



Tillbridge Solar

PEI Report Volume I Chapter 11: Human Health
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11. Human Health

11.1 Introduction

11.1.1 This chapter presents the findings of an assessment of the likely significant effects on human health as a result of the Scheme. For more details about the Scheme, refer to **PEI Report Volume I Chapter 3: Scheme Description** of this Preliminary Environmental Information (PEI) Report.

11.1.2 The chapter identifies and proposes measures to address the potential impacts and likely significant effects on human health during the construction, operation and decommissioning phases of the Scheme. It draws on assessments set out in wider chapters of this PEI Report which assess likely and potentially significant effects on human receptors, community amenities or services which could have an impact on human health including:

- **PEI Report Volume I Chapter 6: Air Quality;**
- **PEI Report Volume I Chapter 7: Climate Change;**
- **PEI Report Volume I Chapter 13: Noise and Vibration;**
- **PEI Report Volume I Chapter 14: Socio-Economics and Land Use;** and
- **PEI Report Volume I Chapter 15: Transport and Access.**

11.1.3 The chapter is supported by the following appendices:

- **PEI Report Volume II Appendix 11-1: Legislation and Planning Policy – Human Health.**

11.2 Legislation and Planning Policy

11.2.1 Legislation, planning policy, and guidance relating to human health and pertinent to the Scheme comprises of those listed below. More detailed information regarding these policies can be found in **PEI Report Volume II Appendix 11-1**.

Legislation

- Infrastructure Planning (Environmental Impact Assessment) Regulations 2017(Ref. 11-1), with particular regard to the requirement for the EIA for infrastructure projects to consider impacts on health; and
- The Health and Care Act (2022) (Ref. 11-2).

National Planning Policy

- Overarching National Policy Statement (NPS) for Energy (EN-1) (Ref. 11-3), with particular regard to Paragraphs 4.3.1 – 4.3.5 which detail requirements for NSIP applications to consider relevant health impacts;

- Draft NPS EN-1 (Ref. 11-4), with particular regard to Section 4.3 which details draft updated requirements for NSIP applications to consider relevant health impacts;
- Draft NPS EN-3 for Renewable Energy (Ref. 11-5);
- NPS for Electricity Networks Infrastructure (EN-5) (Ref. 11-6);
- Draft NPS for Renewable Energy Infrastructure EN-5 (Ref. 11-7); and
- National Planning Policy Framework (NPPF) (Ref. 11-8), with particular regard to: Chapter 8 ‘Promoting healthy and safe communities’; Chapter 12 ‘Achieving well-designed places’; and Chapter 15 ‘Conserving and enhancing the natural environment’.

National Guidance

- National Planning Practice Guidance (NPPG) (2021) (Ref. 11-9);
- Institute of Environmental Management and Assessment (IEMA), Determining Significance For Human Health In Environmental Impact Assessment (EIA) (2022) (Ref. 11-10);
- IEMA, Effective Scoping of Human Health in EIA (2022) (Ref. 11-11);
- NHS Healthy Urban Development Unit (HUDU) Rapid Health Impact Assessment (HIA) Tool (2019) (Ref. 11-12);
- Public Health England (PHE) guidance Spatial Planning for Health: An evidence resource for designing healthier places (2019) (Ref. 11-13);
- PHE Strategy 2020 to 2025 (2019) (Ref. 11-14);
- The Marmot Review: Fair Society Healthy Lives (2010) (Ref. 11-15); Health Equity in England 10 Years On (2020) (Ref. 11-16); Build Back Fairer – the Covid-19 Marmot Review (2020) (Ref. 11-17); and
- NHS Long-Term Plan (Ref. 11-18).

Local Planning Policy

Lincolnshire County Council

- Joint Health and Wellbeing Strategy for Lincolnshire (2018) (Ref. 11-19).
- Central Lincolnshire HIA for Planning Applications: Guidance Note and Checklist (2017) (Ref. 11-20).

Nottinghamshire County Council

- Nottinghamshire Joint Health and Wellbeing Strategy 2022-2026 (Ref. 11-21).

West Lindsey District Council

- Central Lincolnshire Joint Strategic Planning Committee Adopted Central Lincolnshire Local Plan (2023) (Ref. 11-22).

Bassetlaw District Council

- Adopted Bassetlaw Core Strategy (2011) (Ref. 11-23).
- Publication Draft Bassetlaw Local Plan (Addendum) (2022) (Ref. 11-24).

Neighbourhood Planning Documents

West Lindsey District Council Neighbourhood Plans

- Corringham Neighbourhood Plan (Adopted January 2022) (Ref. 11-25);
- Glentworth Neighbourhood Plan (Adopted January 2019) (Ref. 11-26);
- Draft Hemswell and Harpswell Neighbourhood Plan (2022) (Ref. 11-27); and
- Sturton by Stow Neighbourhood Plan (Adopted July 2022) (Ref. 11-28).

Bassetlaw District Council Neighbourhood Plans

- Rampton and Woodbeck Neighbourhood Plan (Adopted July 2022) (Ref. 11-29); and
- Treswell and Cottam Neighbourhood Plan (Adopted February 2019) (Ref. 11-30).

11.3 Assessment Assumptions and Limitations

- 11.3.1 This chapter forms a preliminary assessment of potential effects on human health during the construction, operation and decommissioning phases of the Scheme. The preliminary assessment is based on available information at the time of preparing the PEI Report. A final assessment will be undertaken as part of the EIA and reported in the ES that will be submitted with the DCO submission.
- 11.3.2 The assessment of the significance of human health effects has been carried out against a benchmark of current human health baseline conditions prevailing around the Scheme, as far as is possible within the limitations of human health-related data. Baseline data is subject to a time lag between collection and publication. As with any dataset, these conditions may be subject to change over time which may influence the findings of the assessment. Baseline conditions regarding human health reported in Section 11.6 are based on latest data available at the time of writing.
- 11.3.3 The assessment of likely health effects arising from the Scheme is based on professional judgement, drawing on relevant guidance as set out in Section 11.2. It considers both the potential beneficial and adverse impacts that the Scheme is likely to have on human health.
- 11.3.4 The preliminary assessment of effects on human health draws on preliminary assessments of relevance to human health and its wider determinants. These studies comprise **PEI Report Volume I Chapter 6: Air Quality**; **PEI Report Volume I Chapter 7: Climate Change**; **PEI Report Volume I Chapter 13: Noise and Vibration**; **PEI Report Volume I Chapter 14: Socio-economics and Land Use**; and **PEI Report Volume I Chapter 15: Transport and Access**. These topic assessments will be further investigated and reported in the ES when completed assessments are available. However, the information that is available at the time of writing (February 2023) is considered sufficient to enable a preliminary assessment of likely effects on human health relating to these assessments. Relevant assumptions and limitations relating to these assessments are set out below.

- 11.3.5 For the air quality assessment (as set out in **PEI Report Volume I Chapter 6: Air Quality**), a dust risk assessment has been undertaken on a whole-site basis, assuming that works can be undertaken at any point within the Scheme Boundary. This provides a worst-case assessment, ensuring that if works are undertaken in a different location than anticipated, the assessment has covered this potential.
- 11.3.6 As set out in **PEI Report Volume I Chapter 7: Climate Change**, due to the early stage of the Scheme design, a full assessment of the climate change risks to the Scheme has not been possible. The chapter presents an assessment of climate change risk based on experience from other similar schemes, while making an allowance for the specific location of the Scheme. Worst-case scenarios have been used to ensure a robust assessment.
- 11.3.7 In respect of the transport assessment (as set out in **PEI Report Volume I Chapter 13: Transport and Access**), the traffic flows and non-road mobile machinery during the construction period are based on a worst-case scenario of all infrastructure being built to its maximum Design Principles, which may slightly overestimate the number of vehicles and equipment. A Framework Construction Management Plan (CTMP) will be produced at ES stage, which will consider mitigation measures in more detail. During the operational phase, the Scheme will be manned by a nominal amount of people across the Site. Therefore, due to the low level of trips likely to be generated within network peak hours, an assessment of the operational phase transport effects has been scoped out as agreed.
- 11.3.8 The noise methodology (as set out in **PEI Report Volume I Chapter 13: Noise and Vibration**) sets out a series of assumptions made for the generation of noise models, including:
- Sound level data, which is based on industry sound pressure level measurement data;
 - Surrounding ground conditions, which have been modelled as soft;
 - Air temperature, which is assumed to be 10 degrees and humidity 70%;
 - Three orders of reflection;
 - Land topography; and
 - All receptor points have set a standard height of 1.5m above local ground levels (representative of first floor windows), as is standard industry practice.
- 11.3.9 As set out in **PEI Report Volume I Chapter 13: Noise and Vibration**, the assessment of construction noise (and vibration) has considered construction activities that have the potential to result in significant effects on identified receptors. Construction noise predictions have been undertaken using the computer modelling software SoundPLAN® (version 8.2). Noise predictions were carried out to represent a conservative scenario where construction plant is operational nearest to the identified receptors and does not take into account quieter periods when limited activities take place or at further distances. Therefore, noise predictions may overestimate construction noise levels and be considered to be a reasonable likely worst case.

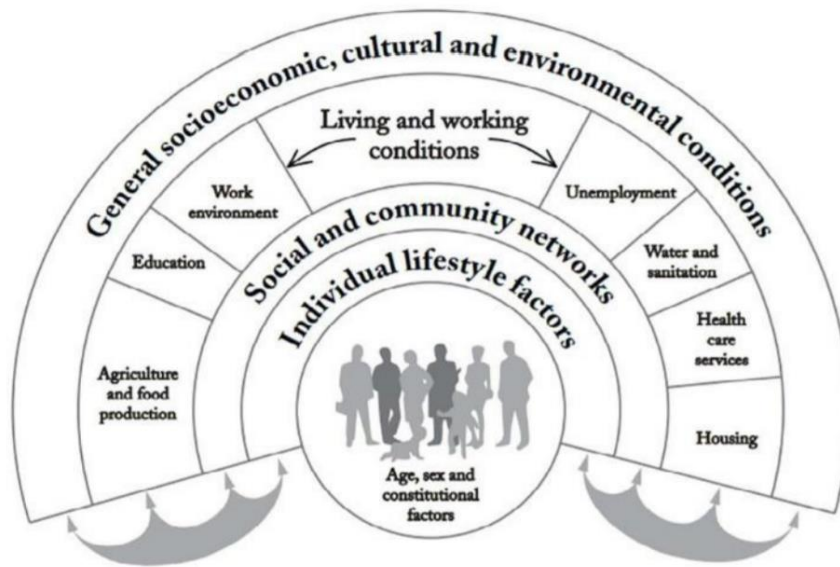
- 11.3.10 Operational noise has been predicted with all plant being in maximum operation at all times of day as a worst-case assumption.
- 11.3.11 This assessment has also considered the socio-economic assessment (**PEI Report Volume I Chapter 12: Socio-economics and Land Use**), which presents population, labour force and local economy information which is based on the latest data available at the time of writing.
- 11.3.12 Decommissioning is assessed as occurring after at least 40 years of operation, and for the purposes of this assessment is treated as taking place no earlier than 2067, based on a 40-year design life. It is possible that certain elements of the Scheme may be decommissioned prior to the end of the 40-year period. Should parts of the Scheme be decommissioned in advance of the main decommissioning phase, the predicted effects would be the same or less than those outlined in this chapter. Similar to the construction period, the assessment of a 24-month decommissioning period therefore represents a realistic worst case.

11.4 Assessment Methodology

Scope of Assessment

- 11.4.1 The IEMA guidance “*Determining Significance For Human Health In Environmental Impact Assessment*” forms the basis of the approach adopted to assess impacts on human health in this chapter. In addition, consideration has been given to NHS England’s Healthy Urban Development Unit’s (HUDU) Rapid Health Impact Assessment (HIA) Toolkit 2019 to help with the identification of relevant health determinants and mapping of health pathways (the route through which changes to health determinants would be expected to lead to changes in health outcomes).
- 11.4.2 The World Health Organisation (WHO) Europe defines health as a ‘*state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity*’ (Ref. 11-31). Public health therefore encompasses general wellbeing, not just the absence of illness.
- 11.4.3 The health and wellbeing of individuals is determined by a broad range of individual constitutional and behavioural factors (or “determinants”), as well as broader environmental, social and economic factors. Some factors are direct and obvious, others are indirect.
- 11.4.4 Dahlgreen and Whitehead’s model of the main determinants of health (Ref. 11-32) illustrates the breadth of possible influences on health, as shown in Plate 11-1. At the centre of the illustration are factors that are largely fixed, including individual age, sex, constitutional and genetic factors. Outside of this are factors generally described as the wider or broader determinants of health. The model emphasises interactions between the layers. Moving outwards from the centre, individual lifestyle choices are embedded in social norms and community networks, and in living and working conditions, which in turn are shaped by and related to the wider socioeconomic and cultural environment.

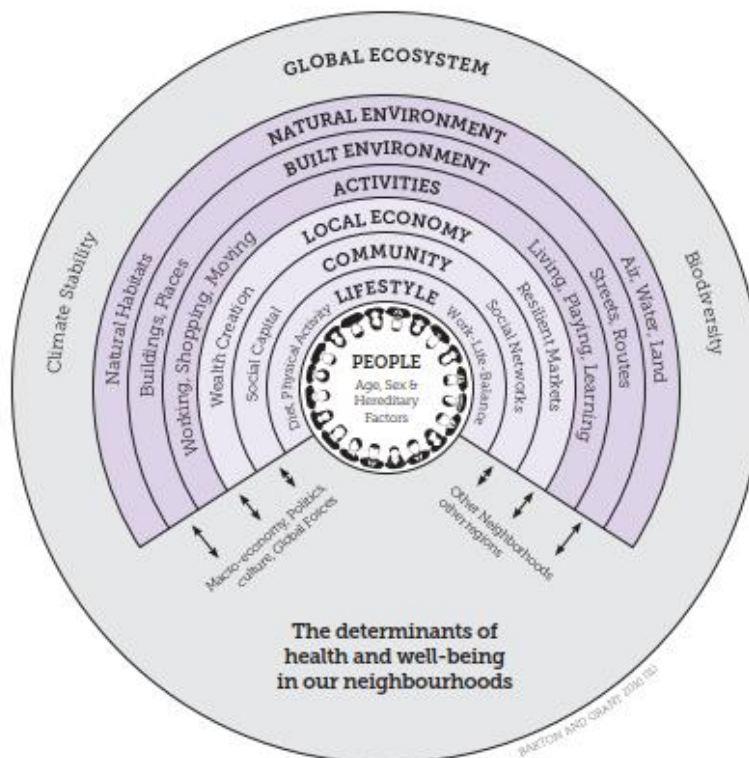
Plate 11-1: Determinants of Health



Source: Dahlgreen and Whitehead (1993)

11.4.5 This model has been developed to show elements of the built environment and communities that are the most significant determinants of health, as shown in Plate 11-2 (Ref. 11-35).

Plate 11-2: Determinants of Health in Neighbourhoods



Source: Barton and Grant (2006)

11.4.6 Within a population there can also be health inequalities, defined by the WHO as “differences in health status or in the distribution of health determinants between different population groups. For example, differences in mobility

between elderly people and younger populations or differences in mortality rates between people from different social classes”.

11.4.7 Drawing on the IEMA guidance, Guide to Effective Scoping of Human Health, this assessment considers the following human health determinants of relevance to the Scheme:

- Transport modes, access and connections, including: community connectivity such as access to services, facilities and open space; prioritisation of walking and cycling; and road and route safety;
- Employment and income, including provision of economic opportunities and resources that protect and promote good health;
- Air quality;
- Noise and vibration; and
- Climate change.

11.4.8 Table 11-1 sets out a summary of the health determinants scoped into this assessment, and the source, pathway and receptor links relevant to each.

Table 11-1: Health determinants – Source-Pathway-Receptor Links

Source	Pathway	Receptor	Project phase
Potential changes to community connectivity, access to healthcare and wider community services (including open space), and/or access to employment arising from temporary or permanent closures, diversions or amenity impacts on public rights of way (PRoW) or impacts on the local road network	Potential adverse impacts on levels of community participation and interaction, social and family support, access to health services including use of community centres, dental, pharmacy and GP services and open spaces, and/or access to employment which could impact human health	Human receptors living within local communities	Construction, operation and decommissioning
Potential temporary or permanent closures, diversions or amenity impacts on public rights of way (PRoW) or impacts on the local road network which impact use by	Potential adverse impacts on journeys made by active travel modes, which could impact human health	Human receptors who are users of local PRoW and the local road network for cycling or walking	Construction, operation and decommissioning

Source	Pathway	Receptor	Project phase
cyclists or pedestrians			
Potential temporary or permanent increases in traffic on the local road network	Potential adverse impacts on road safety, which could impact human health	Human receptors who are users of the local road network	Construction, operation and decommissioning
Potential temporary or permanent increase in employment and training opportunities, directly related to the Scheme, or within the wider supply chain	Potential beneficial economic impacts arising from employment, training and income opportunities for those working on the Scheme, or within the wider supply chain, which could impact human health	Human receptors who could potentially benefit from employment and training opportunities, directly related to the Scheme, or within the wider supply chain	Construction, operation and decommissioning
Potential temporary changes in local air quality including increased dust and particulate matter emissions arising from the construction and decommissioning of the Scheme	Potential adverse human health impacts arising from increased exposure to dust and particulate matter emissions arising from the Scheme	Human receptors likely to be at risk of possible direct and indirect air quality impacts from the Scheme	Construction and decommissioning
Potential temporary or permanent changes in noise levels arising from the Scheme	Potential adverse human health impacts arising from increased exposure to noise arising from the Scheme	Human receptors likely to be at risk of possible direct and indirect noise impacts from the Scheme	Construction, operation and decommissioning
Potential temporary or permanent changes to Greenhouse Gas (GHG) emissions	Potential human health impacts arising from increased or reduced exposure to GHG emissions arising from the Scheme	Human receptors likely to be exposed to increased or reduced GHG emissions arising from the Scheme	Construction, operation and decommissioning
Potential temporary or permanent changes to climate change resilience (CCR) including extreme weather	Potential adverse human health impacts arising from increased on Site risk of extreme weather events,	Human receptors likely to be exposed to increased risk of extreme weather events, flood risk,	Construction, operation and decommissioning

Source	Pathway	Receptor	Project phase
events, flood risk, sea level rise (SLR), temperature change and rainfall change	flood risk, SLR, temperature change or rainfall change	SLR, temperature change or rainfall change on the Site	
Potential temporary or permanent changes to views as a result of the Scheme including from Glint and Glare).	Potential adverse human health impacts arising from visual amenity impacts which may contribute to peoples' mental health and enjoyment of the local landscape	Residential receptors likely to have significant visual effects as a result of the Scheme	Construction, operation and decommissioning

11.4.9 The impacts of the Scheme on these determinants of human health are assessed using professional judgement, best practice, and drawing on other assessments within the PEI Report.

11.4.10 In the Scoping Opinion, the Planning Inspectorate commented (ID 2.2.1) that *“The Scoping Report provides no consideration of EMF. In line with relevant guidance (DECC Power Lines: Demonstrating compliance with EMF public exposure guidelines, A Voluntary Code of Practice 2012), cables above 132 kilovolts (kV) have potential to cause EMF effects. The Proposed Development would require the installation of infrastructure exceeding 123kV, including 400kV cables and two 400kV substations (as stated in paragraph 3.46 of the Scoping Report). Furthermore, there is potential for exceedances of 132kV where infrastructure overlaps. The Inspectorate considers that the ES should demonstrate the design measures taken to avoid the potential for EMF effects from the cable and substation infrastructure on receptors and address the risks to human health arising from EMF to the extent that it is relevant to the nature of the development and where significant effects are likely to occur”.*

11.4.11 In response to this, the potential for human health effects associated with potential exposure to Electromagnetic Fields (EMFs) has been scoped out of this assessment, as no significant human health impacts are expected to arise from EMFs as result of the Scheme. The logic for this is outlined below:

- To connect the Principal Site to Cottam National Grid Substation, a single 400kV cable circuit would be installed. The total length of the cable run within the Cable Route Corridor is approximately 16km. A further 400kV underground cable circuit approximately 8km long will be required within the Principal Site to interconnect the two 400kV/33kV substations. A typical trench depth is assumed to be around 2.0 metres (m).
- The National Grid document ‘Undergrounding high voltage electricity transmission lines’ (Ref. 11-33) states that for a 400kV cable buried at 0.9m depth, the typical magnetic field is 24 microteslas when on top of the cable and 3 microteslas at 5m from the centreline, with the maximum

level known by National Grid being 96 microteslas on top of the cable at 0.9m depth, and 13 microteslas at 5m.

- The Energy Networks Associate publication 'Electric and Magnetic Fields' (Ref. 11-34) states: *"The Government sets guidelines for exposure to EMFs in the UK on advice from the Health Protection Agency (HPA). In March 2004 the UK adopted the 1998 guidelines published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and this policy was reaffirmed by a Written Ministerial Statement in October 2009. These guidelines also form the basis of a European Union Recommendation on public exposure and a Directive on occupational exposure. The ICNIRP 'reference levels' for the public are: 100 microteslas for magnetic fields". It goes on to say: "These are the levels above which more investigation is needed if this level of exposure is likely to occur; the permitted levels of exposure are somewhat higher, 360 microteslas and 9000 volts per metre. They apply where the time of exposure is significant. These guidelines are designed to ensure that EMFs do not interfere with nerves, but were set after examining all the evidence, including the evidence on cancer. The occupational limits are five times higher".*
- Taking into account this guidance and the UK limits set for safety of members of the public, the maximum reported EMF for high voltage cables buried at around 2m would comply with the ICNIRP limits even if the cabling were directly under a human receptor. Therefore, no significant human health impacts are expected to arise from EMFs as result of the Scheme.

Study Area

11.4.12 The study areas for the assessment of potential human health effects have been defined to include human populations likely to be at risk from the possible direct and indirect health impacts that might arise from the Scheme. The study areas for human health are therefore based both on the extent and characteristics of the Scheme, and the populations assessed to be likely to be directly and indirectly affected by it.

11.4.13 The study areas for the health assessment therefore vary by the type of impact being assessed:

- The population health profile baseline study area comprises a local ward area comprising the five wards in which the Scheme is located, within which there is a high likelihood that effects arising from the construction, operation and decommissioning of the Scheme could be experienced: Hemswell, Lea, Stow and Torksey wards in West Lindsey district, and Rampton ward in Bassetlaw district. Where data is not available at the ward level, district level data is considered, for West Lindsey and Bassetlaw districts. The study areas for potential human health impacts arising from impacts on community connectivity, and access to healthcare services and other facilities, includes human receptors that could be impacted by community severance or access impacts arising from the Scheme. As set out within **PEI Report Volume I Chapter 14:**

Socio-Economics and Land Use and PEI Report Volume I Chapter 15: Transport and Access this includes human receptors living, working or visiting areas within 1km of the Scheme; living in Harpswell and Glentworth approximately 500m and 1km to the east of the Scheme Boundary respectively, and Springthorpe and Heapham approximately 500m and 1.5km to the west of the Scheme Boundary; and, human receptors accessing the following roads: A631/B1398 Middle Street Roundabout; A631/A15 Roundabout; A631; A15; B1398 Middle Street; A1500 (Till Bridge Lane); B1241 (Willingham Road); A156; Pilham Lane; School Lane; Springthorpe Road; Common Lane; Kexby Road; Willingham Road; Headstead Bank; Cow Pasture Lane; and Cottam Road/Outgang Lane.

- The study area for potential human health impacts arising from impacts on prioritisation of walking and cycling includes human receptors that could be at risk from possible direct and indirect impacts on access to PRow or impacts arising from increased traffic on the local highway network. As set out in **PEI Report Volume I Chapter 14: Socio-Economics and Land Use**, this includes human receptors accessing PRow within 500m of the Scheme Boundary, and, as set out in **PEI Report Volume I Chapter 15: Transport and Access**, human receptors living in Harpswell and Glentworth approximately 500m and 1km to the east of the Scheme Boundary respectively, and Springthorpe and Heapham approximately 500m and 1.5km to the west of the Scheme Boundary; and, human receptors accessing the following roads: A631/B1398 Middle Street Roundabout; A631/A15 Roundabout; A631; A15; B1398 Middle Street; A1500 (Till Bridge Lane); B1241 (Willingham Road); A156; Pilham Lane; School Lane; Springthorpe Road; Common Lane; Kexby Road; Willingham Road; Headstead Bank; Cow Pasture Lane; and Cottam Road/Outgang Lane.
- The study area for potential human health impacts arising from impacts on road and route safety includes human receptors that could be at risk from traffic and safety impacts on the local road network. As set out in **PEI Report Volume I Chapter 15: Transport and Access**, this includes users of the following roads: A631/B1398 Middle Street Roundabout; A631/A15 Roundabout; A631; A15; B1398 Middle Street; A1500 (Till Bridge Lane); B1241 (Willingham Road); A156; Pilham Lane; School Lane; Springthorpe Road; Common Lane; Kexby Road; Willingham Road; Headstead Bank; Cow Pasture Lane; and Cottam Road/Outgang Lane.
- The study area for potential human health impacts arising from access to employment and training includes human receptors that could benefit from potential local economic and employment impacts. As set out in **PEI Report Volume I Chapter 14: Socio-Economics and Land Use**, this includes human receptors within West Lindsey district, Bassetlaw district, and the wider East Midlands region.
- The study area for potential health impacts arising from air quality impacts includes human receptors that could be impacted by construction phase dust or particulate matter, or emissions generated by

construction road traffic. As set out in **PEI Report Volume I Chapter 6: Air Quality**, this includes human receptors living, working or visiting receptors within 350m of the Scheme boundary, within 50m of the roads expected to be impacted by construction and potential decommissioning phases traffic, and within 500m of site access points.

- The study area for potential health impacts arising from noise impacts includes human receptors within the Zone of Influence (ZoI) for noise effects. As set out in **PEI Report Volume I Chapter 13: Noise and Vibration**, during the construction and decommissioning phases this includes human receptors within 300m of the Scheme boundary, and during the operational phase human receptors within 500m of the Scheme boundary.
- The study area for potential health impacts arising from climate change impacts includes human receptors that could be impacted by changes in GHG emissions or CCR. As set out in **PEI Report Volume I Chapter 7: Climate Change**, with respect to GHG emissions this includes human receptors globally given the potential global locations in which construction materials will be sourced from and as the effects of GHG emissions are not geographically constrained; with respect to CCR this includes human receptors within the Scheme Boundary during operation, including workers on the Scheme.

11.4.14 A summary of the different components of the human health assessment and the study areas for each component is set out in Table 11-2.

Table 11-2: Summary of Potential Human Health Impacts and Study Areas

Potential Impact	Study Area	Rationale for Study Area
Potential adverse impacts on community connectivity; potential adverse impacts on access to healthcare and other local services; potential adverse impacts on access to employment	Homes and communities within proximity of the Principal Site Boundary, including Harpswell and Glentworth approximately 500m and 1km to the east of the Principal Site Boundary respectively, and Springthorpe and Heapham approximately 500m and 1.5km to the west of the Principal Site Boundary; and, users of the following roads: A631/B1398 Middle Street Roundabout; A631/A15 Roundabout; A631; A15; B1398 Middle Street; A1500 (Till Bridge Lane); B1241 (Willingham Road); A156; Pilham Lane; School Lane; Springthorpe Road; Common Lane; Kexby Road; Willingham Road; Headstead Bank; Cow Pasture Lane; and Cottam Road/Outgang Lane.	Study area includes communities and road users that could be affected by severance or access impacts, or journey delay, as set out in PEI Report Volume I Chapter 14: Socio-Economics and Land Use and PEI Report Volume I Chapter 15: Transport and Access . Also refer to PEI Report Volume III Figure 15-1 for the Transport and Access study area.
Potential adverse impacts on travel	PRoW within 500m of the Scheme boundary, and the communities of	Study area includes human receptors that could be

Potential Impact	Study Area	Rationale for Study Area
by active modes (walking and cycling)	Harpwell and Glentworth approximately 500m and 1km to the east of the Scheme Boundary respectively, and Springthorpe and Heapham approximately 500m and 1.5km to the west of the Scheme Boundary; and, the following roads: A631/B1398 Middle Street Roundabout; A631/A15 Roundabout; A631; A15; B1398 Middle Street; A1500 (Till Bridge Lane); B1241 (Willingham Road); A156; Pilham Lane; School Lane; Springthorpe Road; Common Lane; Kexby Road; Willingham Road; Headstead Bank; Cow Pasture Lane; and Cottam Road/Outgang Lane.	affected by impacts on PRoW or the local road network as a result of the Scheme, as set out in PEI Report Volume I Chapter 14: Socio-Economics and Land Use and PEI Report Volume I Chapter 15: Transport and Access . Also refer to PEI Report Volume III Figure 15-1 for the Transport and Access study area.
Potential adverse impacts on road safety	The following roads: A631/B1398 Middle Street Roundabout; A631/A15 Roundabout; A631; A15; B1398 Middle Street; A1500 (Till Bridge Lane); B1241 (Willingham Road); A156; Pilham Lane; School Lane; Springthorpe Road; Common Lane; Kexby Road; Willingham Road; Headstead Bank; Cow Pasture Lane; and Cottam Road/Outgang Lane.	Study area includes roads that could be at risk from traffic and safety impacts as a result of the Scheme, as set out in PEI Report Volume I Chapter 15: Transport and Access . Also refer to PEI Report Volume III Figure 15-1 for the Transport and Access study area.
Potential beneficial impacts on access to employment, training and income opportunities	West Lindsey district, Bassetlaw district, and the East Midlands region.	Study area includes human receptors that could benefit from potential local economic and employment impacts, as set out in PEI Report Volume I Chapter 14: Socio-Economics and Land Use .
Potential adverse impacts on exposure to dust or particulate matter, or emissions from traffic	Within 350m of the Scheme boundary, within 50m of the roads expected to be impacted by construction and decommissioning phase traffic and within 500m of site access points.	Study area includes human receptors that could be impacted by construction phase dust or particulate matter, or emissions generated by construction road traffic, as set out in PEI Report Volume I Chapter 6: Air Quality .
Potential adverse impacts on exposure to increased noise	Within 300m of the Scheme boundary during the construction and decommissioning phases; and, within 500m of the Scheme boundary during the operational phase.	Study area includes human receptors that could be impacted by noise impacts within the Zol for noise effects, as set out in PEI Report Volume I Chapter

Potential Impact Study Area

Rationale for Study Area

Potential adverse or beneficial impacts on exposure to GHG emissions Globally.

13: Noise and Vibration.
Also refer to **PEI Report Volume III Figure 13-1** for the Noise study area.

Potential adverse impacts on CCR Within the Scheme boundary

Study area includes human receptors that could be impacted by changes in exposure to GHG emissions as a result of the Scheme, as set out in **PEI Report Volume I Chapter 7: Climate Change.**

Study area includes human receptors that could be impacted by changes in CCR as a result of the Scheme, as set out in **PEI Report Volume I Chapter 7: Climate Change.**

Sources of Information

11.4.15 This chapter seeks to assess the potential human health effects of the Scheme against the current human health baseline conditions within the study areas set out in Table 11-2 above.

Desktop Survey

11.4.16 In order to understand the existing human population health baseline, data illustrating the existing population health conditions has been collected through a desk-based research exercise using publicly available sources, documents, and web-based applications.

11.4.17 Sources of information consulted include:

- ONS Census 2011 (Ref. 11-36) and Census 2021 (Ref. 11-37);
- Mid-Year Population Estimates (2021) (Ref. 11-38);
- Annual Population Survey (2021) (Ref. 11-39);
- English Indices of Multiple Deprivation (2019) (Ref. 11-40);
- Office for Health Improvement and Disparities (OHID); Health Profiles (Ref. 11-41); and
- Claimant Count, 2022 (Ref. 11-42).

Field Survey

11.4.18 The following field surveys have been carried out by related technical topics relevant to this assessment:

- **PEI Report Volume I Chapter 6: Air Quality** sets out details of field surveys carried out to assess baseline conditions of relevance to the potential air quality impacts of the Scheme;
- **PEI Report Volume I Chapter 13: Noise and Vibration** sets out details of field surveys carried out to assess baseline conditions of relevance to the potential noise impacts of the Scheme; and
- **PEI Report Volume I Chapter 15: Transport and Access** sets out details of field surveys carried out to assess baseline conditions of relevance to the potential transport and access impacts of the Scheme.

Impact Assessment Methodology

Assessment Criteria

11.4.19 The Human Health assessment follows the general assessment methodology set out in **PEI Report Volume I Chapter 5: EIA Methodology**. The specific magnitude and sensitivity criteria applied for the human health assessment are set out below, and reflect the IEMA guidance, Determining Significance for Human Health in EIA, released in 2022.

11.4.20 Best practice principles for assessing impacts on human health are also provided in NHS England's Healthy Urban Development Unit's (HUDU) Rapid HIA Toolkit 2019, which alongside IEMA guidance, has also been drawn on to assess impacts on human health in this chapter. The approach also reflects Central Lincolnshire's HIA for Planning Applications Guidance Note and Checklist.

11.4.21 For human health there is no accepted definition of what constitutes a significant (or not significant) effect. It is, however, recognised that effects are categorised based upon the relationship between the magnitude of effect and the sensitivity of the affected human receptor. As such the significance criteria of human health effects has been assessed based on expert judgment and professional experience of the author, and relies on the following considerations:

- **Sensitivity of human health receptors including general populations and potentially vulnerable sub-populations:** specific values in terms of sensitivity are not attributed to population health due to the diverse range of determinants and indicators that can determine overall health. However, the assessment takes account of the qualitative (rather than quantitative) sensitivity of relevant populations and their likely ability to adapt to change; and
- **Magnitude of impact:** this entails consideration of the scale of the exposure of the population to an impact; whether the impact is one-off or continuous; the likely nature of the human health impact; the permanence of the change; and the proportion of the relevant study area population that would be affected.

Sensitivity of Receptor

11.4.22 Sensitivity of population health is driven by a number of factors which are set out in Table 11-3, and are based on guidance set out by IEMA guidance.

Table 11-3: Human Health Sensitivity Criteria – Population Health

Sensitivity level	Sensitivity criteria
High	High levels of deprivation (including pockets of deprivation); reliance on shared resources (between the population and the Scheme); existing wide inequalities between the most and least healthy; a community whose outlook is predominantly anxiety or concern; people who are prevented from undertaking daily activities; dependants; people with very poor health status; and/or people with a very low capacity to adapt.
Medium	Moderate levels of deprivation; few alternatives to shared resources; existing widening inequalities between the most and least healthy; a community whose outlook is predominantly uncertainty with some concern; people who are highly limited from undertaking daily activities; people providing or requiring a lot of care; people with poor health status; and/or people with a limited capacity to adapt.
Low	Low levels of deprivation; many alternatives to shared resources; existing narrowing inequalities between the most and least healthy; a community whose outlook is predominantly ambivalence with some concern; people who are slightly limited from undertaking daily activities; people providing or requiring some care; people with fair health status; and/or people with a high capacity to adapt.
Very Low	Very low levels of deprivation; no shared resources; existing narrow inequalities between the most and least healthy; a community whose outlook is predominantly support with some concern; people who are not limited from undertaking daily activities; people who are independent (not a carer or dependent); people with good health status; and/or people with a very high capacity to adapt.

Source: Adapted from: IEMA Guide to Determining Significance for Health (Table 7.1).

Magnitude of Impact

11.4.23 Magnitude of impact is driven by a number of factors which are set out in Table 11-4, based on guidance set out by IEMA guidance.

Table 11-4: Human Health Magnitude of Impact Criteria

Magnitude level	Magnitude criteria
High	High exposure or scale; long-term duration; continuous frequency; severity predominantly related to mortality or changes in morbidity (physical or mental health) or very severe illness/injury outcomes; majority of population affected; permanent change; substantial service quality implications
Medium	Low exposure or medium scale; medium-term duration; frequent events; severity predominantly related to moderate changes in morbidity or moderate change in quality of life; large minority of population affected; gradual reversal; small service quality implications

Magnitude level	Magnitude criteria
Low	Very low exposure or small scale; short-term duration; occasional events; severity predominantly related to minor change in morbidity or moderate change in quality of life; small minority of population affected; rapid reversal; slight service quality implications
Very Low	Negligible exposure or small scale; very short-term duration; one off frequency; severity predominantly relates to minor change in quality of life; very few people affected; immediate reversal once activity complete; no service quality implications.

Source: Adapted from: IEMA Guide to Determining Significance for Health (Table 7.2).

Significance of Effects

11.4.24 Human health effects reflect the relationship between the sensitivity of the relevant population health, and the magnitude of the impact, as set out in Table 11-5.

Table 11-5: Impact Assessment and Significance

Magnitude of Impact	Sensitivity of Receptor			
	High	Medium	Low	Very Low
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible
Very Low	Minor	Negligible	Negligible	Negligible

11.4.25 The assessment aims to be objective and quantifies effects as far as possible. However, some effects can only be evaluated on a qualitative basis. Effects are defined as follows:

- **Beneficial** classifications of significance indicate an advantageous or beneficial effect on human health, which may be minor, moderate or major in effect;
- **Adverse** classifications of significance indicate a disadvantageous or adverse effect on human health, which may be minor, moderate or major in effect;
- **Negligible** classifications of significance indicate imperceptible effects on human health; and
- **No effect** classifications of significance indicate that there are no effects on human health.

11.4.26 The geographical scales considered to assess significance for each human health effect considered are described in Table 11-2.

11.4.27 Duration of effect is also considered, with more weight given to longer-term or permanent changes than to shorter-term or temporary ones.

11.4.28 In accordance with the methodology set out in **PEI Report Volume I Chapter 5: EIA Methodology**, the following criteria is applied:

- ‘Moderate’ or ‘Major’ effects are classed ‘**significant**’;
- ‘Minor’ effects are classed as ‘**not significant**’, although they may be a matter of local concern; and
- ‘Negligible’ effects are classed as ‘**not significant**’.

11.5 Stakeholder Engagement

11.5.1 An EIA Scoping Report (**PEI Report Volume II Appendix 1-1**) was submitted to the Secretary of State through the Planning Inspectorate in 2022 in order to request an EIA Scoping Opinion (**PEI Report Volume II Appendix 1-2**). Consultation responses in relation to human health to date, are presented in Table 11-6 below.

11.5.2 Further consultation will be undertaken and input into the human health assessment chapter within the Environmental Statement.

Table 11-6: Engagement Undertaken

Consultee	Summary of main matter raised	How has the matter been addressed?	Location of response in the chapter
Planning Inspectorate (ID 3.6.2) and Environmental Hazards and Emergencies Department, UK Health Security Agency	The Scoping Report sets out that the health assessment will adopt the NHS’ Healthy Urban Development Unit (HUDU) assessment tool and notes that this guidance does not provide significance criteria. The ES should provide significance criteria for this assessment so the reader can understand the potential of any significant effects arising from the health assessment.	The NHS HUDU assessment tool is used in combination with IEMA guidance <i>IEMA Guide to Determining Significance for Health</i> published in November 2022, this chapter sets out a significance assessment of the potential human health impacts of the Scheme.	Section 11.8.
Planning Inspectorate (ID 3.6.3) and Environmental Hazards and Emergencies Department, UK	The ES should consider vulnerable populations within the health assessment.	Vulnerable populations are considered within this chapter through the consideration of sensitivity, in line with 2022 IEMA guidance.	Sections 11.6 and 11.8.

Consultee	Summary of main matter raised	How has the matter been addressed?	Location of response in the chapter
Health Security Agency			
Planning Inspectorate (ID 2.2.1)	The ES should consider the possible health impacts of Electric and Magnetic Fields (EMF) arising from any electrical equipment associated with the development or a statement explaining why EMFs can be scoped out.	The impacts of EMFs have been scoped out of this assessment. The justification for this can be found in Section 11.4.	Section 11.4.
Environmental Hazards and Emergencies Department, UK Health Security Agency	The presence of significant numbers of workers could have an impact on local availability of affordable housing and tourist accommodation. The impact on local accommodation should be considered, and in particular across the wider study area in a cumulative effects assessment.	As set out in PEI Report Volume I Chapter 14: Socio-Economics and Land Use the construction of the Scheme is expected to require an average of 500 direct jobs on Site over the minimum 24 month construction period. Approximately 478 jobs are expected to be taken by people living outside the 45 minute drive time Study Area. The potential effect on local accommodation is assessed within PEI Report Volume I Chapter 14: Socio-economics and Land Use .	N/A.
West Lindsey District Council	The Human Health chapter should consider the cumulative effects with the other three local solar project NSIPs.	The cumulative human health impacts of the Scheme are considered in the cumulative effects analysis.	Section 11.12 PEI Report Volume I Chapter 17: Cumulative Effects.
Fillingham Parish Council	Of particular concern to the community for a development at this scale are access to open space and nature and access to work and training.	The impacts of the scheme on access to open space and nature and access to work and training are considered within the assessment of likely impacts and effects.	Section 11.8 Community connectivity including access to services, facilities (including open space) and

Consultee	Summary of main matter raised	How has the matter been addressed?	Location of response in the chapter
			access to employment.

11.6 Baseline Conditions

- 11.6.1 **PEI Report Volume I Chapter 3: Scheme Description** contains a detailed description of existing conditions within and surrounding the Scheme Boundary. This section describes the baseline conditions of relevance to human health.
- 11.6.2 The human health population health baseline is common to the Principal Site and the Cable Route Corridor since the population health study area includes the six wards in which the Scheme is located. These include Hemswell, Lea, Stow, Scampton and Torksey wards in West Lindsey district, and Rampton ward in Bassetlaw district. A best fit Lower Super Output Area (LSOA)¹ study area is used where ward level data is not available. Where data is not available at the local ward level, district level data is provided for West Lindsey and Bassetlaw districts. Comparator data is provided for the East Midlands and England as a whole, where relevant.
- 11.6.3 A summary of relevant baseline assessments set out in related technical chapters of this PEI Report is also provided below, as set out in **PEI Report Volume I Chapter 6: Air Quality; PEI Report Volume I Chapter 7: Climate Change; PEI Report Volume I Chapter 13: Noise and Vibration; PEI Report Volume I Chapter 14: Socio Economics and Land Use; and PEI Report Volume I Chapter 15 Transport and Access.**

Existing Baseline

Population Health Baseline

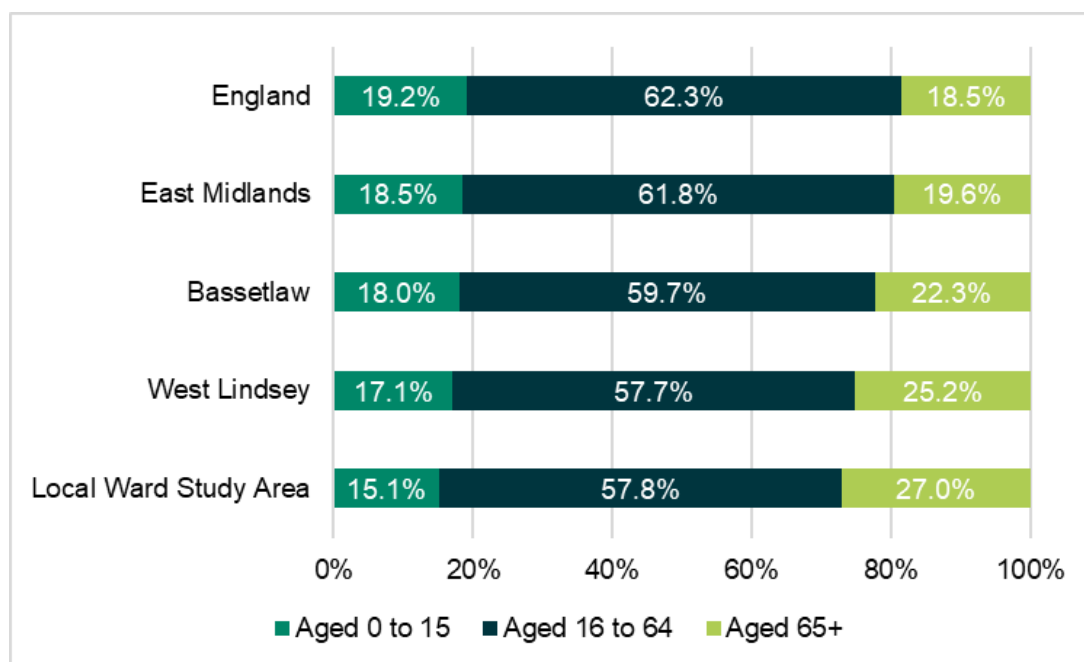
Population

- 11.6.4 Data from the 2021 Census (Ref. 11-37) shows the total population of the LSOA study area is 11,072. Census 2021 population data is not yet available at ward level. This will be considered in the ES if available at that time.
- 11.6.5 The most recent data showing population age breakdown by single year is ONS 2020 mid-year population estimates data (Ref. 11-38) and is available at ward level. As shown in Plate 11-3, the total population of the local ward study area based on this dataset is 15,381. The population in Hemswell is 2,451; in Lea is 2,106; in Stow is 2,379; in Scampton is 3,242; in Torksey is 2,930; and, in Rampton is 2,273.

¹ Lower Super Output Areas (LSOAs) are ONS defined small geographic areas across England designed to allow data reporting across small areas. Each LSOA in England is of a similar population size, with an average of approximately 1,500 residents of 650 households. The best fit LSOA area across the local ward study area comprises the following LSOAs: West Lindsey 005A, West Lindsey 005C, West Lindsey 007A, West Lindsey 007B, West Lindsey 007D and Bassetlaw 015C.

- 11.6.6 The proportion of residents aged 0-16 in the local ward study area is 15.1%. This is slightly lower than the proportions in West Lindsey (17.1%), Bassetlaw (18.0%), the East Midlands (18.5%) and England (19.2%).
- 11.6.7 The proportion of residents of working age (16-to-64-year-olds) in the study area is 57.8%. This is slightly higher than the proportion across West Lindsey (57.7%), but lower than the proportion across Bassetlaw (59.7%), the East Midlands (62.8%) and England (62.3%).
- 11.6.8 The proportion of residents aged 65 and over in the study area is 27.0%. This is higher than the proportions in West Lindsey (25.2%) and Bassetlaw (22.3%), the East Midlands (19.6%) and nationally across England (18.5%).

Plate 11-3: Age Breakdown by Geography



Source: ONS Mid-Year Population Estimates (Ref. 11-38)

Ethnicity

- 11.6.9 Census 2021 provides the latest data showing residents self-identified ethnicity. Data is available at LSOA level, but not yet available at ward level. As shown in Table 11-7, at the time of the 2021 Census, the proportion of White residents living in the LSOA study area (97.9%), West Lindsey (97.0%) and Bassetlaw (96.4%) was higher than in the East Midlands (85.7%) and England as a whole (81.0%) (Ref. 11-37).
- 11.6.10 The proportions of residents of each ethnic minority group recorded by the 2021 Census living in West Lindsey and Bassetlaw was lower than the proportions across the East Midlands region and England as a whole.

Table 11-7: Ethnicity (Census 2021)

Ethnic Group	LSOA Study Area	West Lindsey	Bassetlaw	East Midlands	England
White (%)	97.9	97.0	96.4	85.7	81.0
Mixed/multiple ethnic groups (%)	1.0	1.1	1.2	2.4	3.0
Asian/Asian British (%)	0.4	1.2	1.2	8.0	9.6
Black/African/Caribbean/Black British (%)	0.4	0.3	0.6	2.7	4.2
Other ethnic group (%)	0.3	0.4	0.5	1.3	2.2

Source: Census (2021) (Ref. 11-37). Note that figures may not equal 100 due to rounding.

Deprivation

- 11.6.11 The Government's English Index of Multiple Deprivation (IMD) provides an overall deprivation score for each LSOA and Local Authority in England. The overall score is based on a number of domains and sub-domains which together provide a measure of deprivation. Each area is ranked according to its score, and the index provides a measure of relative deprivation across all areas.
- 11.6.12 Levels of overall deprivation vary across the local LSOA study area. No areas fall within the 1st (most) deprived decile in England, however Bassetlaw 015C LSOA falls within the 2nd most deprived decile in England. West Lindsey 005C falls into the 4th most deprived decile, West Lindsey 007D falls into the 5th most deprived decile, West Lindsey 005C and West Lindsey 007C fall into the 6th decile, and West Lindsey 007A falls into the 7th decile. None of the local LSOA study areas fall into the 30% least deprived areas in England.
- 11.6.13 Across each LSOA levels of overall deprivation have remained relatively consistent between the 2015 and 2019 releases of IMD data. Bassetlaw 015C LSOA became relatively more deprived (moving from the 3rd to the 2nd decile), as did West Lindsey 005A (moving from the 5th to the 4th decile). Levels of relative deprivation improved in West Lindsey 007D (moving from the 4th to the 5th most deprived decile). All other areas remained within the same decile between 2015 and 2019.
- 11.6.14 In terms of relevant sub-domains of deprivation, the health and disability domain measures the risk of premature death and the impairment of quality of life through poor physical or mental health. Bassetlaw 015C LSOA is ranked in the 3rd most deprived decile with respect to health and disability deprivation, and West Lindsey 007B is in the 5th most deprived decile. All other areas within the local LSOA study area are in the 50% least deprived areas in England with respect to health deprivation.

11.6.15 The barriers to housing and services sub-domain of deprivation includes a consideration of physical proximity to local services, as well as wider barriers including housing affordability. All areas of the LSOA study area are in the three most deprived deciles with respect to barriers to housing and services deprivation.

11.6.16 The living environment sub-domain of deprivation measures the quality of the local environment. The indicators fall into two sub-domains. The 'indoors' living environment measures the quality of housing; while the 'outdoors' living environment contains measures of air quality and road traffic accidents. West Lindsey 005A LSOA falls into the most deprived decile in England with respect to quality of the local environment, while Bassetlaw 015C falls into the 2nd most deprived decile. West Lindsey 005C and West Lindsey 007D fall into the 4th most deprived decile. West Lindsey 007A and West Lindsey 007B are in the 50% least deprived areas in England in terms of living environment deprivation.

11.6.17 West Lindsey is ranked 146th most deprived out of England's 317 Local Planning Authority areas². In West Lindsey, 8% of LSOAs are within the 10% most deprived LSOAs in England, 10% are within the 20% most deprived LSOAs and 6% are within the 30% most deprived LSOAs in England (overall 24% of its LSOAs are in the 30% most deprived in England). This is an increase from 2015 when 20% of West Lindsey LSOAs were in the 30% most deprived in England.

11.6.18 Bassetlaw is the 108th most deprived of England's 317 Local Planning Authority areas, with 7% of LSOAs are within the 10% most deprived LSOAs in England, 14% are within the 20% most deprived LSOAs and 16% are within the 30% most deprived LSOAs in England (overall 37% of its LSOAs are in the 30% most deprived in England). This is an increase from 2015 when 35% of Bassetlaw LSOAs were in the 30% most deprived in England.

11.6.19 A summary of relevant IMD data across the LSOA study area and West Lindsey and Bassetlaw districts is shown in Table 11-8.

Table 11-8: IMD (2019 and 2015)

	West Lindsey 005A	West Lindsey 005C	West Lindsey 007A	West Lindsey 007B	West Lindsey 007D	Bassetlaw 015C	West Lindsey	Bassetlaw
Overall deprivation decile / rank (2019)	4th	6th	7th	6th	5th	2nd	5th/ 146th	4th/ 108th
Overall deprivation decile / rank (2015)	5th	6th	7th	6th	4th	3rd	5th/ 147th	4th/ 112th
Health deprivation decile/ rank (2019)	6th	7th	8th	5th	6th	3rd	5th/ 143rd	3rd/ 68th

² Based on IMD rank of average summary measure.

	West Lindsey 005A	West Lindsey 005C	West Lindsey 007A	West Lindsey 007B	West Lindsey 007D	Bassetlaw 015C	West Lindsey	Bassetlaw
Barriers to housing and services (2019)	2nd	3rd	1st	3rd	2nd	1st	5th/ 135th	6th/ 187th
Living environment deprivation (2019)	1st	4th	7th	6th	4th	2nd	5th/ 128th	8th/ 224th

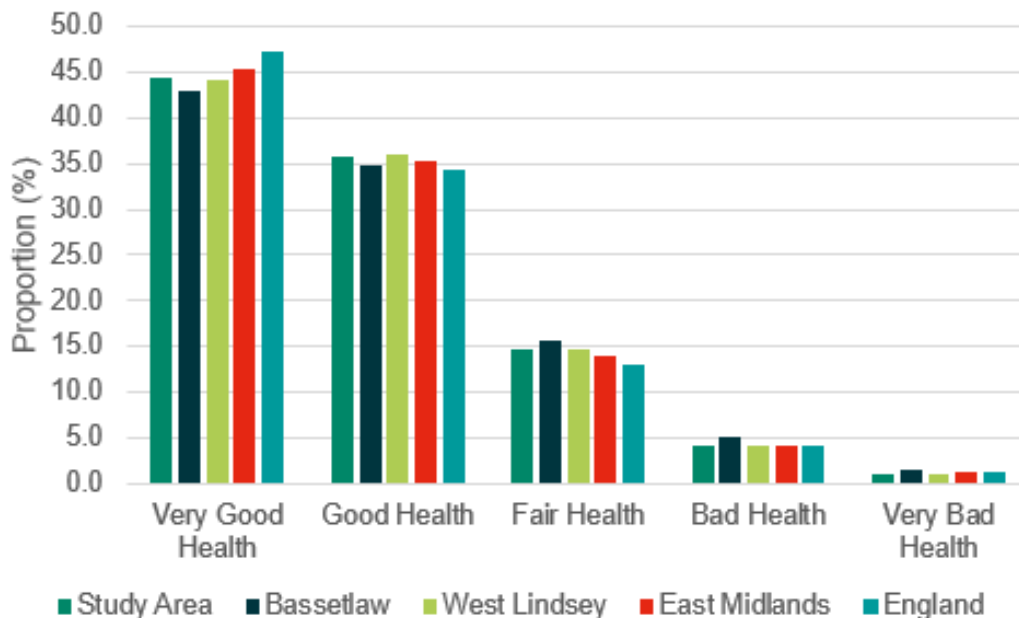
Source: MHCLG English Indices of Deprivation (Ref. 11-40)

Health Profile and Outcomes

11.6.20 Census 2011 (Ref. 11-36) provides the most recent data available showing residents' self-assessment of health with individuals identifying their overall health ranging from 'Very Good' to 'Very Bad'.

11.6.21 Across the local study area, most residents identified they are in 'Very Good' or 'Good' health. At the time of the 2011 Census 5.2% of residents in the ward-level study area believed that they were living in 'bad' or 'very bad' health. This rate is lower than the proportions in West Lindsey (5.4%), Bassetlaw (6.7%), across the East Midlands (5.6%) and England as a whole (5.5%). The full breakdown of self-assessed health across the ward-level study area, West Lindsey, Bassetlaw, the East Midlands and England is shown in Plate 11-4 below.

Plate 11-4: Self-Assessment of Health

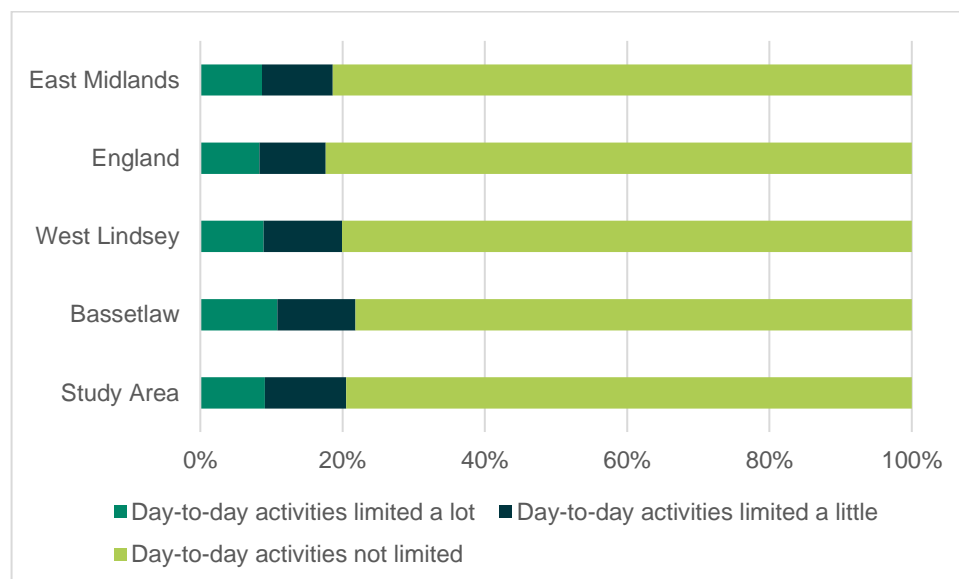


Source: 2011 Census (Ref. 11-36)

11.6.22 Plate 11-5 illustrates self-assessment of the extent to which residents' day to day activities are impacted by long-term health problems or disability, also based on self-assessment and reported in 2011 Census data. The proportion of residents in the local ward study area that experience limitations to their

daily activities a little or a lot as a result of a health problem or disability is 20.6%. This is lower than the proportion of residents in Bassetlaw (21.8%) but slightly higher than in West Lindsey (19.9%) the East Midlands (18.6%) and England as a whole (17.6%).

Plate 11-5: Self-Assessment of Long-Term Health or Disability



Source: 2011 Census (Ref. 11-36)

11.6.23 OHID publishes data on a range of health indicators at ward and local authority level (Ref. 11-41). A summary of relevant indicators is shown in Table 11-9.

11.6.24 Generally across the local ward study area, life expectancy at birth for males is equal to or better (higher) than the national average for England (79.5 years). However, life expectancy at birth for males in Rampton ward is lower, at 77.5 years. Life expectancy at birth for females across the local ward study area is lower than the national average (83.2 years) in Lea ward and Stow ward (both 81.0 years) and Rampton ward (83.1 years). In all other local study area wards, life expectancy at birth for females is higher than the national average.

11.6.25 Data showing inequality between populations with respect to life expectancy at birth is not available at local ward level. Inequality in life expectancy at birth³ for males in both West Lindsey (8.0 years) and Bassetlaw (6.7 years) districts is lower (less unequal) than the national average across England (9.7 years). Inequality in life expectancy at birth for females is higher in West Lindsey (8.9 years) and lower in Bassetlaw (5.8 years) compared to the national average across England (7.9 years).

11.6.26 In terms of the number of deaths among the local population aged 75 and under, generally fewer deaths than national averages rates took place over the years 2016-2020 across the local ward study area, with the exception of

³ Inequality reported based on ONS reporting on the Slope Index of Inequality (SII) between populations.

Stow ward where there were a higher than national average proportion of deaths among under 75s (Standardised Mortality Ratio (SMR)⁴ of 119.8)).

11.6.27 With respect to deaths from respiratory diseases all areas across the local ward study area performed significantly better than the national average over the years 2016-2020.

11.6.28 Rates of deaths from all causes considered preventable (2016-2020) are generally better than the national average across the local ward area, other than in Hemswell ward (SMR of 100.6) and Rampton ward (SMR of 101.2).

11.6.29 Levels of childhood obesity are not available at ward level. The proportion of Year 6 children there who are obese (3-years data combined 2017 to 2018, to 2019 to 2020) is lower in West Lindsey (17.8%), and higher in Bassetlaw (22.5%), compared to the national average for England (21.0%).

⁴ The standardized mortality rate (SMR) is the ratio of the number of deaths observed in a population over a given period to the number that would be expected over the same period if the study population had the same age-specific rates as the standard (England national) population.

Table 11-9: Community Health Profile

	Hemswell ward	Lea ward	Stow ward	Scampton ward	Torksey ward	Rampton ward	West Lindsey	Bassetlaw	East Midlands	England
Life Expectancy at Birth (males) (2016-2020)	79.5	79.5	79.5	84.2	81.1	77.5	79.7	78.8	n/a	79.5
Life Expectancy at Birth (females) (2016-2020)	86.0	81.0	81.0	86.9	88.3	83.1	83.5	82.1	n/a	83.2
Inequality in Life Expectancy at Birth (males 2018-2020)	<i>Data not available at ward level</i>						8.0	6.7	9.2	9.7
Inequality in Life Expectancy at Birth (females 2018-2020)	<i>Data not available at ward level</i>						8.9	5.8	7.6	7.9
Deaths from all causes, under 75 years, Indirectly standardised ratio 2016 to 2020 (Standardised mortality ratio (SMR))	97.0	71.5	119.8	64.2	66.8	94.8	91.0	107.3	n/a	100.0
Deaths from respiratory diseases, all ages, Indirectly standardised ratio, 2016 to 2020 (SMR)	91.6	73.6	63.9	69.0	83.3	56.6	83.5	101.0	n/a	100.0
Deaths from causes considered preventable, under 75 years, Indirectly standardised ratio, 2016 to 2020 (SMR)	100.6	52.4	98.8	49.6	69.6	101.2	82.7	106.5	n/a	100.0
Smoking prevalence (%) (at age 15) (2014)	<i>Data not available at ward level</i>						5.6	5.3	n/a	5.4

	Hemswell ward	Lea ward	Stow ward	Scampton ward	Torksey ward	Rampton ward	West Lindsey	Bassetlaw	East Midlands	England
Obese Children (%) (Year 6) 3-years data combined 2017 to 2018, to 2019 to 2020				<i>Data not available at ward level</i>			17.8	22.5	n/a	20.4

Source: OHID, Public Health Profiles (Ref. 11-41)

Local Health Priorities

11.6.30 Relevant local health priorities are set out at county level within Lincolnshire's Joint Health and Wellbeing Strategy (2018) and Nottinghamshire's Joint Health and Wellbeing Strategy (2018).

11.6.31 Relevant priorities within Lincolnshire's Joint Health and Wellbeing Strategy include:

- Promoting physical activity, including integrating physical activity into strategic planning and delivering improved local services; and
- Reducing obesity, including engaging with spatial planning and design to develop places that support healthy individuals and communities.

11.6.32 Relevant priorities within Nottinghamshire's Joint Health and Wellbeing Strategy include:

- Creating healthy and sustainable places that promote good health and tackle the causes of health inequalities;
- Supporting residents to have a healthy weight, including by ensuring the environment is easy for people to move around in more and lose weight; and
- Ensuring good air quality.

Transport Modes, Access and Connections Baseline

Community Connectivity

11.6.33 **PEI Report Volume I Chapter 14: Socio-Economics and Land Use** sets out that there are eight PRoWs that are within or cross the Cable Route Corridor. These can be found in Section 14.6 of **PEI Report Volume I Chapter 14: Socio-Economics and Land Use**.

11.6.34 **PEI Report Volume I Chapter 14: Socio-Economics and Land Use** sets out that the following communities are within 1km of the Principal Site Boundary: Hemswell approximately 700m to the north; Harpswell adjacent to the north; Hemswell Cliff approximately 700m to the east; Glentworth adjacent to the east; Heapham approximately 700m to the west; and Springthorpe approximately 800m to the west.

PRoW

11.6.35 **PEI Report Volume I Chapter 14: Socio-Economics and Land Use** sets out the PRoW within the Site Boundary.. There is one PRoW located within the Principal Site Boundary: an approximately 500m stretch of Glw/85/1, (which is the prolongation of Fill/85/1, Fill/85/2 and Fill/767/1). These PRoWs connect Willingham Road to Kexby Road.

Local Highway Network

11.6.36 **PEI Report Volume I Chapter 15: Transport and Access** sets out the existing baseline with respect to the local highway network, and access to public transport:

- The A631 is a single-carriageway road to the north of the Principal Site Boundary, which links with the A15 in the east and the A638 past

Gainsborough in the west. The road does not contain footways or street lighting provision within the vicinity of the Principal Site and is rural in character;

- The A15 runs to the east of the Principal Site Boundary running north to south. To the north it provides a connection to the M180. To the south it connects to the A46 to the south and provides a key route to/from Lincoln;
- The B1398 Middle Street is a local route that runs along the eastern extent of the Principal Site. The B1398 provides connections to local villages including Harpswell, Glentworth and Fillingham. The road does not contain footways or street lighting provision within the vicinity of the Principal Site and is rural in character;
- The A1500 (Till Bridge Lane) is located to the south of the Principal Site and runs in an east-west direction through Sturton by Stow and connects to the A156 to the west and the A15 in the east;
- The B1241 (Willingham Road) runs in a north-south direction along the western extent of the Principal Site through Normanby by Stow, Willingham by Stow, Kexby and Upton;
- Common Lane is a narrow rural road which runs in an east-west direction towards Heapham to the west and Harpswell to the east. Common Lane is located within the Principal Site boundary, providing access to the A631 in the east and the B1241 in the west;
- Kexby Road is a narrow rural road which runs in an east-west direction towards Upton to the west and Glenworth to the east. Kexby Road is located within the Principal Site Boundary, providing access to the B1398;
- Willingham Road is a narrow rural road which runs in an east-west direction towards Willingham by Stow to the west and Fillingham to the east. Willingham Road is located within the Principal Site Boundary;
- Springthorpe Road/Hill Road is a single carriageway road with one lane in each direction but no road markings. It runs north-south through Springthorpe in close proximity (500m) to the north-western border of the Principal Site and provides a link to the A631 in the north and the B1241 in the south; and
- High Street/ Willingham Road runs from the B1398 through Fillingham village. The road has a single lane in each direction but no road markings and narrows to a single-track road. The road runs east-west across the south of the site, providing access to the B1398 in the east and Willingham by Stow in the west.

Public Transport

11.6.37 **PEI Report Volume I Chapter 15: Transport and Access** also sets out the existing public transport baseline:

- Bus services 100, 103, 106 and 354 serve the Principal Site. Bus stops are located on the A631, B1398 (Middle Street) and B1241 (Willingham Road), which are in close proximity to the Scheme Boundary. Routes

provide regular services Monday-Saturday to Gainsborough, Lincoln and Scunthorpe; and

- The closest rail stations to the Scheme are in Gainsborough, to the west of the Principal Site (Gainsborough Central Station and Gainsborough Lea Road Station (located circa. 10km from the Principal Site). Gainsborough Lea Road provides connections to Sheffield, Leeds, Lincoln, Cleethorpes, Peterborough and Doncaster. Gainsborough Central provides one morning and evening service in each direction only, Sheffield to Gainsborough to Lincoln/ Cleethorpes.

Access to Services, Facilities and Employment

Healthcare Facilities

11.6.38 The nearest hospital (with an accident and emergency department) to the Principal Site is Lincoln County Hospital, which is approximately 16.5km to the south of the Scheme Boundary.

11.6.39 There is one General Practice (GP) within close proximity of the Principal Site. This is Corringham Branch Surgery (approximately 1km away from the Principal Site). The next closest GPs are Willingham Surgery, which is approximately 3.5km southeast the Principal Site and the Ingham Practice, which is approximately 3.5km southeast of the Principal Site.

Education Facilities

11.6.40 The closest primary school to the Principal Site Boundary is Hemswell Cliff Primary School (approximately 400m to the north of the Principal Site boundary).

11.6.41 The closest secondary schools to the Principal Site Boundary are to the west in Gainsborough.

Community and Recreational Facilities

11.6.42 Glentworth Village Hall is within 500m of the Principal Site Boundary. There are no other community facilities within 500m of the Principal Site Boundary.

Employment

11.6.43 Existing uses within the Principal Site Boundary comprise largely agricultural land in use for arable cropping.

11.6.44 There are a number of businesses within 500m of the Principal Site, including within the settlements of Harpswell and Glentworth, and a number of isolated businesses. These businesses include visitor accommodation, a café, florists, dog grooming and breeding businesses and agricultural businesses. A larger number of employees are located in Hemswell Cliff business park approximately 700m from the Principal Site Boundary.

11.6.45 Larger employment centres are located in the larger towns of: Gainsborough to the west; Lincoln to the south; Scunthorpe to the north; and Grimsby to the north-east.

Prioritisation of Walking and Cycling Baseline

In addition to the PRoW baseline set out above, **PEI Report Volume I Chapter 15: Transport and Access** sets out baseline information with respect to walking and cycling routes close to the Principal Site Boundary. Due to the

location of the Principal Site in rural Lincolnshire, there is limited footway provision in the surrounding area. Footways are limited to parts of the A631:

- Along the northern Principal Site, a narrow footway is provided along the northern side of the A631 from Pilham Lane through Corringham, where the footway widens, until the junction with Springthorpe Lane (approximately 850m);
- A footway is provided along the south side of the A631 through Corringham, ending at the Beckett Arms bus stop. Just after the Caravan Park homes off the northern side of the A631, a footway is provided until the sign for Harpswell, where provision changes to the southern side of the carriageway until the junction with Common Lane (approximately 500m);
- To the west of the Principal Site, the junction between the A631 and Springthorpe Road provides access to Springthorpe where approximately 450m of footway fronts onto residential properties on the eastern side of the carriageway, providing access to the Church and New Inn bus stops in Springthorpe;
- To the east of the Principal Site, the junction between the A631 and Common Lane provides access to Harpswell where approximately 150m of footway is provided on the eastern side of the carriageway fronting onto residential properties and providing access to St Chad's Church;
- To the east of the Principal Site, the junction between the B1398 (Middle Street) and Hanover Hill provides access to Glentworth where approximately 650m of footway is provided along the northern side of the carriageway until it becomes a narrow single lane track after the village. The footway widens when fronting residential properties through Glentworth;
- To the east of the Principal Site along the B1398 (Middle Street), approximately 600m of narrow unkept footways varying between the eastern and western sides of the road exist between the junction with Hanover Hill providing access into Glentworth and residential buildings to the south. The footway widens on the eastern side of the carriageway when fronting the residential properties. Approximately 400m of narrow footway is also provided on the eastern side of the carriageway located north of the junction with the B1398 and Ingham Lane; and
- To the east of the Principal Site, the junction between the B1398 (Middle Street) and High Street provides access to Fillingham where approximately 1km of footway is provided along the northern side of the road until it becomes a narrow single lane track after the village.

11.6.46 There are no on- or off-road dedicated or marked cycling facilities within the immediate vicinity of the Principal Site. Relatively fast vehicle speeds and high traffic flows on the A631 and A15 may deter cyclists, however, the B1241 (Willingham Road) to the west of the Principal Site, the B1398 (Middle Street) to the east and the smaller roads within the Scheme Boundary itself are likely to be attractive to leisure cycling.

11.6.47 The nearest National Cycle Network route (between Harby and Lincoln) is located approximately 25km to the south of the Principal Site. There is also a narrow footway/cycle path on the eastern side of the A15 running for approximately 5.1km between RAF Scampton and Lincoln, to the south of the Site Boundary.

11.6.48 The Principal Site could potentially be accessed by cyclists from Corringham, Hemswell and Springthorpe as all are located within an approximate 3km-4km cycle distance (10 minutes cycle) of one of the proposed accesses along the A631.

Road and Route Safety Baseline

11.6.49 **PEI Report Volume I Chapter 15: Transport and Access** sets out baseline personal injury and collision (PIC) data relevant to the local area. A total of 124 collisions (85 slight, 33 serious and 6 fatal) have occurred within the study area, for the most recent five-year period for which data is available.

11.6.1 One collision cluster was identified at the A1500/ B1241 Sturton by Stow junction, where five collisions occurred over the five-year study period equating to one collision per year.

11.6.2 Full details are set out in **PEI Report Volume I Chapter 15: Transport and Access**.

Employment Baseline

11.6.3 **PEI Report Volume I Chapter 14: Socio-Economics and Land use** sets out the existing baseline with respect to employment:

- In 2020, 55,540 (57.7%) residents in West Lindsey were of working age (defined by ONS as men and women aged 16 to 64). In Bassetlaw, 70,610 residents (59.7%) were of working age. These rates are slightly lower than the rates recorded for the East Midlands (61.8%) and England as a whole (62.3%);
- The proportions of working-age residents with a degree-level qualification or higher is lower in West Lindsey (25.6%) and Bassetlaw (20.1%), compared to the averages across the East Midlands (28.6%) and England (36.8%). The proportion of residents holding no formal qualifications is higher in West Lindsey (9.3%) and lower in Bassetlaw (4.9%) than averages across the East Midlands (7.5%) and England (6.4%);
- With respect to the sub-domains of deprivation, West Lindsey is the 96th most deprived local authority with respect to employment deprivation, and Bassetlaw is the 72nd most deprived;
- In 2021, the economic activity rate among working-age residents (16-64 year-olds) was 73.7% in West Lindsey and 70.8% in Bassetlaw. These rates are lower than the averages of 77.7% in the East Midlands and 78.8% in England;
- In 2020, the unemployment rate for working-age residents was 4.9% in West Lindsey and 5.2% in Bassetlaw, which is higher than the average rates across the East Midlands (4.5%) and England (4.6%). Claimant

count data shows the proportion of residents aged 16-64 claiming Jobseeker's Allowance and the number of Universal Credit claimants placed in the 'Searching for Work' conditionality group. The most recent data recorded in October 2022, showed the claimant count was 3.1% in West Lindsey and 3.0% in Bassetlaw, lower than the rates across the East Midlands (3.2%) and England (3.7%). Across all areas, the latest Claimant Count data is higher than the rates reported in January 2020, prior to the Covid-19 pandemic. These are 3.0% in West Lindsey, 2.8% in Bassetlaw, 2.6% across the East Midlands and 2.9% across England; and

- The most recent recorded gross value added (GVA) per head data (income approach) indicates a lower GVA per head in Lincolnshire (£18,959) and North Nottinghamshire (£18,816) compared to the averages across the East Midlands (£21,845) and England (£27,949). Data is not available at local authority level.

Air Quality Baseline

11.6.4 **PEI Report Volume I Chapter 6: Air Quality** sets out the existing baseline with respect to air quality, a summary of which of relevance to this chapter is below:

- There are no Air Quality Management Areas (AQMAs) declared in West Lindsey District Council or Bassetlaw District Council. Concentrations of Nitrogen Dioxide (NO₂) and particulate matter of 10 micrometres and smaller (PM₁₀) are considered to meet the UK objectives across the districts, which is rural with no large conurbations;
- West Lindsey District Council undertakes routine ongoing monitoring of NO₂ as part of their Local Air Quality Management (LAQM) responsibilities under Part IV of the Environment Act (2021) at 12 locations in the District. All monitoring sites have recorded concentrations in compliance with the annual mean objective value of 40 micrograms per cubic metre (µg/m³) since monitoring began;
- Bassetlaw District Council also conducts routine monitoring of NO₂ via a network of 23 diffusion tube monitoring sites as part of their LAQM responsibilities. All monitoring sites have recorded concentrations in compliance with the annual mean NO₂ objective from 2015 to 2019, with no data currently available on the Council's website after this date;
- A three-month NO₂ diffusion tube monitoring survey was undertaken at nine roadside sites in the vicinity of the Scheme in 2022. Annual mean NO₂ concentrations for 2021 at monitoring sites within the vicinity of the Scheme are all below the annual mean NO₂ objective of 40 µg/m³;
- Background pollutants concentrations data for the relevant 1 km x 1 km grid squares related to the Study Area has been sourced from Defra Background Maps for 2021. Concentrations are below the relevant air quality objectives across all grid squares which encompass the Scheme;
- Baseline rates of soiling are considered normal (based on professional judgement and current background levels); and

- Existing local sources of particulate matter includes wind-blown dust from exhaust emissions from energy plant and road vehicles, brake and tyre wear from road vehicles and the long-range transport of material from outside the Study Area.

Noise and Vibration Baseline

11.6.5 **PEI Report Volume I Chapter 6: Noise and Vibration** sets out the existing baseline with respect to noise, a summary of which of relevance to this chapter is below:

- Sources of noise close to the Principal Site include road traffic noise, wind, bird song, local farming activity noise, aircraft using Sturgate Airfield, fauna and local resident activities Road traffic noise from the surrounding road network was present at the majority of locations surveyed, with wind noise being the most dominant noise source at those locations furthest from roads.
- The baseline sound sources within the Cable Route Corridor are largely similar to those in the vicinity of the Principal Site.

Climate Change Baseline

11.6.6 **PEI Report Volume I Chapter 7: Climate Change** sets out the existing baseline with respect to greenhouse gas (GHG) emissions and climate change resilience (CCR), a summary of which is below:

- With respect to GHG emissions, the existing site is primarily arable agricultural land interspersed with access tracks. While there will be some emissions from the use of machinery on the land, for the purposes of the GHG emissions assessment a conservative estimate of zero existing emissions is assumed.
- With respect to CCR the current baseline for the CCR assessment is the current climate in the location of the Scheme. An estimated future climate baseline is also set out, based on probabilistic climate change projections for pre-defined 20-year periods for annual, seasonal and monthly changes to mean climatic conditions over land areas.

11.7 Embedded Design Mitigation

11.7.1 This section contains the mitigation measures relevant to this chapter that are already incorporated into the Scheme design, as described in **PEI Report Volume I Chapter 3: Scheme Description**.

11.7.2 The Scheme has been designed to take into account sensitive receptors, including human receptors, such as by positioning infrastructure to avoid receptors such as PRow, residential properties and communities as far as possible.

11.7.3 Potential for inclusion of permissive paths into the design will be considered at the ES stage.

Framework Construction Environmental Management Plan (CEMP)

11.7.4 A Framework CEMP has been prepared and submitted with this PEI Report (**PEI Report Volume II Appendix 3-1**). The Framework CEMP sets out

measures to reduce amenity impacts on sensitive receptors during the construction phase (such as noise, air quality, transport and landscape), GHG emissions impacts and flood risk impacts.

11.7.5 Measures to reduce amenity impacts set out within the CEMP include:

- Core construction working hours on-site will run from 07:00 to 19:00 Monday to Saturday, with working days comprising one 12-hour shift, and employees travelling to and from the site outside these times;
- Section 61 Consents will be obtained for the Scheme where noisy works outside of normal working hours are anticipated;
- Specific noise mitigation measures will be put in place to reduce potential noise impacts at nearby noise sensitive receptors, where abnormal or emergency construction traffic movements may occur;
- There will be two central parking areas off the main access routes during construction which workers can use and can be transported to and from the Scheme Boundary via minibus; and
- A wheel wash will be installed to be used by vehicles prior to exiting the Principal Site onto the public road network if there is mud or debris on the construction site.

Framework Operational Environmental Management Plan (OEMP) and Framework Decommissioning Environmental Management Plan (DEMP)

11.7.6 A Framework OEMP and Framework DEMP will be prepared and submitted at ES stage. The Framework OEMP and Framework DEMP will set out measures to reduce amenity impacts on sensitive receptors during the operational and decommissioning phases, respectively.

Framework Construction Traffic Management Plan (CTMP)

11.7.7 A Framework CTMP is included in **PEI Report Volume II Appendix 15-2**. The Framework CTMP includes measures to reduce amenity impacts associated with construction traffic during the construction and decommissioning phases.

11.7.8 Further details with respect to specific embedded mitigation measures relevant to minimising amenity impacts associated with traffic, noise and air quality are set out in **PEI Report Volume I Chapter 6: Air Quality**, **PEI Report Volume I Chapter 7: Climate Change**, **PEI Report Volume I Chapter 13: Noise and Vibration** and **PEI Report Volume I Chapter 15: Transport and Access**.

11.8 Assessment of Likely Impacts and Effects

11.8.1 The Scheme as outlined in **PEI Report Volume I Chapter 3: Scheme Description** has been considered in assessing the likely impacts and effects, whilst considering the embedded mitigation described in the previous section.

11.8.2 The Scheme has the potential to impact human health during construction, operation and during decommissioning, due to impacts on the following health determinants:

- Community connectivity including access to services, facilities (including open space) and employment;
- Prioritisation of travel by walking and cycling;
- Road and route safety;
- Employment and income;
- Air quality;
- Noise and vibration;
- Climate change; and
- Climate change resilience.

Construction (2025 to 2027)

Community connectivity including access to services, facilities (including open space) and access to employment

- 11.8.3 As set out in **PEI Report Volume I Chapter 14: Socio-Economics and Land Use**, there is one PRow located within the Principal Site Boundary (Gltw/85/1), three PRow located within 500m of the Principal Site, eight PRow that are within or run across the Cable Route Corridor and 15 PRow within 500m of the Cable Route Corridor.
- 11.8.4 No permanent closures to PRow are expected during the construction (or operation or decommissioning phases) of the Scheme. In a worst-case scenario, there may be a small number of diversions or temporary closures required. Where temporary closures are needed, there will be a diversion around the works and these diversions managed through traffic management measures.
- 11.8.5 **PEI Report Volume I Chapter 15: Transport and Access** sets out as a reasonable worst-case scenario during the construction phase, it is forecast that there would be up to 120 HGVs travelling to and from the Principal Site per day, representing 240 movements per day. In addition, during the peak construction period, there will be up to 500 construction staff vehicles (1,000 daily movements) and 14 shuttle bus services (28 daily movements) associated with staff for the Principal Site, representing 1,268 daily movements.
- 11.8.6 Based on the initial construction traffic impact assessment, there is expected to be less than a 30% increase in traffic flows across the majority of road link receptors (considered a very low magnitude of change with respect to severance, pedestrian delay and pedestrian and cyclist amenity) within the study area, resulting in negligible effects.
- 11.8.7 The following road link receptors would be expected to experience over 30% increase in traffic flows during the construction phase: A631, West of School Lane; A631, West of Minor Access South; A631, West of B1398 Middle Street; B1398 Middle Street, North of A631; B1398 Middle Street, North of A631; B1398 Middle Street, North of A631; A631, East of B1398 Middle Street; B1398 Middle Street, South of A631; and A631, Hanover Hill, West of Spital Lane. However, given the sensitivity of receptors in transport terms and the

temporary nature of the construction works, impacts in terms of severance, pedestrian delay and pedestrian and cyclist amenity during the construction phase are expected to be minor adverse, and temporary.

- 11.8.8 Overall across the study area, additional traffic movements as a result of the Scheme are considered to be within the overall capacity of the highway network, and a driver delay assessment is not considered necessary to assess the impacts of the Scheme.
- 11.8.9 With respect to the overall changes in connectivity and access to services and employment associated with the construction phase of the Scheme from a human health perspective, the magnitude of change is assessed with reference to the criteria defined by IEMA guidance set out in Table 11-4. Given the short-term duration of the impacts (24 month construction period), the moderate change in quality of life that could arise for residents affected by increased traffic flows, and the rapid reversal in the effect once the construction phase is completed the overall magnitude of change anticipated on community connectivity and access to services and employment is assessed to be **Low**.
- 11.8.10 Given the high levels of deprivation experienced across the local study area with respect to IMD (2019) barriers to housing and services domain, the low levels of existing services locally, the higher than average proportion of residents aged 65 and over (who could be more likely to require more regular access to services including health services requiring travel into Gainsborough or further afield), but the lower than average levels of poor health among the local population, the sensitivity of the local population with respect to community connectivity and access to services is assessed to be **Medium**.
- 11.8.11 Overall the likely effect on human health arising from impacts on community connectivity and access to services during the construction phase of the Scheme is assessed to be **Minor Adverse (not significant)**.

Prioritisation of walking and cycling

- 11.8.12 As set out above, no temporary or permanent diversions to PRoW would be required during the construction (or operation or decommissioning phases) of the Scheme. PRoW Gltw/85/1 (which partially runs through the Principal Site) will continue to be accessible, with woodland screening measures proposed to mitigate against potential amenity impacts.
- 11.8.13 As also detailed above, **PEI Report Volume I Chapter 15: Transport and Access** concludes effects on pedestrian and cyclist amenity during the construction phase would be expected to be negligible to minor adverse.
- 11.8.14 Given the medium-term duration of the impacts (24 month construction period), the minimal change in quality of life that could arise for cyclists and pedestrians affected by increased traffic flows, and the rapid reversal in the effect once the construction phase is completed the overall magnitude of change anticipated on prioritisation of walking and cycling during the construction phase is assessed to be **Low**.
- 11.8.15 Supporting physical exercise is a key local health priority, as set out in local health strategies. As set out in the baseline section above, due to the location

of the Principal Site in rural Lincolnshire, there is limited footway provision in the surrounding area, and there are no dedicated cycle routes. Local residents are however in relatively good health overall in comparison with national indicators. The sensitivity of the local population with respect to prioritisation of walking and cycling is therefore assessed to be **Medium**.

11.8.16 Overall the likely effect on human health arising from impacts on prioritisation of walking and cycling during the construction phase of the Scheme is assessed to be **Minor Adverse (not significant)**.

Road and route safety

11.8.17 **PEI Report Volume I Chapter 15: Transport and Access** assesses the likely impact of the Scheme on fear and intimidation for road users, and accidents and safety, during the construction phase. All effects are assessed to be negligible.

11.8.18 Given the conclusions of the transport assessment (negligible potential change in safety of existing routes arising from the construction phase), the magnitude of change anticipated with respect to road and route safety during the construction phase is assessed to be **Very Low**.

11.8.19 There have been relatively low levels of baseline accidents across the study area over the last five years, as set out in the baseline section above. Numbers of deaths from preventable causes (which could include road traffic incidents) are also lower than national averages. The sensitivity of the local population with respect to road and route safety is therefore assessed to be **Very Low**.

11.8.20 Overall the likely effect on human health arising from impacts on road and route safety during the construction phase of the Scheme is assessed to be **Negligible (not significant)**.

Employment and income

11.8.21 As set out above, the construction period for the Scheme is expected to be a minimum of 24 months, with the construction of the Principal Site taking the full 24 months, and construction of the Cable Route Corridor taking 6 months.

11.8.22 The Applicant estimates that the Scheme will require a peak of 1,250 full-time equivalent (FTE) jobs, and an average of approximately 500 gross direct FTE jobs on-site over the minimum 24 month construction period, although in practice the number will vary across the period. **PEI Report Volume I Chapter 14: Socio-Economics and Land Use** estimates taking account of displacement and indirect and induced employment, the Scheme could result in up to 84 that could be taken by local residents in the 45 minute drive time Study Area, and 478 by residents across the East Midlands as a whole.

11.8.23 The jobs arising from the construction phase of the Scheme would be temporary over the 24 month construction period. The up to 478 additional jobs within the 45 minute drive time Study Area would represent local jobs growth, although the overall change would be small in the context of the overall number of jobs locally. Overall, the magnitude of change anticipated with respect to employment and income during the construction phase is therefore assessed to be **Low** within the 45-minute drive time Study Area, and **Very Low** at the East Midlands level.

11.8.24 Baseline data with respect to employment indicates lower rates of economic activity, higher rates of unemployment and lower GVA per worker within West Lindsey and Bassetlaw compared to national averages. The sensitivity of the local population with respect to employment and income is therefore assessed to be **Medium**.

11.8.25 Overall the likely effect on human health arising from impacts on employment and income during the construction phase of the Scheme is assessed to be **Minor Beneficial (not significant)** at the West Lindsey and Bassetlaw scale, and a **Negligible (not significant)** effect at the regional scale.

Air quality

11.8.26 A preliminary assessment of potential air quality effects during the construction phase of the Scheme is set out in **PEI Report Volume I Chapter 6: Air Quality**. The dust assessment identifies the potential for high risk associated with dust deposition, with low risk to human health. Following implementation of the CEMP, the effect on dust deposition, and human health is anticipated to be **not significant**.

11.8.27 An assessment of the effect of road traffic emissions on local air quality during construction will be included in the ES if traffic volumes are shown to exceed relevant thresholds. However, at this stage, given the relatively good air quality baseline conditions in the Study Area, it is not expected that the additional road traffic will lead to any exceedances of the national air quality strategy objectives. At this stage, these impacts are therefore anticipated to be **not significant**.

11.8.28 The air quality impacts arising from the construction phase of the Scheme would be temporary over the minimum 24 month construction period. Based on the conclusions of the air quality assessment set out in **PEI Report Volume I Chapter 5: Air Quality**, local impacts are likely to be minimal, following mitigation including best practice measures set out in the Framework CEMP. Overall the magnitude of change anticipated with respect to air quality impacts on human health during the construction phase is therefore assessed to be **Very Low**.

11.8.29 Baseline data with respect to air quality indicates low concentrations of NO₂, and background pollutants in the local study area. Rates of deaths from respiratory diseases are also lower in the local area, relative to national average rates. Achieving good air quality is a local policy priority however. The sensitivity of the local population with respect to air quality is therefore assessed to be **Low**.

11.8.30 Overall the likely effect on human health arising from impacts on air quality during the construction phase of the Scheme is assessed to be **Negligible (not significant)**.

Noise and vibration

11.8.31 **PEI Report Volume I Chapter 13: Noise and Vibration** sets out the anticipated noise impacts associated with the construction (and decommissioning) phases of the Scheme.

11.8.32 All predicted noise levels remain below the daytime LOAEL (65 dB) for all daytime construction scenarios and are therefore assessed to be **not significant**.

11.8.33 The LOAEL for the evenings and weekends and the SOAEL for the night (both 55 dB) are exceeded at one location in reference to drilling across Stowe Park Road. Predicted levels are also equal to 55 dB at one location in relation to drilling across Cottam Power Station railway line. If night works are required, such works will be short term, likely no more than a few days. The levels predicted are therefore not considered to be sufficient to result in a significant adverse impact.

11.8.34 For all works that are undertaken outside of core work periods, appropriate consent will need to be obtained by the Principal Contractor in agreement with the Local Planning Authority.

11.8.35 The assessment also concludes that any construction phase vibration impacts would be **not significant**.

11.8.36 The noise and vibration impacts arising from the construction phase of the Scheme would be temporary over the 24 month construction period. Based on the conclusions of the assessment set out in **PEI Report Volume I Chapter 13: Noise and Vibration**, local impacts are likely to be minimal. Overall the magnitude of change anticipated with respect to noise and vibration impacts on human health during the construction phase is therefore assessed to be **Low**.

11.8.37 Baseline data with respect to noise indicates low levels of existing noise across the local study area. Given the rural setting the local area could be sensitive to changes in noise levels potentially impacting quality of life for residents should local tranquillity be impacted. The sensitivity of the local population with respect to noise and vibration is therefore assessed to be **Medium**.

11.8.38 Overall the likely effect on human health arising from impacts on noise and vibration during the construction phase of the Scheme is assessed to be **Minor Adverse (not significant)**.

Climate Change – GHG emissions

11.8.39 **PEI Report Volume I Chapter 7: Climate Change** sets out the anticipated GHG emissions impacts associated with the construction phase of the Scheme. GHG emissions are expected to be generated by the manufacture of the Battery Energy Storage System (BESS) and solar PV panels (embodied carbon impact) and the transport of components from where they are made to the Site. Other sources of GHG emissions include: water, energy and fuel use for construction; fuel use for the transportation of construction materials to the Site; and the transportation and disposal of waste.

11.8.40 Total emissions from construction are estimated at 937,200 tCO₂e. This represents 0.24% of the 4th UK carbon budget.

11.8.41 Based on the conclusions of **PEI Report Volume I Chapter 7: Climate Change** the GHG emissions generated during the 24 month construction

phase would represent a minor adverse effect, which would not be significant. The assessment notes the key role the construction and operation of solar farms such as the Scheme play in Government policy to decarbonise the national grid and for the UK to meet its net zero emissions target by 2050.

11.8.42 **PEI Report Volume I Chapter 7: Climate Change** sets out that under the revised IEMA guidance on assessing the impact of GHG emissions, the significance of the impact is no longer based on whether a project emits GHG emissions, or the magnitude of these emissions, but how a project contributes to reducing GHG emissions compared to a defined baseline. Baseline data with respect to GHG emissions indicates very low levels of existing emissions generated across the existing Scheme Boundary (the baseline assumes zero emissions). As set out in **PEI Report Volume I Chapter 7: Climate Change** due to the nature of GHG emissions, and their cumulative impact on the global climate, IEMA considers that all GHG emissions contribute to climate change. While temporary adverse impacts on GHG emissions levels are anticipated during the construction phase therefore, this is to be considered in the context of the opportunity the Scheme represents to positively respond to the challenges of climate change. Overall the magnitude of change anticipated with respect to GHG emissions on human health during the construction phase is therefore assessed to be **Very Low**.

11.8.43 The relevant receptor with regard to sensitivity to GHG emissions is the global population. The sensitivity of the global population with respect to GHG emissions is assessed to be **High**.

11.8.44 Overall the likely effect on human health arising from impacts on GHG emissions during the construction phase of the Scheme is assessed to be **Minor Adverse (not significant)**.

Landscape and Visual Amenity

11.8.1 A preliminary assessment of the likely impact of the Scheme on the local landscape and visual amenity during the construction phase of the Scheme is provided in **PEI Report Volume I Chapter 12: Landscape and Visual Amenity**.

11.8.2 During the construction phase, significant visual effects may arise as a worst-case scenario for up to around 15 residential receptors adjacent to the Principal Site and up to eight residential receptors on Middle Street.

11.8.3 Given the rural setting, the local area could be sensitive to changes in visual effects potentially impacting quality of life for residents, should local tranquillity be impacted. The sensitivity of the population with respect to human health effects of changes to the landscape and visual amenity is therefore assessed to be **Medium**.

11.8.4 Based on the receptors experiencing significant adverse effects being representative of a low number of residents being affected, with effects being short-term and reversible, the magnitude of impact in relation to human health from landscape and visual amenity is assessed to be **Low**.

11.8.5 Overall, the likely effect on human health arising from impacts on landscape and visual amenity during the construction phase of the Scheme is assessed to be **Minor Adverse (not significant)**.

Operation

Community connectivity including access to services, facilities (including open space) and access to employment

11.8.6 As set out above, **PEI Report Volume I Chapter 14: Socio-Economics and Land Use** sets out no effects on local community severance or users of PRow are anticipated arising from all phases of the Scheme.

11.8.7 **PEI Report Volume I Chapter 15: Transport and Access** sets out the Scheme is expected to generate a low level of vehicle trips during operation – a worst case of up to 12 vehicles (24 movements) per day associated with on-site staff, and an average of five visits per week from four-wheel drive vehicles, HGVs or transit vans for maintenance.

11.8.8 With respect to the overall changes in connectivity and access to services and employment associated with the operation of the Scheme from a human health perspective, the magnitude of change is assessed with reference to the criteria defined by IEMA guidance set out in Table 11-4 and the assessments set out in related chapters. The overall magnitude of change anticipated on community connectivity and access to services and employment is assessed to be **Very Low**.

11.8.9 As above, the sensitivity of the local population with respect to community connectivity and access to services and employment is assessed to be **Medium**.

11.8.10 Overall the likely effect on human health arising from impacts on community connectivity and access to services during the construction phase of the Scheme is assessed to be **Negligible (not significant)**.

Prioritisation of walking and cycling

11.8.11 As set out above no temporary or permanent diversions to PRow would be required during the construction or operation phases of the Scheme.

11.8.12 **PEI Report Volume I Chapter 15: Transport and Access** does not specifically assess effects on pedestrian and cyclist amenity during operation. This has been scoped out, as agreed. However, as set out above overall levels of traffic arising from the operation of the Scheme are expected to be very low.

11.8.13 Overall, the magnitude of change anticipated on human health arising from prioritisation of walking and cycling during the operation of the Scheme is assessed to be **Very Low**.

11.8.14 As above, the sensitivity of the local population with respect to prioritisation of walking and cycling is assessed to be **Medium**.

11.8.15 Overall, the likely effect on human health arising from impacts on prioritisation of walking and cycling during the operation of the Scheme is assessed to be **Negligible (not significant)**.

Road and route safety

- 11.8.16 **PEI Report Volume I Chapter 15: Transport and Access** does not specifically assess effects on road and route safety during operation. This has been scoped out, as agreed. However, as set out above overall levels of traffic arising from the operation of the Scheme are expected to be very low.
- 11.8.17 The magnitude of change anticipated on human health arising from road and route safety during the operation of the Scheme is assessed to be **Very Low**.
- 11.8.18 As above, the sensitivity of the local population with respect to road and route safety is also assessed to be **Very Low**.
- 11.8.19 Overall, the likely effect on human health arising from impacts on road and route safety during the operation of the Scheme is assessed to be **Negligible (not significant)**.

Employment and income

- 11.8.20 As set out in **PEI Report Volume I Chapter 14: Socio-Economics and Land Use**, the Scheme will generate an estimated 10 FTE long-term jobs during the operational phase.
- 11.8.21 The 10 direct additional jobs within West Lindsey would represent local jobs growth, although the overall change would be very small in the context of the total number of jobs locally. Overall the magnitude of change anticipated with respect to employment and income during the operation of the Scheme is therefore assessed to be **Very Low**.
- 11.8.22 As above, the sensitivity of the local population with respect to employment and income is assessed to be **Medium**.
- 11.8.23 Overall, the likely effect on human health arising from impacts on employment and income during the operation of the Scheme is assessed to be **Negligible (not significant)**.

Air quality

- 11.8.24 As set out in **PEI Report Volume I Chapter 6: Air Quality**, the impacts of the Scheme on air quality during its operation are scoped out since the air quality effects arising from the traffic movements expected are anticipated to be negligible.
- 11.8.25 Based on these conclusions, the magnitude of change anticipated with respect to air quality impacts on human health during the operation of the Scheme is assessed to be **Very Low**.
- 11.8.26 As above, the sensitivity of the local population with respect to air quality is assessed to be **Low**.
- 11.8.27 Overall, the likely effect on human health arising from impacts air quality during the operation of the Scheme is assessed to be **Negligible (not significant)**.

Noise and vibration

- 11.8.28 As set out in **PEI Report Volume I Chapter 13: Noise and Vibration**, there is not anticipated to be any noticeable impulsive or intermittent characteristics from plant noise emissions experienced at the surrounding receptors.

Transformers within the BESS compound can have tonal features, although noise emissions from the BESS will be dominated by the cooling fans such that any tonal features of the transformers will not be noticeable. However, overall plant noise emissions experienced at receptors will likely be perceived as a distinctive continuous and steady hum.

- 11.8.29 Based on the conclusions of the assessment set out in **PEI Report Volume I Chapter 13: Noise and Vibration**, noise and vibration effect levels at receptors R6, R39, NR1 and NR3, noise remains below the LOAEL, indicating no adverse impact. At all other receptors, the LOAEL is exceeded, but the SOAEL is not exceeded at any location, indicating non-significant adverse impacts. No significant effects are predicted. the magnitude of change anticipated with respect to noise and vibration impacts on human health during the construction phase is therefore assessed to be **Low**.
- 11.8.30 As above, the sensitivity of the local population with respect to noise and vibration is assessed to be **Medium**.
- 11.8.31 Overall the likely effect on human health arising from impacts on noise and vibration during the operation of the Scheme is assessed to be **Minor Adverse (not significant)**.

Climate Change – GHG emissions

- 11.8.32 **PEI Report Volume I Chapter 7: Climate Change** sets out the anticipated GHG emissions impacts associated with the operation of the Scheme. GHG emissions are expected to be generated by operational energy use, fuel used for the transportation of workers to the Scheme, and maintenance activities.
- 11.8.33 Based on the expected operational lifetime of the Scheme of at least 40 years, total emissions during operation are estimated at 648,868 tCO₂e. Sulphur hexafluoride (SF₆) is another potential source of GHG emissions over the lifetime of the Scheme. It has not been possible to quantify fugitive emissions from the leakage of SF₆ due to insufficient research data being available on this topic.
- 11.8.34 **PEI Report Volume I Chapter 7: Climate Change** sets out any adverse GHG emissions impacts would be far outweighed by the beneficial impact of the Scheme as a result of renewable energy generation. A full assessment of the Scheme's operational carbon intensity (tCO₂e/per kWh) verses forecast grid average intensity will be included in the ES however the operation of the Scheme is anticipated to have a significant beneficial effect on GHG emissions.
- 11.8.35 Given the magnitude of change in terms of GHG emissions during the operation of the Scheme is not set out in **PEI Report Volume I Chapter 7: Climate Change**, it is not currently possible to carry out an assessment of the magnitude of change anticipated with respect to GHG emissions on human health during the operation of the Scheme. This assessment will be completed at ES stage.
- 11.8.36 As above, the sensitivity of global population health with respect to GHG emissions is assessed to be **High**.

11.8.37 The overall likely effect on human health arising from impacts on GHG emissions during the operation of the Scheme will be assessed at ES stage, however the effect is anticipated to be **Minor Beneficial (not significant)**.

Climate Change – CCR

11.8.38 **PEI Report Volume I Chapter 7: Climate Change** sets out a preliminary assessment of CCR to the Scheme. Overall no significant effects are anticipated during operation arising from: increased frequency and severity of extreme weather events or increased SLR.

11.8.39 The overall likely effect on human health arising from CCR during the operation of the Scheme will be completed at ES stage.

Landscape and Visual Amenity

11.8.40 A Preliminary assessment of the likely impact of the Scheme on the local landscape and visual amenity during Operation Year 1 (Winter) and Operation Year 15 (Summer) is provided in **PEI Report Volume I Chapter 12: Landscape and Visual Amenity**.

11.8.41 In a worst-case scenario, significant visual effects may arise during Operation Year 1 (Winter) for up to 15 residential receptors adjacent to the Principal Site and eight residential receptors on Middle Street. For the Cable Route Corridor, significant visual effects may arise for residential receptors on Cottam Road and Floss Lane in Cottam during Operation Year 1 (Winter). This is a worst-case scenario and will arise should there be tree loss around the playing field or gardens where such trees contribute to views and form both a backdrop and screening to the adjacent power station.

11.8.42 For Operation Year 15 (Summer), significant visual effects may still arise for up to eight residential receptors on Middle Street but no significant visual effects are expected associated with the Cable Route Corridor.

11.8.43 As above, the sensitivity of the population with respect to the human health effects of changes to the landscape and visual amenity is therefore assessed to be **Medium**.

11.8.44 Based on the receptors experiencing significant adverse effects being representative of a low number of properties, a low number of residents will be affected in Operation Year 1 (Winter). This also applies to those affected in Operation Year 15 (Summer), with this number of residents being lower. The magnitude of impact in relation to human health is therefore assessed to be **Low**.

11.8.45 Overall, the likely effect on human health arising from impacts on landscape and visual amenity during the operational phase of the Scheme is assessed to be **Minor Adverse (not significant)**.

Decommissioning

11.8.46 Drawing on the assessments set out in **PEI Report Volume I Chapter 6: Air Quality**, **PEI Report Volume I Chapter 7: Climate Change**, **PEI Report Volume I Chapter 13: Noise and Vibration**, **PEI Report Volume I Chapter 14: Socio-Economics and Land Use** and **PEI Report Volume I Chapter 15:**

Transport and Access, effects on human health during the decommissioning of the Scheme are anticipated to be in line with or no worse than effects during the construction phase of the Scheme.

11.9 Additional Mitigation and Enhancements

Additional Mitigation

11.9.1 No additional mitigation is required with respect to human health effects arising from the Scheme.

Enhancements

11.9.2 No additional enhancements are required or provided with respect to human health effects arising from the Scheme.

11.10 Cumulative Effects

11.10.1 An assessment of cumulative effects is presented in **PEI Report Volume I Chapter 17: Cumulative Effects**.

11.11 References

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