliminary Works

2.5.7 There are a range of preliminary works that are required to enable the main construction works to commence on the various phases of construction set out above. These enabling works include the initial mobilisation and access to the Site, and individual enabling works for specific phases of the development.

2.5.8 Within the draft DCO **[EN010153/DR/3.1]** these works are identified as the "permitted preliminary works" and the following activities:

i) environmental surveys, geotechnical surveys, intrusive archaeological surveys and other investigations for the purpose of assessing ground conditions;
ii) receipt and erection of construction plant and equipment;
iii) removal of plant and machinery;
iv) above ground site preparation for temporary facilities for the use of contractors;
v) remedial work in respect of any contamination or other adverse ground conditions;

vi) diversion and laying of apparatus;

vii) the provision of temporary means of enclosure and site security for construction;

viii) the temporary display of site notices or advertisements;

ix) Work No. 8; and

x) site clearance (including vegetation removal, demolition of existing structures or buildings).

2.5.9 The Applicant has thoroughly evaluated the permitted preliminary works and, following assessments within the EIA process, concluded that the environmental impact of these activities does not necessitate the mitigation outlined in the Requirements set out in Schedule 2 of the draft DCO to be in place before they can proceed.

2.5.10 Notwithstanding the above, the Applicant has identified some Requirements deemed necessary to have been discharged for certain permitted preliminary works to commence and this is accounted for in the drafting of the DCO Requirements. The Applicant has also outlined best practice measures to be adopted when undertaking the permitted preliminary works, aimed at reducing potential adverse impacts on environmental receptors. These measures are detailed in **ES Vol 2 Appendix 2-3: Permitted Preliminary Works [EN010153/DR/6.2]**. Compliance with the measures in this appendix is secured by a Requirement in the DCO.

Construction Staff

2.5.11 During the period of peak construction activity, between months 2 and 19, there would be a need for approximately 159 staff on-site on weekdays, on average, and 79 staff on Saturdays. The period of activity requiring the maximum number of staff on site would occur between months 12 and 18, peaking in month 12 when there would be a maximum of approximately 243 staff per weekday, and 122 staff at weekends. The workforce would be distributed across the Site with work happening in parallel across the sub-projects / packages described above.

2.5.12 An indicative workforce resource schedule is presented in **ES Vol 2 Appendix 2-2: Indicative Construction Phasing and Resource Schedule [EN010153/DR/6.2]**.

Construction Hours of Work

2.5.13 Construction operations would generally be limited to 08.00 to 18.00hrs Monday to Friday and 08:00 to 13:00hrs Saturday, with no construction work on Sundays or Bank Holidays. Construction workers would typically arrive in the hour prior to the start of construction and leave in the hour after construction work ceases. Construction staff would therefore arrive at the Site before 08:00 and depart after 18:00 during weekdays.

2.5.14 There may be instances where operations are required outside the above times e.g. delivery of abnormal loads, fit out of internal equipment within the substations, other quiet non-intrusive works such as electrical testing, commissioning and inspection. In such instances, it would be necessary to agree on a modification to the working hours with CWaCC.

Construction Compounds

2.5.15 As set out in Section 2.4, it is anticipated that there would be two main construction compounds and four smaller secondary compounds to facilitate the construction works within the SADA. Two additional compounds would be provided to the north of the River Weaver for the purposes of the SPEN Grid Connection works and one in Cell 3 for the NBBMA.

2.5.16 5.16 construction compounds would be established using a semi-permeable hardcore/gravel mix laid on a geomembrane. In areas where the compounds are situated and will eventually be covered with solar PV arrays, they would remain in place and be covered by the solar array at the end of construction, as it is anticipated that they could be reused when decommissioning occurs.

2.5.17 Where practicable, utility supplies would be taken from main supply utility connections; however, where this is not possible, utilities would be provided from temporary facilities such as the use of generators, water bowsers, local wastewater storage and transport of waste to an approved off-site disposal point.

2.5.18 The main compounds would include the main site offices, site security, employee parking and the main site welfare, together with a fenced laydown area for storing plant, material, equipment and components. Dedicated waste storage, fuel and oil chemical stores, concrete washout areas and refuelling stations would be provided within the main compounds. Temporary buildings, potentially double stacked to reduce footprint, would be installed to provide:

i) Site office space
ii) Toilets and showers
iii) Canteen facilities
iv) Drying room
v) Storage and security offices

2.5.19 The smaller satellite construction compounds would include areas for storing plant, material, equipment and components. Additionally, it is expected that there would be multiple mobile welfare units (toilets, drying rooms and canteen units) that would move around the Site as work progresses. These mobile units would have their own independent power (generally diesel generators) and lighting. As with the compounds, lighting would only be used during periods of low light conditions during the prescribed working hours.

Construction Traffic, Plant and Site Access

2.5.20 The construction access route to the Site would be from the west, leading from Pool Lane roundabout. Pool Lane provides access via the dualled A5117 to Junction 14 of the M56 and Junction 10 of the M53. Vehicles accessing the Site would turn onto Grinsome Road (a private road) from Pool Lane roundabout and travel east towards Protos for approximately 1.5 km, routing north at Grinsome Road Roundabout, along Road 1 of Protos. Vehicles would then turn east along Marsh Lane which provides access to Frodsham Wind

Farm. The Frodsham Wind Farm access tracks provide access to the SADA. No HGVs would be routed through the villages of Frodsham, Ince or Elton.

2.5.21 The access to the SPEN Frodsham Substation would be via the A56 Chester Road, where a dedicated private access road leads to the substation complex. All construction traffic would be directed east along the A56, where onward connections to the strategic highway network, including Junction 12 of the M56, can be made.

2.5.22 No construction traffic would be permitted to route through Frodsham. As such there would be not construction access into the Site from Brook Furlong or Weaver Lane.

2.5.23 An **Outline Construction Traffic Management Plan (oCTMP) [EN010153/DR/7.4]** is provided with the DCO application. The oCTMP sets out the measures used to minimise the impact of construction traffic on local communities by defining the routes that construction traffic must take, any timing restrictions in relation to the use of certain routes, and the penalties to contractors if the oCTMP is not adhered to. It also sets out that a Construction Traffic Management Plan Working Group would be established to manage and co-ordinate the traffic associated with the multiple infrastructure projects being proposed near the Site.

2.5.24 Abnormal Indivisible Loads (AIL) are considered loads that cannot be delivered using traditional vehicles i.e. 40ft artic truck with road haulage limits of 44T. The exact machinery and equipment required for the construction works would require updates at the detailed design stage. However, it is anticipated there would be a need for AIL deliveries for items such as high voltage transformers, cable drums, and cranes. This is considered further in the **Transport Assessment [EN010153/DR/7.3]**.

2.5.25 The two proposed access points described above are of a high standard and are regularly used by HGVs, with the main access into the SADA designed for the construction and maintenance of the Frodsham Solar Farm. As such there is no requirement for any works to be undertaken to the public highway to facilitate access to the Site.

2.5.26 It is assumed that there would be an average of 8 HGV deliveries per day across the 30 month Construction Phase, with a peak of 23 deliveries per day, in Month 13, during the brief period when construction of the Eastern and Western Arrays overlaps with BESS/Substation construction works of access track construction works.

2.5.27 It is anticipated an average of 109 construction-related staff will require access to the Site per day on average across the 30 month Construction Phase, peaking in month 12 when there would be a maximum of approximately 243 staff per weekday, and 122 staff at weekends.

2.5.28 It is anticipated that the majority of Site workers would car share or be brought to Site in small minibuses from the local settlements of Ellesmere Port, Chester and Runcorn or via car sharing arrangements. Parking for approximately 208 cars would be provided on Site, comprising 104 parking spaces located adjacent to each of the Main Site Compounds within the Western Array and the Eastern Array, respectively.

2.5.29 Further details of traffic movements associated with HGVs and LDVs are provided within the **Transport Assessment [EN010153/DR/7.3]**.

2.5.30 Typical vehicles, plant and machinery that are assumed to be required during the Construction Phase would likely include:

i) Articulated Lorries;
ii) Low Loaders;
iii) Tipper Trucks;
iv) Concrete Mixer Lorries;
v) Mobile cranes;
vi) Fuel Tankers;
vii) Water Tankers;
viii) Vacuum Tankers;

ix) Excavators;
x) Telehandlers;
xi) Push press piling rigs;
xii) Power generators;
xiii) Vibrating rollers;
xiv) Cable pullers; and
xv) Skips.

Construction Lighting and Security

2.5.31 Lighting during construction would need to be sufficient to satisfy health and safety requirements, whilst ensuring impacts on the surrounding environment, including from sky glow, glare and light spillage, are minimised.

2.5.32 Artificial lighting would only be used during the hours of darkness, low levels of natural light or during specific construction tasks to ensure the health, safety and welfare of those on site, including construction staff and visitors.

2.5.33 Appropriate lighting would be installed and operated to ensure that:

i) access/egress points are clearly visible during operational hours;
ii) staff and visitors can move safely around the Site;
iii) site security can be monitored and maintained;
iv) sufficient area lighting is provided for the Site office and laydown areas; and
v) impacts on ecological receptors, nearby residents and amenity users of the Site are minimised.

2.5.34 Lighting towers would be required during the winter months at each of the construction compounds. There may also be a requirement for mobile task lighting at some of the construction locations e.g. PCUs, transformer units, BESS compound and Substation compound. Lighting would not be operated outside of the specified construction working hours. Lighting would utilise directional fittings to minimise outward light spill and glare. Measures to control light pollution are documented within the **oCEMP [EN010153/DR/7.7].**

2.5.35 The Site will be secured by temporary fencing (such as Heras fencing) during the construction phase, with overall management of security resting with the Principal Contractor. All plant and materials will be secured to prevent theft or vandalism. Remote monitoring and intrusion detection is likely to be managed via the use of deterrent systems such as 'Armadillo' camera security units.

Construction Environmental Management

2.5.36 The **oCEMP [EN010153/DR/7.7]** outlines the principles, controls, and measures to be implemented during construction to reduce potential significant environmental effects from occurring, including relevant subsidiary plans. Where the Proposed Development relies on mitigation measures in relation to significant construction phase environmental effects from the EIA, these measures have been outlined within the oCEMP.

2.5.37 Post-consent, this outline plan will be developed into a full plan which must be in substantial accordance with the outline and will require approval by CWaCC. The Proposed Development must be undertaken in accordance with the approved plan. This is secured via a Requirement in Schedule 2 of the **draft DCO [EN010153/DR/3.1]**.

2.5.38 The objectives of the CEMP would be to:

i) highlight environmental impacts resulting from the development and identify sensitive receptors within the development site to the construction team;
ii) reduce and manage environmental impacts through appropriate construction methods;
iii) reduce and manage environmental impacts through implementing environmental best practices during the construction period;

iv) undertake ongoing monitoring and assessment during construction to ensure environmental objectives are achieved;
v) provide emergency procedures to protect against environmental damage;
vi) provide an environmental management structure for the construction stage;
vii) recommend mechanisms to reduce the risks of environmental damage occurring; and
viii) ensure procedures are in place for consultation with, and where necessary approval from, EA, Natural England, CWaCC Local Authority Officers and other stakeholders throughout the works if necessary.

Public Rights of Way

2.5.39 As set out in **ES Vol 1 Chapter 1.0**: **Introduction [EN010153/DR/6.1]** there are a number of PRoW that cross the Site, these are illustrated on **ES Vol 3 Figure 1-5: Public Rights of Way [EN010153/DR/6.3]**.

2.5.40 One of the design objectives of the Proposed Development is to retain, enhance and encourage public access throughout the life of the proposal, including during construction and decommissioning, where feasible. As such, the construction works would be designed to minimise disruption to PRoW routes within the Site.

2.5.41 Public safety is the main concern when considering interactions with users of the PRoW, and as such, a cautious approach would be taken by the construction contractor when managing the Site. Typical measures would include using temporary gates and signage to warn, direct and protect PRoW users during the construction period.

2.5.42 Fencing, gates and signage would prevent unauthorised public access to construction areas. Exact methods to deal with PRoW interactions would require review at the detailed design phase. However, an **Outline Public Right of Way Management Plan [EN010153/DR/7.9]** has been prepared and submitted with the DCO application. This document sets out the principles by which PRoW would be managed during the construction, operation and decommissioning phases, with a full Public Right of Way Management Plan produced following grant of the DCO and prior to the start of construction. Table 2-11 summarises the management required for each PRoW within the Site.

Table 2-11: PRoW Management Measures

PRoW Reference	Impact on PRoW	Management Measures Proposed
Frodsham FP93	Frodsham FP93 runs along the easterly border of the Site but lies outside the construction perimeter fence line. As such there would be no permanent requirement for construction traffic to use this route. However, the proposed 132kV overhead line to Frodsham SPEN Substation would cross the PRoW. As such there would be a need to protect users during the stringing of the 132kV lines. This would require the authorisation of temporary use of motor vehicles on this PRoW.	The PRoW would be closed for a period of up to 2 weeks (during the construction working hours) during the stringing of the high voltage cables for the 132kV overhead line construction into the SPEN substation. Appropriate signage warning in advance of closures, and during the closures, would be displayed alongside fencing and gates to prevent access to the area.
Frodsham FP81	A single construction access crossing point would be required across Frodsham FP81. There would also be a need to authorise the temporary use of motor vehicles on this ProW in order to gain access to the works on Frodsham FP93 as described above.	Gated access would be provided, preventing construction vehicles / plant from crossing the PRoW. In order for construction vehicles / plant to cross the PRoW, the gates would need to be reversed, preventing temporary access along the PRoW whilst vehicles make the crossing. After crossing the PRoW, the gates would be returned and locked into their original position.
Frodsham RB99	A single crossing point would be required across Frodsham RB99. A limited temporary closure of a 400m section of Frodsham RB99 would also be needed to protect users during the stringing of the 132kV lines, which would require the authorisation of temporary use of motor vehicles on this PRoW.	A similar 2-gate system to FP81 would be implemented.
Frodsham RB108	A 190m section of Frodsham RB108 would be used as a construction access road to the western half of the SADA (to the west of Brook Furlong). As such it would be necessary to implement measures to avoid conflicts between users of the PRoW and construction traffic.	. During construction working hours, construction traffic would be managed using banksmen along this section of RB108. Banksmen would halt construction traffic when users need to access this section of PRoW. Outside construction working hours the route would be re-opened for use.

Frodsham RB102	A 190m section of Frodsham RB102 would be used as a construction access road. As such it would be necessary to implement measures to avoid conflicts between users of the PRoW and construction traffic.	During construction working hours, construction traffic would be managed using banksmen along this section of RB102. Banksmen would halt construction traffic when users need to access this section of PRoW. Outside construction working hours the route would be re-opened for use.
Frodsham RB98	Temporary closure of the western end of the PRoW for the duration of the construction works.	Users would be directed along the PRoW Frodsham RB97 and Frodsham RB101. This diversion would provide a shorter route than the section closed.
Frodsham RB103	Temporary closure for the duration of the construction works.	Users would be directed along the PRoW Frodsham RB97 and Frodsham RB101. This diversion would provide a shorter route than the section closed.
Ellesmere Port and Neston RB40 / National Cycle Network Route 5 (NCN5)	A 1km section of Ellesmere Port and Neston RB40 (which also forms part of the National Cycle Network Route 5) would be used as a construction access road. As such it would be necessary to implement measures to avoid conflicts between users of the PRoW and construction traffic	Pedestrians and horses would be prohibited from accessing this section of RB40 during construction working hours. Banksmen would be used to ensure safe passage of cyclists. Cyclists wanting to access this section of RB40 would be held until construction traffic has been halted, they would then be allowed to proceed. Outside construction working hours the route would be re-opened for use to all users.
Frodsham RB106 / NCN5	A 150m section at the western end of Frodsham RB106 (which also forms part of NCN5) would be used as a construction access road. As such it would be necessary to implement measures to avoid conflicts between users of the PRoW and construction traffic	Pedestrians and horses would be prohibited from accessing this section of RB106 during construction working hours. Banksmen would be used to ensure safe passage of cyclists. Cyclists wanting to access this section of RB40 would be held until construction traffic has been halted, they would then be allowed to proceed. Outside construction working hours the route would be re-opened for use to all users.

River Weaver

2.5.43 As set out in Table 2-11 the works to 'string' the high voltage cables for the 132kV overhead line construction into the SPEN substation will be undertaken over a two week period. Whilst the 'stinging' operations are being undertaken it would be necessary to prevent use of this section of the river by craft, swimmers, fishermen and other recreational and navigation purposes. It is possible that the closure would be over a much shorter period of time.

2.5.44 It is understood that there is very little commercial navigation on this section of the River Weaver and use is predominantly limited to recreational purposes. As such the river would remain open over weekend periods and only closed during the construction working hours, Monday to Friday.

2.5.45 As set out in the **outline Construction Environmental Management Plan [EN010153/DR/7.5]** there would be a commitment to provide at least 3 months advance notice to the recreational clubs on the River Weaver of any closure of the River Weaver. Notices shall also be published in local newspapers and online community resources e.g. Frodsham Town Council newsletters of scheduled closures.

Utilities

2.5.46 A number of utilities cross the Site, these are illustrated on **ES Vol 3 Figure 1-6: Utilities [EN010153/DR/6.3]**. The easements set out below in Table 2-12 have been adopted for the Indicative Operational Site Layout. Specific safeguards to protect assets would be required to be adopted during construction works, working methods would be agreed with the utility undertakers and adopted within agreed construction method statements. Protective Provisions to safeguard utilities crossing the Site are included within the **draft DCO [EN010153/DR/3.1]** to secure this.

2.5.47 As set out previously the Applicant is also in dialogue with the developers of the HyNet Hydrogen pipeline which is proposed to cross the Site and also the proposed Carbon Dioxide pipeline which would cross the Site and connect the Runcorn Energy Recovery Carbon Capture Plant to the Liverpool Bay Carbon and Capture Storage project. The Proposed Development is being designed cognisant of the potential requirements of these projects.

Table 2-12: Easements applied to Utilities crossing the Site

Utility	Easement applied to the Indicative Design
Shell Grangemouth to Stanlow Pipeline	3.05m either side of the pipe from the pipe edge
Shell/Essar Stanlow to Carrington Pipeline	30.48m diameter for above ground pipe sections and 10m diameter for below ground sections
Essar Stanlow to Runcorn	3.05m either side of the pipe from the pipe edge
Buried gas supply	6.0m easement centred on pipe with additional 3m access strip either side of easement
Private water main	6.0m centred on pipe
Windfarm HV Cables	10.0m centred on the cable – 132 kV Private Wire Connection to lie within this easement
Wind turbines	No dig within 10m diameter No extraction or excavation within 75m diameter No extraction or excavation deeper than 5m within 75 to 100m diameter No buildings or infrastructure taller than 35m height within 125m diameter
400 kV National Grid Overhead Line	30m diameter from the tower base
132 kV SPEN Overhead Line	30m diameter from the tower base

Electric and magnetic fields (EMFs)

2.5.48 Electric and magnetic fields (EMFs) are produced both naturally and as a result of certain human activities. EMFs generally arise wherever electricity is produced, transmitted, distributed and used, and this includes electrical substations, powerlines, as well as domestic, office or industrial equipment that uses electricity. Paragraph 2.9.46 NPS EN-5 states that *"All overhead power lines produce EMFs. These tend to be highest directly under a line and decrease to the sides at increasing distance."*.

2.5.49 International guidelines for public exposure to electromagnetic fields (EMF) are developed and regularly updated by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). The guidelines prepared by the

ICNIRP have been endorsed by the World Health Organization (WHO) and the European Commission (EC).

2.5.50 In March 2004, the National Radiological Protection Board (now part of the Health Protection Agency) provided advice to the Government on public exposure limits, recommending the adoption in the UK of guidelines published in 1998 by the ICNIRP. The Government subsequently adopted this recommendation, saying that limits for public exposures should be applied in terms of the 1999 European Union (EU) Recommendation (EC, 1999) on public exposure to EMF.

2.5.51 NPS EN-5 states at paragraph 2.11.8 that the:

"NPS does not repeat the detail of the ICNIRP 1998 guidelines on restrictions or reference levels. The government has developed with the electricity industry a Code of Practice, 'Power Lines: Demonstrating compliance with EMF public exposure guidelines – a voluntary Code of Practice', published in February 2011 that specifies the evidence acceptable to show compliance with ICNIRP (1998) guidelines".

2.5.52 The Code of Practice states that:

"The Energy Networks Association will maintain a publicly available list on its website of types of equipment where the design is such that it is not capable of exceeding the ICNIRP exposure guidelines, with evidence as to why this is the case. Such types of equipment are likely to include:

- *overhead power lines at voltages up to and including 132kV;*
- *underground cables at voltages up to and including 132kV; and*
- *substations at and beyond the publicly accessible perimeter.*

Compliance with exposure guidelines for such equipment will be assumed unless evidence is brought to the contrary in specific cases."

2.5.53 On this basis, the 132kV overhead lines which form part of the Proposed Development are not considered to present a risk in relation to EMFs.

2.5.54 Whilst not part of the Proposed Development, 400kV overhead electricity transmission lines cross the Site, as shown on **ES Vol 3 Figure 1-6: Utilities [EN010153/DR/6.3]**. These lines emit EMFs, which could affect users of the Site, both in relation to members of the public accessing the footpaths within the Site and also operatives working at the Site during the construction, operational and decommissioning phases.

2.5.55 Paragraph 2.9.51 of NPS EN-5 states that "the levels of EMFs produced by power lines in normal operation are usually considerably lower than the ICNIRP 1998 reference levels. For electricity substations, the EMFs close to the sites tend to be dictated by the overhead lines and cables entering the installation, not the equipment within the site".

2.5.56 Typical EMFs from a 400kV overhead line are in the range of 5 to 10µT (magnetic field) and 3 to 5kV/m (electric field) directly under the overhead line, decreasing to a background level within 150m of the overhead line vi.

2.5.57 The aforementioned Code of Practice states that :

The 1998 ICNIRP exposure guidelines specify a basic restriction for the public which is that the induced current density in the central nervous system should not exceed 2 mA m-2. The Health Protection Agency specify that this induced current density equates to uniform unperturbed fields of 360 µT for magnetic fields and 9.0 kV m-1 for electric fields."

2.5.58 Therefore, the EMF produced by the existing overhead lines is likely to be below the relevant public exposure limits. Furthermore, National Grid, which owns and operates the lines, has set out a Public Position Statement (National Grid, 2018a) stating:

"In all our operations, as a minimum, we comply with legal requirements, including relevant EMF regulations. We also aim to follow industry guidelines

or best practice in the countries and different jurisdictions in which we operate."

2.5.59 On this basis, users of the Site, both in relation to members of the public and operatives, would not be exposed to levels of EMF above the relevant exposure limits in relation to the existing 400kV overhead transmission lines.

2.6 Operational Phase

2.6.1 The Proposed Development comprises a temporary development with an operational phase of up to 40 years. Decommissioning activities would commence 40 years after final commissioning and so decommissioning would be expected to start in 2070.

Operational Workforce and Activities

2.6.2 During the operational phase, access to the Site would principally be to the Frodsham Solar BESS and Substation, and to the wider site for routine maintenance operations, replacement of equipment, habitat management, and farming activities. It is expected that there would be 10 full-time equivalent (FTE) roles during the Operational Phase, covering site maintenance, management and administrative roles, and land management, including landscape maintenance and agriculture. Additional employment is likely to be required for the management of the NBBMA.

2.6.3 At times when significant replacement campaigns are required e.g. replacement of solar PV array areas, multiple transformer or battery storage units are required, more staff and specialist equipment (cranes and low loaders) would be required. Table 2-13 below sets out assumptions regarding the operational lifespan of key individual components of the Proposed Development.

Table 2-13: Indicative Operational Lifespan of Proposed Development Components

Scheme Component	Indicative Operational Lifespan
Solar Modules	15 – 30 years (a single replacement per installed panel and 10% contingency is assumed)
Mounting Structures	40 years
DC Cable	40 years (20% replacement anticipated due to defects)
AC Cables	40 years
Trident Poles	40 years
Solar Balance of Plant (Transformers/Inverters/Switchgear)	20 years (Replacement only for performance or health and safety reasons)
Battery Storage Unit and associated PCU	10 - 20 years (50% replacement anticipated due to defects)
Substation Equipment	40 years
Fencing	10 years

Meteorological monitoring equipment	5 – 15 years
Communication and CCTV	10 – 20 years

2.6.4 Routine maintenance access to the Site would be by a small van or similar. An operations / spares building would be provided within the Frodsham Solar Substation compound. It would contain changing rooms and welfare facilities for site operatives, offices and storage areas for spare parts and maintenance equipment. Where necessary temporary welfare units may be used across the Site to service specific maintenance activities.

2.6.5 Cable maintenance will consist of routine inspections and any reactive maintenance such as where a cable has been damaged. For the Private Wire Connection which will be installed with joint bays, cable sections will be inspected and maintained utilising the joint bay chambers.

Operational Environmental Management

2.6.6 During the operational phase, the routine activities on site would be limited primarily to vegetation and landscape management; maintenance of footpaths, recreational facilities and fencing; equipment maintenance; and servicing, cleaning of solar PV modules, and onsite agricultural management e.g. associated with sheep grazing. The management of the landscaping and green infrastructure is set out in the **oLEMP [EN010153/DR/7.13]**.

2.6.7 There would be a requirement for the replacement of components that fail or reach the end of their lifespan. Table 2-12 above identifies that for many of the components, it can be expected that there would be one or more replacements required over the 40-year lifetime of the project. The assessments presented within the ES for the operational phase provide a worst-case scenario of all of the infrastructure on the Site being constructed at once. The replacement of components would be periodic throughout the lifetime of the scheme and would not involve the intensity of construction required at the outset of the project. As such, the magnitude of effect experienced during the replacement and maintenance works would be less than that assessed for the construction phase and relevant measures have been provided for in the **outline Operational Environmental Management Plan (oOEMP) [EN010153/DR/7.7]** to manage these impacts.

2.6.8 Routine inspections and assessments will be conducted to determine the condition and performance of solar panels, solar balance of plant, battery storage units, and other associated infrastructure set out in Table 2-12. Equipment identified as reaching the end of its functional lifespan or showing reduced operational performance will be scheduled for replacement.

2.6.9 Once operational it is not anticipated that there would be any requirement for below ground works that lie outside the areas impacted by the initial construction works.

2.6.10 An **outline Operational Environmental Management Plan (oOEMP) [EN010153/DR/7.7]** has been prepared. This describes the principles, controls, and measures to be implemented during the operational phase to reduce potential significant environmental effects from occurring, including during any replacement campaigns.

2.6.11 Post-consent, this outline plan will be developed into a full plan by the Applicant, which must be in substantial accordance with the outline and will require approval by CWaCC. The Proposed Development must be operated in accordance with the approved plan. This is secured via a Requirement in Schedule 2 of the **draft DCO [EN010153/DR/3.1]**.

2.6.12 The NBBMA would be managed to deliver the stated outcomes and management objectives set out in the **oLEMP [EN010153/DR/7.13]**. The Applicant envisages that the NBBMA would be managed by, or under the supervision of, an organisation experienced in stewardship of wetland reserves, such as the Local Wildlife Trust or the RSPB.

Vehicular Access

2.6.13 Vehicular access to the Site would be the same as that described above for construction i.e. access would be from the west via Pool Lane, Grinsome Road and the Frodsham Wind Farm access track. Vehicles would not access the Site via Frodsham. Emergency access routes would be provided from Frodsham via Brook Furlong and Marsh Lane, and Weaver Lane. These access points would only be used by emergency service vehicles.

2.6.14 Brook Furlong and Moorditch Lane would also be available for public vehicles to access the newly created car parking area – noting that vehicles already access and park along Moorditch Lane.

2.6.15 There would be maintenance vehicles retained onsite, most likely tractors, trailers and bulk tankers, along with smaller LGVs. These would be used to transport spare components, tools and equipment around the Site, and to undertake landscape maintenance and solar PV module cleaning. These would be stored in the Frodsham Solar Substation compound within parking areas adjacent to the operations / spares building, or within the operations building store area.

2.6.16 There would be no requirement for any regular HGV access, with the vast majority of the routine maintenance, and associated deliveries, undertaken by LGV.

Public Rights of Way and Permissive Paths

2.6.17 During the operational phase, all existing PRoW would be maintained on their existing alignment, and it is not expected that any diversions or stopping-up of PRoW is required. The **outline PROWMP [EN010153/DR/7.9]** describes how the PRoW within the Order Limits, and newly created permissive paths, would be managed over the lifetime of the scheme.

Biodiversity and Vegetation Management (including grazing and Permissive Paths)

2.6.18 A range of different habitat and land management prescriptions would be required to deliver the landscape outcomes envisaged for the Proposed Development. These are set out within the **oLEMP [EN010153/DR/7.13]** which supports the DCO application. Post-consent, this outline plan will be developed into a full plan which must be in substantial accordance with the outline and will require approval by CWaCC. The Proposed Development must be operated in accordance with the approved plan. This is secured via a Requirement in Schedule 2 of the **draft DCO [EN010153/DR/3.1]**.

2.6.19 The oLEMP **[EN010153/DR/7.13]** sets out the management prescriptions and target habitat conditions for the various landscape features identified on the Indicative Environmental Masterplan (see **ES Vol 3 Figure 2-3 (a-e) Illustrative Environmental Masterplan [EN010153/DR/6.3]**). Monitoring processes are also prescribed to record the progress of establishing target habitats and implement remedial measures. This ensures that the habitats created and managed will meet the target condition set out in the oLEMP **[EN010153/DR/7.13].** The **oLEMP [EN010153/DR/7.13]** contains specific detail for the management of the NBBMA. This includes the Non Breeding Bird Mitigation Strategy contained at Appendix B to the **oLEMP [EN010153/DR/7.13]**. This defines a series of specific criteria and habitat objectives to ensure the NBBMA delivers suitable habitat for the target SPA species it is being designed to cater for.

2.7 Decommissioning Phase

2.7.1 When the operational phase ends, the Proposed Development would require decommissioning. All solar PV modules, mounting poles, above ground cabling, inverters, transformers, BESS equipment, the Frodsham Solar Substation, and fencing would be removed from the Site and recycled or disposed of in accordance with good practice and market conditions at that time. It is also likely that below ground cabling would be removed from Site and recycled. The Site would be returned to a condition suitable for return to its original use after decommissioning.

2.7.2 An **Outline Decommissioning Environmental Management Plan (oDEMP) [EN010153/DR/7.9]** has been prepared to support the DCO application. It provides a framework for the management of environmental impacts during the decommissioning phase of the Proposed Development. The oDEMP also set outs monitoring and auditing activities which would be used to ensure mitigation measures are carried out, recorded and effective.

2.7.3 Decommissioning is expected to take between 12 and 24 months and would be undertaken in phases.

2.7.4 The effects of decommissioning are often similar to, or of a lesser magnitude than, construction phase effects. As such, as set out in the Scoping Report, it is not proposed to provide a separate decommissioning assessment within each technical chapter, unless there are specific issues related to decommissioning which could give rise to materially greater impacts than construction. Where this occurs an assessment of these impacts will be provided.

2.7.5 On decommissioning, the landscaping works undertaken across the Site would remain in place, and the land would be handed back to the landowner, with the only exceptions being the potential requirement by the landowner to revert the grassland created on the eastern half of the Site (to the east of Brook Furlong) and the Skylark Mitigation Areas back to land suitable for arable farming. Given that the western half of the Site is currently used for grazing, the grassland created and managed in this area would be retained.

2.7.6 It is likely that tree and scrub planting, together with created pond and wetland habitats, would be retained, including the habitats created within the NBBMA. However, as the land would be handed back to the landowners on completion of decommissioning the long term retention of the landscaping improvement works cannot be guaranteed. Similarly, following decommissioning the landowner may or may not retain the permissive footpaths created across the Site.

2.8 Waste Management

2.8.1 Waste is defined by the Waste Framework Directive (Directive 2008/98/EC) as “any substance or object which the holder discards or intends or is required to discard”.

2.8.2 In practical terms, wastes include surplus spoil, scrap, recovered spills, unwanted surplus materials, packaging, office waste, wastewater, broken, worn-out, contaminated or otherwise spoiled plant, equipment and materials. Often, where waste is generated and subsequently disposed of, there is a potential for resources to be permanently lost and for indirect environmental impacts and associated effects to occur.

2.8.3 Given the nature of the Scheme, significant quantities of waste are not anticipated. Expected waste streams during the construction, operation and decommissioning phases are discussed below.

2.8.4 The **oCEMP [EN010153/DR/7.7], oOEMP [EN010153/DR/7.8] and oDEMP [EN010153/DR/7.9]** describe embedded mitigation measures to control and manage waste on-site, including the development of a Waste Management Plan for each phase. Post-consent, these outline plans will be developed into full plans which must be in substantial accordance with the outline and will require approval by CWaCC. The Proposed Development must be undertaken in accordance with those approved plans. This is secured via a Requirement in Schedule 2 of the **draft DCO [EN010153/DR/3.1]**.

Construction Phase

2.8.5 Many of the infrastructure elements would be prefabricated offsite i.e. PV modules, racks, inverters and transformers, battery energy storage system (BESS) units, substation components. As such, the generation of waste resulting from the construction of these elements will be minimal.

2.8.6 The types of wastes generated during construction are likely to comprise:

i) General waste from site offices and welfare facilities;

ii) Small quantities of waste from the maintenance of construction vehicles;
iii) Packaging waste from incoming materials; and
iv) Other waste from construction of fencing, access roads and other supporting infrastructure.

2.8.7 Waste streams are likely to include:

i) Metals (iron and steel);
ii) Plastic;
iii) Paper and cardboard;
iv) Wood;
v) Chemicals, fuels and oils; and
vi) Waste water.

2.8.8 There will be a requirement for some earthworks on Site, in addition to the earthworks proposed as part of the NBBMA. There would also be soil arisings resulting from the construction of underground cable trenches, piling operations or localised excavations for construction of foundations or placement of services.

2.8.9 CL:AIRE (Contaminated Land: Applications in Real Environments) have produced a Definition of Waste Code of Practice (DoWCoP) which allows the re-use of excavated materials on-site or their transfer between sites under a Materials Management Plan (MMP). In the unlikely event that soil arisings are not used on-site then the contractor would look to reuse soils in accordance with the DoWCoP, thereby minimising export of materials to landfill.

2.8.10 All waste transported off-site will be delivered to the appropriately licensed receivers of such materials. Operators receiving any waste materials resulting from the Proposed Development (which is not envisaged at this stage) will be subject to their own permitting and regulatory procedures.

2.8.11 Prior to construction, opportunities to minimise waste produced through the construction phase as far as possible will be explored. Possibilities to re-use or recycle materials will be explored before resorting to landfill options.

2.8.12 Re-usable waste includes soil excavated for trenches, roads, compound areas and foundations. These will be re-used on-site where possible.

2.8.13 Toxic and / or hazardous waste must be treated by an authorised operator. Transportation of hazardous waste will also require an authorised carrier. Materials are to be dealt with in accordance with the **oCEMP [EN010153/DR/7.7]**. With these measures in place and the appropriate control measures followed, no significant effects are anticipated.

Operational Phase

2.8.14 During operation, waste arisings would be very limited and would include:

i) Welfare facility waste;
ii) Equipment needing replacing;
iii) Waste metals; and
iv) General waste (paper, cardboard, wood, etc.).

2.8.15 Any arisings would be managed in accordance with the Waste Duty of Care Code of Practice , which implements the duty of care set out in Section 34(1) of the Environmental Protection Act 1990. Waste would be sent to an appropriate waste management facility and managed in accordance with the duty to apply the waste hierarchy as required by Regulation 12 of the Waste (England and Wales) Regulations 2011.

2.8.16 During the operational phase of the Scheme, waste arisings are expected to be minimal and are not anticipated to result in a significant effect. As set out above the **oOEMP [EN010153/DR/7.8]** includes a requirement to prepare an Operational Waste Management Plan.

Decommissioning Phase

2.8.17 During the decommissioning phase, it is expected that a number of waste streams will be created. They are likely to include the following:

2.8.18 Solar modules and mounting structures;

i) Cables;
ii) Fencing;
iii) Waste materials from foundations;
iv) Electrical equipment;
v) Energy storage i.e. batteries;
vi) Welfare facility waste;
vii) Waste chemicals, fuels and oils;
viii) Waste metals; and
ix) Waste water from dewatering of excavations and from cleaning activities (e.g. wheel wash).

2.8.19 The majority of the mounting structures, cabling and fencing are comprised of metal and are readily recyclable. PV modules comprise aluminium frames, laminated glass, silicon cells and polymer sheeting. PV modules would be dismantled and the modules separated into their component parts to allow the constituent elements to be recycled. At the point of decommissioning, all of the modules would be removed to a PV panel recycling facility. The resource value of the various components of the modules, along with the legislative requirements of the waste management regime, means that the vast majority of the PV infrastructure would be recycled.

2.8.20 Other associated infrastructure, such as the transformers, will be removed from their concrete foundations and will be transported via HGV off-site. The equipment will either be re-used or recycled where possible.

2.8.21 When removing the substation, the infrastructure will be loaded onto an abnormal indivisible load vehicle (AIL) and removed from site in much the same way as it was delivered to site. The area will be returned to its former condition and the substation is likely to be refurbished and re-used on another site or taken to a recycling facility.

2.8.22 The inverter and transformer platforms and concrete foundations will be broken up and removed off-site. The crushed foundations will be provided to a licensed waste transfer station for appropriate disposal or sold as recycled aggregate. Any uneven ground will be reinstated to its former condition.

2.8.23 All tracks will be restored to the previous condition. The aggregate used for the internal tracks will be recovered, loaded onto HGVs and transported off-site for re-use at another site or to a recycling facility.

2.8.24 Underground cables may either be disconnected from the local electricity network and either removed from site and, if this is done, recycled or left in situ. This would be determined at the time of decommissioning

2.8.25 As such, the quantum of non-recyclable waste will be limited. Any non-recyclable waste would be stored in a skip for regular removal to an appropriate landfill.

2.8.26 All waste transported off-site will be delivered to appropriately licensed receivers of such materials.

2.8.27 Waste arisings will be prevented and designed out where possible. Opportunities to re-use material resources will be sought where practicable. Where re-use and prevention are not possible, waste arisings will be managed in line with the Waste Hierarchy. As set out above, the **oDEMP [EN010153/DR/7.9]** includes a requirement to prepare a Decommissioning Waste Management Plan.

2.9 References

[i] HMSO (2008). Planning Act 2008. Available at: https://www.legislation.gov.uk/ukpga/2008/29/introduction [Last Accessed: 04 October 2023]

[ii] National Infrastructure Planning (2018). Advice Note 9: Using the 'Rochdale Envelope'. Available at: https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-nine-rochdale-envelope/ [Last Accessed: 04 October 2023]

[iii] Ministry of Housing, Communities and Local Government and Department for Levelling Up, Housing and Communities, 30 Apr 2024. Guidance Planning Act 2008: Pre-application stage for Nationally Significant Infrastructure Projects. Paragraph 014 Reference ID 02-014-20240430. Available online at <https://www.gov.uk/guidance/planning-act-2008-pre-application-stage-for-nationally-significant-infrastructure-projects> Accessed 15 Aug 2024

[iv] Smith, T., & Buckley, P. (2020). Biological Flora of the British Isles: Crassula helmsii. Journal of Ecology, 108(2), 797-813.

[v] Liverpool John Lennon Airport Wildlife Hazard Management Plan, Liverpool John Lennon Airport, 2022

[vi] Energy Networks Association (2012). Electric and Magnetic Fields. Available at: https://www.nationalgrid.com/sites/default/files/documents/13791-Electric%20and%20Magnetic%20Fields%20-%20The%20facts.pdf