3 ALTERNATIVES

3.1 Introduction

This Chapter of the Environmental Statement (ES) describes the main alternatives considered during the development of proposals for Caudwell Solar Farm.

Schedule 4 of The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (as amended) - hereafter referred to as the EIA Regulations - sets out the matters for inclusion in the Environmental Statement. Schedule 4(2) states that an Environmental Statement (ES) must include:

> *"A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects."*

This chapter sets out the rational for the selection of the site for the Proposed Development in the context of prevailing national and international obligations, national and regional planning policy and the key environmental considerations that have been instrumental in informing the location and nature of the development proposed.

3.2 Assessment Methodology

This assessment comprises the following stages:

- Consideration of the "*Do Nothing*" Scenario
- Considerations in selecting the Site
- Considerations in selection of infrastructure and design options.

3.3 Do Nothing Scenario

The "*do nothing scenario*" is an assessment of the likely effects of the development proposals not being taken forward. This alternative is generically referred to by the Royal Town Planning Institute (RTPI) as: "*the possibility of not carrying out the Proposed Development at all."* The "*Do Nothing Scenario*" remains an option in any study of alternatives and as such it is best practice to include this in any EIA process.

For the reasons outlined below the "do nothing scenario" must be discounted as an option in this instance.

3.3.1 International Context

The need for the Proposed Development is set within the context of legislation, policy and guidance and renewable energy targets set at international and national levels.

Renewable energy generation and storage is recognised as an established and important part of the solution for climate change and can help achieve the climate and energy targets set at international and national levels. The most relevant renewable energy and climate change legislation and obligations are summarised below.

Kyoto Protocol

The Kyoto Protocol brings the United Nations Framework Convention on Climate Change (UNFCCC) into use by committing industrialised countries and economies to limiting and reducing greenhouse gas emissions in accordance with agreed individual targets (UNFCCC, 1997). The Convention asks those countries to adopt policies and measures on mitigation and to report periodically.

The United Nations Adoption of the Paris Agreement COP21

Some 197 countries, including the UK, adopted the Paris Agreement at the 21st Conference of the Parties (COP21) in Paris in 2015 (UNFCCC, 2015). This is an agreement that seeks to reduce global greenhouse gas emissions and to limit the global temperature increase in this century to 2°C, while pursuing the means to limit

this further to 1.5°C (UNFCCC, 2015). This was ratified by the UK Government in November 2016 and now forms part of UK Government Policy.

The UK's Nationally Determined Contribution (NDC) (HM Government, 2020a) under the Paris Agreement to the United Nations Framework Convention on Climate Change (UNFCCC), submitted in December 2020, commits the UK to reducing economy-wide GHG emissions by at least 68% by 2030, compared to 1990 levels.

Conference of Parties 26th Session (COP26)

At the COP26 summit in November 2021, parties voted to adopt the COP26 report, known as the Glasgow Climate Pact (UNFCCC, 2021). This included commitments to phase down the use of coal and supports a common timeframe and methodology for national commitments on emissions reductions. Countries were tasked to return in 2022 with more ambitious 2030 emissions reductions targets. COP26 revisited targets set during the Paris Agreement 2015, strengthening these limits and setting the new target to limit global warming to below 1.5oC.

3.3.2 National Context

The UK Climate Change Act 2008 (as amended)

In November 2008, the Climate Change Act became law requiring the UK to reduce carbon dioxide (CO_2) emissions, updated in 2019 to provide a legal basis for the target of securing a 100% reduction of greenhouse gas emissions to be achieved by 2050 (compared to 1990 levels).

The Climate Change Act created a framework for setting a series of interim national carbon budgets and plans for national adaptation to climate risks. The Act requires the UK government to set carbon budgets for the whole of the UK.

National Planning Policy Framework

The National Planning Policy Framework (NPPF) (Ministry for Housing, Communities and Local Government, 2021) highlights the importance of the UK's transition to a low carbon future in a changing climate and stresses the need for the increased use and supply of renewable and low carbon energy.

Paragraph 152 states that the planning system should '*support renewable and low carbon energy and associated infrastructure*' and '*shape places in ways that contribute to radical reductions in greenhouse gas emissions*.'

Clean Growth Strategy, 2017

The 2017 Clean Growth Strategy for the UK (Department for Business, Energy and Industrial Strategy) (DBEIS, 2018) contains a key objective of 'Delivering Clean, Smart, Flexible Power' and details specific policies through which this can be achieved.

- Policy 33 of the report states the government's intention to phase out the use of unabated coal for electricity production by 2025.
- Policy 35 sets government's intentions to improve the route to market for renewable technologies, with up to £557 million for further Contract for Different auctions.
- Policy 36 details plans to target a total carbon price in the power sector which will give businesses greater clarity on the total price they will pay for each tonne of emissions.

The Strategy discusses a potential low-carbon pathway whereby annual emissions are as low as 16 MtCO2e by 2032. The report states this is only likely to be achieved if low-carbon power generation including renewables and nuclear has the capacity to provide at least 80% of generation demand.

Energy White Paper: Powering Our Net Zero Future, 2020 & UK Government Net Zero 2050

On 27 June 2019, the UK became the first major economy in the world to legally commit through law to end its contribution to global warming by 2050. This target will require the UK to bring all greenhouse gas emissions to net zero by 2050, compared to the previous target of 80% reduction by 2050 (against 1990 baseline) that was set out in the Climate Change Act 2008.

In support of this target, the Energy White Paper: Powering our net zero future (DBEIS, 2020a) was published, setting out the pathway to achieving net zero emissions through the greater reliance on solar and wind energy.

At the end of June 2021, the UK Government made a further commitment to reduce emissions by 78% by 2035 (compared to 1990 levels) in order to keep Britain on track to end its contribution to climate change while remaining consistent with the Paris Agreement temperature goal to limit global warming to well below 2°C and pursue efforts towards 1.5°C (DBEIS, 2020a).

In November 2020, the Government delivered 'The Ten Point Plan for a Green Industrial Revolution' (DBEIS, 2020b). The Plan lays the foundations for the Green Industrial Revolution by supporting jobs and development of green infrastructure and technology. The plan places focus on advancing green and renewable energies and places an emphasis on "building more network infrastructure and utilising smart technologies" (DBEIS, 2020b).

The Energy White Paper (HM Government, 2020d) builds on the Ten Point Plan to set energy-related measures in a long-term strategic vision, working towards the net zero emissions target for 2050. It establishes a shift from fossil fuels to cleaner energy in terms of power, buildings and industry, whilst creating jobs and growing the economy. In addition to this, the best solutions should be determined for very low emissions and reliable supply, keeping costs low for consumers.

Focusing on electricity is key for the transition away from fossil fuels and decarbonising the economy by 2050. Some commitments from this white paper include:

- Accelerate the deployment of clean electricity generation through the 2020s
- Invest £1 billion in UK's energy innovation programme to develop the technologies of the future such as advanced nuclear and clean hydrogen
- Ensure that the transformation of the electricity system supports UK jobs and new business opportunities, at home and abroad.

The Sixth Carbon Budget: The UK's Path to Net Zero, 2020

The Sixth Carbon Budget: The UK's Path to Net Zero (Climate Change Committee, 2020) recommends that the UK sets its Sixth Carbon Budget to require a reduction in UK emissions of 78% by 2035 relative to 1990. The report states that 'this will be a world-leading commitment, placing the UK decisively on the path to Net Zero by 2050 at the latest, with a trajectory that is consistent with the Paris Agreement.'

Meeting the recommended budget will require major investment, with the upscaling of low carbon markets and supply chains. These investments should also have climate resilience in mind to account for the impacts of future climate change. Key objectives should be:

- reducing demand and improving efficiency require changes that will reduce carbon-intensive activities and the improvement of efficiency in the use of energy and resources
- take-up of low carbon solutions & phase out fossil fuel generation by 2035
- expansion of low carbon energy supplies, increasing renewables to 80% of generation by 2050
- electricity generation will require a significant expansion of low carbon generation including low cost renewables, with more flexible demand and storage.

Increasing the renewables penetration in the UK electricity mix to 80% by 2050 will largely be met with intermittent, non-dispatchable generation types. In order to facilitate such a high penetration of intermittent energy sources, the Climate Change Committee emphasise the requirement for a flexible energy network, partially achieved via the use of battery energy storage systems.

Net Zero Strategy: Build Back Greener, 2021

This strategy (DBEIS, 2021) sets out the UK's long-term plans to meet net zero emissions by 2050 and gives the vision for a decarbonised economy in 2050.

The policies detailed in the strategy will be phased in over the next decade or beyond in order to continue decarbonisation towards net zero. They also aim to keep the UK on track to meet upcoming carbon budgets.

This strategy brings forward the ambition for a fully decarbonised power system by 15 years, building on the targets set out in the Energy White Paper and the Ten Point Plan for a Green Industrial Revolution. The ambition is to fully decarbonise the UK's power system by 2035, through the growth in renewable and nuclear power in addition to an increase in energy storage capacity to increase the flexibility of supply.

Decarbonising the power sector is integral to achieving UK's commitments in legislating a net-zero gas emissions target for the economy by 2050 and requires major investment into renewable technologies, such as solar power, which are supported by planning policy at both local and national levels.

National Infrastructure Strategy, 2020

The National Infrastructure Commission (NIC), official advisor to the Government on Infrastructure, has published a report (Net-Zero Opportunities for the Power Sector, March 2020) setting out the key infrastructure requirements needed to meet the UK's 2050 net-zero target, including the amount of renewable energy development that would need to be deployed.

The National Infrastructure Strategy focuses on the investment and delivery of infrastructure, which is fundamental to delivering net zero emissions by 2050. The strategy sets out the UK Government's plans to deliver on this target, decarbonising the economy and adapting to climate change.

- Work towards meeting the net zero emissions target by 2050 – Decarbonise the UK's power, heat and transport networks, and take steps to adapt to climate change impacts. This will require increased investments in network infrastructure, storage and increased low carbon generation capacity.
- Reducing emissions across whole sectors of the economy must be done in a sustainable way that minimises cost.

In order to ensure a balanced supply of renewable electrical energy it is necessary to ensure that a range of sources are available with sufficient capacity to meet the annual increase in overall demand. Solar energy is a significant part of that energy supply, recognised by Government which has readmitted solar back into the Contracts for Difference (CfD) scheme, which is the method by which it allows operators to fund and sell energy into the national grid.

The NIC recommends that in meeting these targets, the UK's energy mix needs to be made up of around 90% renewables. At page 18 of the report, it is recommended that across all scenarios, significant levels of solar, onshore wind and offshore wind will need to be deployed with between 129 – 237 GW (gigawatts) of renewable energy capacity in operation by 2050. To achieve this, the report recommends the following split:

- 56-121 GW of solar;
- 18-27 GW of onshore wind; and
- 54-86 GW of offshore wind.

To achieve these national targets would require a significant increase in installed capacity across the UK, including over nine times the current installed capacity of solar technologies in the UK, which as of October 2020 is around 13.4GW according to the Department for Business, Energy & Industrial Strategy (BEIS).

When considering the above figures and applying them to the number of local authorities across the UK, this would mean that there is an additional 107.6 GW of solar capacity required across the 382 local authorities across England, Scotland, Wales and Northern Ireland required to meet the NIC's upper figure for solar.

It is therefore reasonable to surmise that every local planning authority, where appropriate developable land allows, should be delivering a significant amount of renewable energy capacity, considering a mixture of landscapes and terrain".

The Proposed Development would meet the annual equivalent electricity demands of approximately 15,200 homes or 26,000 electric cars, while also offsetting 47,000 metric tonnes of CO2 (when compared to generation of electricity by non- renewable sources.

3.4 Site Selection

Site selection is a crucial component of any development project, and it involves a thorough and systematic approach to ensure the chosen site is suitable for the proposed development. This section provides a rationale for the proposed scale of the solar farm development and outlines the requirements and considerations that the applicant has undertaken in identifying a search area and selecting the site as suitable for the proposed development.

The site selection process involved a phased approach:

- desktop assessment of technical feasibility, grid connection, planning considerations, site availability, and evaluation of environmental constraints, such as flood risk, agricultural land classification, and proximity to sensitive receptors.
- site visit to confirm technical suitability and assess potential visual impacts.
- pre-application engagement with relevant authorities to ensure the principle of development is acceptable and to address any detailed studies required to accompany the application.

Throughout the process, the Applicant took a balanced approach to minimize the impact of the proposals upon local receptors and constraints with wider and longer-range impacts, ensuring a sustainable and successful development. The thorough and systematic approach taken by the Applicant in site selection and design is a testament to their commitment to delivering a successful and sustainable renewable energy project.

The critical factors therefore in the site selection process are summarised below.

- Capacity of the electricity grid network and the availability of a suitable grid connection
- Consideration of environmental and planning constraints
- Pre-application engagement with the Planning Authority and Statutory Agencies
- Compatibility with adjoining land uses
- Land availability

3.4.1 Capacity of Electricity Network and Ability to Connect

The Caudwell Solar Farm must have the capability to connect to the electricity network at a location where there is adequate capacity to accommodate the connection and the applicant must be in a position to secure agreement from the District Network Operator (DNO) for exporting electricity at the designated location.

Following engagement with the DNO, it has been confirmed that the network in this region has received a significant number of committed grid connections. As a result, the 132 kV circuits in the area are either approaching or have already reached their capacity limits, whether due to thermal constraints or voltage restrictions.

The need for new connections to this circuit has prompted National Grid to activate an ANM scheme (Active Network Management) in the area This ANM scheme will help to ensure that the grid connection remains stable and reliable, particularly in light of the increased demand for renewable energy sources like solar power.

National Grid has already begun implementing the ANM scheme, which is expected to provide a robust and sustainable solution for managing the increased demand for power in this area.

The process of curtailing electricity generation follows a "Last In First Out" stack approach, whereby generators are prioritised based on the date of their application. In this approach, the most recently added generator is given priority over the ones added earlier, and curtailment is initiated for the generators at the bottom of the stack before those higher up. Caudwell Farm is expected to meet curtailment levels from 4.7% to 11.2% based on most recent assessment.

The outcome of the grid capacity analysis and engagement with the DNO has confirmed that there is capacity in this part of the South Holland District and a connection for a 49.9MW solar farm can be accommodated on the Walpole to Boston 132kv circuit 2, specifically between towers 48HW60 and 48HW59. An export connection offer at Caudwell Solar Farm is formally accepted and that grid connection location dictates the search area for appropriate lands for the Proposed Development.

The analysis undertaken in relation to available options for grid connection alongside agricultural land quality is summarised in Figure 3.1 below.

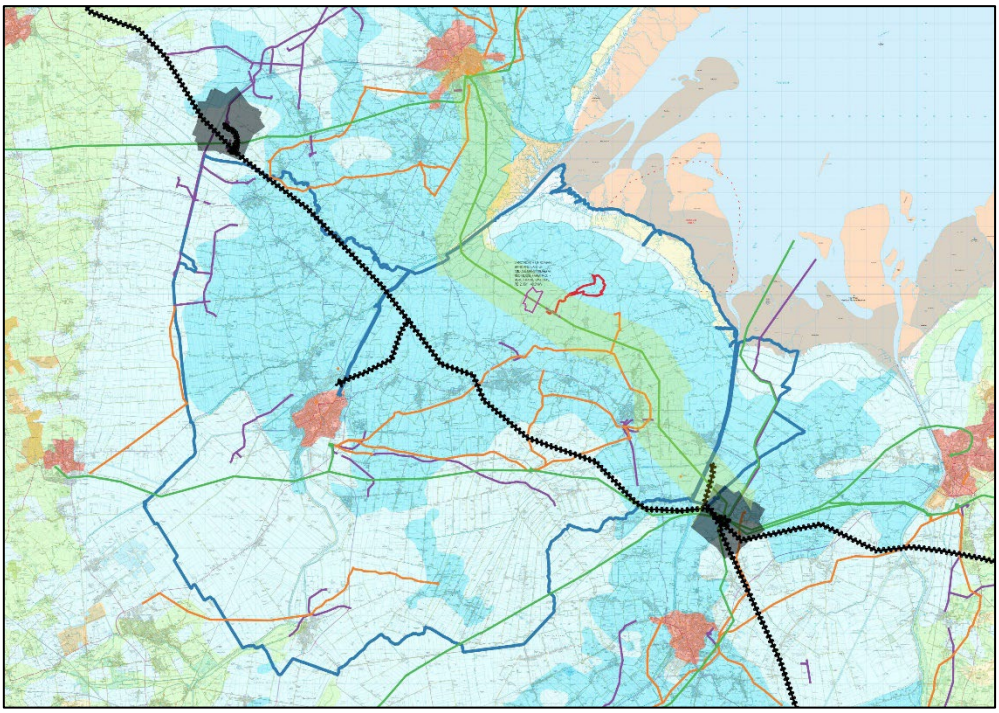

Figure 3.1: Agricultural Land Quality & Connection Options

3.4.2 Environmental and Planning Constraints

The site selection process for the Proposed Development was informed by assessment against a number of environmental and planning criteria:

- ***Statutory Designations**:* The site selection process sought to focus on lands that are not subject to any statutory designations. There are no statutory designated sites within 2 km of the Proposed Development. The Wash Ramsar Wetland and The Wash Special Protected Area (SPA) are located 3.3 km north of the Proposed Development and are designated for ornithological interest. The Wash and North Norfolk Coast Special Area of Conservation (SAC) and component Site of Special Scientific Interest (SSSI) is also located 3.3 km north of the Proposed Development.
- **Landscape Considerations:** The site selection process sought to avoid areas that are subject to landscape designations including Areas of Outstanding Natural Beauty (AoNBs) or landscapes that were otherwise considered to be subject to high levels of sensitivity to change. Consideration was given to the mapping of the National Character Areas. In this instance there are no landscape designations affecting the selected lands and the landscape quality (The Fens) is deemed to be medium with medium overall sensitivity to change.
- **Topography:** The wider site context is dominated by the flat, open agricultural landscape of The Fens Landscape Character Area. The low Sea Bank to the north forms the only feature of elevation in this otherwise flat landscape. The earthwork separates the drained polder of the Fens from the coastal marshes and the coastline of The Wash to the north-east.
- **Proximity to Settlements:** Proximity to settlements is an important consideration in that it impacts on the likely wider impact on the landscape and on residential amenity. In this instance the subject lands are characterised by a flat agricultural landscape is relatively sparsely settled with occasional farms and cottages, accessed from minor road network and via private tracks. Typically, the buildings of the farms are surrounded by larger modern barns and sheds. Hedgerows and some woodland contain some views in this open landscape. Holbeach St Matthew (1.7kms north) and Holbeach St Marks (3.5kms west) form the main villages in the area with the clusters of houses in the villages, softened by well treed settings. In that context the site selected minimise impacts on local settlements
- **Roads & Recreation Routes:** The site selection process has sought to minimise landscape and visual impacts through locating the Proposed Development away from main roads and other well used public vantage points. There are no main roads in the study area so that impacts are restricted to the network of minor roads and farm tracks that wind through the arable farmland. A footpath crosses the southern extent of the site between Marsh Road and Sot's Hole but otherwise the footpath network is limited. Well-

defined hedgerows around the fields, occasional tree belts farm buildings and sheds also interrupt views. A National Cycle Route 1 passes along the country lanes from Holbeach in the south, via Holbeach St Marks, to Boston in the north but otherwise there are no formal tourism and recreation opportunities within 1.5kms of the Site.

- **Flood Risk:** Site selection has taken account of flood risk and drainage consideration in order to ensure that the Proposed Development complies with the Water Framework Directive (WFD), the Flood & Water Management Act 2010 and relevant provisions of the National Planning Policy Framework and to avoid development in areas at risk of flooding. The following considerations have been material in site selection from a flood risk point of view:
  - A review of the Environment Agency Historic Flood Map, South Holland IDB and the 2017 Strategic Flood Risk Assessment do not hold any records of flooding at or within the immediate vicinity of the Site.
  - There are no WFD defined surface water bodies within the vicinity of the Site which the Proposed Development would impact.
  - The Site is defended from the sea by formal flood defences comprising of earth embankments along the shoreline supplemented by salt marsh to maintain foreshore levels. According to Environment Agency records, the defences within the vicinity of the Site are in fair condition, have a crest level of between 6.9 – 8.0 m AOD, and provide a 1 in 150 annual exceedance probability (AEP) standard of protection.
  - A comparison of the Environment Agency's extreme tide levels for Immingham to the West Lighthouse and the crest level of the flood defences, indicates that the Site is not at risk of flooding from the sea, including when taking climate change into account.
  - A comparison of peak modelled water levels for the on-site watercourses and site levels indicates that peak flows would remain in channel during the 1 in 100 AEP event plus 20% climate change.
  - The Flood Risk from Surface Water map indicates that the Site is predominantly at a Very Low risk of flooding from surface water (pluvial) and small watercourses.
  - Given the Site topography and ground conditions, surface water runoff would be expected to slowly infiltrate where conditions allow and flow overland in a direction determined by topography.
- **Agricultural Land Quality**: Agricultural Land Quality is an important consideration in the determination of planning applications. As confirmed in the report on Agricultural Considerations (Volume 2, Appendix 10.1), all of the land in the search area around the grid connection point falls within a Grade 1 classification in the 'provisional' Agricultural Land Classification maps of the 1970s and as 'high' in the 2017 Natural England predictive 'Best & Most Versatile' (BMV) mapping. In that context there is no land available within the search area that is clear of this predicted land classification and the Applicant has sought to address potential impacts through design development. The analysis undertaken in relation to available options for grid connection alongside agricultural land quality is summarised in Figure 3.1 above.
- **Access**: A review of access considerations confirmed that the subject lands can be accessed from the Strategic Road Network, i.e., the A17, to the south via Eastern Road or Sot's Hole Bank. The A17 is predominantly a single carriageway road, approximately 8.0m wide, but widening in sections, such as either side of the roundabout with the B1359 and Station Road. The A17 leads to the Kings Lynn to the east and Sleaford to the northwest. The Site is therefore considered to be well served by the local and strategic road network. In addition, given the nature of the site as a farm, the local road network (and its users) would be accustomed to Heavy Goods Vehicles (HGVs) in all directions.
- **Other designations:** The Site is not subject to any statutory environmental designations, ancient woodland within or directly adjacent to the site boundary, or designated groundwater source protection zones. The site is not heritage-sensitive, having no statutory or local designations protecting it.

3.4.3 Pre-Application Engagement with Statutory Bodies

The Applicant has undertaken pre-application discussions with South Holland District Council who facilitated consultation with relevant statutory agencies, including Natural England, RSPB and the Historic Environment Office of Lincolnshire County Council. In summary that consultation confirmed that:

- While there is potential for some degree of visual impact on landscape character due to the large-scale open nature of the subject lands, there is scope to incorporate appropriate mitigation to address potential impacts.

- There are a small number of residential properties in the vicinity of the site that could be affected by construction and/or decommissioning and these matters need to be satisfactorily addressed in the design and construction methods.
- Traffic impacts are predicted to be confined to the construction period and there is a requirement to manage traffic levels during that period.
- While the Proposed Development would occupy a large proportion of Grade 1 agricultural land, there is potential to facilitate grazing in the operational phase and any effects are temporary as the land will be returned to agriculture and will potentially benefit from a rest from intensive agricultural practices.
- The Historic Environment Officer at Lincolnshire County Council has advised that they are not aware of any below ground archaeology in or around the site, and thus would not recommend any archaeological input be required. However, Hartley House Farm is a historic farmstead, which is located just outside of the site to the north and can be considered as a non-designated heritage asset. The development proposal should take account of potential impacts on the setting and, if necessary, suggest mitigation measures.
- The site is close to wildlife reserves with statutory protection, as well as a priority habitat. Lincolnshire Wildlife Trust have highlighted that there is a significant opportunity to create a biodiverse site that becomes part of the nature recovery network for the area and delivers biodiversity net gain.

3.4.4 Land Availability

Solar farm developments rely on the developer's ability to reach a commercial agreement with the current owner of the land. When considering potential sites for development solar farm developers require land holdings of between 50 and 300 acres in order to deliver viable projects that will make a positive contribution to the national renewable energy objectives, taking account of development costs including connection to the national grid.

The Caudwell solar farm proposal falls within a larger operation farm, Hartley Farm which is a substantial farming enterprise. The core farm extends to 406 ha (1,003 acres) of arable land plus woodland. The farm enterprise operates over, in total, of the order of 1,200 ha of which approximately two thirds is owned. All this land lies within a radius of approximately 6 miles.

In that context any temporary loss of agricultural land to renewable energy production does not materially affect the overall farming operations and the land owner appreciates the potential benefit for the land in longer term through resting it from intensive agricultural practices. The land has been under a continuous arable cropping rotation and is moderately heavily fertilised, typical of most arable farms, with nitrogen, phosphate, and potash. The area has few livestock enterprises and organic manures are not applied, although straw is chopped and incorporated.

The land will be sown to grassland prior to the installation of the solar panels, will be retained in grassland for 40 years and used for sheep grazing. This will allow a gradual restoration of the organic matter levels that have dwindled gradually from an all-arable rotation. Following de-commissioning the land will be returned to full agricultural use.

In that context the landowner is content to make the land available for this important renewable energy project.

3.5 Design Development

3.5.1 Design Principles

The design development has been informed and influenced by the feedback received in pre-application consultations with the Council and statutory bodies and the completion of baseline environmental assessments.

A number of key design principles have underpinned the design evolution of this project. These include:

- Ensuring that the layout respects the existing topography, landscape features - existing site constraints including field boundaries, existing vegetation and site topography.
- Avoiding the need for cut and fill or regrading of land to facilitate panel placement so that excavation is only required for cable laying, creation of any new access tracks required and inverter and substation bases. This constitutes a minimal percentage of the site area.

- Safeguarding landscape features through ensuring that appropriate buffer zones are provided between existing hedgerows and solar panels and that internal access tracks will utilise existing field openings where possible.
- Excluding areas of greatest environmental sensitivity within the wider site from development and a developing a package of environmental management proposals including landscape proposals and ecological enhancement measures as integral components of the project.

3.5.2 Solar Panels, Mounting System & Arrays

Selection of Panels

Alternative options were considered in relation to the nature of the solar PV panels to be utilised and specifically the choice between traditional style mono-facial solar cells and the bifacial option. Bifacial solar panels are an innovative technology that enables the generation of electricity from both sides of the module, harnessing sunlight reflected off the ground in addition to direct sunlight. These panels are designed with a transparent back-sheet or dual-layer glass, allowing them to capture and convert light from the front and rear faces, thereby increasing their overall efficiency. The applicant has opted to utilise bifacial solar panels on both the fixed and tracking solar arrays in order to maximise the efficiency of the generation facility and contribute more to the renewable energy generation targets with a fewer number of panels than would otherwise be the case with the mono-facial option.

Mounting System

A number of alternative design options are proposed by which panels will be fixed to the ground. Each frame table will incorporate either 48 or 24 panels and will be supported on aluminium and steel posts/frames that will be driven or screwed into the ground to depths of up to 1.5m. Where posts are pushed into the ground this is via typical agricultural methods routinely used to erect fence posts on farms and in the rural area. The design development build sin flexibility to allow for local conditions, including the nature of the subsoils, environmental consideration such as potential archaeological assets and opportunities to increase output. In this context frames will be fixed to the ground by either:

- Option 1 - Single post ground fixture, which as suggested will be a single aluminium/steel frame driven into the ground.
- Option 2 - Table post ground fixtures - where frames will be fixed on dual posts driven into the ground.
- Option 3 - In cases where it is required to safeguard potential archaeological assets frames can be mounted using a shallow concrete ‘shoe’ which sits at a maximum of 400mm above ground level.
- Option 4 – fixed/static arrays versus tracker arrays that facilitate the panels following the movement of the sun.

The solar arrays would be set within the flat landscape with partial enclosure provided by the framework of hedgerows and small blocks of woodland which are to be enhanced as part of the landscape proposals. The mounting system used in solar farms is crucial to providing a stable and even surface on which to install the solar panels at the optimal tilt and orientation. The panels on the east of the site (the pink areas in Figure 2.3) would be laid out in straight arrays set at an angle of between 10 to 35 degrees from east to west across the field enclosures. The distance between the arrays would typically be between 3-6 m. The top northern edges of the panels would be up to 2.8 m above ground level and the south lower edges of the panels would be no less than 0.7m above ground level. These arrays would be static. The south-facing solar arrays are designed to ensure that the panels are installed at an optimal tilt angle of around 23 degrees.

The arrays on the western side of the proposal (Yellow areas in Figure 3.3) include single-axis trackers where the mounting is designed respond to the local topography to ensure that the panels remain at an optimal angle throughout the day as they track the sun's movement from east to west. Single-axis trackers are used to rotate the solar panels in one direction to follow the sun's movement from east to west throughout the day, increasing the panels' energy production by up to 20%.

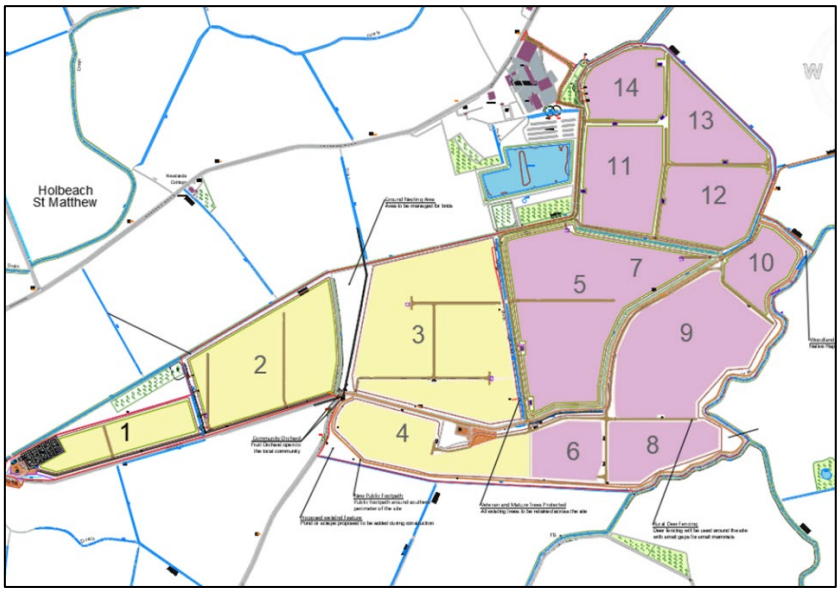

Figure 3.2: Land Parcels & Mounting Systems

These arrays are approximately 1.9metres (m) off the ground; with a maximum height of approximately 3.7m from ground level when the tracks are at a maximum east or west tilt of 45 degrees. Panels will be placed in arrays atop frame tables which are supported on posts screwed or pile driven into the ground.

Consideration was given to the optimum height of panels in respect of balancing the potential visual impacts against the objective of providing a sustainably managed sward under the panels. For static panels the option is to set the front edge of the panels a minimum if 700mm off the to allow mowing equipment or preferably sheep to access the grass beneath the leading edge of the solar panels. For tracker panels the minimum separation off the ground is 1.9m which raises the overall height of the panel with potential implications for visual impacts. In that context the maximum height of the panels is to be set at 3.7m.

Figure 3.3: Typical Static South facing Solar Arrays

Figure 3.4: Typical Single Axis Tracking Solar Arrays

3.5.3 Site Layout

The site layout being brought forward for planning has been adapted in response to the outcome of baseline assessments and feedback from pre-application engagement with Council and environmental agencies.

Built Heritage

The Built Heritage baseline assessment and engagement with the Historic Environment Officer at Lincolnshire County Council resulted in revisions to the layout to ensure that the Proposed Development will not result in and unacceptable impact on the setting of Hartley House which is regarded as a non-designated heritage asset. The fields selected for development ensure that there is limited impact on the setting of Hartley House as the fields to the east make a negligible contribution to the setting due to restricted views and the retention of the existing field patterns and boundaries and continued grazing by livestock maintain the essential character of the setting of Hartley House.

Natural Heritage Considerations

Feedback from Natural England requested that the Applicant consider what environmental features on and around the site could be retained and enhanced and what new features could be incorporated into the proposals to enhance biodiversity and meet Biodiversity Net Gain objectives.

RSPB also recommended that measures, should be considered which might enhance the final product and provide net gain and which would attempt to soften what might otherwise be an artificial, relatively sterile installation. Suggestions/comments included:

- Sowing the area with a wildflower/grass mix to provide nectar-rich plants to support pollinator insect species, as opposed to the usual rough grass seed mix which is used.
- Providing nest boxes for small birds along the perimeter fence.
- Planting native hedgerow species to both create and connect habitat. An initial proposal to plant ivy and clematis to conceal the perimeter fence should not be pursued.
- Ensuring as part of aftercare hedgerows are managed sympathetically, are allowed to mature and not flailed indiscriminately.
- Ensuring as part of aftercare that maintenance of the field layer isn't over-zealous and allows species such as skylark and small mammals to colonise enhancing the biodiversity value. Presence of small mammals might attract species such as barn owl and kestrel. Provision of owl and/or kestrel nest boxes were suggested as a positive step.

The proposals are set out in detail in the Landscape & Ecological Management Plan (LEMP, ES, Volume 3). The proposed layout has been adapted in response to this feedback which was supported by ecology baseline studies.

The layout of the rows of panels and the width of field margins has incorporated agri-environmental measures including strengthening hedgerows, planting new ones, and creating areas for wildlife to maintain the land in "good agricultural and environmental condition" under the Common Agricultural Policy rules of 'cross-compliance'. The design features of the solar farm include a 5m clearance between the ends of the panel rows and the security fence and a 5m clearance between the hedge and the security fence to allow tractor access for hedgerow maintenance.

It is proposed that stock-proof fencing (mesh with wooden posts or similar) to a height of approximately 2 m would be installed along the outer edges of the Site in order to restrict unauthorised access and is lifted off the ground to allow passage of mammals. The security fence will be erected on the inside of the hedgerows, so that it will be screened by the hedgerows in views from the surrounding area, further mitigating any visual impact.

Further, the layout has been adjusted to incorporate substantial habitat enhancement measures including the creation of species-rich grassland, botanically diverse wildflower grassland, new native species-rich hedgerows, tree belts and groups, a community orchard, beehives, significant enhancements areas for skylarks and fieldfares, bat roost boxes and bird nest boxes, otter holts, hedgehog nest boxes, insect hotels, log piles, amphibian and reptile hibernacula features, and mammal gates or small gaps.

The proposed community orchard will consist of a variety of local and English fruit tree varieties, providing a sustainable source of food, supporting local biodiversity, and promoting environmentally friendly practices. The orchard will also be a valuable resource for the local community, offering access to fresh, locally grown fruit, and enhancing community cohesion. The ongoing management of the orchard will require community involvement, providing opportunities for education and skill-building.

Overall, the Proposed Development of the Caudwell Solar Farm will improve the site's biodiversity and the species it supports through habitat enhancement and creation measures. The mitigation measures implemented for nesting birds, disused badger setts, roosting bats, and great crested newts will ensure no significant effects on the wildlife present on the site. The implementation of these measures will result in a significant biodiversity net gain, providing a positive contribution to the environment and the local community.

These measures will result in a biodiversity net gain of 17.48% for habitat units and 94.35% for hedgerow units, with a significant improvement in the support for wildlife and the biodiversity of the site.